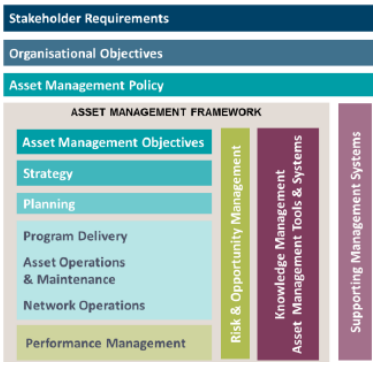
Automation Customer Interface Guide

Guideline

DOCUMENT HIERARCHY

This document resides within the Planning component of Western Power's Asset Management System (AMS).



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RESPONSIBILITIES

Western Power's Engineering & Design Function is responsible for this document

CONTACT

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Contents

Revision Details

Version	Date	Summary of change	Section
0	30/05/2023	Updated document template, section 2 & 3. Added Approval record.	
1	18/08/2023	Added the Telecommunications Section 4. MTP fibre spec, Link and Copyright updates.	4

1. Introduction

This customer interface guideline is intended to provide a reference for customers on Western Power Automation system interface requirements. Project specific requirements shall be advised by Western Power during the design process which may supersede the requirements within this document.

1.1 Purpose and scope

This document does not cover interfacing and connection requirements relating to protection schemes, interlocking or electrical interface requirements.

1.2 Acronyms

Acronym	Definition

1.3 Definitions

Term	Definition
AEMO	Australian Energy Market Operator
AMS	Asset Management System
DCS	Distributed Control System
RCE	Remote Control Equipment
RME	Remote Monitoring Equipment
SCADA	Supervisory Control and Data Acquisition
WEM	Wholesale Electricity Market

1.4 References

References which support implementation of this document

Table 1.1 References

Reference No.	Title
Document Link	WEM - Wholesale Electricity Market Rules (August 2019)
Document Link	AEMO – WEM Procedure: Communications and Control Systems (October 2021)
Document Link	AEMO – Technical Specification: Operational Data Points for Registered Facilities (June 2022)
Document Link	Western Power Technical Rules (December 2016)
Document Link	Automation – Template – Customer Interface List

	Western Power Automation – Design Guidelines[1]
	Telecommunications Site Sharing Licence Agreement Template (Site sharing access application for mounting Customer-owned antenna infrastructure within a Western Power substation) [1]
	Licence Agreement – Access to Substation Communications Maintenance Licence (Licence agreement to allow third party access to a Western Power substation for the purpose of maintaining customer-owned communication equipment) [1]
	Manual – Antenna & Feeders Construction – Telecommunications Design[1]
	Standard Drawing General PPG Wall Mount Rack – Wiring Diagram[1]
	Standard Drawing General PPG Wall Mount Rack – Clipsal 4CC11 Switchboard Assembly Diagram[1]

2. Standard Connection Arrangements

Facility has the meaning given in clause 2.29.1A of the WEM Rules, which can be a Registered Facility or unregistered facility. A new or existing Facility (Customer) participating in the Wholesale Electricity Market (WEM) must be registered as a Rule Participant in the Market Participant class in accordance with the WEM Rules or be granted an exemption in respect of the Rule Participant registration by AEMO to run as an unregistered facility. Market Participant connecting facilities to Western Power Transmission and Distribution system[2] must be registered as one of the following facility classes for the purposes of the WEM Rules[2.] The determination of Facility Class will be made by AEMO in accordance with their registration process.

- a Scheduled Facility
- a Semi-Scheduled Facility
- a Non-Scheduled Facility
- an Interruptible Load and
- a Demand Side Programme

Non-dispatchable loads registered as either interruptible load (in response to under frequency situations) or Demand Side Programme (provide curtailment by the Market Participant) are subject to the same WEM Standing Data[3] and AEMO critical outage periods[4] as all the facility classes.

For an unregistered facility (non-Market Participant), Western Power as the Network Operator may require the facility to provide remote control equipment (RCE) or remote monitoring equipment (RME) to enable the Network Operator to monitor and disconnect the facility remotely from the transmission or distribution system.

The registered and unregistered facility standard arrangements contained in this document for both Transmission and Distribution systems are provided as examples to convey Western Power Automation system requirements.

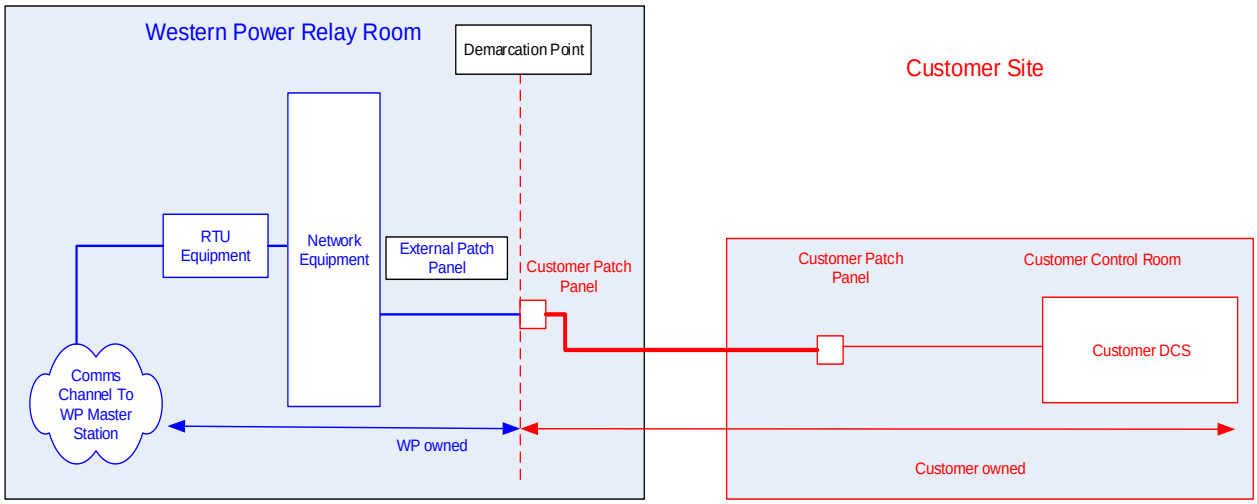
[1] Internal Western Power documentation is available to accredited vendors.

[2] Definitions as per Technical Rules

2.1 Unregistered Facility

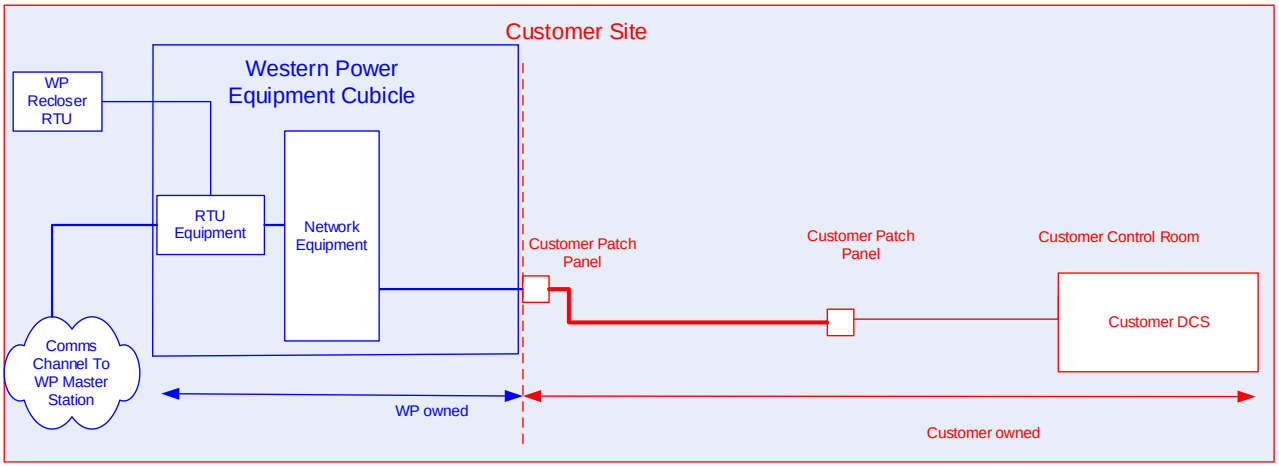
Unregistered Facility connected as a load[3] or generator must utilise one of the following standard connection arrangements shown below. Please note that duplicate connections may be required between the Network Operator and the Facility to support clause 3.3.4.3 or 3.4.10.2 of the Technical Rules based off the monitoring or control requirements. The final connection arrangement will be determined during the detailed design stage.

Arrangement 1: WP equipment within WP Substation Relay Room with connection to Customer site Facility



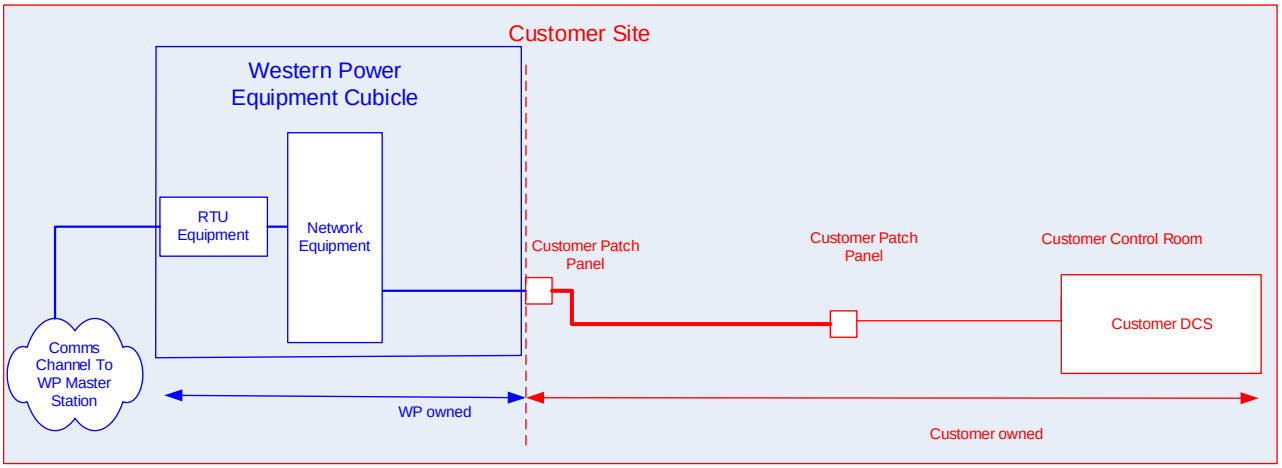
Arrangement 2: WP Equipment within Customer site with connection to WP Recloser

For protection schemes that require a backup in case of failure of the customer equipment, a runback or trip is required, a Western Power Recloser may be installed, and this may interface directly to the WPC RTU on site to enable co-ordination of the load curtailment.



[3] Definition as per WEM Rules section 2.29
[3] Definition as per WEM Rules Appendix 1
[4] Definition as per AEMO WEM Procedure - Communications and Control Systems B.3.1.3

Arrangement 3: WP Equipment within Customer site without Recloser connection requirement



2.1.1 Telemetry

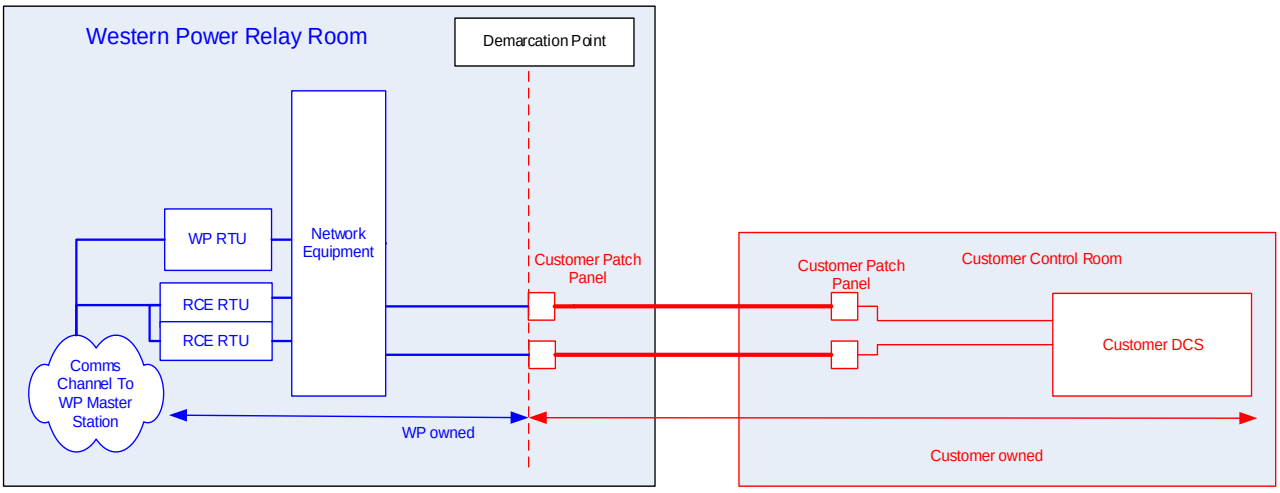
The standard telemetry from the customer is as per the operational data points Facility Interface Customer list[5]. A detailed SCADA points mapping list will be determined during the detailed design phase between Western Power and the Customer.
The Customer Interface List Template shall be used to build their Facility SCADA data list during the design phase in consultation with the AEMO and Western Power.

2.2 Registered Facility

Registered facility Market Participants classed as a Scheduled Facility, Semi-Scheduled Facility, Non-scheduled Facility must utilise one of the following standard connection arrangements shown below. Duplicate connections between the Network Operator and Facility to support the WEM Standing Data[6] and AEMO critical outage periods[7]. The connection arrangement will be determined during the detailed design stage.

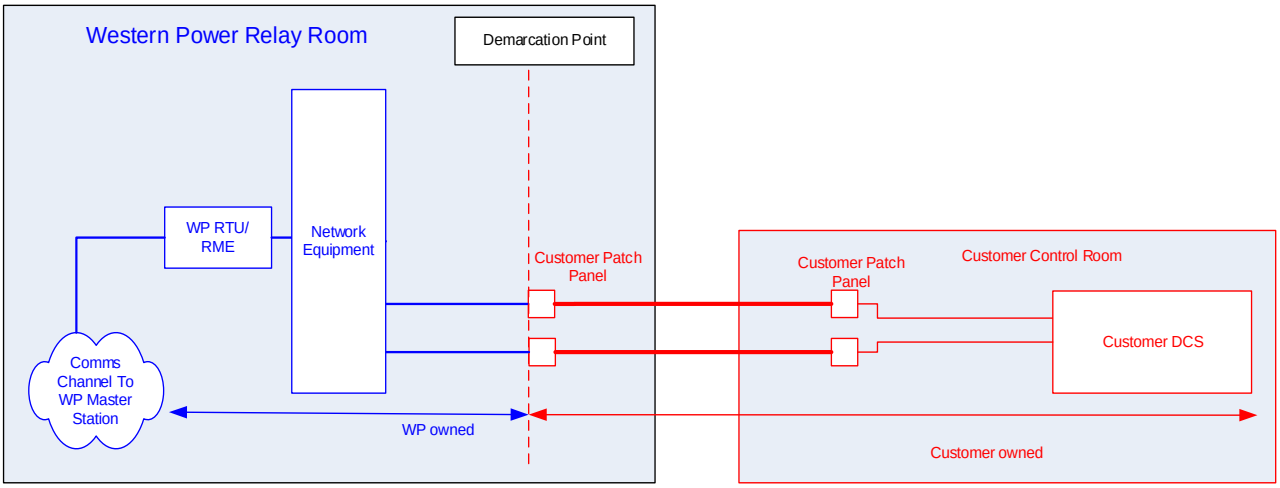
Arrangement 1: WP Equipment and RME with redundant connections to the customer DCS

[5] To update the Facility Interface Customer List refer to EDM#62608242
[6] Definition as per WEM Rules Appendix 1
[7] Definition as per AEMO WEM Procedure - Communications and Control Systems B.3.1.3



Market Participant connected as non-dispatchable load must utilise one of the following standard connection arrangements shown below. Duplicate connections will be required between the Network Operator and Facility to support the WEM Standing Data[8] and AEMO critical outage periods[9]. The connection arrangement will be determined during the detailed design stage.

Arrangement 2: Non-Dispatchable load with WP Equipment connecting to the customer DCS



2.2.1 Telemetry

The standard telemetry from the customer is as per the operational data points Facility Interface Customer list[10]. A detailed SCADA points mapping list will be determined during the detailed design phase between Western Power and the Customer.
The Customer Interface List Template shall be used to build their Facility SCADA data list during the design phase in consultation with the AEMO and Western Power.

[8] Definition as per WEM Rules Appendix 1
[9] Definition as per AEMO WEM Procedure - Communications and Control Systems B.3.1.3
[10] To update the Facility Interface Customer List EDM#62608242

3. Protocol Parameters

3.1 Protocol Interface

The standard supported interface to Western Power equipment is DNP3.

Western Power will always act as the 'master' or 'client' during connection orientated transactions.

3.1.1 Physical Layer

Communications between the External Customer and the Western Power should utilize Ethernet based protocols over fibre networks or digital radio based off the standard arrangement chosen. Refer to section 4 for more detail on physical medium options.

Preferred interface point to customer when sharing a location is a fibre termination enclosure at Western Power Room or Enclosure.

Western Power standard interface for Ethernet communications is 100BaseFX -1310nm over OM3 MMOF (Optical Power out <-15dBm / >-20dBm, Receive sensitivity >-31dBm).

Where Ethernet is not available, communications shall utilize RS232 or RS485 4-wire serial data links. In cases where isolation is required or for long serial links Western Power will free issue a fibre to copper converter to the customer.

3.1.2 DNP3

DNP3 protocol used in equipment must comply with the requirements of a 'Level 2 DNP3 implementation (DNP3-L2) as set out in IEEE Std 1815-2012 DNP3.

Equipment utilizing DNP3 protocol shall be supplied with the manufacturer's DNP3 device profile and certification.

Latency Requirements

Operational Data shall be available to report to the Western Power RTU within 2s from the time the data is converted to digital form. Only solicited polling from Western Power will be utilised.

Analogue Data Representation

Analogue data shall be in the form of a 16-bit signed integer, the values shall be transmitted with a;

- Maximum Dead band of 0.5% of the full-scale range of the value for non-Dispatch data[11].
- Maximum resolution of 1.0% of the full-scale range of the value for non-Dispatch data[12].
- Object 32 Var 2 Analogue Inputs
- Object 40 Var 2 Analogue Outputs
- Set to Class 2 event

[11] Definition as per AEMO WEM Procedure - Communications and Control Systems Appendix B Table 6
[12] Definition as per AEMO WEM Procedure - Communications and Control Systems Appendix B Table 4

DNP3 Binary Controls

Typically, DNP3 controls shall be a Pulse control with a duration of 1 second using select before operate (SBO) function.

- Object 10 Var 2
- Set to Class 1 event

DNP3 Binary Inputs

Typically, DNP3 inputs shall be a Single Point Status (SPS)

- Object 2 Var 2
- Set to Class 1 event

3.2 Hardwired Data Points

Hardwired data received by or issued from the Western Power device shall comply with the following.

All hardwired points are to be wired into the secondary isolation terminals, as per the designs issued from Western Power.

Physical Layer

Hardwired I/O connections are possible to Western Power but are only suitable in cases where there are less than eight points for the interface and no Setpoints or Analogue Outputs are required.

Western Power will provide a Terminal Strip or Krone interface within the Western Power cubicle or interface panel to interface to the customer. The customer shall be responsible from wiring between the cubicle and their equipment.

Digital Input

Whetting supply for digital input points will be sourced from the regulated source to which the device is supplied. 50V DC is preferred.

Digital Output

Digital Outputs will be sourced from voltage free contacts with a continuous carry contact rating of 2A. Only DC voltages less than 120V are accepted, 50V DC preferred.

Analog Input

Analog inputs received shall operate within the range of 0-20mA DC.

4. Telecommunications Requirements and Solution

4.1 Ownership and Demarcation

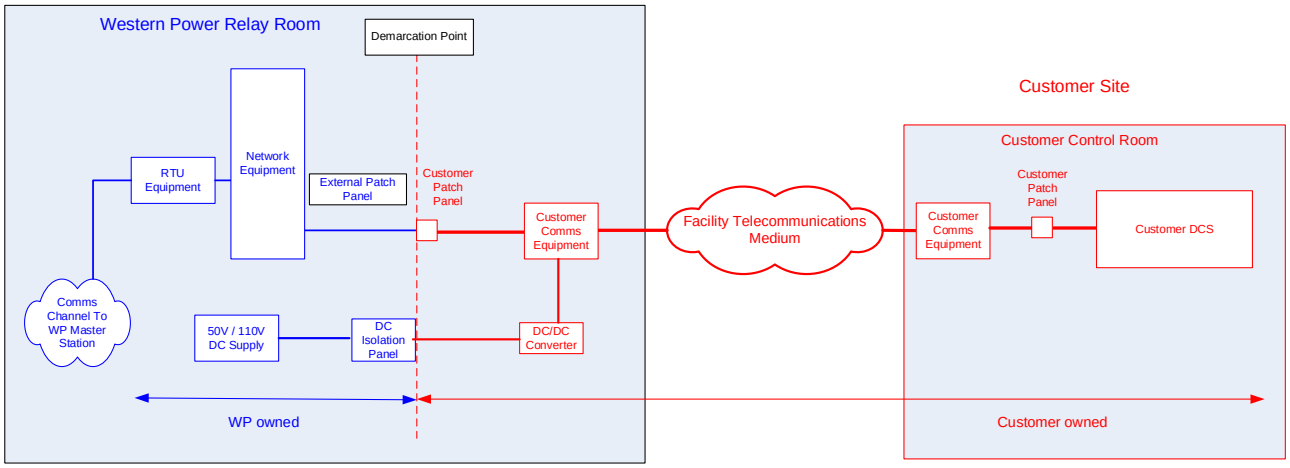
4.1.1 Description

The Facility (Customer) participating in the WEM shall be responsible for providing and maintaining the permanent telecommunication link between the Facility and the local Western Power Substation Automation equipment.

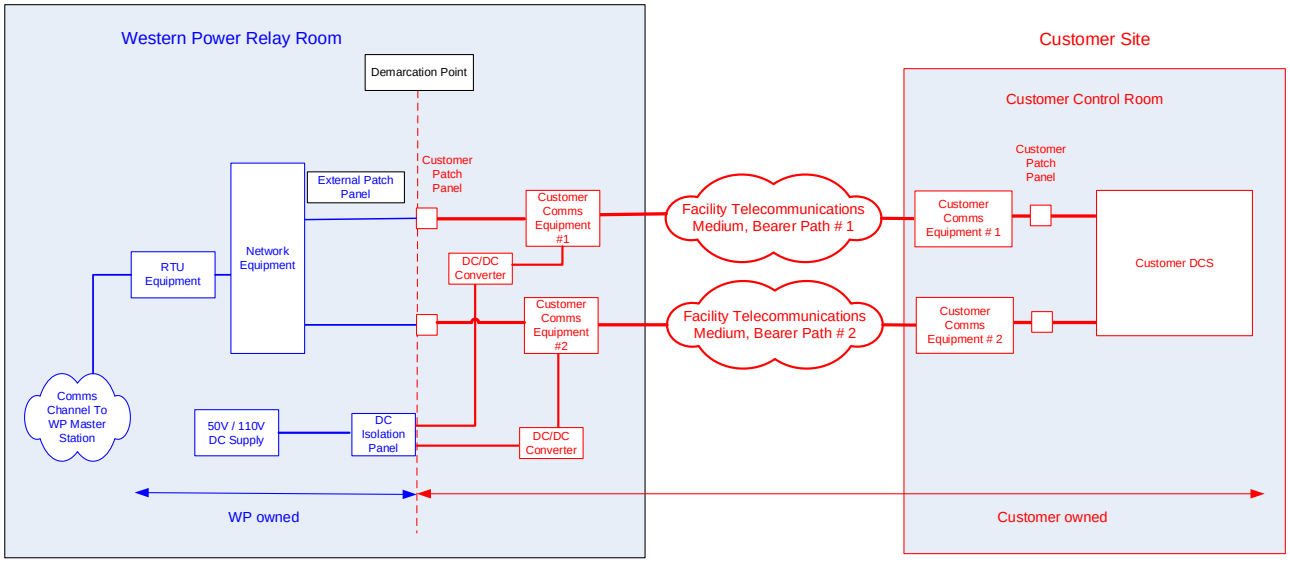
The Customer shall be responsible for the reliability and security of the telecommunications link.

Arrangement 1 and 2 below schematically depicts the proposed topologies and identifies that which is the responsibility of Western Power and the Customer for a typical Customer Facility connection.

Arrangement 1: Unduplicated Communication between WP equipment and the Facility with Demarcation of Responsibility



Arrangement 2: Duplicated Communication between WP equipment and the Facility with Demarcation of Responsibility



4.2 Customer Facility Telecommunications Solutions

4.2.1 Overview

Several alternative communications methods can be utilised by Facility customers to fulfil remote monitoring and control requirements as outlined in The Technical Rules, namely:

- UHF point-to-point radio link
- Fibre Optic direct connection
- Alternative private telecoms service provider solutions

In connecting a Customer Facility, Western Power does not recommend a telecommunications solution; rather, the customer must assess which technology solution is most suitable for the specific requirements of their proposed facility installation.

The customer may suggest alternatives to the solutions outlined below; Western Power will charge labour and materials for participation in testing alternative solutions as required.

4.2.2 Telecommunications Solution Options

4.2.2.1 UHF Point to Point Radio Link

This solution requires the installation of UHF Radios at the Western Power Relay Room and Customer Facility site. The UHF Radios provide a serial/IP interface to connect to the Western Power Automation RTU.

Drawings for this standard design are included in Table 1.1 (References).

The Customer is responsible for the radio path design and analysis. The radios operate on licensed frequencies, and it is the responsibility of the Customer to determine suitable frequencies for use.

Radiofrequency licencing advice may be sought from the Australian Communications and Media Authority (ACMA) national radiofrequency spectrum management and is to be adhered to.

4.2.2.2 Fibre Optic Connection

This solution requires the installation of optical fibre cable between Western Power Relay Room and the Customer Facility site. A fibre converter is required to provide a serial/IP interface to connect to the Western Power Automation RTU.

Drawings for this standard design are included in Table 1.1 (References).

The Customer is responsible for the design of the optical fibre link, buried optical fibre route and any associated environmental, local/state government approvals and/or community consultation as may be required.

The preferred fibre cable to utilise in this application is either of a loose tube construction or of a pre-terminated Multi Fibre Termination Push On (MTP) type.
Irrespective of which cable is chosen, it must be provisioned with a rodent and termite resistant non-metallic armour with a crush resistance exceeding 1500 N/cm with an operational temperature range of -40°C to +85°C.
Single (OS2) or multimode (OM4) cables can be used to suit the application.

4.2.2.3 Alternative Private Telecommunications Service Provider Solution

This solution requires engaging a private telecommunications service provider's ('telco') network to connect the Western Power Relay Room and Customer Facility site.

In the instance where a telco wired solution is to be deployed, the Customer shall determine the final connection arrangement of the solution at the Western Power Relay Room end in consultation with Western Power. This will include determination of any Earth Potential Rise (EPR) isolation equipment that may be required.

Drawings for this standard design are included in Table 1.1 (References).

The Customer is responsible for arranging the telco service at each location, and for any required upgrade of a telco's network infrastructure.

Should a wired solution be deployed, installation of the solution at the Customer Facility site including EPR isolation equipment is to be determined by the Customer.

4.2.2.4 Alternative Customer Initiated Solution

The Customer may suggest alternative communications solutions which should be determined in consultation with Western Power. The customer will be charged for all costs incurred by Western Power for trialling the proposed alternative Customer Facility telecommunications solution. Western Power will advise on labour costs associated with trialling of the solution when a request for estimate is received.

4.2.3 Customer Telecommunications Solution Arrangements

4.2.3.1 Unregistered Facility

For an Unregistered Facility, an unduplicated telecommunications bearer arrangement is utilised between Western Power and the Facility as shown in Arrangement 1 of section 4.1.1.

Please note, as outlined in section 2.1 that duplicated connections may be required between the Network Operator and the Facility to support clause 3.3.4.3 or 3.4.10.2 of the Technical Rules based on the monitoring or control requirements.

4.2.3.2 Registered Facility

A duplicated telecommunications bearer arrangement is utilised between Western Power and the Facility for a Registered Facility as shown in Arrangement 2 of section 4.1.1 and outlined in section 2.2.

4.2.4 Customer Facility Telecommunications – Substation Supporting Infrastructure

4.2.4.1 Overview

Commissioning of the telecommunications solutions identified in section 4.2.2, above, shall require the purchase, installation and commissioning of supporting Customer equipment enclosure, DC supply and wired/wireless interface supporting infrastructure.

Technical details pertaining to this supporting infrastructure are further outlined for Customer review in the following subsections.

4.2.4.2 Location of Customer equipment within Western Power substation

Customer telecommunications equipment cubicle may be installed within a substation. Customer cubicles are typically mounted on the inside wall of relay/control rooms. The Customer shall provide dimensions of the intended cubicle when submitting the site sharing access application.

Western Power shall provide to the Customer the location where the cubicle is to be installed on the inside wall of the substation relay room.

The Customer may propose their own cubicle location and design but will be subject to review and approval by Western Power. The Customer will be charged for the Western Power labour hours incurred for the required review and approval process.

4.2.4.3 Power Supply to Customer telecommunications equipment

A DC supply shall be provided and installed by Western Power at the expense of the Customer in providing power for the Customer's telecommunications equipment at the connecting substation. The supply voltage shall be either 50V DC or 110V DC. Western Power will advise the supply voltage that will be provided.

This supply shall be fused at a Western Power substation DC distribution board. The Customer shall fuse the incoming DC supply at the cubicle before distribution within the cubicle. Details are provided on drawings listed in Table 1.1 (References). The supply is a floating supply and the positive or negative must not be earthed to building earth.

Western Power shall connect the DC supply to a DC isolation panel mounted above the Customer equipment cubicle on the inside wall on the control room. The Customer is responsible for wiring from the isolation panel to the cubicle. Details are included in drawings listed in Table 1.1 (References). Note that the 110V DC floats at 127V DC.

The Customer shall advise of the power consumption of the chosen telecommunications equipment when an estimate is requested. At this time, Western Power will review the capacity of the supply and advise the cost of enhancements, if required.

4.2.4.4 Installation of Customer Facility link antennas and feeders

If the chosen Customer telecommunications solution operates as a radio link, the Customer at its expense may install antennas to support this solution at Western Power's substation site. Antennas may be building mounted or installed onto existing Western Power telecommunications structures on site, if available. The Customer will need to submit a site sharing licence agreement, as per site sharing licence agreement document listed Table 1.1 (References).

Western Power makes no determination regarding suitability of the radio link. When an estimate is requested, Western Power can advise if a structural analysis of the antenna mounting building or structure

is required, cost of the analysis, and the current recurring site sharing costs applicable for the antenna that will be met by the Customer.

After analysing the structure, Western Power will advise the Customer of the suitability of the building or structure for antenna mounting.

All construction activities shall be undertaken in accordance with Western Power's construction standards, as included within Table 1.1 (References).

4.2.4.5 Isolation of Telco lead-in copper telecommunications cabling

If the Customer's chosen communication solution requires a Telco's copper lead-in cable to be terminated into a substation, EPR isolation shall be established in accordance with AS/NZS 3835.1:2006.

Western Power shall be responsible for the design, installation and ownership of EPR isolation within the substation if not already existing, at expense to the Customer.

If changes to the lead-in cable are required, Western Power requires notification to ensure the outage on existing services is appropriately managed.

The Customer is responsible for the EPR isolation at the Customer Facility site, of which works must reference and comply with the following:

- AS/NZS 3835.1:2006 Earth potential rise—Protection of telecommunications network users, personnel and plant, Part 1: Code of practice
- AS/NZS 3835.2:2006 Earth potential rise—Protection of telecommunications network users, personnel and plant, Part 2: Application guide
- HB 219:2006 Earth potential rise - Protection of telecommunications network users, personnel and plant – worked examples for the application guide covering what voltage HV links-only are acceptable and when active isolation is required; the clearance that must be maintained from a customer equipment cabinet to any local earth reference; requirements for installation of the copper lead-in cable (ie. no joints in conduit and all pairs terminated on HV links)

4.2.5 Charges for Customer Facility telecommunications equipment operating within Western Power substations

4.2.5.1 Recurring Changes

Installation of Customer Facility telecommunications equipment at Western Power substations may result in recurring charges to the Customer. These costs, if applicable, are in addition to any connection costs for the Customer Facility, and specifically relate to costs for locating Customer telecommunications equipment within the nominated substation. These recurring costs shall be advised at the time of project estimation.

The following installations will incur recurring charges;

- Installation of Customer antenna infrastructure upon Western Power's existing telecommunications towers, masts or monopoles
- Installation of Customer antenna infrastructure upon, or attached to, Western Power's existing substation buildings

The following installations will not incur recurring charges;

- Installation of the Customer telecommunication equipment cabinet upon a wall at a nominated Western Power substation relay room
- DC power consumed by the Customer's telecommunications equipment installed within a Western Power substation

4.2.5.2 Corrective Maintenance Changes

Telecommunications network faults may result in the degradation or loss of telecommunications link between a Customer Facility and the nominated Western Power substation. In addition to the above recurring charges, coordination and funding of corrective maintenance actions to restore the Customer's telecommunications link is a responsibility of the Customer.

Such maintenance activities are inclusive of, but not limited to, the following:

- Telco line isolation equipment failure
- Telco lead-in cable fault restoration and associated call-out charges

4.2.6 Western Power Substation Access Requirements

Where the Customer, or a third-party service provider to the Customer is completing construction or maintenance works within the confines of a Western Power substation site, a 'Licence Agreement – Maintenance of Telecommunications Equipment within Substation' must be formalised between the Customer and Western Power as per licence agreement listed in Table 1.1 (References).

4.2.7 Western Power Accredited Telecommunications Contractors

The Customer may approach Western Power to request advice pertaining to Telecommunications Services Providers that are accredited to work within and upon Western Power's network, inclusive of electricity substation sites.