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NETWORKS

MANUFACTURER'S ELS PRODUCT DECLARATION FOR ESB NETWORKS FORM NC7-03-R1

ESB Networks DAC requires the information requested on this form to manage your electricity supply connection. As the Distribution System Operator, this information is also required to enable ESB Networks DAC to manage the electricity network. The data controller is ESB Networks DAC. Please refer to our privacy policy at https://esbnetworks.ie/privacy

All mandatory requirements in this form are as those required by ESB Networks Standard 'Conditions Governing the Connection and Operation of Export Limiting Schemes' (DOC-250221-GBT)

'Conditions Governing the Connection and Operation of Export Limiting Schemes' (DOC-250221-GBT) defines the technical design requirements for Export Limitation Schemes which limit the net site export to below an agreed maximum and are installed on the Customer's side of the Connection Point.

While DOC-250221-GBT does not describe a type test procedure, it does describe a number of system requirements. This document describes how the ELS product (outlined in Part 1 below) performs relative to key ESB Networks ELS requirements.

Please complete Parts 1 to 9 below

PART 1: PRODUCT DETAILS

Name of Product: SUN2000 Solar Inverter	Model No.: **SUN2000-3~6KTL-LB0** (Single phase hybrid inverter with battery input)
Manufacturer: Huawei Technologies Co., Ltd	Make: China

Where Manufacturer's ESB Networks ELS Product Declaration Form is unavailable an Export Limiting Relay shall be installed as per ESB Networks Standard 'Conditions Governing the Connection and Operation of Export Limiting Schemes' (DOC-250221-GBT)

PART 2: DESCRIPTION OF OPERATION

ESB Networks ELS Requirement: *A description of the scheme, its settings, and a single line diagram shall be permanently displayed on site.*

When installed, the ELS product (as outlined in Part 1) operates as described below:

Please insert details of operation below or if attached as PDF to this form tick here: ☒

PART 3: POWER QUALITY REQUIREMENTS

ESB Networks ELS Requirements:

Where the ELS product (as outlined in Part 1) relies on power electronics (e.g. Converters etc) to control the load it shall also provide information demonstrating compliance with the harmonics standards (I.S. EN 61000-3-2 and/or I.S. EN 61000-3-12) or provide data on the harmonic currents produced in accordance with the format in the Distribution Code i.e. individual harmonic current and Total Harmonic Distortion.

It is necessary to confirm the ELS product(as outlined in Part 1) complies with harmonic standards cited in the Distribution Code and product standards cited in I.S. EN 50549-1. The Manufacturer (as outlined in Part 1) confirms that the ELS product (as outlined in Part 1) complies with the requirements of the harmonics standards listed above or that the harmonic data has been provided.	Yes ☒ No ☐

PART 4: SYSTEM SCHEMATIC

The ELS product (as outlined in Part 1) is formed of the following main elements:

Document the main elements and provide a system schematic or if attached as PDF to this form tick here: ☒

1. Main elements:

2. System Schematic

PART 5: COMPONENT INTERCONNECTION/FAILSAFE OPERATION

ESB Networks ELS Requirements: The ELS product (as outlined in Part 1) may be formed of discrete units or integrated into a single packaged scheme. Where discrete units are used, they should preferably be interconnected using metallic or fibre optic cables. Other means of connection such as Wi-Fi are not deemed 'Fail Safe' and require installation of Export Limiting Relay. Irrespective of the media used for interconnecting between the discrete units, if the communication path fails the generation output shall be reduced to the allowed MEC within 5 seconds time to prevent the Agreed Export Capacity from being exceeded.

Description of the fail-safe functionality (Interruption of sensor signals, disconnection of load, loss of power, internal fault detection etc.)

5.1 Describe Component Interconnection here:

Text or diagram or if attached as PDF to this form tick here: ☒

5.2 System Fail Safe Test Results:

Please indicate appropriate answer

No.	Test	System Response	Time <5s	Pass
1	Remove Power Supply to PMU	Solar Inverter will cease production	Yes ☒ No ☐	Yes ☒ No ☐
2	Remove Power Supply to CU	Solar Inverter will cease production	Yes ☒ No ☐	Yes ☒ No ☐
3	Remove Power Supply to all Energy Source Units	Solar Inverter will cease production	Yes ☒ No ☐	Yes ☒ No ☐
4	Remove power Supply to all DCUs	N/A	Yes ☐ No ☐	Yes ☐ No ☐
5	Remove Power Supply to all Communication Hub Switches	N/A	Yes ☐ No ☐	Yes ☐ No ☐
6	Unplug PMU- CU Communications Cable	Solar Inverter will cease production, or revert to preset "Safe" power levels	Yes ☒ No ☐	Yes ☒ No ☐
7	Unplug CU – ESIU Communications Cable (at ESIU end)	N/A	Yes ☐ No ☐	Yes ☐ No ☐
8	Unplug all ESIU –Communication Cables in turn	Solar Inverter will cease production	Yes ☒ No ☐	Yes ☒ No ☐
9	Unplug CU – DCU Comms. Cable for each DCU unit (at DCU end)	N/A	Yes ☐ No ☐	Yes ☐ No ☐
10	Unplug DCU – Load Comms cable	N/A	Yes ☐ No ☐	Yes ☐ No ☐

The purpose of the 'Fail Safe' Tests is to ensure that if any part of the ELS fail, the exported power does not exceed the MEC by more than 5% for more than 5 seconds.

It is a fixed requirement that at no time during the 'Fail Safe' sequence shall the exported power rise above the MEC by more than 5% for more than 5 seconds.

PART 6: ACCURACY AND RESPONSE TIME

ESB Networks ELS requirements:
The overall accuracy of the ELS product (as outlined in Part 1) with regard to measurement and control of MEC shall be determined by the manufacturer of the system and published within its operating manual. In carrying out the functional tests these tolerances shall be taken into account.

Functional testing – Injection testing
Export limit conditions can be simulated by temporarily connecting the PMU to a calibrated injection test set.

When using an injection test set, there is no feedback loop between the ELS product (as outlined in Part 1) and the injection test set. This has two significant implications for the test process:

1. As soon as the ELS begins to operate, because it sees no corresponding decrease in export levels, the control loop continues running until the Energy Source Units output is reduced to the programmed export capacity or below.
2. To ensure that the ELS is reacting by the correct amount and within an acceptable time period, a step change needs be applied by the test set to the PMU.

The following Step Change test sequence shall be performed:

Please indicate appropriate answer

No.	Test	Step Change Final Value	Outcome	Pass / Fail
1.	Step change A 95% to 105%	Export = 105% of programmed export limit value	At 95% Voltage	Pass ☒ Fail ☐
			At 100% Voltage	Pass ☒ Fail ☐
			At 110% Voltage	Pass ☒ Fail ☐
	Step change A 95% to 110%	Export = 105% of programmed export limit value	At 95% Voltage	Pass ☒ Fail ☐
			At 100% Voltage	Pass ☒ Fail ☐
			At 110% Voltage	Pass ☒ Fail ☐
	Step change A 95% to 120%	Export = 105% of programmed export limit value	At 95% Voltage	Pass ☒ Fail ☐
			At 100% Voltage	Pass ☒ Fail ☐
			At 110% Voltage	Pass ☒ Fail ☐
2.	Step change B 95% to 105%	Export = 110% of programmed export limit value	At 95% Voltage	Pass ☒ Fail ☐
			At 100% Voltage	Pass ☒ Fail ☐
			At 110% Voltage	Pass ☒ Fail ☐
	Step change B 95% to 110%	Export = 110% of programmed export limit value	At 95% Voltage	Pass ☒ Fail ☐
			At 100% Voltage	Pass ☒ Fail ☐
			At 110% Voltage	Pass ☒ Fail ☐
	Step change B 95% to 120%	Export = 110% of programmed export limit value	At 95% Voltage	Pass ☒ Fail ☐
			At 100% Voltage	Pass ☒ Fail ☐
			At 110% Voltage	Pass ☒ Fail ☐
3.	Step change C 95% to 105%	Export = 120% of programmed export limit value	At 95% Voltage	Pass ☒ Fail ☐
			At 100% Voltage	Pass ☒ Fail ☐
			At 110% Voltage	Pass ☒ Fail ☐
	Step change C 95% to 110%	Export = 120% of programmed export limit value	At 95% Voltage	Pass ☒ Fail ☐
			At 100% Voltage	Pass ☒ Fail ☐
			At 110% Voltage	Pass ☒ Fail ☐
	Step change C 95% to 120%	Export = 120% of programmed export limit value	At 95% Voltage	Pass ☒ Fail ☐
			At 100% Voltage	Pass ☒ Fail ☐
			At 110% Voltage	Pass ☒ Fail ☐

The procedure for performing the test is as follows:

- Initially apply 100% of nominal voltage and inject current (at unity power factor) to mimic an exported Active Power equivalent to 95% of the export limit setting. Check that the ELS product(as outlined in Part 1) does not operate.
- Step up the current to give an export Active Power equivalent to 105% of the export Active Power limit (for Test A), Check that change in export level is "seen" by the PMU.
- Check that the Active Power exported by the generation reduces to a value at least 5% below the export limit setting within the specified reaction time. The test shall be repeated at the maximum statutory voltage (i.e. at 110% of nominal voltage at LV) and also at the minimum voltage limit (i.e. 90% of nominal voltage for LV connections).
- All the above tests shall also be repeated for step increases from 95% to 110% of the export limit and from 95% to 120% of the export limit as detailed above.

When injection testing is complete, the correct orientation of any current monitoring connections (including CT orientations) which may have been removed for the test shall be checked and verified as correct.

PART 6A: CONFIRMATION OF OPERATION OF ELS TO LIMIT EXPORT AS REQUIRED

ESB Networks ELS requirements:
The ELS product(as outlined in Part 1) shall detect an excursion and reduce the export to the MEC or less, within 5 seconds.
Under normal operating conditions, the ELS product (as outlined in Part 1) response time is less than 5 seconds.
Under loss of communications, or loss of power to any part of the ELS product (as outlined in Part 1), response time is less than 5 seconds.

Operation of above is confirmed	Yes ☒ No ☐
Operating Manual is available	Yes ☒ No ☐
The settings applied to ELS product(as outlined in Part 1) have taken account of the published (DOC-250221-GBT) tolerances to ensure the required export limits and voltage limits shall be maintained.	Yes ☒ No ☐

PART 7: PASSWORD PROTECTION

ESB Networks ELS requirement:

Once installed and commissioned, the ELS product(as outlined in Part 1) settings shall not be capable of being readily altered by the Customer and shall only be changed with the written agreement of ESB Networks.	Yes ☒ No ☐
All settings of the ELS product(as outlined in Part 1) are password protected and cannot be altered by the customer.	Yes ☒ No ☐

PART 8: INSTALLATION REQUIREMENTS

ELS Installation Requirements for ELS Product(as outlined in Part 1):

Please insert installation requirements or if attached as PDF to this form tick here: ☒

PART 9: MANUFACTURERS ELS PRODUCT DECLARATION FOR ESB NETWORKS

ESB Networks ELS requirement: Once installed and commissioned, the scheme settings shall not be capable of being readily altered by the Customer and shall only be changed with the written agreement of ESB Networks.

The ELS product (as outlined in Part 1) complies with the 'Conditions Governing the Connection and Operation of Export Limiting Schemes' (DOC-250221-GBT) when installed and commissioned in accordance with the product documentation.

Manufacturer's (as outlined in Part 1) Representative Details

Representative Name: Bouke van der Weerdt

Title: Chief Technical Officer

Email: boukev.weerdt@huawei.com

Contact Telephone Number: +31 638310865

Signature:

Date: 26 May 2025

ESB Networks DAC
Directors: Marguerite Sayers (Chairperson), Nicholas Tarrant, Caroline Spillane, Ian Talbot, Michael Nolan.
Registered office: Three Gateway, East Wall Road, Dublin 3, D03 R583, Ireland.
Registered in Ireland No. 465172

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Part 2: Description of Operation

The Export Limiting System (ELS) is implemented inside the SmartLogger. The SmartLogger is connected to a Power Sensor located at the utility grid connection (behind the meter) via a shielded 2-wire Modbus RTU (RS485) communication line. Depending on the customer's requirements the power generation resources are configured using one or more solar inverters and/or one or more AC coupled Battery Energy Storage Systems (BESS).
Based on the measurements obtained from the Power Sensor, the SmartLogger will adjust the solar inverter and/or BESS AC Output Power to prevent power being exported to the utility grid.
The Power Export threshold value (which can be set to 0 Watts) is configured in the SmartLogger settings. These settings are password-protected from tampering and can only be accessed by an authorized service technician.

Part 4: Main Elements & System Schematic

1. Inverter – One or more "SUN2000" or "SUN5000" Solar inverter products,
   ESS – One or more "LUNA2000" Li-Ion Battery Energy Storage System with integrated DC/AC Power Conversion System.
   These products implement the following ELS functional block:
   * *Energy Source*
   * ESIU – Energy Source Interface Unit

   Note: This document is not applicable to Huawei Hybrid Solar Inverters with DC Coupled Battery Systems.

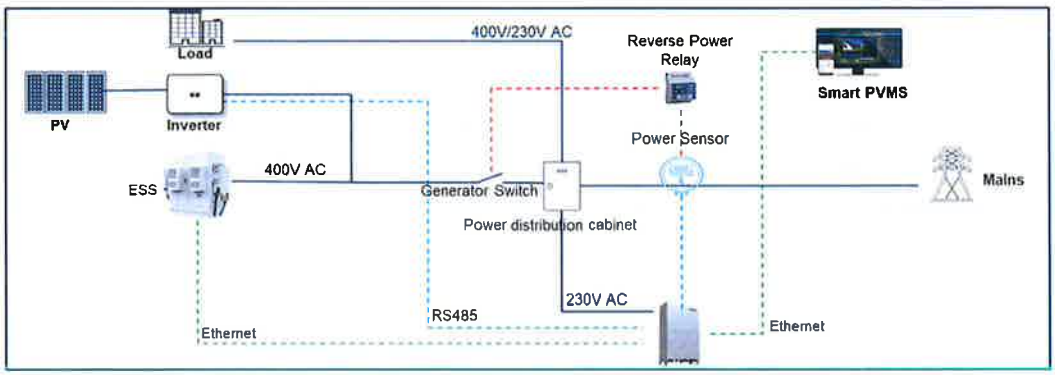
2. Power Sensor – Any of the listed and approved compatible power meters provided in Part 8 of this document.
   This product implements the following ELS functional block:
   * *PMU – Power Measurement Unit*

3. Array Controller – Individual "SmartLogger" products or SmartLogger embedded in "SACU" Smart Array Control Unit.
   This product implements the following ELS functional blocks:
   * CU – Control Unit
   * CH – Communications Hub

   Note: In larger installations, the Communications Hub (CH) may be embedded as an additional component in the Smart Array Control Unit or separate from an individual SmartLogger.

4. Reverse Power Relay – A 3rd party component, not part of Huawei's delivery scope, that must be installed to prevent excessive export power in case of a communications failure in ESIU.

System Schematic



Part 5: Component Interconnection and Failsafe Operation

The Array Controller retrieves the power value from the Power Sensor at regular intervals (approximately every second) and updates the internal power setpoint in the inverter to maintain the power balance in the system and prevents export to the utility grid.

When the Array Controller does not receive data from the power sensor for a predefined period (less than 5 seconds) it will command all connected solar inverters and ESS to a predefined "safe" curtailment power setpoint (i.e. a value that is known never to exceed the internal loads), or to switch off.

Each individual Solar Inverter and ESS power converter has an integrated ESIU. This function monitors the data communication with the connected Array Controller. If the ESIU in an individual Energy Source detects an interruption in the data communication, it will switch off that individual energy source.

In return, the Array Controller may detect the sudden power drop due to the disconnected energy source. It will respond to restore the power flow at the Power Sensor, by commanding the remaining energy sources to increase their output power.

The Energy sources may not respond in time when a communication disruption occurs, in which case it will continue to execute the last known power setpoint. If the control unit is unable to regain control over the Energy Sources, and the condition could lead to an excessive power export to the grid, the Reverse Power Relay will trip and disconnect the energy sources from the customer's distribution system.

System Fail Safe Test Results:

1. *Remove Power Supply to PMU:*
   When the power supply to the PMU is removed, it will no longer provide measurement data to the Control Unit (CU). The CU will command the energy sources to a predefined "safe" output power or to cease operation entirely.
2. *Remove Power Supply to CU:*
   When the power supply is removed from the CU, it will no longer provide setpoints to the connected ESIU's. The individual ESIU's will command the energy sources to cease operation. If the response is too slow and the condition results in an excessive power export condition, the RPR will trip and disconnect all energy sources.
3. *Remove Power Supply to all Energy Source Interface Units:*
   When the power supply to any individual energy source or ESIU is removed, it will immediately cease operation. The CU will attempt to restore the power balance by commanding the remaining ESIU's to a higher power output.
   When power is removed from all energy sources or all ESIU's, all will cease operation immediately. The local loads will be powered from the power grid.
4. *Remove Power Supply to all DCU's:*
   Not Applicable, the DCU is outside the Huawei scope.
5. *Remove Power Supply to all Communication Hub Switches:*
   In some scenario's an additional Communications Hub is used for larger ELS systems. If the power supply to a CH is removed, it will break the communications between the CU and the individual ESIU's. The ESIU's will detect the communications loss and cease operation. The individual ESIU's will command the energy sources to cease operation. If the response is too slow and the condition results in an excessive power export condition, the RPR will trip and disconnect all energy sources.
6. *Unplug PMU – CU Communications Cable:*
   Identical to power loss in the PMU. The CU will command the energy sources to a predefined "safe" output power or to cease operation entirely.
7. *Unplug CU – ESIU Communications Cable:*
   The individual ESIU's will command the energy sources to cease operation. If the response is too slow and the condition results in an excessive power export condition, the RPR will trip and disconnect all energy sources.
8. Unplug all ESIU Communications Cables in turn:
   Each disconnected ESIU will command the related energy source to cease operation. The CU will attempt to restore the power balance by commanding the remaining ESIU's to a new power output. If the response is too slow and the condition results in an excessive power export condition, the RPR will trip and disconnect all energy sources.
9. Unplug CU – DCU Comms. Cable for each DCU unit.
   Not Applicable, the DCU is outside the Huawei scope.
10. Unplug DCU – Load Comms. Cable.
    Not Applicable, the DCU is outside the Huawei scope.

Part 8: Installation Requirements

The following installation requirements shall be observed:

1. The installation requirements referred in the "SUN2000/SUN5000/LUNA2000 User's Manual and Installation Guidelines" are applicable.
2. The installation requirements referred in the "SmartLogger or Smart Array Controller User's Manual and Installation Guidelines" are applicable.
3. The Reverse Power Relay must be sourced from a 3rd party and is not part of Huawei's delivery scope. It must be capable to detect a trip condition above the customer MEC and disconnect the energy sources from the customer distribution cabinet. The local loads will not be disconnected from the mains supply.

List of Supported Power Sensors:

- Acrel PZ96L
- CHiNT DTSU666-H
- CHiNT DTSU666-HW
- CHiNT DTSU71C
- CHiNT DDSU666-H
- CHiNT YDS60-80
- CHiNT DHSU1079-ZT
- Janitza UMG 103-CBM
- Janitza UMG 604
- Janitza UMG 96