# Application Note: AIMETHOD

Revision: 042023

To whom it may concern,

This Application Note is intended to describe the unintentional islanding detection method employed within the CPS SCA25KTL, SCA36KTL, SCA50KTL, SCA60KTL, SCH100KTL, SCH125KTL, and SCH275KTL 3Phs TL inverters. The information provided is in response to the information requested within the National Grid document *Supporting Documentation for Interconnection Study Application For Inverter-based DER Systems*, Version 3.0, 3/1/2022.

*1. Identify the manufacturer*

Chint Power Systems Co., LTD.

*2. Identify the model(s)*

SCA25KTL-DO/US-208, SCA25KTL-DO-R/US-480, SCA36KTL-DO/US-480, SCA50KTL-DO/US-480, SCA60KTL-DO/US-480, SCH100KTL-DO/US-480, SCH100KTL-DO/US-600, SCH125KTL-DO/US-600, and SCH275KTL-DO/US-800.

*3. Identify inverter listing UL1741, UL1741 SA, UL1741 SB Edition 3, Non-listed)*

The CPS SCA25KTL-DO/US-208, SCA25KTL-DO-R/US-480, SCA36KTL-DO/US-480, SCA50KTL-DO/US-480, SCA60KTL-DO/US-480, SCH100KTL-DO/US-480, SCH100KTL-DO/US-600, SCH125KTL-DO/US-600, and SCH275KTL-DO/US-800 inverters are listed to UL1741-SA and UL1741-SB.

*4. Contact information for the inverter manufacturer (Name, email address, mailing address and phone number)*

See below.

*5. Identify if the inverter is 3-phase or 1-phase*

The inverters are 3-phase.

*6. Identify the inverter islanding detection method group as defined in SANDIA report https://www.osti.gov/servlets/purl/1463446*
*Group 1 or Group 2 or Group 2A or Group 2B or Group 2C or Group 3 or Group 4 or Group 5 or Group 6*

CPS 3Phs TL inverters employ the Group 1 islanding detection method.

*7. Provide a brief description of the island detection method proposed.*

CPS 3Phs TL inverters employ an active method to implement a phase and frequency shift to detect an islanding condition when there is a loss of Utility Power. The inverter will connect and export power to the Grid when the Grid voltage and frequency are within the operating ranges defined by IEEE1547. During operation, the inverter injects a very small amount of reactive power into its output current during every cycle. The amount of reactive power injection is comparable to introducing a phase shift between the output current and the Grid voltage at the AC terminals of inverter. The reactive power injection is equivalent to 0.57 degree in phase when frequency at AC terminals stays within +/-0.05 Hz of name-plate frequency. The amount of phase change is increased linearly with how much frequency is deviated from name-plate frequency: from 0.57 degree at a difference of 0.05Hz to a maximum of 2.8 degree at a difference of 0.2Hz or more. If the Grid is not present, the phase shift in current will cause a change in the voltage phase angle when compared to previous cycle. This change in voltage phase angle will result in the inverter attempting to either decrease or increase inverter frequency to follow the shift. When the inverter frequency reaches either the low frequency trip limit or the high frequency trip limit, the inverter will stop exporting power and disconnect from the Grid. If the Grid is present, the voltage phase angle at the AC terminals of inverter will not change in response to a phase shift in current. The inverter frequency will continue matching the Grid frequency. The total time for detection of Grid failure plus disconnection time from Grid takes less than 2 seconds.

*8. Does the inverter employ active or passive islanding detection? Provide documentation confirming that the islanding detection is "turned on" in the proposed inverter.*

The CPS 3Phs TL inverters employ an active method for islanding detection. As required by the NRTL listing to the UL1741 and IEEE1547 safety standards, the inverter (DR) must meet all power system interconnect requirements including an unintentional islanding test. The anti-islanding detection algorithm is "turned on" and set to Enable in the inverter operating firmware by default.

*9. For active islanding detection, various methods are available in the market. Identify the type of detection proposed. Is the method based on Sandia Frequency Shift, Sandia Voltage Shift, Sandia Impedance Shift Detection or Other? If Other, specify.*

The CPS 3Phs TL inverters use an active method for islanding detection based on the Sandia Frequency Shift Detection methodology.

*10. Does the active islanding detection utilize positive feedback?*

Yes, the active islanding detection algorithm uses positive feedback. See #7.

*11. If utilizing positive feedback, does the island detection employ a unidirectional or bi-directional perturbance?*

The frequency/phase shift method for islanding detection within the CPS 3Phs TL inverters employ a bi-directional perturbation. The inverter will attempt to drive the frequency both downward and upward to destabilize the resonant frequency of the island.

*12. Is there a dead zone in which the active islanding does not act?*

There is not a dead zone in which the active islanding does not act.

*13a. If the islanding detection is the same to meet both UL1741SA and UL1741 SB Edition 3, state here. Otherwise, please describe how the islanding detection changed from when the inverter was listed to UL1741SA to when it was listed to UL1741 SB Edition 3. Alternatively, two separate letters may be provided for each firmware version.*

The islanding detection method employed within the CPS 3Phs TL inverters is the same to meet both UL1741-SA and UL1741-SB.

*13b. Identify all functions verified by UL1741 SB as compatible with unintentional islanding compliance.*

The following Grid Support functions were verified as compatible; L/HVRT (Low/High Voltage Ride-Through), L/HFRT (Low/High Frequency Ride-Through), Q(V) (Volt-VAr), SPF (Specified Power Factor), RR (Ramp Rate), FW (Frequency Watt), and VW (Volt-Watt).

*13c. Identify all functions that are not verified by UL1741 SB as compatible with unintentional islanding compliance.*

N/A.

*13d. For each function verified in item 13b above, identify any parameters that adversely affect islanding detection and identify the worst-case tests used in UL1741 SB.*

None of the parameters adversely affected the islanding detection. Each of the unintentional islanding tests were performed multiple times with balanced to 5% percent capacitive/inductive load, with the following Grid Support functions enabled.

| Test | L/HVRT | L/HFRT | SPF | Q(V) | RR | FW |
|---|---|---|---|---|---|---|
| 1 | Enabled | Enabled | PF=1 | Disabled | 6% Pn/Sec | Disabled |
| 2 | Enabled | Enabled | PF=0.8 | Disabled | 10% Pn/Sec | Enabled, Fstart=61.0, Fstop=61.5Hz |
| 3 | Enabled | Enabled | PF=0.8 | Enabled | 10% Pn/Sec | Enabled, Fstart=61.0, Fstop=61.5Hz |

*14. Is there a self-protective overvoltage setting at 1.4pu voltage per ESB756 or lower, set to 1ms or less total clearing time activated in the inverter? If not, is there another means to meet the requirements in ESB 756 B, C, or D section 10.3? Indicate the settings and total clearing time here.*

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*15. Identify the inverter firmware version that incorporates the functionality described above.*

SCA25KTL-DO/US-208; DSP Firmware Version 1.0 or higher
SCA25KTL-DO-R/US-480; DSP Firmware Version 2.0 or higher
SCA36KTL-DO/US-480; DSP Firmware Version 18.0 or higher
SCA50KTL-DO/US-480; DSP Firmware Version 1.0 or higher
SCA60KTL-DO/US-480; DSP Firmware Version 1.0 or higher
SCH100KTL-DO/US-480; DSP Firmware Version 1.0 or higher
SCH100KTL-DO/US-600; DSP Firmware Version 1.0 or higher
SCH125KTL-DO/US-600; DSP Firmware Version 1.0 or higher
SCH275KTL-DO/US-800; DSP Firmware Version 1.0 or higher

*16. Is Rate of Change of Frequency (ROCOF) protection enabled in the inverter? If yes specify the settings.*

The CPS SCA25KTL-DO/US-208, SCA25KTL-DO-R/US-480, SCA36KTL-DO/US-480, SCA50KTL-DO/US-480, SCA60KTL-DO/US-480, SCH100KTL-DO/US-480, SCH100KTL-DO/US-600, SCH125KTL-DO/US-600 and SCH275KTL-DO/US-800 inverters include Rate of Change of Frequency (ROCOF) protection. The ROCOF function is automatically enabled when either the IEEE1547-2018 or HECO grid code is selected and enabled.

*17. Is voltage phase angle change (phase jump/vector shift) protection enabled in the inverter? If yes specify the settings.*

The voltage phase angle change (phase jump/vector shift) protection is automatically enabled within the CPS SCA25KTL-DO/US-208, SCA25KTL-DO-R/US-480, SCA36KTL-DO/US-480, SCA50KTL-DO/US-480, SCA60KTL-DO/US-480, SCH100KTL-DO/US-480, SCH100KTL-DO/US-600, SCH125KTL-DO/US-600 and SCH275KTL-DO/US-800 inverters when either the IEEE1547-2018 or HECO grid code is selected and enabled.

Please feel free to contact CPS if you have any further questions.

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