

Field Device SCADA Requirements

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**Endeavour
Energy**

POWER
together

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Nil.

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Contact Information

The latest version of this document and other standards, are located on Endeavour Energy's standards website located at:

<http://www.endeavourenergy.com.au/aspPortal/webengine/au/com/ee/asp/Standards/Standards>.

For any enquiries relating to the content of this document please contact the Standards Coordinator on 13 10 81.

Document Control

Documentation content coordinator:	Secondary Systems Manager
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1. Documentation Scope

Field device RTUs are used on all primary system network equipment which require communications with Endeavour Energy's SCADA system. The intent of this document is to outline the general requirements necessary for a SCADA field RTU to be connected onto Endeavour Energy's network. Additional equipment technical specification documents may be used in conjunction with this document for specific field device use cases, for example:

- Reclosers.
- Load break switches.
- Voltage regulators.
- Pad-mount 11kV/22kV motorised switchgear.

The tenderer shall state any non-compliance with the specification in the tender submission and any alternative offers may be submitted in full and separately from the main offer. Any proposed variations from this specification must be referred to the Secondary Systems Manager for approval prior to acceptance.

2. References

External Regulations

Electricity Supply Act 1995 (NSW)

Work Health and Safety Act 2011

Work Health and Safety Regulation 2017 (NSW)

External Standards

Standard No.	Year	Title
AS 4417.1	2012	Regulatory compliance mark for electrical and electronic equipment - Specific requirements for particular regulatory applications
AS 4417.2	2020	Regulatory compliance mark for electrical and electronic equipment - Specific requirements for particular regulatory applications
IEEE 1815	2012	Electrical Power Systems Communications – Distributed Network Protocol (DNP3)

Company Policies and Procedures

Company Policy (Network) 9.2.1 – Network Planning

Company Policy (Network) 9.2.5 – Network Asset Design

Company Policy (Network) 9.7.1 – Network Asset Construction
Company Policy (Network) 9.8.3 – Network Operations
Company Policy (Network) 9.9.1 – Network Asset Maintenance

3. Definitions and Abbreviations

Term	Definition
ADMS	Advanced Distribution Management System
CT	Current Transformer
DNP3	Distribution Network Protocol 3
I/O	Input / Output
MOSAIC	Endeavour Energy's SCADA System
M	Mandatory Requirement
NTP	Network Time Protocol
O	Optional Requirement
P	Preferred Requirement
RCM	Regulatory Compliance Mark
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition
SNMP	Simple Network Management Protocol
SNTP	Simple Network Time Protocol
SEF	Sensitive Earth Fault

4. Actions

4.1 Service Conditions

The RTU, and all equipment inside the RTU enclosure must be fit for the following operation service conditions as per Table 1 below. All batteries must be rated for use in an environmentally sealed enclosure.

Table 1 – Service Conditions

Service Condition	Criteria
Maximum operating temperature	+70 deg. C
Minimum operating temperature	-10 deg. C
Average index of mean relative humidity	95%

4.2 Time Synchronisation

The supplier will provide a list of supported time synchronisation options.

The list of options ordered by preference is provided below.

Table 2 – Time Sync requirements

Component	Option
NTP Client	M
NTP Server	O
DNP3 time synchronisation	M
NTP can failover to DNP3 time synchronisation. If NTP is successfully time synced, ignoring DNP3 time from SCADA master station	P
Sync status available as a DNP3 mappable point	M

4.3 Cyber Security Requirements

Supplier to provide details on all cyber security features of the device.

The minimum cyber security requirements are given below in Table 3.

Table 3 – Security requirements

Component	Description	Option
Password Requirements	Password required for local and remote access	M
	Configurable passwords	M
User Management	User group security levels / Role Based Access Control (RBAC)	M
	TACACS+ or RADIUS	P
	Ability to disable unnecessary local accounts	P
Telnet	Disabled, or configurable to be disabled if available	M
SSH	Disabled if not in use.	M
Web HMI	HTTPS	M

	HTTP disabled	M
	Session timeouts	M
	Concurrent sessions or multiple logins	P
System Logging	Security events	M
	Configuration change events	M
	Syslog support	P
DNP3	DNP3 secure authentication	M

4.4 Unit Testing Functionality Requirements

The supplier must provide a means for testing and simulating a field device for workshop and in-service environments using a switchgear emulator capable of proving all functionality.

The supplier must provide details on how to test and simulate field device functionality using the field device RTU.

Below is a list for minimum testing requirements for devices with the following indicators and measurements.

Table 4 – Minimum testing requirements

Requirement	Description
In-line test plugs	Where conventional CT circuits are utilised. CT circuits must be shorted via a “Make before break” mechanism when test plugs are inserted (if applicable).
Secondary test injection	Ability to connect an external test set to inject the following sources: • 3 Phase current • 3 Phase voltage
Field Device Simulation	Prove functionality of primary equipment: • Open • Close • Switch status • Voltage (source / load) • Current • Power • Gas Pressure – As required • Miscellaneous I/O

5. Power and Electrical Requirements

All equipment required to supply the auxiliary power needed for the RTU, communications equipment and operations such as open/close of the switch (if applicable) must be provided. This must include auxiliary transformer, rectifier, batteries, and associated equipment.

The supplier will provide datasheets on the power requirements of the RTU, as well as options for ancillary supply.

All AC/DC supplies, DC/DC supplies, chargers, converters and associated in-scope electrical equipment must adhere the Radiocommunications Act (1992) and Radiocommunications Labelling (Electromagnetic Compatibility) Notice 2017 (where applicable). All relevant RCM markings and compliance requirements as specified in AS/NZS 4417.1:2012 and AS/NZS 4417.2:2020. Wherein a supplier does not believe they are required to meet RCM compliance inclusive of EMI. They must provide relevant evidence and justification, for example, there are no relevant AS/NZS standards in scope for RCM compliance. In which case the manufacturer must have made reasonable efforts to comply with the nearest relevant standards.

Power supply to the communications equipment must be 12Vdc (preferred) or 24Vdc nominal, 8A peak, 4A @12Vdc continuous (based on a 100% duty cycle).

5.1 Battery/Charger Requirements

The battery and charger are required to supply the auxiliary power required for the RTU, communications equipment. The battery shall provide power for at least 16 hours.

The auxiliary power supply must use a storage battery of adequate capacity with a suitable constant voltage battery charger. Where applicable, the provided battery capacity must be adequate to provide standby power for the RTU, communications equipment for at least 10 open/close operations in the event of AC power loss.

Where solar is selected as the primary auxiliary supply source, adequately rated solar panels and charging systems must be provided to accommodate load requirements. Furthermore, the battery storage capacity must allow for the device to remain in operation for the entirety of the time outside daylight hours, as well as account for days with low solar irradiance.

The battery must not be directly connected to the RTU or communications equipment. Supply to RTU and communications equipment must be through a constant voltage battery charger. During an event where the auxiliary supply is unavailable, field equipment providing protection functionality must provide capability to disconnect the communications supply to ensure the RTU continues to function. The priority functionality should be configurable and based on either a dedicated hold-up time or battery life remaining. Other methods may be acceptable and must be described by the supplier. If applicable, the device shall auto disconnect the communications supply once the battery reaches a low voltage condition.

The charger must offer temperature compensated charging to ensure optimum life of the battery is achieved for the complete temperature range.

The charger must provide local and remote indication on the following:

- Low voltage alarm.
- Battery condition.
- Charger failed.

The battery shall be rated for use inside a sealed enclosure, and be rated for the environmental conditions as per section 4.1 - Service Conditions.

The storage batteries must be sealed type requiring no maintenance over their life. All batteries must have a maintenance-free life of at least five (5) years. A label showing the year of manufacture must be affixed to each battery.

If applicable, full details of the battery and charger included must be submitted for approval.

6. Communication Requirements

6.1 Connectivity Requirements

The supplier will provide details on the supported communication ports. The device must be IPv4 capable with configurable IP address, subnet mask, gateway, and DNS server address.

Below are the communication port requirements.

Table 5 – Preferred port requirements

Interface	Physical Port	Speed (Minimum)	Function	Option
Ethernet	RJ45	10/100 Base-T	Remote Communication Local Engineering Access	M
RS232	DB9	9600 Baud	Remote Communication Local Engineering Access	O
Ethernet	Fibre (MM / SM) with LC connector	FE or GE	Remote Communication Local Engineering Access	O
USB	USB Type A, B or C	-	Local Engineering Access	O

It is desirable for the RTU to have at least two (2) communication interfaces. This is to allow the device to remain in service to SCADA while under maintenance or reconfiguration.

6.2 RTU Protocol Requirements

Vendors are expected to be fully compliant with each of the protocols listed below with their respective standard. Information regarding any known deviations from the required protocol shall be provided by the supplier.

The device shall operate in the Master/Slave modes as outlined in **Table 6** for each respective protocol.

Additionally, the items listed in

Table 7 refer to protocol functionality that is specifically required by Endeavour Energy even though a protocol standard may refer to it as optional.

Fundamentally all DNP3 enabled devices must be compatible with the Endeavour Energy Master Station and communications infrastructure.

Table 6 - Protocol Modes

Protocol	Mode	Required
DNP3	Slave	M
	Master	P ¹
Modbus	Slave	O
	Master	O
IEC61850	Server	O
	Client	O

Table 7 – Protocol Requirements

DNP3	Requirements	Required
Master Station Compatibility	To be confirmed during device user acceptance testing. - CGI MOSAIC v5.0 - Schneider ADMS	M
DNP3 Level	Minimum 4	M
Communications	Serial	O
	TCP	M

DNP3	Requirements	Required
	UDP	M
	Configurable TCP / UDP listening ports, for example, 20000, 20001 or 20002	M
	Dynamic UDP - UDP responses received by an RTU must be sent back to the corresponding source port of the Master which sent the request as per DNP3 1815-2012 13.2.3.2.1, Table 13-1.	M
	Accept DNP3 Telemetry from any Master IP Address as per IEEE DNP3 1815-2012 - 13.2.3.2.2. May be achieved via either of the following methods: - Option to ignore or not validate the incoming Master IP address. - IP Address wild cards for Master Station IP addresses, for example, *.*.* or 0.0.0.0. When configured, the RTU must have the ability to learn the destination of the Master Station, for example, the IP address used in last scan.	M ¹
	Accept the following Master Station DNP3 address range: 0 – 65519	M
Unsolicited Responses	Unsolicited response reporting functionality for sending real-time event messages back to the Master once an event occurs outside of standard polling.	M
	Remotely Disable / Enable unsolicited reporting in an RTU via the Master Station as per IEEE DNP3 1815-2012 – 4.4.13.	M
	Per class unsolicited reporting triggers as per IEEE DNP3 1815-2012 – 4.6.2.2. - Class 1, 2, 3 hold time delay prior to sending an unsolicited response. - Number of queued events prior to sending an unsolicited response.	M
	Configurable Transmission Parameters: - Retry delay. - Max retries.	M
DNP3 Point Configuration	Configurable DNP3 Mapping with the following parameters per point: - Class. - Dead-bands.	M
Scan Type	The device must respond to class-based DNP3 scans	M
Dead-bands	Analogue dead-band levels can be configured by either of the following methods: - Engineering units. - Raw units.	M
	Integrated dead-banding, with a configurable dead-band percentage.	P
Default Object	Either of the following is required:	M

DNP3	Requirements	Required
Variations	- Per point object variation configuration. - Configurable default object variation for all points.	
Analog Object Variations	Obj – 30/1 (32-bit signed integer analog) Obj – 30/5 (Single precision floating point analog) Obj – 32/1 (32-bit signed integer analog) Obj – 32/3 (32-bit signed integer analog with time) Obj – 32/5 (Single precision floating point analog without time) Obj – 32/7 (Single precision floating point analog with time)	M
Analog Event Buffer Mode	Option to only store the most recent analog event per point in the buffer as per IEEE DNP3 1815-2012 – 11.9.1.2. For example: - Single / Last Event Mode: Only the most recent instance of an event for a particular DNP3 point will be recorded in the event buffer. - Multiple Mode: All analog data is stored in the event buffer. Note: In single event mode, a single analogue point shall only update the unsolicited queued events counter once, irrespective of the number of analog changes for that point.	M
Class 0 Analog Event Handling	On receiving a class 0 scan, the RTU shall respond with the latest analog value per point irrespective of configured internal dead-bands.	M
DNP Event Buffer	The RTU shall provide a buffer of adequate size to accommodate the following items: - Digital data: 250 events. - Analog data: 250 events.	M
RTU Data	It is desirable for the following data objects to be available as a mappable DNP3 point: - Firmware version. - Configuration revision. - Health Status, for example, configuration errors, internal faults etc.	P

Protocol	Requirements	Required
IEC61850	IEC61850 Edition 2	O
SNMP	SNMP with appropriate MIBs for RTU monitoring. Must be version SNMPv2 or SNMPv3. SNMPv3 with SNMPv2 disabled is preferred.	O

¹As Endeavour Energy's SCADA System has the capability to operate out of multiple geographical locations, Dynamic UDP is required to maintain communications and control during SCADA Master station failover events.

7. Configuration Requirements

7.1 Local Engineering Requirements

The supplier will provide details on the supported local engineering functions/settings.

Below is a list of the local engineering functions/settings.

Table 83 –Local engineering function/setting requirements

Item	Requirement	Option
Configuration	Local configuration	M
	Remote configuration, for example, over TCP/IP.	P
	It is preferred that the port number used for TCP/IP remote configuration can be modified.	
	It is preferred that remote configuration is possible with a low bandwidth (<50 kbps) and high latency (>1s) radio link.	
	Configuration files can be exported, for example, the as left settings.	M
	It is preferred that configuration files are stored in a human readable format for comparison purposes, for example, in Extensible Markup Language (XML).	P
Comparison tool	Offline configuration via manufacturer software without the need to be connected to the equipment. This will provide the ability to create and modify configuration files without physical hardware.	M
	Where applicable, separation of key device context settings, for example, protection, SCADA or communication settings.	P
	This provides the ability to upload/download only relevant settings without impacting other components.	
Standard logging	Factory reset capability	P
	Comparison between multiple configuration files.	O
	Comparison between configuration files and existing device configuration.	M
Status	Events records	M
	Communication statistics	M
	Fault records in COMTRADE file format. This is only applicable for devices providing protection indication.	M
Web HMI	RTU/Device health status/warnings	M
	DNP3 tracing capabilities	P
	Battery charger status (where applicable)	O
Web HMI	For devices with web console access, the following browsers must be supported:	M

Item	Requirement	Option
	• Mozilla Firefox • Google Chrome • Microsoft Edge (Chromium based)	

7.2 Software Requirements

Where software is required to configure or update firmware for an RTU, the supplier shall make these readily available.

Software must be compatible with Endeavour Energy's IT infrastructure. Additionally, all provided software must be compatible with on a computer running the latest Microsoft Windows Operating System, currently Windows 11 at the time of this document specification. This includes any required third-party software components such as licencing systems or software libraries.

Where third-party software is required, the vendor shall supply the appropriate installation software or location where it can be acquired.

Any licence required for the configuration or maintenance of the RTU shall be transferable in the event of a computer system malfunction or migration at no cost to Endeavour Energy. The vendor shall supply software licences for third-party software components if applicable.

8. Acceptance Testing and Documentation

8.1 Acceptance Testing

The supplier must provide Endeavour Energy with a test RTU at the time of evaluation to confirm that minimum functional requirements are satisfied. The supplier shall provide all configuration software to Endeavour Energy with all supporting documentation to test both the configuration and compatibility between the RTU and the Endeavour Energy SCADA system.

8.2 Documentation

Documentation must be concise, relevant, and readily available. It is preferred that documentation be provided in a standardised Portable Document Format (PDF). Where applicable, the supplier must ensure the following categories are documented:

- Device datasheet.
- Device operation.
- Installation.
- Configuration, including setting files and instantiation of setting files.
- Device manual describing relevant features, functions, automation, and available settings.
- Protocol manuals.
- Firmware update procedure.
- Factory reset procedure.

9. Maintenance Requirements

9.1 Spare parts and Maintenance

The supplier shall supply a list of recommended spare parts, special tools and appliances required for the whole of life operation and maintenance of the RTU installation. The list, together with prices, shall be indicated in the appropriate schedule.

9.2 Failure Mode Analysis and Preventative Maintenance

The supplier shall indicate and provide updates to Endeavour Energy the mean time between failures (MTBF) of the RTU and its components including the recommended maintenance regime and maintenance tasks and intervals. This regime shall be based on the mean time between failure (MTBF) and the critical failure modes identified by the failure mode, effects and criticality analysis (FMECA) of the equipment. Details substantiating the FMECA analysis shall be included in the offer.

10. Responsibilities

Head of System Operations has the authority and responsibility for:

- Approving this standard.

Secondary Systems Manager has the authority and responsibility for:

- Keeping the contents of this specification up to date.
- Making recommendations concerning compliance in respect to this specification.

