S5.2.5.10 Oscillation Detection System Settings and Functionality

Purpose

This guideline sets out the general expectations for the settings and functionality of protection systems provided for S5.2.5.10 compliance in the Victorian Declared Shared Network (DSN). The settings provided here are guidelines and the final settings should be set in discussion with VicGrid Access and Connections on a project specific basis.

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General Requirements

Following the commissioning of the oscillation detection system, a three-month monitoring period will apply during which device activity is recorded locally by the plant. During this time, signals must not be transmitted to AEMO or Network Service Provider (NSP) control rooms where applicable. The data collected throughout this period is to be included in the R2 report to support assessment of the detection system's performance during the monitoring phase. After the monitoring phase, and subject to clearance from AEMO and NSP, signal transmission to control rooms may commence where required.

Settings and Alarms

General Capability and Settings	
Applicable Generator Performance Standards clause	**S5.2.5.10 asynchronous generating units' Compliance Requirement for Victorian DSN Connections**
Types of Signal	Alarm and Trip should be capable of being set **independently**
Enablement of the signals	Alarm Signal should be armed **Trip Signal should be disarmed** Note1 Note 1: While trip signal is required to be disarmed at this stage by physical or software isolation, the capability to automatically disconnect the plant once trip flag is activated must be accounted for as part of the instability detection system design. Evidence of isolation must be provided prior to commencement of any commissioning activities
Access to the triggered data	AEMO and VicGrid may need direct access to the triggered data of the proponent's system. At minimum, a rolling 2-month window of data should be stored.
Hierarchy of actions	Contact with AEMO control room may form part of the hierarchy of actions but will need to be agreed with AEMO Onboarding and Connections on a project by project basis. Generally the following actions should be included: • Generating system control room to receive the alarm • Generating system to follow internal compliance monitoring procedures and contact VicGrid Access and Connections team during normal business hours.
Measurement Points	Connection Point
Measurements	Current and voltage
General Notes	AEMO and VicGrid should have the flexibility to change the thresholds as required. These thresholds may be project specific, location specific, or otherwise as needs are identified during operation and should be capable of being changed remotely. The trip signal should be capable of determining the contribution to the oscillation the generating system has. For example, by determining if the Connection Point voltage and reactive power oscillations are in phase by a threshold angle. An oscillation detection system provided under S5.2.5.10 does not have redundancy requirements; however, it is the responsibility of the individual generating system to ensure adequate protection of their equipment. Under voltage, under frequency, and over frequency blocking can be added using auxiliary relays. Associated protection drawings and control the block diagrams must be submitted to AEMO and VicGrid. The trip signal must be isolated from the operation of the generating system's circuit breakers until advised otherwise by AEMO/NSP.

Connection Point Voltage Oscillation - Alarm and Trip Signals 1	
Trigger conditions	The following thresholds should be set for the Alarm and Trip signals. Alarm Threshold: Per phase RMS peak to peak voltage > 0.5% for (1/frequency) + 2 seconds[Note2] • The Alarm should trigger if the Alarm Threshold is exceeded and Conditions 1 to 4 are met. Trip Threshold: Not expected to be utilised. Assign a value that avoids triggering any associated logic or processes. • The Trip signal should trigger if the Trip Threshold is exceeded and Conditions 1 to 4 are met: **Condition 1:** Oscillation frequency is in the range of 0.1Hz to 25Hz **Condition 2:** Voltage > 0.9 p.u. **Condition 3:** Voltage has not been below 0.9 p.u. in the last 15 seconds **Condition 4:** Frequency is in the range of 49.5Hz to 50.5Hz Note 2: If the oscillation detection system is not capable of tripping time as a function of frequency, at least 3 distinct frequency buckets are required with trigger timing set based on the minimum frequency of the respective range. Alternatively, other options that provide similar functionality may be proposed.
Measurement methodology	RMS voltage oscillations measurements over (1/frequency) + 2 seconds period. Note: Ensure that the data is stored for at least 2 seconds before the specific event. Frequency in the above equation is the frequency of the detected oscillation.
Alarm reset	Alarm should reset (1/frequency) + 2 seconds after the trigger criteria cease to be met.

Active Power Oscillation - Alarm and Trip Signals 2	
Trigger condition	The following thresholds should be set for the Alarm and Trip signals. Alarm Threshold: Peak to peak power oscillation >Maximum of 2% of rated active power and 5MW, for (1/frequency) + 2 seconds • The Alarm should trigger if the Alarm Threshold is exceeded and Conditions 1 to 4 are met. Trip Threshold: Peak to peak power oscillation > Maximum of 3% of rated active power and 10MW for 300 seconds • The Trip signal should trigger if the Trip Threshold is exceeded and Condition 1 to 4 is met. **Condition 1:** Oscillation frequency is in the range of 0.1Hz to 25Hz **Condition 2:** Voltage > 0.9 p.u. **Condition 3:** Voltage has not been below 0.9 p.u. in the last 15 seconds **Condition 4:** Frequency is in the range of 49.5Hz to 50.5Hz

Reactive Power Oscillation – Alarm and Trip Signals 3	
Triggered condition	The following thresholds should be set for the Alarm and Trip signals. Alarm Threshold: Peak to peak reactive power oscillation >2% of 0.395 times rated Pmax for (1/frequency) + 2 seconds • The Alarm should trigger if the Alarm Threshold is exceeded and Condition 1 to 5 is met. Trip Threshold: Peak to peak reactive power oscillation >5% of 0.395 times rated Pmax **for 300 seconds** • The Trip signal should trigger if the Trip Threshold is exceeded and Condition 1 to 5 are met. **Condition 1:** Oscillation frequency is in the range of 0.1Hz to 25Hz **Condition 2:** Voltage > 0.9 p.u. **Condition 3:** Voltage has not been below 0.9 p.u. in the last 15 seconds **Condition 4:** Frequency is in the range of 49.5Hz to 50.5Hz **Condition 5:** Phase angle difference between reactive power and voltage < 60 deg

Signals to be provided to AEMO

The required SCADA signals to be sent to the generating system control room are:

1. The alarm signal (alarm 1) generated based on the P or Q or V oscillations alarm thresholds;
2. The trip signal (alarm 2) generated based on the P or Q or V oscillations trip thresholds; and
3. The status signal of the detection system.
4. Alarm 1 and Alarm 2 signals must be received separately.
5. Some or all of the above signals may need to be provided to AEMO control room. This is to be agreed with AEMO Onboarding and Connections on a project by project basis.

Commissioning

Ideally, testing of the oscillation detection system should be completed during Hold Point 0. However, it must be completed before the final hold point.

Please test the following during commissioning:

1. Ensure trip links (associated to S5.2.5.10) are opened for both commissioning and normal operations
2. Thresholds/settings for commissioning to be confirmed with AEMO and VicGrid
3. Undertake signal injection testing to confirm the response of the detection system. This needs to be spread across the multiple frequencies as agreed with AEMO and VicGrid
4. Testing should generally include:
   a. Frequency sweep checks
   b. Frequency spillover checks
   c. Confirm the trip time
   d. Confirm the blocking scheme

After successful commissioning, please confirm the final agreed settings for normal operations with VicGrid and AEMO.