

Self-Testing Report

1. Introduction

1.1 Report Name: SG50CX dry contact response time testing

1.2 Test Standard: Chapter 6 NS protection, VDE-AR-N 4105 2018-11

1.3 Test Result:

1.3.1 Single inverter testing: Single inverter emergency stop within 100ms when receiving command from external NS relay device..... Pass

1.3.2 Double inverters testing: Double inverters emergency stop within 100ms when receiving command from external NS relay device..... Pass

1.4 Hardware:

1.4.1 SG50CX*2

1.4.2 3rd party NS relay device*1

1.4.3 Oscilloscope*1

1.5 Test Date: 13 Dec 2019

1.6 Document:

1.6.1 Tested by: Shield Shi, Jagger Meng

1.6.2 Written by: Shield Shi

2. Single Line Diagram

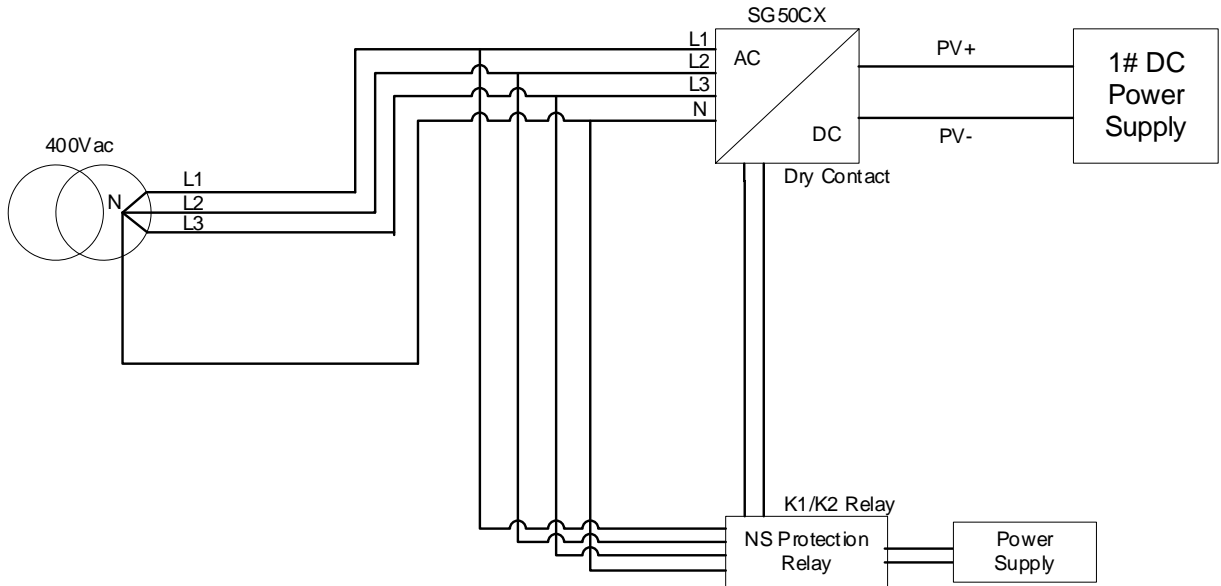


Figure 1 Single inverter testing

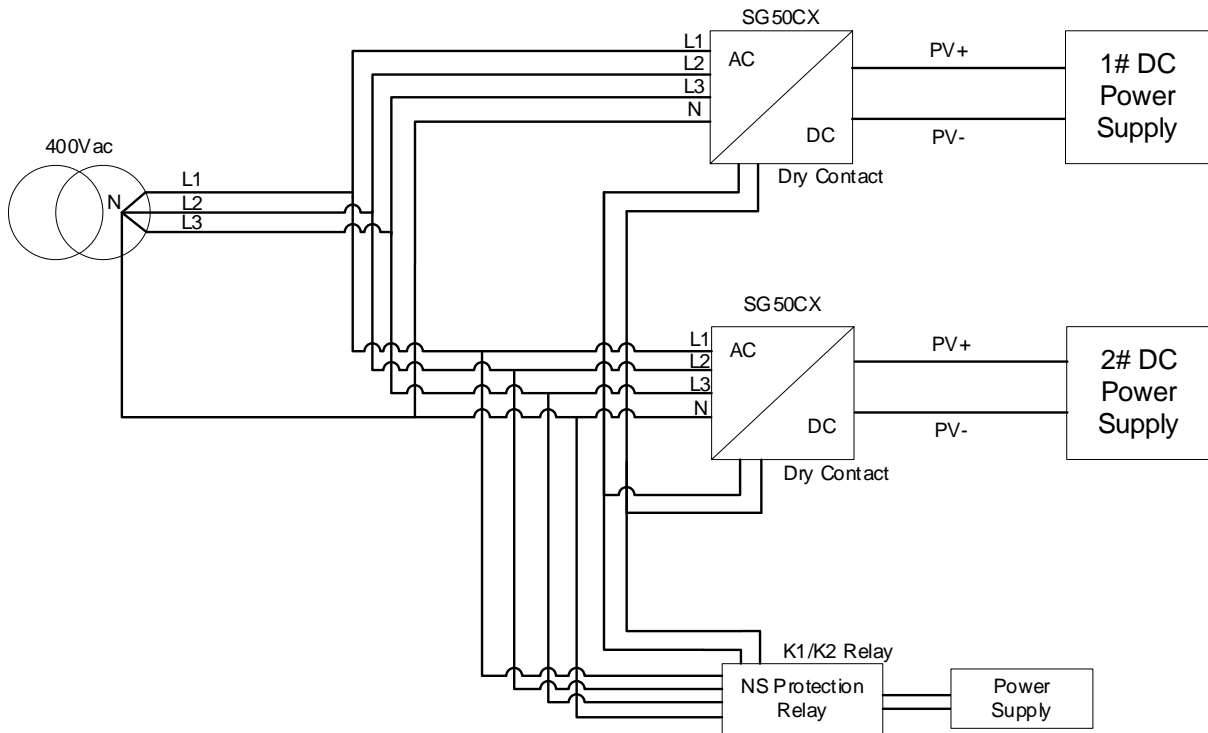


Figure 2 Double inverters testing

3. Test Item

3.1 Sample Information:

3.1.1 Sample Name: Photovoltaic Grid-connected Inverter

3.1.2 Sample Type: SG50CX*2

3.1.3 Sample Picture:



3.2 Testing information

Test Item	SG50CX dry contact response time testing		
Date	13 Dec 2019	Engineer	Jagger Meng, Shield Shi
Temp	15°C/20°C	Site	Testing platform in Workshop 1
Standard	Chapter 6 NS protection, VDE-AR-N 4105 2018-11		

3.3 Test Instruments

Instrument	Type
#1 PV Power supply	1000Vdc. PV.HMI
#2 PV Power supply	1000Vdc. PV.HMI
Normal Grid	400Vac 3P, N

3.4 Single inverter testing

Connected wires and cables as the way showed in figure 1, start the inverter after safety check. Set the inverter' s default protection parameter value higher than the default value required by VDE 4105 2018 to ensure that the inverter won' t take protection action before the NS relay device when a simulate external grid abnormal signal is detected.

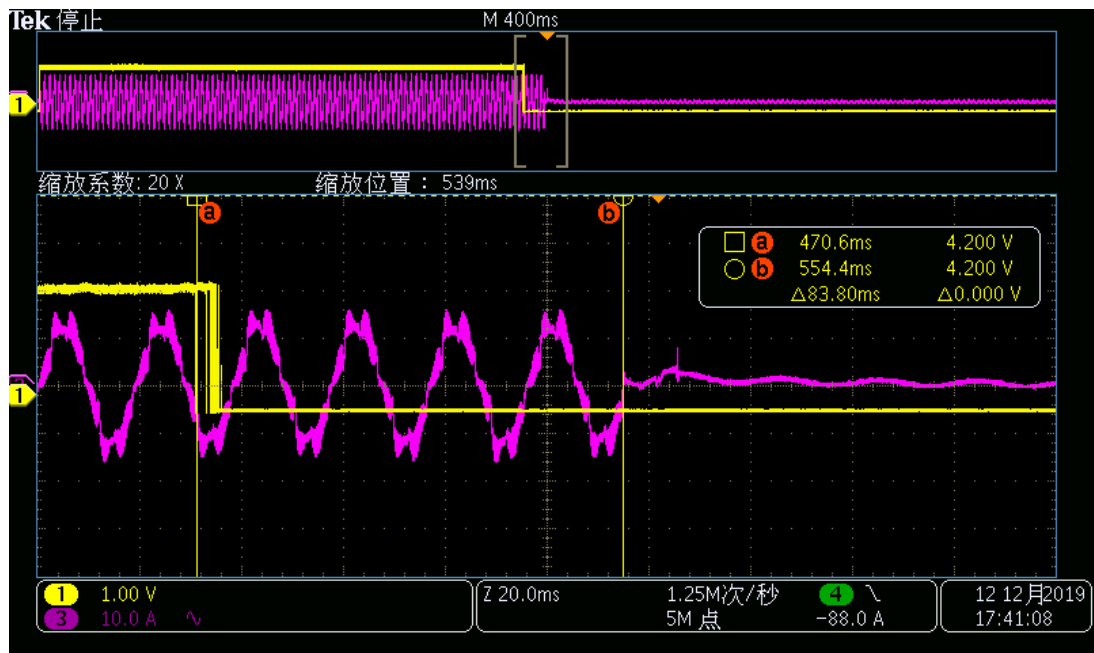
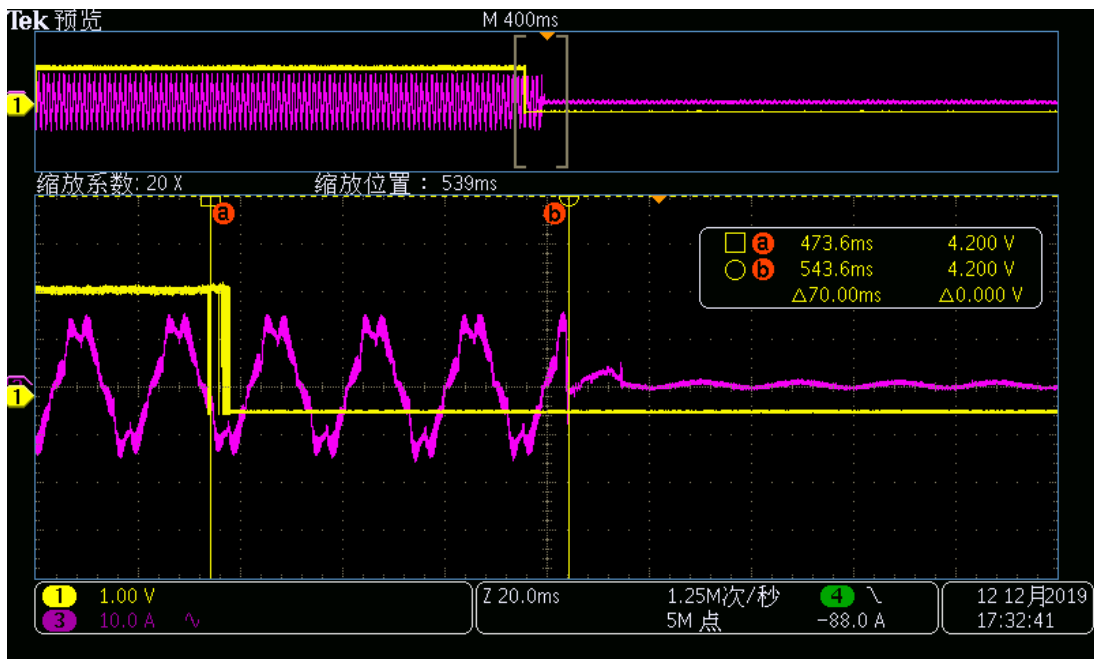
Record the response time of the inverter from receiving the command from the NS relay to emergency stop by the oscilloscope 3 times as result 1, 2 as below:

	4105 Value	Inverter Set Value	Simulate Value	Result 1	Result 2
Over Frequency	51.5Hz	53Hz	52Hz	70ms	83.8ms
Under Frequency	47.5Hz	46Hz	47.3Hz	78.8ms	67.4ms
Over Voltage	287V	300V	290V	79.6ms	72ms
Under Voltage	184V	170V	180V	74.6ms	77.8ms

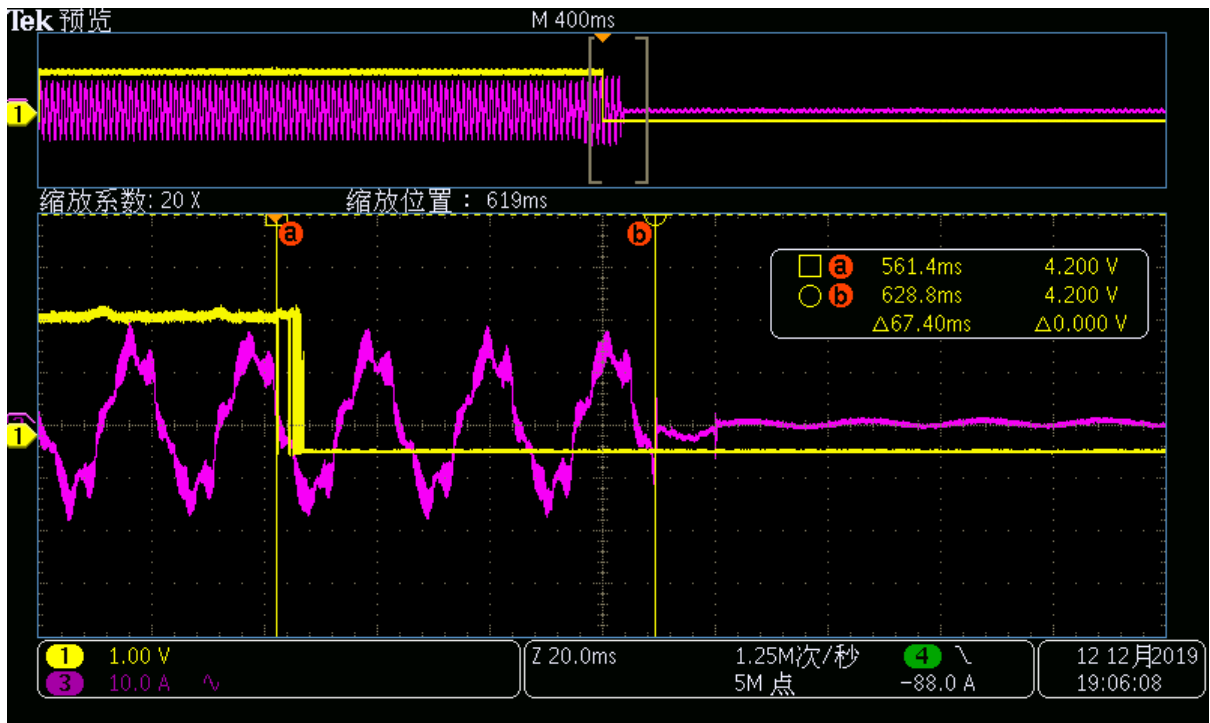
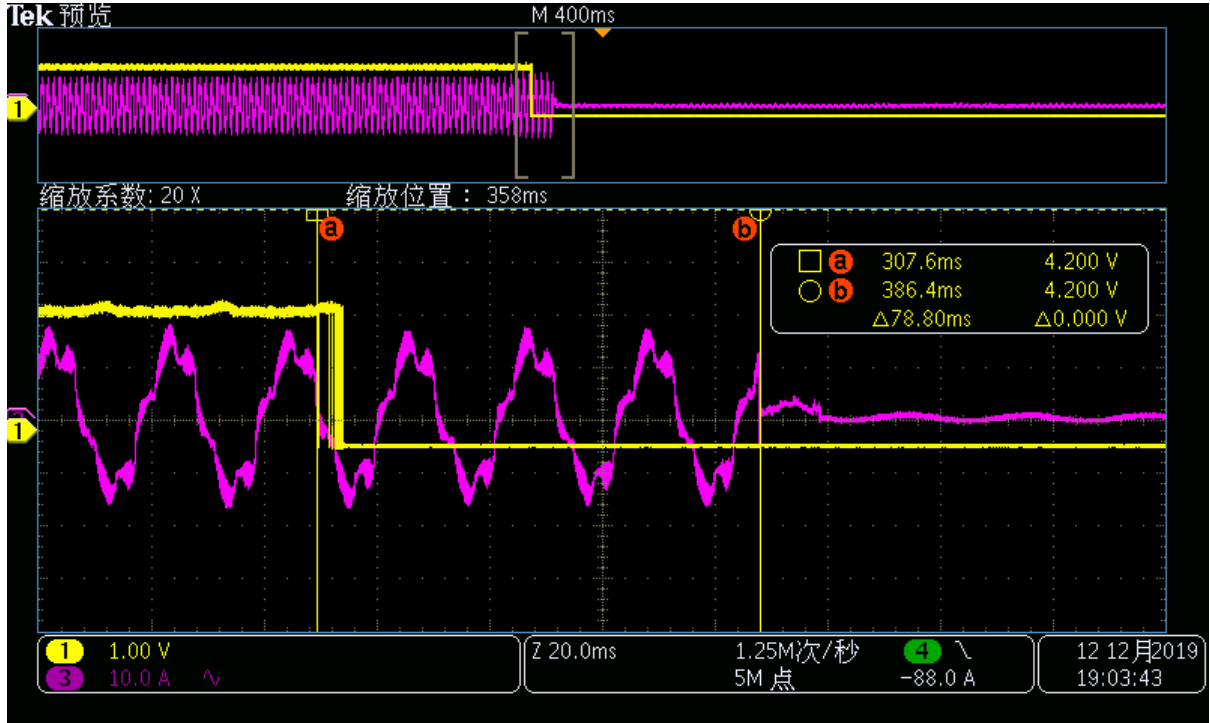
From the results we could know that all of them are lower than 100ms, which means that for single inverter application, the response and switch-off time of the internal AC interface switch integrated in the SG50CX doesn' t exceed 100ms.

Took the first screenshot of 3.4.1 as an example, the purple curve represents the normal running status of the inverter, while the yellow curve is the status of the DI port of the inverter (high level in normal condition, and switching to low when an external short-circuit signal is entered). "a" line meets the timepoint when the level of DI port switch to low from high, "b" line meets the timepoint when the inverter is shut-down. **Delta time ($\Delta 70.00\text{ms}$) of "b" to "a" is the testing result.**

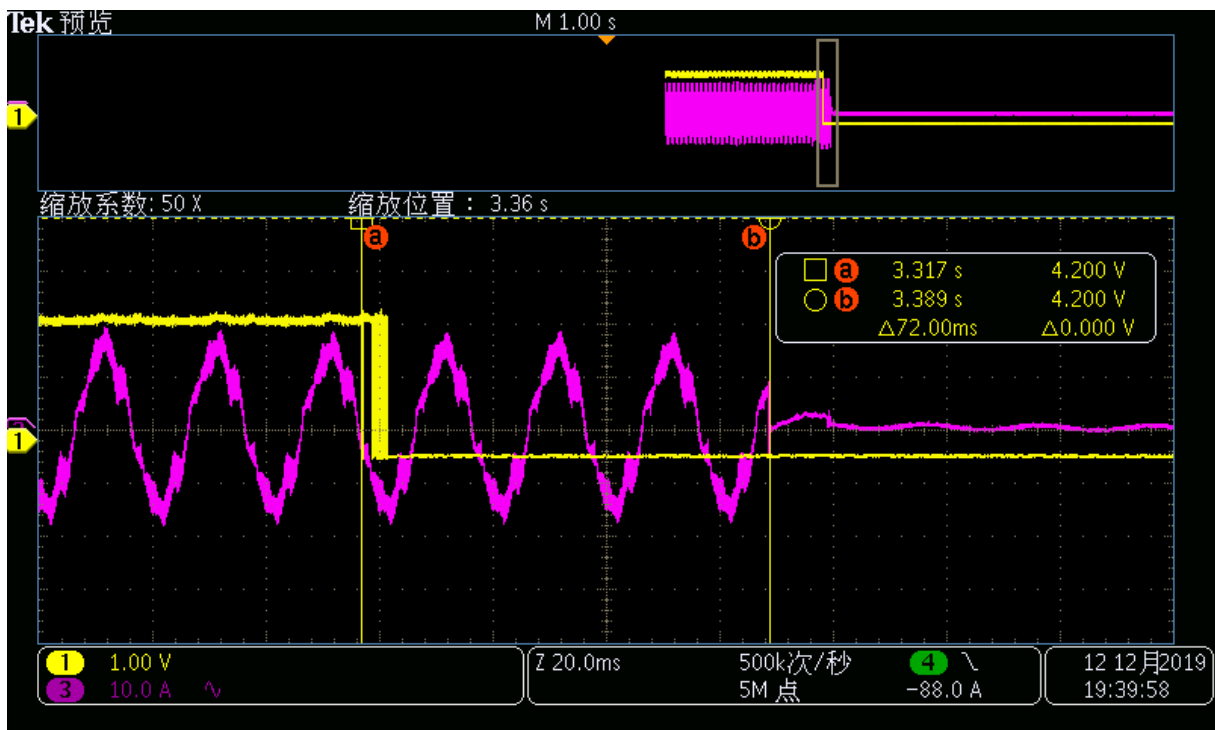
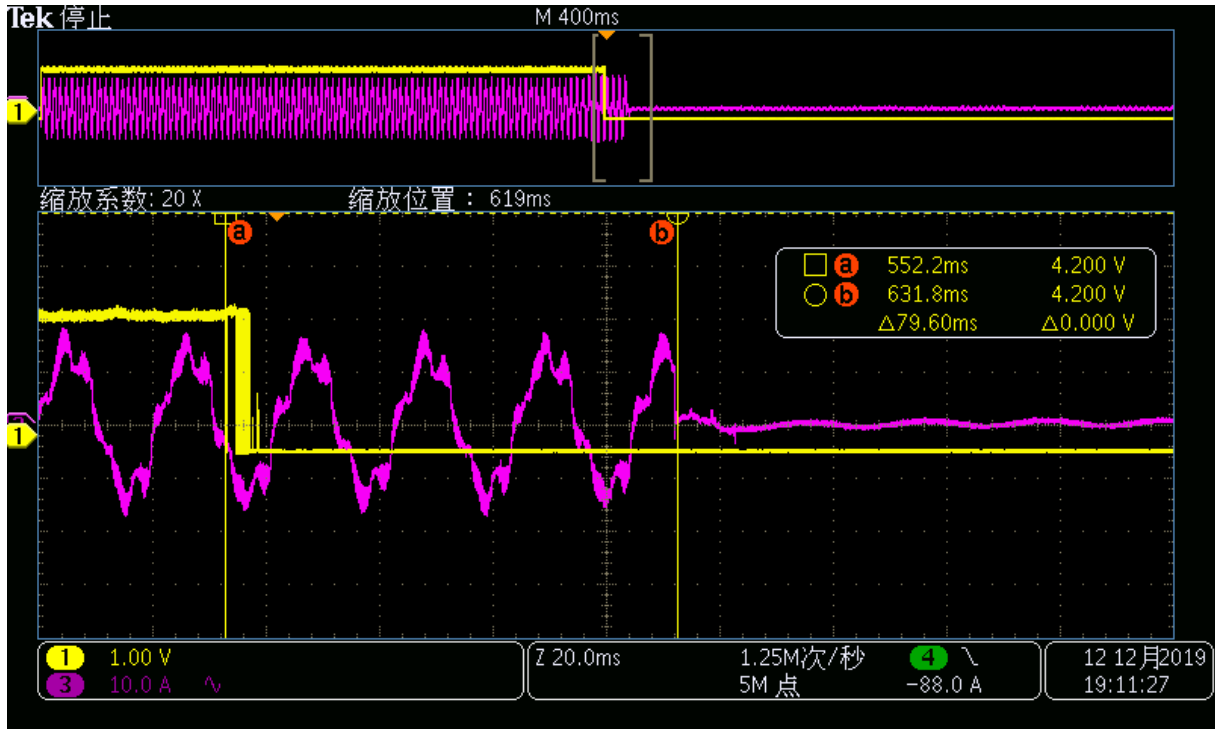
3.4.1 Over frequency testing (52Hz):



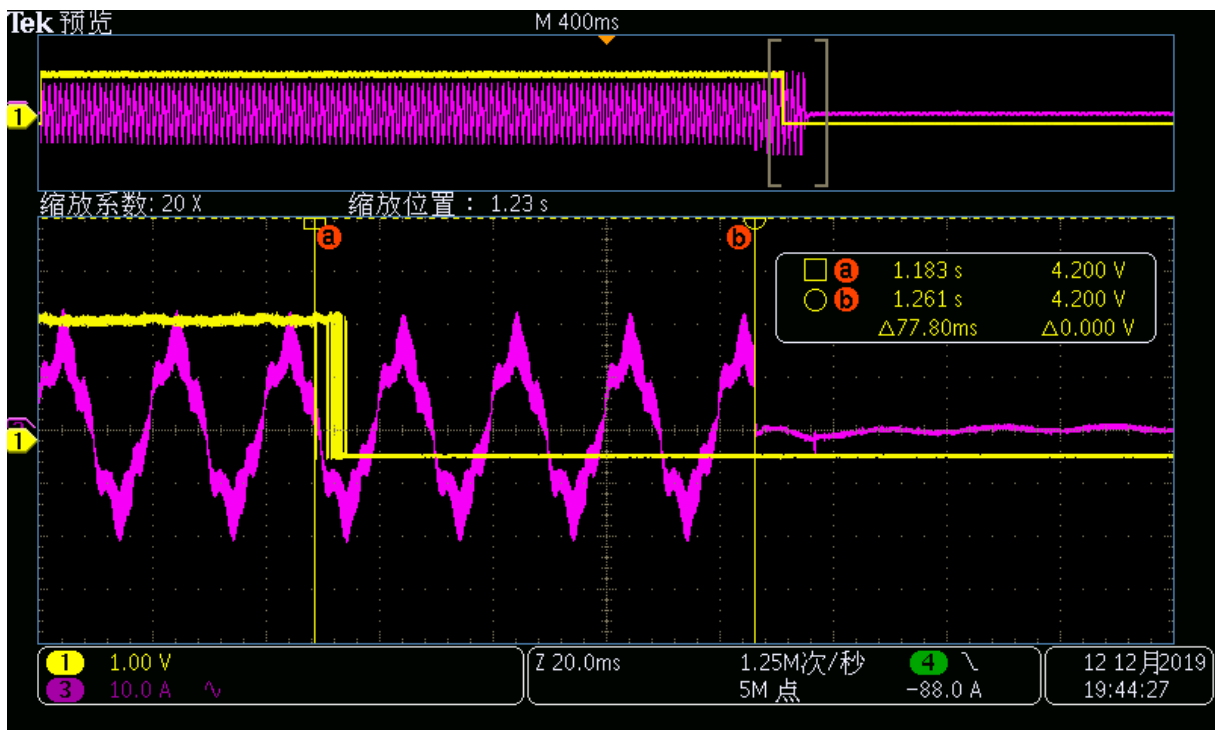
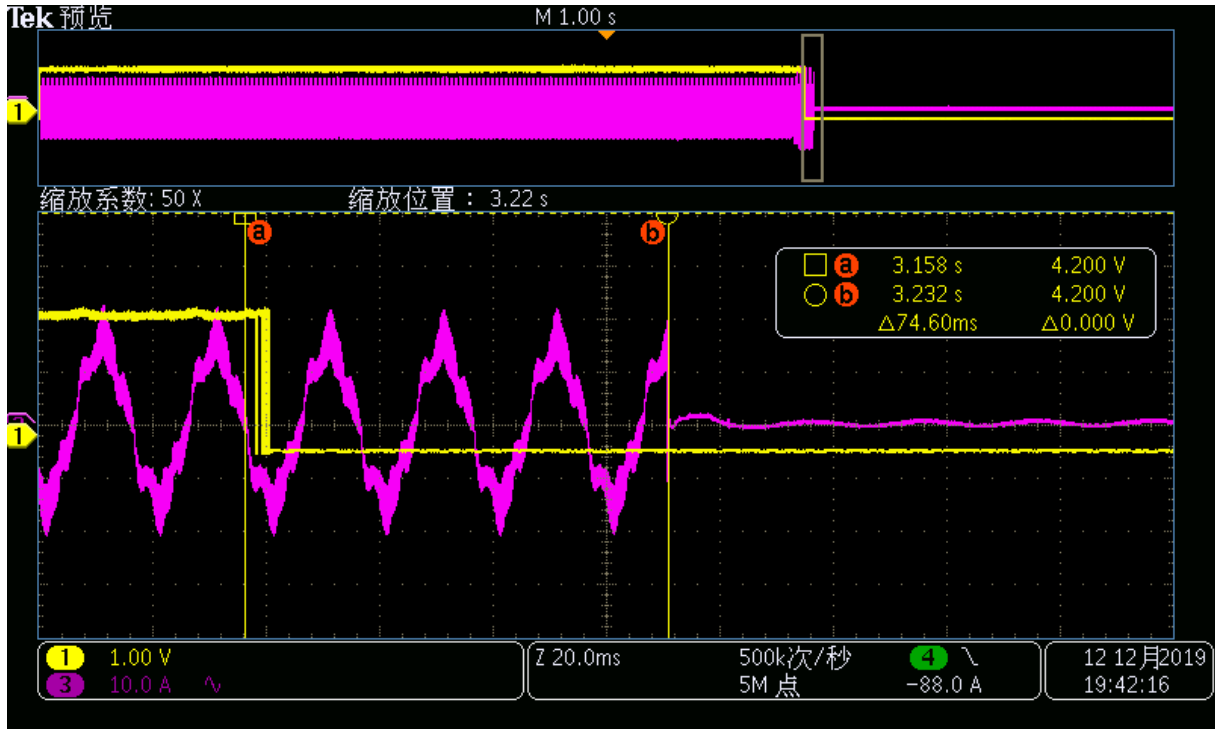
3.4.2 Under frequency testing (47.3Hz):



3.4.3 Over voltage testing (290V):



3.4.4 Under voltage testing (180V):



3.5 Double inverters testing

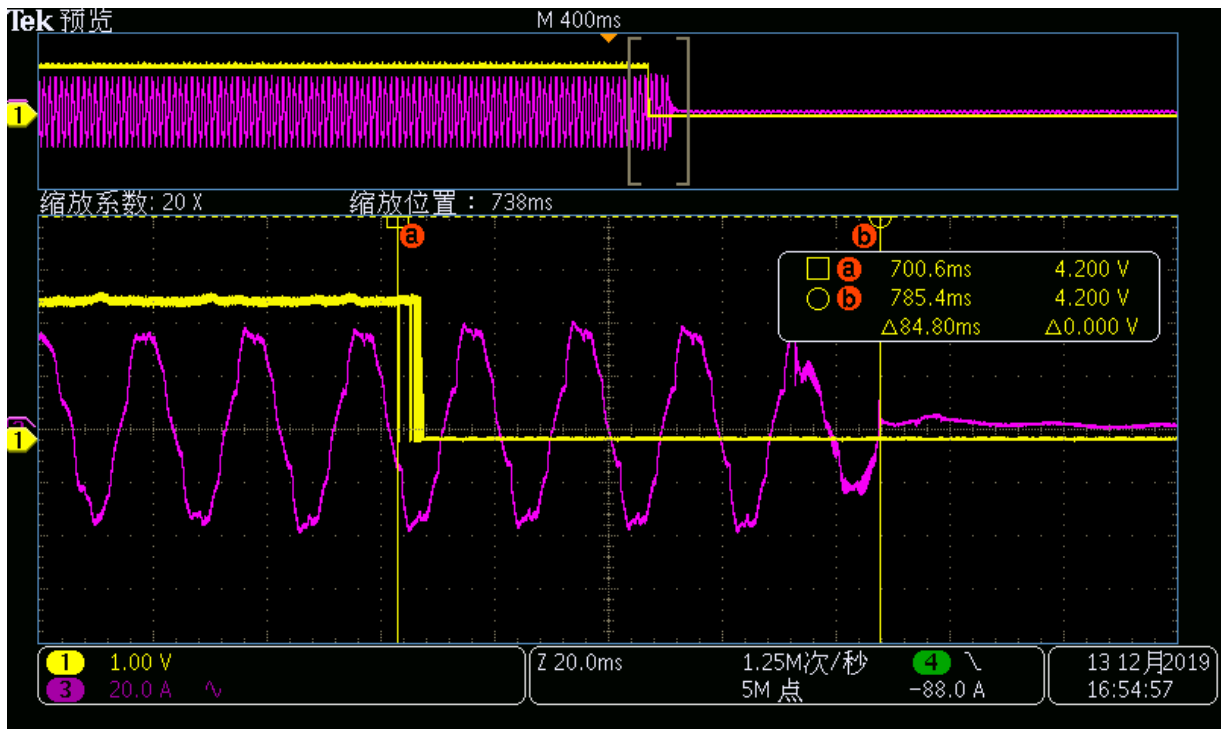
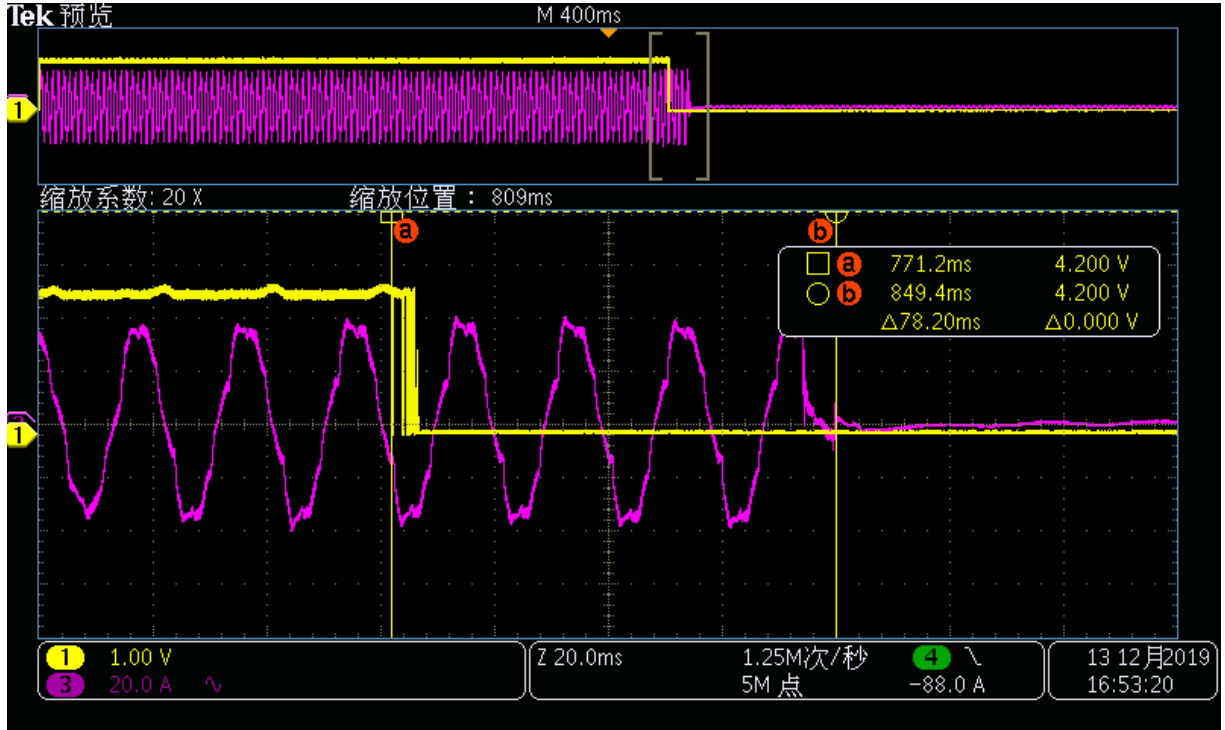
Connected wires and cables as the way showed in figure 2, start the inverters after safety check. Set the inverters' default protection parameter value higher than the default value required by VDE 4105 2018 to ensure that the inverters won't take protection action before the NS relay device when a simulate external grid abnormal signal is detected.

Record the response time of the inverter from receiving the command from the NS relay to emergency stop by the oscilloscope 3 times as result 1, 2 as below:

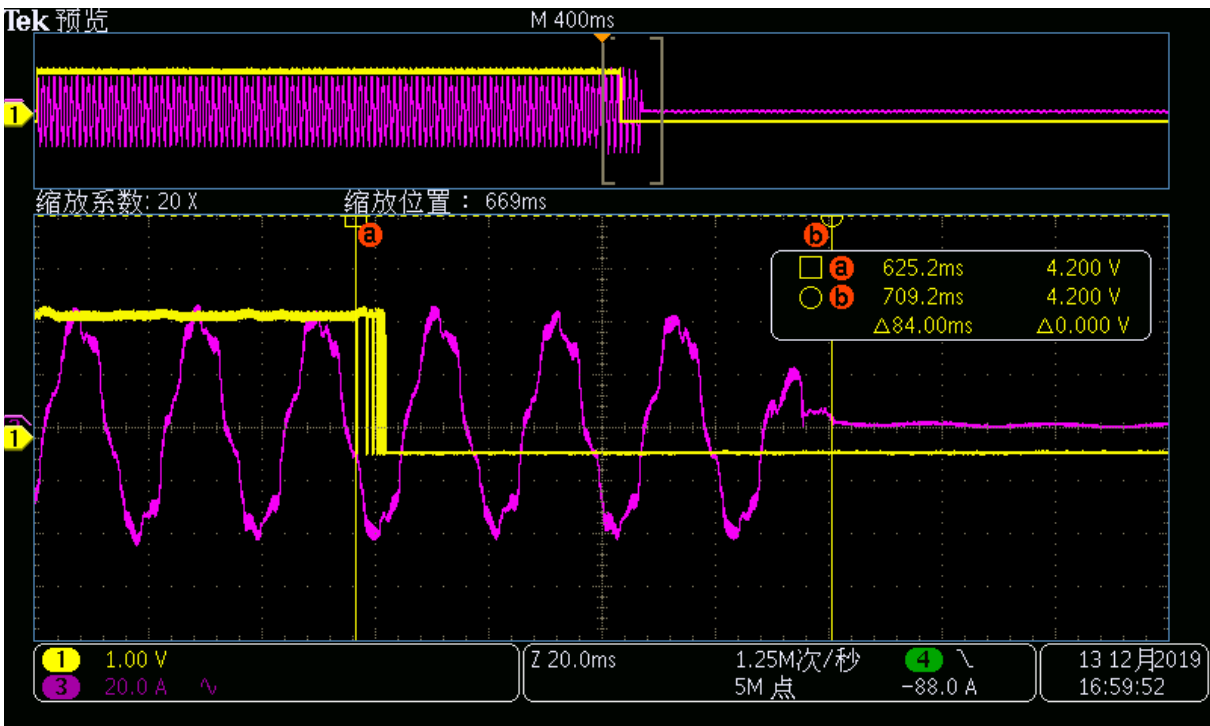
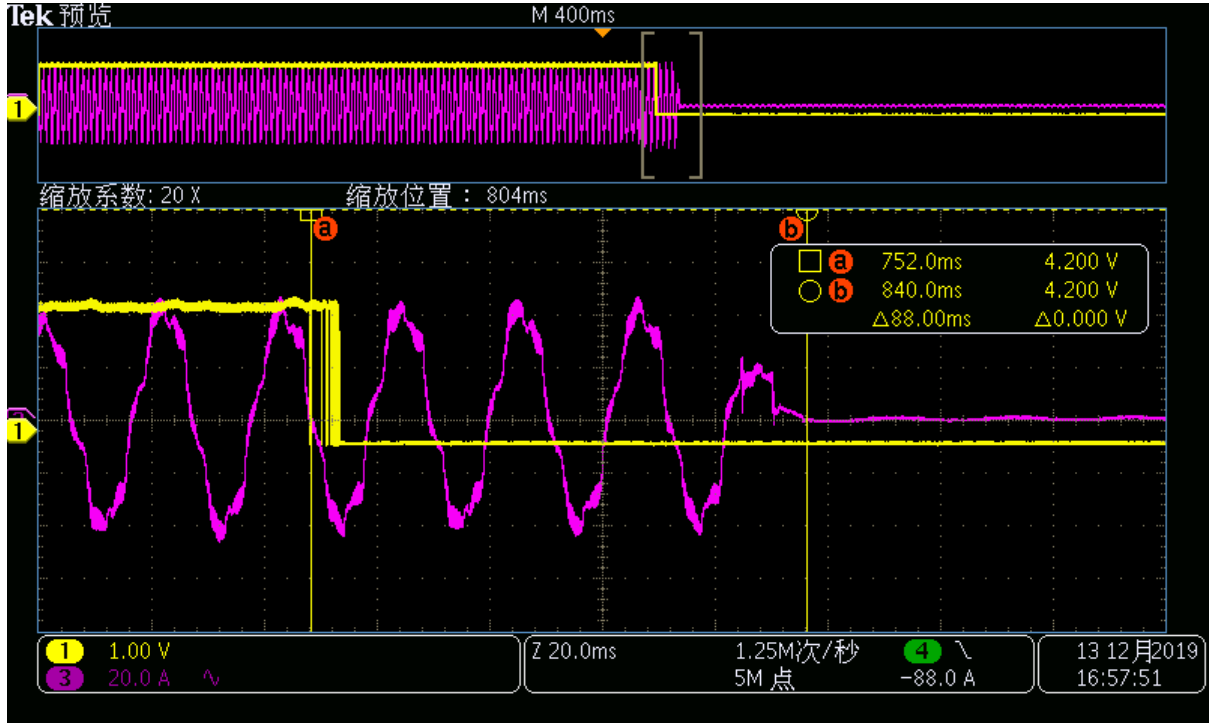
	4105 Value	Inverter Set Value	Simulate Value	Result 1	Result 2
Over Frequency	51.5Hz	53Hz	52Hz	78.2ms	84.8ms
Under Frequency	47.5Hz	46Hz	47.3Hz	88ms	84ms
Over Voltage	287V	300V	290V	77.4ms	79.8ms
Under Voltage	184V	170V	180V	79.8ms	82.6ms

From the results we could know that all of them are lower than 100ms, which means that for double inverters application, the response and switch-off time of the internal AC interface switch integrated in the SG50CX doesn't exceed 100ms.

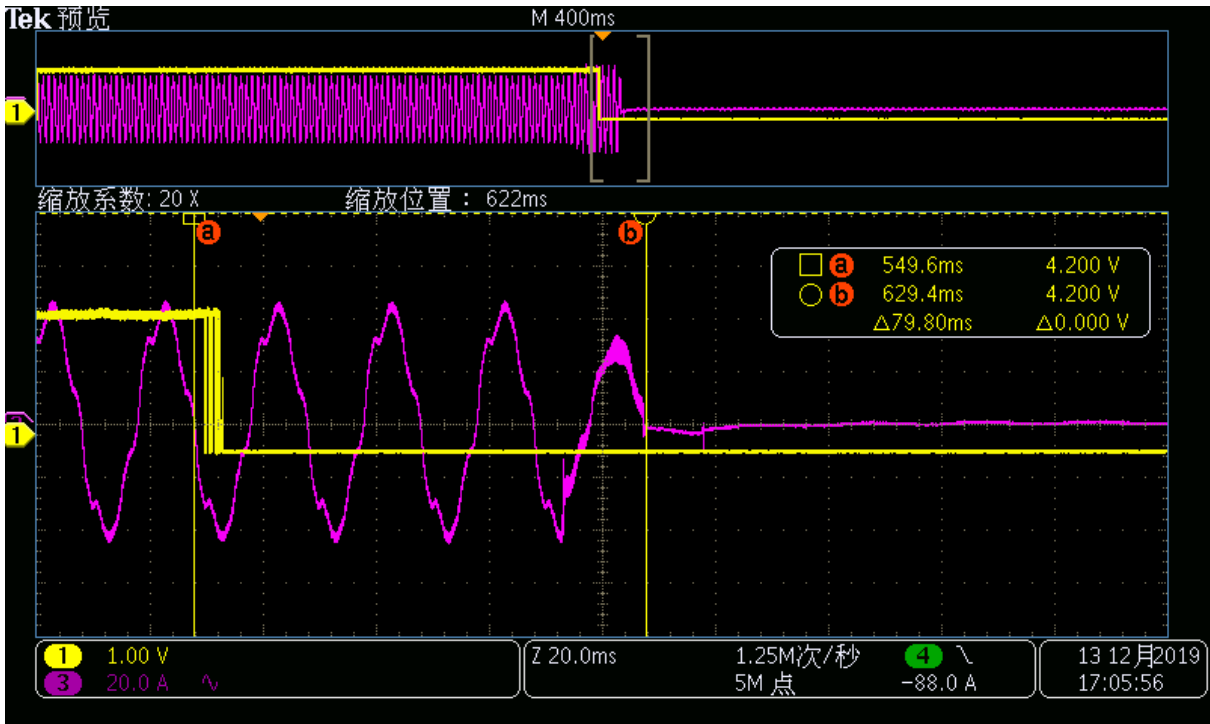
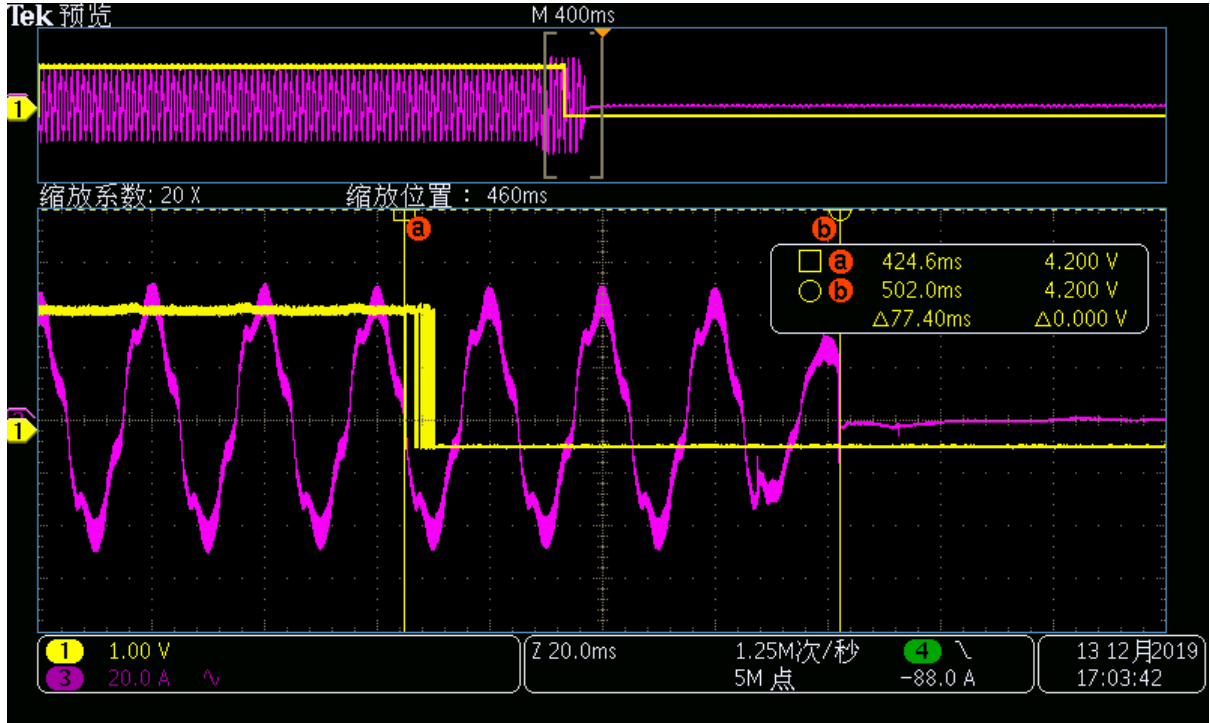
3.5.1 Over frequency testing (52Hz):



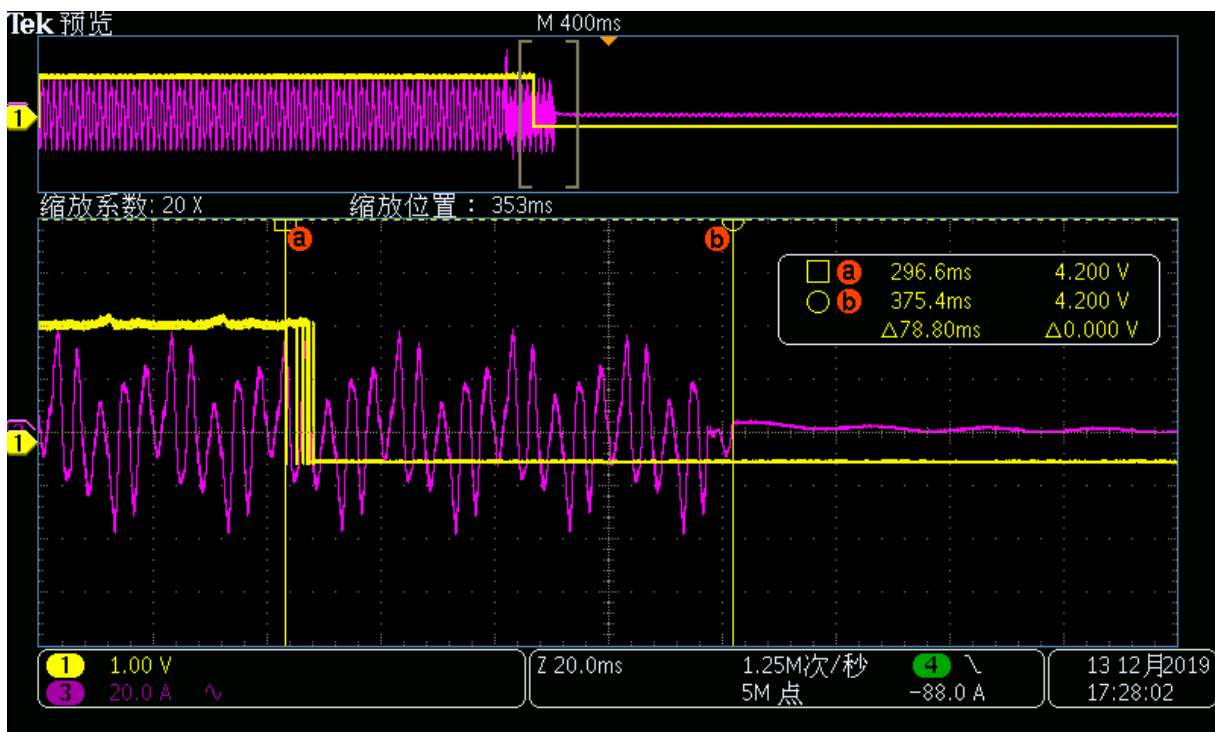
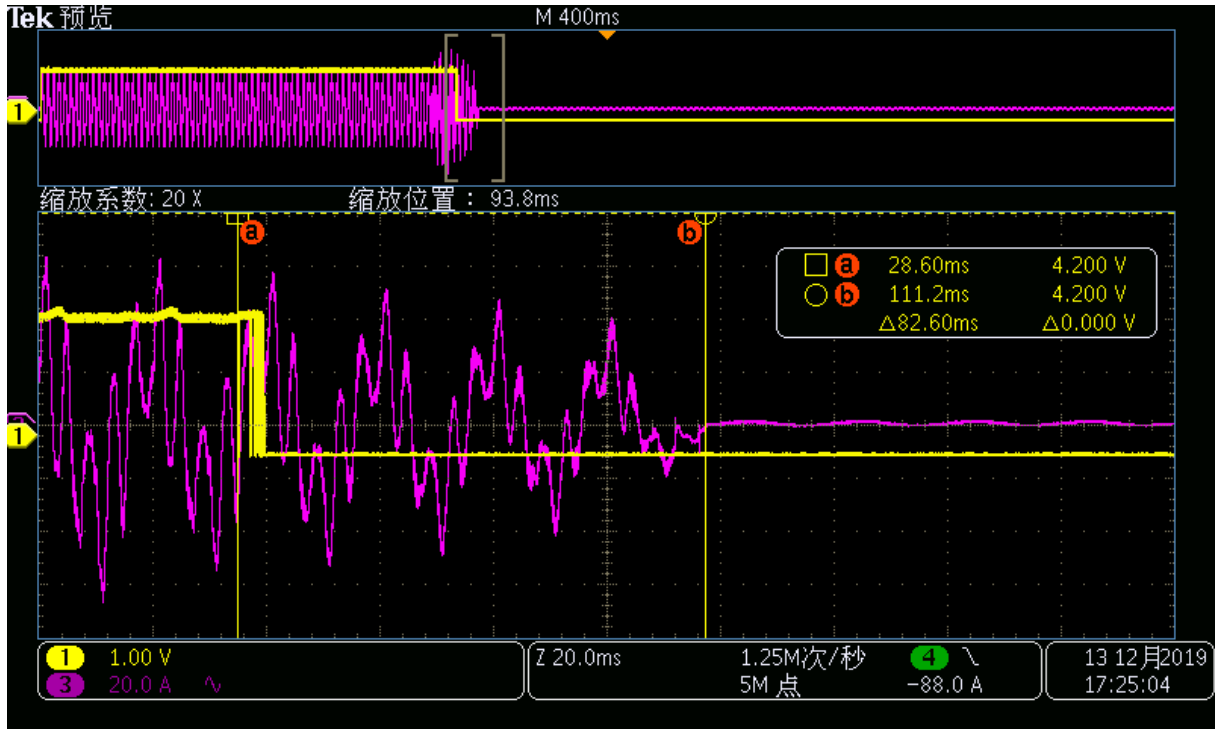
3.5.2 Under frequency testing (47.3Hz):



3.5.3 Over voltage testing (290V):



3.5.4 Under voltage testing (180V):



4. Conclusion

- 4.1 For single SG50CX application, the response and switch-off time of the internal AC interface switch integrated in the SG50CX doesn't exceed 100ms.
- 4.2 For double SG50CXs application, the response and switch-off time of the internal AC interface switch integrated in the SG50CX doesn't exceed 100ms.
- 4.3 The dry contact of the inverter is connected to the potential-free signal contact of the external NS monitoring unit. An AC disconnection by the interface switch installed in the inverter takes place within 100ms after being triggered by the signal contact of the external NS monitoring unit. The AC interface switch integrated in the inverter is checked for correct function by the inverter before each connection process. The inverter also checks the switching capability of its interface switch on a daily basis. In the event of a malfunction, the error is reported and the inverter does not connect to the public power grid, this also applies if it is enabled by the central NS protection (VDE-AR-N 4105: 2018-11 Section 6.4.1 Method C).