




<b>Prüfbericht - Nr.:</b> <i>Test Report No.:</i>	50332537 001	<b>Auftrags-Nr.:</b> <i>Order No.:</i>	168147823	<b>Seite 1 von 83</b> <i>Page 1 of 83</i>
<b>Kunden-Referenz-Nr.:</b> <i>Client Reference No.:</i>	455841	<b>Auftragsdatum:</b> <i>Order date:</i>	2020.01.06	
<b>Auftraggeber:</b> <i>Client:</i>	Guangzhou Sanjing Electric Co., Ltd. No.9, Lizhishan Road, Science City, Guangzhou High-tech Zone, Guangdong, P.R.China			
<b>Prüfgegenstand:</b> <i>Test item:</i>	Grid-Connected PV Inverter			
<b>Bezeichnung / Typ-Nr.:</b> <i>Identification / Type No.:</i>	R5-13K-T2, R5-15K-T2, R5-17K-T2, R5-20K-T2			
<b>Auftrags-Inhalt:</b> <i>Order content:</i>	AK Certification			
<b>Prüfgrundlage:</b> <i>Test specification:</i>	ABNT NBR 16149:2013, ABNT NBR 16150:2013, ABNT NBR IEC 62116: 2012, ANEXO III – parte 2, Portaria n.º 357, de 01 de agosto de 2014			
<b>Wareneingangsdatum:</b> <i>Date of receipt:</i>	2020.01.13			
<b>Prüfmuster-Nr.:</b> <i>Test sample No.:</i>	R5-20K-T2: R5T2203G1847C00545 R5-13K-T2: R5T2133G1847C00540			
<b>Prüfzeitraum:</b> <i>Testing period:</i>	2020.01.13 – 2020.03.04			
<b>Ort der Prüfung:</b> <i>Place of testing:</i>	TÜV Rheinland (Shanghai) Co., Ltd.			
<b>Prüflaboratorium:</b> <i>Testing Laboratory:</i>	TÜV Rheinland (Shanghai) Co., Ltd.			
<b>Prüfergebnis*:</b> <i>Test Result*:</i>	<b>Pass</b>			
<b>geprüft/ tested by:</b>	<b>kontrolliert/ reviewed by:</b>			
2020.04.13 <b>Datum</b> <i>Date</i>	Thomas Qian / PE <b>Name/Stellung</b> <i>Name/Position</i>	 <b>Unterschrift</b> <i>Signature</i>	2020.04.13 <b>Datum</b> <i>Date</i>	John Dai / Reviwer <b>Name/Stellung</b> <i>Name/Position</i>
				 <b>Unterschrift</b> <i>Signature</i>
<b>Sonstiges/ Other Aspects:</b>				
– See the following pages for General product information and comment.				
<b>Zustand des Prüfgegenstandes bei Anlieferung:</b> <i>Condition of test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
* Legende:	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut	3 = befriedigend F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	4 = ausreichend N/A = nicht anwendbar
Legend:	1 = very good P(ass) = passed a.m. test specification(s)	2 = good	3 = satisfactory F(ail) = failed a.m. test specification(s)	4 = sufficient N/A = not applicable
5 = mangelhaft N/T = nicht getestet				
5 = poor N/T = not tested				
<b>Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.</b> This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.				
V04				

**RELATÓRIO DE TESTE**

**TEST REPORT**

**ABNT NBR 16149**

**Sistemas fotovoltaicos (FV) – Características da interface de conexão com a rede elétrica de distribuição**

**Brazilian Specifications for Grid-Connected Inverters**

**ABNT NBR 16150**

**Sistemas fotovoltaicos (FV) – Características da interface de conexão com a rede elétrica de distribuição – Procedimento de ensaio de conformidade**

**Brazilian Specifications for Grid-Connected Inverters**

**Conformity Testing Procedures**

Referência relatório n:..... 50332538 001

Report Reference No.

Testado por (nome + assinatura) Ver página de rosto .....

Tested by (name + signature) See cover page

Aprovado por (nome + assinatura) Ver página de rosto .....

Approved by (name + signature) See cover page

Data de emissão:..... Ver página de rosto

Date of issue See cover page

Laboratório de Ensaios:..... TÜV Rheinland (Shanghai) Co.,Ltd.

Testing Laboratory

Endereço:..... B1-13F No. 177. Lane 777 West Guangzhong Road. Jing'an

Address

District. Shanghai. 200072 P.R.China

Local de teste / endereço: ..... como candidato

Testing location/ address As above

Nome do candidato: ..... Guangzhou Sanjing Electric Co., Ltd.

Applicant's name

Endereço: ..... No.9, Lizhishan Road, Science City, Guangzhou High-tech Zone,

Address

Guangdong, P.R.China

Especificações de ensaio:

Test specification:

Padrão: ..... ABNT NBR 16149:2013

Standard:

ABNT NBR 16150:2013

ABNT NBR IEC 62116: 2012

ANEXO III – parte 2, Portaria n.º 357, de 01 de agosto de 2014

Test Report Form Não. .... NBR 16149/ 16150A

Test Report Form No:

Test Report Form (s) Originator: .. TÜV Rheinland Group

Test Report Form(s) Originator:

mestre TRF: ..... 2014-12

Master TRF:

Descrição do item de teste: ..... Inversor PV conectada à rede

Test item description: Grid-Connected PV Inverter

Marca comercial: .....



Trade Mark:

Fabricante: ..... como candidato

Manufacturer: As applicant






Modelo / Tipo de referência: ..... Veja a lista modelo






Model/Type reference: See model list







Classificações: ..... Veja a lista modelo

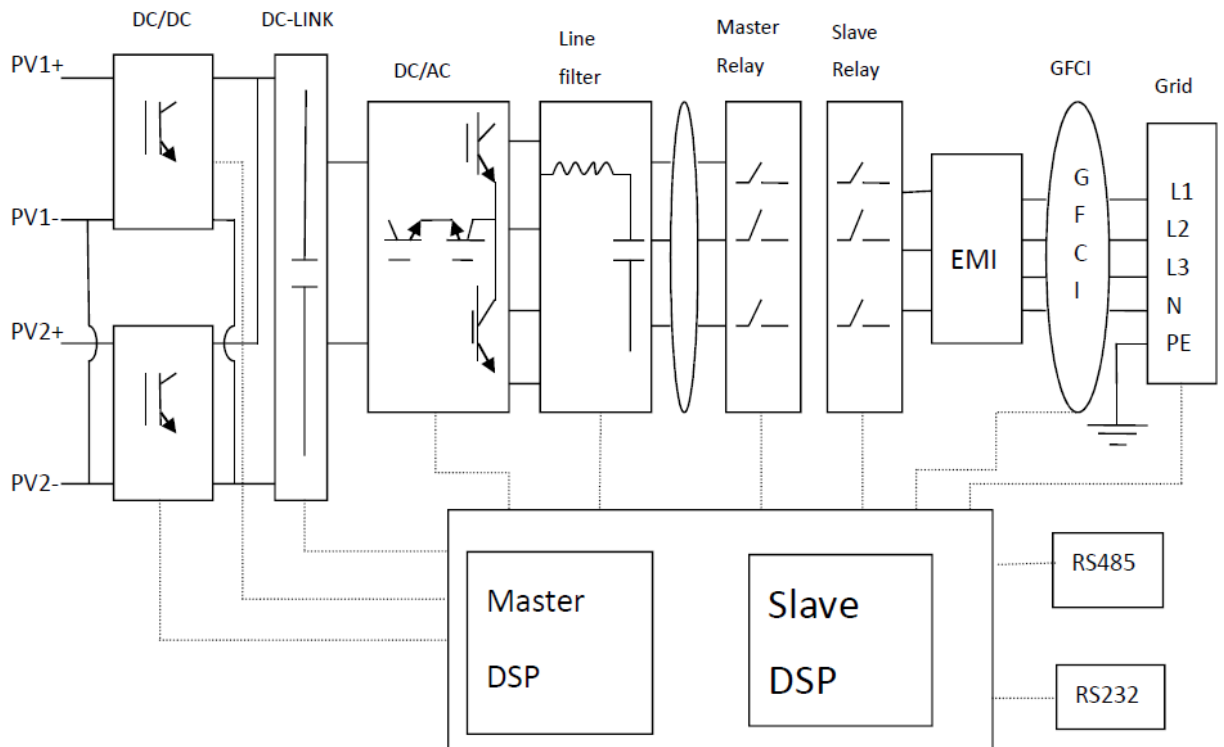
Ratings: See model list

**Cópia da marcação placa:**  
**Copy of marking plate:**

 <b>Guangzhou Sanjing Electric Co., Ltd.</b> Tel: +8620-66605580 Fax: +8620-66605589 Web: www.saj-electric.com - service@saj-electric.com										
<b>INVERSOR DE ENERGIA SOLAR CONECTADO A REDE</b> Tipo: R5-13K-T2										
	<b>ENTRADA (PV)</b>									
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Número máx. arranjo paralelo	2/1									
	<b>SAÍDA (AC)</b>									
	Tensão nominal	3/N/PE 220/380V								
	Corrente nominal	3*19.7A								
	Máxima corrente contínua	3*21.7A								
	Frequência nominal	50/60Hz								
	Potência nominal	13000W								
	Fator de potência	0.8L...1...0.8c								
Temperatura: -40°C~60°C Classe de proteção elétrica: I Categoria sobretensão: II(DC), III(AC) Classe proteção climática: IP65										
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S/N	<input type="text"/>									
P/C	<input type="text"/>									
MADE IN CHINA										

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<div style="display: flex; justify-content: space-between; align-items: center;">  <div> <b>Guangzhou Sanjing Electric Co., Ltd.</b>  <small>Tel: +8620-69605588 Fax: +8620-69605589                  Web: www.saj-electric.com - service@saj-electric.com</small> </div> </div> <p style="text-align: center;"><b>INVERSOR DE ENERGIA SOLAR CONECTADO A REDE</b> Tipo: R5-17K-T2</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2" style="text-align: center;"><b>ENTRADA (PV)</b></td> </tr> <tr> <td style="width: 50%;">Faixa de tensão</td> <td>180V-1100Vdc</td> </tr> <tr> <td>Faixa tensão MPPT</td> <td>180V-950Vdc</td> </tr> <tr> <td>Entrada máx. corrente</td> <td>25/25Adc</td> </tr> <tr> <td>Máx. corrente curto circuito</td> <td>30/30Adc</td> </tr> <tr> <td>Número máx. arranjo paralelo</td> <td>2/2</td> </tr> <tr> <td colspan="2" style="text-align: center;"><b>SAÍDA (AC)</b></td> </tr> <tr> <td>Tensão nominal</td> <td>3/NPE 220/380V</td> </tr> <tr> <td>Corrente nominal</td> <td>3*25.8A</td> </tr> <tr> <td>Máxima corrente contínua</td> <td>3*28.4A</td> </tr> <tr> <td>Frequência nominal</td> <td>50/60Hz</td> </tr> <tr> <td>Potência nominal</td> <td>17000W</td> </tr> <tr> <td>Fator de potência</td> <td>0.8L...1...0.8c</td> </tr> </table> <p>Temperatura: -40°C~60°C                  Classe de proteção elétrica: I                  Categoria sobretensão: I (DC), II (AC)                  Classe proteção climática: IP65</p> <p>EN 50438 EN 50549 VDE-AR-N4105 AS/NZS 4777.2                  CEI 0-21 INMETRO N°004/2011 INMETRO N°017/2016                  INMETRO N°357/2014</p> <div style="display: flex; justify-content: space-around; align-items: center; margin-top: 10px;">  </div> <div style="display: flex; justify-content: space-around; align-items: center; margin-top: 10px;">  </div> <div style="margin-top: 10px;"> <p>S/N <input style="width: 100%;" type="text"/></p> <p>P/C <input style="width: 100%;" type="text"/></p> <p style="text-align: right; font-size: small;">MADE IN CHINA</p> </div>	<b>ENTRADA (PV)</b>		Faixa de tensão	180V-1100Vdc	Faixa tensão MPPT	180V-950Vdc	Entrada máx. corrente	25/25Adc	Máx. corrente curto circuito	30/30Adc	Número máx. arranjo paralelo	2/2	<b>SAÍDA (AC)</b>		Tensão nominal	3/NPE 220/380V	Corrente nominal	3*25.8A	Máxima corrente contínua	3*28.4A	Frequência nominal	50/60Hz	Potência nominal	17000W	Fator de potência	0.8L...1...0.8c	<div style="display: flex; justify-content: space-between; align-items: center;">  <div> <b>Guangzhou Sanjing Electric Co., Ltd.</b>  <small>Tel: +8620-69605588 Fax: +8620-69605589                  Web: www.saj-electric.com - service@saj-electric.com</small> </div> </div> <p style="text-align: center;"><b>INVERSOR DE ENERGIA SOLAR CONECTADO A REDE</b> Tipo: R5-20K-T2</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2" style="text-align: center;"><b>ENTRADA (PV)</b></td> </tr> <tr> <td style="width: 50%;">Faixa de tensão</td> <td>180V-1100Vdc</td> </tr> <tr> <td>Faixa tensão MPPT</td> <td>180V-950Vdc</td> </tr> <tr> <td>Entrada máx. corrente</td> <td>25/25Adc</td> </tr> <tr> <td>Máx. corrente curto circuito</td> <td>30/30Adc</td> </tr> <tr> <td>Número máx. arranjo paralelo</td> <td>2/2</td> </tr> <tr> <td colspan="2" style="text-align: center;"><b>SAÍDA (AC)</b></td> </tr> <tr> <td>Tensão nominal</td> <td>3/NPE 220/380V</td> </tr> <tr> <td>Corrente nominal</td> <td>3*30.3A</td> </tr> <tr> <td>Máxima corrente contínua</td> <td>3*33.4A</td> </tr> <tr> <td>Frequência nominal</td> <td>50/60Hz</td> </tr> <tr> <td>Potência nominal</td> <td>20000W</td> </tr> <tr> <td>Fator de potência</td> <td>0.8L...1...0.8c</td> </tr> </table> <p>Temperatura: -40°C~60°C                  Classe de proteção elétrica: I                  Categoria sobretensão: I (DC), II (AC)                  Classe proteção climática: IP65</p> <p>EN 50438 EN 50549 VDE-AR-N4105 AS/NZS 4777.2                  CEI 0-21 INMETRO N°004/2011 INMETRO N°017/2016                  INMETRO N°357/2014</p> <div style="display: flex; justify-content: space-around; align-items: center; margin-top: 10px;">  </div> <div style="display: flex; justify-content: space-around; align-items: center; margin-top: 10px;">  </div> <div style="margin-top: 10px;"> <p>S/N <input style="width: 100%;" type="text"/></p> <p>P/C <input style="width: 100%;" type="text"/></p> <p style="text-align: right; font-size: small;">MADE IN CHINA</p> </div>	<b>ENTRADA (PV)</b>		Faixa de tensão	180V-1100Vdc	Faixa tensão MPPT	180V-950Vdc	Entrada máx. corrente	25/25Adc	Máx. corrente curto circuito	30/30Adc	Número máx. arranjo paralelo	2/2	<b>SAÍDA (AC)</b>		Tensão nominal	3/NPE 220/380V	Corrente nominal	3*30.3A	Máxima corrente contínua	3*33.4A	Frequência nominal	50/60Hz	Potência nominal	20000W	Fator de potência	0.8L...1...0.8c
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**Diagrama de blocos inversor fotovoltaico:**
**PGU Block Diagram:**

**Lista de modelos:**
**PGU Model list:**

MODELOS LISTA MODELS LIST		R5-13K-T2	R5-15K-T2	R5-17K-T2	R5-20K-T2
ENTRADA(CC) INPUT	Tensão c.c. Máxima [Vc.c.] $V_{MAX}$ PV [Vdc]	1100			
	Rango de voltaje de CC [Vc.c.] DC Voltage Range [Vdc]	160-950		180-950	
	Corrente c.c. Máxima Max. Input Current $I_{MAX}$ [A]	25/12.5		25/25	
	Máx. Corrente curta DC Max. DC Short Current [A]	30/15		30/30	
	Número de MPPT Number of MPPT	2			
	cadena por MPPT string per MPPT	2/1		2/2	

<b>SAÍDA (CA) AC OUTPUT</b>	Tensão c.a. Nominal [Vc.a.] Rated Output Voltage $U_r$ [Vac]	220/380			
	Frequência Nominal Rated Output Frequency $F_{NETZ}$ [Hz]	50/60			
	Potência c.a. Nominal Rated Output Power $P_E$ [W]	13000	15000	17000	20000
	Potência c.a. máxima Max Output Power $P_E$ [VA]	14300	16500	18700	22000
	Corrente nominal CA Rated AC Current [A]	19.7	22.7	25.8	30.3
	Corrente c.c. Máxima Max. Output Current $I_{max}$ [A]	21.7	25.0	28.4	33.4
	Fator de potência $\cos \phi$ Power Factor $\cos \phi$ [ $\lambda$ ]	0.8 cap-0.8 ind			
	Eficiência max. Efficiency max. $\eta_{max}$	98.7%		98.8%	
	Grau de Proteção Enclosure Protection (IP)	IP65			
	Faixa de temperatura operacional Ambient Operating Temperature Range [°C]	-40~60[45°C to 60°C with derating]			
	Pollution degree (PD)	PD 3			
	Dimensões Size (W/D/H) [mm]	480 × 440 × 200		530 × 490 × 210	
	Peso Weight [kg]	26		29	
	Firmware	Hardware version: V1.002; Firmware version: V3.017			
Note:					

Possíveis veredictos do caso de teste:

Possible test case verdicts:

- caso de teste não se aplica ao objeto de teste.... N/A
- test case does not apply to the test object:
- teste objeto faz cumprir a exigência ..... Pass (P)
- test object does meet the requirement:
- teste objeto não cumprir a exigência ..... Fail (F)
- test object does not meet the requirement:

Teste:

Testing:

Data de recepção de itens de teste ..... Ver página de rosto

Date of receipt of test items:

See cover page

Data (s) de realização de testes ..... Ver página de rosto

Date(s) of performance of tests:

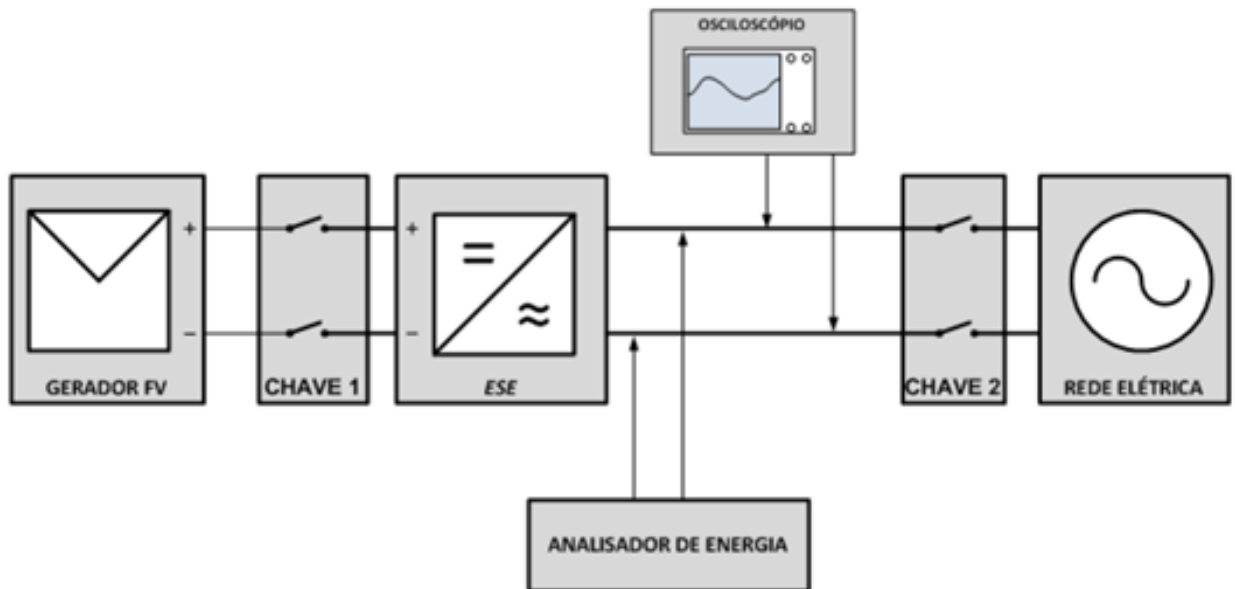
See cover page

Resumo do teste

Summary test

Diagrama de conexões dos instrumentos de medição e aparelhos e componentes:

Wiring diagram of measuring instruments and devices and components:





ABNT NBR 16149: 2013			
Seção Clause	Exigência - Teste Requirement – Test	Resultado - Observação Result - Remark	Veredito Verdict
4	Compatibilidade com a rede Network compatibility		P
4.1	Tensão, potência e frequência Voltage, power and frequency		P
4.2	<p>Faixa operacional normal de tensão</p> <p>O sistemas fotovoltaicos normalmente não regular a tensão, mas apenas a corrente injetada no grid. Portanto, o intervalo normal de tensão é seleccionada como uma função de protecção, de responder a condições anormais de grade. O sistema PV deve operar dentro dos limites de variacao de tensão definidos em 5.2.1</p> <p>Normal operating voltage range</p> <p>The PV systems typically do not regulate the voltage, but only the current injected into the grid. Therefore, the normal voltage range is selected as a protection function of responding to abnormal conditions of the grid. The PV system must operate within the voltage variation limits defined in 5.2.1</p>	<p>Atendeu aos parâmetros da Norma</p> <p>Complied</p>	P
4.3	<p>Cintilação</p> <p>A Operação do sistema de PV não pode causar cintilação acima dos limites mencionados nas secções pertinentes das IEC 61000-3-3 (para sistemas com corrente inferior a 16A), IEC 61000-3-11 (para sistemas com corrente superior a 16A e inferior a 75A) e IEC / TS 61000-3-5 (para sistemas com corrente superior a 75A).</p> <p>Flicker</p> <p>Operation of the PV system can not cause flickering above the limits specified in the relevant sections of IEC 61000-3-3 (for systems with current less than 16A), IEC 61000-3-11 (for systems with higher current to 16A and lower 75A) and IEC / TS 61000-3-5 (for systems with higher current to 75A).</p>	<p>Atendeu aos parâmetros da Norma</p> <p>Complied</p>	P

ABNT NBR 16149: 2013			
Seção Clause	Exigência - Teste Requirement – Test	Resultado - Observação Result - Remark	Veredito Verdict
4.4	<p>Proteção de injeção de componente c.c. na rede elétrica</p> <p>O sistema fotovoltaico deve parar de fornecer energia a rede em 1 s se a injeção de componente c.c. na rede elétrica for superior a 0.5% da corrente nominal do inversor. O sistema fotovoltaico com transformador com separação galvânica em 60Hz não precisa ter proteções adicionais para atender a este requisito.</p> <p>d.c. component injection Protection the power grid</p> <p>The PV system should stop supplying power to network 1 s if the injection d.c. component the power grid is more than 0.5% of the nominal drive current. The photovoltaic system with transformer with galvanic separation at 60Hz not need additional protections to meet this requirement.</p>	<p>Atendeu aos parâmetros da Norma</p> <p>Complied</p>	P
4.5	<p>Faixa Operacional normal de frequência</p> <p>O sistema fotovoltaico deve operar em sincronismo com a rede elétrica e dentro dos limites de variação de frequência definidos em 5.2.2</p> <p>normal Operating frequency range</p> <p>The system photovoltaic must operate in synchronization with the power grid and within the variation limits defined frequency in 5.2.2</p>	<p>Atendeu aos parâmetros da Norma</p> <p>Complied</p>	P

ABNT NBR 16149: 2013																			
Seção Clause	Exigência - Teste Requirement – Test	Resultado - Observação Result - Remark	Veredito Verdict																
4.6	<p>Harmônicos e distorção de formas de onda</p> <p>A distorção harmônica total de corrente deve ser inferior a 5% em relação a corrente fundamental na potência nominal do inversor. Cada harmônica individual deve estar limitada aos valores apresentados na Tabela 1.</p> <p>Harmonics and distortion of waveforms</p> <p>The total harmonic distortion of current must be less than 5% in relation to fundamental current in the inverter rating. Each individual harmonic shall be limited to the values shown in Table 1.</p> <p style="text-align: center;">Tabela 1 – Limite de distorção harmônica de corrente</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Harmônicas ímpares</th> <th>Limite de distorção</th> </tr> </thead> <tbody> <tr> <td>3° a 9°</td> <td>&lt; 4,0 %</td> </tr> <tr> <td>11° a 15°</td> <td>&lt; 2,0 %</td> </tr> <tr> <td>17° a 21°</td> <td>&lt; 1,5 %</td> </tr> <tr> <td>23° a 33°</td> <td>&lt; 0,6 %</td> </tr> <tr> <th>Harmônicas pares</th> <th>Limite de distorção</th> </tr> <tr> <td>2° a 8°</td> <td>&lt; 1,0 %</td> </tr> <tr> <td>10° a 32°</td> <td>&lt; 0,5 %</td> </tr> </tbody> </table>	Harmônicas ímpares	Limite de distorção	3° a 9°	< 4,0 %	11° a 15°	< 2,0 %	17° a 21°	< 1,5 %	23° a 33°	< 0,6 %	Harmônicas pares	Limite de distorção	2° a 8°	< 1,0 %	10° a 32°	< 0,5 %	<p>Atendeu aos parâmetros da Norma</p> <p>Complied</p>	P
Harmônicas ímpares	Limite de distorção																		
3° a 9°	< 4,0 %																		
11° a 15°	< 2,0 %																		
17° a 21°	< 1,5 %																		
23° a 33°	< 0,6 %																		
Harmônicas pares	Limite de distorção																		
2° a 8°	< 1,0 %																		
10° a 32°	< 0,5 %																		
4.7	<p>Fator de potência e injeção/demanda de potência reativa</p> <p>Inversor deve ser capaz de operar no seguinte intervalo de fator de potência quando a alimentação de energia ativa em em rede é de 20% superior da potência nominal do gerador</p> <p>power factor and injection / reactive power demand</p> <p>Inverter must be able to operate on the following power factor range when the power active energy network is 20% higher than the rated power of the generator</p>	<p>Atendeu aos parâmetros da Norma</p> <p>Complied</p>	P																
4.7.1	<p>Sistemas fotovoltaicos com potência nominal menor ou igual a 3kW</p> <p>PF igual a 1 ajustado em fabrica, com tolerancia de trabalho na faixa de 0,98 indutivo ate 0,98 capacitivo.</p> <p>PV systems with lower rated power than or equal to 3kW</p> <p>PF = 1 set in manufactures with work tolerance in 0.98 inductive range up to 0.98 capacitive.</p>	<p>Atendeu aos parâmetros da Norma</p> <p>Complied</p> <p>A capacidade máxima do sistema fotovoltaico é superior a 6 kW.</p> <p>The maximum capacity of the PV system is more than 6 kW.</p>	P																

ABNT NBR 16149: 2013			
Seção Clause	Exigência - Teste Requirement – Test	Resultado - Observação Result - Remark	Veredito Verdict
4.7.2	<p>Sistemas fotovoltaicos com potência nominal maior que 3kW e menos ou igual a 6 kW:</p> <p>FP igual a 1 ajustado em fabrica, com tolerância de trabalhar na faixa de 0.98 indutivo até 0.98 capacitivo. O inversor deve apresentar, como opcional, a possibilidade de operar de acordo com a curva da Figura 1 e com FP ajustavel de 0.95 indutivo até 0.95 capacitivo.</p> <p>PV systems with rated power to 3kW and less than or equal to 6 kW:</p> <p>FP equal to 1 set to manufactures with tolerance to work in inductive range 0.98 to 0.98 capacitive. The inverter shall, as an option, the possibility to operate in accordance with the curve of Figure 1 and FP adjustable inductive 0.95 to 0.95 capacitive.</p>	<p>Atendeu aos parâmetros da Norma</p> <p>Complied</p> <p>A capacidade máxima do sistema fotovoltaico é superior a 6 kW.</p> <p>The maximum capacity of the PV system is more than 6 kW.</p>	P

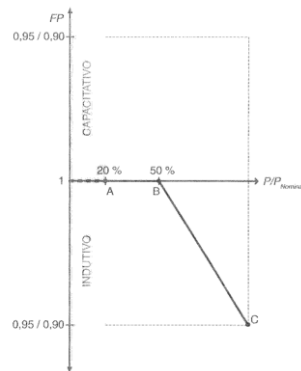
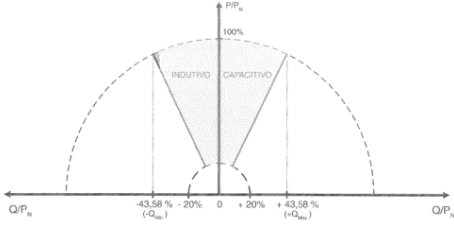
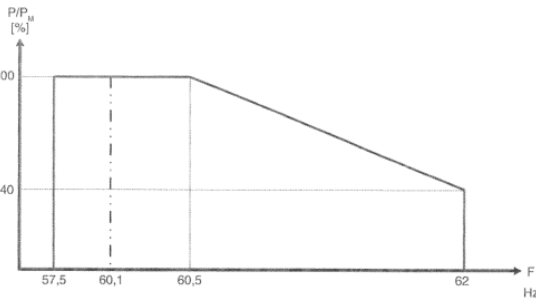


Figura 1 – Curva do FP em função da potência ativa de saída do inversor

ABNT NBR 16149: 2013			
Seção Clause	Exigência - Teste Requirement – Test	Resultado - Observação Result - Remark	Veredito Verdict
4.7.3	<p>Sistemas fotovoltaicos com potência nominal maior que 6kW</p> <p>O sistema fotovoltaico pode operar com em dois modos:</p> <p>PF igual a 1 ajustado em fábrica, com tolerância a trabalhar a partir de 0,98 indutivo a 0,98 capacitivo. O inversor deve apresentar, como opcional, a possibilidade de operar de acordo com a curva da Figura 1 e com FP ajustável de 0,90 indutivo a 0,90 capacitivo; ou(ii) controle da potência reativa (Var), conforme Figura 2.</p> <p>Photovoltaic systems with higher rated power than 6kW</p> <p>The photovoltaic system can operate in two modes:</p> <p>PF = 1 set in the factory with tolerance to work from 0.98 to 0.98 Capacitive Inductive. The inverter shall, as an option, the possibility to operate in accordance with the curve of Figure 1 and adjustable from 0.90 inductive to 0.90 capacitive FP; or (ii) control of reactive power (Var), as shown in Figure 2.</p>  <p>Figura 2 – Limites operacionais de injeção/demanda de potência reativa para sistemas com potência nominal superior a 6 kW.</p>	<p>Atendeu aos parâmetros da Norma</p> <p>Complied</p> <p>A capacidade máxima do sistema fotovoltaico é superior a 6 kW.</p> <p>The maximum capacity of the PV system is more than 6 kW.</p>	P
5	<p>Segurança pessoal e proteção do sistema FV</p> <p>Esta Seção fornece informações e considerações para a operação segura e correta dos sistemas fotovoltaicos conectados à rede elétrica.</p> <p>personal safety and protection of the PV system</p> <p>This section provides information and considerations for the safe and correct operation of photovoltaic systems connected to the power grid.</p>		P

ABNT NBR 16149: 2013															
Seção Clause	Exigência - Teste Requirement – Test	Resultado - Observação Result - Remark	Veredito Verdict												
5.1	<p>Perda da tensão da rede</p> <p>Para prevenir o ilhamento, um sistema fotovoltaico conectado à rede deve o fornecimento de energia a rede, independentemente das cargas ligadas ou outros geradores, em um tempo-limite especificado.</p> <p>A rede elétrica pode não estar energizada por várias razões. Por exemplo, a atuação de proteções contra faltas e a desconexão devido a manutenção.</p> <p>Loss of voltage</p> <p>To prevent islanding, a photovoltaic system is connected to the network the network power supply regardless of other connected loads or generators in a specified time limit.</p> <p>The grid can not be energized for several reasons. For example, the performance of protection against faults and disconnection due to maintenance.</p>	<p>Atendeu aos parâmetros da Norma</p> <p>Complied</p>	P												
5.2	<p>Variações de tensão e frequência</p> <p>Variations in voltage and frequency</p>		P												
5.2.1	<p>Variação de tensão</p> <p>Quando a tensão da rede sai da faixa de operação especificada na Tabela2, o sistema fotovoltaico deve parar de fornecer energia a rede.</p> <p>Voltage variation</p> <p>When the mains voltage out of operating range specified in Table 2, the photovoltaic Sistema should stop supplying power to network.</p> <p style="text-align: center;">Tabela 2 – Resposta às condições anormais de tensão</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2">Tensão no ponto comum de conexão (% em relação à V<sub>nominal</sub>)</th> <th>Tempo máximo de desligamento<sup>a</sup></th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">V</td> <td style="text-align: center;">&lt; 80 %</td> <td style="text-align: center;">0,4 s</td> </tr> <tr> <td style="text-align: center;">80 % ≤ V ≤</td> <td style="text-align: center;">110 %</td> <td style="text-align: center;">Regime normal de operação</td> </tr> <tr> <td style="text-align: center;">110 % &lt; V</td> <td></td> <td style="text-align: center;">0,2 s</td> </tr> </tbody> </table> <p><sup>a</sup> O tempo máximo de desligamento refere-se ao tempo entre o evento anormal de tensão e a atuação do sistema fotovoltaico (cessar o fornecimento de energia para a rede). O sistema fotovoltaico deve permanecer conectado à rede, a fim de monitorar os parâmetros da rede e permitir a "reconexão" do sistema quando as condições normais forem restabelecidas.</p>	Tensão no ponto comum de conexão (% em relação à V <sub>nominal</sub> )		Tempo máximo de desligamento <sup>a</sup>	V	< 80 %	0,4 s	80 % ≤ V ≤	110 %	Regime normal de operação	110 % < V		0,2 s	<p>Atendeu aos parâmetros da Norma</p> <p>Complied</p>	P
Tensão no ponto comum de conexão (% em relação à V <sub>nominal</sub> )		Tempo máximo de desligamento <sup>a</sup>													
V	< 80 %	0,4 s													
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110 % < V		0,2 s													

ABNT NBR 16149: 2013			
Seção Clause	Exigência - Teste Requirement – Test	Resultado - Observação Result - Remark	Veredito Verdict
5.2.2	<p><b>Variação de frequência</b></p> <p>Quando a frequência da rede assumir valores abaixo de 57.5Hz, o sistema fotovoltaico deve cessar de fornecer energia a rede elétrica em até 0.2 s. O sistema somente deve voltar a fornecer energia a rede quando a frequência retornar para 59.9Hz, respeitando o tempo de reconexão descrito em 5.4</p> <p>Quando a frequência da rede ultrapassar 60.5Hz e permanecer abaixo de 62Hz, o sistema fotovoltaico deve reduzir a potência ativa injetada na rede segundo a equação:</p> <p>Frequency variation</p> <p>When the grid frequency assume values below 57.5Hz, the photovoltaic system must cease to supply power to the power grid up to 0.2 s. The system should only return to supply power to the network when the frequency back to 59.9Hz, respecting the reconnection time to paragraph 5.4</p> <p>When the grid frequency exceeds 60.5Hz and remain below 62Hz, the photovoltaic sistema should reduce the injected active power in the network according to the equation:</p> $\Delta P = [f_{rede} - (f_{NOMINAL} + 0,5)] \times R$  <p>Figura 3 – Curva de operação do sistema fotovoltaico em função da frequência da rede para a desconexão por variação de frequência</p>	<p>Atendeu aos parâmetros da Norma</p> <p>Complied</p>	P

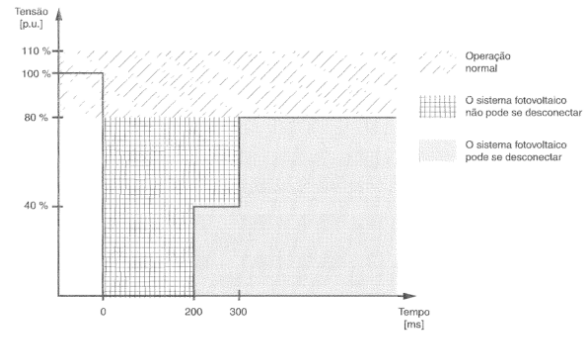
ABNT NBR 16149: 2013			
Seção Clause	Exigência - Teste Requirement – Test	Resultado - Observação Result - Remark	Veredito Verdict
5.3	<p>Proteção contra ilhamento</p> <p>O sistema fotovoltaico deve cessar de fornecer energia a rede em até 2 s após a perda da rede.</p> <p>NOTA Os procedimentos de ensaio de anti-ilhamento são objetos da ABNT NBR IEC 62116</p> <p>islanding protection</p> <p>The photovoltaic system must cease to supply power to network up to 2 s after the loss of the network.</p> <p>NOTE The anti-islanding test procedures are the NBR IEC 62116 objects</p>	<p>Atendeu aos parâmetros da Norma</p> <p>Complied</p>	P
5.4	<p>Reconexão</p> <p>Depois de uma "desconexão" devido a uma condição anormal da rede, o sistema fotovoltaico não pode retomar o fornecimento de energia a rede elétrica (reconexão) por um período de 20 s a 300 s após a retomada das condições normais de tensão e frequência da rede.</p> <p>reconnection</p> <p>After a "disconnection" due to an abnormal condition of the network, the photovoltaic system can not resume the power supply to grid (reconnection) for a period of 20 s to 300 s after the resumption of normal voltage conditions and frequency of network .</p>	<p>Atendeu aos parâmetros da Norma</p> <p>Complied</p>	P
5.5	<p>Aterramento</p> <p>O equipamento de interface com a rede deve estar aterrado em conformidade com a IEC 60364-7-712.</p> <p>Grounding</p> <p>DO with the network interface equipment must be grounded in accordance with IEC 60364-7-712.</p>		P
5.6	<p>Proteção contra curto-circuito</p> <p>O sistema fotovoltaico deve ter proteções contra curto-circuito na interface de conexão com a rede, em conformidade com a IEC 60364-7-712.</p> <p>Short-circuit protection</p> <p>The fotovoltaico system must have protections against short-circuit in the connection interface to the network, in accordance with IEC 60364-7-712.</p>		P



ABNT NBR 16149: 2013			
Seção Clause	Exigência - Teste Requirement – Test	Resultado - Observação Result - Remark	Veredito Verdict
5.7	<p>Isolação e seccionamento</p> <p>Um metodo de isolacao e seccionamento do equipamento de interface com a rede deve ser disponibilizado em conformidade com a IEC 60364-7-712.</p> <p>Isolation and sectioning</p> <p>A method of insulation in isolation interface equipment to the network shall be provided in accordance with IEC 60364-7-712.</p>		P
5.8	<p>Religamento automático da rede</p> <p>O sistema fotovoltaico deve ser capaz de suportar religamento automático fora de fase na pior condição possível (em oposição de fase).</p> <p>Automatic network reconnection</p> <p>The photovoltaic system must be capable of supporting automatic reclosing out of phase in the worst condition (in phase opposition).</p>	<p>Atendeu aos parâmetros da Norma</p> <p>Complied</p>	P
6	<p>Controle externo</p> <p>O sistema fotovoltaico deve estar preparado para receber sinais de controle por telecomando.</p> <p>external control</p> <p>The photovoltaic system must be prepared to receive control signals by remote control.</p>	<p>Atendeu aos parâmetros da Norma</p> <p>Complied</p>	P

ABNT NBR 16149: 2013			
Seção Clause	Exigência - Teste Requirement – Test	Resultado - Observação Result - Remark	Veredito Verdict
6.1	<p>Limitação de potência ativa</p> <p>O sistema fotovoltaico com potência nominal superior a 6kW deve ser capaz de limitar a potência ativa injetada na rede por meio de telecomandos.</p> <p>A potência ativa limitada pelo comando externo deve ser atingida no máximo dentro de 1 min após o recebimento do sinal, com tolerância de + - 2,5% da potência nominal sistema, respeitando as limitações de potência na entrada do sistema fotovoltaico.</p> <p>active power limitation</p> <p>The photovoltaic system with a nominal power to 6kW must be able to limit the active power injected into the network via remote controls.</p> <p>The active power limited by the external command must be achieved at most within 1 min after receiving the signal, with tolerance of + - 2.5% of the nominal power system, respecting the power limitations at the entrance of fotovoltaico system.</p>	<p>A capacidade máxima do sistema fotovoltaico é inferior a 6 kW.</p> <p>The maximum capacity of the PV system is more than 6 kW.</p>	P
6.2	<p>Comando de potência reativa</p> <p>O sistema fotovoltaico com de potência nominal superior a 6 kW deve ser capaz de regular a de potência retiva injetada/demandada por meio de telecomandos, dentro dos limites estabelecidos na Seção 4.7.</p> <p>A potência reativa exigida pelo telecomando deve ser atingida no máximo dentro de 10 s após o recebimento do sinal, com tolerância de +/-2.5% da potência nominal do sistema.</p> <p>reactive power control</p> <p>The photovoltaic system with a rated output of more than 6 kW should be able to regulate the power injected retiva / demanded by remote controls, within the limits set forth in Section 4.7.</p> <p>The reactive power required by the remote control should be achieved at most within 10 seconds after receiving the signal, with a tolerance of +/- 2.5% of the rated power of the system.</p>	<p>A capacidade máxima do sistema fotovoltaico é inferior a 6 kW.</p> <p>The maximum capacity of the PV system is more than 6 kW.</p>	P

ABNT NBR 16149: 2013			
Seção Clause	Exigência - Teste Requirement – Test	Resultado - Observação Result - Remark	Veredito Verdict
6.3	<p>Desconexão/reconexão do sistema fotovoltaico da rede</p> <p>O sistema fotovoltaico deve ser capaz de desconectar-e/reconectar-se da rede elétrica por meio de telecomandos.</p> <p>A desconexão/reconexão deve ser realizada em no máximo 1 min após o recebimento do telecomando.</p> <p>Disconnection / Reconnection of photovoltaic network system</p> <p>The PV system should be able to disconnect and / reconnect the electrical network through remote controls.</p> <p>The disconnection / reconnection should be performed in at most 1 min after receiving the remote control.</p>	<p>Atendeu aos parâmetros da Norma</p> <p>Complied</p>	P

ABNT NBR 16149: 2013			
Seção Clause	Exigência - Teste Requirement – Test	Resultado - Observação Result - Remark	Veredito Verdict
7	<p>Requisitos de suportabilidade a subtensões decorrentes de faltas na rede (fault ride through –FRT)</p> <p>Para evitar a desconexão indevida da rede em casos de afundamento de tensão, Para evitar a desconexão indevida da rede em casos de afundamento de tensão, o sistema fotovoltaico com potência nominal maior ou igual a 6kW eve continuar satisfazendo os requisitos representados graficamente na Figura 4</p> <p>supportability requirements to overvoltages arising from faults in the network (fault ride through -FRT)</p> <p>To avoid undue network disconnection in the event of voltage sag, to avoid undue network disconnection in the event of voltage sag, the photovoltaic system with greater horsepower or equal to 6kW eve further satisfying the requirements represented graphically in Figure 4</p>	<p>Atendeu aos parâmetros da Norma</p> <p>Complied</p>	P
 <p>Figura 4 – Requisitos de suportabilidade a subtensões decorrentes de faltas na rede (fault ride through – FRT)</p>			

ABNT NBR 16150: 2013			
Seção Clause	Exigência - Teste Requirement – Test	Resultado - Observação Result - Remark	Veredito Verdict
5	Requisitos para equipamentos Requirements for equipment		P
5.1	Simulador de rede c.a. a.c. network simulator	ver tabela 1 See table 1	P
5.2	Simulador de gerador fotovoltaico PV Array Simulator	ver tabela 2 See table 2	P
6	Procedimento de ensaio Test Procedure		P
6.1	Cintilação Flicker	ver tabela 3 See table 3	P
6.2	Injeção de componente c.c. Injection dc component .	ver tabela 4 See table 4	P
6.3	Harmônicas e distorção de Forma de Onda Harmonics and Waveform distortion	ver tabela 5 See table 5	P
6.4	Fator de potência Power factor		P
6.4.1	Fator de potência – fixo Power factor- Fixed	ver tabela 6 See table 6	P
6.4.2	Fator de Potência como a curva do FP Power factor as the curve of the FP	ver tabela 6 See table 6	P
6.5	Injeção / demanda de potência reativa Injection / reactive power demand		P
6.6	Variações de tensão voltage variations		P
6.6.1	Medição da tensão de desconexão por sobretensão Measurement overvoltage disconnection voltage	ver tabela 7 See table 7	P
6.6.2	Medição de tempo de desconexão por sobretensão Overvoltage disconnection time measurement	ver tabela 7 See table 7	P
6.6.3	Medição da tensão de desconexão por subtensão Measurement disconnection voltage undervoltage	ver tabela 7 See table 7	P

ABNT NBR 16150: 2013			
Seção Clause	Exigência - Teste Requirement – Test	Resultado - Observação Result - Remark	Veredito Verdict
6.6.4	Medição do tempo de desconexão por subtensão disconnection time measurement undervoltage	ver tabela 7 See table 7	P
6.7	Variação de frequência Frequency variation		P
6.7.1	Medição da frequência de desconexão por sobrefrequência Measurement of frequency of disconnection overfrequency	ver tabela 8 See table 8	P
6.7.2	Medição do tempo de desconexão por sobrefrequência disconnection time measurement for overfrequency	ver tabela 8 See table 8	P
6.7.3	Medição da frequência de desconexão por subfrequência Measurement frequency of disconnection by underfrequency	ver tabela 8 See table 8	P
6.7.4	Medição do tempo de desconexão por subfrequência Measurement the disconnection time for underfrequency	ver tabela 8 See table 8	P
6.8	Controle de Potência Ativa em sobrefrequência Active Power control overfrequency	ver tabela 9 See table 9	P
6.9	Reconexão Reconnect	ver tabela 7, tabela 8 See table 7, table 8	P
6.10	Reconexão automática fora de fase Automatic reconnection phase out	ver tabela 10 See table 10	P
6.11	Limitação da potência activa Active Power Limitation		P
6.12	Comando de potência reativa reactive power control		P
6.13	Desconexão e reconexão do sistema fotovoltaico da rede Disconnection and reconnection of the photovoltaic network system	ver tabela 13 See table 13	P

ABNT NBR 16150: 2013			
Seção Clause	Exigência - Teste Requirement – Test	Resultado - Observação Result - Remark	Veredito Verdict
6.14	Requisitos de suportabilidade a subtensoes decorrentes de faltas na rede (fault ride through -FRT) supportability requirements to overvoltages arising from faults in the network (fault ride through -FRT)		P

ABNT NBR IEC 62116: 2012			
Seção Clause	Exigência - Teste Requirement – Test	Resultado - Observação Result - Remark	Veredito Verdict
6	Ensaio de inversor monofásico ou polifásico Single phase or multi-phase inverter testing.	ver tabela 15 See table 15	P

Portaria n.º 357, de 01 de omman de 2014			
Seção Clause	Exigência - Teste Requirement – Test	Resultado - Observação Result - Remark	Veredito Verdict
ANEXO III/ Parte 2	INVERSORES PARA SISTEMAS FOTOVOLTAICOS CONECTADOS À REDE INVERTERS FOR PHOTOVOLTAIC SYSTEMS CONNECTED TO NETWORK		P
	15 Proteção contra inversão de polaridade 15 Protection against reverse polarity	Após o ensaio de inversão de polaridade, o inversor fotovoltaico iniciado e conectado à rede, o seguimento de energia para a rede ao longo de 5 minutos, a funcionar normalmente.  After the reverse polarity test, the PV inverter started and connected to the network, the power follow to the nework over 5 minutes, working normally.	P
	16 Sobrecarga 16 Overload	O poder do PV inversor de saída ac foi limitado até 8kW. Após o teste, o inversor fotovoltaico iniciado e conectado à rede, continua a funcionar normalmente.  The ac output power of PV inverter was limited up to 8kW. After test, the PV inverter started and connected to the network, continues to operate normally.	P



5.1	TABELA 1: Corrente Alternada Gerador AC TABLE 1: Alternate Simulator atual AC	P
Especificações de fonte AC AC supply specifications		
	Itens Items	Especificações Specification
	Tensão (passo mínimo) Voltage (Min. step)	0.1 V
	THD de tensão THD voltage	<0.1%
	Frequência (passo mínimo) Frequency (min. step)	0.001 Hz
	Erro de Fases Sincronismo Phase error Synchro	<1°

5.2	TABELA 2: Simulador fotovoltaica é TABLE 2: Photovoltaics Simulator	P
Especificações do PV Simulator PV Simulator Specifications		
	Itens Items	Especificações Specification
	Potência de saída Output power	0-15kW
	Tempo de resposta Response time	<1ms
	Estabilidade Stability	<1%
	Preencha gama Fator Fill factor range	0.4

6.1	TABELA 3: Cintilação TABLE 3: Flicker			P																																																																																											
Modelo : Model		R5-13K-T2																																																																																													
Impedância aplicada: Impedance		0.4Ω+0.25j																																																																																													
Fase 1	Medição Measurement	Plt	0.10	Limite Limit	0.65																																																																																										
		Pst	dc(%)	dmax(%)	d(t)(ms)																																																																																										
		Limite=1.0 Limit	Limite=3.3 Limit	Limite=4.0 Limit	Limite=500 Limit																																																																																										
	1	Count <span style="color: magenta;">█</span> 12/12 Interval <span style="color: green;">█</span> 10m00s/10m00s Element 1 Volt Range 600V(230V/50Hz) Element1 Judgement: Pass Un (U1) 220.290 V Total Judgement: Pass Freq(U1) 60.000 Hz (Element1)																																																																																													
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<b>ase 3</b>	1	<table border="1"> <tr> <td>Count</td> <td colspan="2">12/12</td> </tr> <tr> <td>Interval</td> <td colspan="2">10m00s/10m00s</td> </tr> <tr> <td>Element</td> <td colspan="2">1</td> </tr> <tr> <td>Volt Range</td> <td>600V(230V/50Hz)</td> <td>Element1 Judgement: <b>Pass</b></td> </tr> <tr> <td>Un (U1)</td> <td>220.250 V</td> <td>Total Judgement: <b>Pass</b></td> </tr> <tr> <td>Freq(U1)</td> <td>60.000 Hz</td> <td>(Element1)</td> </tr> <tr> <th>Limit</th> <th>dc[%]</th> <th>dmax[%]</th> <th>d(t)[ms]</th> <th>Pst</th> <th>Plt</th> </tr> <tr> <td>Limit</td> <td>3.30</td> <td>4.00</td> <td>500</td> <td>1.00</td> <td>0.65</td> </tr> <tr> <td></td> <td colspan="5">3.30(%)</td> </tr> <tr> <td>No. 1</td> <td>0.15 <b>Pass</b></td> <td>0.18 <b>Pass</b></td> <td>0 <b>Pass</b></td> <td>0.12 <b>Pass</b></td> <td rowspan="12">N:12</td> </tr> <tr> <td>2</td> <td>0.11 <b>Pass</b></td> <td>0.13 <b>Pass</b></td> <td>0 <b>Pass</b></td> <td>0.12 <b>Pass</b></td> </tr> <tr> <td>3</td> <td>0.11 <b>Pass</b></td> <td>0.15 <b>Pass</b></td> <td>0 <b>Pass</b></td> <td>0.13 <b>Pass</b></td> </tr> <tr> <td>4</td> <td>0.13 <b>Pass</b></td> <td>0.15 <b>Pass</b></td> <td>0 <b>Pass</b></td> <td>0.12 <b>Pass</b></td> </tr> <tr> <td>5</td> <td>0.13 <b>Pass</b></td> <td>0.18 <b>Pass</b></td> <td>0 <b>Pass</b></td> <td>0.13 <b>Pass</b></td> </tr> <tr> <td>6</td> <td>0.11 <b>Pass</b></td> <td>0.13 <b>Pass</b></td> <td>0 <b>Pass</b></td> <td>0.12 <b>Pass</b></td> </tr> <tr> <td>7</td> <td>0.12 <b>Pass</b></td> <td>0.15 <b>Pass</b></td> <td>0 <b>Pass</b></td> <td>0.12 <b>Pass</b></td> </tr> <tr> <td>8</td> <td>0.13 <b>Pass</b></td> <td>0.16 <b>Pass</b></td> <td>0 <b>Pass</b></td> <td>0.12 <b>Pass</b></td> </tr> <tr> <td>9</td> <td>0.13 <b>Pass</b></td> <td>0.18 <b>Pass</b></td> <td>0 <b>Pass</b></td> <td>0.12 <b>Pass</b></td> </tr> <tr> <td>10</td> <td>0.11 <b>Pass</b></td> <td>0.15 <b>Pass</b></td> <td>0 <b>Pass</b></td> <td>0.13 <b>Pass</b></td> </tr> <tr> <td>11</td> <td>0.12 <b>Pass</b></td> <td>0.16 <b>Pass</b></td> <td>0 <b>Pass</b></td> <td>0.12 <b>Pass</b></td> </tr> <tr> <td>12</td> <td>0.10 <b>Pass</b></td> <td>0.13 <b>Pass</b></td> <td>0 <b>Pass</b></td> <td>0.13 <b>Pass</b></td> </tr> <tr> <td><b>Result</b></td> <td><b>Pass</b></td> <td><b>Pass</b></td> <td><b>Pass</b></td> <td><b>Pass</b></td> <td>0.12 <b>Pass</b></td> </tr> </table>				Count	12/12		Interval	10m00s/10m00s		Element	1		Volt Range	600V(230V/50Hz)	Element1 Judgement: <b>Pass</b>	Un (U1)	220.250 V	Total Judgement: <b>Pass</b>	Freq(U1)	60.000 Hz	(Element1)	Limit	dc[%]	dmax[%]	d(t)[ms]	Pst	Plt	Limit	3.30	4.00	500	1.00	0.65		3.30(%)					No. 1	0.15 <b>Pass</b>	0.18 <b>Pass</b>	0 <b>Pass</b>	0.12 <b>Pass</b>	N:12	2	0.11 <b>Pass</b>	0.13 <b>Pass</b>	0 <b>Pass</b>	0.12 <b>Pass</b>	3	0.11 <b>Pass</b>	0.15 <b>Pass</b>	0 <b>Pass</b>	0.13 <b>Pass</b>	4	0.13 <b>Pass</b>	0.15 <b>Pass</b>	0 <b>Pass</b>	0.12 <b>Pass</b>	5	0.13 <b>Pass</b>	0.18 <b>Pass</b>	0 <b>Pass</b>	0.13 <b>Pass</b>	6	0.11 <b>Pass</b>	0.13 <b>Pass</b>	0 <b>Pass</b>	0.12 <b>Pass</b>	7	0.12 <b>Pass</b>	0.15 <b>Pass</b>	0 <b>Pass</b>	0.12 <b>Pass</b>	8	0.13 <b>Pass</b>	0.16 <b>Pass</b>	0 <b>Pass</b>	0.12 <b>Pass</b>	9	0.13 <b>Pass</b>	0.18 <b>Pass</b>	0 <b>Pass</b>	0.12 <b>Pass</b>	10	0.11 <b>Pass</b>	0.15 <b>Pass</b>	0 <b>Pass</b>	0.13 <b>Pass</b>	11	0.12 <b>Pass</b>	0.16 <b>Pass</b>	0 <b>Pass</b>	0.12 <b>Pass</b>	12	0.10 <b>Pass</b>	0.13 <b>Pass</b>	0 <b>Pass</b>	0.13 <b>Pass</b>	<b>Result</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>	<b>Pass</b>	0.12 <b>Pass</b>
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6.2		TABELA 4: Injeção de componente c.c. TABLE 4: DC component								P
Modelo : Model		R5-20K-T2								
Poder Power [%nominal VA]	Poder Power [W]	Tensão nominal Rated Voltage [Vrms]	Corrente nominal Rated Current [Arms]			Valor intervenção D.C. Intervention value D.C.			Tempo de viagem Trip Time (s)	Limite Limit [s]
			R	S	T	[A]	[%In]	$I_{dc} \gg$		
33± 5	6777	220	30.3	30.3	30.3	R:0.32	1.06%	0,5% In	0.168	1
						S:0.16	0.53%		0.109	
						T:0.22	0.73%		0.130	
66± 5	13515	220	30.3	30.3	30.3	R:0.23	0.76%	0,5% In	0.181	1
						S:0.16	0.53%		0.181	
						T:0.55	1.82%		0.179	
100 ± 5	19960	220	30.3	30.3	30.3	R:0.21	0.69%	0,5% In	0.140	1
						S:0.17	0.56%		0.142	
						T:0.19	0.63%		0.121	
Nota: Note:										

6.3		TABELA 5: Harmônicas e distorção de forma de onda TABLE 5: Harmonics and Wave Form distortion						P
Modelo: Model		R5-13K-T2						
<b>Harmônicos na operação contínua Harmonics at continuous operation</b>								
P/Pn[%]	10%	20%	30%	50%	75%	100%	Limites Limit	
Fase Phase	L1							
Ordem Ordinal number	Medição [Harmonic / Fundamental] Measurement [Harmonic/Fundamental]							
	[%]	[%]	[%]	[%]	[%]	[%]		[%]
2	0.101	0.674	0.305	0.299	0.176	0.302	1.0	
3	3.485	0.524	0.360	0.171	0.140	0.147	4.0	
4	0.139	0.230	0.366	0.260	0.144	0.119	1.0	

5	1.789	3.437	2.902	2.049	1.387	1.099	4.0
6	0.131	0.316	0.236	0.160	0.091	0.081	1.0
7	0.910	1.531	1.673	1.337	0.991	0.772	4.0
8	0.071	0.387	0.242	0.158	0.113	0.093	1.0
9	0.683	0.111	0.083	0.057	0.044	0.036	4.0
10	0.044	0.424	0.300	0.192	0.131	0.106	0.5
11	0.389	0.584	0.581	0.588	0.489	0.413	2.0
12	0.091	0.068	0.050	0.047	0.030	0.026	0.5
13	0.361	0.597	0.393	0.461	0.390	0.316	2.0
14	0.137	0.216	0.124	0.086	0.055	0.048	0.5
15	0.325	0.073	0.049	0.037	0.028	0.023	2.0
16	0.195	0.153	0.080	0.050	0.036	0.027	0.5
17	0.215	0.379	0.208	0.223	0.236	0.189	1.5
18	0.126	0.063	0.047	0.032	0.021	0.018	0.5
19	0.279	0.307	0.241	0.209	0.248	0.209	1.5
20	0.064	0.116	0.059	0.036	0.022	0.018	0.5
21	0.116	0.053	0.035	0.023	0.019	0.017	1.5
22	0.032	0.171	0.110	0.064	0.052	0.046	0.5
23	0.169	0.118	0.155	0.095	0.168	0.146	0.6
24	0.036	0.055	0.035	0.024	0.017	0.014	0.5
25	0.018	0.078	0.119	0.050	0.124	0.101	0.6
26	0.038	0.143	0.097	0.057	0.043	0.040	0.5
27	0.098	0.050	0.033	0.019	0.019	0.016	0.6
28	0.027	0.080	0.056	0.030	0.019	0.015	0.5
29	0.033	0.188	0.123	0.022	0.080	0.066	0.6
30	0.017	0.044	0.030	0.018	0.014	0.011	0.5
31	0.013	0.169	0.077	0.064	0.124	0.110	0.6
32	0.011	0.088	0.065	0.041	0.026	0.020	0.5
33	0.016	0.051	0.039	0.024	0.014	0.012	0.6
THD	4.170	4.108	3.559	2.656	1.919	1.556	5
Nota: Note:							
P/Pn[%]	10%	20%	30%	50%	75%	100%	Limites Limit
Fase Phase	L2						
Ordem Ordinal number	Medição [Harmonic / Fundamental] Measurement [Harmonic/Fundamental]						
	[%]	[%]	[%]	[%]	[%]	[%]	[%]

2	0.153	0.681	0.442	0.348	0.106	0.162	1.0
3	2.960	0.394	0.338	0.220	0.167	0.168	4.0
4	0.370	0.358	0.244	0.204	0.114	0.106	1.0
5	2.424	3.550	3.001	2.127	1.417	1.092	4.0
6	0.304	0.216	0.176	0.150	0.086	0.078	1.0
7	1.297	1.528	1.645	1.306	0.953	0.738	4.0
8	0.209	0.342	0.260	0.173	0.100	0.067	1.0
9	1.495	0.128	0.098	0.057	0.042	0.035	4.0
10	0.428	0.379	0.252	0.164	0.112	0.091	0.5
11	0.745	0.575	0.578	0.619	0.506	0.422	2.0
12	0.248	0.056	0.052	0.047	0.027	0.022	0.5
13	0.320	0.547	0.342	0.434	0.368	0.297	2.0
14	0.224	0.219	0.115	0.080	0.055	0.044	0.5
15	0.437	0.054	0.044	0.026	0.022	0.017	2.0
16	0.206	0.164	0.085	0.050	0.035	0.025	0.5
17	0.273	0.384	0.212	0.236	0.245	0.194	1.5
18	0.208	0.050	0.037	0.031	0.020	0.017	0.5
19	0.308	0.289	0.228	0.194	0.237	0.200	1.5
20	0.165	0.111	0.070	0.036	0.025	0.018	0.5
21	0.198	0.039	0.033	0.022	0.017	0.014	1.5
22	0.057	0.177	0.114	0.065	0.051	0.045	0.5
23	0.121	0.102	0.155	0.100	0.179	0.155	0.6
24	0.062	0.037	0.031	0.023	0.016	0.013	0.5
25	0.044	0.086	0.120	0.050	0.115	0.096	0.6
26	0.062	0.139	0.097	0.058	0.045	0.042	0.5
27	0.126	0.053	0.033	0.017	0.014	0.011	0.6
28	0.028	0.089	0.059	0.031	0.021	0.015	0.5
29	0.024	0.166	0.111	0.023	0.084	0.071	0.6
30	0.010	0.034	0.027	0.017	0.013	0.011	0.5
31	0.011	0.183	0.084	0.074	0.119	0.105	0.6
32	0.013	0.100	0.070	0.042	0.027	0.019	0.5
33	0.019	0.068	0.044	0.024	0.014	0.010	0.6
THD	4.521	4.172	3.618	2.709	1.912	1.507	5
Nota: Note:							
P/Pn[%]	10%	20%	30%	50%	75%	100%	Limites

Fase Phase	L3						Limit
Ordem Ordinal number	Medição [Harmonic / Fundamental] Measurement [Harmonic/Fundamental]						[%]
	[%]	[%]	[%]	[%]	[%]	[%]	
2	0.028	0.754	0.452	0.363	0.186	0.304	1.0
3	3.524	0.244	0.233	0.155	0.144	0.177	4.0
4	0.062	0.397	0.266	0.214	0.113	0.118	1.0
5	1.901	3.542	2.970	2.092	1.418	1.093	4.0
6	0.105	0.221	0.187	0.161	0.085	0.086	1.0
7	0.995	1.587	1.696	1.345	0.976	0.753	4.0
8	0.084	0.487	0.313	0.209	0.129	0.097	1.0
9	0.645	0.119	0.100	0.081	0.052	0.050	4.0
10	0.069	0.383	0.272	0.174	0.122	0.103	0.5
11	0.354	0.585	0.562	0.583	0.483	0.409	2.0
12	0.078	0.068	0.054	0.053	0.028	0.030	0.5
13	0.333	0.591	0.375	0.460	0.382	0.311	2.0
14	0.106	0.248	0.143	0.087	0.066	0.053	0.5
15	0.324	0.077	0.051	0.030	0.025	0.023	2.0
16	0.086	0.154	0.081	0.049	0.036	0.028	0.5
17	0.263	0.387	0.227	0.232	0.237	0.190	1.5
18	0.095	0.053	0.042	0.032	0.021	0.021	0.5
19	0.191	0.332	0.237	0.201	0.244	0.207	1.5
20	0.062	0.118	0.067	0.036	0.024	0.019	0.5
21	0.077	0.087	0.062	0.039	0.028	0.022	1.5
22	0.018	0.171	0.113	0.066	0.050	0.047	0.5
23	0.181	0.101	0.158	0.102	0.170	0.147	0.6
24	0.026	0.054	0.038	0.024	0.016	0.016	0.5
25	0.021	0.108	0.138	0.055	0.127	0.104	0.6
26	0.033	0.165	0.106	0.065	0.048	0.045	0.5
27	0.100	0.094	0.063	0.033	0.016	0.014	0.6
28	0.027	0.093	0.060	0.033	0.021	0.016	0.5
29	0.029	0.146	0.101	0.029	0.081	0.064	0.6
30	0.020	0.038	0.033	0.018	0.014	0.013	0.5
31	0.020	0.202	0.104	0.066	0.116	0.103	0.6
32	0.011	0.109	0.078	0.044	0.029	0.022	0.5
33	0.021	0.130	0.085	0.054	0.033	0.018	0.6



THD	4.246	4.227	3.624	2.701	1.928	1.544	5
Nota: Note:							
Modelo: Model	R5-20K-T2						
<b>Harmônicos na operação contínua</b> <b>Harmonics at continuous operation</b>							
P/Pn[%]	10%	20%	30%	50%	75%	100%	Limites Limit
Fase Phase	L1						
Ordem Ordinal number	Medição [Harmonic / Fundamental] Measurement [Harmonic/Fundamental]						
	[%]	[%]	[%]	[%]	[%]	[%]	[%]
2	0.068	0.370	0.142	0.444	0.509	0.626	1.0
3	3.158	0.343	0.210	0.398	0.314	0.203	4.0
4	0.101	0.383	0.252	0.181	0.119	0.080	1.0
5	1.704	2.846	2.215	0.494	0.362	0.299	4.0
6	0.130	0.233	0.149	0.218	0.181	0.158	1.0
7	0.590	1.675	1.424	0.456	0.321	0.260	4.0
8	0.060	0.265	0.171	0.325	0.215	0.182	1.0
9	0.737	0.073	0.059	0.132	0.089	0.066	4.0
10	0.032	0.287	0.209	0.211	0.126	0.093	0.5
11	0.282	0.596	0.620	0.746	0.734	0.595	2.0
12	0.077	0.049	0.035	0.074	0.050	0.042	0.5
13	0.293	0.410	0.478	0.475	0.509	0.385	2.0
14	0.130	0.126	0.097	0.110	0.082	0.047	0.5
15	0.231	0.043	0.035	0.092	0.058	0.034	2.0
16	0.170	0.074	0.057	0.147	0.082	0.047	0.5
17	0.185	0.200	0.223	0.281	0.284	0.196	1.5
18	0.094	0.039	0.026	0.072	0.045	0.030	0.5
19	0.167	0.229	0.195	0.222	0.268	0.228	1.5
20	0.046	0.053	0.031	0.080	0.054	0.030	0.5
21	0.052	0.031	0.023	0.062	0.050	0.032	1.5
22	0.019	0.107	0.070	0.087	0.064	0.045	0.5
23	0.109	0.140	0.081	0.301	0.189	0.147	0.6
24	0.027	0.031	0.021	0.063	0.039	0.025	0.5
25	0.021	0.106	0.037	0.513	0.270	0.122	0.6
26	0.025	0.094	0.060	0.081	0.059	0.045	0.5
27	0.077	0.029	0.019	0.100	0.082	0.032	0.6

28	0.018	0.057	0.036	0.061	0.046	0.038	0.5
29	0.019	0.106	0.026	0.518	0.257	0.126	0.6
30	0.012	0.027	0.019	0.058	0.041	0.029	0.5
31	0.013	0.068	0.063	0.250	0.147	0.153	0.6
32	0.007	0.058	0.042	0.063	0.044	0.033	0.5
33	0.014	0.030	0.024	0.057	0.046	0.046	0.6
THD	3.768	3.520	2.823	1.726	1.425	1.197	5

Nota:

Note:

P/Pn[%]	10%	20%	30%	50%	75%	100%	Limites Limit
Fase Phase	L2						
Ordem Ordinal number	Medição [Harmonic / Fundamental] Measurement [Harmonic/Fundamental]						
	[%]	[%]	[%]	[%]	[%]	[%]	[%]
2	0.155	0.381	0.223	0.357	0.529	0.634	1.0
3	2.558	0.347	0.232	0.493	0.377	0.220	4.0
4	0.273	0.229	0.165	0.155	0.147	0.116	1.0
5	1.952	2.969	2.299	0.521	0.395	0.346	4.0
6	0.218	0.161	0.113	0.240	0.217	0.184	1.0
7	0.539	1.640	1.402	0.519	0.328	0.244	4.0
8	0.180	0.212	0.148	0.333	0.256	0.213	1.0
9	1.419	0.089	0.063	0.107	0.091	0.080	4.0
10	0.285	0.229	0.170	0.229	0.140	0.128	0.5
11	0.402	0.586	0.649	0.792	0.787	0.632	2.0
12	0.229	0.046	0.039	0.088	0.081	0.073	0.5
13	0.254	0.359	0.451	0.455	0.482	0.387	2.0
14	0.121	0.104	0.075	0.112	0.094	0.061	0.5
15	0.267	0.045	0.030	0.073	0.058	0.039	2.0
16	0.146	0.078	0.050	0.177	0.081	0.056	0.5
17	0.164	0.197	0.228	0.267	0.315	0.213	1.5
18	0.167	0.033	0.026	0.072	0.059	0.046	0.5
19	0.210	0.219	0.181	0.225	0.247	0.222	1.5
20	0.096	0.066	0.036	0.109	0.056	0.037	0.5
21	0.120	0.032	0.022	0.063	0.042	0.033	1.5
22	0.050	0.107	0.068	0.091	0.065	0.053	0.5
23	0.075	0.140	0.076	0.311	0.211	0.169	0.6
24	0.039	0.029	0.022	0.066	0.049	0.038	0.5

25	0.019	0.108	0.035	0.514	0.243	0.114	0.6
26	0.041	0.098	0.064	0.095	0.060	0.046	0.5
27	0.095	0.032	0.021	0.115	0.043	0.035	0.6
28	0.021	0.059	0.037	0.055	0.042	0.038	0.5
29	0.011	0.105	0.020	0.520	0.262	0.131	0.6
30	0.008	0.028	0.019	0.056	0.046	0.031	0.5
31	0.010	0.072	0.072	0.233	0.082	0.145	0.6
32	0.011	0.064	0.046	0.058	0.041	0.033	0.5
33	0.014	0.033	0.025	0.054	0.037	0.056	0.6
THD	3.673	3.574	2.877	1.779	1.494	1.264	5
Nota: Note:							
P/Pn[%]	10%	20%	30%	50%	75%	100%	Limites Limit
Fase Phase	L3						
Ordem Ordinal number	Medição [Harmonic / Fundamental] Measurement [Harmonic/Fundamental]						
	[%]	[%]	[%]	[%]	[%]	[%]	[%]
2	0.025	0.356	0.194	0.596	0.613	0.806	1.0
3	3.091	0.238	0.151	0.552	0.469	0.315	4.0
4	0.063	0.316	0.197	0.245	0.158	0.131	1.0
5	1.674	2.935	2.264	0.563	0.430	0.369	4.0
6	0.102	0.186	0.129	0.273	0.208	0.195	1.0
7	0.557	1.712	1.440	0.434	0.323	0.267	4.0
8	0.067	0.319	0.200	0.407	0.225	0.204	1.0
9	0.735	0.098	0.081	0.143	0.106	0.091	4.0
10	0.041	0.257	0.201	0.255	0.120	0.115	0.5
11	0.194	0.585	0.607	0.799	0.746	0.609	2.0
12	0.064	0.052	0.037	0.094	0.084	0.079	0.5
13	0.295	0.392	0.477	0.480	0.503	0.377	2.0
14	0.087	0.148	0.099	0.152	0.089	0.070	0.5
15	0.284	0.056	0.032	0.107	0.066	0.045	2.0
16	0.066	0.075	0.054	0.191	0.081	0.055	0.5
17	0.209	0.224	0.225	0.289	0.293	0.191	1.5
18	0.073	0.039	0.026	0.082	0.069	0.052	0.5
19	0.158	0.219	0.188	0.252	0.265	0.228	1.5
20	0.045	0.071	0.042	0.123	0.062	0.040	0.5
21	0.053	0.054	0.036	0.080	0.056	0.038	1.5

22	0.013	0.113	0.070	0.107	0.068	0.053	0.5
23	0.130	0.148	0.085	0.322	0.202	0.166	0.6
24	0.020	0.035	0.025	0.086	0.057	0.043	0.5
25	0.018	0.118	0.039	0.502	0.251	0.115	0.6
26	0.023	0.111	0.072	0.105	0.069	0.052	0.5
27	0.078	0.063	0.041	0.205	0.097	0.041	0.6
28	0.022	0.057	0.036	0.068	0.052	0.039	0.5
29	0.014	0.090	0.023	0.506	0.242	0.161	0.6
30	0.015	0.028	0.019	0.079	0.054	0.031	0.5
31	0.013	0.079	0.067	0.240	0.126	0.156	0.6
32	0.008	0.073	0.048	0.075	0.049	0.037	0.5
33	0.017	0.080	0.060	0.075	0.056	0.071	0.6
THD	3.683	3.598	2.866	1.932	1.557	1.387	5
Nota: Note:							

<b>6.4/6.5</b>	<b>TABELA 6: Fator de Potência – FIXO</b> <b>TABLE 6: Power Factor - FIXED</b>	<b>P</b>
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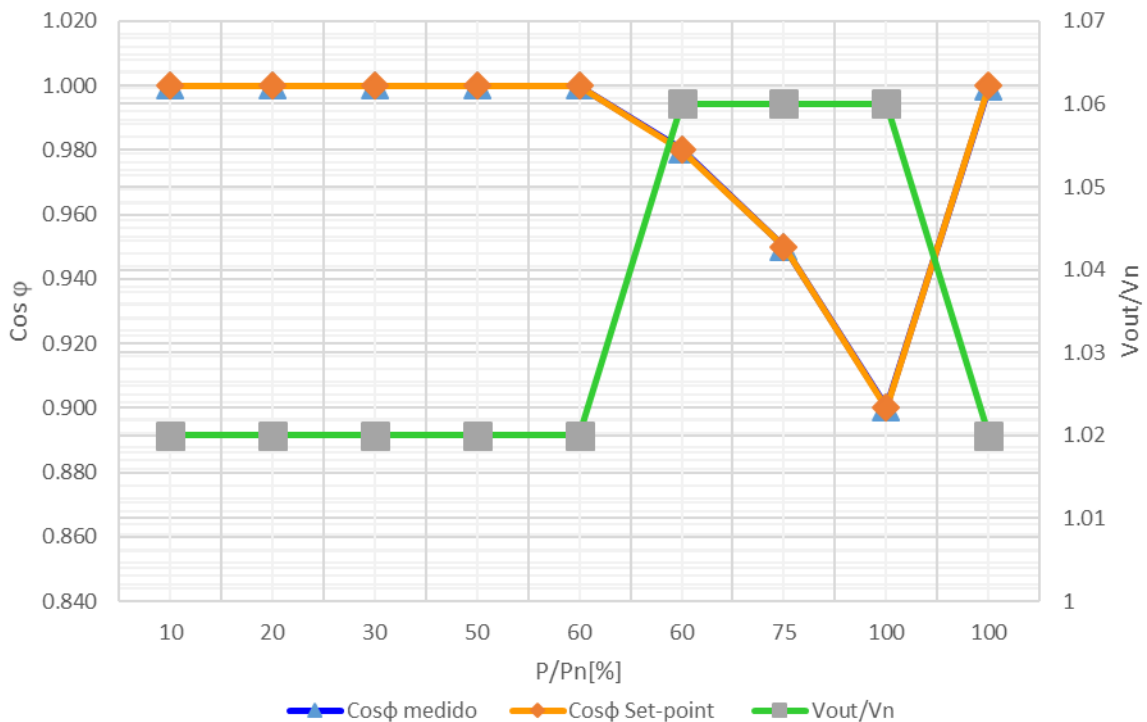
**Test 1: Power Factor Curve**

Lock-in: 1,04Vn (Vn and 1,1 Vn with steps of 0,01)

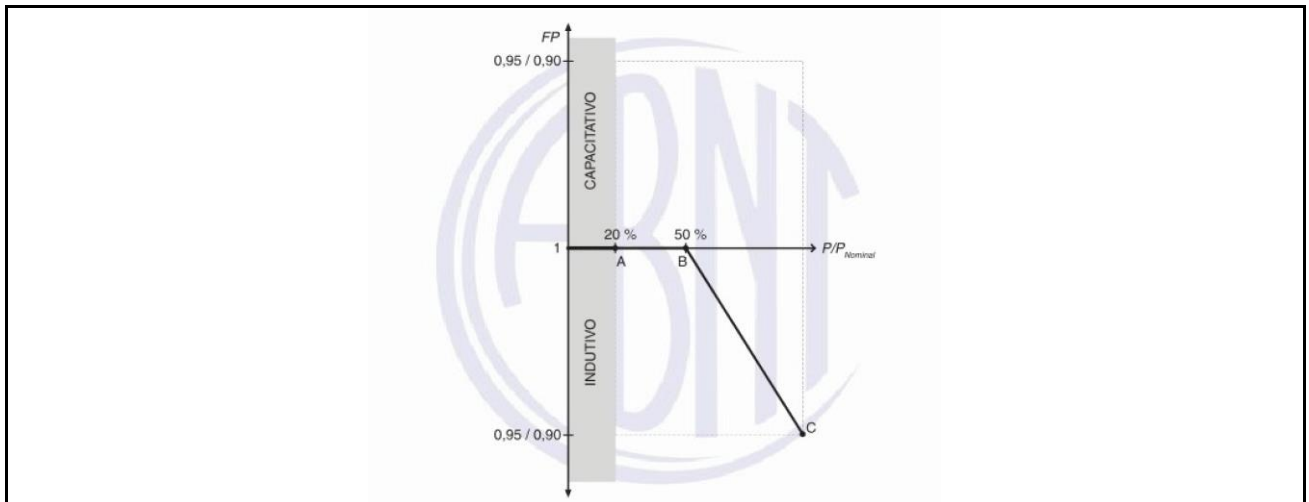
Lock-out: 1,00Vn (0,9 Vn and Vn with steps of 0,01)

Modelo: Model			R5-20K-T2					
P/Pn[%] setpoint	P[W]	P/Pn [%]	Vout/Vn	Q[Var]	Cosφ measured	Cosφ Set-point	ΔCosφ	LIMIT Δcosφ_max
10	2016.53	10.08	1,02	5.61	1.000	1	0.000	+/-0,025
20	4036.46	20.18	1,02	25.58	1.000	1	0.000	+/-0,025
30	6037.33	30.19	1,02	28.95	1.000	1	0.000	+/-0,025
50	10015.32	50.08	1,02	72.29	1.000	1	0.000	+/-0,025
60	12036.14	60.18	1,02	95.80	1.000	1	0.000	+/-0,025
60	12036.63	60.18	1,06	-2428.13	0.980	0.98	0.000	+/-0,025
75	15037.87	75.19	1,06	-4941.95	0.950	0.95	0.000	+/-0,025
100	20122.22	100.61	1,06	-9734.50	0.900	0.90	0.000	+/-0,025
100	20153.11	100.77	0,98	113.67	1.000	1	0.000	+/-0,025

**Gráfico produção de potência reativa de acordo com uma característica Curva do Fator de Potência**  
**Graph reactive power production according to a characteristic Power Factor Curve**



**Gráfico produção de potência reativa de acordo com uma característica Curva do Fator de Potência**  
**Graph reactive power production according to a characteristic Power Factor Curve**


**Test 2: Injection / Demand of Reactive Power**

Modelo: Model	R5-20K-T2
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**Q<sub>cmax</sub>**

Power-Bin	Active power [W]	Reactive Power [VAr]	Reactive Power/ Pn	Power Factor (cosφ)	Reactive Power/ Pn setpoint	Deviation	Limits
10 %	2034.44	9679.54	48.40%	0.206	48,43%	-0.03%	--
20 %	4014.03	9683.10	48.42%	0.383	48,43%	-0.01%	+/-2,5%
30 %	6041.14	9684.51	48.42%	0.529	48,43%	-0.01%	+/-2,5%
50 %	10015.52	9691.28	48.46%	0.719	48,43%	0.03%	+/-2,5%
75 %	14990.52	9687.44	48.44%	0.840	48,43%	0.01%	+/-2,5%
100 %	20057.46	9697.39	48.49%	0.900	48,43%	0.06%	+/-2,5%

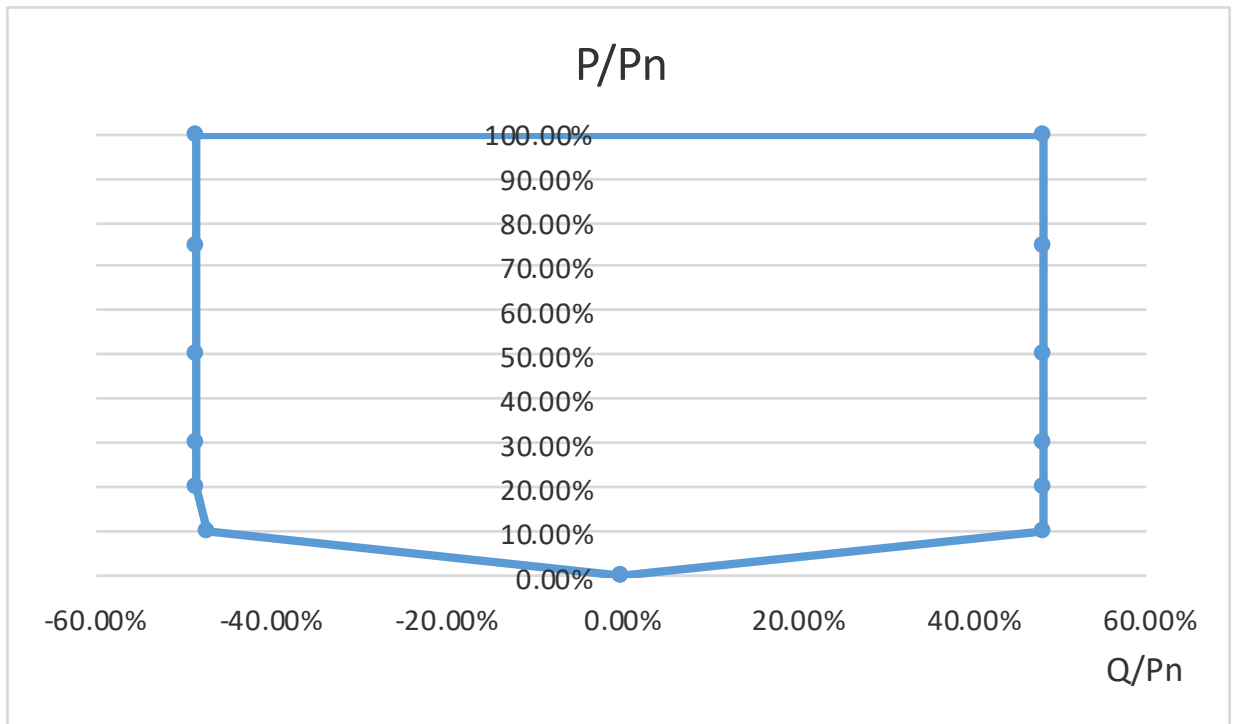
**Q<sub>Lmax</sub>**

Power-Bin	Active power [W]	Reactive Power [VAr]	Reactive Power/ Pn	Power Factor (cosφ)	Reactive Power/ Pn setpoint	Deviation	Limits
10 %	2017.83	-9477.57	-47.39%	0.208	48,43%	1.04%	--
20 %	3999.92	-9692.26	-48.46%	0.381	48,43%	-0.03%	+/-2,5%
30 %	6001.92	-9678.99	-48.39%	0.527	48,43%	0.04%	+/-2,5%
50 %	10023.18	-9686.50	-48.43%	0.719	48,43%	0.00%	+/-2,5%
75 %	14959.10	-9682.18	-48.41%	0.839	48,43%	0.02%	+/-2,5%
100 %	20012.62	-9675.17	-48.38%	0.900	48,43%	0.05%	+/-2,5%

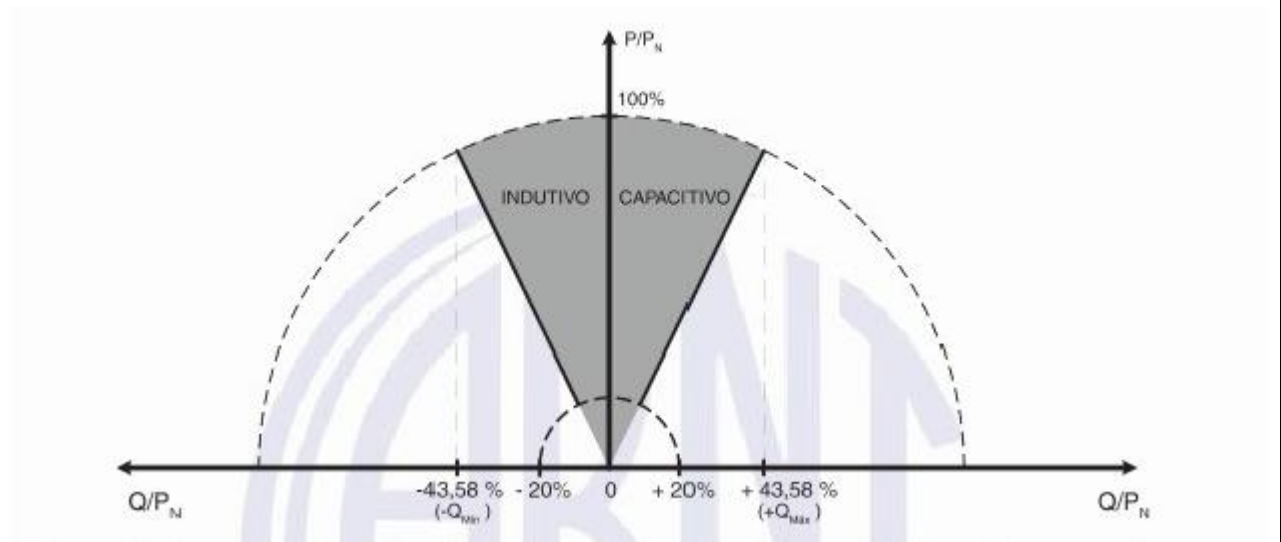
**Q=0**

Power-Bin	Active power [W]	Reactive Power [VAr]	Reactive Power/ Pn	Power Factor (cosφ)	Reactive Power/ Pn setpoint	Deviation	Limits
10 %	2026.63	16.37	0.14%	1.000	0	0.14%	--
20 %	4001.40	8.23	0.07%	1.000	0	0.07%	+/-2,5%
30 %	6002.76	-18.40	-0.15%	1.000	0	-0.15%	+/-2,5%
50 %	10028.59	14.94	0.12%	1.000	0	0.12%	+/-2,5%
75 %	15016.31	80.19	0.67%	1.000	0	0.67%	+/-2,5%
100 %	20076.70	251.01	2.09%	1.000	0	2.09%	+/-2,5%

Graficar la producción de potencia reactiva de acuerdo con una curva de potencia reactiva característica  
 Graph reactive power production according to a characteristic reactive power Curve



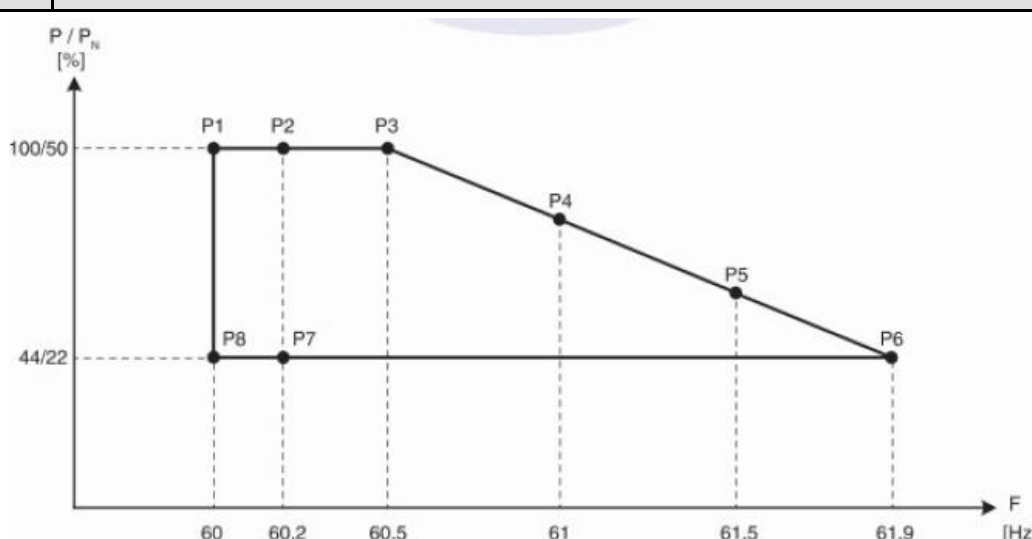
Graficar la producción de potencia reactiva de acuerdo con una curva de potencia reactiva característica  
 Graph reactive power production according to a characteristic reactive power Curve



6.6.1, 6.6.2, 6.6.3, 6.6.4		TABELA 7: Desconexão devido a Alto / Baixo Tensão TABLE 7: Disconnection due to High/Low Voltage				P
		Baixa ommand: Low voltage:		Alta ommand: High voltage:		
PASSOS para valor viagem [V to V]: STEPS for trip value:		88%Un -> diminuir por max 0,4%Un cada etapa 88%Un -> decrease by max 0,4%Un per. steps		Un -> aumentar por max 0,4%Un cada etapa Un -> increase by max 0,4%Un per. steps		
Limite [U/Un%]: Limit:		80%Un		110%Un		
Fase Phase	L1	A precisão da medição do valor de trip [V] [%]: Measurement accuracy of the tripping	176.1	80.0%	242.0	110.0%
	L2		176.0	80.0%	242.1	110.0%
	L3		176.0	80.0%	242.0	110.0%
PASSO para o tempo de viagem [V to V]: STEP for trip time:		$U_{trip}+2\%Un \rightarrow V_{trip}-1\%Un$		$U_{trip}-2\%Un \rightarrow U_{trip}+1\%Un$		
Definir o valor do tempo de viagem [ms]: Setting value of trip time:		400		200		
Fase Phase	L1	Medição do tempo de intervenção [ms]: Measurement the trip time:	326		170	
	L2		326		169	
	L3		333		172	
Mensuração o tempo de reconexão [s]: Measurement the reconnection time:		36		37		
Nota: Note: O valor de ajuste eo valor da viagem tensão não pode variar mais do que $\leq 2\% Un$ e 2%. The setting value and the trip value of the voltage may not vary by more than $\leq 2\% Un$ and 2%.						



6.7.1, 6.7.2, 6.7.3, 6.7.4	<b>TABELA 8: Desconexão devido a Alto / Baixo frequência</b> <b>TABLE 8: Disconnection due to High/Low Frequency</b>		P
	<b>Baixa frequência:</b> <b>Low frequency:</b>	<b>Alta frequência:</b> <b>High frequency:</b>	
PASSOS para valor viagem [Hz to Hz]: STEPS for trip value:	58Hz -> diminuir por max 0,1Hz cada etapa 58Hz -> decrease by max 0,1Hz per. steps	60Hz -> aumentar por 0,1Hz cada etapa 60Hz -> increase by max 0,1Hz per. steps	
Limite [Hz]: Limit:	57.5	62	
A precisão da medição do valor de trip [Hz] : Measurement accuracy of the tripping value:	57.50	61.99	
PASSO para o tempo de viagem [Hz to Hz]: STEP for trip time:	58Hz -> Freq. <sub>trip</sub> -0.1Hz	60Hz -> Freq. <sub>trip</sub> +0.1Hz	
Definir o valor do tempo de viagem [ms]: Setting value of trip time:	200	200	
Medição do tempo de intervenção [ms]: Measurement the trip time:	186.9	184.5	
Mensuração o tempo de reconexão [s]: Measurement the reconnection time:	37	37	
Nota: Note: O valor de ajuste eo valor da viagem frequência não pode variar mais do que ± 0,1Hz e 2%. The setting value and the trip value of the frequency may not vary by more than ±0,1Hz and 2%.			

6.8	TABELA 9: Controle de potência ativa em Alta frequência TABLE 9: Control of Active Power in High Frequency		P			
Modelo: Model	R5-20K-T2					
						
Sequência A: 100% P <sub>n</sub> Sequence A: 100%P <sub>n</sub>						
Passo # Step	Set potência de saída [%] Set output power	frequência [Hz] frequency	Valor de potência esperado [W] Expected power value	Os valores de potência reais * [W] Actual power values*	Limites limits	ponto Graph Graph point
P1	100	60.0	20000	20067	--	P1
P2	100	60.2	20000	20063	± 2.5% P <sub>n</sub>	P2
P3	100	60.5	20000	20064	± 2.5% P <sub>n</sub>	P3
P4	100	61.0	16000	16098	± 2.5% P <sub>n</sub>	P4
P5	100	61.5	12000	12069	± 2.5% P <sub>n</sub>	P5
P6	100	61.9	8880	8934	± 2.5% P <sub>n</sub>	P6
P7	100	60.2	8880	8934	± 2.5% P <sub>n</sub>	P7
P8	tempo de atraso de recuperação de energia: 336 s, Limitação: ≥300 s Power recovery delay time: 342 s, limitation: ≥300 s					
	Máxima de aumento Gradiente (%P <sub>M</sub> /min) : 17.67, Limitação : 20%P <sub>M</sub> /min. maximum rising Gradient (%P <sub>M</sub> /min): 17.67, limitation: 20% P <sub>M</sub> / min.					
	100	60.0	20000	20068	± 2.5% P <sub>n</sub>	P8
Sequência B: 50% P <sub>n</sub> Sequence B: 50%P <sub>n</sub>						
Passo # Step	Set potência de saída [%] Set output power	frequência [Hz] frequency	Valor de potência esperado [W] Expected power value	Os valores de potência reais * [W] Actual power values*	Limites limits	ponto Graph Graph point

P1	50	60.0	10000	10022	--	P1
P2	50	60.2	10000	10008	± 2.5% Pn	P2
P3	50	60.5	10000	10002	± 2.5% Pn	P3
P4	50	61.0	8000	7942	± 2.5% Pn	P4
P5	50	61.5	6000	5910	± 2.5% Pn	P5
P6	50	61.9	4440	4369	± 2.5% Pn	P6
P7	50	60.2	4440	4371	± 2.5% Pn	P7
P8	tempo de atraso de recuperação de energia: 340 s, Limitação: ≥300 s Power recovery delay time: 340 s, limitation: ≥300 s					
	Máxima de aumento Gradiente (%P <sub>M</sub> /min) : 8.93, Limitação : 20%P <sub>M</sub> /min. maximum rising Gradient (%P <sub>M</sub> /min): 8.93, limitation: 20% PM / min.					
	50	60.0	10000	10008	± 2.5% Pn	P8
Nota: Note: *) 30s valor médio. *) 30s mean value.						

6.10	<b>TABELA 10 Reconexão automática fora de fase</b> <b>TABLE 10: Automatic Reconnection out of phase</b>			P
Modelo: Model	R5-20K-T2			
Teste Test	Potência de saída [W] Output Power	deslocamento de fase [°] Phase displacement	corrente de fase [A] Phase current	Resultado Result
1	14451	+90°	20.2	Nenhum dano Inversor desconectado. No damage Inverter disconnected.
2	14551	-90°	22.0	Nenhum dano Inversor desconectado. No damage Inverter disconnected.
3	14540	+180°	22.6	Nenhum dano Inversor desconectado. No damage Inverter disconnected.
4	14544	-180°	22.0	Nenhum dano Inversor desconectado. No damage Inverter disconnected.
Nota: N/A Note: N/A				

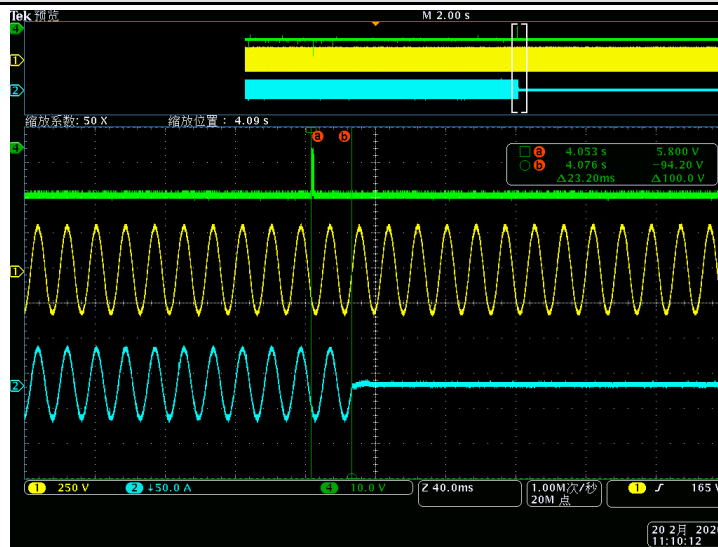
<b>6.11</b>	<b>TABELA 11: Limitação de energia ativa / comando remoto (para sistemas maiores que 6kW)</b>					<b>P</b>
	<b>TABLE 11: Active Power Limitation / Remote Command (for systems bigger than 6kW)</b>					
Modelo: Model	R5-20K-T2					
	Test Procedure .....	NBR 16150:2013/ clause 6.11			—	
	Site .....	PVE Laboratory			—	
Set Point		Actual power [W]	Precision [%]	$\Delta P/P_n\%$	Limit [%]	RESULT
$[\Delta P/P_n\%]$	P[W]					
100%	20000	19988	99.94%	0.06%	$\pm 2,5 \% P_n$	PASS
90%	18000	18022	90.11%	-0.11%	$\pm 2,5 \% P_n$	PASS
80%	16000	16028	80.14%	-0.14%	$\pm 2,5 \% P_n$	PASS
70%	14000	14032	70.16%	-0.16%	$\pm 2,5 \% P_n$	PASS
60%	12000	11811	59.06%	0.94%	$\pm 2,5 \% P_n$	PASS
50%	10000	9778	48.89%	1.11%	$\pm 2,5 \% P_n$	PASS
40%	8000	8012	40.06%	-0.06%	$\pm 2,5 \% P_n$	PASS
30%	6000	6007	30.03%	-0.03%	$\pm 2,5 \% P_n$	PASS
20%	4000	4011	20.05%	-0.05%	$\pm 2,5 \% P_n$	PASS
10%	2000	2002	10.01%	-0.01%	$\pm 2,5 \% P_n$	PASS
Nota: Note:						

<b>6.12</b>	<b>TABELA 12: Limitação de potência reativa / comando remoto (para sistemas maiores que 6kW)</b>					<b>P</b>
	<b>TABLE 12: Reactive Power Limitation / Remote Command (for systems bigger than 6kW)</b>					
Modelo: Model	R5-20K-T2					
	Test Procedure .....	NBR 16150:2013/ clause 6.12			—	
	Site .....	PVE Laboratory			—	
AC output power:50%Pn						
Set-Point Q/Pn [%]	Actual power [W]	Measured Q/Pn [%]	Deviation $\Delta Q/P_n$ [%]	Limt [%]	RESULT	
-43,58%	9968	-43.44	0.14	$\leq 2.5$	PASS	
0	10049	0.58	0.58	$\leq 2.5$	PASS	
+43,58%	9990	43.39	-0.19	$\leq 2.5$	PASS	
Nota: N/A Note: N/A						

<b>6.13</b>	<b>TABELA 13: Desconexão e reconexão de Inverter / Remote Comando</b> <b>TABLE 13: Disconnection and Reconnection of Inverter / Remote Command</b>	P
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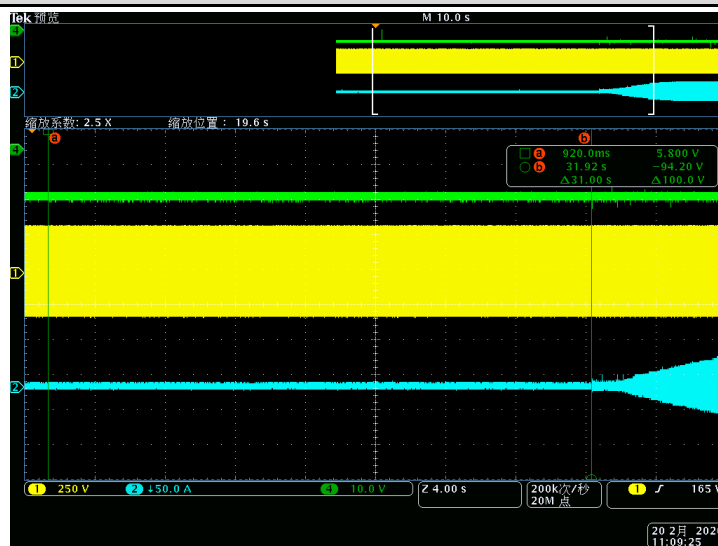
Modelo: Model	R5-20K-T2
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Desconectado da rede pelo comando externo:  
 Disconnected from grid by external command:



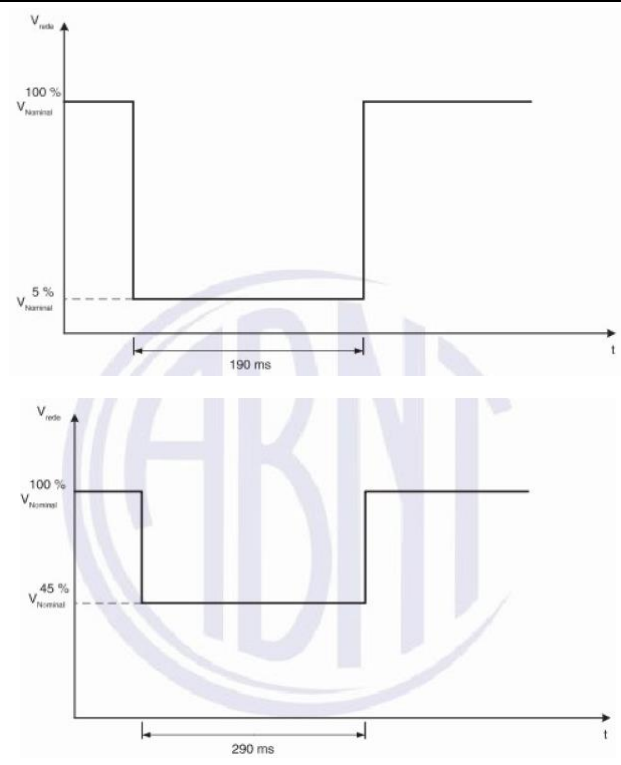
0.023s

Reconectado à rede pelo comando externo:  
 Reconnected to grid by external command:

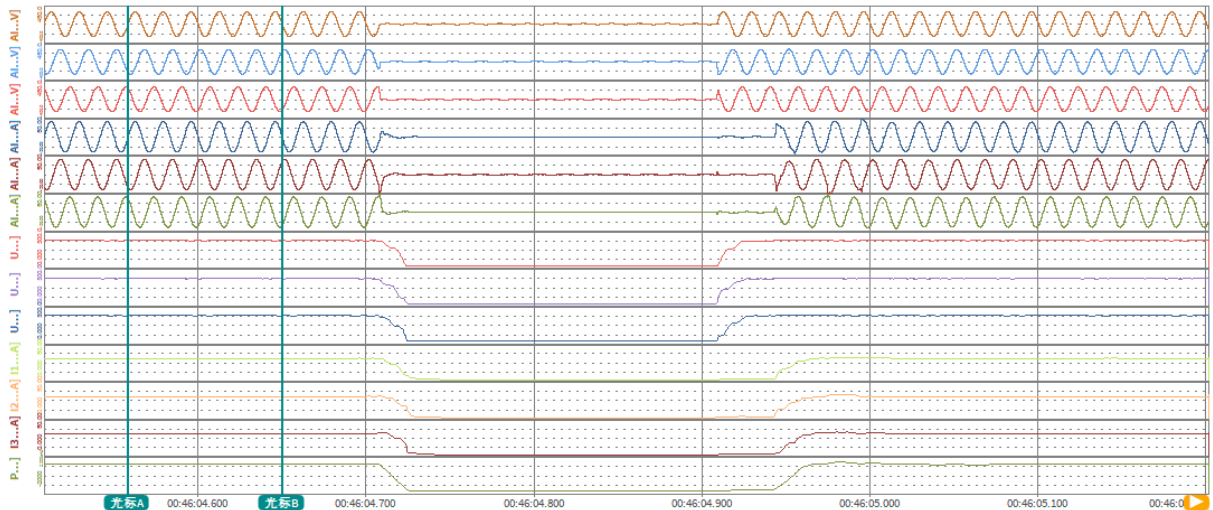


31.00s

Nota:  
Note:

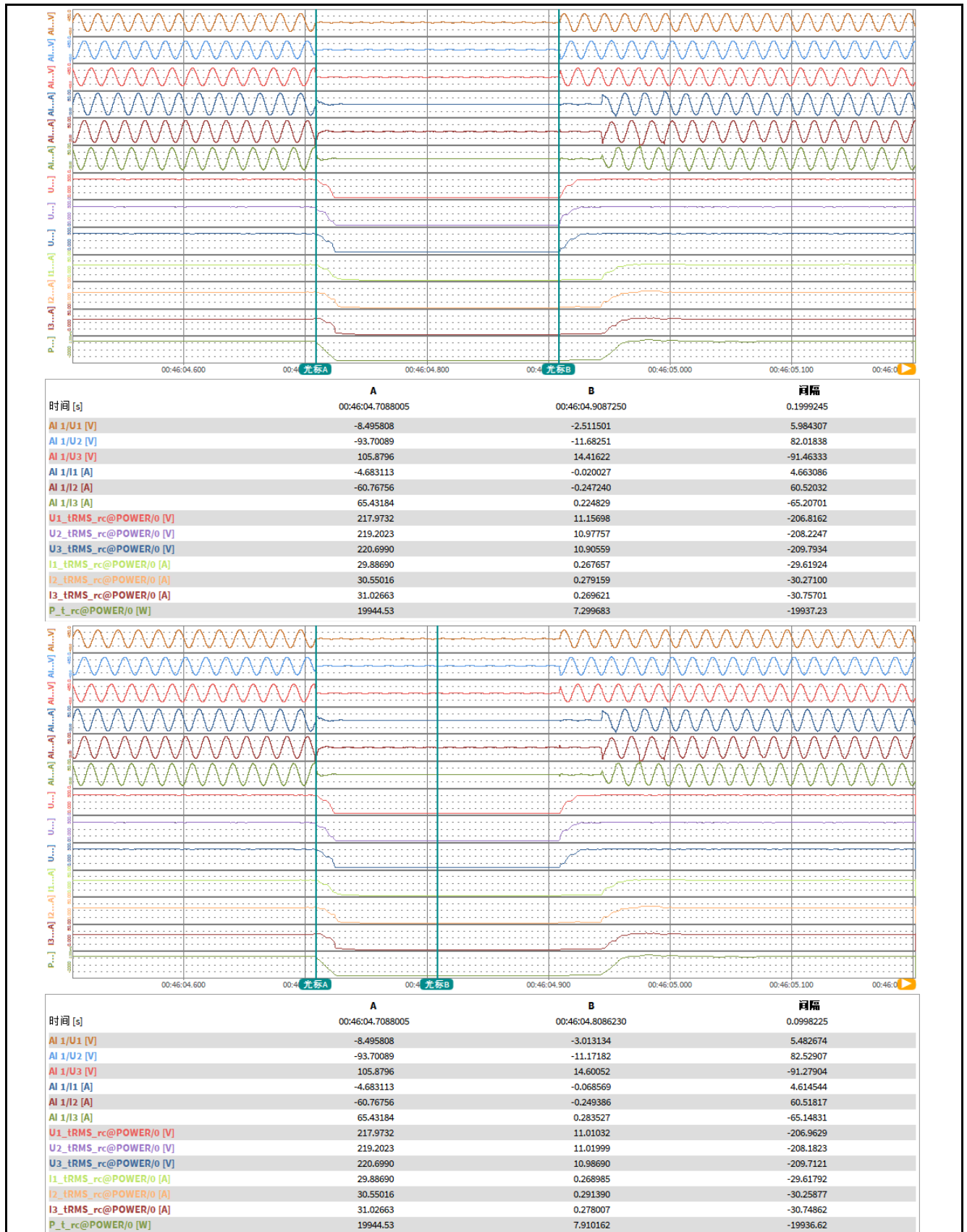
<b>6.14</b>	<b>TABELA 14 Passeio da falha completamente-FRT(para sistemas maiores que 6kW)</b> <b>TABLE 14: Fault Ride Through – FRT (for systems bigger than 6kW)</b>	<b>P</b>																												
Modelo: Model	R5-20K-T2																													
	Test Procedure .....	NBR 16150:2013/ clause 6.14	—																											
	Site .....	PVE Laboratory	—																											
 <p data-bbox="654 1500 1085 1545"><b>Two-Phase Asymmetrical Fault</b></p> <table border="1" data-bbox="399 1556 1340 1713"> <thead> <tr> <th rowspan="2">Fault</th> <th colspan="3">Phase/Neutro (% of nominal voltage)</th> <th colspan="3">Phase Angle</th> </tr> <tr> <th>Phase 1</th> <th>Phase 2</th> <th>Phase 3</th> <th>Angle1</th> <th>Angle2</th> <th>Angle3</th> </tr> </thead> <tbody> <tr> <td>5%</td> <td>87% +- 5%</td> <td>87% +- 5%</td> <td>5% +- 5%</td> <td>27</td> <td>-147</td> <td>113</td> </tr> <tr> <td>45%</td> <td>90% +- 5%</td> <td>90% +- 5%</td> <td>45% +- 5%</td> <td>15</td> <td>-135</td> <td>115</td> </tr> </tbody> </table>				Fault	Phase/Neutro (% of nominal voltage)			Phase Angle			Phase 1	Phase 2	Phase 3	Angle1	Angle2	Angle3	5%	87% +- 5%	87% +- 5%	5% +- 5%	27	-147	113	45%	90% +- 5%	90% +- 5%	45% +- 5%	15	-135	115
Fault	Phase/Neutro (% of nominal voltage)				Phase Angle																									
	Phase 1	Phase 2	Phase 3	Angle1	Angle2	Angle3																								
5%	87% +- 5%	87% +- 5%	5% +- 5%	27	-147	113																								
45%	90% +- 5%	90% +- 5%	45% +- 5%	15	-135	115																								

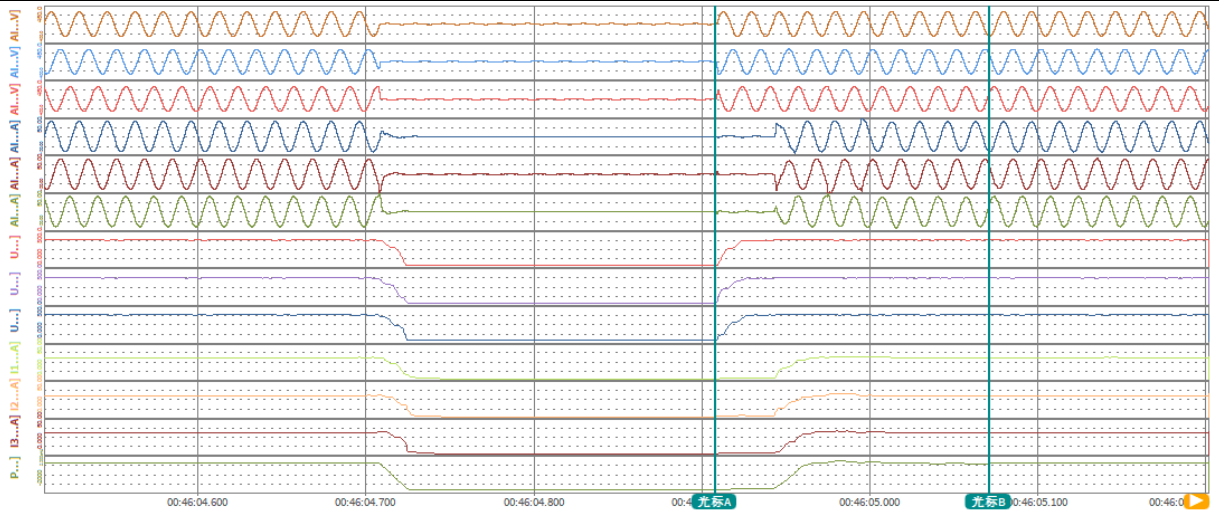
Output power: 20000W				Limit: 100% P <sub>n</sub> .				
	residual magnitude [V-l-n]			phase angle [°]			Power output before the FRT [W]	Power output after the FRT 200ms [W]
	R	S	T	Φ1	Φ2	Φ3		
<b>1 - three phases symmetric failure</b>	11.01	11.01	10.99	0	-120	120	19937	19494
<b>2 - three phases symmetric failure</b>	99.04	98.93	99.10	0	-120	120	19930	19504
<b>3 - not symmetric two phases failure (A-B)</b>	191.47	191.57	10.95	27	-147	113	19946	19502
<b>4 - not symmetric two phases failure (A-B)</b>	198.12	198.36	98.84	15	-135	115	19941	19991
<b>5 - not symmetric two phases failure (C-B)</b>	10.95	191.62	191.32	113	27	-147	19915	19572
<b>6 - not symmetric two phases failure (C-B)</b>	98.97	197.90	198.23	115	15	-135	19943	19639
<b>7 - not symmetric two phases failure (A-C)</b>	191.57	10.97	191.35	-147	113	27	19929	19591
<b>8 - not symmetric two phases failure (A-C)</b>	198.14	98.88	198.15	-135	115	15	19932	19440

**1 – three phases symmetric failure**


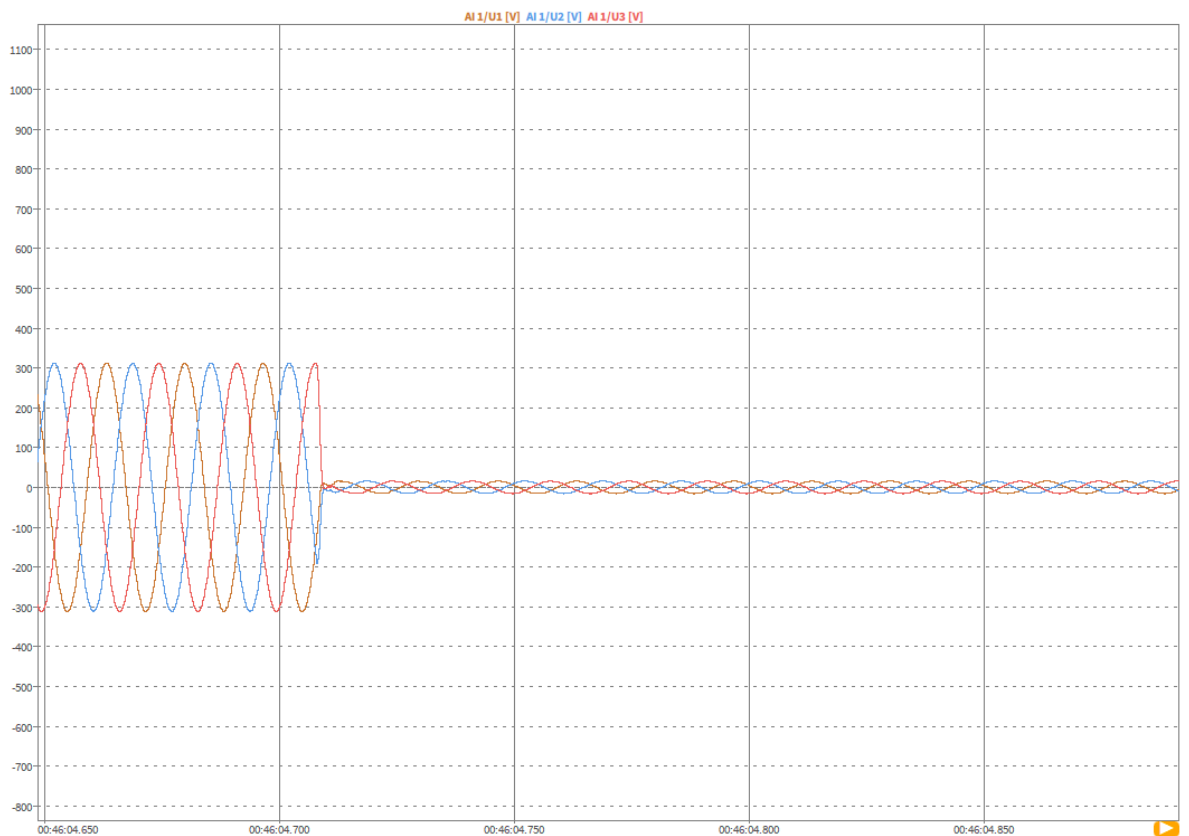
时间 [s]	A 00:46:04.5581218	B 00:46:04.6502380	间隔 0.0921162
AI 1/U1 [V]	-111.5191	62.24871	173.7678
AI 1/U2 [V]	-195.9522	233.1996	429.1518
AI 1/U3 [V]	308.1925	-296.2687	-604.4612
AI 1/I1 [A]	-15.12742	7.982779	23.11020
AI 1/I2 [A]	-27.22674	32.07689	59.30362
AI 1/I3 [A]	42.29932	-40.09257	-82.39189
U1_tRMS_rc@POWER/0 [V]	220.7565	220.8475	0.091095
U2_tRMS_rc@POWER/0 [V]	220.7606	220.6517	-0.108963
U3_tRMS_rc@POWER/0 [V]	220.1231	220.1133	-9.842e-3
I1_tRMS_rc@POWER/0 [A]	30.23619	30.25520	0.019012
I2_tRMS_rc@POWER/0 [A]	30.12965	30.11846	-0.011189
I3_tRMS_rc@POWER/0 [A]	30.04131	30.05100	9.689e-3
P_t_rc@POWER/0 [W]	19937.36	19940.40	3.042969

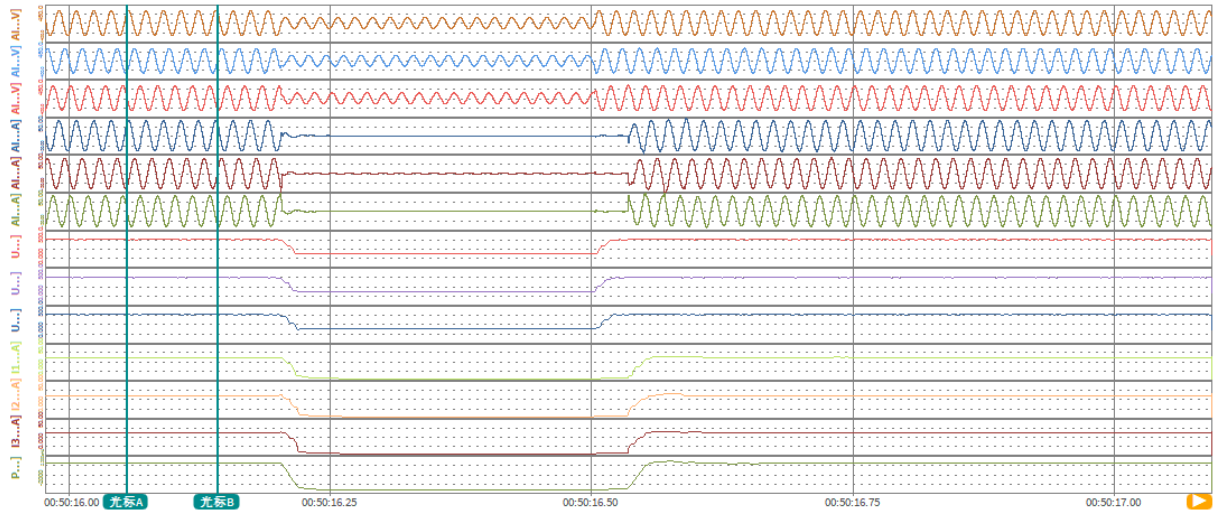






时间 [s]	A	B	间隔
	00:46:04.9077800	00:46:05.0708234	0.1630434
AI 1/U1 [V]	-8.223057	-295.3241	-287.1010
AI 1/U2 [V]	-7.047177	234.0565	241.1037
AI 1/U3 [V]	15.56683	62.62088	47.05406
AI 1/I1 [A]	-0.295401	-39.79955	-39.50415
AI 1/I2 [A]	-0.136471	32.47018	32.60665
AI 1/I3 [A]	0.397778	7.300377	6.902600
U1_tRMS_rc@POWER/0 [V]	11.09031	220.6621	209.5718
U2_tRMS_rc@POWER/0 [V]	11.09041	220.6045	209.5141
U3_tRMS_rc@POWER/0 [V]	10.85309	220.3619	209.5088
I1_tRMS_rc@POWER/0 [A]	0.264768	29.54009	29.27533
I2_tRMS_rc@POWER/0 [A]	0.281492	29.68431	29.40282
I3_tRMS_rc@POWER/0 [A]	0.264855	29.21898	28.95413
P_t_rc@POWER/0 [W]	7.224395	19494.09	19486.87

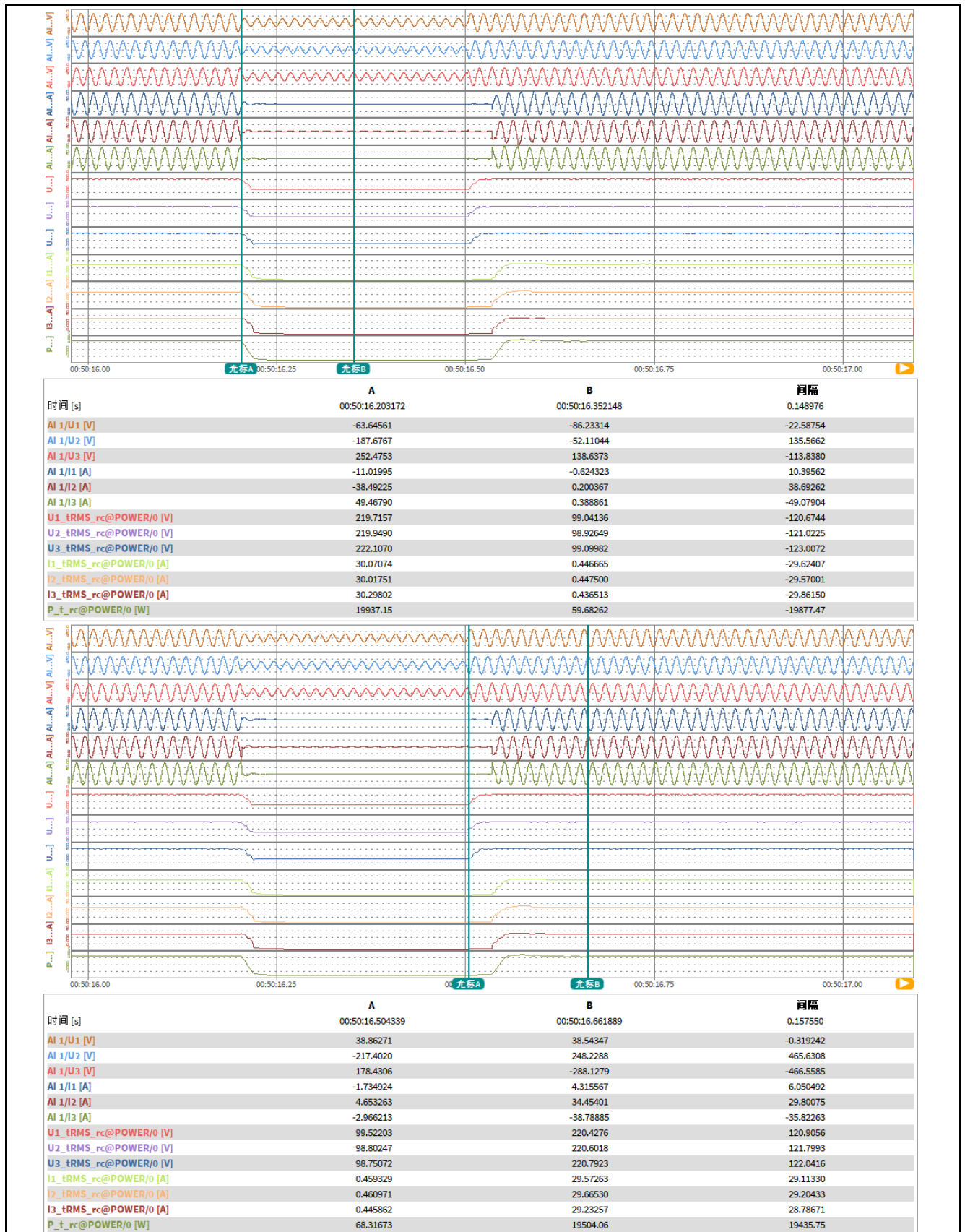


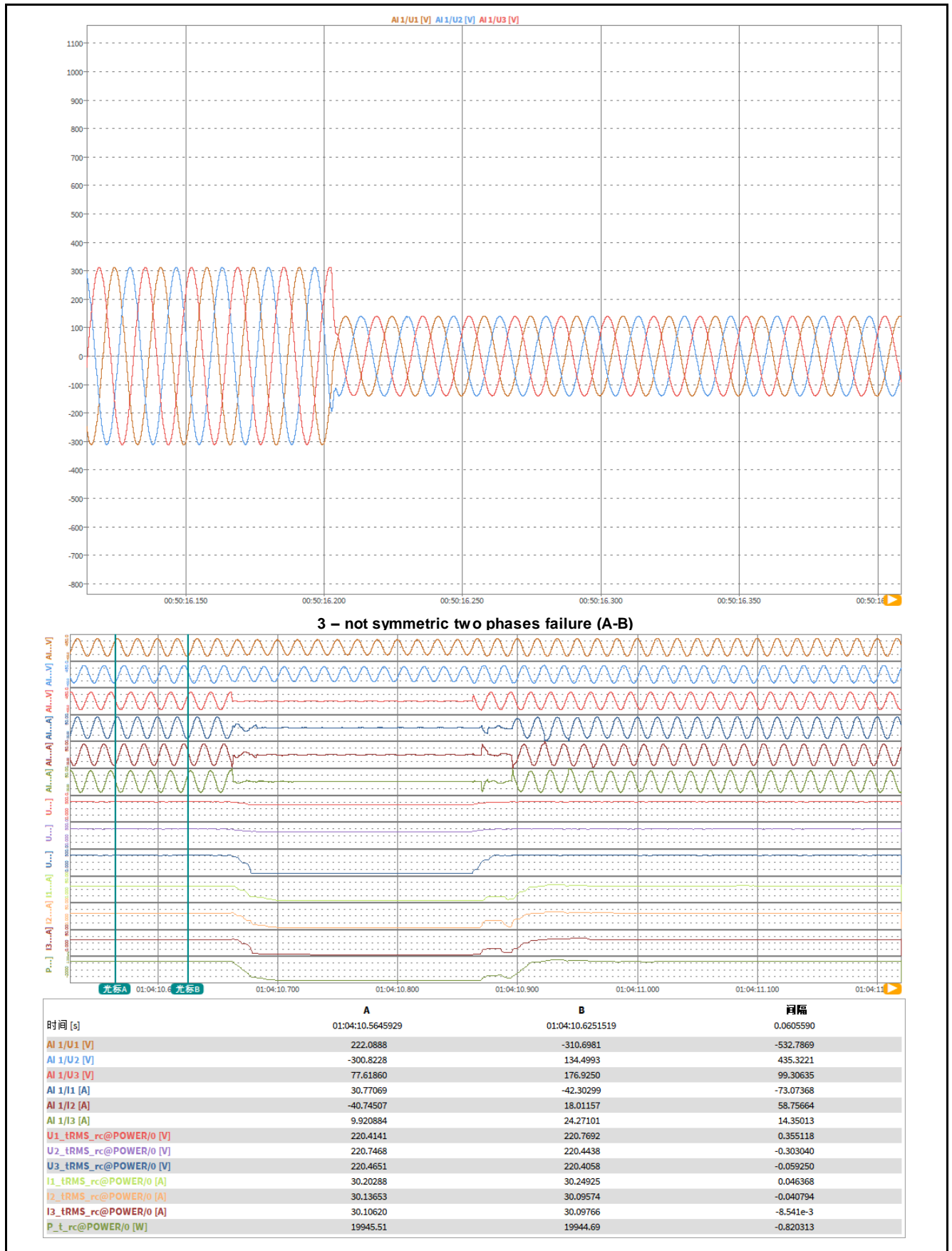
**2 – three phases symmetric failure**


时间 [s]	A	B	间隔
	00:50:16.054818	00:50:16.142081	0.087263
AI 1/U1 [V]	123.7884	299.1262	175.3378
AI 1/U2 [V]	-309.3846	-70.61387	238.7707
AI 1/U3 [V]	186.8274	-227.1545	-413.9819
AI 1/I1 [A]	16.80236	40.93261	24.13025
AI 1/I2 [A]	-41.99400	-9.577466	32.41654
AI 1/I3 [A]	25.15893	-31.38700	-56.54593
U1_tRMS_rc@POWER/0 [V]	220.9858	220.8755	-0.110367
U2_tRMS_rc@POWER/0 [V]	220.1017	220.3515	0.249832
U3_tRMS_rc@POWER/0 [V]	220.7296	220.5771	-0.152496
I1_tRMS_rc@POWER/0 [A]	30.23308	30.22354	-9.541e-3
I2_tRMS_rc@POWER/0 [A]	30.02185	30.06700	0.045149
I3_tRMS_rc@POWER/0 [A]	30.09266	30.08811	-4.557e-3
P_t_rc@POWER/0 [W]	19929.73	19936.10	6.373047

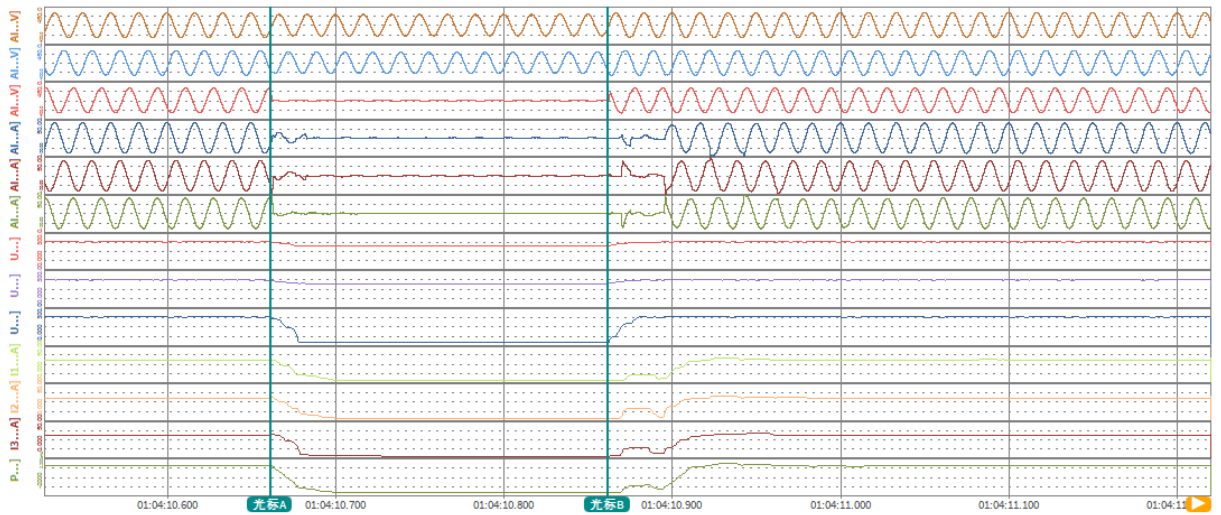


时间 [s]	A	B	间隔
	00:50:16.203172	00:50:16.503717	0.300545
AI 1/U1 [V]	-63.64561	-9.928465	53.71714
AI 1/U2 [V]	-187.6767	-116.8540	70.82272
AI 1/U3 [V]	252.4753	126.7507	-125.7246
AI 1/I1 [A]	-11.01995	-0.375319	10.64463
AI 1/I2 [A]	-38.49225	0.069666	38.56192
AI 1/I3 [A]	49.46790	0.273991	-49.19391
U1_tRMS_rc@POWER/0 [V]	219.7157	99.52203	-120.1937
U2_tRMS_rc@POWER/0 [V]	219.9490	98.80247	-121.1465
U3_tRMS_rc@POWER/0 [V]	222.1070	98.75072	-123.3563
I1_tRMS_rc@POWER/0 [A]	30.07074	0.459329	-29.61141
I2_tRMS_rc@POWER/0 [A]	30.01751	0.460971	-29.55654
I3_tRMS_rc@POWER/0 [A]	30.29802	0.445862	-29.85215
P_t_rc@POWER/0 [W]	19937.15	68.31673	-19868.83

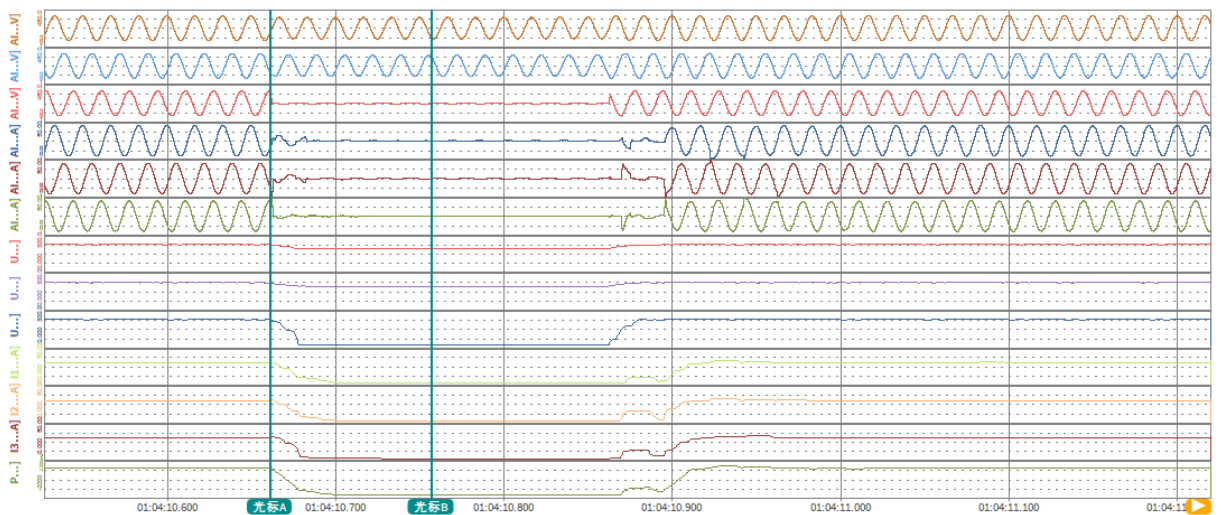




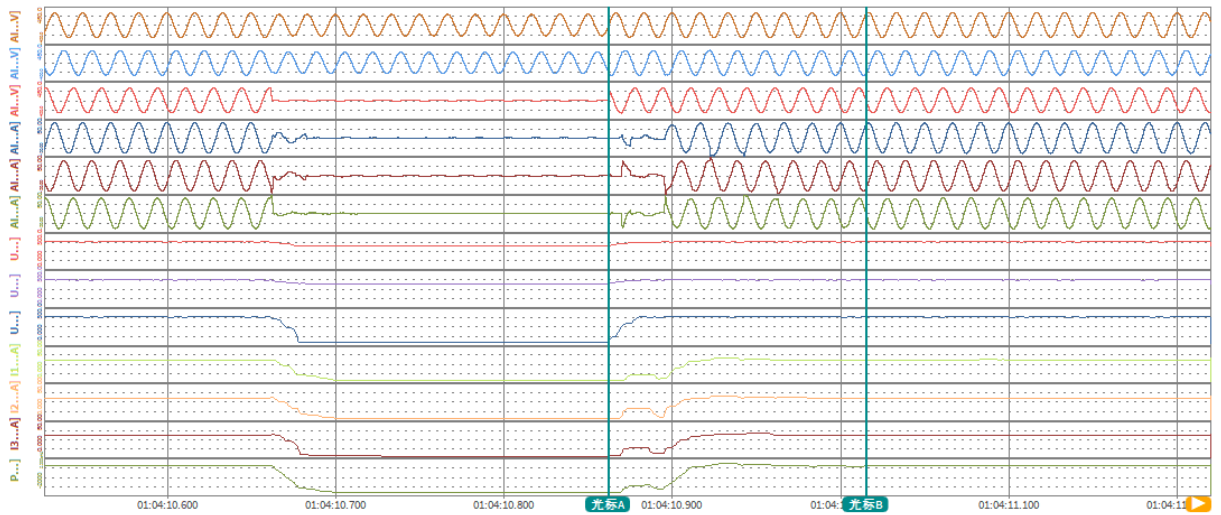




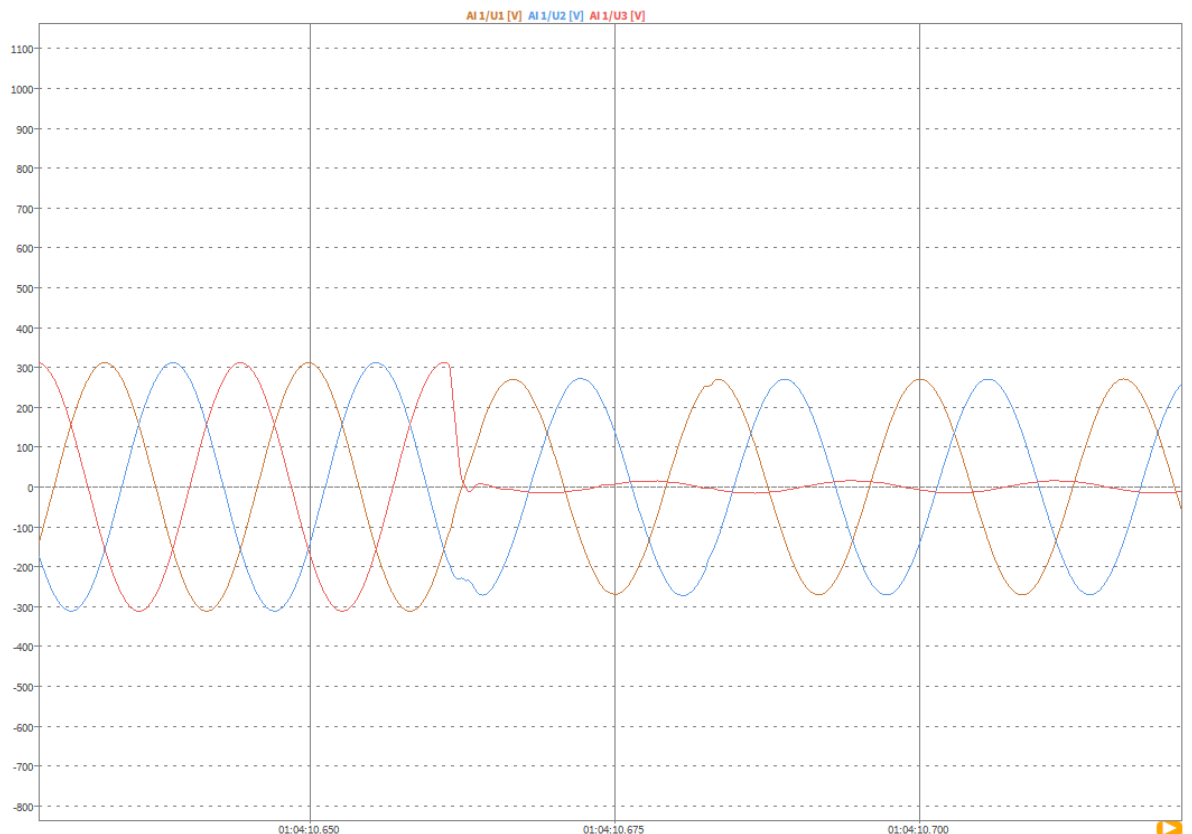
时间 [s]	A	B	间隔
	01:04:10.6610880	01:04:10.8616780	0.2005899
AI 1/U1 [V]	-156.3683	-92.96823	63.40003
AI 1/U2 [V]	-156.7216	-173.0065	-16.28494
AI 1/U3 [V]	312.2091	15.26213	-296.9470
AI 1/I1 [A]	-21.39478	-1.160288	20.23449
AI 1/I2 [A]	-21.50254	1.067448	22.56999
AI 1/I3 [A]	42.84449	0.021791	-42.82270
U1_tRMS_rc@POWER/0 [V]	220.3647	191.3916	-28.97305
U2_tRMS_rc@POWER/0 [V]	219.8761	191.2821	-28.59407
U3_tRMS_rc@POWER/0 [V]	221.3707	10.99112	-210.3795
I1_tRMS_rc@POWER/0 [A]	30.19158	0.987947	-29.20363
I2_tRMS_rc@POWER/0 [A]	30.01273	0.782935	-29.22979
I3_tRMS_rc@POWER/0 [A]	30.23466	0.292602	-29.94206
P_t_rc@POWER/0 [W]	19943.71	46.89537	-19896.82

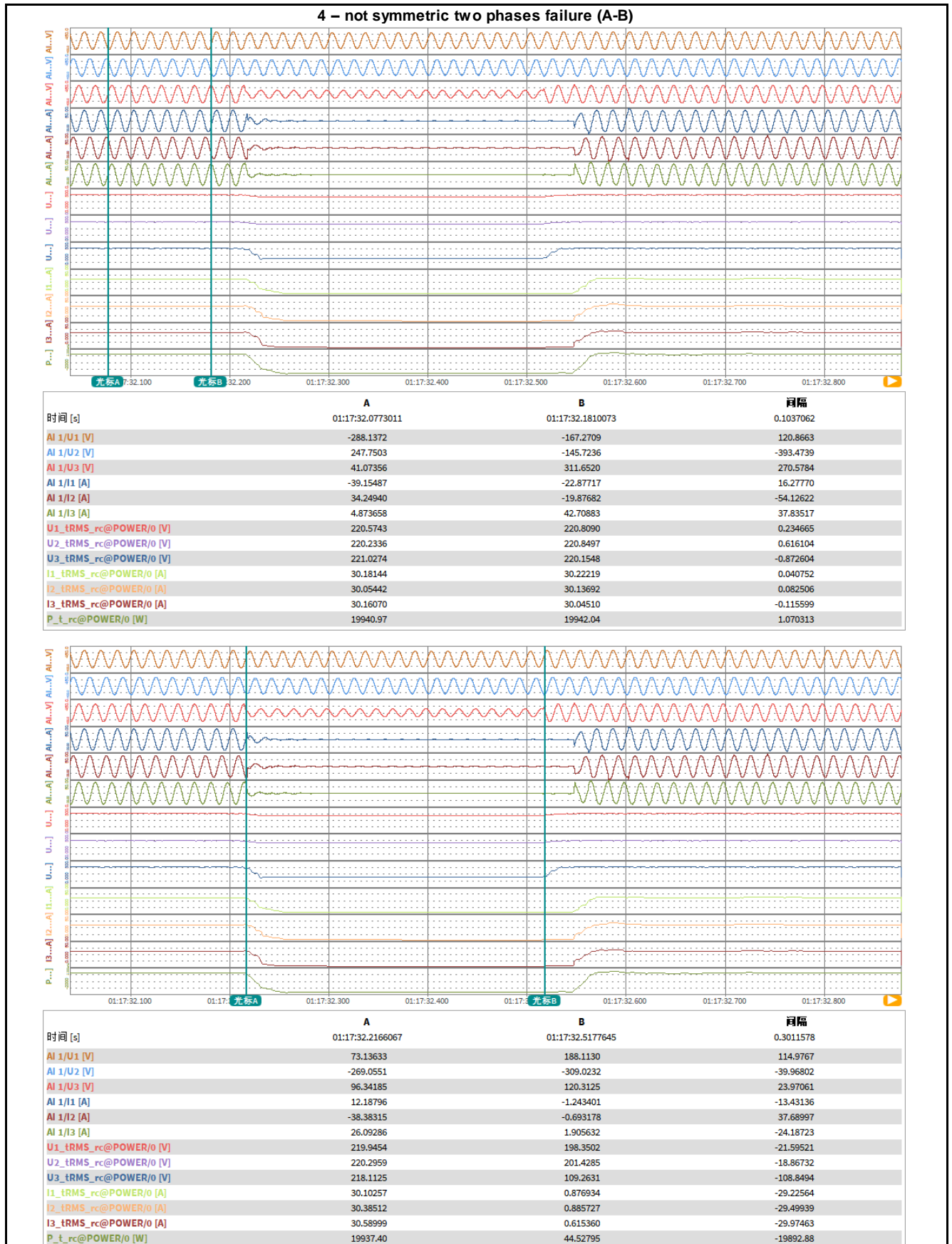


时间 [s]	A	B	间隔
	01:04:10.6610880	01:04:10.7569176	0.0958296
AI 1/U1 [V]	-156.3683	-230.3968	-74.02850
AI 1/U2 [V]	-156.7216	238.6866	395.4082
AI 1/U3 [V]	312.2091	-0.227928	-312.4371
AI 1/I1 [A]	-21.39478	0.628042	22.02282
AI 1/I2 [A]	-21.50254	-0.282335	21.22021
AI 1/I3 [A]	42.84449	-0.162506	-43.00699
U1_tRMS_rc@POWER/0 [V]	220.3647	191.4666	-28.89807
U2_tRMS_rc@POWER/0 [V]	219.8761	191.5732	-28.30292
U3_tRMS_rc@POWER/0 [V]	221.3707	10.95392	-210.4167
I1_tRMS_rc@POWER/0 [A]	30.19158	0.938463	-29.25312
I2_tRMS_rc@POWER/0 [A]	30.01273	1.204149	-28.80858
I3_tRMS_rc@POWER/0 [A]	30.23466	0.379730	-29.85493
P_t_rc@POWER/0 [W]	19943.71	-137.8705	-20081.58

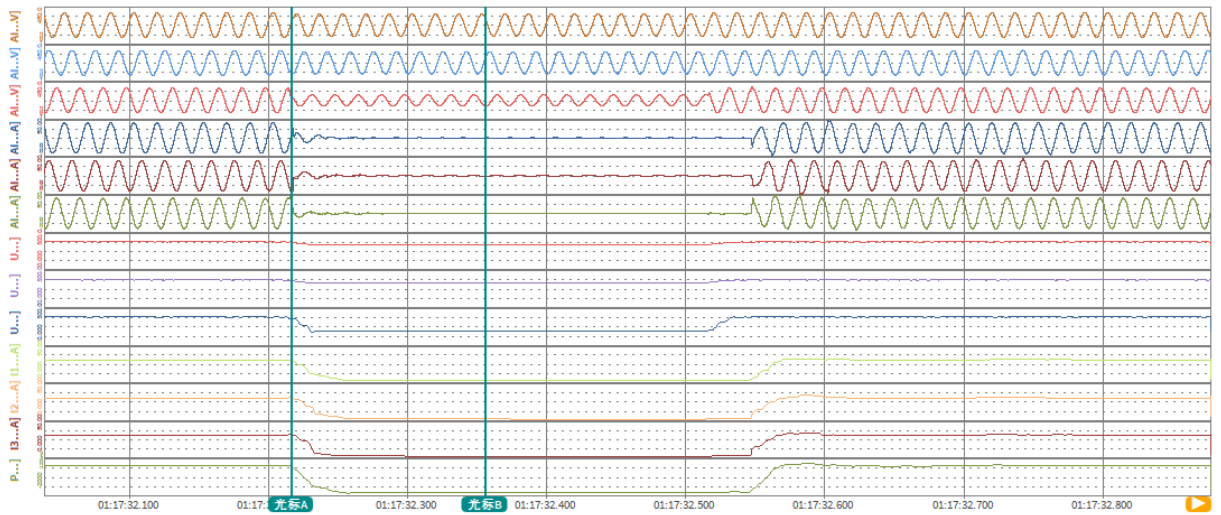


时间 [s]	A	B	间隔
	01:04:10.8620639	01:04:11.0151251	0.1530611
AI 1/U1 [V]	-54.11601	260.5372	314.6532
AI 1/U2 [V]	-202.2662	-278.2407	-75.97447
AI 1/U3 [V]	14.89425	16.55603	1.661778
AI 1/I1 [A]	-1.502800	36.64761	38.15041
AI 1/I2 [A]	1.185703	-37.77914	-38.96485
AI 1/I3 [A]	0.216198	1.116705	0.900507
U1_tRMS_rc@POWER/0 [V]	191.2701	220.5588	29.28877
U2_tRMS_rc@POWER/0 [V]	191.4020	220.7222	29.32016
U3_tRMS_rc@POWER/0 [V]	10.99471	220.3636	209.3689
I1_tRMS_rc@POWER/0 [A]	0.985417	29.58011	28.59469
I2_tRMS_rc@POWER/0 [A]	0.784201	29.45929	28.67509
I3_tRMS_rc@POWER/0 [A]	0.290159	29.42607	29.13591
P_t_rc@POWER/0 [W]	46.02344	19501.71	19455.68

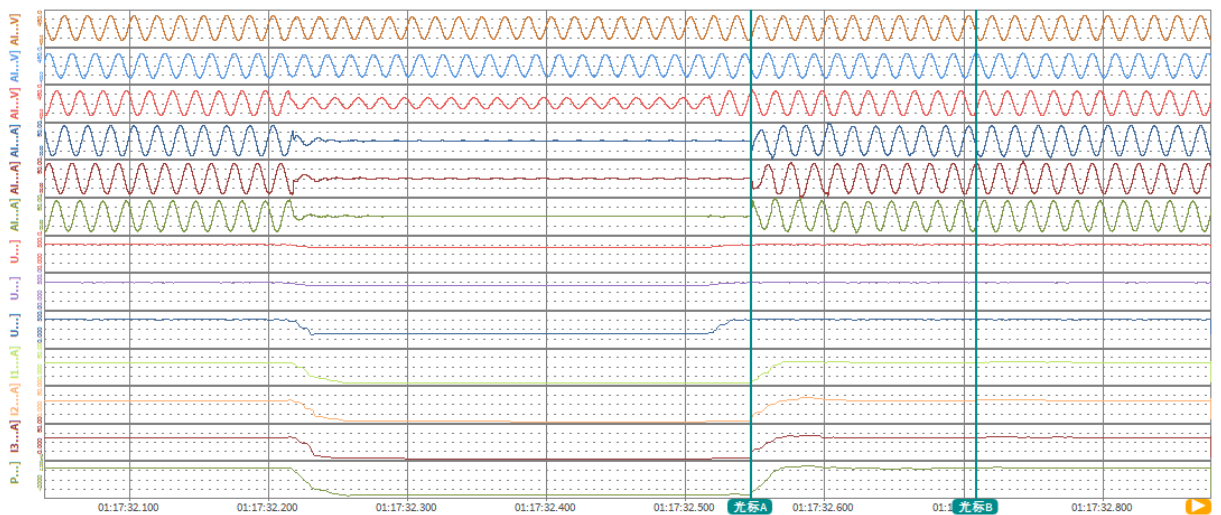




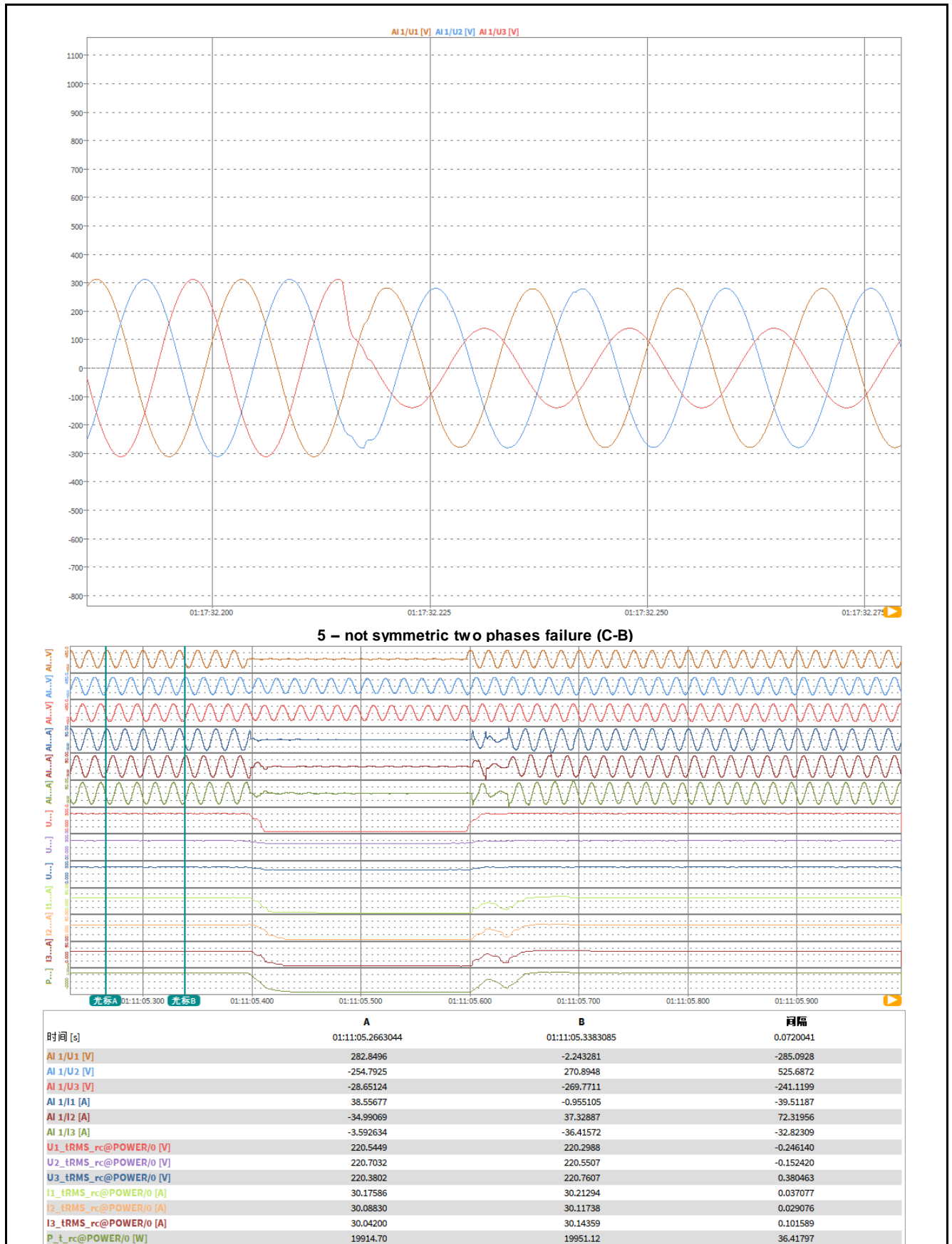


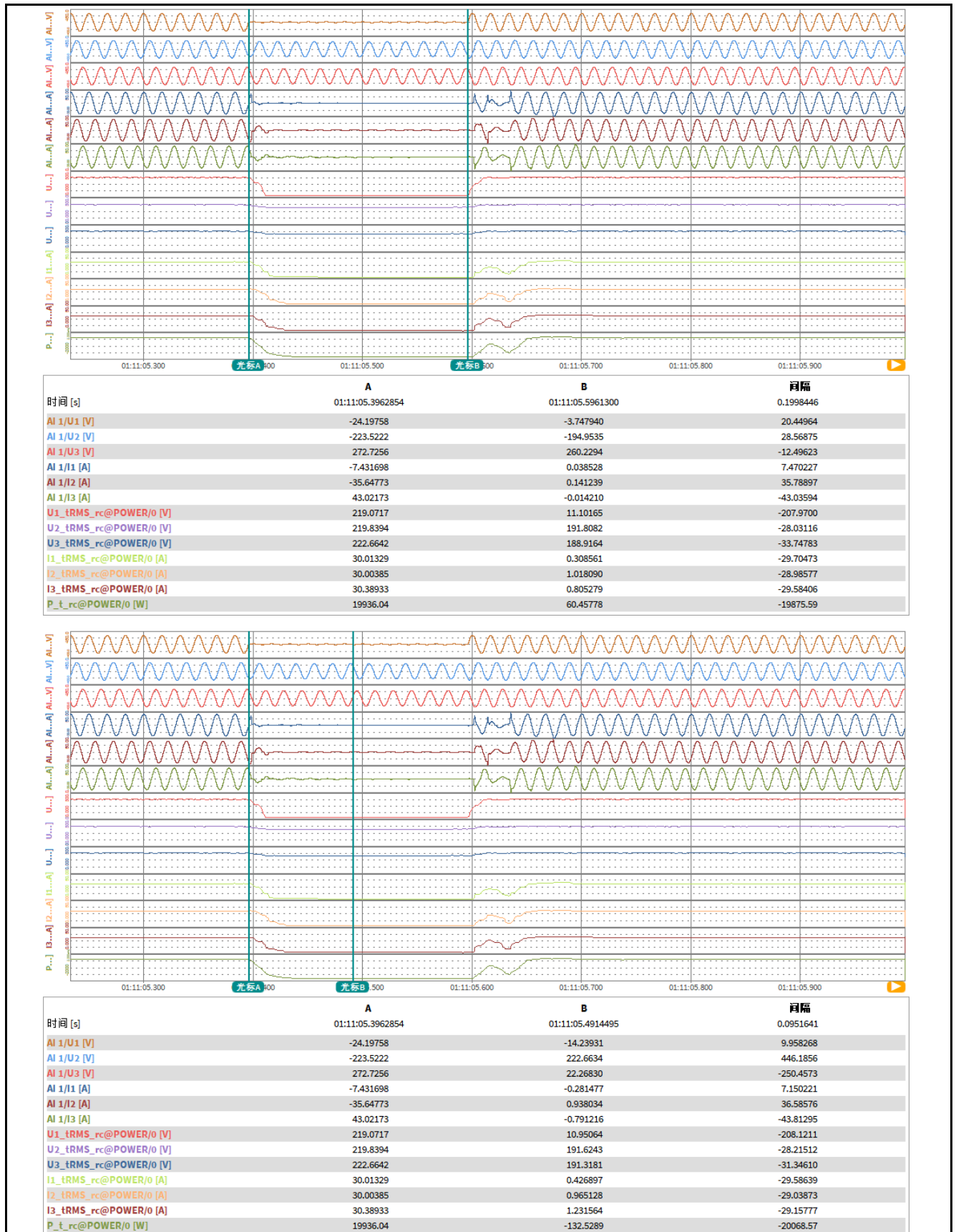


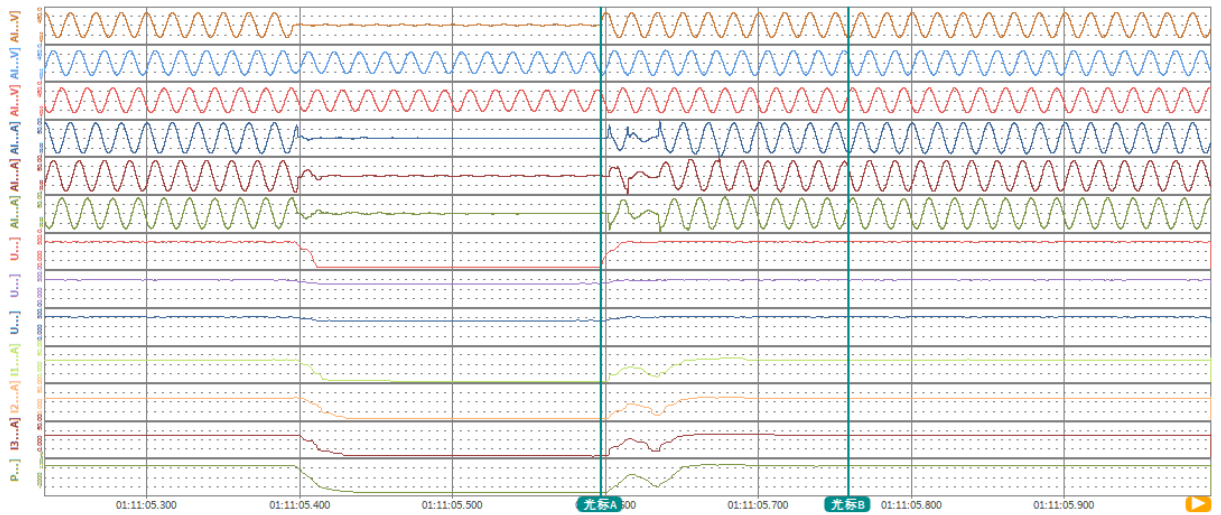
时间 [s]	A	B	间隔
	01:17:32.2166067	01:17:32.3559123	0.1393056
AI 1/U1 [V]	73.13633	170.6355	97.49914
AI 1/U2 [V]	-269.0551	106.5514	375.6066
AI 1/U3 [V]	96.34185	-138.6821	-235.0240
AI 1/I1 [A]	12.18796	1.134682	-11.05328
AI 1/I2 [A]	-38.38315	-1.326180	37.05697
AI 1/I3 [A]	26.09286	0.138903	-25.95396
U1_tRMS_rc@POWER/0 [V]	219.9454	198.1233	-21.82205
U2_tRMS_rc@POWER/0 [V]	220.2959	198.3587	-21.93716
U3_tRMS_rc@POWER/0 [V]	218.1125	98.83981	-119.2727
I1_tRMS_rc@POWER/0 [A]	30.10257	0.877425	-29.22515
I2_tRMS_rc@POWER/0 [A]	30.38512	0.836714	-29.54841
I3_tRMS_rc@POWER/0 [A]	30.58999	0.274379	-30.31561
P_t_rc@POWER/0 [W]	19937.40	-30.51711	-19967.92



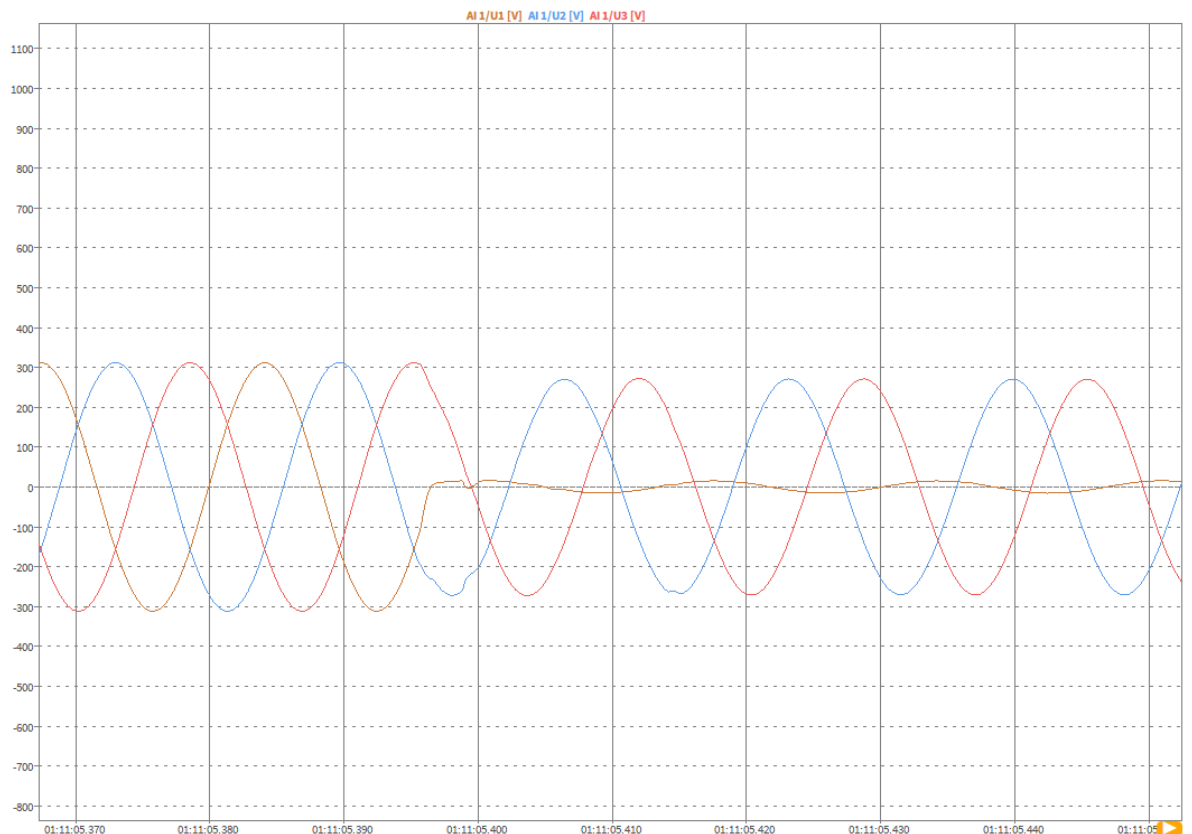
时间 [s]	A	B	间隔
	01:17:32.5467529	01:17:32.7086051	0.1618522
AI 1/U1 [V]	-259.0027	-118.7506	140.2521
AI 1/U2 [V]	-20.18571	310.4863	330.6720
AI 1/U3 [V]	278.9326	-192.7025	-471.6351
AI 1/I1 [A]	-0.692654	-16.59618	-15.90352
AI 1/I2 [A]	1.106119	44.31272	43.20660
AI 1/I3 [A]	-0.442505	-27.75603	-27.31352
U1_tRMS_rc@POWER/0 [V]	219.7897	220.3652	0.575516
U2_tRMS_rc@POWER/0 [V]	220.4559	220.6573	0.201401
U3_tRMS_rc@POWER/0 [V]	219.8451	220.7365	0.891434
I1_tRMS_rc@POWER/0 [A]	0.790001	30.10312	29.31312
I2_tRMS_rc@POWER/0 [A]	0.843191	30.26480	29.42161
I3_tRMS_rc@POWER/0 [A]	1.012794	30.27959	29.26680
P_t_rc@POWER/0 [W]	87.09467	19990.56	19903.47

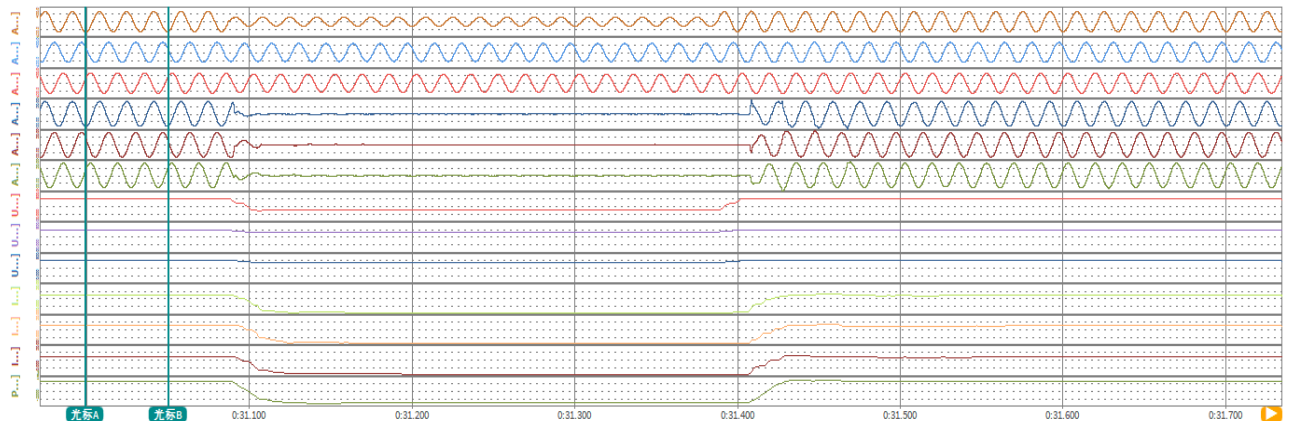




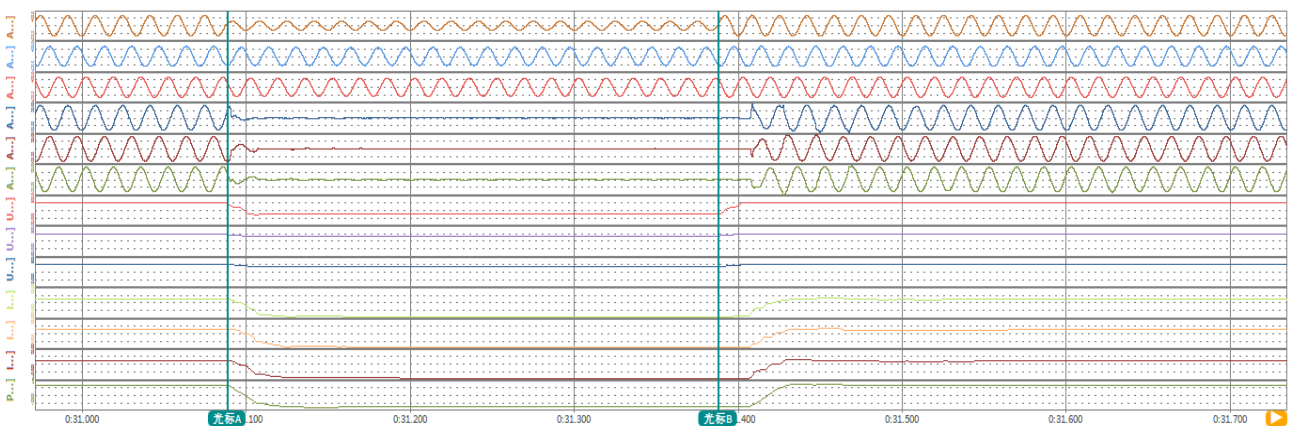


时间 [s]	A	B	间隔
	01:11:05.5968620	01:11:05.7586410	0.1617790
AI 1/U1 [V]	1.574040	-303.8962	-305.4702
AI 1/U2 [V]	-237.3700	211.8278	449.1978
AI 1/U3 [V]	239.0547	93.60171	-145.4530
AI 1/I1 [A]	-0.117016	-40.07421	-39.95719
AI 1/I2 [A]	0.285101	28.38826	28.10316
AI 1/I3 [A]	0.017738	11.64041	11.62267
U1_tRMS_rc@POWER/0 [V]	10.96525	220.6263	209.6610
U2_tRMS_rc@POWER/0 [V]	191.5286	220.6164	29.08784
U3_tRMS_rc@POWER/0 [V]	191.5899	220.3202	28.73024
I1_tRMS_rc@POWER/0 [A]	0.303640	29.92081	29.61717
I2_tRMS_rc@POWER/0 [A]	1.003440	29.14989	28.14645
I3_tRMS_rc@POWER/0 [A]	0.793394	29.72819	28.93480
P_t_rc@POWER/0 [W]	57.08624	19571.87	19514.78

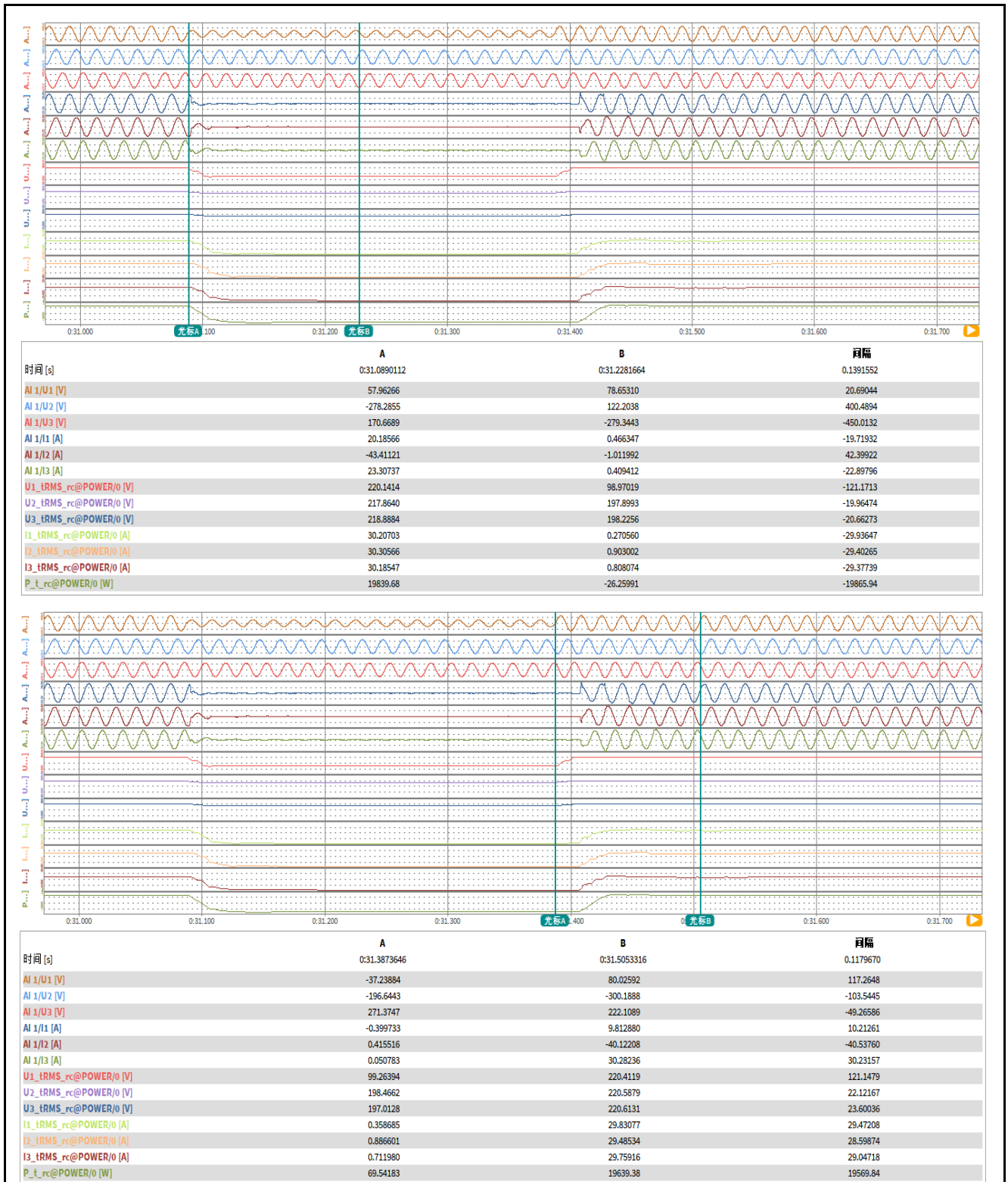


**6 – not symmetric two phases failure (C-B)**


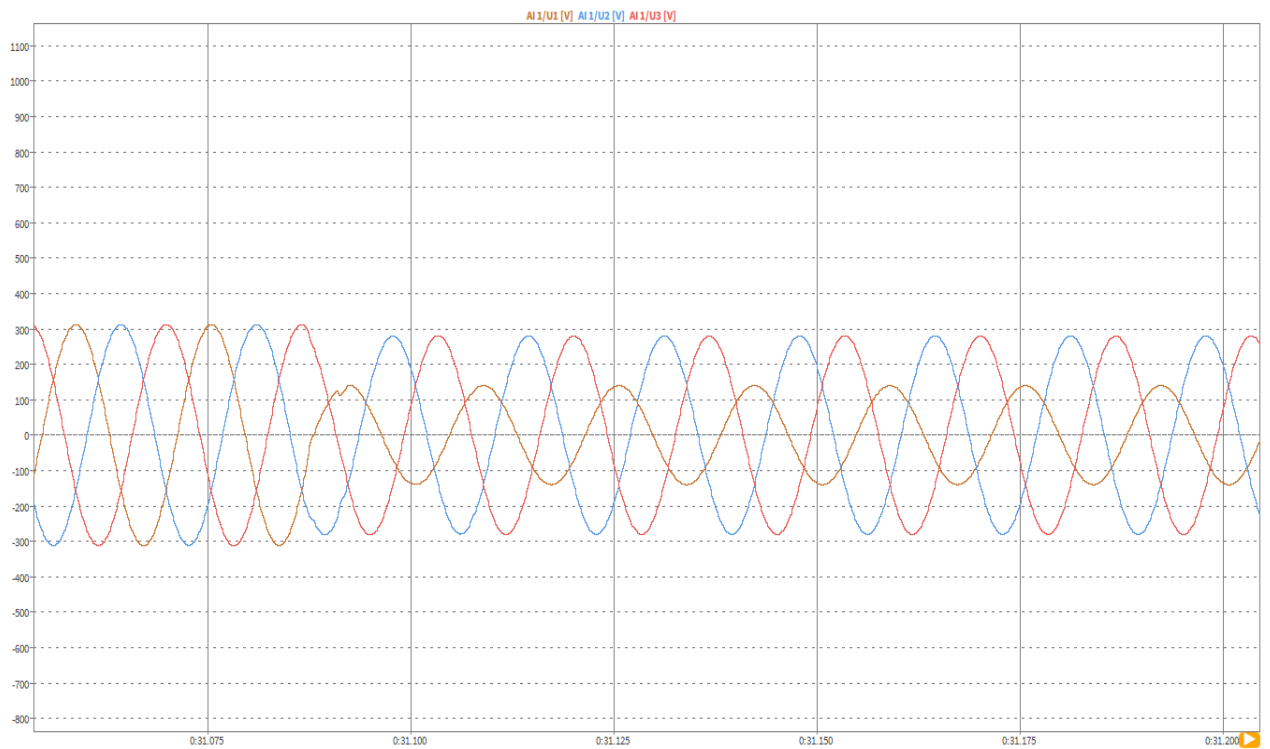
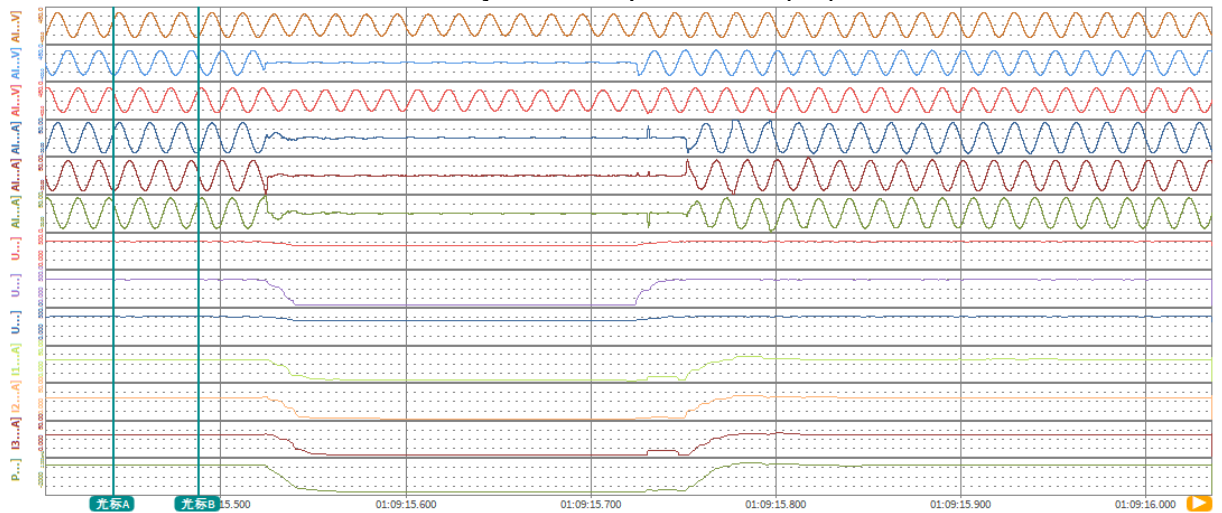
时间 [s]	A	B	间隔
	0:30.9997946	0:31.0507930	0.0509984
AI 1/U1 [V]	-301.5502	-309.7868	-8.236647
AI 1/U2 [V]	219.0375	121.3043	-97.73327
AI 1/U3 [V]	83.64511	188.5367	104.8915
AI 1/I1 [A]	-41.13636	-42.09686	-0.960493
AI 1/I2 [A]	30.12762	16.10689	-14.02073
AI 1/I3 [A]	10.96244	25.97385	15.01141
U1_tRMS_rc@POWER/0 [V]	220.7918	220.8124	0.020599
U2_tRMS_rc@POWER/0 [V]	220.5734	220.4133	-0.160141
U3_tRMS_rc@POWER/0 [V]	220.3521	220.5991	0.247009
I1_tRMS_rc@POWER/0 [A]	30.24522	30.23385	-0.011364
I2_tRMS_rc@POWER/0 [A]	30.10255	30.06570	-0.036848
I3_tRMS_rc@POWER/0 [A]	30.07633	30.08394	7.612e-3
P_t_rc@POWER/0 [W]	19943.45	19937.77	-5.679688



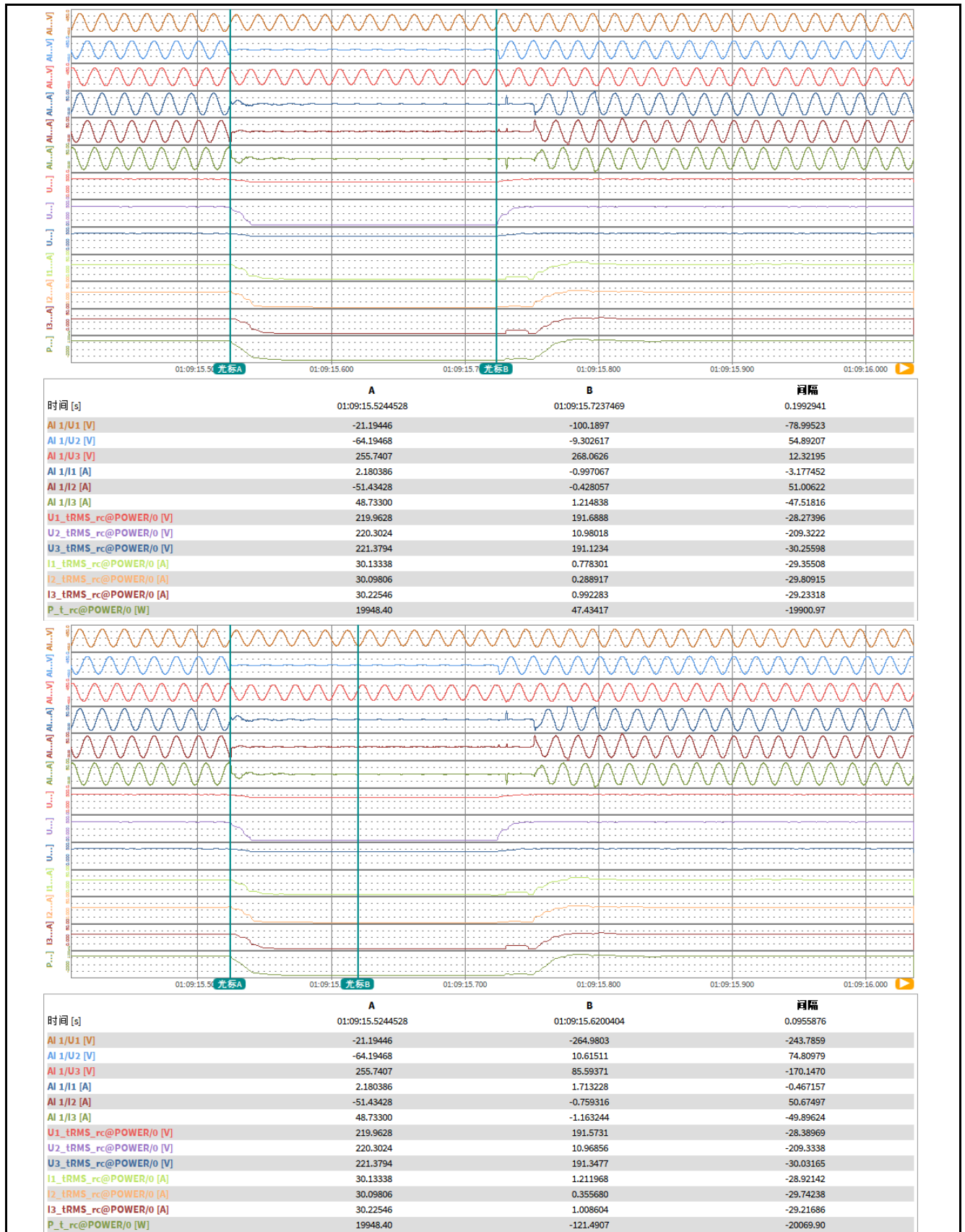
时间 [s]	A	B	间隔
	0:31.0890112	0:31.3879372	0.2989261
AI 1/U1 [V]	57.96266	-8.241654	-66.20431
AI 1/U2 [V]	-278.2855	-234.1092	44.17634
AI 1/U3 [V]	170.6689	251.2918	80.62292
AI 1/I1 [A]	20.18566	-0.233555	-20.41922
AI 1/I2 [A]	-43.41121	-0.152779	43.25843
AI 1/I3 [A]	23.30737	0.418615	-22.88876
U1_tRMS_rc@POWER/0 [V]	220.1414	99.46817	-120.6733
U2_tRMS_rc@POWER/0 [V]	217.8640	197.7361	-20.12785
U3_tRMS_rc@POWER/0 [V]	218.8884	197.3521	-21.53625
I1_tRMS_rc@POWER/0 [A]	30.20703	0.356282	-29.85075
I2_tRMS_rc@POWER/0 [A]	30.30566	0.892880	-29.41278
I3_tRMS_rc@POWER/0 [A]	30.18547	0.711147	-29.47432
P_t_rc@POWER/0 [W]	19839.68	63.27806	-19776.40



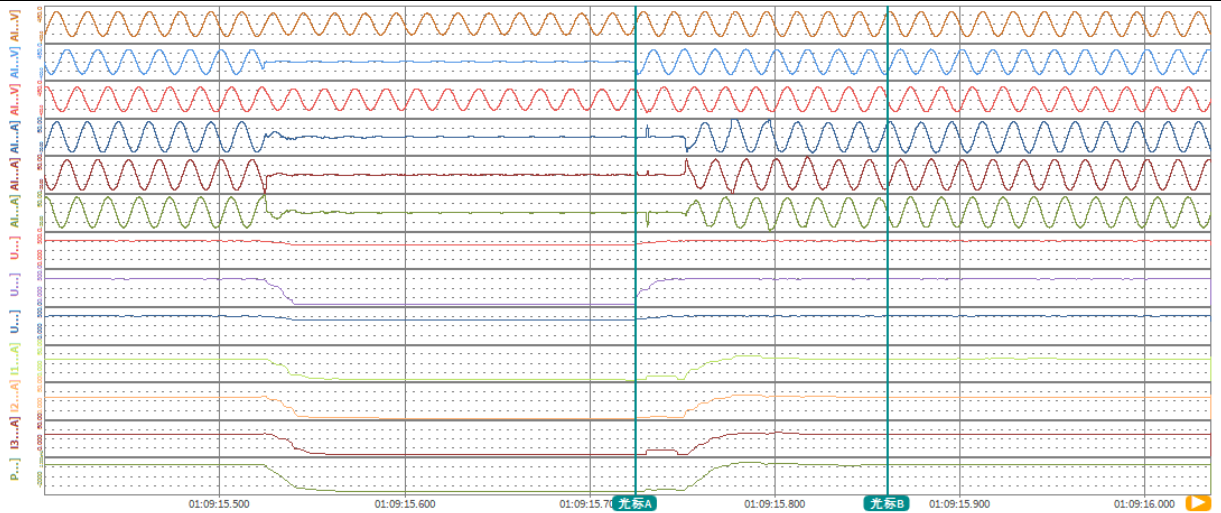



**7 – not symmetric two phases failure (A-C)**


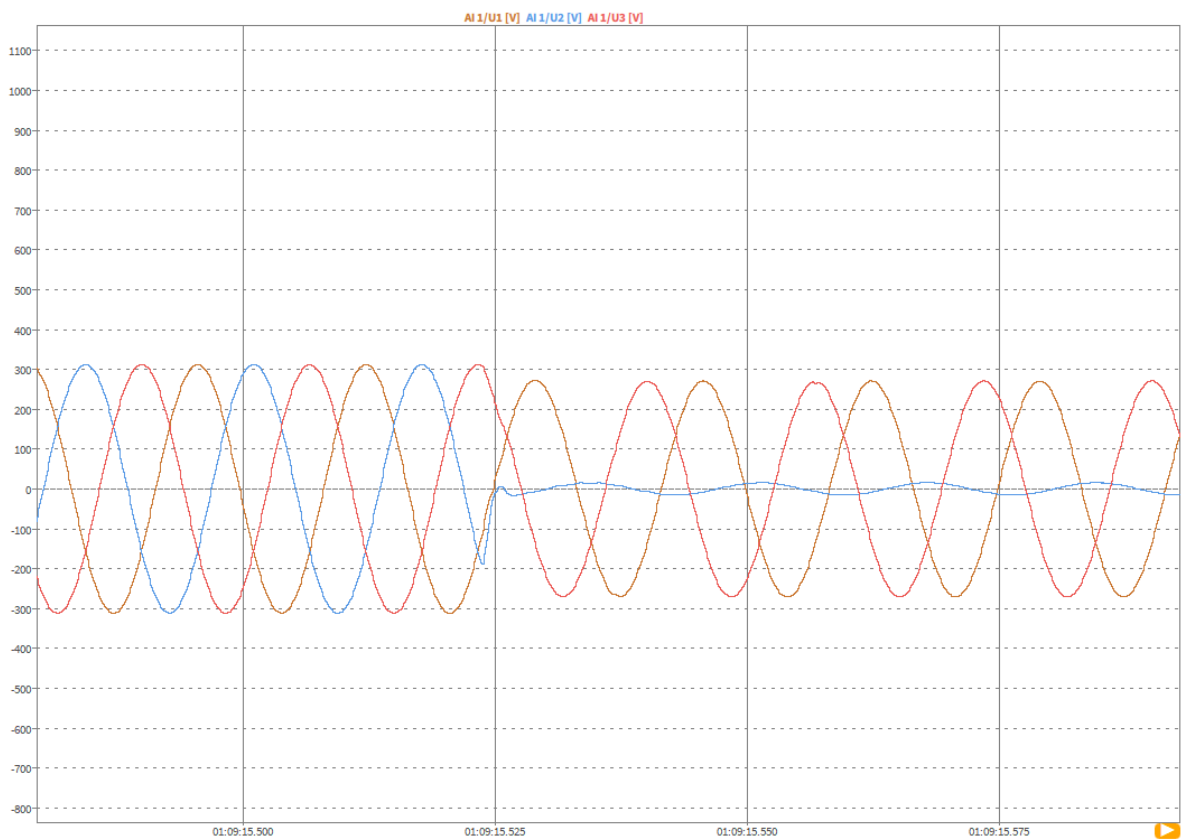
时间 [s]	A	B	间隔
	01:09:15.4419208	01:09:15.4881537	0.0462329
AI 1/U1 [V]	78.72129	-288.5416	-367.2629
AI 1/U2 [V]	-299.9783	40.65180	340.6301
AI 1/U3 [V]	222.9061	246.6889	23.78273
AI 1/I1 [A]	10.28609	-39.25472	-49.54081
AI 1/I2 [A]	-40.87825	4.756975	45.63523
AI 1/I3 [A]	30.55711	34.45392	3.896809
U1_tRMS_rc@POWER/0 [V]	220.3774	220.7885	0.411102
U2_tRMS_rc@POWER/0 [V]	220.7073	220.3635	-0.343781
U3_tRMS_rc@POWER/0 [V]	220.5938	220.5281	-0.065643
I1_tRMS_rc@POWER/0 [A]	30.15869	30.22989	0.071203
I2_tRMS_rc@POWER/0 [A]	30.10565	30.07403	-0.031624
I3_tRMS_rc@POWER/0 [A]	30.09840	30.10847	0.010078
P_t_rc@POWER/0 [W]	19928.82	19939.83	11.01367

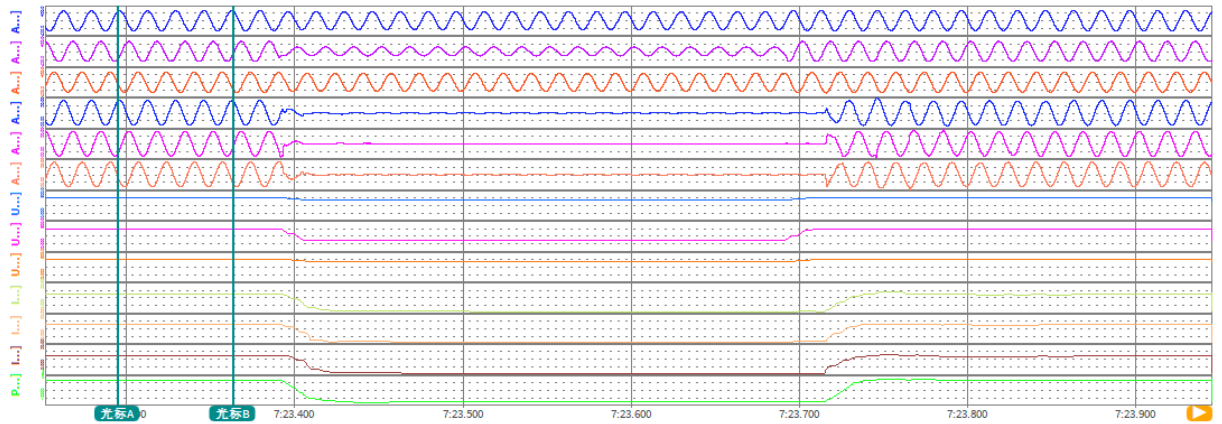




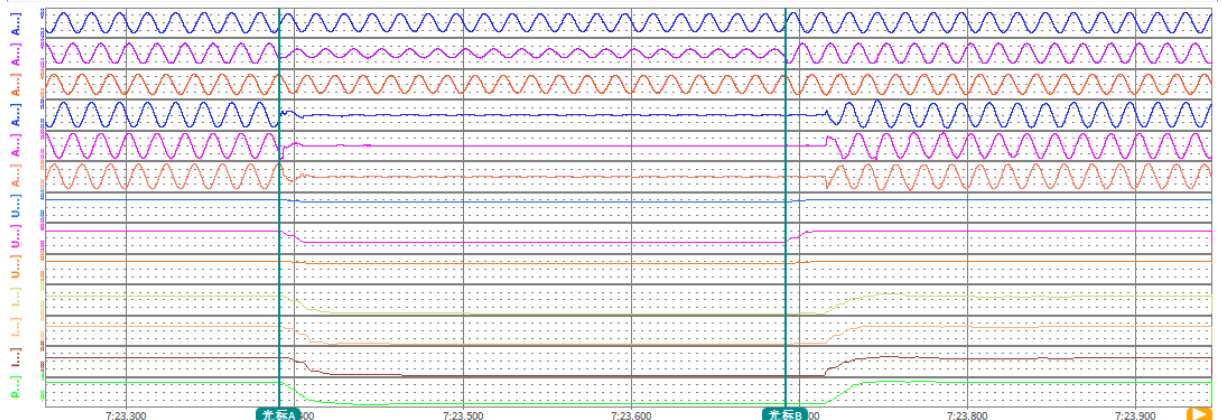


时间 [s]	A	B	间隔
	01:09:15.7247028	01:09:15.8608243	0.1361216
AI 1/U1 [V]	-8.928538	271.7605	280.6890
AI 1/U2 [V]	-30.45559	-269.0380	-238.5824
AI 1/U3 [V]	239.1956	-3.885031	-243.0806
AI 1/I1 [A]	-1.039696	37.29663	38.33633
AI 1/I2 [A]	1.031876	-36.13477	-37.16665
AI 1/I3 [A]	0.262404	-1.227331	-1.489735
U1_tRMS_rc@POWER/0 [V]	191.7998	220.6696	28.86978
U2_tRMS_rc@POWER/0 [V]	11.01461	220.6792	209.6646
U3_tRMS_rc@POWER/0 [V]	191.3214	220.3250	29.00360
I1_tRMS_rc@POWER/0 [A]	0.773968	29.93762	29.16366
I2_tRMS_rc@POWER/0 [A]	0.288333	29.61129	29.32296
I3_tRMS_rc@POWER/0 [A]	0.988174	29.32854	28.34036
P_t_rc@POWER/0 [W]	47.13462	19591.13	19543.99

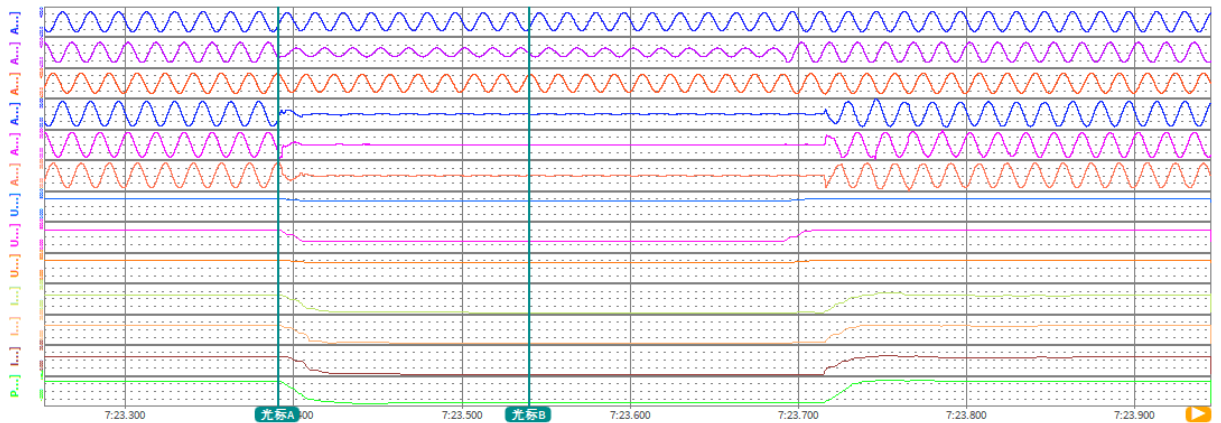


**8 – not symmetric two phases failure (A-C)**


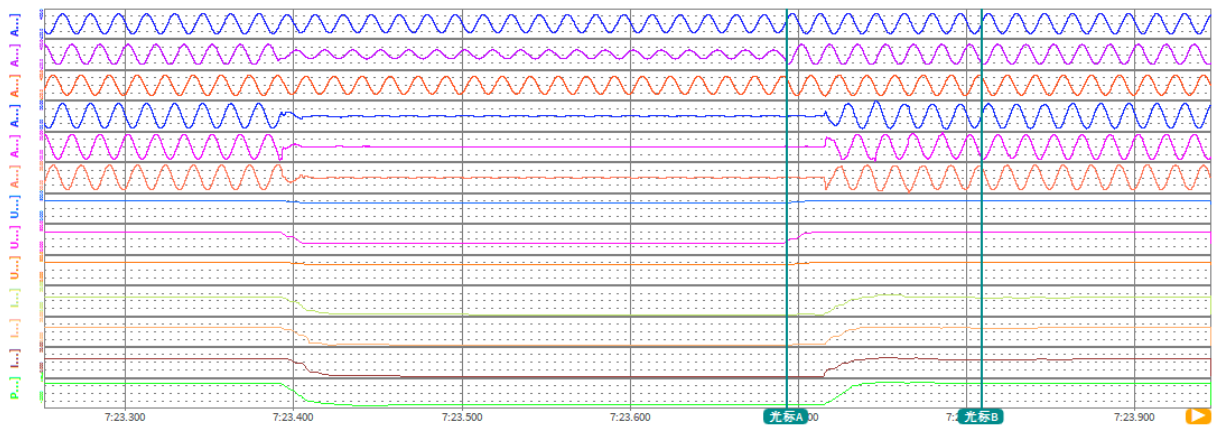
时间 [s]	A	B	间隔
	7:23.2950708	7:23.3636156	0.0685448
AI 1/U1 [V]	254.5650	310.1969	55.63188
AI 1/U2 [V]	-283.0672	-123.2352	159.8320
AI 1/U3 [V]	27.66824	-185.9517	-213.6200
AI 1/I1 [A]	35.48484	42.33132	6.846476
AI 1/I2 [A]	-38.34200	-16.72301	21.61899
AI 1/I3 [A]	2.818537	-25.65618	-28.47471
U1_tRMS_rc@POWER/0 [V]	220.6279	220.2194	-0.408524
U2_tRMS_rc@POWER/0 [V]	220.7210	220.5604	-0.160553
U3_tRMS_rc@POWER/0 [V]	220.4473	220.9925	0.545212
I1_tRMS_rc@POWER/0 [A]	30.19214	30.15402	-0.038124
I2_tRMS_rc@POWER/0 [A]	30.09999	30.09524	-4.755e-3
I3_tRMS_rc@POWER/0 [A]	30.06998	30.14929	0.079311
P_t_rc@POWER/0 [W]	19932.20	19939.41	7.210938



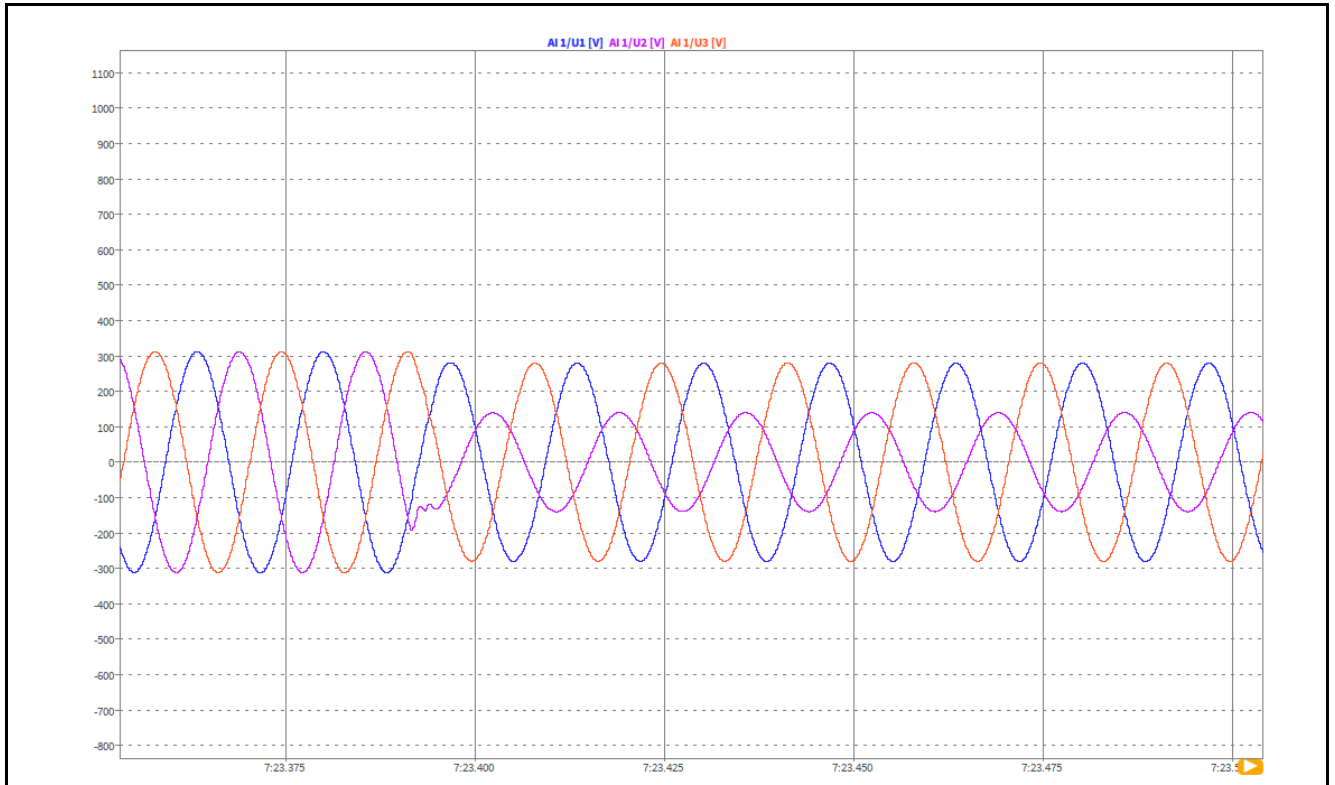
时间 [s]	A	B	间隔
	7:23.3909004	7:23.6919783	0.3010779
AI 1/U1 [V]	-173.5160	-73.32874	100.1873
AI 1/U2 [V]	-138.5632	-98.42086	40.14230
AI 1/U3 [V]	311.1305	270.6397	-40.49087
AI 1/I1 [A]	-23.85516	-1.099205	22.75596
AI 1/I2 [A]	-18.84527	-0.130701	18.71457
AI 1/I3 [A]	42.65299	1.112986	-41.54001
U1_tRMS_rc@POWER/0 [V]	220.4860	198.3300	-22.15605
U2_tRMS_rc@POWER/0 [V]	219.8456	99.02286	-120.8228
U3_tRMS_rc@POWER/0 [V]	221.4346	197.6666	-23.76797
I1_tRMS_rc@POWER/0 [A]	30.18570	0.739955	-29.44575
I2_tRMS_rc@POWER/0 [A]	29.98917	0.419809	-29.56936
I3_tRMS_rc@POWER/0 [A]	30.20278	0.896559	-29.30622
P_t_rc@POWER/0 [W]	19934.86	149.9405	-19784.92



时间 [s]	A	B	间隔
	7:23.3909004	7:23.5399686	0.1490682
AI 1/U1 [V]	-173.5160	-238.7774	-65.26137
AI 1/U2 [V]	-138.5632	-3.637076	134.9261
AI 1/U3 [V]	311.1305	246.3384	-64.79216
AI 1/I1 [A]	-23.85516	-0.253057	23.60211
AI 1/I2 [A]	-18.84527	0.238991	19.08426
AI 1/I3 [A]	42.65299	-0.155783	-42.80877
U1_tRMS_rc@POWER/0 [V]	220.4860	198.1370	-22.34900
U2_tRMS_rc@POWER/0 [V]	219.8456	98.88468	-120.9610
U3_tRMS_rc@POWER/0 [V]	221.4346	198.1477	-23.28685
I1_tRMS_rc@POWER/0 [A]	30.18570	0.784008	-29.40169
I2_tRMS_rc@POWER/0 [A]	29.98917	0.286822	-29.70235
I3_tRMS_rc@POWER/0 [A]	30.20278	0.887813	-29.31497
P_t_rc@POWER/0 [W]	19934.86	1.997685	-19932.86



时间 [s]	A	B	间隔
	7:23.6930297	7:23.8088238	0.1157941
AI 1/U1 [V]	42.02891	-46.95010	-88.97901
AI 1/U2 [V]	-208.8592	-241.7963	-32.93705
AI 1/U3 [V]	231.0505	291.1220	60.07147
AI 1/I1 [A]	-2.249432	-5.279017	-3.029585
AI 1/I2 [A]	3.084374	-32.86576	-35.95014
AI 1/I3 [A]	-0.605869	38.10387	38.70974
U1_tRMS_rc@POWER/0 [V]	198.4244	220.4044	21.98000
U2_tRMS_rc@POWER/0 [V]	98.95218	220.5115	121.5593
U3_tRMS_rc@POWER/0 [V]	197.9251	220.8150	22.88989
I1_tRMS_rc@POWER/0 [A]	0.736544	29.50897	28.77242
I2_tRMS_rc@POWER/0 [A]	0.420895	29.45748	29.03658
I3_tRMS_rc@POWER/0 [A]	0.890971	29.18792	28.29695
P_t_rc@POWER/0 [W]	148.6234	19440.07	19291.45



6	<b>TABELA 15: Proteção contra ilhamento</b> <b>TABLE 15: Islanding Protection</b>					P
Modelo: Model	R5-20K-T2					
<b>Condição A: 100% de potência nominal</b> <b>Condition A: 100% of rated power</b>						
condições Conditions	P <sub>w</sub> [W]	Q <sub>L</sub> [VA]	Q <sub>c</sub> [VA]	Q <sub>f</sub>	Tempo de viagem [ms] Trip time	Limite Limit [ms]
PR: 90% PQ: 110%	L1: 6170	L1: 7520	L1: 6710	1.15	1160	2000
	L2: 6190	L2: 7540	L2: 6740	1.15		
	L3: 6130	L3: 7540	L3: 6640	1.15		
PR: 90% PQ: 105%	L1: 6120	L1: 7160	L1: 6710	1.13	476	2000
	L2: 6170	L2: 7190	L2: 6740	1.13		
	L3: 6130	L3: 7210	L3: 6650	1.13		
PR: 90% PQ: 100%	L1: 6110	L1: 6860	L1: 6700	1.11	952	2000
	L2: 6170	L2: 6870	L2: 6740	1.10		
	L3: 6110	L3: 6860	L3: 6640	1.10		
PR: 90% PQ: 95%	L1: 6110	L1: 6470	L1: 6700	1.08	650	2000
	L2: 6150	L2: 6520	L2: 6730	1.08		
	L3: 6080	L3: 6520	L3: 6640	1.08		
PR: 90% PQ: 90%	L1: 6080	L1: 6140	L1: 6710	1.05	158	2000
	L2: 6150	L2: 6170	L2: 6740	1.05		
	L3: 6110	L3: 6170	L3: 6650	1.05		
PR: 95% PQ: 110%	L1: 6490	L1: 7520	L1: 6710	1.09	1018	2000
	L2: 6520	L2: 7530	L2: 6740	1.09		
	L3: 6470	L3: 7530	L3: 6640	1.09		
PR: 95% PQ: 90%	L1: 6440	L1: 6170	L1: 6690	1.00	142	2000
	L2: 6460	L2: 6180	L2: 6730	1.00		
	L3: 6410	L3: 6170	L3: 6630	1.00		
PR: 100% PQ: 110%	L1: 6800	L1: 7520	L1: 6710	1.04	1372	2000
	L2: 6860	L2: 7530	L2: 6740	1.04		
	L3: 6790	L3: 7540	L3: 6650	1.04		
PR: 95% PQ: 105%	L1: 6490	L1: 7160	L1: 6710	1.07	1097	2000
	L2: 6530	L2: 7200	L2: 6740	1.07		
	L3: 6460	L3: 7190	L3: 6650	1.07		
PR: 95% PQ: 100%	L1: 6470	L1: 6860	L1: 6700	1.05	445	2000
	L2: 6500	L2: 6910	L2: 6740	1.05		
	L3: 6430	L3: 6860	L3: 6640	1.05		
PR: 95%	L1: 6460	L1: 6480	L1: 6690	1.02	152	2000

Pq: 95%	L2: 6500	L2: 6530	L2: 6730	1.02		
	L3: 6410	L3: 6520	L3: 6640	1.03		
PR: 100% PQ: 105%	L1: 6810	L1: 7160	L1: 6720	1.02	622	2000
	L2: 6810	L2: 7210	L2: 6750	1.02		
	L3: 6780	L3: 7210	L3: 6660	1.02		
PR: 100% PQ: 100%	L1: 6780	L1: 6820	L1: 6720	1.00	246	2000
	L2: 6790	L2: 6860	L2: 6740	1.00		
	L3: 6750	L3: 6860	L3: 6660	1.00		
PR: 100% PQ: 95%	L1: 6740	L1: 6470	L1: 6710	0.98	160	2000
	L2: 6790	L2: 6520	L2: 6740	0.98		
	L3: 6730	L3: 6520	L3: 6650	0.98		
PR: 105% PQ: 105%	L1: 7120	L1: 7170	L1: 6710	0.97	511	2000
	L2: 7150	L2: 7200	L2: 6740	0.97		
	L3: 7100	L3: 7190	L3: 6650	0.97		
PR: 105% PQ: 100%	L1: 7110	L1: 6850	L1: 6710	0.95	338	2000
	L2: 7140	L2: 6850	L2: 6740	0.95		
	L3: 7100	L3: 6850	L3: 6650	0.95		
PR: 105% PQ: 95%	L1: 7110	L1: 6470	L1: 6700	0.93	161	2000
	L2: 7130	L2: 6520	L2: 6730	0.93		
	L3: 7070	L3: 6520	L3: 6640	0.93		
PR: 100% PQ: 90%	L1: 6740	L1: 6140	L1: 6700	0.95	160	2000
	L2: 6770	L2: 6160	L2: 6740	0.95		
	L3: 6740	L3: 6170	L3: 6640	0.95		
PR: 105% PQ: 110%	L1: 7140	L1: 7520	L1: 6710	0.99	1063	2000
	L2: 7180	L2: 7540	L2: 6740	0.99		
	L3: 7130	L3: 7540	L3: 6650	0.99		
PR: 105% PQ: 90%	L1: 7070	L1: 6140	L1: 6690	0.91	143	2000
	L2: 7100	L2: 6170	L2: 6730	0.91		
	L3: 7070	L3: 6170	L3: 6640	0.91		
PR: 110% PQ: 110%	L1: 7460	L1: 7520	L1: 6710	0.86	997	2000
	L2: 7490	L2: 7540	L2: 6740	0.87		
	L3: 7420	L3: 7540	L3: 6640	0.87		
PR: 110% PQ: 105%	L1: 7430	L1: 7160	L1: 6700	0.93	305	2000
	L2: 7480	L2: 7200	L2: 6740	0.93		
	L3: 7400	L3: 7200	L3: 6650	0.93		
PR: 110% PQ: 100%	L1: 7450	L1: 6840	L1: 6690	0.91	703	2000
	L2: 7460	L2: 6860	L2: 6730	0.91		
	L3: 7380	L3: 6860	L3: 6640	0.91		
PR: 110% PQ: 95%	L1: 7450	L1: 6490	L1: 6690	0.88	161	2000
	L2: 7470	L2: 6510	L2: 6730	0.89		

	L3: 7370	L3: 6520	L3: 6630	0.89		
PR: 110% PQ: 90%	L1: 7430	L1: 6170	L1: 6680	0.86	152	2000
	L2: 7420	L2: 6170	L2: 6710	0.87		
	L3: 7370	L3: 6170	L3: 6620	0.87		

<b>Condição B: 66% de potência nominal</b> <b>Condition B: 66% of rated power</b>						
condições Conditions	P <sub>w</sub> [kW]	Q <sub>L</sub> [kVA]	Q <sub>c</sub> [kVA]	Q <sub>f</sub>	Tempo de viagem [ms] Trip time	Limite Limit [ms]
PR: 100% PQ: 95%	L1: 4520	L1: 4260	L1: 4460	0.97	172	2000
	L2: 4520	L2: 4280	L2: 4550	0.98		
	L3: 4520	L3: 4330	L3: 4440	0.97		
PR: 100% PQ: 96%	L1: 4510	L1: 4330	L1: 4470	0.98	178	2000
	L2: 4520	L2: 4330	L2: 4550	0.98		
	L3: 4510	L3: 4330	L3: 4450	0.98		
PR: 100% PQ: 97%	L1: 4520	L1: 4380	L1: 4460	0.98	210	2000
	L2: 4520	L2: 4280	L2: 4550	0.98		
	L3: 4520	L3: 4330	L3: 4440	0.98		
PR: 100% PQ: 98%	L1: 4520	L1: 4420	L1: 4480	0.99	286	2000
	L2: 4550	L2: 4430	L2: 4550	0.99		
	L3: 4510	L3: 4480	L3: 4450	0.99		
PR: 100% PQ: 99%	L1: 4530	L1: 4450	L1: 4490	0.99	442	2000
	L2: 4530	L2: 4490	L2: 4510	0.99		
	L3: 4500	L3: 4520	L3: 4430	0.99		
PR: 100% PQ: 100%	L1: 4490	L1: 4510	L1: 4490	1.00	696	2000
	L2: 4520	L2: 4520	L2: 4510	1.00		
	L3: 4500	L3: 4570	L3: 4440	1.00		
PR: 100% PQ: 101%	L1: 4510	L1: 4540	L1: 4490	1.00	278	2000
	L2: 4520	L2: 4550	L2: 4510	1.00		
	L3: 4510	L3: 4610	L3: 4430	1.00		
PR: 100% PQ: 102%	L1: 4520	L1: 4600	L1: 4490	1.01	254	2000
	L2: 4520	L2: 4610	L2: 4500	1.01		
	L3: 4510	L3: 4660	L3: 4430	1.01		
PR: 100% PQ: 103%	L1: 4520	L1: 4640	L1: 4500	1.01	237	2000
	L2: 4550	L2: 4650	L2: 4520	1.01		
	L3: 4520	L3: 4700	L3: 4440	1.01		
PR: 100% PQ: 104%	L1: 4520	L1: 4690	L1: 4500	1.02	224	2000
	L2: 4550	L2: 4700	L2: 4520	1.01		
	L3: 4530	L3: 4750	L3: 4440	1.01		
PR: 100% PQ: 105%	L1: 4520	L1: 4720	L1: 4490	1.02	212	2000
	L2: 4540	L2: 4730	L2: 4510	1.02		
	L3: 4520	L3: 4790	L3: 4430	1.02		

<b>Condição C: 33% de potência nominal</b> <b>Condition C: 33% of rated power</b>						
condições Conditions	P <sub>w</sub> [kW]	Q <sub>L</sub> [kVA]	Q <sub>C</sub> [kVA]	Q <sub>f</sub>	Tempo de viagem [ms] Trip time	Limite Limit [ms]
PR: 100% PQ: 95%	L1: 2170	L1: 2130	L1: 2120	0.98	165	2000
	L2: 2260	L2: 2170	L2: 2240	0.98		
	L3: 2240	L3: 2160	L3: 2220	0.98		
PR: 100% PQ: 96%	L1: 2150	L1: 2160	L1: 2110	0.99	189	2000
	L2: 2260	L2: 2200	L2: 2240	0.98		
	L3: 2240	L3: 2200	L3: 2220	0.98		
PR: 100% PQ: 97%	L1: 2150	L1: 2170	L1: 2110	0.99	222	2000
	L2: 2260	L2: 2230	L2: 2240	0.99		
	L3: 2240	L3: 2210	L3: 2220	0.99		
PR: 100% PQ: 98%	L1: 2150	L1: 2200	L1: 2110	1.00	310	2000
	L2: 2260	L2: 2240	L2: 2240	0.99		
	L3: 2240	L3: 2220	L3: 2220	0.99		
PR: 100% PQ: 99%	L1: 2160	L1: 2220	L1: 2110	1.00	400	2000
	L2: 2260	L2: 2250	L2: 2240	1.00		
	L3: 2240	L3: 2250	L3: 2220	1.00		
PR: 100% PQ: 100%	L1: 2230	L1: 2240	L1: 2200	1.00	962	2000
	L2: 2260	L2: 2280	L2: 2240	1.00		
	L3: 2240	L3: 2270	L3: 2220	1.00		
PR: 100% PQ: 101%	L1: 2230	L1: 2260	L1: 2200	1.00	472	2000
	L2: 2260	L2: 2300	L2: 2240	1.00		
	L3: 2240	L3: 2280	L3: 2220	1.00		
PR: 100% PQ: 102%	L1: 2240	L1: 2290	L1: 2220	1.01	324	2000
	L2: 2260	L2: 2310	L2: 2240	1.00		
	L3: 2240	L3: 2300	L3: 2220	1.01		
PR: 100% PQ: 103%	L1: 2180	L1: 2300	L1: 2130	1.01	219	2000
	L2: 2260	L2: 2340	L2: 2240	1.01		
	L3: 2240	L3: 2330	L3: 2210	1.01		
PR: 100% PQ: 104%	L1: 2190	L1: 2320	L1: 2120	1.01	192	2000
	L2: 2260	L2: 2360	L2: 2240	1.01		
	L3: 2240	L3: 2240	L3: 2210	1.01		
PR: 100% PQ: 105%	L1: 2190	L1: 2350	L1: 2120	1.02	167	2000
	L2: 2260	L2: 2390	L2: 2240	1.02		
	L3: 2250	L3: 2380	L3: 2210	1.02		
Observação: Remark:						



Apêndice I Fotos  
Appendix I Photos



Figura 1. Vista frontal do R5-13K-T2 e R5-15K-T2  
Figure 1. Front view of R5-13K-T2 and R5-15K-T2



Figura 2. Vista em painel de conectores de R5-13K-T2 e R5-15K-T2  
Figure 2. Connector panel view of R5-13K-T2 and R5-15K-T2



Figura 3. Vista superior do R5-13K-T2 e R5-15K-T2  
Figure 3. Top view of R5-13K-T2 and R5-15K-T2



Figura 4. Vista esquerda do R5-13K-T2 e R5-15K-T2  
Figure 4. Left view of R5-13K-T2 and R5-15K-T2



Figura 5. Vista direita do R5-13K-T2 e R5-15K-T2  
Figure 5. Right view of R5-13K-T2 and R5-15K-T2



Figura 6. Vista interna para R5-13K-T2, R5-15K-T2  
Figure 6. Internal view for R5-13K-T2, R5-15K-T2





Figura 7. Vista frontal da placa de entrada / saída para R5-13K-T2, R5-15K-T2  
Figure 7. Front view of the input/output board for R5-13K-T2, R5-15K-T2

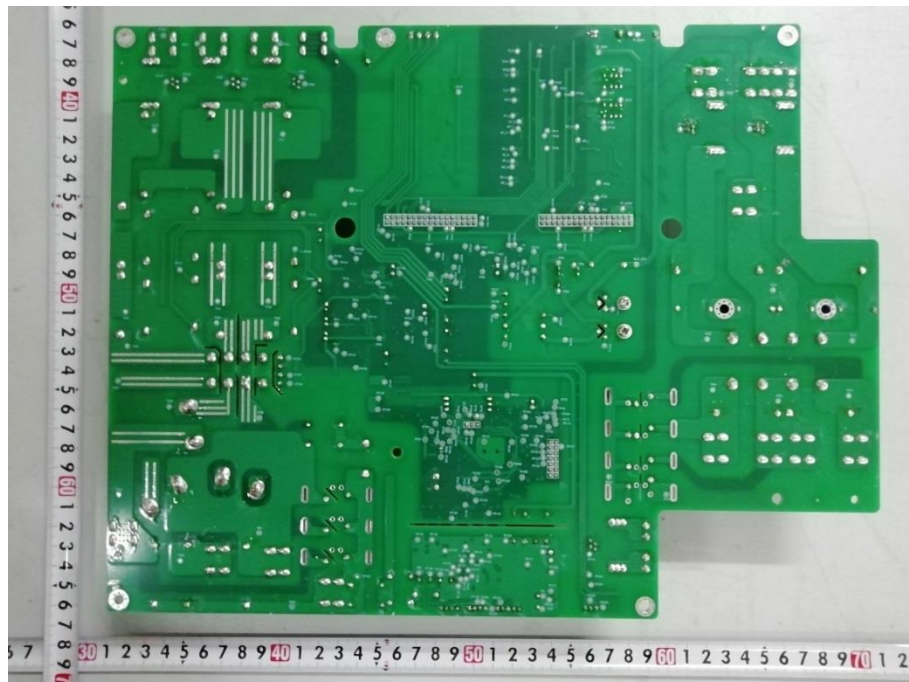


Figura 8. Vista traseira da placa de entrada / saída para R5-13K-T2, R5-15K-T2  
Figure 8. Back view of the input/output board for R5-13K-T2, R5-15K-T2

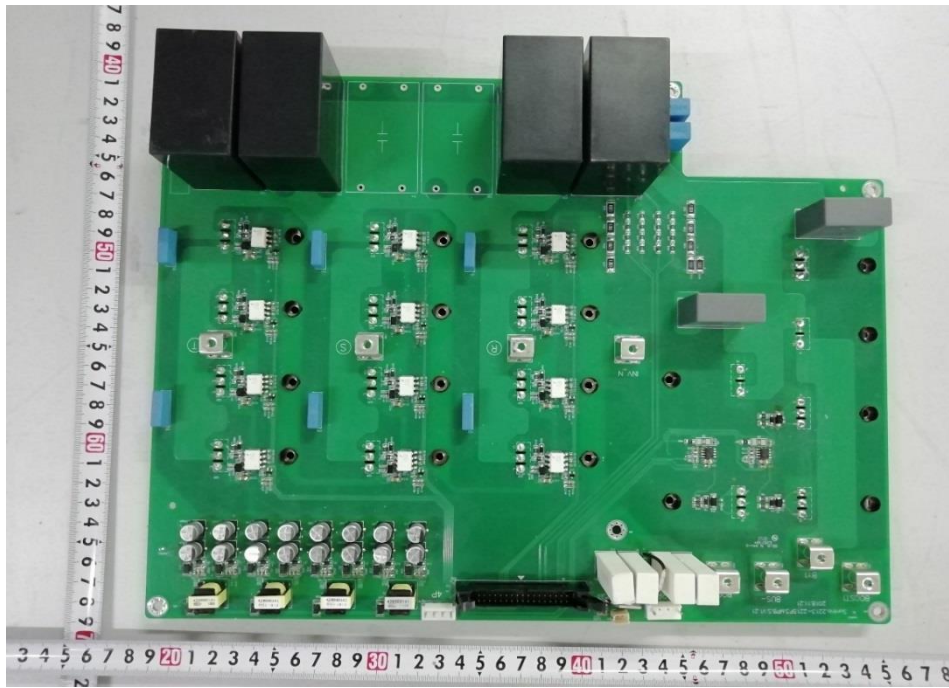


Figura 9. Vista frontal da placa de alimentação principal para R5-13K-T2, R5-15K-T2  
Figure 9. Front view of the main power board for R5-13K-T2, R5-15K-T2

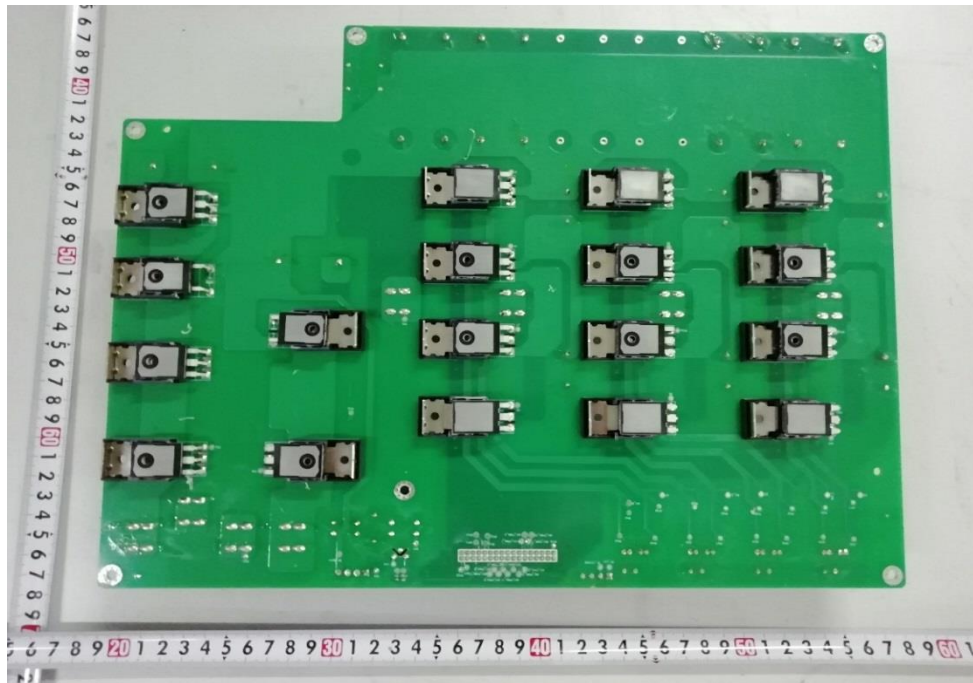


Figura 10. Vista traseira da placa de alimentação principal para R5-13K-T2, R5-15K-T2  
Figure 10. Back view of the main power board for R5-13K-T2, R5-15K-T2



Figura 11. Vista frontal do R5-17K-T2 e R5-20K-T2  
Figure 11. Front view of R5-17K-T2 and R5-20K-T2



Figura 12. Vista em painel de conectores de R5-17K-T2 e R5-20K-T2  
Figure 12. Connector panel view of R5-17K-T2 and R5-20K-T2





Figura 13. Vista superior do R5-17K-T2 e R5-20K-T2  
Figure 13. Top view of R5-17K-T2 and R5-20K-T2



Figura 14. Vista esquerda do R5-17K-T2 e R5-20K-T2  
Figure 14. Left view of R5-17K-T2 and R5-20K-T2



Figura 15. Vista direita do R5-17K-T2 e R5-20K-T2  
Figure 15. Right view of R5-17K-T2 and R5-20K-T2



Figura 16. Vista interna para R5-17K-T2, R5-20K-T2  
Figure 16. Internal view for R5-17K-T2, R5-20K-T2



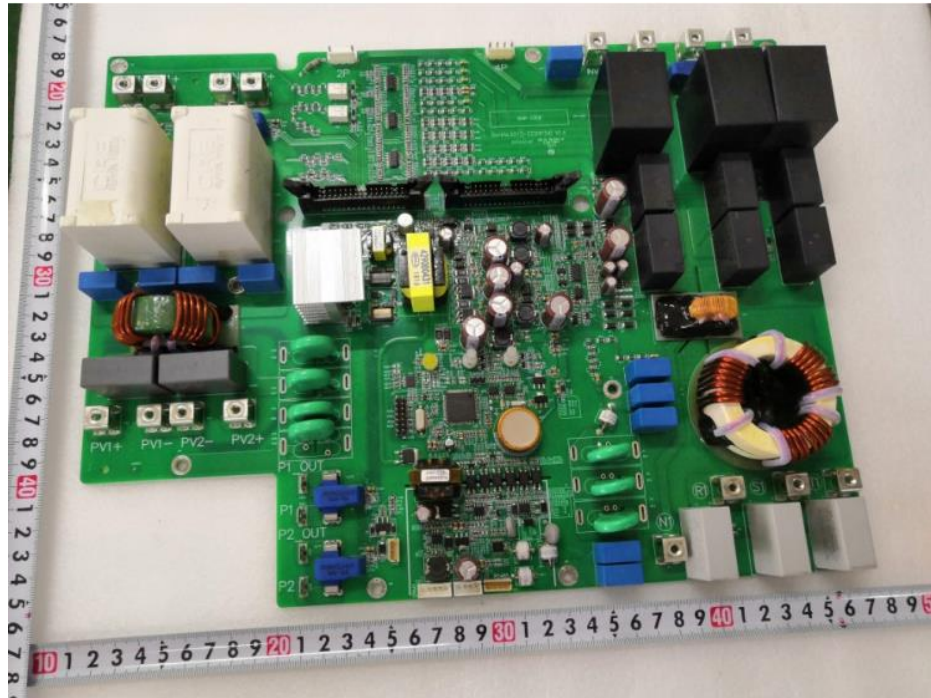


Figura 17. Vista frontal da placa de entrada / saída para R5-17K-T2, R5-20K-T2  
Figure 17. Front view of the input/output board for R5-17K-T2, R5-20K-T2

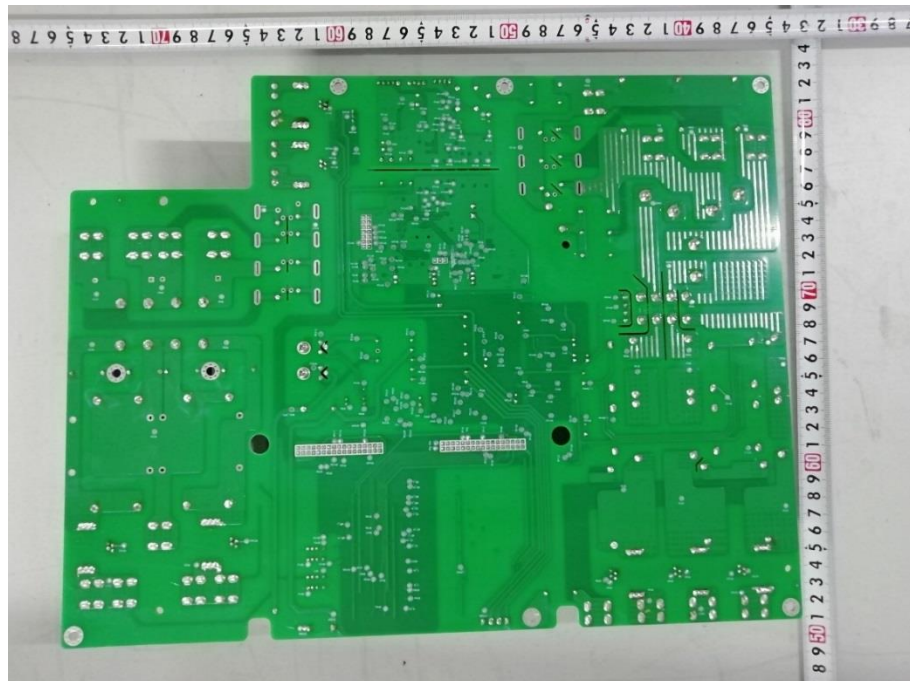


Figura 18. Vista traseira da placa de entrada / saída para R5-17K-T2, R5-20K-T2  
Figure 18. Back view of the input/output board for R5-17K-T2, R5-20K-T2

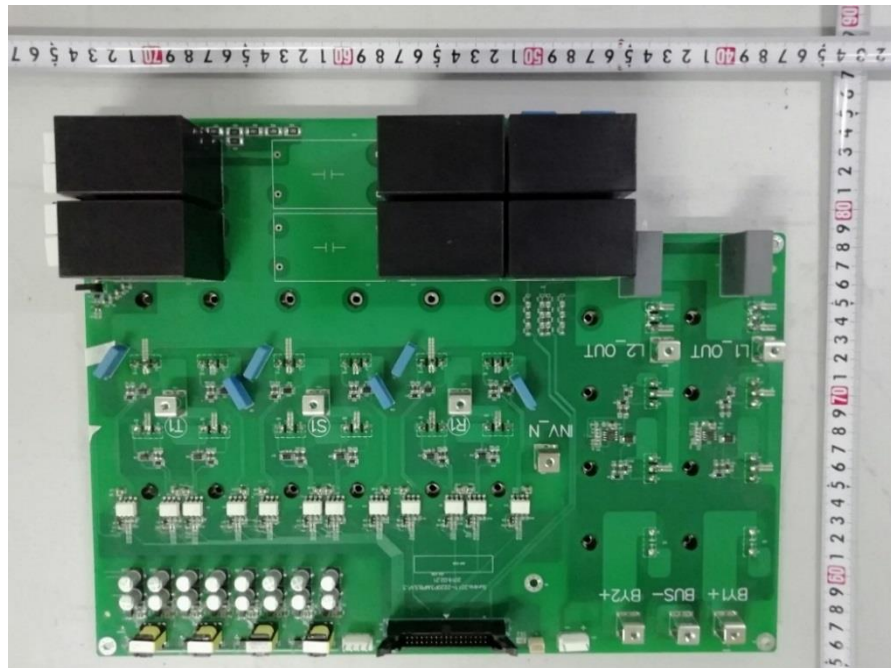


Figura 19. Vista frontal da placa de alimentação principal para R5-17K-T2, R5-20K-T2  
Figure 19. Front view of the main power board for R5-17K-T2, R5-20K-T2

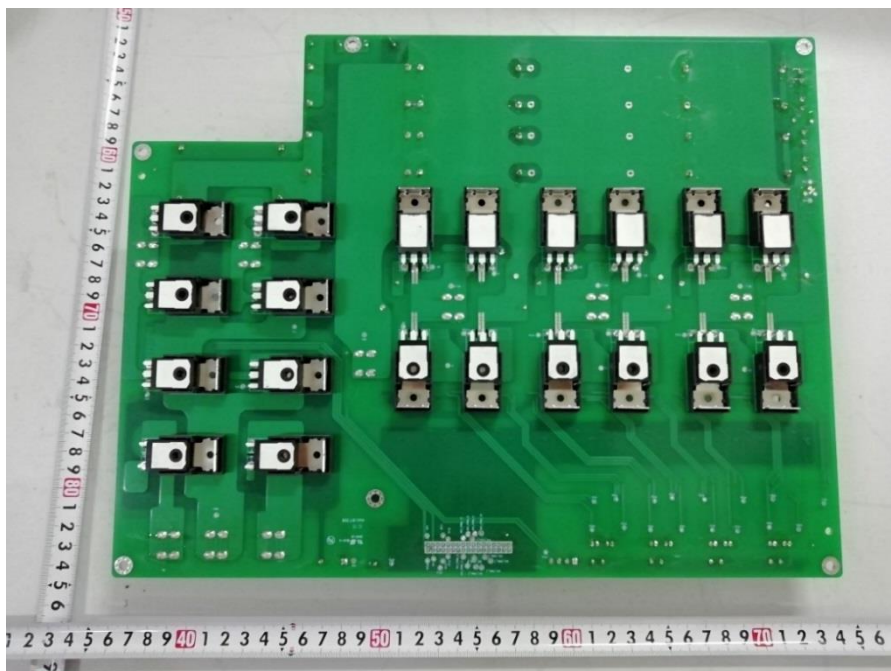


Figura 20. Vista traseira da placa de alimentação principal para R5-17K-T2, R5-20K-T2  
Figure 20. Back view of the main power board for R5-17K-T2, R5-20K-T2



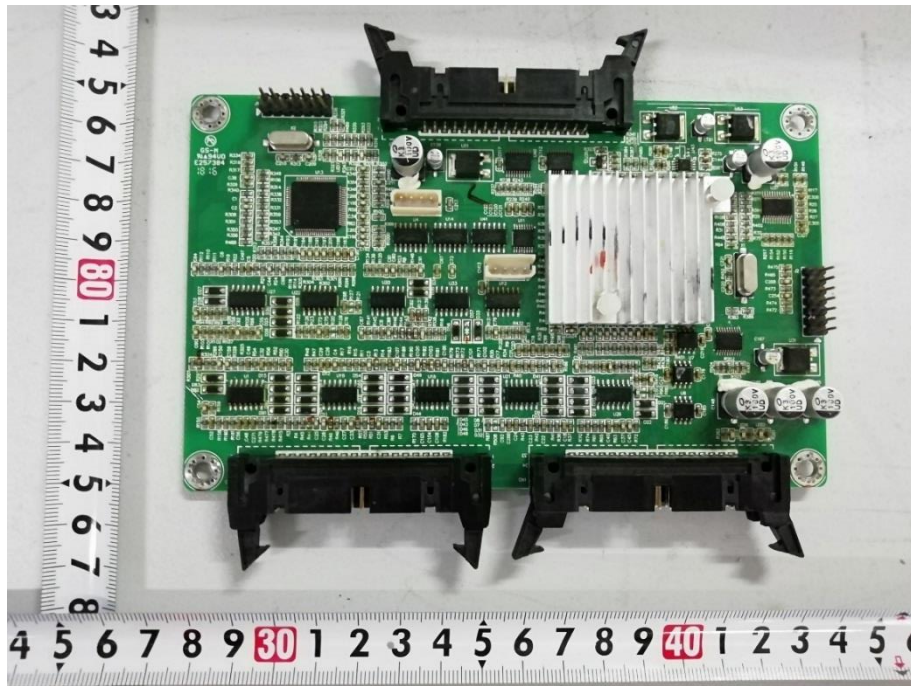


Figura 21. Vista frontal do painel de controle  
Figure 21. Front view of the control board

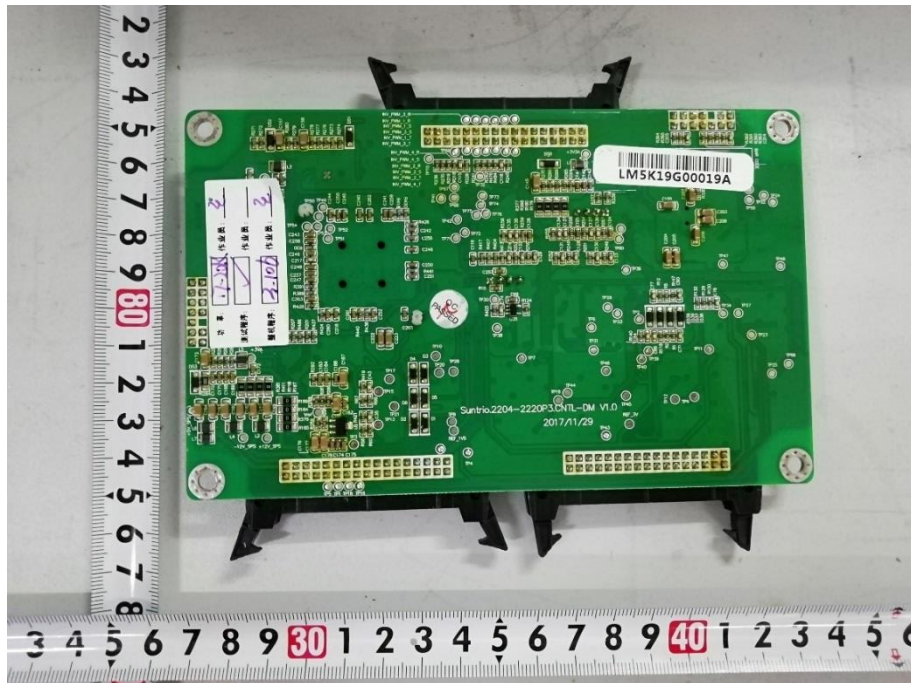


Figura 22. Vista traseira do painel de controle  
Figure 22. Back view of the control board

-Fim do relatório de ensaio-  
-End of test report-