Compliance Evaluation Report

หมายเลขรายงาน: CSSC/BOS/003 (Report no.)

วันที่ออกรายงาน: February 13, 2023 (Issued date)

ผู้ขอรับบริการ (APPLICANT) :	SolaX Power Network Technology (Zhejiang) Co., Ltd. No.288, Shizhu Road, Tonglu Economic Development Zone, Tonglu City, Zhejiang Province, 310000 P. R. CHINA
ผู้รับรายงาน (SUBMITTED TO) :	ตามที่อยู่ผู้ขอรับบริการ (Same as above)
ผลิตภัณฑ์ (PRODUCT) :	PV grid-connected inverter
ยี่ห้อ (BRAND) :	SOLAX
รุ่น (MODEL) :	X1-MINI-3.0K-G4

ขอบข่ายการประเมิน (Scope) :

รายงานฉบับนี้เป็นการให้ความคิดเห็นต่อความเป็นไปตามข้อกำหนดของผลิตภัณฑ์ ตามมาตรฐาน / ระเบียบที่ระบุในส่วนต่อไป วัตถุประสงค์ของการประเมินความเป็นไปตามข้อกำหนดในรายงานฉบับนี้ เพื่อระบุความเป็นไปตามข้อกำหนดตามมาตรฐานหรือระเบียบที่เกี่ยวข้องของการไฟฟ้าฝ่ายจำหน่าย สำหรับประกอบการพิจารณาอนุมัติการขนานเข้าระบบ ความคิดเห็นในรายงานฉบับนี้เป็นการประเมินจากหลักฐานทางเทคนิคซึ่งจัดส่งให้ศูนย์ฯโดยผู้ขอรับบริการและ/หรือผู้ผลิตอุปกรณ์

มาตรฐาน / ระเบียบ (Standards/regulations) :

ระเบียบการไฟฟ้านครหลวงว่าด้วย ข้อกำหนดการเชื่อมต่อระบบโครงข่ายไฟฟ้า พ.ศ. 2558

หลักฐานทางเทคนิค (Technical evidence) :

รายงานผลการทดสอบ, ข้อกำหนดคุณลักษณะเฉพาะของผลิตภัณฑ์ และเอกสารที่เกี่ยวข้องอื่น ๆ ซึ่งจัดหาให้โดยผู้ขอรับบริการ

นายสิทธิชัย มังกรฤทธิ์ วิศวกรทดสอบ **ผู้เตรียม (Prepared by)**	นายบัลลังก์ หมื่นพินิจ หัวหน้าหน่วยทดสอบอุปกรณ์ประกอบระบบ **ผู้ทบทวน (Reviewed by)**
ดร. มานิตย์ สีแป้น ผู้จัดการฝ่ายทดสอบ **ผู้ทบทวน (Reviewed by)**	(รศ.ดร. อนวัช แสงสว่าง) รองผู้อำนวยการ สายงานวิชาการ **ผู้อนุมัติ (Approved by)**

Compliance Evaluation Report

CSSC
CES SOLAR CELLS TESTING CENTER

หมายเลขรายงาน: CSSC/BOS/003 (Report no.)

วันที่ออกรายงาน: February 13, 2023 (Issued date)

คำอธิบายผลิตภัณฑ์ (Product description)	
ยี่ห้อ: (Brand)	SOLAX
รุ่น: (Model)	X1-MINI-3.0K-G4
ข้อกำหนดคุณลักษณะเฉพาะ:	

Output		Input	
Voltage	220/230/240V	Max. voltage	550V
Frequency	50/60Hz nom.	Voltage range	40 – 550V MPPT
Current	13.1A nom.	Current	16Amax.
Power	3000W nom.	Power	6000W max.

หมายเหตุ ข้อกำหนดคุณลักษณะดังระบุใน ภาคผนวก ข.

ผลการประเมิน (Compliance case verdicts)

ผ่าน: (Complied)	ผลการทดสอบเป็นไปตามข้อกำหนด (Submitted result complied with the requirement.)
ไม่ผ่าน: (Does not comply)	ผลการทดสอบไม่เป็นไปตามข้อกำหนด (Submitted result does not comply with the requirement.)
ไม่ครบถ้วน: (Undetermined)	ผลการทดสอบหรือข้อมูลที่เกี่ยวข้องไม่เพียงพอสำหรับการประเมิน (The test results are not sufficient for evaluation.)

หมายเหตุ (General remark)

(1) รายงานการทดสอบนี้ต้องไม่ถูกทำซ้ำบางส่วน โดยไม่ได้รับความยินยอมจากศูนย์พัฒนามาตรฐานและทดสอบระบบเซลล์แสงอาทิตย์ เป็นลายลักษณ์อักษร ยกเว้นได้ทำซ้ำเต็มฉบับ

(This report shall not be reproduced, except in full, without the written approval of CES Solar Cells Testing Center (CSSC))

(2) รายงานผลทดสอบฉบับอิเล็กทรอนิกส์ฉบับนี้ต้องได้รับการลงลายมือชื่อที่ได้รับการยืนยันความถูกต้องจากเจ้าหน้าที่ของศูนย์ฯ เท่านั้น

(The authorized CSSC staff signature through electronic means shall have the same validity as a manually executed signature to the fullest extent of a paper-based report issued by CSSC)

รายงานฉบับนี้ประกอบด้วยเอกสารดังต่อไปนี้:

- การตรวจสอบความเป็นไปตามข้อกำหนดของผลการทดสอบ
- แบบตรวจสอบและรับรองรายงานการทดสอบอินเวอร์เตอร์ที่ใช้ในระบบผลิตไฟฟ้าประเภทเชื่อมต่อกับโครงข่ายของ กฟน.
- ภาคผนวก ก1. – List of documents from TÜV Rheinland (Shanghai) Co., Ltd.
- ภาคผนวก ก2. – MEA Grid Code Compliance Table.
- ภาคผนวก ข. – X1 Series User Manual 0.6kW - 3.3kW.
- ภาคผนวก ค. – TÜV Rheinland's Report No: CN23GLMZ 001.
- ภาคผนวก ง. – Laboratory Accreditation Certificate No. CNAS L3038.

Compliance Evaluation Report

CSSC
CES SOLAR CELLS TESTING CENTER

หมายเลขรายงาน: CSSC/BOS/003 (Report no.)

วันที่ออกรายงาน: February 13, 2023 (Issued date)

รายละเอียดผลการพิจารณาอินเวอร์เตอร์ ยี่ห้อ *SOLAX* รุ่น *X1-MINI-3.0K-G4*
รายงานผลการทดสอบ หมายเลข *CN23GLMZ 001* ลงวันที่ : *13.01.2023*
จากสถาบันทดสอบ TÜV Rheinland (Shanghai) Co., Ltd
ตามข้อกำหนดสำหรับอินเวอร์เตอร์ที่ซีในระบบผลิตไฟฟ้าประเภทเชื่อมต่อกับโครงข่ายของ กฟน.
(Test Compliance Validation)

ลำดับ	หัวข้อ	ผลการพิจารณา	รายละเอียด
1	กระแสฮาร์มอนิก *(Harmonics Current)*	☒ **ผ่าน** (Complied) ☐ ไม่ผ่าน (Does not comply) ☐ ไม่ครบถ้วน (Undetermined)	ตามแบบตรวจสอบและรับรองรายงานการทดสอบอินเวอร์เตอร์ 2.1 การทดสอบกระแสฮาร์มอนิก หน้า 5-6
2	แรงดันกระเพื่อม *(Voltage Fluctuation)*	☒ **ผ่าน** (Complied) ☐ ไม่ผ่าน (Does not comply) ☐ ไม่ครบถ้วน (Undetermined)	ตามแบบตรวจสอบและรับรองรายงานการทดสอบอินเวอร์เตอร์ 2.2 การทดสอบแรงดันกระเพื่อม หน้า 6
3	การจ่ายไฟฟ้ากระแสตรง *(Direct Current)*	☒ **ผ่าน** (Complied) ☐ ไม่ผ่าน (Does not comply) ☐ ไม่ครบถ้วน (Undetermined)	ตามแบบตรวจสอบและรับรองรายงานการทดสอบอินเวอร์เตอร์ 2.3 การทดสอบการจ่ายไฟฟ้ากระแสตรง หน้า 6
4	ช่วงความถี่ทำงาน *(Operating Frequency Range)*	☒ **ผ่าน** (Complied) ☐ ไม่ผ่าน (Does not comply) ☐ ไม่ครบถ้วน (Undetermined)	ตามแบบตรวจสอบและรับรองรายงานการทดสอบอินเวอร์เตอร์ 2.4 การทดสอบช่วงความถี่ทำงาน หน้า 7
5	ช่วงแรงดันทำงาน *(Operating Voltage Range)*	☒ **ผ่าน** (Complied) ☐ ไม่ผ่าน (Does not comply) ☐ ไม่ครบถ้วน (Undetermined)	ตามแบบตรวจสอบและรับรองรายงานการทดสอบอินเวอร์เตอร์ 2.5 การทดสอบช่วงแรงดันทำงาน หน้า 7
6	การป้องกันสภาวะไอส์แลนดิ่ง *(Islanding test)*	☒ **ผ่าน** (Complied) ☐ ไม่ผ่าน (Does not comply) ☐ ไม่ครบถ้วน (Undetermined)	ตามแบบตรวจสอบและรับรองรายงานการทดสอบอินเวอร์เตอร์ 2.6 การทดสอบการป้องกันสภาวะไอส์แลนดิ่ง หน้า 8
7	การเชื่อมต่อหลังไฟฟ้ากลับคืน *(Power Recovery Response)*	☒ **ผ่าน** (Complied) ☐ ไม่ผ่าน (Does not comply) ☐ ไม่ครบถ้วน (Undetermined)	ตามแบบตรวจสอบและรับรองรายงานการทดสอบอินเวอร์เตอร์ 2.7 การทดสอบการเชื่อมต่อหลังไฟฟ้ากลับคืน หน้า 9
8	อื่นๆ (other)	☒ **ครบถ้วน** (Complied) ☐ ไม่ครบถ้วน (Undetermined)	1. พบ Firmware version ในรายงานผลการทดสอบ 2. ผ่านการทดสอบจากห้องปฏิบัติการทดสอบที่ได้รับการรับรอง ISO/IEC 17025:2005 ในขอบข่ายการทดสอบอินเวอร์เตอร์ ตาม Laboratory Accreditation Certificate Number CNAS L3038

ความคิดเห็นของการประเมินความเป็นไปตามข้อกำหนดตามผลการทดสอบ/ข้อมูลจากห้องปฏิบัติการทดสอบที่ได้รับการรับรองตาม ISO/IEC17025 ซึ่งผู้ขอรับบริการ / ผู้ผลิตจัดส่งให้ศูนย์พัฒนามาตรฐานและทดสอบระบบเซลล์แสงอาทิตย์ รายละเอียดห้องปฏิบัติการทดสอบดังภาคผนวก ง.

Compliance Evaluation Report

หมายเลขรายงาน: CSSC/BOS/003 (Report no.)

วันที่ออกรายงาน: February 13, 2023 (Issued date)

แบบตรวจสอบและรับรองรายงานผลการทดสอบ
อินเวอร์เตอร์ที่ใช้ในระบบผลิตไฟฟ้าประเภทเชื่อมต่อกับระบบโครงข่ายไฟฟ้าของการไฟฟ้านครหลวง

สวนที่ 1 การรับรองรายงานผลการทดสอบอินเวอร์เตอร์

1.1 รายละเอียดอินเวอร์เตอร์	
ยี่ห้อ	*SOLAX*
รุ่น	*X1-MINI-3.0K-G4*
Firmware Version	*Master:1.00,Manager:1.00*
พิกัดทางไฟฟ้า	*3000W*
1.2 รายละเอียดของรายงานผลการทดสอบ	
หมายเลขรายงานผลการทดสอบ	*CN23GLMZ 001*
ออกเมื่อวันที่	*13.01.2023*
ชื่อสถาบันหรือหน่วยงานที่ออกรายงานผลการทดสอบอินเวอร์เตอร์	*TÜV Rheinland (Shanghai) Co., Ltd.*
ที่อยู่สถาบันหรือหน่วยงานที่ออกรายงานผลการทดสอบอินเวอร์เตอร์	*No. 177, Lane 777 West Guangzhong Road, Jing'an District, Shanghai, 200072 P.R. China*
1.3 การรับรองรายงานผลการทดสอบ	
ข้าพเจ้าขอรับรองว่าข้อมูลที่กรอกในเอกสารฉบับนี้มีความถูกต้องเป็นจริง และได้ตรวจสอบพบว่าผลการทดสอบอินเวอร์เตอร์ตามรายงานในข้อ 1.2 เป็นไปตามข้อกำหนดสำหรับอินเวอร์เตอร์ที่ใช้ในระบบผลิตไฟฟ้าประเภทเชื่อมต่อกับระบบโครงข่ายไฟฟ้าของการไฟฟ้านครหลวงทุกประการ	
ชื่อหน่วยตรวจสอบและรับรองผลการทดสอบอินเวอร์เตอร์	*ศูนย์พัฒนามาตรฐานและทดสอบระบบเซลล์แสงอาทิตย์ (CSSC)* *สถาบันพัฒนาและฝึกอบรมโรงงานต้นแบบ* *มหาวิทยาลัยเทคโนโลยีพระจอมเกล้าธนบุรี*
ที่อยู่หน่วยตรวจสอบและรับรองผลการทดสอบอินเวอร์เตอร์	*49 ซอยเทียนทะเล 25, ถนนบางขุนเทียน-ชายทะเล แขวงท่าข้าม* *บางขุนเทียน กรุงเทพมหานคร 10150* *โทร.: +662 470 7445 - 49* *โทรสาร: +662 470 7445*
วันที่ออกเอกสาร	*13 กุมภาพันธ์ 2566*

ตรวจสอบและรับรองข้อมูลโดย	อนุมัติโดย
ลงชื่อ ..... (ดร.มานิตย์ สีแป้น) ตำแหน่ง ผู้จัดการฝ่ายทดสอบ	ลงชื่อ ..... (รศ.ดร. อนวัช แสงสว่าง) ตำแหน่ง รองผู้อำนวยการ สายงานวิชาการ **หมายเหตุ**: ผู้อนุมัติต้องเป็นหัวหน้าสูงสุดของหน่วยตรวจสอบและรับรองผลการทดสอบ หรือผู้ที่ได้รับมอบหมายให้ปฏิบัติงานแทน

หมายเลขอ้างอิง.....

หมายเลขรายงาน: CSSC/BOS/003 (Report no.)

วันที่ออกรายงาน: February 13, 2023 (Issued date)

ส่วนที่ 2) รายละเอียดผลการทดสอบอินเวอร์เตอร์

2.1 การทดสอบฮาร์มอนิก (Harmonics Current)

Order	33 % of output current		66% of output current		100 % of output current		Limit (% of Output current)	Result confirmation
	Measured In Amp*	% of output current*	Measured In Amp*	% of output current*	Measured In Amp*	% of output current*		
2nd	0.01	0.08 %	0.01	0.08 %	0.03	0.23 %	≤ 1 %	☒ Pass ☐ Fail
3rd	0.04	0.31 %	0.08	0.61 %	0.15	1.15 %	≤ 4 %	☒ Pass ☐ Fail
4th	0.01	0.08 %	0.00	0.00 %	0.00	0.00 %	≤ 1 %	☒ Pass ☐ Fail
5th	0.09	0.69 %	0.12	0.92 %	0.21	1.61 %	≤ 4 %	☒ Pass ☐ Fail
6th	0.01	0.08 %	0.00	0.00 %	0.00	0.00 %	≤ 1 %	☒ Pass ☐ Fail
7th	0.04	0.31 %	0.09	0.69 %	0.15	1.15 %	≤ 4 %	☒ Pass ☐ Fail
8th	0.01	0.08 %	0.00	0.00 %	0.00	0.00 %	≤ 1 %	☒ Pass ☐ Fail
9th	0.01	0.08 %	0.03	0.23 %	0.09	0.69 %	≤ 4 %	☒ Pass ☐ Fail
10th	0.00	0.00 %	0.00	0.00 %	0.00	0.00 %	≤ 1 %	☒ Pass ☐ Fail
11th	0.01	0.08 %	0.01	0.08 %	0.06	0.46 %	≤ 2 %	☒ Pass ☐ Fail
12th	0.00	0.00 %	0.00	0.00 %	0.00	0.00 %	≤ 0.5 %	☒ Pass ☐ Fail
13th	0.01	0.08 %	0.01	0.08 %	0.03	0.23 %	≤ 2 %	☒ Pass ☐ Fail
14th	0.00	0.00 %	0.00	0.00 %	0.00	0.00 %	≤ 0.5 %	☒ Pass ☐ Fail
15th	0.00	0.00 %	0.00	0.00 %	0.01	0.08 %	≤ 2 %	☒ Pass ☐ Fail
16th	0.00	0.00 %	0.00	0.00 %	0.00	0.00 %	≤ 0.5 %	☒ Pass ☐ Fail
17th	0.00	0.00 %	0.00	0.00 %	0.01	0.08 %	≤ 1.5 %	☒ Pass ☐ Fail
18th	0.00	0.00 %	0.00	0.00 %	0.00	0.00 %	≤ 0.375 %	☒ Pass ☐ Fail
19th	0.00	0.00 %	0.00	0.00 %	0.01	0.08 %	≤ 1.5 %	☒ Pass ☐ Fail
20th	0.00	0.00 %	0.00	0.00 %	0.00	0.00 %	≤ 0.375 %	☒ Pass ☐ Fail
21th	0.00	0.00 %	0.00	0.00 %	0.01	0.08 %	≤ 1.5 %	☒ Pass ☐ Fail
22th	0.00	0.00 %	0.00	0.00 %	0.00	0.00 %	≤ 0.375 %	☒ Pass ☐ Fail
23th	0.00	0.00 %	0.00	0.00 %	0.01	0.08 %	≤ 0.6 %	☒ Pass ☐ Fail
24th	0.00	0.00 %	0.00	0.00 %	0.00	0.00 %	≤ 0.15 %	☒ Pass ☐ Fail
25th	0.00	0.00 %	0.00	0.00 %	0.01	0.08 %	≤ 0.6 %	☒ Pass ☐ Fail
26th	0.00	0.00 %	0.00	0.00 %	0.00	0.00 %	≤ 0.15 %	☒ Pass ☐ Fail
27th	0.00	0.00 %	0.00	0.00 %	0.01	0.08 %	≤ 0.6 %	☒ Pass ☐ Fail
28th	0.00	0.00 %	0.00	0.00 %	0.00	0.00 %	≤ 0.15 %	☒ Pass ☐ Fail
29th	0.00	0.00 %	0.00	0.00 %	0.00	0.00 %	≤ 0.6 %	☒ Pass ☐ Fail
30th	0.00	0.00 %	0.00	0.00 %	0.00	0.00 %	≤ 1 %	☒ Pass ☐ Fail
31th	0.00	0.00 %	0.00	0.00 %	0.00	0.00 %	≤ 0.6 %	☒ Pass ☐ Fail

หมายเลขอ้างอิง.....

ตรวจสอบและรับรองข้อมูลโดย.....

หมายเลขรายงาน: CSSC/BOS/003 (Report no.)

วันที่ออกรายงาน: February 13, 2023 (Issued date)

Order	33 % of output current		66% of output current		100 % of output current		Limit (% of Output current)	Result confirmation
	Measured In Amp*	% of output current*	Measured In Amp*	% of output current*	Measured In Amp*	% of output current*		
32th	0.00	0.00 %	0.00	0.00 %	0.00	0.00 %	*≤ 0.15 %*	☒ Pass ☐ Fail
33th	0.00	0.00 %	0.00	0.00 %	0.00	0.00 %	*≤ 0.6 %*	☒ Pass ☐ Fail
34th	0.00	0.00 %	0.00	0.00 %	0.00	0.00 %	*≤ 0.15 %*	☒ Pass ☐ Fail
35th	0.00	0.00 %	0.00	0.00 %	0.00	0.00 %	*≤ 0.3 %*	☒ Pass ☐ Fail
36th	0.00	0.00 %	0.00	0.00 %	0.00	0.00 %	*≤ 0.075 %*	☒ Pass ☐ Fail
37th	0.00	0.00 %	0.00	0.00 %	0.00	0.00 %	*≤ 0.3 %*	☒ Pass ☐ Fail
38th	0.00	0.00 %	0.00	0.00 %	0.00	0.00 %	*≤ 0.075 %*	☒ Pass ☐ Fail
39th	0.00	0.00 %	0.00	0.00 %	0.00	0.00 %	*≤ 0.3 %*	☒ Pass ☐ Fail
40th	0.00	0.00 %	0.00	0.00 %	0.00	0.00 %	*≤ 0.075%*	☒ Pass ☐ Fail
TRDi		1.23 **%**		1.42 **%**		1.24 **%**	*≤ 5%*	☒ Pass ☐ Fail

อ้างอิงจากรายงานผลการทดสอบตามข้อ 1.2 หน้า: ***TÜV Rheinland's Report No: CN23GLMZ 001., Page 9– 11,***

หมายเหตุ: * กรณีอินเวอร์เตอร์ชนิด 3 เฟส ให้ระบุค่าสูงสุดที่ได้จากแต่ละเฟส

2.2 การทดสอบแรงดันกระเพื่อม (Voltage Fluctuation)

	Pst	Plt
Limit	≤ 1.0	≤ 0.65
Test results	***0.01***	***0.01***
Result confirmation	☒ Pass ☐ Fail	☒ Pass ☐ Fail

อ้างอิงจากรายงานผลการทดสอบตามข้อ 1.2 หน้า: ***TÜV Rheinland's Report No: CN23GLMZ 001., Page 12***

2.3 การทดสอบการจ่ายไฟฟ้ากระแสตรง (Direct Current)

Test level	33 % of rated output current	66 % of rated output current	100 % of rated output current
Limit (% of rated Output current)	≤ 0.5%	≤ 0.5%	≤ 0.5%
Test results* (% of rate Output current)	***0.33%***	***0.35%***	***0.38%***
Result confirmation	☒ Pass ☐ Fail	☒ Pass ☐ Fail	☒ Pass ☐ Fail

อ้างอิงจากรายงานผลการทดสอบตามข้อ 1.2 หน้า: ***TÜV Rheinland's Report No: CN23GLMZ 001., Page 13. and 126.***

หมายเหตุ: * กรณีอินเวอร์เตอร์ชนิด 3 เฟส ให้ระบุค่าสูงสุดที่ได้แต่ละเฟส

หมายเลขอ้างอิง.....

ตรวจสอบและรับรองข้อมูลโดย.....

2.4 การทดสอบช่วงความถี่ทำงาน (Operating Frequency Range)

	Actual Trip Setting		Test Result	Limit	Result confirmation
	Frequency (Hz)	Trip Time (sec)	Trip Time* (sec)	Time Delay (sec)	
Underfrequency	46.9	*0.070*	***0.086***	≤ 0.1	☒ Pass ☐ Fail
Overfrequency	52.1	*0.070*	***0.079***	≤ 0.1	☒ Pass ☐ Fail

อ้างอิงจากรายงานผลการทดสอบตามข้อ 1.2 หน้า: ***TÜV Rheinland's Report No: CN23GLMZ 001., Page 16 and 47-56.***

หมายเหตุ: * ให้ระบุค่าสูงสุดที่ได้จากการทดสอบ

2.5 การทดสอบช่วงแรงดันการทำงาน (Operating Voltage Range)

☒ Grid-connected inverter which connected to grid at low voltage (230/400) (1)

	Actual Setting			Result	Limit	Result confirmation
	☒ $V_{L-N\ setting}$ (2) (V)	☐ $V_{L-L\ setting}$ (2) (V)	Time Delay (sec)	Time Delay (3) (sec)	Time Delay (sec)	
Undervoltage level 2 (4)	☒ 114 or ☐	☐ 198 or ☐	*0.090*	***0.076***	≤ 0.1	☒ Pass ☐ Fail
Undervoltage level 1	199	345	*1.900*	***1.987***	≤ 2	☒ Pass ☐ Fail
Overvoltage level 1	241	417	*1.900*	***1.978***	≤ 2	☒ Pass ☐ Fail
Overvoltage level 2 (4)	☐ 311 or ☒ 271	☐ 539 or ☐	*0.040*	***0.036***	≤ 0.05	☒ Pass ☐ Fail

☐ Grid-connected inverter which connected to the grid at voltage ≥ 12kV (1)

	Actual Setting		Result	Limit	Result confirmation
	V setting (% of rate output voltage)	Time Delay (sec)	Time Delay (3) (sec)	Time Delay (sec)	
Undervoltage level 2 (4)	☐ 135% or ☐ .....%			≤ 0.1	☐ Pass ☐ Fail
Undervoltage level 1	110%			≤ 2	☐ Pass ☐ Fail
Overvoltage level 1	85%			≤ 2	☐ Pass ☐ Fail
Overvoltage level 2 (4)	☐ 50% or ☐ .....%			≤ 0.05	☐ Pass ☐ Fail

อ้างอิงจากรายงานผลการทดสอบตามข้อ 1.2 หน้า: ***TÜV Rheinland's Report No: CN23GLMZ 001., Page 14-15 and Page 27-46.***

Note: (1) Select MEA's voltage level where grid – connected inverter connected to.
(2) Select between line-neutral or line – line voltage test based on the actual operation of inverter.
(3) Insert maximum value recorded during test.
(4) If inverter cannot be adjusted for overvoltage and/or undervoltage trip setting as per MEA' grid – connected Inverter regulation, it shall be adjusted the overvoltage or undervoltage trip setting to the maximum and/or minimum voltage that inverter can to be set.

หมายเลขอ้างอิง.....

ตรวจสอบและรับรองข้อมูลโดย.....

2.6 การทดสอบการป้องกันสภาวะไอส์แลนดิ่ง (Islanding Protection)

Item	Test Condition C			Test Condition B			Test Condition A		
	P_{AC} (% of nominal)	Q_{AC} (% of nominal)	Run on Time (sec) (Limit ≤2 Sec)	P_{AC} (% of nominal)	Q_{AC} (% of nominal)	Run on Time (sec) (Limit ≤2 Sec)	P_{AC} (% of nominal)	Q_{AC} (% of nominal)	Run on Time (sec) (Limit ≤2 Sec)
1	*0*	*0*	***0.425***	0	0	**0.920**	0	0	0.262
2	*0*	*-5*	0.150	0	-5	0.074	-10	-10	0.100
3	*0*	*-4*	0.168	0	-4	0.120	-10	-5	0.120
4	*0*	*-3*	0.386	0	-3	0.206	-10	0	0.314
5	*0*	*-2*	0.375	0	-2	0.378	-10	+5	0.250
6	*0*	*-1*	0.340	0	-1	0.392	-10	+10	0.119
7	*0*	*1*	0.260	0	1	0.250	-5	-10	0.093
8	*0*	*2*	0.240	0	2	0.216	-5	-5	0.135
9	*0*	*3*	0.150	0	3	0.244	-5	0	**0.660**
10	*0*	*4*	0.216	0	4	0.330	-5	+5	0.310
11	*0*	*5*	0.084	0	5	0.234	-5	+10	0.101
12							0	-10	0.085
13							0	-5	0.106
14							0	+5	0.236
15							0	+10	0.120
16							+5	-10	0.088
17							+5	-5	0.114
18							+5	0	0.415
19							+5	+5	0.218
20							+5	+10	0.108
21							+10	-10	0.117
22							+10	-5	0.104
23							+10	0	0.254
24							+10	+5	0.234
25							+10	+10	0.117
Result confirmation	☒ Pass ☐ Fail			☒ Pass ☐ Fail			☒ Pass ☐ Fail		

อ้างอิงจากรายงานผลการทดสอบตามข้อ 1.2 หน้า: ***TÜV Rheinland's Report No: CN23GLMZ 001., Page 18-24. and Page 57-106.***

หมายเลขอ้างอิง..... ตรวจสอบและรับรองข้อมูลโดย.....

2.7 การทดสอบการเชื่อมต่อหลังไฟฟ้ากลับคืน (Power Recovery Response)

	Actual Setting (sec)	Test Result (sec) (Limit ≥120)	Compliance with Clause 5.10.2(c) of IEEE std 1547.1-2005 [1]	Compliance with Clause 5.10.2(g) of IEEE std 1547.1-2005 [2]	Result confirmation
Underfrequency	*120*	***126.8***	☒ Yes ☐ No	☒ Yes ☐ No	☒ Pass ☐ Fail
Overfrequency	*120*	***127.0***	☒ Yes ☐ No	☒ Yes ☐ No	☒ Pass ☐ Fail
Undervoltage level 2	*120*	***127.4***	☒ Yes ☐ No	☒ Yes ☐ No	☒ Pass ☐ Fail
Undervoltage level 1	*120*	***127.2***	☒ Yes ☐ No	☒ Yes ☐ No	☒ Pass ☐ Fail
Overvoltage level 1	*120*	***127.0***	☒ Yes ☐ No	☒ Yes ☐ No	☒ Pass ☐ Fail
Overvoltage level 2	*120*	***127.1***	☒ Yes ☐ No	☒ Yes ☐ No	☒ Pass ☐ Fail

อ้างอิงจากรายงานผลการทดสอบตามข้อ 1.2 หน้า: ***TÜV Rheinland's Report No: CN23GLMZ 001., Page 25 and Page 107-124.***

Note:

[1] Adjust the voltage so that it beyond the reconnect voltage by twice the manufacture's stated tolerance. The Simulated area EPS voltage source shall maintain the abnormal voltage for two times the reconnect time delay. Verify that the EUT does not reenergize the simulated area EPS.

[2] To verify that the timer resets for additional voltage excursions within the reconnect, retest with an abnormal voltage step change event that is introduced during the reconnect countdown period. While the unit is counting down to reconnect, step to voltage to a value 5% outside of the manufacture's specified normal operating voltage for the trip time setting plus twice the manufacturer's stated timer accuracy, and then return to the normal operating voltage. The unit shall restart is reconnect timer and not reconnect until the grid voltage has been within the specified range for the specified reconnect time.

2.8 การตรวจสอบสถาบันหรือหน่วยงานที่ออกรายงานผลการทดสอบอินเวอร์เตอร์

รายละเอียด	Result confirmation
☐ อินเวอร์เตอร์ผ่านการทดสอบจากสถาบันหรือหน่วยงานทดสอบที่เป็นกลางภายในประเทศ ซึ่งได้รับการรับรองห้องปฏิบัติการทดสอบตามมาตรฐาน มอก. 17025 (สำหรับอินเวอร์เตอร์) จากสำนักงานคณะกรรมการแห่งชาติว่าด้วยการรับรองระบบงาน หรือได้รับการตรวจสอบและยอมรับจากการไฟฟ้านครหลวง	☒ Pass ☐ Fail
☒ อินเวอร์เตอร์ผ่านการทดสอบจากสถาบันหรือหน่วยงานทดสอบที่เป็นกลางในต่างประเทศ ซึ่งได้รับการรับรองห้องปฏิบัติการทดสอบตามมาตรฐาน ISO/IEC 17025 (สำหรับอินเวอร์เตอร์) จากหน่วยงานระดับชาติที่มีหน้าที่เทียบเคียงกันกับ สำนักงานคณะกรรมการแห่งชาติว่าด้วยการรับรองระบบงาน และอยู่ในทะเบียนขององค์กรความร่วมมือระหว่างประเทศว่าด้วยการ รับรองห้องปฏิบัติการ (International Laboratory Accreditation Cooperation, ILAC)	

หมายเลขอ้างอิง..... ตรวจสอบและรับรองข้อมูลโดย.....

ภาคผนวก ก1. *List of documents from TÜV Rheinland (Shanghai) Co., Ltd.*

TÜV Rheinland (Shanghai) Co., Ltd.
Member of TÜV Rheinland Group

TÜVRheinland®
Precisely Right.

Dear Whom it may concerns ,

For compliance test report evaluation, we herewith submit following documentations to CSSC:

1. Technical specification of product :	Manual.pdf
2. Test report:	CN23GLMZ 001.pdf
3. Laboratory accreditation:	CNAS L3038 certificate-EN.pdf
4. Table of compliance:	Comply table.pdf
5. Documentation list:	Confirmation letter.pdf

We appreciate your valued support and would like to offer any help and varied services in the future.

With kind regards,

TÜV Rheinland (Shanghai) Co., Ltd.

Allen Hu
Project Engineer
Solar & Commercial Products

TÜV Rheinland (Shanghai) Co., Ltd.
莱茵技术(上海)有限公司
10-15/F, Huatsing Building, No. 88, Lane 777, West Guangzhong Road, 200072 Shanghai, P.R. China
上海市广中西路 777 弄 88 号 华清大厦 10-15 层 邮编：200072
Tel.: (+86) 21-61081188
Fax: (+86) 21-6108 1199
E-mail: info@shg.chn.tuv.com
Website: www.chn.tuv.com

ภาคผนวก ก2. *MEA Grid Code Compliance Table.*

SolaX Power Network Technology (ZheJiang) Co., Ltd.

MEA Grid code compliance table

Item	Description	MEA requirement	Test results /Comment	Refer to Test report(or document)/ page	Complied/ Does not comply
1	Harmonics	Refer to MEA code	Total harmonic distortion:%TRD (max) =1.42% Current harmonics are in the limit according to MEA code	Refer to the name plate of product in report CN23GLMZ 001 / Page 9-11.	Complied
2	Voltage fluctuation	Refer to IEC	Pst value: Pst(max)= 0.01 Plt value: Plt(max)= 0.01	Refer to Test report CN23GLMZ 001 / Page 12.	Complied
3	DC injection	Refer to IEC	DC injection value(max): 0.383% of rated current	Refer to Test report CN23GLMZ 001 / Page 13 and 126.	Complied
9	Under and Over frequency protection	Disconnect time of MEA requirement f < 47 Hz = 0.1 Sec f > 52 Hz = 0.1 Sec	Under and Over frequency trip time value (max): f < 47 Hz = 0.086 Sec f > 52 Hz = 0.079 Sec	Refer to Test report CN23GLMZ 001 / Page 16 and 47-56.	Complied
8	Under and Over voltage protection	Disconnect time of MEA requirement V < 114V = 0.1 Sec	Under and Over voltage trip time value (max): V < 114V = 0.076 Sec V < 199V = 1.987 Sec	Refer to Test report CN23GLMZ 001 / Page 14-15 and 27-46.	Complied

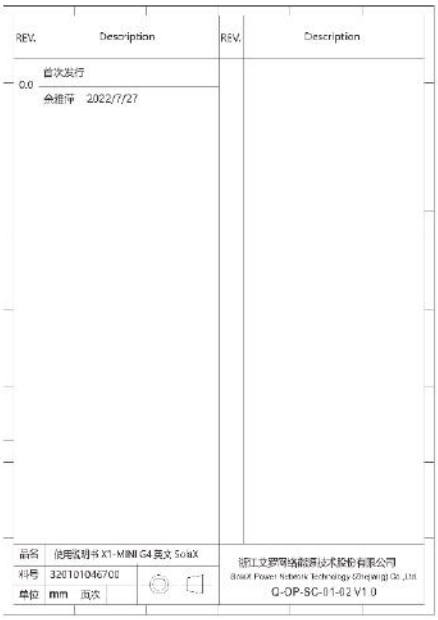
ภาคผนวก ก2. *MEA Grid Code Compliance Table. (ต่อ)*

		V < 199V 2 Sec V > 241V = 2 Sec V > 271V =0.05 Sec	V > 241V 1.984 Sec V > 271V =0.036 Sec		
10	Anti-Islanding	Disconnect time of IEC 62116 requirement 2 Sec Max.	Trip time value (max): P_{EUT}100%, P_R0%, Q_C0%, 0.262 Sec P_{EUT}66%, P_R0%, Q_C0%, = 0.920 Sec P_{EUT}33%, P_R0%, Q_C0%, = 0.425 Sec	Refer to Test report CN23GLMZ 001 / Page 18-24 and 57-106.	Complied
11	Reconnection to utility recovery	Reconnection time of MEA requirement > 120s	Reconnection time value: After back to specified recovery voltage range V = 200V =127.2 Sec V = 240V =127.0 Sec After back to specified frequency voltage range f = 47.0Hz =126.8 Sec f 52.0Hz 127.0 Sec	Refer to Test report CN23GLMZ 001 / Page 26-27 and 107-124.	Complied

หมายเลขรายงาน: CSSC/BOS/003 **วันที่ออกรายงาน: February 13, 2023**

(Report no.) (Issued date)

ภาคผนวก ข. *X1 Series User Manual 0.6kW - 3.3kW .*



ภาคผนวก ข. *X1 Series User Manual 0.6kW - 3.3kW . (ต่อ)*

SOLAX
POWER

Solax Power Network Technology(Zhejiang) Co., Ltd.

No.288 Shizhu Road, Tonglu Economic Development Zone, Tonglu City, Zhejiang Province, China.
Tel: +86 0571-56260011
E-mail: info@solaxpower.com

EN

320101046700

www.solaxpower.com

ภาคผนวก ข. *X1 Series User Manual 0.6kW - 3.3kW . (ต่อ)*

Contents

Contents

02

Notes on this Manual

1.1 Scope of Validity

1 Notes on this Manual

This manual is an integral part of X1 Series. It describes the assembly, installation, commissioning, maintenance and failure of the product. Please read it carefully before operating.

X1-MINI-0.6K-G4	X1-MINI-0.7K-G4	X1-MINI-1.1K-G4	X1-MINI-1.5K-G4
X1-MINI-2.0K-G4	X1-MINI-2.5K-G4	X1-MINI-3.0K-G4	X1-MINI-3.3K-G4

Note: "**X1**" means single phase; "**MINI**" means MINI series; "**K**" means kW; "**G4**" means 4th generation.
Keep this manual at where is accessible all the time.

1.2 Target Group
1.3 Symbols Used

This manual is for qualified electricians. The tasks described in this manual can only be performed by qualified electricians.
The following types of safety instructions and general information appear in this document as described below:

DANGER!
"Danger" indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING!
"Warning" indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION!
"Caution" indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

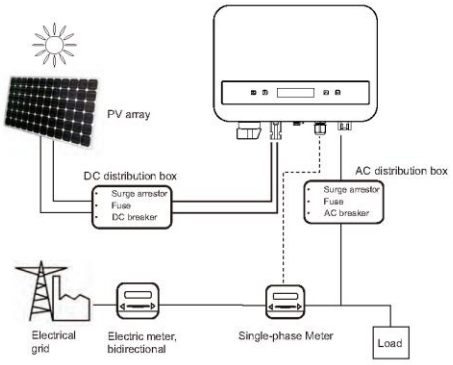
NOTE!
"Note" provides tips that are valuable for the optimal operation of your product.

03

2 Safety

2.1 Appropriate Usage

This series inverter are PV inverters which can convert the DC current of the PV generator into AC current and feed it into the public grid.



Lightning will cause a damage either from a direct strike or from surges due to a nearby strike.

Induced surges are the most likely cause of lightning damage in most situations or installations, especially in rural areas where electricity is usually provided by long overhead lines. Surge may be included on both the PV array conduction and the AC cables leading to the building.

Specialists in lightning protection should be consulted during the end use application. Using appropriate external lightning protection, the effect of a direct lightning strike into a building can be mitigated in a controlled way, and the lightning current can be discharged into the ground.

All DC cables should be installed to as short as possible, and positive and negative cables of the string or main DC supply should be bundled together. Avoid creating loops in the system. This requirement for short runs and bundling includes any associated earth bundling conductors.

Spark gap devices are not suitable to be used in DC circuits once conducting, they won't stop conducting until the voltage passes through their terminals typically less than 30 volts.

➢ Anti-Islanding Effect

Islanding effect is a special phenomenon that grid-connected PV system still supply power to the nearby grid when the voltage loss is happened in the power system. It is dangerous for maintenance personnel and the public.

This series inverter provides Active Frequency Drift (AFD) to prevent islanding effect.

ภาคผนวก ข. *X1 Series User Manual 0.6kW - 3.3kW . (ต่อ)*

2.2 Important Safety Instructions

DANGER!
- Danger to life due to high voltages in the inverter!
- All work must be carried out by qualified electrician.
- The appliance is not to be used by children or persons with reduced physical sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction.
- Children should be supervised to ensure that they do not play with the appliance.

CAUTION!
Danger of burn injuries due to hot enclosure parts!
- During operation, the upper lid of the enclosure and the enclosure body may become hot.
- Only qualified electrician can touch the lower enclosure lid during operation.

CAUTION!
Possible damage to health as a result of the effects of radiation!
Pregnant women and children should not stay close to the inverter.

NOTE!
Grounding the PV generator!
Comply with the local requirements for grounding the PV modules and the PV generator. We recommend connecting the generator frame and other electrically conductive surfaces in a manner which ensures continuous conduction and ground these in order to have optimal protection of system and persons.

WARNING!
- Ensure input DC voltage ≤Max. DC voltage. Over voltage may cause permanent damage to inverter or other losses, which will not be included in warranty!

WARNING!
Risk of electric shock!

WARNING!
- Authorized service personnel must disconnect both AC and DC power from the inverter before attempting any maintenance or cleaning or working on any circuits connected to the inverter.

- Prior to the application, please read this section carefully to ensure correct and safe application. Please keep the user manual properly.
- Use only recommended attachments. Otherwise may result in a risk of fire, electric shock, or injury to person.
- Make sure that existing wiring is in good condition and that wire is not undersized.
- Do not disassemble any parts of inverter which are not mentioned in installation guide. It contains no user-serviceable parts. See Warranty for instructions on obtaining service. Attempting to service the inverter yourself may result in a risk of electric shock or fire and will void your warranty.
- Keep away from flammable, explosive materials to avoid fire disaster.
- The installation place should be away from humid or corrosive substance.
- Authorized service personnel must use insulated tools when installing or working with this equipment.
- PV modules shall have an IEC 61730 class A rating.
- Avoid touching the PV connecting device in case of electric shock.
- After the MAINS and PV supply has been disconnected, the capacitor of the unit still contains hazardous voltage for up to 5 minutes, please don't touch during this period.
- Hazardous voltage will present for up to 5 minutes after disconnection from power supply.
- CAUTION-RISK of electric shock from energy stored in capacitor. Never operate on the solar inverter couplers, the MAINS cables, PV cables or the PV generator when power is applied. After switching off the PV and Mains, always wait for 5 minutes to let the intermediate circuit capacitors discharge before you unplug DC and MAINS couplers.
- When accessing the internal circuit of solar inverter, it is very important to wait 5 minutes before operating the power circuit or demounting the electrolyte capacitors inside the device. Do not open the device beforehand since the capacitors require time to sufficiently discharge!
- Measure the voltage between terminals UDC+ and UDC- with a multi-meter (impedance at least 1 Mohm) to ensure that the device has totally discharged.

- 2.3 PE Connection and Leakage Current
- The inverter incorporates a certified internal Residual Current Device (RCD) in order to protect against possible electrocution and fire hazard in case of a malfunction in the cables or the inverter. There are two trip thresholds for the RCD as required for certification (IEC 62109-2: 2011). The default value for electrocution protection is 30 mA, and for slow rising current is 300 mA.
- If an external RCD is required by local regulations, check which type of RCD is required for relevant electric code. It recommends using a type-A RCD. The recommended RCD values is 300 mA unless a lower value is required by the specific local electric codes.

The device is intended to connect to a PV generator with a capacitance limit of approx 700 nf.

WARNING!
- High leakage current!
- Earth connection is essential before connecting power supply.

2.4 Explanation of Symbols

- Symbols on the Inverter

This section gives an explanation of all the symbols shown on the inverter and on the type label.

Symbol	Explanation
	When the blue light is on, it indicates the inverter is working normally.
	When the red light is on, it indicates an error has occurred.

- Symbols on the Type Label

Symbol	Explanation
CE	CE mark. The inverter complies with the requirements of the applicable CE guidelines.
UK CA	Compliant with UKCA standards.
	RCM remark.
	TUV certification.
	Beware of hot surface. The inverter can become hot during operation. Avoid contact during operation.
	Danger of high voltages. Danger to life due to high voltages in the inverter!
	Danger. Risk of electric shock!
	Observe enclosed documentation.
	The inverter can not be disposed together with the household waste. Disposal information can be found in the enclosed documentation.
	Do not operate this inverter until it is isolated from mains and on-site PV generation suppliers.
	Danger to life due to high voltage. There is residual voltage in the inverter which needs 5 min to discharge. • Wait 5 min before you open the upper lid or the DC lid.

2.4 CE Directives

This section describes the requirements of the European low voltage regulations, including safety instructions and system licensing conditions, the user must comply with these regulations when installing, operating, and maintaining the inverter, otherwise personal injury or death may occur, and the inverter will be damaged.
Please read the manual carefully when operating the inverter. If you do not understand "Danger", "Warning", "Caution" and the description in the manual, please contact the manufacturer or service agent before installing and operating the inverter.

Make sure that the whole system complies with the requirements of EC (2014/35/EU, 2014/30/EU, etc.) before starting the module (i.e. to start the operation).

Standard of 2014/35/EU (LVD)
EN IEC 62109-1; EN IEC 62109-2
EN 62477-1
Standard of 2014/30/EU (EMC)
EN IEC 61000-6-1; EN IEC 61000-6-2;
EN IEC 61000-6-3; EN IEC 61000-6-4;
EN IEC 61000-3-2; EN 61000-3-3;
EN IEC 61000-3-11; EN 61000-3-12
EN 55011

The assembly shall be installed in accordance with the statutory wiring rules. Install and configure the system in accordance with safety rules, including the use of specified wiring methods. The installation of the system can only be done by professional assemblers who are familiar with safety requirements and EMC. The assembler shall ensure that the system complies with the relevant national laws. The individual subassembly of the system shall be interconnected by means of the wiring methods outlined in national/international such as the national electric code (NFPA) No. 70 or VDE regulation 4105.

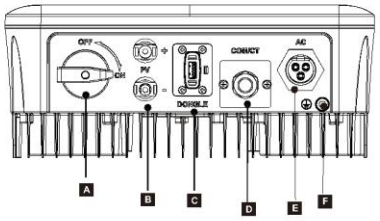
3 Introduction

3.1 Basic Features

Thanks for purchasing our inverter. The inverter incorporates advanced technology, high reliability, and convenient control features.

- Advanced DSP control technology.
- Utilize the latest high-efficiency power component.
- Optimal MPPT technology.
- One MPP Tracking.
- Wide MPPT input range.
- Advanced anti-islanding solutions.
- Class I protection level.
- Max. efficiency up to 98%. EU efficiency up to 96.5%.
- THD<3%.

3.2 Terminals of the Inverter

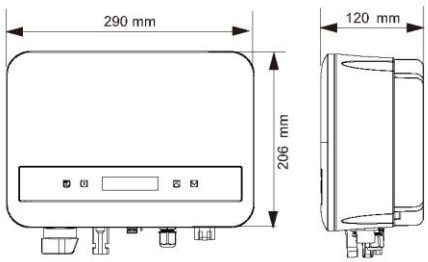


Object	Description
A	DC switch
B	DC input terminal
C	Dongle
D	COM/CT
E	AC output terminal
F	Ground terminal

Note: CT and meter is opptional. If necessary, please consult us in detail.

WARNING!
Only authorized personnel are allowed to set the connection.

3.3 Dimension
Dimension



4. Technical Data

4.1 DC Input

Model	X1-MINI -0.6K-G4	X1-MINI -0.7K-G4	X1-MINI -1.1K-G4	X1-MINI -1.5K-G4	X1-MINI -2.0K-G4	X1-MINI -2.5K-G4	X1-MINI -3.0K-G4	X1-MINI -3.3K-G4
Max. PV array input power (Wp)	1200	1400	2200	3000	4000	5000	6000	6600
Max. PV input voltage [V]	450	450	450	450	450	550	550	550
Startup voltage [V]	50	50	50	50	50	50	50	50
Nominal input voltage [V]	360	360	360	360	360	360	360	360
MPP tracker voltage range [V]	40-450	40-450	40-450	40-450	40-450	40-550	40-550	40-550
No. of MPP trackers/Strings per MPP tracker	1/1							
Max. input current [A]	16 A							
Max. short circuit current [A]	22 A							

4.2 AC Output

Model	X1-MINI -0.6K-G4	X1-MINI -0.7K-G4	X1-MINI -1.1K-G4	X1-MINI -1.5K-G4	X1-MINI -2.0K-G4	X1-MINI -2.5K-G4	X1-MINI -3.0K-G4	X1-MINI -3.3K-G4
Nominal AC output power [W]	600	700	1100	1500	2000	2500	3000	3300
Nominal AC output current [A]	2.6	3.1	4.8	6.5	8.7	10.9	13.1	14.4
Max. AC output apparent power [VA]	600	770	1210	1650	2200	2750	3300	3300
Max. AC output current [A]	3	3.5	5.5	7.5	10	12.5	15	15
Nominal AC voltage [V]	220/230/240							
Nominal grid frequency [Hz]	50/60							
Displacement power factor	0.8leading-0.8lagging							
THDi (rated power) [%]	<3							

4.3 System Data, Protection and Standard

Model	X1-MINI -0.6K-G4	X1-MINI -0.7K-G4	X1-MINI -1.1K-G4	X1-MINI -1.5K-G4	X1-MINI -2.0K-G4	X1-MINI -2.5K-G4	X1-MINI -3.0K-G4	X1-MINI -3.3K-G4
Max. efficiency [%]	98	98	98	98	98	98	98	98
Euro. efficiency [%]	95	95	95.5	96	96.5	96.5	96.5	96.5
Standby consumption [W] @Night	<1							
Ingress protection	IP66							
Protection class	Class I							
Over voltage category	II (DC),III (AC)							
Operating temperature range [℃]	-25-60							
Max. operation altitude [m]	<4000							
Humidity [%]	0-100							
Typical noise emission [dB]	25							
Storage temperature [℃]	-30-70							
Dimensions(W×H×D) [mm]	290x206x120							
Weight [kg]	5.2	5.2	5.2	5.2	5.2	5.5	5.5	5.5
Cooling concept	Nature cooling							
Communication interfaces	WiFi/LAN/4G Dongle (optional) &USB,RS485/CT/DI/DO							
Protection								
Overlunder voltage protection	YES							
D.C isolation protection	YES							
Monitoring ground fault protection	YES							
Grid monitoring	YES							
D.C injection monitoring	YES							
Back feed current monitoring	YES							
Residual current detection	YES							
Anti-islanding protection	YES							
Over temperature protection	YES							
SPD (PV/AC)	Type II (Optional)							
AFCI	Optional							
Standard								
Safety	EN/IEC62109-1/2							
EMC	EN61000-6-1/2/3/4; EN61000-3-2/3/11/12; EN55011							
Certification	IEC61727, EN50549, G98, AS 4777.2, VDE4105, CEI 0-21, VFR							

ภาคผนวก ข. *X1 Series User Manual 0.6kW - 3.3kW . (ต่อ)*

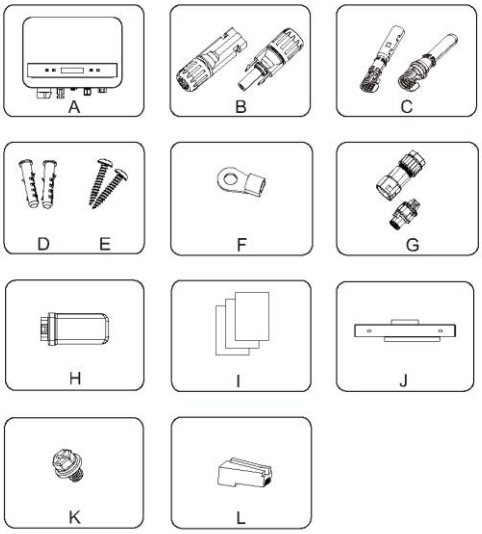
5. Installation

5.1 Check for Transport Damage

Make sure the inverter is intact during transportation. If there are some visible damages, such as cracks, please contact your dealer immediately.

5.2 Packing Lists

Open the package and fetch out the product, check the accessories at first. The packing list is shown as below.



Object	Quantity	Description
A	1	Inverter
B	2	Female DC unit*1, Male DC unit *1
C	2	DC pin contact positive*1 DC pin contact negative*1
D	2	Expansion tube
E	2	Self-tapping screw
F	1	Earth terminal
G	1	AC connector
H	1	Dongle (optional)
I	/	Documentation
J	1	Bracket
K	1	M5*L8 screw
L	1	RJ45 terminal

NOTE!
For the optional accessories, please be subject to the actual delivery.

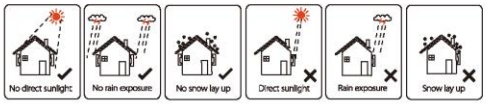
ภาคผนวก ข. *X1 Series User Manual 0.6kW - 3.3kW . (ต่อ)*

5.3 Installation Precaution

The inverter is designed for outdoor installation (IP 66).

Make sure the installation site meets the following conditions:
Avoid exposure to glare.
Avoid placing in areas where highly flammable materials are stored.
Avoid placing in potential explosive areas.
Avoid placing near the television antenna or antenna cable.
Avoid placing in an altitude of higher than 4000 m above sea level.
Avoid placing in environment of precipitation or humidity (100%).
Be sure the ventilation is good enough.
The ambient temperature in the range of -30℃ to +70℃.
The slope of the wall should be within ±5°.
The wall hanging the inverter should meet conditions below:
1) Solid brick/concrete, or strength equivalent mounting surface;
2) Inverter must be supported or strengthened if the wall's strength isn't enough (such as wooden wall, the wall covered by thick layer of decoration)

Please avoid direct sunlight, rain exposure, snow laying up during installing and operating.



Available Space Size

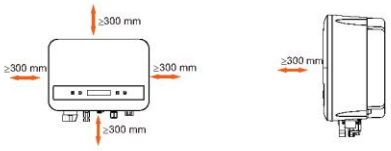


Table2 Available Space Size

Position	Min.size
Left	300 mm
Right	300 mm
Top	300 mm
Bottom	300 mm
Front	300 mm

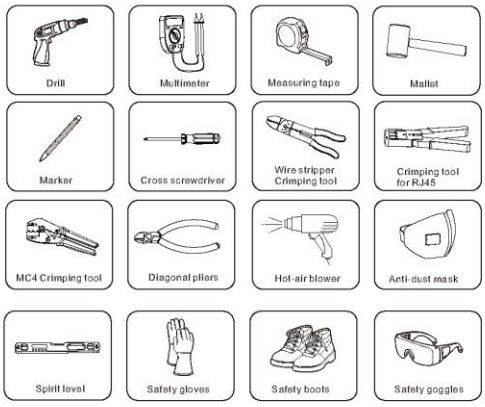
NOTE!
Avoid installing in the confined space!

ภาคผนวก ข. *X1 Series User Manual 0.6kW - 3.3kW . (ต่อ)*

5.4 Installation Steps

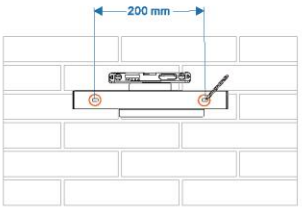
➢ Preparation

Tools below are needed before installation.

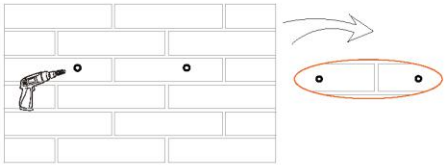


➢ Step 1: Screw the wall bracket on the wall

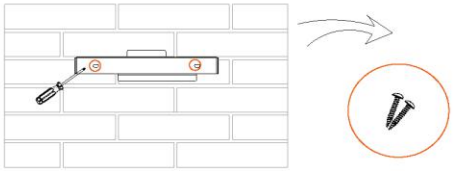
a) Use the wall bracket as a template to mark the position of the 2 holes on the wall.



b) Drill holes with the drill (hole diameter: 6mm), make sure the holes are deep enough (at least 50 mm) for installation.



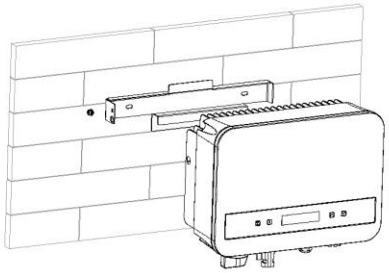
c) Insert the expansion tubes in the holes using the mallet, place the wall bracket and use self-tapping screws to tighten the bracket.



ภาคผนวก ข. *X1 Series User Manual 0.6kW - 3.3kW . (ต่อ)*

➢ Step 2: Match the inverter with wall bracket

d) Hang the inverter over the bracket, move the inverter close to it, slightly lay down the inverter, and make sure the mounting bar on the back are fixed well with the groove on the bracket.



e) Screw down the M5*L8 screw on the left side of the inverter.

5.5 Connections of the Inverter

5.5.1 The Main Steps to Connect to the Inverter

➢ PV String Connection

The inverter has one-string PV connector. Please select PV modules with excellent function and reliable quality. Open circuit voltage of module array connected should be < Max. DC (table as follows) input voltage, and operating voltage should be within the MPPT voltage range.

Table3 Max. DC Voltage Limitation

Model	X1-MINI-0.6K/0.7K/1.1K/1.5K/2.0K-G4	X1-MINI-2.5/3.0/3.3K-G4
Max.DC Voltage (V)	450	550

DANGER!
Danger to life due to high voltages on DC conductors.
- When exposed to sunlight, the PV array generates dangerous DC voltage which is present in the DC conductors. Touching the DC conductors can lead to lethal electric shocks.
- Cover the PV modules.
- Do not touch the DC conductors.

WARNING!
PV module voltage is very high which belongs to dangerous voltage range, please comply with the electric safety rules when connecting.

WARNING!
Please do not ground the PV positive or negative!

Please follow the requirements of PV modules as below:
- Same type; Same quantity; Identical alignment; Identical tilt.
- In order to save cable and reduce the DC loss, we suggest installing the inverter near PV modules.

Table 4 Cable and Micro-breaker recommended

Model	X1-MINI-0.6K-G4	X1-MINI-0.7K-G4	X1-MINI-1.1K-G4	X1-MINI-1.5K-G4	X1-MINI-2.0K-G4	X1-MINI-2.5K-G4	X1-MINI-3.0K-G4	X1-MINI-3.3K-G4
L,N cable	2.5-6 mm²	2.5-6 mm²	2.5-6 mm²	2.5-6 mm²	2.5-6 mm²	2.5-6 mm²	2.5-6 mm²	2.5-6 mm²
PE cable	2.5-6 mm²	2.5-6 mm²	2.5-6 mm²	2.5-6 mm²	2.5-6 mm²	2.5-6 mm²	2.5-6 mm²	2.5-6 mm²
Micro-breaker	10 A	10 A	10 A	10 A	16 A	20 A	20 A	20 A

*Copper cable is recommended, if you use aluminum cable, please consult the inverter manufacturer.
*The parameter varies because of different environment and material. Please choose appropriate cable and micro-breaker according to the local laws and regulations.

- **Connection Steps**

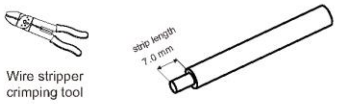
Tools below are needed before connection.

Wire stripper crimping tool

MC4 crimping tool (4mm² - 6mm²)

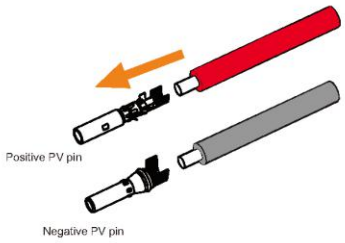
MC4 crimping tool recommended model : H4TC0001 manufacturer: Amphenol

a) Turn off the DC switch, then choose 4mm² wire to connect the PV module.
b) Strip 7mm of insulation from the wire end by using the wire stripper crimping tool.



Wire stripper crimping tool

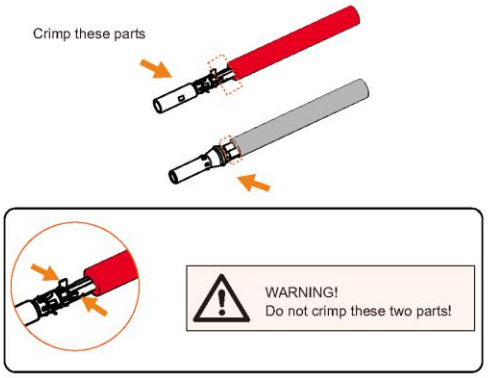
c) Insert striped wire into pin contact and ensure all conductor strands are captured in the pin contact.



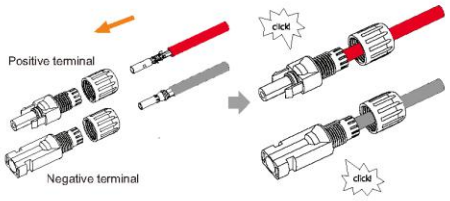
d) Crimp pin contact by using the MC4 crimping tool.

MC4 crimping tool (4mm² - 6mm²)

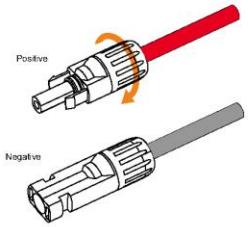
(recommended model: H4TC0001, manufacturer: Amphenol)



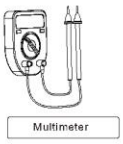
e) Separate the DC connector as two parts: the plug and the cable nut. Insert the wire into plug forcibly, when a "click" is heard or felt, the pin contact assembly is seated correctly.



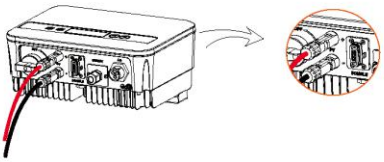
f) Then screw down the cable nut.



g) Use a multimeter to measure the open circuit voltage of the positive pole and negative pole of the PV cable, and make sure the open circuit voltage less than the permissive max input voltage;



h) Remove the blue protective cover of the PV +&- interface at the bottom of the inverter, and insert the completed PV terminals according to the positive and negative correspondence.



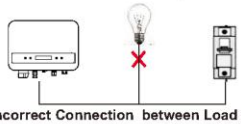
NOTE!
Keep the DC switch of the inverter OFF during connection.

➢ Grid Connection

The inverter is designed for single phase grid. Voltage range is 220/ 230/ 240 V, frequency is 50/ 60 Hz. Other technical requests should comply with the requirement of the local public grid.

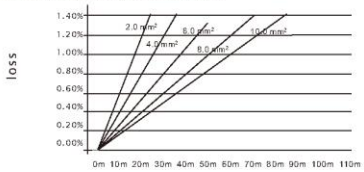
NOTE!
Inverters should not be used in multiple phase combinations.

Micro-breaker should be installed between inverter and grid, any loads should not be connected with inverter directly.



Incorrect Connection between Load and Inverter

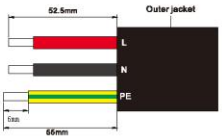
Impedance of the Inverter AC connecting dot should be less than 2 Ω. To ensure reliable anti-islanding function, PV cable should be used to ensure wire loss < 1% than normal power. Moreover, length between AC side and grid connecting dot should be less than 150 m. The following chart is the cable length, section area and wire loss.



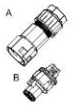
This product has a professional IP67 AC waterproof connector (after connection). You have to wire AC by yourself. Please see the figure above.

• Connection Steps

a) Check the grid voltage and compare with the permissive voltage range (refer to technical data).
b) Disconnect the circuit-breaker from all the phases and secure against re-connection.
c) Strip the wires:
- Strip L and N wires to 52.5mm and the PE wire to 55mm.
- Use the crimping pliers to strip 6mm of insulation from all wire ends as below.



d) The AC connector provided in the packing list includes 2 parts (A and B).

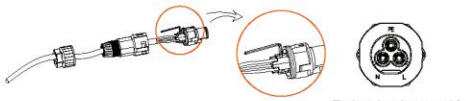


- Separate A into 2 components.

- Then the AC connector is finally classified into 3 components for use (as shown below).

e) Slide the component 1 and component 2 onto the cable.

f) Insert the stripped end of each three wires into the appropriate hole in the component 3, and then tight each screw (to tight each wire in place). (Allen wrench. Torque: 0.5±0.1N·m)



The front view of component 3

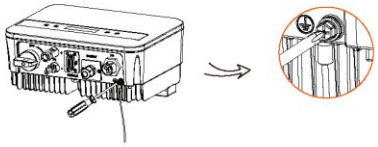
g) Insert component 3 into component 2.

h) Screw down the component 1 tightly. (torque: 3±0.3N·m)

I) Connect the AC plug to the inverter.

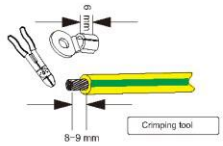
➢ **Earth Connection**

Screw the ground screw with cross screwdriver shown as follow. (torque: 1.5± 0.2N.m)

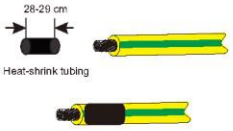


WARNING!
Be sure the ground wire must be connected!

Connection steps:
1) Use a crimping tool to strip the terminal from the PE cable.



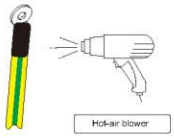
2) Slide the heat-shrink tubing (UI224 125℃ VW-1 600V) over the PE cable.

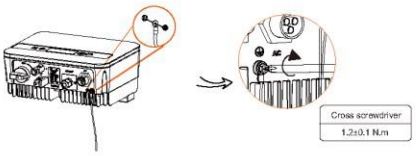


3) Insert the PE cable into the terminal.

4) Use a crimping tool to squish the terminal.

5) Use a hot-air blower to blow the heat-shrink tubing.



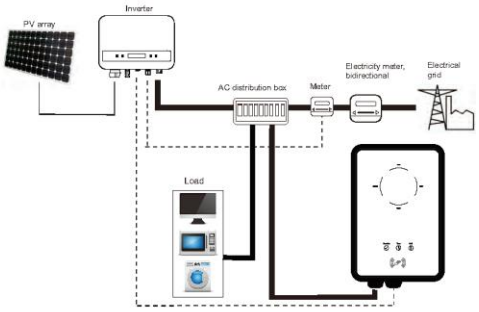


5.5.2 Communication interface
This product has a series of communication interfaces: such as WiFi, COM/CT.

5.6 EV-Charger Function

The inverter can communicate with the smart EV-Charger to form an intelligent photovoltaic, storage and EV charging energy system, thus maximizing the utilization of photovoltaic energy.

Diagram: Intelligent Photovoltaic, Storage and EV Charging Energy System



Wiring operation

a) Plug one terminal of the communication cable to the right pin of the EV-Charger and the other terminal to PIN 4 & 5 of the "COM/CT" port of the inverter.

b) Connect the meter to PIN 4 & 5 of the "COM/CT" port of the inverter.

Setting

Turn on the power of the entire system, enter the "Settings" page of the inverters on the LCD screen.

a) Enter the "Export Control" page and chose "CT" or "Meter".

>Export Control DRM Function	>Mode Select Meter
	>Mode Select CT

b) Select "EvChargerEnable" and then enter "Mode Select". Ensure the interface shows "Enable" under "Mode Select", which indicates the EV-Charger function started successfully.

>EvChargerEnable Adapter Box	>Mode Select Enable

For the installation and settings of the EV-Charger, please refer to the user manual of the EV-Charger for details.

Note!
The EV-Charger function and the parallel system with Datahub or the parallel system with Modbus Function cannot be used at the same time currently.

④ Upgrade

User can update the inverter system through the USB flash dirver.

WARNING!
Make sure the input voltage is more than 100 V dc (in good illumination condition), otherwise it may result in failing during updating.

➢ Upgrade Steps:

1) Please contact our service support to get the update file, and extract it into your USB flash dirver as the following file path:

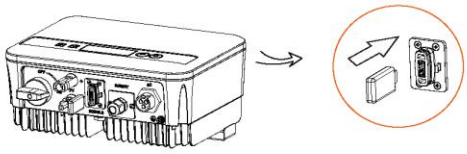
"Update\ARM\323101023800_X1_MINI_G4_ARM_VXXX.XX_XXXXXXXX.bin";
"Update\DSP\323101023700_X1_MINI_G4_DSP_VXXX.XX_XXXXXXXX.bin".

Note: Vx.xx is version number, xxxxxxxx is file completion date.

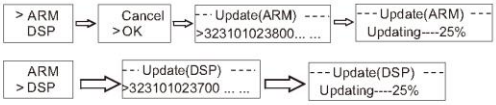
WARNING!
Make sure the directory is in accordance with above form strictly!
Do not modify the program file name! Otherwise it may cause the inverter not to work anymore!

NOTE!
The format of U-disk system shall be FAT32.

2) Insert USB flash drive with update program into the DONGLE port on the bottom of the inverter. Turn on DC switch or connect the PV connector.



3) Short press up and down key to select the one that you want to update and long press down key to confirm.



4) After the upgrade is completed, please pull off the U-disk.

WARNING!
If the upgrade fails, please repeat the above operation.

5.6 Run the Inverter

➢ Start inverter after checking all below steps:

a) Check that device is fixed well on the wall.
b) Make sure the DC breaker and AC breaker are disconnected.
c) AC cable is connected to grid correctly.
d) The DC cable is properly and reliably connected;
e) The ground cable is properly and reliably connected;
f) The communication cable is properly and reliably connected.
g) All PV panels are connected to inverter correctly.
h) No foreign items, such as tools, are left on the top of the machine or in the junction box (if there is).
I)Turn on the external DC and then AC connectors.
j) Turn on the DC switch to the "ON" position.

➢ Start the inverter

a) Inverter will start automatically when PV panels generate enough energy.
b) Check the status of LED indication and LCD screen, the LED indication should be blue and the LCD screen should display the main interface.
c) If the LED indication is not blue, please check the following conditions:

- All the connections are correct.
- All the external disconnect switches are closed.
- The DC switch of the inverter is in the "ON" position.

➢ The following is the three status when operating, which means inverter starting up successfully.

Status	Description
Waiting	Inverter is waiting to check when DC input voltage from panels is greater than 40 V (start-up voltage) but less than 50 V (lowest operating voltage). When the inverter with auxiliary power supply lacks PV, the screen also shows "waiting".
Checking	Inverter will check DC input environment automatically when DC input voltage from the PV panels exceeds 50 V and PV panels have enough energy to start inverter.
Normal	Inverter begins to operate normally when the blue light is constantly on. Meanwhile feedback energy to grid (if condition permits), LCD displays present output power.

Enter the setting interface to follow the instructions when it is first time to start up.

WARNING!
Power to the unit must be turned on only after installation work has been completed. All electrical connections must be carried out by qualified personnel in accordance with legislation in force in the country concerned.

NOTE!
Please set the inverter according to local requirements.

Isolation Fault Alarm

The isolation fault alarm installed into the inverter, is the standard configuration, as required by AS 4777_2020 and New Zealand, it will give a visual alarm once the isolation impedance of the PV arrays is less than 20 KΩ.
The error indicator light will be in red and the control panel will display isofault.

Commissioning

Please select Australia Region A, B, C for power quality response modes and grid protection settings during commissioning.

- You can adjust setpoints for power quality response modes and grid protection settings if required.

After commissioning, you can view the following settings through the LCD of the inverter after commissioning:

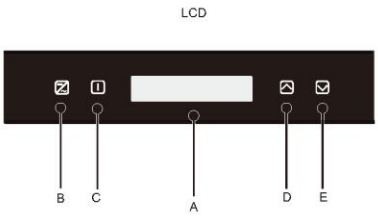
- Firmware version
- Region settings (and setpoints) for grid protection settings
- Region settings (and setpoints) for power quality response modes.

NOTE!
Once settings are selected at commissioning they are locked to view only.

NOTE!
Password should not be readily available – if you need that, you can find the password that either in a separate maintenance/service manual or available from manufacturer/importer upon request

6. Operation Method

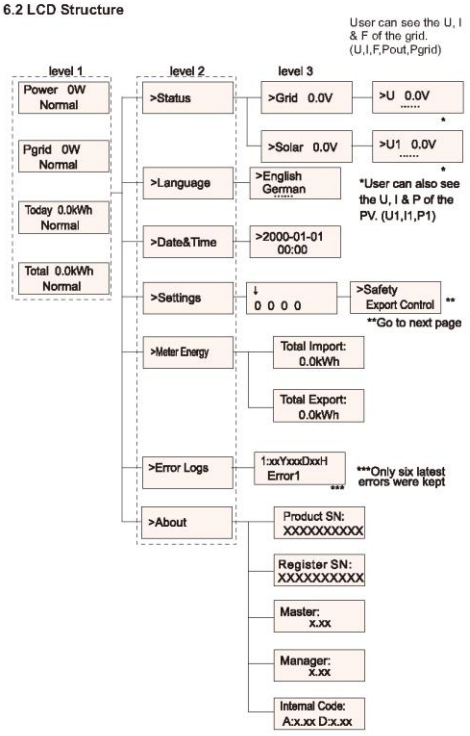
6.1 Control panel

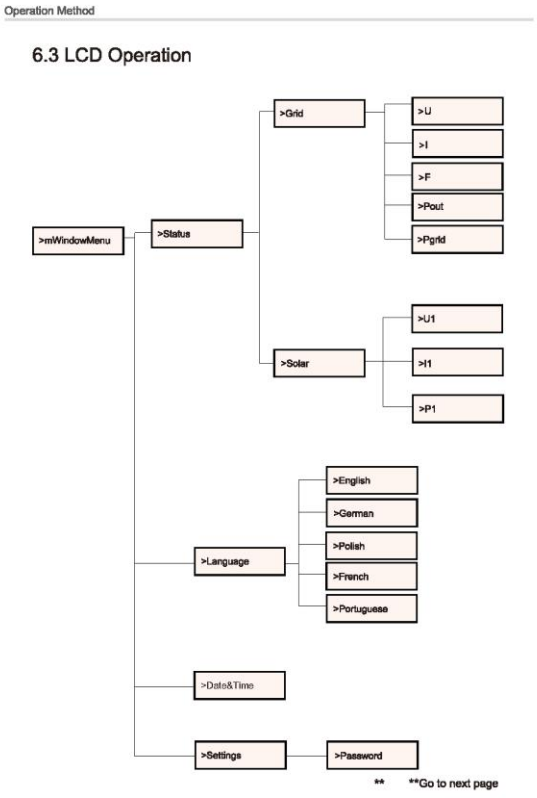


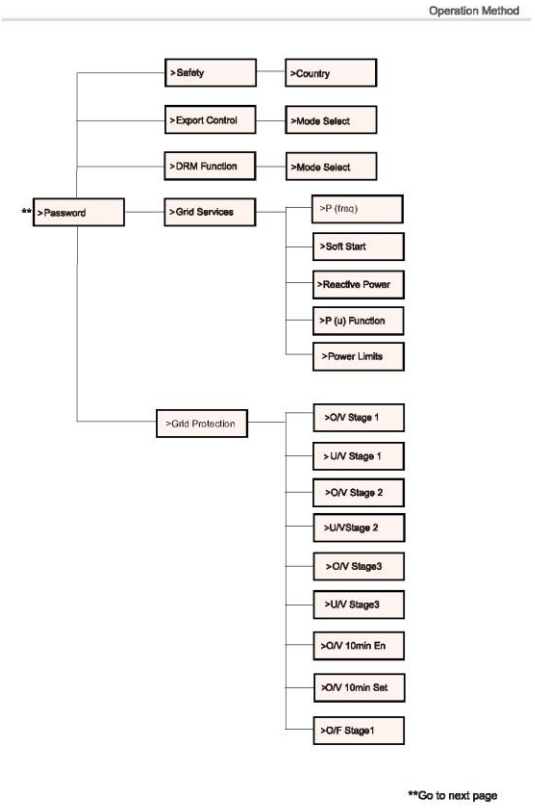
Object	Name	Description
A	LCD Screen	Display the information of the inverter.
B	Indicator LED	Light in blue: The inverter is in normal status. Flash in blue: The inverter is in waiting status.
C		Light in red: The inverter is in fault status.
D	Function Button	Up/ESC button: Short press to move cursor up or increase value. Long press to return from the current interface function.
E		Down/Enter button: Short press to move cursor down or decrease value. Long press to confirm and change parameters.

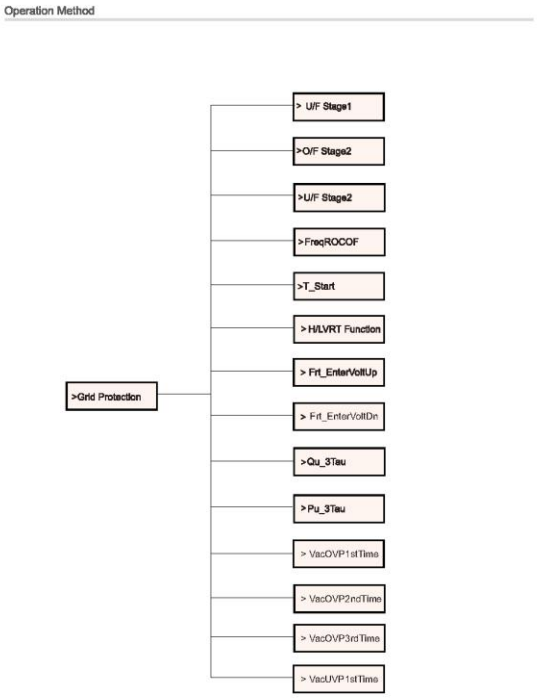
Note: When the inverter is in "Waiting" and "Checking" status, the blue light "B" is flashing; when in "Normal" status, the blue light "B" is always on.

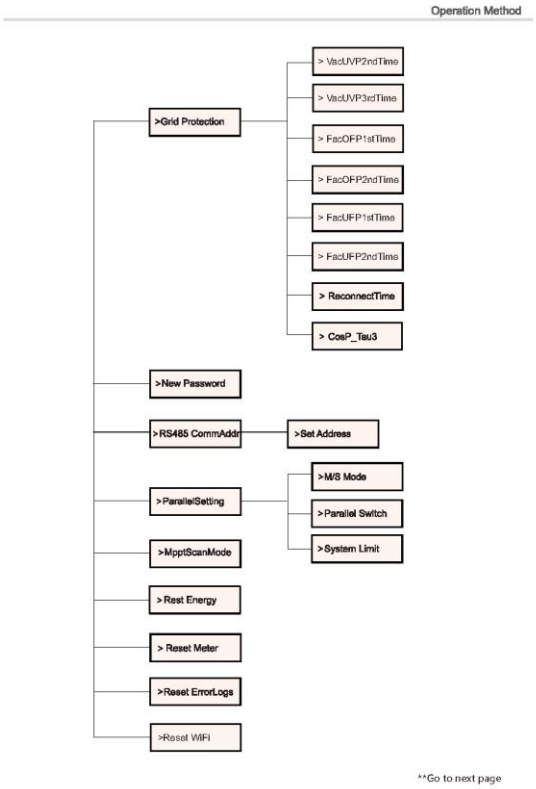
6.2 LCD Structure

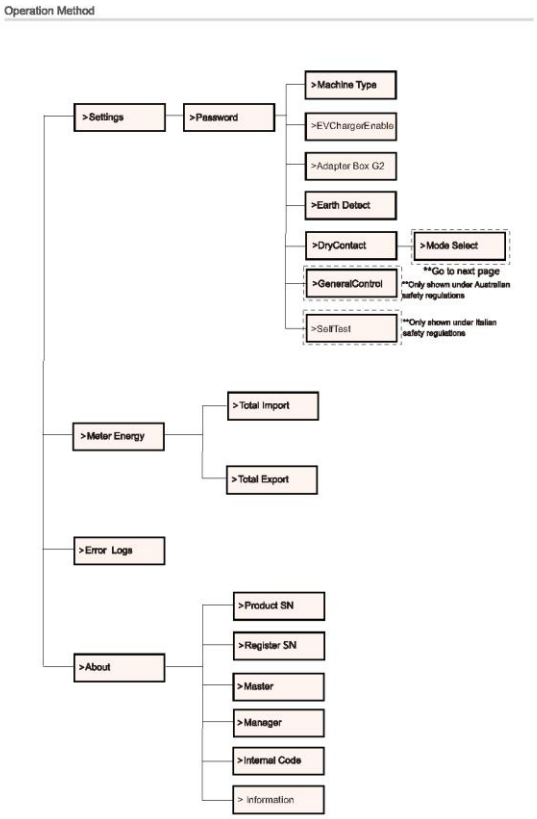


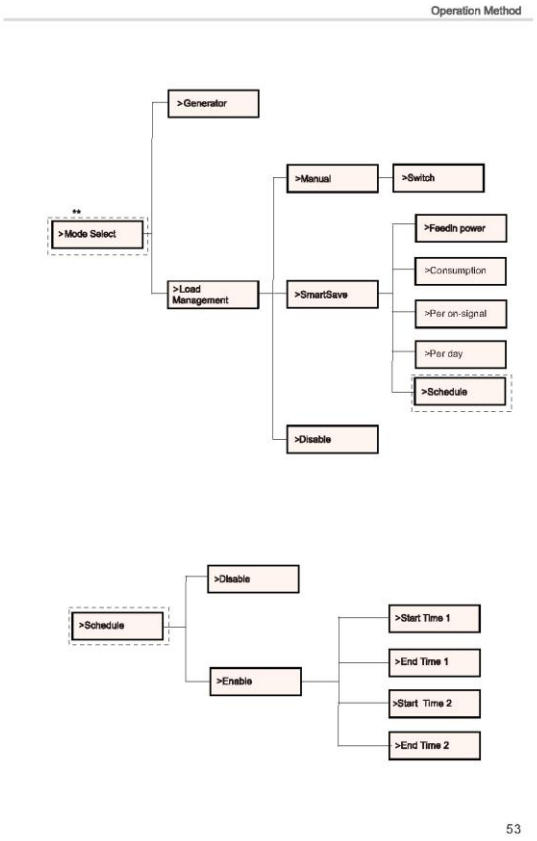

Operation Method
6.3 LCD Operation
>mWindowMenu
>Status
>Grid
>U
>I
>F
>Pout
>Pgrid
>Solar
>U1
>I1
>P1
>Language
>English
>German
>Polish
>French
>Portuguese
>Date&Time
>Settings
>Password
**
**Go to next page
50

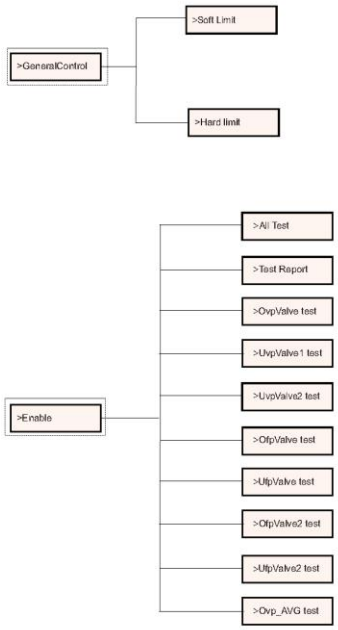

Operation Method
**
>Password
>Safety
>Country
>Export Control
>Mode Select
>DRM Function
>Mode Select
>Grid Services
>P (freq)
>Soft Start
>Reactive Power
>P (u) Function
>Power Limits
>Grid Protection
>O/V Stage 1
>U/V Stage 1
>O/V Stage 2
>U/VStage 2
>O/V Stage3
>U/V Stage3
>O/V 10min En
>O/V 10min Set
>O/F Stage1
**Go to next page
51

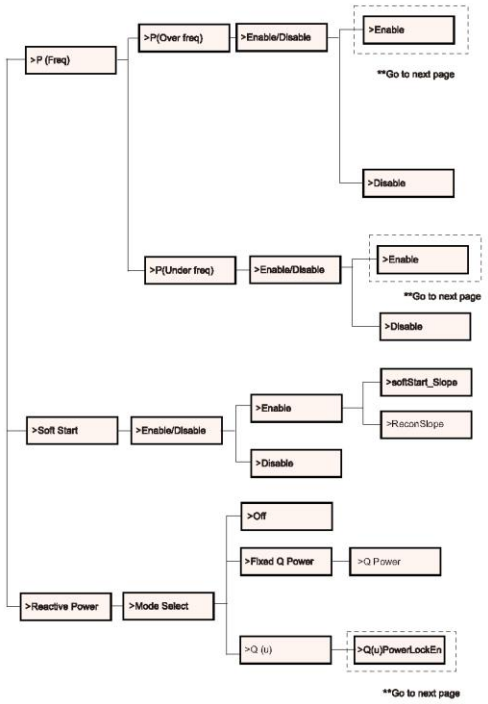

Operation Method
>Grid Protection
> U/F Stage1
>O/F Stage2
>U/F Stage2
>FreqROCOF
>T_Start
> H/LVRT Function
> Frt_EnterVoltUp
> Frt_EnterVoltDn
>Qu_3Tau
>Pu_3Tau
> VacOVP1stTime
> VacOVP2ndTime
> VacOVP3rdTime
> VacUVP1stTime
52


Operation Method
>Grid Protection
> VacUVP2ndTime
> VacUVP3rdTime
> FacOFP1stTime
> FacOFP2ndTime
> FacUFP1stTime
> FacUFP2ndTime
> ReconnectTime
> CosP_Tau3
>New Password
>RS485 CommAddr
>Set Address
>ParallelSetting
>M/S Mode
>Parallel Switch
>System Limit
>MpptScanMode
>Rest Energy
> Reset Meter
>Reset ErrorLogs
>Reset WiFi
**Go to next page
53

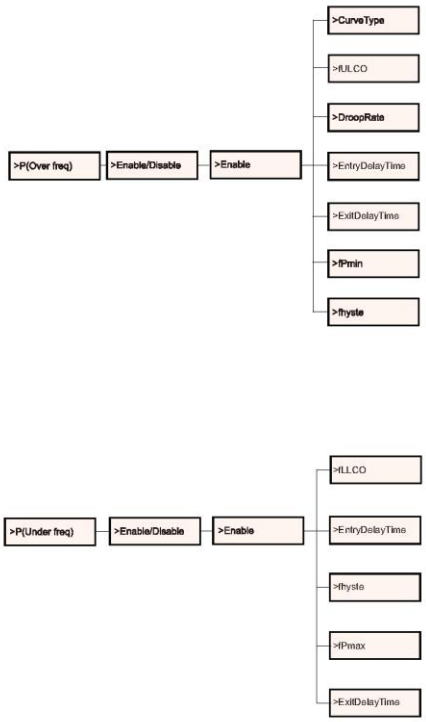

Operation Method
>Settings
>Password
>Machine Type
>EVChargerEnable
>Adapter Box G2
>Earth Detect
>DryContact
>Mode Select
**Go to next page
>GeneralControl
**Only shown under Australian safety regulations
>SelfTest
**Only shown under Italian safety regulations
>Meter Energy
>Total Import
>Total Export
>Error Logs
>About
>Product SN
>Register SN
>Master
>Manager
>Internal Code
> Information
52

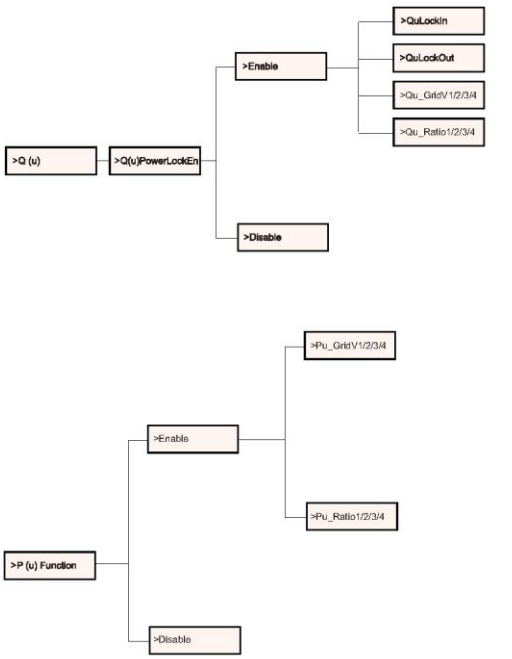

Operation Method
**
>Mode Select
>Generator
>Load Management
>Manual
>Switch
>SmartSave
>Feedin power
>Consumption
>Per on-signal
>Per day
>Schedule
>Disable
>Schedule
>Disable
>Enable
>Start Time 1
>End Time 1
>Start Time 2
>End Time 2
53


>GeneralControl
>Soft Limit
>Hard limit
>Enable
>All Test
>Test Report
>OvpValve test
>UvpValve1 test
>UvpValve2 test
>OfpValve test
>UfpValve test
>OfpValve2 test
>UfpValve2 test
>Ovp_AVG test


>P (Freq)
>P(Over freq)
>Enable/Disable
>Enable
**Go to next page
>Disable
>P(Under freq)
>Enable/Disable
>Enable
**Go to next page
>Disable
>Soft Start
>Enable/Disable
>Enable
>softStart_Slope
>ReconSlope
>Disable
>Reactive Power
>Mode Select
>Off
>Fixed Q Power
>Q Power
>Q (u)
>Q(u)PowerLockEn
**Go to next page

ภาคผนวก ข. *X1 Series User Manual 0.6kW - 3.3kW . (ต่อ)*





➢ LCD Display

• Level 1

Power 0W Normal	Pgrid 0W Normal	Today 0.0kWh Normal	Total 0.0kWh Normal

1) The first line displays the parameters(Power, Pgrid, Today and Total) and the values.

Parameter	Meaning
Power	The output power of inverter.
Pgrid	The power export to or import from the grid; (Positive value means the energy feeds into grid, negative value means the energy used from the grid).
Today	The power generated within the day.
Total	The power generated in total.

2) The second line shows the running status.
"Normal" means the running status of the inverter.

• Level 2

Long press the "Enter" button to enter the second-level interface.
User can see parameters, such as the Status, Language, Date Time, Settings (need password), Meter energy (including Total Import, Total Export), Error Logs (of the inverter), and About (the user can browse the information of the inverter, including product serial number, machine type, register sn, master, slave, manager and internal code).

```
---------- Menu ----------
>Status
 Language
```

a) Status
The status function contains two aspects: the grid and the solar.
Press "Up" and "Down" to select and long press "down" to confirm the selection, long press "Up" to return to Menu.


```
---------- Status ----------
>Grid
 Solar
```

1) Grid
This status shows the current condition of the AC output port of the inverter, such as voltage, current, output power and grid power.
This status includes 5 parameters: U, I, F, Pout, Pgrid.
Press "Up" and "Down" to select and long press "down" to confirm the selection, long press "Up" to return.

```
---------- Grid ----------
>U          0.0V
 I          0.0A
```

2) Solar
This status shows the real time PV condition of the system, such as input voltage, current and power situation of each PV input.
This status includes 6 parameters: U1, I1,P1.
Press "Up" and "Down" to select and long press "down" to confirm the selection, long press "Up" to return

```
---------- Solar ---------
>U1         0.0V
 I1         0.0A
```

b) Language
Users can select a language from English, German, Polish, French, Portuguese, Chinese, Spanish, Italian and Dutch by this function.

```
------- Language -------
>English
 German
```

c) Date Time
This interface is for the user to set the system date and time. Increase or decrease the word by pressing "Up" or "Down" button. Long press "Down"

to confirm and alternate to next parameter. After all the numbers are confirmed. Long press "Down" to enter the date and time.

------ Date&Time ---------

>2000-01-01
00: 00

d) Settings

This function is used for setting the inverter.

--------- Settings --------

↓
1 0 0 0

* Password

The default password is "2014" for the installer, which only allows the installer to review and modify necessary settings complying to the local rules and regulations. If further advanced setting is required, please contact the distributor or us for assistance. We need to increase or decrease the word by pressing up or down button. Long press "Down" to confirm and alternate to the next number.

------- Settings ---------

↓
1 0 0 0

After inputting the password, the information of the LCD interface is shown as below.

------- Settings ----------

>Safety
Export Control

1) Safety

The user can set the safety standard here according to different countries and grid tied standards. There are several standards for choice (May change without notice). In addition, the user has an "UserDefined" option which allows the user to customize relevant parameters within a wider range.

---------- Safety ---------

>Country
VDE4105

NOTE!
The grid standard needs to be set as different regions according to local requirements. If there is any doubt, please consult our service technicians for details.

The default settings for different regions are shown as follows:

Region	Australia A	Australia B	Australia C	New Zealand	
Standard Code	AS4777_2020_A	AS4777_2020_B	AS4777_2020_C	New Zealand	Setting Range
OV-G-V	265V	265V	265V	265V	230-300V
OV-GV1-T	1.5S	1.5S	1.5S	1.5S	
OV-G-V2	275V	275V	275V	275V	230-300V
OV-GV2-T	0.1S	0.1S	0.1S	0.1S	
UN-G-V1	180V	180V	180V	180V	40-230V
UNGV1-T	10S	10S	10S	10S	
UN-G-V2	70V	70V	70V	70V	40-230V
UNGV2-T	1.5S	1.5S	1.5S	1.5S	
OV-G-F1	52Hz	52Hz	56Hz	55Hz	50-55Hz
OVGF1-T	0.1S	0.1S	0.1S	0.1S	
OV-G-F2	52Hz	52Hz	56Hz	55Hz	50-55Hz
OVGF2-T	0.1S	0.1S	0.1S	0.1S	
UN-G-F1	47Hz	47Hz	45Hz	46Hz	45-50Hz
UNGF1-T	1.5S	1.5S	5S	1.5S	
UN-G-F2	47Hz	47Hz	45Hz	46Hz	45-50Hz
UNGF2-T	1.5S	1.5S	5S	1.5S	
Startup-T	60S	60S	60S	60S	15-1000S
Restore-T	60S	60S	60S	60S	15-600S
Recover-VH	253V	253V	253V	253V	
Recover-VL	205V	205V	205V	198V	
Recover-FH	50.15Hz	50.15Hz	50.15Hz	50.15Hz	
Recover-FL	47.5Hz	47.5Hz	47.5Hz	47.5Hz	
Start-VH	253V	253V	253V	253V	
Start-VL	205V	205V	205V	198V	
Start-FH	50.15Hz	50.15Hz	50.15Hz	50.15Hz	
Start-FL	47.5Hz	47.5Hz	47.5Hz	47.5Hz	

2) Export Control

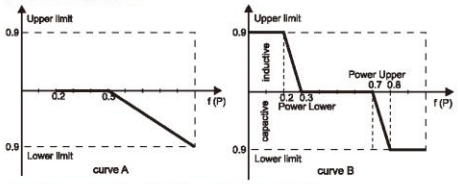
With this function the inverter can control energy exported to the grid.
Whether having this function is based on user's wishes.
Choose "Disable" means the function will be shut off.
The user value set by installer must be within the range of 0 kW to 60 kW.
Press "Up" and "Down" button to select and long press "Down" to confirm.

ภาคผนวก ข. *X1 Series User Manual 0.6kW - 3.3kW . (ต่อ)*

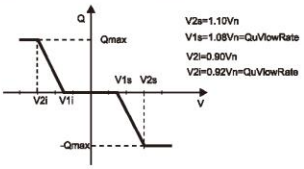
---- Export Control ------

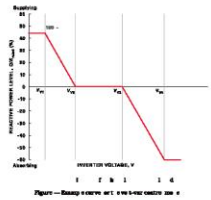
>Mode Select
Disable/Meter/CT

4-2.
Reactive power control, Reactive standard curve cos φ = f(P)
For VDE ARN 4105, curve cos φ = f(P) should refer to curve A. Default values of setting are as shown in curve A.
For E 8001, curve cos φ = f(P) should refer to curve B. Default values of setting are as shown in curve B.



Reactive power control, Reactive standard curve Q= f(V)





Voltage 1(Vv1): 180-230V
(Default: AS4777_2020_A(207V);AS4777_2020_B(205V);AS4777_2020_C(215V);New Zealand(207V))
Voltage 2(Vv2): 180-230V
(Default: AS4777_2020_A(220V);AS4777_2020_B(220V);AS4777_2020_C(230V);New Zealand(220V))
Q-Limit 2(Vv2): 0%
Voltage 3(Vv3): 230V-265V
(Default: AS4777_2020_A(240V);AS4777_2020_B(235V);AS4777_2020_C(240V);New Zealand(235V))
Q-Limit 3(Vv3): 0%
Voltage 4(Vv4): 230V-265V
(Default: AS4777_2020_A(258V);AS4777_2020_B(255V)AS4777_2020_C(255V);New Zealand(244V))
"Vv1" Leading(Supplying): +30~+60%
(Default: AS4777_2020_A(+44%);AS4777_2020_B(+30%);AS4777_2020_C(+44%);New Zealand(+60%))
Lagging(Absorbing): -30~-60%
(Default: AS4777_2020_A(-60%);AS4777_2020_B(-40%);AS4777_2020_C(-60%);New Zealand(-60%))

5.
------- P(u) Function ----------

> Enable/Disable
>Enable<

Enter
Back

> Pu_GridV1
0. 0

This function can limit the power. There are several values to be set.

3) DRM Function
Installer can choose "Enable" to control the inverter's power off through the external communication.

-----DRM Function -------

>DRM Function
Enable/Disable

4) Grid Services

Usually end user do not need to set the grid parameters. All default value have been set before leaving factory according to safety rules.

If reset is needed, any changes should be made according to the requirements of local grid.

---- Grid Service ---------

>P (freq)
Soft Start

1. ---------- P(freq) ---------

> P(Overfreq)
P(Underfreq)

If reset is needed, any changes should be made according to the requirements of local grid.

2. ---------- Soft Start -------

> Enable/Disable
>Disable <

If reset is needed, any changes should be made according to the requirements of local grid.

3. Soft Start_Slope
9%

If set as shown, 9 percent of the rated power increase per minute.

4-1. ------- Reactive Power ---

> Mode Select
>Off <

If reset is needed, any changes should be made according to the requirements of local grid.

Mode Select	Comment
Off	–
Over-Excited	PF value
Under-Excited	PF value
PF(P)	PowerFactor 1/2/3/4
	PowerRatio 1/2/3/4
	EntryVolt
	ExitVolt
Q(u)	Q(u) PowerLockEn
	Q(u) LockIn
	Q(u) LockOut
	Q(u) GridV1/V2/V3/V4
	QuRatio1/2/3/4
Fix Q Power	Q Power

NOTE!
The terms shown in the interface depend on the local safety regulations.

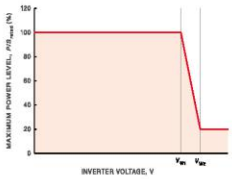


Figure — Example curve for the volt-watt response mode

Status:Enable/Disable (Note:This is used to enable or disable the Volt-Watt mode)
Voltage 1(Vw1): 235V-255V
(Default: AS4777_2020_ A(253V); AS4777_2020_B (250V); AS4777_2020_ C(253V); New Zealand(242V))
P-Limit 1(Vw1): 100%
Voltage 2(Vw2): 240V-265V
(Default: AS4777_2020_A (260V); AS4777_2020_B (260V); AS4777_2020_ C(260V); New Zealand(250V))
P-Limit 2(Vw2): 0-20%(Default: 20% for AS4777_2020_ A; AS4777_2020_B ; AS4777_2020_ C; New Zealand)

6. ------- Power Limits -------

> Proportion
0.00

User can set the power limit here, the setting value is between 0.00 and 1.1.

5) Grid Protection

Usually end user do not need to set the grid Protection. All default values have been set before leaving factory according to safety rules.
If reset is needed, any changes should be made according to the requirements of local grid.

------ **Export Control** ------

> O/V Stage1
0.0

6) New Password

The user can set the new password here. We need to increase or decrease the word by pressing "Up" or "Down" button. Long press "Down" to confirm and alternate to next word. After word is confirmed, long press "Down" to reset the password.

------- New Password -------

>
0 0 0 0

7) RS485 CommAddr

If "Enable" is selected, the inverter will communicate with the computer, through which the operating status of the inverter can be monitored. When multiple inverters are monitored by one computer, RS485 communication addresses of different inverters need to be set. RS485 function will only be effective when the address is identical. The default address is "1".

------ RS485 CommAddr------

> Set Address
2

8) ParallelSetting

When the user wants to use the parallel system with Modbus Function, enable this function and complete the settings following the instructions in section "Parallel Connection". If not needed, disable this function.

------- ParallelSetting -------

> Parallel Switch
Enable

9) Mppt Scan Mode

There are 4 modes for selection: "Off", "LowFreqScan", "MidFreqScan", "HighFreqScan". It shows the frequency of PV panel scan.
If "LowFreqScan" is selected, the inverter will scan the PV panel by low frequency.
Time for LowFreqScan: 4h; for MidFreqScan: 3h; for HighFreqScan: 1h..

------- **Mppt Scan Mode**-------

Mode Select
>Off<

10) Reset Energy

The user can clear the power energy of CT and meter by this function (if the user uses meters)

--------- Reset Energy ---------

> Reset
>YES/NO<

11) Reset Meter

The user can clear the meter and CT energy by this function. Press "Up" or "Down" button to select and long press "Down" to confirm. (The user can select "Yes" to reset meter if the user uses meters)

--------- Reset Meter ---------

> Reset
>YES/NO<

12) Reset Errorlog

The user can clear the errorlogs by this function. Press "Up" or "Down" button to select and long press "Down" to confirm.

---------- Reset Errorlog -------

> Reset
>YES/NO<

13) Reset WIFI

The user can restart the WIFI by this function.

---------- Reset WIFI --------

> Reset
>YES/NO<

14) Machine Type

The user can check the Machine Type by this function.

------- Machine Type---------

>Machine Type
X1 MINI 3.3K G4

15) EvChargerEnable

The user can turn on EvCharger function by select "Enable".

---------EvChargerEnable-------

Mode Select
> Enable/Disable <

15) Adapter Box G2

The user can connect the adapter box by this function

---------Adapter Box ----------

Mode Select
> Enable/Disable <

17) Earth Detect

The user can enable or disable the Earth Detect by this function.

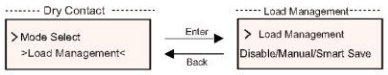
-------- Earth Detect----------

Mode Select
> Enable/Disable <

18) Dry Contact

The user can use the Dry Contact to connect heat pump by this function (require SG Ready).

There are three functions(Disable/Manual/Smart Save) which can be selected for Load Management. "Disable" means the heat pump is off. When "Manual" is selected the user can control the external relay to remain close or open manually. "Smart Save" mode can set the values of the heat pump's on/off time and conditions, operating modes.
If the user uses the inverter dry contacts to control heat pump through Adapter box, please refer to the Adapter Box Quick Installation Guide to set the parameters here.

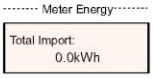


19) General Control

Under the Australia safety regulations, general control will show as meter control.

- Meter Energy

The user can check the import and export energy by this function. There are four parameters: "Total Import", "Total Export". Press "Up" and "Down" to browse the values.

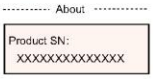


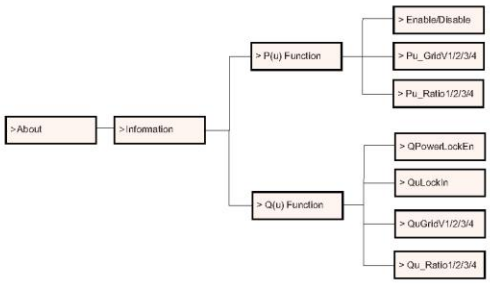
- Error Logs

The Error log contains error information happened. It can record six items at most. Press "Up" and "Down" button to review parameter. Long press "up" to return to the main interface.

- About

This interface shows information of the inverter, including "Product SN", "Register SN", "Master", "Manager" and "Internal Code".





- Level 3

Long press the "Enter" button to enter the third-level interface.

a) Status: The user can see the U/I/P parameters of the grid and the PV, such as the Ugrid, Igrid, P and F of the grid, and the Usolar, Isolar and Psolar of the PV.
b) Language: This inverter provides several languages for customer to choose.
c) Settings: Entering the installer password, the information of the LCD interface is shown in the previous page.
(1) Safety: The user can set the right safety standard here.
(2) Grid: Usually end user do not need to set the grid parameters.

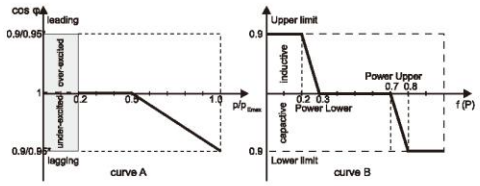
If you need to reset, any changes should comply with the requirement of local grid.

Parameter	Comment
Para	
O/V Stage1	Slow overvoltage point
U/V Stage1	Slow undervoltage point
O/V Stage2	Rapid overvoltage point
U/V Stage2	Rapid undervoltage point
O/V Stage3	Stage-3 rapid overvoltage point
U/V Stage3	Stage-3 rapid undervoltage point
O/V 10min En	10 min average overvoltage enabled
O/V 10min Set	10 min average overvoltage setting value
O/F Stage1	Slow overfrequency point
U/F Stage1	Slow underfrequency point
O/F Stage2	Rapid overfrequency point
U/F Stage1	Rapid underfrequency point
FreqROCOF	Rate of frequency change
T_Start	Self-test time
H/LVRT Function	High/low voltage ride enabled
Frt_EnterVoltDn	Entry value of low voltage ride through
Qu_3Tau	Reactive step response time constant
Pu_3Tau	Active step response time constant
VacOVP1stTime	Stage-1 overvoltage protection time
VacOVP2ndTime	Stage-2 overvoltage protection time
VacOVP3rdTime	Stage-3 overvoltage protection time
VacUVP1stTime	Stage-1 undervoltage protection time
VacUVP2ndTime	Stage-2 undervoltage protection time
VacUVP3rdTime	Stage-3 undervoltage protection time
FacOFP1stTime	Stage-1 overfrequency protection time
FacOFP2ndTime	Stage-2 overfrequency protection time
FacUFP1stTime	Stage-1 underfrequency protection time
FacUFP2ndTime	Stage-2 underfrequency protection time
ReConnectTime	Reconnect time
CosP_Tau3	Power factor step response time constant
Frt_EnterVoltUp	Entry value of high voltage ride through

(3) Power Factor: (For specific country if required by the local grid.)
There are 6 modes for selecting: Off, Under-Excited, Over-Excited, PF (p), Q (u).
All parameters are shown below.

Mode	Comment
Off	
Under excited	PF Value
Over excited	PF Value
PF(p)	PowerFactor1
	PowerFactor2
	PowerFactor3
	PowerFactor4
	PowerRatio1
	PowerRatio2
	PowerRatio3
	PowerRatio4
	EntryVolt
	ExitVolt
Q(u)	QPowerLockEn
	QuLockIn
	QuLockOut
	QuGridV1/2/3/4
	QuRatio1/2/3/4
Fixed Q Power	Q Power

For VDE 4105, curve cos φ = f(P) should refer to curve A. The default setting values are as shown in curve A.
For TOR, curve cos φ = f(P) should refer to curve B. default values of setting are as shown in curve B.



7 Troubleshooting

7.1 Troubleshooting

This section contains information and procedures for solving possible problems with the inverters, and provides you with troubleshooting tips to identify and solve most problems that could occur with the inverters.
This section will help you narrow down the source of any problems you may encounter. Please read the following troubleshooting steps.
Check warnings or fault messages on System Control Panel or Fault codes on the inverter information panel. If a message is displayed, record it before doing anything further.
Attempt the solution indicated in troubleshooting lists.

If your inverter's information panel is not displaying a Fault light, check the following list to make sure that the present state of the installation allows proper operation of the unit.

— Is the inverter located in a clean, dry, adequately ventilated place?
— Have the DC input breakers been opened?
— Are the cables adequately sized and short enough?
— Are the input and output connections and wiring in good condition?
— Are the configurations settings correct for your particular installation?
— Are the display panel and the communications cable properly connected and undamaged?

Contact our Customer Service for further assistance. Please be prepared to describe details of your system installation and provide model and serial number of the unit.

Code	Faults	Diagnosis and solution
IE:00001	TzFault	Over Current Fault. -Wait for about 10 seconds to check if the inverter is back to normal. -Disconnect the DC switch and restart the inverter. -Or consult us for solutions.
IE:00002	GridLostFault	Grid Lost Fault. -Check if the mains cable is loose. -Wait for a while and the system will reconnect when the utility is back to normal. -Or consult us for solutions.
IE:00003 IE:00004 IE:00005	GridVoltFault	Grid Voltage Out of Range. -Check if the mains cable is loose. -Wait for a while and the system will reconnect when the utility is back to normal. -Or consult us for solutions.
IE:00006 IE:00007 IE:00008	GridFreqFault	Grid Frequency Out of Range. -Wait for a while and the system will reconnect when the utility is back to normal. -Or consult us for solutions.
IE:00009	PVVoltFault	PV Voltage Fault. -Check whether the PV is overvoltage. -Or consult us for solutions.
IE:00010 IE:00061 IE:00062	BusVoltFault	DC Bus Voltage Out of Normal Range. -Check if the PV input voltage is within the operating range of the inverter. -Disconnect PV wiring and reconnect. -Or consult us for solutions.
IE:00012	GridVolt10MFault	Grid Overvoltage for Ten Minutes Fault. -The system will reconnect when the utility is back to normal. -Or consult us for solutions.
IE:00013	DciInjOCP	DCI Overcurrent Protection Fault. -Wait for a while to check if the inverter is back to normal. -Or consult us for solutions.
IE:00034	HardLimitFault	Hard Limit Fault (in Australian standard). -Wait for a while to check if the inverter is back to normal. -Or consult us for solutions.
IE:00018 IE:00019	ResidualOCP	Overcurrent Protection Fault. -Check the connections of the inverter. -Wait for a while to check if the inverter is back to normal. -Or consult us for solutions.
IE:00020	IsoFault	Isolation Fault. -Check the connections of the inverter. -Or consult us for solutions.
IE:00021	OverTempFault	Over Temperature Fault. -Check if the inverter and the ambient temperature exceeds the operating range. -Or consult us for solutions.
IE:00055	EarthFault	Earth Fault. -Check if the earth is connected properly -Or consult us for solutions.

Code	Faults	Diagnosis and solution
IE:00029	LowTempFault	Low Temperature Fault. -Check if the ambient temperature is too low. -Or consult us for solutions.
IE:00036	InternalComFault	Internal Communication Fault. -Restart the inverter to check if it is back to normal. -Update the ARM software or reburn the program. -Or consult us for solutions.
IE:00037	EepromFault	DSP EEPROM Fault. -Disconnect PV wiring and reconnect. -Or consult us for solutions.
IE:00038	RcDeviceFault	Residual Current Device Fault. -Restart the inverter. -Update the ARM software or reburn the program. -Or consult us for solutions.
IE:00041 IE:00042 IE:00043 IE:00044	PVConnDirFault	PV Direction Fault. -Check if the PV+/- sides are connected correctly. -Or consult us for solutions.
IE:00039 IE:00056	GridRelayFault	Relay Fault. -Check the grid connection. -Restart the inverter. -Or consult us for solutions.
ME:00103	Mgr EEPROM Fault	ARM EEPROM Fault. -Disconnect PV and grid, then reconnect. -Or consult us for solutions.
ME:00105	Meter Fault	Meter Fault. -Check the connection of the meter. -Check if the meter is in working order. -Or consult us for solutions.
ME:00101	PowerTypeFault	Power Type Fault. -Check the version of ARM and DSP. -Check the product SN number. -Or consult us for solutions.
ME00104	Mgr Comm Fault	Mgr InterCom Fault -Shut down photovoltaic, battery and grid, reconnect. -Or ask for help from the installer if it can not return to normal .
IE:00016	SW OCP Fault	Software Overcurrent Protection Fault. -Wait for a while to check if the inverter is back to normal. -Disconnect PV and grid, then reconnect. -Or consult us for solutions.

ภาคผนวก ข. *X1 Series User Manual 0.6kW - 3.3kW . (ต่อ)*

7.2 Routine Maintenance

Inverters do not need any maintenance or correction in most condition, but if the inverter often loses power due to overheating, this can be the following reason:

The cooling fins on the rear of house are covered by dirt.
Clean the cooling fins with a soft dry cloth or brush if necessary.
Only trained and authorized professional personnel who are familiar with the requirements of safety were allowed to perform servicing and maintenance work.

Safety checks
Safety checks should be performed at least every 12 months by manufacturer's qualified person who has adequate training, knowledge, and practical experience to perform these tests. The data should be recorded in an equipment log. If the device is not functioning properly or fails any of test, the device has to be repaired. For safety check details, refer to this manual, section 2 Safety instruction and EC Directives.

Maintain periodically
Only qualified person may perform the following works.
During the process of using the inverter, the manage person shall examine and maintain the machine regularly. The concrete operations are as follows.

1) Check that if the cooling fins on the rear of house are covered by dirts, and the machine should be cleaned and absorbed dust when necessary. This work shall be check time to time.
2) Check that if the indicators of the inverter are in normal state, check if the keys of the inverter are in normal state, check if the display of the inverter is normal. This check should be performed at least every 6 months.
3) Check that if the input and output wires are damaged or aged. This check should be performed at least every 6 months.
4) You should get the inverter panels cleaned and their security checked at least every 6 months.

8 Decommissioning

8.1 Dismantling the Inverter

- Disconnect the inverter from DC Input and AC output。
- Wait for 5 minutes for de-energizing.
- Remove the inverter from the bracket.
- Remove the bracket if necessary.

WARNING!
Before dismantling the inverter, please be sure to disconnect the DC switch, and then unplug the PV and AC cables, otherwise it will lead to an electric shock hazard.
Do not touch any inner live parts until for at least 10 minutes after disconnecting the inverter from the utility grid and the PV input.

8.2 Packaging

If possible, please pack the inverter with the original packaging.
If it is no longer available, you can also use an equivalent carton that meets the following requirements.

- Suitable for loads more than 30 kg.
- With handle.
- Can be fully closed.

8.3 Storage and Transportation
Store the inverter in dry place where ambient temperatures are always between -25 °C - +60 °C. Take care of the inverter during the storage and transportation, keep less than 4 cartons in one stack.

When the inverter or other related components need to be disposed. Have it carried out according to local waste handling regulations. Please be sure to deliver wasted inverters and packing materials to certain site, which can assist relevant department to dispose and recycle.

9 Disclaimer

This limited warranty applies to products sold after date of 1st Jan 2022, and sold through our company or authorized resellers. The defective parts or units replaced under a warranty claim become our properties, and must be returned to us or Authorized Cooperated Partners (distributors) for inspection with the original or equivalent packaging.
The product is not covered by warranty in the following cases:

A.The product is out of the warranty period;

B.Product failure is not reported to us within one month of appearance;

C.Failed to comply with our installation manual or maintenance instructions for the inverter or accessory;

D.Failed to comply with the safety rules and regulations in respect of the inverter or accessory;

E.The inverter or accessory is damaged during transportation but the claimant has signed the delivery receipt (which requests the claimant to double check the outside & inside of the package and take pictures as evidence before signing the delivery receipt);

F.The replaced products have not been returned to us or cooperated partners (distributors) within 30 days;

G.The defect is caused by improper usage of the product or failure to comply with the usage of the product for purposes other than those for which the product was designed or intended;

H.The product is moved for any reason after it has been installed (regardless of whether it has been reinstalled subsequently or moved back to the same location) unless it is reinstalled at the same address by a qualified installer who has provided a test report to our company.

I.The damage or defect is caused by lightning, flood, fire, power surge, corrosion, pest damage, actions of a third-party, or any other force majeure factors;

J.The damage or defect is caused by embedded or external software or hardware (eg. the devices to control the inverters or the devices to control battery charging or discharging) from third

parties without authorization (agreement in writing) from our company;

K.The product is modified or altered (including the cases in which the product series number or product label is altered, removed, or defaced);

L.Flaws (eg. any external scratch or stain, or nature material wearing which does not represent a defect) that do not adversely affect the proper functioning of the inverter or accessory

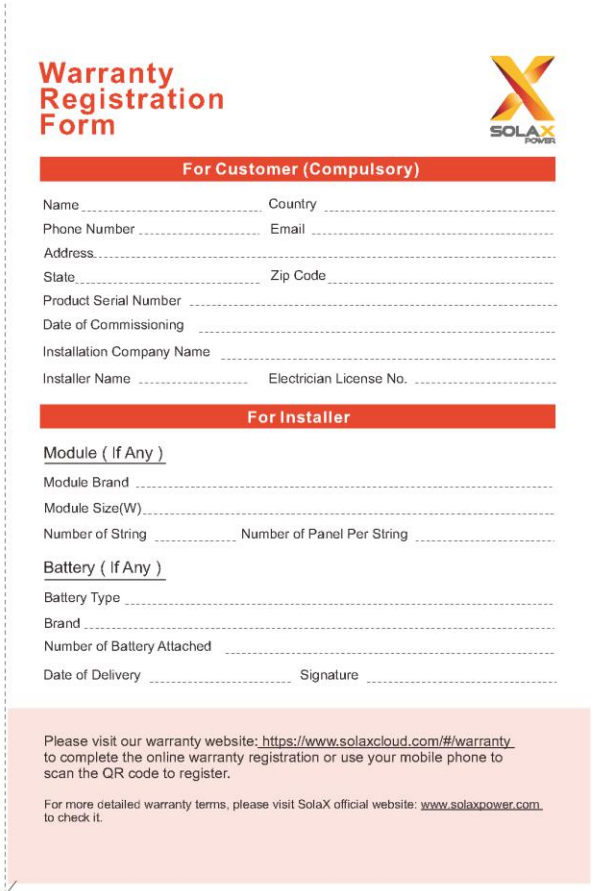
M.Normal wear or tear;

N.Travel and subsistence expenses as well as on-site installation, modification and normal maintenance costs;

O.Duties, import/export fees or costs and other general administrative costs;

The substitute inverter or accessory with technical improvement may not be entirely compatible with the remaining components of the photovoltaic system. The costs incurred as a consequence will not be covered by the warranty or extended warranty.

Furthermore, all other costs including but not limited to compensation from direct or indirect damages arising from the defective device or other facilities of the PV system, or loss of power generated during the product downtime are not covered by this warranty. In any other case, whether in contract, tort, or otherwise, the maximum compensation for customer losses caused by its faults shall not exceed the amount paid by the customer for the purchase of the equipment.



Warranty Registration Form

SOLAX POWER

For Customer (Compulsory)

Name _____ Country _____

Phone Number _____ Email _____

Address _____

State _____ Zip Code _____

Product Serial Number _____

Date of Commissioning _____

Installation Company Name _____

Installer Name _____ Electrician License No. _____

For Installer

Module (If Any)

Module Brand _____

Module Size(W) _____

Number of String _____ Number of Panel Per String _____

Battery (If Any)

Battery Type _____

Brand _____

Number of Battery Attached _____

Date of Delivery _____ Signature _____

Please visit our warranty website: https://www.solaxcloud.com/#/warranty to complete the online warranty registration or use your mobile phone to scan the QR code to register.

For more detailed warranty terms, please visit SolaX official website: www.solaxpower.com to check it.


PLEASE REGISTER THE WARRANTY
IMMEDIATELY AFTER INSTALLATION!
GET YOUR WARRANTY CERTIFICATE
FROM SOLAX!
KEEP YOUR INVERTER ONLINE & WIN
SOLAX POINTS!
1
Open your camera app and point your device at the QR code
2
Wait for the camera to recognize the QR code
3
Click banner or notification when it appears on the screen
4
Warranty registration page will be loaded automatically

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Issue Date:	13.01.2023	Project Engineer:	Allen Hu
Lab Target:	TÜV Rheinland (Shanghai) Co., Ltd	Signature:	Allen Hu

Testing Location:	
Name:	**TÜV Rheinland (Shanghai) Co., Ltd**
Address:	*No. 177, Lane 777 West Guangzhong Road, Jing'an District, Shanghai, 200072 P.R.China*

Electrical rating of the equipment:	
Rated Input:	See appended rating label
Rated Output:	See appended rating label for more detail.
Firmware version:	Master:1.00,Manager:1.00
Phase:	☒ Single-phase ☐ Three-phase
Protection class:	☐ Class 0 ☒ Class I ☐ Class II ☐ Class III
Overvoltage Category(OVC):	☐ OVC I ☒ OVC II (PV) ☒ OVC III (Mains) ☐ OVC IV
Pollution degree (PD):	☐ PD 1 ☒ PD 2 (Inside) ☒ PD 3 (Outside)
Max. operating temperature:	See appended rating label

Documents attached:	Remark
☒ Rating label	See following page.
☒ Product photo	See attachment 3.
☒ Test equipment list	See attachment 2.
☒ Wave diagram in test	See attachment 1.

Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 1 of 130

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Copy of marking plate:

Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd. Document No.: MS-0025001-appendix 13

Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Clause	Test description	Remark	Result
☒ 3	Technical Specifications	See below for detail.	Pass
☒ 3.1	Power Quality Control	See below for detail.	Pass
☒ 3.1.1	Harmonics	See clause 4.3.1.	Pass
☒ 3.1.2	Voltage Fluctuation	See clause 4.3.2.	Pass
☒ 3.1.3	Direct Current Injection	See clause 4.3.3.	Pass
☒ 3.2	Response to Electrical System	See below for detail.	Pass
☒ 3.2.1	Operating Voltage Range	See clause 4.3.4.	Pass
☒ 3.2.2	Operating Frequency Range	See clause 4.3.5.	Pass
☒ 3.2.3	Islanding Protection	See clause 4.3.6.	Pass
☒ 3.2.4	Response to Utility Recovery	See clause 4.3.7.	Pass
☒ 4	Testing Methodology	See below for detail.	Pass
☒ 4.1	Testing Institute or Organization	All tests are conducted in the organization with ISO/IEC 17025 certified laboratory.	Pass
☒ 4.2	Type of the Test	See below for detail.	Pass
☒ 4.2.1	Design Test	All tests are performed on single representative of inverter for each model.	Pass
☒ 4.3	Test Procedure and Assessment	All tests are performed according to the procedures specified in MEA regulation 2015 version.	Pass
☒ 4.3.1	Harmonics Test	See appended table 4.3.1.	Pass
☒ 4.3.2	Voltage Fluctuation Test	See appended table 4.3.2.	Pass
☒ 4.3.3	Direct Current Injection Test	See appended table 4.3.3.	Pass
☒ 4.3.4	Operating Voltage Range Test	See appended table 4.3.4.	Pass

Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

Page 4 of 130

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd. Document No.: MS-0025001-appendix 13

Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Clause	Test description	Remark	Result
☒ 4.3.5	Operating Frequency Range Test	See appended table 4.3.5.	Pass
☒ 4.3.6	Islanding Protection Test	See appended table 4.3.6.	Pass
☒ 4.3.7	Response to Utility Recovery Test	See appended table 4.3.7.	Pass
Remark:			

Revision History:

Date YYYY-MM-DD	Contents of modification (latest on top)	Prepared by	Approved by
2016-05-31	Original Test Plan	Tobias Yang	Li Weichun

Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 5 of 130

Test Data / Test Plan TÜV Rheinland (Shanghai) Co., Ltd.		TÜVRheinland® Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Special notice to test engineer

Please contact and communicate with project engineer immediately when any of the following conditions occurred:

- Unclear of the test operating conditions and test items,
- Uncertain of the test requirements or possible typing errors found in the test plan,
- Unusual operating conditions of the EUT (unusual noises, unstable operation, ...etc), any unusual phenomenon of the operation that attracts your attention,
- Receive different model/type name of samples that does not match to the test plan,
- Short of the test samples,
- Unusual high temperatures observed during testing,
- Enclosure distortion, cracks, or loosening of any enclosure parts observed during testing, and
- Fire occurred within the EUT during testing

Handling of test samples after completed all tests:

☒ Store in warehouse and wait for further notice
☐ Return to project engineer
☐ Dispose test samples according to current lab procedures
☐ Return to the client

Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 6 of 130

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Requirements to the Measurement Precision of the Measuring Devices

The used measuring devices must fulfill at least the following measuring precisions.

Minimum measuring precisions

Measured Variable	Frequency Range	Measuring Precision relative to the Measuring Range
Voltage up to 1 000 V	50 Hz	± 0.1 %
	DC to 1 kHz (except for 50 Hz)	± 1.0 %
	1 kHz to < 5 kHz	± 1.5 %
	5 kHz to < 20 kHz	± 2.5 %
	≥ 20 kHz	± 5.0 %
Current < 5A	50 Hz	± 0.5 %
	DC to < 60 Hz (except for 50 Hz)	± 1.0 %
	60 Hz to < 5 kHz	± 1.5 %
	5 kHz to < 20 kHz	± 2.5 %
Current > 5A	50 Hz	± 0.5 %
	≥ 20 kHz (except for 50 Hz)	± 5.0 %
	DC to < 5 kHz	± 1.5 %
	5 kHz to < 20 kHz	± 3.5 %
	≥ 20 kHz	± 5.0 %
Frequency	DC to < 60 Hz	± 0.01 Hz
	60 Hz to 5 kHz	± 0.2 %
	5 kHz to < 20 kHz	± 0.5 %
	≥ 20 kHz	± 1 %
Displacement Factor cosφ		0.001
Time	10 ms to < 200 ms	± 5 % of the measured value
	200 ms to <1 s	± 10 ms
	≥ 1 s	± 1 % of the measured value
Temperature	> -35°C to 100°C	± 2°C
Relative humidity	30 % to 95 % RH	± 6 % RH

Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 7 of 130

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Measured Variable	Frequency Range	Measuring Precision relative to the Measuring Range
Barometric air pressure		± 10 kPa

The selected measuring range must not be bigger than 150% of the nominal value of the signal to be measured.
Source: CTL Decision Sheet DHS251B / 2009, modified

Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 8 of 130

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

4.3.1. Harmonics Test

PROCEDURE
Test method complies with standard IEEE 1547.1-2005, clause 5.11.1.

Limits see following table:

Odd Order	Current limit (%)	Even Order	Current limit (%)
3 - 9	4.0	2 - 10	1.0
11 - 15	2.0	12 - 16	0.5
17 - 21	1.5	18 - 22	0.375
23 - 33	0.6	24 - 34	0.15
≥ 35	0.3	≥ 36	0.075
Total harmonic current distortion (THDi) 5.0 %			

RESULTS ☒Pass / ☐Fail

4.3.1	TABLE: Harmonic and waveform distortion							
Mains voltage: 230V								
P/Pn[%]	100%		66%		33%		Limit	
Ordinal number	Measurement							
	[A]	[%]	[A]	[%]	[A]	[%]	[A]	[%]
total	12.985	99.58	8.585	65.84	4.287	32.88	–	–
1	12.984	99.57	8.583	65.82	4.284	32.85	–	–
2	0.03	0.23	0.01	0.08	0.01	0.08	0.13	1.0
3	0.15	1.15	0.08	0.61	0.04	0.31	0.52	4.0
4	0.00	0.00	0.00	0.00	0.01	0.08	0.13	1.0
5	0.21	1.61	0.12	0.92	0.09	0.69	0.52	4.0
6	0.00	0.00	0.00	0.00	0.01	0.08	0.13	1.0

Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

Page 9 of 130

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

7	0.15	1.15	0.09	0.69	0.04	0.31	0.52	4.0
8	0.00	0.00	0.00	0.00	0.01	0.08	0.13	1.0
9	0.09	0.69	0.03	0.23	0.01	0.08	0.52	4.0
10	0.00	0.00	0.00	0.00	0.00	0.00	0.13	1.0
11	0.06	0.46	0.01	0.08	0.01	0.08	0.26	2.0
12	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.5
13	0.03	0.23	0.01	0.08	0.01	0.08	0.26	2.0
14	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.5
15	0.01	0.08	0.00	0.00	0.00	0.00	0.26	2.0
16	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.5
17	0.01	0.08	0.00	0.00	0.00	0.00	0.20	1.5
18	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.375
19	0.01	0.08	0.00	0.00	0.00	0.00	0.20	1.5
20	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.375
21	0.01	0.08	0.00	0.00	0.00	0.00	0.20	1.5
22	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.375
23	0.01	0.08	0.00	0.00	0.00	0.00	0.08	0.6
24	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.15
25	0.01	0.08	0.00	0.00	0.00	0.00	0.08	0.6
26	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.15
27	0.01	0.08	0.00	0.00	0.00	0.00	0.08	0.6
28	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.15
29	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.6
30	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.15
31	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.6

Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 10 of 130

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

32	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.15
33	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.6
34	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.15
35	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.3
36	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.075
37	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.3
38	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.075
39	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.3
40	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.075
TRD	1.24		1.42		1.23		5	

Remark:

I_{rated}=13.04A

$I_h\% = I_h/I_{rated}*100\%$

$$TRDi = \frac{\sqrt{I_{Rms}^2 - I_1^2}}{I_{rated}} \times 100\%$$

Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

4.3.2. Voltage Fluctuation Test

PROCEDURE
Test method complies with standard IEC 61000-3-3 or IEC 61000-3-11.

RESULTS ☒Pass / ☐Fail

4.3.2	TABLE: Flicker				
Mains voltage: 230V					
Reference Impedance Z_{test} used:		L=0.15+0.15j, N=0.1+0.1j			
	Measurement	Plt	0.01		
		Limit	0.65		
		Pst	dc(%)	dmax(%)	d(t) (ms)
		Limit= 1.0	Limit= 3.3	Limit= 4.0	Limit= 500
Phase A	1	0.01	0.00	0.51	0.00
	2	0.01	0.00	0.51	0.00
	3	0.01	0.00	0.51	0.00
	4	0.01	0.00	0.51	0.00
	5	0.01	0.00	0.51	0.00
	6	0.01	0.00	0.51	0.00
	7	0.01	0.00	0.51	0.00
	8	0.01	0.00	0.51	0.00
	9	0.01	0.00	0.51	0.00
	10	0.01	0.00	0.51	0.00
	11	0.01	0.00	0.51	0.00
	12	0.01	0.00	0.51	0.00

Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 12 of 130

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

4.3.3. Direct Current Injection Test

PROCEDURE
The test methods complies with standard IEEE 1547.1-2005 clause 5.6

RESULTS ☒Pass/ ☐Fail

4.3.3	TABLE: DC Injection						
Mains voltage: 230V							
PowerP/Pn[%]	100%						
Measurement						Limit	
Phase A		Phase B		Phase C			
[A]	[%]	[A]	[%]	[A]	[%]	[A]	[%]
0.050	0.383	--	--	--	--	0.065	0.5
PowerP/Pn[%]	66%						
Measurement						Limit	
Phase A		Phase B		Phase C			
[A]	[%]	[A]	[%]	[A]	[%]	[A]	[%]
0.045	0.345	--	--	--	--	0.065	0.5
PowerP/Pn[%]	33%						
Measurement						Limit	
Phase A		Phase B		Phase C			
[A]	[%]	[A]	[%]	[A]	[%]	[A]	[%]
0.043	0.329	--	--	--	--	0.065	0.5

Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 13 of 130

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd. Document No.: MS-0025001-appendix 13

Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

4.3.4. Operating Voltage Range Test

PROCEDURE

Test method complies with standard Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2013), clause 4.3.4.

RESULTS ☒Pass / ☐Fail

4.3.4	TABLE: Over/Under voltage						
	Rated voltage Un: 230V						
Setting value							
Voltage detection accuracy [V]	±1		Voltage detection cycle Td[ms]		20		
Magnitude Vo1 [V]	241		delay time To1 [ms]		1900		
Magnitude Vo2 [V]	271		delay time To2 [ms]		40		
Magnitude Vu1 [V]	199		delay time Tu1 [ms]		1900		
Magnitude Vu2 [V]	114		delay time Tu2 [ms]		90		
Over voltage level 1	Measurement [ms]				Limit [ms]	Remark	
	L1	L2	L3	L123			
1	1973.1	--	--	--	2000	Mains voltage From: 230 V Jump to: 242 V	
2	1975.0	--	--	--	2000		
3	1953.5	--	--	--	2000		
4	1977.7	--	--	--	2000		
5	1953.5	--	--	--	2000		
Over voltage level 2	Measurement [ms]				Limit [ms]	Remark	
	L1	L2	L3	L123			

Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

Page 14 of 130

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

1	35.9	--	--	--	50	Mains voltage From: 230 V Jump to: 272 V
2	35.4	--	--	--	50	
3	34.1	--	--	--	50	
4	32.8	--	--	--	50	
5	30.7	--	--	--	50	
Under voltage level 1	Measurement [ms]				Limit [ms]	Remark
	L1	L2	L3	L123		
1	1987.2	--	--	--	2000	Mains voltage From: 230 V Jump to: 198 V
2	1963.5	--	--	--	2000	
3	1977.4	--	--	--	2000	
4	1976.7	--	--	--	2000	
5	1973.4	--	--	--	2000	
Under voltage level 2	Measurement [ms]				Limit [ms]	Remark
	L1	L2	L3	L123		
1	59.0	--	--	--	100	Mains voltage From: 230V Jump to: 113V
2	76.1	--	--	--	100	
3	74.0	--	--	--	100	
4	72.4	--	--	--	100	
5	72.0	--	--	--	100	

Remark:
Vo1= First level over voltage magnitude, Vo2= Second level over voltage magnitude,
Vu1= First level under voltage magnitude, Vu2= Second level under voltage magnitude
To1= Delayed time for first level over voltage tripping, To2= Delayed time for second level over voltage tripping
Tu1= Delayed time for first level under voltage tripping, Tu2= Delayed time for second level under voltage tripping

Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 15 of 130

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

4.3.5. Operating Frequency Range

PROCEDURE
Test method complies with standard Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2013), clause 4.3.5

RESULTS ☒Pass / ☐Fail

4.3.5	TABLE: Over/Under frequency			
	Rated voltage frequency: 50Hz			
Setting value				
Frequency detection accuracy [Hz]	±0.1	Frequency detection cycle Td [ms]		20
Magnitude Fo [Hz]	52.1	Fo delay time To [ms]		70
Magnitude Fu [Hz]	46.9	Fu delay time Tu [ms]		70
Over frequency	Measurement [ms]		Limit [ms]	Remark
1	68.8		100	Mains voltage frequency From: 50Hz Jump to: 52.2Hz
2	66.2		100	
3	68.1		100	
4	77.9		100	
5	79.3		100	
Under frequency	Measurement [ms]		Limit [ms]	Remark
1	78.6		100	Mains voltage frequency From: 50Hz Jump to: 46.8Hz
2	85.7		100	
3	85.8		100	
4	84.7		100	
5	65.5		100	
Remark:				

Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 16 of 130

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Fo= Over frequency magnitude, Fu= Under frequency magnitude, To= Delayed time for over frequency tripping
Tu= Delayed time for under frequency tripping

Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 17 of 130

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

4.3.6 Islanding Protection

PROCEDURE
Test method complies with standard IEC 62116. $Q_f = \sqrt{(Q_L)} * \sqrt{(Q_C)/P_W}$

RESULTS ☒Pass / ☐Fail

4.3.6	TABLE: Islanding Protection						
	Mains voltage: 230V						
Power 100%							
Conditions	P_W[W]	Q_L[Var]	Q_C[Var]	Q_f	Trip time [ms]	Limitation [ms]	
P_R: -10% Q_C: +10%	L1: 2561	L1: 3000	L1: 3296	1.15	119ms		
	L2: --	L2: --	L2: --	--		2000	
	L3: --	L3: --	L3: --	--			
P_R: -10% Q_C: +5%	L1: 2561	L1: 3000	L1: 3146	1.12	250ms		
	L2: --	L2: --	L2: --	--		2000	
	L3: --	L3: --	L3: --	--			
P_R: -10% Q_C: 0%	L1: 2561	L1: 3000	L1: 2996	1.09	314ms		
	L2: --	L2: --	L2: --	--		2000	
	L3: --	L3: --	L3: --	--			
P_R: -10% Q_C: -5%	L1: 2561	L1: 3000	L1: 2846	1.07	120ms		
	L2: --	L2: --	L2: --	--		2000	
	L3: --	L3: --	L3: --	--			
P_R: -10% Q_C: -10%	L1: 2561	L1: 3000	L1: 2696	1.04	100ms		
	L2: --	L2: --	L2: --	--		2000	
	L3: --	L3: --	L3: --	--			
P_R: -5%	L1: 2703	L1: 3000	L1: 3296	1.10	101ms		

Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

Page 18 of 130

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Qc: +10%	L2: –	L2: –	L2: –	–		2000
	L3: –	L3: –	L3: –	–		
PR: -5% Qc: -10%	L1: 2703	L1: 3000	L1: 2696	0.98		
	L2: –	L2: –	L2: –	–	93ms	2000
	L3: –	L3: –	L3: –	–		
PR: 0% Qc: +10%	L1: 2845	L1: 3000	L1: 3296	1.04		
	L2: –	L2: –	L2: –	–	120ms	2000
	L3: –	L3: –	L3: –	–		
PR: -5% Qc: +5%	L1: 2703	L1: 3000	L1: 3146	1.07		
	L2: –	L2: –	L2: –	–	310ms	2000
	L3: –	L3: –	L3: –	–		
PR: -5% Qc: 0%	L1: 2703	L1: 3000	L1: 2996	1.04		
	L2: –	L2: –	L2: –	–	660ms	2000
	L3: –	L3: –	L3: –	–		
PR: -5% Qc: -5%	L1: 2703	L1: 3000	L1: 2846	1.01		
	L2: –	L2: –	L2: –	–	135ms	2000
	L3: –	L3: –	L3: –	–		
PR: 0% Qc: +5%	L1: 2845	L1: 3000	L1: 3146	1.02		
	L2: –	L2: –	L2: –	–	236ms	2000
	L3: –	L3: –	L3: –	–		
PR: 0% Qc: 0%	L1: 2845	L1: 3000	L1: 2996	0.99		
	L2: –	L2: –	L2: –	–	262ms	2000
	L3: –	L3: –	L3: –	–		
PR: 0%	L1: 2845	L1: 3000	L1: 2846	0.97	106ms	

Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 19 of 130

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Qc: -5%	L2: –	L2: –	L2: –	–		2000
	L3: –	L3: –	L3: –	–		
PR: +5% Qc: +5%	L1: 2987	L1: 3000	L1: 3146	0.97		
	L2: –	L2: –	L2: –	–	218ms	2000
	L3: –	L3: –	L3: –	–		
PR: +5% Qc: 0%	L1: 2987	L1: 3000	L1: 2996	0.95		
	L2: –	L2: –	L2: –	–	415ms	2000
	L3: –	L3: –	L3: –	–		
PR: +5% Qc: -5%	L1: 2987	L1: 3000	L1: 2846	0.92		
	L2: –	L2: –	L2: –	–	114ms	2000
	L3: –	L3: –	L3: –	–		
PR: 0% Qc: -10%	L1: 2845	L1: 3000	L1: 2696	0.94		
	L2: –	L2: –	L2: –	–	85ms	2000
	L3: –	L3: –	L3: –	–		
PR: +5% Qc: +10%	L1: 2987	L1: 3000	L1: 3296	1.00		
	L2: –	L2: –	L2: –	–	108ms	2000
	L3: –	L3: –	L3: –	–		
PR: +5% Qc: -10%	L1: 2987	L1: 3000	L1: 2696	0.90		
	L2: –	L2: –	L2: –	–	88ms	2000
	L3: –	L3: –	L3: –	–		
PR: +10% Qc: +10%	L1: 3130	L1: 3000	L1: 3296	0.95		
	L2: –	L2: –	L2: –	–	117ms	2000
	L3: –	L3: –	L3: –	–		
PR: +10% Qc: +5%	L1: 3130	L1: 3000	L1: 3146	0.93		
	L2: –	L2: –	L2: –	–	234ms	2000

Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 20 of 130

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

	L3: --	L3: --	L3: --	--		
PR: +10% Qc: 0%	L1: 3130	L1: 3000	L1: 2996	0.91	254ms	
	L2: --	L2: --	L2: --	--		2000
	L3: --	L3: --	L3: --	--		
PR: +10% Qc: -5%	L1: 3130	L1: 3000	L1: 2846	0.88	104ms	
	L2: --	L2: --	L2: --	--		2000
	L3: --	L3: --	L3: --	--		
PR: +10% Qc: -10%	L1: 3130	L1: 3000	L1: 2696	0.86	117ms	
	L2: --	L2: --	L2: --	--		2000
	L3: --	L3: --	L3: --	--		
Power 66%						
Conditions	P_W[W]	Q_L[VA]	Q_C[VA]	Q_f	Trip time [ms]	Limitation [ms]
PR: 0% Qc: -5%	L1: 1880	L1: 1980	L1: 1883	0.96	74ms	
	L2: --	L2: --	L2: --	--		2000
	L3: --	L3: --	L3: --	--		
PR: 0% Qc: -4%	L1: 1880	L1: 1980	L1: 1903	0.96	120ms	
	L2: --	L2: --	L2: --	--		2000
	L3: --	L3: --	L3: --	--		
PR: 0% Qc: -3%	L1: 1880	L1: 1980	L1: 1923	0.97	206ms	
	L2: --	L2: --	L2: --	--		2000
	L3: --	L3: --	L3: --	--		
PR: 0% Qc: -2%	L1: 1880	L1: 1980	L1: 1943	0.98	378ms	
	L2: --	L2: --	L2: --	--		2000
	L3: --	L3: --	L3: --	--		
PR: 0%	L1: 1880	L1: 1980	L1: 1963	0.98	392ms	

Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 21 of 130

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd. Document No.: MS-0025001-appendix 13

Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Qc: -1%	L2: –	L2: –	L2: –	–		2000
	L3: –	L3: –	L3: –	–		
PR: 0% Qc: 0%	L1: 1880	L1: 1980	L1: 1983	0.99		
	L2: –	L2: –	L2: –	–	920ms	2000
	L3: –	L3: –	L3: –	–		
PR: 0% Qc: +1%	L1: 1880	L1: 1980	L1: 2002	0.99		
	L2: –	L2: –	L2: –	–	250ms	2000
	L3: –	L3: –	L3: –	–		
PR: 0% Qc: +2%	L1: 1880	L1: 1980	L1: 2022	1.00		
	L2: –	L2: –	L2: –	–	216ms	2000
	L3: –	L3: –	L3: –	–		
PR: 0% Qc: +3%	L1: 1880	L1: 1980	L1: 2042	1.00		
	L2: –	L2: –	L2: –	–	244ms	2000
	L3: –	L3: –	L3: –	–		
PR: 0% Qc: +4%	L1: 1880	L1: 1980	L1: 2062	1.00		
	L2: –	L2: –	L2: –	–	330ms	2000
	L3: –	L3: –	L3: –	–		
PR: 0% Qc: +5%	L1: 1880	L1: 1980	L1: 2082	1.00		
	L2: –	L2: –	L2: –	–	234ms	2000
	L3: –	L3: –	L3: –	–		
Power 33%						
Conditions	P_W[w]	Q_L[VA]	Q_C[VA]	Q_f	Trip time [ms]	Limitation [ms]
PR: 0% Qc: -5%	L1: 971	L1: 990	L1: 935	0.92		
	L2: –	L2: –	L2: –	–	150ms	2000
	L3: –	L3: –	L3: –	–		

Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

Page 22 of 130

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

PR: 0% Qc: -4%	L1: 971	L1: 990	L1: 945	0.93	168ms	
	L2: --	L2: --	L2: --	--		2000
	L3: --	L3: --	L3: --	--		
PR: 0% Qc: -3%	L1: 971	L1: 990	L1: 955	0.94	386ms	
	L2: --	L2: --	L2: --	--		2000
	L3: --	L3: --	L3: --	--		
PR: 0% Qc: -2%	L1: 971	L1: 990	L1: 965	0.94	375ms	
	L2: --	L2: --	L2: --	--		2000
	L3: --	L3: --	L3: --	--		
PR: 0% Qc: -1%	L1: 971	L1: 990	L1: 975	0.94	340ms	
	L2: --	L2: --	L2: --	--		2000
	L3: --	L3: --	L3: --	--		
PR: 0% Qc: 0%	L1: 971	L1: 990	L1: 985	0.96	425ms	
	L2: --	L2: --	L2: --	--		2000
	L3: --	L3: --	L3: --	--		
PR: 0% Qc: +1%	L1: 971	L1: 990	L1: 995	0.96	260ms	
	L2: --	L2: --	L2: --	--		2000
	L3: --	L3: --	L3: --	--		
PR: 0% Qc: +2%	L1: 971	L1: 990	L1: 1005	0.96	240ms	
	L2: --	L2: --	L2: --	--		2000
	L3: --	L3: --	L3: --	--		
PR: 0% Qc: +3%	L1: 971	L1: 990	L1: 1015	0.97	150ms	
	L2: --	L2: --	L2: --	--		2000
	L3: --	L3: --	L3: --	--		
PR: 0%	L1: 971	L1: 990	L1: 1024	0.97	216ms	

Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 23 of 130

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Qc: +4%	L2:	--	L2:	--	L2:	--	--		2000
	L3:	--	L3:	--	L3:	--	--		
PR: 0% Qc: +5%	L1:	971	L1:	990	L1:	1034	0.98	84ms	
	L2:	--	L2:	--	L2:	--	--		2000
	L3:	--	L3:	--	L3:	--	--		
Remark:									

Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 24 of 130

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

4.3.7 Response to Utility Recovery

PROCEDURE

Test method complies with standard IEEE 1547.1-2005, clause 5.10.

RESULTS ☒Pass / ☐Fail

4.3.7	TABLE: Response to Utility Recovery			
	Rated voltage Un: 230V		Rated frequency Fn: 50Hz	
Setting value				
Voltage detection accuracy [V]	±1		Frequency detection accuracy [Hz]	±0.1
Specified recover voltage range	200-240V		Specified recover frequency range	47-52Hz
Recover time [s]	120			

Conditions[2]	U_M[1] back to 242V	U_M back to 238V	U_M back to 198V	U_M back to 202V
Reconnection	☐ Yes/ ☒ No	☒ Yes/ ☐ No	☐ Yes/ ☒ No	☒ Yes/ ☐ No
Recover time [s]	N/A	127.0	N/A	127.2
Conditions[3]	F_M[1] back to 52.2Hz	F_M back to 51.8Hz	F_M back to 46.8Hz	F_M back to 47.2Hz
Reconnection	☐ Yes/ ☒ No	☒ Yes/ ☐ No	☐ Yes/ ☒ No	☒ Yes/ ☐ No
Recover time [s]	N/A	127.0	N/A	126.8
Conditions[4]	U_M[1] back to 242V	U_M back to 238V	U_M back to 198V	U_M back to 202V
Reconnection	☐ Yes/ ☒ No	☒ Yes/ ☐ No	☐ Yes/ ☒ No	☒ Yes/ ☐ No
Recover time [s]	N/A	127.1	N/A	127.4
Conditions[5]	U_M back to 238V	U_M back to 202V	F_M back to 51.8Hz	F_M back to 47.2Hz
Reconnection	☒ Yes/ ☐ No	☒ Yes/ ☐ No	☒ Yes/ ☐ No	☒ Yes/ ☐ No
Recover time [s]	127.6	127.1	127.4	127.6
Conditions[6]	U_M back to 238V	U_M back to 202V		
Reconnection	☒ Yes/ ☐ No	☒ Yes/ ☐ No		
Recover time [s]	126.7	127.7		

Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Remark:
1) U_M =Mains voltage; F_M=Mains frequency.
2) After mains voltage tripped the over/under voltage level 1 limit.
3) After mains voltage frequency tripped the over/under frequency limit.
4) After mains voltage tripped the over/under voltage level 2 limit.
5) Retest with an abnormal 1st level voltage/frequency change event that is introduced during the reconnect countdown period.
6) Retest with an abnormal 2nd level voltage/frequency change event that is introduced during the reconnect countdown period.

Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 26 of 130

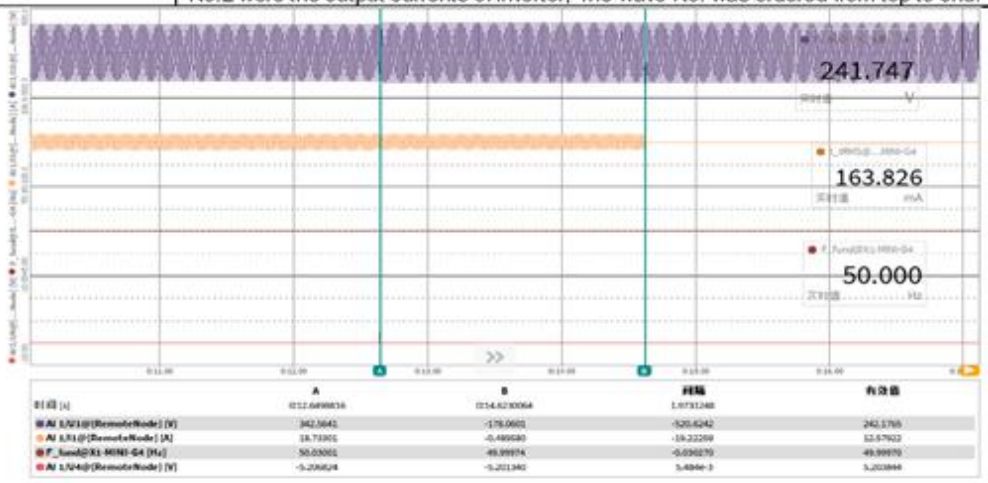
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	1	Clause:	4.3.4
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☒ First Over Voltage Magnitude ☒ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During the first level over voltage test, the L1 grid voltage was jumped to 242.0V approximately, trip time 1973.1ms. The wave No.1 were the grid voltages; The wave No.2 were the output currents of inverter; The wave No. was ordered from top to end.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

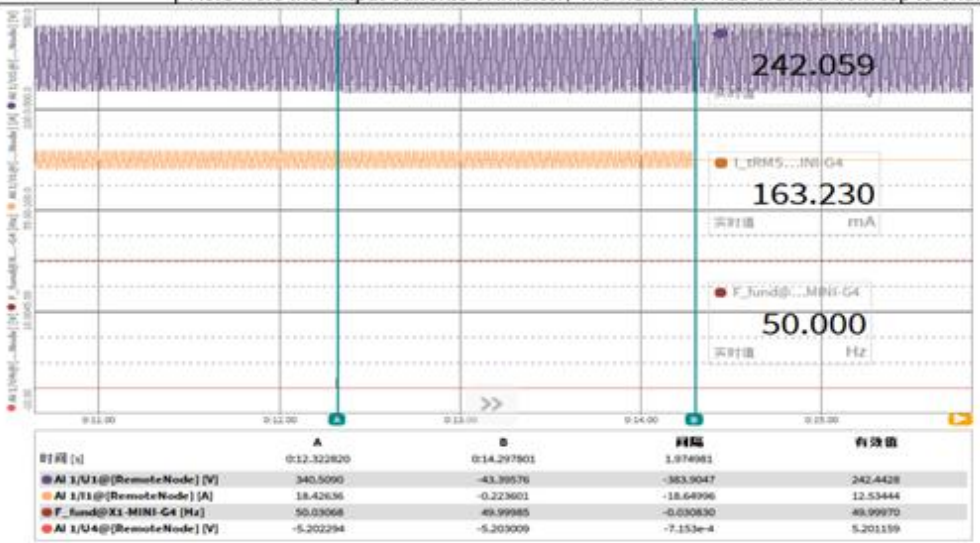
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	2	Clause:	4.3.4
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☒ First Over Voltage Magnitude ☒ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During the first level over voltage test, the L1 grid voltage was jumped to 242.0V approximately, trip time 1975.0ms. The wave No.1 were the grid voltages; The wave No.3 were the output currents of inverter; The wave No. was ordered from top to end.		



	A	B		
时间 [s]	0:12.322820	0:14.297801	1.974981	
AI 1/U1@[RemoteNode] [V]	340.5090	-43.39576	-383.9047	242.4428
AI 1/I1@[RemoteNode] [A]	18.42636	-0.223601	-18.64996	12.53444
F_fund@X1-MINI-G4 [Hz]	50.03068	49.99985	-0.030830	49.99970
AI 1/U4@[RemoteNode] [V]	-5.202294	-5.203009	-7.153e-4	5.201159

Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

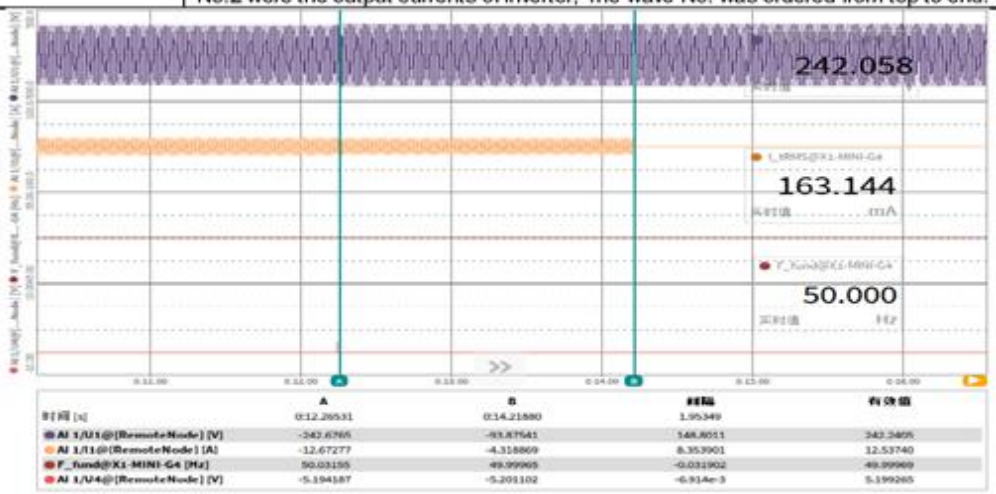
Review date: Reviewed by:

Page 28 of 130

Test Data / Test Plan		TÜVRheinland®	
TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	3	Clause:	4.3.4
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☒ First Over Voltage Magnitude ☒ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During the first level over voltage test, the L1 grid voltage was jumped to 242.0V approximately, trip time 1953.5ms. The wave No.1 were the grid voltages; The wave No.2 were the output currents of inverter; The wave No. was ordered from top to end.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

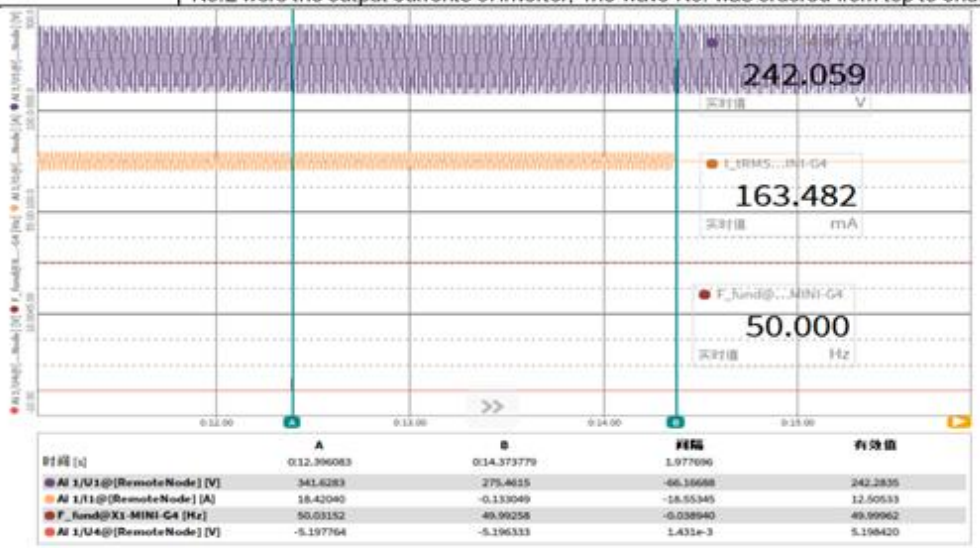
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	4	Clause:	4.3.4
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☒ First Over Voltage Magnitude ☒ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During the first level over voltage test, the L1 grid voltage was jumped to 242.0V approximately, trip time 1977.7ms. The wave No.1 were the grid voltages; The wave No.2 were the output currents of inverter; The wave No. was ordered from top to end.		



	A	B		
时间 [s]	0:12.396083	0:14.373779	1.977696	
AI 1/U1@[RemoteNode] [V]	341.6283	275.4615	-66.16688	242.2835
AI 1/I1@[RemoteNode] [A]	18.42040	-0.133049	-18.55345	12.50533
F_fund@X1-MINI-G4 [Hz]	50.03152	49.99258	-0.038940	49.99962
AI 1/U4@[RemoteNode] [V]	-5.197764	-5.196333	1.431e-3	5.198420

Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

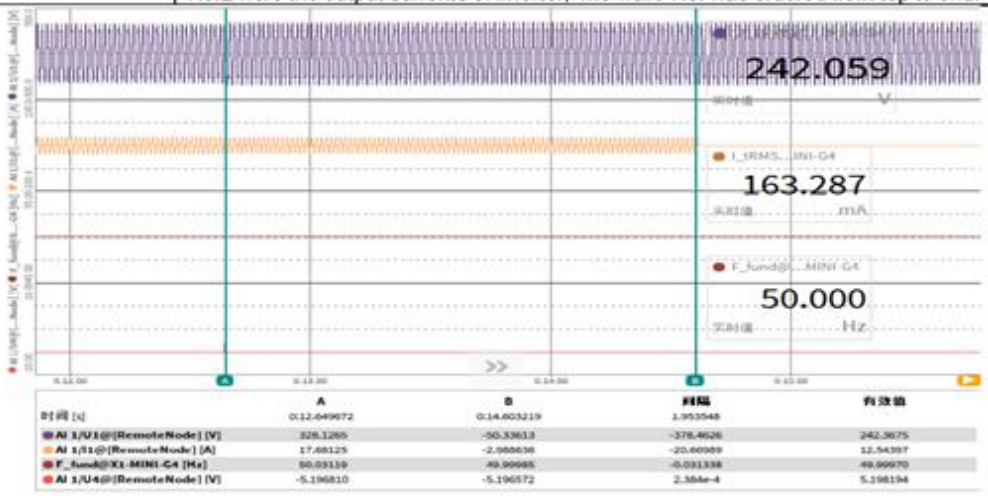
Review date: Reviewed by:

Page 30 of 130

Test Data / Test Plan		TÜVRheinland®	
TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	5	Clause:	4.3.4
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☒ First Over Voltage Magnitude ☒ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During the first level over voltage test, the L1 grid voltage was jumped to 242.0V approximately, trip time 1953.5ms. The wave No.1 were the grid voltages; The wave No.2 were the output currents of inverter; The wave No. was ordered from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

Page 31 of 130

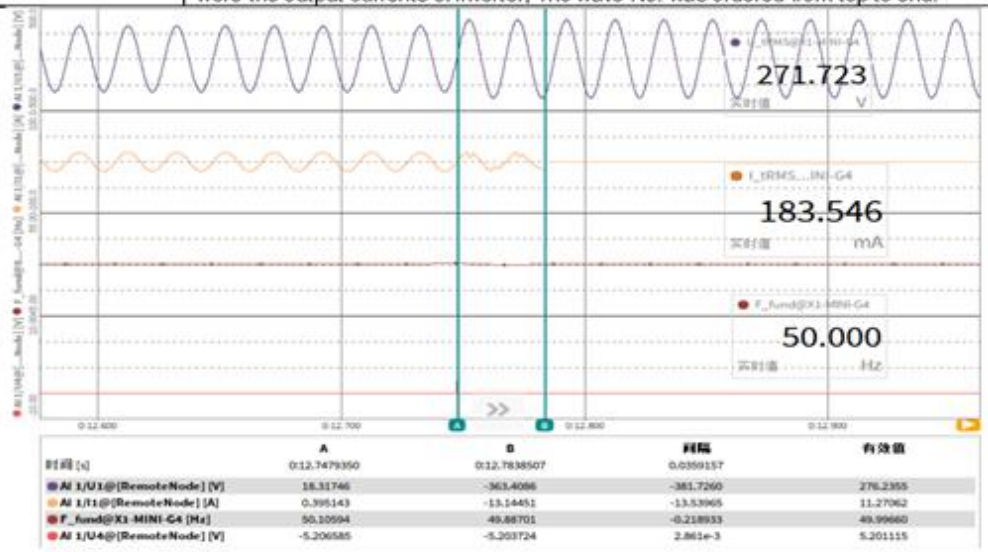
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	6	Clause:	4.3.4
Test:	☐ Islanding Protection ☒ Secondary Over Voltage Magnitude ☒ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During the second level over voltage test, the L1 grid voltage was jumped to 272.0V approximately, trip time 35.9ms. The wave No.1 were the grid voltages; The wave No.2 were the output currents of inverter; The wave No. was ordered from top to end.		



	A	B		
时间 [s]	0:12.7479350	0:12.7838507	0.0359157	
AI 1/U1@[RemoteNode] [V]	18.31746	-363.4086	-381.7260	276.2355
AI 1/I1@[RemoteNode] [A]	0.395143	-13.14451	-13.53965	11.27062
F_fund@X1-MINI-G4 [Hz]	50.10594	49.88701	-0.218933	49.99660
AI 1/U4@[RemoteNode] [V]	-5.206585	-5.203724	2.861e-3	5.201115

Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

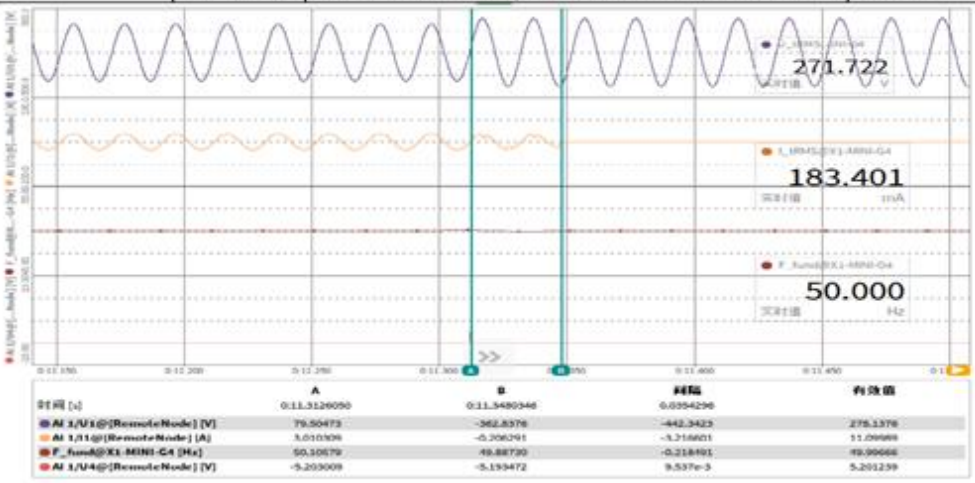
Review date: Reviewed by:

Page 32 of 130

Test Data / Test Plan		TÜVRheinland®	
TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	7	Clause:	4.3.4
Test:	☐ Islanding Protection ☒ Secondary Over Voltage Magnitude ☒ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During the second level over voltage test, the L1 grid voltage was jumped to 272.0V approximately, trip time 35.4ms. The wave No.1 were the grid voltages; The wave No.2 were the output currents of inverter; The wave No. was ordered from top to end.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

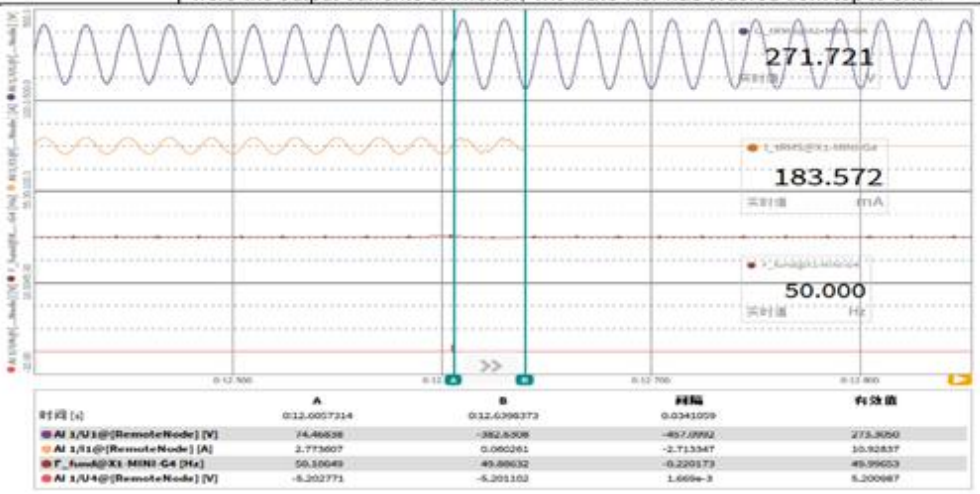
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	8	Clause:	4.3.4
Test:	☐ Islanding Protection ☒ Secondary Over Voltage Magnitude ☒ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During the second level over voltage test, the L1 grid voltage was jumped to 272.0V approximately, trip time 34.1ms. The wave No.1 were the grid voltages; The wave No.2 were the output currents of inverter; The wave No. was ordered from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

Page 34 of 130

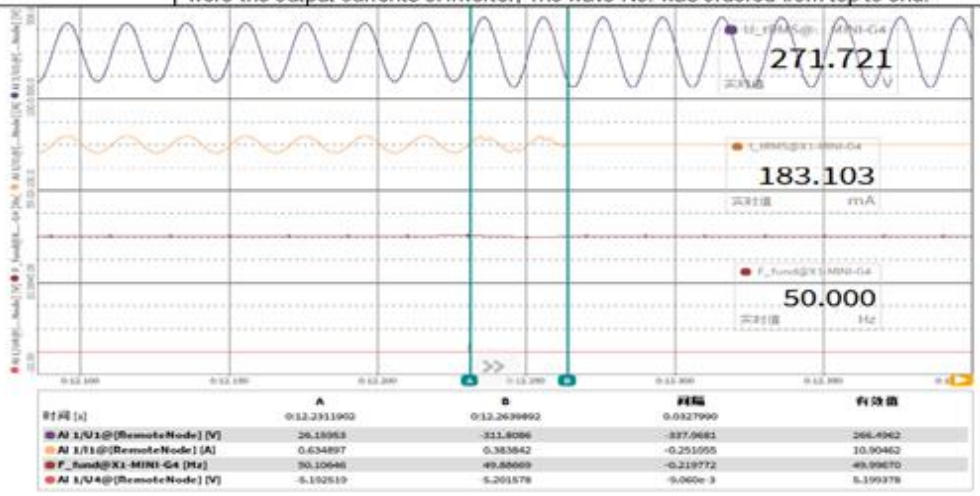
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	9	Clause:	4.3.4
Test:	☐ Islanding Protection ☒ Secondary Over Voltage Magnitude ☒ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During the second level over voltage test, the L1 grid voltage was jumped to 272.0V approximately, trip time 32.8ms. The wave No.1 were the grid voltages; The wave No.2 were the output currents of inverter; The wave No. was ordered from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

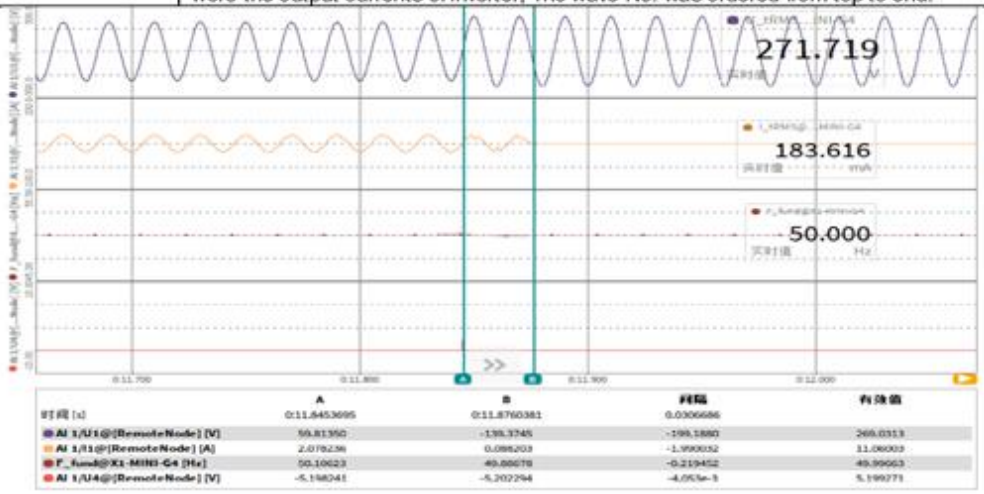
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	10	Clause:	4.3.4
Test:	☐ Islanding Protection ☒ Secondary Over Voltage Magnitude ☒ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During the second level over voltage test, the L1 grid voltage was jumped to 272.0V approximately, trip time 30.7ms. The wave No.1 were the grid voltages; The wave No.2 were the output currents of inverter; The wave No. was ordered from top to end.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

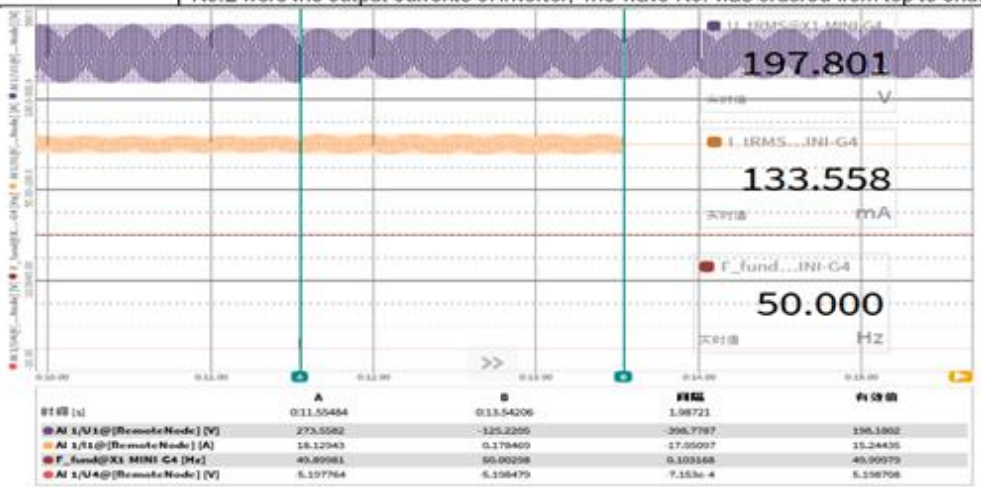
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	11	Clause:	4.3.4
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☒ First Under Voltage Magnitude ☒ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During the first level under voltage test, the L1 grid voltage was jumped to 198.0V approximately, trip time 1987.2ms. The wave No.1 were the grid voltages; The wave No.2 were the output currents of inverter; The wave No. was ordered from top to end.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

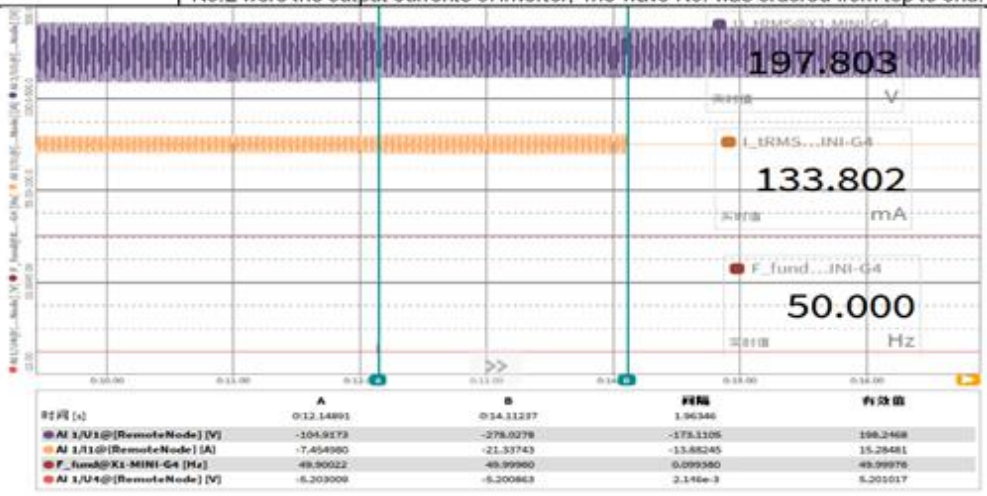
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	12	Clause:	4.3.4
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☒ First Under Voltage Magnitude ☒ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During the first level under voltage test, the L1 grid voltage was jumped to 198.0V approximately, trip time 1963.5ms. The wave No.1 were the grid voltages; The wave No.2 were the output currents of inverter; The wave No. was ordered from top to end.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

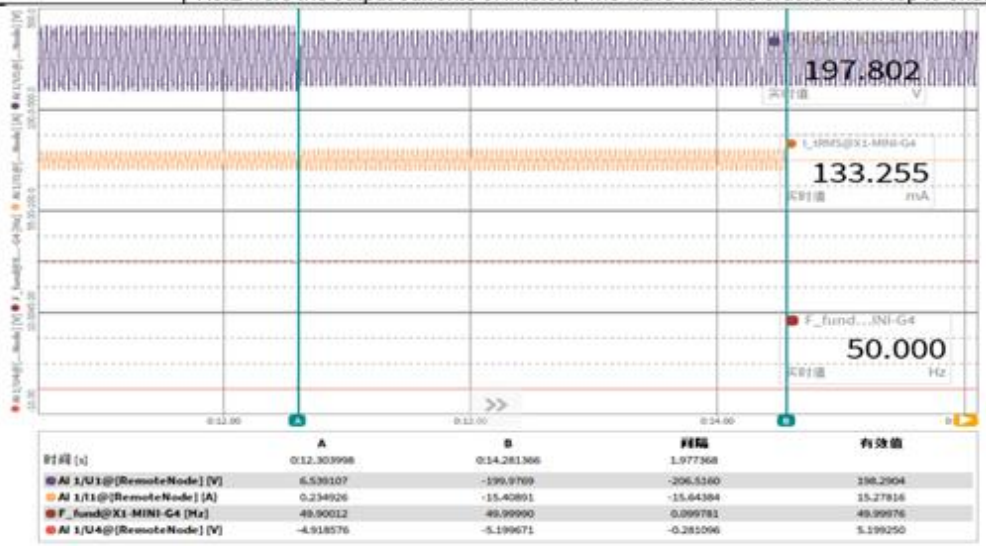
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	13	Clause:	4.3.4
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☒ First Under Voltage Magnitude ☒ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During the first level under voltage test, the L1 grid voltage was jumped to 198.0V approximately, trip time 1977.4ms. The wave No.1 were the grid voltages; The wave No.2 were the output currents of inverter; The wave No. was ordered from top to end.		



	A	B	相隔	有效值
时间 [s]	0:12.303998	0:14.281366	1.977368	
AI 1/U1@[RemoteNode] [V]	6.539107	-199.9769	-206.5160	198.2904
AI 1/I1@[RemoteNode] [A]	0.234926	-15.40891	-15.64384	15.27816
F_fund@X1-MINI-G4 [Hz]	49.90012	49.99990	0.099781	49.99976
AI 1/U4@[RemoteNode] [V]	-4.918576	-5.199671	-0.281096	5.199250

Used equipment No.: See equipment list for details Sample No.: N/A

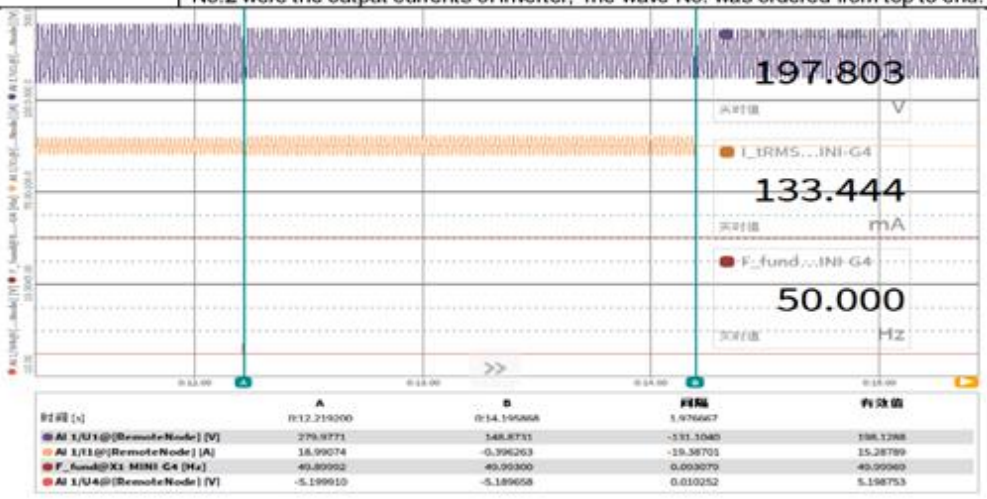
Finished date: Tested by:

Review date: Reviewed by:

Test Data / Test Plan		TÜVRheinland®	
TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	14	Clause:	4.3.4
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☒ First Under Voltage Magnitude ☒ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During the first level under voltage test, the L1 grid voltage was jumped to 198.0V approximately, trip time 1976.7ms. The wave No.1 were the grid voltages; The wave No.2 were the output currents of inverter; The wave No. was ordered from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

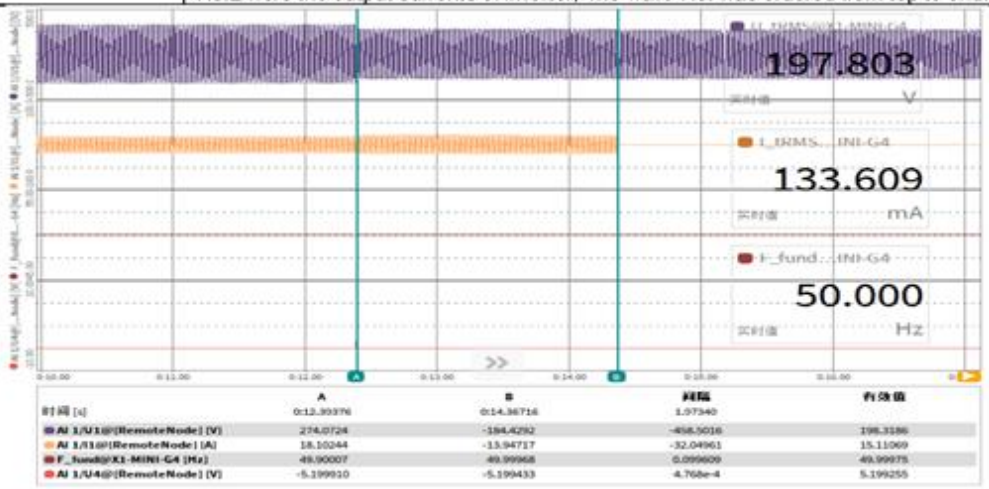
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	15	Clause:	4.3.4
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☒ First Under Voltage Magnitude ☒ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During the first level under voltage test, the L1 grid voltage was jumped to 198.0V approximately, trip time 1973.4ms. The wave No.1 were the grid voltages; The wave No.2 were the output currents of inverter; The wave No. was ordered from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

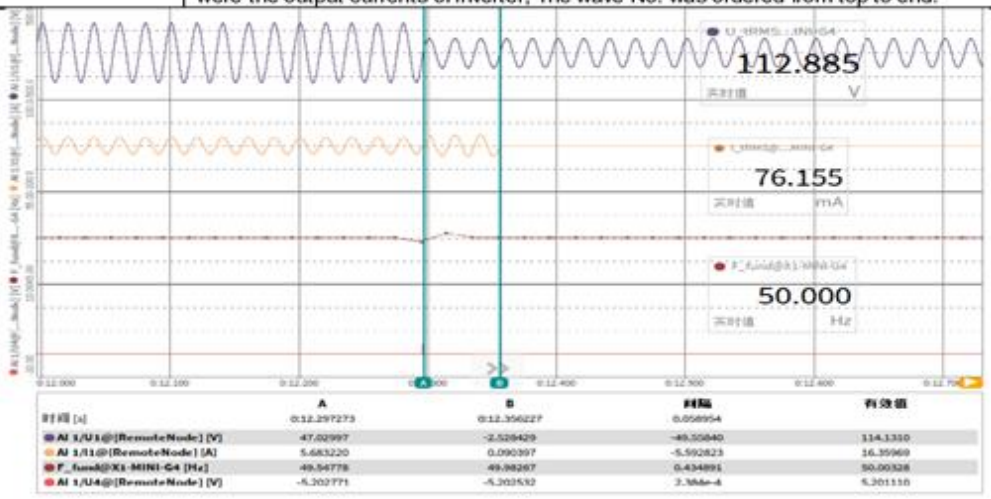
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	16	Clause:	4.3.4
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☒ Secondary Under Voltage Magnitude ☒ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During the second level under voltage test, the L1 grid voltage was jumped to 113.0V approximately, trip time 59.0ms. The wave No.1 were the grid voltages; The wave No.3 were the output currents of inverter; The wave No. was ordered from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

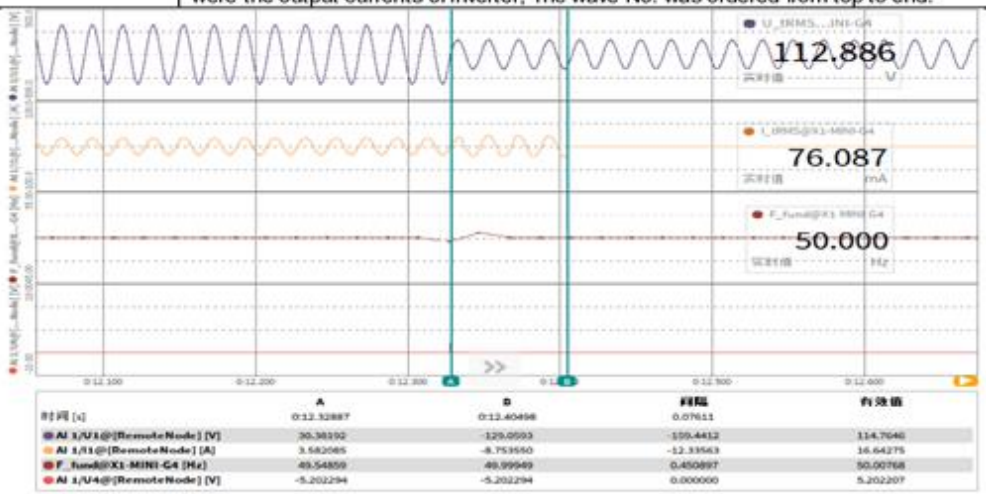
Review date: Reviewed by:

Page 42 of 130

Test Data / Test Plan		TÜVRheinland®	
TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	17	Clause:	4.3.4
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☒ Secondary Under Voltage Magnitude ☒ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During the second level under voltage test, the L1 grid voltage was jumped to 113.0V approximately, trip time 76.1ms. The wave No.1 were the grid voltages; The wave No.3 were the output currents of inverter; The wave No. was ordered from top to end.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

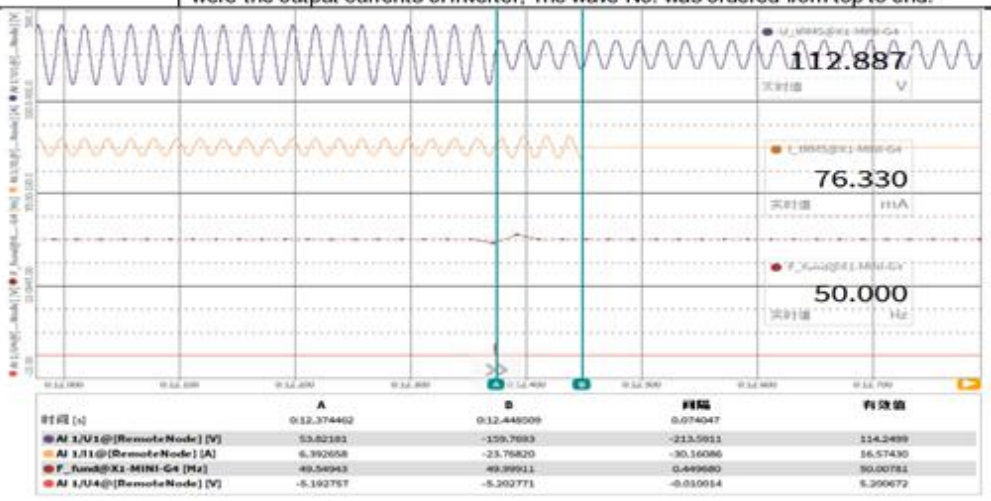
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	18	Clause:	4.3.4
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☒ Secondary Under Voltage Magnitude ☒ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During the second level under voltage test, the L1 grid voltage was jumped to 113.0V approximately, trip time 74.0ms. The wave No.1 were the grid voltages; The wave No.2 were the output currents of inverter; The wave No. was ordered from top to end.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 44 of 130

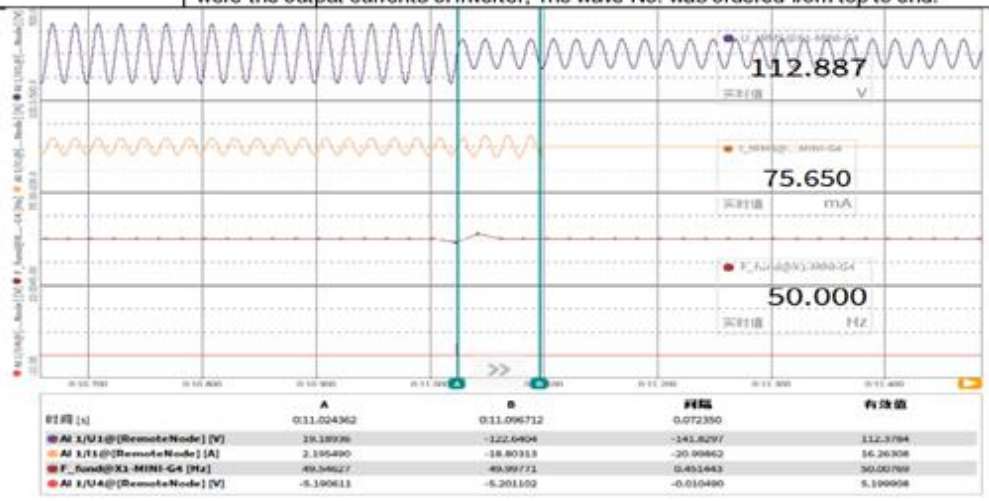
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	19	Clause:	4.3.4
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☒ Secondary Under Voltage Magnitude ☒ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During the second level under voltage test, the L1 grid voltage was jumped to 113.0V approximately, trip time 72.4ms. The wave No.2 were the grid voltages; The wave No.3 were the output currents of inverter; The wave No. was ordered from top to end.		

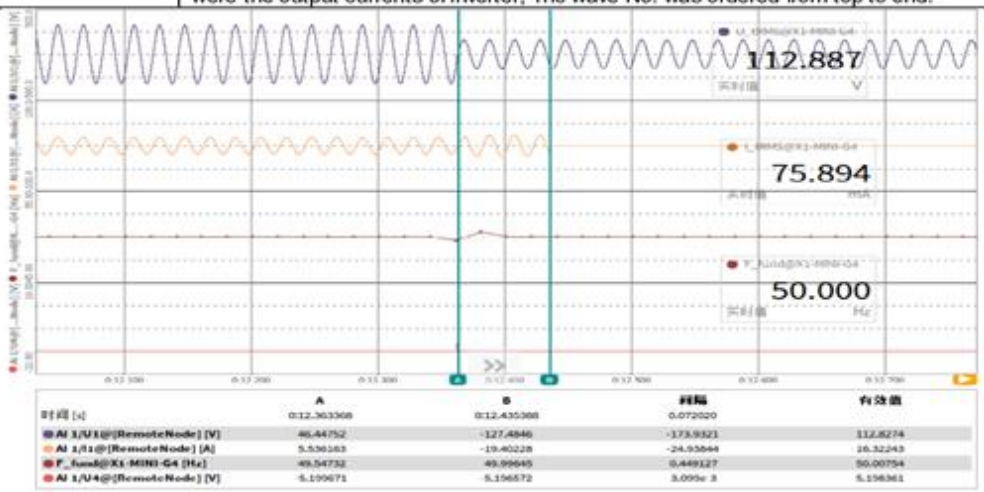


Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Test Data / Test Plan		TÜVRheinland®	
TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	20	Clause:	4.3.4
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☒ Secondary Under Voltage Magnitude ☒ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During the second level under voltage test, the L1 grid voltage was jumped to 113.0V approximately, trip time 72.0ms. The wave No.1 were the grid voltages; The wave No.2 were the output currents of inverter; The wave No. was ordered from top to end.		

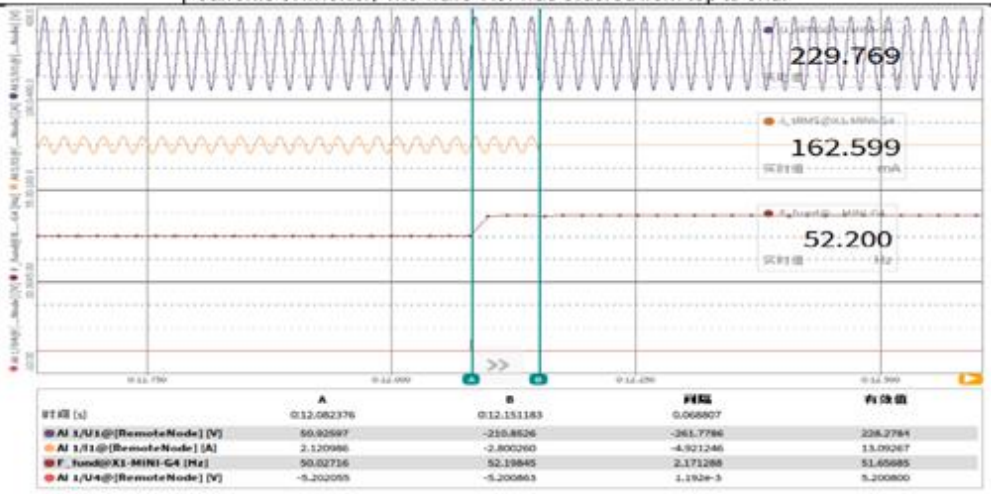


Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Test Data / Test Plan		TÜVRheinland®	
TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	21	Clause:	4.3.5
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☒ Over Frequency Magnitude ☒ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During over frequency test, the grid voltage was jumped to 52.2Hz approximately, trip time 68.8ms. The wave No.1 were the grid voltages; The wave No.2 were the output currents of inverter; The wave No. was ordered from top to end.		



	A	B	
时间 (s)	0:12.082376	0:12.151183	0.068807
AI 1/U1@[RemoteNode] [V]	50.92597	-210.8626	-261.7786
AI 1/I1@[RemoteNode] [A]	2.120986	-2.800260	-4.921246
F_fund@X1-MINI-G4 [Hz]	50.02716	52.19845	2.171288
AI 1/U4@[RemoteNode] [V]	-5.202055	-5.200863	1.192e-3

Used equipment No.: See equipment list for details Sample No.: N/A

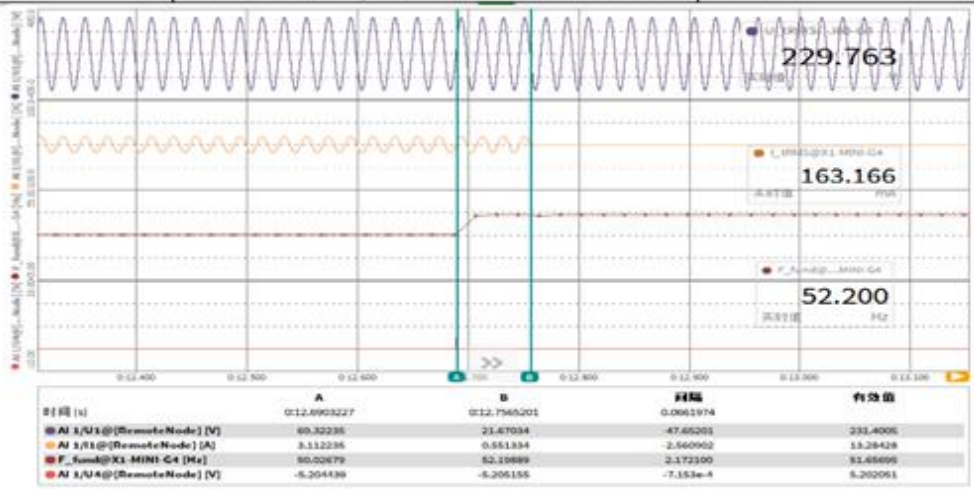
Finished date: Tested by:

Review date: Reviewed by:

Test Data / Test Plan		TÜVRheinland®	
TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	22	Clause:	4.3.5
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☒ Over Frequency Magnitude ☒ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During over frequency test, the grid voltage was jumped to 52.2Hz approximately, trip time 66.2ms. The wave No.1 were the grid voltages; The wave No.3 were the output currents of inverter; The wave No. was ordered from top to end.		

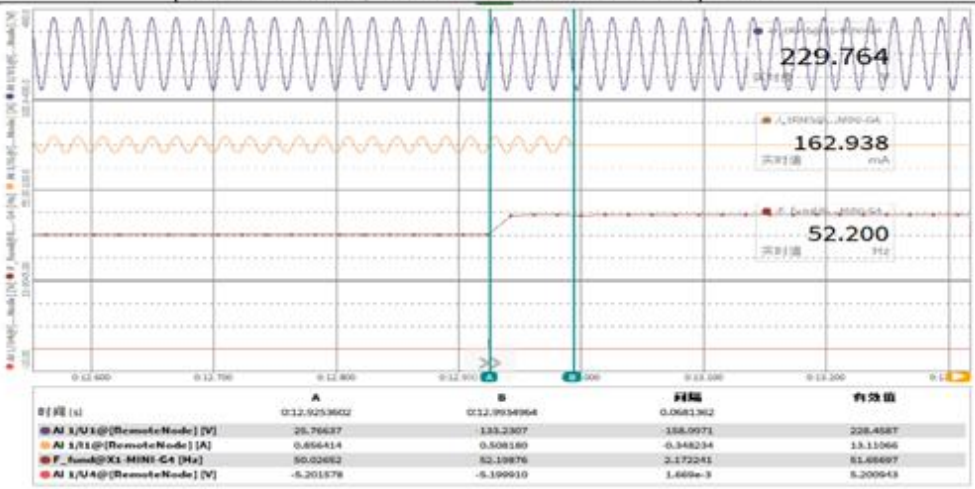


Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Test Data / Test Plan		TÜVRheinland®	
TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	23	Clause:	4.3.5
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☒ Over Frequency Magnitude ☒ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During over frequency test, the grid voltage was jumped to 52.2Hz approximately, trip time 68.1ms. The wave No.1 were the grid voltages; The wave No.2 were the output currents of inverter; The wave No. was ordered from top to end.		

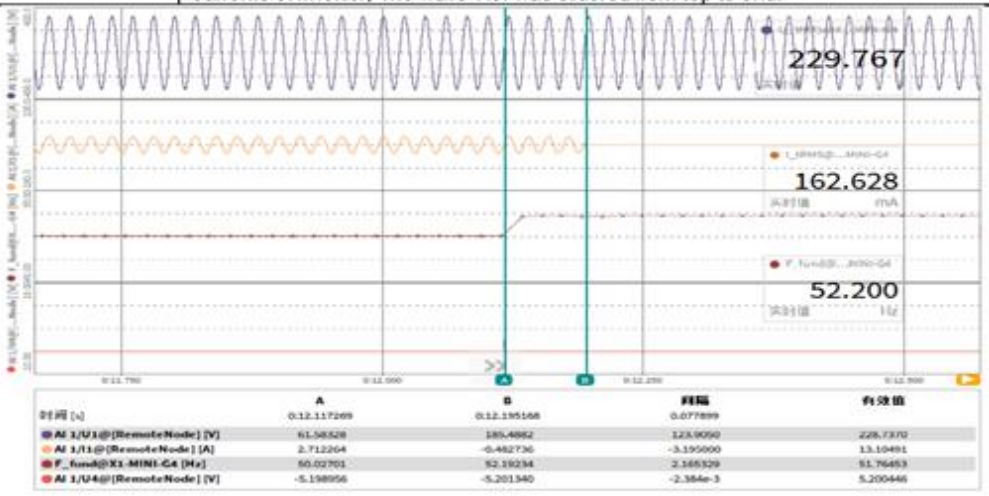


Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Test Data / Test Plan		TÜVRheinland®	
TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	24	Clause:	4.3.5
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☒ Over Frequency Magnitude ☒ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During over frequency test, the grid voltage was jumped to 52.2Hz approximately, trip time 77.9ms. The wave No.1 were the grid voltages; The wave No.2 were the output currents of inverter; The wave No. was ordered from top to end.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

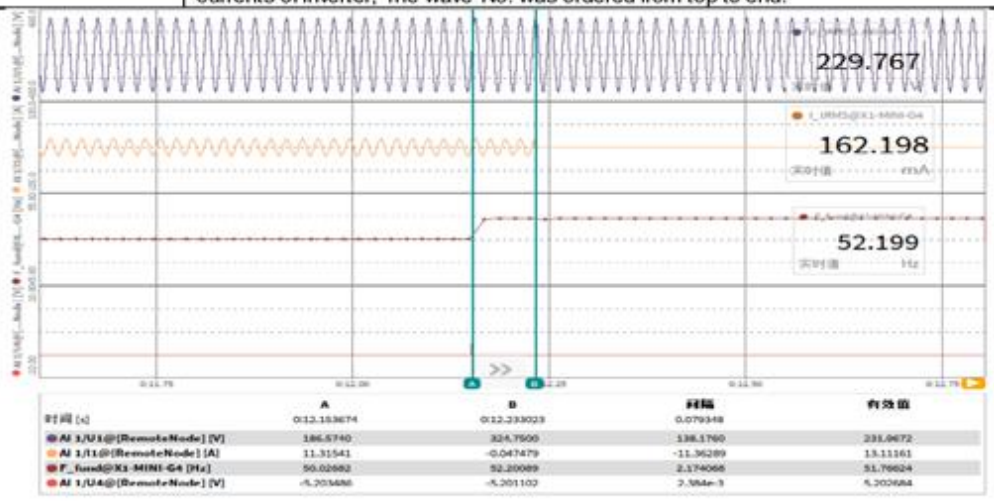
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	25	Clause:	4.3.5
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☒ Over Frequency Magnitude ☒ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During over frequency test, the grid voltage was jumped to 52.2Hz approximately, trip time 79.3ms. The wave No.1 were the grid voltages; The wave No.2 were the output currents of inverter; The wave No. was ordered from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

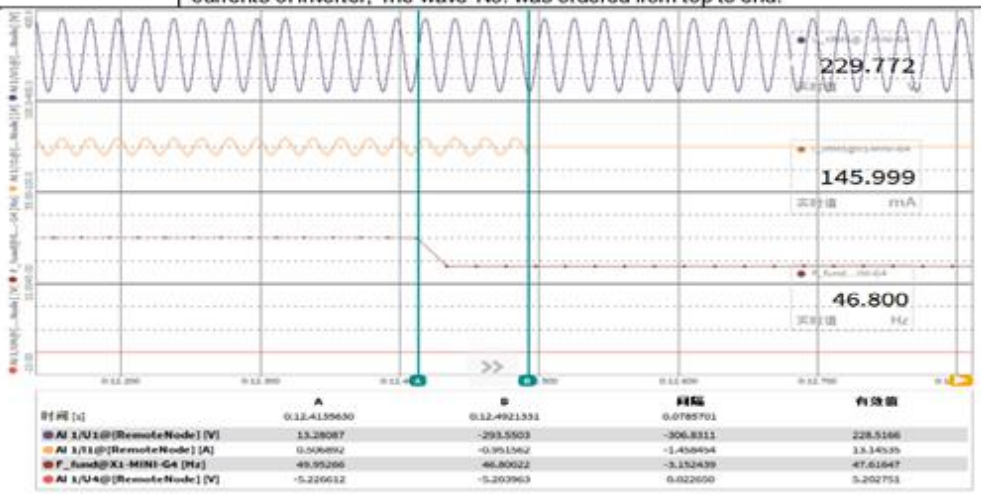
Review date: Reviewed by:

Page 51 of 130

Test Data / Test Plan		TÜVRheinland®	
TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	26	Clause:	4.3.5
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☒ Under Frequency Magnitude ☒ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During under frequency test, the grid voltage was jumped to 46.8Hz approximately, trip time 78.6ms. The wave No.1 were the grid voltages; The wave No.2 were the output currents of inverter; The wave No. was ordered from top to end.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

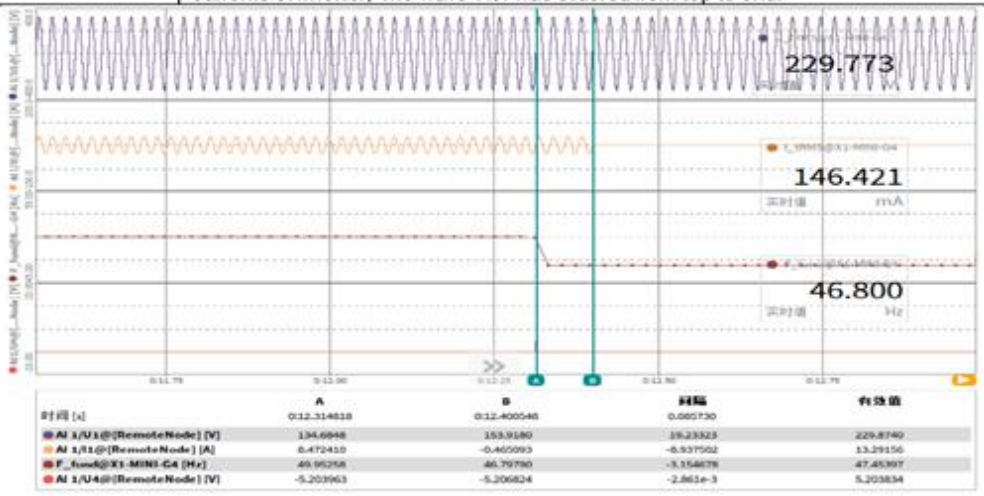
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	27	Clause:	4.3.5
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☒ Under Frequency Magnitude ☒ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During under frequency test, the grid voltage was jumped to 46.8Hz approximately, trip time 85.7ms. The wave No.1 were the grid voltages; The wave No.3 were the output currents of inverter; The wave No. was ordered from top to end.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

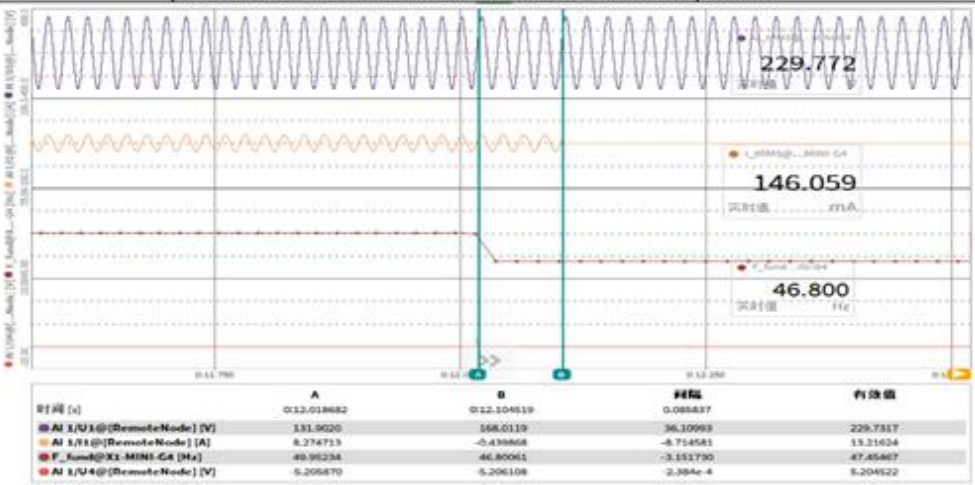
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	28	Clause:	4.3.5
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☒ Under Frequency Magnitude ☒ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During under frequency test, the grid voltage was jumped to 46.8Hz approximately, trip time 85.8ms. The wave No. 1 were the grid voltages; The wave No. 2 were the output currents of inverter; The wave No. was ordered from top to end.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

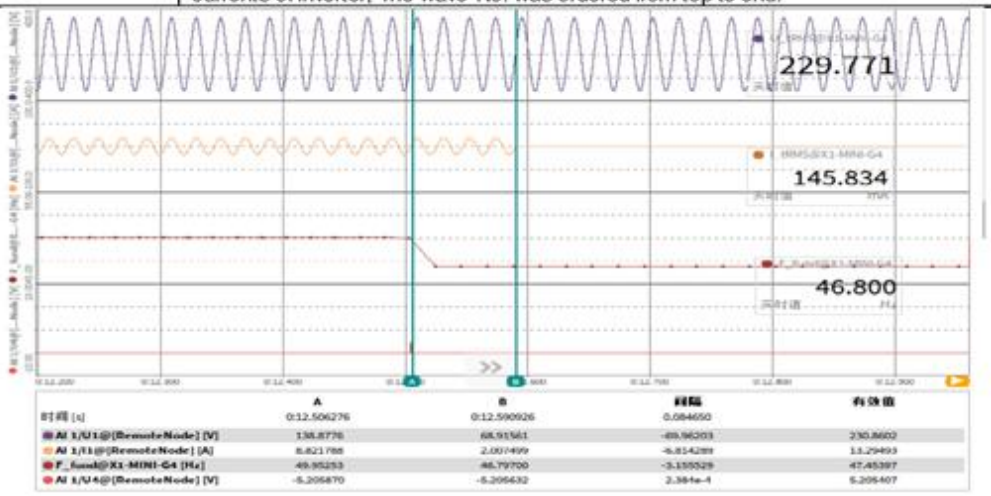
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	29	Clause:	4.3.5
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☒ Under Frequency Magnitude ☒ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During under frequency test, the grid voltage was jumped to 46.8Hz approximately, trip time 84.7ms. The wave No. 1 were the grid voltages; The wave No. 2 were the output currents of inverter; The wave No. was ordered from top to end.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 55 of 130

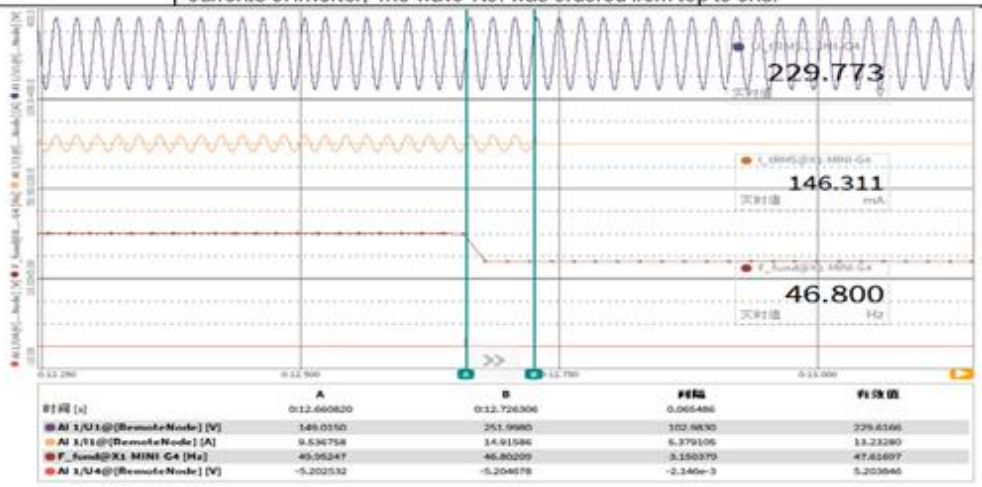
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	30	Clause:	4.3.5
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☒ Under Frequency Magnitude ☒ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	During under frequency test, the grid voltage was jumped to 46.8Hz approximately, trip time 65.5ms. The wave No. 1 were the grid voltages; The wave No. 2 were the output currents of inverter; The wave No. was ordered from top to end.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

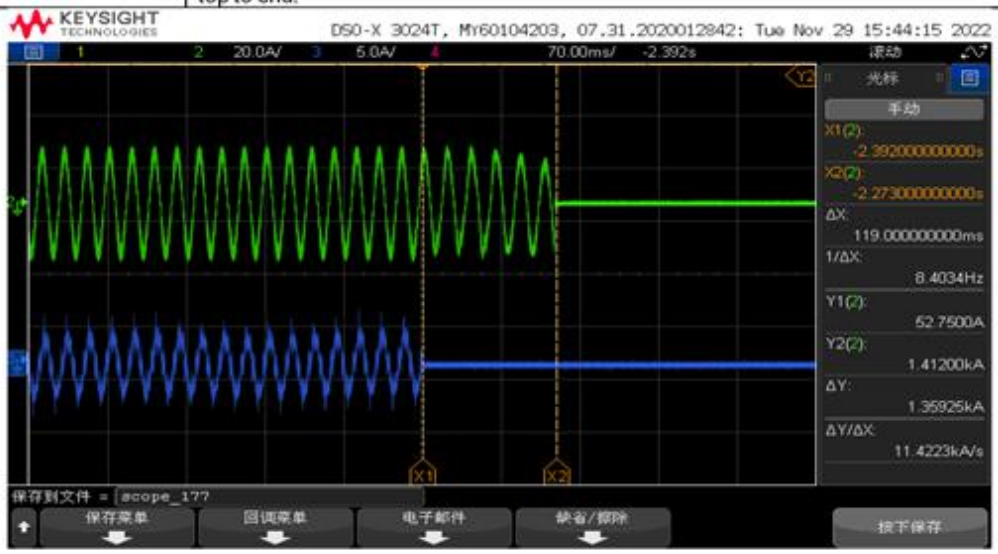
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	31	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	100% load, PR: -10%, QC: +10%, the trip time of protection was 119.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

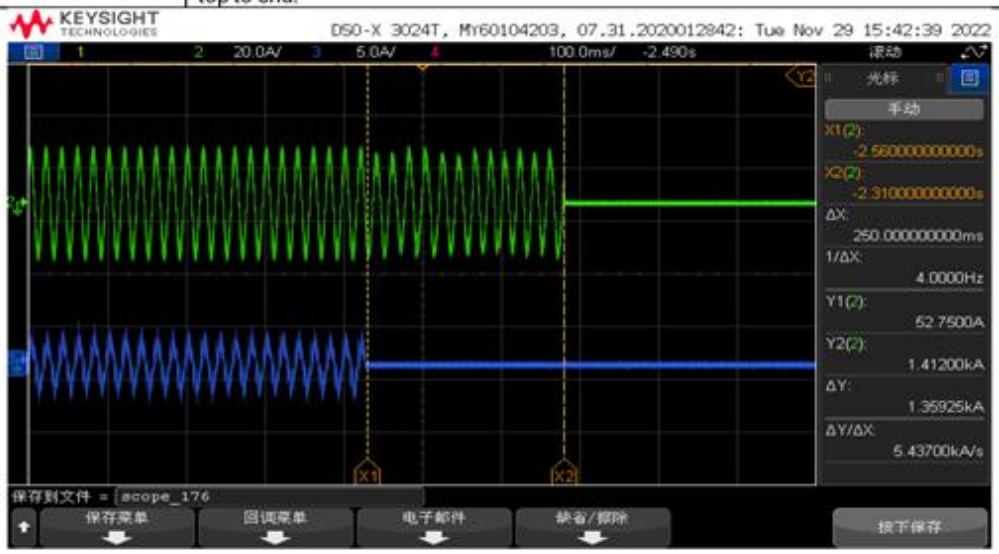
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	32	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	100% load, PR: -10%, QC: +5%, the trip time of protection was 250.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

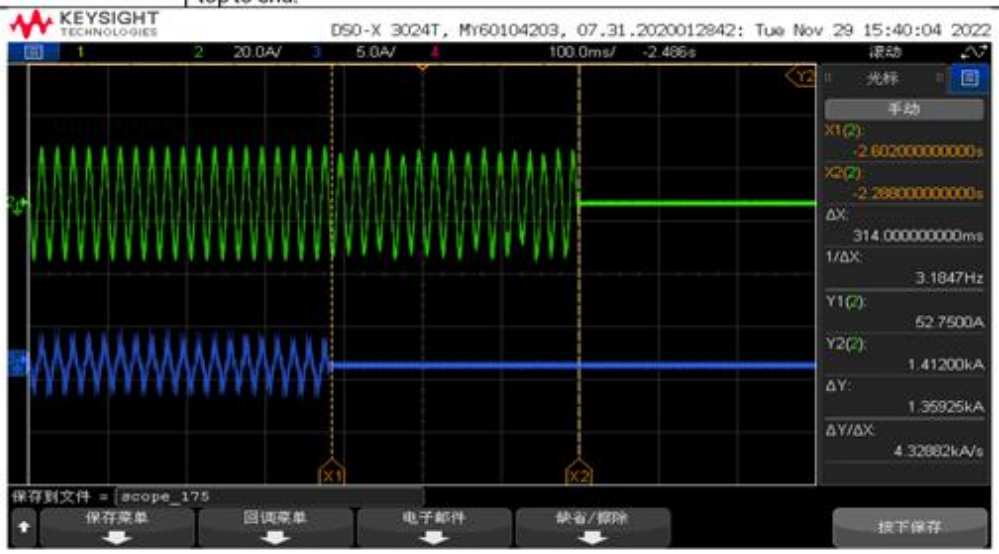
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	33	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	100% load, PR: -10%, QC: 0%, the trip time of protection was 314.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

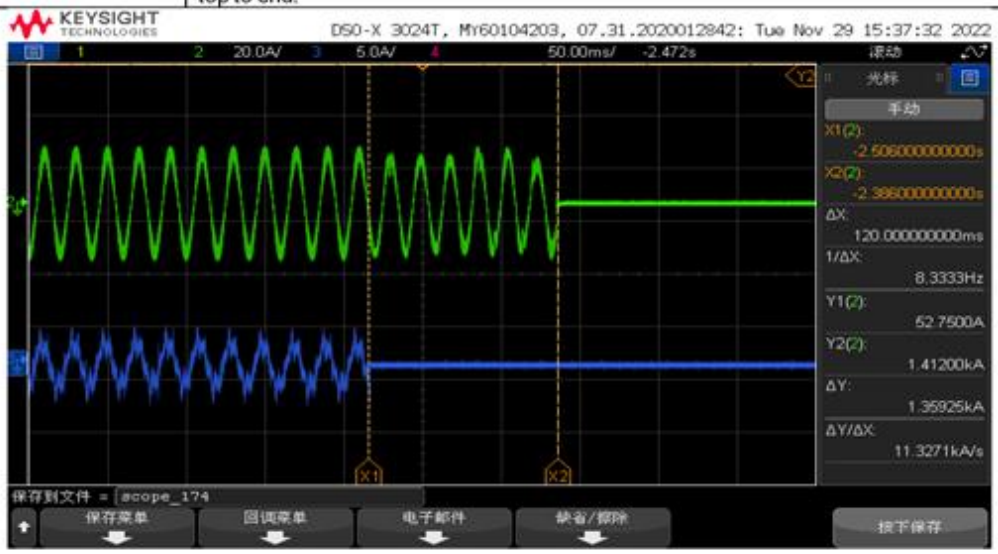
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	34	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	100% load, PR: -10%, QC: -5%, the trip time of protection was 120.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

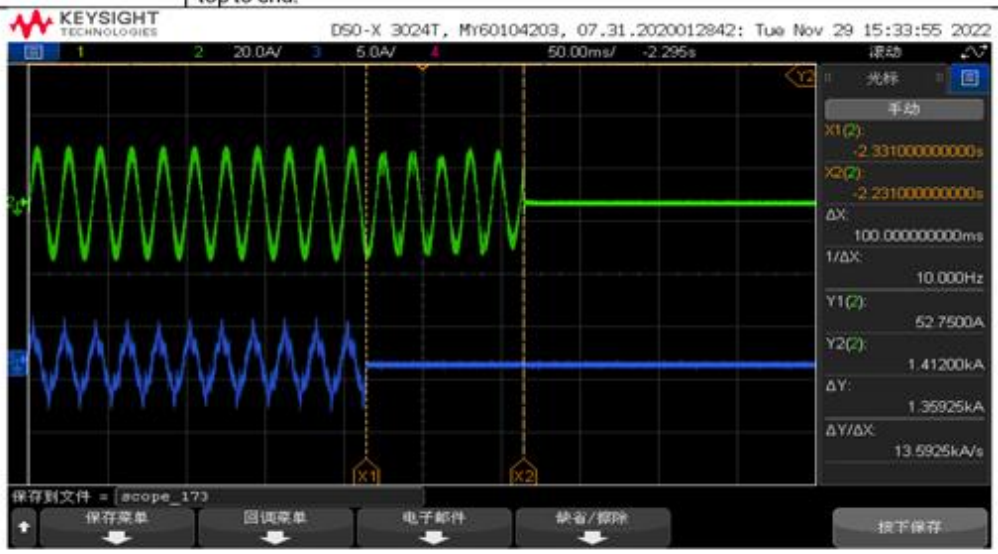
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	35	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	100% load, PR: -10%, QC: -10%, the trip time of protection was 100.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

Page 61 of 130

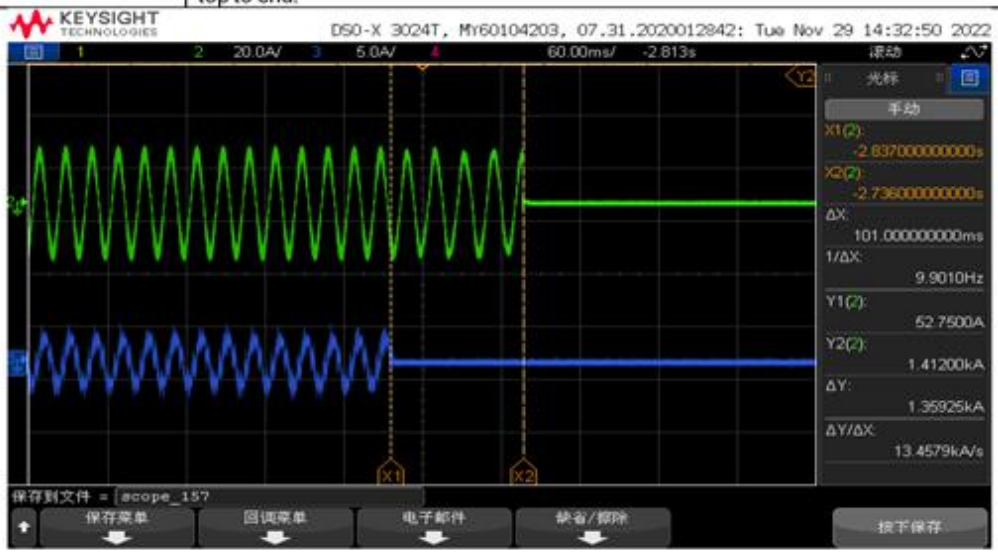
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	36	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	100% load, PR: -5%, QC: +10%, the trip time of protection was 101.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

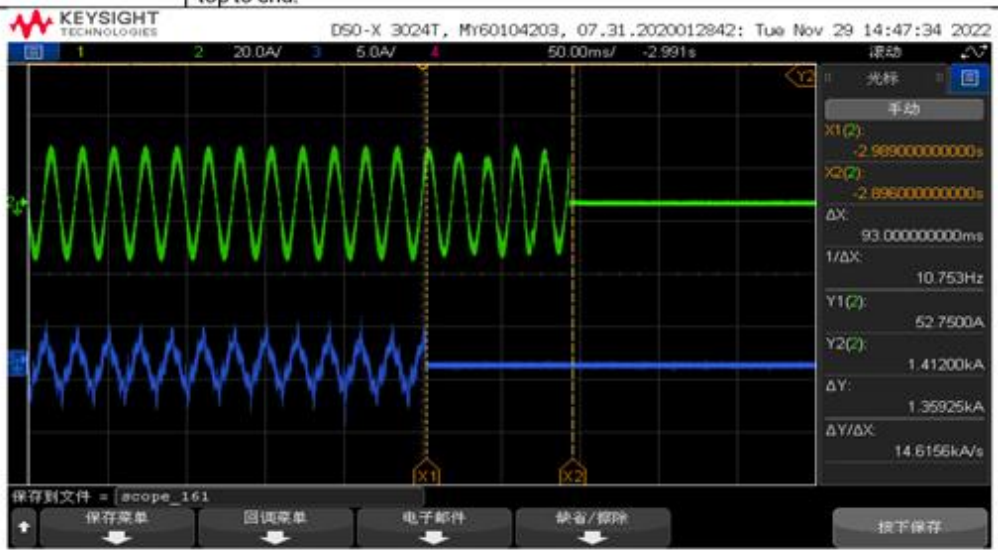
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	37	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	100% load, PR: -5%, QC: -10%, the trip time of protection was 93.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

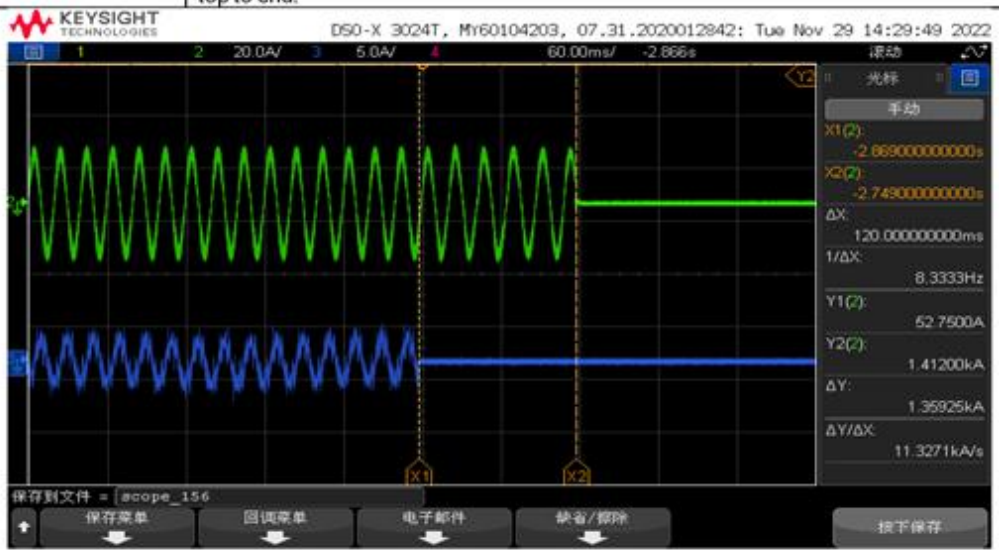
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	38	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	100% load, PR: 0%, QC: +10%, the trip time of protection was 120.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

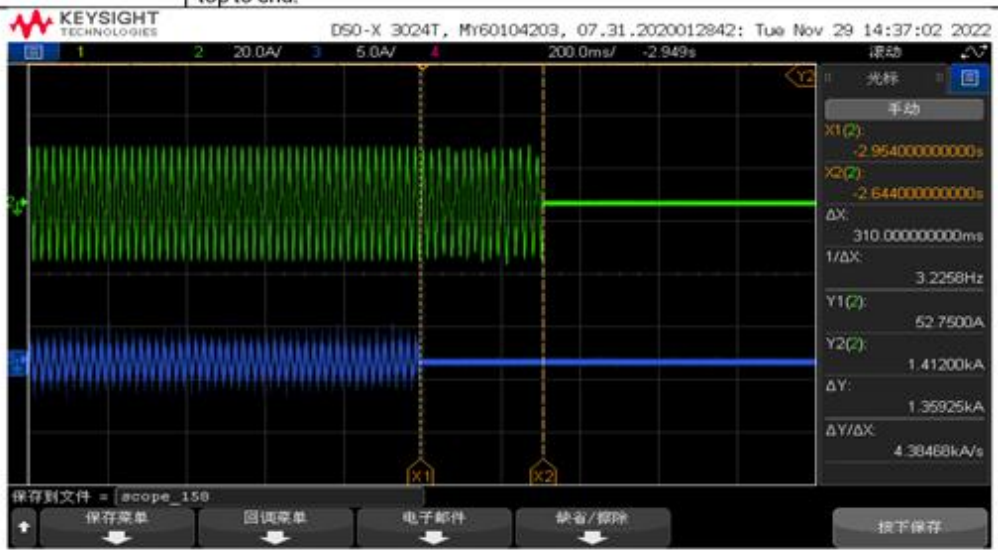
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	39	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	100% load, PR: -5%, QC: +5%, the trip time of protection was 310.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

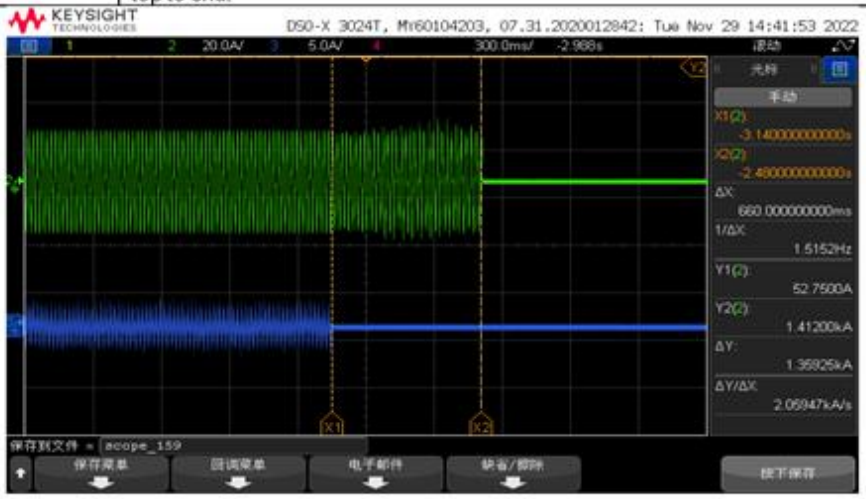
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	40	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	100% load, PR: -5%, QC: 0%, the trip time of protection was 660.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

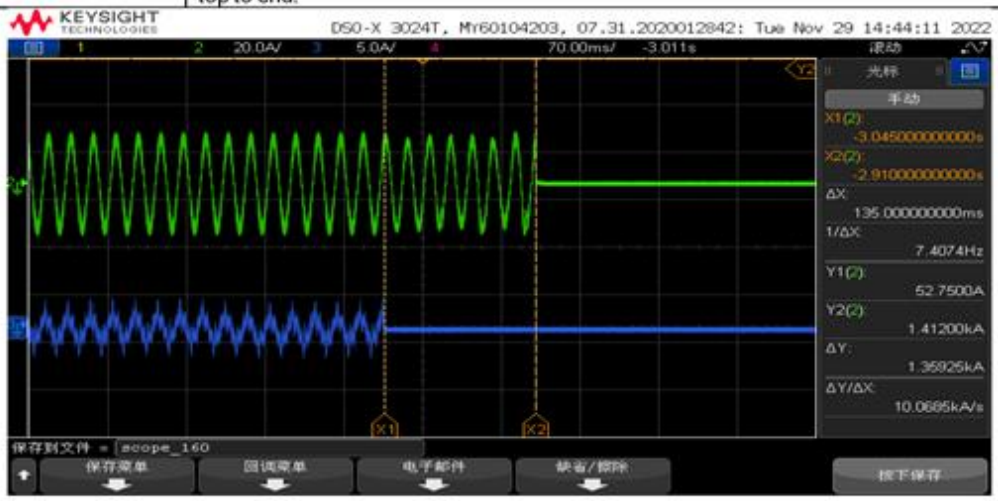
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	41	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	100% load, PR: -5%, QC: -5%, the trip time of protection was 135.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

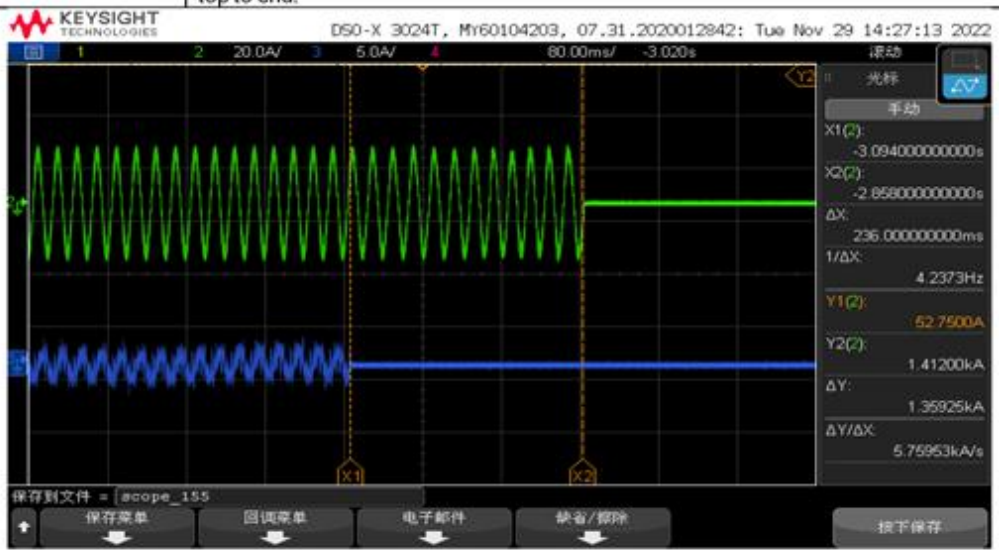
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	42	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	100% load, PR: 0%, QC: +5%, the trip time of protection was 236.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

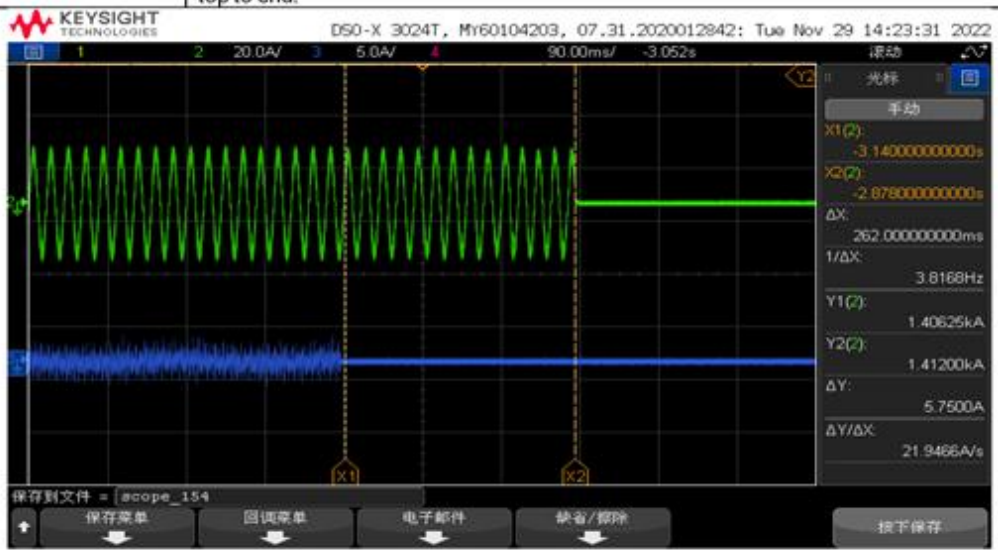
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	43	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	100% load, PR: 0%, QC: 0%, the trip time of protection was 262.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

ภาคผนวก ค. TÜV Rheinland's Report No: CN23GLMZ 001. (ต่อ)

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	44	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	100% load, the fundamental magnitude of grid current of phase L1 was 0.018A, less than 1% of the rated current 0.130A. See the screenshot of the power analyzer for detail. (1st order harmonic current)		

X1-Mini-G4

	相 1		三相总和	
U_tRMS	230.07	V	230.07	V
I_tRMS	491.34	mA	491.34	mA
P_t	3.5063	W	3.5063	W
Q_t	112.96	var	112.96	var
S_t	113.04	VA	113.04	VA
PF_t	0.0310		0.0310	
F_fund			50.000	Hz
U_fundRMS	230.07	V	230.07	V
I_fundRMS	18.408	mA	18.408	mA
P_fund	3.4760	W	3.4760	W
Q_fund	-364.66	mvar	-364.66	mvar
S_fund	4.2352	VA	4.2352	VA

Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

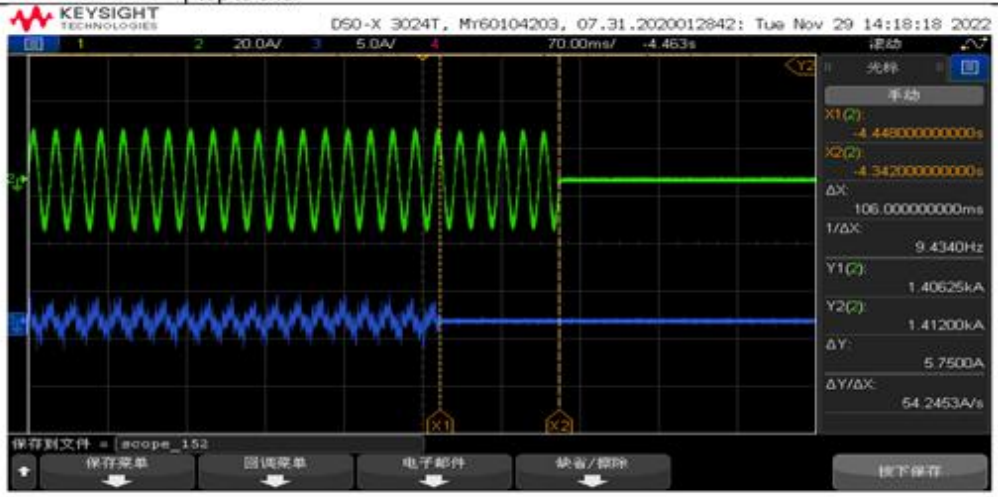
Review date: Reviewed by:

Page 70 of 130

Test Data / Test Plan		TÜVRheinland®	
TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	45	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	100% load, PR: 0%, QC: -5%, the trip time of protection was 106.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

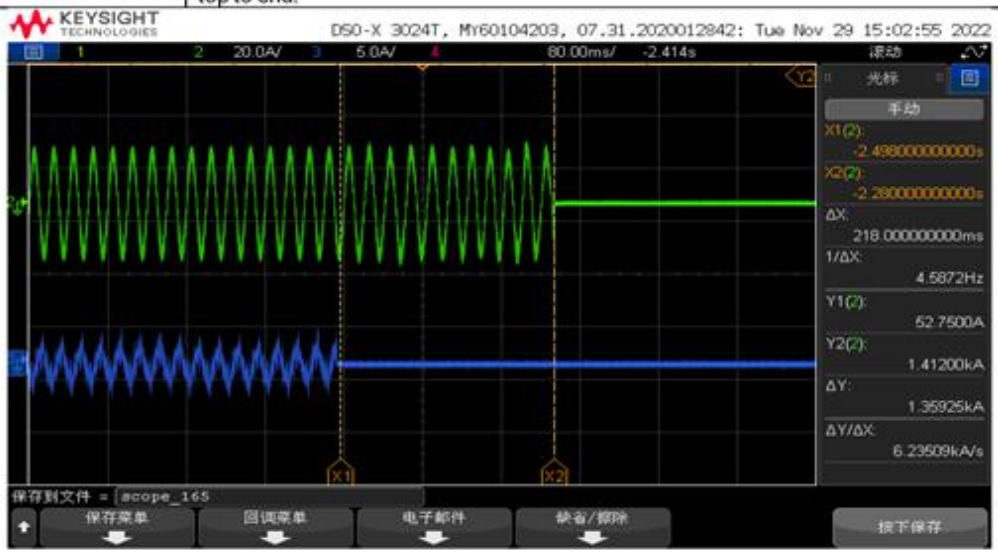
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	46	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	100% load, PR: +5%, QC: +5%, the trip time of protection was 218.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

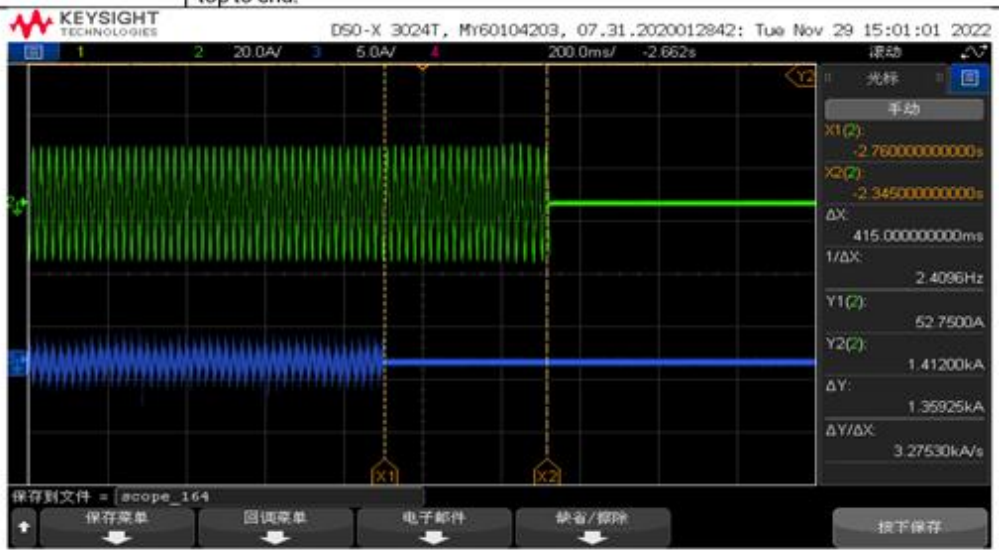
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	47	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	100% load, PR: +5%, QC: 0%, the trip time of protection was 415.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

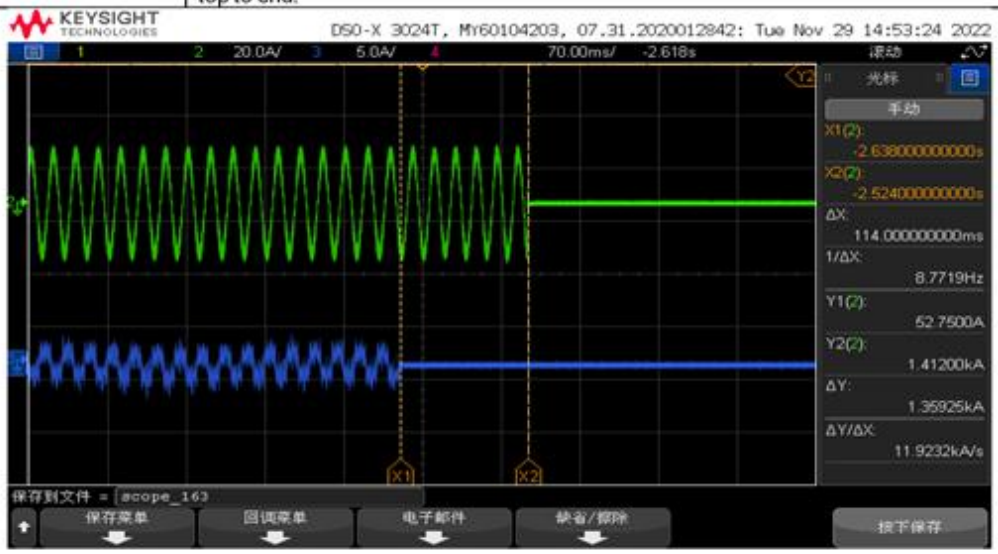
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	48	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	100% load, PR: +5%, QC: -5%, the trip time of protection was 114.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

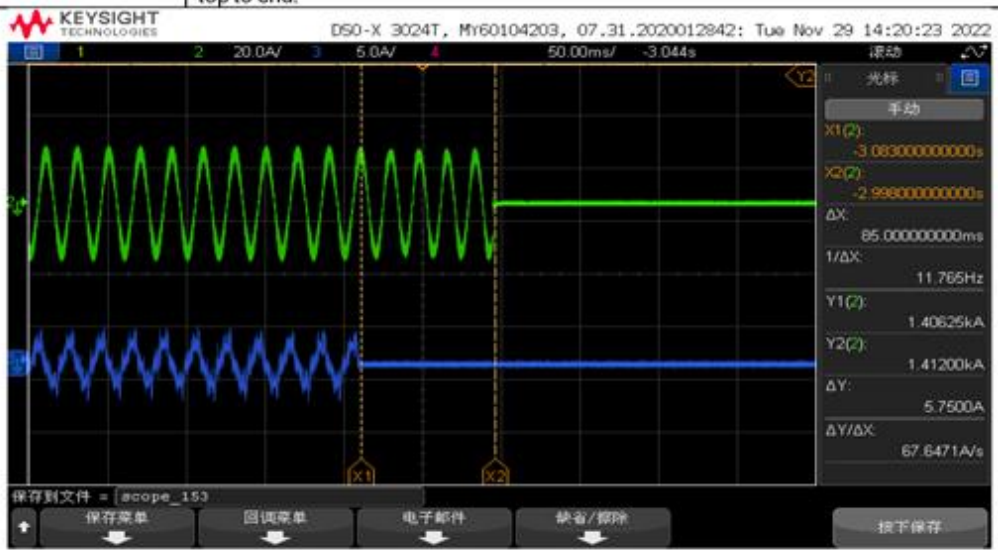
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	49	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	100% load, PR: 0%, QC: -10%, the trip time of protection was 85.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

Page 75 of 130

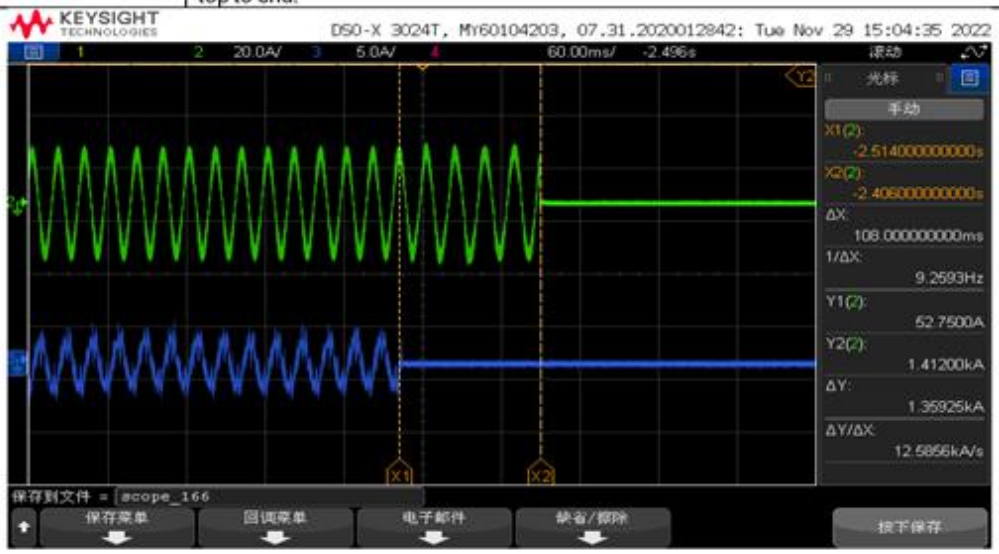
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	50	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	100% load, PR: +5%, QC: +10%, the trip time of protection was 108.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

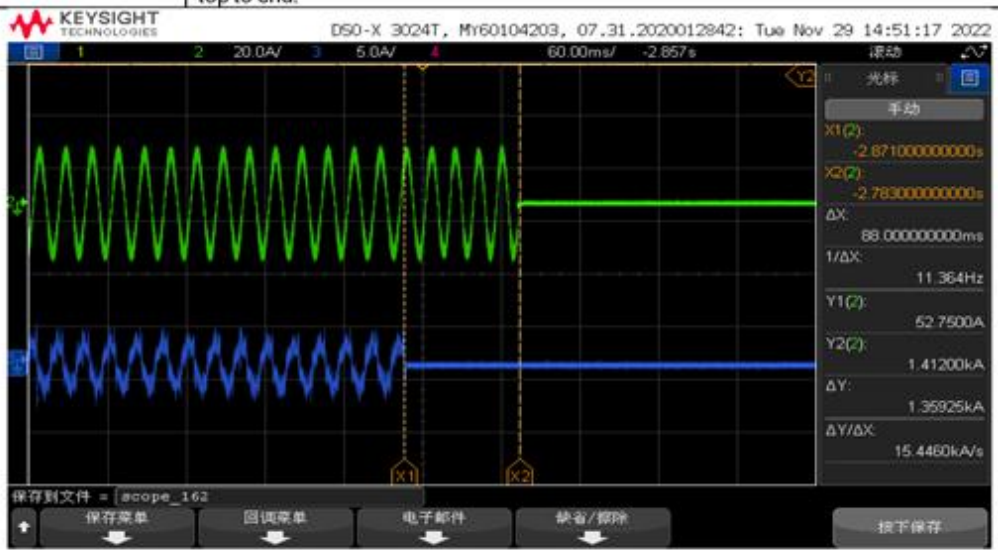
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	51	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	100% load, PR: +5%, QC: -10%, the trip time of protection was 88.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

Page 77 of 130

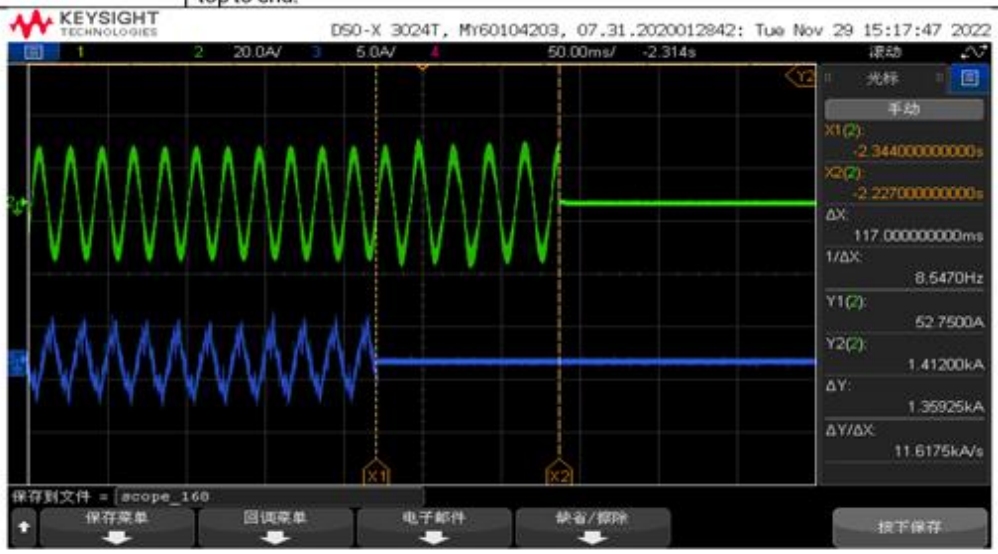
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	52	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	100% load, PR: +10%, QC: +10%, the trip time of protection was 117.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

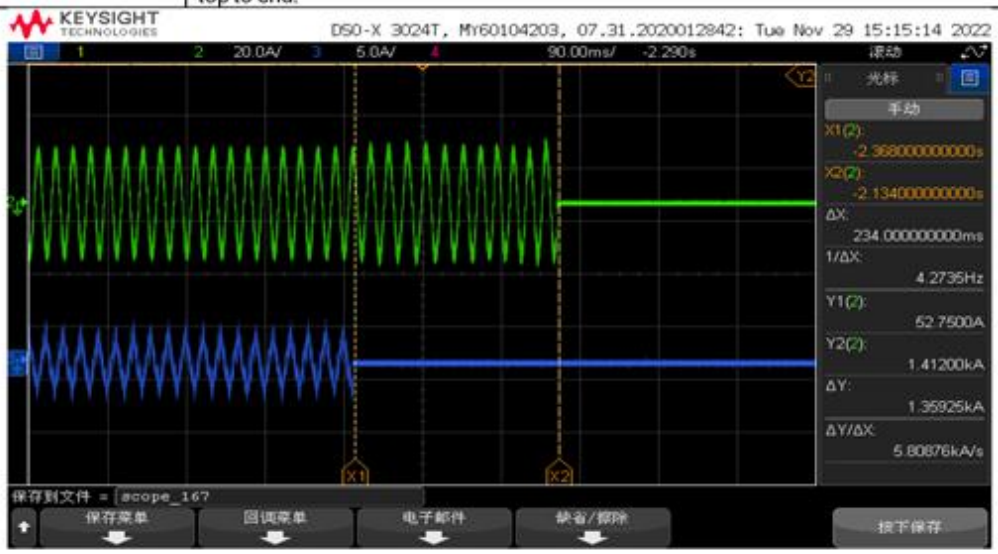
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	53	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	100% load, PR: +10%, QC: +5%, the trip time of protection was 234.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

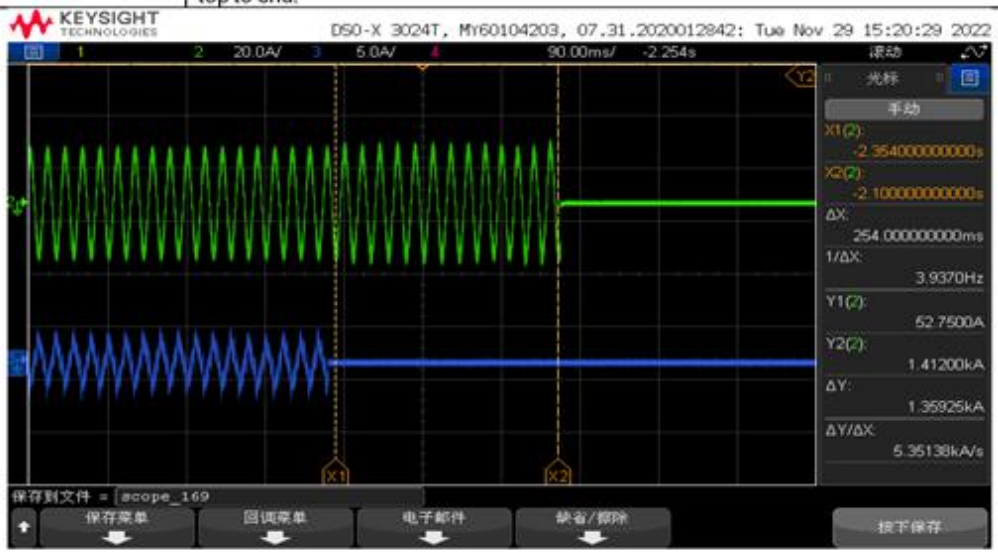
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	54	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	100% load, PR: +10%, QC: 0%, the trip time of protection was 254.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

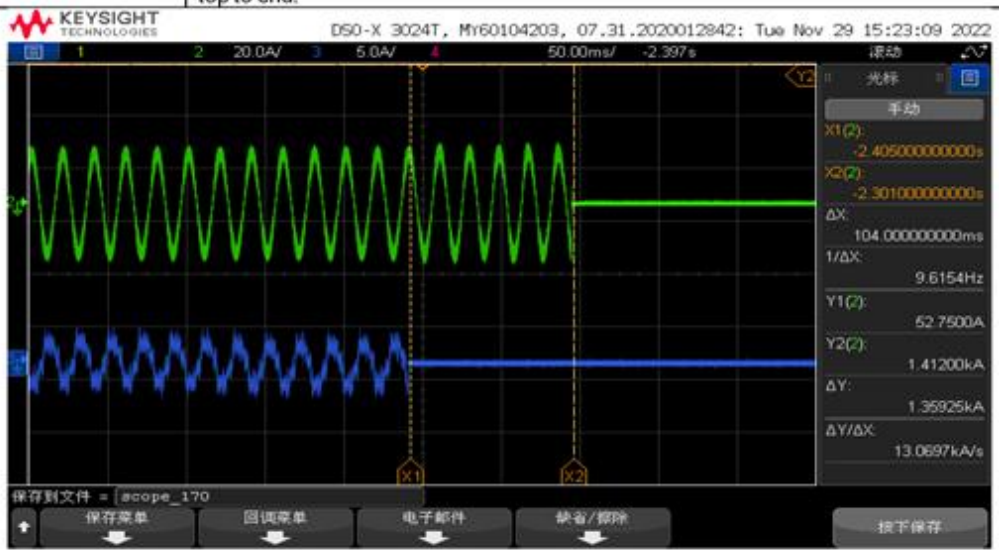
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	55	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	100% load, PR: +10%, QC: -5%, the trip time of protection was 104.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

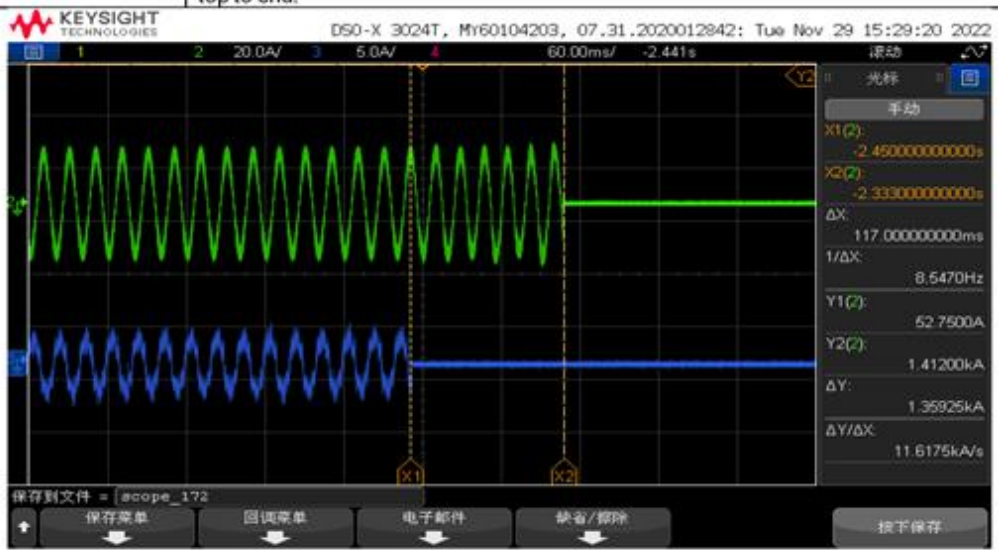
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	56	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	100% load, PR: +10%, QC: -10%, the trip time of protection was 117.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

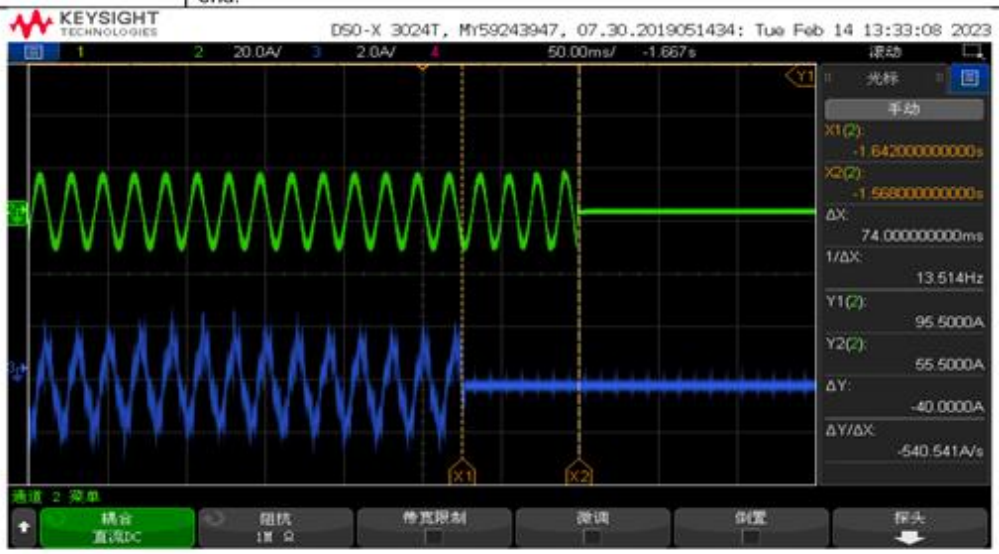
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	57	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	66% load, PR: 0%, QC: -5%, the trip time of protection was 74.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

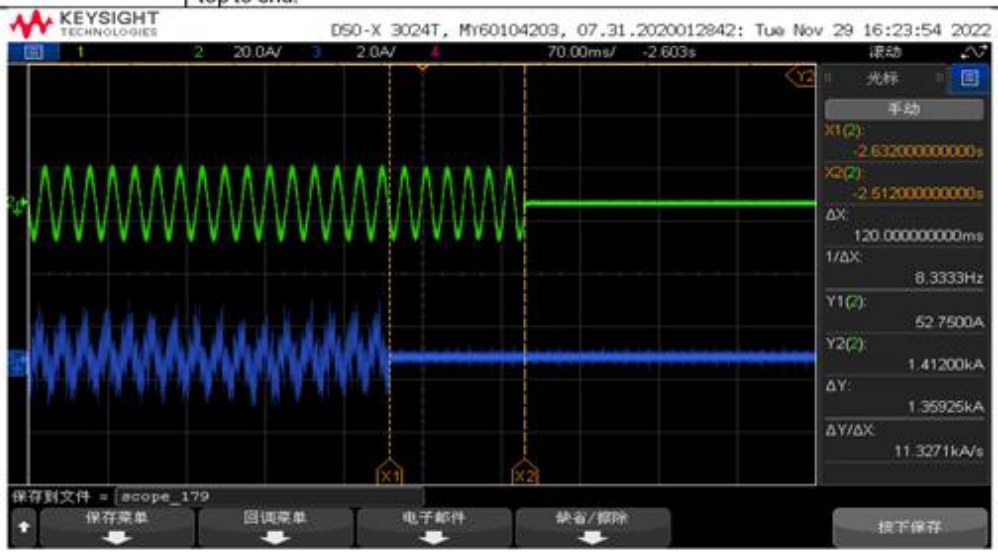
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	58	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	66% load, PR: 0%, QC: -4%, the trip time of protection was 120.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

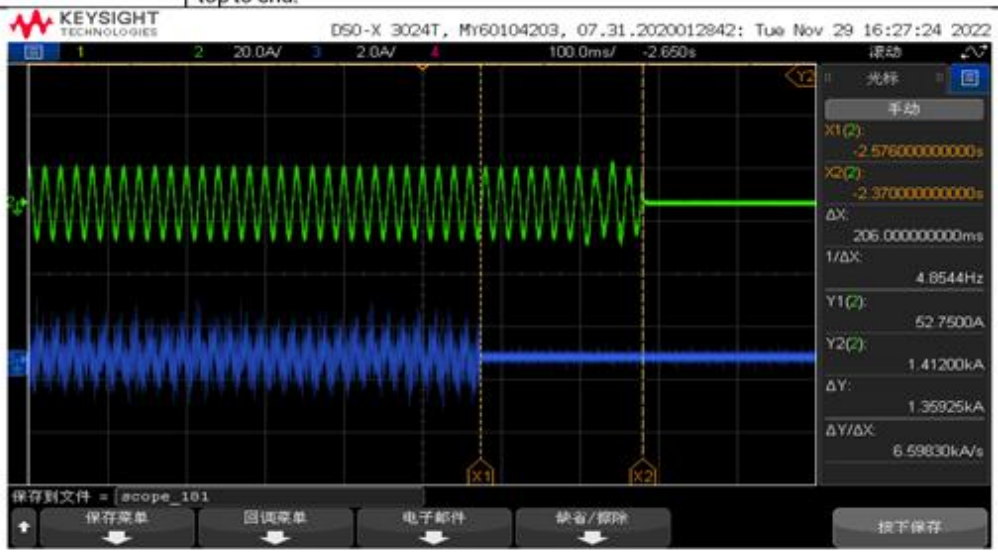
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	59	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	66% load, PR: 0%, QC: -3%, the trip time of protection was 206.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

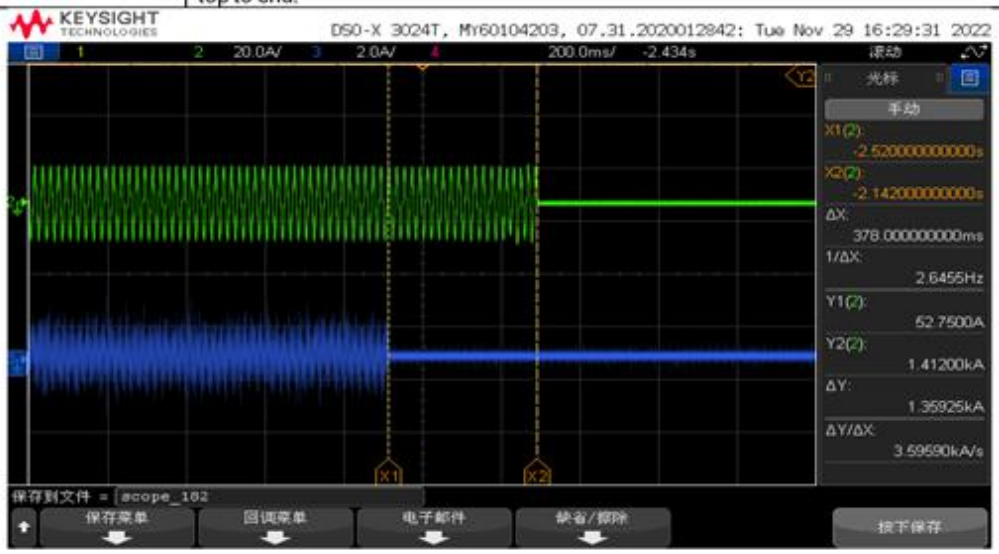
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	60	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	66% load, PR: 0%, QC: -2%, the trip time of protection was 378.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

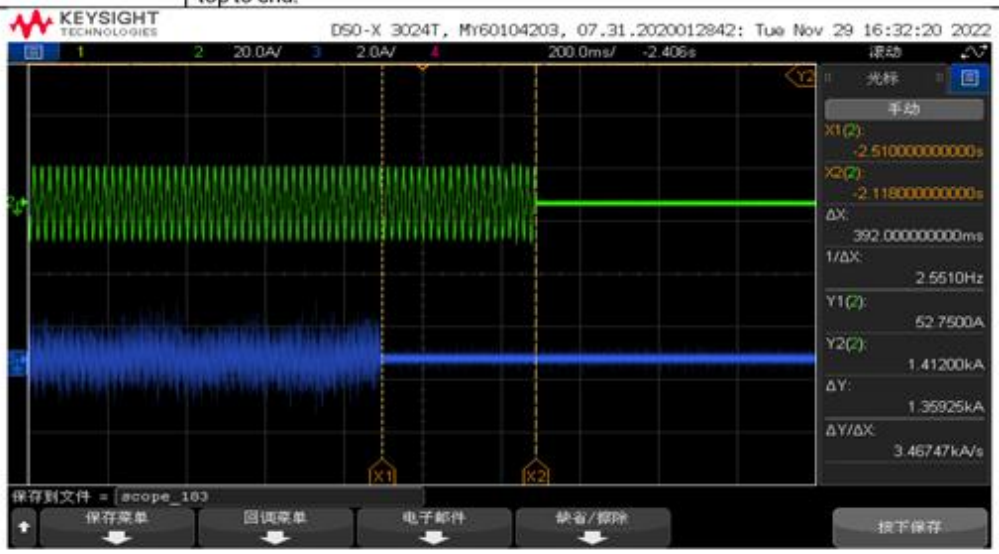
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	61	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	66% load, PR: 0%, QC: -1%, the trip time of protection was 392.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

Page 87 of 130

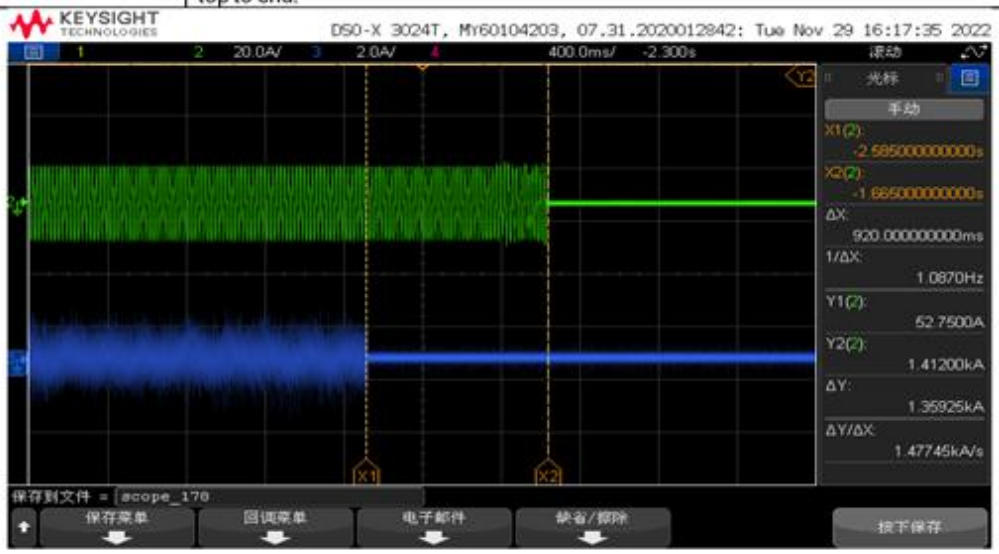
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	62	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	66% load, PR: 0%, QC: 0%, the trip time of protection was 920.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	63	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	66% load, the fundamental magnitude of grid current of phase L1 was 0.039A, less than 1% of the rated current 0.130A. See the screenshot of the power analyzer for detail. (1st order harmonic current)		

X1-Mini-G4

	相1		三相总和	
U_tRMS	230.34	V	230.34	V
I_tRMS	369.82	mA	369.82	mA
P_t	-8.3205	W	-8.3205	W
Q_t	84.748	var	84.748	var
S_t	85.184	VA	85.184	VA
PF_t	-0.0978		-0.0978	
F_fund			49.999	Hz
U_fundRMS	230.34	V	230.34	V
I_fundRMS	38.966	mA	38.966	mA
P_fund	-8.3094	W	-8.3094	W
Q_fund	-3.0124	var	-3.0124	var
S_fund	8.9757	VA	8.9757	VA

Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

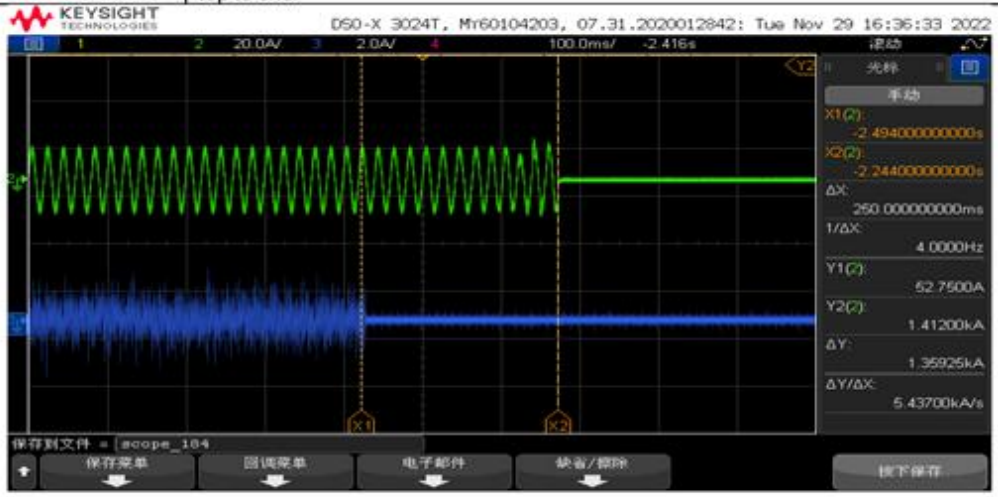
Review date: Reviewed by:

Page 89 of 130

Test Data / Test Plan		TÜVRheinland®	
TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	64	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	66% load, PR: 0%, QC: +1%, the trip time of protection was 250.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

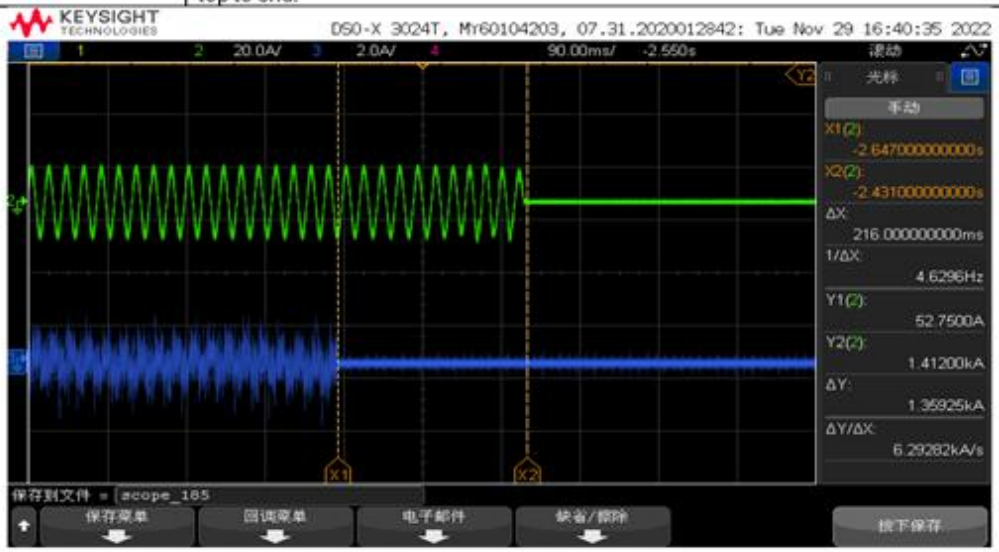
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	65	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	66% load, PR: 0%, QC: +2%, the trip time of protection was 216.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

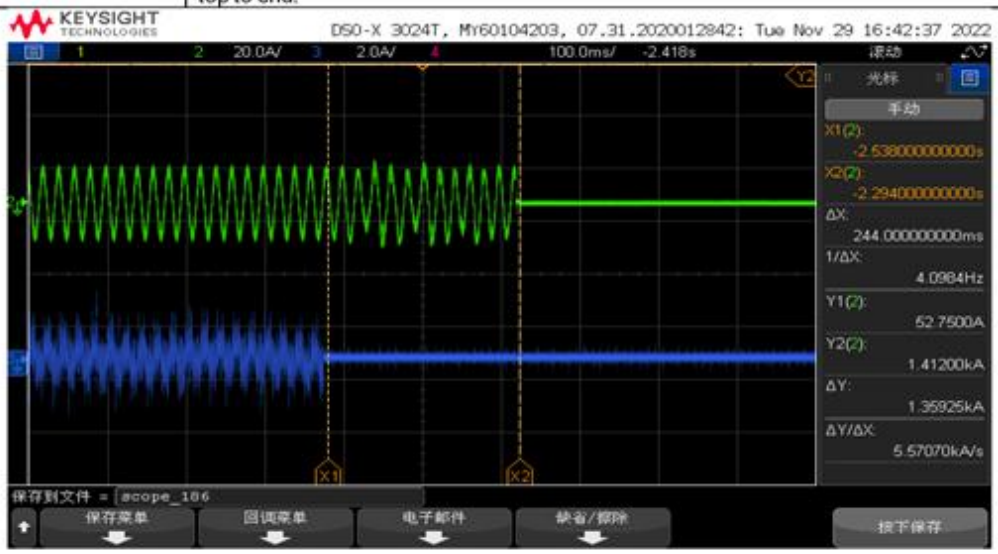
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	66	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	66% load, PR: 0%, QC: +3%, the trip time of protection was 244.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

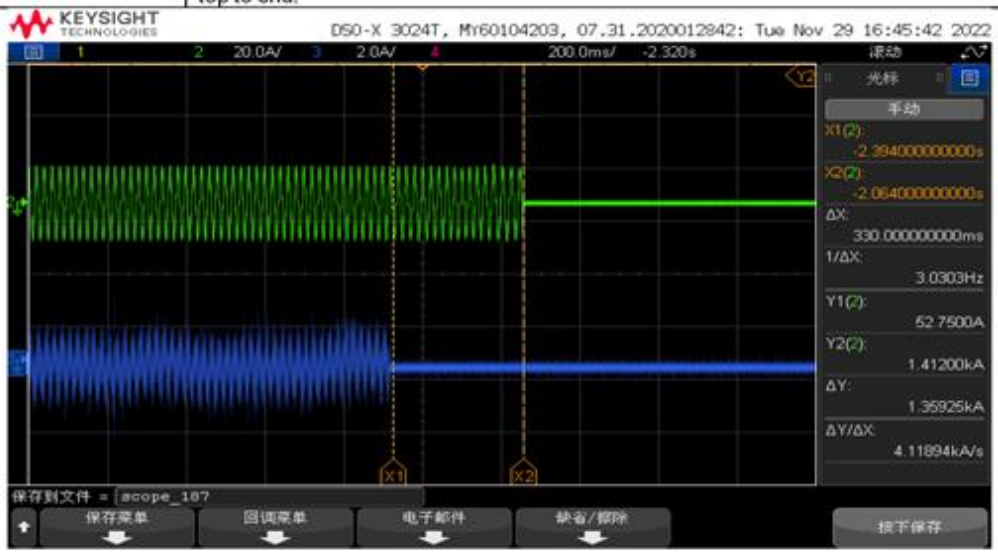
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	67	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	66% load, PR: 0%, QC: +4%, the trip time of protection was 330.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

Page 93 of 130

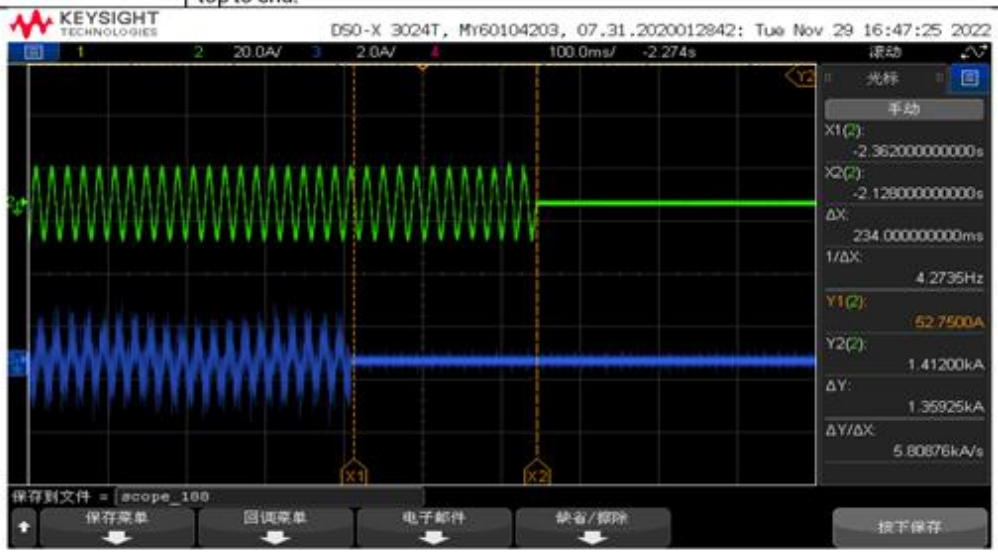
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	68	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	66% load, PR: 0%, QC: +5%, the trip time of protection was 234.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

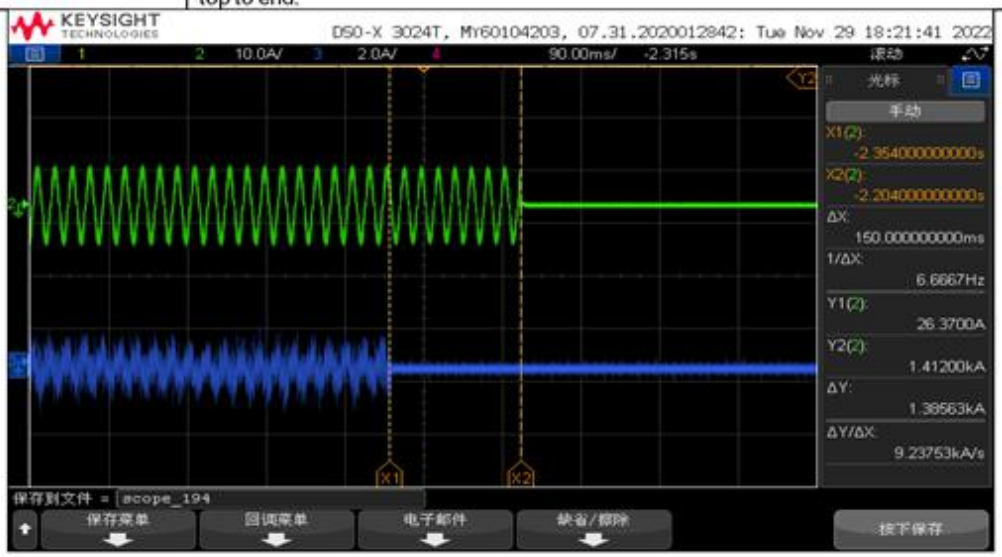
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	69	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	33% load, PR: 0%, QC: -5%, the trip time of protection was 150.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

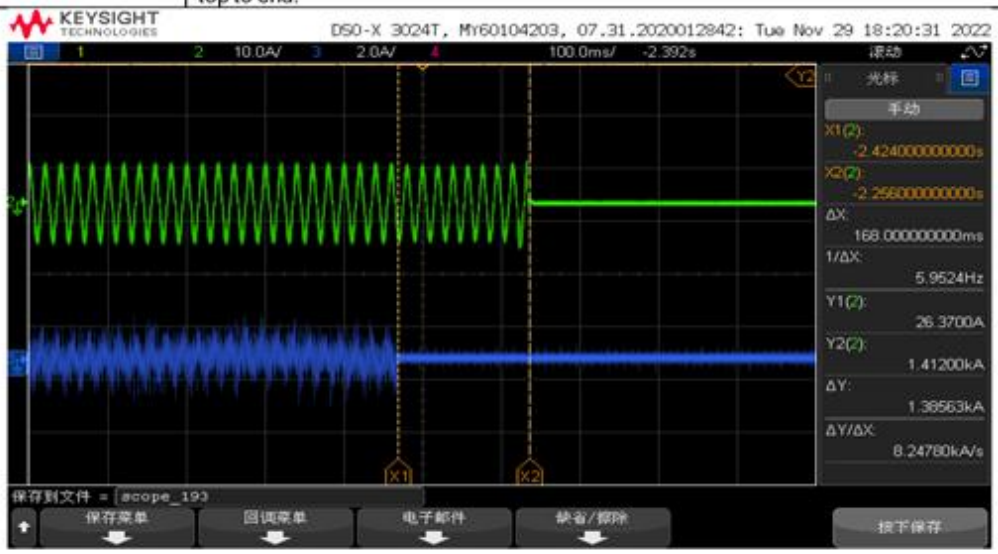
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	70	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	33% load, PR: 0%, QC: -4%, the trip time of protection was 168.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

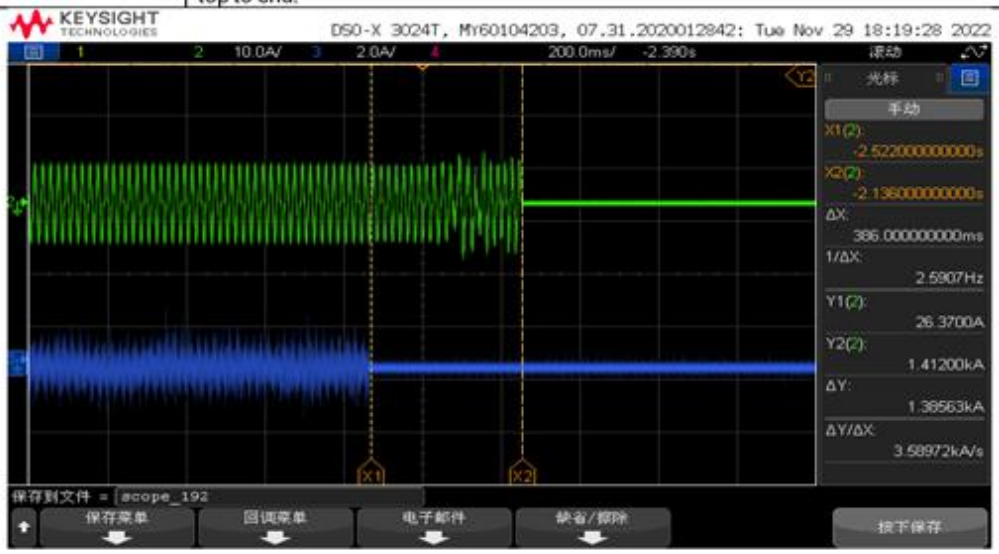
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	71	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	33% load, PR: 0%, QC: -3%, the trip time of protection was 386.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

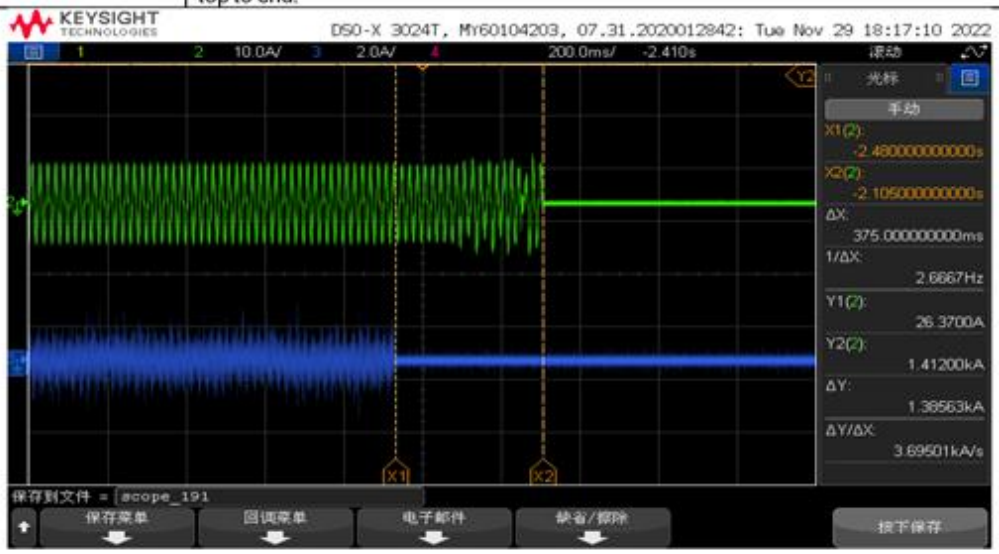
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	72	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	33% load, PR: 0%, QC: -2%, the trip time of protection was 375.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

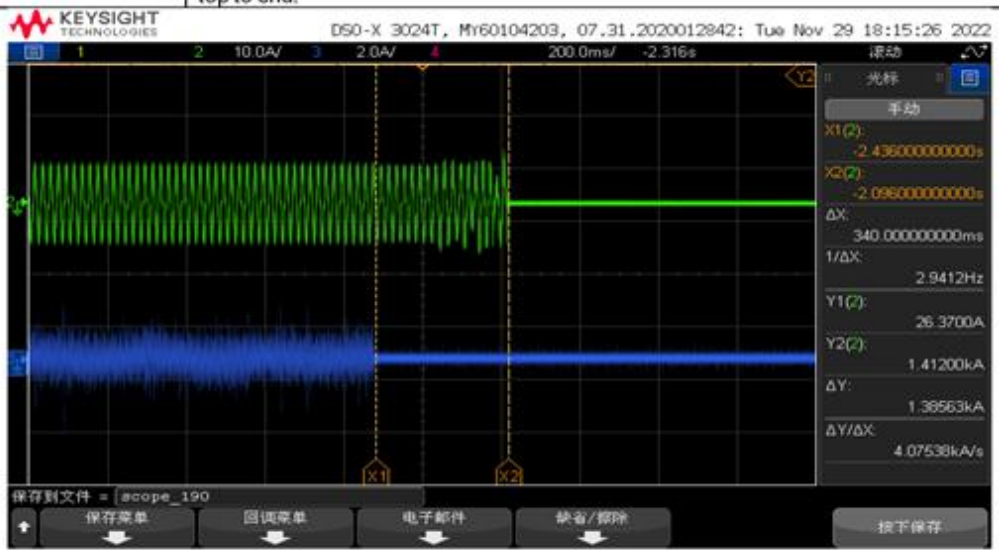
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	73	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	33% load, PR: 0%, QC: -1%, the trip time of protection was 340.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 99 of 130

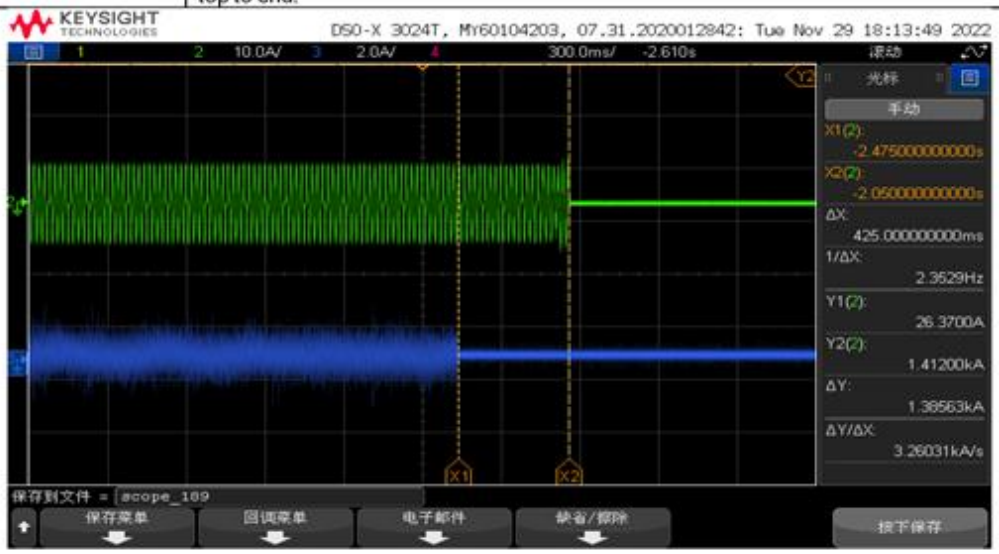
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	74	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	33% load, PR: 0%, QC: 0%, the trip time of protection was 425.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

Page 100 of 130

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	75	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	33% load, the fundamental magnitude of grid current of phase L1 was 0.015A, less than 1% of the rated current 0.130A. See the screenshot of the power analyzer for detail. (1st order harmonic current)		

X1-Mini-G4

	相1		三相总和	
U_tRMS	230.40	V	230.40	V
I_tRMS	290.56	mA	290.56	mA
P_t	648.50	mW	648.50	mW
Q_t	66.928	var	66.928	var
S_t	66.946	VA	66.946	VA
PF_t	0.0095		0.0095	
F_fund			49.999	Hz
U_fundRMS	230.40	V	230.40	V
I_fundRMS	15.271	mA	15.271	mA
P_fund	657.64	mW	657.64	mW
Q_fund	-3.1863	var	-3.1863	var
S_fund	3.5183	VA	3.5183	VA

Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

Page 101 of 130

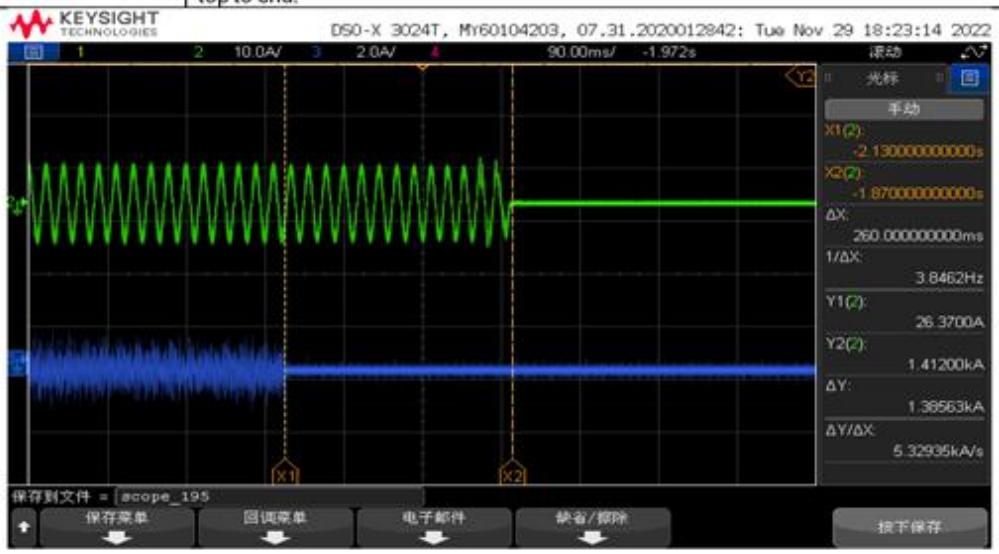
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	76	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	33% load, PR: 0%, QC: +1%, the trip time of protection was 260.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 102 of 130

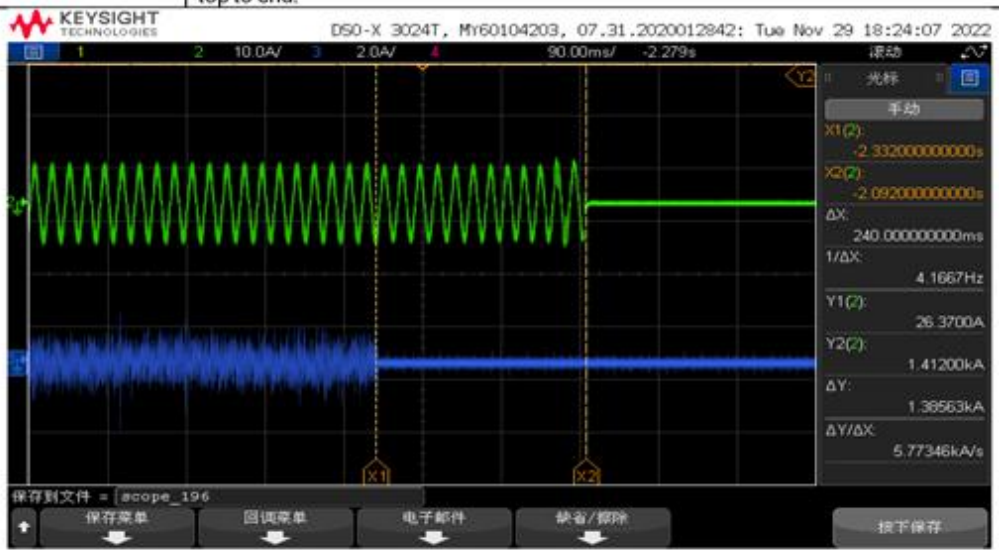
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	77	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	33% load, PR: 0%, QC: +2%, the trip time of protection was 240.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

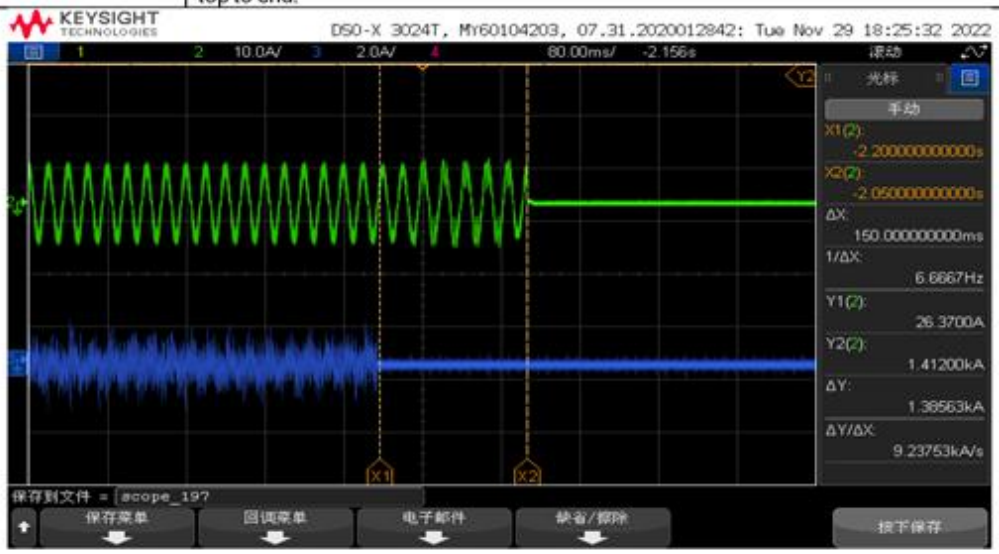
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	78	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	33% load, PR: 0%, QC: +3%, the trip time of protection was 150.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

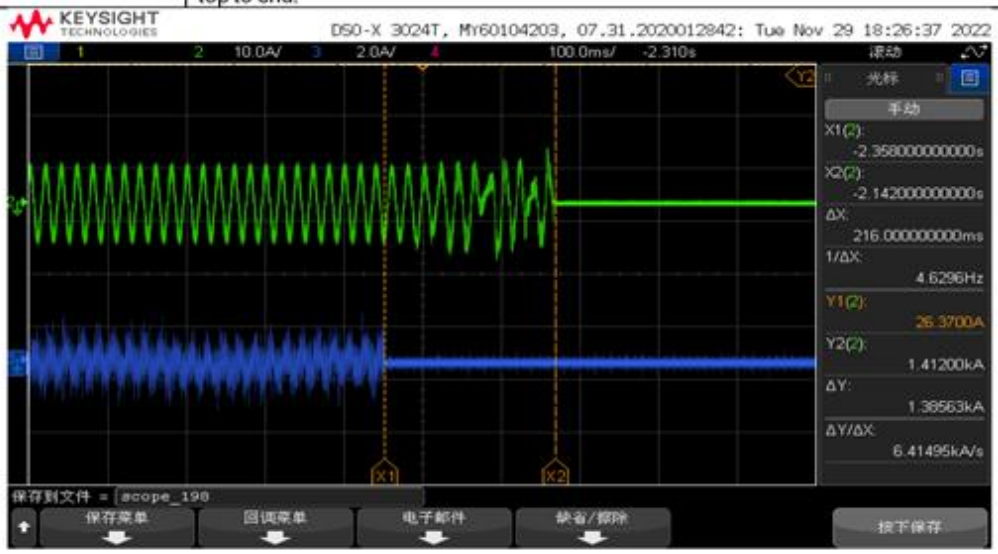
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	79	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	33% load, PR: 0%, QC: +4%, the trip time of protection was 216.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 105 of 130

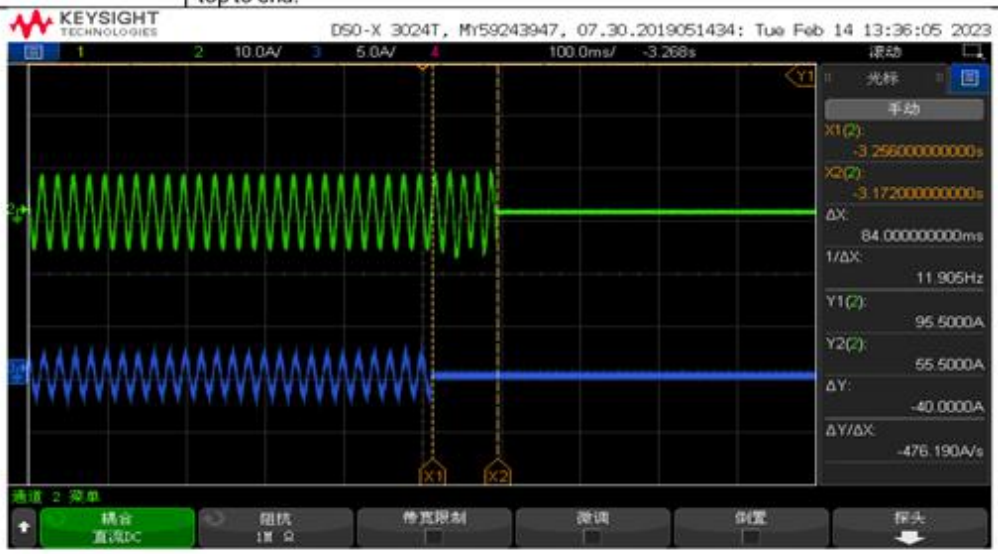
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	80	Clause:	4.3.6
Test:	☒ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☐ Response to Utility Recovery
Test description:	33% load, PR: 0%, QC: +5%, the trip time of protection was 84.0ms. CH1 were the output currents of the inverter; CH2 were the currents flowing through to the grid, also regarded as the trip signal while the grid was switched off. The wave No. was orded from top to end.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

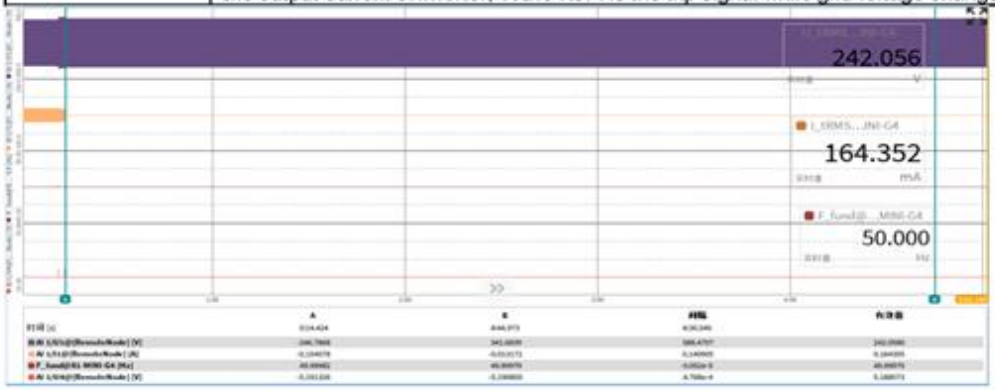
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	81	Clause:	4.3.7
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☒ Response to Utility Recovery
Test description:	Inverter won't reconnect to grid while the grid voltage remained over 240V after the first level over voltage protection was tripped; Wave No.1 is the grid voltage; Wave No. 2 is the output current of inverter; Wave No.4 is the trip signal while grid voltage changed.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

Page 107 of 130

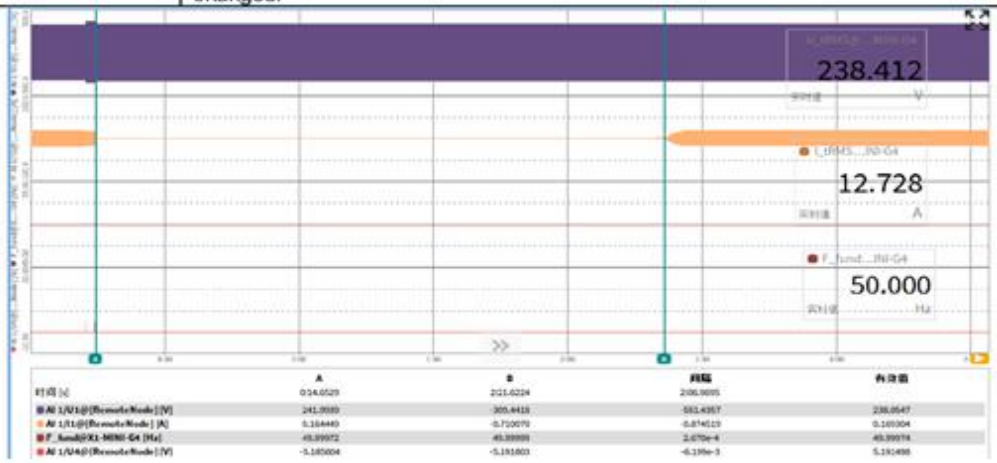
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	82	Clause:	4.3.7
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☒ Response to Utility Recovery
Test description:	Inverter reconnect to grid with 127.0s delay while grid voltage remained below 240V after the first level over voltage protection was tripped; Wave No.1 is the grid voltage; Wave No. 2 is the output current of inverter; Wave No.4 is the trip signal while grid voltage changed.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

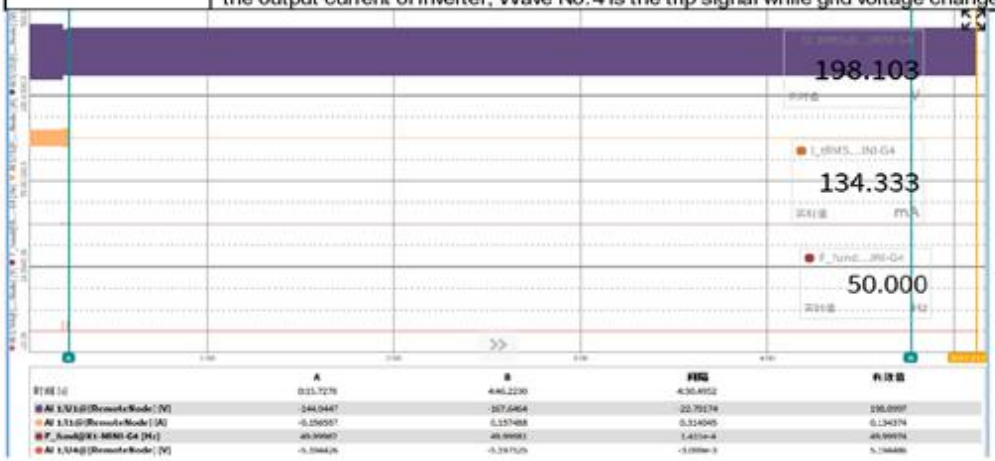
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	83	Clause:	4.3.7
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☒ Response to Utility Recovery
Test description:	Inverter won't reconnect to grid while the grid voltage remained under 200V after the first level under voltage protection was tripped; Wave No.1 is the grid voltage; Wave No. 3 is the output current of inverter; Wave No.4 is the trip signal while grid voltage changed.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

Page 109 of 130

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	84	Clause:	4.3.7
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☒ Response to Utility Recovery
Test description:	Inverter reconnect to grid with 127.2s delay while grid voltage remained above 200V after the first level under voltage protection was tripped; Wave No.1 is the grid voltage; Wave No. 3 is the output current of inverter; Wave No.4 is the trip signal while grid voltage changed.		

Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

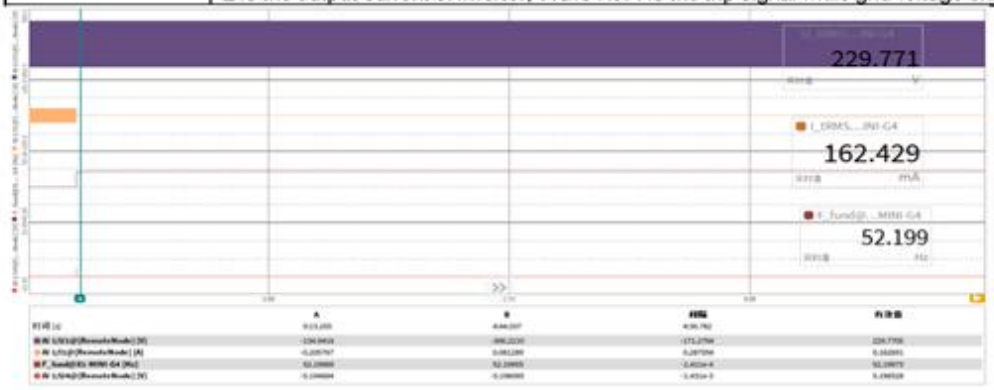
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	85	Clause:	4.3.7
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☒ Response to Utility Recovery
Test description:	Inverter won't reconnect to grid while the grid voltage frequency remained above 52Hz after the over frequency protection was tripped; Wave No.1 is the grid voltage; Wave No. 2 is the output current of inverter; Wave No.4 is the trip signal while grid voltage changed.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 111 of 130

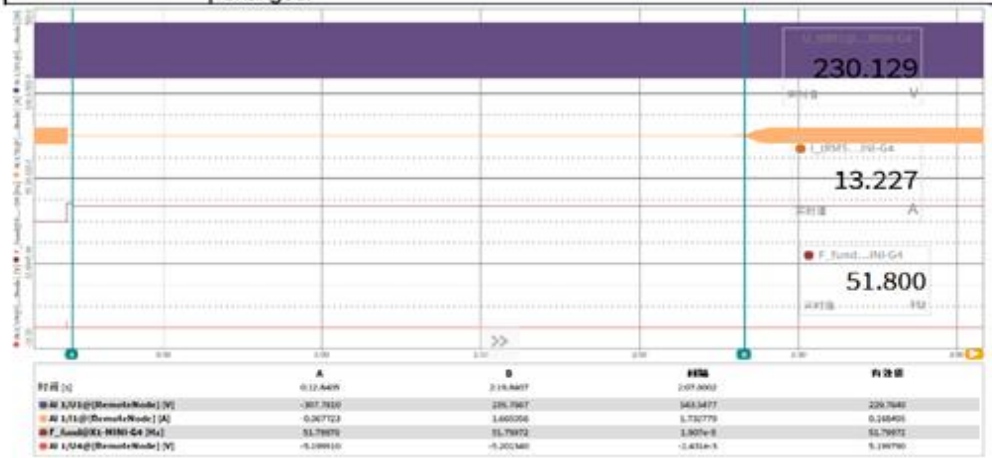
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	86	Clause:	4.3.7
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☒ Response to Utility Recovery
Test description:	Inverter reconnect to grid with 127.0s delay while grid voltage frequency remained below 52Hz after the over frequency protection was tripped; Wave No.1 is the grid voltage; Wave No.3 is the output current of inverter; Wave No.4 is the trip signal while grid voltage changed.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

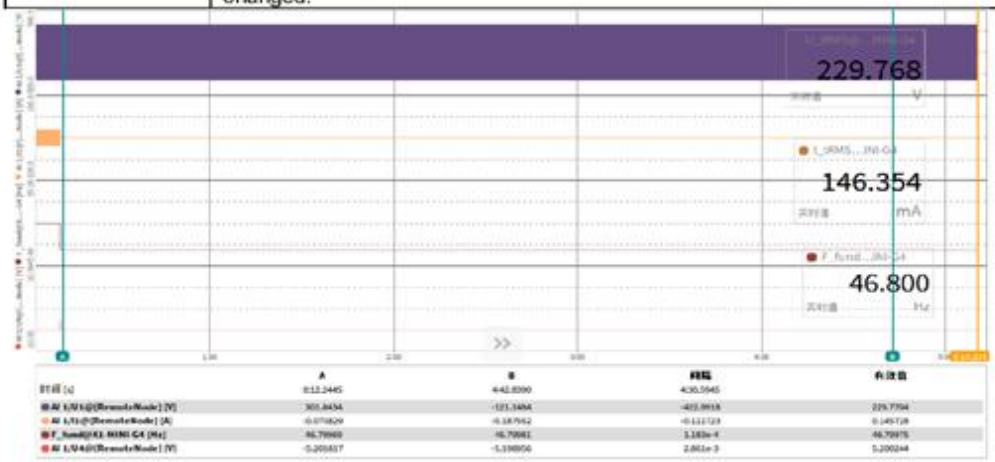
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	87	Clause:	4.3.7
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☒ Response to Utility Recovery
Test description:	Inverter won't reconnect to grid while the grid voltage frequency remained below 47Hz after the under frequency protection was tripped; Wave No.1 is the grid voltage; Wave No. 2 is the output current of inverter; Wave No.4 is the trip signal while grid voltage changed.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

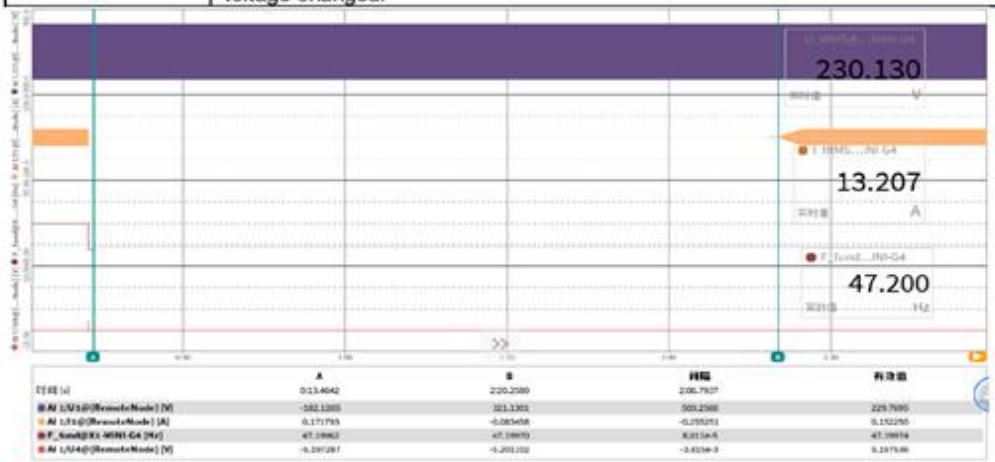
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	88	Clause:	4.3.7
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☒ Response to Utility Recovery
Test description:	Inverter reconnect to grid with 126.8s delay while grid voltage frequency remained over 47Hz after the under frequency protection was tripped; Wave No.1 is the grid voltage; Wave No. 2 is the output current of inverter; Wave No.4 is the trip signal while grid voltage changed.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

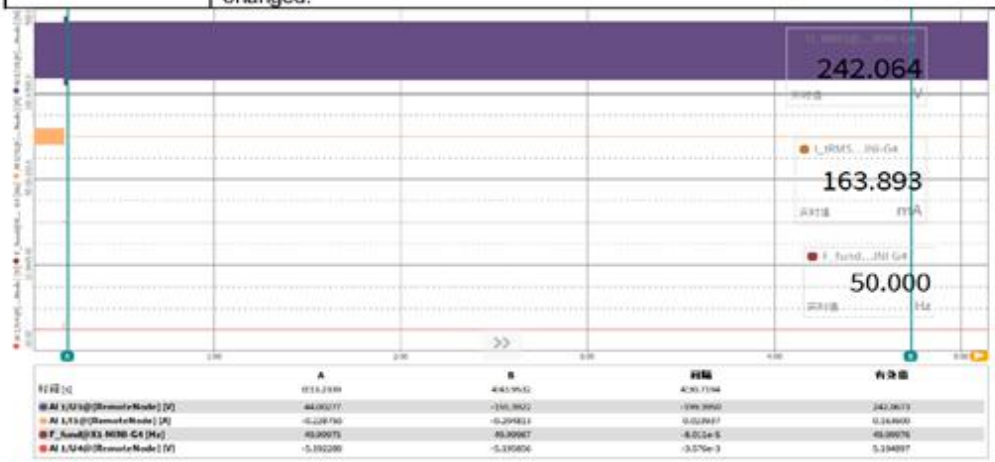
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	89	Clause:	4.3.7
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☒ Response to Utility Recovery
Test description:	Inverter won't reconnect to grid while the grid voltage remained over 240V after the second level 2 over voltage protection was tripped; Wave No.1 is the grid voltage; Wave No.2 is the output current of inverter; Wave No.4 is the trip signal while grid voltage changed.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

Page 115 of 130

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	90	Clause:	4.3.7
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☒ Response to Utility Recovery
Test description:	Inverter reconnect to grid with 127.1s delay while grid voltage remained below 240V after the level 2 over voltage protection was tripped; Wave No.1 is the grid voltage; Wave No. 2 is the output current of inverter; Wave No.4 is the trip signal while grid voltage changed.		

Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

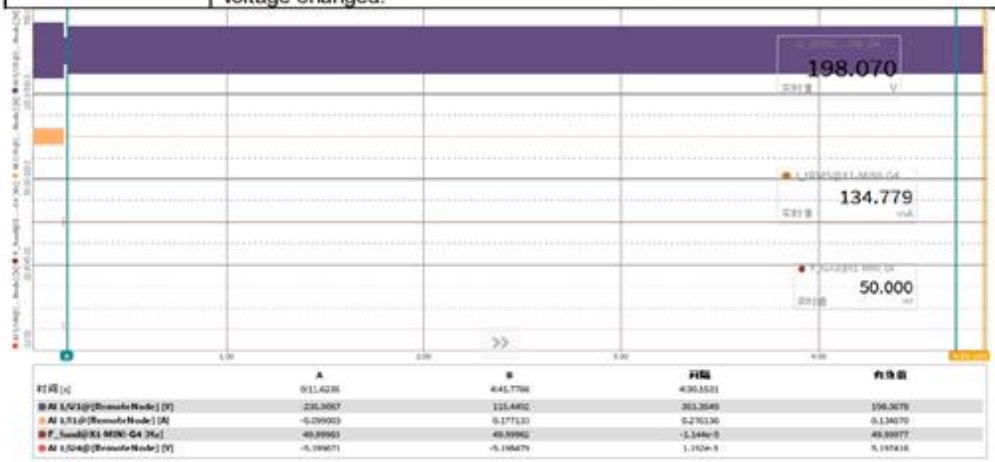
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	91	Clause:	4.3.7
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☒ Response to Utility Recovery
Test description:	Inverter won't reconnect to grid while the grid voltage remained under 200V after the second level 2 under voltage protection was tripped; Wave No.1 is the grid voltage; Wave No. 2 is the output current of inverter; Wave No.4 is the trip signal while grid voltage changed.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

Page 117 of 130

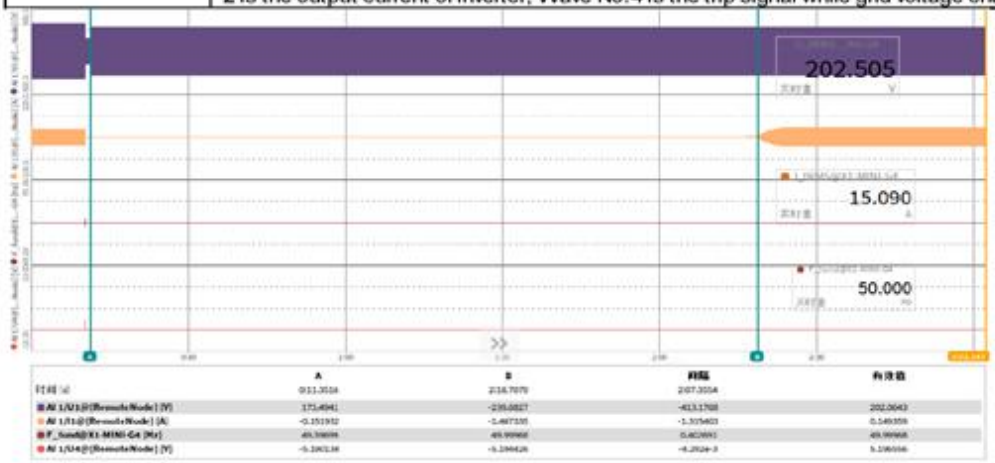
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	92	Clause:	4.3.7
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☒ Response to Utility Recovery
Test description:	Inverter reconnect to grid with 127.4s delay while grid voltage remained above 200V after the level 2 under voltage protection was tripped; Wave No.1 is the grid voltage; Wave No. 2 is the output current of inverter; Wave No.4 is the trip signal while grid voltage changed.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

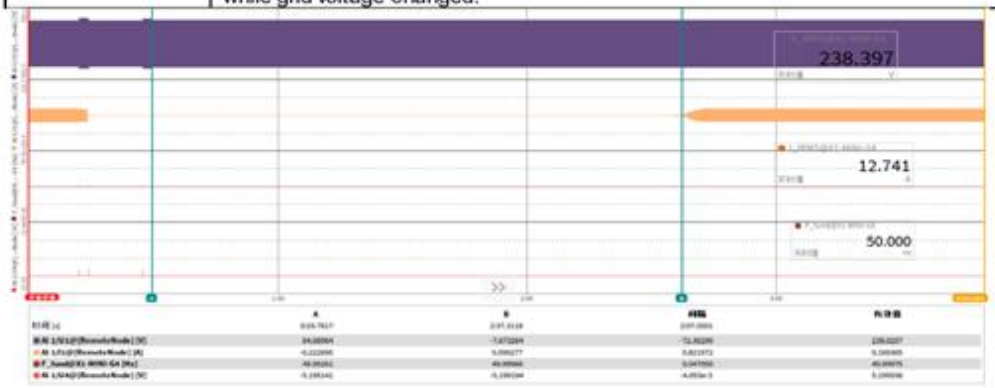
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	93	Clause:	4.3.7
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☒ Response to Utility Recovery
Test description:	Inverter reconnect to grid with 127.6s delay while grid voltage remained below 240V. The grid voltage tripped over voltage level 1 again during the countdown period; Wave No.1 is the grid voltage; Wave No. 2 is the output current of inverter; Wave No.4 is the trip signal while grid voltage changed.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 119 of 130

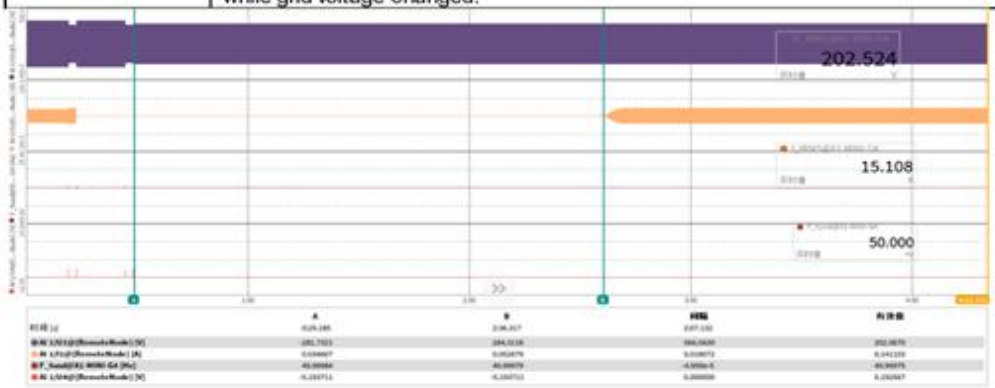
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	94	Clause:	4.3.7
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☒ Response to Utility Recovery
Test description:	Inverter reconnect to grid with 127.1s delay while grid voltage remained above 200V. The grid voltage tripped over under level 1 again during the countdown period; Wave No.1 is the grid voltage; Wave No. 2 is the output current of inverter; Wave No.4 is the trip signal while grid voltage changed.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 120 of 130

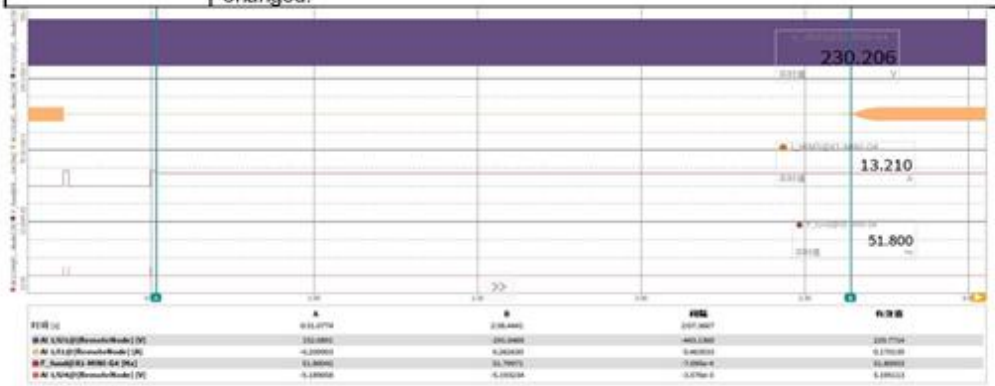
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	95	Clause:	4.3.7
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☒ Response to Utility Recovery
Test description:	Inverter reconnect to grid with 127.4s delay while grid voltage frequency remained below 52Hz. The grid voltage frequency jumped over 52Hz again during the countdown period after the under frequency protection was tripped; Wave No.1 is the grid voltage; Wave No. 2 is the output current of inverter; Wave No.4 is the trip signal while grid voltage changed.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 121 of 130

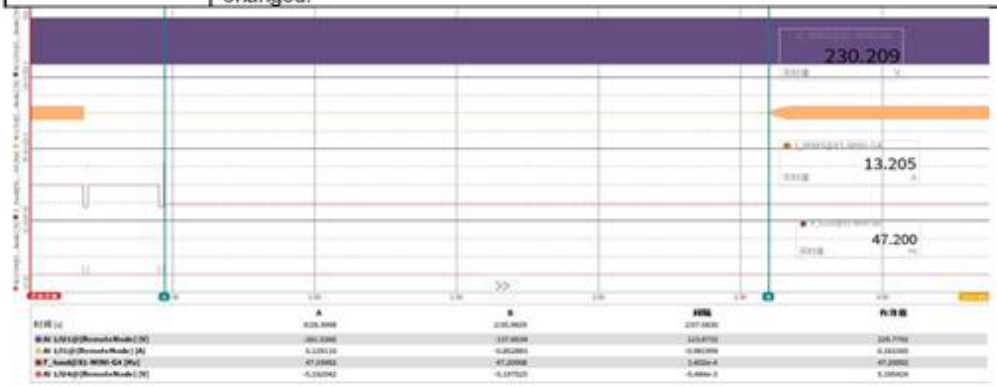
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	96	Clause:	4.3.7
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☒ Response to Utility Recovery
Test description:	Inverter reconnect to grid with 127.6s delay while grid voltage frequency remained above 47Hz. The grid voltage frequency jumped below 47Hz again during the countdown period after the under frequency protection was tripped; Wave No.1 is the grid voltage; Wave No. 2 is the output current of inverter; Wave No.4 is the trip signal while grid voltage changed.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

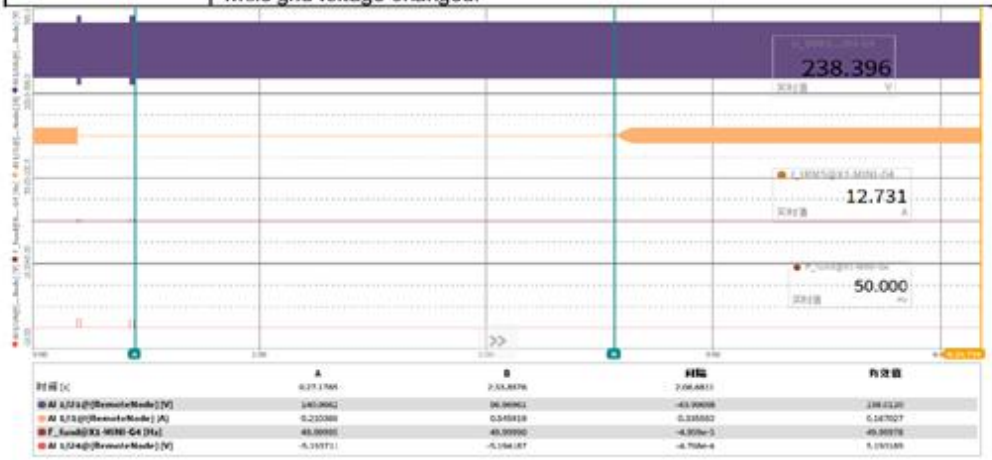
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	97	Clause:	4.3.7
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☒ Response to Utility Recovery
Test description:	Inverter reconnect to grid with 126.7s delay while grid voltage remained below 240V. The grid voltage tripped over voltage level 2 again during the countdown period; Wave No.1 is the grid voltage; Wave No. 2 is the output current of inverter; Wave No.4 is the trip signal while grid voltage changed.		



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

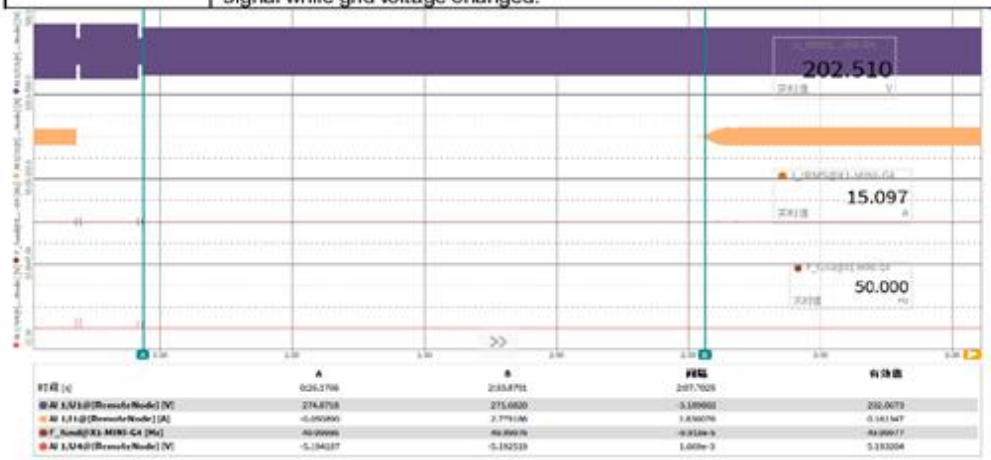
Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Picture No.:	98	Clause:	4.3.7
Test:	☐ Islanding Protection ☐ Secondary Over Voltage Magnitude ☐ Secondary Over Voltage Trip Time ☐ Secondary Under Voltage Magnitude ☐ Secondary Under Voltage Trip Time ☐ Under Frequency Magnitude ☐ Under Frequency Trip Time		☐ First Over Voltage Magnitude ☐ First Over Voltage Trip Time ☐ First Under Voltage Magnitude ☐ First Under Voltage Trip Time ☐ Over Frequency Magnitude ☐ Over Frequency Trip Time ☒ Response to Utility Recovery
Test description:	Inverter reconnect to grid with 127.7s delay while grid voltage remained above 200V. The grid voltage tripped under voltage level 2 again during the countdown period; Wave No.1 is the grid voltage; Wave No. 2 is the output current of inverter; Wave No.4 is the trip signal while grid voltage changed.		



Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

Page 124 of 130

Test Data / Test Plan

TÜVRheinland®

TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

Remark: Trip signal of each test		
1.	Under/over frequency test	The trip signal on the wave diagram was given by the AC source. For each operation on AC source a voltage signal would be given out. (from high level change to low level or from low level change to high level). In this test, we push the button on interface of AC source to change the simulated grid voltage frequency while a trip signal was given out to Oscilloscope automatically.
2.	Response to Utility Recovery	The trip signal on the wave diagram was given by the AC source. For each operation on AC source a voltage signal would be given out. (from high level change to low level or from low level change to high level). In this test, we push the button on interface of AC source to change the simulated grid voltage or voltage frequency while a trip signal was given out to Oscilloscope automatically.
3.	Islanding protection	In this test the trip signal was the current flowing to the grid. When the grid were not disconnected yet, a little current remained even in 100% balance condition, in which case the fundamental current is close to zero, but harmonic component still remains. While the grid is disconnected the gird current would disappeared thoroughly. So it's easy to find the moment while the grid is disconnected by the wave of grid current. The grid current as well as the inverter output current may appear impulses after the switch S2 released or the inverter cease to energize. It was caused not by the real current, but by the electromagnetic noise which may impact the current transducer appearing very small pulse signal while there is no real current flowing through it.

Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

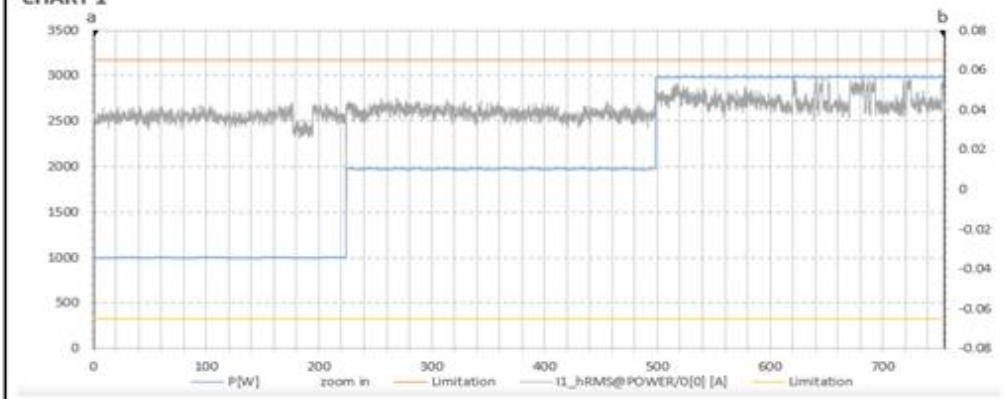
Page 125 of 130

Test Data / Test Plan		TÜVRheinland®	
TÜV Rheinland (Shanghai) Co., Ltd.		Document No.:	MS-0025001-appendix 13
Grid-connected Inverter Regulation (Metropolitan Electricity Authority 2015)		Report No:	CN23GLMZ 001
Order No. :	244466490	Product:	Grid-Connected PV Inverter
Client Name :	SolaX Power Network Technology (Zhejiang) Co., Ltd.	Model designation:	X1-MINI-3.0K-G4

Attachment : 1

DC Injection Trend Line TÜVRheinland®

CHART 1



Used equipment No.:	See equipment list for details	Sample No.:	N/A
Finished date:		Tested by:	
Review date:		Reviewed by:	

Page 126 of 130

TÜV Rheinland (Shanghai) Co. Ltd.
QMA 30.041.01SHG_7.14

TÜVRheinland

Measurement and Test Equipment List
Used MTE

Revision: 20 July, 2007/ G.Luebken

Attachment: 2

Report No.: CN23GLMZ 001 **Order No.: 244466490**

Equip.	Description	Model	Manufacturer
9017073	Power Analyser(DEWETRON)	DEWE2-PA7	Austria, DEWETRON
9017074	Current Sensor(For WT3000)	IT 200-S	LEM
9017075	Current Sensor(For WT3000)	IT 200-S	LEM
9017076	Current Sensor(For WT3000)	IT 200-S	LEM
9017077	Current Sensor(For WT3000)	IT 200-S	LEM
9017078	Programmable AC Source(61860)	61860	Chroma ATE INC.
9017080	Oscilloscope	MDO3024	Tektronix
G1819265	ScopeCoder	DL850	JAPAN, Yokogawa
G1819266	Power Analyser(WT3000)	WT3000	JAPAN, Yokogawa
G1819267	T-Power Software	TP100-P-LVHA/STP	JAPAN, Yokogawa
G1819268	Anti-islanding test detection devices	ACLT-4830H	QUNLING Energy Resources
G1819269	Harmonic impedance analog flicker system	ACLT-6150	QUNLING Energy Resources
G1819277	PV array simulator	62150H-1000S	Chroma Co.
G1819278	PV array simulator	62150H-1000S	Chroma Co.
G1819279	PV array simulator	62150H-1000S	Chroma Co.
G1819280	PV array simulator	62150H-1000S	Chroma Co.

Used equipment No.: See equipment list for details Sample No.: N/A

Finished date: Tested by:

Review date: Reviewed by:

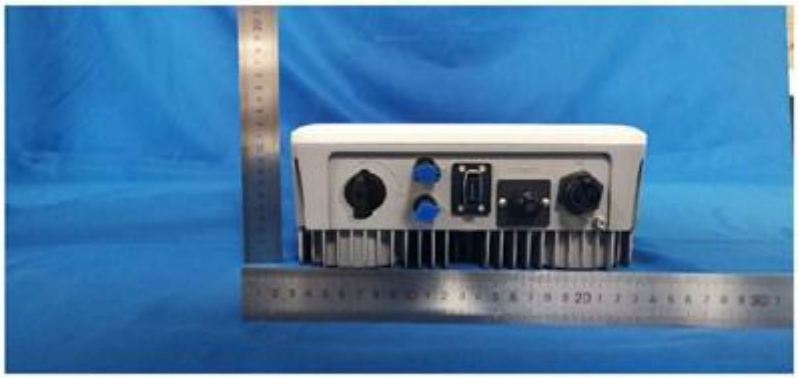
Page 127 of 130

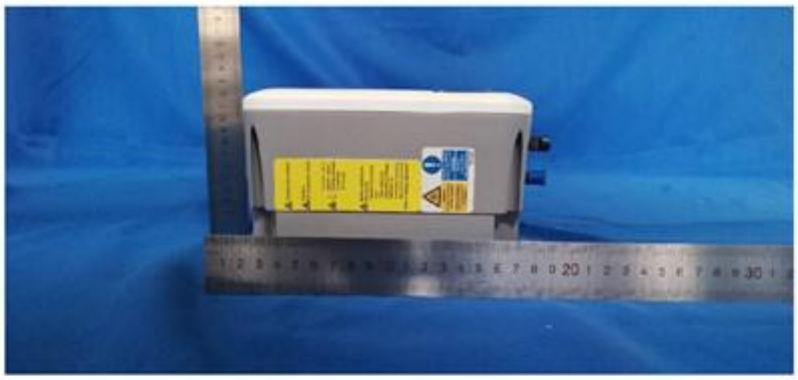
Attachment 3: **Photo Documents**
Report Number: **CN23GLMZ001**
Model: **X1-MINI-3.0K-G4**

TÜVRheinland

Attachment 3: **Photo Documents**
Report Number: **CN23GLMZ001**
Model: **X1-MINI-3.0K-G4**

TÜVRheinland





Attachment 3: **Photo Documents**
Report Number: **CN23GLMZ001**
Model: **X1-MINI-3.0K-G4**

TÜVRheinland

ภาคผนวก ง. Laboratory Accreditation Certificate No. CNAS L3038.

China National Accreditation Service for Conformity Assessment

LABORATORY ACCREDITATION CERTIFICATE

(Registration No. CNAS L3038)

TUV Rheinland (Shanghai) Co., Ltd.

(Legal Entity: TUV Rheinland (Shanghai) Co., Ltd.)

1/F. of No.10, No.153/165/177/178/179/182/189/192/198, Lane 777, Guangzhong West Road, Jing'an District, Shanghai, China

is accredited in accordance with ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories(CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence to undertake the service described in the schedule attached to this certificate.

The scope of accreditation is detailed in the attached schedule bearing the same registration number as above. The schedule forms an integral part of this certificate.

Effective Date: 2019-10-30

Expiry Date: 2023-11-18

Signed on behalf of China National Accreditation Service for Conformity Assessment

China National Accreditation Service for Conformity Assessment (CNAS) is authorized by Certification and Accreditation Administration of the People's Republic of China (CNCA) to operate the national accreditation schemes for conformity assessment. CNAS is a signatory of the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement (ILAC MRA) and the Asia Pacific Accreditation Cooperation Mutual Recognition Arrangement (APAC MRA).

The validity of the certificate can be checked on CNAS website at http://www.cnas.org.cn/english/findanaccreditedbody/index.shtml.