Troubleshooting X,Y,Z sensor/nulling error in ICON

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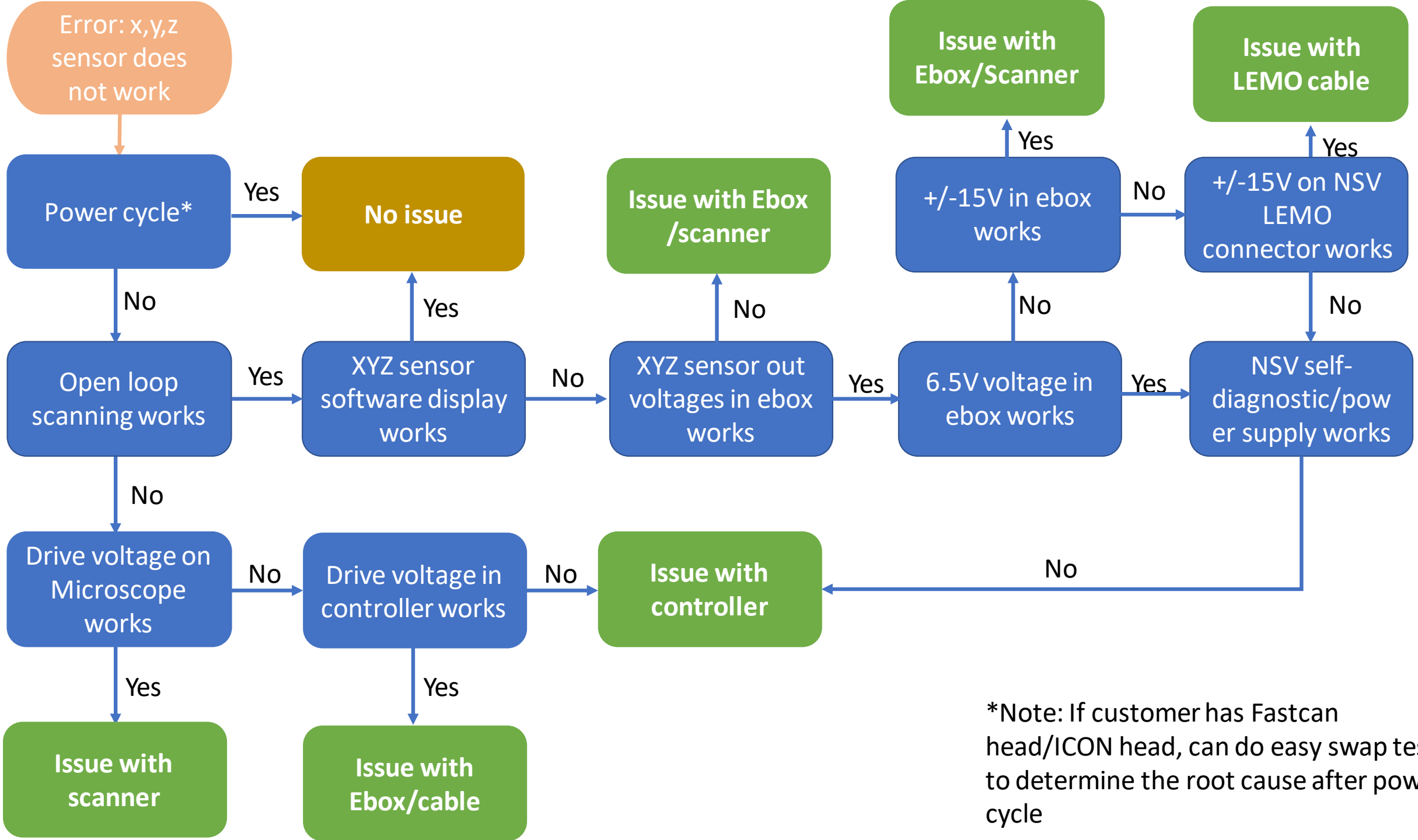
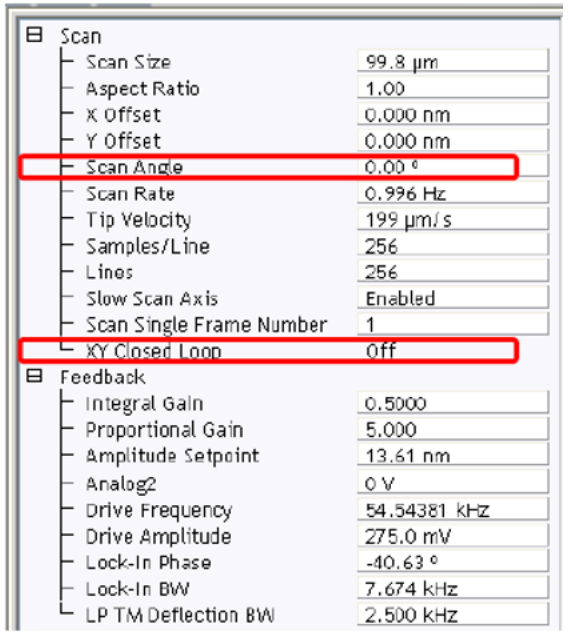
- The purpose of this document is to collect as many data as possible from customer, please provide all the data collected and send to Bruker service Engineers.

- Please refer to following the documents for additional troubleshooting details if you have fundamental questions:
  NBSB0143_Scanner Closed-Loop Errors on NS5 Systems
  TS guide Closed-loop Rev B_r
  Stargate Scanner Troubleshooting Guide
  NS-V controller troubleshooting procedure
  NBSB0003 NS5 Diagnostic System Tool
  NBSB0016 Testing the HV Board and Supply on NS5 and BIO-II Controllers


Error: x,y,z sensor does not work
Power cycle*
Yes
No issue
No
Yes
Open loop scanning works
Yes
XYZ sensor software display works
No
XYZ sensor out voltages in ebox works
Issue with Ebox /scanner
No
Yes
6.5V voltage in ebox works
Yes
NSV self-diagnostic/power supply works
No
+/-15V in ebox works
No
+/-15V on NSV LEMO connector works
Yes
Issue with Ebox/Scanner
Yes
Issue with LEMO cable
No
Drive voltage on Microscope works
No
Drive voltage in controller works
No
Issue with controller
Yes
Issue with scanner
Yes
Issue with Ebox/cable
*Note: If customer has Fastcan head/ICON head, can do easy swap test to determine the root cause after power cycle

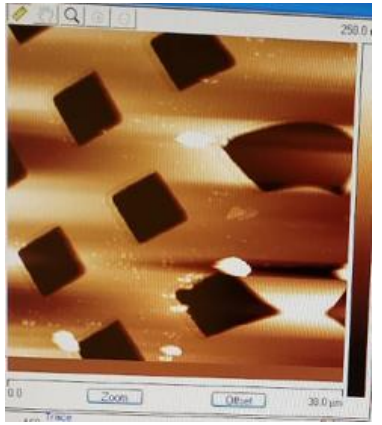
Power cycle and check open loop

- First power cycle: close software>> controllers>> computer; then turn on computer>>controllers>>software and try to scan again
- Load contact/tapping mode, Put open loop(closed loop off), use Calibration grid sample to get a max scan size image, collect both **height and height sensor** chanels. save the image and send to support team
- Check if tip is moving normally in the video image

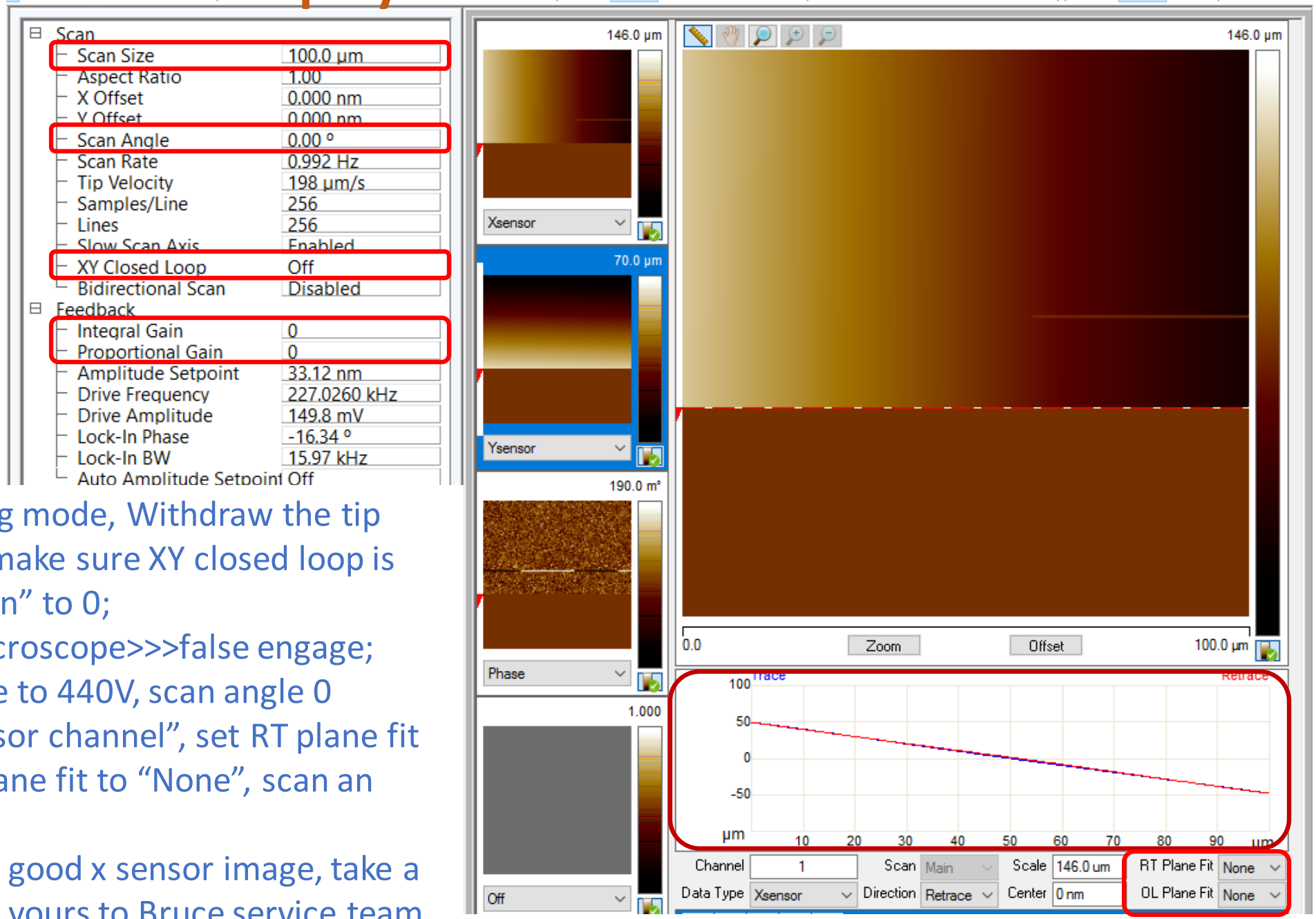


1. If open loop works, check slides 4- 13

2. If open loop can't engage or the image is distorted, go to slides 16-22(check ICON scanner drive voltage). example of a distorted Open loop height image below:



XYZ sensor software display: X sensor

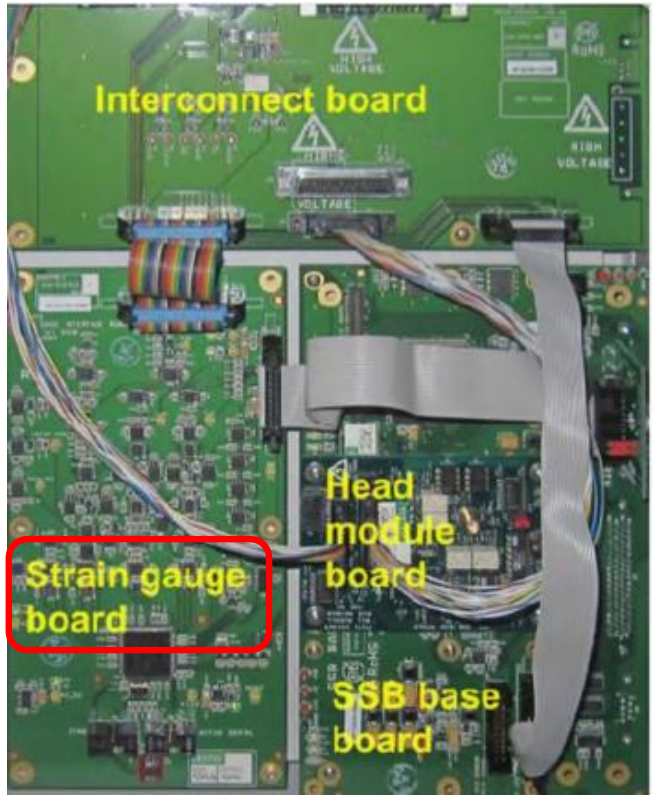


- Load contact/Tapping mode, Withdraw the tip twice to lift the tip, make sure XY closed loop is off; put “Igain” “Pgain” to 0;
- Click on to menu Microscope>>>false engage;
- Set the Max scan size to 440V, scan angle 0 degree, open “X sensor channel”, set RT plane fit to “None” and OL plane fit to “None”, scan an image
- Right is a example of good x sensor image, take a screenshot and send yours to Bruce service team.

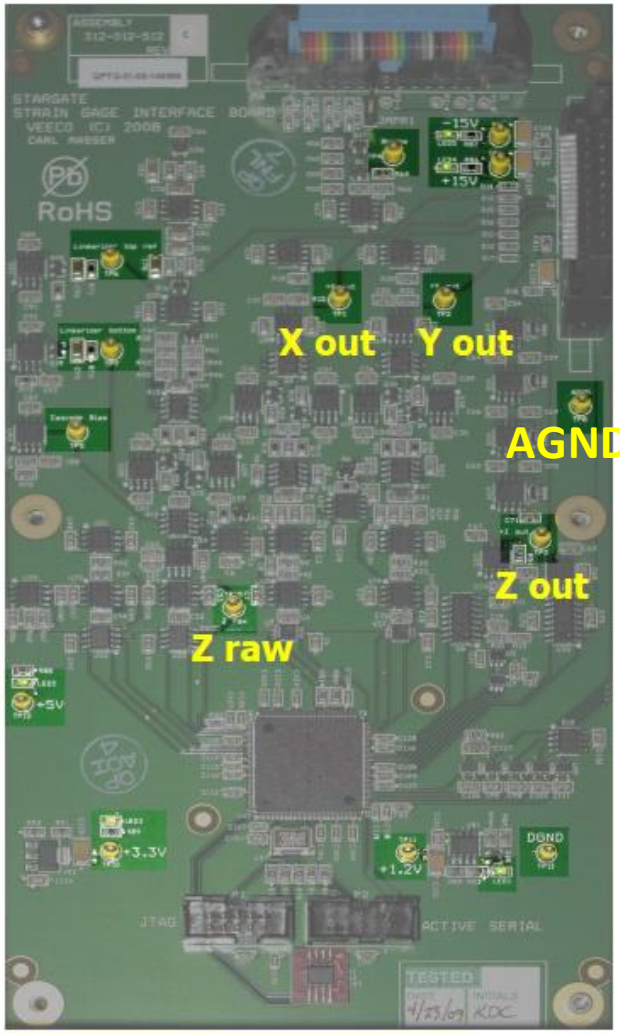
Measure the +X out in the e-box(false engage)

Test Point	Reference	Function
TP1	+X OUT	+X sensor out signal

1. Find where the Strain gauge board located in ebox



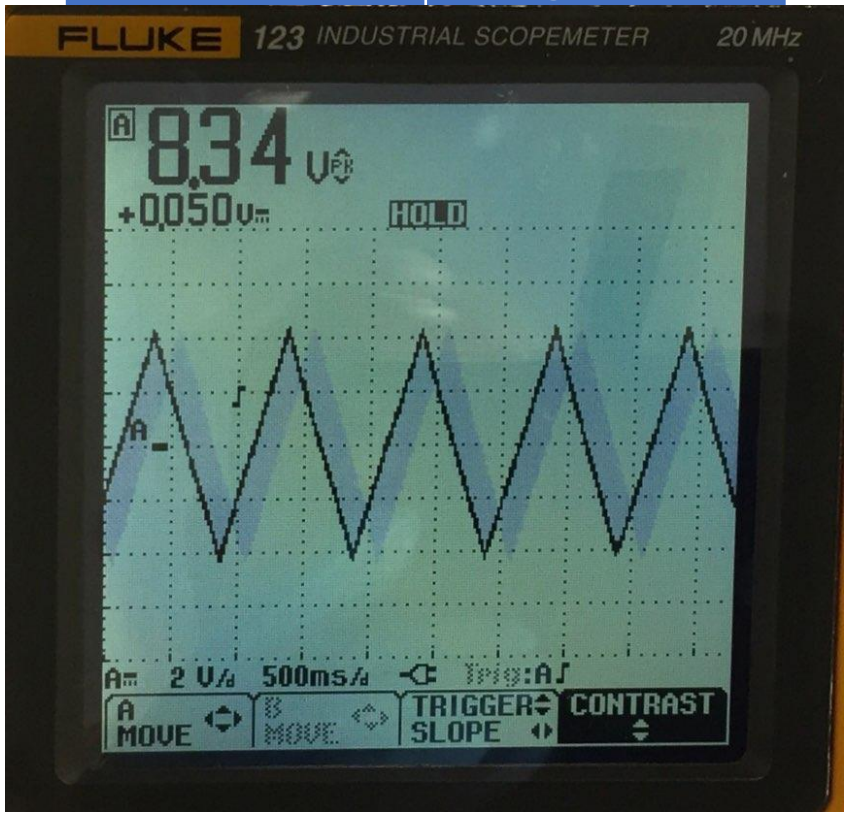
2. Find where +X out on strain gauge board



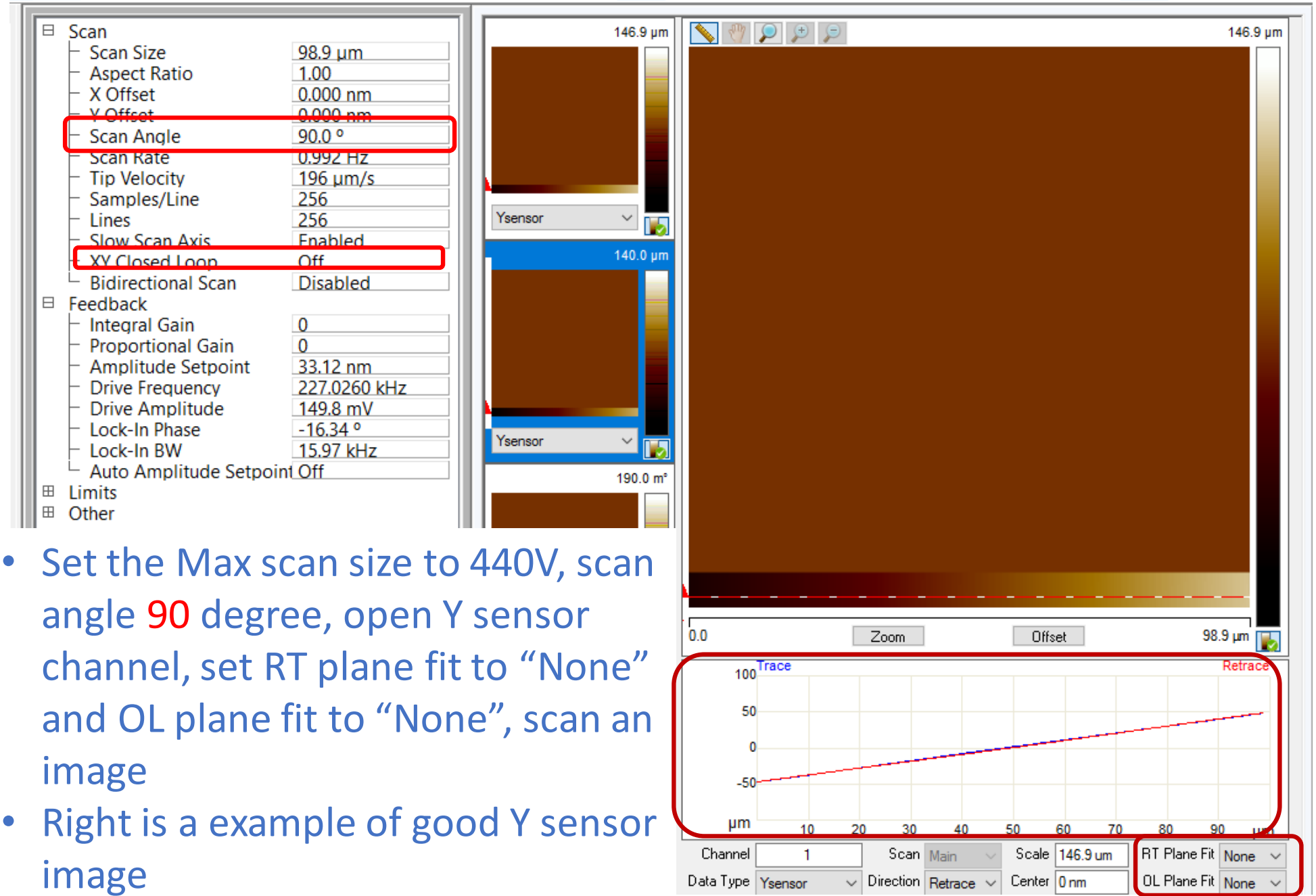
Strain gauge interface board

3. Use Oscilloscope to measure, use **AGND** as ground

+X OUT	8~10 Vpp triangular wave



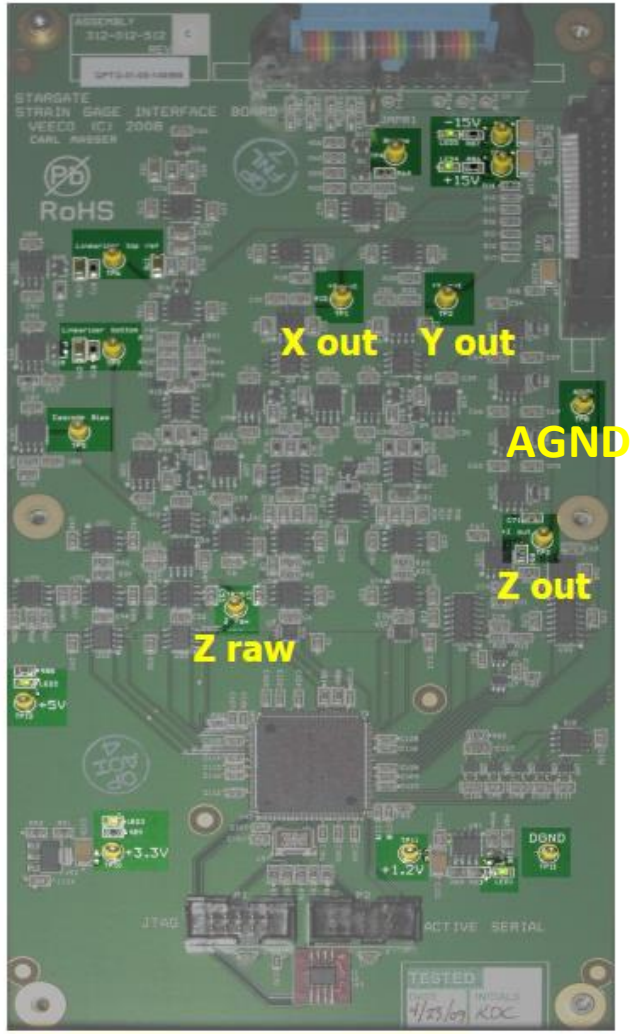
XYZ sensor software display: Y sensor(90°)



- Set the Max scan size to 440V, scan angle 90 degree, open Y sensor channel, set RT plane fit to “None” and OL plane fit to “None”, scan an image
- Right is a example of good Y sensor image

Measure the +Y out (false engage, 90°)

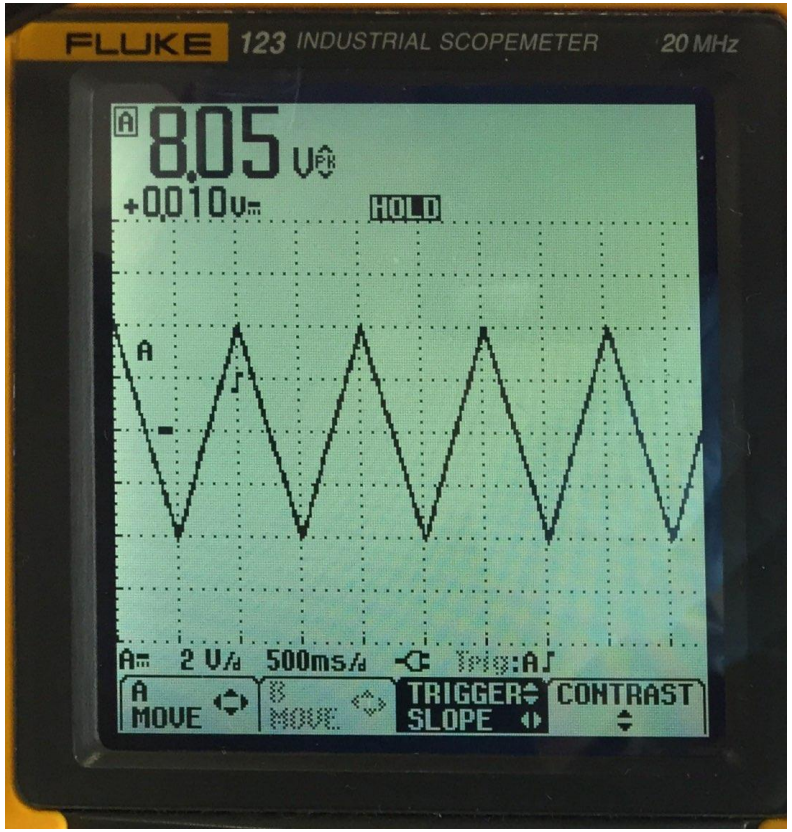
TP2	+Y OUT	+Y sensor out signal



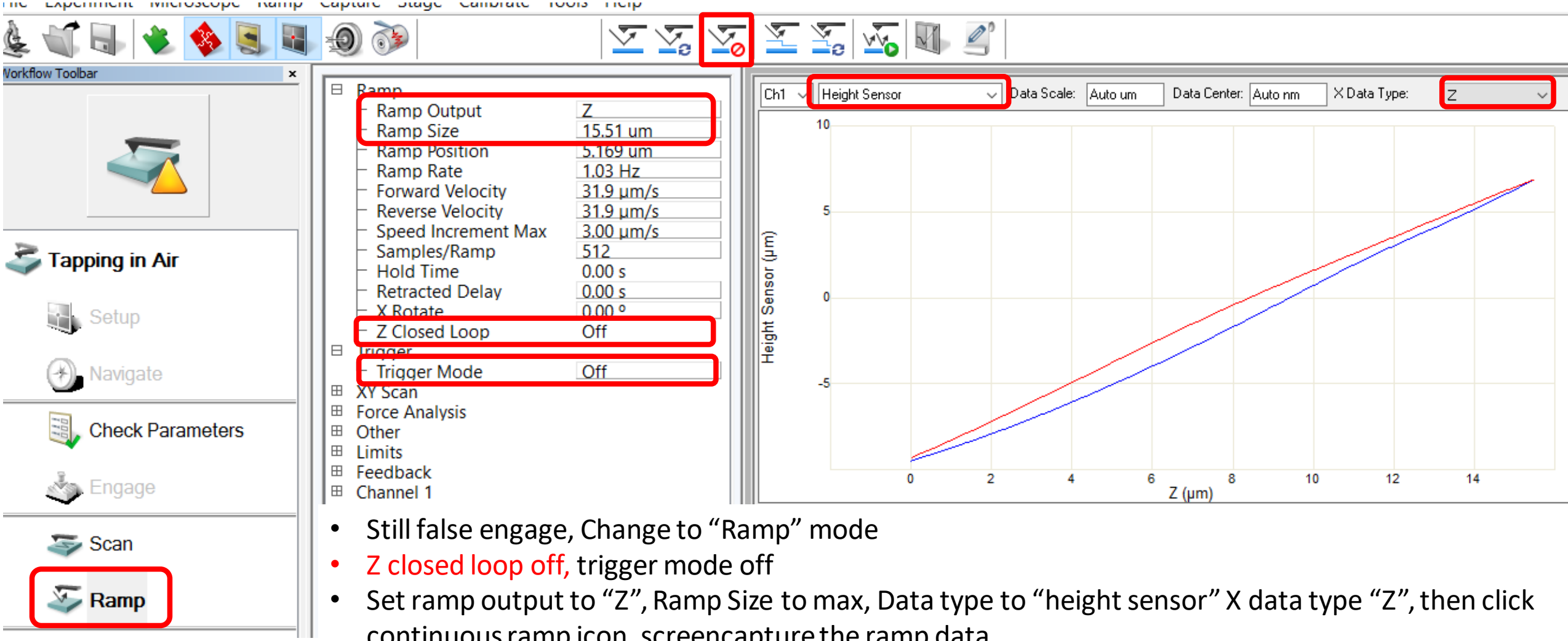
Strain gauge interface board

Use Oscilloscope to measure +Y out, use **AGND** as ground

+Y OUT	**8~ 10 Vpp triangular wave**



XYZ sensor software display: Z sensor

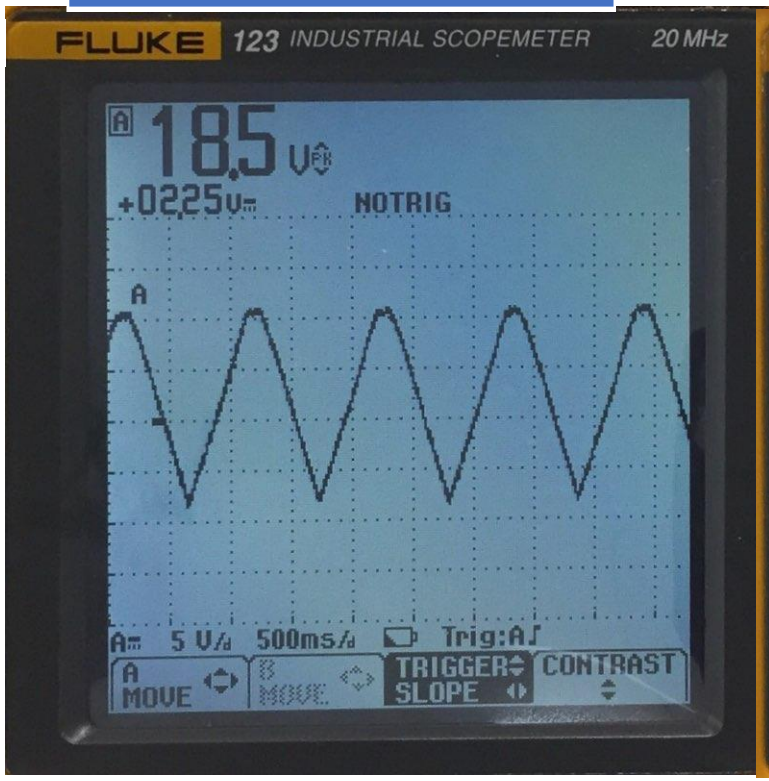


- Still false engage, Change to “Ramp” mode
- Z closed loop off, trigger mode off
- Set ramp output to “Z”, Ramp Size to max, Data type to “height sensor” X data type “Z”, then click continuous ramp icon, screencapture the ramp data
- Above is a good example of Z sensor

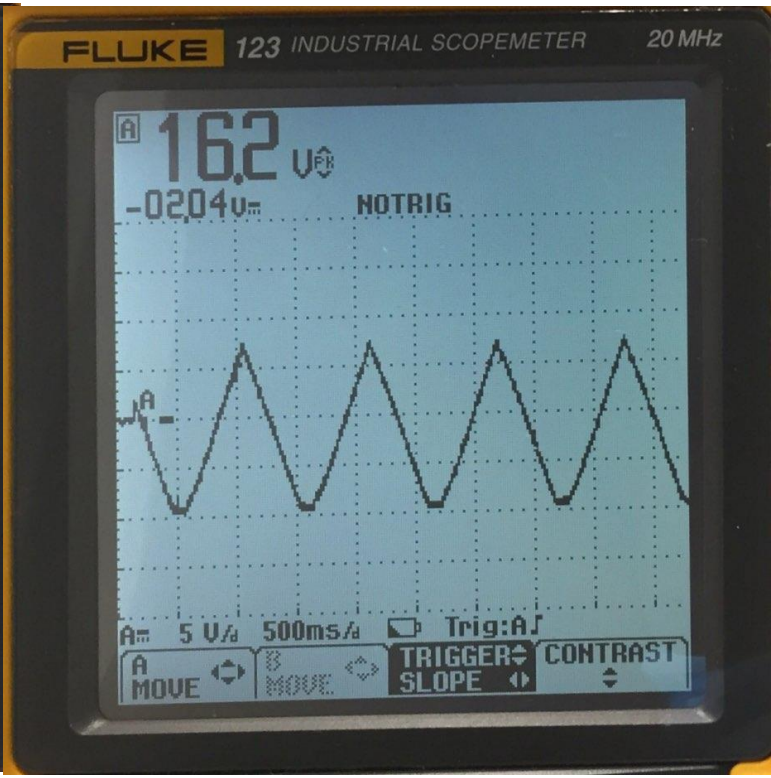
Measure the +Z out/Z raw and use AGND as ground in ebox

TP3	+Z OUT	+Z sensor out signal
TP15	Z raw	Z sensor signal before selectable gain stage

+Z Raw(from scanner)



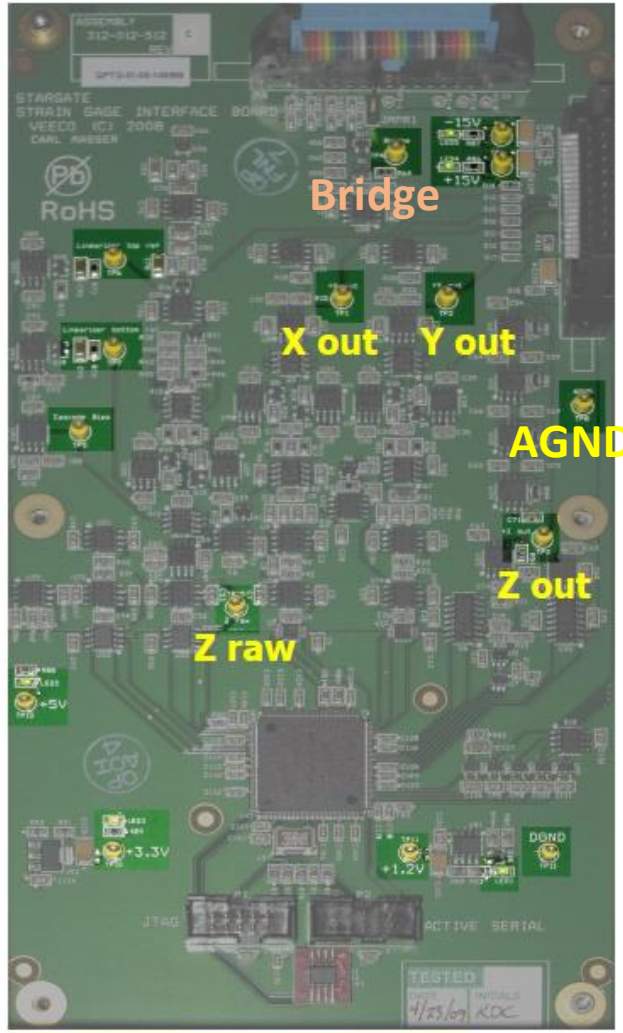
+Z OUT(to controller)



measureTP4 +6.5 V DC and others in ebox

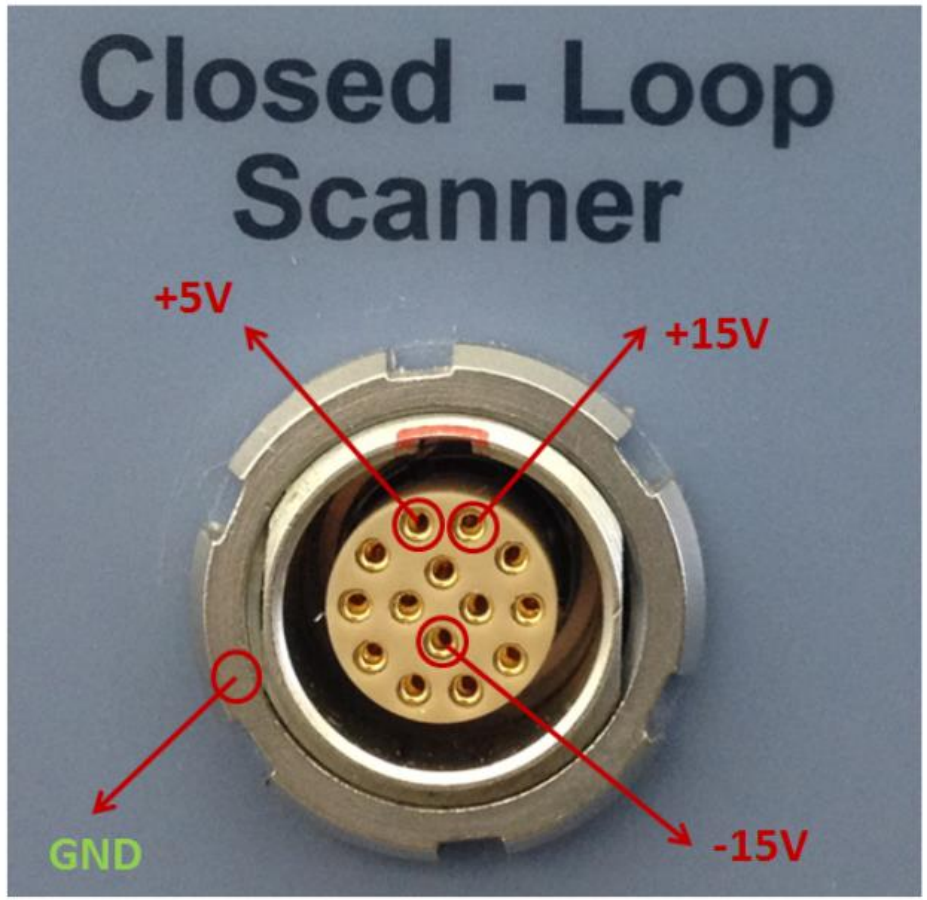
Please measure the voltages in the table below and send to Bruker service

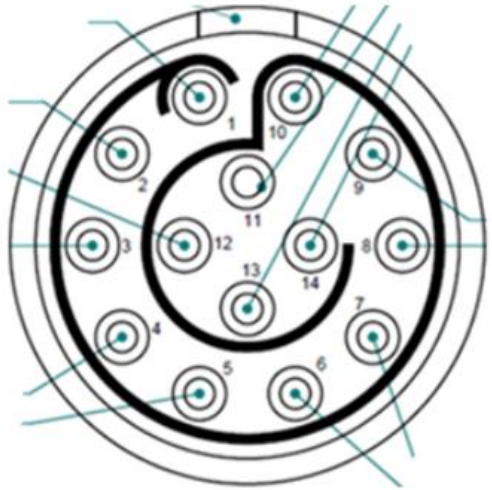
Test point	Reference	function	Measurement condition
TP4	BRIDGE	+6.5V supply between BRIDGE(TP4) and AGND for head preamp board	With scanner connected
TP4	BRIDGE	+6.5V supply between BRIDGE(TP4) and AGND for head preamp board	Disconnect scanner cable from Microscope
TP9	-15V	-15V power supply in ebox	Disconnect scanner
TP14	+15V	+15V power supply in ebox	Disconnect scanner
TP12	+5V	+5V power supply in ebox	Disconnect scanner
CL connector NSV controller	see picture in next slide	LEMO cable connector on the NSV controller	Disconnect scanner



Strain gauge interface board

Check voltage on NS-5 CL connector





- 1: +5V
- 10: +15V
- 13: -15V

- First please unplug the scanner, and check TP4 and TP14 in Ebox, see if now they reads correct voltage (+6.5V and +15V).
- If still not, then check what is the voltage reading on the +15V pin on NS5 controller front panel, please see the pin layout in following slide.
- If it reads abnormal, then the controller is the problem.
- If it has correct +15V, then check the resistance of each wire in the close loop cable, they should be only a few ohms of resistance for each wire.
- If the cable is confirmed good, then the problem is in the Ebox.

NS5Diagnostic Test

- 1. turn off all the controllers, computer can be on.
- 2. disconnect all the cables on front panel of NS5 controller
- 3. turn on the power of NS5 controller
- 4. Do NS5diagnostics test, download below if can't find in the D drive(D>> program files>>Bruker>>self diagnostic)

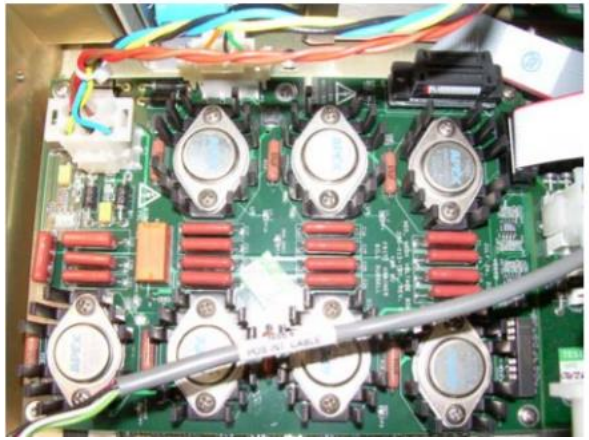
ftp://anonymous@sboftp.bruker-nano.com/outgoing/GPTech/Linghan/NS5DiagnosticSystemInstaller.zip

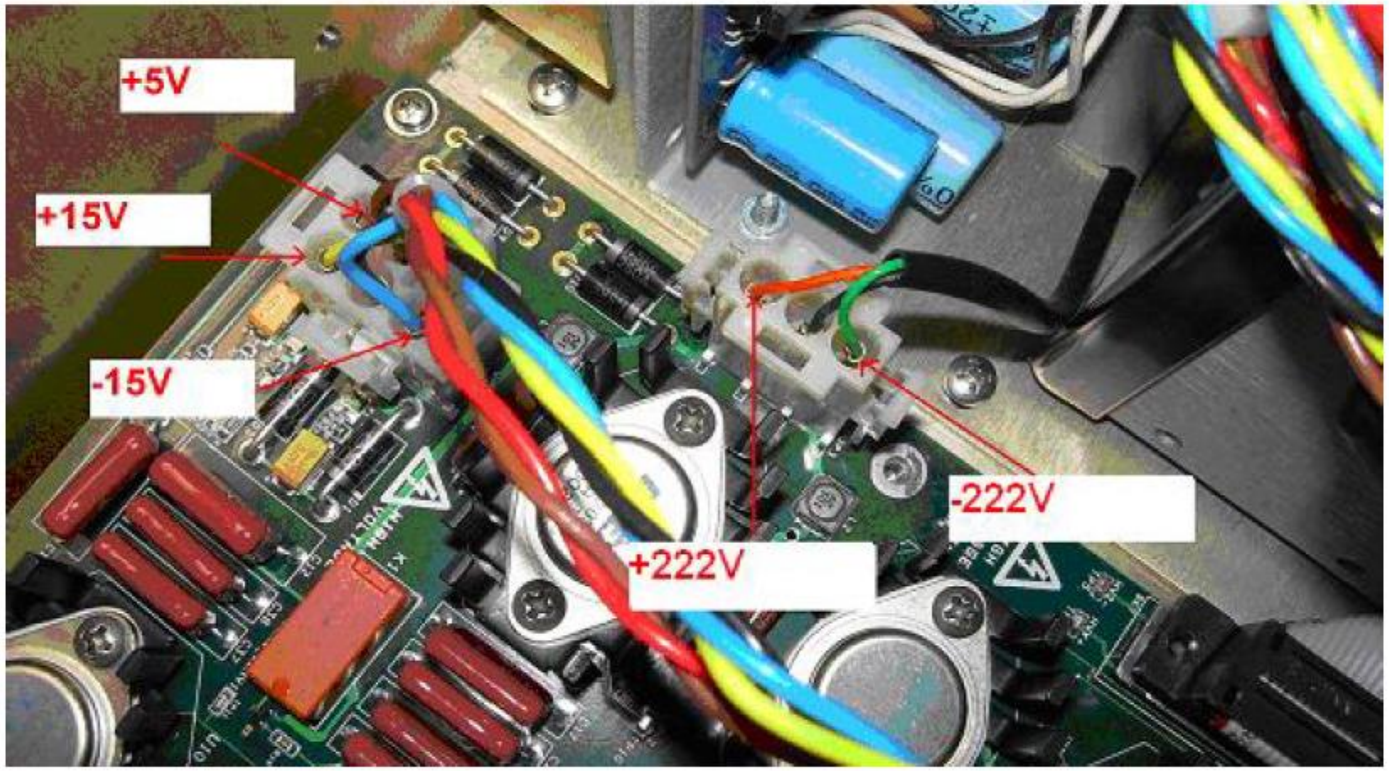
Follow: NBSB0003 NS5 Diagnostic System Tool

5. Need to restart this test if can't run, usually takes 20 min.

6. If fail, test the power supply of the controller (NBSB0016) next slide

Check POWER SUPPLY in the NSV controller (NBSB0016)





open loop does not work tests

Test drive voltage on Microscope

- Unplug the scanner, and measure the piezo drive signal from microscope (procedure in next slide)
- Need to bypass I2C below.
- If old version software, add the bypass I2C line in system.par (for example 8.15);
- if it's very old software, can't add the bypass I2C, then no need to unplug the scanner, skip this test.

1. Bypass I^2C:
    a. Close NanoScope software
    b. Go to folder: D:\Program Files\Nanoscope\8.15xxx
    c. Double click file "system.par"
    d. Set "\Bypass Faulty Scanner I2C: Yes"

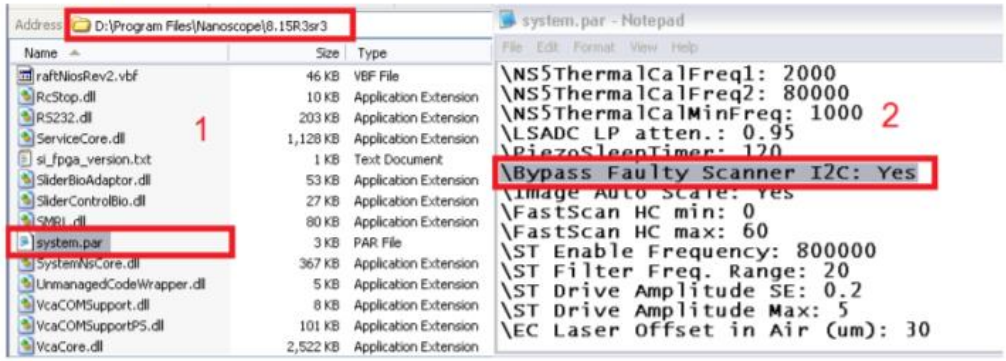
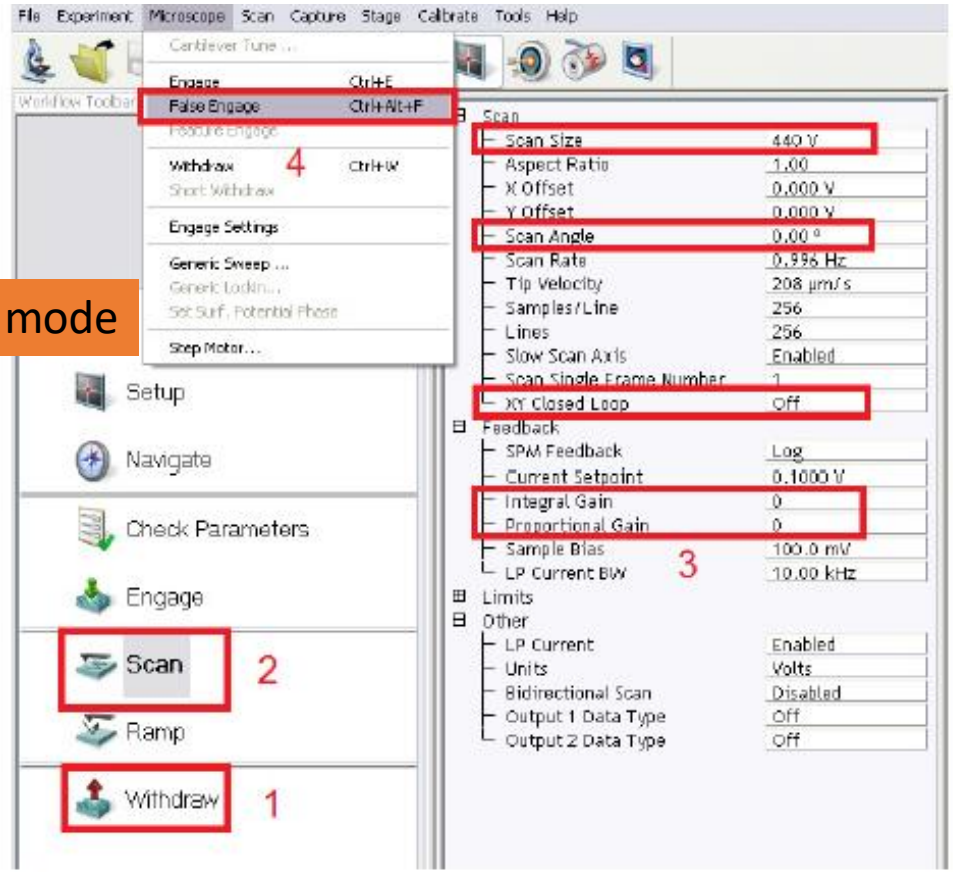


Figure 14. Bypass I^2C in system.par

contact mode



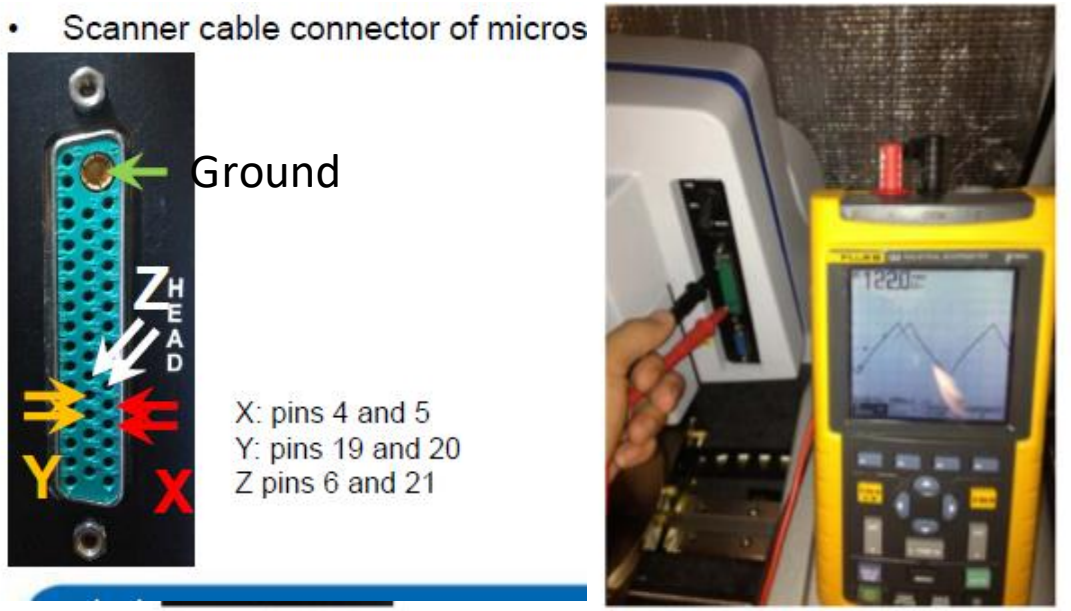


Figure 15. Pin layout of the scanner connector

1. Load contact mode, do “alt~”, go to “stage control”, turn crash protection off; Click “withdraw” twice
2. Click “scan”, set the “scan size” to 440V, “ scan angle 0 degree”, ”Closed loop off”, “Integral gain 0” and “Proportial gain 0”
3. Click the Miscoscope on the top menu>>> false engage
4. Measure the XYZ voltage shown above
5. If see a 440 V triangular wave, then issue with scanner; If not, go to the next test
6. **Remember to put crash protection on when finish all the troubleshooting!!!!**

Test drive voltage in controller

when scanner is removed:

- Set Bypass I2C to yes
- alt ~, stage control; crash protection off
- Check controller
- **Remember to put crash protection on once done!!!!**

1. Bypass I^2C:
    a. Close NanoScope software
    b. Go to folder: D:\Program Files\Nanoscope\8.15xxx
    c. Double click file "system.par"
    d. Set "\Bypass Faulty Scanner I2C: Yes"

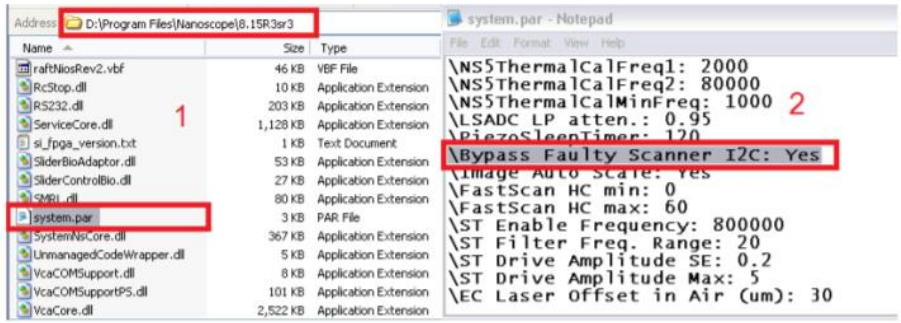
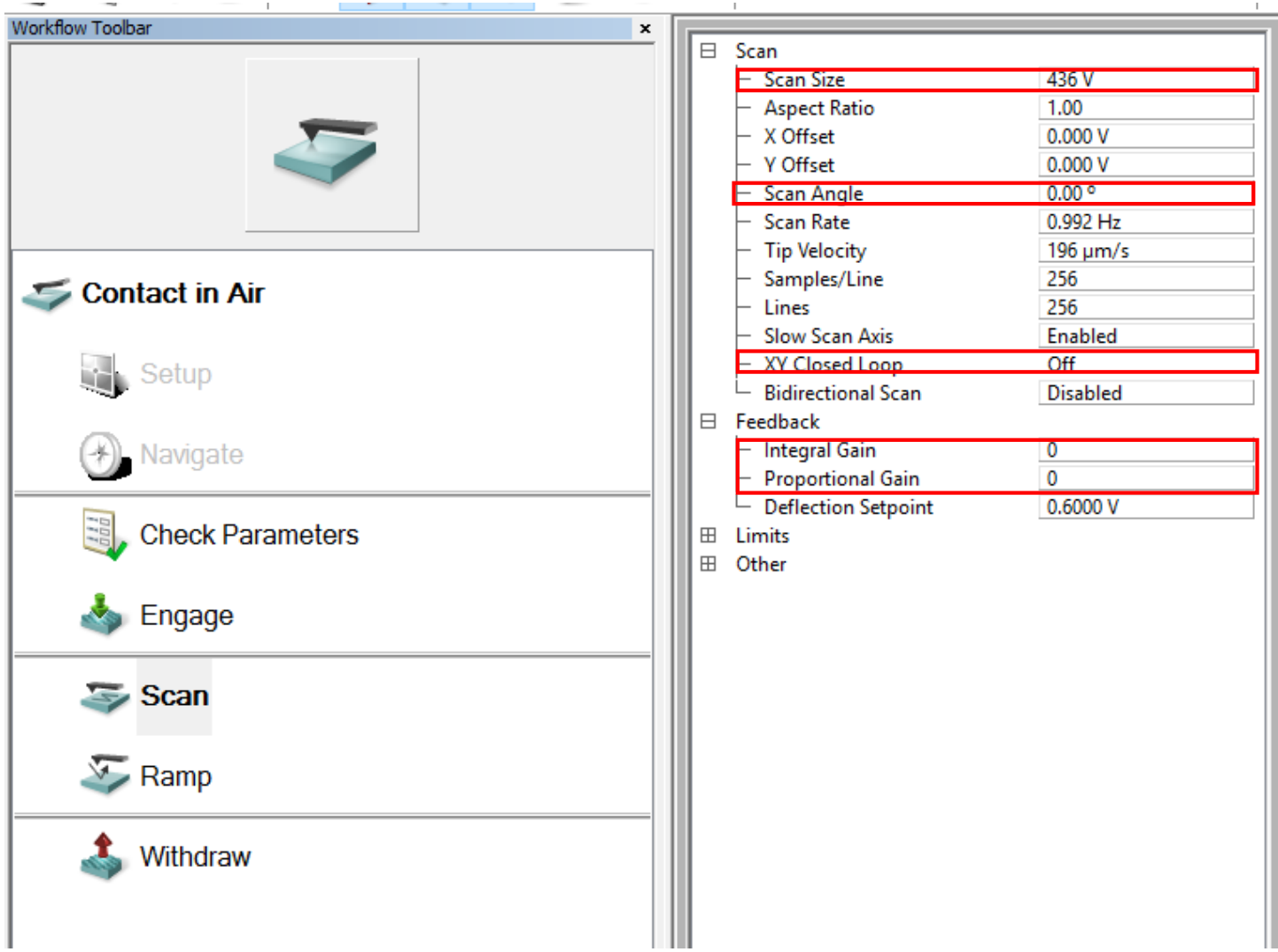


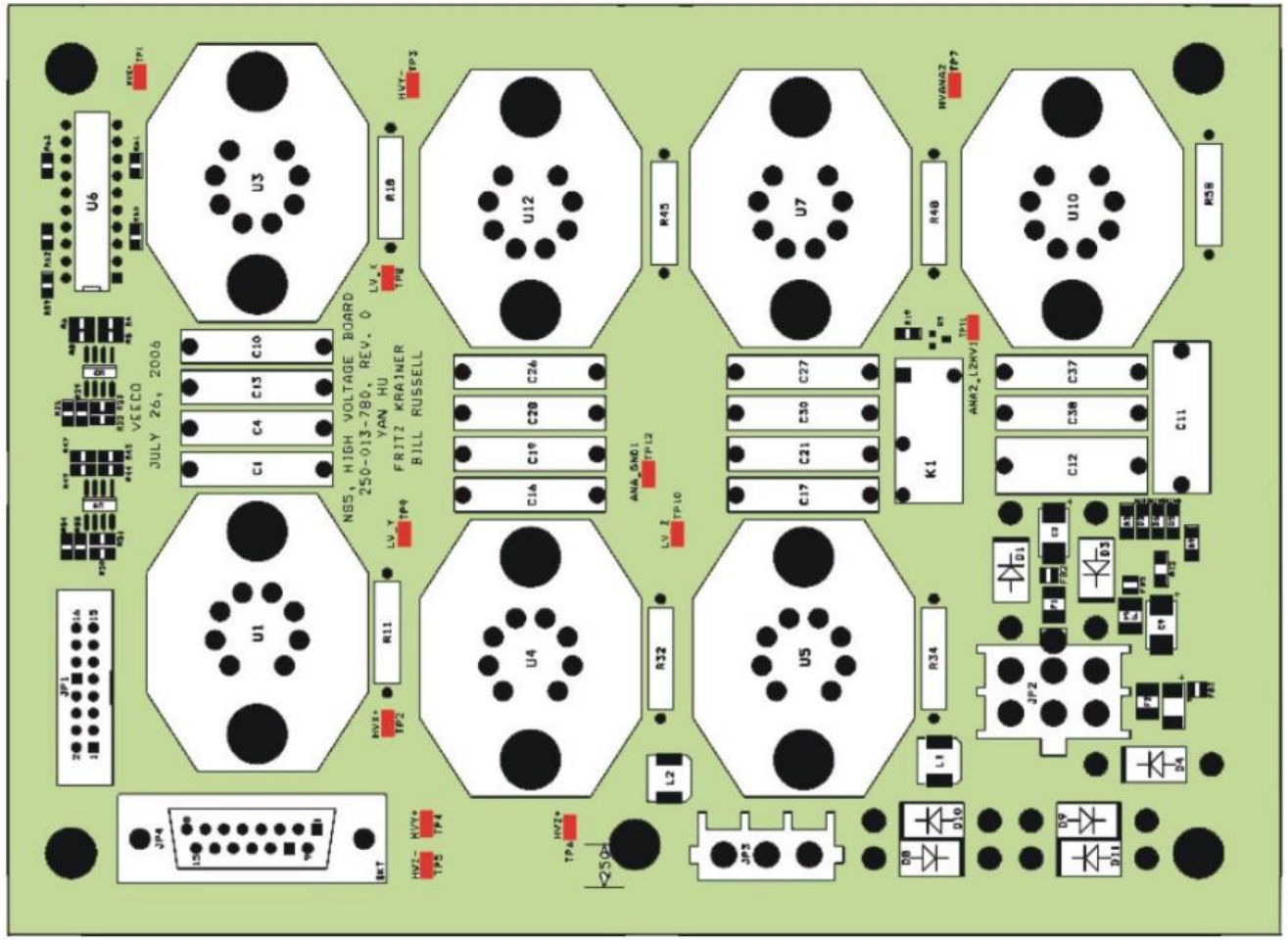
Figure 14. Bypass I^2C in system.par

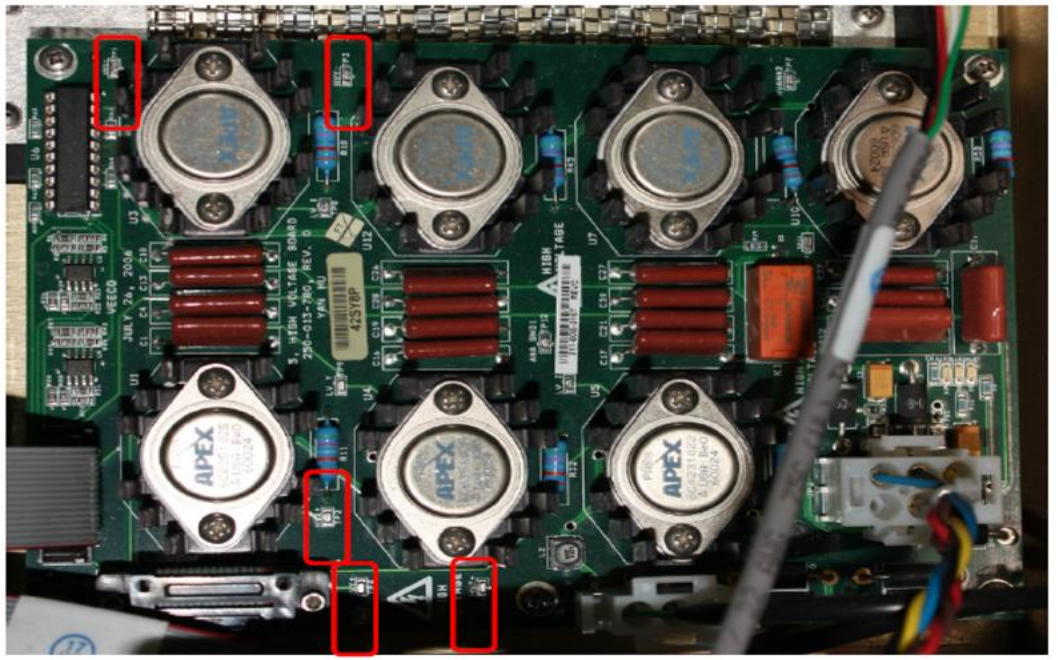
Test X drive voltage in controller

- Setup the oscilloscope to read properly. Put scan size 440 V, gain to 0,**closed loop off**,
- Go to microscope menu in the software>>false engage
- Locate the HV_X test point on the in the controller. (All test points are shown next page)



Drive voltage test points for Controller(need to update right side controller picture)

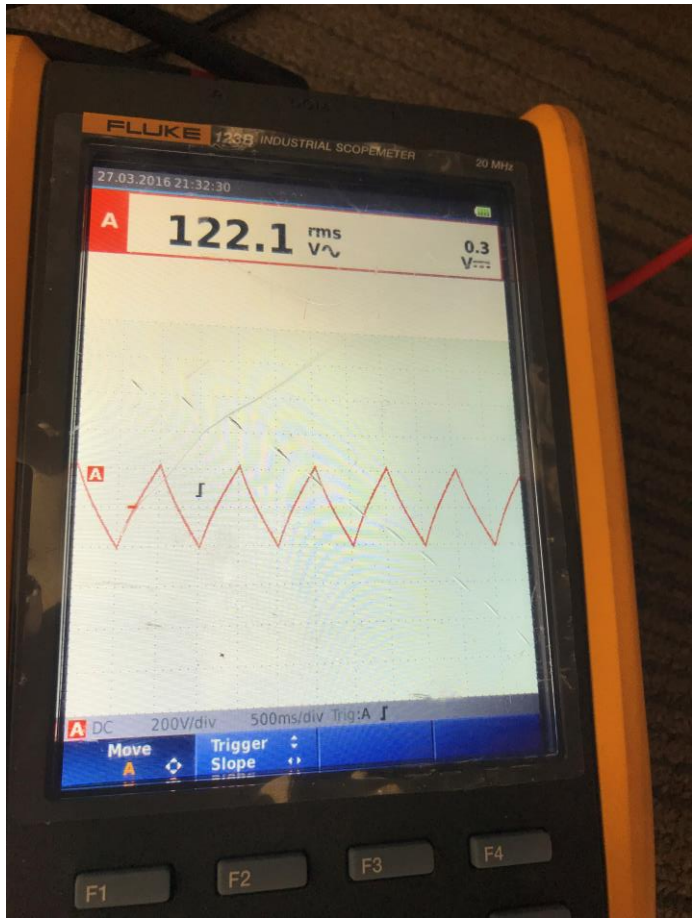




TEST POINTS MARKED IN RED

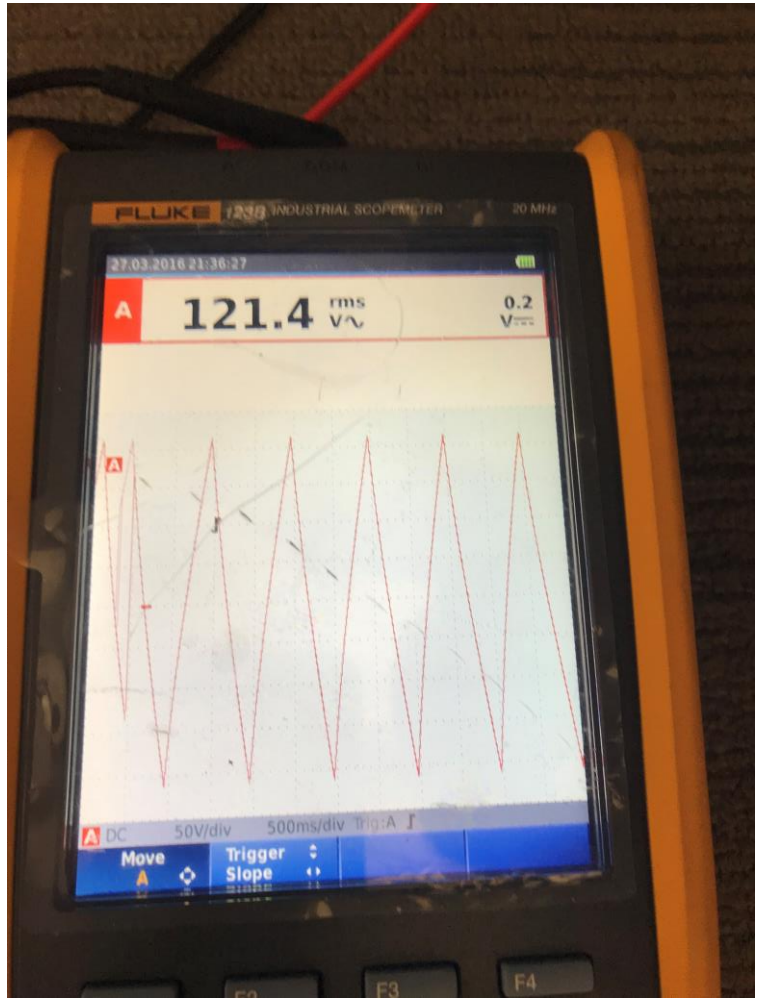
TEST POINT	REFERENCE VOLTAGE
TP1	HV X-
TP2	HV X+
TP3	HV Y-
TP4	HV Y+
TP5	HV Z-
TP6	HV Z+

- scan at 0Deg, scan size is 440V test HV_X: triangular waveform at 1HZ, image shown below



HV X

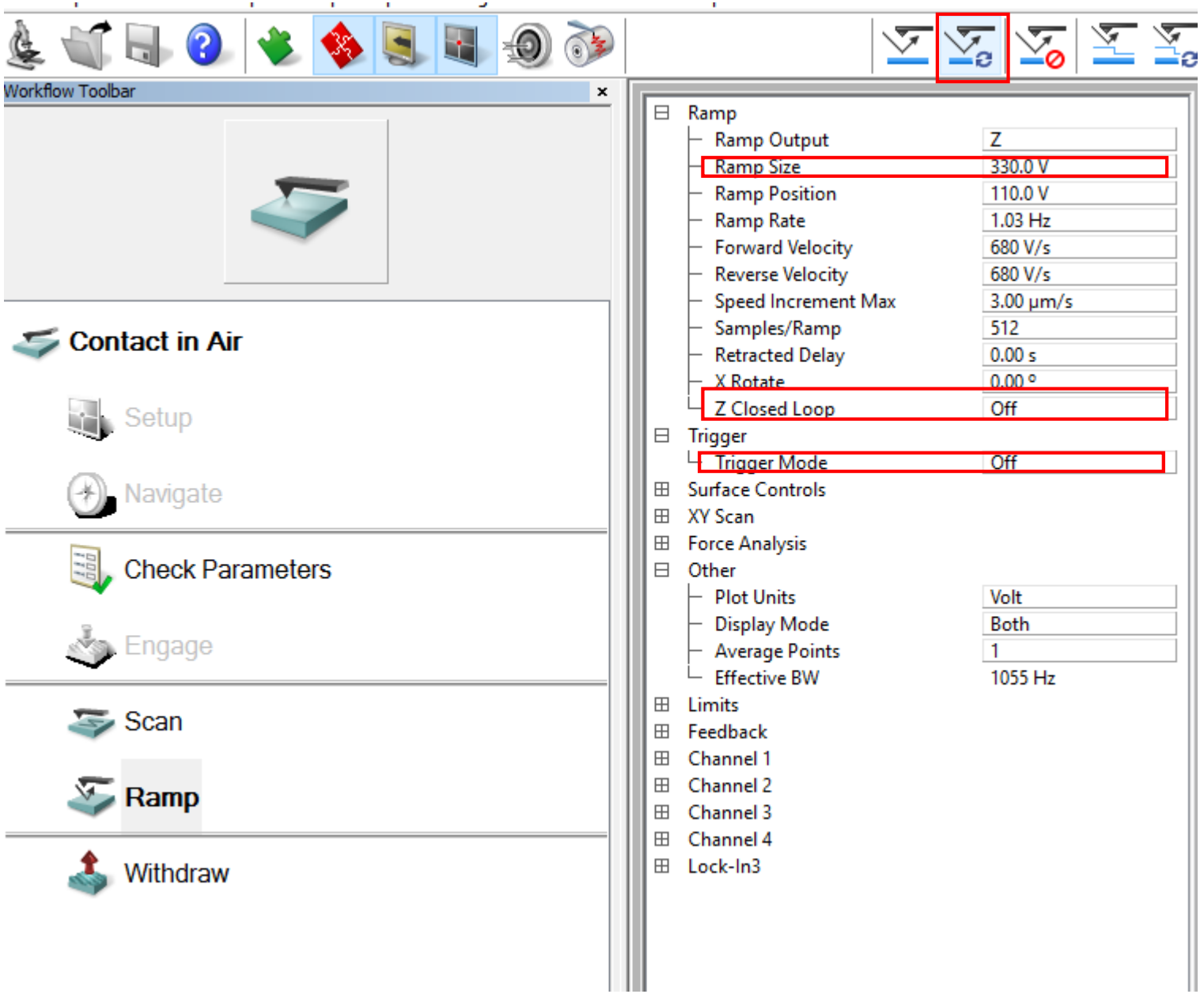
- Change scan angle to 90 Deg, scan size is 440V test HV_Y: triangular waveform at 1HZ, image shown below



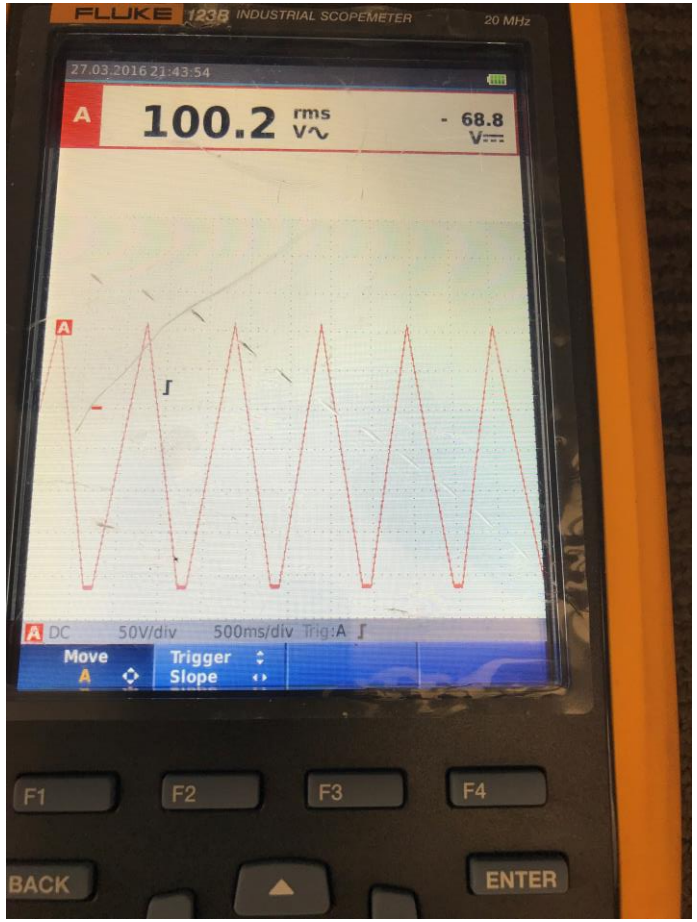
HV Y

Test Z drive voltage

- While still false engaged hit the ramp view in the left hand screen. Change the ramp parameter list as shown
- Click the continuous curves button.
- Use the oscilloscope to test HV_Z- test point.
- 330V triangular waveform on the HV test points.



Z voltage, HV_Z-(HV+Z has no voltage)



HV Z-