Customer Connection SCADA Requirements

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Endeavour Energy

POWER together

Revision History

Nil.

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Document Control

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Contents

1. Documentation Scope

This Design Instruction details:

- The criteria for determining when Endeavour Energy (EE) remote monitoring and control is required in a customer installation,
- The minimum monitoring and control requirements if required,
- The minimum physical requirements where appropriate, and
- The technical requirements regarding EE SCADA and communication systems.

This document also includes the requirements where EE are the chosen Intervening Facilitator when a connecting generator requires access to Automatic Generator Control (AGC) controls from AEMO.

2. References

External Regulations
Electricity Supply Act 1995 (NSW)
Work Health and Safety Act 2011
Work Health and Safety Regulation 2017 (NSW)
National Electricity Rules
AEMO Power System Data Communication Standard v3.0
Clean Energy Council (CEC) approved inverter list

External Standards		
Standard No.	Year	Title
AS 4777.2	2021	Grid connection of energy systems via inverters – Inverter requirements
AS 2067	2016	Substations and high voltage installations
IEEE 2030.5	2023	Smart Energy Profile Application Protocol
IEEE 1815	2012	Electrical Power Systems Communications – Distributed Network Protocol (DNP3)
IEEE 802.3	2022	IEEE Standard for Ethernet

Company Policies and Procedures
PDI5000 – Protection of Embedded Generation
ADI0006 – Substation Communication Systems

3. Definitions and Abbreviations

Definitions	
AEMO SCADA Lite	SCADA Lite will enable NEM non-NSP participants to establish a bi-directional connection to exchange operational information (telemetry and control) with AEMO
Flexible Exports	Remote-control function for dynamically changing generator output based on network constraints. All subsection functions in Section 7.

Abbreviations	
ADMS	Advanced Distribution Management System
AGC	Automatic Generation Control
CSIP-AUS	Common Smart Inverter Profile
CB	Circuit Breaker
CEC	Clean Energy Council
CT	Current Transformer
DER	Distributed Energy Resource
DNP	Distribution Network Protocol
EE	Endeavour Energy
EG	Embedded Generation or Embedded Generating
FAT	Factory Acceptance Testing
GDL	Generation Dispatch Limit
HVC	High Voltage Customer
I/O	Input / Output
IES	Inverter Energy System
M	Mandatory Requirement
MMOF	Multimode-optic fibre
NTP	Network Time Protocol
O	Optional Requirement
P	Preferred Requirement
PSDCS	Power System Data Communication Standard
RCD	Residual Current Device
RCM	Regulatory Compliance Mark
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition
SEF	Sensitive Earth Fault
SNMP	Simple Network Management Protocol
SNTP	Simple Network Time Protocol
WAN	Wide Area Network

4. Application of Standard

4.1 General Application

This standard is applied to assess new customer installations for remote monitoring and control of the customer site, meeting the following criteria, with exemptions as outlined in Section 4.2:

a) High Voltage Customer (HVC) connection with connecting load greater than or equal to 2MW
b) Customer connection with aggregated generation exceeding 200 kVA

The minimum requirements relating to connections in 4.1 a) are described in Section 5.

The minimum requirements relating to connections in 4.1 b) are described in Section 6.

All connection applications needing to meet 4.1 a) and 4.1 b) with this standard shall complete and return the accompanying checklist at the Enquiry stage to assess compliance with ADI0002 prior to proceeding with the application stage.

Remote monitoring of the customer's connection point shall be implemented to provide visibility of real-time operating conditions and to detect the status and health of the protection system. Any alarm indicating a compromised protection system shall be promptly communicated to Endeavour Energy.

4.1.1 Special Requirements

Including the minimum monitoring and control requirements in Section 5 or 6 of this standard, EE may require additional controls which are agreed upon in the detailed design phase in consultation with the EE Network Planning, EE Grid Engineering and Secondary System sections.

Additional special requirements could include (but are not limited to):

a) Controls and monitoring requirements to fulfill an agreed individual Operating Protocol,
b) The combined generation capacity of an installation represents a significant portion of the total local network load,
c) Network constraints are identified during the planning process,
d) Requirements deemed necessary by EE during the connection feasibility study.

4.2 Exemptions

This standard does not apply to any connection where:

a) HVC connections with less than 2MW of connecting load unless identified as contributing to network constraints in the planning phase,
b) The aggregate generation capacity within the installation is less than 200kVA,

5. High Voltage Customer Connection

5.1 Assessment

All HVC connections with a connecting load greater than or equal to 2MW will automatically require the installation of EE SCADA and communication equipment to achieve remote monitoring, and any remote control agreed upon in the HV operating protocol. The connecting customer shall complete the ADI0002 checklist during the detailed design process.

On a case-by-case basis, some requirements can be negotiated and agreed with EE during the connection application process.

5.1.1 Exemptions to Requirements

Where agreed in the HV operating protocol, HVC's may be exempt from 5.2 where supply for the site is provided through a dedicated SCADA connected recloser or load break switch or their network does not provide the ability to create a ring on the EE network.

5.2 Requirements

5.2.1 Typical control system architecture

The typical control system architecture between the Customer control system and the EE SCADA system is shown in Figure 1.

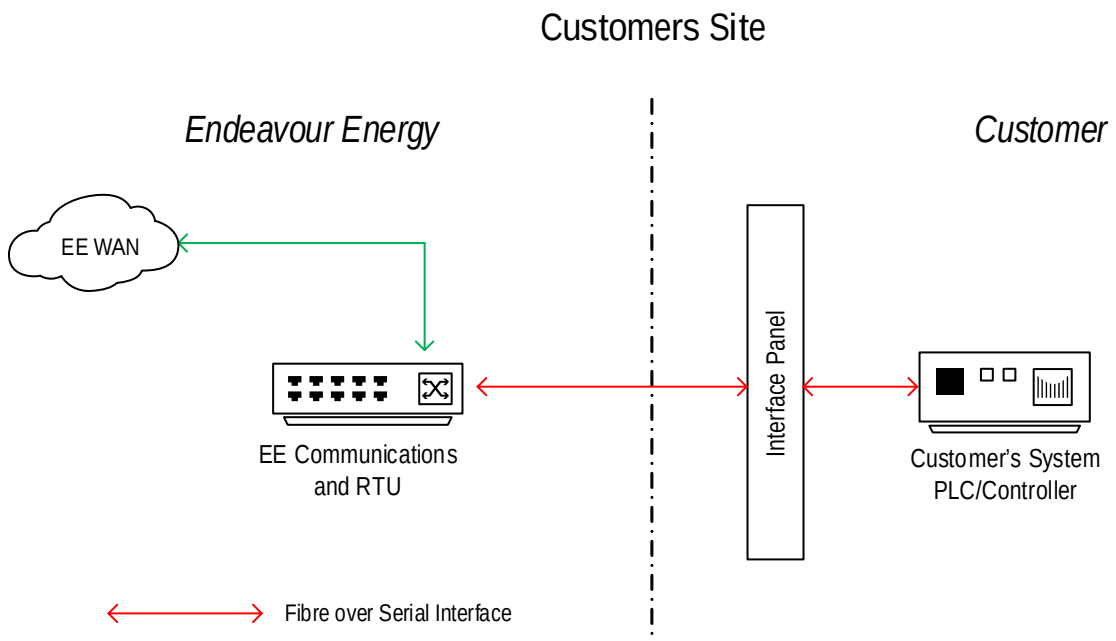


Figure 1 - Architecture of typical SCADA interface installation at Customer's site

5.2.2 Minimum remote monitoring requirement

Should it be deemed that the customer installation requires remote control and supervision the customer must provide the following signals.

5.2.2.1 Status/Indications

Below are the minimum status/indication requirements for HVC's.

Table 1: Minimum status/indications for HVC connections

Status/Indication	Condition
a) Position and status indication of Circuit Breakers at the point of connection	Open/Closed
b) All HV CB/switches position where a ring can be formed between points of connection	Open/Closed
c) Protection operation alarms (including CB Fail)[1]	Operated/Restored
d) HVC Protection System Compromised[2]	Operated/Restored

1 – Protection related alarms to be agreed in consultation with EE

2 – The HVC shall provide a single alarm to indicate the protection scheme is not in its intended, fully dependable state – See Appendix B for standardised operation logic

Where additional requirements are specified as per 4.1.1, the customer is to provide a complete SCADA points list which shall be negotiated with the EE Grid Engineering and Secondary Systems sections.

5.2.2.2 Analogues

Below are the minimum analogue data requirements for HVC's.

Table 2: Minimum analogues for HVC connections

Status/Indication
a) Connection Point Active Power
b) Connection Point Reactive Power
c) Connection Point 3ph Current (Aph, Bph and Cph Amps)
d) Connection Point 3ph L-L Voltage (AB, BC and CA Volts)
e) Transformer Active Power (where under EE operational control)
f) Transformer Reactive Power (where under EE operational control)
g) Transformer 3ph Current (where under EE operational control)
h) Transformer 3ph L-L Voltage (where under EE operational control)

Power conventions shall align to Appendix A – Power Value Convention

Where additional requirements are specified as per 4.1.1, the customer is to provide a complete SCADA points list which shall be negotiated with the EE Grid Engineering and Secondary Systems sections.

5.2.3 Control Requirements

The control requirements will be negotiated with the EE Grid Engineering and Secondary Systems sections and will be specified in the HV operating protocol.

5.2.4 Communication Protocol

The communications protocol between the customer controller and the EE RTU must be either:

a) DNP3 over serial (preferred), or
b) Modbus RTU

5.2.5 Physical Requirements

5.2.5.1 Site Access

24 hours site access to EE's equipment for faults and maintenance (escorted or non-escorted) is required. Site access requirements are to be specified in the HV customer operating protocol or equivalent, including provisions for site inductions and emergency access as required.

5.2.5.2 Accommodation for Endeavour Energy's Equipment

The customer shall provide:

a) A suitable location for the installation of EE RTU and associated communication equipment as close as practical to the customer's generator control system, or in an easily accessible location. EE equipment shall be installed in a lockable enclosure, either within a dedicated cubicle or 19" rack, confirmation of which will be agreed in the detailed design,

b) A 32mm ⌀ (minimum) conduit to the location of the EE SCADA and associated communication equipment, including provision for:

   i. 2.5mm^2 copper cable for the dc supply.

   ii. Optic fibre cable (as per 5.2.5.4.b) to interface between customer control system and EE SCADA equipment.

c) Accommodation for the remote communications equipment under 5.2.5.3,

d) Within the control room the EE SCADA enclosure clearance shall comply with AS 2067,

e) A suitably sized earth bonding for the enclosure back to the customer's common earth bar.

Note, equipment procurement, installation and commissioning responsibilities to be agreed between the EE and the customer within the final agreement.

5.2.5.3 Fibre/Radio Connection to Customer's Control Room

Allowance shall be made for:

a) External entry of communication cables into the customers control room to the EE SCADA cubicle as required,

b) Subject to a communications assessment by EE, the customer shall provide (where deemed necessary) a suitable pole or antenna mounting location for an EE antenna, microwave dish etc. and supporting coaxial cable as per ADI0006.

5.2.5.4 Interface

The physical communications connection between the customer controller and the Endeavour Energy RTU interface must be:

a) A single point-to-point connection

b) A MMOF communication cable is preferred, appropriate alternatives include:

   - SMOF for installations where distance makes MMOF unfeasible
   - Optical to copper converters where native MMOF interface is unavailable

c) A TCP/IP (IEEE 802.3) interface with adequate cyber security controls shall be considered on request

5.2.5.5 DC Supply

A DC circuit is required for supplying the EE SCADA equipment, including any associated communication assets. Proponents are to provide a minimum 48V dc power supply with adequate backup from the customer's protection and control system to supply the EE SCADA enclosure.

5.2.5.6 AC Supply

The customer is to provide an RCD protected 230V socket outlet for commissioning and maintenance purposes.

5.2.6 Testing Communication Interface

Prior to commencing EE SCADA works on site, the customer's controller may be required to be brought into EE offices for Factory Acceptance Testing (FAT) and confirmation that the controller communicates correctly with the EE equipment.

6. Generator Connections

6.1 Assessment

There are four remote-control interface requirements possible for a generator connection, which are based on the aggregate generator capacity and the generator export operation. The remote-control interfaces are:

- AEMO SCADA Lite
- SCADA – assess to Section 6.3
- CSIP-AUS – assess to Section 0
- Automatic Generation Control (AGC) – review Section 0 for details

The remote-control interface requirements for various embedded generation systems are outlined in Table 3, and will form the initial requirement during the connection application process.

For scenarios with more than one option for the remote-control interface on Table 3, the connecting customer will assume the SCADA connection requirements until EE and the connecting customer have agreed on the final requirements.

Table 3: Monitoring and control requirements for Embedded Generators

Production unit type	>200kVA & ≤1.5MVA	>1.5MVA & <5MVA	≥5MVA
IES	CSIP-AUS (0)	SCADA (6.3)	SCADA (6.3) and AGC[1] (0) Or AEMO SCADA Lite[2]
Non-IES	SCADA (6.3)	SCADA (6.3)	SCADA (6.3) and AGC[1] (0) Or AEMO SCADA Lite[2]

1 – AGC only required if the generator is registered as a scheduled generating unit requiring active power controls as per NER S5.2.5.14

2 – Should EE determine that remote monitoring or control is not required, the customer may choose to engage AEMO directly (See 6.2)

6.1.1 Inverter Energy System

The IES connected to Endeavour Energy's network shall comprise of inverters that are:

- tested by an authorised testing laboratory and certified as compliant with AS/NZS 4777.2, including an accreditation number.
- registered with the Clean Energy Council (CEC) as approved grid-connect or multiple mode inverters.
- installed in compliance with AS/NZS 4777.1. Energy Storage System

6.1.2 Flexible Exports

Flexible exports is a remote-control feature that allows for generator connections with a maximum generation capacity greater than the upstream EE network capacity to connect to the network. EE reserves the right to implement flexible exports on embedded generation to curtail generator to as low as 0MW if deemed necessary (e.g. where network constraints or fault current limiting are employed within the generating system).

The flexible export feature is required for embedded generation connections requiring an CSIP-AUS or SCADA connection as per Table 3. The customer and EE will agree on flexible export limits during the detailed design phase of the connection process.

The implementation of flexible exports is in addition to the protection requirements as specified in PDI5000.

Details of the flexible export functions are described in Section 0 of this standard.

6.2 AEMO SCADA Lite Requirements

Embedded generation systems who are approved to connect direct to AEMO via AEMO SCADA Lite are exempt from the requirements of this standard. Any augmentation works to the connection point or additional equipment installed within the customers installation may however override this exemption in which case the requirements of this standard shall be assessed and implemented.

6.3 SCADA Connection Requirements

Generator connections assessed as requiring a SCADA remote-control interface shall conform to all subclauses in 6.3.

6.3.1 Typical Control System Architecture

The typical control system architecture between the Customer control system and the EE SCADA system is shown in Figure 2.

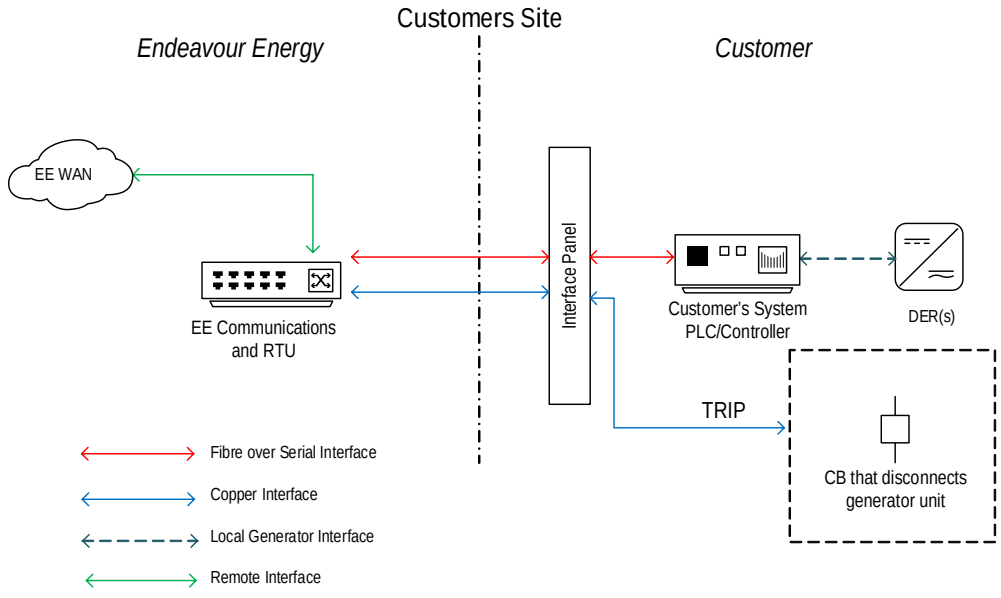


Figure 2 : Architecture of typical SCADA interface installation at Customer's site

Refer to sections 6.3.7.3, and 6.3.7.4 for details on the WAN, and Interface connections respectively.

Wireless trip signals may be utilised with approval from EE during the detailed design process.

6.3.2 Inverter Requirement (IES only)

Inverters must be capable of (either directly or from a central controller) receiving and accepting flexible exports via Generation Dispatch Limit (GDL) and power factor set points issued by the EE RTU.

Therefore, if an inverter is certified as being AS/NZS 4777 compliant but does not have an interface enabling the MW and PF limits to be applied in real time, either directly from the EE SCADA system or by an overarching generating system controller, it is unacceptable for connection to EE's network should flexible exports be required.

6.3.3 Minimum remote monitoring requirement

A detailed list of interface signals will be prepared as the customer's generating system project progresses.

Should it be deemed that the customer installation requires SCADA remote control interface as defined in Table 3; the customer must provide the following:

6.3.3.1 Status/Indication

Below are all common status/indication requirements for IES and non-IES embedded generation.

Table 4: Minimum status/indication requirements – SCADA connection

Status/Indication	Condition
a) Circuit Breaker position	Open/Closed
b) Circuit Breaker status	Available/Failed
c) Protection operation alarms (including CB Fail)[1]	Operated/Restored
d) HVC Protection System Compromised[2]	Operated/Restored

1 – Protection related alarms to be agreed in consultation with EE

2 – The HVC shall provide a single alarm to indicate the protection scheme is not in its intended, fully dependable state – See Appendix B for standardised operation logic

Below are additional signals for Battery Energy Storage Systems (BESS).

Table 5: Minimum BESS status/indication requirements – SCADA connection

Status/Indication	Condition
e) Export power (Discharge) Mode	On/Off
f) Import power (Charging) Mode	On/Off
g) Grid (Parallel) Mode	On/Off
h) Island Mode	On/Off

Below are additional signals for non-IES.

Table 6: Minimum non-IES status/indication requirements – SCADA connection

Status/Indication	Condition
i) Generating Unit Status (For all Generating Units)	Running/Stopped

Where additional requirements are specified as per 4.1.1, the customer is to provide a complete SCADA points list which shall be negotiated with the EE Grid Engineering and Secondary Systems sections.

6.3.3.2 Analogues

Below are all common analogue data requirements for IES and non-IES embedded generation.

Table 7: Minimum analogue requirements – SCADA connection

Analogues	
a)	Connection Point Active Power[1]
b)	Connection Point Reactive Power[1]
c)	Connection Point 3ph Current (Aph, Bph and Cph Amps)
d)	Connection Point 3ph L-L Voltage (AB, BC and CA Volts)
e)	Generating System Active Power[1]
f)	Generating System Reactive Power[1]
g)	Generating System Current (three-phase Amps)
h)	Generating System Voltage (three-phase Volts)
i)	Number of Generating Units Connected
j)	Generating System Dispatch Limiter Feedback
k)	Power System Dispatch Limiter Feedback
l)	Power Factor Set Point Control Feedback (if required)
m)	Charge Rate Limiter for Energy Storage Systems Acknowledged (if required)
n)	Frequency Response Import/Export Limit (if required)
o)	State of Charge % (BESS only)

1 - Power conventions shall align to Appendix A – Power Value Convention

6.3.4 Control Requirements

A detailed list of interface signals, and generator functions will be prepared as the customer's generating system project progresses. Should it be deemed that the customer installation requires SCADA remote control interface as defined in Table 3; the customer controller shall facilitate the following controls.

6.3.4.1 Flexible Exports Setpoint Controls

EE will issue analogue setpoints as shown below.

Table 8: Minimum control requirements – SCADA connection

Setpoint Controls	
a)	Generation Dispatch Limit (GDL) Setpoint – Refer to Section 7.1
b)	Generating System Net Export Limiter Setpoint – Refer to Section 7.2
c)	Power Factor Setpoint Control (if required) – Refer to Section 7.3
d)	Charge Rate Limiter for Energy Storage Systems (if required) – Refer to Section 7.4
e)	Discharge Rate Limiter for Energy Storage Systems (if required) – Refer to Section 7.4
f)	Frequency response active import/export limit (if required) – Refer to Section 7.5

Real-time control feedback from the customer to the EE RTU are required in response to these setpoints.

Where additional requirements are specified as per 4.1.1, the customer is to provide a complete SCADA points list which shall be negotiated with the EE Grid Engineering and Secondary Systems sections.

6.3.4.2 Additional Controls

EE will also require the below discrete controls; final control (and mechanism to achieve control) will be by agreement with consultation of EE:

Table 9: Additional control requirements – SCADA connection

Additional Controls	Detail
a) Generator CB open	To enable centralised anti-islanding trip scheme from EE's control system to disconnect generation in the event of a system outage.
b) Generator Shutdown	Direct control to shut /ramp down generator where it is not possible to disconnect via a CB trip. Required for removing generation during system emergency events.

6.3.5 Communication Protocol

The communications between the customer controller and the EE RTU must either:

a) DNP3 over serial (preferred), or
b) Modbus RTU

6.3.6 Communications Signal Failsafe

The customers controller must be capable of receiving a health pulse from the EE RTU in 60 second intervals to indicate healthy communications. Upon loss of communications between the EE RTU and the customers control room, a controlled shutdown of the generating system is to be automatically carried out by the customer following a timeout delay of 15-45 minutes or as agreed.

Note, In the case of non-export systems if there are sufficient controls approved by EE to prevent export to the grid the requirement for automatic shutdown of generation may be exempt.

6.3.7 Physical Requirements

6.3.7.1 Site Access

24 hours site access to EE's equipment for faults and maintenance (escorted or non-escorted) is required. Site access requirements are to be specified in the HV customer operating protocol or equivalent, including provisions for site inductions and emergency access as required.

6.3.7.2 Accommodation for Endeavour Energy's Equipment

The customer shall provide:

a) A suitable location for the installation of EE RTU and associated communication equipment as close as practical to the customer's generator control system, or in an easily accessible location. EE equipment shall be installed in a lockable enclosure, either within a dedicated cubicle or 19" rack, confirmation of which will be agreed in the detailed design,

b) A 32mm ⌀ (minimum) conduit to the location of the EE SCADA and associated communication equipment, including provision for:

   i. 2.5mm^2 copper cable for the dc supply.

ii. Optic fibre cable (as per 6.3.7.4.b) to interface between customer control system and EE SCADA equipment.

c) An accommodation for the remote communications under 6.3.7.3,

d) Within the control room the EE SCADA enclosure clearance shall comply with AS 2067,

e) A suitably sized earth bonding for the enclosure back to the customer's common earth bar,

Note, equipment procurement, installation and commissioning responsibilities to be agreed between Customer Network Solutions and the customer.

6.3.7.3 Fibre/Radio Connection to Customer's Control Room

Allowance shall be made for:

a) External entry of fibre optic cables into the customers control room to the EE SCADA cubicle as required,

b) Subject to a communications assessment by EE the customer shall provide (where deemed necessary) a suitable pole or antenna mounting location for an EE antenna, microwave dish etc. and supporting coaxial cable as per ADI0006.

6.3.7.4 Interface

The physical communications connection between the customer controller and the EE RTU interface must be:

a) A single point-to-point connection

b) A MMOF communication cable is preferred, appropriate alternatives include:

- SMOF for installations where distance makes MMOF unfeasible
- Optical to copper converters where native MMOF interface is unavailable

c) A TCP/IP (IEEE 802.3) interface shall be considered on request

Note, additional interface requirements may apply based on control interface requirements of the generator rating and operational requirements.

6.3.7.5 DC Supply

A DC circuit is required for supplying the EE SCADA equipment, including any associated communication assets. Proponents are to provide a minimum 48V dc power supply with adequate backup from the customer's protection and control system to supply the EE SCADA enclosure.

6.3.7.6 AC Supply

The customer is to provide an RCD protected 230V socket outlet for commissioning and maintenance purposes.

6.3.8 Testing Communication Interface

Prior to commencing EE SCADA works on site, the customer's controller may be requested to be brought into EE offices for Factory Acceptance Testing (FAT) and confirmation that the controller communicates correctly with the EE equipment.

6.4 CSIP-AUS Requirements

Generator connections assessed to require the common smart inverter profile (CSIP-AUS) remote-control interface shall meet the requirements of the subclauses in 0.

Standards Australia Handbook 218:2013 defines the CSIP-AUS profile.

6.4.1 Inverter CSIP Gateway/Client Requirement

The customer must utilise a Clean Energy Council (CEC) approved CSIP-AUS Compliant inverter / gateway pair listing with their communication software clients that are compliant to IEEE 2030.5 CSIP-AUS. Refer to the list on the Clean Energy Council website https://cleanenergycouncil.org.au/industry-programs/products-program/inverters

6.4.2 Typical Control System Architecture(s)

There are three typical paths for CSIP-AUS compatibility to Endeavour Energy's CSIP-AUS utility Server:

(a) **On-Device –** CSIP software client directly on the inverter
(b) **Hardware Gateway –** CSIP software client on a gateway device in customer installation
(c) **Cloud platform –** CSIP software client provided by the OEM or an Aggregator on a certified cloud connection, with remote connection to the DER.

The customer shall register their system into Endeavour Energy's Utility Server utilising the inverter OEM's provided Installer App. Endeavour Energy's systems will be notified when a new installation is registered and validate this system in our Installer portal.

Communications between CSIP gateway client to the customer DER to be in line to industry best practice and shall ensure that control and failsafe features in Section 6.4 are not diminished.

The architecture for each option connection to Endeavour Energy's Utility Server, options shown on Figure 3.

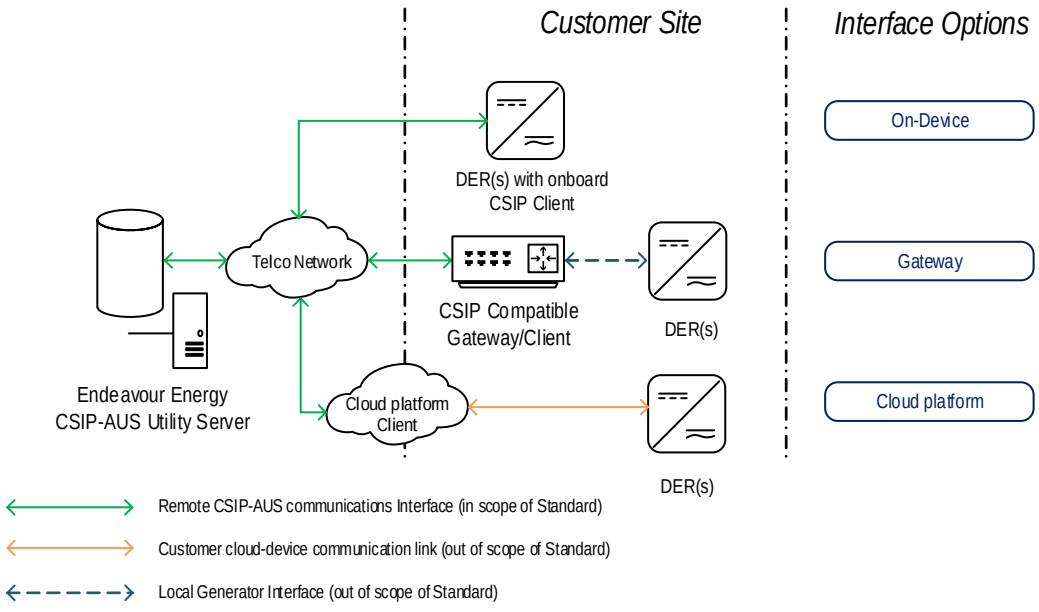


Figure 3: Architectures for CSIP-AUS interface/communication options

For systems which do not have a connection to the Utility Server due to limited communication access (or where the customer chooses not to) a lower export limit will be placed on the installation. This can be removed in the future if connection is established in the future.

6.4.3 Registering to CSIP-AUS Utility Server

The customer shall register for CSIP-AUS through the Endeavour Energy installer portal. The installer portal will request information on the type of connection, inverter manufacturer and inverter model to confirm compliance to CEC approved inverter list.

Once registered, Endeavour Energy representatives will finalise any required configuration during the system energisation.

6.4.4 Communications Signal Failsafe

The customers client must be capable of monitoring communication health to the Endeavour Energy Utility Server. Where communications have been lost for an agreed duration, the client must limit export of the generator to either zero export or a maximum default export limit agreed between the customer and EE during the connection agreement after the last export limit schedule has been received/actioned.

6.4.5 Testing Communication Interface

Prior to completing the installation, the customer's installer must verify the operational integrity of the communication interface in accordance with Endeavour Energy processes[1].

6.4.6 Multiple Inverters

Multiple Inverters within an installation shall be handled by the CSIP-AUS software client in a master slave arrangement.

[1] The testing procedure will be specified within the Permission to Connect (PTC). This process is subject to refinement as industry practices and internal requirements evolve.

6.5 Automatic Generation Control

Embedded generators registered as a scheduled production unit (refer NER Clause 2.2.2) require access to active power control as per NER S5.2.5.14, including Automatic Generation Controls (AGC) from AEMO.

The proponent can engage the connecting DNSP to act as the intervening facilitator for AGC signals. As the intervening facilitator, EE facilitate the signal mapping between the proponent and AEMO using the existing EE ICCP connection. Should the proponent engage EE to act as the intervening facilitator, EE reserves the right to request the proponent to invest in additional communication systems to achieve the required reliability requirements to meet the Power System Data Communications Standard (PSDCS).

Refer to the PSDCS for minimum reliability, data latency and data quality service levels, and the overview of the Data Communication Facilities.

Note, all requirements under 6.5 are in addition to the requirements under 6.3 (if applicable).

6.5.1 EE Intervening Facilitator Architecture

The typical EE intervening facilitator architecture from the customer installation to the AEMO systems are shown in Figure 4.

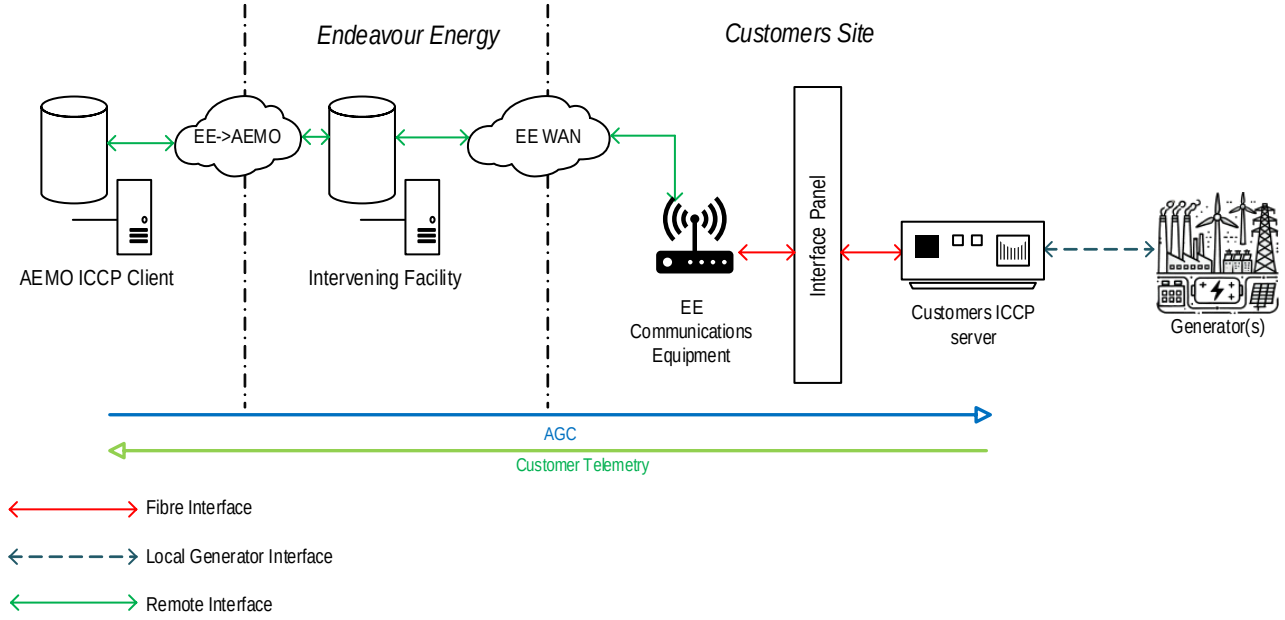


Figure 4: Architecture of typical EE Intervening Facilitator at Customer's Site

There shall be no reliance on the EE substation RTU for the proponents ICCP communications. It is not acceptable to use local peer-to-peer communications from the proponent's RTU to the EE RTU for the provision of AGC and other market signals.

6.5.2 Data Requirements

The data requirements as per NER Clause S5.2.6.1.

It is the responsibility of the proponent to engage and agree on data requirements and signal maps with AEMO. Signal maps will be provided to EE during the detailed design project phase to configure the EE intervening facility, and the proponent shall coordinate all configuration and testing with EE to meet the AEMO registration and energisation timing requirements.

Endeavour Energy reserve the right to request additional data in additional to requirements as per 6.5.2 during detailed design phase.

6.5.2.1 Data Agreement Form

The proponent will be provided with the Endeavour Energy ICCP Signal template document which will be updated by the proponent with the agreed signals. The document has all instructions nominating the ICCP data types, and tag name conventions to be followed by the proponent. The document will have revision history and will be signed off by both parties once signal list has been finalised.

6.5.3 Communication Protocol

The customer controller shall support ICCP (or IEC60870/TASE.2).

6.5.4 Physical Requirements

To facilitate the AGC connection, the following requirements must be assessed by the customer. All final hardware requirements within the customer installation will be agreed between EE and the customer during the detailed design.

6.5.4.1 Accommodation for Communications Equipment

Where applicable, the customer shall provide a suitable location for the installation of communication equipment as close as practical to the customer's generator control system, or in an easily accessible location. EE equipment shall be installed in a lockable enclosure, either within a dedicated cubicle or 19" rack, confirmation of which will be agreed in the detailed design.

Note, equipment procurement, installation and commissioning responsibilities to be agreed between Customer Network Solutions and the customer.

6.5.4.2 Fibre/Radio Connection to Customer's Control Room

Where applicable, allowance shall be made for external entry of fibre optic cables into the customers control room to the EE cubicle as required.

7. Flexible Export Control Signals

7.1 Generation Dispatch Limit

A Generator Dispatch Limit (GDL) control system must be provided to control the proposed generating system's real power output. The GDL control system required by Endeavour Energy will consist of a control signal that will be initiated via Endeavour Energy.

The GDL will provide an analogue signal providing the set point, which will normally be set at the rated capacity of the network connection. However, subject to network conditions, the GDL set point may be altered to constrain the generating system's output between 0MW and the rated capacity of the generation system to suit the network or AEMO dispatch requirements.

7.2 Net Export Limit

The net export limit control system will be provided to enable Endeavour Energy to control the export at the connection point of the proposed generating system's real power output. The net export limiter will consist of a control signal that will be initiated manually via Endeavour Energy to constrain the net site export at the connection point to suit the network requirements (e.g. abnormality on the Network).

7.3 Power Factor Setpoint

In order to meet network requirements, Endeavour Energy may vary the generating system's power factor set point at the connection point, taking into consideration the technical and reasonable limitations of the inverter. The required power factor will be applied automatically via the power factor set point control.

7.4 Discharge/Charge Rate Limit

When an energy storage system has the ability to charge from the network, the proposed energy storage system may be subject to limits on the time and/or rate at which it may charge. A constraint may also be applied on the amount and/or rate of energy discharged back into the network.

7.5 Frequency Response Limit

Generating systems intending to participate in the Frequency Control Ancillary Services (FCAS) market may be subject to export and import limits at the connection point to prevent overload / reverse overload of distribution network limits during delivery of FCAS.

The generating system's control system must be capable of accepting net import / export limits at the connection point from Endeavour Energy and ensure the bidding algorithms take these limits into account such that the net power flow at the connection point does not violate the distribution network limits during delivery of FCAS.

8. Responsibilities

Head of System Operations has the authority and responsibility for:

- Approving this standard.

Secondary Systems Manager has the authority and responsibility for:

- Endorsing this Standard

Delivery Manager Secondary Systems has the authority and responsibility for:

- Keeping this Standard up to date in accordance with Company Procedure GAM 0001 – Network Standards Framework: Preparation and Amendment of Network Standards.
- Overseeing the implementation of this standard within the Secondary Systems Delivery section.
- Approving exceptions to this standard, provided that the exceptions are compliant with Company Policy 9.2.2 – Network Protection.

Senior Automation Engineer

- As is applicable for an Automation Engineer (listed below).
- Approving designs which are compliant with this standard.

Automation Engineer/Specialist and Secondary Systems Development Specialist/Engineer

- Maintaining familiarity with and for complying with the requirements of this Standard with respect to automation work.

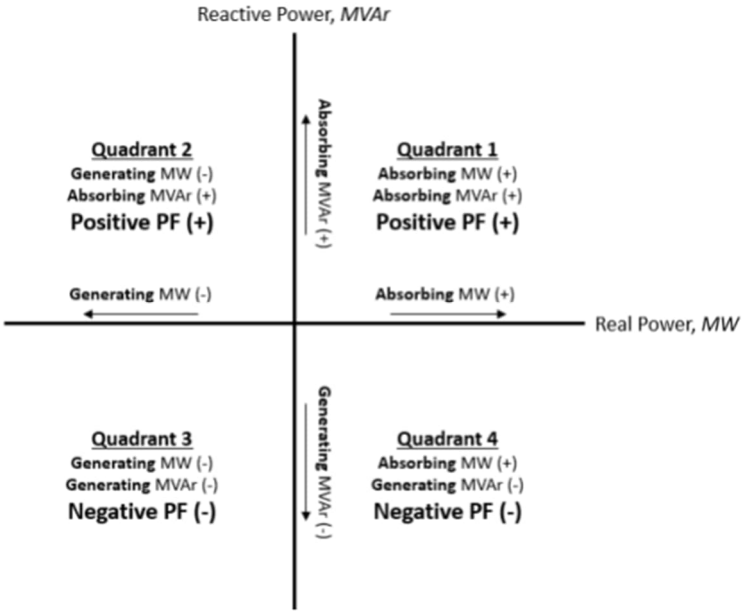
Customer Network Solutions Employees

- Maintaining familiarity with and complying with the requirements of this standard.

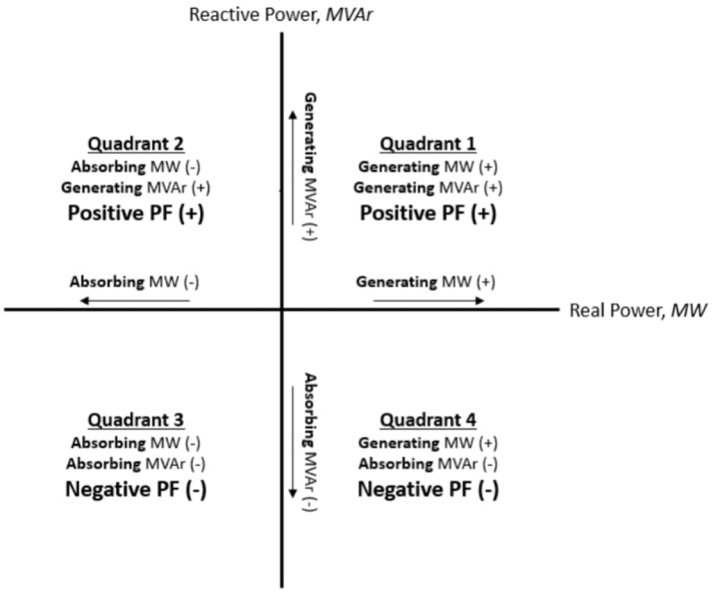
Appendix A – Power Value Convention

Metering of individual generating units or of the total generating system measured downstream of the connection point shall be configured as per diagrams below, with positive while generating and negative while absorbing active power. The sign of the corresponding reactive power shall be relative to the direction of active power flow such that a positive value shall indicate reactive flow in the same direction as active power flow whilst a negative value shall indicate reactive flows in the opposing direction to active power flows.

Net metering (where applicable) as seen at the connection point shall be positive for flows from the network through the connection point (i.e. whilst absorbing active/reactive power) and negative for flows to the network through the connection point (i.e. whilst exporting active/reactive power).



Power Convention at connection point



Power Convention at generator terminals

Appendix B – Protection System Compromised Alarm Logic

A single alarm point should be made available for Endeavour Energy which indicates that the protection scheme is not in its intended, fully dependable state.

The alarm shall **assert if any** of the following conditions occur (logical OR), and **restore** once all conditions clear:

1. Major/self-supervision failure of any relay implementing Endeavour Energy-required protection functions as per PDI1000 or PDI5000.
2. Abnormality of any **DC supply feeding protection relays, interposing relays, or trip coils**, including loss/low voltage or operation of a fuse/MCB in those circuits.
3. **Trip Circuit Supervision** failure on any required trip path (including duplicate A/B paths), such as open circuit, loss of trip voltage with breaker closed, or operation of a fuse/MCB in the trip circuit.
4. **Protection scheme unavailable or degraded**, including but not limited to:
   (a) Line differential **communications/channel unavailable** or **element blocked**,
   (b) VT/CT failure detection that blocks required elements,
   (c) Protection **Out of Service / Test / Inhibited** states for any required element,
   (d) Breaker Failure protection unavailable (where specified).

Redundancy. Where protection or trip paths are duplicated, the alarm shall assert upon the loss of any single component that removes redundancy and only restore when full redundancy is re-established.

Presentation. The HVC may retain detailed local annunciation; Endeavour Energy requires the **single consolidated** telemetered point.

Filtering. Apply an on-delay of 2 s to prevent chatter; no latching is required for telemetry (local latching is acceptable).

Endeavour Energy

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