

## Company Directive

### STANDARD TECHNIQUE: TP18A/2

#### Application of Connection Control Panels for Soft Intertrip and/or Voltage Constraint Schemes

##### Summary

This document provides guidance on the application of Western Power Distribution's Connection Control Panels (CCPs). These panels may be configured for Soft Intertrip or Voltage Constraint.

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**Implementation Date:** May 2019

**Approved by**



**Policy Manager**

**Date:**

30 April 2019

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## **IMPLEMENTATION PLAN**

### **Introduction**

This document provides guidance on the application of Connection Control Panels. These panels are used by Western Power Distribution to reduce the export and/or import of distributed energy resources, when this is required, to maintain network security and/or to prevent thermal limits, voltage limits or power quality limits from being exceeded.

### **Main Changes**

Clarification has been provided regarding the application of soft intertrip schemes used to mitigate thermal issues or severe voltage excursions. In these situations soft Intertrip shall only be used to curtail generation or demand in anticipation of an additional circuit outage / fault. This approach is known as pre-event curtailment. Post event curtailment shall be provided using other techniques such as protection class intertripping.

The section on power flow convention and on the required CT and VT connections has been updated to cater for CCPs fitted to incoming metering circuit breakers.

Stage 2 shall trip one or more customer circuit breakers to disconnect the relevant load (demand or generation) as applicable.

New guidance for customer installations that only utilise one stage of constraint is provided.

Guidance on setting CCPs has been amended and the generic setting sheets have been updated accordingly.

### **Impact of Changes**

The changes prevent Soft Intertrip Schemes being used for some post-event curtailment schemes.

### **Implementation**

WPD Plant Centres to note changes to Appendix A. These changes are also relevant to ICPs.

### **Implementation Timescale**

This document shall be implemented on issue. No retrospective action is required as a result of its issue.

## REVISION HISTORY

DOCUMENT REVISION & REVIEW TABLE		
Date	Comments	Author
May 2019	<ul style="list-style-type: none"> <li>References to SURF have been replaced with WPD Telecoms</li> <li>Clause 2.5.1: Clarification; Soft Intertrip Schemes may be provided where the agreed import or export capacity is 250kW or more.</li> <li>Clause 2.5.3: Clarification; Soft Intertrip Schemes used to mitigate thermal and voltage issues shall provide pre-event curtailment.</li> <li>Clause 2.6.1: Clarification; Voltage Constraint schemes may be provided where the total, summed, capacity of the power generating modules is 500kW or more.</li> <li>Clause 3.5.1.6: Stage 2 Constraint shall be wired to trip the relevant load (demand or generation).</li> <li>Clause 3.5.1.9: Additional guidance has been provided for Customer installations that can only provide a single stage of constraint.</li> <li>Section 3.3: The Power Convention requirements have been modified and new CT / VT connection diagrams added.</li> <li>Section 4.0 and Appendix B1: The setting guidance and generic setting sheet for Soft Intertrip schemes has been updated.</li> <li>Section 5.0: The setting guidance and generic setting sheet for Voltage Constraint (with Soft Intertrip) has been updated.</li> </ul>	Andy Hood / Sven Hoffmann
June 2018	<p>Extensive revision as a result of software / firmware change from V18 to V20, allowing panels to be configured for demand constraint and energy storage constraint as well as generation constraint:</p> <ul style="list-style-type: none"> <li>New settings explained</li> <li>General arrangement drawings revised</li> <li>Generic setting sheet updated</li> <li>Detailed drawings removed from document, replaced with hyperlink to shared drive</li> </ul>	Sven Hoffmann
December 2017	<p>Text revisions due to supplier name change.</p> <p>Revision to clause 5 and the table in Appendix A due to equipment changes.</p>	Stephen Hennell

## **1.0 INTRODUCTION**

- 1.1 This document provides guidance on the application and operation of Connection Control Panels (CCPs). It is based on Western Power Distribution's standard control panels manufactured and supplied by ZIV Automation Ltd. The document will be modified to accommodate other makes of panel as they are developed and approved by the Policy Section and by Surf Telecom.
- 1.2 Where any difficulty is encountered in the application of the Standard Technique the author of the document shall be consulted who will determine if a variation is appropriate.

## **2.0 APPLICATION**

### **2.1 Summary**

- 2.1.1 In accordance with ST: SD4OA and ST: SD4OB, CCPs shall be installed at all HV and EHV connections that have an Agreed Export Capacity of 500kW or above. CCPs may also be installed where the criteria defined in 2.5 or 2.6 are satisfied or where Active Network Management is required.

This document covers Soft Intertrip and Voltage Constraint application only. Both options are designed to ensure network limits (e.g. thermal or voltage limits) are not exceeded. Voltage Constraint Schemes only apply to generation connections whereas Soft Intertrip Schemes may be applied to both generation and controllable demand connections.

- 2.1.2 It should be noted that the Soft Intertrip functionality of the CCP is always available (as long as POF is programmed accordingly) regardless of whether the voltage constraint function is enabled.

### **2.2 Soft Intertrip Schemes**

- 2.2.1 The Soft Intertrip option is one of three "alternative connection" methods that are currently available. The other two alternative connection methods are "Timed" and "Active Network Management" schemes. Further guidance on alternative connections is included in POL:SD10 and the associated STs in the SD10 series.
- 2.2.2 When selected to Soft Intertrip mode the CCP relies on POF / ENMAC to determine when the connection needs to be constrained. A sequential control (SQC) scheme is written for POF / ENMAC which monitors analogue information (e.g. current, power, voltage etc.), alarms, and the status of the network (e.g. which switches are open and which are closed). When certain conditions occur, or limits are exceeded, POF / ENMAC sends a signal to the CCP to constrain the connection.

- 2.2.3 When a constraint signal is received the CCP sends a signal to the customer instructing them to limit their export (in the case of generation) or their import (in the case of controllable demand).

## 2.3 Voltage Constraint Schemes

- 2.3.1 Voltage Constraint is not seen as an “alternative connection” method but is simply a way of constraining generation under back feed conditions (when the local voltage exceeds limits).
- 2.3.2 When the CCP is set to Voltage Constraint mode, the scheme measures the local voltage and if this exceeds the voltage limit setting (for a sufficient period of time) the panel sends a signal to constrain the generator.

## 2.4 Monitoring of the Constraint

- 2.4.1 Whichever type of scheme is implemented, when the panel signals a constraint it monitors whether the customer successfully implements the first stage of constraint and, if not, initiates a second, more severe, stage of constraint. This second stage trips one, or more, customer owned circuit breaker/s directly disconnecting all, or part of, their load (e.g. generation, energy storage and/or demand).
- 2.4.2 If the second stage of constraint is not implemented successfully the panel sends an alarm to Control, allowing them to take further action, if required. This could include tripping the metering circuit breaker where this is necessary to maintain the integrity of WPD’s network.

## 2.5 When should a Soft Intertrip scheme be installed?

- 2.5.1 Guidance on the application of Soft Intertrip schemes is included in POL: SD10 and ST:SD10B. Soft Intertrip schemes may be considered where all of the following criteria apply:
- The connection is made at HV or above.
  - The agreed import or export capacity of the connection is 250kW or more.
  - The connection needs to be constrained due to thermal limitations, protection limitations, fault level limitations or remote voltage limitations.
- 2.5.2 Soft Intertrip schemes used to mitigate thermal issues and voltage excursions shall only be used to curtail the load (exported power or imported power) in anticipation of an additional circuit outage. This approach is known as pre-event curtailment. This is because soft intertrip schemes will take a significant time to curtail the load (typically 10s to 30s).

2.5.3 Where post-event curtailment is required this shall be provided by protection class intertripping systems instead.

2.5.4 The risks associated with exceeding fault level ratings during short term parallels (e.g. when moving open points) are typically controlled by applying appropriate operational restrictions and not by installing Soft Intertrip schemes.

## 2.6 **When should a Voltage Constraint scheme be installed?**

2.6.1 A voltage Constraint scheme shall be specified where all of the following criteria are satisfied:

- A generator connection is made at EHV (66KV or 33kV) or HV (11kV or 6.6kV).
- The total, summed, capacity of the power generating modules at the connection is 500kW or more.
- Under normal operating conditions the voltage at the connection is not expected to exceed appropriate limits\*.
- Under first circuit outage (N-1) conditions, the generation needs to be constrained in order to prevent the voltage at the connection point exceeding appropriate limits\* (under certain demand / generation conditions).

2.6.2 Note, if the local voltage is expected to be outside of appropriate limits\* when fed normally the network should be reinforced or an alternative connection arrangement provided.

*\* POL: SD4 provides guidance on appropriate limits for 11kv and 6.6kV network.*

## 3.0 **CONSTRAINT SCHEME DETAILS**

### 3.1 **General Description and Layout**

3.1.1 A constraint scheme consists of a single panel which is connected to the local metering or protection CTs and VT and also requires a 230Vac supply. The panel includes its own 48Vdc battery / charger system that will sustain the panel for 24 hours should the ac supply fail.

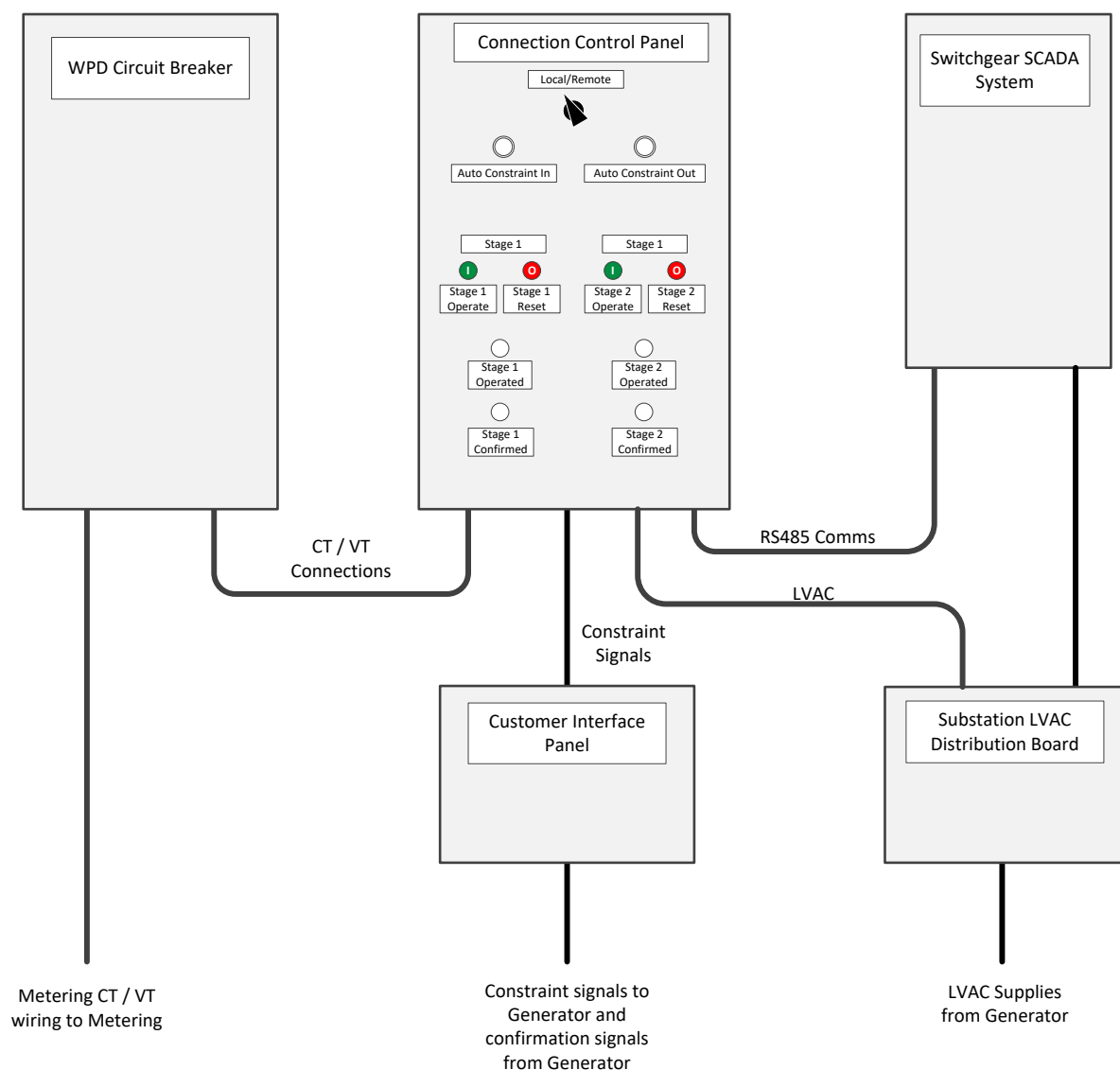
3.1.2 All CCPs and their associated switchgear, including the metering circuit breaker must be provided with SCADA facilities. It should be noted that for 11kV Ring Main Unit applications the tee off circuit breaker, in addition to the ring switches, must be automated. In most cases the CCP and switchgear share the same radio system.

This requirement may be waived where retro-fit of SCADA facilities to Primary switchgear is not practical.

- 3.1.3 The panel is hard wired to the customer's control or protection systems, via a customer interface panel. There are two versions of this panel – a standard version with pull-out links for isolation, and an alternative one incorporating interposing relays for enhanced isolation – to be used where HV and LV earths require segregation. Further guidance is contained in ST:TP21D.
- 3.1.4 Figures 1 and 2 show how a typical CCP is connected at 33kV and 11kV respectively. Photographs of a CCP are provided in Figures 3 and 4.
- 3.1.5 The external dimensions of the ZIV Connection Control Panel and CT/VT marshalling cabinet are as follows:

CCP: 800mm (H) x 1000mm (W) x 300mm (D)

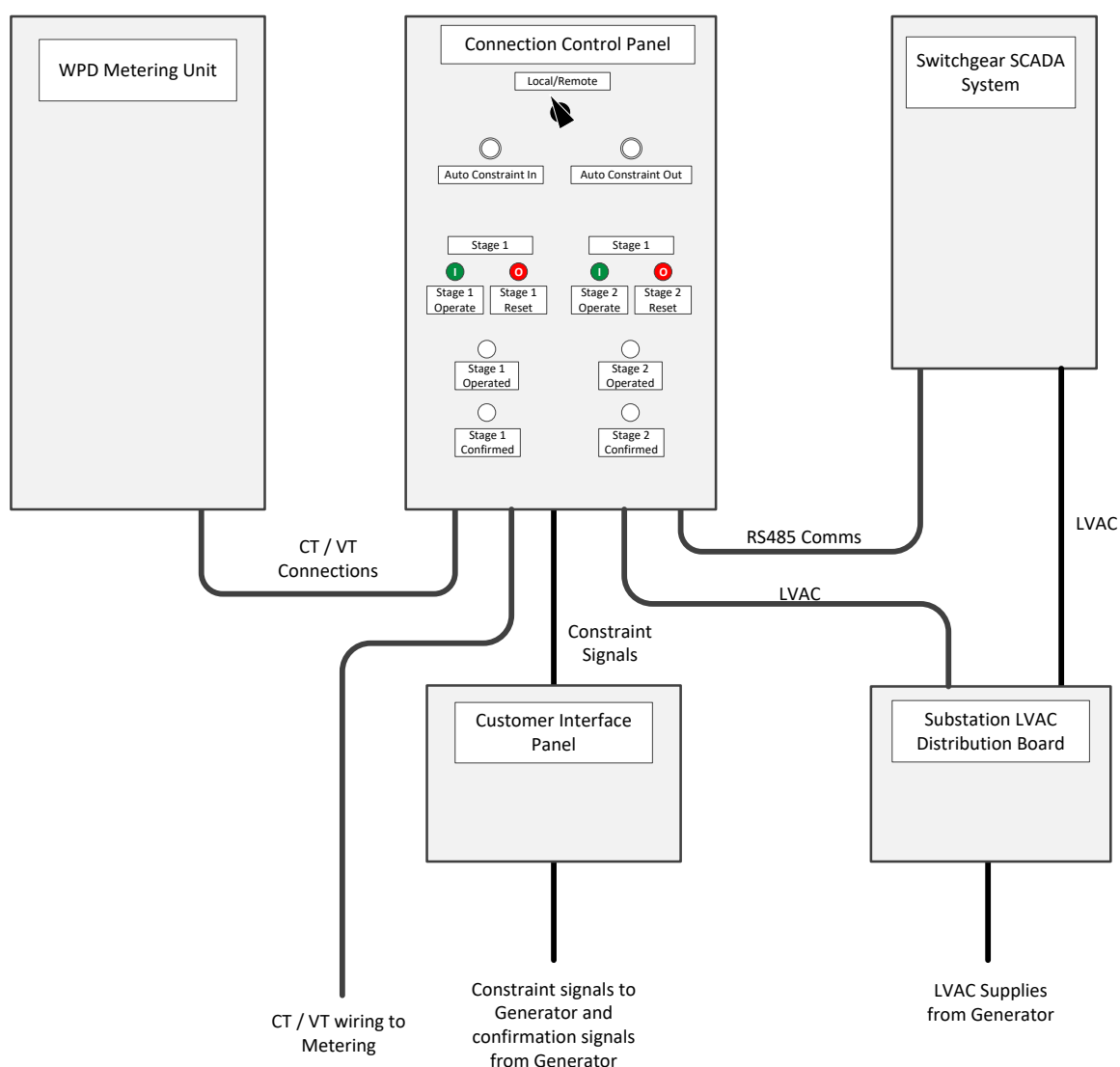
CT/VT Cabinet: 300mm (H), 200mm (W) x 60mm (D)



**Figure 1 Typical 33kV Connection Arrangement**

This arrangement also applies to 11kV arrangements utilising primary type switchgear.

Note: the customer interface panel includes links that may be used to isolate connections to / from the generator's installation.



**Figure 2 Typical 11kV Arrangement utilising secondary type switchgear i.e. Ring Main Units**

Note: the customer interface panel includes links that may be used to isolate connections to / from the generator's installation.





**Figure 3** CCP (Front Panel)



**Figure 4** CCP (Internal Wiring)

## 3.2 CT and VT Requirements

- 3.2.1 Connection Control Panels are connected to a VT and a set of CTs so that they can determine the phase voltage (all three phase to phase voltages), current, active power and reactive power.
- 3.2.2 11kV and 6.6kV connections rated up to 10MVA (i.e. supplied from Ringmaster switchgear or equivalent) may be connected to the metering CTs and a metering VT in the metering unit. This is because Metering Code of Practice 3 (COP 3) which is applicable to loads between 1MVA and 10MVA allows additional burdens to be connected to metering CTs and VT windings.
- 3.2.3 For larger 11kV and 6.6kV connections (>10MVA) and all connections made at 33kV and above, the current and voltage shall be derived from protection CTs and a protection VT winding. This is because Metering Code of Practice 2 (COP 2) which is applicable to loads between 10MVA and 100MVA prohibits additional burdens from being connected to the main metering CT and VT windings.
- 3.2.4 Two versions of the Connection Control Panel are available, one for use with 1A CTs and another for use with 5A CTs. It is important that the correct version is ordered.
- 3.2.5 Normally only two metering CTs are provided (L1 and L3) and so the Connection Control Panel is configured so that it only requires L1 and L3 to calculate power flow. If three CTs are available, L2 must not be connected to the panel.
- 3.2.6 The burden of the CT inputs and VT inputs of the Connection Control Panel are negligible, however, the secondary wiring and multicore cables may add a significant burden to the CTs.
- 3.2.7 It is essential that the total burden connected to the CTs is within their rating. Where the panel is connected to metering CTs, the accuracy of the metering will be adversely affected if the CT rating is exceeded.
- 3.2.8 Table 1 provides information on the burden of the CCP, the secondary wiring / multicores. The 5A CTs provided in standard 11kV metering units have a rated burden of 10VA (as defined in EE SPEC:2 and 1A CTs normally have a rated burden of 7.5VA or higher.

Equipment	Impedance	Burden <sup>[1]</sup>
<b>ZIV Automation Panel:</b>		
Voltage Inputs	300kΩ	< 0.0411 VA (at 0.37mA) <sup>[2]</sup>
Current Inputs	<2mΩ (5A board) <5mΩ (1A board)	< 0.0500 VA (at 5A) < 0.0050 VA (at 1A)
<b>Copper Conductor<sup>[3][4]</sup>:</b>		
2.5 mm <sup>2</sup>	7.4 mΩ/m	= 0.1850 VA/m (at 5A) = 0.0074 VA/m (at 1A)
4.0 mm <sup>2</sup>	4.6 mΩ/m	= 0.1150 VA/m (at 5A) = 0.0046 VA/m (at 1A)
6.0 mm <sup>2</sup>	3.1 mΩ/m	= 0.0775 VA/m (at 5A) = 0.0031 VA/m (at 1A)
10.0 mm <sup>2</sup>	1.83 mΩ/m	= 0.0458 VA/m (at 5A) = 0.0018 VA/m (at 1A)
16 mm <sup>2</sup>	1.15 mΩ/m	= 0.0288 VA/m (at 5A) = 0.0012 VA/m (at 1A)
25 mm <sup>2</sup>	0.73 mΩ/m	= 0.0182 VA/m (at 5A) = 0.0007 VA/m (at 1A)

**Table 1 CT and VT Burdens**

Note 1 The burden of an item of equipment that has a known impedance is calculated as follows:

$$\text{Burden (VA)} = I^2 Z$$

Where:

I = current (A) flowing into the equipment

Z = the impedance (Ω) of the equipment

Note 2 The high impedance of the voltage inputs (300kΩ) restrict the current flowing into the Voltage Constraint Panel and through the associated VT wiring to 0.37mA. This means the burden of the VT secondary wiring and the burden of the voltage inputs is negligible.

Note 3 For CT wiring, the burden is calculated using the rated CT current (i.e. 1A or 5A). The CT current flows in a loop from the CT to the equipment and back to the CT again. The length of the conductor is therefore at least 2x the length of the associated multicore cable.

### 3.2.9 CT Burden Example

3.2.9.1 CTs with a 5A secondary rating are to be connected to a CCP and are also used to supply the settlement metering. If the meters have a total burden of 1VA and the total length of multicore is 20m, will 2.5mm<sup>2</sup> Copper multicore be acceptable?

- The burden of the metering = 1 VA
- The burden of Voltage Constraint Panel = 0.05 VA

- The burden of 25m of 2.5mm<sup>2</sup> multicore is approximately 20m x 2 x 0.185 = 7.40 VA
- An additional 2m length of 2.5mm<sup>2</sup> secondary wiring is assumed within the panels themselves giving an additional burden of 2 x 2 x 0.1850 = 0.74 VA.

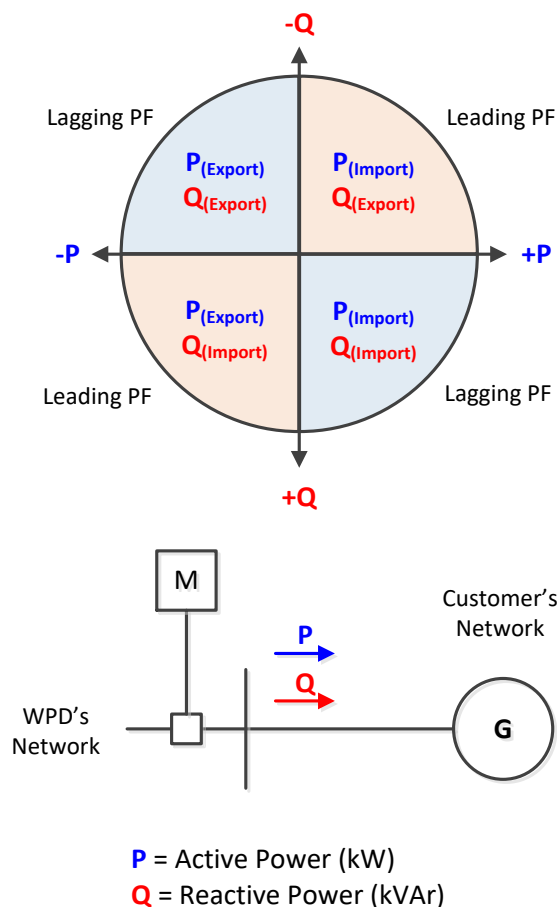
3.2.9.2 This gives a total burden of 9.19 VA which is just below the 10VA rated burden of the CTs.

3.2.9.3 If the conductors within the multicore cable were doubled up (i.e. each phase consisted of 2 x 2.5mm<sup>2</sup> copper conductors) the burden would be reduced to approximately 5.49 VA.

### 3.3 Power Flow Convention

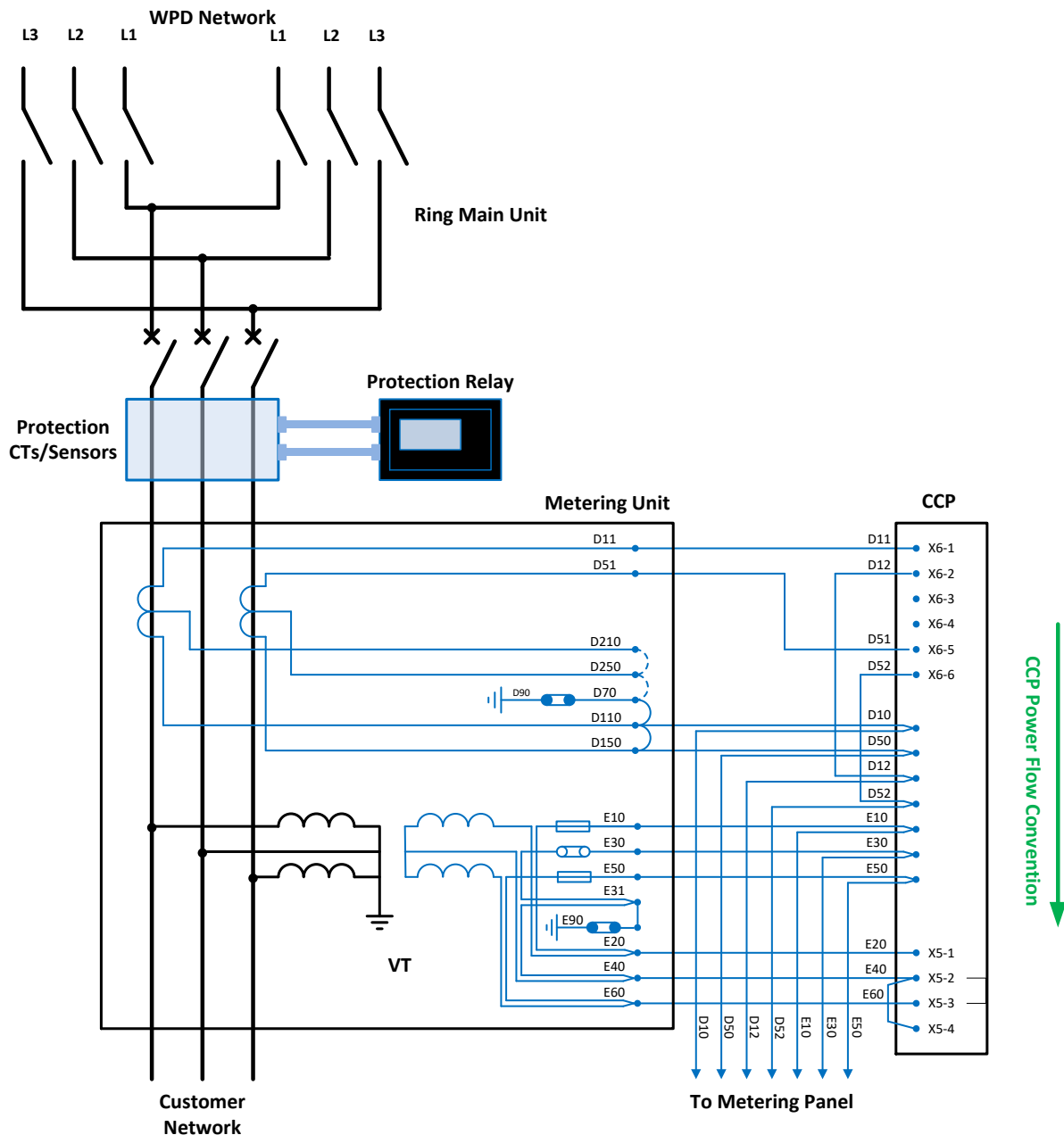
3.3.1 CCPs use the following convention for power flow direction:

When Active Power is imported, i.e. Active Power flows from WPDs network into the Customer's installation the value is deemed to be positive (+ve) and when the Active Power is exported it is deemed to be negative (-ve). The same approach is taken for the flow of lagging Reactive Power. This convention is shown in Figure 5.



**Figure 5 Power Flow Conventions**

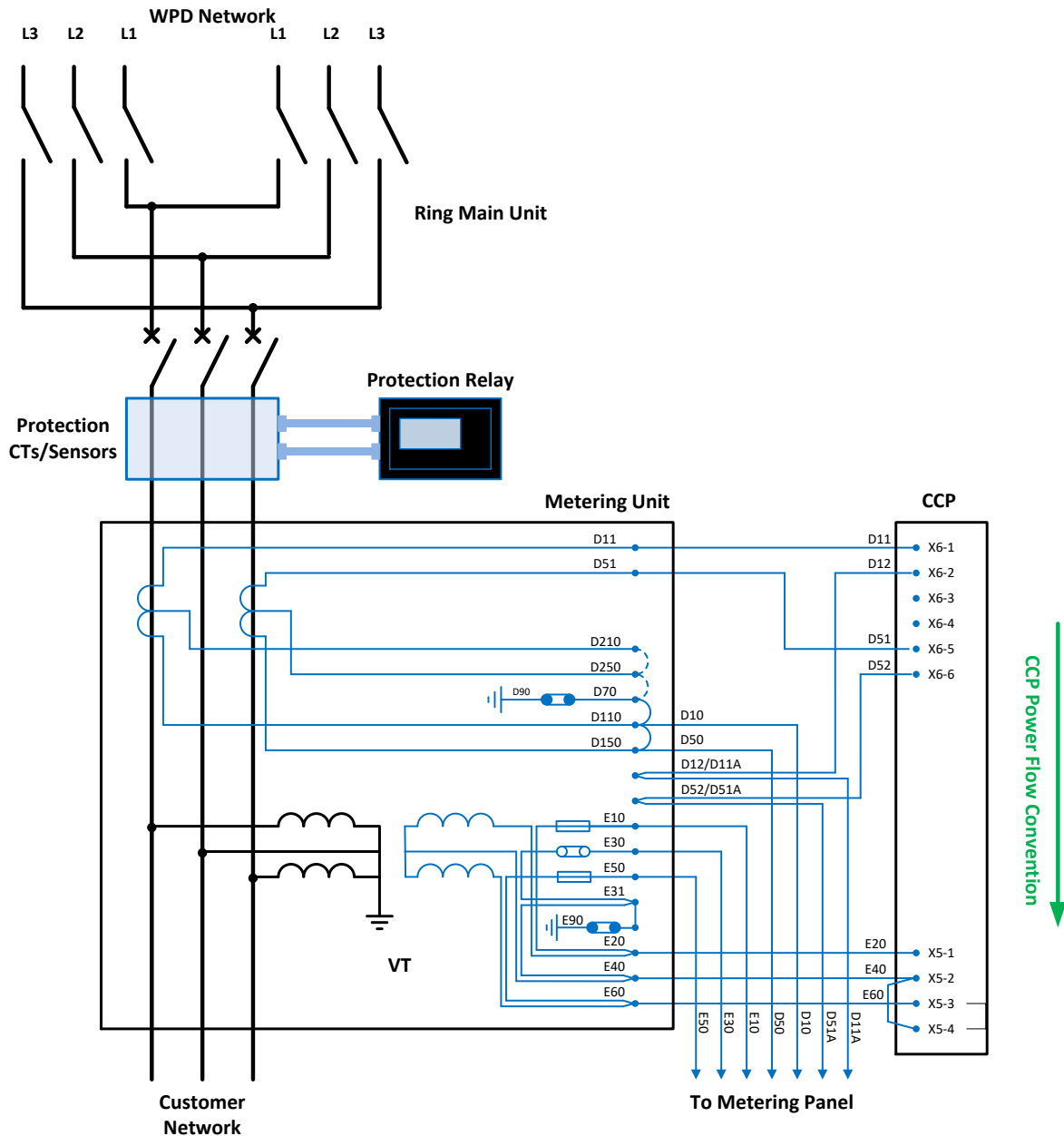
- 3.3.2 There is no facility within the CCP software to reverse the default power flow direction and therefore it is essential that the CTs and VTs are connected with the correct polarity.
- 3.3.3 For CCPs connected to CTs fitted on the customer side of the metering circuit breaker, for example, where a Ring Main Unit and Metering Unit or an outgoing primary metering circuit breaker is used the standard connections shown in Figure 6, 7 and 8 are used.
- 3.3.4 For CCPs connected to CTs fitted to the WPD side of the metering circuit breaker, for example where an incoming metering circuit breaker is used, the connections shown in Figure 9 are used. In this case the CTs connections within the CCP are reversed (compared to the standard connections shown in Figure 6, 7 and 8).



Notes:

- 1) Metering CT and metering VT connections are terminated within the CCP (as shown above) and a single multicore is laid from the CCP to the meter panel.
- 2) The open-delta VT winding, which is typically included in the metering unit is not shown, for simplicity.
- 3) The protection relay is shown as a self-powered phase fault and earth fault relay. A more complex protection relay with NVD protection is often installed instead.

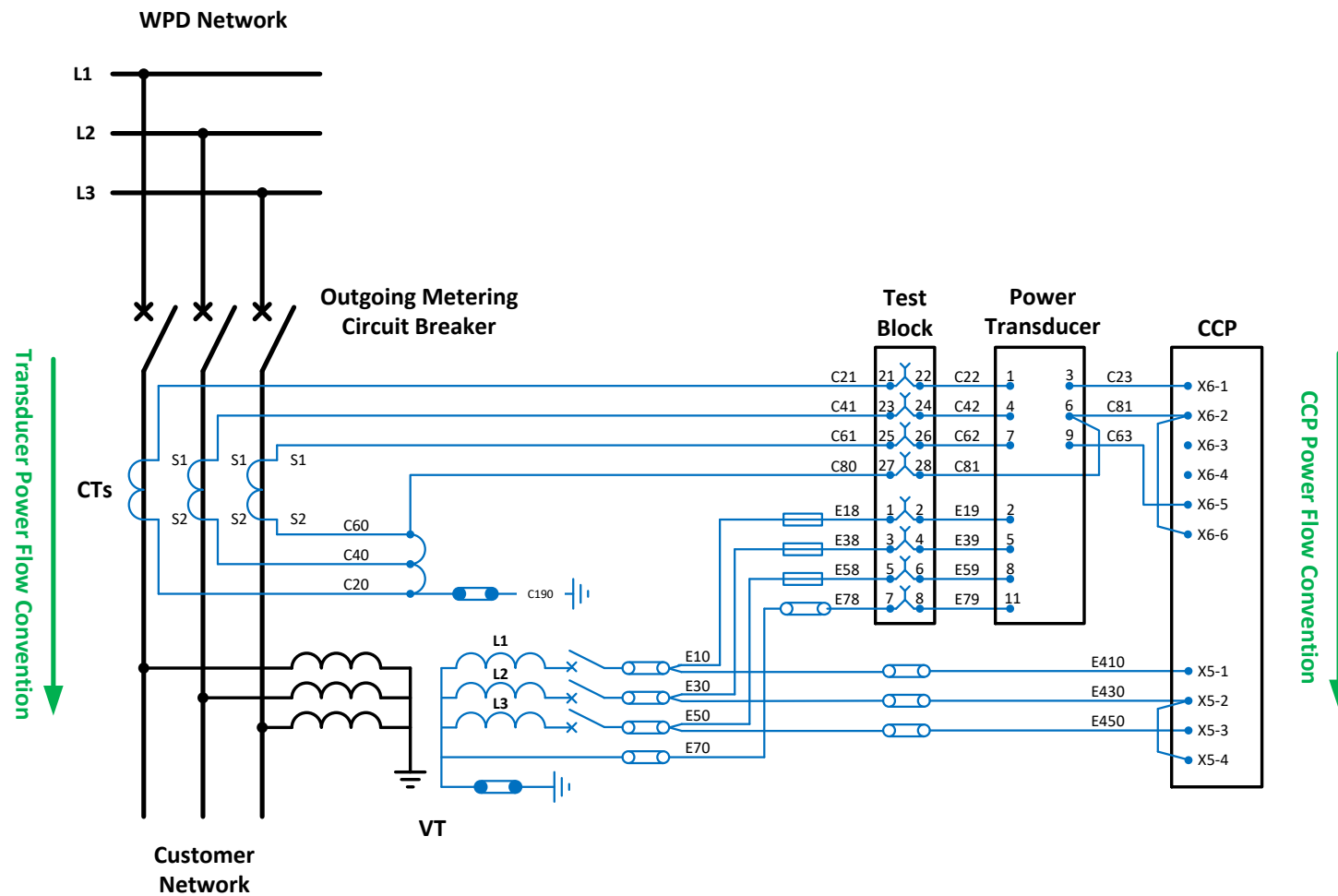
**Figure 6 Connection Control Panel CT and VT Connections for a HV Ring Main Unit / Metering Unit Application – Option 1, with Metering CT/VT Connections Terminated in the CCP**



**Notes:**

- 1) Metering CT and metering VT connections are terminated within the CCP (as shown above) and a single multicore is laid from the CCP to the meter panel.
- 2) The open-delta VT winding, which is typically included in the metering unit is not shown, for simplicity.
- 3) The protection relay is shown as a self-powered phase fault and earth fault relay. A more complex protection relay with NVD protection is often installed instead.

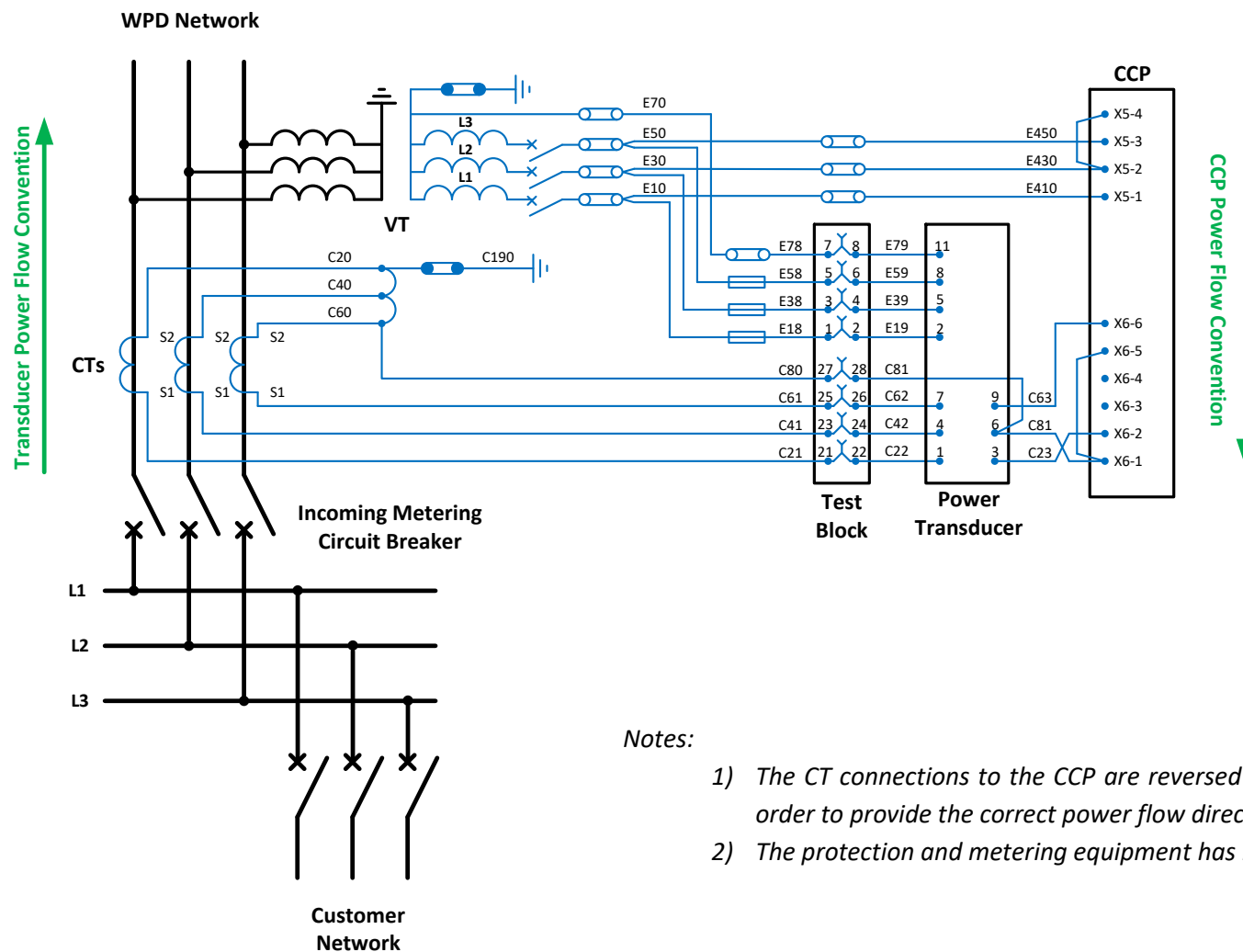
**Figure 7 Connection Control Panel CT and VT Connections for a HV Ring Main Unit / Metering Unit Application – Option 2, with Metering CT/VT Connections made via a Plug and Socket Facility in the Metering Unit.**



*Note, the protection and metering equipment has been omitted for simplicity*

**Figure 8** Standard Connection Control Panel CT and VT Connections for an Outgoing Metering Circuit Breaker





**Figure 9** Standard Connection Control Panel CT and VT Connections for an Incoming Metering Circuit Breaker

### **3.4 SCADA Requirements**

- 3.4.1 WPD switchgear associated with CCPs, including the metering circuit breaker must be fitted with SCADA tele-control facilities so that Control are able to re-configure the network or disconnect the connection should they fail to constrain. CCPs also require SCADA facilities so that Control can monitor alarms and, if necessary operate, reset, disable or enable the constraint scheme.
- 3.4.2 The WPD standard CCPs operate using three different communications protocols, Modbus, DNP3.0 and IEC60870-101 which means they can be connected to all of SURF's existing communications systems.
- 3.4.3 All CCP systems require a licensed communications system (i.e. scanned telemetry system).
- 3.4.4 Ordering requirements for SCADA / Radio equipment are specified in section 5.2.

### **3.5 Description of Operation**

#### **3.5.1 Automatic Operation**

- 3.5.1.1 All CCPs include two stages of constraint.
- 3.5.1.2 Panels configured for Soft Intertrip only initiate a Stage 1 Constraint when they receive a Stage 1 Operate signal from POF / ENMAC whereas Panels configured for Voltage Constraint initiate a Stage 1 Constraint when the voltage exceeds the Stage 1 Operate Voltage setting for a period of time that exceeds the Stage 1 Operate Time Delay setting (assuming Automatic Constraint is selected to "in").
- 3.5.1.3 When Stage 1 Constraint is initiated a normally open contact is closed that instructs the connected customer to reduce their import/export to a predetermined level.
- 3.5.1.4 If Automatic Constraint is "in" the CCP checks that:
  - the customer has closed their Stage 1 Confirmation contact, and;
  - Active Power (kW) flowing through the metering circuit breaker is within the agreed limit for Stage 1. In this context imported Active Power has a positive value and exported Active Power has a negative value.

If, for example, it is agreed that the site must export less than 1MW, the scheme checks that the flow of Active Power is mathematically greater than -1MW. A value of -900kW is, for example, greater than -1MW.

3.5.1.5 If the Stage 1 Constraint is successfully implemented by the customer the restriction remains in place until either:

- Stage 1 Constraint is reset via SCADA.
- Stage 1 Constraint is reset locally.
- In the case of a Voltage Constraint scheme only, the measured voltage (on all phases) is below the Reset Voltage setting for a period of time that exceeds the Stage 1 Reset Time Delay setting.

3.5.1.6 If the Stage 1 Constraint is not successfully implemented the scheme will initiate a Stage 2 Constraint condition by closing a second contact. This shall be designed to trip the relevant load (demand or generation), as applicable, via one or more customer circuit breakers. The CCP then checks that:

- The customer's Stage 2 Confirmation contact is closed, and;
- Active Power (kW) flowing through the metering circuit breaker is within the agreed limit for Stage 2.

3.5.1.7 The Stage 2 Constraint condition may only be reset via SCADA or locally.

3.5.1.8 If the Stage 2 Constraint is unsuccessful a "failed to constrain" alarm is sent to Control.

3.5.1.9 If the Customer only has the facility to implement a single stage of constraint the Stage 1 and the Stage 2 constraint contacts shall be paralleled (so that either condition will initiate the constraint). These contacts shall be wired to trip the relevant load (demand or generation) via one or more customer circuit breakers. In addition, the Customer's confirmation contact shall be wired to the Stage 1 and the Stage 2 Confirmation inputs.

### 3.5.2 Local Operation

3.5.2.1 The Stage 1 Constraint and/or Stage 2 Constraint can be selected manually on site when the Local / Remote switch is in the Local position.

3.5.2.2 If Automatic Constraint is left in its Enabled status when Stage 1 Constraint is operated locally the scheme will escalate to Stage 2 if the customer confirmation and Active Power checks described in 3.1.3 are not successful. Also, in the case of a Voltage Constraint scheme, the scheme may automatically reset if the voltage is below the reset voltage setting.

3.5.2.3 If Automatic Constraint is Disabled the scheme will not escalate to Stage 2 or reset automatically.

### 3.5.3 Remote Operation

3.5.3.1 The Stage 1 Constraint and/or Stage 2 Constraint can be selected remotely by Control when the Local / Remote switch is in the Remote position.

3.5.3.2 If Automatic Constraint is left in its Enabled status when Stage 1 Constraint is operated locally the scheme is still capable of operating and resetting automatically (as described above).

3.5.3.3 If Automatic Constraint is Disabled the scheme will not reset / operate automatically and it will not check that the customer has successfully implemented their constraint instructions.

## 4.0 SETTINGS – Soft Intertrip Only

4.1 When determining whether or not a Soft Intertrip scheme is appropriate consideration must be given to the limitations of the SCADA system and ENMAC / POF Sequential Schemes (SQC). Analogue information (e.g. current, voltage and power) measured by relays or transducers and then transmitted over SCADA have certain tolerances and the SCADA system will add significant time delays. Further guidance on the design of SQC schemes may be obtained from Operations Support.

4.2 Soft Intertrip schemes may be configured to curtail the site export (e.g. where parallel generation is installed) the site import (e.g. where a large demand is installed) or to curtail both export and import (e.g. where battery storage is installed). It is important that, whatever the specific application, a customer breaker is available to be wired to the Connection Control Panel Stage 2 output that will, when tripped, disconnect the required Generation, Demand or Battery Storage, as necessary.

4.3 The settings applied to Connection Control Panels for Soft Intertrip are relatively straightforward since the conditions that trigger the constraint are implemented within an SQC scheme. Given this, many of the available settings are not applicable and should be left as defaults. A description of the available settings and guidelines on their application are given below:

- a) CT Primary Current (A): The primary rating of the CTs. Typical values are 200, 400 or 800A.
- b) CT Secondary Current (A): The secondary rating of the CTs (i.e. 1A or 5A).

- c) VT Primary Voltage (V): The primary voltage rating of the VT (i.e. 6600, 11000, 33000 or 66000).

The “VT secondary” value applied in the CCP software is the VT Primary Voltage divided by the VT Secondary Voltage. For example, for a 33000/110V VT the value would be  $33000/110 = 300$ .

- d) VT Secondary Voltage (V): The secondary voltage rating of the VT (i.e. 110V).

The “VT Primary” value applied in the software is 1.

- e) Stage 1 Operate Voltage (V): Not applicable (leave on default)
- f) Stage 1 Reset Voltage (V): Not applicable (leave on default)
- g) Stage 1 Operate Time Delay (s): Not applicable (leave on default)
- h) Stage 1 Operate Timer – Reset Delay (s): Not applicable (leave on default)
- i) Stage 1 Reset Time Delay (s): Not applicable (leave on default)
- j) Stage 1 Confirmation Contact Time Delay (s): This is the time limit within which the connected customer must confirm that the Stage 1 Constraint has been implemented (from initiation of the Stage 1 Constraint). Typically this is set to 1s.
- k) Stage 1 Power Limit Time Delay (s): This is the time limit within which the measured Active Power must satisfy the Stage 1 Power Limit (from initiation of the stage 1 constraint). A setting of 10s is normally applied.

This setting may be increased, up to a maximum setting of 30s where the customer is unable to control their load (generation or demand) within 10s, as long as WPD’s network is capable of withstanding this level of export for 30s.

- l) Stage 2 Confirmation Contact Time Delay (s): This is the time limit within which the connected customer must confirm that the Stage 2 Constraint has been implemented (from initiation of the Stage 2 Constraint). This time delay must be at least 1s longer than the setting on the Stage 2 Output Time Delay relay.

For example, if the Stage 2 Output Time Delay relay is set at 20s a Stage 2 Confirmation Contact Time Delay of 25s would be acceptable. This would give the customer 5s to confirm that they have implemented Stage 2 following receipt of the Stage 2 operate signal.

- m) Stage 2 Power Limit Time Delay (s): This is the time limit within which the measured Active Power must satisfy the Stage 2 Power Limit (from initiation of the Stage 1 Constraint). This delay must be at least 1s longer than the Stage 2 Output Time Delay Relay.

For example, if the Stage 2 Output Time Delay relay is set at 20s a Stage 2 Power Limit Time Delay of 30s would be acceptable. This would give the customer 10s to trip their associated load (generation or demand) following receipt of the Stage 2 operate signal.

Note, if the customer's installation only has one stage of constraint then operation of the Stage 1 Constraint will bypass the Stage 2 Time Delay relay and cause the customer's circuit breaker/s to trip instantaneously.

- n) Stage 1 Power Setting (kW): depending on the status of the Generator Constraint and Demand Constraint functions, the stage 1 power import/export limit on the connected customer is determined either by the Stage 1 Power Setting alone, or in conjunction with the Stage 1 Power Delta setting (see (4.3.z) below) as follows:

If the Generator Constraint Function is set to "1" and the Demand Constraint Function is set to "0" the CCP is set for generation constraint and the stage 1 power limit is equal to the Stage 1 Power Setting (irrespective of the Stage 1 Power delta (+/-) setting).

If the Generator Constraint Function is set to "0" and the Demand Constraint Function is set to "1" the CCP is set for demand constraint and the stage 1 power limit is equal to the Stage 1 Power Setting (irrespective of the Stage 1 Power delta (+/-) setting).

In all cases, a positive value of Active Power indicates imported Active Power, while a negative value indicates exported active power. For a panel in generator constraint mode only, the measured power must be mathematically greater than the Stage 1 setting, in demand constraint mode the measured power must be mathematically lower than the Stage 1 setting.

If the Generator Constraint Function is set to "1" and the Demand Constraint Function is set to "1" the CCP is set for energy storage constraint and two stage 1 power limits (i.e. an upper limit and lower limit are provided).

- o) Stage 2 Power Setting (kW): as per the description of the Stage 1 Power Setting (see 4.3.n above), depending on the status of the Generator Constraint and Demand Constraint functions, the stage 2 power import/export limit on the connected customer is determined either by the Stage 2 Power Setting alone, or in conjunction with the Stage 2 Power Delta setting (see (4.3.aa) below).
- p) Power Dead Band (kW): This is a range of measured Active Power that is considered, by the CCP, to be zero. The reason for having a dead band is to ensure that errors in the CTs, VTs and programmable logic controller (PLC) do not give rise to false operations when Stage 1 or Stage 2 Power Limits are set at, or close to zero. The required setting depends on the connection voltage (i.e. VT primary voltage) and the rating of the CT primary winding. The minimum settings are given in the following table:

Minimum Power Dead Band Settings (kW)					
CT Primary (A)	Connection Voltage				
	132kV	66kV	33kV	11kV	6.6kV
50	90	50	30	10	10
100	180	90	50	20	10
200	350	180	90	30	20
400	690	350	180	60	40
600	1030	520	260	90	60
800	1380	690	350	120	70
1000	1720	860	430	150	90
1200	2060	1030	520	180	110

- q) Frequent Operation Counter: Not applicable (leave on default)
- r) Frequent Operation Alarm Time Delay (s): Not applicable (leave on default)
- s) Voltage Block Setting (kV): When the voltage drops below this value the Soft Intertrip Scheme is blocked. A setting of 80% of the primary VT winding shall be used.
- For example, if an 33kV/110V VT is used the setting shall be 80% of 33kV = 26.40kV.
- t) Soft Intertrip Algorithm: A value of 1 is applied, which implements the soft intertrip logic only (rather than Soft Intertrip logic in conjunction with the Voltage Constraint logic).

- u) Agreed Export Capacity (kW): The export capacity of the connected customer in kW derived from their Connection Agreement.

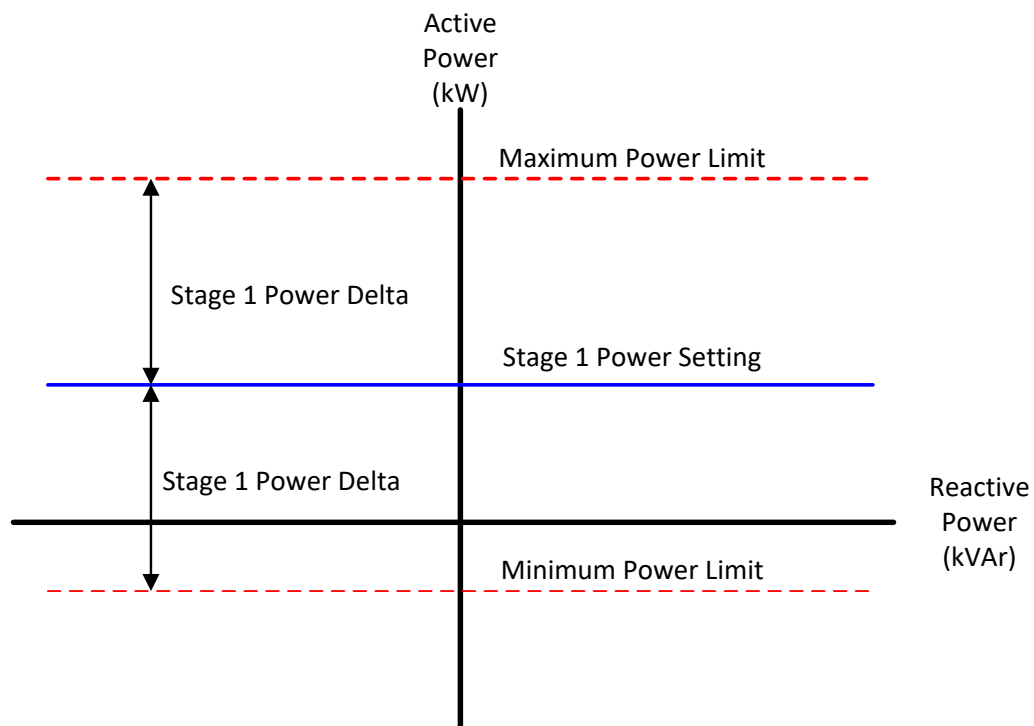
For example, if the Agreed Export Capacity is 10MVA a value of 10000kW is used.

- v) Agreed Export Capacity Exceeded Alarm Time Delay: The time period over which export must be above the Agreed Export Capacity before an alarm is sent to Control. A value of 30s is used.
- w) Comms Fail Restoration Time: The time taken before Stage 1 is automatically reset, following restoration of the communications link between the CCP and PowerOn. Note, this automatic stage 1 reset function is over-ruled / blocked if Stage 1 is operated by PoF / Control or by the local operator. A time delay setting of 300s is used.
- x) Agreed Import Capacity (kW): The import capacity of the connected customer derived from their connection agreement.

For example, if the Agreed Import Capacity is 10MW a value of 10000kW is used.

- y) Agreed Import Capacity Exceeded Alarm Time Delay: The time period over which import must be above the Agreed Export Capacity before an alarm is sent to Control. A value of 30s is used.
- z) Stage 1 Power Delta (+/-): used only when both the demand constraint and generator constraint functions are set to "1". This setting is used in combination with the stage 1 power setting to determine both an upper and lower limit for the permitted power flow at the connection point, as per the diagram below:





- aa) Stage 2 Power Delta (+/-): used only when both the demand constraint and generator constraint functions are set to “1”. This setting is used in combination with the stage 2 power setting to determine both an upper and lower limit for the permitted power flow at the connection point, as per the diagram above.

The combination of stage 1 / stage 2 power settings and power deltas can be used to impose a “one-sided” constraint where the connected apparatus is capable of both export and import.

If a battery storage site, for example, were to be required to constrain to zero export under stage 1, but be unconstrained for import, then the stage 1 power setting would be half the agreed import capacity, with the stage 1 power delta also being set to half the import capacity.

Alternatively, the stage 2 output from the panel could be wired to trip a customer breaker, disconnecting the apparatus entirely.

- bb) Demand Constraint Function: Set to “1” to enable demand constraint.
- cc) Generator Constraint Function: Set to “1” to enable generator constraint.

Note that at least one of the demand / generator constraint functions must be enabled. Otherwise the panel will default to generator constraint.

- dd) Comms Fail Operate Delay (s): when the CCP receives a coms fail signal from the RTU for a period exceeding the Comms Fail Operate Delay the CCP initiates a stage 1 constraint.

WPD RTUs wait 2 minutes, before sending a comms fail signal to the CCP and therefore a Coms Fail Operate Delay setting of 0s gives a total coms fail operating time of 120s and a setting of 30s gives a total delay of 150s.

PSD specify these settings in increments of 30s (e.g. 0s, 30s, 60s up to 180s) to ensure that for widespread communications problems or for IT problems the load is curtailed in discrete stages, separated by a time delay of 30s, to prevent network instability issues.

- ee) Stage 2 Output Time Delay (s): This is a discrete time delay relay that closes a normally open contact to implement the stage 2 constraint. This is used to trip one or more customer circuit breakers to disconnect the generation, demand or energy storage, as appropriate, to satisfy the Stage 2 Power Limit requirement.

Where one or more of these customer circuit breakers are located in the same switch room as the Generator Constraint Panel a time delay is applied to the relay to give a local operator time to vacate the room before the circuit breaker/s trip.

The standard time delay is 20s but this should be reduced to a minimum value where the circuit breakers are not located in the same switch room as the CCP. Note, the Stage 2 Confirmation Time Delay and the Stage 2 Power Limit Time Delay settings must be greater than this setting.

A standard setting sheet is given in Appendix B1.

## **5.0 SETTINGS - Voltage Constraint Scheme with Soft Intertrip (Generation Constraint Only)**

- 5.1 Unlike the Soft Intertrip-only schemes, Voltage Constraint schemes may only be applied to generation constraint schemes. Voltage constraint cannot be used for with demand constraint or energy storage constraint schemes.

- 5.2 Voltage constraint schemes are initiated when the voltage measured by the CCP exceeds the Stage 1 Operate Voltage setting, or when instructed by PoF / Control. The settings applied to Connection Control Panels for Voltage Constraint Schemes are more complex than those for Soft Intertrip schemes. Guidance on the application of these setting is given below:

- a) CT Primary Current (A): The primary rating of the CTs. Typical values are 200, 400 or 800A.

- b) CT Secondary Current (A): The secondary rating of the CTs (i.e. 1A or 5A)
- c) VT Primary Voltage (V): The primary voltage rating of the VT (i.e. 6600, 11000, 33000 or 66000).

The “VT secondary” value applied in the CCP software is the VT Primary Voltage divided by the VT Secondary Voltage. For example, for a 33000/110V VT the value would be  $33000/110 = 300$ .

- d) VT Secondary Voltage (V): The secondary voltage rating of the VT (i.e. 110V).

The “VT Primary” value applied in the software is 1.

- e) Stage 1 Operate Voltage (kV): The phase to phase voltage above which, the scheme picks up and starts the Stage 1 Operate Timer. This value only has to be exceeded by one phase to phase voltage to start the timer. A value that is 1% above the relevant voltage limit is typically applied

For an 11kV or 6.6kV network the maximum voltage limit is derived from Table 1 or Table 2 of POL: SD4, as applicable. For example, if WPD’s distribution transformers are set on the +5% tap position the voltage limit is 11.59kV. In this case a setting of  $11.59\text{kV} \times (101/100) = 11.71\text{kV}$  is applied.

For 33kV, 66kV and 132kV networks the setting, if required, is typically 1% above the statutory voltage limit. For example, for a 33kV Network a setting of  $33\text{kV} \times (106/100) \times (101/100) = 35.33\text{kV}$  is applied.

- f) Stage 1 Reset Voltage (kV): If Stage 1 Constraint is initiated and the measured phase to phase voltage across all phases is below the Stage 1 Reset Voltage setting the Stage 1 Reset Timer starts. Typically a setting of 99% of the Stage 1 Operate Voltage is applied.

For the example, if the Stage 1 Operate Voltage is 11.71kV then a value  $11.71 \times (99/100) = 11.59\text{kV}$  is applied to the Stage 1 Reset Voltage.

If the Stage 1 Operate Voltage is 35.33kV then a value of  $35.33 \times (99/100) = 34.98\text{kV}$  is applied to the Stage 1 Reset Voltage.

- g) Stage 1 Operate Time Delay (s): If the measured voltage exceeds the Stage 1 Operate Voltage for more than this duration the Stage 1 Constraint will operate. In most cases this time delay is set above the time delay applied to the tap-change control relays at the substation (primary substation, BSP etc.) that supplies the connection. This allows time for the tap-changers to resolve any high voltage issues before the generator is constrained. If the tap-change control relays have a time delay of 90s, for example, a Stage 1 Operate Time Delay of 100s would be appropriate.

In some cases it may be necessary to apply a time delay which is shorter than the tap-change control relay delays, for example, at sites where the voltage is expected to rise substantially under back-feed conditions. Where this is the case the Stage 1 Operate Time Delay could be set as low as 10s.

- h) Stage 1 Operate Timer Reset Delay (s): Not currently used. Leave on the default value of 0s.
- i) Stage 1 Reset Time Delay (s): Once the Stage 1 Constraint has operated, if the voltage returns below the Stage 1 Reset Voltage for longer than this setting the Stage 1 Constraint will reset. A setting of 10 minutes (600s) is used.
- j) Stage 1 Confirmation Contact Time Delay (s): This is the time limit within which the Generator must confirm that the Stage 1 Constraint has been implemented (from initiation of the Stage 1 Constraint). This is typically set to 1s.
- k) Stage 1 Power Limit Time Delay (s): This is the time limit within which the measured Active Power must satisfy the Stage 1 Power Limit (from initiation of the stage 1 constraint). A setting of 10s is normally applied.

This setting may be increased, up to a maximum setting of 30s where the Generator is unable to reduce their export within 10s, as long as WPD's network is capable of withstanding this level of export for 30s.

- l) Stage 2 Confirmation Contact Time Delay (s): This is the time limit within which the connected customer must confirm that the Stage 2 Constraint has been implemented (from initiation of the Stage 2 Constraint). This time delay must be at least 1s longer than the setting on the Stage 2 Output Time Delay relay.

For example, if the Stage 2 Output Time Delay relay is set at 20s a Stage 2 Confirmation Contact Time Delay of 25s would be acceptable. This would give the Generator 5s to confirm that they have implemented Stage 2 following receipt of the Stage 2 operate signal.

- m) Stage 2 Power Limit Time Delay (s): This is the time limit within which the measured Active Power must satisfy the Stage 2 Power Limit (from initiation of the stage 1 constraint). This delay must be at least 1s longer than the Stage 2 Output Time Delay Relay.

For example, if the Stage Output Time Delay relay is set at 20s a Stage 2 Power Limit Time Delay of 30s would be acceptable. This would give the Generator 10s to trip the associated load (generation or demand) following receipt of the Stage 2 operate signal.

Note, if the customer's installation only has one stage of constraint then operation of the Stage 1 Constraint will bypass the Stage 2 Time Delay relay and cause the customer's circuit breaker/s to trip instantaneously.

- n) **Stage 1 Power Setting (kW):** This is the Active Power limit that the Generator must satisfy when a Stage 1 Constraint is initiated. A positive value of Active Power indicates imported Active Power. This means that the measured Active Power must be mathematically greater than the limit in order for this requirement to be satisfied.

For example, if the export is to be reduced to 1MW when Stage 1 Constraint is initiated a value of -1000kW is selected. In this case a measured export of -999kW would satisfy the requirement.

- o) **Stage 2 Power Setting (kW):** This is the Active Power limit that the Generator must satisfy when a Stage 2 Constraint is initiated. This value should be mathematically greater than Stage 1 Power limit.

For example, if the generator is expected to disconnect all generation when a Stage 2 Constraint is initiated a setting of 0kW would be selected. This value is mathematically greater than the -1000kW setting chosen in the Stage 1 Power limit example).

- p) **Power Dead Band (kW):** This is a range of measured Active Power that is considered, by the CCP, to be zero. The reason for having a dead band is to ensure that errors in the CTs, VTs and programmable logic controller (PLC) do not give rise to false operations when Stage 1 or Stage 2 Power Limits are set at, or close to zero. The required setting depends on the connection voltage (i.e. VT primary voltage) and the rating of the CT primary winding. The minimum settings are given in the following table:

<b>Minimum Power Dead Band Settings (kW)</b>					
<b>CT Primary (A)</b>	<b>Connection Voltage</b>				
	<b>132kV</b>	<b>66kV</b>	<b>33kV</b>	<b>11kV</b>	<b>6.6kV</b>
50	90	50	30	10	10
100	180	90	50	20	10
200	350	180	90	30	20
400	690	350	180	60	40
600	1030	520	260	90	60
800	1380	690	350	120	70
1000	1720	860	430	150	90
1200	2060	1030	520	180	110

- q) Frequent Operation Counter: It is possible that under N-1 conditions the voltage constraint scheme will operate and reset several times in short succession (as the generation is constrained then restored again). A Frequent Operations Alarm is provided that warns Control if the number of operations exceeds the number defined by the Frequent Operations Counter within the Frequent Operation Time Delay. A setting of 3 is used.
- r) Frequent Operation Alarm Time Delay (s): The time delay associated with the Frequent Operations Alarm, as described above. A setting of 40 minutes is applied.
- s) Voltage Block Setting (kV): When the voltage drops below this value the constraint scheme is blocked. This prevents the scheme mal-operating during network faults. A setting of 80% of the primary VT winding is used.

For example, if a 33kV / 110V VT is used the setting shall be 80% of 33kV = 26.40kV.

- t) Soft Intertrip Algorithm: A value of 0 is applied, which implements the Voltage Constraint logic in conjunction with the Soft Intertrip logic (rather than the Soft Intertrip logic only).
- u) Agreed Export Capacity (kW): The export capacity of the connected customer as determined from their connection agreement.

For example, if the Agreed Export Capacity is 10MVA a value of 10000kW is used.

- v) Agreed Export Capacity Exceeded Alarm Time Delay: The time period over which export must be above the Agreed Export Capacity before an alarm is sent to Control. A value of 30s is used.
- w) Comms Fail Restoration Time: The time taken before Stage 1 is automatically reset, following restoration of the communications link between the CCP and PowerOn. Note, this automatic stage 1 reset function is over-ruled / blocked if Stage 1 is operated by PoF / Control or the local operator, or if it is initiated by high volts. A time delay setting of 300s is used.
- x) Agreed Import Capacity (kW): The import capacity of the connected customer as determined from their connection agreement.

For example, if the Agreed Import Capacity is 10MVA a value of 10000kW is used.

- y) Agreed Import Capacity Exceeded Alarm Time Delay: The time period over which import must be above the Agreed Import Capacity before an alarm is sent to Control. A setting of 30s is used.
- z) Stage 1 Power Delta (+/-): Not applicable.
- aa) Stage 2 Power Delta (+/-): Not applicable.
- bb) Generation Constraint Function: Set to "1" to enable generator constraint.
- cc) Demand Constraint Function: Voltage constraint schemes applicable to generation only, set to "0" to disable demand constraint.
- dd) Comms Fail Operate Delay (s): when the CCP receives a coms fail signal from the RTU for a period exceeding the Coms Fail Operate Delay the CCP initiates a stage 1 constraint.

WPD RTUs wait 2 minutes, before sending a comms fail signal to the CCP and therefore a Coms Fail Operate Delay setting of 0s gives a total coms fail operating time of 120s and a setting of 30s gives a total delay of 150s.

PSD specify these settings in increments of 30s (e.g. 0s, 30s, 60s up to 180s) to ensure that for widespread communications problems or for IT problems the load is curtailed in discrete stages, to prevent network instability issues.

- ee) Stage 2 Output Time Delay (s): This is a discrete time delay relay that closes a normally open contact to implement the stage 2 constraint. This is used to trip one or more customer circuit breakers that disconnect the relevant generation in order to satisfy the Stage 2 Power Limit requirement.

Where one or more of these circuit breakers are located in the same switch room as the Generator Constraint Panel a time delay shall be applied to the relay to give a local operator time to vacate the room before the circuit breaker/s trip.

The standard time delay is 20s but this should be reduced to a minimum value where the circuit breakers are not located in the same switch room as the CCP. Note, the Stage 2 Confirmation Time Delay and the Stage 2 Power Limit Time Delay settings must be greater than this setting.

A standard setting sheet is given in Appendix B2.

## **6.0 PLANT ORDERING AND COSTS**

### **6.1 Plant Ordering Process**

6.1.1 Plant ordering forms for CCPs are available from the WPD Plant Centre Ordering link on the Corporate Information page. At the time of writing the following options are available:

- Option A: CCP with T1/21 RN2d RMU with 200A tee off, T300, Modbus card, 3 actuators, CT/VT marshalling cabinet, VIP300/VIP400 and MU2d/N25 Metering Unit (100/50/5 metering CTs).
- Option B: CCP with T2/21 RN2d RMU with 200A tee off, T300, Modbus card, 3 actuators, CT/VT marshalling cabinet, VIP300/VIP400 relay and MU2d/N26 Metering Unit (200/100/5 metering CTs).
- Option C: CCP with T2/21 RN6c RMU with 630A tee off, T300, Modbus card, 3 actuators, CT/VT marshalling cabinet, VIP300 relay and MU6/N16 Metering Unit (400/200/5 metering CTs).
- Option D: CCP with T2/21 RN6c RMU with 630A tee off, T300, Modbus card, ACE card, DC to DC converter, 3 actuators, CT/VT marshalling cabinet, Sepam Relay (with NVD) and MU6/N16 Metering Unit (400/200/5 metering CTs).
- Option E: CCP only suitable for use with 1A protection CTs
- Option F: CCP only suitable for use with 5A protection CTs

6.1.2 A marshalling cabinet may, in some cases, be required between the CCP and Generator's equipment/switchgear. Where this is the case, this shall be specified and ordered separately.

### **6.2 Communications System Ordering Process**

6.2.1 SURF Telecom two different ordering processes, one for 11kV Automation (which rely on unlicensed communications) and another for Licensed Communication Systems (for Soft Intertrip Schemes and for all  $\geq 33$ kV sites):

#### **6.2.1.1 Unlicensed Radio (i.e. for 11kV and 6.6kV Automation)**

Unlicensed Radio systems for 11kV and 6.6kV Voltage Constraint Schemes are ordered via the SURF Automation Request Form which may be accessed from the Corporate Information Page or via the following link:

[11kV Automation Request Forms](#)

Two forms are available, one for the Midlands and another for the South West and Wales.



For all Midlands Areas, and also for South West and South Wales locations using the new PDR121 radio systems, the following facilities shall be ordered:

- DNP\_T200\_4 (for the switchgear requirements)
- DNP\_LDCON (for the CCP)

For South West and South Wales locations that utilise existing Netman radio systems:

- T200\_CGGC (for the switchgear and CCP)

Note, where a SEPAM relay is fitted to the Ringmaster RMU and NVD facilities are required this requirement must be specifically stated in the comments field.

#### 6.2.1.2 Licensed Radio (i.e. Soft Intertrip and all $\geq 33\text{kV}$ Connections)

For all licensed radio applications the WPD Telecoms Enquiry Form shall be used. This form is available via “WPD Telecoms” and then “WPD Telecoms Solutions Page” link on the Corporate Information page. Alternatively the following link may be used:

[WPD Telecoms Enquiry Form](#)

### 6.3 Costs

- 6.3.1 CROWN estimating and charging includes Standard Work Elements (SWEs) for CCPs. Two options are included, one for an 11kV or 6.6kV CCP and another for a 33kV or 66kV CCP. In both cases costs are included for connecting and testing the CCPs. These costs include the provision of a CT/VT Marshalling Cabinet (in the case of ordering options A, B, C and D).
- 6.3.2 An additional marshalling cabinet may, in some cases, need to be installed between the CCP and the Generator’s switchgear / equipment (as shown in Figure 1). Any such costs shall be included as an extra.
- 6.3.3 SWEs have not been set up for the costs associated with the radio system. These costs, which are provided by WPD Telecoms, shall be added as an extra.

## 7.0 COMPETITION IN CONNECTIONS

- 7.1 The CCPs, customer interface panels, and radio equipment is deemed to be non-contestable whereas the associated switchgear, metering unit and T300 RTU are all contestable. Appendix A includes a list of the contestable plant items for ordering options A to D.

- 7.2 For ordering option A to D, where an ICP is providing the Schneider RMU, metering unit and RTU, the ICP must deliver their equipment to the WPD's Plant Workshop at Cwmbran or Huthwaite so that the CCP can be connected and all the equipment tested together before being delivered to site. The contestable plant items described in Appendix A includes multicore cables and glands that are used to connect between the various items. Additional cables and glands are provided by WPD.
- 7.3 In the case of ordering option E and F the Plant Centre will test the CCP separately. It will then be connected to the remaining equipment on site. In this case the multicore cables and glands that connect between the CCP and WPDs switchgear and SCADA equipment will be provided and installed by WPD. The complete system will then be tested and commissioned.
- 7.4 Multicores required between the customer's equipment and the CCP / marshalling cabinet shall be provided by the customer. WPD or the ICP, as appropriate, shall connect the multicores to the CCP / marshalling cabinet.

## **8.0 COMMISSIONING REQUIREMENTS**

### **8.1 Testing in the Workshop**

- 8.1.1 CCPs must undergo extensive commissioning in Cwmbran or Huthwaite Plant Workshop prior to being installed on site. Where the panel is associated with a new 11kV ring main unit the CCP, Automation RTU and the plant (switchgear and metering unit) shall be connected and tested together. Further information will be provided in ST:SP10LA (Workshop Testing of Soft Intertrip Schemes) and ST:SP10LB (Workshop testing of Voltage Constraint Schemes).

### **8.2 On Site Testing**

- 8.2.1 Additional tests and checks are required on site. These tests should include (but are not limited to):
- Visual inspection of the CCP, CT connections VT connections and auxiliary supply connections.
  - Application and check of final settings
  - On load tests to confirm CT and VT connections and the magnitude of the voltage, current, active power and reactive power measured by the CCP. These test should confirm that the power flow is in the correct direction (imported power is +ve).
  - Local and remote operation of the CCP to confirm to its operation and associated indications (local and remote indications and alarms).
  - Check that the generation is constrained correctly and the generator provides confirmation signals.

## LIST OF CONTESTIBLE PLANT ITEMS ASSOCIATED WITH CCP INSTALLATIONS

Description of Item	WPD E5 Reference No.
<b>Plant Ordering Option A</b>	
Schneider T1/21 RN2d RMU with 200A tee off, VIP400 & 3 actuators (including CB actuator)	61750
Schneider Metering Unit MU2d - N25 100/50/5 CTs	61755
Schneider T300	61701
Schneider T300 Mounting Kit	61853
Schneider Modbus Card *	43496
<b>Plant Ordering Option B</b>	
Schneider T1/21 RN2d RMU with 200A tee off, VIP400 & 3 actuators (including CB actuator)	61750
Schneider Metering Unit MU2d - N26 200/100/5 CTs	61756
Schneider T300	61701
Schneider T300 Mounting Kit	61853
Schneider Modbus Card *	43496
<b>Plant Ordering Option C</b>	
Schneider T1/21 RN6c RMU with 630A tee off, VIP300 & 3 actuators (including CB actuator)	42597
Schneider Metering Unit N16 400/200/5 CTs	60769
Schneider T300	61701
Schneider T300 Mounting Kit	61852
Schneider Modbus Card *	43496
<b>Plant Ordering Option D</b>	
Schneider T1/21 RN6c RMU with 630A tee off, SEPAM Relay & 3 actuators (including CB actuator) and DC to DC converter.	60776
Schneider Metering Unit N16 400/200/5 CTs	60769
Schneider T300	61701
Schneider T300 Mounting Kit	61852
Schneider Modbus Card	43496

\* For Options A, B and C the Modbus cards are not required for installations in East Midlands and West Midlands Areas

## GENERIC SETTING SHEET (Soft Intertrip Only)

Parameter	Setting	Software Parameter	Software Value
CT Primary Current	800A	CT Secondary	800
CT Secondary Current	1A	CT Primary	1
VT Primary	33000V	VT Secondary	300
VT Secondary	110V	VT Primary	1
Stage 1 Operate Voltage	Not used	S1_VT1_ENABLE	Not used
Stage 1 Reset Voltage	Not used	S1_VT2_DISABLE	Not used
Stage 1 Operate Time Delay	Not used	TT1_S1_ENABLE_TIME	Not used
Stage 1 Operate Timer - Reset Delay	Not used	S1_RESET_TIMER_PERIOD	Not used
Stage 1 Reset Time Delay	Not used	TT2_S1_DISABLE_TIME	Not used
Stage 1 Confirmation Contact Time Delay	1s	S1_RESP_TIME	1,000ms
Stage 1 Power Limit Time Delay	10s	TT3_S2_ENABLE_TIME	10,000ms
Stage 2 Confirmation Time Delay*	25s	S2_RESP_TIME	25,000ms
Stage 2 Power Limit Time Delay*	30s	FAILED_TO CONSTRAIN_TIMEOUT	30,000ms
Stage 1 Power Setting	-5000kW	PWR_MIN_ALLOWED	-5000kW
Stage 2 Power Setting	0kW	FTC_PWR_MIN_ALLOWED	0kW
Power Dead Band (+/-)	+/- 350kW	PWR_DISCONNECT_DELTA	350kW
Frequent Operations Alarm Count	Not used	FOP_ALLOWABLE_COUNT	Not used
Frequent Operations Alarm Time Delay	Not used	FOP_ALLOWABLE_TIME	Not used
Voltage Block Setting	26.40kV	VALID_VOLTAGE_LEVEL	26400V
Soft Intertrip Algorithm 0 = Voltage Constraint 1 = Soft Intertrip	1	ENABLE_SOFT_INTERTRIP	1
Agreed Export Capacity	10000kW	MAX_EXPORT_CAPACITY	-10000kW
Export Capacity Exceeded Alarm Time Delay	30s	EXPORT_ALARM_ENABLE_TIME	30,000mS
Comms. Fail Restoration Time	300s	COMMS_FAIL_RESTORE_TIME	300,000mS
Agreed Import Capacity	10000kW	MAX_IMPORT_CAPACITY	10000kW
Import Capacity Exceeded Alarm Time Delay	30s	IMPORT_ALARM_ENABLE_TIME	30,000mS
Stage 1 Power Delta (+/-) <sup>[2]</sup>	+/- 0kW	TARGET_POWER_DELTA	0
Stage 2 Power Delta (+/-) <sup>[2]</sup>	+/- 0kW	FTC_POWER_DELTA	0
Generation Constraint Function <sup>[1]</sup> 0 = Disabled 1 = Enabled	1	ENABLE_EXPORT_CONSTRAINT	1
Demand Constraint Function <sup>[1]</sup> 0 = Disabled 1 = Enabled	0	ENABLE_IMPORT_CONSTRAINT	0
Comms. Fail Operate Delay	0 to 180s	COMMS_FAIL_DELAY_TIME	0 to 180,000mS
Stage 2 Output Time Delay Relay (discrete relay)	20s		

**GENERIC SETTING SHEET (Soft Intertrip with Voltage Constraint)**

Parameter	Setting	Software Parameter	Software Value
CT Primary Current	800A	CT Secondary	800
CT Secondary Current	1A	CT Primary	1
VT Primary	33000V	VT Secondary	300
VT Secondary	110V	VT Primary	1
Stage 1 Operate Voltage	35.33kV	S1_VT1_ENABLE	35330V
Stage 1 Reset Voltage	34.98kV	S1_VT2_DISABLE	34980V
Stage 1 Operate Time Delay	100s	TT1_S1_ENABLE_TIME	100,000ms
Stage 1 Operate Timer - Reset Delay	0s	S1_RESET_TIMER_PERIOD	0s
Stage 1 Reset Time Delay	600s	TT2_S1_DISABLE_TIME	600,000ms
Stage 1 Confirmation Contact Time Delay	1s	S1_RESP_TIME	1,000ms
Stage 1 Power Limit Time Delay	10s	TT3_S2_ENABLE_TIME	10,000ms
Stage 2 Confirmation Time Delay*	25s	S2_RESP_TIME	25,000ms
Stage 2 Power Limit Time Delay*	30s	FAILED_TO CONSTRAIN_TIMEOUT	30,000ms
Stage 1 Power Setting	-1000kW	PWR_MIN_ALLOWED	-1000kW
Stage 2 Power Setting	0kW	FTC_PWR_MIN_ALLOWED	0kW
Power Dead Band (+/-)	+/- 350kW	PWR_DISCONNECT_DELTA	350kW
Frequent Operations Alarm Count	3	FOP_ALLOWABLE_COUNT	3
Frequent Operations Alarm Time Delay	2400s	FOP_ALLOWABLE_TIME	2400000mS
Voltage Block Setting	26.40kV	VALID_VOLTAGE_LEVEL	26400V
Soft Intertrip Algorithm 0 = Voltage Constraint 1 = Soft Intertrip	0	ENABLE_SOFT_INTERTRIP	0
Agreed Export Capacity	10000kW	MAX_EXPORT_CAPACITY	-10000kW
Export Capacity Exceeded Alarm Time Delay	30s	EXPORT_ALARM_ENABLE_TIME	30,000mS
Comms. Fail Restoration Time	300s	COMMS_FAIL_RESTORE_TIME	300,000mS
Agreed Import Capacity	10000kW	MAX_IMPORT_CAPACITY	10000kW
Import Capacity Exceeded Alarm Time Delay	30s	IMPORT_ALARM_ENABLE_TIME	30,000mS
Stage 1 Power Delta (+/-) <sup>[2]</sup>	Not used	TARGET_POWER_DELTA	Not used
Stage 2 Power Delta (+/-) <sup>[2]</sup>	Not used	FTC_POWER_DELTA	Not used
Generation Constraint Function <sup>[1]</sup> 0 = Disabled 1 = Enabled	1	ENABLE_EXPORT_CONSTRAINT	1
Demand Constraint Function <sup>[1]</sup> 0 = Disabled 1 = Enabled	0	ENABLE_IMPORT_CONSTRAINT	0
Comms. Fail Operate Delay	0 to 180s	COMMS_FAIL_DELAY_TIME	0 to 180,000mS
Stage 2 Output Time Delay Relay (discrete relay)	20s		

### DRAWINGS

Schematic drawings and wiring diagrams applicable to the ZIV connection control panel can be found [here](#).

## **APPENDIX D**

### **SUPERSEDED DOCUMENTATION**

This document supersedes ST: TP18A/1 dated June 2018 which has now been withdrawn.

## **APPENDIX E**

### **ANCILLARY DOCUMENTATION**

POL:SD4	11kV and 6.6kV Network Design
POL:SD3	33kV and 66kV Network Design
POL:SD10	Managing Processes for Alternative Connections
ST:SD10A	Process for Offering a Timed Connection
ST:SD10B	Process for Offering a Soft Intertrip Connection
ST:SP10LA	Workshop Testing of Generator Constraint Panels Configured for Soft Intertrip
ST:SP10LB	Workshop Testing of Generator Constraint Panels Configured for Voltage Constraint
POL: TP14	Electricity Metering Interface
ST: SD4OA	11kV and 6.6kV Connections to Customers and IDNOs Secondary Type Switchgear Arrangements
ST: SD4OB	11kV and 6.6kV Connections to Customers and IDNOs Primary Switchgear Arrangements

## **APPENDIX F**

### **KEY WORDS**

Constraint, Curtail, Generator Constraint Panel, Demand Constraint, Energy Storage Constraint, CCP, Voltage Constraint, Soft Intertrip, Active Network Management.