Metering Field Manual

Version 2.0

November 2017

Overview Of This Manual

This manual defines technical information and methodology relevant to installing, maintaining and repairing TasNetworks' Types 1-4 metering assets that comprise the metering installation at a connection point for measurement of electricity consumption in accordance with the National Electricity Market (NEM) requirements.

As of December 22nd, this manual does not cover the requirements for installing, maintaining and repairing TasNetworks' Type 6 metering assets.

Document Control

Version	Document no.	Comments	Approved by	Date
1.0	R0000554739	New Metering Field Manual. Replaces most existing work instructions and covers all metering technical requirements.	Leader HSE & Technical Competence Group	03/04/2017
2.0	R0000554739	Changes made to reflect new connections process in response to Power of Choice reforms. Affected Sections: • 1.3 Scope • 3.2 Faulty Meters • 7.9.3 Requirement for Sealing • 7.9.4 Suspected Tampering The embedded generation diagram updated to clarify the meter connections in 4.2.2. A note that the meter test unit must be earthed to avoid test inaccuracies has been added to section 9.3.3 Additional Mk10D programming FIP codes from older but still valid programs are included in Appendix A	Leader HSE & Technical Competence Group	23/11/2017

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1. Preface

1.1. Purpose

This manual defines the technical information and methodology relevant to installing, maintaining, repairing and testing TasNetworks metering and ancillary metering assets that comprise a metering installation.

1.2. Audience

This specification is intended for all TasNetworks metering staff and contractors engaged in working on metering assets.

1.3. Scope

This manual applies to:

- All new and existing type 1, 2, 3 and 4 metering installations connected to the TasNetworks distribution network.
- All works associated with the installation, replacement, maintenance or in-field testing of metering and ancillary assets performed by TasNetworks.

The following subject areas are beyond the scope of this manual:

- Type 6 or 'Basic' metering works.
- Customer-owned metering installations (e.g. check meters).
- Testing and refurbishment of metering equipment conducted in the laboratory.

1.4. Responsibilities

It is the user's responsibility to ensure that they have a current copy of these specifications. All copies, including print and electronic, are uncontrolled.

Position	Responsibilities
Metering technicians and contractors	• Ensure that the metering installation meets the requirements of this specification. • Ensure that the metering equipment is fit-for-purpose and operates in accordance with this specification. • Ensure that the installation is correctly represented in all appropriate drawings. • Ensure that all relevant information is recorded in accordance with TasNetworks procedures.

Position	Responsibilities
	• Ensure that test equipment is connected and tests are performed in accordance with this specification and any related TasNetworks procedures.
Metering Team	• Responsible for data entry and filing the metering reports in accordance with relevant TasNetworks procedures. • Identify any deficiencies and out-of-date information contained in the specification.
Network Metering Manager	• Ensure that all new and replacement metering equipment and installations comply with the relevant regulatory requirements. • Ensure that relevant staff and contractors are adequately trained in the application of this specification. • Ensure that standards are being met by the metering team and contractors. • Responsible for approving any non-standard metering systems.Responsible for maintaining this specification.

1.5. Definitions

1.5.1. Interpretation

Term	Definition
must	There is an absolute requirement to observe the behaviour.
must not	There is an absolute prohibition on the behaviour.
should	The behaviour is recommended or encouraged but there might be valid circumstances for adopting a different behaviour.
should not	The behaviour is not recommended or is discouraged but there might be valid circumstances for adopting the behaviour.
might or may	The behaviour is optional.

1.5.2. Abbreviations And symbols

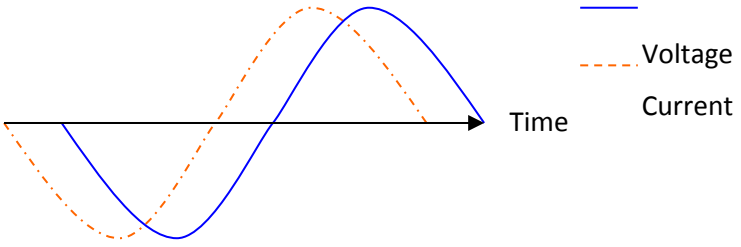
Term	Description
A	amp (ampere)
CT	current transformer
DC	direct connect

Term	Description
EDMI	EDMI meters
EM1210	Landis & Gyr single-phase meter
EM3030/3330/3500	Landis & Gyr 3000 series multiphase meters
EmpWin	Landis & Gyr meter programming interface
EziView	EDMI meter programming interface
FIP	field-initiated program
HV	high voltage
Hz	hertz
I^2t	ampere-squared second $A^2 \cdot s$ (thermal energy)
Ib	basic current
Imax	maximum current
In	nominal current
L&G	Landis & Gyr (previously Ampy and Email) meters
LV	low voltage
MEN	multiple earthed neutral
MK10/10A/10D/10E	EDMI MK10 series multiphase meters
MK6/6E	EDMI MK6 series multiphase meters
MK7A	EDMI MK7A single-phase meter
MTL	TasNetworks Meter Testing Laboratory
MV-90	Itron remote communications and metering data collection system
NA	not applicable
NATA	National Association of Testing Authorities
NECF	National Energy Customer Framework
NER	National Electricity Rules
NMA	National Measurements Act
PF	power factor
SIR	TasNetworks Service and Installation Rules (Part 1 of the SIS)
SIS	TasNetworks Service and Installation Standard
TEC	Tasmanian Electricity Code
TMTE	meter testing software application
UMS	unmetered supply (type 7)

Term	Description
V	volt
VAR	volt-ampere reactive, also megaVAR (MVAR) and kiloVAR (kVAR)
VT	voltage transformer

1.5.3. Terms And Parameters

The technical terms used in this document are described below.

Term	Description
direct connect	Whole current metering – i.e. metering that does not use a CT for current measurements and the total current of customer load passes through the meter.
metering installation type	Metering installation types 1 to 7 as defined in chapter 7 of the NER.
basic meter	A manually read acumulation meter. This meter does not use a modem or support interval data.
basic current (Ib)	Current that sets the relevant performance of a DC meter.
maximum current (Imax)	Maximum current the meter complies with the Australian Standards.
nominal current (In)	Current that sets the relevant performance of a CT meter.
hand switch	Device used to stop and start meter accuracy tests manually after visually observing a number of disk rotations or pulses.
high voltage	Installations metered at more than 1000V – i.e. 11kV, 22kV, 33kV, etc.
low voltage	Installations metered at less than 1000V – i.e. 230/400V
import energy	Metering installation where energy is imported to the distribution system. Note that L&G's use of this term is the reverse.
export energy	Metering installation where energy is exported from the distribution system. Note that L&G's use of this term is the reverse.
inspection	The activity of measuring, testing or otherwise examining meters for determining conformity with the specified requirements.
lagging current	The current lags the voltage by cosθ, where θ is the phase angle of the load. 

Term	Description
photocell pickup	Sensor connected to the meter that shines a light on the rotating disc and senses a break in the reflection caused by the black line on the disk. Used to count the rotations of the disk.
power factor (PF)	The ratio of the active power to the apparent power. Power factor is given by cosθ, where θ is the phase angle of the load; cos (–60) is 0.5.
Power of Choice (PoC)	The term refers to reforms created by the Australian Energy Market Commission, that noteably requires all new and replacement meters after 1 December are to be remotely read advanced meters.
meter constant	Is the revs/kWh or pulses/kWh and can be found by looking at the name plate on the meter to be tested.
multiplying factor	Is the factor that the readings are multiplied by to get the kWh's used. Is applied to Current Transformer metered installation.
rated current	Value of current with which the relevant performance of a CT-operated meter is fixed.
Ring Fencing	The Australian Energy Regulator has tightenend its requirement for TasNetworks to separate its regulated operations from areas of commercial competition. This new requirement to strictly 'Ring Fence' these areas away from one another begins 1 Jan 2018.
whole current	Same as Direct Connect above
wholesale	Metering installations that measure the energy between the transmission network and load (the distribution network or Major Industrial Customers) or generation

1.6. Related Documents

Reference	Available
TasNetworks Metering Framework	Metering Asset Management Framework
TasNetworks Metering Procedures	Promapp
TasNetworks Service and Installation Rules	TasNetworks Website
TasNetworks Laboratory Meter Testing Manual	TasNetworks Metering Manuals
TasNetworks Work Procedure for High Voltage Transformer Connect Metering	The Zone – Metering Work Practices
TasNetworks Work Procedure for Metering Accuracy Testing	The Zone – Metering Work Practices
TasNetworks Work Procedure for Replacing Metering Modems	The Zone – Metering Work Practices
TasNetworks Work Procedure for Direct Connect Metering	The Zone – Metering Work Practices

Reference	Available
TasNetworks Work Procedure for Low Voltage Current Transformer Metering	The Zone – Metering Work Practices
AS 1284 Metering Series	Standards On-Line (SAI Global)
AS 1199 Sampling procedures: Inspection by Attributes	Standards On-Line (SAI Global)
AS 60044.1 Current Transformers	Standards On-Line (SAI Global)
AS 60044.2 Single phase inductive Voltage Transformers	Standards On-Line (SAI Global)
NITP 14 National Instrument Test Procedures for Utility Meters, National Measurement Insitute (NMI), Electricity Meters, 2nd edn, 2nd rev., March 2013.	http://www.measurement.gov.au/Publications/NMIVDocuments/Documents/NITP14.pdf
AS ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories, Standards Australia, 2005, 2nd edn, reissued Dec 2006.	Standards On-Line (SAI Global)
Metrology for the NEM, AEMO Education, 2012	MTL
Various technical specifications and OEM manuals for metering equipment	Metering Manufacturer Manuals

1.7. Administration

TasNetworks administers the development, revision and publication of this manual.

1.8. Authorisations

Action	Name/Position	Date	Signature
Prepared by	Tim McAuley, Documen Pty Ltd		
Reviewed by (technical review)	James Lord		
Reviewed by (business review)			
Approved by	Leader HSE & TC Group		

1.9. Contact For Technical Enquiries

Please direct all technical enquiries concerning metering installations to the Meter Provider (MPB) at mp@tasnetworks.com.au.

2. How This Manual operates

This manual is aligned with:

- The **National Electricity Market** (NEM) and relevant legislation and regulations.
- The **TasNetworks metering framework** for managing metering equipment assets.
- The **TasNetworks policies and standards** for performing work in a safe manner.
- The over-arching **TasNetworks metering work procedures**, shown in the document map below, for electrical and legislative compliance, training and minimum qualifications, and safe work practices.
- The **TasNetworks Service and Installation Standard** (SIS), including the applicable Australian Standards and government regulations defined in the SIS.

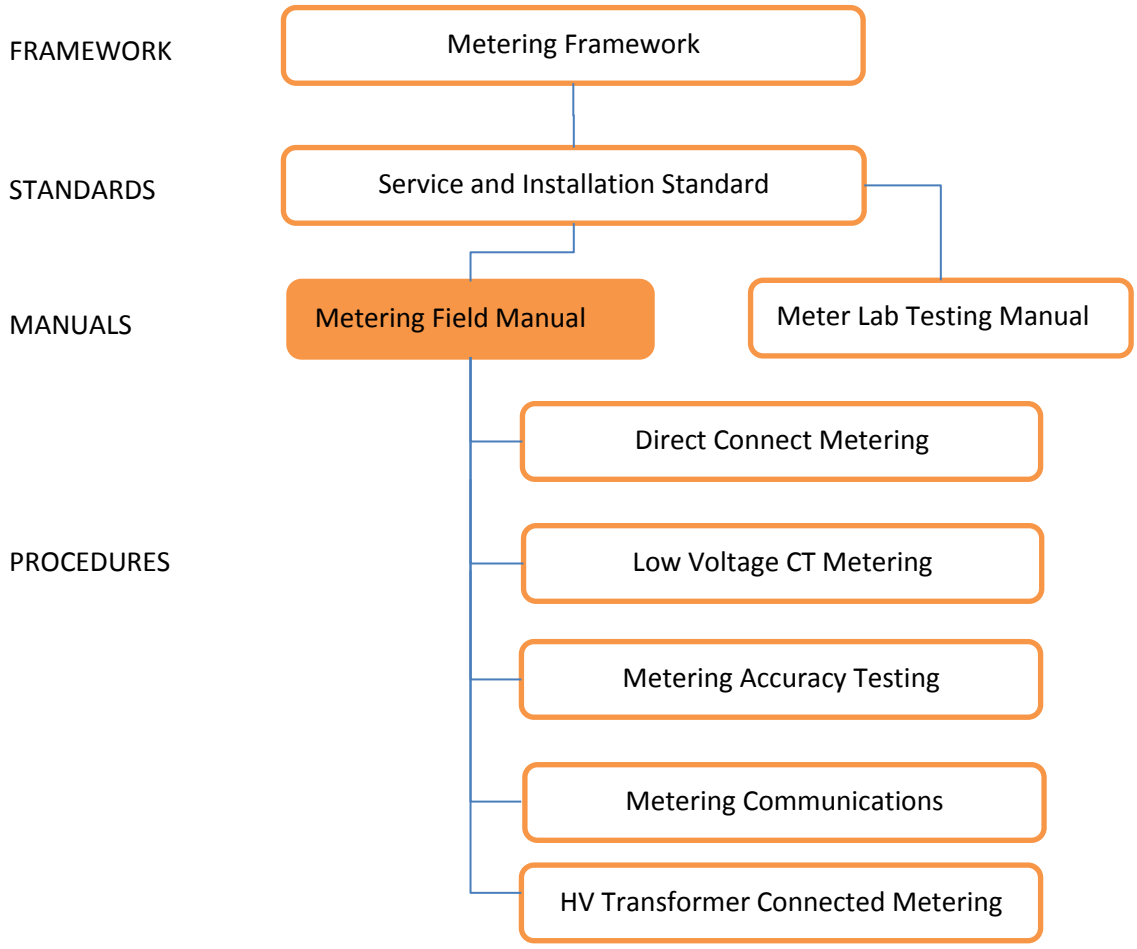


Figure 1 Document roadmap

This manual is divided into nine main sections plus appendices, which are described in Table 1.

Table 1 How to use this manual

Section	Purpose
1	**Preface** – Describes the purpose and scope of the manual, responsibilities of TasNetworks personnel related to its use, definitions of the terms used in the manual, and related documents.
2	**How this manual operates** – Provides an overview of how this manuals operates in conjunction with relevant legislation, NEM requirements, safety, qualifications, training, and procedures.
3	**Metering equipment management** – Describes the status and management procedures for metering equipment.
4	**Metering installations** – Describes the types of metering installations and their metering requirements.
5	**Meter selection** – Describes the processes by which meters are selected for different metering installations and tariff combinations.
6	**Meter descriptions** – Describes the capabilities of TasNetworks approved meters.
7	**Ancillary equipment** – Describes the capabilities of other approved equipment installed at metering installations.
8	**Meter programming** – Describes the laboratory-installed and field initiated meter programs approved for use in TasNetworks metering equipment.
9	**Meter testing and inspection** – Describes the equipment and conditions approved for inspecting and testing metering equipment installed at a metering installation.
Appendices	Provides details that support and are referenced from the above sections, including meter programming, meter errors and warnings, and guidelines for using metering test equipment.

3. Metering Equipment Management

3.1. Metering Equipment Status

The status types of metering equipment used in the TasNetworks distribution system are described in Table 2. The status determines whether:

- a particular type of metering equipment is permitted to be installed at a new installation, and
- the equipment installed at an existing metering installation needs to be replaced, and
- if equipment is removed from an installation, whether it should be refurbished or disposed of.

Refer to Section 6 for descriptions of the metering equipment currently in use in the TasNetworks distribution system and their current status.

Table 2 Metering equipment status

Status	Description	Purchase	Install	Leave	Refurbish
Approved	Equipment is approved for purchasing by TasNetworks. Stocks of new and refurbished equipment are maintained in the TasNetworks warehouse.	Yes	Yes	Yes	If not damaged
Obsolete	Equipment should be taken out-of-service when metering or connection work is performed on the installation. Equipment is disposed of and not refurbished.	No	No	No	Dispose
Restricted	Use of equipment is restricted to special situations approved by Network Metering Manager. For example, old stocks of refurbished equipment are maintained for sale to customers for non-NEM installations.	No	No	Refer to Network Metering Manager.	

3.2. Faulty Meters

Faulty Type 1-4 meters cannot be bypassed under any circumstances.

3.3. Meter Amalgamation

When replacing meters, multiple meters should be amalgamated if practical. In other words, if there are two or more meters on an installation, metering the same tariff, then the superfluous meters can be removed and the remaining meter reprogrammed.

Metering technicians must consider the following requirements when amalgamating meters:

- The amalgamation needs to be achieved by the pairing of meter loops.
- The customer's installation and supply arrangement to equipment must not be changed by the metering alteration—phase sequence or mains load balancing, for example.
- Meters must not be overloaded beyond their rated capacity and must be matched to the maximum demand.

Note: When installing a TOU tariff with embedded generation, all affected meters **must be amalgamated** to a single meter. For example, a site with a single phase T31 and multi-phase T42 metering must be amalgamated to one three-phase meter. This will ensure all installation consumption is offset by any excess embedded generation.

3.4. Refurbishment Of Metering Equipment

All serviceable Approved metering equipment must be returned to Stores for refurbishment and testing. If the metering equipment is Obsolete or damaged or otherwise unserviceable, it must be disposed of in accordance with Section 3.5. Bins are provided at TasNetworks depots for return of serviceable equipment and the disposal of unserviceable equipment.

3.5. Disposal Of Metering Equipment

To prevent illegal connections, all metering equipment, including seals, service fuses and links, must be disposed of in a manner that renders the equipment unusable, typically by mechanical crushing. Bins are provided at TasNetworks depots to provide suitable disposal of meters. Metering equipment must not be disposed of in general rubbish.

3.6. Meter Identification

All meters are identified by a meter number or part number (PN), which is displayed with its barcode on the meter faceplate and packaging. Take care to use the meter number when recording information and not the manufacturer's serial number (SN), which might also appear on the meter faceplate and packaging (see example below). Barcodes use Code 39 symbology.

Figure 2 Example of meter faceplate showing meter number (PN) and barcode

The meter number prefix (B, C or D) indicates the meter readout type: five, six or seven digits or dials. Prefix A (four dials) meters are no longer used. Any meter with an invalid meter number must be returned to Stores for assessment and renumbering. Valid meter number prefixes are listed in Table 3.

Table 3 Valid meter number prefixes

Prefix	Meter readout type
B	Five dials or digits, i.e. readings 00000 to 99999
C	Six dials or digits, i.e. readings 000000 to 999999
D	Seven dials or digits, i.e. readings 0000000 to 9999999

3.7. Meter Labelling

Labels are affixed to the front of meters, either in the Meter Test Laboratory or in the field, to indicate which tariffs the meter is set up for and, if refurbished, the date the meter was last tested:

- The Meter Test Laboratory affixes yellow labels to the front of meters after they are refurbished to indicate the specific tariff combination that has been programmed in the meter (e.g. 1-RATE, SOLAR IMPORT/EXPORT) and the date the meter was last tested.
- New multisetup meters will be provided directly from the factory without any labels.
- Field personnel affix yellow MULTI SETUP and / or green Solar Import labels to the front of meters where those features have been enabled in the field.

Figure 3 Example of Solar Import labels, shown for a 1 rate program (left) and 2 rate program (right).

When removed from an installation, a label is affixed to the back of the meter, showing:

- If a final meter read is required
- Date removed
- Name of metering technician
- Reason meter was removed.
- If the meter is faulty, what is wrong with it.

4. Metering Installations

4.1. Unmetered Installations

The consumption of energy by unmetered installations, such as public street lights, is estimated by the Tasnetworks billing system from the equipment specifications without the use of a physical meter. Refer to work instruction **Unmetered Supplies** for work on all unmetered installations.

4.2. Direct Connect Metering

4.2.1. Compliance

All direct connect metering work must comply with the technical requirements in this Metering Field Manual and the safety, training and electrical compliance requirements in the Direct Connect Metering Work Procedure.

4.2.2. Embedded Generation Metering

Note. A solar import-export meter does not measure all energy produced by the customer's co-generation unit. Only the net energy that flows into the electricity grid is measured from a single tariff.

Unless otherwise specified, the solar import-export meter must replace or be installed as the primary meter on the installation. There are three possible metering arrangements for the connection of embedded generation:

Table 4 Solar import-export metering arrangements for DC metering

Solar Import on Tariff	Metering Panel		Notes
	Position 1	Position 2	
31 or 22	Two-rate import-export meter for tariffs 31 or 22	None	
41	One-rate meter for tariff 31	One-rate import-export meter for tariff 41 and embedded generation	
Split tariff – 31 and 41 OR 22 and 41	One-rate import-export meter for tariff 22 or 31	one-rate import-export meter for tariff 41	A split embedded generation system must be equipped with two inverters with fixed generation capacity and with two independent meters to avoid meter reading confusion.

The wiring diagram for a solar import-export L&G EM1210 or EDMI MK7A meter is shown in Figure 3.

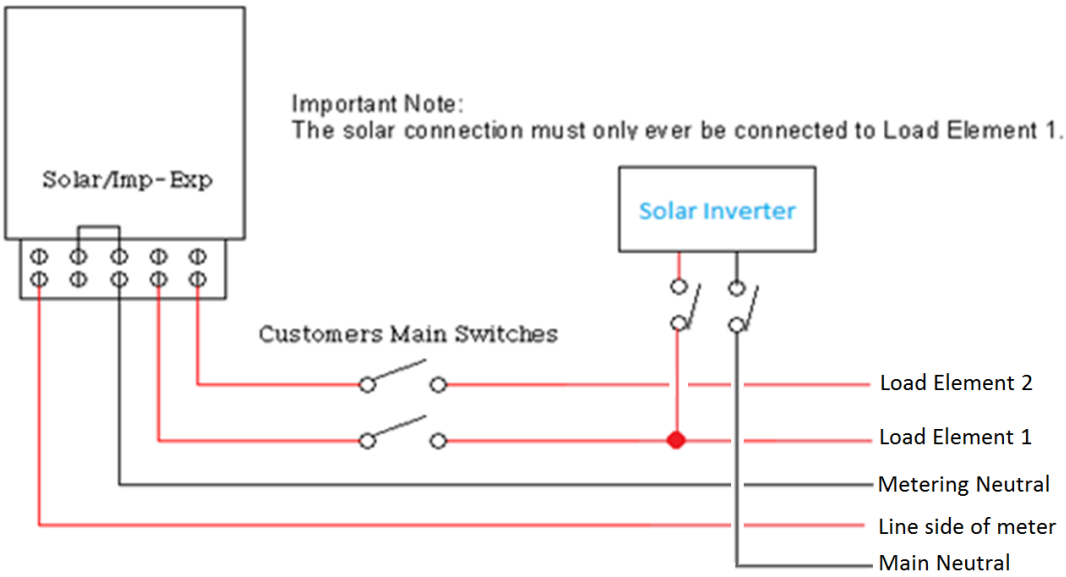


Figure 4 Wiring diagram for solar import-export meter. Note that the connection diagram above is depicting an EM1210 terminal block.

4.3. Low Voltage CT metering

4.3.1. Compliance

All low-voltage CT metering work must comply with the technical requirements in this Metering Field Manual and the safety, training and electrical compliance requirements in the Low Voltage CT Metering Work Procedure.

4.3.2. Meter Connection

4.3.2.1. Approved CTs

The required CT to terminal block and terminal block to meter connections of the currently approved (Warburton Franki) CTs are shown in Tables 5 and 6 and Figures 4 and 5. Note that the CT wiring loom uses all white coloured cores numbered 1 to 6, as shown in Figure 6.

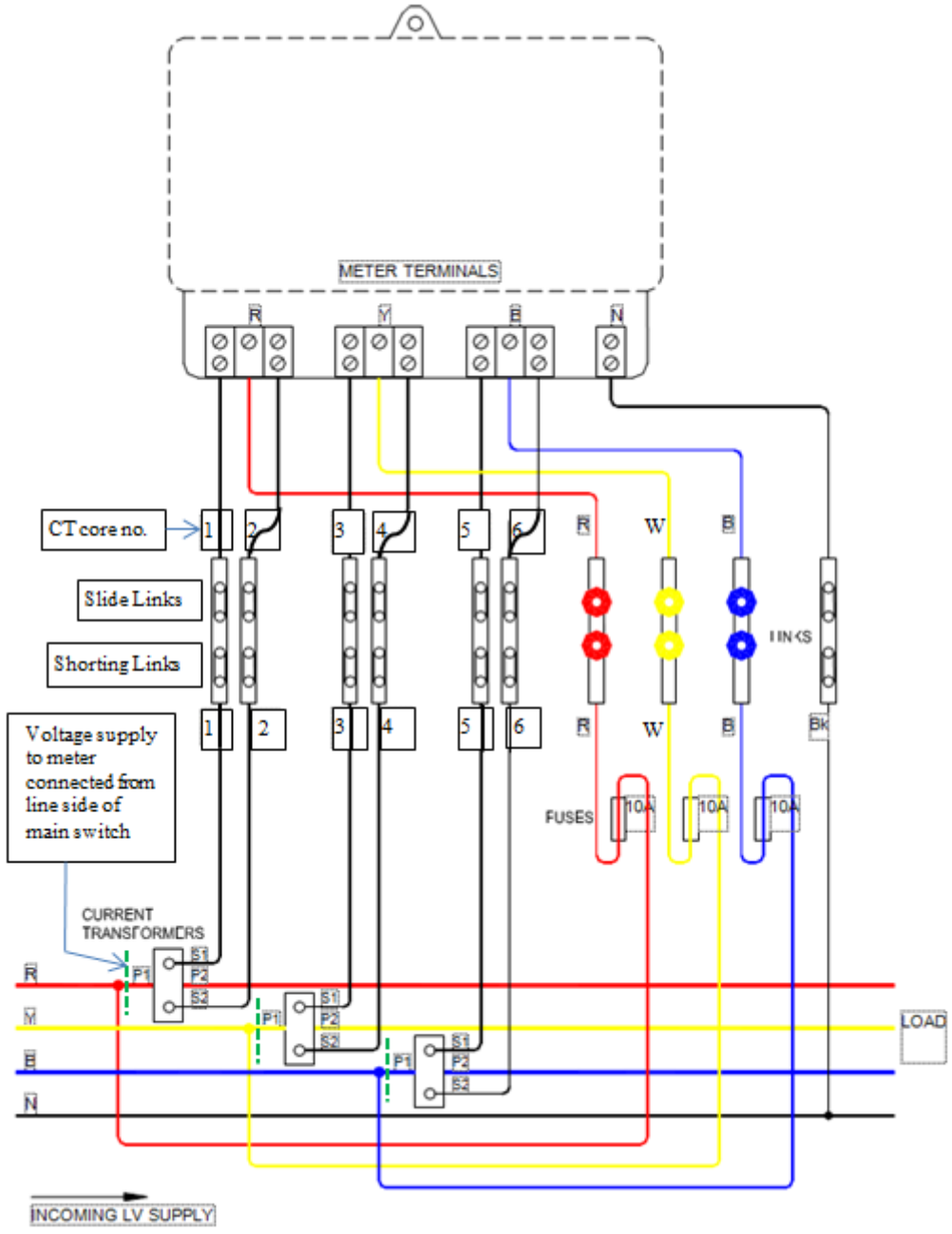


Figure 5 Wiring diagram for low voltage CT metering

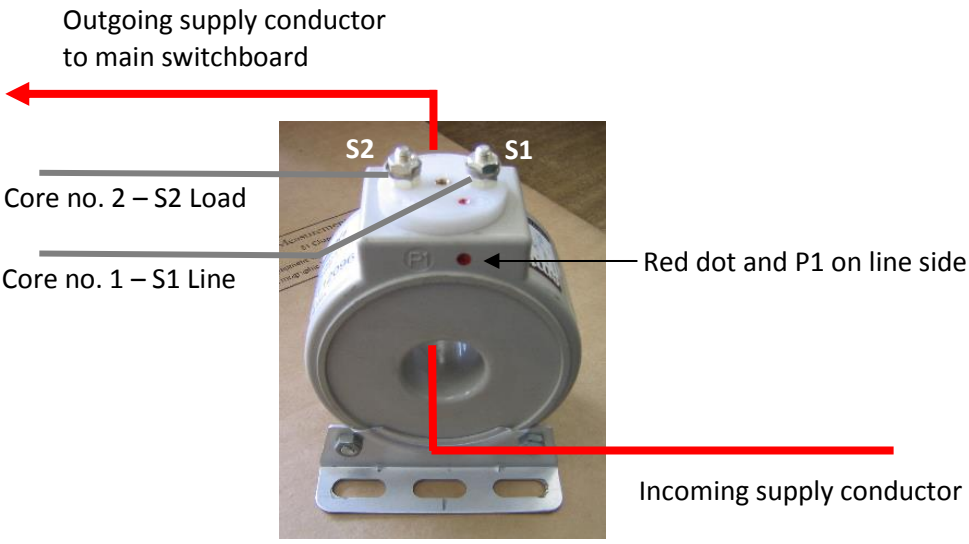


Figure 6 Warburton Franki 200/5 CT on red phase supply conductor

Table 5 CT to terminal block connections

Phase	Core number	CT secondary	Terminal block
Red	1	S1	Bottom-Left Red
	2	S2	Bottom-Right Red
White	3	S1	Bottom-Left White
	4	S2	Bottom-Right White
Blue	5	S1	Bottom-Left Blue
	6	S2	Bottom-Right Blue

Table 6 CT terminal block to meter connections

Phase	Core number	CT secondary	Terminal block
Red	1	Top-Left Red	Red IN
	2	Top-Right Red	Red OUT
White	3	Top-Left White	White IN
	4	Top-Right White	White OUT
Blue	5	Top-Left Blue	Blue IN
	6	Top-Right Blue	Blue OUT

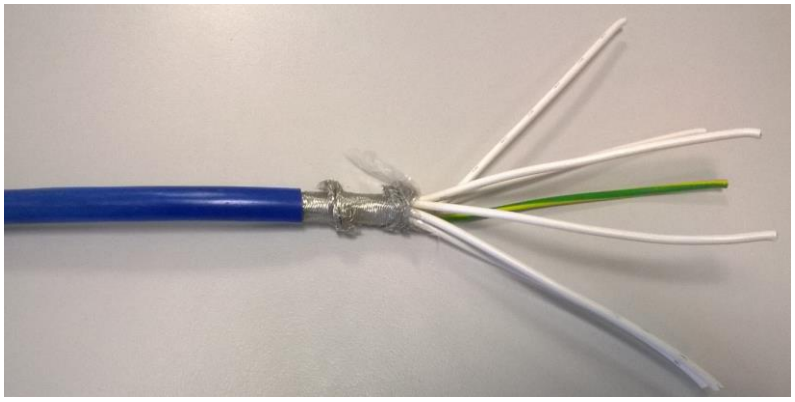


Figure 7 CT wiring loom

When connecting CT cores, ensure polarity (the red dot of the CT) lines up with the direction of the incoming supply load conductor and each CT core conductor is solidly connected to the correct terminals from the CT to the meter terminals.

Important. After connecting the CT cores, each CT circuit must be belled out and checked. For details, refer to the Low Voltage CT Metering Work Procedure.

4.3.2.2. Older CTs

At older existing installations, the model and make of CTs installed and the markings and polarity may be different to the currently approved equipment. For example, for the Nielsen multi-tap 2000/5 CT shown in Figure 7,

- M (main) and red dot indicate line side of transformer. M is equivalent to S1 in Figure 5.
- L indicates load side and equivalent to S2 in Figure 5.
- M1 (2000), M2 (1500), and M3 (1000) only one tap line with grey stripe.
- L to load side with black stripe.

Figure 8 Nielsen 2000/5 Type C CT

4.3.3. CT Commissioning Tests

All CT commissioning tests must be performed any time that a CT or CT-connected meter is installed.

For all new, complete all steps (1 through 8) listed in Table 7 and record the results of these tests on the form F905B. If any test cannot be performed, ensure that this is recorded in form F905B. Use form F905A to record asset management data.

F905B Audit Checklist **Version 2**

CT Installation / Meter Installation / Meter Exchange / Testing / Follow Up Audit

Complete all blue shaded cells

Document Control	Clear Page	Upload to The Zone	
Reason for visit:	Meter Install	**Audit not completed because:**	
Address			
NMI		**Meter Number**	
Checklist Completed By:		**Date**	
HV or LV installation?	LV	**3 or 4 wire metering (HV only)**	

Figure 9 Form F905B

Table 7 CT commissioning test procedure

Step	Detail	Refer to
1. Compliance	Ensure installation complies with metering section of the SIR—in particular, the requirements for transformer connected metering.	Service and Installation Rules
2. Wiring	Trace-out the wiring and check that all CT and voltage wiring is installed correctly	Section 4.3.3.1
3. CT Ratio	To avoid major loss of revenue or overcharging the customer, check that the CT ratio multiplying constant is correct.	
4. Meter	Check the meter has program appropriate for customer tariff	Section 8.3
	Check that no error codes appear on the display and date and time is correct to Eastern Standard Time.	
	Record the CT secondary and voltage values present at the CT terminal block and available to the meter.	Section 4.3.3.2

Step	Detail	Refer to
	If authorised, connect to the meter with a laptop computer and optical probe and check for correct voltage-current phase relationship using metering software.	Refer to Appendix D Phase Checks For EDMI Meters
5. Burden Test	Ensure that the connected burden on the CT circuits is less than the burden rating of the CT.	Section 4.3.3.3
6. Load Rotation Test	If load is available, verify that each phase accumulates energy when individually connected to the meter.	Section 4.3.3.4
7. Label	Affix a CT multiplying constant sticker on the meter with the correct multiplying constant written on it. Affix Solar Import/Export sticker on all LV solar tariff installations.	
8. Connections	To avoid major loss of revenue, check that: • All voltage slide links are closed and tightened. • All CT slide links are opened. • All shorting links have been properly opened (but must not be totally removed).	Section 4.3.2
9. Record	The metering officer that completes the CT metering work and commissioning is responsible for ensuring forms F905A and F905B are filled in and correct. **Note.** If no supply is available during commissioning or there is insufficient load to perform tests, note this on form F905B and fill out as much of the form as possible.	
End		

4.3.3.1. Wiring Trace-out Check

Test	**Wiring Trace-out Check**
Purpose	To verify that the CT and voltage wiring has been installed correctly

Test procedure	Check the following:
	• All connections are secure and tight.
	• Each CT core conductor is connected to the correct terminal.
	• Each CT circuit bells out as complete (i.e. no open circuit is found) from the sending CT secondary connection all the way through the meter and back to the receiving CT secondary connection point.
	• Each voltage conductor for connection to the meter lines up with its corresponding CT circuit and no voltage wires are crossed or terminated in the wrong location to cause phase sequence error. Specifically:
	  ○ Check that red phase voltage is connected to the conductor that passes through the red phase CT window.
	  ○ Trace the red phase voltage conductor from the CT connection to the bottom of the CT voltage test link.
	  ○ Trace the red phase voltage conductor from the top of the CT voltage test link to the red phase voltage terminal connection at the meter.
	  ○ Repeat above steps for the white and blue phases.
	• The neutral is connected correctly to the meter.
	• The metering neutral is properly terminated, at the main switchboard connection point and the meter terminal and the CT voltage test link.
	• In addition to the CT metering circuit, all mains cables and bus bars and associated connections and tee offs must be checked to ensure there is no connection crossover that could cause a problem.

Test equipment	General purpose multimeter
Test sheet	F905B
Applicable to	CTs
Criteria	The test fails if any of the steps identify that non-compliant connections have been made.

4.3.3.2. Secondary Measurements Check

Test	**Meter Check**
Purpose	To record that the voltage and current connections to the meter are correct
Test procedure	1. Tong the CT secondary wiring and record the current on the F905B form 2. Measure the voltage supplied at the CT terminal block and record this on the 905B form 3. Measure the Phase Angle between each current and voltage and record this on

	the 905B form. 4. Verify that the measurements are typical values.
Test equipment	Clamp current meter, AC multimeter
Test sheet	F905B
Applicable to	CTs
Criteria	The test fails if any of the voltage or phase angle measurements are beyond the following limits: **Terminal block voltages:** Greater than 200V and less than 260V phase-neutral (for LV connected systems). Greater than 100V and less than 120V phase-neutral (for HV connected systems) **Phase angles**: Each phase should be no more than 10° leading and 30°lagging for typical loads The test also fails if the secondary current is more or less than would be expected from the connected load (i.e. no current is observed when load is supplied).

4.3.3.3. Burden Test

Test	**Burden Test**
Purpose	To measure the applied burden to a CT or VT secondary circuit. This should be done each time a CT site is inspected or tested. If the burden applied to the instrument transformer is too large, then the metering will under-read the energy measurement and could cause equiment damage. The same steps can be followed to measure the burden of a CT or VT.
Test procedure	Current Transformer Burden Testing
Test equipment	Red Phase 704 CT Circuit Burden Tester, PVC Burden Tester
Test sheet	F905B
Applicable to	CTs
Conditions	The test fails if the measured burden is higher than the rated burden (the CT/VT does not correctly measure energy).

4.3.3.4. Load Rotation Test

Test	**Load Rotation Test**
Purpose	To verify that each phase is correctly connected to the meter. If any of the current or voltage phases have been transposed then this test will identify this issue.
Test procedure	Perform the steps as shown in Table 8. If test cannot be performed in accordance with this procedure, refer to alternative methods in Table 9.
Test equipment	N/A
Test sheet	F905B

Applicable to	CTs
Conditions	The test fails if the direction of energy flow and rate of energy flow does not match with any of the steps outlined in Table 8.

Table 8 Load Rotation Test procedure

Step	Detail
1	Check each CT to make sure it matches up with the correct phase voltage.
2	Check voltage is correct and that the CT secondaries and neutral are not live.
3	Blue phase under load rotation test (refer to Figures 9, 10 and 11): 1. Open white phase voltage link. 2. Open red phase voltage link. 3. Short out white phase CT current link. 4. Short out red phase CT current link. 5. With blue phase voltage and current only applied to the meter: • For an electromechanical meter, the rotor disc should turn in the direction of the arrow. • For an electronic meter, the flashing kW indicator should flash in the correct direction for indicating correct operation. In Q3 and Q4 meters, the kW arrow flashes to the right. Refer to relevant meter OEM manual for more details.
4	White phase under load rotation test: • Repeat step 3, using the same principles for shorting out the red and blue CT links.
5	Red phase under load rotation test: • Repeat step 3, using the same principles for shorting out the blue and white CT links.
6	After completing the load rotation test for red phase (step 5), remove the white phase CT short and apply the white phase voltage so that the red and white phase voltage and currents are applied: • For an electromechanical meter, the rotor disc should turn faster than for one phase load only. • For an electronic meter, the flashing kW indicator should flash faster in the correct direction than for one phase only.
7	Remove the blue phase CT short and apply the blue phase voltage so that all three phase voltages and all three phase currents are applied: • For an electromechanical meter, the rotor disc should turn faster than in the previous step • For an electronic meter, the flashing kW indicator should flash faster in the correct direction than in the previous step
End	Test complete.

Figure 10 Shorting out CTs and opening voltages for red phase load test

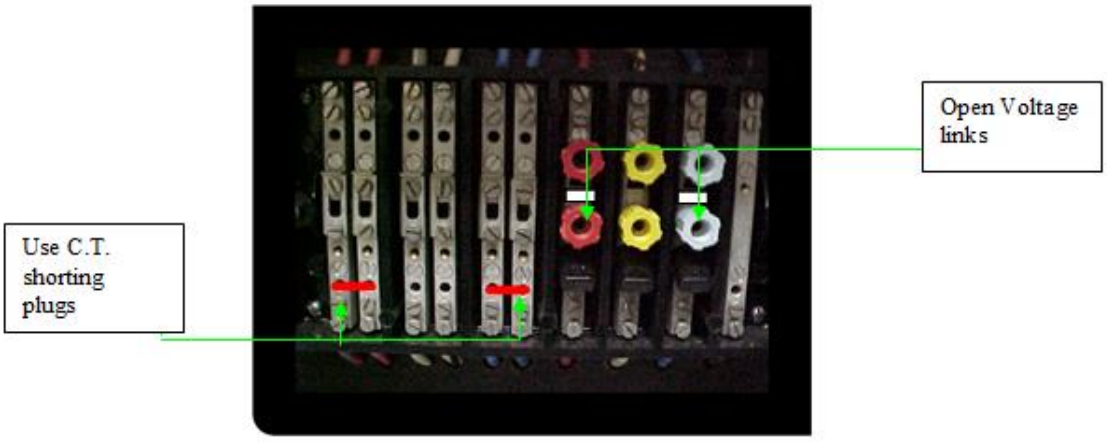


Figure 11 Shorting out CTs and opening voltages for white phase load test

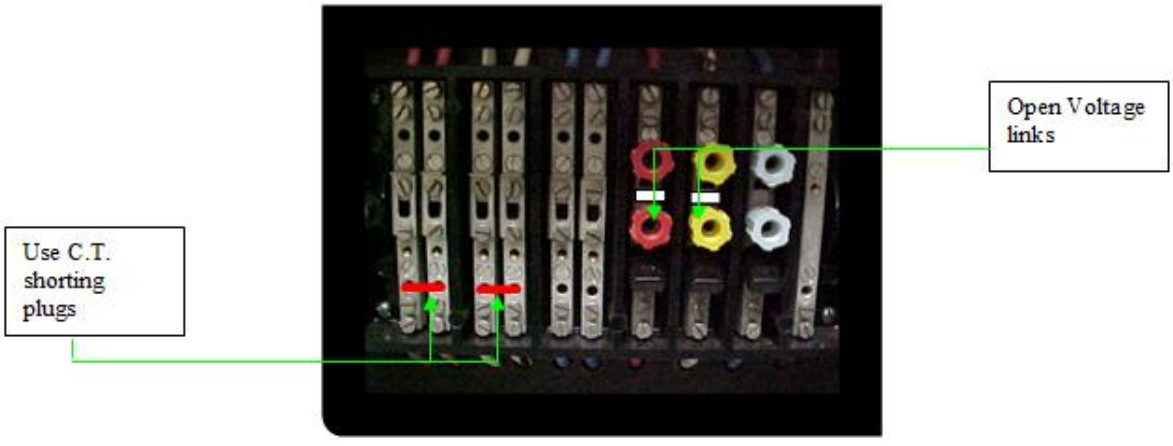


Figure 12 Shorting out CTs and opening voltages for blue phase load test

Table 9 Alternative phase and load rotation check methods

Method	Detail
Use meter interface program	If, the load is too light to do a rotation test or the meter is of an electronic type that cannot be used for a manual load rotation test, use a laptop computer with the appropriate meter interface program to do a phase rotation check as described in: • Appendix D Phase Checks For EDMI Meters, or • Appendix E Phase Checks For L&G meters
Use polyphase meter accuracy test set	Alternatively, use the polyphase meter accuracy test set, if available, to check the input parameters (voltage and current angles) to confirm voltage and current rotation is correct.
Use a temporary meter	If an electronic meter is unsuitable for load rotation test, fit an electro-mechanical meter to perform the test, after test complete refit of electronic meter.
Delay the test	If none of the above are possible, return as soon as possible later on when the supply has been connected to do the load rotation test.

4.4. High Voltage Transformer Connected Metering

High-voltage (HV) transformer connect metering is usually a NEM Type 3 or 4 metering installation. These installations comprise CTs, VTs and meters connected in an arrangement. Often the CTs and VTs are housed in a combination “metering unit”, which can be mounted on a pole or on a plinth.

4.4.1. Responsibility

Typically, HV metering units are owned and maintained by TasNetworks. New installations can be purchased by the customer or paid for by a customer contribution, but, unless otherwise agreed, the ownership of the CTs and VTs is transferred to TasNetworks.

Where TasNetworks is nominated as the Metering Provider for an installation, regardless of ownership of the devices, TasNetworks is responsible for ensuring that all equipment meets the accuracy requirements for the installation class.

4.4.2. Compliance

All HV metering work must comply with the technical requirements in this Metering Field Manual and the safety, training and electrical compliance requirements in High Voltage Transformer Connected Metering Work Procedure.

4.4.3. Installation Types

HV metering units can be aerial bus type, ground-mounted, or pole-mounted.

Pole-mounted **Aerial bus type** **Ground-mounted**

Figure 13 HV metering installation types

4.4.3.1. Aerial Bus Type

A combined CT and VT metering unit is mounted below outdoor buswork in aerial bus metering. The meters are housed in an enclosure at the base of the mounting plinth. Details of the metering unit installation can be found in the work practice Aerial Bus Metering Installation.

4.4.3.2. Ground Mounted

For a ground mounted metering installation, CTs and VTs are housed inside the substation switchgear. The meter is installed in a meter box on an outside wall that is accessible to TasNetworks Technicians.

4.4.3.3. Pole Mounted

For a pole-mounted HV metering unit, the meter box can be installed on the same pole provided it is adequately earthed. Where it is impractical to install a HV metering unit such that the HV phase sequence is in the standard A, B, C configuration, the unit can be installed on the other side of the pole. The phase sequence at the meter panel in the meter box can be swapped to ensure the correct phase sequence is connected to the meter.

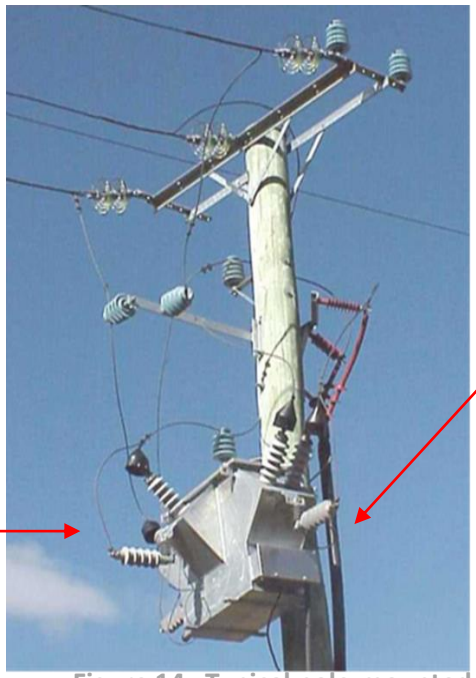


Figure 14 Typical pole-mounted unit

4.4.4. HV Metering Units

HV metering units are combined CT and VT units that can be mounted on a pole or plinth. The status of HV metering units currently in use in the TasNetworks distribution system are listed in Table 10.

Table 10 HV metering unit status

Metering unit	Wiring configuration	CTs	VT secondary	Status
TWS Energy Controls HV metering unit	Three-element	3	Star	Approved
ABB metering unit	Two-element	2	Star	Approved
Baldwin	Two-element	2	Unknown	Obsolete

TWS Energy Controls HV metering unit

TWS Energy Controls HV metering units (6.6 kV, 11 kV or 22 kV) have a fixed CT ratio of 200/5. The wiring diagram is shown in Figure 14. See TWS Energy Controls schematics for full schematics.

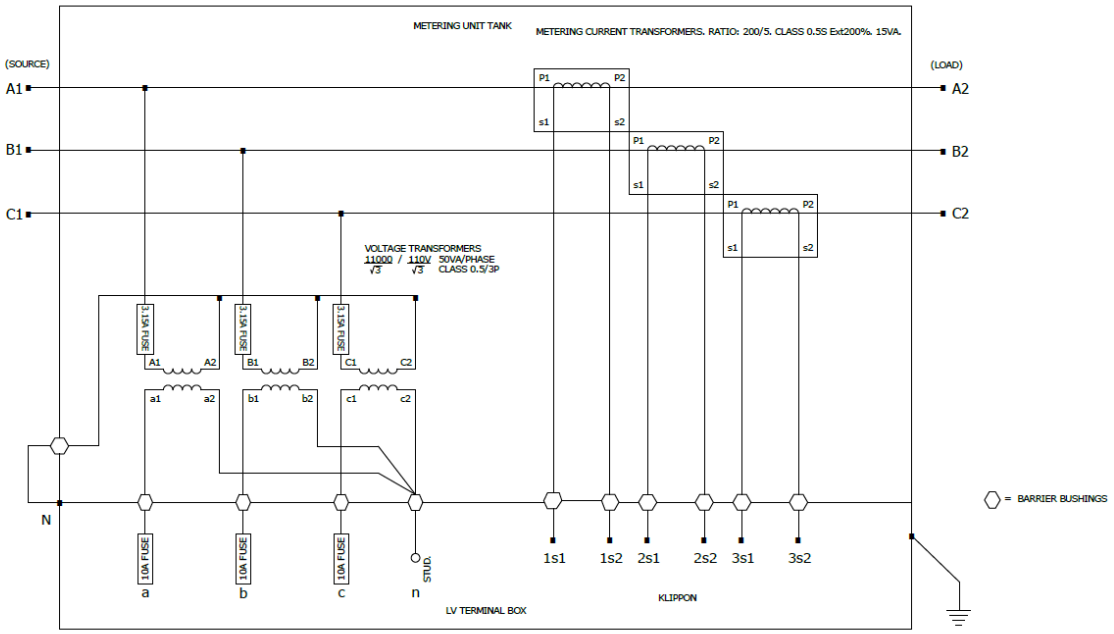


Figure 15 TWS Energy Controls HV metering unit

ABB metering unit

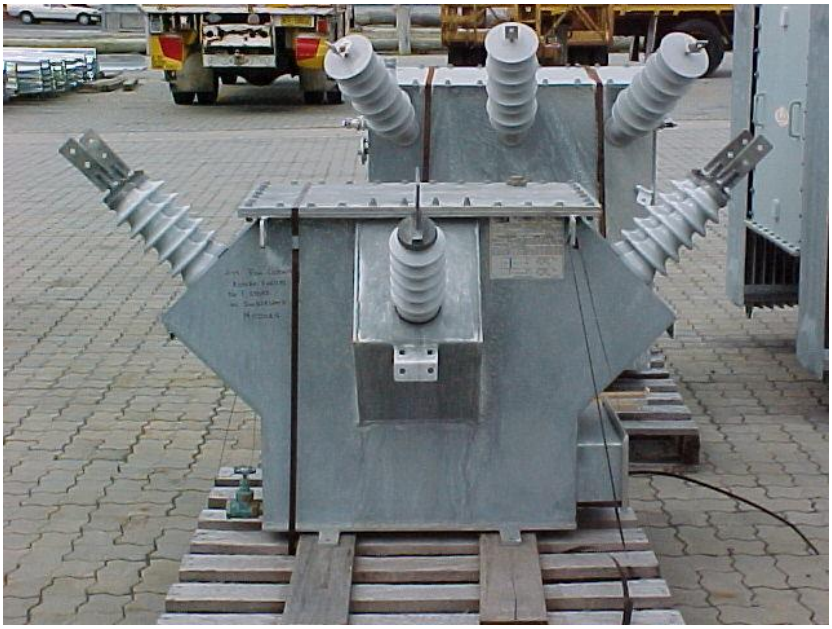


Figure 16 ABB pole-mounted HV metering unit

4.4.4.1. New installations

When installing a HV metering unit, ensure that:

- All secondary voltage conductors (and neutral if star-connected) and CT tappings are brought out to the meter box and labelled accordingly to properly identify them.
- The common return for both the 110 V metering supply and the CTs must be earthed (see Section 4.4.6).
- The HV metering unit is properly earthed (usually done by a Line Work Crew) in accordance with drawing D-OH1-2.3/17 for physical installation of the unit and associated HV and LV earthing arrangement in the **Overhead Line Design & Construction Manual**.

4.4.4.2. Private HV installations

Private HV installations must comply with **AS2067 High Voltage Installations** and be inspected and approved by an Electrical Inspector working on behalf of Building Standards & Occupational Licensing (BSOL).

4.4.5. Wiring Configurations

Existing network installations include both two- and three-element configurations.

- Two element configuration
- Three element configurations

The TasNetworks standard for new installations is three-element metering.

Note. In a three-element configuration, the CTs are contained within a metering unit and the three phases are measured by a single meter and, hence, there are no advantages with using two-element metering.

4.4.5.1. Two element configuration

Note. Two-element configurations are also known as “three-phase three-wire“.

The two-element star VT HV metering arrangement. is shown in Figure 16.

Meter connection

Ensure that for all two-element metering installatons:

- A connection from the white phase voltage terminal must be made to the meter neutral terminal. EDMI recommends that the white phase VT secondary also be connected to the white phase meter input (in addition to the meter neutral), as shown in Figure 17.

CT connection

Ensure that for all two-element metering installatons:

- The white phase CT (if present) is not used and must be shorted out at the CT test link.
- A white phase CT short must still be applied where the white phase CT is not installed.
- Where the white phase CT is not installed, the secondary return terminals of red and blue phase must still be joined and earthed

VT connection

Ensure that for all two-element metering installatons:

- The VT secondary neutral conductor is not connected to the meter.
- The VT secondary neutral conductor must be brought out to the voltage test link so it can be used for testing phase to neutral voltages.
- One VT secondary output terminal must be earthed. Earth the VT secondary neutral if the neutral is available. Earth the white phase VT secondary terminal if the secondary neutral is unavailable.

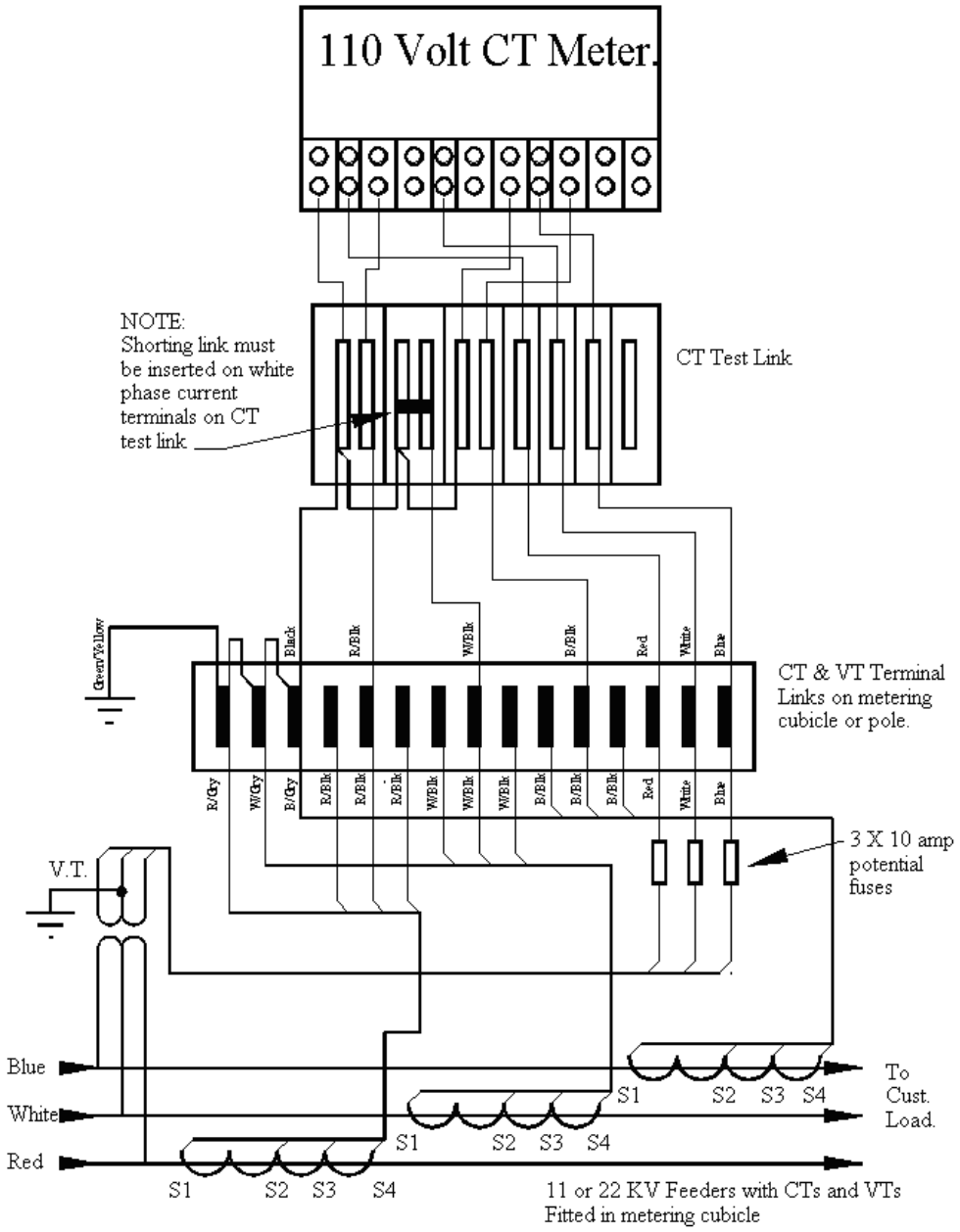


Figure 17 Wiring diagram for two-element star VT with three available CTs

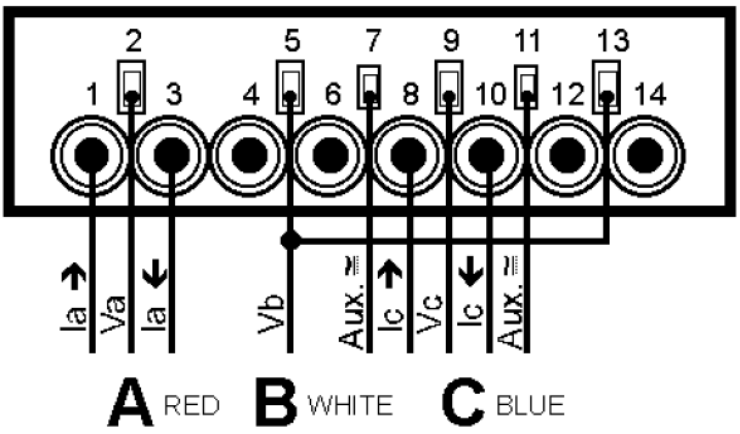


Figure 18 Two-element meter connection

4.4.5.2. Three element configurations

Note. Three-element configurations are also known as “three-phase four-wire“

The standard three-element star VT HV metering configuration is shown in Figure 18. This is same as the low-voltage CT metering configuration described in Section 4.3, except that the secondary phase-to-phase voltage from the VTs is 110 V and phase-to-neutral voltage is 63.5 V (instead of 415 V and 240 V, respectively).

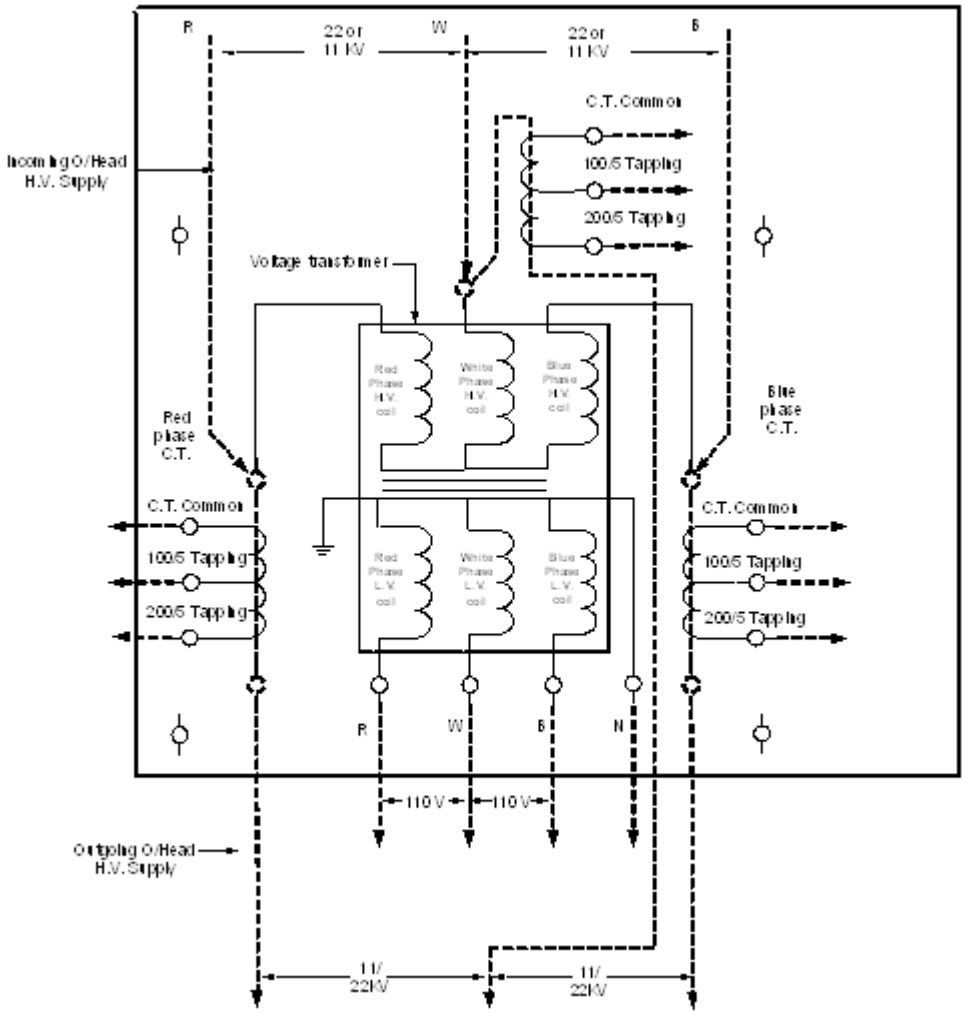


Figure 19 Three element star VT HV metering configuration

4.4.6. Common Return For All CTs

The CT circuits should be starred by joining the load side secondary terminals together at the metering unit and at CT terminal block after the meter. This lowers the burden of the CT circuit as the star points remove the need for return current to flow between the CT star point and the meter star point.

4.4.7. Isolation of CTs

CTs must never be open circuited. Whenever work is performed on a CT meter, CT shorts must be applied to the CT terminal block. Whenever work is performed on the CT secondary wiring, CT shorts must be applied to the CT secondary terminals directly.

Where CT shorting slide-links are unabailable, use the banana leads as shown in Figure 19 and ensure each CT is shorted to the common return conductor.

When work has finished at a site it is important that the CT shorts are removed to avoid loss of revenue. It is also important to note that the white phase CT may be shorted permanently if two-element metering is

used. Note the initial position of shorting links or banana plugs before you commence work, and return the CT terminal block to the arrangement you found it in at the completion of the task.

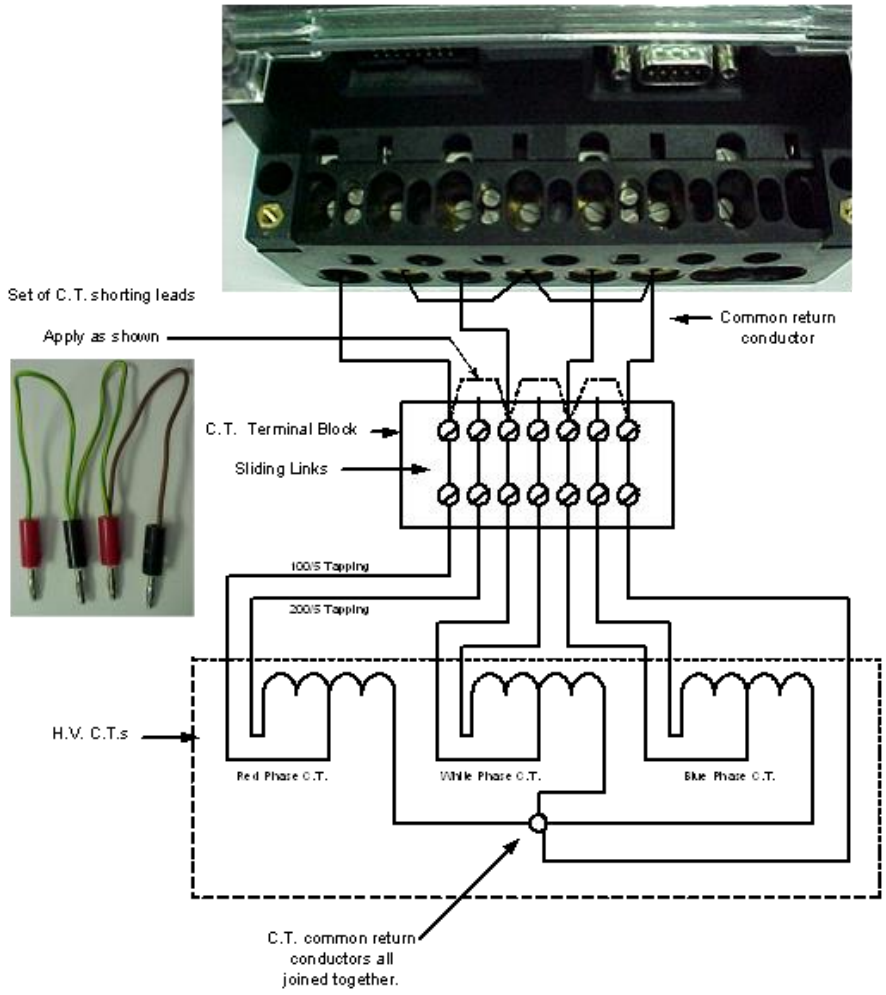


Figure 20 Three element star VT HV metering configuration with common return conductor

4.4.8. Commissioning checks

The tests listed in Table 11 must be followed when commissioning or making changes to a HV metered site, and the results recorded on form F905B.

Table 11 HV metering commissioning checks

Step	Detail	Refer to
1. Compliance	Ensure installation complies with the HV metering section of this document and any relevant design requirements in the SIR.	Service and Installation Rules Overhead Design and Construction Manual
2. Wiring	Trace-out the wiring and check that all CT and VT wiring is installed correctly.	Tables 12 and 13

Step	Detail	Refer to
3. CT and VT ratios	To avoid major loss of revenue or overcharging the customer, check that the CT and VT ratios are correct.	
4. Meter	Check the meter has program appropriate for customer tariff	Section 8.3
	Check that no error codes appear on the display and date and time is correct to Eastern Standard Time.	
	Record the CT secondary and voltage values present at the CT terminal block and available to the meter.	Section 4.3.3.2
	If authorised, connect to the meter with a laptop computer and optical probe and check for correct voltage-current phase relationship using metering software.	Refer Appendix D Phase Checks For EDMI Meters
5. Burden Test	Ensure that the connected burden on the CT and VT circuits are less than the burden rating of the CT or VT.	Section 4.3.3.3
6. Load Rotation Test	If load is available, verify that each phase accumulates energy when individually connected to the meter.	Section 4.3.3.4
7. Connections	To avoid major loss of revenue, check that: • All voltage slide links are closed and tightened. • All CT slide links are opened. • All shorting links have been properly opened (but must not be totally removed).	Section 4.3.2
8. Record	The metering officer that completes the HV metering work and commissioning is responsible for ensuring forms F905A and F905B are filled in and correct. **Note.** If no supply is available during commissioning or there is insufficient load to perform tests, note this on form F905B and fill out as much of the form as possible.	
End		

4.4.9. Tracing And Checking HV Metering Wiring

4.4.9.1. New HV Metering Installation

As part of the commissioning checks in Section 4.4.8, perform the steps listed in Tables 12 (check out unit) and 13 (trace out wiring) when installing a new HV metering unit. Where possible, perform these tasks before the unit is installed. If the unit is already installed, it must be checked before the HV supply is connected.

Important. Once the HV supply is connected, it is very difficult to have it disconnected, so ensure all checks are performed before connection.

Table 12 Checking out a new HV metering unit

Step	Detail
1	Remove the terminal plates and identify: • Incoming and outgoing HV supply connection terminals • Incoming and outgoing HV primary current coil terminals • Terminal connections for the secondary voltages and currents
2	All terminal connections should be numbered to match those detailed on the wiring diagram, which usually appears on the name plate or under the terminal plate. Figure 20 shows the numbered HV supply connections for the incoming (A2P1) and outgoing (AP2) HV red phase supply conductor and matching numbers on the wiring diagram.
3	Take a picture or draft a sketch of the wiring diagram and the terminal connections. This provides a useful reference after the unit is installed.
4	Confirm the wiring arrangement matches one of those listed in the above HV Metering Wiring Configurations. The above example in Fig. 3. is a two element CT and three phase four wire secondary output voltage wiring arrangement.

Table 13 Tracing out the HV metering wiring

Step	Detail
1	Check all connection terminals at the HV metering unit to ensure: • The outgoing CT common for the red phase is a numbered black colour cable connected to the correct terminal. Do the same for the blue phase CT connection. • Each CT tapping terminal has an outgoing red and black tracer cable connected to it and correctly numbered. • All the 110 V phase voltages are connected to the correct terminal and numbered. • If a neutral terminal is present, a neutral cable is connected and brought down to the metering position and terminated at the CT test link.
2	With an appropriate continuity tester, bell out each CT cable from the HV metering unit to the termination link. Check the numbering of each CT cable is correct and confirms what has been belled out.

Step	Detail
3	At the CT termination link, ensure each CT tapping cable is appropriately marked to indicate the correct ratio e.g. 200/5. Also, ensure the common return conductor is clearly marked.
4	Bell out each CT cable from the CT termination link to the CT/VT test link. Also, ensure each CT cable is marked to match the corresponding cable from the HV metering unit.
5	Bell out each CT cable from the top of the CT test link to the meter terminal connection.
6	To avoid any crossovers, check that the common CT cable is connected to the top-left and bottom-left terminals of the CT test link and that the CT tapping cable is connected to the right side of the CT.
7	At the meter, with the CT cables disconnected, bell out the meter CT terminals to ensure there is a CT circuit through the meter. Then connect the continuity tester to the red phase CT common cable and the CT tapping cable to check for full circuit continuity from the meter terminal through the CT and back to the meter terminal. Do the same for the blue phase CT. The resistance readings for each circuit should be low and equal. If so, the tracing is correct.
8	Check that the CT links are closed for the red and blue phase CT circuits and the white phase CT circuit is shorted out at the test link.
9	Use the same procedure as above for checking, marking and belling out the red, white and blue phase voltages to the meter terminal.
10	Finally, check that all terminal connections are secure (do a tug test at each connection) and check over once again for correct wire markings and CT ratio connections.

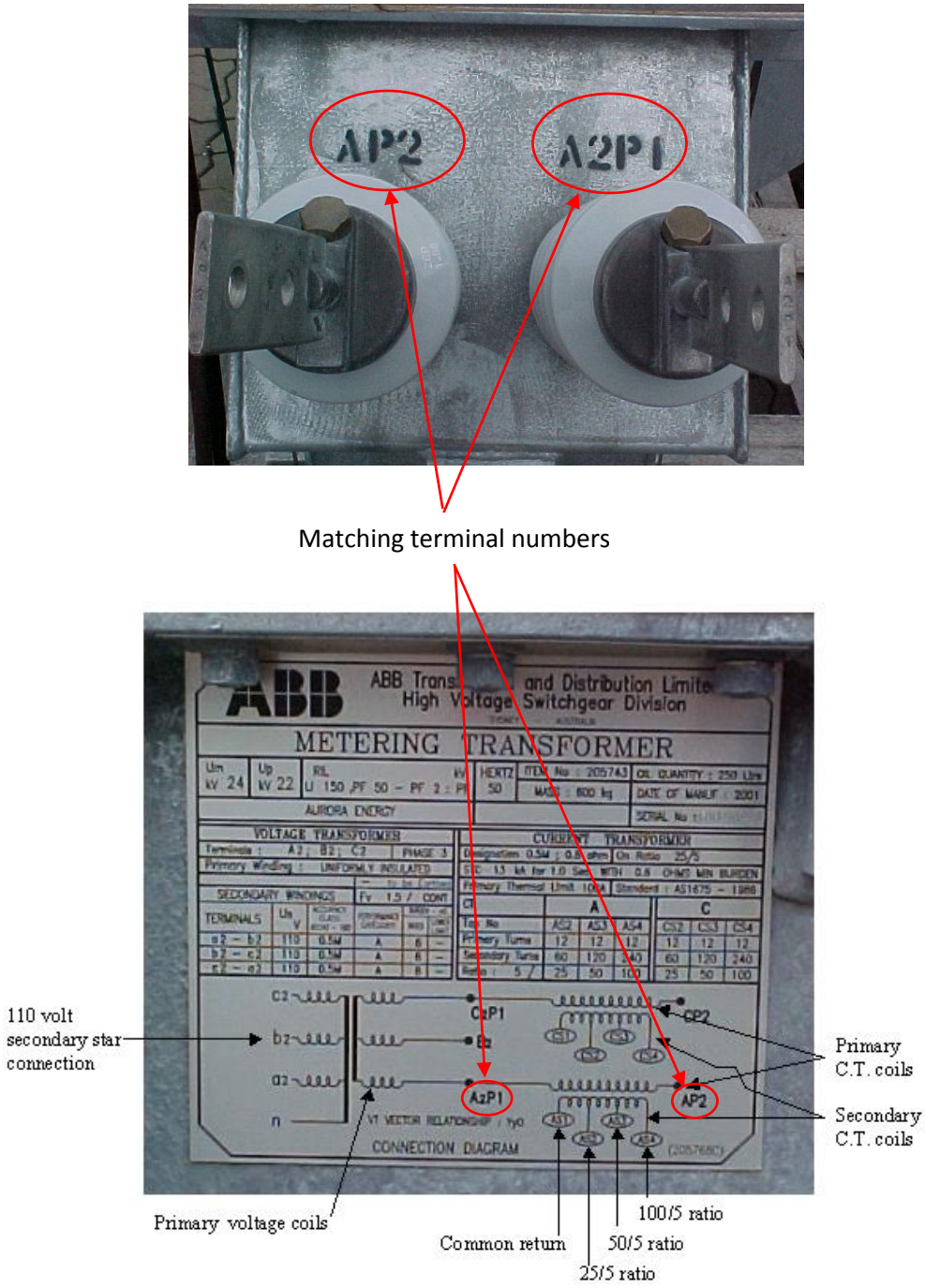


Figure 21 Terminals and wiring diagram showing matching numbers of an ABB metering unit

4.4.9.2. Existing HV metering installation

As part of the commissioning checks in Section 4.4.8, follow the steps in Table 14 if the supply is connected and an alteration is required to an existing HV metering installation, such as changing the meter or changing to a higher CT tap level.

Table 14 Checking an existing HV metering installation

Step	Detail
1	Record all meter readings and log all actions taken in the comments of form F905A.
2	From a revenue protection point of view, the following checks must be performed before starting any metering work: • Check the phasor diagram of the existing installation – refer to section 4.4.9.1 • Measure the voltages at the meter terminals between phases and to earth – refer to diagrams in Section 4.4.4. • Do a visual check of the wiring arrangement and the wiring connections – refer to 4.4.9.3
3	If a possible problem with the existing metering is indicated in step 2, do not proceed with any metering work. Instead, contact mp@tasnetworks.com.au to discuss the possible ramifications on possible loss of revenue or overcharging and the course of action to take from there on.

4.4.9.3. Phasor Diagrams

The phasor diagram can be viewed by connecting a field tablet or laptop to an electronic meter.

For details on how to connect to each meter type, Refer to Appendix D - **Phase Checks For EDMI Meters** or Appendix E - **Phase Checks For L&G meters.**

Three-element phasor diagrams

Figure 22 Three-element phasor diagramTwo-element phasor diagrams

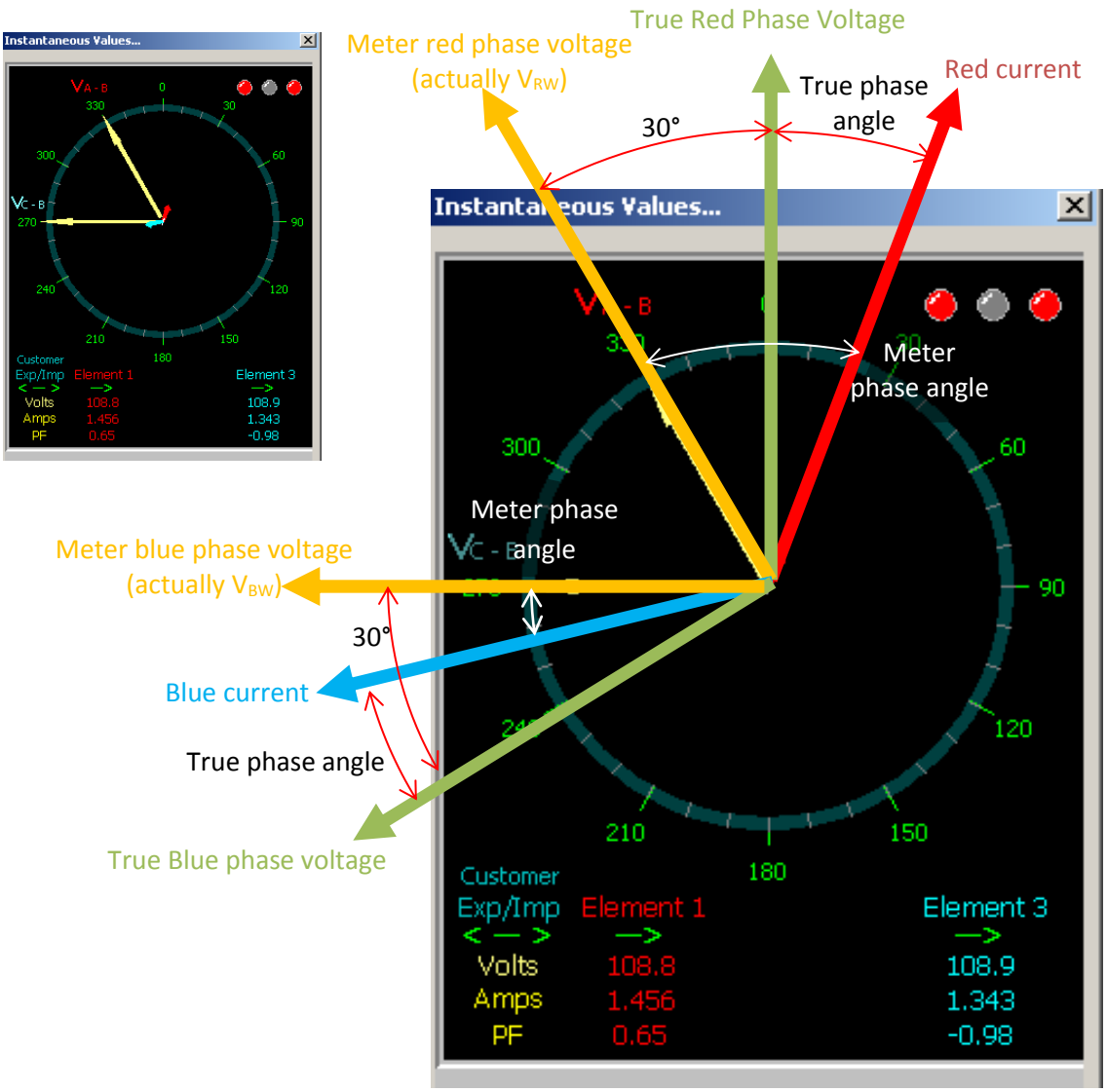


Figure 23 Two-element phasor diagram

4.5. Wholesale Metering

Wholesale metering is connected at the boundary of TasNetworks Transmission Network. Wholesale meters are all HV connected, and typically meter the secondary side of supply transformers.

4.5.1. Drawings

Drawings for wholesale sites can be found in TasNetworks' drawing management system - SCOPE.

4.5.2. Communications Equipment

If more than one meter is installed, daisy chain the meters to be remote read through a single phone line or mobile phone. When the communications equipment required has been determined, to avoid delay, obtain the equipment as early as possible so that it can be bench tested before installing the equipment on site.

4.5.3. Split Core CTs

The use of split core CTs makes it easy to retrofit NEM-compliant metering to existing HV cables. Figure 24 shows a split core CT used in Transend Wholesale metering installations throughout the state.

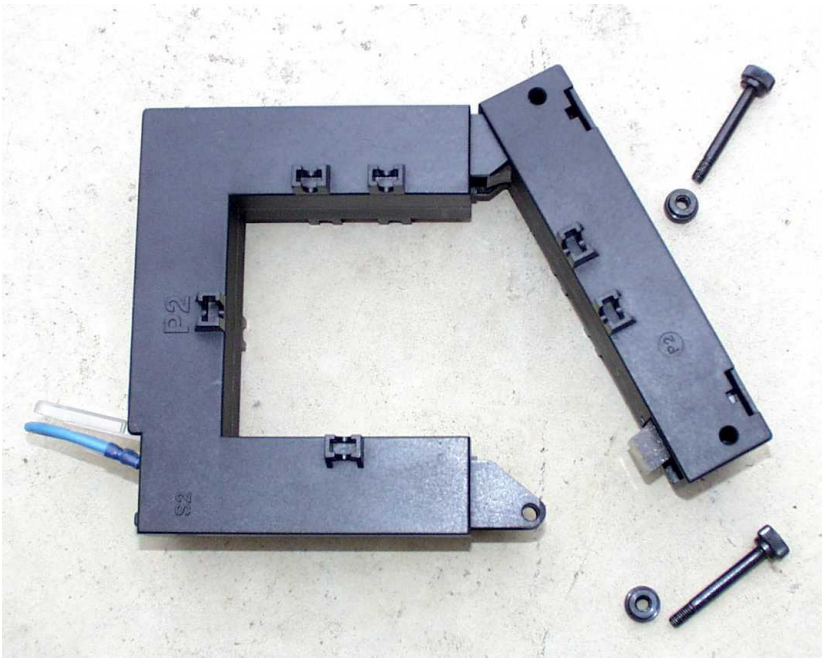


Figure 24 Crompton split core CT, showing the magnetic circuit open

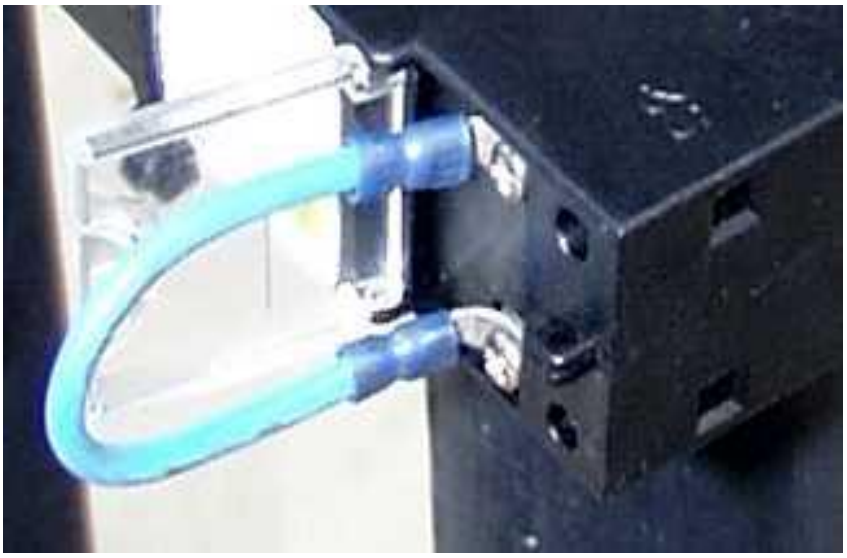
The Crompton split core CT shown in Figure 24 has an 80 x 80 mm opening through which the HV cable must pass. Larger sizes are available; however, this size fits most transformer cables used in Tasmania. The magnetic circuit can be opened by removing two small bolts and easing the keeper away from the remainder of the core. In this way, split core CTs can be fitted to HV cables without the need to interrupt the current in the circuit.

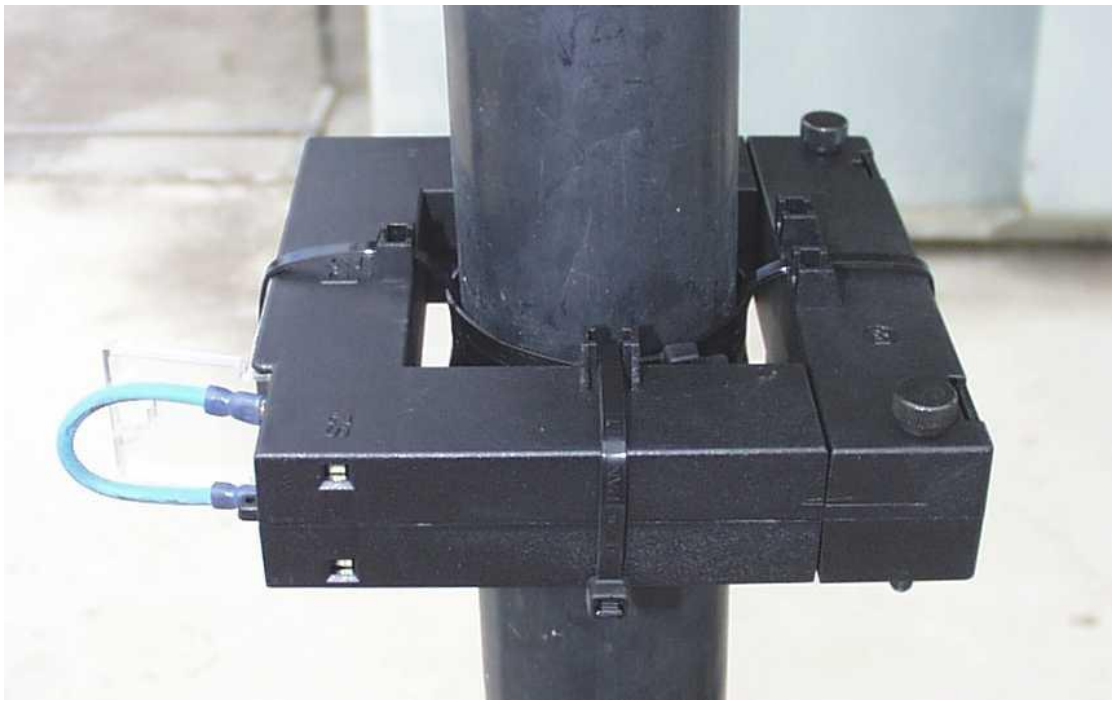
Fitting a split core CT to a HV cable

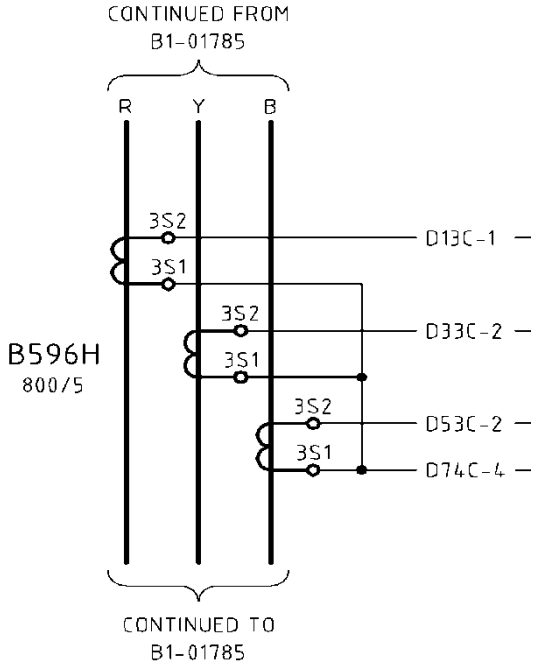
To fit a split core CT to a HV cable, perform the steps listed in Table 15. Although mounting screws and brackets are supplied with each Crompton CT, these are generally not used when the CT is mounted on a HV cable. Instead, a method of mounting has been devised using cable ties: one cable tie ensures that the CT is centred on the cable regardless of its orientation.

Table 15 Tracing out the HV metering wiring

Step	Detail
1	Select the location on the cable where the CT is to be mounted. This will usually be below the HV switchgear cable termination cubicle. Ensure that the cable is clean and free of pitch that may have leaked from the cable termination above.
2	Fit eight cable ties to the cable as shown in Figure 25. Make sure that the vertical ties are facing outwards, and that they are placed at 90-degree intervals round the cable. Check also that the ends of the horizontal ties lie together and in between two of the vertical ties. This will ensure that they do not interfere with the CT plastic enclosure.  Figure 25 Cable tie arrangement for mounting split core CTs
3	As shown in Figure 26, fit a shorting link to the screw terminals under the CT cover plate. This will carry the secondary current until the CT cable can be fitted.

Step	Detail
	 Figure 26 Temporary CT shorting link
4	Offer up the open CT to the cable and choose an orientation that will facilitate access to the secondary terminals later. Be careful to get the primary polarity correct (P1, P2). In all wholesale installations, P1 faces the transformer and P2 faces the switchgear. Fit the keeper pole and replace the securing bolts. It is very important to replace the keeper pole the right way round. Both parts of the core are labelled with the primary polarity. Check that the pole faces are clean and avoid touching them wherever possible. Fit the CT to the cable as shown in Figure 27 by fastening each vertical tie around one side of the CT core. Do not fully tighten the ties at this stage. When all are in place, progressively secure each one so that the CT remains centred on the cable. Trim off the tails. Check that the securing bolts are tight.

Step	Detail
	 Figure 27 Cable-mounted split core CT
5	If each phase is supplied by one HV cable, then only one CT is required and the CT secondary cable can be connected to the main terminals S1 and S2. This cable can be run directly to the metering panel. If, however, there are two or more cables per phase, then each requires a CT to be fitted as described above. In this case, a termination box is fitted somewhere near the CTs in which the secondary connections of each CT can be paralleled, as shown in Figure 28.  Figure 28 CT termination box with three CTs connected in parallel In either case, it is important to connect the S1 terminal of all CTs together to form a star point, as

Step	Detail
	shown in Figure 29. This will significantly reduce the route length and hence the CT burden.  Figure 29 CT termination wiring with one CT per phase
6	Once the CT cable has been terminated at the test block within the meter panel and the test terminals have been short-circuited, the temporary links can be removed from the CT. The cover plate can then be sealed in place.

5. Meter selection

When selecting a meter for a new installation or replacement of an existing meter ensure that:

- the metering equipment is correctly sized to the load,
- the status of the meter is Approved,
- the accuracy class of the meter meets or exceeds the accuracy requirement of the metering installation, and
- the meter is correctly programmed for the installation type and tariff(s) required.

Meters containing a fixed program (non FIP meters) must be ordered from the Meter Test Laboratory (MTL) with a program suitable for the tariff. The stickers affixed to the face of the meter will identify its set program. If FIP is available, then the program required for a specific tariff will be set upon installation.

The meters available for selection for each metering installation type are summarised in Table 16 and described in the following sections. For descriptions of each meter, refer to Section 6.

Table 16 Meters available for each installation type

Meter type	Installation type					Notes
	Single-phase DC	PAYG	Polyphase DC	Low-voltage CT	High-voltage CT/VT	
EDMI MK7A	●	●				
L&G EM1210	●	●				"Blue rectangle" required for PAYG
Actaris Payguard		●				With single-phase DC meter
EDMI MK10			●	●		
EDMI MK10A			●	●		
EDMI MK10D			●			
EDMI MK10E				●		
EDMI MK6			●	●	●	
EDMI MK6E				●	●	
EDMI MK3				●	●	
L&G EM3030			●			
L&G EM3050				●		
L&G EM3330			●			

Meter type	Installation type					Notes
L&G Q3			●	●		
L&G Q4			●	●		
L&G Q4A			●			
Siemens D22CML				●		

5.1. Single-Phase DC Meter Selection

Meters available for single-phase DC metering are listed in Table 17. For details of each meter, refer to Section 6.

A single-phase meter is normally used in a two-wire installation, between TasNetwork's isolation breaker and the active conductors tariff 'load ends' . Single-phase meters are normally provided for installations up to 100 amps. Single-phase meters are electronic with either single or multiple registers depending on tariff requirements.

The accuracy of a basic meter without a modem must be Class 2S or lower (Class 1S). A remote read type 4 meter (COMMS 4) must be Class 1S.

Table 17 Single-phase DC meter selection

Meter	Status	Accuracy class	Wiring diagrams	Import / export capable	FIP Programming Status
EDMI MK7A	Approved	1S or 2S	Mk7A wiring Solar Export To Grid	Yes	Yes
EDMI MK7A with Payguard	Approved	1S or 2S	Payguard wiring	Yes	Yes
L&G EM1200	Approved	1S	EM1210 wiring Solar Export To Grid	Yes	No

5.2. Polyphase DC Meter Selection

Meters available for polyphase DC metering are listed in Table 18. For details of each meter, refer to Section 6.

Three-phase meters are normally provided for installations up to 100 amps per phase. Polyphase DC meters are electronic with either single or multiple registers depending on tariff requirements.

The accuracy of a basic meter without a modem must be Class 2S or lower (Class 1S). A remote read type 4 meter (COMMS 4) must be Class 1S.

Table 18 Polyphase DC meter selection

Manufacturer	Model	Status	Accuracy class	Import / export capable	FIP Status
EDMI	MK10	Approved	1S or 2S	Yes	No
EDMI	MK10A	Approved	1S or 2S	Yes	No
EDMI	MK10D	Approved	1S or 2S	Yes	Yes
EDMI	MK6	Approved	0.2S or 0.5S	Yes	No
L&G	EM3030	Approved	1S	No	No
L&G	EM3330	Approved	1S	Yes	No
L&G	Q3	Approved	1S	No	No
L&G	Q4	Approved	1S	No	No
L&G	Q4A	Approved	1S	Yes	No

5.3. Low Voltage CT Connected Meter Selection

Meters available for low-voltage CT connected metering are listed in Table 19. For details of each meter, refer to Section 6.

Current transformer-connected (CT) metering is used where the load is greater than 100 amps per phase. A multiplication factor reflecting the CT ratio is applied to the meter reading to obtain the quantity of energy used. Low-voltage CT connected meters are electronic with either single or multiple registers depending on tariff requirements.

The accuracy of a basic meter without a modem must be Class 2S or lower (1S or 0.5S for e.g.). A remote read type 3 (COMMS 3) or type 4 meter (COMMS 4) must be Class 1S or lower.

Table 19 Low voltage CT meter selection

Manufacturer	Model	Status	Accuracy class	Import / export capable	FIP Status
EDMI	MK10	Approved	1S or 2S	Yes	no
EDMI	MK10A	Approved	1S or 2S	Yes	no
EDMI	MK10E	Approved	0.5S or 1S	Yes	Yes
EDMI	MK6	Approved	0.2S or 0.5S	Yes	no
EDMI	MK6E	Approved	0.2S or 0.5S	Yes	no
EDMI	MK3	Approved	0.2S or 0.5S	Yes	no
L&G	EM3050	Approved	1S	No	no

Manufacturer	Model	Status	Accuracy class	Import / export capable	FIP Status
L&G	Q3	Approved	0.5S	No	no
L&G	Q4	Approved	0.5S	No	no
Siemens	D22CML	Approved	unknown	unknown	no

5.4. High Voltage Transformer Connect Meter Selection

Meters available for high-voltage transformer connect metering are listed in Table 20. For details of each meter, refer to Section 6.

For all HV installations, an overall error calculation must be performed to determine if the error is below the requirements of NER section 7.2.3. In general, the accuracy of a remote read type 3 (COMMS 3) meter must be Class 1S or lower, remote read type 2 (COMMS 4) meter must be Class 0.5S or lower, and remote read type 1 (COMMS 1) meter must be Class 0.2S or lower.

Table 20 High voltage transformer connected meter selection

Manufacturer	Model	Status	Accuracy class
EDMI	MK6	Approved	0.2S or 0.5S
EDMI	MK6E	Approved	0.2S or 0.5S
EDMI	MK3	Approved	0.2S or 0.5S

5.4.1. Two Element Metering Requirements

For a two-element HV installation, Line and Load Terminal B is not connected.

5.4.2. Wholesale Metering Requirements

EDMI MK6 and MK3 meters are used on wholesale metering points. All wholesale metering must be approved by the Network Metering Manager and must comply with **Transend Metering Specification TNM-GS-809-0024**.

5.4.3. Check Metering Requirements

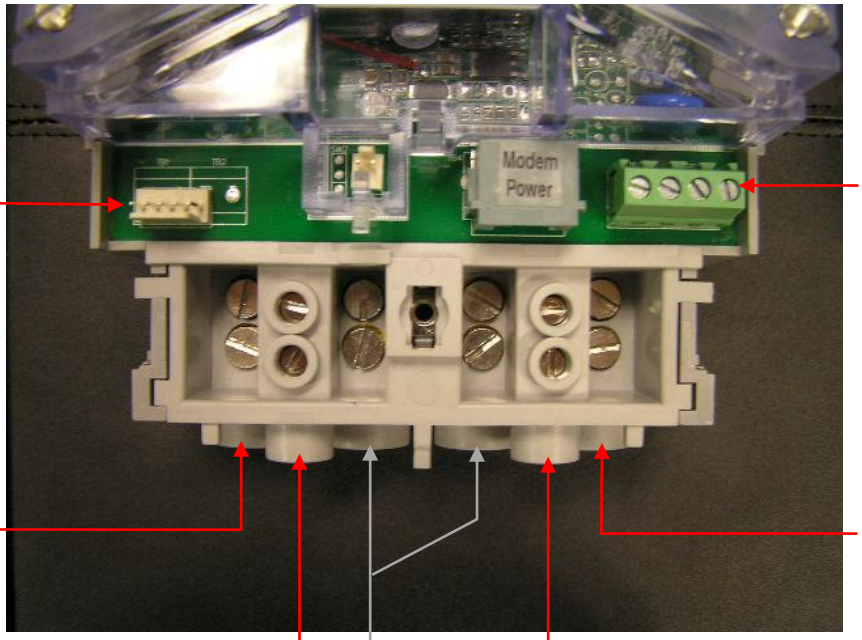
Refer to NER, Section 7.2.4 for check metering requirements for high voltage transformer connect metering.

6. Meter Descriptions

6.1. EDMI MK7A

Meter	**EDMI MK7A**
Status	Approved
Metering installation	Single-phase DC
Programmable	Multi-setup
Remote read	Modem compatible; modem and comms program setup required
Tariffs	Any
Solar import-export	Yes
Manuals	EDMI MK7A Reference Manual
Notes	
	

Terminals



TB1 Plug for relay control (Used for PAYG only)

Pulse Output Terminals (for PAYG only)

Terminal 1 Line Side Active Supply Conductor from the bottom of the isolation switch

Terminal 4 Load side Element 1

Terminal 6 Load side Element 2

Terminal 5 not used
Note: This terminal is never to be used

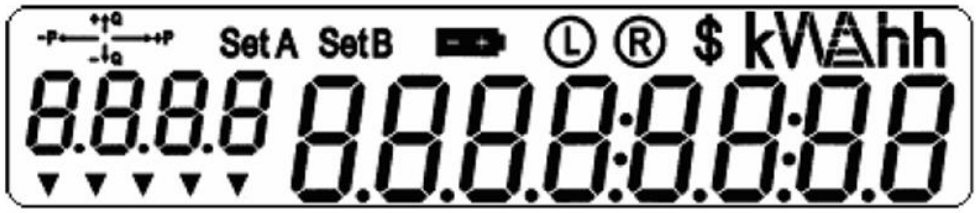
Terminals 2 & 3 Neutral
Note: All redundant neutrals are to be removed

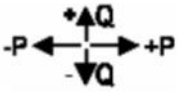
Connection of load terminals

Tariff	Terminal	Element	Connect to	Contactor status
1 Rate (e.g. for Tas93)	4	1	TAS 22 / 31 / 93 tariff main switch	Always closed
	6	2	Do not connect	Always open
1 Rate + TAS 41	4	1	TAS 22/31 tariff main switch	Always closed
	6	2	TAS 41 tariff main switch	Always closed
1 Rate +TAS 61/63	4	1	TAS 22/31 tariff main switch	Always closed
	6	2	TAS 61/63 tariff main switch	Controlled
TAS 61/63 Only	4	1	TAS 61/63 tariff main switch	Controlled
	6	2	Do not connect	Always open

For times that the controlled elements operate, see **Network Tariff Application and Price Guide** (http://www.tasnetworks.com.au/our-network/network-revenue-pricing/distribution-fees-and-tariffs).

Display



	The four arrows with characters and plus/minus sign at the top left display the direction of Watts and vars respectively. A plus sign indicates positive/export/delivered energy, while a minus sign indicates negative/import/received energy[3].
	Low Battery indicator. Please refer to the section on the battery earlier this chapter.
	L shows local communication or login on the local port. R shows remote communication or login on the modem port. The R will flash if the meter is connected to the GPRS network in persistent mode.
	k is the multiplier for kilo.
	These segments allow for display of units. The units are W, var, VA, Wh, varh, VAh, V and A.
	Currency indicator.
	Display set as explained in the Section LCD/Select Button above.
	4 seven-segment characters. There can be a maximum of 4 characters to describe the value shown in the 8 seven-segment on the right side of the LCD. The size of this seven-segment character is 3 mm x 6 mm.
	8 characters of seven-segment displays register contents as setup in LCD setup. Please refer to Chapter 6 for LCD Display. The size of this seven-segment character is 4 mm x 10 mm.

Registers

Set A is the default register display. These registers can be stepped through by pressing the clear button above the optical port.

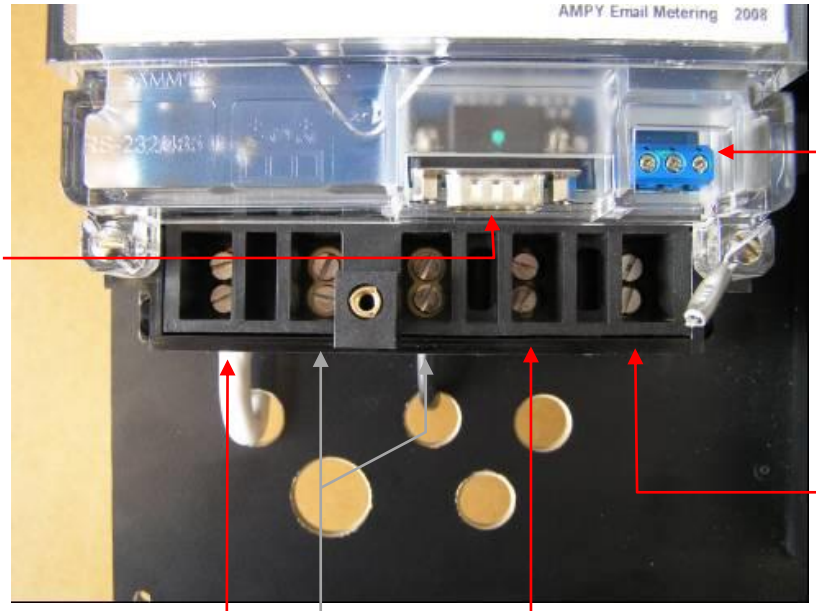
Set B is the alternate register display. To access this mode, hold in the clear button above the optical port for 3 seconds. These registers can be stepped through by pressing the same clear button.

Set A	Set B
10 – kWh – element 1	06 – kWh total (both elements)
15 – Date	04 – kWh element 1
20 – kWh – element 2 (not in “T61/T63 Only“)	05 – kWh element 2 (if applicable)
55 – Time	07 – kWh element 1 & 2 rate A
88 –Test	08 – kWh element 1 & 2 rate C
90 – Programmed tariffs	01 – Present Voltage
	SIG – Modem signal strength
	PID – Meter program identifier

6.2. L&G EM1210

Meter	**Landis & Gyr EM1210**
Status	Approved
Metering installation	Single-phase DC
Programmable	Requires optical pickup and tablet with EmpWin meter interface program
Remote read	No
Tariffs	Any
Solar import-export	Yes
Manuals	EM1200 Manual
Notes	Maximum off-peak switchable load is 63 amps
	

Terminals



RS232 connection for PAYG relay board

Pulse Output Terminals (for PAYG only)

Load side Element 2 Terminal L1 Controlled by S1

Line side Terminal From bottom of the metering isolation switch.

Neutral Terminals Note: All redundant neutrals are to be removed

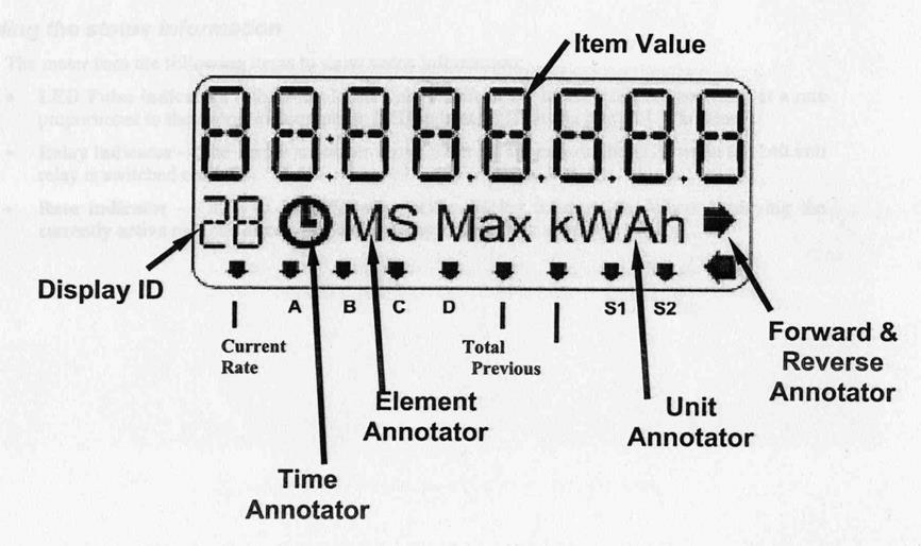
Load side Element 1 Terminal LM Controlled by S2

Connection of load terminals

Tariff	Terminal	Element	Connect to	Contactor status
1 Rate (e.g TAS 22/31)	LM	1	TAS 22/31 tariff main switch	S2 always closed
	L1	2	Do not connect	S1 always open
1 Rate + TAS 41	LM	1	TAS 22/31 tariff main switch	S2 always closed
	L1	2	TAS 41 tariff main switch	S1 always closed
1 Rate + TAS 61/63	LM	1	TAS 22/31 tariff main switch	S2 always closed
	L1	2	TAS 61/63 tariff main switch	S1 controlled

For times that the controlled elements operate, see **Network Tariff Application and Price Guide** (http://www.tasnetworks.com.au/our-network/network-revenue-pricing/distribution-fees-and-tariffs).

Display



LEDs at the top of the meter labelled S2, S1:

S2 is the main load element contactor (left load terminal)

S1 is the secondary load element contactor (right load terminal)

When lit, LEDs indicate that the state of the load element contactor is in the “closed” position. When not lit, LEDs indicates that the state of the load element is in the “open” position.

Registers

Registers can be stepped through by pressing the “scroll” button. The alternate display shows no metering information

Default	Alternative
10 – kWh – Element 1	Not applicable
15 – Date	
20 – kWh – Element 2 (Not in single rate “1 Rate“ setup)	
55 – Time	
90 – Load element contactor S1 Status (if applicable)	
91 – Load element S2 Status	

6.3. EDMI MK7A with Actaris Payguard

Meter	**EDMI MK7A with Actaris Payguard**
Status	Approved
Metering installations	PAYG
Manuals	Actaris Payguard Manual
Notes	Installed with single phase DC meter
	

6.3.1. PAYG installation guidelines

Meter selection

The EDMI MK7A meter with the Actaris Payguard unit is recommended for all new PAYG installations. If a MK7A is unavailable, the EM1210 “blue rectangle” meter fitted with an additional relay control card can also be used in conjunction with the Actaris Payguard unit.

Approved installations

PAYG metering can only be fitted to single-phase residential electrical installations. PAYG is not permitted where:

- The installation is non-domestic.
- The installation is multiphase.
- The customer has import/export (solar) metering.
- The customer has no access to the meters.
- Installations are fitted with a customer-owned load limiter installed on the meter panel.

- The customer is using PAYG to solve meter access issues.
- The installation does not meet the height restrictions in Section 0.
- The installation is not AS3000-compliant (refer to Electrical Safety).
- The metering panel is made of Zelemite (refer to Asbestos Policy).
- The metering panel needs to be modified to fit the equipment.
- The load ends are larger than the meter terminal holes.
- A contactor controls the customer's off peak load end.
- The mains cable is too short.

Height restrictions

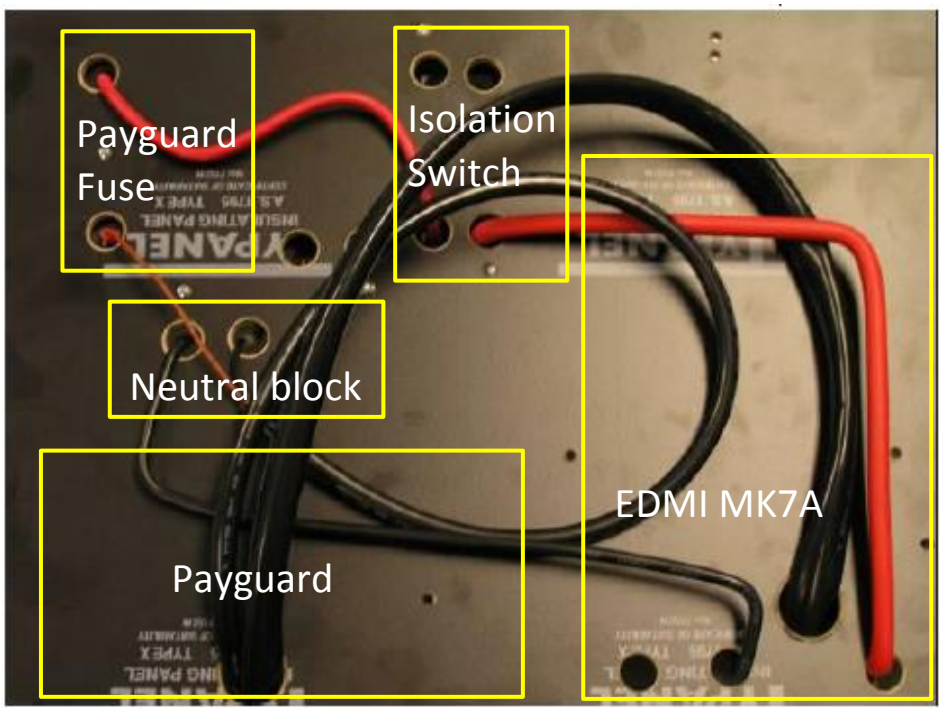
The Actaris Payguard must not be installed more than 1.8 metres from the ground to the bottom of the Payguard unit. This height restriction can be met with a "permanent step" as defined in AS-1657-1992, section 3.1.1, provided that the step is in place when the metering is installed.

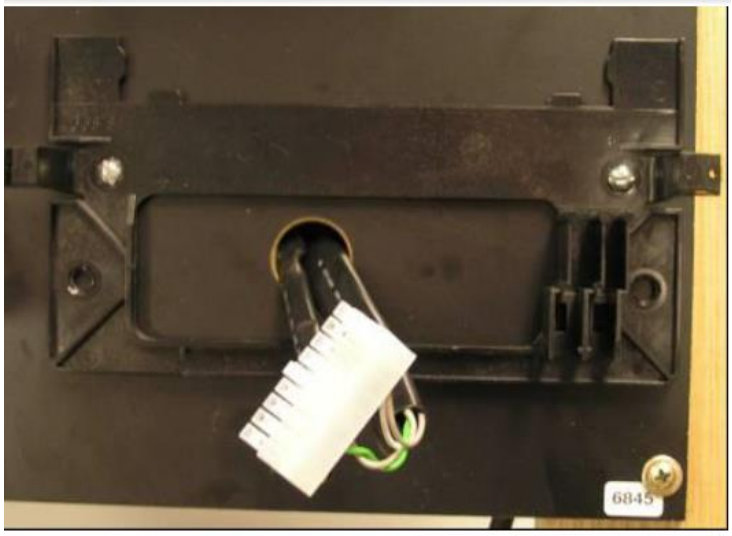
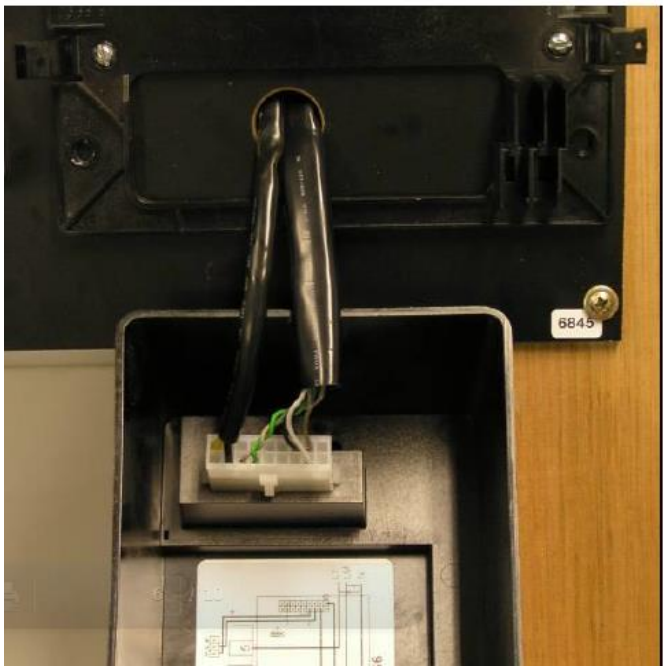
Multiple meters

Multiple Actaris Payguard units can be installed in a single meter box.

Payguard installation

Note. Actaris Payguard units can be fitted to a wooden meter panel provided that the old cloth-covered mains are not disturbed (use discretion).

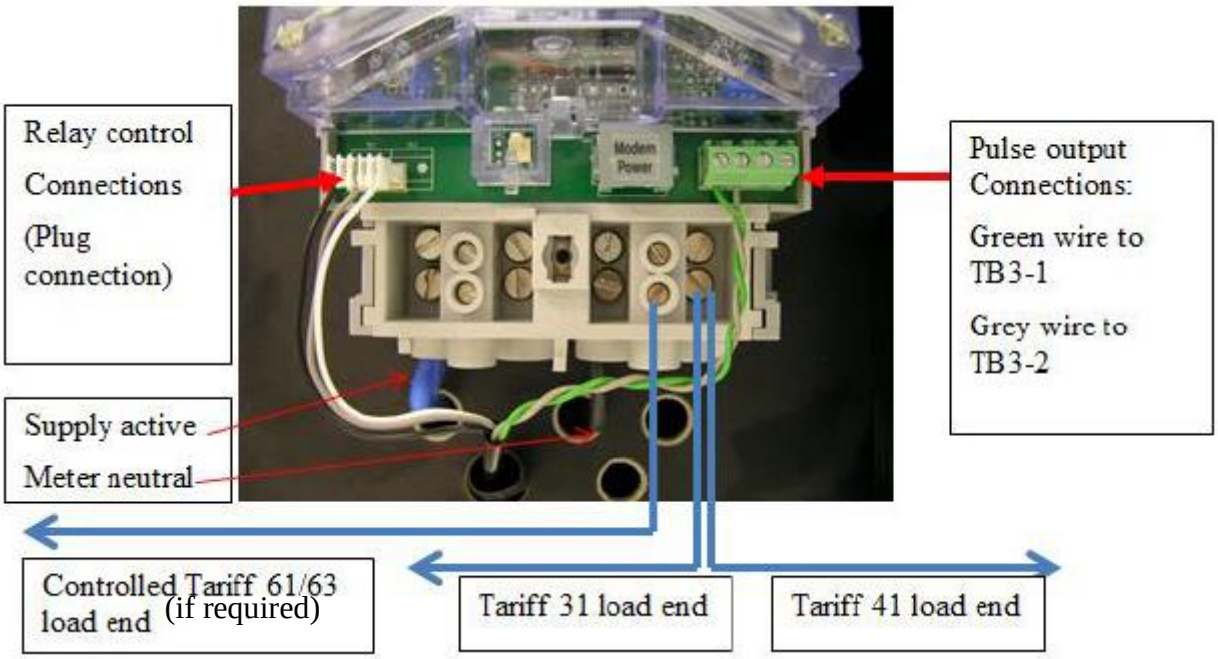
Step	Detail
1	Divide the Payguard wiring loom into two parts: the Payguard supply and the signalling loom.
	

Step	Detail
2	Payguard supply active (brown) is wired into the Payguard isolation fuse & neutral (black) is wired into the metering neutral link (as shown above). Also note that the supply for the Payguard isolation fuse is supplied from the switched (bottom) side of the metering isolation switch.
3	Mount the Payguard mounting plate using short metal thread screws. Bring the wiring loom through the pre-drilled 20 mm hole. 
4	Clip the wiring look connector into the back of the Payguard unit. 
5	Position the Payguard unit over the mounting plate using the two side guides. Press the unit onto the mounting plate until it clicks into place.

Step	Detail
	

Meter wiring diagram

Tariff 31+ Tariff 41 or Tariff 42 + Tariff 61 or Tariff 63



Special notes

- Tariffs TAS92 and TAS93 are exactly the same from a metering set up perspective. For PAYG sites when Time of Use metering is installed, TAS92 must be indicated as the Tariff in TVD to ensure TasNetworks has a record that the NMI has PAYG metering on site.
- If there are existing non-EDMI MK7A meters, they must be removed and record on the work sheet and also in the comments in TVD (if you have access to TVD) this has been done, so that if the

customer requires reverting back to conventional metering, it will be known that a job will need to be created to install an additional Tariff 41 or Tariff 42 meter.

- The controlled Tariff 61/63 terminal can only handle maximum load of 60A. If load is greater than 60A connect a 4mm minimum size conductor to operate the coil of a contactor supplied by the customer (to be installed on customer's switchboard panel) rated to carry the load and, the contactor must be properly sealed to prevent access to terminals.
- On the use of contactors, refer to the **Service and Installation Rules** sections 5.3.1 Provision of equipment for direct-connect-metering and 5.4.4 Security Of Equipment.
- Total load of meter for all Tariff loads combined must not exceed 100 A.
- Any existing T61 load to be connected to T63. The old Tariff 41 meter and Tariff 61 or 63 meter must be removed. Record on the work sheet and also in TVD (if you have access to TVD) this has been done, so that if the customer requires reverting back to conventional metering, it will be known that a job will need to be created to install additional meters for Tariff 41 or Tariff 42 and Tariff 63.

Troubleshooting

See Appendix B for error codes relevant for Actaris Payguard.

6.4. EDMI MK10

Meter	**EDMI MK10**
Status	Approved
Metering installations	Polyphase DC Low-voltage CT
Manuals	EDMI MK10 Reference Manual
	

6.5. EDMI MK10A

Meter	**EDMI MK10A**
Status	Approved
Metering installations	Polyphase DC Low-voltage CT
Manuals	EDMI MK10A Reference Manual
	

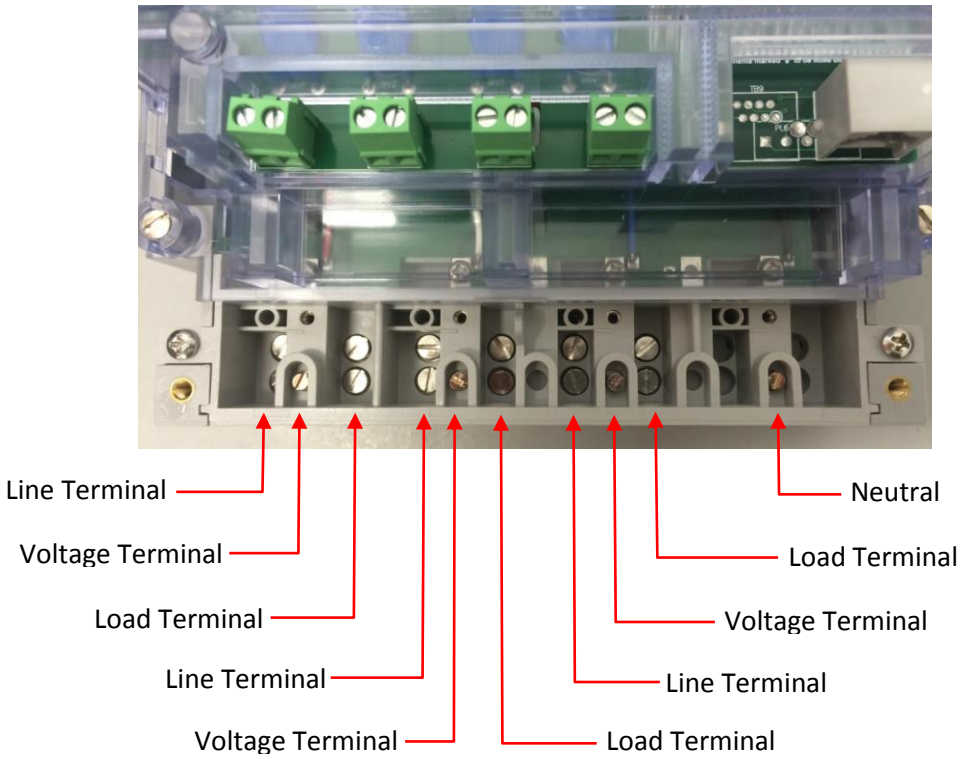
6.6. EDMI MK10D

Meter	**EDMI MK10D**
Status	Approved
Metering installations	Polyphase DC
Manuals	EDMI Mk10D Reference Manual
	

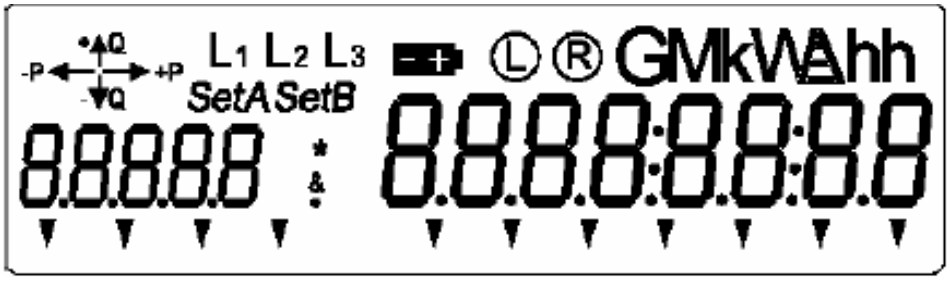
6.7. EDMI MK10E

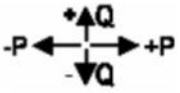
Meter	**EDMI MK10E**
Status	Approved
Metering installations	Low-voltage CT
Notes	The meter is suitable for HV and LV CT installations only. Not to be used for Wholesale (Transmission) installations.
Manuals	EDMI Mk10E Reference Manual
	

Terminals


Line Terminal
Voltage Terminal
Load Terminal
Line Terminal
Voltage Terminal
Load Terminal
Neutral
Load Terminal
Voltage Terminal
Line Terminal

Display



	The four arrows with characters and plus/minus sign at the top left display the direction of Watts and vars respectively. A plus sign indicates positive/export/delivered energy, while a minus sign indicates negative/import/received energy[3].
	Low Battery indicator. Please refer to the section on the battery earlier this chapter.
	L shows local communication or login on the local port. R shows remote communication or login on the modem port. The R will flash if the meter is connected to the GPRS network in persistent mode.
	k is the multiplier for kilo.
	These segments allow for display of units. The units are W, var, VA, Wh, varh, VAh, V and A.
	Currency indicator.
	Display set as explained in the Section LCD/Select Button above.
	4 seven-segment characters. There can be a maximum of 4 characters to describe the value shown in the 8 seven-segment on the right side of the LCD. The size of this seven-segment character is 3 mm x 6 mm.
	8 characters of seven-segment displays register contents as setup in LCD setup. Please refer to Chapter 6 for LCD Display. The size of this seven-segment character is 4 mm x 10 mm.

Registers

Registers can be stepped through by pressing button B. Set B (the alternate register display) can be shown by holding Button B for 3 seconds.

Set A	Set B
Test Screen	Imp Wh – Imported Kwh
TASNETW	SIG- Modem signal strength
Time Date	Pid – Meter Program Identifier
004 - kWh	Volt A – Red Phase voltage
	Volt B – White Phase voltage
	Volt C – Blue Phase voltage
	Amp A – Red Phase current
	Amp B – White Phase current
	Amp C – Blue Phase current
	PF – Power Factor
	Freq – Frequency
	SN – Device Serial number

6.8. EDMI MK6

Meter	**EDMI MK6 (Genius)**
Status	Approved
Metering installation	Polyphase DC Low-voltage CT High-voltage CT/VT
Manuals	EDMI Mk6 User Manual
	

6.9. EDMI MK6E

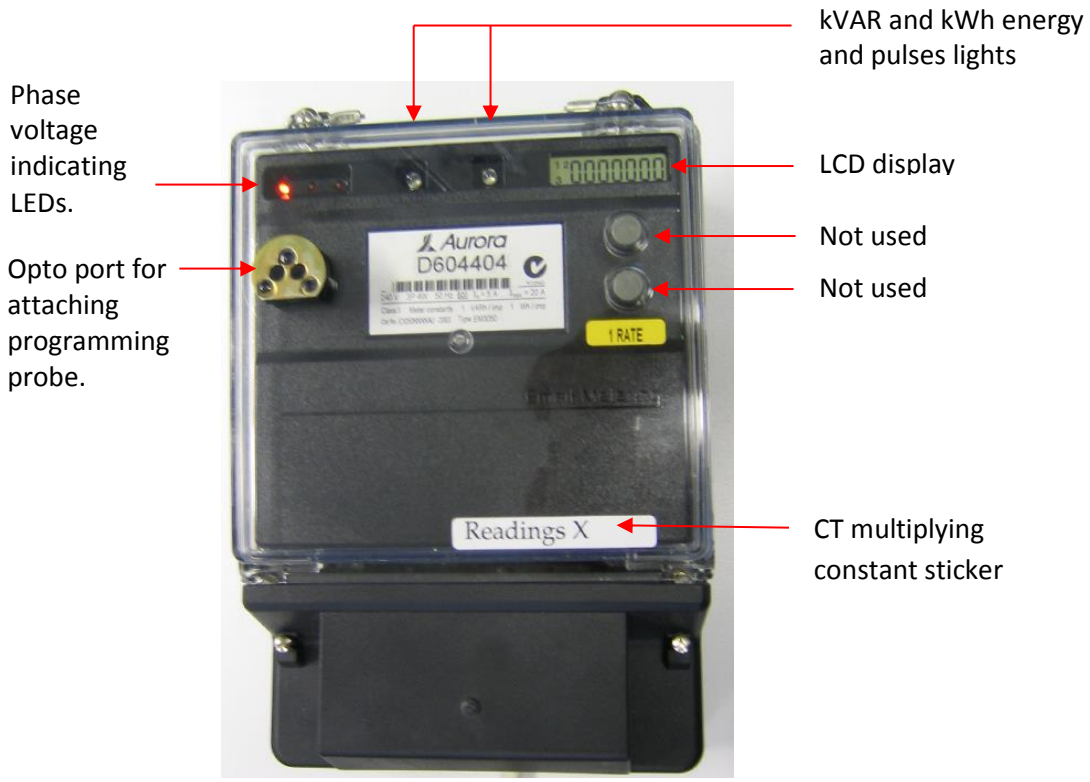
Meter	**EDMI MK6E**
Status	Approved
Metering installation	Low-voltage CT High-voltage CT/VT
Notes	High-precision meter for generation and transmission applications (wholesale sites).
Manuals	EDMI Mk6E User Manual
	

6.10. EDMI MK3

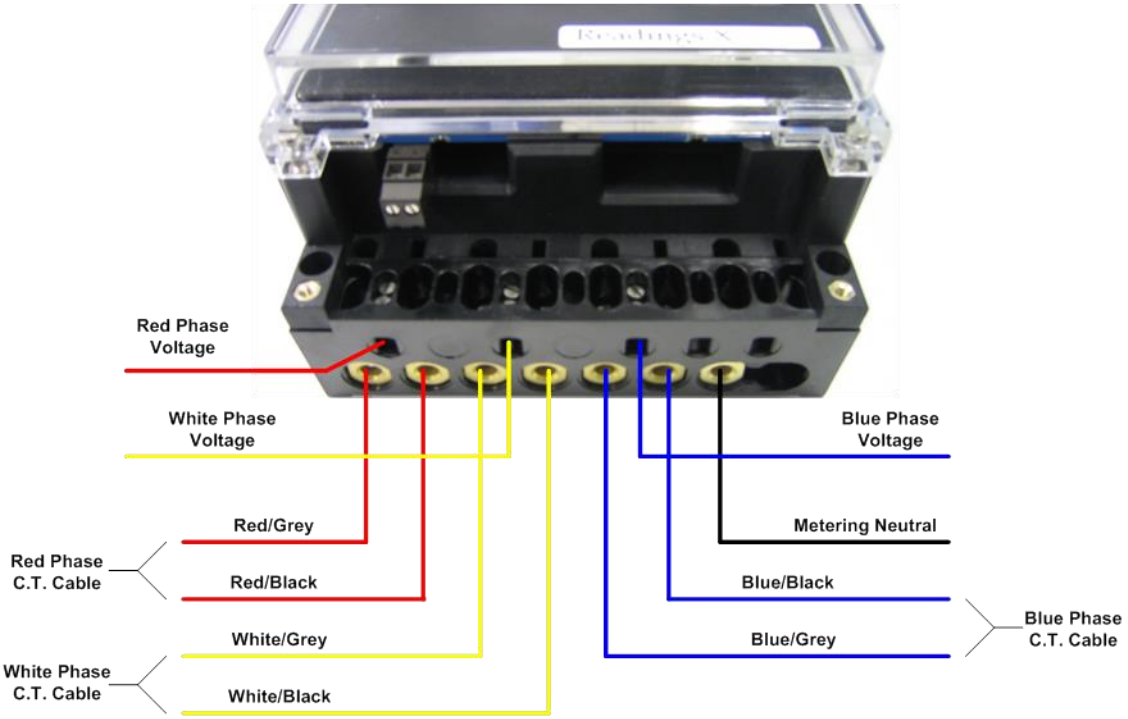
Meter	**EDMI MK3**
Status	Approved
Metering installation	Low-voltage CT High-voltage CT/VT
Notes	

6.11. L&G EM3030 and EM3050

Meter	**Landis & Gyr EM3000 Series**
Status	Approved
Metering installation	EM3030: Polyphase DC EM3050: Low-voltage CT
Manuals	Landis & Gyr EM3000 Series Manual



Terminals



Error codes

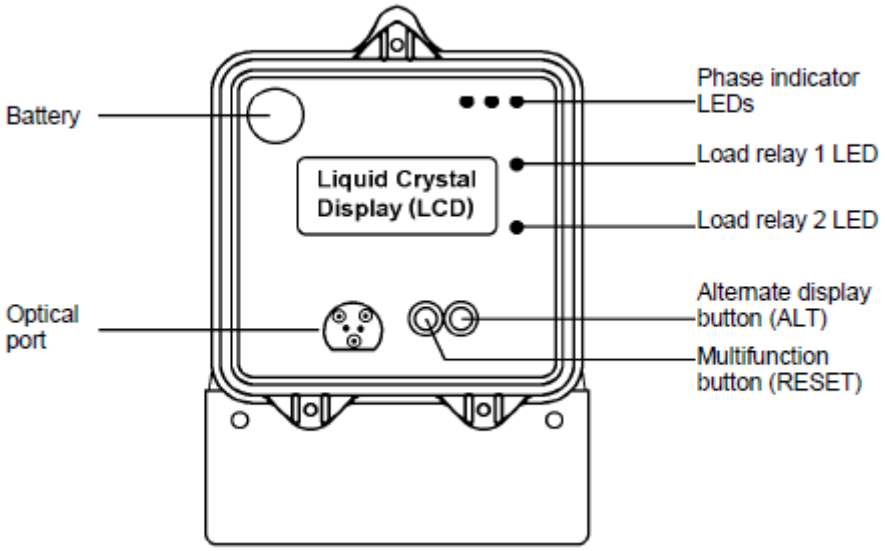
Meter will scroll between KWh register and error message FL00100 and the LED pulse /per watt will not flash if reverse energy is detected on any phase.

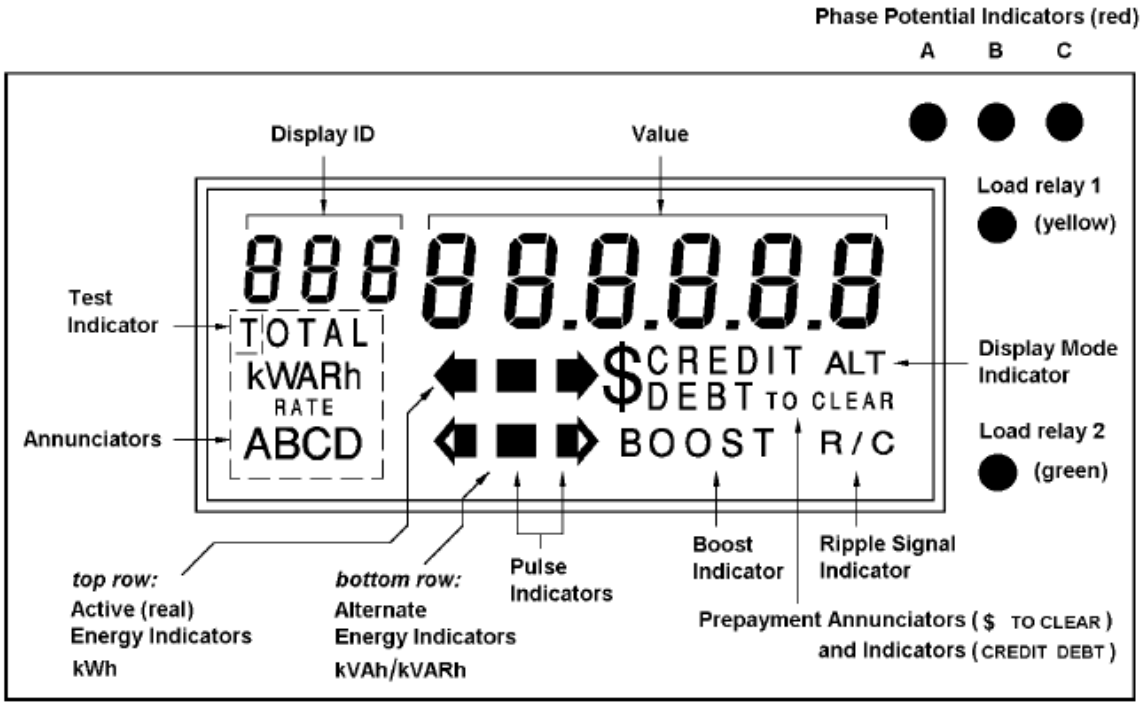
6.12. L&G EM3330

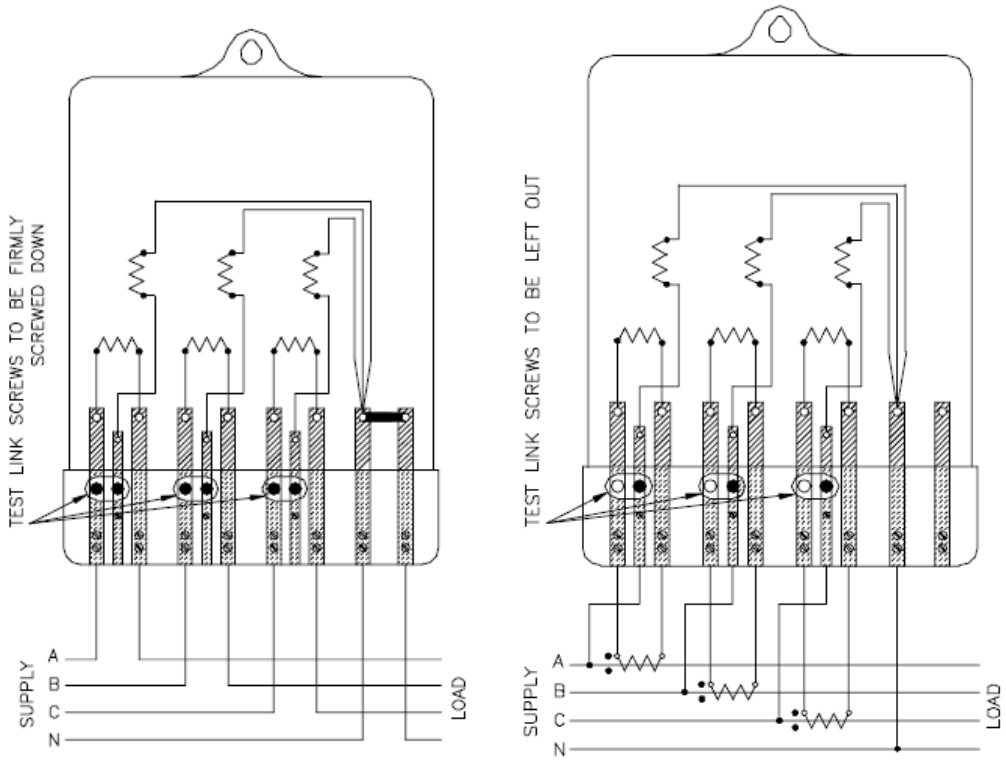
Meter	**Landis & Gyr EM3330**
Status	Approved
Metering installation	Polyphase DC
Manuals	Landis & Gyr EM3300 Series Manual

6.13. L&G Q3

Meter	**Landis & Gyr Q3**
Status	Approved
Metering installation	Polyphase DC Low-voltage CT
Notes	Landis & Gyr Q3 Manual
	





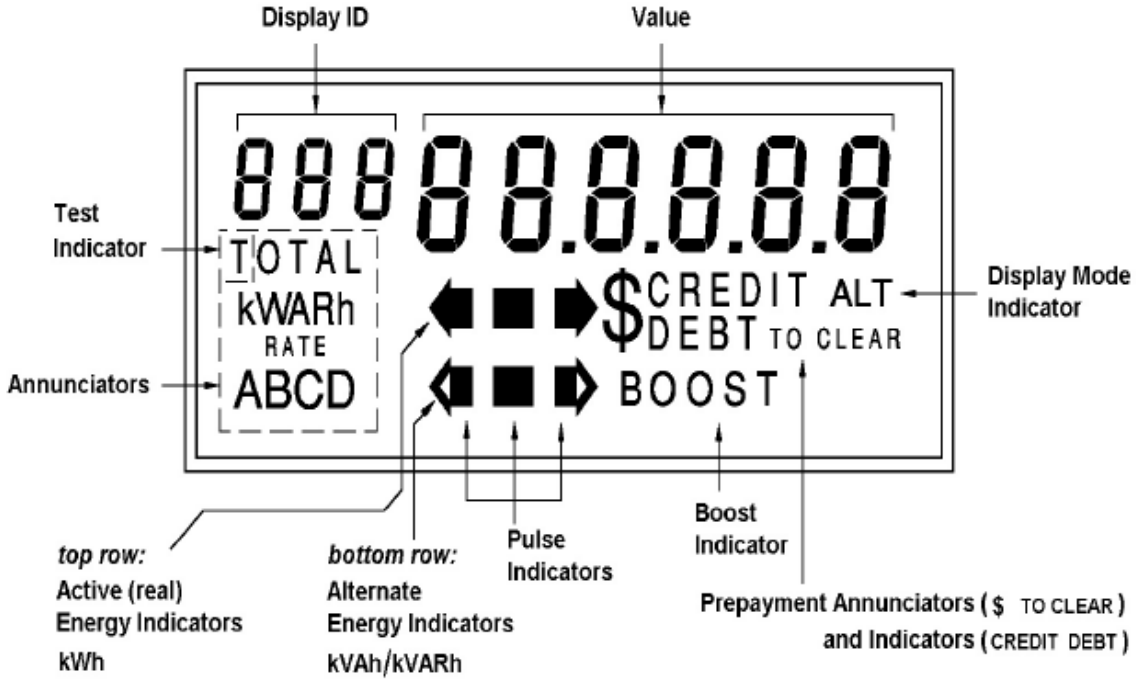


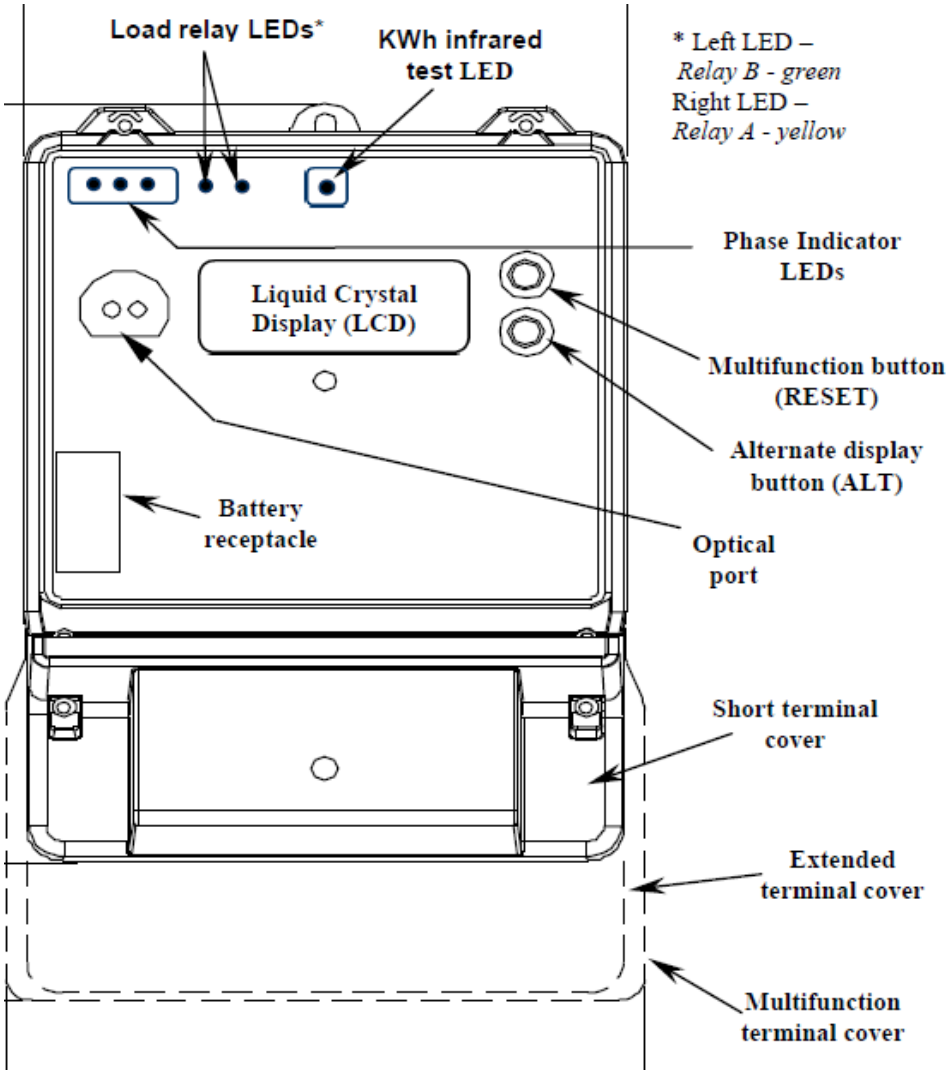
Configuration 1
3-phase, 4-wire, Direct-connect

Configuration 2
3-phase, 4-wire, with Current Transformers

6.14. L&G Q4 and Q4A

Meter	**Landis & Gyr Q4 and Q4A**
Status	Approved
Metering installation	Polyphase DC (Q4 or Q4A) Low-voltage CT (Q4)
Manuals	Landis & Gyr Q4 Manual





6.15. Siemens D22CML

Meter	**Siemens D22CML**
Status	Approved
Metering installation	Low-voltage CT
Notes	

7. Ancillary equipment

7.1. Current Transformers

7.1.1. CT types

The types of current transformers in use by TasNetworks are shown in Table 21, and their selection criteria are shown in Table 22. Note that a wider aperture CT can be used for larger diameter conductors, e.g. a type T in place of a type S45.

Table 21 CT types

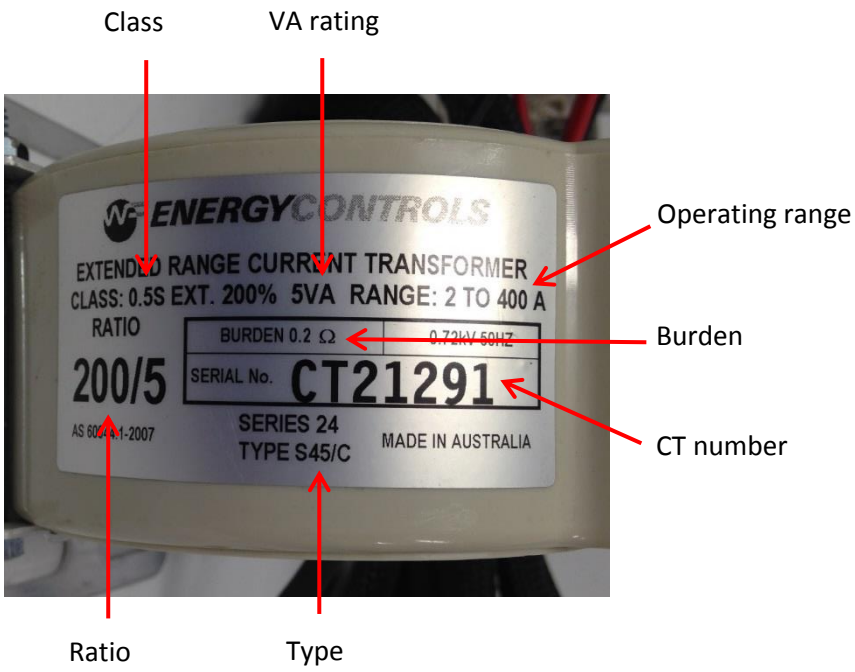
Type	Status	Ratio	Aperture (mm)	Class	Burden (Ω)	Burden (VA)
S32/A “grey”	Approved	200/5	32	0.5	0.4	10
S32/A	Approved	200/5	32	0.5	0.4	10
S45/C	Approved	200/5	45	0.5	0.2	5
T	Approved	800/5	85	0.5	0.6	15
W	Approved	1500/5	112	0.5	0.6	15

Table 22 CT selection chart

Main Switch Size or Maximum Demand of Installation (amps)	Preferred	Alternative
100 to 300	Type S	Type T,W
300 to 600	Type T	Type W
600 to 1000	Type T	Type W
1000 to1500	Type W	–
1500 to 2500	Type W	–
Over 2500	Refer to Metering Group	–

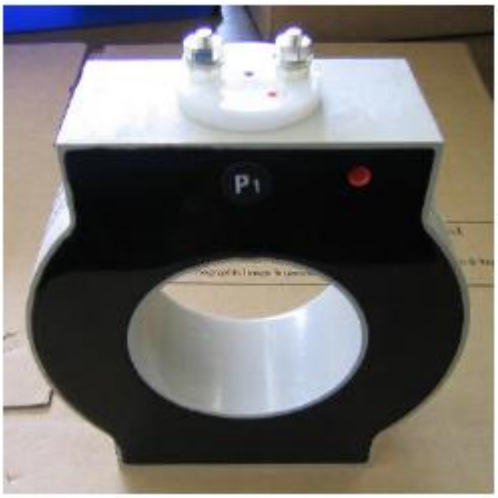
7.1.2. Type S single tap 200/5 amp

CT	**Type S single tap 200/5 amp**
Status	Approved
Multiplier	40
Usage	Extended range primary current up to 400 A
Connections	P1 and Red Dot indicate line side of transformer S2 load with black stripe S1 line with grey stripe When making connections ensure that enough insulation is stripped; the wire is twisted and bent into a loop tight enough to fit into the cup washer supplied. Do not over-tighten as this may damage internal connections. Do a tug test to ensure that solid connection is made. Ensure that the cable insulation is not clamped.



7.1.3. Type T single tap 800/5 amp

CT	**Type T single tap 800/5 amp**
Status	Approved
Multiplier	160
Usage	Extended range primary current up to 1600 A
Connections	P1 and Red Dot indicate line side of transformer S2 load with black stripe S1 line with grey stripe When making connections ensure that enough insulation is stripped; the wire is twisted and bent into a loop tight enough to fit into the cup washer supplied. Do not over-tighten as this may damage internal connections. Do a tug test to ensure that solid connection is made. Ensure that the cable insulation is not clamped.

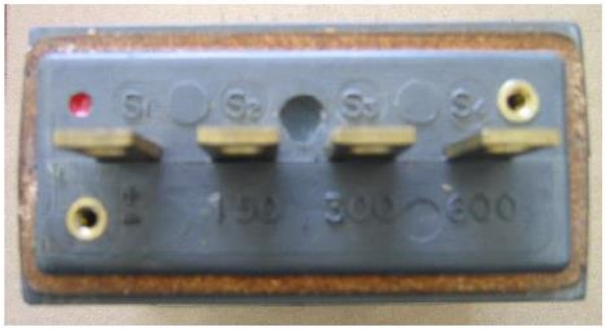


7.1.4. Type W single tap 1500/5 amp

CT	**Type W single tap 1500/5 amp**
Status	Approved
Multiplier	300
Usage	Extended range primary current up to 3000 A
Connections	P1 and Red Dot indicate Line side of transformer S2 load with black Stripe S1 Line with grey stripe When making connections, ensure that enough insulation is stripped, the wire is twisted and bent into a loop tight enough to fit into the cup washer supplied. Do not over tighten as this may damage internal connections. Do a tug test to ensure that solid connection is made. Ensure that you have not clamped the cable insulation.

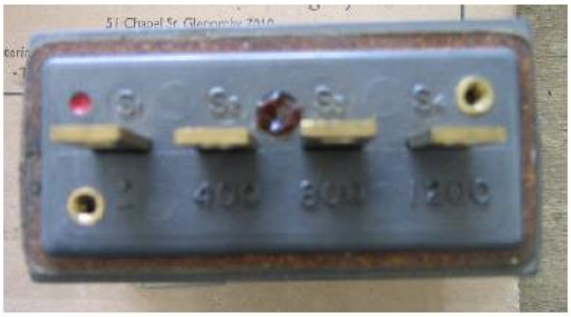
7.1.5. Type A multi-tap 600/5 amp

CT	**Type A multi-tap 600/5 amp**
Status	Obsolete
Multiplier	Terminal S2 (150) 30 Terminal S3 (300) 60 Terminal S4 (600) 120
Usage	Primary current up to 600 A
Connections	Red Dot indicates line side of transformer S2 load with black stripe S2 (150), S3 (300), S4 (600) only one to Load Side with black stripe When making connections ensure that enough insulation is stripped; the wire is twisted and bent into a loop tight enough to fit into the cup washer supplied. Do not over-tighten as this may damage internal connections. Do a tug test to ensure that solid connection is made. Ensure that the cable insulation is not clamped.



7.1.6. Type B multi-tap 1200/5 amp

CT	**Type B multi-tap 1200/5 amp**
Status	Obsolete
Multiplier	Terminal S2 (400) 80 Terminal S3 (800) 160 Terminal S4 (1200) 240
Usage	Primary current up to 1200 A
Connections	Red Dot indicates line side of transformer S2 load with black stripe S2 (400), S3 (800), S4 (1200) only one to Load Side with black stripe When making connections ensure that enough insulation is stripped; the wire is twisted and bent into a loop tight enough to fit into the cup washer supplied. Do not over-tighten as this may damage internal connections. Do a tug test to ensure that solid connection is made. Ensure that the cable insulation is not clamped.



7.1.7. Type C multi-tap 2000/5 amp

CT	**Type C multi-tap 2000/5 amp**
Status	Obsolete
Multiplier	Terminal M1 (2000) 400 Terminal M2 (1500) 300 Terminal M3 (1000) 200
Usage	Primary current up to 2000 A
Connections	L indicates Load Side L to Load Side with black stripe M1 (2000), M2 (1500), M3 (1000) only one to Line with grey stripe When making connections ensure that enough insulation is stripped; the wire is twisted and bent into a loop tight enough to fit into the cup washer supplied. Do not over-tighten as this may damage internal connections. Do a tug test to ensure that solid connection is made. Ensure that the cable insulation is not clamped.

7.2. Voltage Transformers

Voltage transformers are used to connect metering to HV installations. These devices are installed inside ground-mounted switchgear in places where a pole-top or aerial metering unit cannot be connected.

Figure 30 Siemens 22 kV to 110 V transformer

7.3. Time Switches

Time switches were used to implement off-peak tariffs with obsolete electronic and electro-mechanical meters. They are also used at multi-tenant installations where multiple installations require off-peak tariffs with the use of customer-owned contactors. Tables 23 shows the status of time switches used by TasNetworks for metering and instructs what action to perform when performing metering works at these sites.

Table 23 Single pole time switches

Time Switches	Model	Status	Action
EDMI MK7A programmed as a time switch	MK7A	Approved	Install
Energy Controls	WF	obsolete	Leave if battery good
Warburton Franki (Electronic)	WF12	obsolete	Leave if battery good
Energy Controls (Electronic)	14/7D	obsolete	Leave if battery good
Energy Controls	EC14	obsolete	Leave if battery good
Warburton Franki (Large Black)	WF11	obsolete	Remove

Single-phase

If attending a single-phase time switch repair and the load is under 60 amps, remove the time switch and the meter and replace with an approved single phase meter from Section 5, programmed to a suitable format (e.g “1 rate + 61”).

Multi-phase

If off-peak is on a separate phase or needs to be standalone due to customer’s other multi-phase metering, remove the time switch and replace it and the meter with a MK7A programmed to “T61 only”. In standalone “T61 only” format, the EDMI MK7A is capable of handling up to 100 amps.

For multi-phase and CT connected metering that cannot be replaced by a new direct connect meter due to load size or panel space restrictions, maintain the existing load contactor and replace the time switch with an EDMI Mk7A programmed to perfrom as a time switch. These specific EDMI units need to be programmed in the meter lab and labelled appropriately.

Time adjustments

When adjusting a time switch, mark the date the adjustment was made on the time switch. If it needs to be adjusted again within 12 months, replace it.

Rating

Note that some time switches are rated to 100 amps. For larger loads the customer will need to install a load contactor at their own expense.

7.4. CT Terminal Block

Every CT connected metering installation must have a CT terminal block. These devices allow the CTs to be shorted and the voltage inputs to be isolated. Every core of a metering CT should be brought out to a terminal block. The star point must then be joined and only the required CT core connections will be connected to the CT terminal block.

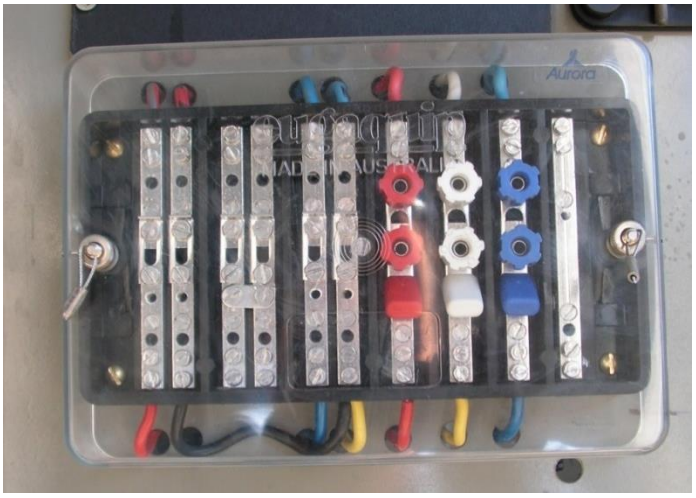


Figure 31 CT terminal block

7.5. Contactors

TasNetworks will replace contactors in SDM meter enclosures if they are TasNetworks contactors but will not install new contactors or replace customer contactors. TasNetworks will not replace contactors used to control single customers.

7.6. Pulse Outputs

TasNetworks will supply export Wh or VARh pulse outputs to a link beside the meter if requested by the customer.

Pulse rates depend on the meter type and program installed on the meter. The standard pulse rates of current meter programs are shown in Table 24. Before using these rates, check with the Meter Testing Laboratory and confirm these pulse rates for the specific meter.

Table 24 Pulse rates for standard meter programs currently available

Meter	Wh per pulse	VARh per pulse
EDMI 10 (DC)	10	10
EDMI 10A (DC)	10	10
EDMI 10 (CT)	1	1
EDMI 10A (CT)	1	1
EDMI Mk7A	1	1
L&G EM1210	1	1
EDMI 10E	1	1
L&G Q4	1	1

Note that:

- The output characteristics of these pulse output contacts are a dry contact and therefore must not have 240 V AC connected to them under any circumstance.
- TasNetworks will not summate pulse from different meters. Customers must do this with their own equipment.
- The customer is required to pay for the installation and equipment.
- Scaling due to CT and VT ratios may need to be considered by a customer when interpreting meter pulses.
- TasNetworks does not provide an end-of-interval pulse.

7.7. Communications Equipment

7.7.1. Field Work Practice

Comply with the work practice **Install And Maintain Metering Communications** when performing metering communications work out in the field.

7.7.2. Obsolete Communications Enabled Meters And Modems

Older electricity meters, such as Email Q4 meters, that cannot be communicated with through the Telstra Next G mobile phone network using the “current standard modem and antenna”.

Obsolete meters that are installed and connected to a land line should remain in service unless either the meter or its associated communications equipment fails. Both the meter and the communications equipment must then be replaced with the current approved standard equipment.

7.7.3. Approved Communications Enabled Meters

The following approved meters are capable of communications through the Tesltra Next G mobile phone network or a land line and compatible with the current standard modems listed in Section 7.7.4.

- EDMI MK7A
- EDMI MK10
- EDMI MK10A
- EDMI MK10D
- EDMI MK10E

It is possible to configure modems to use with other meters not listed above for unique circumstances (wholesale metering installations for e.g).

7.7.4. Current Standard Modems

Table 25 Current standard modems

Modem	Technology	Status
EDMI EWM1000	3G Modem	Approved
EDMI TWM1000	3G Modem	Obsolete
Maxon Modmax MM6280L	3G Modem (requires external power)	Approved – for wholesale only
RF Innovations R1 Piccolo	433 MHz radio modem	Approved

7.7.5. Modem signal strength

The range of signal strengths recommended by EDMI are shown in Figure 32. The far left column can be used to interpret the signal strength of a meter installed at an installation.

Signal Code in Meter LCD	Actual Signal Strength of GPRS Modem	Signal Strength Quality Scale
31	-51 dBm or greater	
30	-53 dBm	
29	-55 dBm	
28	-57 dBm	**Excellent (above -75dBm)**
27	-59 dBm	Should not be affected by cell breathing/ loading.
26	-61 dBm	Normally, no external antenna would be required.
25	-63 dBm	
24	-65 dBm	
23	-67 dBm	
22	-69 dBm	
21	-71 dBm	
20	-73 dBm	
19	-75 dBm	
18	-77 dBm	**Good (-75 to -85dBm)**
17	-79 dBm	Normally, would have no problem holding a connection
16	-81 dBm	without the use of an external antenna.
15	-83 dBm	
14	-85 dBm	**Workable under Most Conditions (-85 to -95dBm)**
13	-87 dBm	An outdoor gain type antenna would probably helps.
11	-91 dBm	Could suffer poor throughput and disconnects due to
10	-93 dBm	cell loading/ breathing.
9	-95 dBm	
8	-97 dBm	
7	-99 dBm	
6	-101 dBm	**Marginal (-95dBm or lower)**
5	-103 dBm	Very likely to experience low throughput and
4	-105 dBm	disconnects due to cell loading/ breathing.
3	-107 dBm	Even with an outdoor antenna.
2	-109 dBm	
1	-111 dBm	
0	-113 dBm or less	
99		**No Signal (Not detectable/ not known condition)

Figure 32 Recommended signal strengths (EDMI)

7.7.6. Antennas

Use a standard 4.5 db gain elevated feed antenna in metropolitan areas and 6.5 db gain antenna in city fringe and rural areas. If installation is found to have insufficient reception, work through the following options:

- Install a larger antenna
- Relocate the antenna outdoors or to another area
- Install a point-point radio modem
- Use a landline modem as a last resort.

Figure 33 Standard 4.5 db gain antenna

7.7.7. Installation

Refer to AS S009 for the following considerations when installing communications cabling and external antennas:

- Positioning conduits or cables (consider hazardous or damp environments, separation from electrical and fire services, specific requirements for indoor, underground or aerial installations)
- Requirements for surge suppression and earthing requirements
- Conduit labelling requirements
- Requirements for antenna positioning

7.7.8. Power Supply

The following EDMI meters are capable of directly powering a modem:

- MK6 meter has a 12V output.
- MK7A and MK10A meters have a modem power connection port that can power a Next G modem
- MK10 meter has a modem power connection port that can power a GSM modem (obsolete).

If an external modem power supply is required, a 2 amp circuit breaker and din-rail mounted timer, fed by a minimum size 4 mm^2 cable is required to be installed to power and control the modem. The timer must be set to switch the modem off daily for 5 minutes at 12.00 pm. An in-line fuse must not to be installed due to high fault currents at wholesale metering sites.

7.8. Fuses

All VT secondary lines must have fuses installed to adequately protect the VT should any connected device fail.

An external power supply for metering modems requires a dedicated fuse.

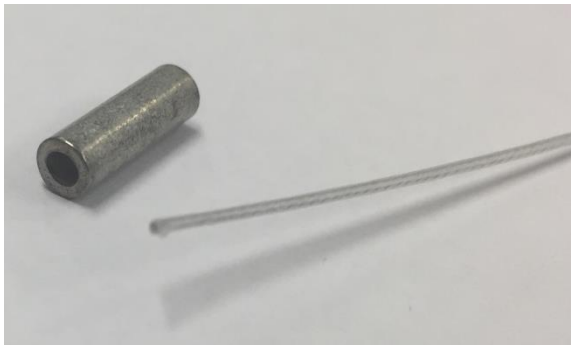
7.9. Security equipment

7.9.1. Keys For Metering

Metering keys are only to be issued by the Training School in accordance with the metering procedures and are to be returned when no longer required. The Training School keeps a register of persons issued with metering keys. This key register also holds data on who has been issued with the Maun Sealing Tool.

7.9.2. Sealing Equipment

Use the Maun sealing tool for all meter sealing. Each tool has a unique identifier. Numbered Toolless ROTO seals can be used if appropriate. The Network Metering Group (Revenue) uses a sealing wire with green coating. Sealing tools are issued by the Health, Safety and Environment (HSE) team.



The demand reset on maximum demand meters can be sealed using numbered Single Use Lock Seals.

Isolation switches can be sealed in the off position using a non-renewable plastic seal type. The product details of this approved seal is PULL SECURE EN4011. Note that this seal must not be used for any other purpose.

7.9.3. Requirement for Sealing

All items listed below must be sealed with a separate seal at every sealing point:

- Meter covers and meter terminal covers
- CT secondary terminal cover and escutcheon panel
- High voltage CT and VT enclosure
- Potential fuses
- Metering Test Terminal Block
- any other associated metering equipment
- any un-metered connections in the customer's installation beyond the Point of Supply

7.9.4. Suspected Tampering

If a seal is broken, the installation must be immediately investigated by the metering technician for signs of tampering. The metering technician should use their judgement to determine if energy theft has occurred.

After 1 December 2017, all tampering must be dealt with in the following manner:

- Perform a full inspection of the installation
- Take photographic evidence of the theft or tampering
- If the illegal connection or method of electricity theft is causing an unsafe situation, issue a Notice of Disconnection of Electrical Supply and isolate the supply in accordance with Isolation of LV Supply.
- Notify TasNetworks Metering Provider (MP@tasnetworks.com.au) as soon as possible

The TasNetworks Meter Provider will ensure that a follow up job is created to replace or test the relevant assets.

IMPORTANT Never confront a customer about suspected electricity theft.

8. Meter Programming

Refer to Appendix A for approved meter programs.

Refer to Appendix B for meter program error codes.

Refer to Appendix C for instructions how to use Field Initiated Programming (FIP).

8.1. Meter Setups

Specific meter programs are required wherever a meter will be manually read by a meter reader. The individual program aligns with the tariff that is requested by the customer.

Meter programs are available for all tariffs listed in the TasNetworks ***Network Tariff Application and Price Guide*** (http://www.tasnetworks.com.au/TasNetworks/media/pdf/our-network/PP002-Network-Tariff-Application-and-Price-Guide-(Approved).pdf). An extract of this document is shown in the table below, listing the program 'feature' that will be required to measure a given tariff.

Table 26 Program feature required for available Network Tariffs in manually read meters

TasNetworks Code	Description	Program 'feature' required
TAS31	Residential low voltage general	"1 rate" kWh
TAS22	Business low voltage general	"1 rate" kWh
TAS41	Uncontrolled low voltage heating	"1 rate" kWh
TAS61	Controlled low voltage energy – off-peak with afternoon boost	Load control - 61
TAS63	Controlled low voltage energy – night period only	Load control - 63
TAS75	Irrigation low voltage time of use	TOU
TAS82	Business low voltage kVA demand	KVA demand
TASSDM	Business high voltage kVA specified demand	KVA demand
TAS92	Residential low voltage pay as you go time of use	TOU
TAS94	Business low voltage time of use	TOU
TAS93	Residential low voltage time of use	TOU
TAS15	Business high voltage kVA specified demand (>2.0 MVA)	KVA demand
TASX1I	Residential low voltage import transitional	Solar
TASX2I	Business low voltage import transitional	Solar
TASX4I	Residential low voltage import fair and reasonable	Solar
TASX5I	Business low voltage import fair and reasonable	Solar
TASX6I	Non-qualifying import	Solar

An explanation of the program features has been provided below:

Table 27 Meter Program Features

Program Feature	Description
1 Rate	A typical energy recording program measuring cumulative kWh
61 or 63	An off-peak program that controls a load contactor and measures cumulative kWh
Solar	Import and Export energy will be correctly measured by this meter, suitable for metering embedded generation
TOU	Time Of Use tariffs charge the customer at different rates depending on the time of the day
KVA Demand	A 'Maximum Demand' tariff records an accumulation of the peak power usage in each demand period

The combination of tariffs requested by the customer will drive the selection of meter and program.

8.2. Non-FIP Meters

Some basic meters are only available with a single program when it is issued from the MTL. Multi-setup meters use Field Initiated Programming (FIP) to select a program to match the required tariff. Non-FIP meters must be requested from the MTL specifying the tariff requirements to pre-install.

The single program meters will have a sticker affixed to the front describing the program 'features' that have been installed in the meter. Program stickers may describe that a number of 'features' are available. For e.g. a "1 Rate + 61" sticker indicates that there is a cumulative kWh register on one meter element, then a controlled load contactor measuring kWh in a second element.

8.3. Field Initiated Programming

Field Initiated Programming (FIP) is a method of selecting a program within some EDMI meters. The program will select when internal contactors operate and need to align with the tariffs that are requested by the customer. The following meters can be used with FIP:

- EDMI MK7A (single phase)
- EDMI MK10D (polyphase)
- EDMI MK10E (polyphase)

All meters with tamper switches installed can be programmed with FIP. Some older models of the above were not purchased with terminal covers and so are to be programmed with a fixed setup by the Meter Laboritory.

The energy registers of the meters are cleared when a meter program is selected, so care needs to be taken that a final read is performed before using FIP.

Some meters with tamper switches and FIP available may contain an obsolete version of a meter program. The version of the selected program should be checked against the tables in Appendix A whenever re-programming a meter using FIP.

Instructions on how to use FIP programming can be found in Appendix C.

8.4. Communications Enabled Meters

If the annual energy usage of a site is large enough, the metering must be communications enabled. These sites are referred to as Type 1, 2, 3 or 4 metering or COMMS1, COMMS2, COMMS3 and COMMS4 respectively in Tasmania.

Some Network Tariffs offered for smaller customers can only be used with communications enabled meters. These are Network Tariffs are listed in the following table:

Table 28 Network Tariffs that will always require communications-enabled meters

TasNetworks Code	Description
TAS87	Residential time of use demand (not yet offered by a retailer)
TAS88	LV commercial time of use demand (not yet offered by a retailer)
TAS89	Large LV commercial time of use demand (not yet offered by a retailer)

Meters that require communications will need to be programmed specifically for this purpose in the Meter Testing Laboratory (MTL) as the standard programs are incompatible with the MV-90 communications system. Meters with communications measure power in all four-quadrants – import, export, watts and VARs every 15 minutes.

9. Meter Testing And Inspection

9.1. Test Equipment

9.1.1. Certification

Test equipment must be certified by a NATA-accredited laboratory every 12 months. Certification requirements are set out in NER section 7.4.3(b)(5) and ISO/IEC Guide 25 "General Requirements for the Competence of Calibration and Testing Laboratories". Certificates are held by Geartrack.

Field tests of CTs, VTs and meter accuracy must be NATA traceable. Multimeters used to test VTs and CTs in NER type 1 - 4 (non-basic) metering installations also need to be NATA traceable.

9.1.2. RedPhase 689

Test equipment	**RedPhase 689**
Test types	DC and CT, single-phase and polyphase meter accuracy
OEM manual	http://assetzone.tnad.tasnetworks.com.au/metering/Manuals/Red%20Phase%20689B%20Manual.pdf

9.1.3. MTE PTS 2.3

Test equipment	**MTE PTS 2.3**
Test types	DC and CT, single-phase and polyphase meter accuracy
OEM manual	http://assetzone.tnad.tasnetworks.com.au/metering/Manuals/MTE%20PTS%202.pdf

9.1.4. RedPhase 590G V2 / 590G

Test equipment	**RedPhase 590G V2**
Test types	CT and single phase-ground VT testing
OEM manual	http://assetzone.tnad.tasnetworks.com.au/metering/Manuals/Red%20Phase%20590G-V2%20Manual.pdf

9.1.5. RedPhase 590J

Test equipment	**RedPhase 590J**
Test types	CT and VT accuracy testing
OEM manual	http://assetzone.tnad.tasnetworks.com.au/metering/Manuals/Red%20Phase%20590J%20Manual.pdf

9.1.6. RedPhase 590D

Test equipment	**RedPhase 590D**
Test types	Attachment for RedPhase 590G to measure a single phase VT
OEM manual	http://assetzone.tnad.tasnetworks.com.au/metering/Manuals/Red%20Phase%20590D1%20Manual.pdf

9.2. Test Conditions

9.2.1. Electromagnetic Radiation (induction)

Test equipment and measurement leads must, wherever possible, be kept away from the sources of strong magnetic fields and electrical noise.

9.2.2. Test Supply Quality

The test supply quality will interfere with the results of accuracy testing. If the test fails and the supply quality was not up to standard then note this in the test comments. For reliable results, the following is required:

- The test voltage must not vary by more than 1% during the error measurement.
- The test current must not vary by more than 1% during the error measurement.
- The frequency must not depart from the rated value by more than 1%.
- The distortion factor of the test current must not exceed 2.0.

9.2.3. Environmental Conditions

The environmental conditions may interfere with the test results. If the test results fail and the following conditions were not met, make note of the unsuitable conditions in the comments. The meters are designed to operate when:

- The ambient temperature is between 5 °C and 40 °C
- Relative humidity does not exceed 80%

9.3. Meter Accuracy Testing

Note. Basic current (Ib) of a meter is the lower current range shown on the nameplate e.g. basic current of 10/60 meter is 10 amps.

If the meter under test is a whole current meter, Ib is to be used in place of In on all pertinent test points.

9.3.1. Pulse Sensing Head

At least 10 pulses must be measured.

9.3.2. Embedded Generation Meter Testing

If the meter under test is capable of measuring both import and export energy and, in normal operation, the meter measures energy in these modes, a dial test must be performed with the test set used in both import and export energy modes.

9.3.3. Earth Reference for test equipment

The earth lead of any test equipment must be connected to the customer earth, or if the earth is not accessible, connected to the customer neutral.

It has been found that meter errors of at least 3% can be introduced to the test results for reactive power injection where the earth connection is not made with the Red Phase 689B.

9.3.4. Field Test Programs

Table 29 Field test programs

Field Test Program	Test											
	Creep Test	Starting Current Test	Light Load Test	Full Load Test	Full Load 2 Test PF=0.5	Half Load 1 Test PF=1.0	Half Load 1 Test PF=0.5	Full Load 2 Test PF=0.866	Dial Test / Display Test	Burden Test	Inspection Test	kVAR Test
Electromechanical Meter Test Program	●	●	●	●	●	●	●		●			
Electronic Meter Test Program			●	●	●	●	●		●			
Light Load CT Meter Test Program			●						●	●	●	●
Full Load CT Meter Test Program			●	●	●			●	●	●	●	●
Customer Test Program	●	●	●		●				●			
Test pass-fail criterion	1 = Single test is run. Accuracy of test must not exceed ±2.5%. 3 = Three tests are run. Average accuracy of all tests must not exceed ±2.5%.											
	1	1	3	3	3	3	3	3	1	1	1	1

9.3.5. kVAR Test

Test	**kVAR Test**
Purpose	Reactive energy export or import for meters measuring VARs only
Applicable to	Reactive energy metering only
Conditions	Refer to Table 28 for test points

Table 30 Test points for kVAR Test

Meter class	Test current	PF		
		0.8 lead	Zero	0.5 lag
2%, 1%, 0.5% & 0.2%	10% of In		●	●
2%, 1%, 0.5% & 0.2%	50% of In	●	●	●
2%, 1%, 0.5% & 0.2%	100% of In		●	●
2%, 1%, 0.5% & 0.2%	Itest	●	●	●

9.3.6. Creep (No Load) Test

Observe the disk for 1 minute. If it doesn't move, then pass the test. If it moves slowly, observe it for 10 minutes. If the disk completes one full revolution, fail the test.

Current	0.001 Ib
PF	1

9.3.7. Starting Current Test

Check that the disk starts and completes one full revolution.

Current	0.005 Ib
PF	1

9.3.8. Load Tests

Meter Accuracy Test Point	Test					
	Light Load Test	Full Load Test	Full Load 2 Test PF=0.5	Half Load 1 Test PF=1.0	Half Load 1 Test PF=0.5	Full Load 2 Test PF=0.866
Current (multiplier × rating)	0.1 Ib	1 Ib (DC) 1 In (CT)	1 Ib (DC) 1 In (CT)	0.5 Ib (DC) 0.5 In (CT)	0.5 Ib (DC) 0.5 In (CT)	1 Ib (DC) 1 In (CT)
PF	1	1	0.5	1	0.5	0.866

Note. Basic current (Ib) of a meter is the lower current range shown on the nameplate e.g. basic current of 10/60 meter is 10 amps. Nominal current (In) is the same thing for CT meters, but has a different naming convention.

Note. Most meters will run at full basic current. When a large load is applied, brake magnets restrict overshoot of the meter disk. The brake magnets may lose their effectiveness over time.

9.3.9. Display / Dial Test

Test	**Display / Dial Test**
Purpose	Tests the display or dials of an electronic or mechanical meter respectively
Test procedure	**Mechanical Meter:** Pass energy through the meter until the fastest moving drum or pointer is observed to move a whole unit. **Electronic Meter:** Browse to the screen test display of the LCD and verify that all of the display segmentsare working on the screen.
Test equipment	NA
Test sheet	F918D
Applicable to	Electronic or electromechanical meters
Conditions	The test fails if the display or dials do not correctly operate.

9.3.10. Testing Constants

The following is a list of testing constants that can be useful when required to conduct accuracy testing of existing older type meters.

C.T. Electronic Meters Testing Constants				Test Set	Visual	Test Set	Visual	Test Set		
Meter	Wiring	Voltage	Current	Revs per	Kh Value	Test	Kh Value	Test	Pulse Ratio	Output
Type	Configuration		Range	KWh	Arrow	Constant	Square	Constant	Kh to Ke	Pulse Ke
				Col (1)	Col (2)	Col (3)	Col (4)	Col (5)	Col (6)	Col (7)
E1*	3P 4W	63.5	0.5 - 4	N/A	0.18	5555.556	N/A	N/A	12	0.015
E1	3P 4W	63.5	0.5 - 4	N/A	0.216	4629.63	N/A	N/A	12	0.018
E1	3P 4W	63.5	2.5 - 20	N/A	1.08	925.9259	N/A	N/A	12	0.09
E1	3P 3W	110	0.5 - 4	N/A	0.24	4166.667	N/A	N/A	12	0.02
E1	3P 3W	110	2.5 - 20	N/A	1.2	833.333	N/A	N/A	12	0.1
E1	3P 4W	240	0.5 - 4	N/A	0.72	1388.889	N/A	N/A	12	0.06
E1	3P 4W	240	2.5 - 20	N/A	3.6	277.7778	N/A	N/A	12	
E1	3P 4W	240	10 - 125	N/A	43.2	23.14815	N/A	N/A	12	3.6
E1R	3P 4W	63.5	0.5 - 4	N/A	0.216	4629.63	N/A	N/A	36	0.006
E1R	3P 4W	63.5	2.5 - 20	N/A	1.08	925.9259	N/A	N/A	36	0.03
E1R	3P 3W	110	0.5 - 4	N/A	0.24	4166.667	N/A	N/A	24	0.01
E1R	3P 3W	110	2.5 - 20	N/A	1.2	833.3333	N/A	N/A	24	0.05
E1R	3P 4W	240	0.5 - 4	N/A	0.72	1388.889	N/A	N/A	36	0.02
E1R	3P 4W	240	2.5 - 20	N/A	3.6	277.7778	N/A	N/A	36	0.1
E1R	3P 4W	240	10 - 125	N/A	43.2	23.14815	N/A	N/A	36	1.2
SDME	3P 3W	110	0.5 - 1.5	5000	0.2	5000	N/A	N/A	10	0.02
SDME	3P 3W	110	2.5 - 7.5	1000	1	1000	N/A	N/A	10	0.1
SDME	3P 4W	240	0.5 - 3	1333.3'	0.75	1333.333	1.5	666.6667	10	0.075
SDME (2110 Reg)	3P 4W	240	2.5 - 15	266.6'	0.375	666.6667	N/A	N/A	10	0.375
SDME (2160 Reg)	3P 4W	240	2.5 - 15	266.6'	0.375	1333.333	N/A	N/A	10	0.375
SDME	1P 3W	240	10 - 60	66.6'	15	66.66667	N/A	N/A	10	1.5
SDME	3P 4W	240	10 - 60	66.6'	15	66.66667	N/A	N/A	10	1.5
SDME	3P 4W	240	10 - 125	22.2'	45	22.22222	N/A	N/A	10	4.5
A1K, A1R& A1D	3P 4W	240	5 - 20	N/A	0.15	6666.667	1.8	555.5556	2	0.075
A1R	3P 3W	110	5 - 20	N/A	0.1	10000	1.2	833.3333		
Q3	3P 3W	110	5 - 15	N/A	0.05	20000	0.5	2000	2	0.025
Q3	3P 4W	240	5 - 15	N/A	0.1	10000	1	1000	2	0.05
Q4	3P 3W	110	5 - 15	N/A	0.05	20000	0.5	2000	2	0.025
Q4	3P 4W	240	5 - 15	N/A	0.1	10000	1	1000	2	0.05
Q4A	3P 4W	240	10 - 100	N/A	1	1000	10	100		
EDMI Mk3	Any Config.	Any Volts	Any amps	N/A	1	1000	N/A	N/A	N/A	N/A
Genius	Any Config.	Any Volts	Any amps	N/A	1	1000	N/A	N/A	N/A	N/A

9.4. Site Audit

Test	**Site audit**
Purpose	Used to confirm what assets are installed, the general metering accuracy and the appropriateness of connected burdens.
Test equipment	NA
Test sheet	Meter Installation Audit Sheet
Applicable to	Wholesale and HV metering sites
Conditions	Complete all blank cells of the Installation Audit Sheet by inspecting the CTs, VTs, meters and modem.

Wholesale and HV metering installations

Site inspections are scheduled on different timeframes for wholesale and HV metering installations depending on the amount of energy that passes through the meter. These will often be scheduled to be performed at the same time as other tests (VT, CT, or meter testing).

Basic and COMMS-4 metering installations

Site inspections are to be performed for Basic and COMMS-4 metering installations at the same time as the meter is accuracy tested.

Site audit

During a site audit, follow the Site Audit Sheet and perform the following tasks:

- Check seals.
- Record CT and VT nameplate details and measure burdens and circuit lengths.
- Record meter details.
- Re-measure the VT and CT burdens
- Complete inspection worksheet to compare displayed voltage and current with measured values.
- For HV metering, take photos of meter, test block, site layout, and nameplates.

9.5. CT And VT testing

9.5.1. CT Test

Test	**CT Test**
Purpose	CT accuracy testing
Test equipment	RedPhase 590G V2
Applicable to	CTs
Test sheet	CurrentTXUserForm.xlsm
Conditions	Refer to OEM manual for instructions This test form collects multiple results from each tester. For each CT record: • Nameplate detals • Secondary resistance (mΩ) • Tested turns ratio • Secondary Voltage (V), magnetising Admittance – Gm (mS) and Susceptance – Bm (mS) • Magnitude error (%) and phase errors (minutes) for all test points requested by the test form. The CT should be tested at 200% rated current if it is extended range or 120% if it is not extended range. Check for compliance with AS60044.1 if the CT was installed before 2007 or As1675 if it was installed after 2007. Provide an overall Pass/Fail for the CT against the relevant standard

9.5.2. VT Test

Test	**VT Test**
Purpose	VT admittance test
Test equipment	RedPhase 590G V2 with 590D attachment
Applicable to	VTs
Test sheet	F936A Voltage Transformer Field Testing Details
Conditions	Refer to OEM manual for instructions For each VT core record: • Nameplate details • Primary Resistance (Ω) • Secondary Resistance (mΩ) • Short Circuit Impedance (Ω) • Voltage Ratio • VT internal parameters (Y, Ka and turns ratio) • Accuracy at prompted burdens and voltages (percentage and phase angle errors) Check for compliance with AS 60044.2 for single phase VTs Check for compliance with AS 1243-1982 for three phase VTs Provide an overall Pass/Fail for the VT against the relevant standard

9.5.3. Burden Test

This test ensures that CTs and VTs are not loaded beyond their class rating, and is necessary to calculate the overall error of a site. Refer to 4.3.3.3 for details.

9.6. Laboratory Testing

Refer to **Meter Laboratory Testing Manual** for descriptions of all laboratory testing.

Appendix A Meter Programs

A.2 FIP Programs

FIP programs in EDMI MK7A, MK10D and MK10E meters are listed in the following tables.

Refer to Status column for the program status – "Approved" (available for use) and "In-use" (still valid but an older version ID).

Refer to the table in Meter Setups section for details individual tariff features listed in the Tariff column. TOU tariffs are associated with Res (residential), Bus (Business) or IRR (Irrigation) tariffs.

Table A-4 Programming codes EDMI MK7A

Tariff	FID Display Code	PID Display Code	Status
One Rate & T41	4132	4132-104	Approved
One Rate & T61	6135	6135-104	Approved
One Rate & T63	6335	6335-104	Approved
One Rate Only	3132	3132-104	Approved
T61 Only	61ONLY	61ONLY-104	Approved
T63 Only	63ONLY	63ONLY-104	Approved
One Rate Solar	31SOLAR	3132-204	Approved
One Rate & T41 Solar	41SOLAR	4132-204	Approved
One Rate & T61 Solar	61SOLAR	6135-204	Approved
One Rate & T63 Solar	63SOLAR	6335-204	Approved
TOU-RES	93_ONLY	9335-104_1_Rate	Approved
TOU-RES & T63	93_63	9335-104_2_Rate_63	Approved
TOU-RES Solar	93_X	9335-204_1_Rate	Approved
TOU-RES & T63 Solar	93_63_X	9335-204_2_Rate_63	Approved
TOU-BUS	9435	9435-104	Approved
TOU-BUS Solar	94SOLAR	9435-204	Approved
One Rate & T41	4132	4132-103	In-use
One Rate & T61	6135	6135-103	In-use
One Rate & T63	6335	6335-103	In-use
One Rate Only	3132	3132-103	In-use
T61 Only	61ONLY	61ONLY-103	In-use

A.4 EDMI MK10E Programming Codes

Table A-5 Programming codes EDMI MK10E

Tariff	FID Display Code	PID Display Code	Status
LV CT Installations ONLY			
One Rate (22, 31, 41 or 42)	___2222	2222-104	Approved
One Rate + Solar	22Solar	X1I/2222-204	Approved
94 (TOU-Bus)	___9425	9425-104 CT	Approved
75 (TOU-IRR)	___7525	7525-104 CT	Approved
93 (TOU-Res)	___9325	9325-104 CT	Approved
82 (KVA Demand)	___8222	8222-104	Approved
TOU-IRR + Solar	X1I7525	X1I 7525-204 CT	Approved
TOU-Bus + Solar	X1I9425	X1I 9425-204 CT	Approved
TOU-Res + Solar	X1I9325	X1I 9325-204 CT	Approved
One Rate (22, 31, 41 or 42)	___2222	2222-101	In-use
One Rate + Solar	22Solar	X1I/2222-201 CT	In-use
94 (TOU-Bus)	___n13C	N13C-101 CT	In-use
75 (TOU-IRR)	___n08b	N08b-101 CT	In-use
82 (KVA Demand)	___8222	8222-101	In-use
TOU-IRR + Solar	___n08bSolar	X1I N08b-201 CT	In-use
TOU-Bus + Solar	___n13CSolar	X1I N13C-201 CT	In-use
HV Installations ONLY			
15 (3 element)	_1512_3EL	Select Solutions (Global M): 1512-102 HV 3EL AusGrid (TCA): 1512-103 HV 3EL	Approved
15 (2 element)	_1512_2EL	Select Solutions (GlobalM): 1512-102 HV 2EL AusGrid(TCA): 1512-103 HV 2EL	Approved

A.5 EDMI MK10D Programming Codes

Table A-6 Programming codes EDMI MK10D

Tariff	FID Display Code	PID Display Code	Status
One Rate	___2232	2232-103 DC	Approved
61 Only	61 Only	6135-106 DC	Approved
63 Only	63 Only	6335-106 DC	Approved
TOU-IRR	___7535	7535-103 DC	Approved
KVA Demand	___8232	8232-103 DC	Approved
TOU-Res	93_Only	9335_1_Rate	Approved
TOU-Res + Solar	___93_X	9335_Solar	Approved
TOU-Bus	___9435	9435-103-DC	Approved
One Rate + Solar	_X1l-22	X1I/2232-203	Approved
TOU-IRR + Solar	X1I7535	X1I/7535-203 DC	Approved
TOU-BUS + Solar	X1I9435	X1I/9435-203 DC	Approved
One Rate	___2232	2232-102 DC	In-use
61 only	61 Only	6135-105 DC	In-use
KVA Demand	___8232	8232-102 DC	In-use
NULL	LABTEST	LABTEST	In-use
TOU-IRR	___N08b	N08b-102 DC	In-use
TOU-Bus	___N13C	N13c-102 DC	In-use
One Rate + Solar	_X1l-22	X1I/2232-202	In-use
TOU-IRR + Solar	X1IN08b	X1I/N08b-202 DC	In-use
TOU-BUS + Solar	X1IN13C	X1I/N13c-202 DC	In-use

TOU = Time of Use IRR=Irrigation RES = Residential BUS = Business

Appendix B Meter Error And Warning Codes

B.1 Email Q4, A11 And A11L Error And Warning Codes

Table B-1 Meter error and warning codes Email Q4, A11 and A11L

Code	Description	Action
Errors		
ER 000001	Indicates that the clock/calendar has stopped	Record all displays, remove meter and return for a new battery
ER 000010	Indicates meter program loading error	Record all displays and reprogram meter
ER 000100	Indicates a programming configuration error	Record all displays, remove meter and return for repairs.
Warnings		
F 000001	Indicates low battery	Record all displays, remove meter and return for a new battery
F 000010	Indicates an internal communication error in the meter caused by severe electrical noise, such as generated by an electrical storm.	No action required
F 000100	Indicates that reverse energy has been detected	No action required
F 001000	Indicates phase sequence is incorrect or phase voltages are below 75% of the nominal value	Change phase sequence and check voltage
F 010000	Indicates memory overrun error	No action required

B.2 Actaris Payguard Error Codes

Table B-2 Meter error and warning codes Actaris Payguard

Error code	Description
11	Invalid Supplier ID
12	Invalid Meter No
13	Authentication Fail
14	Invalid CRN
15	Invalid ARN
16	RAM Corruption detected
17	Problem with 5v rail

Error code	Description
18	Rate Switch Matrix invalid
19	Credit would exceed limit
20	Blank Token Not acknowledged
21	Not configd for Blank Token
22	BT - Attachment has no Meter Number
24	Credit Back Token Inserted
25	Wrong consumers token - multi
26	Credit Back Timestamp not found
27	Same tstamp seen twice
29	Mtce Card - No of uses error
30	Mtce Card - Expiry date error
31	Credit back store full error
32	Battery Removed
33	Battery Low voltage
34	Corrupt Tariff
35	Error writing to error store
36	Error reading from error store
37	Corruption of Time/Date
38	Cover Open Alarm
39	Short Circuit Alarm
255	No Error

Table B-3 Meter faults and remedies Actaris Payguard

Fault no.	Error no.	Problem	Possible cause	Remedy
1		Supply cannot be restored using recommended procedures.	Unknown	Emergency credit can be activated to restore supply. Out of hours, add credit using maintenance card to ensure customer will not be without supply, or If a replacement Payguard cannot be installed at the time, a manual bypass of the Payguard will be required. The Electricity Retailer MUST be notified of any Payguards that are bypassed. In TVD use, the F/L comments to advise of this. The faulty Payguard will need to be replaced as soon as possible.
2	F030	Maintenance cards not accepted	Maintenance card out of date Payguard date set incorrectly	Check date setting within Payguard; If date setting is in advance of today's date, reset this using the 'Set time' maintenance card. If the date cannot be reset, replace Payguard using the procedure outlined at Fault No. 1 above. If date setting is correct, maintenance card is possibly out of date. Return maintenance cards to the Electricity Retailer for refresh. Using accepted maintenance cards, clear error codes leaving Payguard operational
3	F032	Battery fault or removed	Battery failure Bad connection Tamper	Replace battery, Clear error codes and ensure supply is restored. Check error code listing using Extend display configuration. If error registers again, replace Payguard using procedure outlined at Fault No. 1, above.

Fault no.	Error no.	Problem	Possible cause	Remedy
4	F033	Battery voltage low	Battery voltage is low	Replace battery, Clear error codes and ensure supply is restored. Check error code listing using Extend display configuration.
5	F035 F102 F132	Supply isolated Read Error – Vital data store 1 Read error – Error store	Component failure	Scroll through displays and note credit remaining, if possible Replace Payguard using procedure outlined at No. 1, above.
6	None	Customer card not accepted by Payguard, display number '8'.	Customer card programmed incorrectly. Customer card corrupt.	Request POS agent to 'Read Token'. If card reads correctly and has the appropriate meter number and customer name, Payguard unit should be replaced. If card cannot be read by the POS agent, customer should obtain a replacement card by contacting Aurora Customer Service Centre (CSC) on 1300 132003 to obtain card issue codes.
7	None	Payguard display is blank but electricity supply is available	Power supply to Payguard has bad connections Faulty display	Check the active and neutral connections between the electricity meter and the Payguard wiring loom are made correctly. Connections can be confirmed by checking the 240v supply is available at pins 1 & 11 of the 18 pin connector. If Payguard display is not able to be restored the Payguard will need to be replaced using the procedure outlined at Fault No. 1, above.

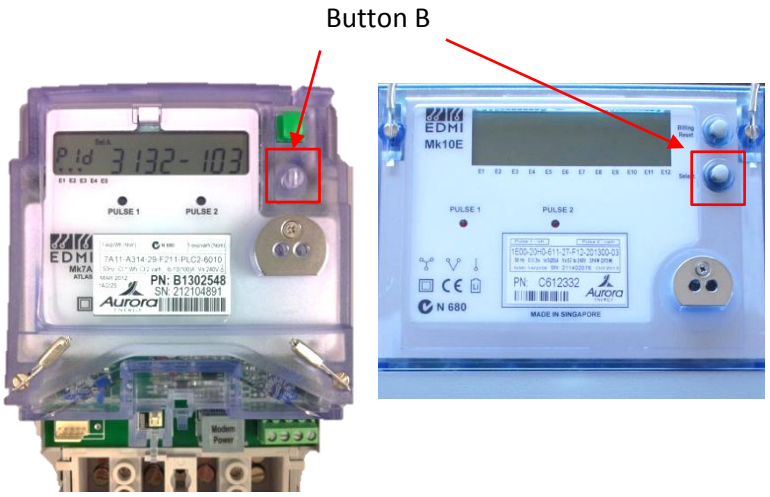
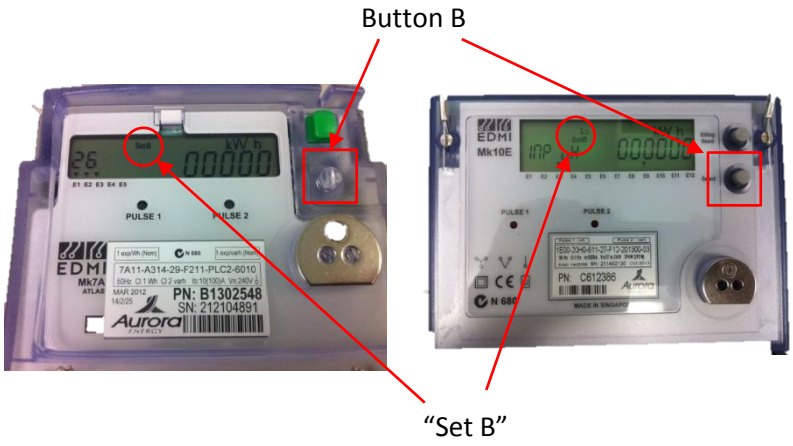
Fault no.	Error no.	Problem	Possible cause	Remedy
8	None	Payguard exhausts credit at an abnormally high rate	Payguard not initialised correctly	Payguard initialization can be confirmed by checking that emergency credit is available at display [5] on Payguard. If Payguard is not initialized correctly; Insert the 'Initialisation' maintenance card and confirm the number [9] is displayed on the left hand side of the display. Select 'Emergency credit' by pressing the red button to restore power supply for the customer Advise Aurora immediately that this error has been rectified by telephoning 1300 132003 so that the customer credit can be made available via Special Action. Customer will need to visit the POS to collect their credit by completing a 'Verify' transaction.
9	None	Payguard is deducting 'Standing charges' only from available credit	Pulse weighting from meter is not connected correctly Pulse weighting at energy meter is not programmed correctly	A flashing bracket on the left hand side of the Payguard display number confirms that the pulse output is being received by Payguard. If the bracket is not flashing when a load is connected; Check the pulse output is connected as outlined within the installers manual and Re-program the energy meter pulse output to confirm that this is programmed correctly

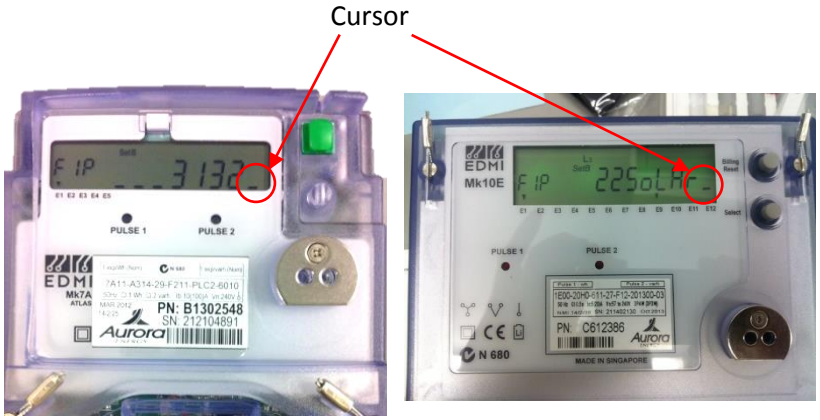
Appendix C Using FIP In EDMI meters

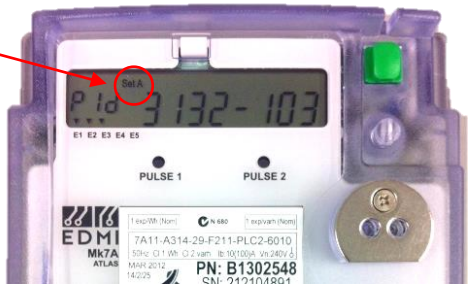
Note. The examples show MK7A and MK10E meters, but the process is identical for other meter types.

Table C-1 Instructions for using FIP in EDMI meters

Step	Instruction
1. Existing MK7A meter	If re-programming and existing meter ensure final readings are recorded before continuing. **Note.** Meter registers will be reset to 00000 when reprogramming meter. The version of the meter program must be checked to see if it is current against the programs listed in the Metering Field Manual. Older meters may not contain a valid program for the tariff required.
2. After installation of new meter	Once installed the meter requires five (5) minutes to calibrate and self check before field initiated programming (FIP) can begin.
3. Remove terminal cover	The meters terminal cover must be removed before FIP is possible.  
4. Scroll to PID display	Quick press “button B” until PID screen is displayed. Check current program against Appendix A to make sure it needs to be updated. **Note.** For MK10D and MK10E meters, enter Set B by following Step 5 before scrolling to the PID screen.

Step	Instruction
	
5. Enter Set B	Press and hold “button B” for 1 second, until “Set B” is displayed. 
6. Enter FIP	Press and hold “button B” for 1 second, until “Set B’ begins flashing.
7. Enable FIP	Press and hold “button B” for 6 seconds, until curser begins flashing.

Step	Instruction
	
8. Select required program	Refer Appendix A for list of available programs. Quick press “button B” until required program (FIP Display Code) is displayed. 
9. Disable FIP	Press and hold “button B” for 6 seconds, until curser disappears.
10. Apply new programming	Press and hold “button B” for 6 seconds, until “Will Clear” is displayed. 
11. Confirm new programming	Press and hold “button B” for 6 seconds, until “Apply Setup” is displayed, once released “Done Setup” will be displayed.

Step	Instruction
	 
12. Exit Set B	Quick press “button B” until “Exit” is displayed, then press and hold “button B” for 1 second until “Set A” is displayed.  “Set A” 
13. Confirm programming	Quick press “button B” until PID screen is displayed. Check meter program (PID Display Code) against Appendix A **Note.** For MK10D and MK10E meters, enter Set B by following Step 5 before scrolling to the PID screen.

Step	Instruction
	 
	If program is correct, proceed to step 14. If program is incorrect, return to step 5.
14. Seal meter and check time & date	Replace terminal cover and seal meter. Press “button B” to check time and date. **Note.** Time is set to Eastern Standard Time. During daylight saving, time will be 1 hour behind local time.  

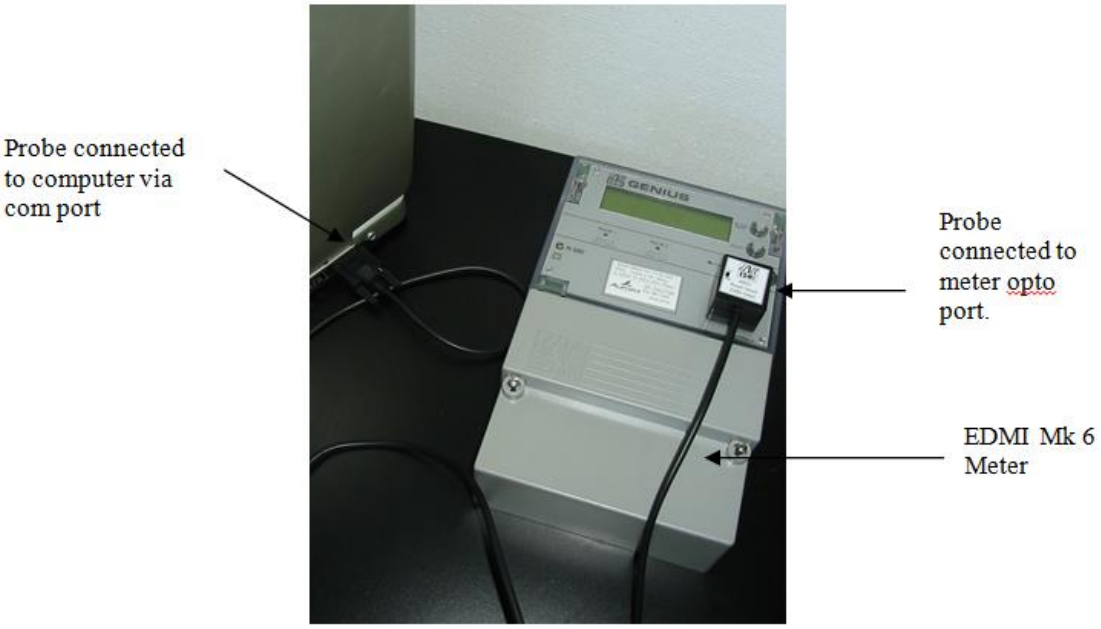
Appendix D Phase Checks For EDMI Meters

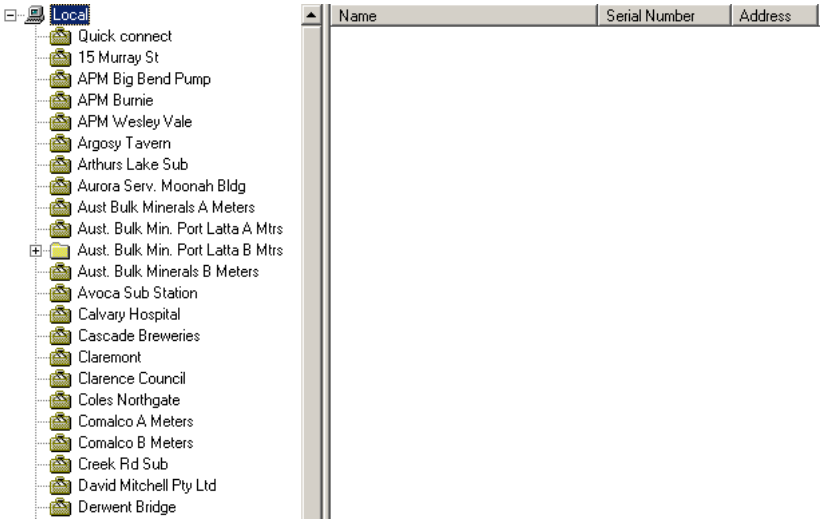
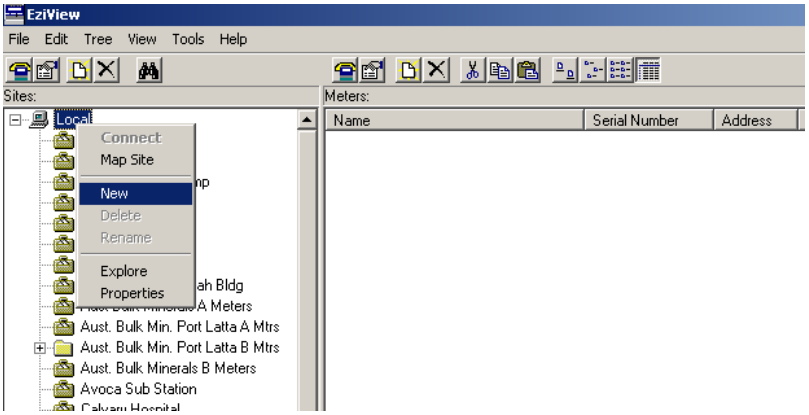
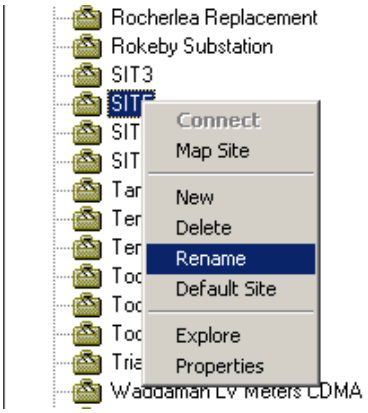
This section describes the use of the EDMI EzyView meter software to check correct voltage and current phase sequence of EDMI polyphase electronic current transformer (CT) meters.

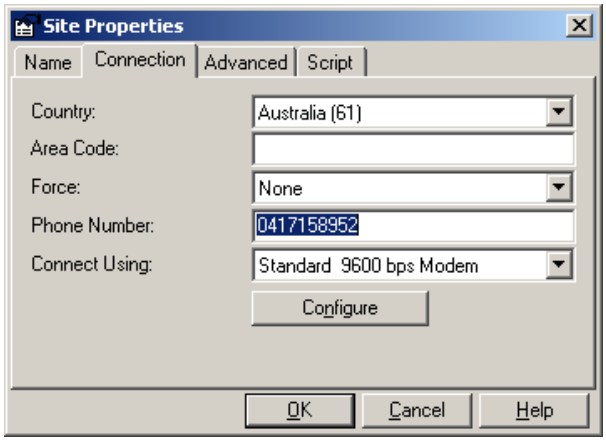
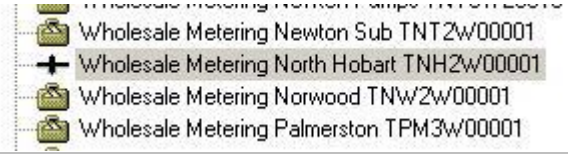
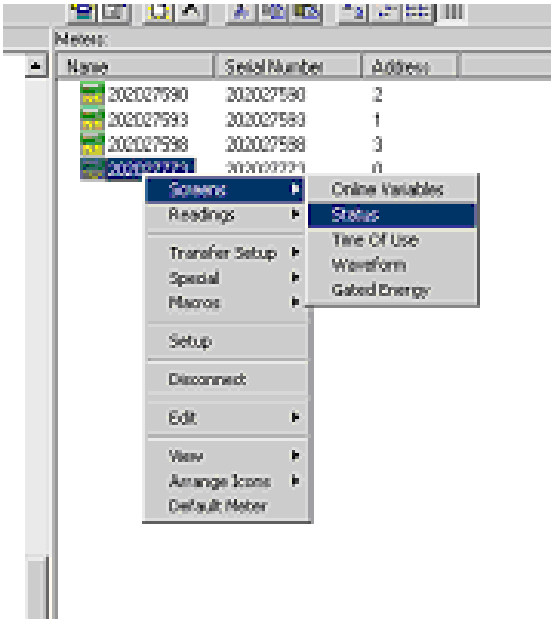
To use this instruction you must have:

- A laptop computer with registered EzyView software in accordance with MP 1201 (Metering Software Control).
- For electronic communication from the computer to the meter, a suitable opto probe like the following U.S. Microtel PM 500 shown.
- Authorisation to carry out transformer connected metering work from
- Basic training on the use of the EzyView software.

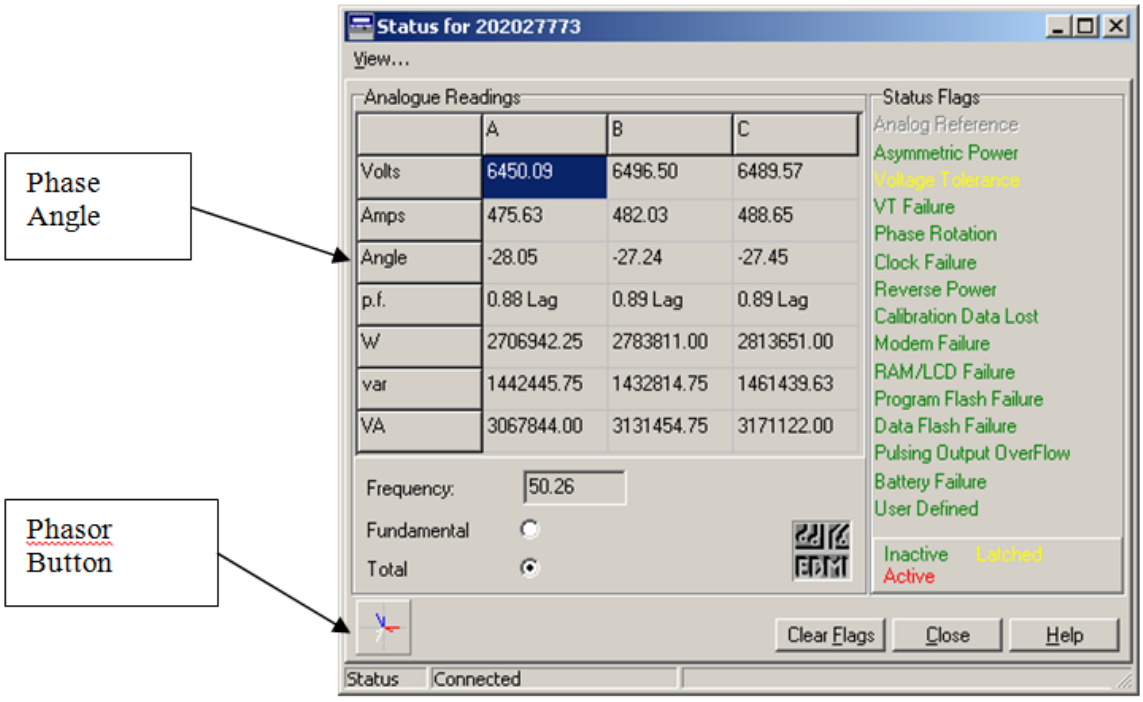
Table D-1 Phase check procedure using EDMI EziView meter software

Step	Instruction
1	Connect the opto probe to the computer and the meter as shown below. 
2	Start EzyView and enter your **User Name** and **Password**. **Note.** For security reasons, usernames and passwords cannot be shown in this work instruction. 

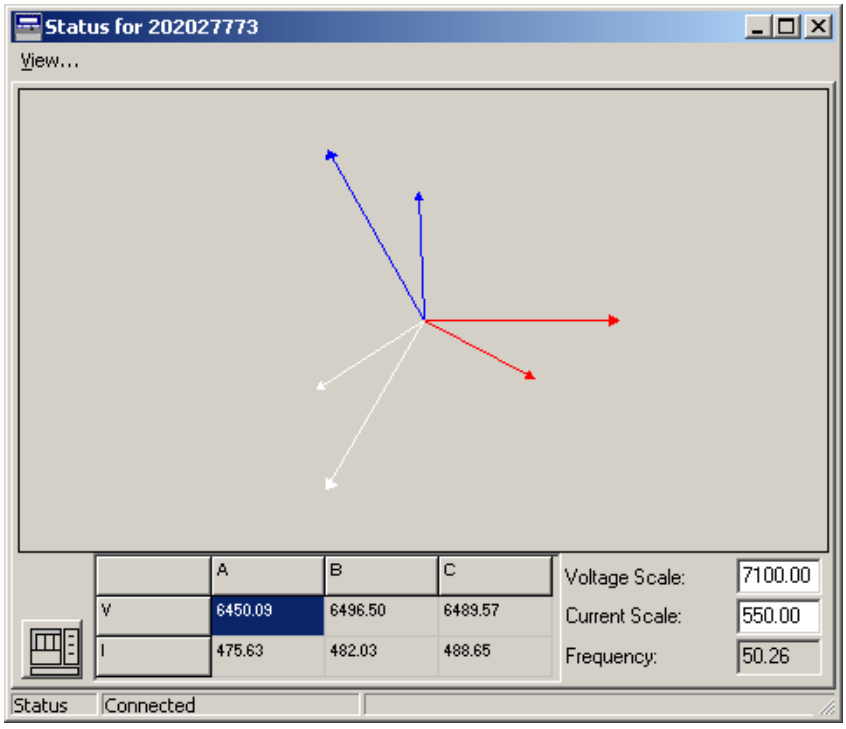
Step	Instruction
3	The main screen is displayed. If the site is listed on the left of the screen, go to step 6. Otherwise, continue at step 4. 
4	Right-click on the **Local** tree menu and then left-click on the **New** option. A new site is created with the default name SIT1, SIT2, SIT3 etc. depending on how many sites have been created. 
5	Locate the new site in the **Sites** panel, then right-click on the site and left-click on **Rename**. Rename the site as appropriate, e.g. Smith Industries. 

Step	Instruction
6	Right-click on the site again, and then left-click on **Properties** to display the communications setup. The local optical probe should be selected in the 'Connect Using' field. 
7	Right-click on the site again, and then left-click on **Connect** to dial the site. When the site is connected the icon beside the site changes: 
8	Right-click on a meter, and then select **Screens> Status**. 

Step	Instruction
9	Click the **Phasor** button at the bottom left of the display.



Check the angle of the current to the voltage. Most loads have lagging currents with power factors between 0.65 and 0.95. This indicates the correct CT currents are connected to the right phase voltage. This is also confirmed in the phasor diagram (below).



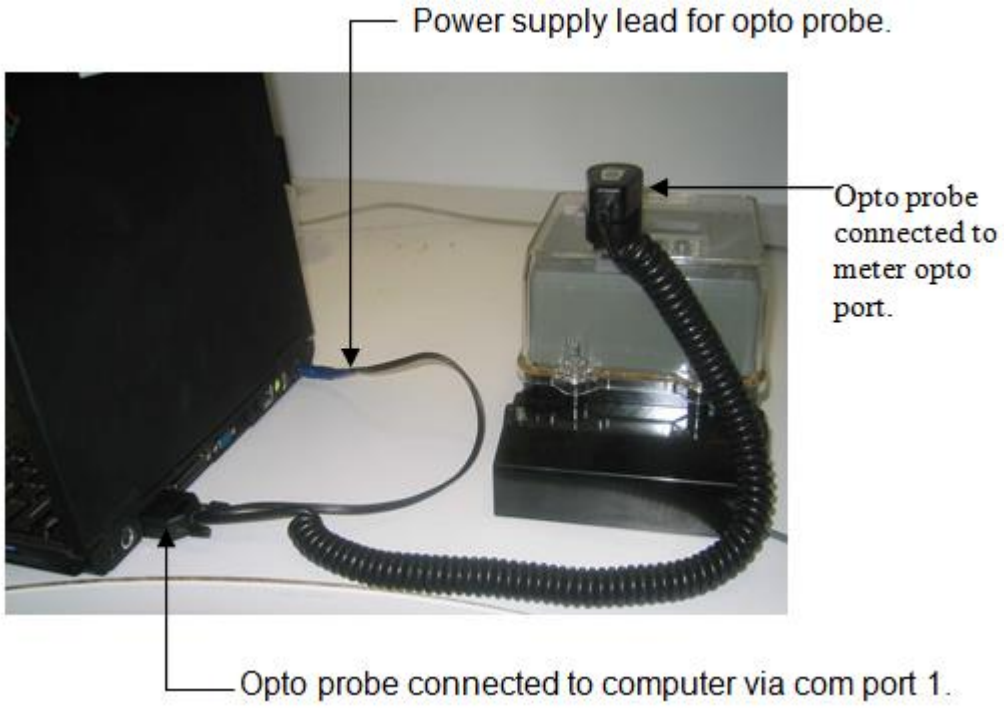
Appendix E Phase Checks For L&G meters

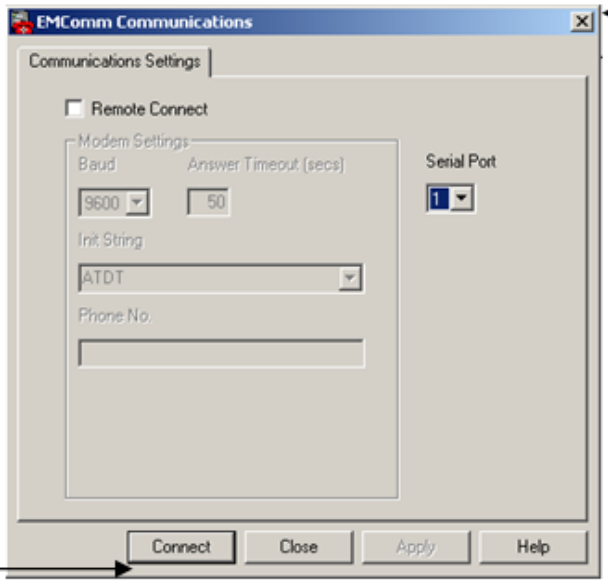
This section describes the use of the Landis & Gyr EmpWIn meter software to check correct voltage and current phase sequence of L&G polyphase electronic current transformer (CT) meters.

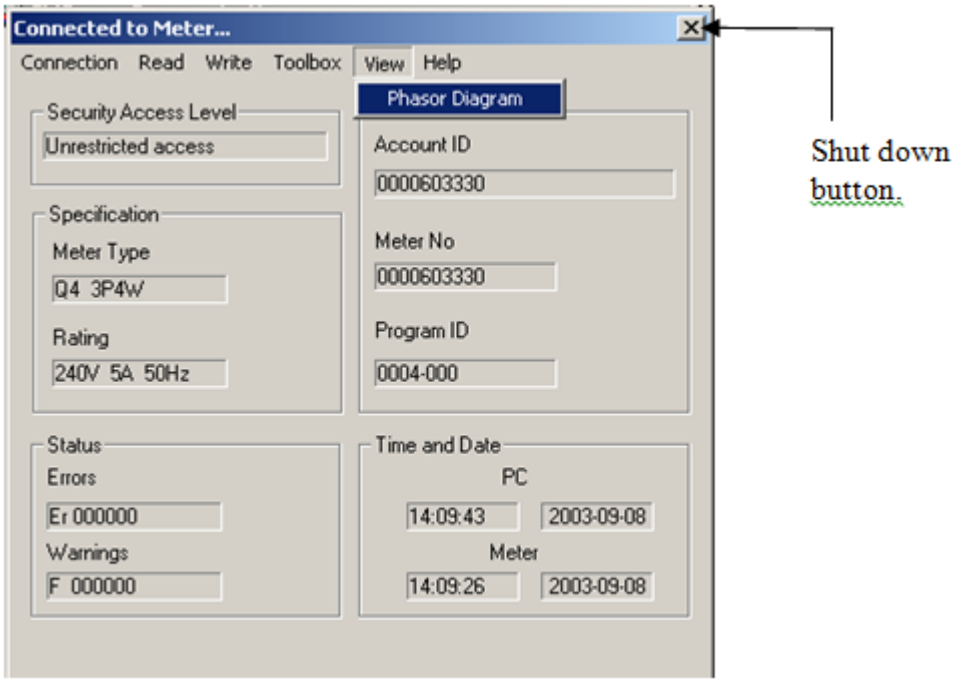
To use this instruction you must have: -

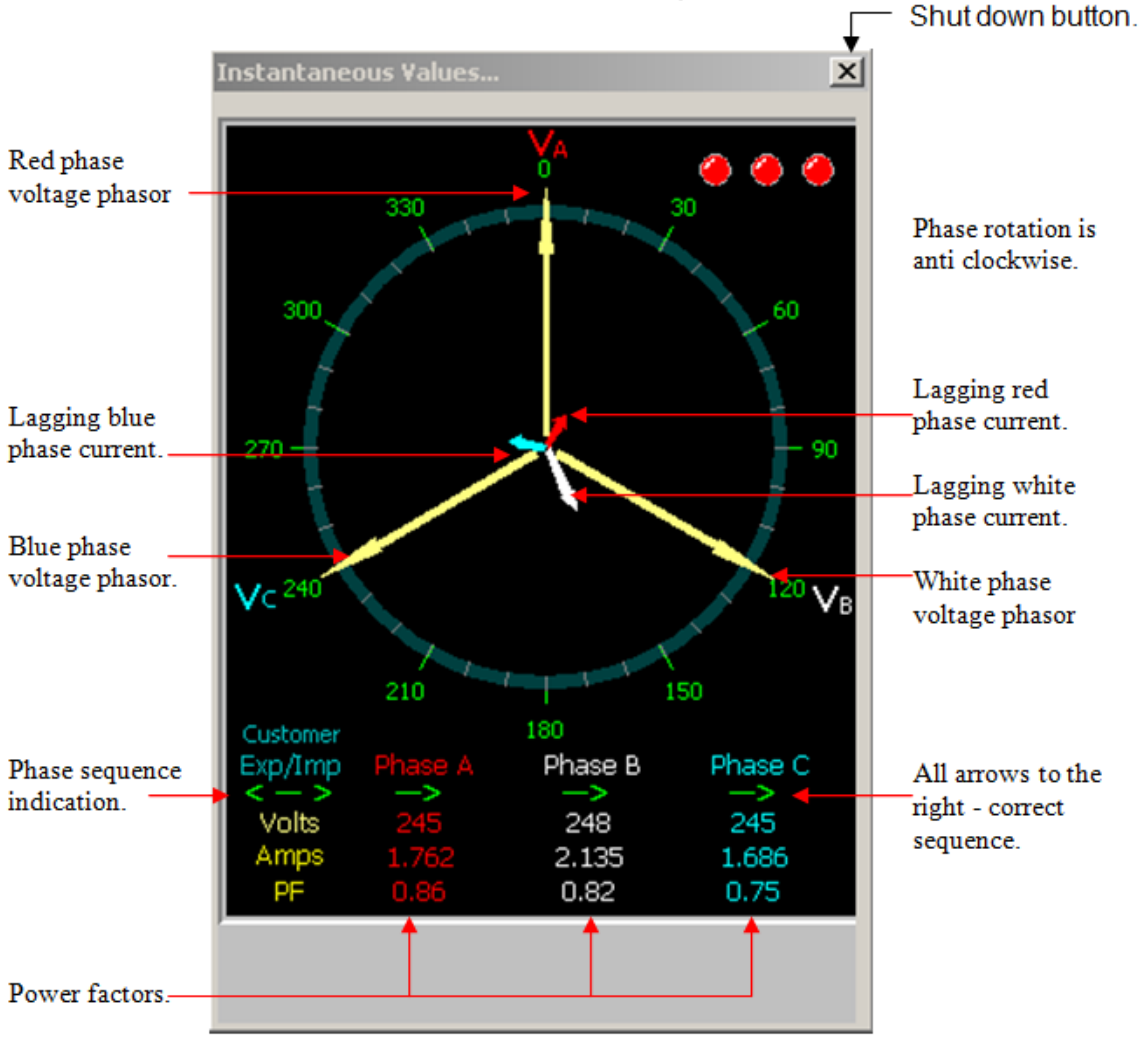
- A laptop computer with registered Emp Win software In accordance with MP 1201 (Metering Software Control).
- For electronic communication from the computer to the meter, a suitable opto probe like the following U.S. Microtel PM 500 shown.
- Authorisation to carry out transformer connected metering work.
- Basic training on the use of the EmpWin software.

Table E-1 Phase check procedure using L&G EmpWin meter software

Step	Instruction
1	Connect the opto probe to the computer and the meter as shown below. 

Step	Instruction
2	Start EmpWin and select the communications option: Click on this icon for polyphase Q3 and Q4 meters. 
3	Check the Communications Settings are as shown below: 

Step	Instruction
4	Click the **Connect** button open communications with the site. When the site is displayed, select the **View** tab and click the **Phasor Diagram** button. 

Step	Instruction
5	On the phasor diagram, carefully check the voltage direction arrows. All arrows should point to the right. Also check the angle of the current to the voltage. Just about all loads have lagging currents, with power factors typically between 0.65 and 0.95. This would indicate the correct CT currents are connected to the correct phase voltage. Note that the example screen is shown for three-element metering.  Figure 34 Example of correct HV three-element phasor diagram
6	If the phasor diagram indicates a problem, trace out the wiring and correct the problem. Repeat this procedure to confirm voltage and current sequence is correct.

Step	Instruction
7	Once the correct phase sequence is confirmed, click on all the shut down buttons to close the displays screens and close EmpWin. **Note**. The phasor display is handy for checking the CT ratio is correct. Simply multiply each current on the phasor display by the CT ratio. The calculated currents should match the primary currents measured using a tong tester.

Appendix F Using The MTE PTS Test Set

This section will be extended in future versions of this manual. Refer to an OEM Manual in Section 9.1.

Appendix G Using the RedPhase 689 Test Set

This section will be extended in future versions of this manual. Refer to an OEM Manual in Section 9.1.

Appendix H Using Phase Angle Meters

H.1 Purpose

The Phase Angle Meter (PAM) is a purpose-built device that measures the phase angle, AC voltage, AC current and frequency in an electricity supply network. It is used to identify reactive losses in power distribution.

H.2 Details

Tests must be undertaken as per steps in H.3 and H.4 below.

The user interface consists of a keypad and 2 x 16 character LCD display. Voltage and current overload warnings are provided and the voltage and current inputs are fully isolated from each other and the user.

On power up, the PAM meter samples both voltage and current terminals. If both waveforms are present and the current range has been selected, the meter automatically measures the true RMS AC values and phase angle between them. All three values are displayed simultaneously.

Option	Description
ON/OFF	Turn PAM meter on or off
BACK LIGHT	Turn back light on/off
MODE	Display Volts, Current and Phase Angle or power in VA, Watts and Power Factor.
360/180	Display Phase Angle as either 0-360 degrees or +/- 180 (the negative (-) indicating the Current is leading the Voltage)
RANGE	Choose LOW (< 1000 mA) or HIGH (0.1 – 10 amps) current input range

H.3 Test procedure

To ensure correct measurements are obtained using the PAM Meter it is extremely important that connections are made correctly to ensure that damage does not occur to the PAM Meter or Current Transformers.

Table H-1 Phase Angle Meter test procedure

Step	Instruction
1	Connect appropriate leads to the PAM Meter. Red and Black leads to the Voltage Terminals, Blue and Black leads to the Current Terminals ensuring the Blue Lead is connected to the correct current range
2	Turn meter ON
3	Select the appropriate Current range by pushing the Low or High range button that is aligned with the Blue current lead
4	Connect the Voltage leads (Red & Black) to the potential stud and neutral bar of the CT test link or 2 phases (110volt) for some HV installations.
5	Connect Current leads (Blue & Black) to the CT test link as follows:Blue lead to Grey trace cable from current transformer.Black current lead to Grey trace cable connected to meter. Make sure these connections are firm. Note: Ensure that the Voltage and Current common leads are not transposed as these terminals are fully isolated from each other.
6	Open the current slide link the PAM meter is connected to. At this point the meter is connected in series with the energy meter and will indicate Voltage, Current and Phase Angle on the screen
7	Disconnect the PAM in the following order: 1. Close the CT slide link that the PAM is connected to 2. Remove current leads from test link 3. Remove voltage leads from test link

H.4 Measurements

The measurements obtained are Voltage (phase to neutral or phase to phase), Current (current flowing in the secondary circuit of CT) and Phase Angle (difference between Voltage and Current waveform). The measurement is displayed as a positive (+) number indicating the current is lagging the voltage (It is the Metering convention). If the symbol is negative (-) this indicates that the current is leading the voltage.

If the phase angle measured is greater than 90 degrees this indicates that the current and voltage phase relationship is incorrect or that the customer is generating more energy than they are using. Check connections and CT wiring to ensure it is correct.

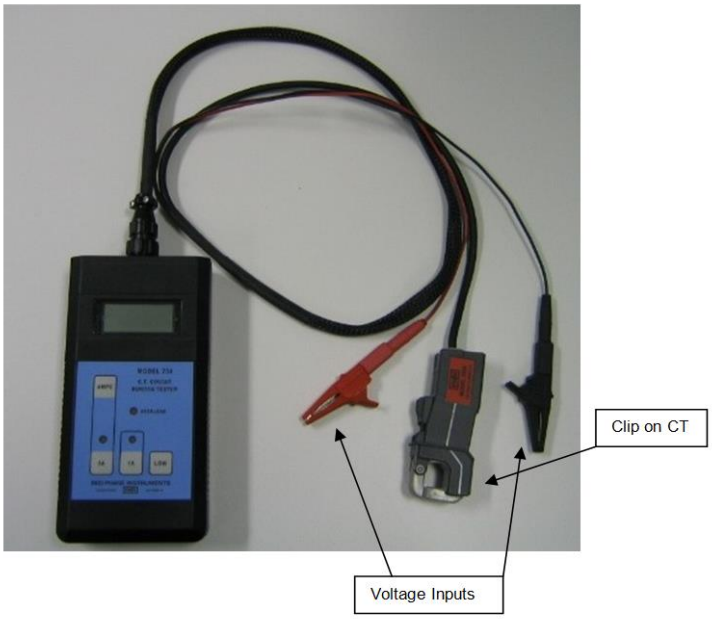
By pushing the Mode button the screen changes to indicate power in VA, Watts and Power Factor of the measured circuit.

Appendix I Using The CT Burden Tester

I.1 Purpose

The CT burden tester measures the current flowing in the CT circuit and the burden placed on the CTs.

I.2 Details



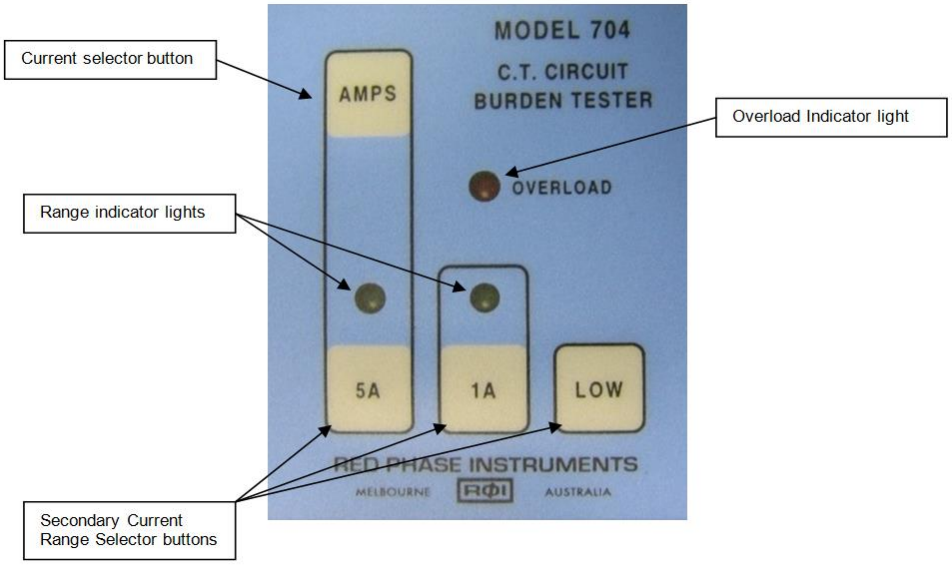


Figure I-1 Model 704 CT Circuit Burden Tester and control panel

I.3 Safety

As this test is performed live, extreme care must be taken when making connections to CT Terminals. Tests must be undertaken as per the Low Voltage Testing Procedure. The test is to be performed at the CT terminals, ensure that it is safe to do so before proceeding.

I.4 Test Procedure

To measure the CT burden using the Red Phase Instruments Model 704 tester, it is extremely important to note that connections are made firmly and correctly to avoid short circuit possibilities and to ensure that damage does not occur to the tester or the CTs.

Table I-1 CT burden tester test procedure

Step	Instruction
1	Ensure that the test lead set is matched to the tester. The tester has a number on the top beside the lead connection; this must be matched to the number on the clip on CT.
2	Connect the test lead to the unit.
3	Clip the voltage inputs to the Current Transformer Secondary Terminals. (For multi-range CTs ensure that the connections are to the terminals in use). Polarity is not important
4	Clamp the Clip on CT around one of the secondary cables.
5	Select the range required. This is determined by the secondary current rating of the CT, e.g. 200/5 the range required would be 5A. Most CTs used by TasNetworks have a secondary rating of 5 amps. (Some High voltage & EHV metering units have a 1 amp secondary)
6	To power up the unit, press either the ‘5A’ or the ‘1A’ key. This locks the 704 in that range.
7	While in the 5A range, press and hold the ‘AMPS’ key to read the CT secondary current.
8	Release the ‘AMPS’ key to read the burden of the secondary circuit in ohms.
9	If the current or voltage is low and the burden reading is erratic, select the appropriate range for best accuracy and then press and hold the ’LOW’ key for a few seconds to display burden.
10	Disconnect the tester in the reverse order to how it was connected: step 4, then 3, then 2.
11	Repeat steps 1 to 10 for white and blue phases.

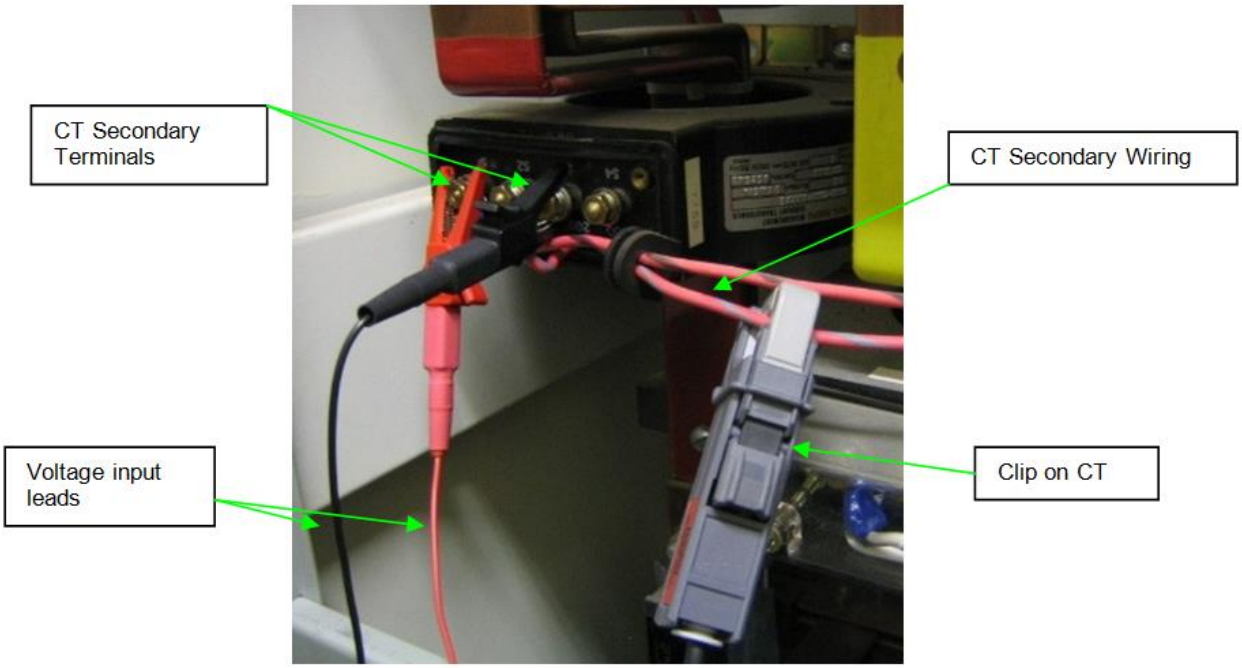


Figure I-2 Connecting the CT burden tester

I.5 Measurements

Burden is rated in VA. The ohm test measurement is converted to VA by:

$$VA = I^2R$$

where,

I is the current measurement taken at step 7, and

R is the resistance measurement taken at step 8.

If the VA is greater than the rating of the CT, then the CT is overloaded.

Appendix J Troubleshooting Meter Accuracy Test Sets

J.1 How The Type Of Meter Affects Method Of Testing Parameters

Electro-mechanical meters

For all electro-mechanical meters divide the revs/Kwh, shown on the meter nameplate, into 1000 to obtain the test constant, e.g. test constant for an Email SDM 240 Volt, 5/15 amp CT meter is

1000/266.66 revs/kWh = 3.75

As the above procedure is simple for determining the test constant for electro-mechanical meters, test constants for these meters have not been listed on the test constants sheet.

Hybrid meters (part electro-mechanical and part electronic)

An example of this is the type SDME meter that has an electronic display but also has a spinning rotor disc. Options for testing this type of meter are:

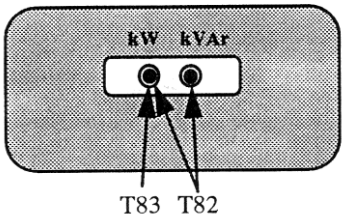
- Use the Revs/kWh value shown in Col (1) on the test constants sheet and divide this into 1000 for the test constant and then count up to 10 revolutions of the rotor disc using the hand switch or photo head, or
- Use the flashing right arrow Kh test constant in Col (3) on the test constants sheet and, to detect the flashing arrow:
    - Use the photo head or hand switch, or
    - LED probe affixed over the flashing arrow.

  Set the test set to automatically count 10 complete arrow flashes.

Fully electronic meters (no rotor disc)

These meters normally have a flashing right arrow and a flashing square that can be used for accuracy testing. The Email type E1R meter has flashing circles as shown.

E1R Display



A circle surrounds each flashing dot. If a dot is flashing, it means energy is being consumed by the customer. If a circle is flashing, energy is coming from the customer or there is a connection problem.

For E1R meters, use the left hand flashing kW dot for testing.

For E1 meters use the Yellow flashing LED for testing.

EDMI electronic meters

EDMI meters can be tested if the Pulse1 LED (kW) is set to 1Wh per pulse (use photo head or LED probe to detect the Pulse1 LED flashes). The test constant is then 1000. However, some EDMI meters have been programmed with a higher pulse output value, which should show up on the screen display. If you don't see a pulse output value greater than 1 then test the meter using the 1000 test constant. If the accuracy value is way out or outside 2% (a grey area) or the pulse output value shown is greater than 1 then contact TasNetworks Asset Engineering for assistance to determine the correct pulse rate.

J.2 Accuracy is way out or test constant looks wrong

1. If the test set shows an accuracy reading of +99% or -99% this indicates the test constant entered is incorrect or some other part of the test procedure has gone wrong.

2. Double check the Kh constant shown on the meter, and divide it into 1000. See if this value is the same as entered into the meter and recheck wiring and connections etc. Redo the test again.

3. If the accuracy error returned is still +99% or -99% the problem is most likely either:

    - You were out in your hand count of 10 revolutions or;
    - The photo head or LED probe missed counting one or more of the flashes or dots or;
    - The test constant is still incorrect. This might be because the kWh constant shown on the meter is not the correct value for testing. Email type SDME meters have this problem; this is because some electronic meters count meter pulses using only one edge of the square wave pulse while others count both edges and therefore, the proper test constant might be half or double the actual Kh value shown on the meter.

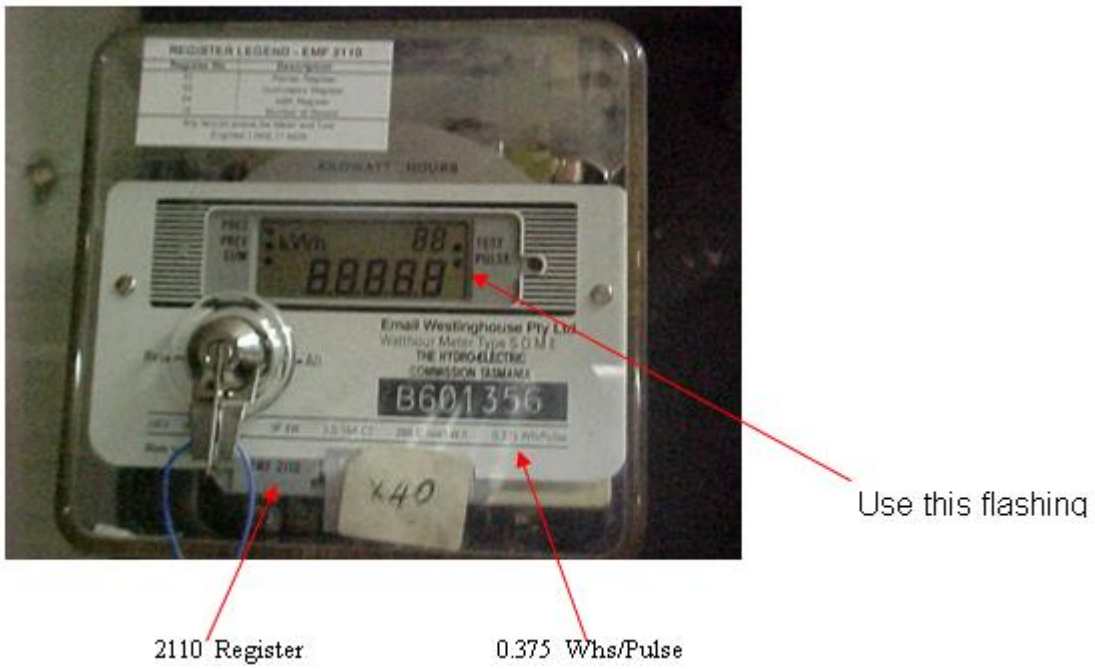
4. Therefore, if you are sure the hand count is accurate or the photo head or LED probe is properly picking up the flashing arrow, dot or pulse output and wiring, connections, currents, phase angles and test set configuration is correct, then do the following steps:

    - If the accuracy value is a high negative value (up to -99%) the test constant entered is too high (the test set is running slower than the meter). Therefore, divide the Kh value into 1000 and then halve it and enter this as the new test constant and, if this does not fix the problem then observe the accuracy value. If the accuracy value is still negative but half of what it was before, you are on the right track. Simply halve the previous value again and divide that into 1000 and enter this value as the new test constant and repeat this halving process until you get an accuracy value within 2%. If so, you have figured out a plausible test constant.
    - If the accuracy value shown is a high positive value, (up to +99%) the test constant entered is too low (test set is running faster than the meter), divide the kWh constant into 1000 and double that value each time until you get an accuracy reading within 2%, to determine the correct test constant.
    - If a new test constant has been derived using the above methods, contact Asset Engineering or the MTL to confirm if these test constants have been observed before. The results obtained from a single meter test using this method described above cannot be relied upon until the assumed constant is confirmed.

- If, despite your best efforts, the accuracy value obtained is outside 2%, say +6%, then this is a grey area you are in. It's possible that the value is correct (the meter is really operating too fast and is inaccurate and needs replacing) or, you still haven't' got the test constant correct. In this situation, if you have any doubt, then contact someone for technical support to, help resolve the problem or, confirm that what you have done is correct.

Example on how to determine the correct test constant

As a working guide using the above process, here is an example of determining the correct test constant for an Email Type SDME electronic hybrid meter with a 2110 register, when using the photo head to pick up the flashing dot on the RHS of the meter display. As the following picture shows, the Kh on the nameplate is 0.375 Wh per pulse.



But 1000/0.375 = 2666.66' as the test constant. Using this value gives an accuracy result of -99% (test set running too slow). So, we need to halve 2666.66' = 1333.33' as the test constant. This gave an accuracy figure of 44.68% (on the right track but still incorrect).

So, halving 1333.33 = 666.66' as the new test constant. When used, this gave a meter accuracy of -1.78%. Therefore, 666.66' is the correct test constant for an Email SDME electronic, 240V, 3ph, 4wire, 2.5/15 amp CTmeter with a 2110 register. Note: If an SDME meter uses a 2160 register, use the flashing right arrow for testing.

J.3 Test Set Not Working

Check for any blown fuses on the test set. If any are blown, do not replace them to operate the test set again. Instead, bring the test set back from the field, as it may need to be sent back to the supplier for a full check over and, repairs if necessary.

Also, double check test lead connections and the correctness of the metering wiring to try and determine what has caused the test set to fail (e.g. loose leads or leads shorting out).

J.4 Incorrect Voltages Displayed On Test Set

If the test set is displaying high or low voltage values way outside the normal voltage value expected, e.g. 270V instead of 240V, then the cause is most likely a poor metering circuit neutral connection causing a floating voltage. Check this by measuring the value of the neutral conductor at the test link to a separate independent earth. For a proper connection, the neutral to earth voltage should be zero or very close to zero volts. If you measure the neutral to earth voltage to be a few volts you must stop testing and then raise an installation fault job with your team leader.

J.5 CT Current Not Displayed By Test Set

1. If it is just the white phase CT circuit not displaying current, and you are testing a star connected metering circuit, check the input parameters of the test set. It is most likely that the previous test done was for a high voltage two element delta connected metering circuit and the input parameter has been left in this mode. If so, change the input parameter to four wire star configuration and check that the white phase current is now being displayed.

2. If the input parameters are correct but one of the CT circuit currents is not being displayed:

    - Check the continuity of the CT test leads and for proper connection to the test link and, if this proves okay and you still have a problem: -
    - Stop testing and check the continuity of the CT circuit in question. If there appears to be an open circuited CT or circuit seek technical support from your Team Leader on how best to fix the problem and;
    - Contact someone from Asset Engineering to check out the metering for revenue loss implications.

Appendix K TasNetworks Metering Equipment

Refer to Table K-1 for status of all meters and metering equipment.

Refer to Section 6 for details of all Approved equipment.

Table K-1 TasNetworks metering equipment

Manufacturer	Model	Phases	DC, CT or VT	LV or HV	Status
Ampy	AP (Old PAYG)	Single	DC	LV	Obsolete
Ampy	5162K (Reporter)	Single	DC	LV	Obsolete
???	CF6	Single	DC	LV	Obsolete
Chamberlain & Hookham	CH	Single	DC	LV	Obsolete
EDMI	MK7A	Single	DC	LV	Approved
Email	A11	Single	DC	LV	Restricted
Email	A11L	Single	DC	LV	Restricted
Email	AZ	Single	DC	LV	Obsolete
Email	BAZ 10A	Single	DC	LV	Obsolete
Email	BAZ 10/40A	Single	DC	LV	Obsolete
Email	BAZ 10/60A	Single	DC	LV	Obsolete
Email	CAZ	Single	DC	LV	Obsolete
Email	M1	Single	DC	LV	Obsolete
Email	M2	Single	DC	LV	Obsolete
Email	M3	Single	DC	LV	Obsolete
Ferranti	FD	Single	DC	LV	Obsolete
General Electric	GE	Single	DC	LV	Obsolete
HMT	HMT	Single	DC	LV	Obsolete
ISKRA	ISKRA	Single	DC	LV	Obsolete
Itron	ERT	Single	DC	LV	Obsolete
L&G	CL170	Single	DC	LV	Obsolete
L&G	EM1210	Single	DC	LV	Approved
L&G	EM1210 Blue Rectangle	Single	DC	LV	Approved
???	MC2	Single	DC	LV	Obsolete
???	MC3	Single	DC	LV	Obsolete

Manufacturer	Model	Phases	DC, CT or VT	LV or HV	Status
Meas A Meter	MA	Single	DC	LV	Obsolete
Metro Vickers	MV	Single	DC	LV	Obsolete
Nilsen	26FRC	Single	DC	LV	Obsolete
Siemens	S2AT	Single	DC	LV	Obsolete
UVE	UVE	Single	DC	LV	Obsolete
???	WF2	Single	DC	LV	Obsolete
???	WF3	Single	DC	LV	Obsolete
EDMI	MK10	Multi	CT DC	LV	Approved
EDMI	MK10A	Multi	CT DC	LV	Approved
EDMI	MK10D	Multi	DC		Approved
EDMI	MK10E	Multi	CT		Approved
EDMI	MK6	Multi	CT DC	LV	Approved
EDMI	MK6E	Multi	CT		Approved
EDMI	MK3	Multi	CT	LV	Approved
L&G	EM3030	Multi	DC		Approved
L&G	EM3050	Multi	CT	LV	Approved
L&G	EM3330	Multi	DC		Approved
L&G	ML240	Multi	CT		Obsolete
L&G	ML	Multi	CT DC	LV	Obsolete
L&G	MF3	Multi	CT	LV	Obsolete
L&G	Q3	Multi	CT DC	LV	Approved
L&G	Q4	Multi	CT DC	LV	Approved
L&G	Q4A	Multi	DC		Approved
L&G	PAZ	Multi	DC		Obsolete
L&G	SD	Multi	CT DC	LV	Obsolete
L&G	SDM	Multi			Obsolete
L&G	SDME	Multi	CT DC	LV	Obsolete
Email	A1R	Multi	CT DC	LV	Obsolete
Email	E1R	Multi	CT DC	LV	Obsolete
L&G	FF3		CT	LV	Obsolete

Manufacturer	Model	Phases	DC, CT or VT	LV or HV	Status
Ampy	Reporter ART	Multi	DC		Obsolete
Siemens	D22CML	Multi	CT	LV	Obsolete

Appendix L Metering Technical Work Instructions

All current standard and old work instructions related to technical requirements for installation of metering and associated equipment are listed below. The use of some of the old instructions relates to metering equipment that:

- Is currently in service but is not the current approved standard equipment that would be installed for a new installation. However this equipment may be removed and be re-furbished and re-used as replacement equipment.
- May be marked as obsolete i.e. the equipment can remain in service but, once it is removed (e.g. after becoming faulty or through a removal program of work) this equipment will not be installed anymore and instead will be scrapped.
- Requires technical knowledge when perfroming field work (e.g. operating a test instrument or needing to re-program an EC14 electronic time switch). Therefore, the work instruction is a handy reference to refer to.

Note. Although some of these old work instruction may show Aurora Energy throughout, they are still relevant and apply for use by TasNetworks employees and service providers performing metering work for TasNetworks.

Note. Meter programs in old work instructions may have changed. Refer to this manual for correct current programs.

Single phase direct connect work instructions

Checking and Changing Tariff 61/62 EMS2600_26FRC Meters

Install Nielsen Type EMS2600_26FRC Single Phase Meter

Checking and Changing Tariff 61/62 A11L Meters

Install Single Phase A11L Meter

Electro-mechanical Plug In Meter

Connecting and Measuring Unmetered Supplies

Install Single Phase Landis & Gyr PAYGO Meter

Install Single Phase Electro-mechanical Meter

PAYG Fault Finding And Actaris Activate De-Activate Process

PAYG Fault Response Technical Support

Talexus And Actaris Payguard Full Technical Details

Polyphase direct connect work instructions

Install Polyphase Direct Connect Two Rate Electro-mechanical Meter

Install Polyphase Direct Connect Ampy Meter

Install Multi Phase Import/Export Meter

Install Polyphase Electro-mechanical Meter

Install And Program EDMI Mk10D Direct Connect Polyphase Meter

LV transformer connected work instructions

Install EDMI Mark 3 CT Meter

Install Electro-mechanical CT Meter

Install Electro-mechanical Single Phase CT Meter

Install Email Type Q3 Or Q4 CT Meter

Install Email Type E1 And E1R CT Meter

Install EDMI Mk 6 CT Meter

Install Email Type EM3050 KWH CT

Install Email Type A1 Series Meter

Install Polyphase Two Rate Electro-mechanical Meter

Use PVC Phase Angle Measurement Tester

Use The Ampstik Current Tester

HV transformer connected work instructions

HV Metering Audit

HV Metering Voltage Transformer Calibration

HV Aerial Bus Metering Installation

HV Transformer Auxilliary Burden Calculations and Installation

SWMS For HV Metering Work

Time switch work instructions

Warburton Franki WF 11 Series Time Switch

Horstman VA 12 1B SRS 2 Time Switch

Warburton Franki Series 12 Form 2A Time Switches

Electronic Time Switch Model 14 7D

Electronic Time Switch Model EC14

Metering communications work instructions

Meter Data Download Using Empro Hand Held Unit

Reprogramming Tariffs In Email Type Q4 Meters

Request Form for Meter Program Change

Replace Metering Modems