Protection and Automation - Equipment Hardware and Software

Document Number: 1-09-FR-28

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1. Purpose

The purpose of this document is to describe the requirements for secondary system's hardware platforms and software that must be applied to both bay and substation levels.

2. Scope

This document states the functional requirements for secondary systems devices at hardware platform and software level in order to be integrated in a systematic approach. The specified requirements must be applied to ElectraNet's transmission system substations.

3. Terms and acronyms

3.1 Terms

Term	Definition
IP2X	Is an ingress protection rating accordance with IEC 60529. *Informative: IP2X provides:* ▪ *a jointed test finger of 12.5 mm Ø, 80 mm length, has adequate clearance from hazardous parts.* ▪ *an object probe, sphere of 12.5 mm Ø, does not fully penetrate.* ▪ *no protection against ingress of water.*
IP3X	Is an ingress protection rating accordance with IEC 60529. *Informative: IP3X requires:* ▪ *an access probe of 2.5 mm Ø shall not penetrate* ▪ *no protection against ingress of water.*

3.2 Acronyms and initialisms

Acronym or initialism	Definition
AC	Alternating Current, is periodic electric current with negligible direct component.
BCD	Binary Coded Decimal, is a system for coding a number in which each digit of a decimal number is represented individually by its binary equivalent.
CBF	Circuit Breaker Failure protection, is protection which is designed to clear a system fault by initiating tripping of other circuit-breaker(s) in the case of failure to trip of the appropriate circuit-breaker.
CT	Current Transformer, is a transformer for use with meters and/or protection devices in which the current in the secondary winding is, within prescribed error limits, proportional to and in phase with the current in the primary winding.
DC	Direct Current. Is an electric current that is time-independent.
DNP3	Distributed Network Protocol 3, is a set of communications protocols used between components in process automation systems.

Acronym or initialism	Definition
DNSP	Distribution Network Service Provider, is an organisation that engages in the activity of owning, controlling, or operating an electrical distribution system.
DTT	Direct Transfer Trip systems, are a form of protection signalling, where the received signal carries information from protection at the remote end of the circuit which indicates that the fault is not in the protected zone. A receiving end forward over-reaching element must give a trip output after a co-ordination time if no signal is received from a reverse reaching zone at its remote end.
GPS	Global Positioning System, is a U.S.-owned utility that provides users with positioning, navigation, and timing services.
IRIG-B	Inter-Range Instrumentation Group-B, is a standard format for transferring timing information between power system devices, such as relays and meters.
LAN	Local Area Network, is a computer network located on a user's premises within a limited geographical area.
LED	Light Emitting Diode, is a semiconductor light source.
MCB	Miniature Circuit Breaker, is an automatic switch that opens in the event of excessive current flowing through the circuit. Once the circuit returns to normal, it can be reclosed without any manual replacement. MCBs are used in low voltage applications.
NER	National Electricity Rules, are rules made under the national electricity law and govern the operation of the national electricity market.
NTP	Network Time Protocol, is a networking protocol for clock synchronization between computer systems over packet-switched, variable-latency data networks.
PTPv2	Precision Time Protocol version 2, is a protocol used to synchronise clocks throughout a computer network.
RMS	Root Mean Square, is the root mean square value of a quantity.
SCADA	Supervisory Control And Data Acquisition, is the monitoring and remote control of equipment from a central location using computers.
VT	Voltage Transformer, is a transformer for use with meters and/or protection devices in which the voltage across the secondary terminals is, within prescribed error limits, proportional to and in phase with the voltage across the primary terminals.

4. Functional requirements

4.1 Safety (and environmental) requirements

4.1.1 Equipment compliance requirements

In addition to the requirement stated in Section 5.1 of 1-09-FR-34, equipment must comply with the requirements within Table 1.

Table 1: Safety requirements

No.	Clause	Standard	Section	Requirement
1	Clearance and creepage	IEC 60255-27	10.6.3	See standard
2	Accessible parts test	IEC 60255-27	10.6.2.5	-
3	IP rating	IEC 60255-27	10.6.2.6	IP2X (connection terminals)
4	Impulse voltage	IEC 60255-27	10.6.4.2	5 kV
				1 kV
5	Dielectric voltage	IEC 60255-27	10.6.4.3	2 kV
				0.5 kV
6	Insulation resistance	IEC 60255-27	10.6.4.4	500 V DC
7	Protective bonding	IEC 60255-27	10.6.4.5	≤0.1 Ω
8	Flammability (visual inspection)	IEC 60255-27	10.6.5.2	-
	Housing			70/80°C
	Cover			70/80°C
	Terminals			V-2
	Push buttons			55/70°C
	Display			
	PCB boards			V-2
	(Input) transformers			V-1
	Optocouplers			
	Output relays			
	Wires			
9	Single fault condition	IEC 60255-27	10.6.5.5	no fire risk
	Power supply circuit			

No.	Clause	Standard	Section	Requirement
10	Thermal short-time test	IEC 60255-27	10.6.5.3	(as declared by the manufacturer)
	Overvoltage VT, cont.			
	Overvoltage VT, 10 s.			
	Overcurrent CT, cont.			3 x I_N
	Overcurrent CT, 1 s			100 x I_N

4.1.2 Equipment safety earthing

Equipment must satisfy the following safety earth requirements:

1. Equipment enclosures must be provided with an external earthing stud for connection to the local earthing point.
2. Equipment must be supplied with dedicated earthing conductors; reliance must not be made on any other conductive parts.
3. Equipment earth conductors must be adequately rated to prevent risk of harm to personnel or damage to equipment.
4. Equipment earth conductors must be designed to not carry any currents under quiescent conditions.

4.2 Planning and design requirements

4.2.1 Equipment life

Equipment, unless specified otherwise, must be designed for a service life of at least 15 years, and preferably 20 years, without the need for routine servicing.

4.2.2 Equipment lifetime support

The supplier must indicate the following:

1. Timeframe that the device may continue to be manufactured prior to becoming obsolete.
2. Frequency of major firmware upgrades and hardware component upgrades of the device.
3. Frequency of major software updates.
4. Historical record of equipment software compatibility with previous versions of Windows operating system.

The equipment supplier must provide ElectraNet with equipment defect notifications and service bulletins, including firmware upgrade notifications, throughout the life of the equipment.

Where the ElectraNet has no previous history with the equipment, the equipment supplier must be responsible for the provision of training to ElectraNet's operations and maintenance personnel. ElectraNet may advise this requirement within the contract specific documentation.

4.2.3 Equipment information

The supplier must provide the information according to Section 9.2 of IEC 60255-27 standard, as well as the documentation listed below:

1. Abridged schematic(s)
2. Equipment general arrangement diagrams
3. Equipment logic diagram(s).

4.2.4 Equipment hardware platform requirements

4.2.4.1 Atmospheric environment

Equipment must comply with the requirements listed in Table 2.

Table 2: Climatic environmental requirements

No.	Clause	Standard	Section	Requirement
1	Dry heat operational	IEC 60255-1 (IEC 60068-2-2, test Bd)	6.12.3.1	+70°C, 16 h
2	Cold operational	IEC 60255-1 (IEC 60068-2-1, test Ad)	6.12.3.2	-25°C, 16 h
3	Dry heat storage	IEC 60255-1 (IEC 60068-2-2, test Bb)	6.12.3.3	+85°C, 16 h
4	Cold storage	IEC 60255-1 (IEC 60068-2-1, test Ab)	6.12.3.4	-40°C, 16 h
5	Change of temperature	IEC 60255-1 (IEC 60068-2-14, test Nb)	6.12.3.5	-25°C, +70°C 3 h 5 cycles
6	Damp heat steady state	IEC 60255-1 (IEC 60068-2-78, test Cab)	6.12.3.6	+40°C, 93% 10 d
7	Cyclic temperature with humidity	IEC 60255- (IEC 60068-2-30, test Db)	6.12.3.7	+25°C, 40°C 97%, 93% 6 cycles

4.2.4.2 Mechanical environment

Equipment must comply with the requirements listed in Table 3.

Table 3: Mechanical environment requirements

No.	Clause	Standard	Section	Requirement
1	Vibration response	IEC 60255-1 (IEC 60255-21-1)	6.13.1	class 1
2	Vibration endurance	IEC 60255-1 (IEC 60255-21-1)	6.13.1	class 1
3	Shock response	IEC 60255-1 (IEC 60255-21-2)	6.13.2	class 1
4	Shock withstand	IEC 60255-1 (IEC 60255-21-2)	6.13.2	class 1
5	Bump	IEC 60255-1 (IEC 60255-21-2)	6.13.2	class 1
6	Seismic (single axis sweep)	IEC 60255-1 (IEC 60255-21-3)	6.13.3	class 1
7	IP enclosure protection	IEC 60255-1 (IEC 60529)	6.3	IP3X

4.2.4.3 Electrical environment

Equipment must comply with the requirements listed in Table 4.

Table 4: Electrical environment requirements

No.	Clause	Standard	Section	Requirement
1	Burden voltage transformers	IEC 60255-1	6.10.1	-
2	Burden current transformers	IEC 60255-1	6.10.2	-
3	Burden AC power supply (quiescent, maximum load, inrush current, power-up duration)	IEC 60255-1	6.10.3	-
4	Burden DC power supply (quiescent, maximum load, inrush current, power-up duration)	IEC 60255-1	6.10.4	-
5	Burden for binary input	IEC 60255-1	6.10.5	-

No.	Clause	Standard	Section	Requirement
6	Input circuit of energizing quantities	IEC 60255-1	6.9.1 6.9.2	20 x I_N
				100 x I_N, 1 s
				V_{max}
				V_{withst}, 10 s
				Input characteristic must be defined by the manufacturer

4.2.4.4 Electromagnetic compatibility

Equipment must comply with the requirements listed in Table 5.

Table 5: Electromagnetic compatibility requirements

Emission				
No.	**Clause**	**Standard**	**Section**	**Requirement**
1	Radiated emission	IEC 60255-26	table 1	Class A
		CISPR 11	table 6	
		CISPR 22	table 7	
2	Conducted emission	IEC 60255-26	table 2	Class A
		CISPR 22	table 2/4	
3	1 MHz damped oscillatory wave	IEC 60255-26 (IEC 61000-4-18)	7.2.6	2.5 kV CM
				1.0 kV DM
				1 kV CM
				0 kV DM
4	Electrostatic discharges	IEC 60255-26 (IEC 61000-4-2)	7.2.3	6 kV cont.
				8 kV air
5	Radiated radio frequency magnetic field	IEC 60255-26 (IEC 61000-4-3)	7.2.4	80 – 1000 MHz
				10 V/m
				1.4 – 2.7 GHz
				10 V/m
				80, 160, 380, 450, 900, 1850, 2150 MHz
				10 V/m
6	Fast transient/burst	IEC 60255-26 (IEC 61000-4-4)	7.2.5	Zone A
				4 kV CM
				2 kV CM

Emission				
No.	**Clause**	**Standard**	**Section**	**Requirement**
7	Surge	IEC 60255-26 (IEC 61000-4-5)	7.2.7	Zone A to 4 kV LE to 2 kV LL
8	Conducted disturbance induced by RF fields	IEC 60255-26 (IEC 61000-4-6)	7.2.8	0.15 - 80 MHz 10 V 27.68 MHz 10 V
9	Power frequency voltage	IEC 60255-26 (IEC 61000-4-16)	7.2.9	Zone A 150 V DM 300 V DM
10	Power frequency H-field	IEC 60255-26 (IEC 61000-4-8)	7.2.10	30 A/m cont 300 A/m 1-3 s

4.2.4.5 Contact performance

Equipment must comply with the requirement listed in Table 6: Contact performance requirements.

Table 6: Contact performance requirements

No.	Clause	Standard	Section	Requirement
1	Mechanical endurance	IEC 60255-1	6.11	V_{max} 10000 op
2	Limiting making capacity	IEC 60255-1	6.11	V_{max}, P_{max} L/R = 40 ms 1000 op.
3	Short time contact current	IEC 60255-1	6.11	V_{max}, I_{max}, 200 ms 1000 op.
4	Continuous contact current	IEC 60255-1	6.11	V_{max}, I_{cont}, 4 h
5	Limiting breaking capacity	IEC 60255-1	6.11	V_{max}, P_{max} L/R = 40 ms 1000 op.

4.2.5 Performance requirements under service conditions

1. Equipment must suffer any unwanted operation during energisation or de-energisation. This requirement must be met without the use of additional guard relays or elements that might degrade protection dependability.

2. Equipment must not suffer unwanted operation in the presence of electrical noise that might be caused by switching operations, power system faults, lightning, electromagnetic coupling, radio frequency interference, electro-static discharges etc.
3. Equipment, in the event of it becoming defective, must be designed to be secure from unwanted operation because of system fault.

4.2.6 Operation speed

Equipment supplied for protection applications must provide the following performance requirements:

1. The operation speed, which must be measured from fault inception to device contact operation, must be not less than 10 ms and not greater than 30 ms.
2. The resetting time of protection element must be no greater than 50 ms.

4.2.7 Setting accuracy

Equipment supplied for protection applications must provide the following performance requirements:

1. The setting accuracy for each protection element must be in the range of -5% and +5% inclusive.
2. Timer must have an accuracy of ±2% or better.
3. Phase angle settings must be in the range of ±2°.

4.2.8 Thermal requirements

1. Equipment supplied by current transformer circuits must satisfy the following requirements:
   a. Minimum continuous thermal withstand of 3 x I_N
   b. The thermal withstand current for short duration overloads, after reaching a steady temperature with an initial load of 3 x I_N, must be not less than the values provided in Table 7.

Table 7: CT input thermal requirement

Duration (min)	20	10	5	3	2
Current	4 x I_N	4.5 x I_N	5.0 x I_N	6.0 x I_N	7.0 x I_N

2. Equipment supplied by voltage transformer circuits must satisfy the following requirements:
   a. Minimum continuous withstand of 1.2 x V_N
   b. Minimum 30 s withstand of 1.5 x V_N.

4.2.9 Physical performance requirements

Unless it is specified otherwise, equipment must satisfy the following requirements:

1. Equipment must be capable of being supplied from the substation 110 V DC systems, as specified in 1-09-FR-25.
2. Equipment must operate correctly with a power supply voltage range of 87.5 V DC to 137.5 V DC.
3. Equipment must not be affected from interruptions to the power supply for durations of less than 10 ms.

4. Equipment must not be affected for AC component or ripple in the DC power supply of less than 12%.
5. Equipment must refrain from unwanted operation in the event of sudden removal or application of its power supply.
6. Equipment must provide supervision for auxiliary supplies, with a fail-safe alarm arrangement.
7. Equipment must preferably have no dependence on an internal battery, however where internal batteries are required the service life must be greater than 10 y.
8. Internal battery replacement must be capable of being undertaken without the need to remove the equipment from service.

4.2.10 Digital inputs

Digital inputs must provide galvanic isolation in accordance with the requirements of Table 1. Generally, other than control inputs, digital inputs must be initiated from a single-pole contact arranged to switch the supply positive.

4.2.10.1 Single point digital inputs

Single point inputs consist of single physical inputs and are generally used where there is a need to detect only two discrete states (i.e., on/off condition).

The single point inputs must be used for receiving the following:

1. Equipment status inputs if it is specified.
2. Alarm inputs.
3. Command inputs.

The validation of state change for this type of inputs is described in 4.2.10.4 and 4.2.10.5.

4.2.10.2 Double digital point inputs

Double point inputs consist of two physical inputs and are generally used where there is a need to detect on/off condition and any intermediate state.

Double point inputs must be used for receiving plant status signals. The logical representation of this type of input must be in accordance with Table 8 below.

Table 8: Double point inputs logical representation

Bit 0	Bit 1	State
0	0	0
1	0	1
0	1	2
1	1	3

1. States 1 and 2 must be used to represent normal conditions.
2. States 0 and 3 must be classified as intermediate state.

The validation of state change for this type of inputs is described in Section 4.2.10.4 and 4.2.10.5.

4.2.10.3 Transformer tap position inputs

Transformer tap position must be recognised via either in 4 – 20 mA signal or a BCD signal. Transformer tap position inputs must be presented in a '1' of 'n' format.

4.2.10.4 Digital input filtering

Filtering must be applied to all inputs for state transitions. The new state must only be recognised if it persists for the configured period of time. The filtering function must be compliant with the following requirements:

1. The filter delay setting must be assignable on an individual input basis.
2. The filter delay setting must not extend the fault clearing time to durations which fail to satisfy the requirements of the NER.

4.2.10.5 Digital input initiate thresholds

Digital inputs must be compliant with the following requirements:

1. A logical '0' must be equivalent to a physical input voltage of less than 30% of the nominal value.
2. A logical '1' must be equivalent to a physical input voltage of more than 75% of the nominal value.
3. Programmable facilities must be provided by the protection equipment for the user to transpose the physical input conditions into the logical input conditions for all inputs.
4. Digital inputs must be suited for external, nominal wetting voltages of 110 V DC.
5. Digital inputs for control and protection applications must be self-monitored and provide an alarm in the event of failure.
6. Digital inputs must be immune from initiation for the discharge of a 1 micro-farad capacitor that was charged to 150V.
7. Digital inputs must be immune from initiation due to an earth fault on the associated site wiring.

4.2.11 Digital outputs

4.2.11.1 General requirements

All digital outputs must have two states:

1. Closed state (logic 1) where the output impedance must be less than 10 Ω.
2. Open state (logic 0) where the output impedance must be greater than 100 kΩ.

Digital output contacts must be suitable for connection to an external whetting voltage of 110 V DC and must be self-monitored, initiating an alarm in the event of failure.

4.2.11.2 Single pole digital outputs

Single pole digital outputs consist of a single physical output and must be used where there is a need to signal only two discrete states (i.e., ON and OFF conditions).

Single pole outputs must be used for:

1. Status indications
2. Alarms
3. Watchdog contact must be closed when auxiliary power is removed from the equipment

4. Control and transfer tripping.

The outputs must be presented as voltage free contacts and must be active according to application requirement.

4.2.11.3 Circuit breaker direct tripping outputs

Digital Outputs which are arranged to directly initiate circuit breaker trip coils must be rated in accordance with Table 9: Direct circuit breaker tripping output requirements. These outputs must be capable of directly supervising the trip system they initiate or must be capable of being connected with auxiliary equipment to supervise the trip system. The requirements for trip circuit supervision are specified within 1-09-FR-13.

Table 9: Direct circuit breaker tripping output requirements

Make and carry capacity			
Time Period	200 ms	1 s	Continuous
DC Rating L/R > 10 ms	3000 W With max of 20 A and 300 V	2000 W With max of 10 A and 300 V	1000 W With max of 4 A and 300 V
Continuous current carrying capacity (closed contact)			
Time Period	200 ms	1 s	Continuous
Min DC Current	35 A	20 A	4 A
Breaking capacity			
DC Rating L/R > 40 ms	30 W With max of 2 A and 300 V		
DC Resistance	60 W		

4.2.12 Analogue inputs

4.2.12.1 CT inputs

Current transformer inputs must have a nominal, root mean square rating of 1 A. The minimum required continuous and short-term ratings, based on a 1 A nominal rating are tabulated within Table 10.

Table 10: CT input overload requirements

Duration	Withstand current (A)
Continuous	3.0
20 min	4.0
10 min	4.5
5 min	5.0
3 min	6.0
2 min	7.0
1 s	100

In addition, current transformer inputs must satisfy the following requirements:

1. The burden imposed connected current transformer must not exceed 1 VA.
2. Current transformer inputs must satisfy the requirements of Table 1: Safety requirements.

4.2.12.2 Voltage transformer inputs

Voltage transformer inputs must have a nominal, root mean square rating of 110/√3V phase to ground or 110 V phase to phase connections. ElectraNet's preference is to use phase to ground connections. Voltage transformer inputs must be continuously rated for a minimum of 1.2 times the nominal rating.

In addition, the voltage transformer inputs must satisfy the following requirements:

1. The burden imposed on the connected voltage transformer must be less than 0.1 VA based on nominal input rating.
2. Voltage transformer inputs must satisfy the requirements within Table 1: Safety requirements.

4.2.12.3 Transducer inputs

1. Inputs must be suited for use with
   a. 0–5 mA
   b. -5–0–5 mA
   c. 0–10 mA
   d. -10–0–10 mA
   e. 4–20 mA

   DC transducer outputs.
2. 4–20 mA is ElectraNet's preferred nominal input.
3. The input burden must not exceed 300 Ω.
4. Resolution, encoding and accuracy requirements for the respective input types are given in Table 11.

Table 11: Transducer input requirements

Resolution as % of normal maximum reading	Accuracy as % of normal maximum reading
0.125	0.2

1. Active power (W) and reactive power (VARs) are bi-directional quantities, meaning Import and Export conditions. The '-' sign must be used for import and '+' sign must be used for export condition.
2. The relationship between voltage, current and the resultant import/export conditions must be set according to Figure 1.
3. All inputs must be provided with an over range capacitor, at least up to 125% of the normal maximum reading. The accuracy of the reading must be maintained according to Table 11 for the extended range.
4. Inputs for control applications must be self-monitored. In the event of failure, an alarm must be generated and logged.

4.2.13 Front panel indication

Equipment must provide the following local operator interfaces:

1. Equipment must be equipped with front facia LED lamps for the purposes of local indication.
2. Equipment must be equipped with front panel display which must be configured to provide local indication of:
    a. Phase RMS current, phase to phase RMS voltage and protection object name as default when the device is idle or reset.
    b. The faulted phase and operated protection element for the latest operation if any operation occurred.

4.2.14 Substation time reference

Equipment must provide the following time synchronisation facilities:

3. Time synchronisation protocol must be in accordance with 1-09-FR-21.
4. The IRIG-B time code must be compatible with the extension specified in IEEE Standard C37.118 via distributed fibre optic network. The fibre connector must be ST type that is compatible with multi-mode cabling with wavelength of 820 nm.
5. Equipment must be able to maintain ±1 ms time synchronisation accuracy with reference to substation clock.

4.2.15 Informative interface

1. Equipment must be equipped with an informative interface for connection to the substation LAN as specified in 1-10-ADM-20.
2. The preferred type of interface is optical fibre with LC connector.
3. The informative interface must be used for the following functions:
    a. SCADA interface according to 1-09-FR-22
    b. Operational communication interface according to 1-10-ADM-20.
4. It is acceptable that the interfaces in (c) can be combined into a single port.
5. The following communication protocol for SCADA interface must be provided as minimum requirement:
    a. DNP3
    b. IEC 61850

6. Redundant informative interface is preferred.

4.2.16 Local interface

Equipment must be equipped with the following local user interface:

1. An RS232 front of panel interface.
2. The local interface must provide full, password protected, access to the equipment's configuration and actual values.

4.2.17 Soft reboot function

1. The equipment must be capable of being rebooted from a remote command.
2. All output contacts must be inhibited from operation during the soft reboot.

4.2.18 Other requirements

1. All equipment must be suitable for location in both open and closed 19 in racks.
2. The temperature of cover and accessible items must not exceed 65°C for metallic parts or 75°C for insulating materials.
3. Labelling must be provided as necessary to advise of handling precautions required to avoid component/equipment damage due to electrostatic discharge.
4. The equipment must process all protection and control actions in a manner that is designed to ensure no erroneous outputs activated.
5. Equipment failure mode information must be supplied.

4.2.19 Software and firmware

1. All equipment must correctly and consistently deal with time and date, up to the year 2050 and must not be affected by events such as leap years or leap seconds.
2. All software and firmware (including programmable logic arrays) must be downloadable from the informative interface.
3. For user programmable equipment, the supplier must advise on any implications with respect to warranty and maintenance agreements in the event of the user making use of these facilities.
4. Stored data, SCADA points, parameterisation and settings must be stored in non-volatile memory, providing memory retention in the event of a loss of power supply for a period of at least one year.
5. Software must be provided as necessary to enable ElectraNet to utilise the informative and local interfaces.

5. Sap data capture requirements

The equipment must provide sufficient facility to enable the maintainability requirements that are stated in Section 6 of 1-09-FR-34.

City West Substation

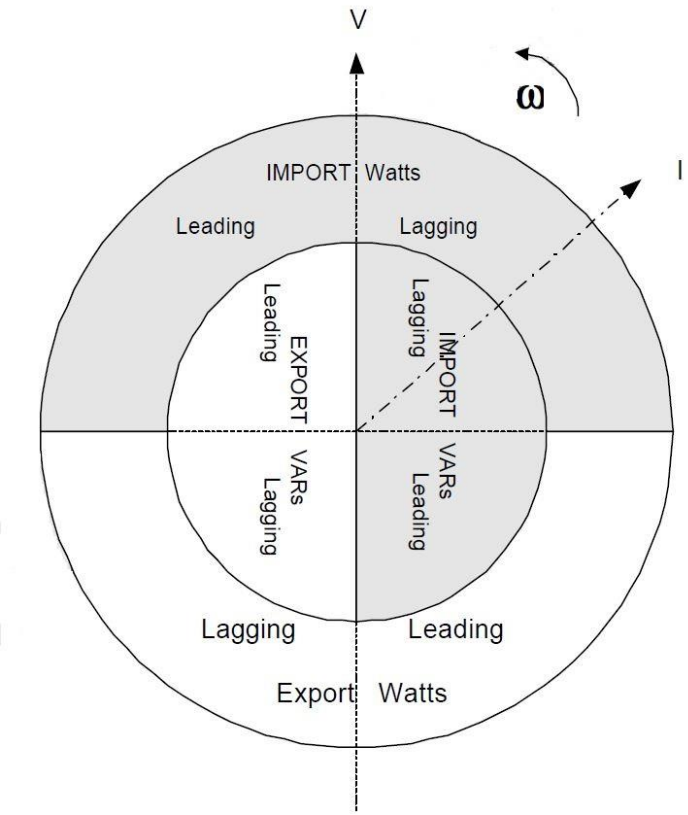
Appendices

ElectraNet

Appendix A Import and export conditions

1. For measurements at 330, 275 and 132 kV substations, the reference point must be substation busbar.
2. For measurements at generation connection points (e.g., windfarms), the reference point must be the busbar on the high voltage side of transformer.
3. For measurements at the connection points to third party (e.g., DNSP), the reference point must be the busbar on the low voltage side of transformer.

Figure 1: Import and export conditions



For the example shown in Figure 1, the current lags the voltage by 45°. The diagram indicates the condition is an import lagging watts for this quadrant.

References

Legislation

Legislation
National Electricity Rules
South Australia Electricity Act 1996
Electricity Transmission Code

Standards

Name	Title
CISPR 11	Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement
CISPR 22	Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement
IEC 60068-2	Environmental Testing – Part 2
IEC 60255-1	Measuring Relays and Protection Equipment – Part 1
IEC 60255-21	Electrical Relays – Part 21
IEC 60255-26	Measuring Relays and Protection Equipment – Part 26
IEC 60255-27	Measuring Relays and Protection Equipment – Part 27
IEC 61000-4	Electromagnetic Compatibility (EMC) – Part 4

ElectraNet documents

Name	Title
1-09-FR-34	Requirements for the Application, Design and Setting of Protection Systems
1-09-FR-21	Time Synchronisation
1-09-FR-22	Substation SCADA System
1-09-FR-25	DC Supply System
1-10-ADM-20	IP Network Equipment

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