



Department of Primary Industries

ADVANCED METERING INFRASTRUCTURE

Minimum AMI Functionality Specification
(Victoria)

September 2008

Release 1.1

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1 DOCUMENT CONTROL

1.1 Version Control

Version	Date	Description
Release 1.0	October 2007	Based upon the Minimum State-wide Functionality Specification, Version 6.6, dated 29 September 2007, endorsed by the Victorian AMI Industry Steering Committee on 10 October 2007.
Release 1.1	September 2008	As recommended by the Victorian AMI Industry Steering Committee on 11 August 2008.

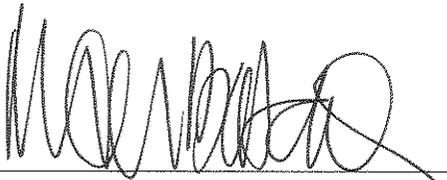
1.2 Citation

An appropriate citation for this specification is:

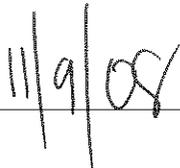
“Minimum AMI Functionality Specification (Victoria)”

1.3 Approval

This specification has been approved by



Hon. Peter Batchelor, Minister for Energy and Resources



Date

2 INTRODUCTION

2.1 Background

In early 2006, the Victorian Government formally endorsed the deployment of *Advanced Metering Infrastructure (AMI)* to all Victorian electricity customers consuming less than 160MWh per annum. An amendment to the *Electricity Industry Act 2000* was passed by the Victorian Parliament in August 2006, providing the Government with legislative heads of power to make Orders in Council (OIC) establishing a range of requirements for the deployment of *AMI*, including the setting of minimum *AMI* functionality, performance levels and service levels.

2.2 Purpose of Document

This specification defines the minimum functionality and performance levels for *AMI systems* deployed in Victoria.

2.3 Scope of application

The requirements established by this specification apply to all metered electricity customer installations where the annual consumption is less than 160MWh and where the electricity *supply* is non-incident.

The requirements in this specification apply to *AMI systems*. These requirements are minimum requirements only and do not limit the implementation of *AMI systems* that have functionality and performance that exceed the requirements of this specification.

3 MINIMUM FUNCTIONALITY REQUIREMENTS

3.1 Applicable *meter* configurations

- (a) These functionality requirements apply to all *AMI metering installations* for Victoria. However, the following lists the minimum requirement for *AMI meter* configurations:
- (1) single phase, single element;
 - (2) single phase, single element with integrated controlled load contactor;
 - (3) three phase direct connect;
 - (4) three phase direct connect with integrated single phase controlled load contactor;
 - (5) three phase direct connect with integrated relay for operation of an external three phase controlled load contactor; and
 - (6) three phase *CT* connect (excluding *supply contactor*).
- (b) All *meter* types shall meet the relevant requirements of AS62052.11, AS62053.22, AS62053.21, and any pattern approval requirements of the National Measurement Institute.

3.2 Metrology

- (a) The following requirements shall apply to all *AMI meters*:
- (1) single phase *meters* to be two quadrant *meters* and separately *record active energy* for *import*¹ and *export* in *trading intervals*;
 - (2) three phase *meters* to be four quadrant *meters* and to separately *record active and reactive energy, import*¹ and *export* in *trading intervals*;
 - (3) *record total accumulated energy* for each *recorded* channel of interval data;
 - (4) the resolution for *collection of interval energy data* shall be at least 0.1 kWh for *active energy* and 0.1 kVArh for *reactive energy*;
 - (5) the resolution of *energy consumption* displayed on a *meter's* display shall be at least 0.1 kWh and 0.1 kVArh for direct connected *meters*;
 - (6) for all *meters*, a minimum storage of 35 *days* per channel of *interval energy data*; and
 - (7) all channels of *interval energy data* shall be able to be read locally as well as remotely read.
- (b) An *AMI meter* shall be capable of meeting the requirements (including accuracy) of *type 4, type 5* and *type 6 meters* (non-TOU capability).
- (c) The values to be *recorded* for *import* and *export* are actual values at the Connection Point for direct connect *meters*².
- (d) It shall be possible to remotely and locally select or configure whether *import interval energy data* is *recorded* or not.
- (e) It shall be possible to remotely and locally select or configure whether *reactive energy interval energy data* is *recorded* from three phase *meters* or not.

¹ It is noted that in accordance with the conventions of the *National Electricity Market*, *export* is when energy is *exported* from the network to a customer and *import* is when the customer delivers energy into the network.

² For example, if a customer has local generation from photovoltaic cells, and during the first 20 minutes of a half hour period there was export from the network to the customer of 3 kWh and during the next 10 minutes the network imported 2 kWh from the customer, although the mathematical total for the half hour is 1 kWh exported, the actual values recorded for that half hour would be, Export – 3 kWh, Import – 2 kWh

- (f) When a *meter* has the Import Interval Energy Data Recording setting set to disabled and *import energy* is detected, an Import Energy Detected event shall be *recorded* in the *AMI system*.

3.3 Remote and local reading of *meters*

- (a) When *meters* are remotely read, the *meter's total accumulated energy per collected channel* shall be able to be *collected* by the *AMI system* at least once every 24 hours.
- (b) Where *meters* are remotely read the *interval energy data per collected channel* shall be able to be *collected* by the *AMI system* at least once every 24 hours.
- (c) When *meters* are locally read, the *meter's total accumulated energy per collected channel* and the *interval energy data per collected channel* shall be able to be *collected*.
- (d) For individual reads of *meters*, it shall be possible to select up to 35 *days of interval energy data* to be *collected* per channel.
- (e) The following shall also be able to be remotely and/or locally *collected* from the *meter*:
- (1) settings;
 - (2) *time*³;
 - (3) date;
 - (4) status indicators; and
 - (5) events logs.

Note that Appendix A details the events, settings and status indicators.

3.4 Supply Disconnect and Reconnect⁴

3.4.1 General Requirements

- (a) All *meter* types excluding *CT* connected *meters* shall have a *supply contactor*.
- (b) The *AMI system* shall support both local and *remote disconnection*, and local and remote reconnection of customer *supply* via the *supply contactor*. When an *AMI meter* performs a disconnect operation, all outgoing circuits from the *meter* shall be disconnected.
- (c) To confirm the current state of a *meter*, the *AMI system* shall support "on-demand" remote polling of the *meter* to determine whether the *supply contactor* is open or closed.
- (d) The *AMI system* shall complete on-demand polling commands, returning the *supply contactor* position status, with the performance levels set out in section 4.
- (e) The *meter* shall provide clear local visual indication of the status (open/closed) of the *supply contactor*.

3.4.2 Disconnect

- (a) The *AMI system* shall support both local and remote customer *supply* disconnect functionality.

³ The meter time and date needs to be cross referenced to an upstream system

⁴ The term "connect" is equivalent to the term "re-energisation" used in *National Electricity Market* documents. Similarly the term "disconnect" is equivalent to the term "de-energisation".

- (b) For *remote disconnects*, the *AMI system* shall complete the disconnect command, returning the *supply contactor* position status, within the performance levels set out in section 4.

3.4.2.1 Local Disconnect⁵

- (a) *Local disconnect* via the *meter* shall only be able to be performed by an authorised technician. Unauthorised persons shall be physically prevented from operating the *supply contactor* to disconnect *supply*.
- (b) The *AMI system* shall support the following:
- (1) opening of the *supply contactor* performed locally;
 - (2) remote communication of the status (open/closed) of the *supply contactor* (if *AMI* communications are active) from the *meter* to the *NMS*; and
 - (3) event logging by the *AMI system* of the *local disconnection* at that *meter*.

3.4.2.2 Remote Disconnect

- (a) The *AMI system* shall support the following:
- (1) opening of the *supply contactor* performed remotely;
 - (2) remote communication of the status (open/closed) of the *supply contactor* (if *AMI* communications are active) from the *meter* to the *NMS*; and
 - (3) event logging by the *AMI system* of the *remote disconnection* at that *meter*.

3.4.3 Reconnection

- (a) The *AMI system* shall support both local and remote customer *supply* reconnection functionality.
- (b) When a command is performed remotely, the *AMI system* shall complete the command, returning the appropriate *meter* status to the *NMS*, within the performance levels set out in section 4.

3.4.3.1 Local reconnection

- (a) Reconnection via the *meter* shall only be able to be performed locally by an authorised technician. Unauthorised persons shall be physically prevented from operating the *supply contactor* to reconnect *supply*.
- (b) The *AMI system* shall support the following:
- (1) closing of the *supply contactor* performed locally;
 - (2) remote communication of the status (open/closed) of the *supply contactor* (if *AMI* communications are active) from the *meter* to the *NMS*; and
 - (3) event logging by the *AMI system* of local reconnection at that *meter*.

3.4.3.2 Remote reconnection

- (a) For safety, the *meter* shall support an auto-disconnect function if load is detected flowing through the *meter* upon remote closing of the *supply contactor*.

⁵ The circumstances in which local disconnection may occur include (but is not limited to) where:

- (1) A technician is already on-site performing works and it is most efficient for the technician to perform the disconnection;
- (2) An *AMI* meter is installed; however the communications infrastructure has not been rolled out or has failed.

(b) The *AMI system* shall support the following:

- (1) Closing of the *supply contactor* performed remotely;
- (2) Remote communication of the status (open/closed) of the *supply contactor* from the *meter* to the *NMS*;
- (3) Event logging by the *AMI system* of remote reconnection;
- (4) *Meter* will auto-disconnect if more than “X” Watts of load is detected flowing through the *meter* for more than “Y” seconds during the auto-disconnect active period of “Z” seconds after the *supply contactor* is remotely closed, where:
 - (i). “X” range: 20 W – 2.5 kW per element, per phase, remotely and locally settable in 20 W increments;
 - (ii). “Y” range: 1- 3,600 seconds, remotely and locally settable in 1 second increments;
 - (iii). “Z” range: 1- 3,600 seconds, remotely and locally settable in 1 second increments;
 - (iv). Enabling/disabling of auto-disconnect function, remotely and locally configurable;
 - (v). Remote alarming to the *NMS* that the *meter* has auto-disconnected; and
 - (vi). Event logging of auto-disconnection.

3.5 Time Clock Synchronisation

(a) Date and *time* within *meters* shall be maintained within 20 seconds of Australian Eastern Standard *Time*.

3.6 Load Control

3.6.1 Load control Groups

- (a) All load control, whether controlled load (section 3.6.2) or *utility* control of other load (section 3.6.3) shall be able to respond to group commands and individual load control commands. Group commands may be delivered by broadcast.
- (b) Groups shall provide for a minimum of 20 primary groups (for use by Distributors), 200 secondary groups (for use by Distributors) and 200 tertiary groups (for use by *Retailers*).
- (c) The 200 tertiary groups are to be allocated across the *retailers* to allow several groups per *retailer*.

3.6.2 Controlled load management at *meters*

- (a) The following are the features required of single phase or three phase *meters* with an internal controlled load contactor and three phase *meters* equipped to operate an external controlled load contactor:
 - (1) The controlled load contactor shall be remotely and locally programmable to respond to one primary group, one secondary group and one tertiary group;
 - (2) Storage in the *meter* of 1 set of 5 “turn on” and “turn off” times applicable to weekdays and 1 set of 5 “turn on” and “turn off” times applicable to weekend *days*;
 - (3) “Turn on” and “turn off” *times* are remotely and locally settable for each *meter* individually and in groups through the *AMI* communications system;
 - (4) *Meters* shall recognise “turn on” and “turn off” commands that will override the switching program stored in the *meter*. The “turn on” and “turn off” functionality shall be individually

addressable or by groups. The action of receiving a remote “turn on” or “turn off” command shall disable or override the preset time based “turn on” and “turn off” schedule for a programmable period between 0 and 2,880 minutes, settable in 1 minute increments;

- (5) *Meters* with an integrated single phase controlled load contactor are to have “boost” functionality. This functionality shall be able to be remotely and locally enabled or disabled. When the *meter’s* “boost” function is activated, the *meter* will energise the controlled load for a preset time, which is remotely and locally programmable from 1 to 6 hours in half hour increments. When the Boost Primacy setting is set to disabled and a Controlled Load Override “turn off” command per section 3.6.2.a (4) is active within the *meter*, activation of the *meter’s* “boost” function will not energise the controlled load;
- (6) *Meters* with integrated single phase controlled load contactor shall have a controlled load contactor with a minimum current rating of 31.5 A resistive (ACI rating) and a nominal *voltage* rating of 230 Vac⁶;
- (7) *Meters* for three phase load control, shall have an integral relay with a minimum rating of 1 A, and a nominal *voltage* rating of 230 Vac for operation of an external load control contactor; and
- (8) The *meter* shall provide clear local visual indication of the status (open/closed) of the controlled load contactor.

3.6.3 Utility Control of Other Load

- (a) The *AMI system* shall have the capability to communicate to “other load control” devices through the *AMI communications network*. The following are the requirements of these “other load control” devices:
 - (1) “Other load control” devices shall be remotely and locally programmable to respond to one primary group, one secondary group, and one tertiary group;
 - (2) Storage in the “other load control” devices of 1 set of 5 “turn on” and “turn off” times applicable to week *days* and 1 set of 5 “turn on” & “turn off” times applicable to weekend *days*;
 - (3) “Turn on” and “turn off” *times* are remotely and locally settable individually and in groups, through the *AMI communications system*; and
 - (4) Recognition of “turn on” and “turn off” commands that will override the stored switching program. The “turn on” and “turn off” functionality shall be individually addressable or by groups. The action of receiving a remote “turn on” or “turn off” command shall disable or override the preset *time* based “turn on” and “turn off” schedule for a remotely and locally settable period between 0 and 2,880 minutes, settable in 1 minute increments.

3.6.4 Random Load Control Switching Delay

- (a) As specified in Table 1, certain load control switching, whether controlled load management at *meters* (section 3.6.2) or *utility* control of other load (section 3.6.3), shall be randomly delayed up to a maximum configurable period of time, from 0 to 60 minutes, which shall be remotely and locally settable in 1 minute increments:

⁶ The tolerance on the rated voltage is as per the Electricity Distribution Code

Load Control Type	“Turn on” Random Switching Delay active	“Turn off” Random Switching Delay active
Controlled load management at <i>meters</i> – programmed switching	Yes	No
Controlled load management at <i>meters</i> – individual <i>meter</i> override command	No	No
Controlled load management at <i>meters</i> – primary and secondary group <i>meter</i> override command	Yes	No
Controlled load management at <i>meters</i> – tertiary group <i>meter</i> override command	Yes	Yes
<i>Utility</i> control of other load – programmed switching	Yes	No
<i>Utility</i> control of other load – Individual device override command	No	No
<i>Utility</i> control of other load – primary and secondary group device override command	Yes	No
<i>Utility</i> control of other load – tertiary group device override command	Yes	Yes

Table 1 - application of random switching delay to controlled load

3.7 Meter Loss of Supply detection and outage detection

- (a) All *AMI systems* shall include a means of detecting loss of *supply* to *meters* including those at individual customer’s premises.
- (b) When a *meter loss of supply* or outage is detected it is to be alarmed to the *NMS* as soon as possible.

3.8 Quality of Supply & other event recording

- (a) All *AMI systems* are to have the capability to *record* and store the 100 most recent Quality of Supply (QoS) events and other events that occur at each *meter* as detailed in Appendix A. The *AMI system* shall *record* the nature of the event (eg: outage, undervoltage, disconnect etc), the date and *time* of the beginning of the event, and the date and *time* of the end of the event.

3.8.1 Meter Loss of Supply

- (a) The trigger for a *meter loss of supply* event is when the *supply voltage* reduces to a point where the *meter* shuts down. The meter must continue to operate down to a voltage of at least 80% of nominal *voltage*.

3.8.2 Undervoltage & overvoltage recording

- (a) Undervoltage and overvoltage events shall be *recorded*. The thresholds shall be remotely and locally settable for undervoltage in the range of at least -5% to -20% in 1% steps and for overvoltage in the range of at least +5% to +20% in 1% steps.
- (b) All events of a period equal to or longer than the undervoltage/overvoltage time threshold setting, which may be in the range of 1-60 seconds in 1 second increments, shall be *recorded*.

- (c) For each undervoltage event the minimum *voltage* that occurred during the period shall be *recorded*. For each overvoltage event the maximum *voltage* that occurred during the period shall be *recorded*. For three phase *meters*, the phases affected shall also be *recorded*.

3.8.3 Events for daily collection

- (a) For each *meter* the following events shall be *recorded* in the *AMI system* and be available for daily collection:
- (1) *Meter loss of supply*;
 - (2) Boost activated;
 - (3) Tamper detected;
 - (4) the *supply contactor* has changed state – open or closed – for any cause;
 - (5) *Import Energy* detected;
 - (6) Controlled load override;
 - (7) HAN events as detailed in 3.10(h) and 3.10(i); and
 - (8) Whenever there is a change of *AMI meter* settings that is performed locally or remotely.

3.8.4 Other events

- (a) The complete list of events which must be logged is detailed in Appendix A.

3.9 Supply Capacity Control

- (a) *AMI meters* (except *CT connected meters*) shall have two *supply* capacity limit settings – a normal limit and an emergency limit. This functionality applies only to direct connected *meters* (ie: does not apply to *CT connected meters*).
- (b) All *supply* capacity control settings shall be remotely and locally configurable.

3.9.1 Normal supply capacity limit operation

3.9.1.1 When energy is exported from the network to a customer

- (a) The *supply contactor* shall open if the average kW demand across the last X number of *trading intervals* is greater than the demand limit (Y kW), where:
- X is settable from 1 to 10 *trading intervals* in increments of 1 *trading interval*; and
- Y is settable from 0.5 to 99 kW in increments of 0.5 kW .

3.9.1.2 When energy is imported from a customer to the network

- (a) The *supply contactor* shall open if the average kW demand across the last U number of *trading intervals* is greater than the demand limit (V kW), where:
- U is settable from 1 to 10 *trading intervals* in increments of 1 *trading interval*; and
- V is settable from 0.5 to 99 kW in increments of 0.5 kW.

3.9.1.3 Enabling, disabling and event recording

- (a) The *supply* capacity control functionality shall be able to be remotely and locally enabled and disabled.
- (b) If the *supply contactor* has opened due to the demand having exceeded the demand limit, the *supply contactor* shall remain open for a period of T minutes (where T is settable from 1 to 60 minutes in 1 minute increments) and then automatically reclose.

- (c) The disconnection and any subsequent reconnection shall be *recorded* as events as described in section 3.8.4.

3.9.2 Emergency supply capacity limit operation when energy is exported from the network to a customer

- (a) The *AMI system* shall have the capability to remotely and locally activate or de-activate the emergency *supply* capacity limit in *AMI meters* by either primary or secondary groups of *meters*, or by commands sent to individual *meters*.
- (b) When the emergency *supply* capacity limit is activated this will then take precedence over the normal *supply* capacity limit, except where the normal supply capacity limit is lower than the emergency supply capacity limit.
- (c) The emergency *supply* capacity limit functionality in *AMI meters* must be capable of being remotely and locally enabled or disabled for selected *meters*.
- (d) When the emergency *supply* capacity limit is activated, the *supply contactor* shall open if the average kW demand across R minutes is greater than the emergency *supply* capacity limit (S kW) where:
- R is settable from 0 to 60 minutes in increments of 1 minute; and
- S is settable from 0.5 kW to 99kW in increments of 0.5 kW.
- (e) If the *supply contactor* has opened due to the demand having exceeded the emergency demand limit, the contactor shall remain open for a period of T minutes (where T is settable from 1 to 60 minutes in 1 minute increments) and then automatically reclose.

3.10 Interface to Home Area Network (HAN)

- (a) All direct connected *AMI meters* shall be certified to operate as an Energy Service Portal (ESP) as detailed in the ZigBee® Alliance Smart Energy Profile (SEP) Specification (ZigBee® Document Numbers 075356r14 and 084914r03).
- (b) The ESP shall operate in the 2.4GHz *ISM band* and comply with the Radiocommunications (Low Interference Potential Devices) Class Licence 2000 as amended - made under sections 132 and 135 of the Australian Radiocommunications Act 1992. The ESP shall operate with an effective radiated power of at least 50mW.
- (c) The ESP shall be configured to operate in a Utility Private HAN and shall support all ESP mandatory and optional clusters.
- (d) Communications to all HAN devices shall first require that those devices join the Utility Private HAN using the secure key establishment method.
- (e) The ESP shall be capable of interacting with a minimum of 16 Smart Energy Profile certified devices that have joined the Utility Private HAN. The *AMI system* shall support an average of 3 HAN devices per ESP.
- (f) The *AMI system* shall enable the interactions between the head end and the ESP as detailed in the SEP.
- (g) The *AMI system* shall provide to the ESP, and the ESP shall store, the tariff information required to allow the ESP to populate the fields in the SEP publish price command for implementation of a TOU tariff (with at least 1 set of 7 TOU periods for weekdays, 1 set of 7 TOU periods per Saturday and 1 set of 7 TOU periods per Sunday) and critical peak price notification.
- (h) The meter shall record as an event when tariff information is updated or changed in the ESP.
- (i) The meter shall record as an event any confirmation or status response (arising from a command from the *AMI system*) that the ESP receives from HAN devices, triggered by:

- (1) a message confirmation (as detailed in the SEP) from a HAN device
- (2) a load control report event status (as detailed in the SEP) from a HAN device
- (3) a notification that a HAN device has joined or failed to join the Utility Private HAN

3.11 Tamper Detection

- (a) The *AMI system* shall be capable of detecting and *recording* as an event attempts to tamper with the *meter*.

3.12 Communications and data security

- (a) The *AMI system* shall ensure all communications between system components shall be secured in such a way as to prevent unauthorised interception and modification.
- (b) All device elements shall contain the necessary security to prevent unauthorised access or modification of data.

3.13 Remote Firmware Upgrades

- (a) The *AMI system* shall have the capability to remotely upgrade the firmware in *AMI system* devices including data concentrators and *meters* (and ZigBee[®] Energy Services Portal).
- (b) It shall be possible to remotely change firmware without impacting the metrology functions of the *meter*.

3.14 Self registration of meters

- (a) *Meters* shall have the capability to *self register* with the *NMS*.

4 PERFORMANCE LEVELS

The following are the *AMI system* performance levels required.

- (a) These performance levels apply to the complete *AMI system*, but not to any upstream systems or downstream systems.
- (b) These performance levels specifically apply from the *NMS* to the *meter* and return.
- (c) It is noted that an *AMI system* may include communications links provided by third parties such as telecommunications carriers and which are outside of the control of the party that operates the *AMI system*.
- (d) The performance levels are average performance levels over the period of a year and exclude force majeure events.

4.1 Performance levels for *collection* of daily *meter* readings

- (a) The following are the performance levels required for the daily *collection* of the previous *trading day's interval energy data* and *total accumulated energy* (as required in section 3.3):
 - (1) All data from 99% of *meters* within 4 hours after midnight; and
 - (2) All data from 99.9% of *meters* within 24 hours after midnight.

4.2 Performance levels for remote reads of individual *meters*

- (a) The performance level of an individual read (refer to section 3.3) applies to the *collection* of seven *days of interval energy data* and the current *total accumulated energy* from a particular *AMI meter*. The performance level required is:
 - (1) Action performed at 90% of *meters* within 30 minutes;
 - (2) Action performed at 99% of *meters* within 1 hour; and
 - (3) Action performed at 99.9% of *meters* within 6 hours.
- (b) The total number of individual *meters* read in any 24 hour period can be up to 2% of the installed, operational *AMI meter* population.

4.3 Performance levels for remote connect/disconnect

- (a) The performance level required for individual *meters* is:
 - (1) Action performed at 90% of *meters* within 10 minutes;
 - (2) Action performed at 99% of *meters* within 1 hour; and
 - (3) Action performed at 99.9% of *meters* within 6 hours.
- (b) The total number of connects/disconnects commands to individual *meters* in any 24 hour period can be up to 2% of the installed, operational *AMI meter* population.

4.4 Performance levels for remote load control commands

- (a) The actions covered in this category are specified in section 3.6 for Controlled Load Management and for *Utility Control of Other Loads*. For commands to any primary, secondary or tertiary group of *meters* the performance level required is:
 - (1) Action performed at 99% of *meters* within 1 minute.
- (b) For commands sent to individual *meters*, the performance level required is:
 - (1) Action performed at 90% of *meters* within 30 minutes;
 - (2) Action performed at 99% of *meters* within 1 hour; and

- (3) Action performed at 99.9% of *meters* within 6 hours.
- (c) The total number of load control commands to individual *meters* in any 24 hour period can be up to 2% of the installed, operational *AMI meter* population

4.5 Performance levels for *Meter loss of supply* and outage detection

- (a) Alarms to be received within one hour for 90% of *meters*.

4.6 Performance levels for emergency *supply* capacity limiting

- (a) The actions covered in this category are specified in section 3.9.2 for emergency *supply* capacity control. For commands to any primary or secondary group of *meters* the performance level required is:
 - (1) Action performed at 90% of *meters* within 10 minutes; and
 - (2) Action performed at 99% of *meters* within 1 hour.
- (b) For commands sent to individual *meters*, the performance level required is:
 - (1) Action performed at 90% of *meters* within 30 minutes;
 - (2) Action performed at 99% of *meters* within 1 hour; and
 - (3) Action performed at 99.9% of *meters* within 6 hours.
- (c) The total number of load control commands to individual *meters* in any 24 hour period can be up to 2% of the installed, operational *AMI meter* population.

4.7 Performance levels for remotely altering settings in *meters*

- (a) The performance level required for individual *meters* is:
 - (1) Action performed at 90% of *meters* within 30 minutes;
 - (2) Action performed at 99% of *meters* within 1 hour; and
 - (3) Action performed at 99.9% of *meters* within 6 hours.
- (b) The total number of commands to alter settings at individual *meters* in any 24 hour period can be up to 2% of the installed, operational *AMI meter* population.

4.8 Performance levels for remotely reading settings and status indicators from *meters*

- (a) Performance level required for reading all the settings and status indicators of an individual *meter* (refer section 3.3) is:
 - (1) Action performed at 90% of *meters* within 30 minutes;
 - (2) Action performed at 99% of *meters* within 1 hour; and
 - (3) Action performed at 99.9% of *meters* within 6 hours.
- (b) The total number of commands to read settings and status indicators from individual *meters* in any 24 hour period can be up to 2% of the installed, operational *AMI meter* population.

4.9 Performance levels to remotely read events logs

- (a) The performance level required for reading the full event log that pertains to an individual *meter* is:
 - (1) Action performed for 90% of *meters* within 30 minutes;
 - (2) Action performed for 99% of *meters* within 1 hour; and

- (3) Action performed for 99.9% of *meters* within 6 hours.
- (b) The total number of commands to read the full event log pertaining to individual *meters* in any 24 hour period can be up to 2% of the installed, operational *AMI meter* population.
- (c) To read the event logs pertaining to all *meters*:
 - (1) The data pertaining to 99.5% of *meters* in 1 week; and
 - (2) The data pertaining to 99.9% of *meters* in 2 weeks.

4.10 Performance levels associated with the Home Area Network (HAN)

- (a) The *AMI system* shall support up to 6 *HAN instructions* per day being sent to the ESP.
- (b) The performance level required for *HAN instructions* is:
 - (1) *HAN instruction* received by 98% of ESPs in 3 hours;
 - (2) *HAN instruction* received by 99.9% of ESPs in 12 hours

A. Appendix - List of Events, Settings and Status Indications

ID	Events	Daily collection required	Reference
1	Import energy detected	✓	3.2(f)
2	Supply contactor opened – local	✓	3.4.2.1(b)(3)
3	Supply contactor opened – remote	✓	3.4.2.2(a)(f)
4	Supply contactor closed – local	✓	3.4.3.1(b)(3)
5	Supply contactor closed – remote	✓	3.4.3.2(b)(3)
6	Supply contactor opened – auto-disconnection on re-energisation	✓	3.4.3.2(b)(4)(v)
7	Supply contactor opened – Supply Capacity	✓	3.9.1.3(c) and 3.9.2(e)
8	Supply contactor closed – auto-reclose after supply capacity control event	✓	3.4.3.2(b)(3), 3.9.1.3(c) and 3.9.2(e)
9	Meter loss of supply	✓	3.8.1(a)
10	Undervoltage event		3.8.2(a)
11	Overvoltage event		3.8.2(b)
12	Controlled load override activated by boost button	✓	3.6.2(a)(5)
13	Tamper detected	✓	3.11(b)
14	Whenever there is a change of AMI meter settings locally	✓	3.8.4(a)
15	Controlled load override – remote on	✓	3.6.2(a)(4)
16	Controlled load override – remote off	✓	3.6.2(a)(4)
17	Tariff information updated	✓	3.10(h)
18	Message acknowledgement received by ESP from HAN device	✓	3.10(i)(1)
19	ZigBee® load control report event status	✓	3.10(i)(2)
20	HAN device joined utility private HAN	✓	3.10(i)(3)
21	HAN device failed to join utility private HAN	✓	3.10(i)(3)

ID	Setting	Available Values	Reference
1	Import Interval Energy Data recording	Enabled or Disabled	3.2(f)
2	Reactive energy interval data recording	Enabled or Disabled	3.2(e)
3	Remote reconnection load detection – power	20 to 2,500 Watts, in 20W increments	3.4.3.2(b)(4)(i)

ID	Setting	Available Values	Reference
4	Remote reconnection load detection – period	1 to 3,600 seconds, in 1 second increments	3.4.3.2(b)(4)(ii)
5	Remote reconnection – auto-disconnection	Enabled or Disabled	3.4.3.2(b)(4)(iii)
6	Remote reconnection – auto-disconnect active period	1 to 3,600 seconds, in 1 second increments	3.4.3.2(b)(4)(vi)
7	Controlled load – Primary Group id	Determined by DNSP	3.6.1(b)
8	Controlled load – Secondary Group id	Determined by DNSP	3.6.1(b)
9	Controlled load – Tertiary Group id	Determined by DNSP	3.6.1(b)
10 to 14	Controlled load weekday turn on time – 1 through to 5	Time, in 24-hour clock format	3.6.2(a)(2)
15 to 19	Controlled load weekday turn off time – 1 through to 5	Time, in 24-hour clock format	3.6.2(a)(2)
20 to 24	Controlled load weekend turn on time – 1 through to 5	Time, in 24-hour clock format	3.6.2(a)(2)
25 to 29	Controlled load weekend turn off time – 1 through to 5	Time, in 24-hour clock format	3.6.2(a)(2)
30	Random load control switching delay	0 to 60 minutes, in 1 minute increments	3.6.4(a)
31	Controlled load override duration	0 to 2,880 minutes, in 1 minute increments	3.6.2(a)(4)
32	Boost duration	1 to 6 hours, in ½ hour increments	3.6.2(a)(5)
33	Boost functionality	Enabled or Disabled	3.6.2(a)(5)
34	Boost Primacy	Enabled or Disabled	3.6.2(a)(5)
35	Undervoltage event recording variance threshold	-5% to -20%, in 1% increments	3.8.2(a)
36	Overvoltage event recording variance threshold	+5% to +20%, in 1% increments	3.8.2(a)
37	Undervoltage and Overvoltage time threshold	1 to 60 seconds, in 1 second increments	3.8.2(b)
38	Normal supply capacity – Export – demand limit	0.5 – 99kW, in 0.5kW increments	3.9.1.1(a)
39	Normal supply capacity – Import – demand limit	0.5 – 99kW, in 0.5kW increments	3.9.1.2(a)
40	Emergency supply capacity – Export – demand limit	0.5 to 99kW, in 0.5kW increments	3.9.2(d)
41	Normal supply capacity – Export – intervals	1 to 10 trading intervals, in 1 trading interval increments	3.9.1.1(a)

ID	Setting	Available Values	Reference
42	Normal supply capacity – Import – intervals	1 to 10 trading intervals, in 1 trading interval increments	3.9.1.2(a)
43	Emergency supply capacity – Export – period	0 to 60 minutes, in 1 minute increments	3.9.2(d)
44	Normal supply capacity limit	Enabled or Disabled	3.9.1.3(a)
45	Emergency supply capacity limit	Enabled or Disabled	3.9.2(c)
46	Normal supply capacity limit – auto-reclose delay	1 to 60 minutes, in 1 minute increments	3.9.1.3(b)
47	Emergency supply capacity limit – auto-reclose delay	1 to 60 minutes, in 1 minute increments	3.9.2(e)

ID	Status indicators (visible at the meter and collectable)	Reference
1	<i>Supply contactor</i> position – open or closed	3.4.1(e)
2	Controlled load contactor position – open or closed	3.6.2(a)(8)

B. Glossary

active energy

Active energy means a measure of electrical *energy* flow, being the *time* integral of the product of *voltage* and the in-phase component of current flow across a connection point expressed in Watt-hours (Wh) and multiples thereof.

active power

Active power means the rate at which *active energy* is transferred.

AMI (Advanced Metering Infrastructure)

AMI means the infrastructure associated with the installation and operation of electricity *metering* and communications including *interval meters* designed to transmit data to and receive data from a remote locality.

AMI metering installation

An *AMI metering installation* is a "*metering installation*" which conforms with the minimum functionality and performance requirements of this specification.

AMI system

AMI system means the *AMI metering installation*, communications network, infrastructure and all other systems required to comply with this specification.

Australian Standard (AS)

Australian Standard means the most recent edition of a standard publication by Standards Australia (Standards Association of Australia).

collect

Collect means to retrieve the data *recorded* in the *meter*.

communications network

Communications network means all communications equipment, processes and arrangements that lie between the *meter* and the *NMS*.

current transformer (CT)

Current transformer means a *transformer* for use with *meters* and/or protection devices in which the current in the secondary winding is, within prescribed error limits, proportional to and in phase with the current in the primary winding.

day

Day means unless otherwise specified, the 24 hour period beginning and ending at midnight Eastern Standard *Time* (EST).

distribution network

Distribution network means a *network* which is not a transmission *network*.

distribution system

Distribution system means a *distribution network*, together with the connection assets associated with the *distribution network*, which is connected to another transmission or *distribution system*. Connection assets on their own do not constitute a *distribution system*.

energy

Energy means *active energy* and/or *reactive energy*.

energy data

Energy data means *interval energy data* and *total accumulated energy*.

Export

Export means the delivery of *energy* from the *network* to a customer.

HAN Instruction

HAN Instruction means up to 256 bytes of data (including but not limited to tariff information, SEP commands or messages) sent to the ESP via the *AMI System*.

Import

Import means the delivery of *energy* from an end-use customer into the *distribution network*.

interval energy data

Interval energy data means the data that results from the measurement of the flow of electricity in a power conductor where the data is prepared by a *data logger* into intervals which correspond to a *trading interval* or are sub-multiples of a *trading interval*.

interval meter

Interval meter means a *meter* that *records interval energy data*.

ISM band

ISM band means one of the Industrial Scientific and Medical radio frequency bands as defined by the International Telecommunication Union in sections 5.138, 5.150, and 5.280 of the Radio Regulations.

Local disconnect

Local disconnect means the operation of the supply contactor to effect a disconnection of *supply* not by the *AMI* communications system but performed locally at the *meter* by alternative electronic means.

market

Market means any of the *markets* or exchanges described in the *National Electricity Rules*, for so long as the *market* or exchange is conducted by *NEMMCO*.

meter

Meter means a device complying with *Australian Standards* which measures and *records* the production or consumption of electrical *energy*.

meter loss of supply

Meter loss of supply means that the power system *voltage* has reduced to point where the *meter* can no longer function, generally because its power *supply* has shutdown.

metering data

Metering data means the data obtained from a *metering installation*, the processed data or substituted data.

metering installation

Metering installation means the assembly of components and/or processes that are controlled for the purpose of metrology and which lie between the *metering point(s)* or non *metered* connection point and the point of connection to the *telecommunications network*. The assembly of components may include the combination of several *metering points* to derive the *metering data* for a *connection point*. The *metering installation* must be classified as a *revenue metering installation* and/or a *check metering installation*.

metering point

Metering point means the point of physical *connection* of the device measuring the current in the power conductor.

Metrology Procedure

Metrology Procedure means the procedure developed and published by *NEMMCO* in accordance with clause 7.14 of the *National Electricity Rules*.

NEM (National Electricity Market)

National Electricity Market means the wholesale electricity *market* operated by *NEMMCO* under the *National Electricity Rules*.

National Electricity Rules (NER)

National Electricity Rules means the rules made by the Australian *Energy Market Commission* (AEMC) under the *National Electricity (South Australia) Act 1996* (the “new” *National Electricity Law*) that governs the operation of the *National Electricity Market*.

NEMMCO

NEMMCO means the *National Electricity Market Management Company Limited* ACN 072 010 327, the company which operates and administers the *market* in accordance with the *National Electricity Rules*.

network

Network means the apparatus, equipment, *plant* and buildings used to convey, and control the conveyance of, electricity to customers (whether wholesale or retail) excluding any *connection assets*. In relation to a *Network Service Provider*, a *network* owned, operated or controlled by that *Network Service Provider*.

NMS (Network Management System)

Network Management System means the component of an *AMI system* that manages the *AMI communications network*.

plant

Plant means, in relation to a *connection point*, all equipment involved in generating, utilising or transmitting electrical *energy*.

reactive energy

Reactive energy means a measure in varhours (varh) of the alternating exchange of stored *energy* in inductors and capacitors, which is the *time*-integral of the product of *voltage* and the out-of-phase component of current flow across a *connection point*.

record

Record means to store the measured parameter in the *meter*

remote disconnect

Remote disconnect means the utilisation of the communication system to disconnect the customer's *supply* at the *meter* by the operation the *AMI* contactor.

Retailer

Retailer means an entity which maintains a *retail licence* and is the *market* participant that is financially responsible for a customer's connection point.

retail licence

Retail licence means a *licence* issued by the *Essential Services Commission* under the Electricity Industry Act 2000 to sell electricity.

revenue meter

Revenue meter means the *meter* that is used for obtaining the primary source of *metering data*.

self registering

Self registering means the ability of the *meter* upon being added to the *NMS* of the *AMI system* when installed to register or configure itself with the *AMI system* so that it will commence performing its proper functions without further local intervention.

supply

Supply means the delivery of electricity at a connection point.

supply contactor

Supply contactor means the contactor in the *meter* that, when opened, causes a premise with *supply* to be disconnected and, when closed, allows a premise with *supply* to become connected.

time

Time means Eastern Standard Time, being the *time* at the 150th meridian of longitude east of Greenwich in England, or Co-ordinated Universal *Time*, as required by the National Measurement Act, 1960.

total accumulated energy

Total accumulated energy means the total or accumulated amount of *energy* measured and recorded per channel of a *meter* since the installation of the *meter* or the resetting of the value.

trading day

Trading day is the same as a *day* and means a 24 hour period that finishes at midnight Eastern Standard Time.

trading interval

Trading interval means a 30 minute period ending on the hour (Eastern Standard Time) or on the half hour and, where identified by a *time*, means the 30 minute period ending at that *time*.

transformer

Transformer means a *plant* or device that reduces or increases the *voltage* or alternating current.

Type 4 meter

Type 4 meter means a remotely read electricity *interval meter* that is a component of a compliant *type 4 metering installation*, that meets the requirements of the *National Electricity Rules* and the *metrology procedure*.

Type 5 meter

Type 5 meter means an electricity *interval meter* that is a component of a compliant *type 5 metering installation*, that meets the requirements of the *National Electricity Rules* and the *metrology procedure*.

Type 6 meter

Type 6 meter means an accumulation electricity *meter* that is a component of a compliant *type 6 metering installation* that meets the requirements of the *National Electricity Rules* and the *metrology procedure*.

Utility

Utility means either an entity operating a *distribution network* or a retail entity that sells electricity to customers.

voltage

Voltage means the electronic force or electric potential between two points that gives rise to the flow of electricity.