Criterion NDT
ST-11R™ Eddy Current Test Instrument
SETUP MANUAL Rev. 03

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Minimum Requirements (for the customer supplied computer)

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✓	Operating System:	Windows 7 SP1 (Windows 8.1 or later preferred) with .NET Framework 4.7.1 or later
✓	Ethernet Port:	Dedicated 100MB/s port for connection to the ST-11R (to reduce risk of USB related delays, avoid the use of USB to Ethernet adapters in production environments)
✓	Storage:	SSD with minimum 4GB free space
✓	RAM:	8GB
✓	Processor:	64bit quad core 2.4GHz or better
✓	USB:	1 – USB 2.0 or better for file transfer via memory device

Recommended

✓	Dedicated PC:	Having a dedicated PC for the ST-11R application will ensure the highest reliability vs. when additional programs consume RAM or clock cycles which could result in delays within Windows. As with any PC, beware of malware/virus threats and their sources (such as USB storage devices which could be used to transfer such files).
✓	Operating System:	Windows 10
✓	Network:	Dedicated 100Mb/s port for connection to the ST-11R. If using the Remote Control feature, a second dedicated 100Mb/s port is required.
✓	Performance:	Disabling Wi-Fi and disconnecting outside networks as well as turning off Windows updates can help to ensure timely operation without interruption.
✓	Storage:	SSD with >10GB free space
✓	Interface:	ST-11R software has been developed for use with a touchscreen. A mouse will work just fine, but operators may be tempted to use the touch interface.
✓	Processor:	64bit i5 quad core 2.8GHz or better
✓	USB:	3 – USB 2.0 or better for file transfer via memory device and keyboard/mouse connections.

ST-11R Specifications

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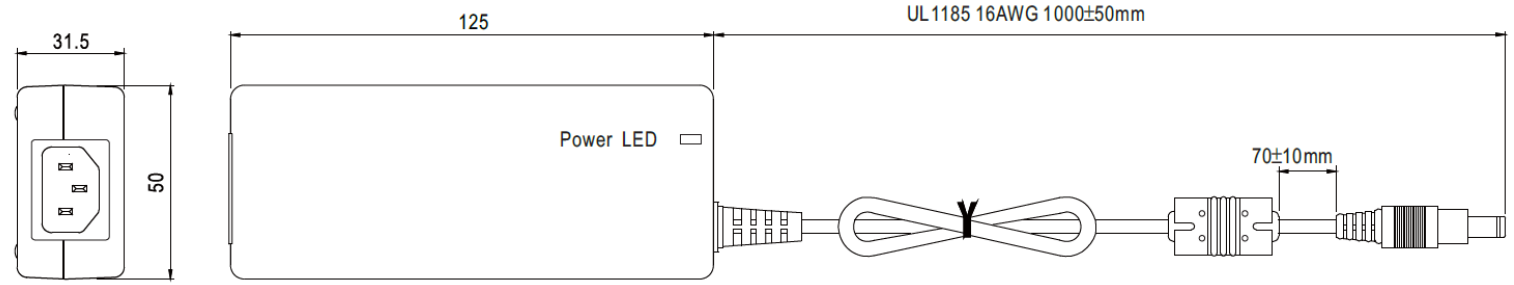
- ✓ Dimensions: See next page
- ✓ Mounting pattern: See next page
- ✓ Weight: 8 lbs.
- ✓ Enclosure type: Aluminum
- ✓ Shipping weight: ~10 lbs. (8 lbs. + cables, test coils, packaging materials)
- ✓ Discrete I/O: Yes (see Industrial I/O section for details)
- ✓ Universal AC Power: Yes (100-240VAC 50/60Hz)
  - ✓ 13 watts typical
  - ✓ 20 watts maximum
- ✓ Interface: Ethernet 100Mbps (TCP/IP custom protocol for use with Criterion NDT ST-11 software)
- ✓ Auto MDIX: Yes
- ✓ Environment:
  - Operating Temperature: -10°C to +45°C
  - Storage Temperature: -20°C to +60°C
  - Humidity: 20-90% non-condensing

Power Supply Dimensions (mm)



ST-11R Mounting/Dimensions (in / mm)

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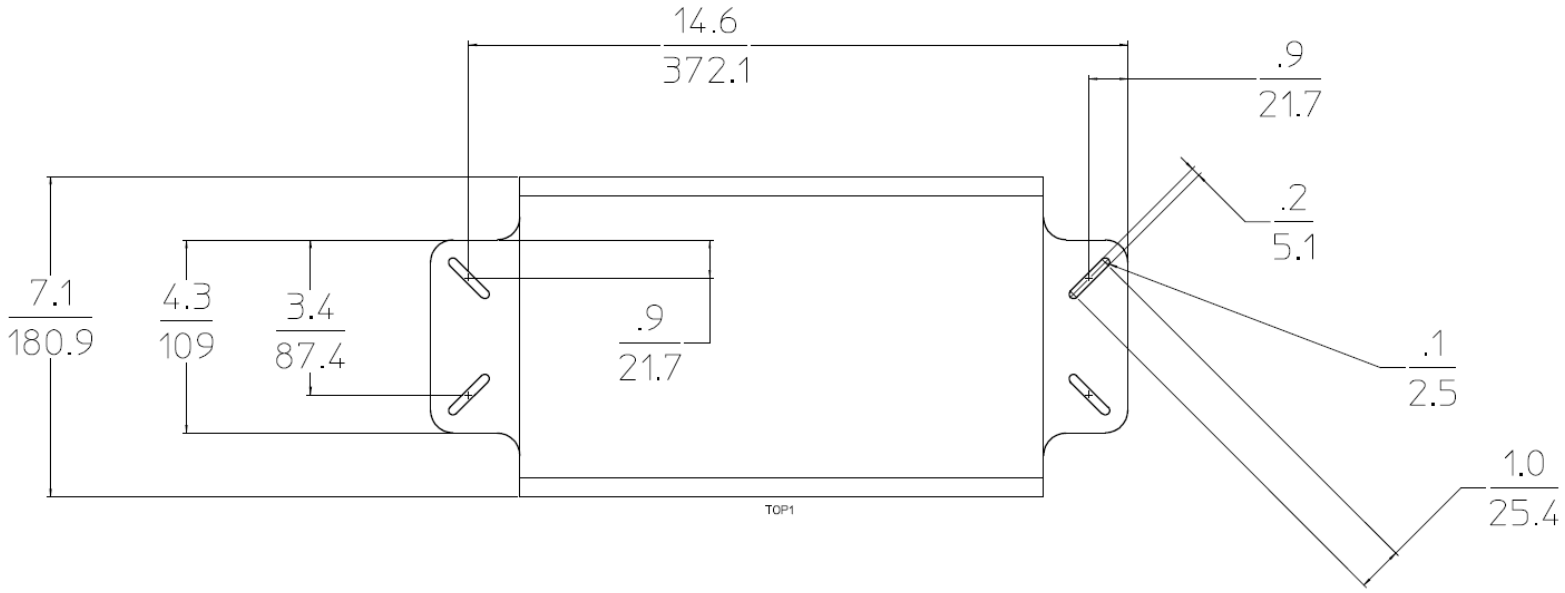

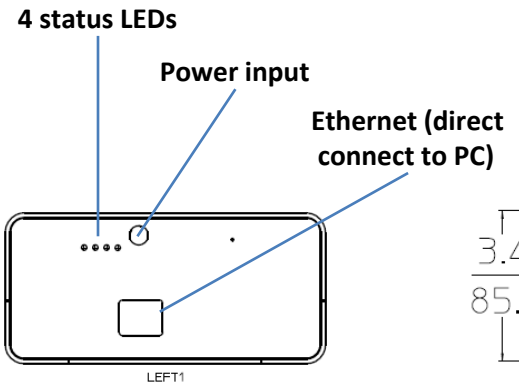

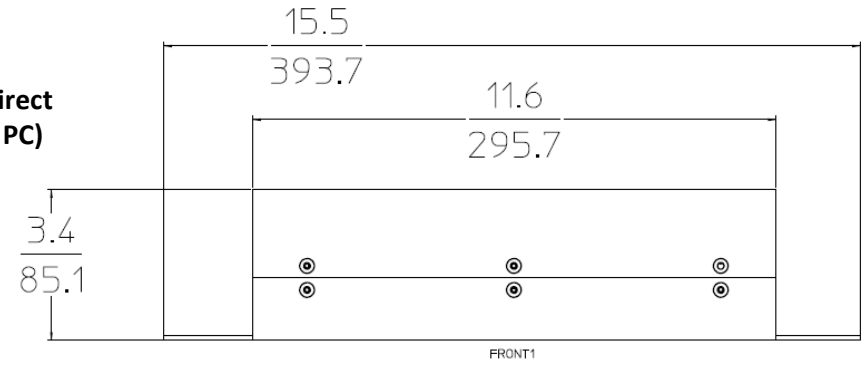

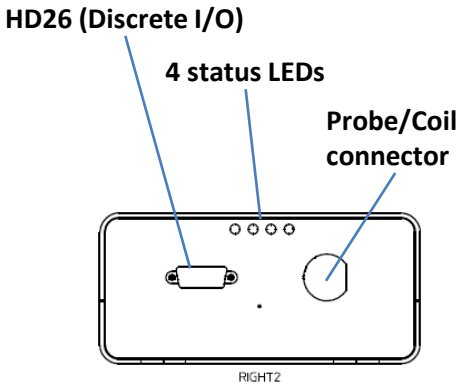

Windows Environment Setup

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In order to make Windows more responsive, there are a number of steps that can be taken. However, only a few should be necessary.

1. Ensure the PC does not go to sleep. If the display is using a USB touchscreen, ensure that USB selective suspend is OFF (disabled), and that the Power Management setting for that connection in Device Manager has the "Allow the computer to turn off this device to save power" deselected.
2. It is acceptable to use a USB to Ethernet adapter for non-critical (non-production) demonstration purposes only.
   - If such an adapter is used, ensure that it's power management settings have also been set to the highest performance, and that it's USB selective suspend feature is OFF (disabled) to avoid loss of connection with the ST-11R unit.
   - When using a USB to Ethernet adapter, avoid using a wireless USB mouse on the same USB controller interface, as some will consume much more USB resources than a wired mouse. Which may result in communication issues with the Ethernet adapter.
3. There are a number of services which can be turned off to potentially increase the performance of a Windows PC which is not connected to the internet, and who's sole purpose is to run the ST-11R software and related activities. NOTE: Some of these services may be required if any additional programs are running on the same machine (Criterion NDT recommends a dedicated PC). This list is for Windows 7, other OS versions may have slightly different names for the same functions. Review each before disabling services to ensure compatibility.
   - Indexing Service
   - Microsoft FTP Service
   - Security Center
   - Themes
   - UPnP Device Host
   - Windows Media Player Network Sharing
   - Windows Search
   - Windows Update
4. Once the ST-11 software is running in the production environment (with all other programs and timing parameters set to their nominal values and running in a standard production mode), check the resource monitor to ensure that the PC being used is not overburdened by the combination of tasks that it is expected to perform. An overburdened PC can lead to unexpected operation which may result in errors.

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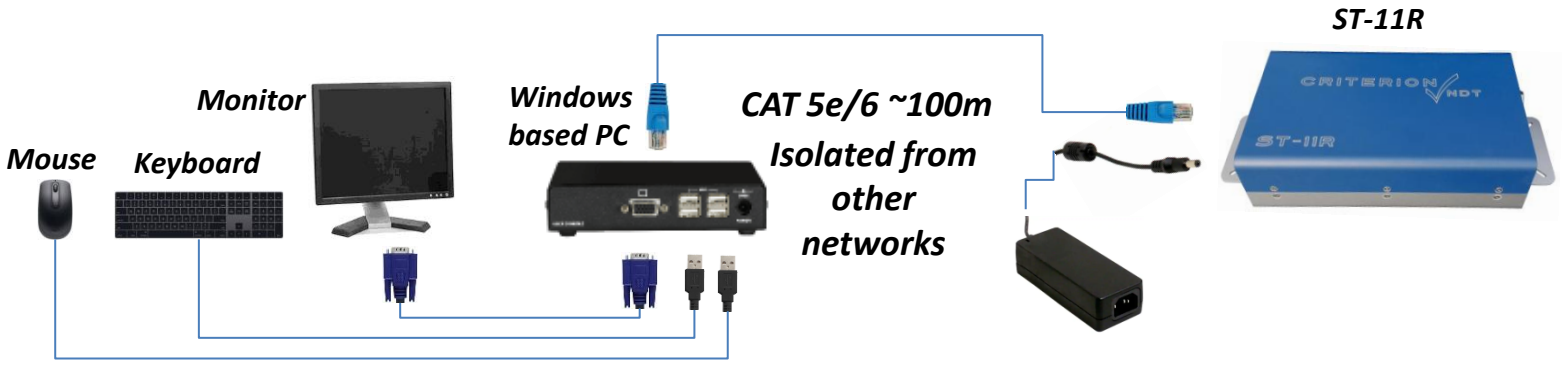
- ✓ Connect the ST-11R directly to an available network port on your Windows based PC using a CAT-5 (or better) Ethernet cable.
- ✓ Power up the ST-11R using the supplied power supply module.



- ✓ The ST-11R includes a medical grade 12VDC power supply which provides an earth ground path through the buildings AC plug. The shield inside the probe cable along with any metal body probe/coil will also be tied to earth ground via this method.
- ✓ The ST-11R does not have an internal fan for cooling. This prevents the drawing in of airborne contaminates. To cool the internal components, ensure that the chassis is bolted to a surface which can help wick heat away from the chassis, and/or have some amount of room temperature (or cooled) air flow around the ST-11R.

- ✓ **See the ST-11 Manual for additional details about software operation. Once the software provided for the ST-11R has been installed, a shortcut to the manual will be on the desktop, or can be found in the "ST11/Prog" folder (typically C:\ST11\Prog\ST-11 Manual (current rev).PDF)**

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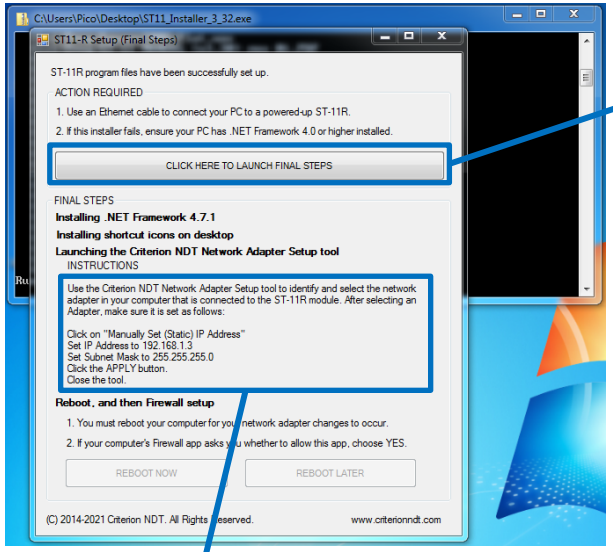
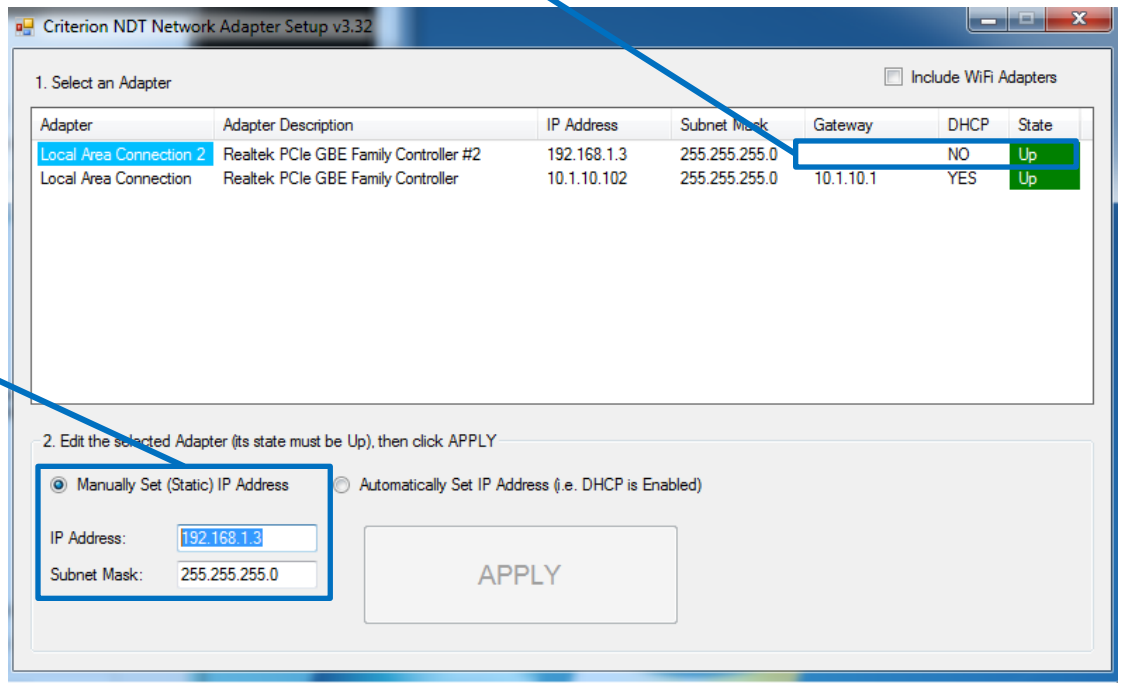
Using the self extracting setup tool:

1. After launching the ST-11 Installer, the folder structure will be crated and files will be transferred, then the following screen will be displayed:



Final steps:

2. Verifies that a compatible .NET Framework version (minimum 4.7.1) is installed, and provides an update if needed.
3. Launches the Criterion Network Adapter Setup tool to assist with IP Address configuration.
4. Identify the adapter which is connected to the ST-11R unit. It will be listed as "Up" if the cable is connected and the ST-11R unit is powered ON. It will have no Gateway, and DHCP will be set to "NO".



5. Set the IP Address of the Adapter to "192.168.1.3" and select "APPLY".
6. Close the Criterion NDT Network Adapter Setup tool (using the) and complete the installer by selecting one of the reboot options and cycle power on the ST-11R unit.
7. Go to 'Display Settings' and verify that 'Scale and Layout' is set to "100%"
8. Launch "ST11.exe" from the desktop shortcut
9. Upon first launch, the software will set up some additional files and folder structure within the ST11 folder on the C: drive. Select 'OK' to dismiss the messages

IP Address configuration

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Communication between ST-11R and PC:

- The ST-11R uses an IP address to communicate between the ST-11R box and the PC.
- The ST-11R Ethernet port has a static IP address (192.168.1.2).
- The ST-11R communicates with a PCs Ethernet adapter set to a static IP address (192.168.1.3) which does not use DHCP.

Communication between PC and Remote Controller:

- In some cases it may be desirable to connect from the PC (running the ST-11 software) to a remote controller (PLC, HMI, or another PC).
- That connection would have the properties of the Remote Control interface described in the 'ST-11 Manual' and 'Remotely Controlling the ST-11.PDF'.
- It uses the Ethernet port name and IP Address listed in the "C:\ST11\Data\Configs_Instrument_.ST11sys" file on the PC running the ST-11 software. The .ST11sys file can be viewed with a text editor such as Notepad. Towards the bottom of that file, you'll find the following three entries, which can be adjusted if needed for establishing the remote connection.
  - "_RemoteControlAdapterName": "Local Area Connection 2",
  - "_RemoteControlIpAddress": "192.169.1.2",
  - "_RemoteControlSubnetAddress": "255.255.255.0",
- If using the PC (running the ST-11 software) in a Remote Controller configuration, it may be necessary to set a firewall rule within that PC, permitting connection to the "C:\ST11\Prog\ST11.exe" program.

Upgrade Instructions

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Criterion NDT makes every effort to provide ST-11R customers with the most up-to-date software/firmware as soon as it is available. If you would like to make suggestions/requests for the next software/firmware update, or if you think the manual could use a modification/addition, please contact us and include as much detail as possible so that we can be sure to provide the best solution.

There are two types of update files that we may provide to you:

✓ A .zip file which includes the folder structure to be placed on the root of a USB stick:

1. Unzip the "ST11Update_*****.zip" file (where ***** represents the software version)
2. Copy the folder "ST11" to the root of a USB stick
3. Insert the USB stick into the computer running ST-11R software
4. Might have to insert the USB stick twice to get the driver assigned the first time
5. After the USB screen appears, ensure that the correct (latest) update file is selected and tap the "Install" button
6. At the 'are you sure' message, choose "OK"
7. You will see a message "Currently processing firmware. Please wait, in order to avoid firmware damage" – At this point, the updating software checks the firmware in the internal EPC board to see if what is already running matches the update. If it matches, no firmware update is required and this message only lasts a few seconds. If the currently running firmware does not match the update package, this step will take exactly 6 minutes to complete.
    - If it does need a firmware update, at the end of the 6 minute timer, a message will appear that indicates to cycle power and install the update again. Just use the power switch on the rear to turn the unit off, then back on again.
    - Power the ST-11 back up, go to the Main Menu, and back to "USB Files"
    - Select the same update package file, and tap "Install" again.
8. This time it will verify that the firmware has been installed, but will only take a few seconds to verify (instead of 5 minutes).
9. Follow on-screen instructions for completing the software update.

✓ A .ST11PKG file that needs to be placed on a USB stick within the 'packages' folder:

1. If a USB stick has already been used with an ST-11, then the folder structure already exists on that device.
2. Place the "*****.ST11PKG" file on the USB stick in the "ST11\Packages" folder. (if the "Packages" folder does not yet exist, create one within the ST11 folder and place the .ST11PKG file in it).
3. Follow the instructions above, beginning at step 3.

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Network connection problem with an ST-11R:

There can be several reasons for a connection issue, but some basic troubleshooting can help narrow down the root cause.

- ***This is the first time this ST-11R and this PC have been connected together:***
  - **Review 'Understanding IP Address Configuration'.**
  - **Use the Criterion Network Adapter Setup tool to verify that the network adapter connected to the ST-11R unit is set to 192.168.1.3**
  - **Verify that the connection is listed as 'UP'. If not, check the ST-11R units power supply (ensure that the LEDs are ON to indicate power)**
  - **Check the Ethernet cable (try a known good cable).**
- ***This unit has been running for some time and has experienced a connection problem:***
  - **Restart the system, then run the Criterion Network Adapter Setup tool to verify the connection is UP and set to the correct IP Address. If it is set to 192.169.1.2, change the adapter name to something other than "Local Area Connection 2", set the IP Address to 192.168.1.3, then restart the computer.**
  - **Go to the Properties for the network adapter which is used for ST-11R communication and select the Power Management tab. Ensure that the "Allow the computer to turn off this device to save power" option is deselected.**
- ***When attempting to set the IP Address with the Criterion Network Adapter Setup tool, the IP Address fails to be set after selecting Apply, and reverts back to what it was previously set too.***
  - **This problem can be caused by an attempt to use a different network adapter than was previously used with that IP Address.**
    - **Solution 1: Reconnect the ST-11R and any other network devices to the same physical locations they were previously connected too.**
    - **Solution 2:** Clear disconnected network adapters from Windows.

1. Use one of the following methods to go to a command prompt:
   1. In Windows 8 or in Windows Server 2012, use the Search charm to search for cmd, and then tap or select **Command Prompt.**
   2. In earlier versions of Windows, select **Start**, select **Run**, type "cmd.exe", and then press **Enter**.
2. Type "**set devmgr_show_nonpresent_devices=1**", and then press **Enter**.
3. Type "**devmgmt.msc**", and then press **Enter**.
4. Select **View**, and then select **Show Hidden Devices**.
5. Expand the **Network Adapters** tree.
6. Right-click the dimmed network adapter, and then select **Uninstall**
7. You can uninstall all of the adapters that appeared on the CriterionNetworkAdapterSetup tool. Do not check the box to remove the software; just uninstall the adapters so that after rebooting, the same drivers will be assigned to the same adapters again. Then use the CriterionNetworkAdapterSetup tool to reassign the IP Addresses as desired.

- ***The network connection failed message appeared, and the "Retry" button doesn't seem to help.***
  - **In some cases, your Windows PC may have determined that the network port was not properly closed such as when a surprise disconnect of the ST-11R from power loss or cable disconnection has occurred without first closing the ST-11R app. Windows has a default timeout period before the network resource will become available again. The default timeout period is typically 2 minutes.**

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Noisy eddy current signal:

Sources of noise:

- ***Bad cable*** **– If a system which has been working well suddenly acquires a noisy signal, it could be from a broken connection inside a cable.**
  1. **Set Persist to >1 and carefully move the cable at both ends and at any stress points along the length to identify the exact location of the problem (use caution at the connectors to ensure only the cable is being moved, and not the contacts within the connector – as any movement within the contacts will normally cause noise)**
  2. **If you have a known good test station, try moving the suspect cable to it, and see if the problem follows the cable.**
- ***Bad coil*** **– Most coils last for many years, but it's good practice to keep a known good spare on-hand to exchange with a suspect one.**
  1. **The most common cause of coil failure is mechanical damage caused by abrasion over time. Examine the entire coil/probe carefully for any signs of wear. Smaller pencil probes may require microscope examination to see the damage.**
  2. **Check for damage around the connector by observing the eddy current signal in the Test/Review screen (XY view) with persist set to "1" while carefully wiggling the connector at the body of the probe/coil.**
- ***Inadequate variety or number of parts trained*** **– When starting the alarm training process in the Alarm Setup page, the ST-11R begins at its most zoomed in (sensitive) state. After a minimum of three parts are trained, the alarm ellipse will be drawn. If those first three parts happen to produce very similar eddy current responses (because they are all 'good' parts, and happen to have very similar material structure), the resultant ellipse will be very small and will therefore be very sensitive to changes in material structure. This can sometimes appear as noise. Yes, it is noise, but not unexpectedly so. This type of noise is similar to looking through a very powerful telescope at a distant star without a tri-pod to hold the telescope in place. If you zoom out a bit, the image is much easier for your eyes to process because the relative motion of that star is reduced because you have a wider field of view. By the same respect, training more parts will encompass a wider variety of material structure conditions, and the ST-11 will automatically become less sensitive to small changes in the magnetic field by zooming out to accommodate the wider variety of eddy current signals. Additionally, consider changing the alarm size using the Adjust All Alarms button, or individual adjustments on each X/Y plot.**
- ***Nearby motors or induction heating coils*** **– If your facility has potentially noisy motors or induction heating coils on the same electrical circuit, or in close proximity to the ST-11, try examining the eddy current signals when those sources are turned off. Repositioning the coils or trying other test frequencies may help reduce the noise from outside sources. A future ST-11 software/firmware upgrade will include advanced noise filtering – please let us know what types of noise issues you've had with external sources so that we can test to ensure successful filtering of those sources.**
- ***Internal Test Enable setup problem*****: Software/firmware version 1.21 and lower use all/any test frequencies for triggering an Internal Enable. Please ensure that you are using software 3.33 or later so that you have the option to choose which frequency is used for internal triggering from the Config Settings screen.**
- ***Internal ST-11R failure*** **– While we strive to provide the best quality product possible, if you've been unsuccessful at eliminating the problem by external means, please give us a call or e-mail and we'll be happy to review the problem with you and provide the best solution possible.**

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Will not power up/boot:

- ***After shorting the I/O 12v power to GND*** **– If the +12vdc power on pins 19 & 20 of the 26 pin I/O connector has been shorted to GND, it is likely that removing the short and re-powering the ST-11R will get the unit up and running again. If not – it is possible that the internal 3A circuit breaker has been tripped. To reset it, unplug the ST-11R and insert an object (paper clip size) strait into the hole just above the letter "R" in the Criterion NDT logo. Insertion should be limited to no more than 3/8 of an inch to reset the breaker.**
- ***No power*** **– If none of the LEDs on the ST-11R illuminate upon connecting the power supply, you can verify the supply voltage at the barrel connector (outside is negative, inside is positive). It should measure ~12VDC.**

Inadequate separation between good and bad parts: *Call a Criterion NDT Apps Specialist*

- ***Oversized coils*** **– Ensure that you are using appropriate coils for the job by discussing and sharing pictures of your application with a Criterion NDT Apps Specialist.**
- ***Wrong test frequency*** **– While the Factory Default frequencies provide a good general starting point, they may not be best suited for separating certain fail conditions, or with certain coils.**
    1. **To help fine tune your test to the best test frequencies, gather a few parts which represent the various fail conditions.**
    2. **Set the persistence value to "1" so that you can view live data.**
    3. **Go to the Alarm Setup page and perform a Balance on a good part like normal, then place each known bad part in the test coil, while observing the frequency which produces the largest deviation from the Balance point.**
    4. **Keep track of the frequencies that create the largest separation.**
    5. **Then use the Min/Max frequency adjust on the Config Settings page to choose a smaller range of frequencies centered around those with the best separation to help fine tune and select the best frequency from that group.**
    6. **In a multi-frequency test, place the best frequencies in your list, then choose a few higher, and a few lower frequencies to help find anomalies that may not have shown up in your sampling of known bad parts.**
- ***Too much, or not enough drive voltage*** **– After ensuring you are using the best frequencies, you can experiment with drive voltages less than 20vpp to see if a reduction of analog clipping will help separate good from bad parts with even better accuracy, and/or less noise.**
- ***Open transmitter coil (bad probe)*** **– On the Config Settings page, try adjusting the Drive voltage all the way down to 0.1vpp and run through the setup again. If you don't notice a significant reduction in separation and performance as a result, you may have a dead transmit drive coil.**
- ***Too much distance between part and coil*** **– It is essential that there be reliable part to part positioning. Along with repeatable placement, having the part as close to the coil as possible will often yield the best separation.**

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