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POWER SYSTEM DATA COMMUNICATION STANDARD

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VERSION RELEASE HISTORY

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2.0	xx xxxx 2016	Updated following review of standard
1.2	7 April 2005	Revised to make consistent with National Electricity Rules
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1. INTRODUCTION

1.1. Purpose and Scope

This is the Power System Data Communication Standard made under clause 4.11.2(c) of the NER (**Standard**).

This Standard has effect only for the purposes set out in the NER. The NER and the *National Electricity Law* prevail over this Standard to the extent of any inconsistency.

Data Communication Facilities (**DCFs**) must be maintained to this Standard to enable AEMO to discharge its *market* and *power system security* functions as set out in Chapters 3 and 4 of the NER.

1.2. Definitions and Interpretation

1.2.1. Glossary

The words, phrases and abbreviations set out below have the meanings set out opposite them when used in this Standard.

Terms defined in the *National Electricity Law* or the NER have the same meanings in this Standard unless otherwise specified in this section. Those defined terms are intended to be identified in this Standard by italicising them, but failure to italicise a defined term does not affect its meaning.

Term	Definition
Analogue Value	Digital representation of a continuous value (for example, a power flow)
Control Command	A representation of an instruction to perform a defined action (for example a <i>generation</i> increase).
Critical Outage	<p>For an RME or RCE</p> <p>A loss for more than 60 seconds of the ability to transmit Operational Data to AEMO or receive Control Commands from AEMO, but not where the loss arises from a:</p> <ol style="list-style-type: none"> 1. Force Majeure. 2. Failure, or outage, of equipment that does not form part of the DCF. 3. Failure or outage of equipment that affects less than 5% of all Operational Data items of that RME or RCE. 4. <i>Scheduled generating unit, scheduled network service or scheduled load</i> that is not available for <i>central dispatch</i>. 5. <i>Power system plant</i> that is not in service and the <i>control centre</i> has been notified of that <i>outage</i>. 6. Outage for work to upgrade DCFs to comply with this Standard and <i>control centre</i> has been notified in advance. 7. Loss of DCFs of an Intervening Facility. <p>For an Intervening Facility</p> <p>A loss for more than 3 minutes of the ability to transmit Operational Data to AEMO or receive Control Commands from AEMO, but not where the loss arises from a:</p> <ol style="list-style-type: none"> 1. Force Majeure. 2. Failure, or outage, of equipment that does not form part of the DCF. 3. Loss of less than 10 minutes that does not affect Dispatch Data. 4. Loss affecting no more than one <i>dispatch interval</i> (or as otherwise agreed with AEMO) arising from a test of DCFs at a disaster recovery site, for which the <i>control centre</i> has been given at least 24 hours' notice. 5. Loss affecting no more than one <i>dispatch interval</i> (or as otherwise agreed with AEMO) arising from a test of a major upgrade of an Intervening Facility, for which the <i>control centre</i> has been given at least 24 hours' notice. 6. Loss arising from a loss of DCFs of a Data Concentrator, RME or RCE.
Communication Protocol	ICCP IEC60870-6 TASE.2 and its extensions secure ICCP

Term	Definition
Data Communications Facility (DCF)	A generic term used to denote any part of equipment used to transmit Operational Data from one site to another, and includes: <ol style="list-style-type: none"> 1. The part of RME and RCE providing analogue to digital conversion functions. 2. The part of RME and RCE providing data communication functions. 3. Telecommunications equipment and media. 4. Any Data Concentrator. 5. Power supply equipment for items 1 to 4 above.
Data Concentrator	A DCF that: <ol style="list-style-type: none"> 1. Communicates with an Intervening Facility. 2. Collects data from multiple RMEs. 3. Relays Control Commands to RCE.
Deadband	A deadband is a region of values where a change in the value of data will not result in activation of data transmission. A deadband is necessary to prevent repeated transmission of data when it has not changed significantly.
Discrete Value	A digital representation of one of a limited set of values (for example a <i>transformer tap position</i>).
Dispatch Data	Data that represents: <ol style="list-style-type: none"> 1. The <i>dispatch</i> of <i>scheduled generating units</i>, <i>scheduled network services</i> or <i>scheduled loads</i>. 2. An <i>interconnector</i> flow. 3. The status, or the amount, of a <i>market ancillary service</i>. 4. A <i>dispatch instruction</i>.
Force Majeure	An event or effect which is neither anticipated, nor controllable, by the affected parties including acts of nature, governmental interventions and acts of war.
High Resolution Data	Measurements of the following types of data: <ol style="list-style-type: none"> 1. System frequency. 2. Electrical Time.
ICCP	Inter-Control Centre Communications Protocol
Intervening Facility	A DCF that: <ol style="list-style-type: none"> 1. Receives polls from a <i>control centre</i>. 2. Collects data from RME and relays that data to <i>control centre</i>.
System Data	Data concerning all <i>plant</i> within: <ol style="list-style-type: none"> 1. An <i>interconnection</i> Substation. 2. A <i>market customer</i> Substation. 3. A Substation containing <i>plant</i> that operates at a nominal <i>voltage</i> of at least 220 kV. 4. A Substation having at least four sources of <i>supply</i>, including <i>power station</i> sources. <p>System data is not directly used in dispatch</p>
NER	National Electricity Rules
NIST	National Institute of Standards and Technology
Other Data	Data that represents: <ol style="list-style-type: none"> 1. Status Indications 2. Discrete Values 3. Analogue Value 4. Control Commands. 5. System data from plant that operates at nominal voltage of less than 220 kV 6. Any other data which not dispatch data, high resolution data or system data
Operational Data	All data - dispatch data, high resolution data, system data, and other data
Poll	An electronic request sent from a <i>control centre</i> or an Intervening Facility to a <i>power station</i> or <i>substation</i> to request Status Indications, Discrete Values or Analogue Values.
RCE	<i>Remote control equipment</i>

Term	Definition
RME	<i>Remote monitoring equipment</i>
Scale Range	The range of measurements for an Analogue Value that can be represented by a
Status Indication	The state of a device that has a finite number of discrete states. It includes switching and control indications and alarm conditions.
Substation	As defined in the NER, and for purposes of this Standard, a <i>facility</i> with one or more <i>transmission lines</i> .
Telecommunication Carrier	A carrier as defined in the Telecommunications Act 1997.

1.2.2. Interpretation

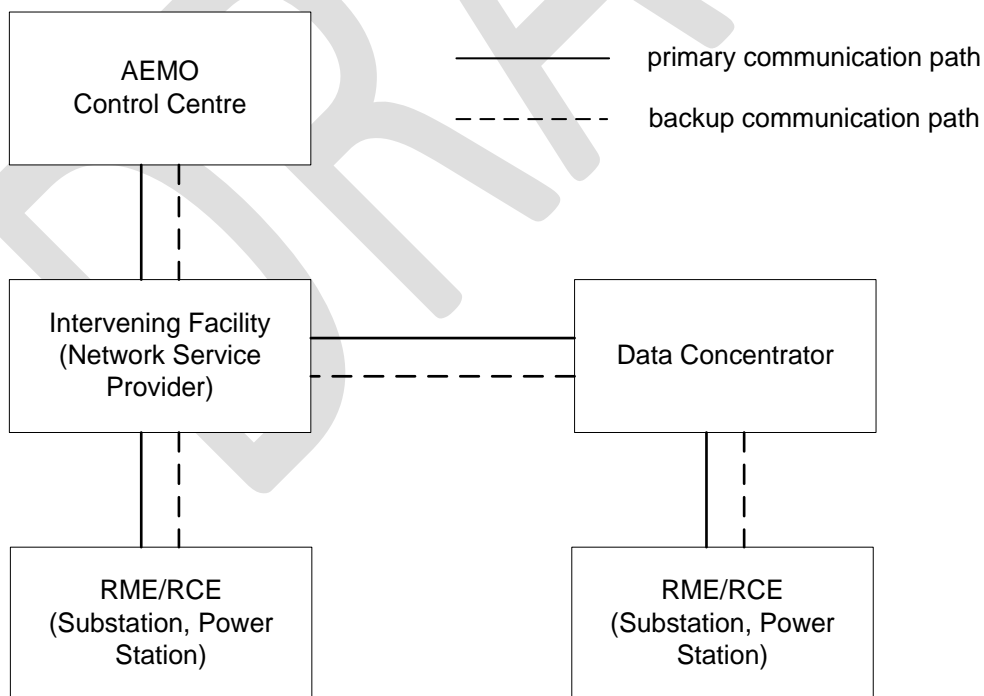
The following principles of interpretation apply to this Standard unless otherwise expressly indicated:

- (a) This Standard is subject to the principles of interpretation set out in Schedule 2 of the National Electricity Law.
- (b) References to time are references to Australian Eastern Standard Time.

1.3. General Structure of DCFs

The following diagram illustrates the relationships between:

- AEMO control centres
- Intervening Facilities
- Data Concentrators
- *Remote monitoring equipment (RME)/Remote control equipment (RCE)*



2. CAPACITY AND PERFORMANCE OF OPERATIONAL DATA

The purpose of this section is to ensure that DCFs have sufficient capacity and perform effectively.

2.1. Quantity of data

- (a) DCFs must be capable of transmitting all Operational Data required by AEMO and includes all data that:
 - (i) was in use at the time this Standard came into effect;
 - (ii) has been requested in writing by AEMO; and
 - (iii) has not been subsequently rejected in writing by AEMO.
- (b) The transmission of additional Operational Data beyond that required by AEMO under the NER or any agreement between AEMO and a *Registered Participant* does not diminish the obligations of the *Registered Participant* to comply with this Standard.

Explanatory note: Chapters 4 and 5 of the NER allow AEMO to request data that it requires to discharge its *market* and *power system security* functions. This Standard sets out requirements that apply to data that AEMO already receives and to data that AEMO might require in the future.

2.2. Representation of data

DCFs must transmit Operational Data to and from AEMO in accordance with this section 2.2.

- (a) Analogue Data must be transmitted:
 - (i) with the sign convention nominated by the *Registered Participant* from which the data originates; and
 - (ii) with the resolutions specified in Table 1.

Table 1 Resolution required for Analogue Data

Category of Analogue Data	Resolution (Max % of Scale Range)
Dispatch Data	0.1
System Data	0.2
Other Data	1.0

- (b) Analogue Values, Status Indications and Discrete Values must be transmitted with a data quality in accordance with the Communication Protocol.
- (c) Control Commands must be transmitted in accordance with the Communication Protocol.
- (d) Quality of data indicators must indicate:
 - (i) whether there is a sustained communication failure between an Intervening Facility and RME (including failure of a relevant Data Concentrator); and
 - (ii) whether a value has been overridden at any RME, Data Concentrator or Intervening Facility.
- (e) *Registered Participants* must notify AEMO of their sign convention when applying to AEMO for registration as a *Registered Participant*. To change the sign convention, *Registered Participants* must give 60 *business days*' notice to AEMO.
- (f) A sustained communications failure is a failure lasting 30 seconds or more. A transient communication failure is one that lasts less than 30 seconds.

2.3. Age of data

- (a) Operational Data must be available for transmission to AEMO in response to a poll within the time intervals specified in Table 2. The time interval is calculated from the instant the data first gets converted to digital form.

Table 2 Time intervals for data to be available for transmission to AEMO

Category	Data Type	Time Interval (seconds)	Time Interval via Data Concentrator (seconds)
High Resolution Data	Analogue Value	2	2
Dispatch Data	Status Indication	6	7
	Analogue Value	6	7
	Discrete Value	6	7
System Data	Status Indication	8	9
	Analogue Value	14	15
	Discrete Value	14	15
Other Data	Status Indication	12	13
	Analogue Value	22	23
	Discrete Value	22	23

- (b) A Status Indication is considered converted to digital form when the digital signal representing it is carried by circuits that are not used solely for that Status Indication.
- (c) Status Indications and Discrete Values do not have to be re-transmitted for up to five minutes if the relevant data has not changed since the last transmission.
- (d) Analogue Values do not have to be re-transmitted for up to five minutes if the relevant data has not changed by the relevant deadband amount shown in Table 3.

Table 3 Deadband for analogue data transmission

Category of Analogue Data	Deadband (% of Scale Range)
Dispatch Data	0.2
System Data	0.5
Other Data	0.5

- (e) An Intervening Facility must respond to polls once per second with the relevant data.

2.4. Control command delay

Registered Participants must relay Control Commands to relevant RCE within 3 seconds of receiving a Control Command from AEMO or within 4 seconds if transmitted via a Data Concentrator.

3. RELIABILITY

The purpose of this section is to ensure the reliability of data transmitted to AEMO.

3.1. Reliability requirements

- (a) The total period of Critical Outages for a RME and RCE in a rolling 12-month assessment period must be no greater than those indicated in Table 4.
- (b) The total period of Critical Outages of an Intervening Facility over a rolling 12-month assessment period must be no greater than those indicated in Table 5. AEMO will actively monitor and report on the Intervening Facility performance.
- (c) If, in any rolling 12-month assessment period, the total period of Critical Outages exceeds those indicated in Tables 4 and 5, the responsible *Registered Participants* must jointly take reasonable corrective action to bring those times within the times required by section 3.1(a) or (b) (as applicable).

Table 4 Total period of Critical outages of RME and RCE over a 12-month period

Category of RME and RCE	Total period of Critical Outages
RME transmitting Dispatch Data where there is no agreed substitute data	6 hours
RME transmitting or receiving Dispatch Data where there is agreed substitute data	12 hours
RCE	24 hours

Table 5 Total period of Critical outages of Intervening Facility over a 12-month period

Category of Intervening Facility	Period per Critical Outage	Total Period of Critical Outages
Transmitting Dispatch Data	1 hour	2 hours
Not transmitting any Dispatch Data	4 hours	6 hours

3.2. Redundant elements

DCFs must have sufficient redundant elements to reasonably satisfy the reliability requirements set out in section 3.1, taking into account:

- (a) the likely failure rate of their elements;
- (b) the likely time to repair of their elements; and
- (c) the likely need for planned outages of their elements.

4. SECURITY

The purpose of this section is to ensure that cyber security considerations are appropriately addressed by all parties. *Registered Participants* and AEMO must have robust programs in place to adequately and continuously manage cyber security risks that could adversely impact *power system* communications and supporting systems and infrastructure.

These cyber security programs must address those functions and categories identified in the NIST Framework for Improving Critical Infrastructure Cyber Security.

Function	Definition	Categories
Identify	An understanding of cyber security risks to systems, assets, data, and capabilities and how to manage these.	Asset management Business environment Governance Risk assessment Risk management strategy
Protect	The controls and safeguards necessary to protect or deter cybersecurity threats	Access control Awareness and training Data security Data protection processes Maintenance Protective technologies
Detect	Continuous monitoring to provide proactive and real-time alerts of cybersecurity-related events	Anomalies and events Continuous monitoring Detection processes
Respond	Incident response activities	Response planning Communications Analysis Mitigation Improvements
Recover	Business continuity plans to maintain resilience and recover capabilities after a cyber breach	Recovery planning Improvements Communications

4.1. Physical security and computer network security

DCF's and Operational Data transmitted must not be susceptible to unauthorised interference. *Registered Participants* must:

- (a) prevent unauthorised access to DCF sites, and to DCF's and Operational Data via computer networks;
- (b) prevent unauthorised access to, or use of, AEMO's wide area network (WAN) via computer networks;
- (c) prevent the ingress and distribution of malicious software into DCF's or AEMO's WAN;
- (d) keep access information, including computer network address information, confidential;
- (e) consult with AEMO on any matter that could reasonably be expected to adversely impact the security of DCF's or AEMO's WAN; and
- (f) ensure that adequate procedures and training are provided to persons who are authorised to have access to DCF's and AEMO's WAN.

5. INTERFACING

The purpose of this section is to ensure appropriate interfaces between DCFs and AEMO systems.

5.1. Physical and logical interfaces

- (a) Where AEMO agrees to extend its WAN to *Registered Participant* DCFs, each relevant *Registered Participant* must establish a physical connection to an AEMO-designated port on an AEMO router and it must use Ethernet and TCP/IP protocols.
- (b) Where AEMO agrees that a *Registered Participant* may establish a logical connection to AEMO's WAN, the *Registered Participant* must do so by engaging a Telecommunications Carrier to provide a digital communications service between the *Registered Participant*'s DCFs and an AEMO-designated network access facility.

5.2. Data communications protocols

Any communication of Operational Data through a physical or logical interface with AEMO must use the secure ICCP TASE.2 protocol. Legacy non secure ICCP connections will continue to be supported.

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6. MAINTENANCE

The purpose of this section is to ensure that outages of DCFs do not unduly impact on *central dispatch* or *power system security*.

6.1. Response to failures

In response to a DCF failure a *Registered Participant* must:

- (a) rectify the DCF within the timeframes specified in Tables 4 and 5,
- (b) inform AEMO¹ of the progress of related rectification works, if a failure is causing a Critical Outage, and
- (c) consult with AEMO about the priority of related rectification works, if a failure is causing or likely to cause a Critical Outage.

6.2. Outage co-ordination

- (a) A *Registered Participant* must give AEMO five *business days*' notice, subject to section 6.2(d), of a planned outage of any of its DCFs affecting, or likely to affect:
 - (i) Dispatch Data; or
 - (ii) the majority of Operational Data to or from a Substation or *power station*.
- (b) If 5 *business days*' notice cannot be given, subject to section 6.2(d), AEMO may defer the outage.
- (c) AEMO may defer or cancel outages and require DCFs on outage to be returned to service if AEMO considers that a planned outage would:
 - (i) adversely affect *power system security*;
 - (ii) occur when *power system security* is adversely affected by other events; or
 - (iii) occur when AEMO has issued, or is likely to issue, a *lack of reserve* notice.
- (d) If plant related to the DCF is out of service at that time, and will not return to service while the DCF is out of service, the outage notice may be reduced to 24 hours.
- (e) A planned outage of DCFs excludes an outage that does not cause a Critical Outage.

6.3. Data management and co-ordination

- (a) *Registered Participants* must keep AEMO informed of planned and unplanned changes to Status Indications, Discrete Values and Analogue Values transmitted to AEMO and Control Commands received from AEMO.
- (b) *Registered Participants* must notify AEMO of planned changes to DCFs, subject to section 6.3(c), with sufficient details to allow AEMO to implement the corresponding changes to its own control centre facilities. AEMO must be notified:
 - (i) at least 15 *business days* before the planned implementation date for a minor augmentation of an existing *power station* or Substation; and
 - (ii) at least 30 *business days* before the planned implementation date for a new Substation or *power station* or major augmentation of an existing *power station* or Substation.
- (c) The periods of 15 and 30 *business days* in section 6.3(b) may be reduced by agreement between the *Registered Participant* and AEMO if the *Registered Participant*:
 - (i) includes AEMO's corresponding implementation tasks in its project schedules, with task durations agreed with AEMO; and

¹ Control centre

- (ii) provides the major part of the detailed information in an electronic format suitable for AEMO to automatically populate its relevant databases.
- (d) For an unplanned change to DCFs the *Registered Participant* must:
 - (i) promptly notify AEMO before the change is implemented;
 - (ii) coordinate with AEMO by phone before the change is implemented; and
 - (iii) confirm the change in writing within 14 days of the change.
- (e) An augmentation is taken as implemented when the relevant primary *plant* is first electrically connected to the *power system*, or when the relevant secondary *plant* is commissioned.
- (f) Unless AEMO agrees otherwise, a major augmentation includes the installation of:
 - (i) a *busbar, transmission line* or *transformer* intended to operate at more than 100 kV; and
 - (ii) a *scheduled generating unit, scheduled network service* or *scheduled load*.A minor augmentation is any other project.
- (g) A planned change is one that could reasonably have been foreseen in sufficient time to give prior written notice under section 6.3(b).

6.4. Testing to confirm compliance

- (a) A *Registered Participant* installing, upgrading or replacing RME or RCE must test a representative sample of Operational Data of that RME or RCE. These tests must confirm compliance with the timing requirements set out in section 2.3.
- (b) A test under section 6.4(a) must be carried out either prior to or within 60 *business days* of the relevant RME or RCE being placed into service.
- (c) Prior to a test, the *Registered Participant* installing, upgrading or replacing the RME or RCE must:
 - (i) coordinate with the provider(s) of Data Concentrator(s) and Intervening Facility(ies) relaying the Operational Data to be tested;
 - (ii) prepare and provide to AEMO the test procedure;
 - (iii) amend the test procedure if AEMO reasonably considers it inadequate to assess compliance; and
 - (iv) consult and agree with AEMO with regards to the RME or RCE and the associated Operational Data to be tested.
- (d) A *Registered Participant* that provides an Intervening Facility for another *Registered Participant* must cooperate with that *Registered Participant* and AEMO in planning and conducting the tests.
- (e) The *Registered Participant* providing the RME or RCE must submit a report to AEMO within a reasonable time after the test. The report must summarise the results of the test and any remedial action necessary to ensure compliance with section 2.3. For that purpose, a test under section 6.4 must be used to determine at least five measurements (not synchronous with scanning of the data) within a single period of at least 5 minutes.