MultiLab 2000 Series 2 LHS-Roodra

Service Manual

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Section 1: General Description

The purpose of the MULTILAB SERIES II LHS RODRA (ROODRA) is to meet market requirements for a noninvasive diagnostic tool for investigation of blood flow including diagnostic testing for Peripheral Arterial Disease (PAD). It is designed to perform all standard noninvasive physiological arterial and venous studies.

The ROODRA unit enables technicians to perform noninvasive studies and evaluation of PAD. It displays the diagnostic information derived from each study to simplify the vascular diagnosis by the physician. Full segmental studies should be possible in 20 to 25 minutes. Two-channel calibrated Pulse-Volume Recording is capable of obtaining bilateral waveforms simultaneously. Doppler probe display a waveform of arterial blood flow (velocity) and provides bidirectional audio of the Doppler signal and can be used for both waveforms and segmental pressures. Dual-channel photoplethysmography (PPG), incorporating easily applied PPG clips, provides dual-channel pressure testing of segmental arteries or digital arteries. Temperature probe can be used to conduct Raynaud's Examination. The ROODRA also has the ability to record and communicate the test results.

Intended Use

The MultiLab Series II LHS Roodra devices are non – invasive vascular diagnostic instruments. They are designed to diagnose patients with Peripheral Vascular Disease (PVD) non-invasively. The MultiLab instruments were designed to provide accurate results, quickly and easily, and provide many years of use when properly maintained.

Note: The accuracy of non-invasive vascular diagnostic studies depends on the knowledge, skill and experience of the technologist and the physician performing the interpretation of the study. The operator's manual is intended to be used as a guide to instrument operation only, and as such, should not be viewed as a substitute for formal clinical vascular education.

The system uses a structured menu guided sequence and procedures wherein professional health care provider will use the data to diagnose the patient or keep the record for further consultation. During this test until its completion, the professional health care provider will be in close proximity to the patient. The patient connecters for blood pressure cuffs have been designed for easy detachment in case of discomfort apart from other automatic safety feature in the unit.

Power Requirements

Supply Voltage 110-130VAC (220VAC nom option available)
Frequency 60Hz +\- 5%
Max Power 600 VA

Leakage Current

Less than 100 uAmp.

Dimensions and Weight

Cart dimensions: 20”W x 28.5”D x 68”H some dimensions adjustable
Approximate weight of system: 170lbs

Bi-directional Doppler

TruDop 8 frequency 8 MHz +/- 5%, continuous wave, NPL estimated in-situ total power 6.7 mW maximum.

TruDop 5 frequency 5 MHz +/- 5%, continuous wave, NPL estimated in-situ total power 4.7mW maximum.

Photoplethysmography

Dual channel simultaneous operation.
IR emitter and receiver. Operable in either AC or DC coupled mode.

Pneumatics

Manometer, Simultaneous Dual Channel
Range: 0-300 mm/hg
Accuracy: +/- 1% of full scale

Pneumoplethysmograph, Simultaneous Dual Channel
Range: 0-100 mm/hg
Sensitivity: >.0015mm/hg

Standard Cuff Set
SC-10, Nylon Shell, 300 mm/hg max pressure
11 x 85 cm

SC-12, Nylon Shell, 300 mm/hg max pressure
13 x 85 cm

PC-2.5, Natural Latex, 100 mm/hg max pressure
2.5 x 12 cm

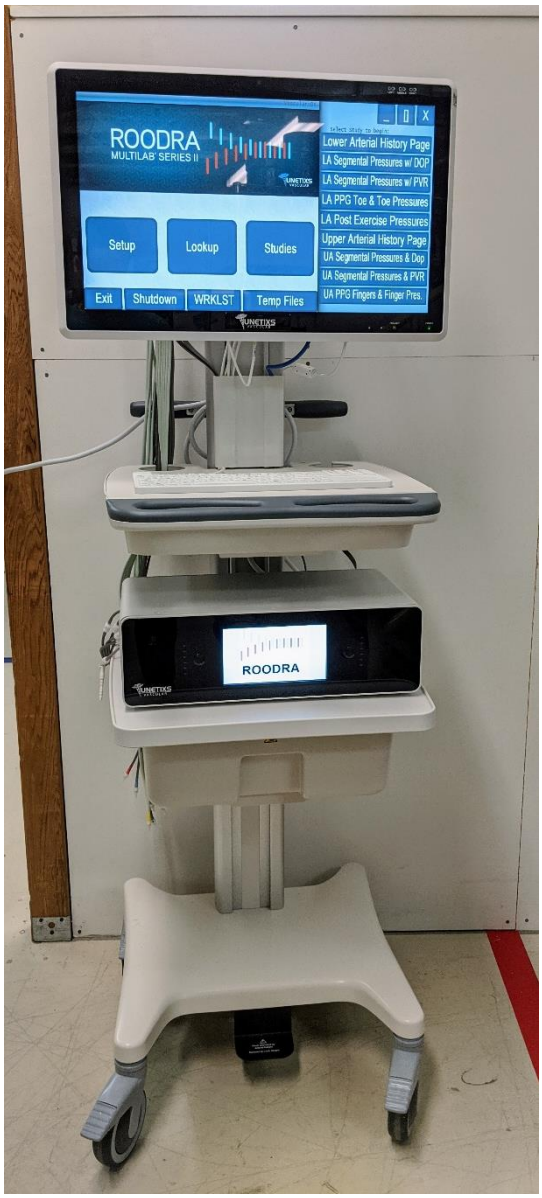
Infrared Thermometry

Range 0 – 39 degrees C (32 – 100) degrees F
Response <1 second
Accuracy + / - 2% Full Scale

External Hoses

Material: PVC

Section 2: Installation Guide



Multilab Series 2 Roodra Installation Guide

11309-0001-01 Rev D

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Roodra (Standard Option):

Step 1: Unpacking the MultiLab Series 2 Roodra

Remove the external strapping from around the shipping box. Remove the top from the box. Cut the tape keeping the box together and remove the outer shipping box from the wooden shipping pallet. See **Figure 1** for reference.

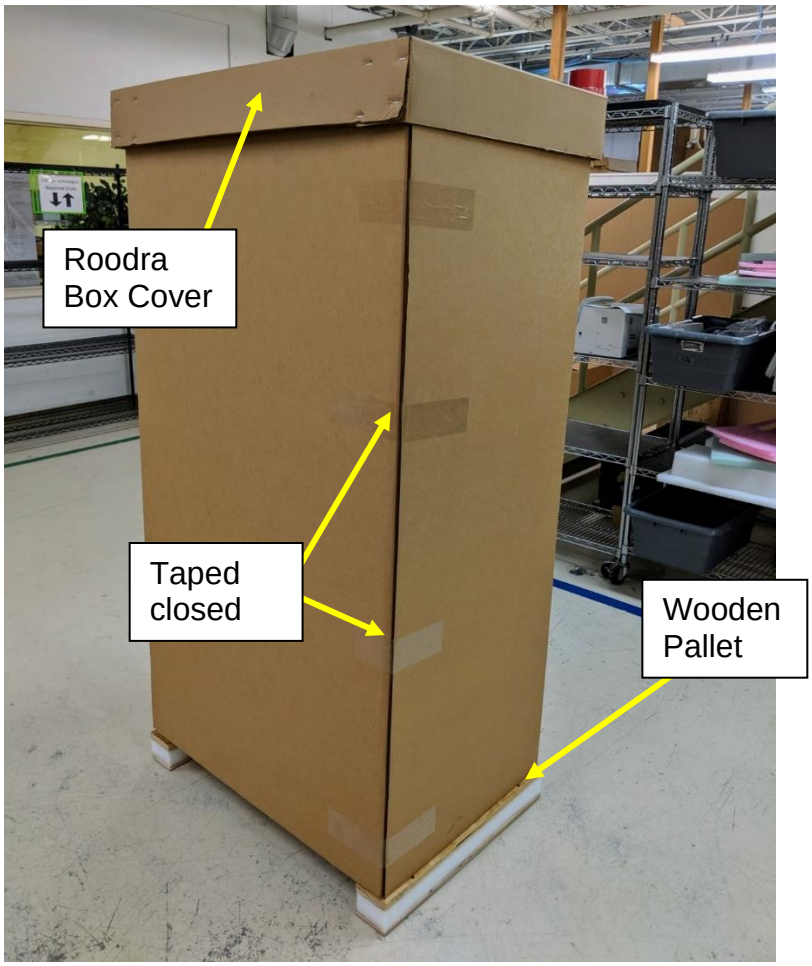

Figure 1

Careful remove the shrink film from around the cart to remove the computer box, chassis box, printer box, and basket box from the cart. Note: the printer and basket are optional accessories so they may not be included. See **Figure 2** for reference.

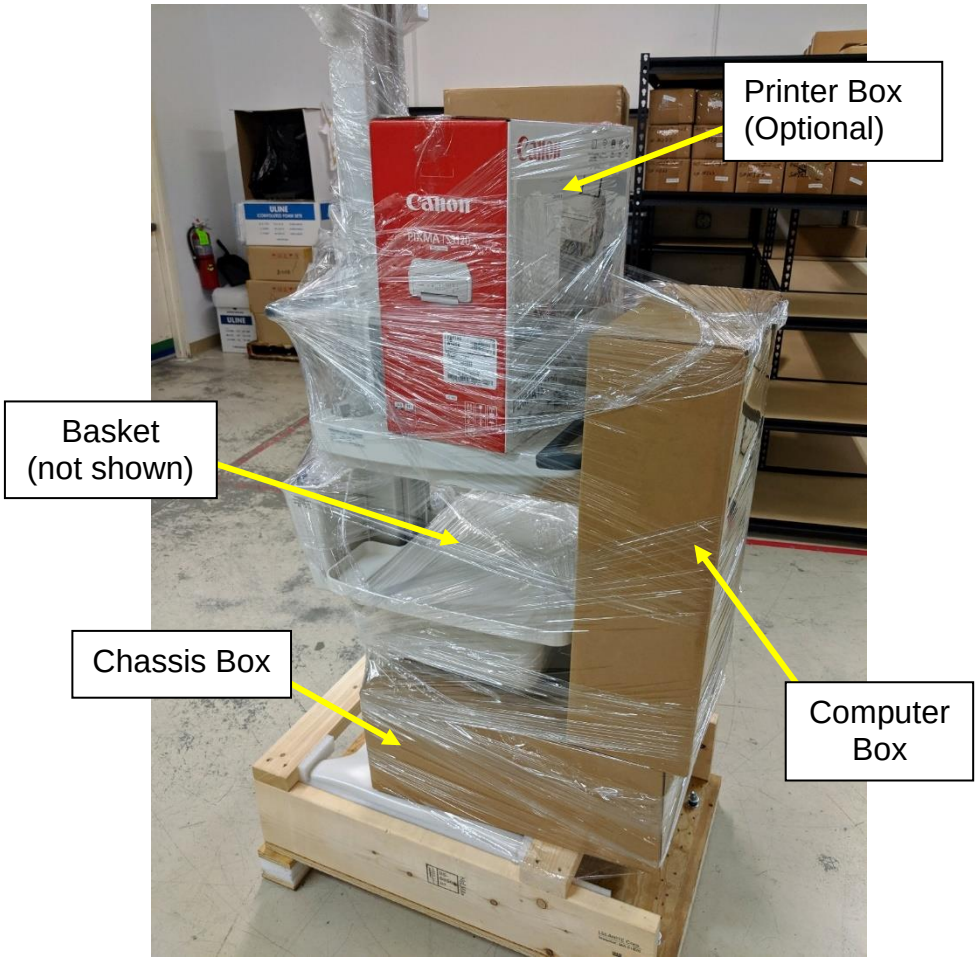

Figure 2

Remove the wrapping from the cable sets. See **Figure 3** and **Figure 4** for reference.

Figure 3

Figure 4

Remove the wooden restraining strap from the front of the pallet by removing the 4 Philips head screws. A power screwdriver is advisable for removal. See **Figure 5** for reference.

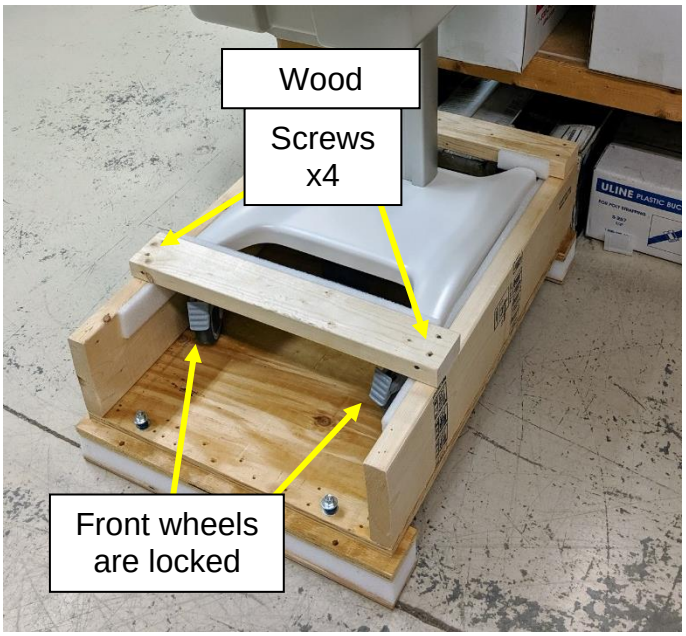

Figure 5

Unlock the front two wheels and carefully remove the cart off the wooden pallet.

Before commencing with the assembly and attachment of the accessories, we request that you take a pre check of all the items listed below. **Note: This is a comprehensive list and some items are optional, please confirm with your packing list to see what items you should have.**

Part Number	Description	Qty
11982-0000-01	Roodra Cart Assembly	1
11983-0000-01	Roodra Chassis	1
10353-0004-01	Touch Panel Computer	1
10304-0006-01	Keyboard	1
11966-0000-01	Bleed Valves	2
11980-0000-01	Left Hose Set	1
11981-0000-01	Right Hose Set	1
11938-0000-01	Left PPG	1
11939-0000-01	Right PPG	1
11928-0000-01	Left Finger Clip	1
11929-0000-01	Right Finger Clip	1
11930-0000-01	Doppler Cable	1
10628-0001-01	Ultrasonic Doppler Gel	1
10383-0001-01	USB Flash Drive	1
10377-0000-01	Remote Control	1
40001-1005-01	Doppler / PPG Holder	1
10635-0001-01	Double Sided Tape	1
11309-0000-01	Operators Manual	1
11309-0001-01	Installation Guide	1
10339-0007-04	Daigle Vascular & CME Manual	1
F03 01	Acknowledgment of Acceptance	1
Optional Items		
11962-0000-01	5 MHz Doppler Probe	1
11963-0000-01	8 MHz Doppler Probe	1
11990-0000-01	Cuff Set A	1
11991-0000-01	Cuff Set B	1
10329-0011-01	Printer	1
10308-0000-01	Wireless USB Adapter	1
10638-0000-01	Deskjet Paper	1
10679-0010-10	Cart Basket	1
10679-0010-05	Display Arm	1
10353-0004-02	Computer Batteries	3
11951-0000-01	Temp Gun	1
10346-0000-01	Temp Gun Cable	1

Once you have confirmed the contents, you will be ready to proceed with the assembly.

Step 2: Install the Touch Panel Computer

Open the Touch Panel Computer box and remove the top foam. If the order comes with computer batteries, they will be here, so remove them out from foam and set them aside for later install. See **Figure 6** for reference.

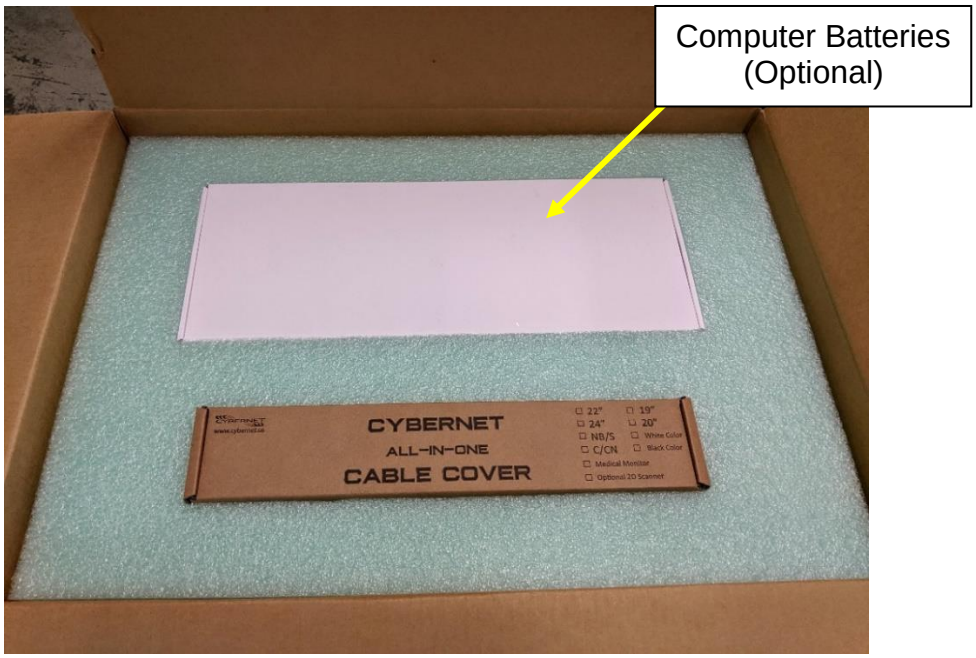

Figure 6

Underneath the second layer of foam will be the Touch Panel Computer, remove the computer from the foam and plastic and remove the 4 Phillips head screws from the back of the computer. Using those 4 screws, attach the Touch Panel Computer to the display mount (or display arm if applicable) on the cart assembly. See **Figure 7** for reference.

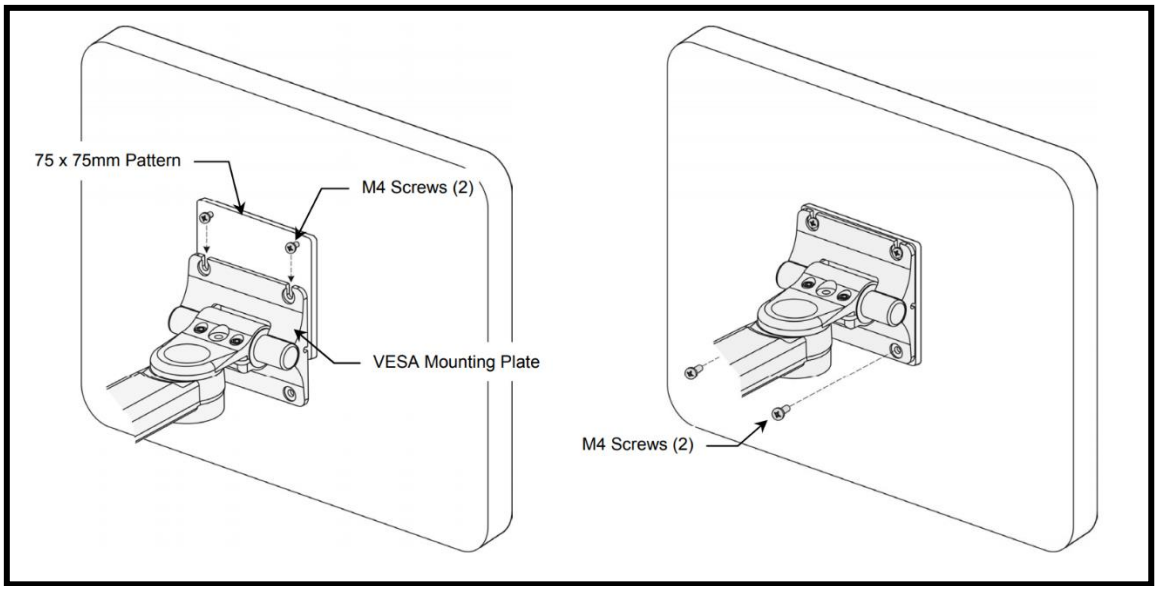

Figure 7

Once the computer is mounted connect the power cable, USB keyboard, network cable and USB Cable to the appropriate ports. See **Figure 8** for reference.

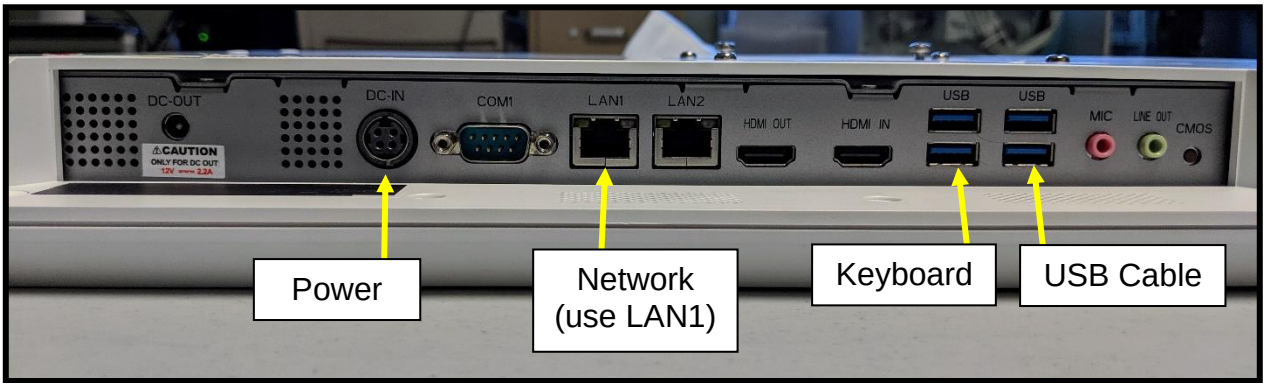

Figure 8

If your order has the display arm option, use **Figure 9**, **Figure 10** and **Figure 11** to adjust the tension if necessary.

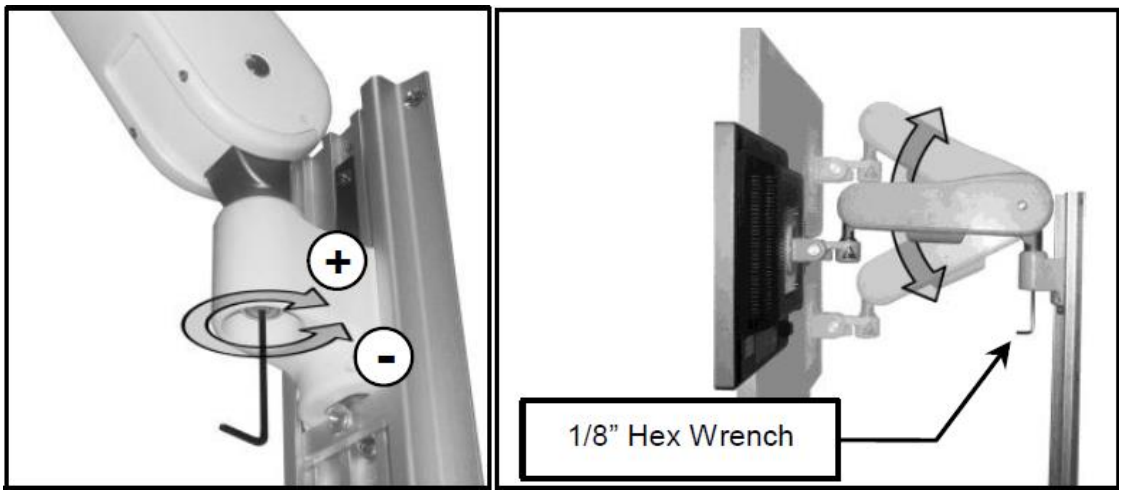

Figure 9 – Counterbalance Adjustment

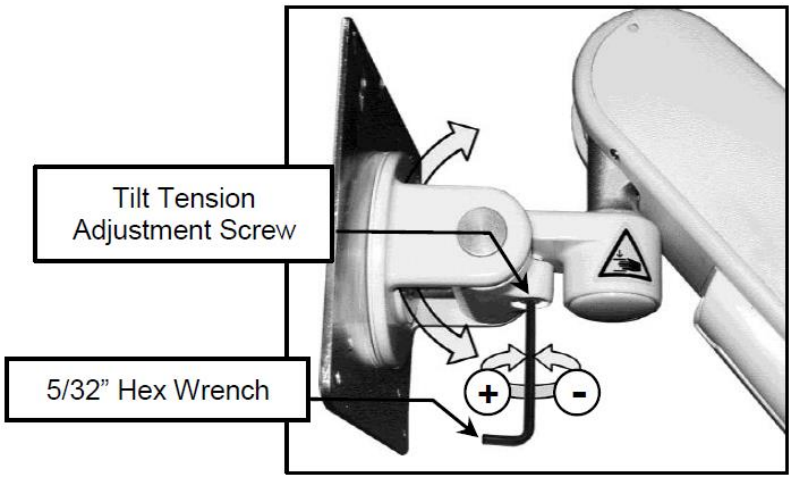

Figure 10 – Tilt Adjustment

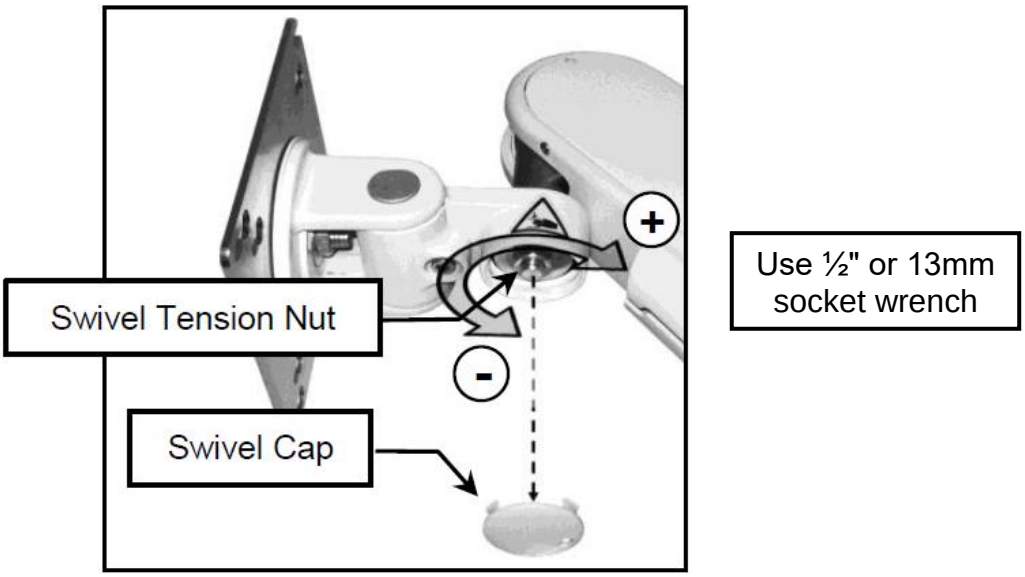

Figure 11 – Swivel Tension Adjustment

Step 3: Install Roodra Chassis

Open the chassis box and remove the chassis from the foam and plastic. Place the chassis on top of the storage drawer as shown in **Figure 12**.

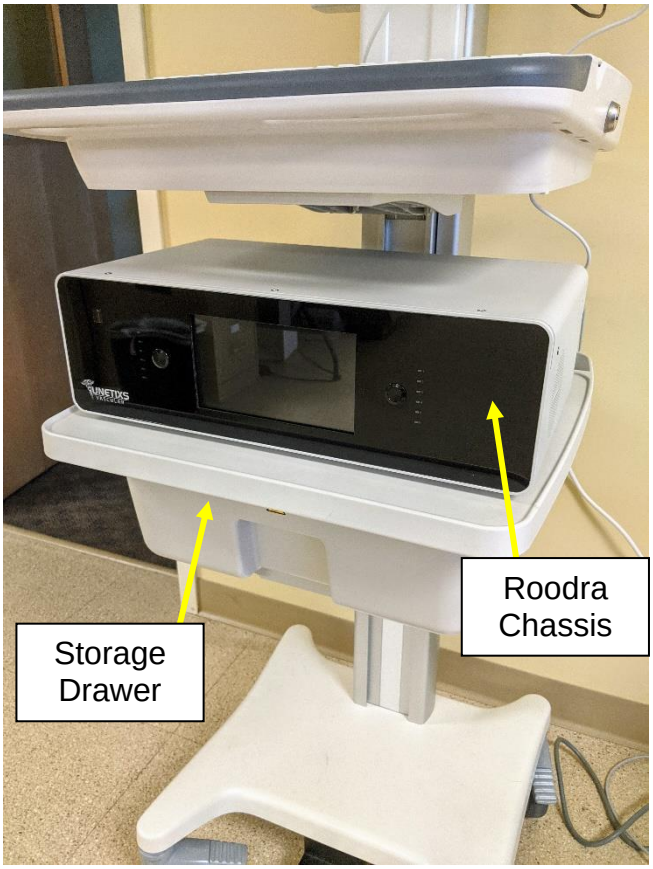

Figure 12

Attach the power cable and USB Cable to the back of the chassis as shown in **Figure 13** and **Figure 14**.

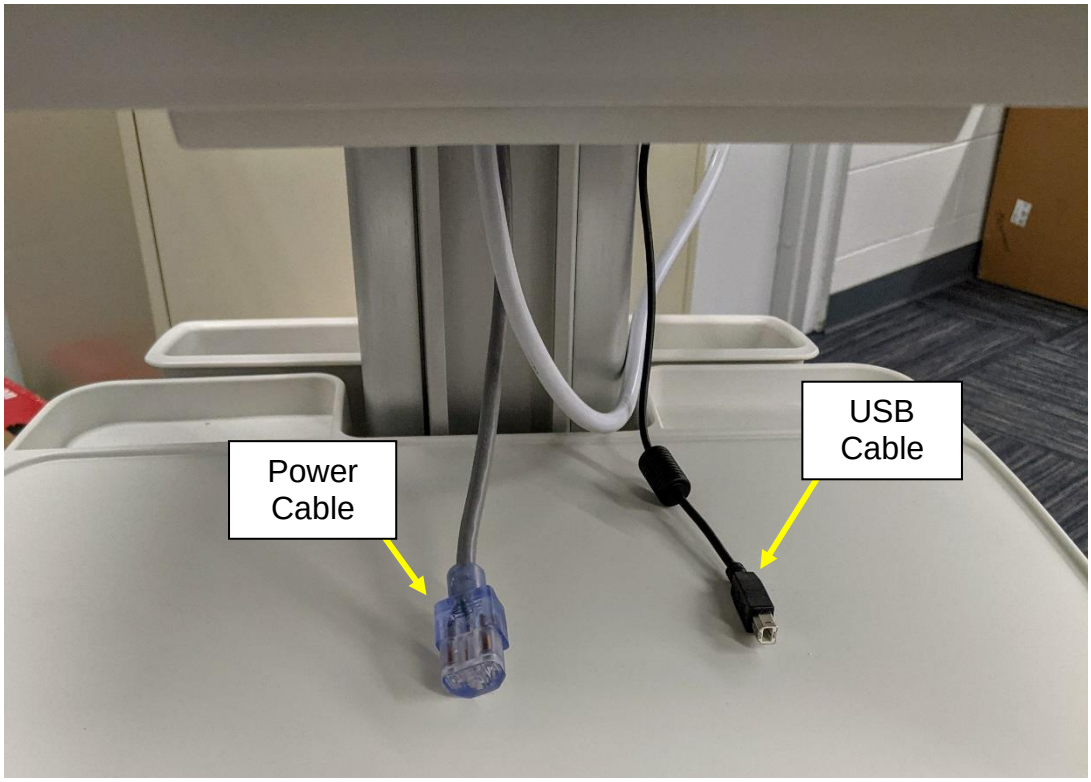

Figure 13

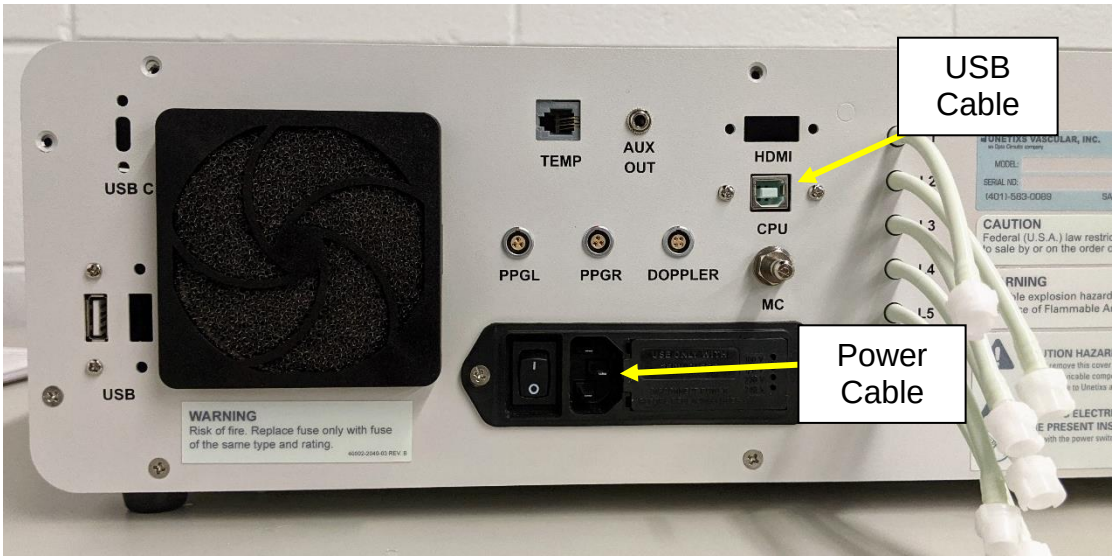

Figure 14

Step 4: Computer Batteries Install (Optional)

If your order comes with the backup batteries for the Touch Panel Computer, remove the 3 batteries from their packaging and install them into the battery bays located along the top of the Touch Panel Computer as shown in **Figure 15**.

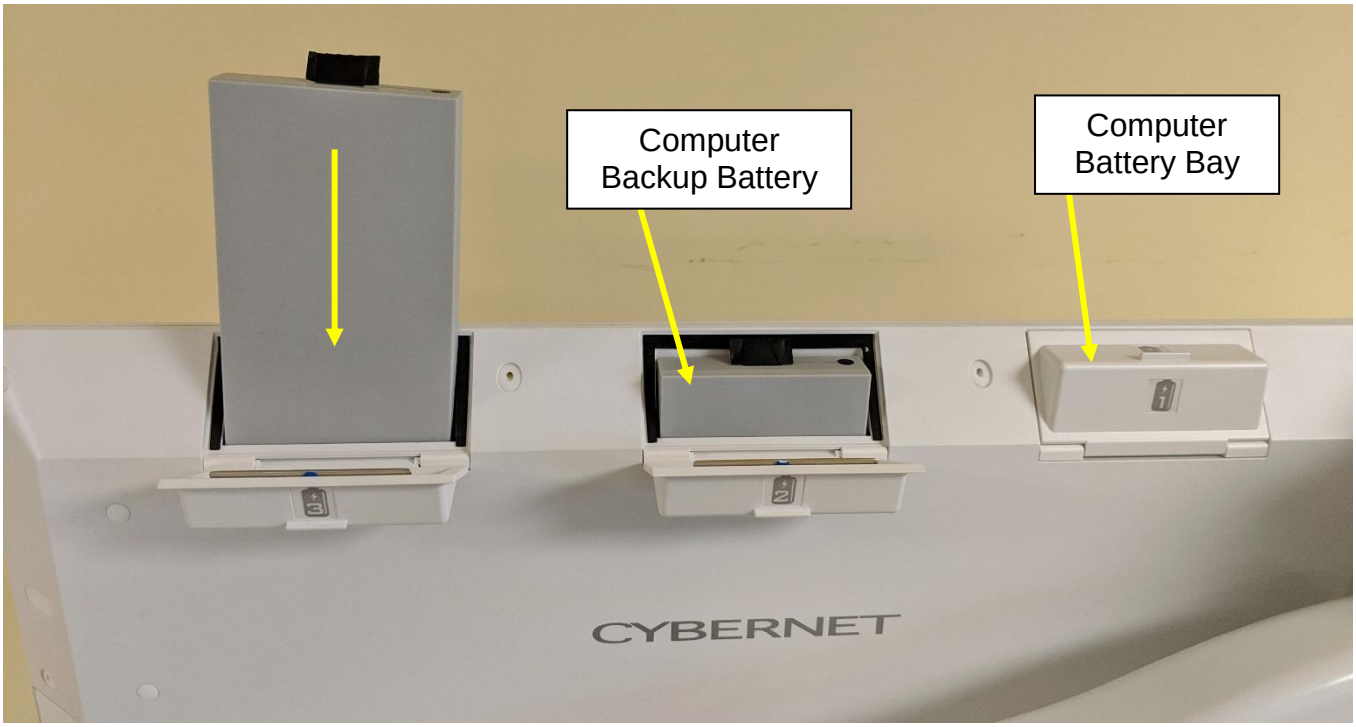

Figure 15

Step 5: Cart Basket Install (Optional)

If you order comes with the cart basket, remove it from its packaging and then remove the 4 Phillips head screws from the bottom mounting plate located on the back of the cart. See **Figure 16** for reference.

Figure 16

Using those 4 screws, attach the basket to the mounting plate as shown in **Figure 17**.

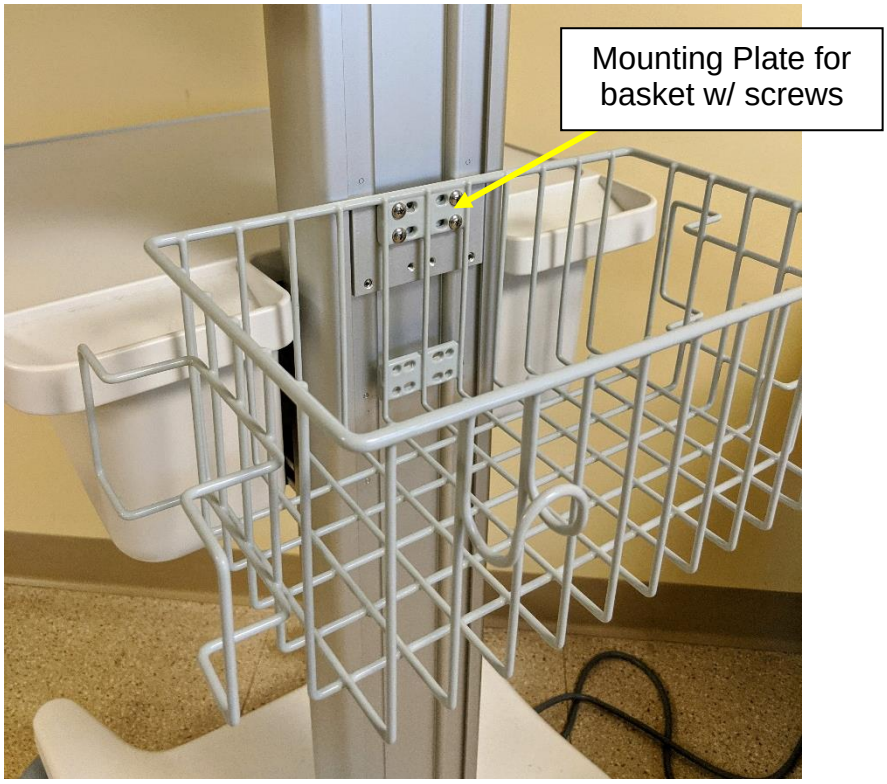

Figure 17

Step 6: Printer Install (Optional)

If your order comes with a printer, remove it from its packaging and place it in a secure location near the Roodra unit. Follow the guide that comes with the printer and follow the steps to install the ink cartridges and initial setup. If the printer asks to start connection during these steps, select “Do not connect”. When you reach the home screen on the printer, you may continue.

Select the **gear icon** from the printer home screen. Select **Settings** --- **Device Settings** --- **LAN Settings** --- **Wireless Direct** --- **Wireless Direct active/inactive** --- **ON**. A confirmation screen will appear asking if you want to display the password information, select **Yes**. The list of Wireless Direct settings will then be displayed.

Connect the Roodra unit to a power outlet using the power cord (see Figure 18).

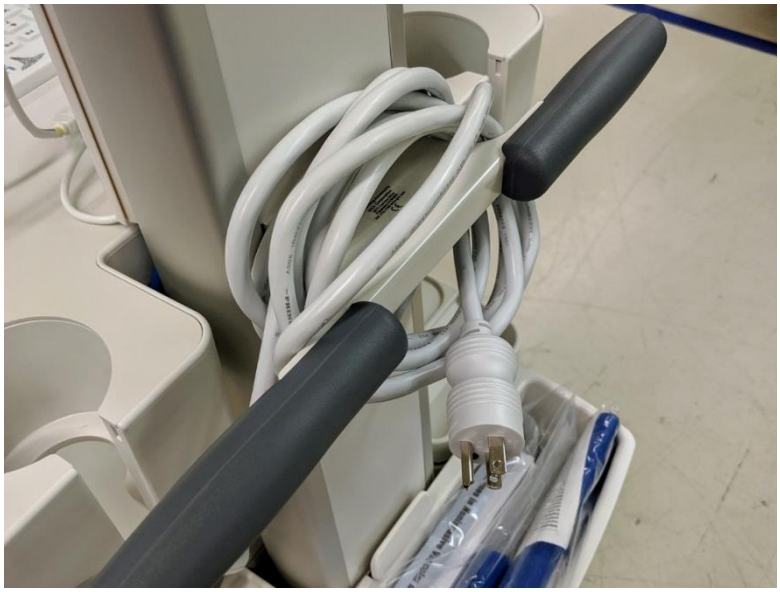

Figure 18

Turn on the Touch Panel Computer. Once the computer has booted, exit the S2 software to reach the desktop. Select the network icon from the and select **Wi-Fi 2** from the drop-down menu as shown in **Figure 19**.

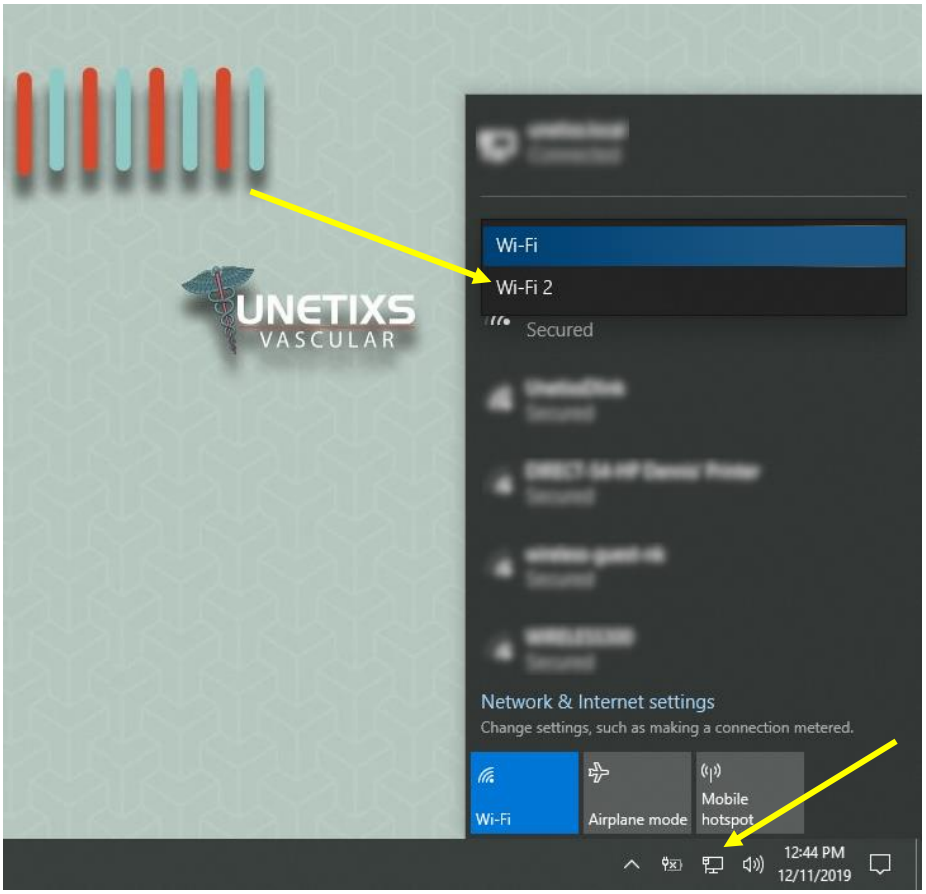

Figure 19

Select the printer from the list of available networks, the name of the printer is listed in the wireless direct settings on the printer itself in the SSID field. The name will be “DIRECT-XXXX-TS5100series” (“X” will be unique alphanumeric characters).

Enter the security key (not a pin), which can be found in the wireless direct settings in the password field. Click **Next** and then select **No** when asked about PC discoverability.

Once connected, select the **Start Icon** --- **Settings** --- **Devices** --- **Printers & scanners**. Click **Add a printer or scanner** and it will begin to search for available printers. When it appears, select the printer and click **add device**. The printer name will be “TS5100 series _XXXXXXX…” (“X” will be unique alphanumeric characters). When the printer is successfully connected, ensure that the box next to “Let Windows manage my default printer” is unchecked. Then click on the Canon printer under “Printers & scanners” and select **manage** --- **Set as default**.

The printer setup is now complete.

Step 7: Accessories & Vascular Connections

Attach the hoses to the back of the Roodra chassis as shown in **Figure 20**. Take care to connect the hoses by the correct number. Attach the bleed valves to number 6, between the chassis and the hose. Hang the hoses on the hose hanger on top of the cart assembly.

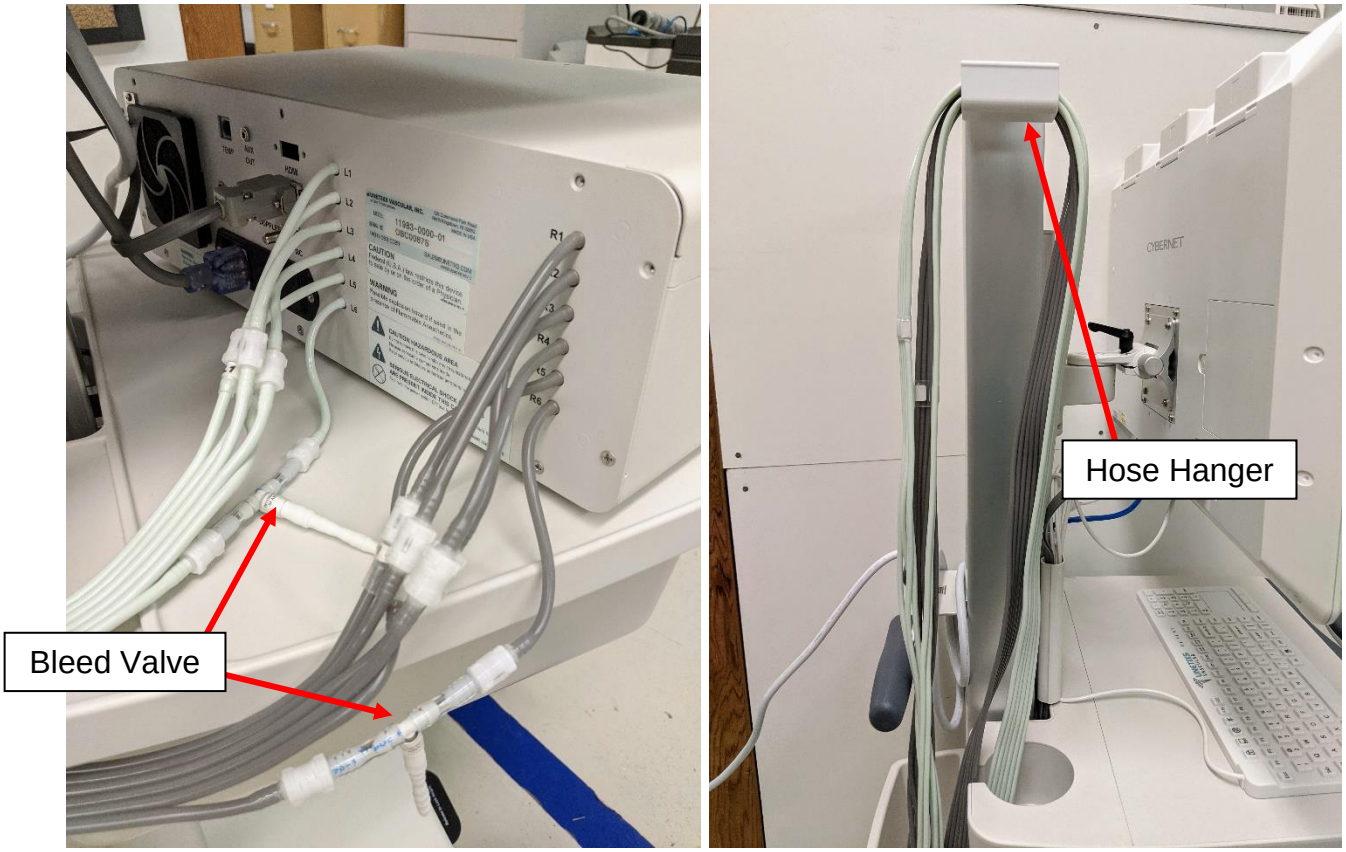

Figure 20

Attach the PPG and Doppler cables to the back of the Roodra chassis as shown in **Figure 21**.

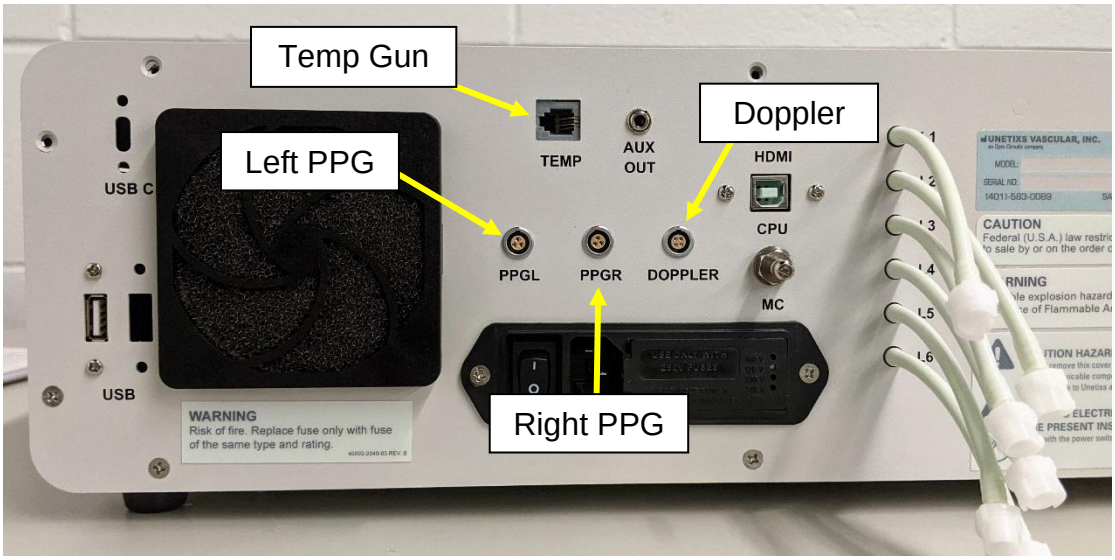

Figure 21

Connect the right and left PPG clips to their appropriate cables/sensors and connect the Doppler to its cable.

Attach the PPG/Doppler holder to a secure position on the cart and attach the Doppler and PPGs to it as shown in **Figure 22**.

Figure 22

Step 8: Powering On

Plug the power cable (see **Figure 18**) into an appropriate power outlet.

Turn on chassis via power switch on the back of the chassis.

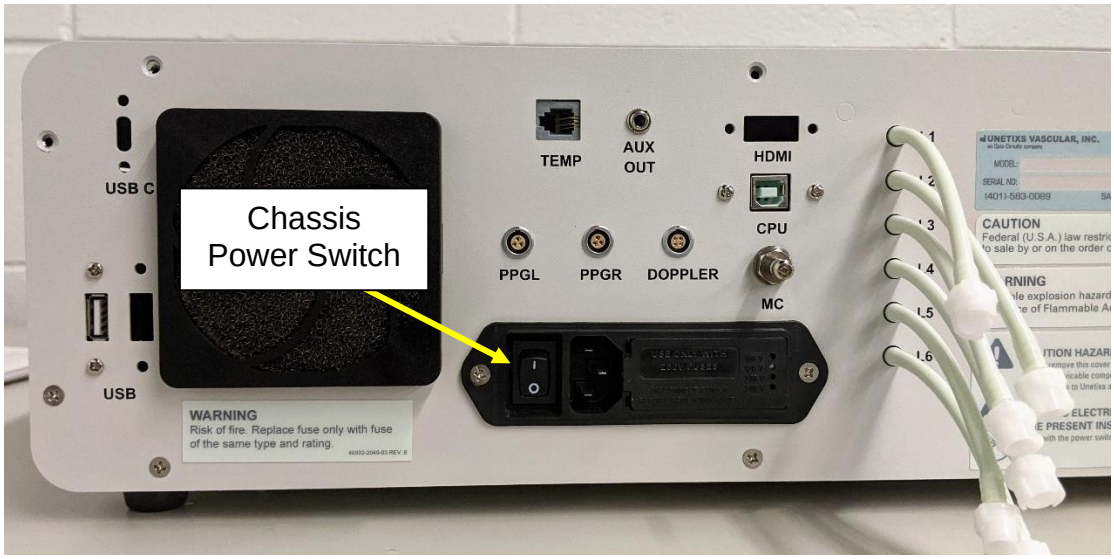

Figure 23

Turn on the computer via power button on the front of the computer.

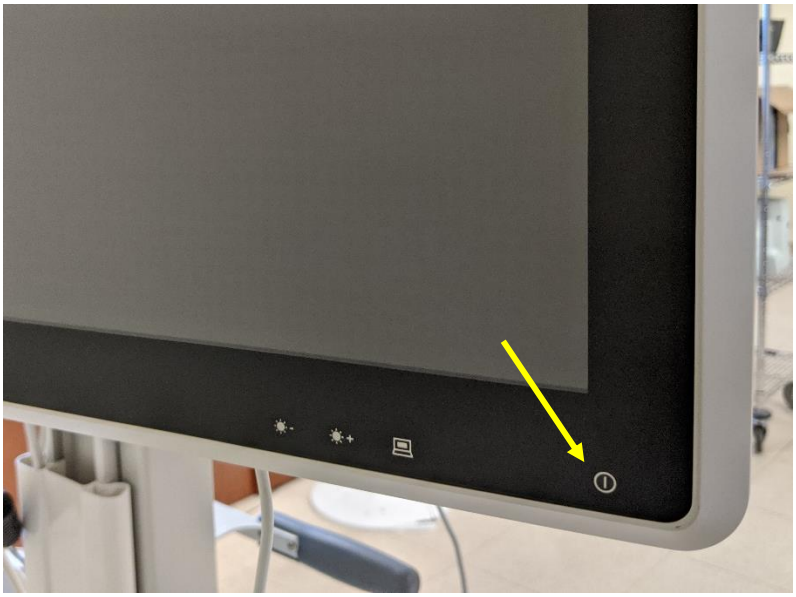

Figure 24

Installation is complete.

Once the assembly, installation and training are completed, the sales representative must fill out the Acknowledgement of Acceptance (F03 01) with the customer's representative and return the completed form to Unetixs.

Roodra (ESA Option):

Step 1: Unpacking

Remove the external strapping from around the shipping box. Remove the top from the box. Cut the tape keeping the box together and remove the outer shipping box from the wooden shipping pallet. Remove the top foam piece.

Figure 25

Carefully remove the shrink film from around the cart to access the computer box, chassis box, accessory box, and cart drawer.

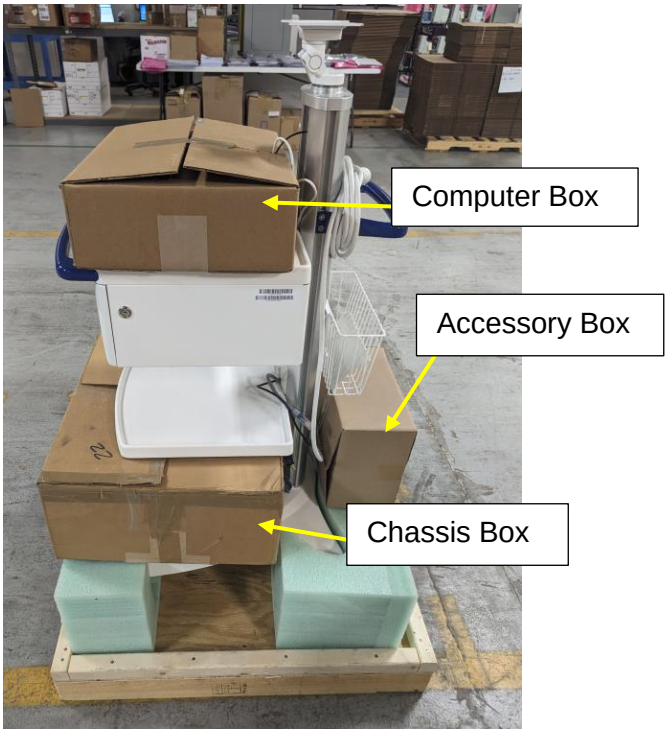

Figure 26

Before commencing with the assembly and attachment of the accessories, we request that you take a pre check of all the items listed below. **Note: This is a comprehensive list and some items are optional, please confirm with your packing list to see what items you should have.**

NOTE: The computer and keyboard are connected to the cart assembly via USB cables so take extra care when removing them from the box.

Part Number	Description	Qty	Location
11976-0000-01	ESA Cart Assembly	1	Skid
11983-0000-01	Roodra Chassis	1	Chassis box
10353-0005-01	Touch Panel Computer	1	Computer box
10304-0006-01	Keyboard	1	Computer box
20095-0020-01	M4 Mounting Screws	4	Computer box
40001-1005-03	Doppler / PPG Holder	1	Computer Box
11966-0000-01	Bleed Valves	2	Cart Drawer
11980-0000-01	Left Hose Set	1	Accessory Box
11981-0000-01	Right Hose Set	1	Accessory Box
11938-0000-01	Left PPG	1	Cart Drawer
11939-0000-01	Right PPG	1	Cart Drawer
11928-0000-01	Left Finger Clip	1	Cart Drawer
11929-0000-01	Right Finger Clip	1	Cart Drawer
11930-0000-01	Doppler Cable	1	Cart Drawer
10628-0001-01	Ultrasonic Doppler Gel	1	Cart Drawer
10383-0001-01	USB Flash Drive	1	Cart Drawer
10377-0000-01	Remote Control	1	Cart Drawer
40002-2047-01	Doppler Gel Holder	1	Cart Drawer
10660-0001-01	Hose Hook	2	Cart Drawer
10635-0001-01	Double Sided Tape	1	Cart Drawer
N/A	Top Channel Cover	1	Cart Drawer
11309-0000-01	Operators Manual	1	Accessory Box
11309-0001-01	Installation Guide	1	Accessory Box
10339-0007-04	Daigle Vascular & CME Manual	1	Accessory Box
F03 01	Acknowledgment of Acceptance	1	Accessory Box
Optional Items			
11962-0000-01	5 MHz Doppler Probe	1	Cart Drawer
11963-0000-01	8 MHz Doppler Probe	1	Cart Drawer
11990-0000-01	Cuff Set A	1	Accessory Box
11991-0000-01	Cuff Set B	1	Accessory Box
10329-0010-01	Printer	1	Printer Box
10326-0006-01	USB Printer Cable	1	Cart Drawer
10638-0000-01	Deskjet Paper	1	Cart Drawer
11951-0000-01	Temp Gun	1	Cart Drawer
10346-0000-01	Temp Gun Cable	1	Cart Drawer

Once you have confirmed the contents, you will be ready to proceed with the assembly.

Step 2: Installing the Computer

Open the computer box and carefully remove the keyboard, bag of mounting screws, and computer from the box.

Mount the computer to the display mounting using the (4) M4 screws provided as shown in **Figure 27**.

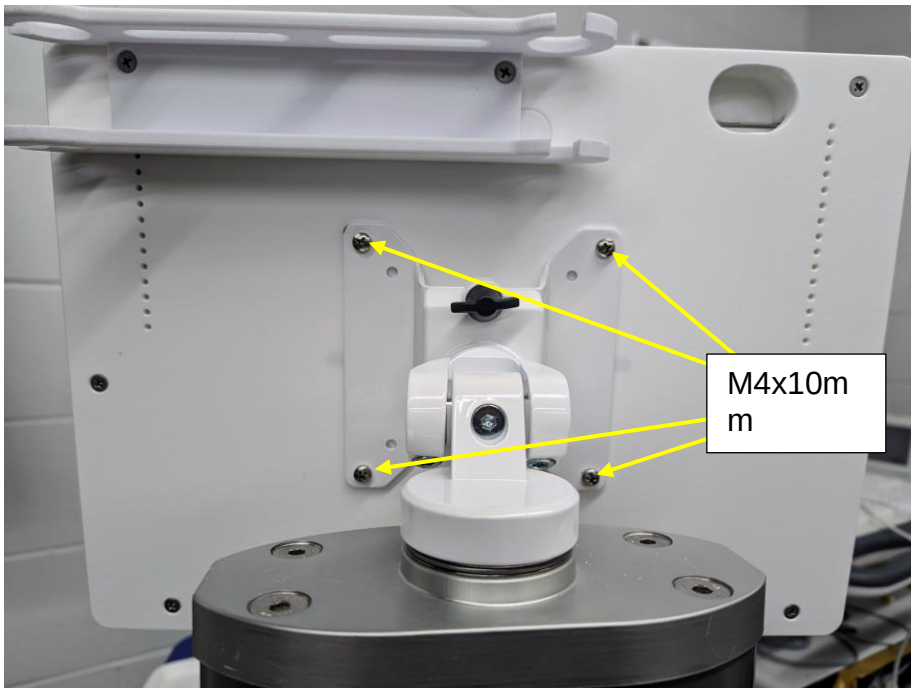

Figure 27

Carefully remove the cart from the foam and the skid.

Place keyboard on top shelf and store excess cable inside the channel. Attach the top channel cover with the USB C cable routed through the top notch and the keyboard cable routed through the bottom notch as shown in **Figure 28**.

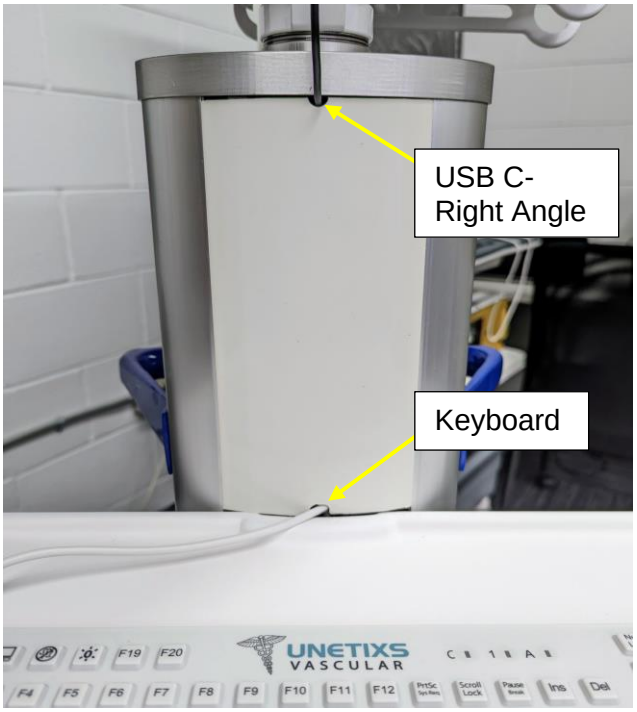

Figure 28

Step 3: Installing the Roodra Chassis

Open the chassis box and remove the chassis from the foam and plastic. Place the chassis on the bottom shelf of the cart.

Connect the power cable and the USB cable to the back of the chassis as shown in **Figure 29**.

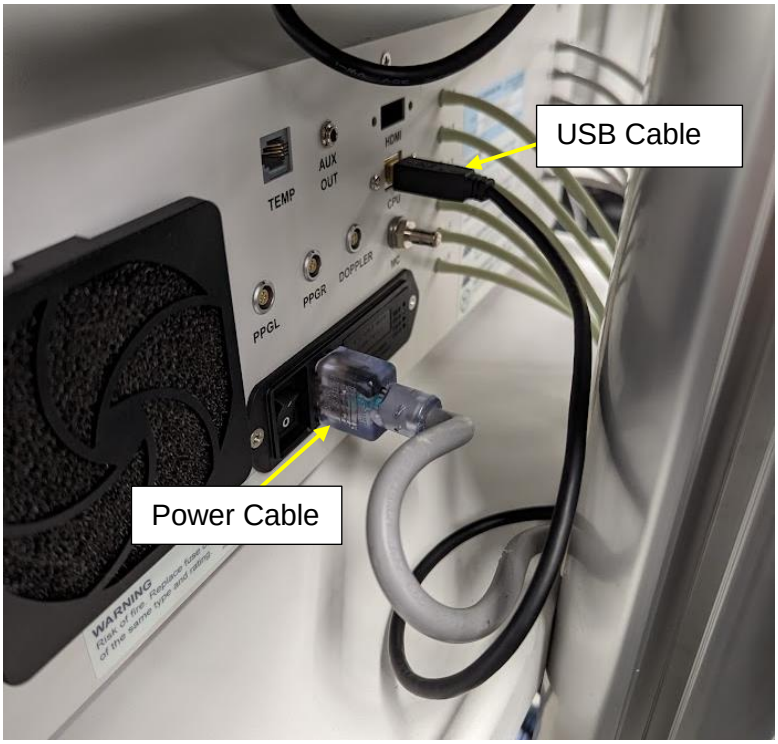

Figure 29

Step 4: Accessories and Vascular Connections

Attach the hoses to the back of the Roodra chassis as shown in **Figure 30**. Take care to connect the hoses to match the corresponding labels on the chassis. Attach the bleed valves to the number 6 hoses, between the chassis and the hose.

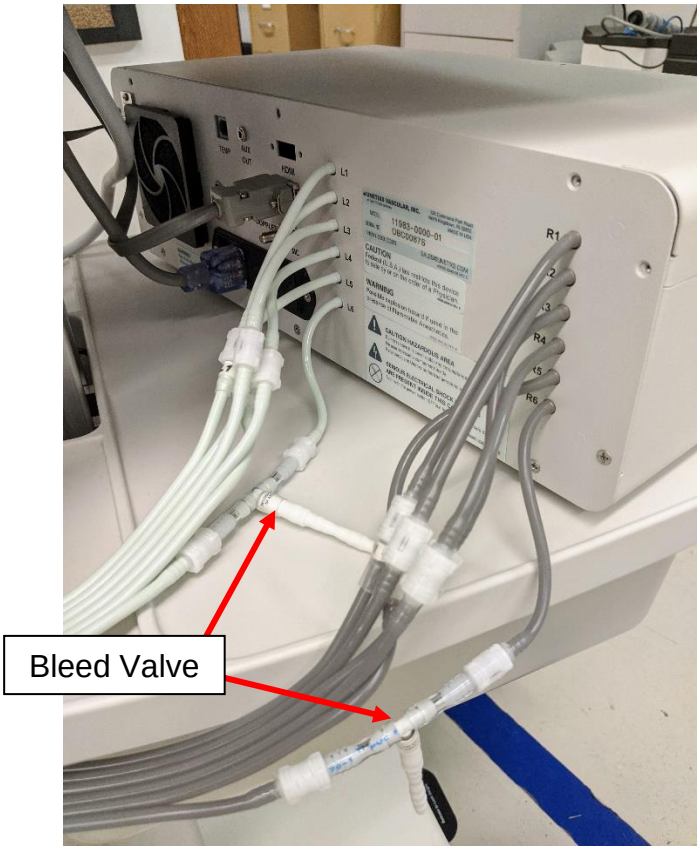

Figure 30

The hose hooks maybe attached to either handle as shown in **Figure 31**.

Figure 31

Attach the PPG and Doppler cables to the back of the Roodra chassis as shown in **Figure 32**. May also connect Temp Gun cable and Temp Gun if available.

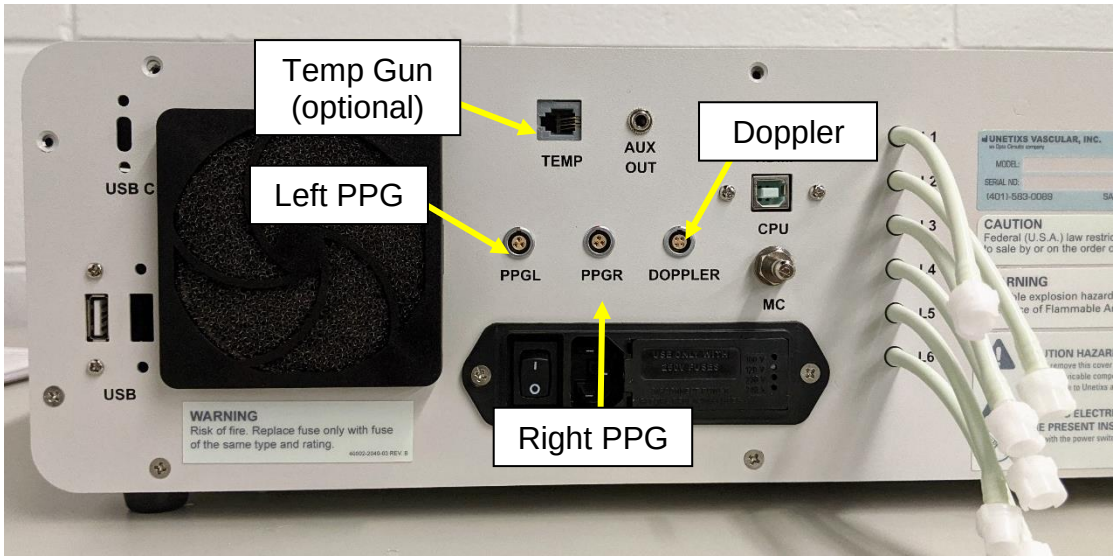

Figure 32

Connect the right and left PPG clips to their appropriate cables/sensors and connect the Doppler probe to its cable.

Attach the Doppler and PPG probes to the Doppler/PPG holder on the back of the computer as shown in **Figure 33**.

Figure 33

Attach the Doppler Gel Holder to the top of the cart using either of the thumbscrews as shown in **Figure 34**.

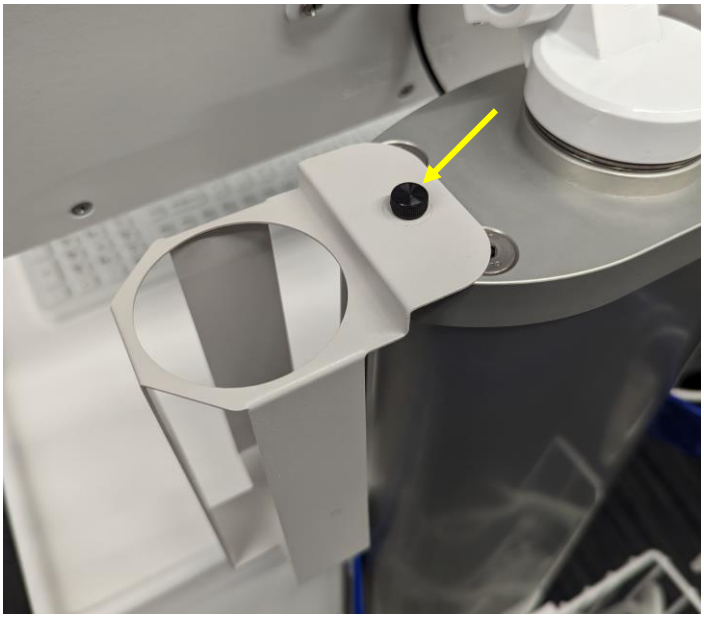

Figure 34

Step 5: Printer Install (Optional)

If your order comes with a printer, remove it from its packaging and place it in a secure location near the Roodra unit. Follow the guide that comes with the printer and follow the steps to install the ink cartridges.

Take the provide USB Printer cable, connect one end to the printer and the other end to the free USB port on the USB hub of the cart which is located under the drawer as shown in **Figure 35**.

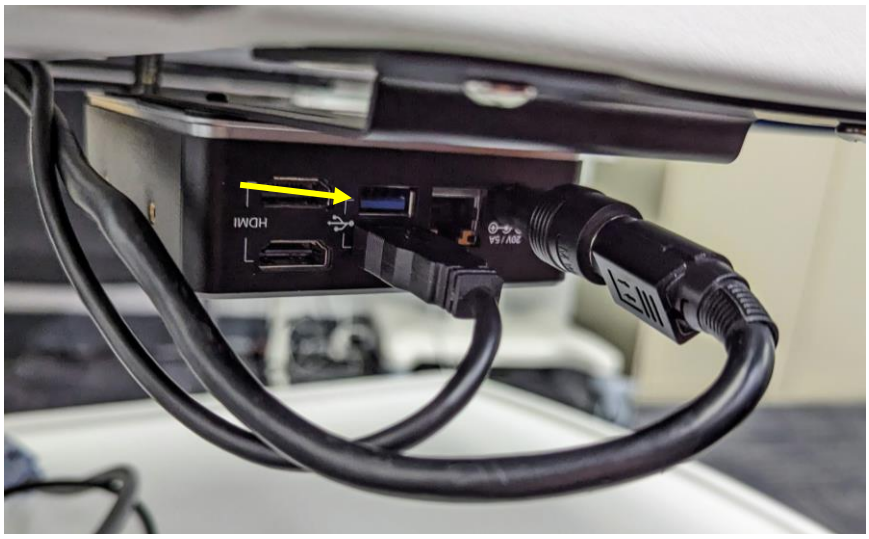

Figure 35

Step 6: Powering On

Connect the USB Hub and chassis power cables to the power strip as shown in **Figure 36**.

Figure 36

Connect the main system power cable to an appropriate power outlet.

Turn on the Roodra chassis via the power switch on the back of the chassis as shown in **Figure 37**.

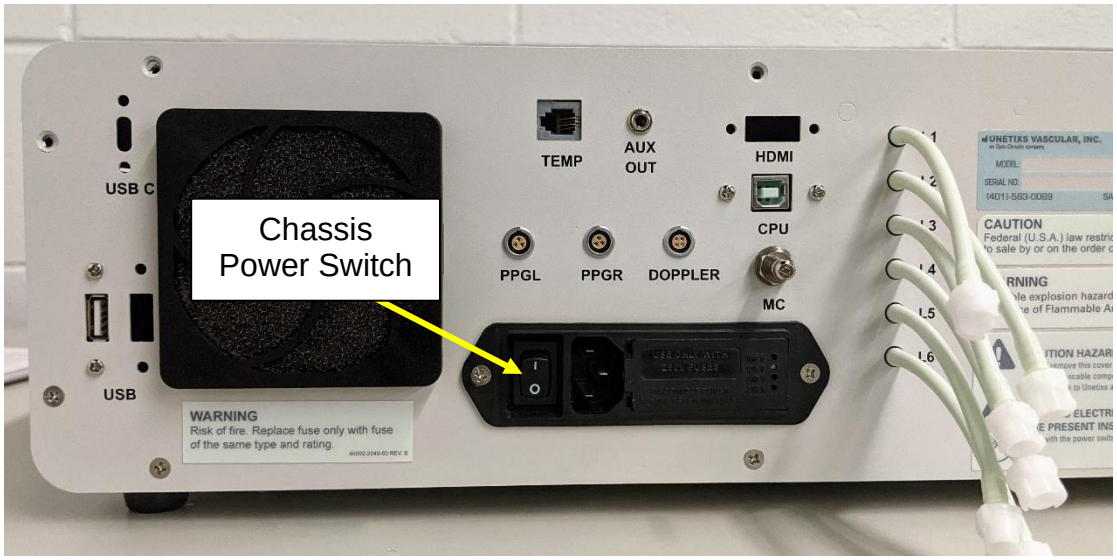

Figure 37

Turn on the computer via the power button on the back of the computer as shown in **Figure 38**.

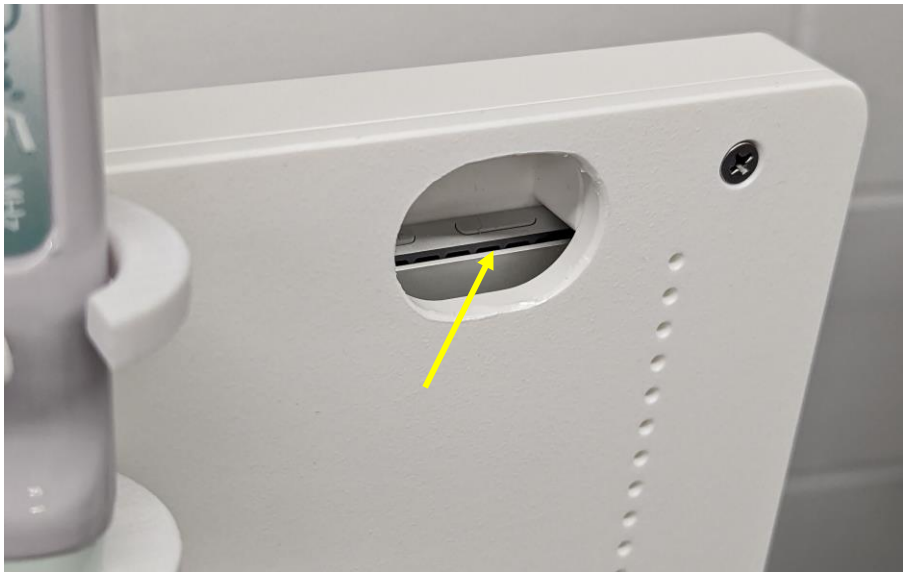

Figure 38

Installation is complete.

Once the assembly, installation and training are completed, the sales representative must fill out the Acknowledgement of Acceptance (F03 01) with the customer's representative and return the completed form to Unetixs.

Custom Vanity Display

If you wish to change the vanity display with a custom image(s) use the following steps:

Logo

1. Create a Folder on the Flash Drive named “Logo” (name is case sensitive).
2. Place the desired logo image inside the Logo folder, only one image must be in the folder at a time when replacing. The image may be in .jpg, .jpeg, .png, .bmp, and .tiff format. The resolution of the screen is 800x480.
3. Ensure Roodra chassis (11983-0000-01) is off.
4. Insert the USB Flash Drive to the USB slot on the back of the Roodra Chassis.
5. Turn on the Roodra Chassis.
6. A command window will appear on the LCD screen saying searching for USB. If successful it will then say that the logo change is complete and to turn off the chassis.
7. Turn off the chassis. Remove the USB Drive. When the chassis is powered back on the new Logo will appear.

Default Logo

1. Connect the USB flash drive (10383-0001-01 from 11989-0000-01) to the free USB A port on the USB dock.
2. Open Windows Explorer and navigate to C:/programs/Logo. Run the ToThumb batch file. A command window will pop up and run the file. It will give a success message when complete, then press any key to continue and close the window. Close Windows Explorer.
3. Eject the flash drive from the computer. Turn off the Roodra chassis. Insert the flash drive into the USB A port on the back side of the Roodra chassis.
4. Turn the Roodra chassis on. A command window will appear on the chassis display saying searching for USB. It will find the USB and then the logo folder and logo on it. It will then replace the logo and once complete will say to power cycle the Roodra chassis. Turn off the Roodra chassis. Remove the flash drive from the back of the chassis. Turn the Roodra chassis back on and the new logo will appear on the display.

Slideshow

1. Create a Folder on the Flash Drive named “RoodraSlideshow” (name is case sensitive).
2. Place the desired images inside the RoodraSlideshow folder, images may be in .jpg, .jpeg, .png, .tiff, .bmp, .gif (not animated) formats. The resolution of the screen is 800x480.
3. Ensure Roodra Chassis (11983-0000-01) is off.
4. Insert the USB Flash Drive to the USB slot on the back of the Roodra Chassis.
5. Turn on the Roodra Chassis.
6. A command window will appear on the LCD screen saying searching for USB. Once it locates the USB drive the slideshow will load and begin to play.

Videos

1. Create a Folder on the Flash Drive named “RoodraVid” (name is case sensitive).
2. Place the desired video files into the folder. The player supports resolutions up to 1080p and formats like .avi, .mov, .mkv, .mp4, .m4v encoded with H.264 codec.
3. Ensure Roodra Chassis (11983-0000-01) is off.
4. Insert the USB Flash Drive to the USB slot on the back of the Roodra Chassis.
5. Turn on the chassis.
6. A command window will appear on the LCD screen saying searching for USB. Once it locates the USB drive the videos will load and begin to play.

For Additional Help Contact:
Unetixs Vascular, Incorporated
333 Strawberry Field Rd, Suite #11
Warwick, RI 02886

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www.unetixs.com

Section 3: Operator's Manual

MultiLab Operator's Manual

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CHAPTER 1: CARE OF EQUIPMENT

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Fax: 401-294-7541
Internet: Sales@unetixs.com

Or contact your local Unetixs Vascular Field Representative

Contact Unetixs, Inc. for:

- Any questions regarding the operation of the system
- Service and repair information
- To purchase consumable items (paper, gel, replacement accessories) or options.

Do not return the system or accessories to the factory without prior authorization from the Customer Service Manager. Unauthorized returns will be returned to the sender at the sender's expense. To obtain authorization, write or call:

Customer Service hours are between 8:30 am and 5:00 p.m. Eastern Time. Please have your model and serial numbers ready prior to calling.

NOTES

Our Responsibility

As the manufacturer, Unetixs Vascular, Inc. is responsible for the effects on safety and performance only when:

1. Installation procedures, training, programming, modifications, or repair are performed by individuals authorized by Unetixs Vascular, Inc.
2. The MultiLab is used in accordance with instructions for use.

The Customers Responsibility

The user of the MultiLab is responsible for using the system according to instructions. The user is further responsible for the establishment of a general cleaning and maintenance schedule, the lack of which could lead to failure and premature retirement of the device.

Note: This system can be affected by radio frequency energy from other medical and non-medical devices. If other devices are causing interference:

1. Relocate either the MultiLab or other device.
2. Increase the distance between the MultiLab and the other device.
3. Power the MultiLab from a different source than the other device.
4. Consult Unetixs Service for other suggestions.

Note: Do not use other devices which intentionally transmit RF Signals such as cell phones, radio transceivers, or radio controlled products near the MultiLab while in operation.

Troubleshooting

Most problems can be fixed by simply restarting the system. Turn off the system with the power switch. Unplug the system from power for 10 seconds. Plug back in and turn back on. If this does not fix your problem then contact technical support above.

Note for **2CP**: By default the system power settings, in Windows, are set to disable sleeping and to disable turning off the display. If these are changed, you may notice a color inversion or a partial shifting of the display. To fix this, just restart the system. To turn these off again, connect a keyboard. Press the "windows" key and type "power". Touch "Power and Sleep Settings". Set Screen "Turn off after:" to "Never". Set Sleep "PC goes to sleep after:" to "Never". Close the Settings window and restart the system.

Intended Use and Misuse

Intended Use

The MultiLab is intended for use as a non-invasive diagnostic device by trained medical personnel following physician orders. This device is intended for the detection of obstruction to blood flow in human arteries and veins as an aid for the diagnosis of disease in the peripheral vascular system. IT IS NOT INTENDED FOR MONITORING PATIENT VITAL SIGNS OR TO ADVISE IN THE ADMINISTRATION OF ANY DRUG.

NOTE: The accuracy of non-invasive vascular diagnostic studies depends on the knowledge, skill and experience of the technologist and the physician performing the interpretation of the study. This operator's manual is intended to be used as a guide to instrument operation only, and as such, should not be viewed as a substitute for formal clinical vascular education.

NOTE: The manufacturer and its agents cannot accept liability for loss, indirect or consequential damages resulting from misuse of or modification to the device or from operator negligence.

Because the results of the studies are dependent upon operator skill, procedures and interpretation beyond the manufacturer's control, the manufacturer or its agents cannot accept any liability arising from operator error or Physician misinterpretation.

It is recommended, in the event of an uncertain diagnosis following a primary testing with the system, that the patient be referred to an expert vascular practitioner and/or laboratory for further evaluation.

Limited Warranty

Your system is warranted to be free from defects in both workmanship and in materials for:

24 months of parts
24 months of labor
6 months on cuffs
12 months on probes

This warranty period commences from the original date of purchase. The Acknowledgement of Acceptance must be returned within 10 days of the date of purchase.

All material found defective within the warranty period will be repaired or replaced at no extra charge by the manufacturer. Unetixs Inc. assumes no liability for service representation. The warranty will be void if the instrument is determined to have been subjected to abnormal environmental conditions, mechanical or physical abuse.

This warranty is exclusive and is in lieu of all other warranties expressed or implied, including but not limited to any implied merchantability or fitness for a particular purpose or use. Unetixs Incorporated will not be liable for any special, indirect, incidental or consequential damages or loss, whether in contract, tort or otherwise.

NOTE: Unetixs Incorporated reserves the right to make improvements in the design, construction and appearance of its products without notice.

The following incoming inspection is required whether it is a first time arrival or a return from service. Prior to clinical use, the instrument should be inspected for the following:

- Fill out and return your Acknowledgement of Acceptance immediately.
- Carefully inspect the cartons for damage that may have occurred during shipping. Open the carton carefully.
- Remove the system and its accessories (see packing list and shipping documents) from the shipping carton. Inspect the system for damage that might have been incurred during shipping.
- If you find any damage, notify the carrier and Unetixs Inc. (the manufacturer) Customer Service Department immediately. See the CUSTOMER SERVICE AND WARRANTY section of this manual for further information.
- Please also go through the packing documents and inspect your accessories for completeness and possible damage.

IMPORTANT: Save the entire original packing materials until you have confirmed the system operates properly. We STRONGLY recommend you save them for future service or moving.

Specified Environmental Conditions for use of MultiLab

1. Indoor use ONLY.
2. 68 – 78 Degrees Fahrenheit (20 – 25.5 Celsius)

SYMBOLS

Symbol	Definition
	Refer to Operator's Manual for Information
	Shock Hazard
	Do not dispose of in municipal waste. Wheeled bin symbol indicates separate collection for electrical and electronic equipment (WEEE Directive 2002/96/EEC)
IPX0	Identifies the degree of protection against Fluid & Dust.
	Alternating Current (AC)
	Type BF Equipment
	Class I
	Technical Support Phone Number

Safety

Definition of Warning and Caution symbols:

⚠ **WARNING** ⚠ Designates a possible dangerous situation. Non-observance may lead to death or the most severe injuries.

⚠ **CAUTION** ⚠ Designates a possible dangerous situation. Non-observance may lead to minor injuries or damage to the product.

Warning

⚠ Before operating instrument, please go through the Operator's Manual which contain theory of operation, setup, and application of device to minimize the risk of improper usage

⚠ Inspect for damage! User should inspect the system for signs of damage. Do not use the system if damage is evident or failure is evident or suspected.

⚠ Make frequent electrical and visual checks on Power cables, Doppler & PPG cables and Pneumatic hoses.

⚠ When the unit or its accessories have been dropped or severely abused, it should be checked by the qualified service personnel from Unetixs Inc. to verify proper operation.

⚠ Possible explosion hazard! Do not use the MultiLab Series II in the presence of anesthetics.

⚠ Possible explosion hazard! Do not use the MultiLab Series II in the presence of gas mixtures which may be flammable.

⚠ The device should not be used in MRI environment.

⚠ The device is to be operated by trained medical personnel only.

⚠ All the cables and tubing should be carefully routed to avoid the possibility of patient entanglement and strangulation. Patient should not be left unattended

⚠ Operators are not to leave the patient unattended during testing.

⚠ If the patient should feel severe discomfort during cuff inflation, the cuff can be deflated by pressing the deflate button on the MultiLab Series II screen or cuff pressure can be rapidly exhausted by pressing the capture button. The same result can be obtained by physically removing the air hose from the blood pressure cuff.

⚠ All power cords must have hospital grade plugs and be plugged into hospital grade outlets. (The electrical installation of the relevant room must comply with NFPA 70: National Electric Code of NFPA 99: Standard for Health Care Facilities. Outside the United States, the relevant room must comply with all electrical installation regulations mandated by the local and regional bodies of government.)

⚠ Use proper power cord with the correct attachment plug style. If the power source is 120 VAC, use a power cord which is a Hospital Grade Power Cord with NEMA 5-15 style plug, labeled for 125 volts AC with UL and C-UL approvals. If the power source is a 240 VAC supply, use the tandem (T blade) type attachment plug with ground conductor power cord that meets the respective European country's safety regulations.

⚠ Device should be located, such that user should have easy access for the removal of power card.

⚠ Changes or modifications not expressly approved by UNETIXS, Inc., may cause unexpected results (Shock Hazards to the patient or the operator), and may also void the warranty.

⚠ Risk of electrical shock! Do not remove cover. There are no user serviceable parts.

⚠ Do not re-use accessories labeled as single use.

⚠ U.S. Federal law restricts this device to sale by or on the order of a physician.

⚠ When transporting equipment always use the transport position (if applicable).

⚠ People who are suffering from Deep Vein Thrombosis (DVT, i.e., blood clot in the veins of the legs) should not undergo for an ABI test.

⚠ Do not connect luer or bayonet fittings into any other equipment.

⚠ Do not connect cuffs with luer lock or bayonet connectors to intravenous fluid systems or air may enter the patient. Immediately consult a physician if this occurs.

⚠ When inflated above 10mmHg, make sure the cuffs will not remain on patient for more than 10 minutes, which may lead to patient distress, disturbance in blood circulation and injury to the peripheral nerves.

⚠ Cuffs should not be wrapped on patient where skin is delicate or damaged.

⚠ Cuffs should not be wrapped very tightly, at least a space of 1 finger must be allowed between the patient and the top of the cuff.

⚠ The Doppler probes are not intended to be used on open skin. Disinfect the probe before using it again in case of open wound contamination.

⚠ The Doppler probes are not intended to be used on or near the eyes.

⚠ The Doppler probes are not intended for fetal use.

Caution

⚠ The system is not intended for continuous or unattended monitoring.

⚠ The MultiLab Series II is non–invasive vascular diagnostic equipment and thus is neither for monitoring the patient's vital signs nor for use in ICU or in operating theater, administering or advice for administering any kind of drugs.

⚠ Testing to be performed by trained medical personnel in a separate room where care against fluid ingress has been taken.

⚠ Doppler and PPG connectors are push/pull connectors ONLY for easy detachment. Any attempt to twist or "screw" these cables in or out will result in damage to the cables and instrument.

⚠ Use the equipment only with recommended accessories! Use of unapproved accessories may cause inaccurate readings.

⚠ Do not store equipment at extreme temperatures. Temperatures exceeding specified storage temperatures (-5 to 50 ºC) could damage the system and accessories.

⚠ Do not press on the keys and screen with surgical instruments or other tools. Sharp or hard objects could damage the keys and screen. Use only your fingertips to press on the keys and screen.

⚠ Do not use the Ethernet ports for internet access, as computer viruses may occur. Ethernet connection is intended for communication with EMR and other patient healthcare software. If Ethernet port must be used, use of firewalls and/or virus protection scanning software is recommended.

⚠ Do not use devices like USB memory stick which is used with the system without scanning for virus or malware bytes. UNETIXS, Inc. assumes no responsibility if the user chooses to leave the system unprotected.

⚠ Unit to be operated in an un-interrupted power supply environment.

⚠ Do not operate the system on an unstable cart or stand. The system may fall causing injury. Use the system with a cart approved or supplied by the manufacturer.

⚠ Do not hang anything from the monitor arm (LHS ERGO IDC option only).

⚠ Refer to the sections below for proper use of the monitor arm (LHS ERGO IDC option only) when the system is being transported, is at rest, or is in use.

⚠ Do not remove the cover of your MultiLab Series II or attempt to service the system. Any service on the MultiLab Series II must be performed by the factory or by a factory-authorized technician. Unauthorized service or part substitution may impair operation and will void the manufacturer warranty.

⚠ Unit to be serviced by UNETIXS, Inc. trained service personnel.

⚠ When products and accessories are near expiry dates and/or require disposal, these items must be processed in accordance with relevant product processing regulations. For further information, please contact UNETIXS, Inc., or its representative agencies.

⚠ Use only in specified environmental conditions.

⚠ Avoid placing the device near diagnostic or therapeutic equipment like X-ray machines, ultrasound machines, electrically operated beds, etc.

⚠ Avoid use of mobile phones in the vicinity of the device.

⚠ If the PPG probe is applied using Velcro™, avoid excessive pressure during wrapping as this can obliterate arteriolar flow causing an abnormal waveform.

Preventive Maintenance & Cleaning

Preventive Maintenance - General

The MultiLab Series II has been designed in such a way as to minimize the amount of preventive maintenance required; however there are some things that should be monitored on a regular basis.

1. Check the connectors on the cable assemblies to insure that the connections are secure.
2. Check that the all ventilation slots are clear of obstructions and dust. Vacuum if necessary.
3. Inspect all cable assemblies (including power cables) for damage or wear. Replace any suspect cables.
4. Inspect blood pressure cuff bladders for signs of wear and air leakage, replace as needed.
5. Check monitor base to insure clamps are secure and that the monitor base is undamaged.
6. Check nuts and bolts used to secure the wheels to the cart to insure tightness.
7. Check all exposed hardware for tightness and correct functionality.

The module from the unit should be returned to the factory once every 24 months for calibration (this service is included in Unetixs .Inc service contracts.)

Preventive Maintenance - Technical

Please refer to LHS Assembly document, 11949-0003-01(see Technical Manual) to perform the following:

⚠ In addition to the user Preventive Maintenance above, the following should be performed by qualified service personnel once per year. Perform this maintenance more often if equipment is used in dusty or damp locations.

1. Remove all covers from MultiLab (if applicable)
2. Turn unit on.
3. Verify that the fan in the back of the module is working.
4. Verify that the fan in the computer assembly is working.
5. Turn unit off and unplug from power mains.
6. Remove computer assembly (11945-0000-01) from cart. (Except Roodra. The All-in-One Computer is not user serviceable)

7. Remove Module Assembly (11903-0000-01) from cart.
8. Vacuum the interior of the cart.
9. Check all interior cables for wear, replace as needed.
10. Check that all interior hardware is securely fastened.
11. Remove cover from Module assembly.
12. Vacuum interior of module.
13. Check that the module fan is clean and rotates freely.
14. Replace module cover.
15. Remove left side of cover from CPU assembly. (Except Roodra)
16. Vacuum interior of computer.
17. Check that CPU fan is clean and rotates freely.
18. Replace Cover on computer assembly.
19. Reinstall computer assembly into cart.
20. Reinstall module assembly into cart.
21. Replace all covers onto MultiLab Cart.

Cleaning

⚠ Shock Hazard! Turn the power off and disconnect the power cable before cleaning the Power supply parts, sensor, or probes.

⚠ Do not use abrasive cleaners on the MultiLab series or on any sensors or probes. Abrasive cleaners can damage the MultiLab series, sensors, display, and probes.

⚠ The exterior surface of the MultiLab series, except for the display screen, may be wiped clean with alcohol and dried with a soft, dry cloth. It is best to use a cotton cloth to clean the MultiLab series. Paper towels or tissues can scratch the surface of the display.

⚠ Do not use full strength alcohol on the display screen. Repeated use of strong cleaners can damage the screen. Clean the display window by wiping it with a clean, soft, lint-free cloth sprayed with common glass cleaner. Do not spray glass cleaner directly on the display.

The following products are approved for exterior surfaces except the touch screen surface:

- 70% isopropyl alcohol (IPA)
- Oxivir Tb (accelerated hydrogen peroxide based0)
- Protex spray or wipes
- Sani-Cloth HB (QUAT based)
- Sani-Cloth Plus (QUAT/IPA based)
- DISPATCH® Hospital Cleaner/Disinfectant with Bleach

Caution: Do Not Use T-Spray on Unetixs Products

The following products are approved for Doppler Probes, PPG Probes/Clips, and Lead Wires:

Do not immerse any UNETIXS PPG sensor, and probe connector in any liquid. Doing so may damage the connector. PPG sensor and probe can be wiped clean with alcohol or you may use:

- SONO Wipes™
- Sani Professional® No-Rinse Sanitizing Multi-Surface Wipes
- Sani-Cloth® Bleach Germicidal Disposable Wipe – Safe - However will cause discoloration to the probe casing)
- DISPATCH® Hospital Cleaner/Disinfectant with Bleach - (Safe - However cause discoloration to the probe casing)

The following products are approved for the Touch Screen and Roodra All-In-One:

- PDI Easy Clean cleaning wipes

Unetixs Infectious Control Keyboard Cleaning Instructions:

Lock keyboard: Hold down the lock key (1B) or both Ctrl keys (1) for 3 seconds to lock. The lock indicator signals that the keyboard is locked (1 and/or 2). Clean keyboard with approved cleaning method and approved disinfectant or soap and water. To unlock keyboard, repeat procedure.

Unetixs Infectious Control Keyboard Approved cleaning methods:

The use of the Following Cleaners are Approved to Clean the Unetixs Infectious Control Keyboard:

- SONO Wipes™
- Sani-Cloth – No Bleach

The following products are approved for cleaning keyboards:

1. To clean while the keyboard is plugged in, lock the keyboard by pressing the Locking Key for three seconds – Ergo and Roodra only.
2. Clean the surface of the product by wiping, brushing, spraying or dipping it. Use only rags, sponges or soft bristle brushes. DO NOT place the USB connector into the fluid.
3. Either wipe with dry cloth or allow to air dry.
4. Unlock the keyboard by pressing the Locking key for three seconds.

Disinfectants recommended

- Chlorine based (max 10% solution) – Chlorox, Novalsan, etc.
- Formaldehyde based - Formaldehyde Solution 37%, Vinco Formaldegen…
- Glutaraldehyde based – Aldacide 200, Lysofume, Wavicide, etc.
- Phenol based – Lysol I.C., Beaucoup, Magna Clean, Tek-Trol, etc.
- Alcohol based – Cavicide, Isopropyl Alcohol, Medicide, etc.
- Oxidizing – Hydrogen Peroxide 3% Solution, Lifegard Series, etc.
- Quaternary Ammonium – Roccal-D, Bacto-Sep, Parvosol, etc.
- Soap and water.
- DO NOT USE: Petroleum based cleaning fluids, such as Gasoline, Acetone, over 10% bleach solutions, temperature or pressure sterilization, buffing pads or scrubbing pads.

Cleaning Procedure for Unetixs MultiLab and Accessories:

Manufacturer's instructions for Proper Care of Straight and Contoured Cuffs: Web: www.hokanson.cc
Cleaning Cuffs: Removable covers on straight and contoured cuffs make cleaning easy. The cuff covers are made of Nylon and Velcro.

1. Remove the bladder then wash the cuff cover in warm water using mild soap in a washing machine on gentle cycle or by hand.
2. Open the top of the cuff cover and line dry only. When completely dry, reinsert the bladder. If bladder is contaminated, wash it in soapy water, and rinse well without getting any liquid in the bladder or tubing.

Disinfecting Cuffs:

1. Spray or wipe entire surfaces of cuff with disinfectant until wet.
2. Allow the cuff to remain visibly wet for a minimum of 10 minutes to insure complete disinfection.
3. Wipe dry with clean cloth.

The following disinfectants have been tested for compatibility with our cuffs:

Please Note: The manufacturers do not claim effective disinfection on porous surfaces; we have been unable to find any disinfectants that claim disinfection on porous surfaces.

1. Hydrogen peroxide
2. Hydrogen peroxide with silver (Sanosil®)

3. Hydrogen peroxide
4. Peroxyacetic acid, silver (Steriplex™)
5. Silver with citric acid (PureGreen24™ & SpectraSan™ 24)
6. Octyl decyl dimethyl ammonium chloride with dioctyl dimethyl ammonium chloride with didecyl dimethyl ammonium chloride with dimethyl benzyl ammonium chloride (Protex™)
7. 99% isopropyl alcohol.

Note: Some disinfectants may cause the cuff blue color to bleed into cuff labeling. This does not affect the cuff's performance.

Do not sterilize cuffs: The design of the Cuffs is such that they are not sterilizable.

Pneumatic Hose Cleaning:

Clean the hose according to hospital protocol for cleaning of reusable equipment cables. Typically this protocol consists of the following:

1. Disconnect the hose from the monitor and cuff.
2. Wipe the hose with a nonabrasive cloth moistened with a mild detergent and warm water or a disinfectant.
3. Dry thoroughly.
4. Do not use alcohol or solvents to clean the hose.
5. Do not allow the connectors to come in contact with liquids.
6. Do not fully immerse the hose in liquids.
7. Do not Autoclave, nor EtO sterilize, the hose.

Operation of the LHS Cart

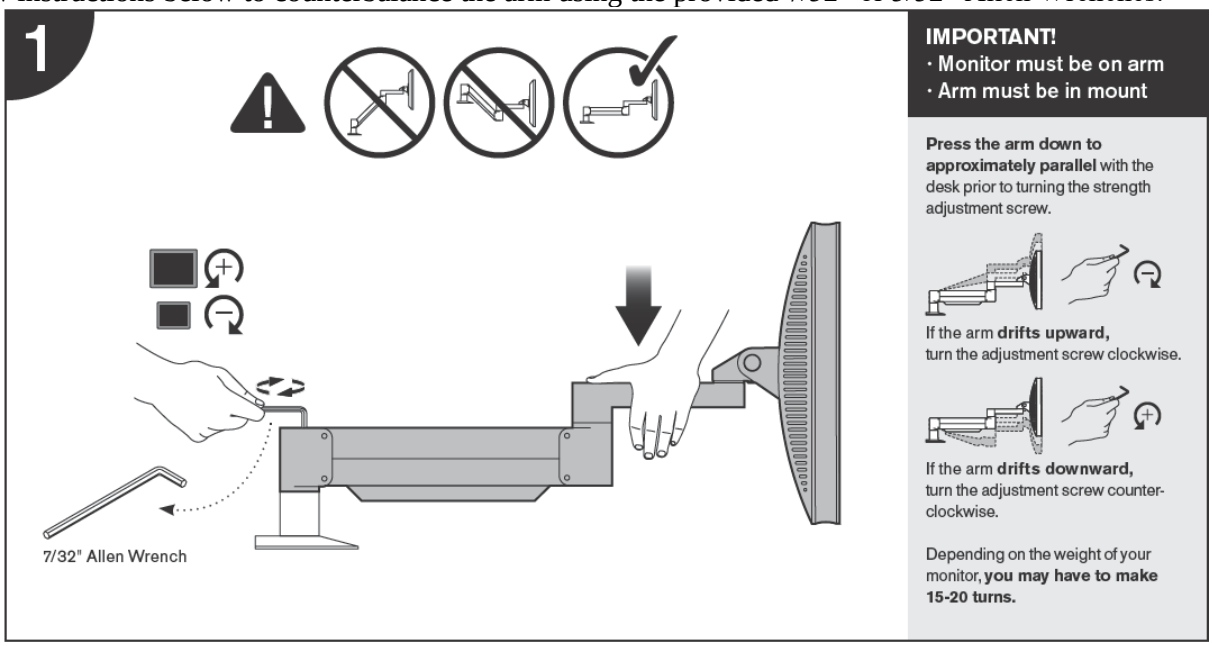
- **Storage Drawer**
  Accessory storage is conveniently located on the front of the cart, under the printer. Simply push down on the latch and pull. The latch will automatically re-engage when the drawer is closed.
- **Power Switch**
  The main power switch is located on the front of the cart, under the drawer. Make sure the computer has been properly shut down before turning off main power.
- **Cable Storage**
  An opening at the rear of the cart, at the bottom, is provided for power and network cables.
- **Casters**
  The cart has 4 locking casters. When the switch is up on each caster, the cart will move in any direction. The front casters lock completely (wheel brakes and directional lock) when the switch is down; use this position when performing studies (for ERGO IDC option, lock all four casters). The rear casters only lock directionally; they do not have wheel brakes. When transporting the cart, the front wheel switches should be up and the rear wheel switches should be down.
- **Rear Access Panel**
  This panel is found on the rear of the cart, near the top. Its main use is for service and maintenance functions. There are two latches holding the panel; both have to be disengaged simultaneously for the panel to be opened. Take care when removing as the whole panel comes off the cart. When replacing the panel, insert the bottom tabs first; the latches will re-engage automatically when the panel is closed.
- **Computer Access Panels**
  These panels are found on the Left (front of Computer Tower) and Right (rear of Computer Tower). Their main use is for service and maintenance functions. Take care during removal as the whole panel comes off of the cart. When replacing the panel, insert the bottom tabs first; the latch will re-engage automatically when the panel is closed.

Operation of the Monitor Arm (ERGO IDC option)

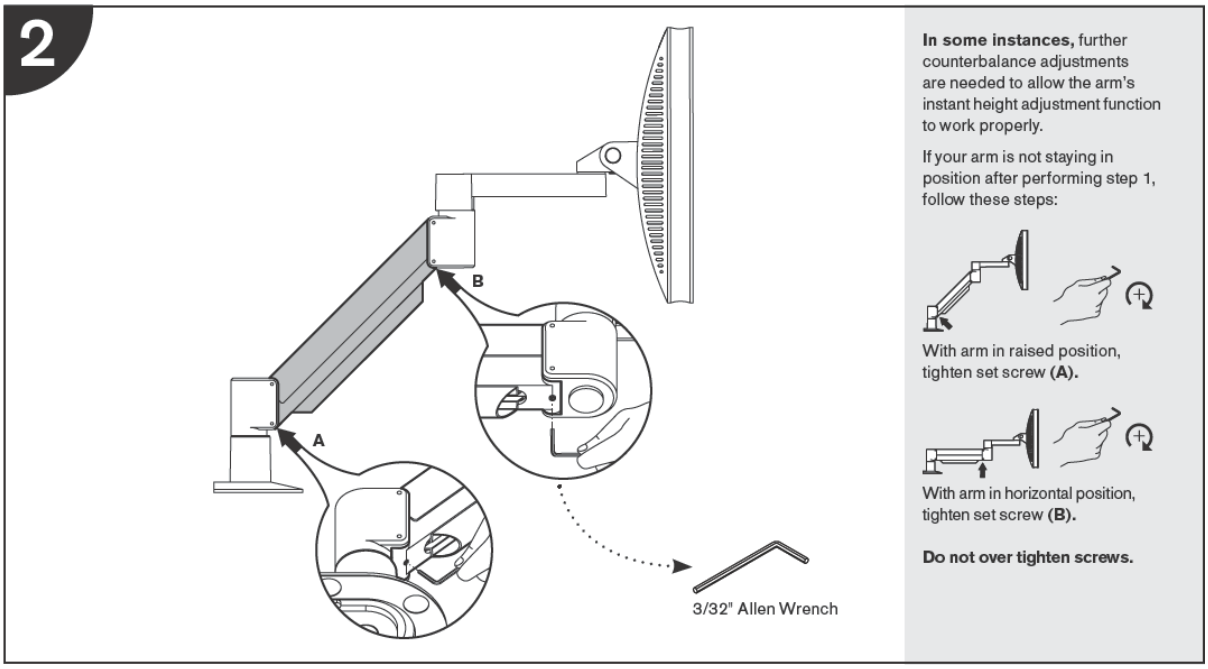
The MultiLab Series II LHS provides mobility of the monitor with its arm option. Benefiting from the fully ergonomic design, the arm has 31" of horizontal range and 18" of vertical range. It allows the monitor to tilt over 200 degrees. The arm rotates 360 degrees in three joints and can be easily folded in just 3"W x 10"H x 14"L of space for transportation or rest position. The operator can raise or lower the monitor, adjust the viewing angle or rotate the monitor. The state-of-art mechanical design also makes it durable, cleanable and recyclable.

Arm Alignment (if necessary)

Follow instructions below to counterbalance the arm using the provided 7/32" or 3/32" Allen Wrenches.

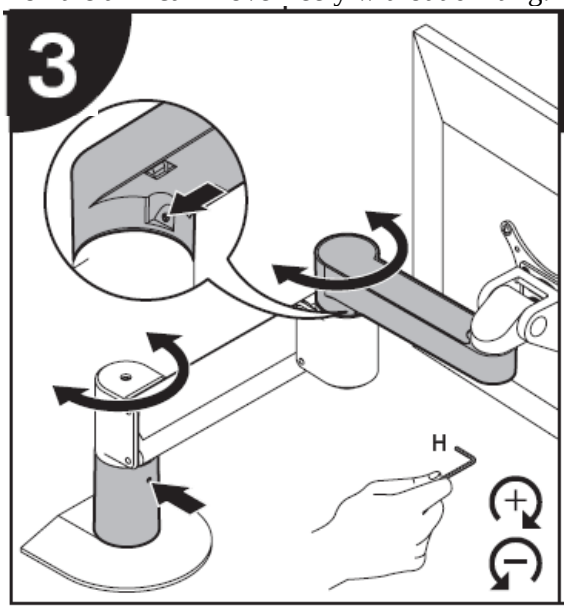


Counterbalance the Arm



Counterbalance the Arm

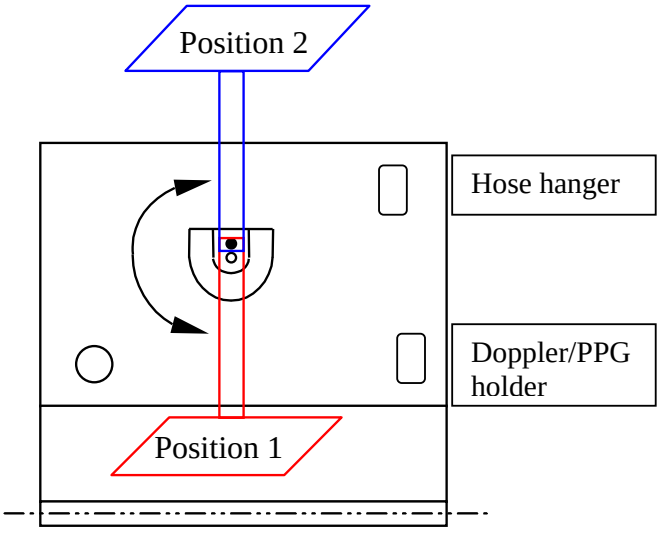
To align the arm rotation stability, adjust the arm as shown below using the provided 7/32" or 3/32" Allen Wrenches, so that the each section on the arm can move freely without drifting.



Arm rotation adjustment

Using the Arm

Your MultiLab Series II LHS will be set up so that the hose hanger and Doppler/PPG holder are located on the right side of the cart. The monitor arm is then free to move on the left half of the cart as shown. It can travel from Position 1 to Position 2 freely and stop at any position that you want in between (see below). The arm suspends the monitor weightlessly above the cart. It helps you to move the touch screen close and avoid glare on the monitor.



Top View

Since the MultiLab Series II LHS cart has four casters for its mobility, before you start your test you should lock all four casters (see previous section on LHS Cart Operation) to prevent the cart from moving while you are working with the arm. Move the caster switches down for the lock position.

The monitor arm operation is very straight forward. There are two handles on each side of the monitor for your convenience. To adjust the height, you can easily grab the handle and position the monitor up and down (see below).

Positions of the monitor

To adjust the viewing angle, you can tilt the monitor to the desired angle by holding the monitor with both handles. You can also rotate the monitor by moving the two handles and rotating the tilter.

Viewing angles

Cautions

For your safety and your patient's safety, the following instructions have to be followed during the study.

DO NOT tip the cart more than 5 degrees in any direction at any time.

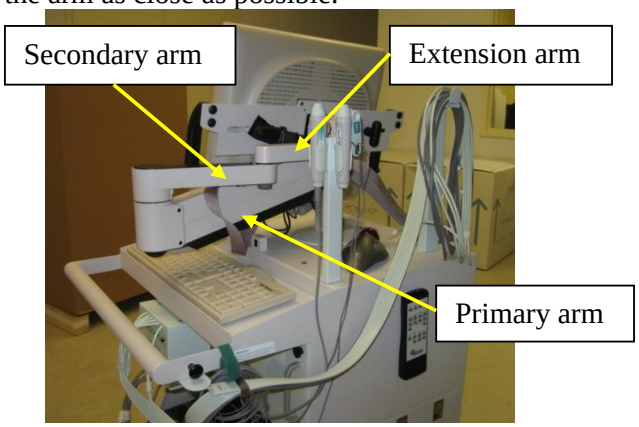
DO NOT hang foreign articles on the monitor arm. It might tip the cart.

Transportation position

Follow the steps listed below to move the MultiLab Series II LHS unit from one location to another:

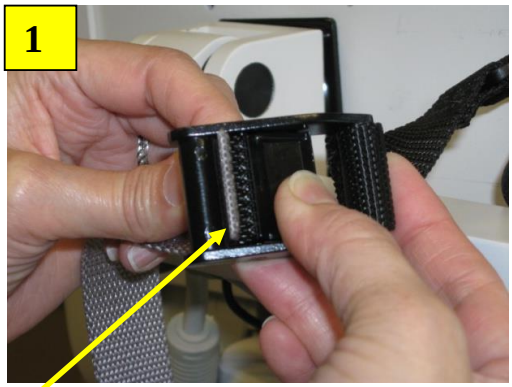
- Rotate the primary monitor arm counter-clockwise so that the primary arm is right in the middle of the cart front as shown below
- Adjust the position of the monitor so that the secondary arm and the extension arm rest right above the primary arm, aligning to it as shown.
- Rotate the monitor so that it stays to the left of the arm as close as possible.

Transportation position (left view)

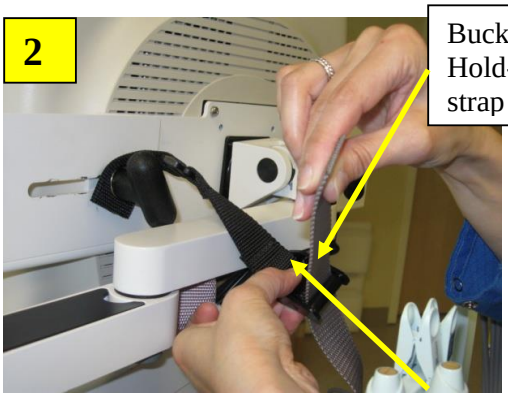


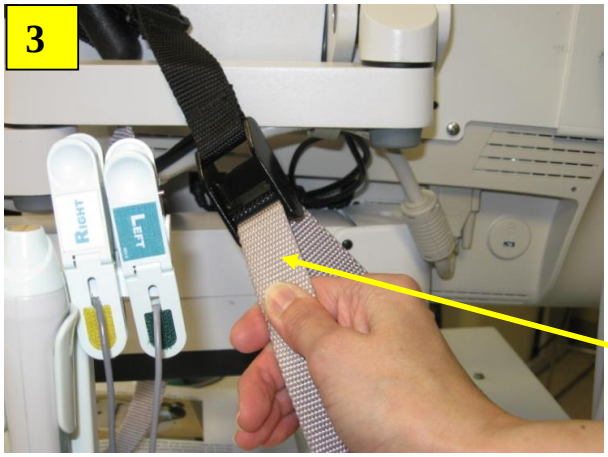
Transportation position (right view)

- Buckle the hold down strap and pull the free end tight by following the steps as shown below. This will secure the arm and prevent the monitor from moving.



Push the latch open with one hand and lead the strap through the gap using another hand.





Make sure the buckle is installed so that this latch can only be pushed inward.

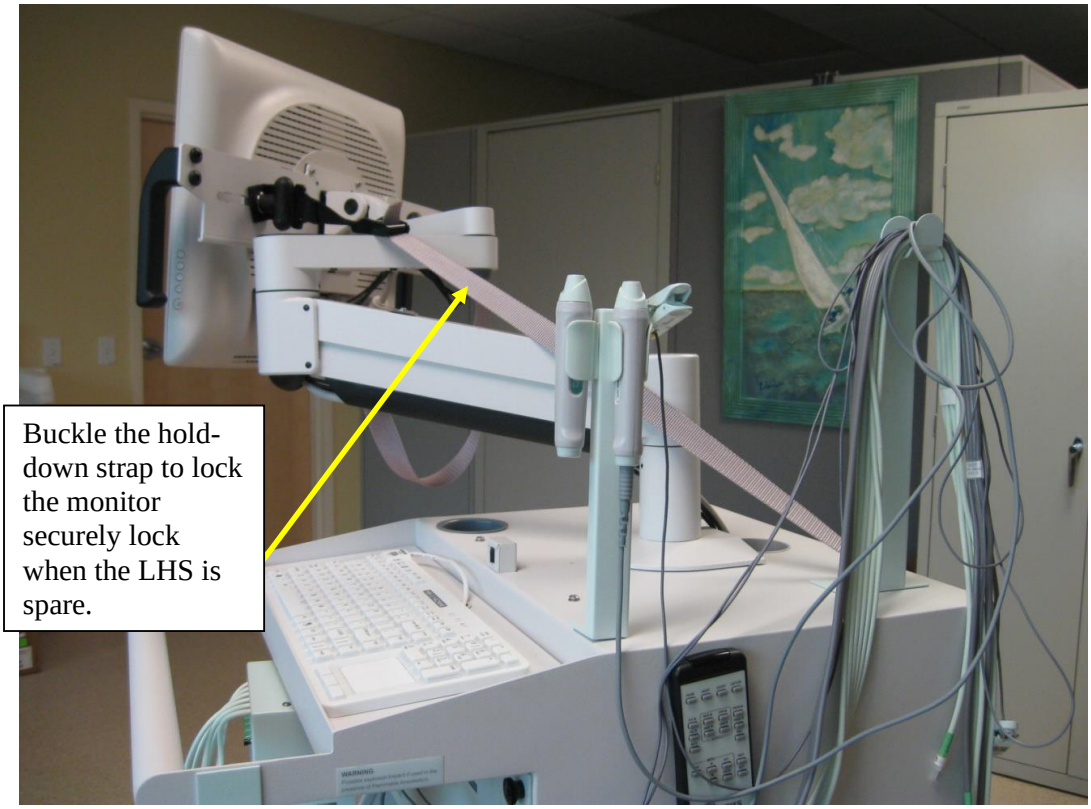
Pull the free end of the strap until the monitor is securely locked in place.

Transportation position: side view

- Unlock all four wheels.
- Push the handle to move the cart around. Watch out for bumps and obstacles.
- Cart should not be tipped more than 5 degree during transportation.
- At your destination, unbuckle the hold-down strap and lock all four wheels.

Rest/Safety position

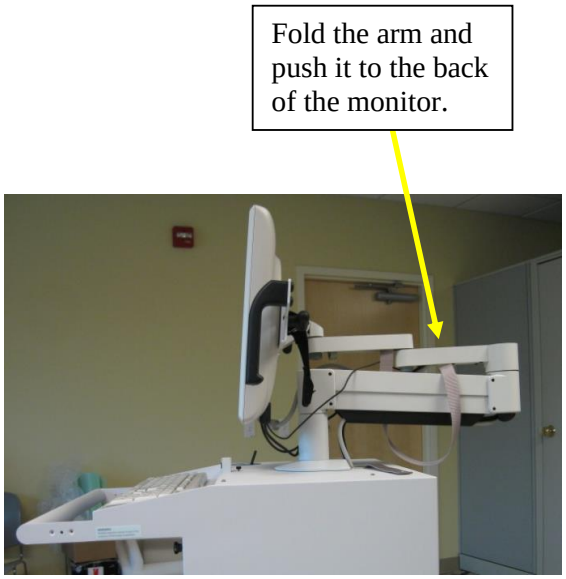
Another usage of the buckle and hold-down strap is to keep the monitor in a secured position when the unit is not in use. The hold-down strap can be easily tied with the buckle so that the monitor is locked securely to prevent any unexpected abrupt movement.



Keyboard position

While adding mobility to the monitor, the arm can still provide a center position for working on the collected data by pushing and folding the arm to the back of the monitor as shown below.

Front view



Side view

Keyboard position

Using the Medical Grade Keyboard (ERGO IDC, Roodra, 2CP)

The medical grade keyboard that is installed in Ergo, Roodra, and 2CP is a waterproof and contaminant resistant keyboard with an integrated three-button touchpad mouse. The touchpad is positioned on the right side of the keyboard under the same silicon rubber housing. The sealed rigid surface is durable and moisture resistant for easy cleaning. It is also quieter than most other keyboards and mice.

There are some specially designed keys on this keyboard for the user's convenience:

Locking key: Press and hold this key for three seconds to lock the keyboard and the touchpad. Press and hold the key for three seconds to unlock the keyboard and the touchpad.

Touchpad Locking key: Press and hold this key for three seconds to lock the touchpad. Press and hold the key for three seconds to unlock the touchpad.

Cleaning Reminder Key: To set cleaning reminder, press and hold the Left Ctrl key and press Cleaning Reminder key

- 1 time for every hour reminder,
- 2 times for every 2 hours reminder,
- 3 times for every 4 hours reminder,
- 4 times for every 8 hours reminder,
- 5 times for every 12 hours reminder,
- 6 times for every 24 hours reminder,
- 7 times for every 48 hours reminder, or
- 8 times for every 1 week reminder.

The C LED light (the LED to the left of the Num Lock LED) will blink when it is time to clean the keyboard. After the keyboard is cleaned, press the Cleaning Reminder key once to stop the blinking C LED and reset the timer to the last setting.

Backlight Key: Press this key

- 1 time for 30% brightness.
- 2 times for 60% brightness.
- 3 times for full brightness.
- 4 times to turn the backlight off.

Operation of the Roodra Cart (Standard Option)

- **Adjust Cart Height**
  A foot switch is located between the front wheels. Depress the foot switch to raise or lower the All-in-One Monitor, Keyboard Shelf, and Storage Drawer. At the lowest setting, the technologist can reach the touch screen from a seated position. When transporting or at rest, the Roodra should be in the lowest possible position.

- **Storage Drawer**
  Accessory storage is conveniently located on the front of the cart below vascular module shelf. Simply pull to open. There is no latch.
- **Electric Cord Management**
  The top of the keyboard shelf lifts up. Underneath one can visualize the power supply and power cords for the various electrical components of the Roodra. The lid of the electrical storage area can be locked with the supplied key.
  CAUTION – If the lock is utilized, do not misplace the key!
- **Pneumatic Hose Hanger**
  Drape the pneumatic hoses over the hangers found at the top of the Roodra tower.

- **Casters**
  The cart has 4 brake locking casters that rotate 360 degrees. The brake is engaged by depressing the textured edge of the caster as demonstrated in the figure below:

- **Roodra Module Power Switch**
  The power switch for the Roodra module is located on its back panel, next to the power cord. To turn on, simply move the switch to the "I" position. To turn off, move the switch to the "O" position.
  CAUTION – If relocating the Roodra to another room, be sure to turn off the Roodra module prior to unplugging the system.

- **All-in-One Computer and Monitor Power Switch**
  The power switch for the all-in-one computer and monitor can be found on the lower right corner of the front of the monitor. Touch momentarily to turn on. Press the Shutdown button from the software or use Windows™ Commands (Press Alt+F4 to open the Shut down Windows Dialog Box. Click the down arrow to choose Shut Down, touch OK)
- **All-in-One Computer and Monitor Batteries**
  If the supplied batteries are utilized in the all-in-one computer and monitor, the unit will stay on should Roodra lose power or be unplugged for relocation.
  CAUTION – Turn off the Roodra module prior to unplugging the system.
- **Network Cable Connection**
  Find the network connection port on the bottom of keyboard tray, facing downward.

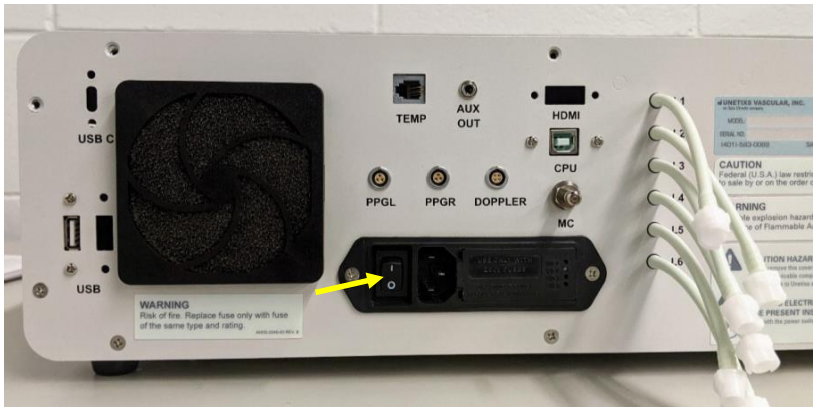
Operation of the Roodra Cart (ESA Option)

- **Transportation Position**
  Wrap AC power cord around rear handle.

Ensure all hoses and cables are off the floor to avoid damage and/or trip hazard.

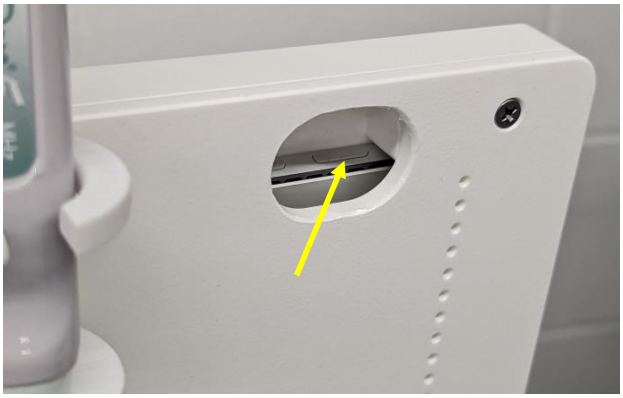
- **Casters**
  The cart has 4 brake locking casters that rotate 360 degrees. The brake is engaged by depressing the textured edge of the caster as demonstrated in the figure below:

- **Roodra Module Power Switch**
  The power switch for the Roodra module is located on its back panel, next to the power cord. To turn on, simply move the switch to the "I" position. To turn off, move the switch to the "O" position.
  CAUTION – If relocating the Roodra to another room, be sure to turn off the Roodra module prior to unplugging the system.

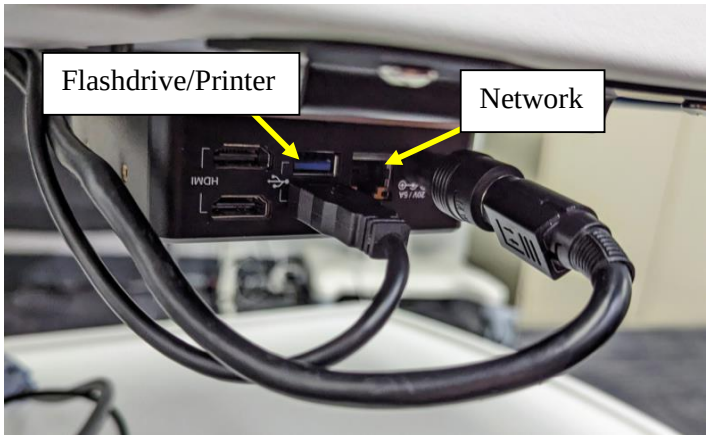


- **All-in-One Computer Power Switch**
  The power switch for the all-in-one computer can be found on the top right corner of the back of the monitor. Press to turn on. Press the Shutdown button from the software or use Windows™ Commands

(Press Alt+F4 to open the Shutdown Windows Dialog Box. Click the down arrow to choose Shut Down, touch OK)



- **Network & USB Connection**
  Find the network connection port and the USB port for flash drive or printer connection on the USB hub located under the storage drawer.

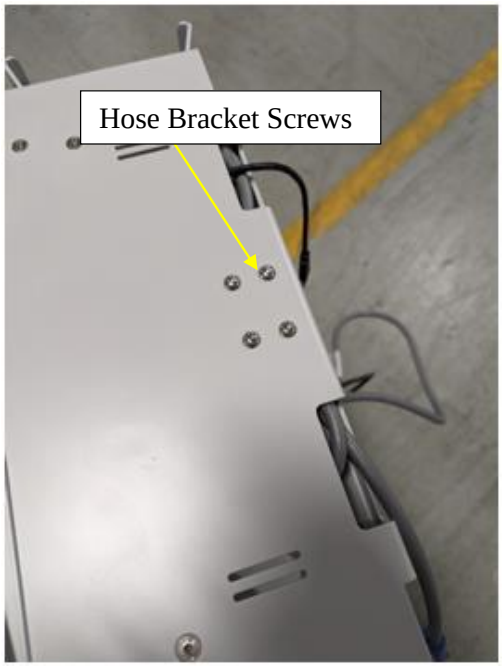


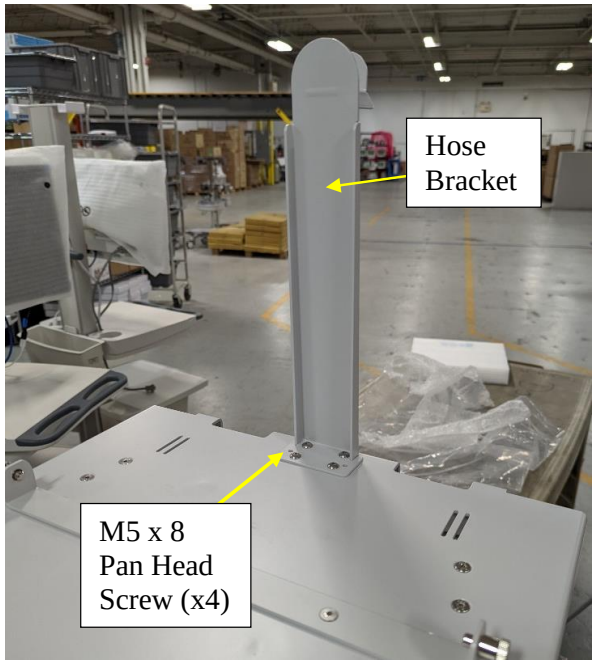
- **Storage Drawer**
  Accessory storage is conveniently located on the front of the cart below the keyboard shelf. Simply pull to open. There is no latch. The storage drawer can be locked with the supplied key.
  CAUTION – If the lock is utilized, do not misplace the key!

- **Printing**
  The cart must be plugged into AC Mains for printing to function. It is preferable if the cart and the printer are plugged into the same outlet. Remember to connect the USB cable from the printer into the port under the storage drawer (see USB Connection above).

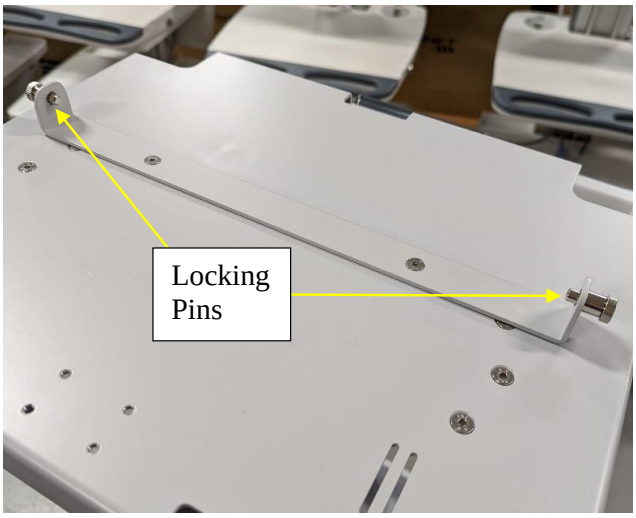
Operation of the 2CP Cart

- **Assembly**
  1. Attach the hose bracket to the tabletop using the four M5 x 8 pan head screws that are attached to the tabletop already along with the Allen wrenches provided.



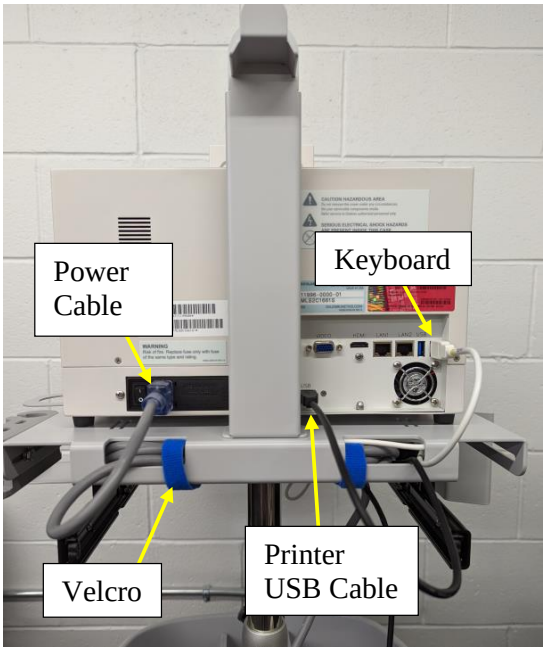


  2. On the 2CP mount located on the tabletop of the cart, there are two spring loaded locking pins. Pull the pins out and place the 2CP chassis into the bracket, letting the pins slide into the mounting holes on either side of the chassis to secure it in place.

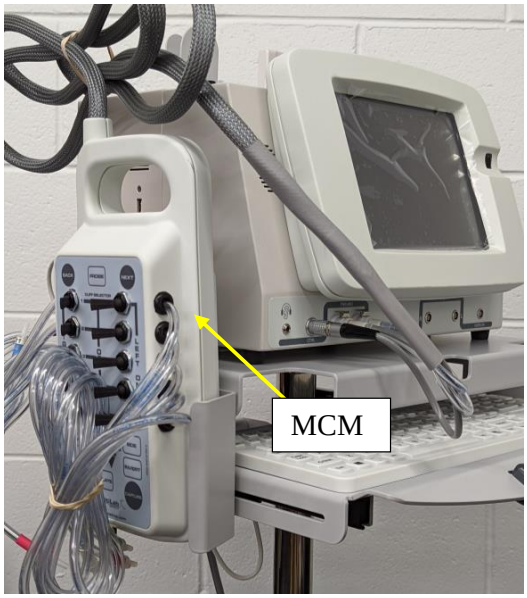


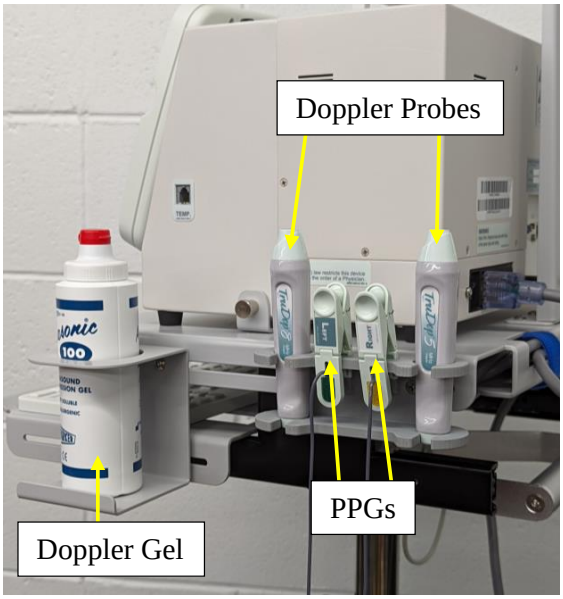
3. Place the printer on the printer shelf. Connect the printer power cable and USB printer cable to the printer. Connect the other end of the printer power cable to the power strip.

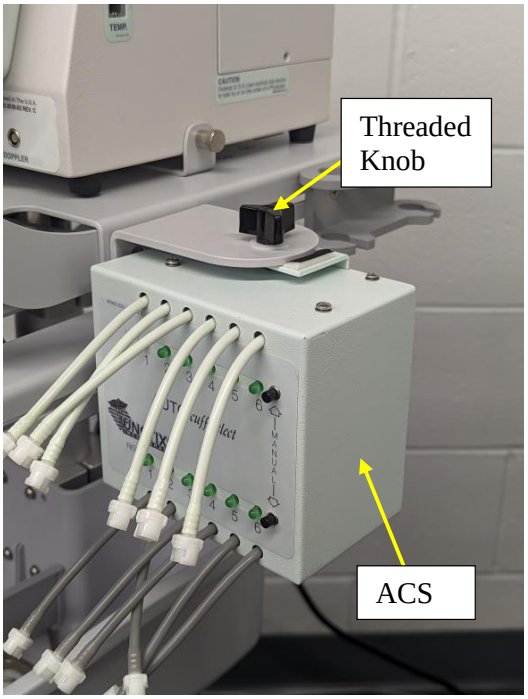
4. Pull out the keyboard tray as far as it will go. Place the keyboard on the keyboard tray and run its USB cable underneath the tabletop, through the back of the tabletop and connect to the back of the chassis. Bundle the excess keyboard USB cable within the Velcro straps underneath the tabletop and return keyboard tray to its closed position. Connect the power cable and USB printer cable to the 2CP chassis. Connect the other end of the power cable to the power strip.



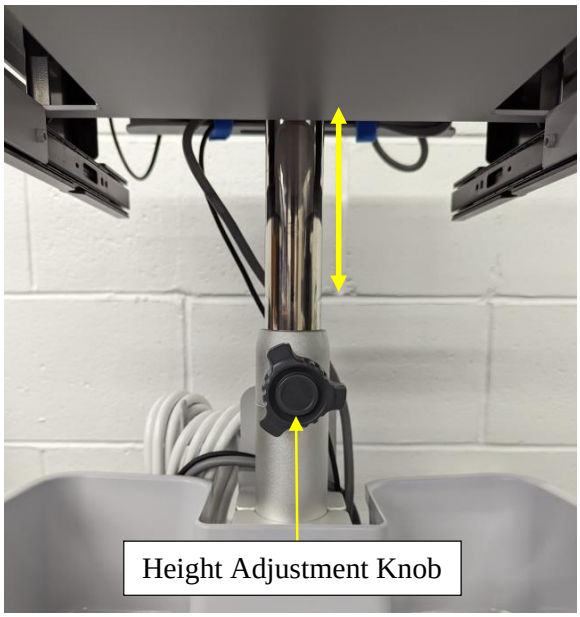
5. Attach the ACS, MCM, PPGs, Doppler probes, and doppler gel accessories to the cart as shown below. For the ACS, mount to the cart using the threaded knob of the ACS module and connect the ACS power cable to the rear DIN connector on the ACS.
   Note: Actual accessories will vary depending on your system.







- **Usage**
  - **Adjust Cart Height**
    To adjust the height of the cart, loosen the height adjustment knob on the pole. The gas assisted cylinder will allow you to raise or lower the tabletop. Once you have reached the desired height, tighten the knob to hold it in place.



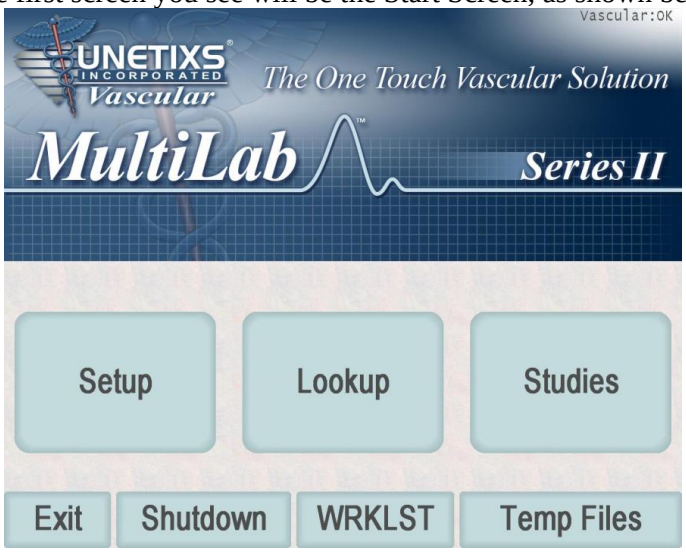
- **Casters**
  The cart has 4 casters that can rotate 360 degrees. The front two casters can be locked by depressing the brake.

- **Keyboard Tray**
  The keyboard tray can be pulled out for more convenient access to the keyboard. When the tray is pulled out all the way in an extended position, it will lock in place. To return to a closed position, pushing with a small amount of force will allow the tray to move again. It will lock in place again in the retracted position.

- **Transportation/Resting Position**
  When the cart is at rest or in transportation the height should be set to the lowest possible position, the keyboard tray should be locked in the closed position, the chassis should be secured in its mount, and there are no loose cables dangling. Also, when at rest the front casters should be in the locked position.

CHAPTER 2: START SCREEN FUNCTIONS

The MultiLab Series II is shipped ready to be used. Now that the system has been unpacked, assembled and plugged in, turn it on. On the MultiLab Series II-LHS, the power switch is located beneath the storage drawer in the bottom of the system cart. This switch will activate ALL electrical aspects of the MultiLab, including the printer. On the MultiLab Series II-P models, the power switch is located on the rear panel next to the power cord input. Once powered up, the first screen you see will be the Start Screen, as shown below:



Please note that the system can be controlled via the touch-sensitive video screen, the keyboard, or the remote control unit. The Start screen displays the following options:

SETUP Allows the user to go into the system to change factory presets, perform diagnosis and calibration of the system, configure custom exam protocols, etc.

LOOKUP Allows the user to access any patient studies archived on the Hard Disk Drive. **Note**: the name of this button is defined in the System Setup

STUDIES Allows the user access to the various vascular tests to be performed.

TEMP. FILES Allows user to access patient studies that have been performed, but not yet been archived to the Hard Disk Drive. (NOTE: if you suffer a power outage or interruption during patient testing, press this button after power resumes to access and resume the study in progress.)

WRKLST Activates DICOM worklist query. This requires our optional DICOM software. **Note**: the name of this button is defined in the System Setup.

SHUTDOWN Exits the MultiLab software and signals the Operating System to shut down.

EXIT Allows user to exit MultiLab Software.

The following are optional replacements to the exit button (see System Setup)

EXIT TO WINDOWS (For Windows™ Operating System) Allows user to exit MultiLab Software.

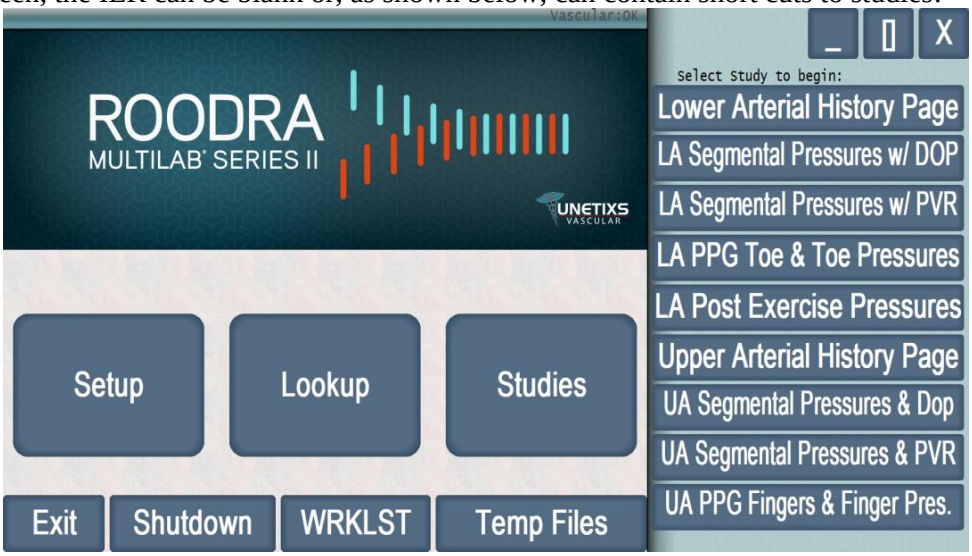
CONTRAST UP & DOWN (NOT functional on color screen models) Allows user to adjust visibility of the monochrome LCD screen to compensate for room lighting conditions.

Roodra Interactive Live Reporter (ILR)

Some MultiLab systems utilize a wide screen format, allowing more information and functionality on screen. Throughout the software on Roodra the left hand portion (⅔) of the screen will contain all MultiLab functions.

The right hand portion (⅓) of the screen contains the Interactive Live Reporter or ILR. Here we will discuss the start screen and the most common ILR buttons, other buttons will be discussed later in the manual.

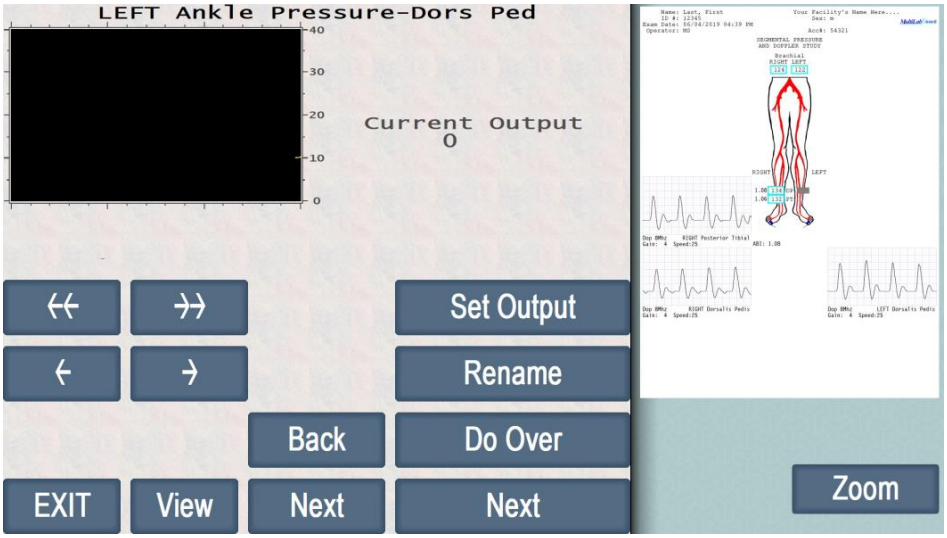
On the Start Screen, the ILR can be blank or, as shown below, can contain short cuts to studies:



The user may access all of the functions detailed above or go straight into a study. The buttons in the upper right corner will minimize the application (-), Restore the application (□), or Close the application (X).

ILR View

During an exam, the ILR can display the report as it is generated (see below); if the report is not shown, simply press the View button:



ILR Zoom

The ILR's Zoom button doubles the size of the report. The default zoom is to show the upper center of the report, where the pressures are shown, but simple press Zoom again to return to a full page view. When in the zoomed mode, you may change the focus by dragging, with the mouse or touch screen, on the report image itself; note that the focus will be remembered even if you change screens.

ILR Copy

When not performing an exam, the report can still be viewed. In these instances a Copy button will be provided instead of Zoom. The Copy button places a copy of the report onto the Windows™ clipboard (24-bit color, 2400x3150 pixels).

ILR Controls

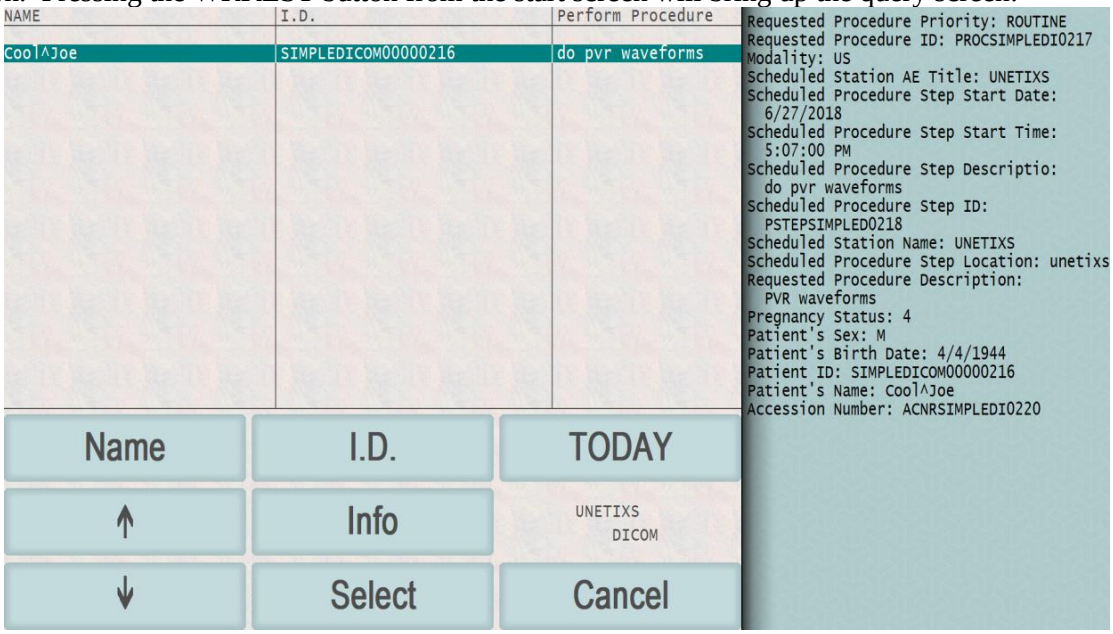
During an exam, for some modalities, the Controls button will allow for following parameters to be modified:

Speed: Adjusts the waveform sweep speed up ↑ or down ↓.
Inflate to: Adjusts the target inflation, for automatic inflation, up ↑ or down ↓.
Defl. rate: Adjusts the deflation rate, for automatic deflation, up ↑ (faster) or down ↓ (slower).

Note: Not that the parameters provided are dependent on the active modality for the exam.

Importing Patient Information (DICOM Worklist)

If you have the DICOM option on your system, you can use DICOM modality worklist to import patient information. Pressing the WRKLST button from the start screen will bring up the query screen:



The query buttons shown, for Name, ID, and TODAY, are configurable. To query for patient data, press one of the query buttons. **Note**: as shown above, one of the query buttons may be configured to happen automatically. Highlight the desired patient using the Up and Down Arrow buttons. Use the Info button if you need to see more information about the highlighted patient. Press Cancel to exit the query with no patient selected. Use the Select button to choose the highlighted patient.

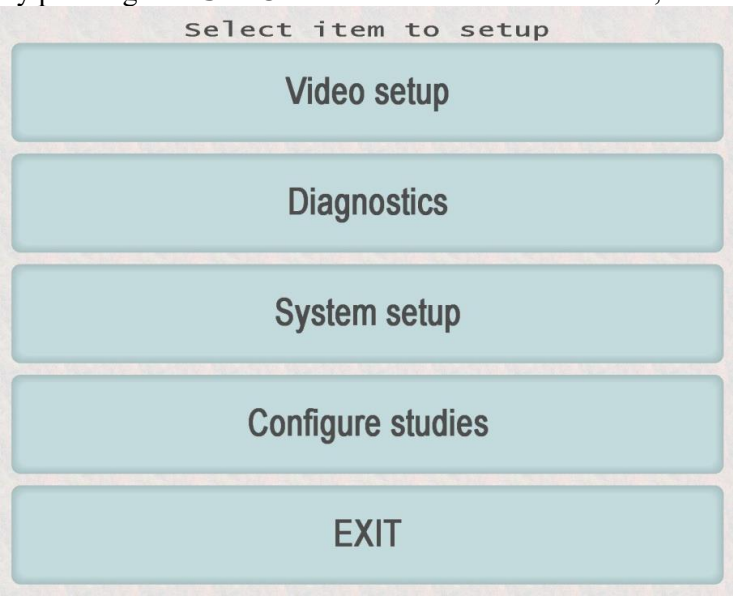
The selected patient will be shown on the start screen above the Lookup and Studies buttons. If you press Lookup, the selected patient will be searched for. If you press Studies, a study will be created using the information for the selected patient. To remove the selected patient, simply press the Temp. Files button followed by the Exit button.

Worklist ILR

The ILR will display the information for the highlighted patient, the same as the Info button. If the information does not fit on a single screen, a More button will be provided. Press the More button again to return to the initial information.

CHAPTER 3: SETUP FUNCTIONS

By pressing the "**SETUP**" button from the Start Screen, the following options become available:



CAUTION – There are areas within the SETUP menu which if accessed improperly, can decrease the performance of the instrument or cause it to stop working entirely. Only proceed in this portion of the program with factory assistance, or after thoroughly reading the operation of the functions listed below:

Note: There is no ILR function within Setup.

VIDEO SETUP	Allows user to calibrate the touch sensitive screen (will not normally need to be accessed).
DIAGNOSTICS	Allows user to access the Diagnostic and Calibration section of the instrument (do NOT access without consulting with Unetixs Service Technician)
SYSTEM SETUP	Allows user to access common system functions, such as changing date and time, data backup and printer utilities.
CONFIGURE STUDIES	Allows user to access the MultiLab custom study configuration editor to modify factory default studies or to create new unique studies.
EXIT	Returns user to the MultiLab Start Menu.

Video Setup

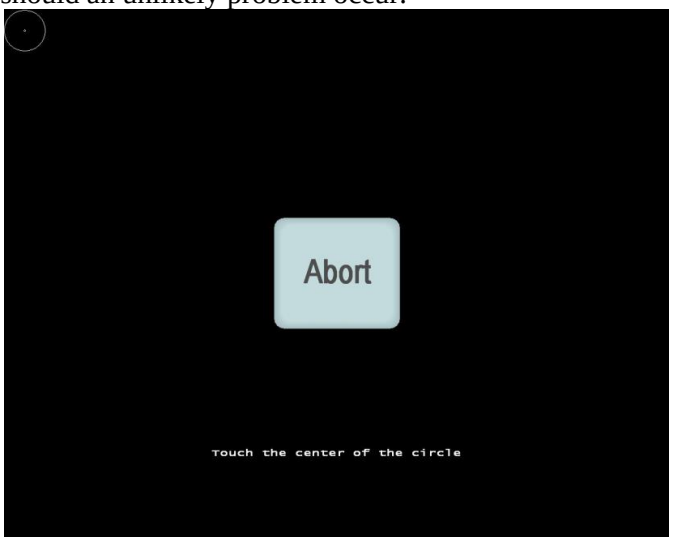
By pressing the "**VIDEO SETUP**" (or "V" key on the system keyboard) button on the touch-screen, the following options become available:

- Calibrate TOUCH
- EXIT

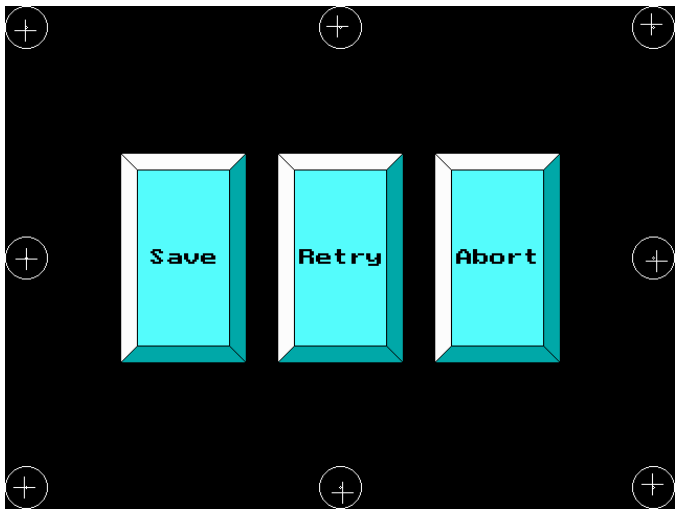
NOTE: If your system is functioning properly, do not re-calibrate the touch screen.

NOTE: Newer systems use a Windows™ touch driver to communicate with the touch screen. To calibrate these systems, exit the program from the start screen, and go to the control panel in Windows™. From there, select Touch screen and then press the Align button.

By pressing the "**Calibrate TOUCH**" button (or by pressing the "T" key on the system keyboard) the user can re-calibrate the touch screen should an unlikely problem occur:



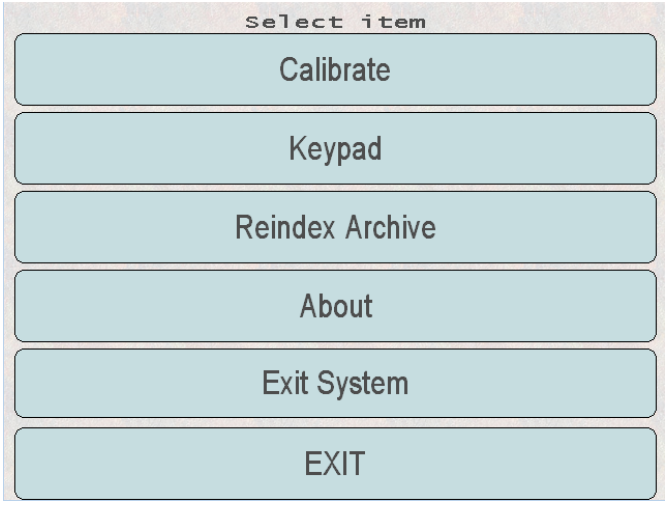
After pressing the Calibrate button you will see the above screen. Notice the circle in the upper left-hand corner. Touch it and another will appear. Keep touching the circles as they appear so the calibration of the touch capability will be complete. The following screen is a representation of all of the locations you will touch during this process.



If during this process you make a mistake you can select the retry button to retouch that location. You can also save your calibration when finished by pressing the save button (or "S" key on the system keyboard). If at any time you wish to quit this process press the Abort button. Once you press the save button you will return to the setup menu screen and then can continue with the setup of additional items in the system.

Diagnostics

If the **Diagnostics** option is selected from the **Setup** menu you will see the following screen.

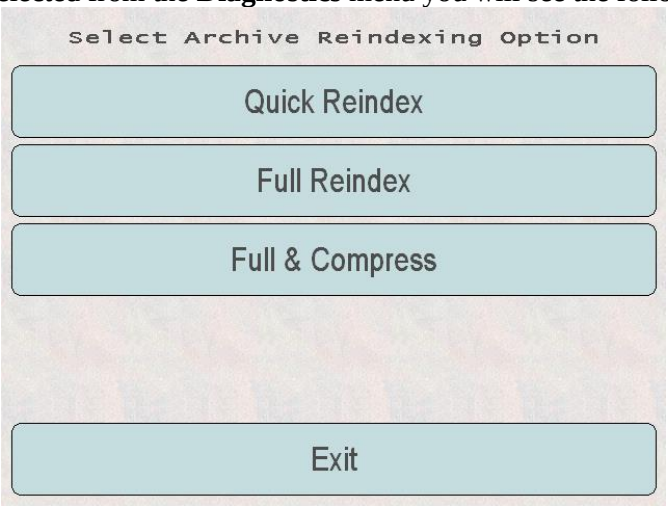


CAUTION: The "Calibrate" features on this screen should be used only while on the phone with a factory customer service representative. If for any reason you feel the unit is not functioning properly, first call the Unetixs Customer Service department before you enter this portion of the software program, as potential for misalignment of instrument is possible without proper supervision.

KEYPAD	Allows the user to test the remote control keypad (see chapter 7).
REINDEX ARCHIVE	Allows the user to check, rebuild, or compress the Archive database.
ABOUT	Shows the software version, company name, address, and phone number. Remote Help can be accessed here. Reply "Yes" when asked for permission. A password is not required; just touch Connect (only if asked by Unetixs service).
EXIT SYSTEM	Exits the MultiLab software (completely) and returns to the operating system.
EXIT	Returns to the setup functions screen.

Reindex Archive

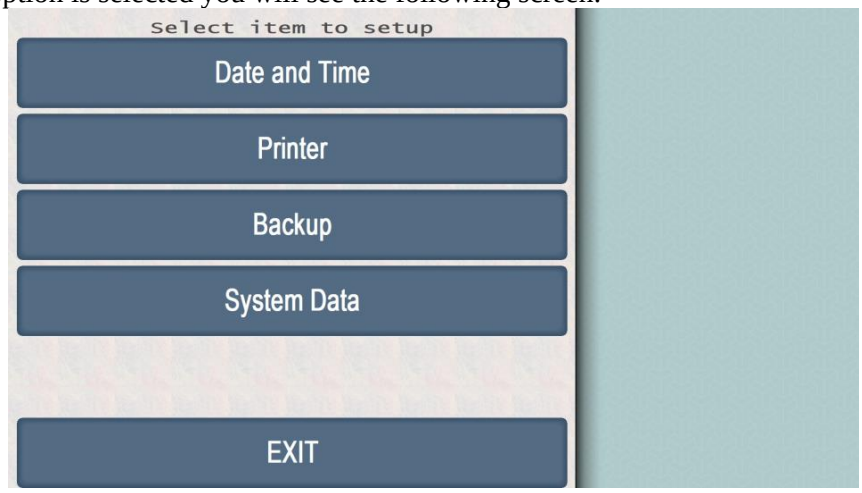
The archive is a collection of report pages where each page is a separate file in ascending order. A database is used to greatly increase the speed of all archive functions. A Maximum of 50000 pages can be stored. If the **Reindex Archive** option is selected from the **Diagnostics** menu you will see the following screen:



QUICK REINDEX	Checks all entries in the database and repairs only those that have a problem.
FULL REINDEX	Completely rebuild the database.
FULL & COMPRESS	Renumber the ascending files in the archive so that there are no gaps, and then completely rebuild the database.
EXIT	Returns to the Diagnostics Menu.

System Setup

If the system setup option is selected you will see the following screen:



DATE and TIME Allows the user to adjust the system for different time zones or to allow compensation for Daylight Savings Time changes.

PRINTER Allows user to access the printer troubleshooting utility.

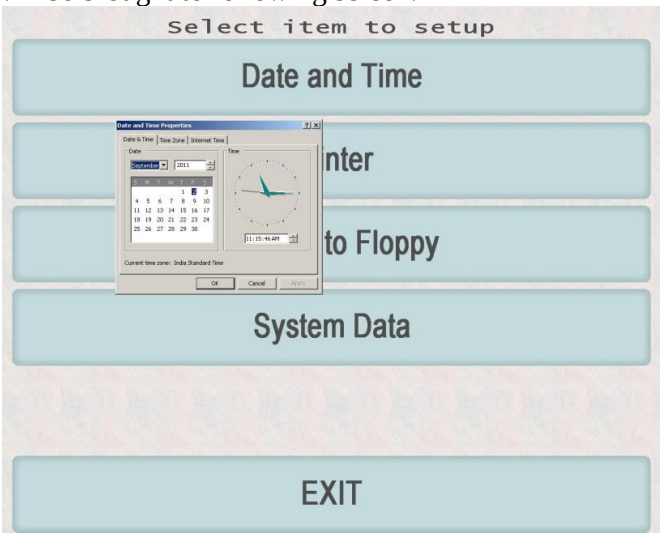
BACKUP Allows user to access the back-up utility to save patient files or custom studies to 3 ½″ floppy disks or USB Memory sticks.

SYSTEM DATA Allows user to access various internal hardware and software settings for the instrument.

EXIT Returns user to basic SETUP menu.

Changing Date and Time

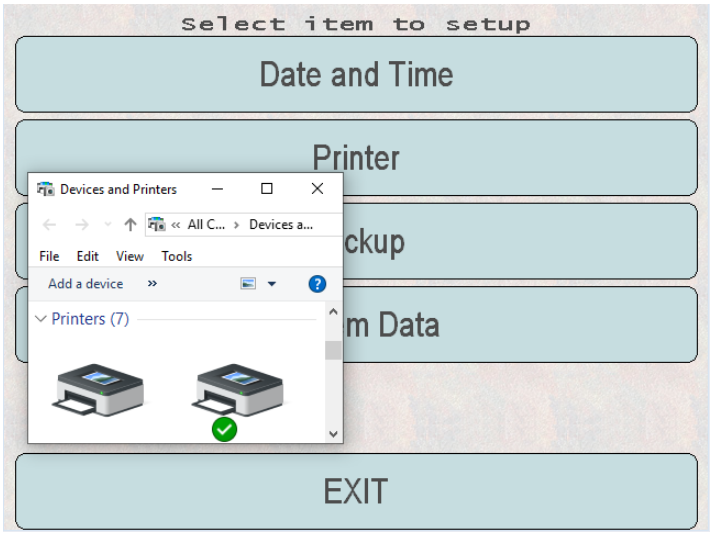
If you chose this option you will be brought to following screen:



Enter the date and time into the control panel, and then press 'OK'.

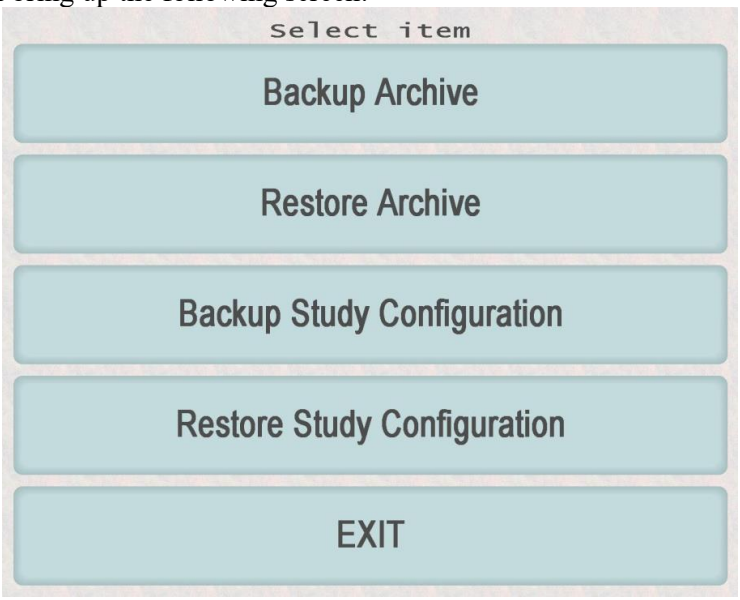
Printer Utility

NOTE: As Hewlett Packard™ frequently changes printer models and characteristics, the printer utilities are different as well. If your printer does not seem to be working properly, contact Unetixs Customer Service and identify the model of printer that came with your instrument.



Backing Up

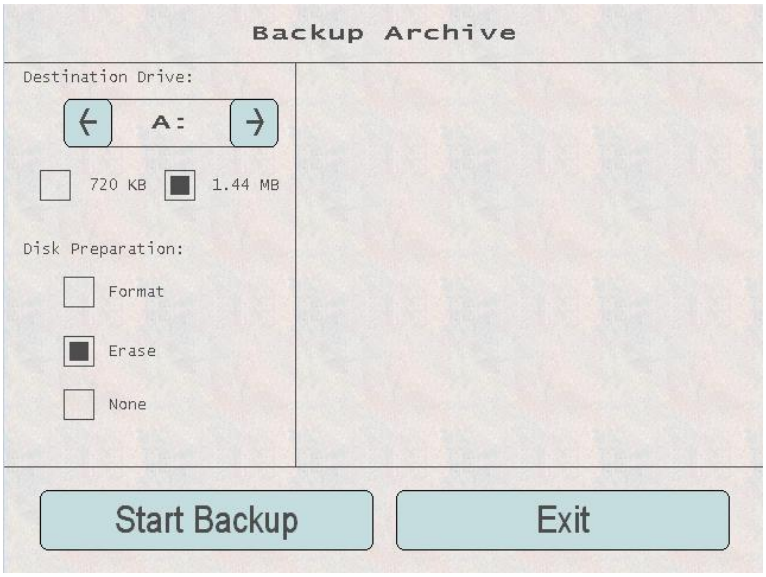
Touching "**Back UP**" will bring up the following screen:



BACKUP ARCHIVE	Backs up the archive of all your patient studies
RESTORE ARCHIVE	Restores previously backed up patient studies.
BACKUP STUDY CONFIGURATION	Backs up the studies you have custom configured.
RESTORE STUDY CONFIGURATION	Restores your backed up configurations.
EXIT	Exits this screen to the previous one.

Backing up Patient Studies

Touching 'Backup Archive', then 'Yes', will bring up the following screen:



To back up to floppy, set the destination drive to A or B, the size of the floppy, and then specify the disk preparation. If you have attached an external drive, such as a USB thumb drive, you may specify that drive's letter; no disk preparation is allowed for external drives. Press Start Backup to begin and follow any on-screen instructions.

When backing up to floppy, the filename on the floppy will be S2ARCBK.ZIP. When backing up to an external drive, the filename will start with UTX_0001.ZIP and count upwards from there.

Restoring Patient Studies

Touching 'Restore Archive', then 'Yes', will bring up the following screen:

Select the source drive and press Start Restore. Insert a disk into the source drive and press Continue. Press 'OK' on the reminder to reindex the archive when the restore is complete.

Overwrite Existing files are replaced by the files from the restore source.

Append Add the files from the restore source to the end of the Archive (files will be renamed).

Skip Existing archive file is kept and the restore source file is ignored.

Continue to follow the onscreen instructions until all source files are complete. For files on an external drive, each UTX_*xxxx*.ZIP file is considered to be a separate disk. Press Cancel and then Exit when all disks are complete.

Backup Study Configuration

Touch "Backup Study Configuration" on screen. Insert a blank Floppy Disk or USB memory device into the drive bay; the system will erase the floppy if it is not blank. Press the "Y" key on the keyboard when prompted if you wish to continue. NOTE: it is a very good idea to make a backup Study Configuration Disk after the instrument has been customized to your specifications. If you have 2 or more MultiLab instruments, you only need to custom configure your studies on one system, and using the Backup and Restore Study Configuration utility, enable all systems to run the exact same programs.

Newer windows systems can also back up to external drives. If no floppy disk is found, then the system will switch to backing up to the first compatible external drive found.

The software creates a file call S2STYBK.ZIP on the root of the destination drive.

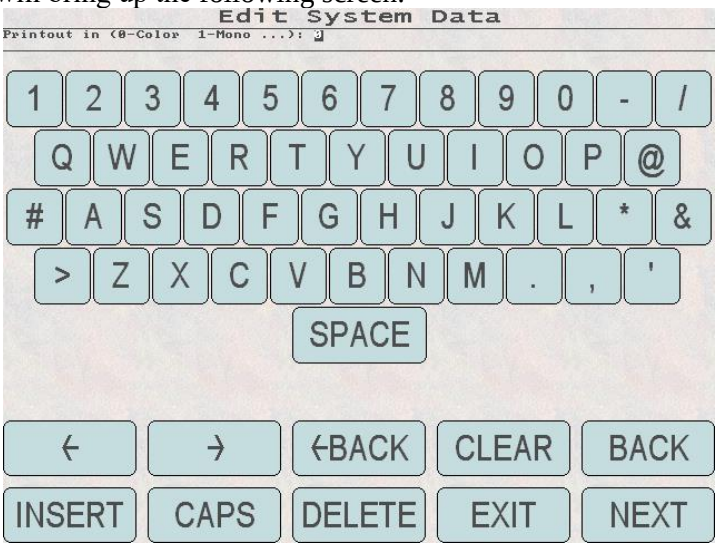
Restore Study Configuration

Press the "Restore Study Configuration" button on touch screen. Insert the desired Backup Study Configuration disk into the Floppy Disk Drive. Press the "Y" key on the keyboard when prompted to complete study restoration. Note: You may get a "file exists, do you want to overwrite it?" warning. Press "Yes" or "All" as a response.

Newer windows systems can also restore from removable USB drives. The floppy drive must be empty before the software will try to use an external drive. The software will use the first USB drive it finds.

System Data

Touching "**System Data**" will bring up the following screen:



Use the NEXT and BACK buttons to select an item. Use the EXIT button to return to the setup menu. The other buttons affect the currently selected item. The first item shown above affects the default output to the printer.

Pressing the NEXT button brings up the following item, which affects the output to the display when viewing reports:

Adding a value of two (+2) will change the default zoom when viewing reports.

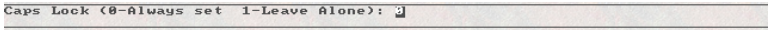
CAUTION: Changing data from this point onward may result in decreased performance of the instrument, or failure to operate at all. Do not continue unless advised by Unetixs service personnel.

Pressing the NEXT button brings up the following item, which controls the printer:

This is the name of the printer to print to (**Note**: for network printers use the network URL instead). The software will print directly to older compatible DeskJet™ and LaserJet™ printers; to print to all other printers, place a '+' symbol as the first character as shown above. If no printer name is specified, as shown above, then the Windows™ default printer is used. A '-' character disables printing.

Pressing the NEXT button brings up the following item, which affects the screen when entering text data:

Pressing the NEXT button brings up the following item, which affects the CAPS LOCK keyboard option. This action is taken right before patient information is entered (name, id, etc…).

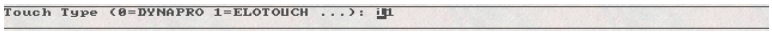


Pressing the NEXT button brings up the following item, which affects exit options on the Start Screen. The 'P' option shows contrast buttons for monochrome LCD displays, the 'CP' option shows nothing, the 'Exit' option shows just an exit button, the 'Windows' option shows an exit to windows button and the 'Shutdown' option shows both exit & shutdown.

Pressing the NEXT button brings up the following item, which inputs the hardware address of the RS232 touch.

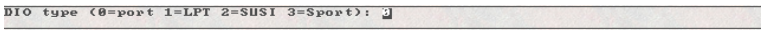
Pressing the NEXT button brings up the following item, which inputs the interrupt address of the RS232 touch.

Pressing the NEXT button brings up the following item, which inputs the type of touch screen.



A value of 2 will open to a window instead of full screen, but the RS232 touch will be disabled. A value of 3 will start full screen but disable the R232 touch; this option will be used if a windows driver handles the touch screen. Adding four (+4) to the value will attempt to double the screen resolution, used by the software, to 1280 by 960 pixels (if the hardware is capable). Adding eight (+8) to the value will double the resolution but use as much vertical resolution as possible (usually up to 1280 by 1024 pixels). Adding twelve (+12) to the value will double the resolution, but use as much vertical resolution as possible while allowing the taskbar to remain visible (the taskbar must be arranged to be at the bottom of the desktop). Note: only one of the additive (+) options can be used.

Pressing the NEXT button brings up the following item, which inputs the type of digital I/O.



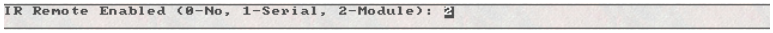
Pressing the NEXT button brings up the following item, which inputs the hardware address of digital output.

Pressing the NEXT button brings up the following item, which inputs the hardware address of digital input.

Pressing the NEXT button brings up the following item, which inputs the hardware address of the vascular.

Pressing the NEXT button brings up the following item, which inputs the interrupt address of the vascular.

Pressing the NEXT button brings up the following item, which enables the IR remote.



Pressing the NEXT button brings up the following item, which inputs the hardware address of the IR remote.

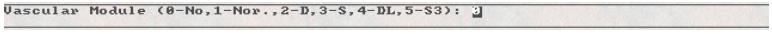
Pressing the NEXT button brings up the following item, which inputs the interrupt address of the IR remote.

Pressing the NEXT button brings up the following item, which enables the Automatic Cuff Selector (disabling the remote control cuff selector (see chapter 7). A value of 2 may be used if DIO is not needed.

Pressing the NEXT button brings up the following item, which sets the initial operating system command.

Pressing the NEXT button brings up the following item, which sets the operating system shutdown command.

Pressing the NEXT button brings up the following item, which sets the type of vascular. Check your module's serial number, if it ends in a letter then set this appropriately. **Note**: use 3 for Roodra.



Pressing the NEXT button brings up the following item, which sets the vascular supports for spectral Doppler.

Pressing the NEXT button brings up the following item, which activates the spectral probe's mute switch.

Pressing the NEXT button brings up the following item, which sets the button color (0-normal, 1-Blue).

Pressing the NEXT button brings up the following item, which sets the main archive location. If you wish to disable the archive, just make the first character a '\' (as in \C:\ARCHIVE\).

Pressing the NEXT button brings up the following item, which sets the file extension of the main archive.

Pressing the NEXT button brings up the following item, which sets the secondary archive location.

Pressing the NEXT button brings up the following item, which sets the file extension of the secondary archive.

Pressing the NEXT button brings up the following item, which sets the text of the export button (6 char. max).

Pressing the NEXT button brings up the following item, which sets the first export control program.

Pressing the NEXT button brings up the following item, which sets the first path to export to.

Pressing the NEXT button brings up the following item, which sets options for the first export.

Pressing the NEXT button brings up the following item, which sets the name for the first export.

Pressing the NEXT button brings up the following item, which sets the second export control program.

Pressing the NEXT button brings up the following item, which sets the second path to export to.

Pressing the NEXT button brings up the following item, which sets options for the second export.

Pressing the NEXT button brings up the following item, which sets the name for the second export.

Pressing the NEXT button brings up the following item, which sets the import control program.

Pressing the NEXT button brings up the following item, which sets the import destination path.

Pressing the NEXT button brings up the following item, which sets options for the import.

Pressing the NEXT button brings up the following item, which sets the text of the import button (6 char. max).

Pressing the NEXT button brings up the following item, which sets the title of the third import field (after name and I.D.).

Pressing the NEXT button brings up the following item, which sets the type of waveform scroll.

Pressing the NEXT button brings up the following item, which sets the new study button's text (10 char. max).

Pressing the NEXT button brings up the following item, which sets the lookup button's text (10 char. max)

Pressing the NEXT button brings up the following item, which sets the delay before manual inflation.

Pressing the NEXT button brings up the following item, which sets the delay before manual deflation.

Pressing the NEXT button brings up the following item, which inputs the right blood pressure offset.

Pressing the NEXT button brings up the following item, which inputs the right blood pressure span.

Pressing the NEXT button brings up the following item, which inputs the left blood pressure offset.

Pressing the NEXT button brings up the following item, which inputs the left blood pressure span.

Configure Studies

Due to the highly technical nature of study configuration, newer versions of the software have password protected this option. Contact Unetixs customer support if you feel you need to access this feature. This should only be performed by trained personnel.

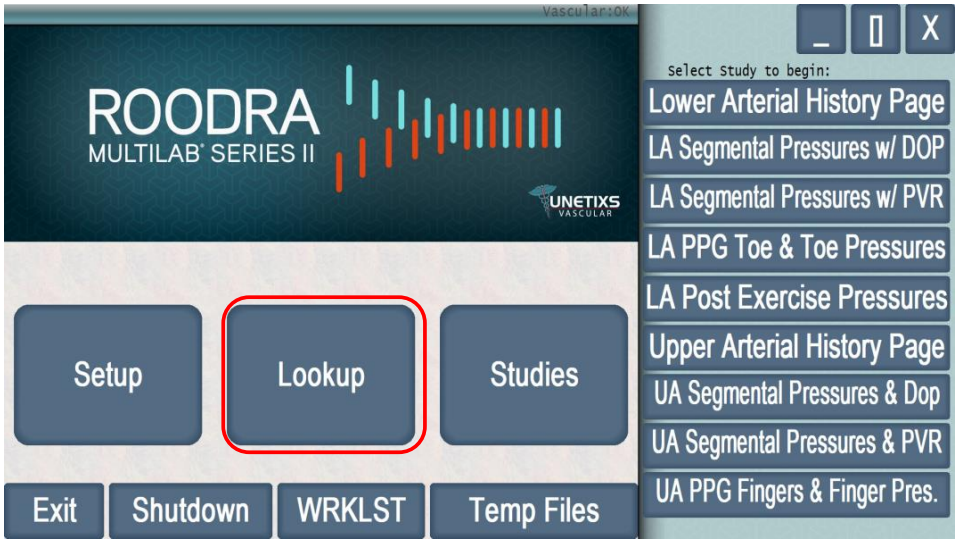
Since there are so many variables in the types of vascular studies that are performed, the order in which they are performed, and a multitude of personal preferences in the field of Physiologic Vascular Testing, the MultiLab Series II instruments have been designed to give unparalleled flexibility in customizing the MultiLab to each facility or even to each individual within the facility. See CHAPTER 11: CONFIGURING STUDIES.

Some of the more popular items that can be customized are: Inflation targets, which can be preset for each site (e.g. the Ankle site can be preset to inflate to 150 mmHg, while the calf can be set for 160 mmHg, Thigh – 175 etc. Deflation Rate – there are 40 different bleed rates for the pressure cuffs, adjustable in 1/8th mm per second intervals. Sequencing order, some prefer to do waveforms first, and then finish with Segmental Pressures. Others prefer the opposite. Some like to start at the thigh and work down the leg, others like to start at the ankle and move up. Wherever you like to start, and whatever order you like to proceed, the MultiLab can be configured exactly to your liking, even down to how you like your finished printed report to look.

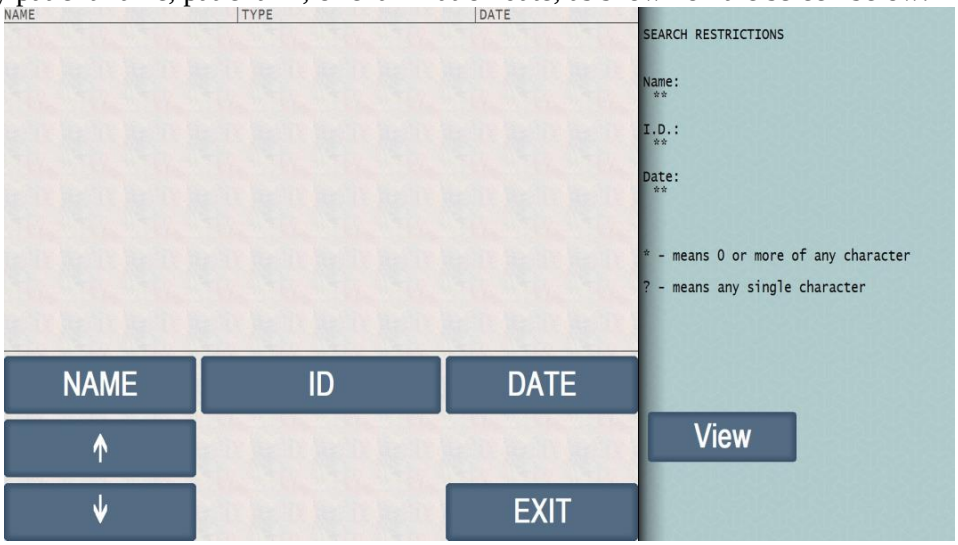
Since there are so many variables that can be modified, Configuring Studies merits a separate chapter of its own. Don't let the number of choices worry you, however, the MultiLab instruments come pre-loaded with a number of commonly performed standard vascular procedures.

The configuration utility does work with a touchscreen or mouse. On some screens an on-screen keyboard will be automatically displayed, but on others you must activate the onscreen keyboard by clicking the '▒' in the upper right hand corner. If keyboard help exists, at the bottom of a screen, those fields can be clicked on directly to perform those functions. Text fields can be directly clicked into. Number fields can be changed by dragging left (-1), right (+1), up (+10), or down (-10). Selection fields can be changed by dragging left or right.

CHAPTER 4: LOOKUP FUNCTIONS



The Lookup Function allows you to access patient reports that have been archived to the MultiLab hard disk drive. These files can be accessed at any time by pressing the "**Lookup**" button from the Start screen. You may get the error message "database missing: reindex for speed"; either continue as normal, or from the Start screen press setup, then diagnostics, then reindex archive, then finally full & compress. You can then look up archived patient reports by patient name, patient ID, or examination date; as shown on the screen below:



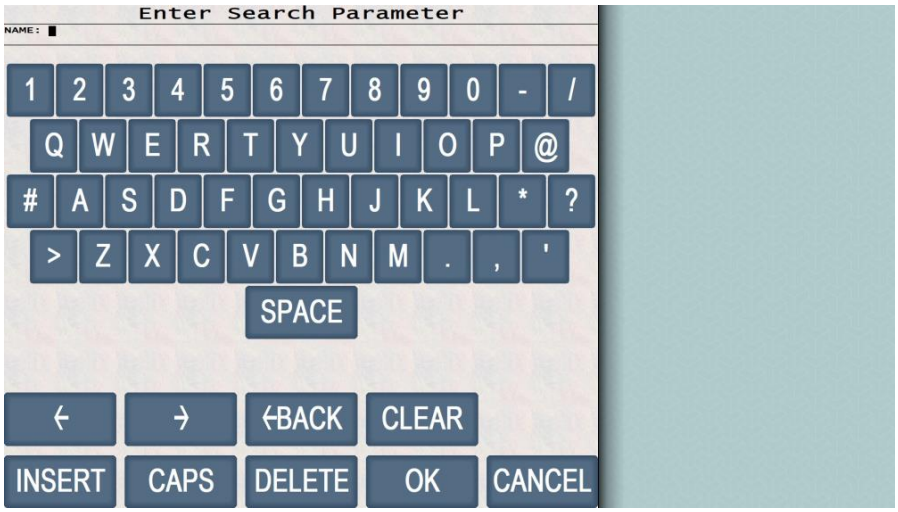
Lookup ILR

For the Lookup screen, the ILR can show the search restrictions entered. This is important since each search uses all three parameters, name, ID, and date, as restrictions to the patients found in the lookup. To view a highlighted patient report, simply press the View button and the ILR will display the report instead. To return from the report view, simply press the Clear button.

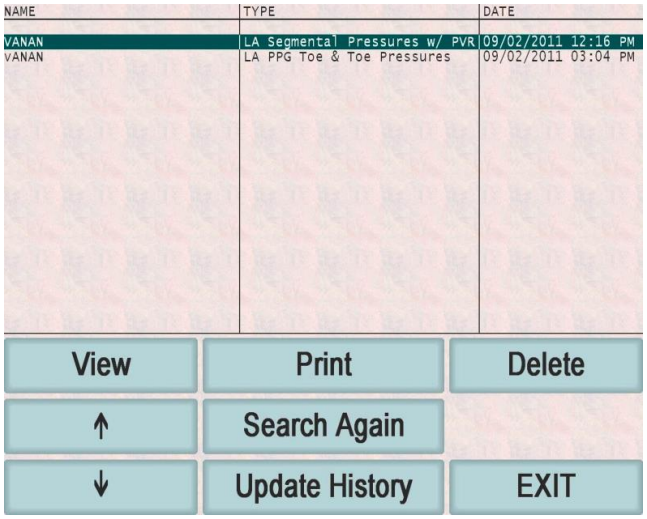
Lookup Example

For example, pressing the "**NAME**" button from the previous screen will prompt you to type in the patient name, as shown below. You can use the keyboard or the onscreen touch keyboard to enter this information. If you press the ENTER key on your keyboard or the "OK" button on the touch screen without entering in any name information, the MultiLab will display the first 100 archived patient reports.

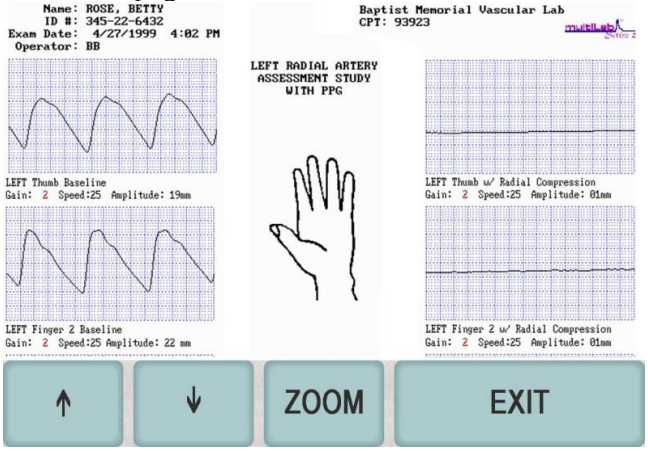
It is not necessary to enter the full patient name. For example, to search for "Washington" simply type "wash" or "ingt" and the MultiLab will display any patient records that have those four letters in that order.



Once the patient's names are displayed (as shown below) you can select a patient by using the up or down arrow keys to highlight the desired patient report. You can then view, print, or delete the patient's report by pressing the appropriate button.

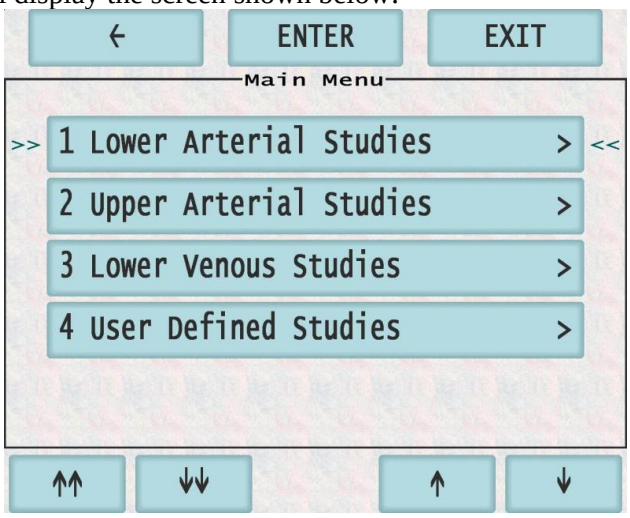


Below is an example of what will appear when you press the view button on the MultiLab screen. You can use the up or down arrows to view the entire page.



CHAPTER 5: STUDIES FUNCTION

The Patient Studies that can be performed by the MultiLab can be accessed by pressing the "**Studies**" button from the Start screen. This will display the screen shown below:



Note: the above screen is an example of the Factory Default main menu and can be modified in any desired fashion using the Study Configurator. The "Main Menu" shown above contains four sub-menus which in turn contain various studies. It is sometimes desirable to put your most common studies onto the "Main Menu" to reduce screen touches to access your patient exams.

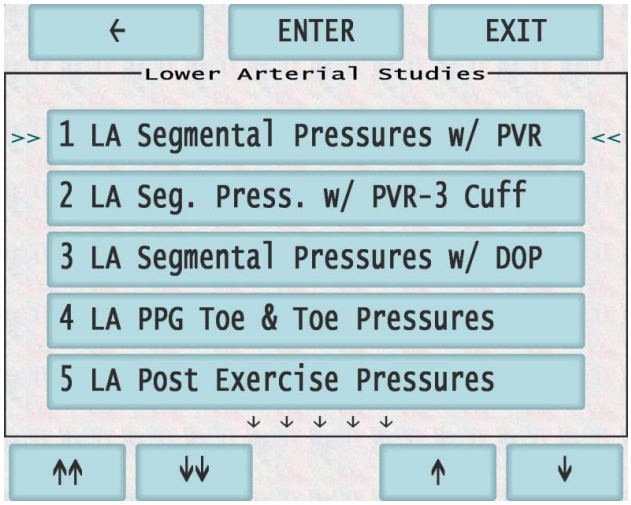
←	This will take you to the previous screen.
ENTER	This will take you into the study or sub-menu bracketed by the ">> <<" symbols.
EXIT	This will take you back to the Start screen.
↓↓	This will display studies or sub-menus 6 and higher (if any).
↑↑	This will display studies or sub-menus one page up (if applicable).
↓	This will move the selector brackets (>> <<) down.
↑	This will move the selector brackets (>> <<) up.
1, 2, 3, 4 or 5	These will take you into the study or sub-menu according to the number touched.

Studies ILR

For Studies function, the ILR will show the list of measurements for the selected study. There are no buttons.

Studies Example

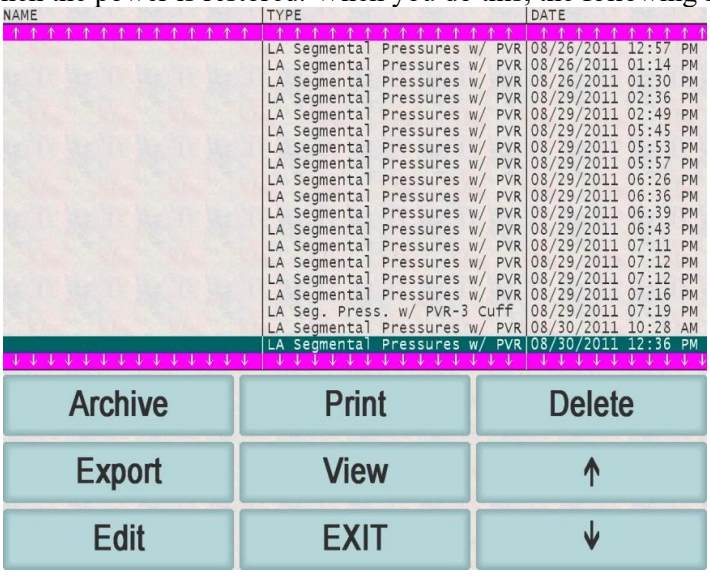
Pressing the "**Enter**" or "**1 Lower Arterial Studies**" from the above screen will bring up the Factory Default Lower Arterial Studies menu shown below:



Note: Any unwanted studies can be deleted and will not be displayed (see Configure Studies).

CHAPTER 6: TEMP. FILE'S FUNCTIONS

Pressing the "**Temp Files**" button from the Start screen will allow you to access patient reports that have not been archived to the MultiLab hard disk drive. For example, if the power should go out in the middle of a study press the "**Temp Files**" button when the power is restored. When you do this, the following screen will appear:



The most recent patient will be at the top. The following functions are available from the Temp. Files menu:

Archive Will save the patient report to the MultiLab hard disk drive. (See Archive Patient Reports in Chapter 10)

Print Will print the patient report. (See Printing Patient Reports in Chapter 10)

Delete Will delete the highlighted patient report. You will be given the opportunity to change your mind by touching "**No**" when prompted by the MultiLab "are you sure?" question.

Export Will export the patient report. (See Exporting Patient Reports in Chapter 10)

View Will allow you to view the patient report on the MultiLab screen.

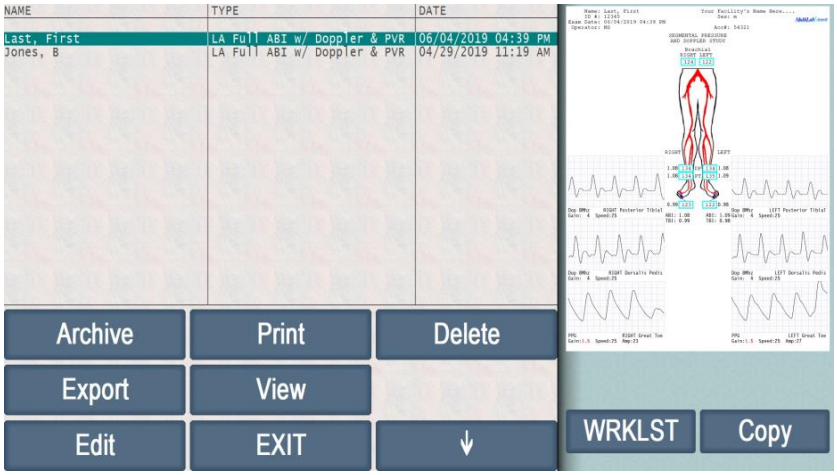
Edit Will allow you to go into, resume, or make changes to the highlighted patient report. (See Chapter 10: Editing Patient Reports)

Exit Will exit to the Start screen.

↑ This will allow you to move the highlight cursor up.

↓ This will allow you to move the highlight cursor down.

ILR Temp File Functions



When Temp File is opened the ILR will display the first study in Temp Files; which is the most recent study performed. As other studies are highlighted, the displayed report will change.

WRKLST Will allow user to see the worklist information for the selected study, if it exists. **Note**: the name of this button is defined in the System Setup.

More Will display more of the worklist. Keep pressing the button to return to the beginning of the worklist information.

View This is the default function. Will show the patient report for the select study

Copy Will copy a picture of the report to the Windows™ clipboard.

View ILR

If the View button is pressed, the ILR changes to show the patient's name and their file information on the system. The file information can be useful if you are viewing from the lookup and want to extract a particular patient's file. Also, a View button is available on the ILR. This View button will show the report for the patient which is the same report already being viewed, but the ILR may also have left and right arrow keys which can change the ILR's report view to other pages of the patient's study. From the report view, press the Info button to return to the file information.

CHAPTER 7: MULTILAB REMOTE CONTROLS

The MultiLab instruments will ship with either one or both of two devices for controlling the instrument remotely. They are the Remote Control Cuff Selector and the Wireless Remote Control.

The Remote Control Cuff Selector

The remote-control cuff selector manifold is used to hook up all the pressure cuffs at one time, and also allows remote control of the MultiLab Instrument. The cuff selector is best positioned between the patient's feet for most examinations. Upon inspection, you will notice 5 hoses exiting the cuff selector on each side. The #1 hose is longer than the remaining 4. Typically in a Lower Arterial study using the 4-cuff method, the #1 hose is attached to the arm cuff, the #5 hose to the ankle cuff, the # 4 hose to the calf cuff, etc…

If you desire to obtain toe pressures, or transmetatarsal PVR waveforms, feel free to attach the #1 hose to those cuffs after the Arm pressures have been obtained. The 10 toggle switches on the selector direct the flow of air to the desired cuff. When the switches are in the center position, all air valves will be closed, and no air will be directed to the cuffs. Make sure that only one switch is open at a time, unless performing certain bilateral studies (such as PVR) that record left and right channels at the same time.

The remote controls are self-descriptive in most cases with a few exceptions. When a waveform or pressure reading is "Captured" the "Baseline" and the "Gain" keys become scrolling keys. To scroll a captured waveform or pressure, "Gain" is for fast scrolling, "Baseline" will scroll slowly.

Other Remote Control Functions (with exception of above paragraph) are:

BACK	This will take the user to previous screen or backward 1 site.
NEXT	This will take user to next screen or forward 1 site.
PROBE	Allows user to activate and change probes during Pressure studies.
VOLUME	One touch will adjust volume by 1 step; pressing and holding will be continuous.
GAIN	One touch will increase or decrease Gain by next increment.
BASELINE	One touch will move baseline up or down by 1 increment, and holding will provide continuous movement.
SIDE	Used while scrolling "Captured" 2 Channel Waveforms (PVR or PPG). If Left side waveform is acceptable, but right is not, press the "SIDE" key to enable of scrolling 1 waveform (Left or Right) at a time.
INVERT	Inverts the Doppler Waveform. This button is active only in Doppler Waveform mode.
DEFLATE	One touch will begin Auto-deflation at preset rate (see Note*).
INFLATE	One touch will begin inflating to preset target pressure (see Note*).
CAPTURE	One touch will "Freeze" waveform or pressure. 2nd touch will move user to next site.

***Note**: If the Inflate or Deflate button is depressed slowly or held down for more than a moment, both buttons will revert to "Manual" mode allowing user to control inflation and deflation by continuing to hold

buttons down as long as Inflation or Deflation is desired. One Quick touch of either button will return controls to "Automatic" mode.

The Infrared Wireless Remote Control

The buttons on the remote control (Shown Below) function as follows:

PROBE Allow user to change the active probe. The active probe will be displayed on the MultiLab Screen

INVERT Invert the Doppler Signal (in Waveform Mode only)

D/OVER "Do Over" an Exam Segment

CAPTURE "Capture" a Waveform or Pressure

VOL ↑↓ Increase or decrease the volume of the Doppler probe

BASE ↑↓ Move the baseline (or waveform) up or down.

GAIN ↑↓ Increase or decrease the sensitivity of the active probe

PRESS ↑ Begins pump inflation. (See NOTE below)

PRESS ↓ Begins Cuff deflation. (See NOTE below)

MUTE One touch will reduce the Doppler volume to zero. A second touch will restore the previous volume setting

SIDE When performing bilateral studies, will activate Left, Right, or both sides for capturing waveforms or pressures, and when scrolling. The active side will be displayed on the Touch-Screen Color Monitor

BACK Move one site back each time button is depressed.

NEXT Advance one site forward each time button is depressed.

NOTE: The **PRESS ↑** and **PRESS ↓** buttons have TWO functions each: One brief touch of either button will begin automatic inflation or deflation. Depressing either button for more than one moment, will engage "Manual Mode", where button must be held down to continue inflation or deflation. When the instrument is operating in "Manual Mode" one quick touch of either button will resume automatic inflation or deflation.

Remote Control MENU Commands

This group of buttons is for use while navigating the MultiLab Video Menu screens. They are not used while performing studies on patients.

NEW Will allow user to select another exam to perform on a patient.

↑ And ↓ Buttons Will allow user to navigate up or down while Menu items are displayed on the monitor.

ENTER and EXIT Will allow user to select study or menu item displayed on the video monitor, or to exit from the current selection.

Scrolling Button Functions

The BASELINE (BASE) and GAIN keys also function as "Scrolling" keys when you have captured or "Frozen" a waveform or pressure. (On any "active" screen they will increase or decrease the position of the waveform or baseline and increase or decrease the sensitivity of the active probe.

The **BASE** ↑ and ↓ are for SLOW scrolling (forwards and backwards)
The **GAIN** ↑ and ↓ buttons are for FAST scrolling (forwards and backwards)

Battery Installation

The Infrared Wireless Remote Control requires 2 "AAA" batteries for operation. Unetixs recommends the use of alkaline batteries for maximum remote performance. Slide lower back portion of remote downward to reveal battery compartment as shown.

Insert 2 "AAA" batteries, paying attention to positive (+) and negative (-) alignment and close battery cover by sliding upward until cover "snaps" into place.

CHAPTER 8: AUTOMATIC CUFF SELECTOR USAGE

The optional Automatic Cuff Selector allows the operator to perform pressure examinations without having to manually open and close valves at each desired site.

The valves will automatically open and close to correspond to the desired sites. The valves are automatically activated by the software commands within each selected study. For most applications, the #1, right and left, valves will control the arm cuffs, the #2 valves will control to the thigh cuffs, the #3 valves will control the Above Knee cuffs, the #4 valves will control the Calf cuffs, the #5 valve will control the Ankle cuffs, and the #6 valves will control the Great Toe/Metatarsal cuffs.

Note: the right side hoses are clear and the left side hoses are blue. For newer systems and the Roodra, the right side hoses are gray and the left side hoses are light green.

A study configurator screen is shown:

```
                                1 Pressure

Tag: "RIGHT Brachial Pressure"          Gain Units: Normal
Pressure Designation: PA                Gain Unlocked
Print-X: 900    Print-Y: 500            Gain is set from previous site
Hide Timer                              Initial Gain: 4
                                        Baseline Invisible
Outer Graphic Box Disabled              Baseline Unlocked
Justification: Right                    Baseline is set from previous site
Print if captured                       Initial Baseline: 10.00 mm
                                        Audio Unlocked
Probe Unlocked                          Audio is set from previous site
Probe is set from previous site         Initial Audio (0 = Off): 2
Initial Probe: Doppler 8 MHz            Manometer Side: Right
                                        Auto Cuff Selector: Right 1
Inflation Type: Automatic               Export Code: 128
Target Pressure: 160                    Spectral: No
Overflow Pressure: 300
Deflation Type: Automatic
Deflation Rate: 3.000 mmHg/s
Capture Record: 0
Speed: 10 mm/sec
Filter: 28 Hz + HP

<F1> for Help          <F10> to Save and Exit          <ESC> to exit
```

The bottom right column in the study configurator is where the valve assignments are made. We can see from the screen that the Right Valve 1 is active while taking a Right Brachial Pressure. The valve numbers can be changed as desired and/or reassigned easily from the "Configure Studies" portion of the software.

The Automatic Cuff Selector is quite simple in its operation. The software controls the valves for every study, and each valve has a green light on the Auto Manifold. If you are uncertain which valve is active when performing an examination, just look to see which light is illuminated. In cases of Bilateral PVRs or Pressures, both lights will be illuminated.

Auto Cuff Selector ILR

During an examination with a modality, the ILR report view will be highlighted with the current measurement. If the measurement involves the Auto Cuff Selector, that measurement will be highlighted with the color of the active hose:

Valve 1	Blue
Valve 2	Yellow
Valve 3	Green
Valve 4	Red
Valve 5	White
Valve 6	Black

Manual Operation on the Automatic Manifold

If for some reason, your Automatic Manifold is not switching properly, or if you simply wish to operate it manually, you will notice that there are two "Manual" switches on the front panel of the Automatic Manifold:

Repeatedly pressing the Left and Right "Manual" buttons will allow you to override the default setting in the software. Continue pressing the "Manual" button until the L.E.D. is illuminated over the desired valve number.

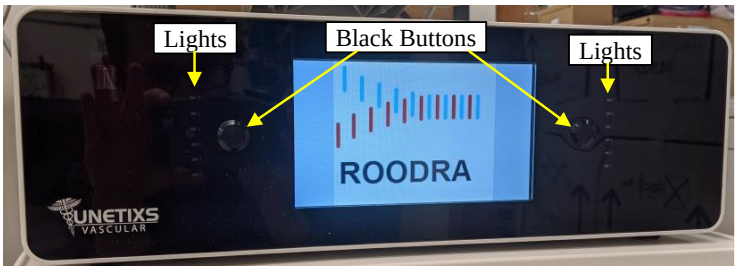
NOTE: If you are performing a field retrofit of these components, you must first alert the MultiLab so it will recognize this new component. Follow these steps to before you attempt to perform patient studies:

1. Press "Setup" from the Start-up Screen
2. Press: "System Setup".
3. Press: "System Data"
4. Observing the top line of the video monitor, continue pressing the "Next" button on the Touch-Screen until you see the following command: Auto Cuff Select.
5. Press "1" to activate the Automatic Cuff Selector and then press exit until you return to the Start screen. The Automatic Cuff Selector should now be functional.

Roodra Cuff Manifold

The cuff manifold is housed within the Roodra Module. Small, green lights will illuminate on the front panel of the Roodra Module corresponding to the cuff hose that is about to be utilized in the procedure. In a Doppler pressure modality, one light will be active, in PVR waveforms and PPG pressures two lights will be active.

The user may override the procedure and choose a different hose, or a different pair of hoses. Simply press one of the two black buttons (Right and Left) to advance the light(s) to the desired hose.



CHAPTER 9: PATIENT TESTING

In this chapter you will be introduced to the methods and concepts of patient testing that can be performed with MultiLab Series II instruments. All patient testing exams discussed herein follow clinically accepted methods and protocols. As there is always some variation from lab to lab and from individual to individual; we have created the Study Configuration utility (see CHAPTER 11: CONFIGURING STUDIES) so you can define the manner in which you wish to perform your exams if you decide not to use the factory preset studies.

Before we begin, it is important that we understand the various modalities that are incorporated into the instrument and the merits and shortcomings of each modality.

Modalities of Testing

Today's peripheral vascular labs use the following transducers to produce physiologic information about arterial and venous circulation in the arms, legs and digits of the hands and feet.

Doppler

Doppler is able to detect flow within a vessel through the use of the Doppler principle. CW (Continuous Wave) Doppler is used to evaluate the quality of flow within a vessel allowing the user to determine:

1. Presence or absence of flow
2. Direction of flow
3. Frequency changes relative to velocity changes
4. Frequency (velocity) waveform.

When CW Doppler is utilized during the segmental pressure exam, it is being used as a "stethoscope" to detect the presence or absence of flow.

CW Doppler is non-imaging and uses a probe housing both sending and receiving crystals. The MultiLab supports both 5 and 8 MHz Doppler transducers. The 8 MHz probe is best utilized for shallow lying (superficial) vessels, while the 5 MHz transducer, offering deeper penetration through tissue, is best used for vessels located further from the skin surface.

Strength: Can determine direction of blood flow, better suited to smaller vessels than a stethoscope for segmental pressure exams.

Weakness: Cannot "see" the vessel being examined, cannot determine optimum angle for velocity measurements, very operator dependent.

Photoplethysmography (PPG)

Photoplethysmography (PPG) is able to detect flow in the arterial bed located in the digits of the hands and feet. PPG is very sensitive to the minute pulse-volume changes that occur with each systolic pressure rise that occurs in the arterial tree. PPG uses a sending non-visible light transducer and a photo-voltaic infrared receiver transducer. PPG waveforms are very similar to PVR waveforms. PPG is also used in venous reflux testing to determine the time for venous refilling after emptying. PPG may be used to replace CW Doppler during the segmental pressure exam.

Strength: Very good at measuring micro-circulation in fingers and toes.

Weakness: Sensitivity can be reduced if digits are cold, or if sensor is applied too tightly or loosely.

Calibrated pulse volume recording (PVR)

Calibrated pulse volume recording (PVR) is able to detect the "total flow" in a limb segment by the use of a cuff wrapped around a limb segment and inflated to 65 mmHg pressure (the inflation pressure is used to eliminate venous flow artifact). As Arterial blood flows underneath the cuff, the limb segment expands causing a change in air pressure in the cuff. (Tissue volume swells with systole and rebounds during diastole.) This subtle change in cuff pressure results in a wave tracing (see interpretation manual) which is an indirect measurement of the flow of all the arteries beneath the cuff.

The Unetixs' MultiLab uses "Calibrated PVR" (which displays exact pressure AND air volume inside each cuff during recording) to insure the clinical validity and repeatability of PVR testing. The cuff Volume and Pressure measurements are printed on the final report for accuracy during interpretation.

Strength: Quick, simple to perform, detects collateral flow, reproducible, low operator error.

Weakness: Cannot identify individual vessels

Clinical Techniques for Peripheral Vascular Testing

Cuff Application

NOTE: For accurate systolic pressure measurements, the general recommendation is that a cuff width should be 20% larger than the diameter of the limb. An under-sized cuff causes falsely elevated pressures. Although an over-sized cuff will not affect segmental pressures they will dampen the amplitude during calibrated PVR testing.

Since we are diagnosing vascular disease instead of hypertension, most practitioners in the vascular field today utilize the "4-cuff method" (using 4 pressure cuffs on each leg) when performing Lower Limb Arterial Studies. While usually artificially elevating the above knee and thigh pressures, it is viewed as preferable by being able to differentiate between Superficial Femoral and Aortoiliac disease (see interpretation manual section on Segmental Pressures for more information).

IMPORTANT: DO NOT APPLY BRACHIAL CUFFS IN THE FOLLOWING CONDITIONS:

- Over a "PICC" line, or venous access port.
- On an arm that is swollen, hot or hard (possible DVT).
- On female mastectomy patients as advised by their physician.

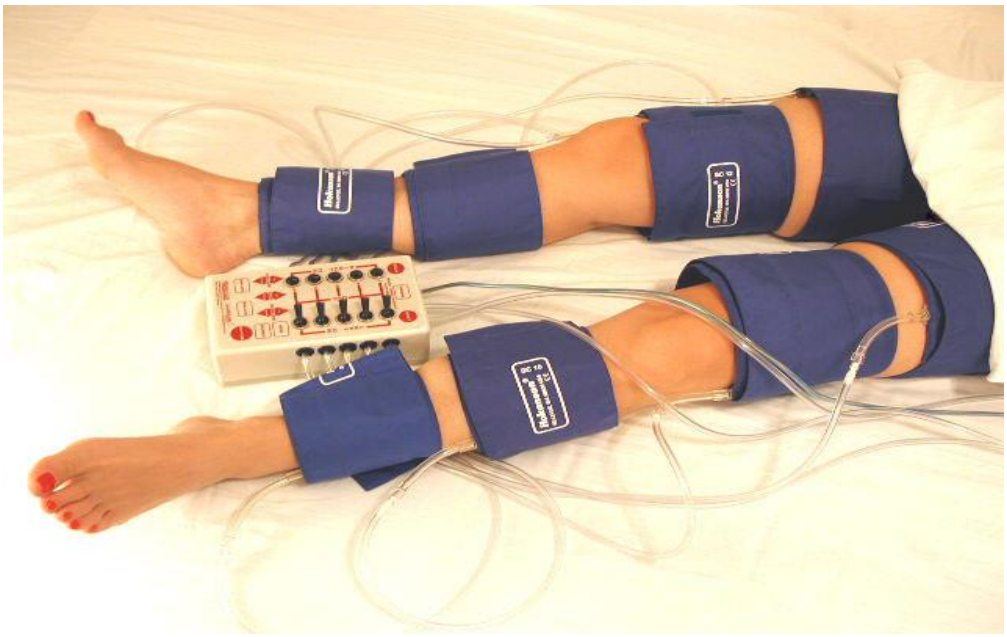
Cuff Sizes and Placement

The MultiLab instrument may ship with blood pressure cuffs designed for 3 or 4 cuff testing methods:

CC-17	(17 Centimeters wide) Contoured Thigh cuff for 3-cuff method.
SC-12	(12 Centimeters wide) for Above the Knee and High Thigh sites.
SC-10	(10 Centimeters wide) for Calf, Ankle and Arm sites.
TMC-7	(7 Centimeters wide) for Transmetatarsal or Hand use.
PC-2.5	(2 ½ Centimeters wide) for Fingers and Toes.

Optional cuffs (may be ordered directly from Unetixs) include:

CC-22	(22 Centimeters wide) Contoured Thigh cuffs for 3-cuff method.
SC-12L	(12 Centimeters wide) Extra-length cuffs for large Thighs.
DC-1.9	(1.9 Centimeters wide) for small Toes.



Proper cuff positioning for 4-cuff method

Cuffs should be wrapped snugly with looseness not exceeding "1-finger width" of the technologist. Wrinkles should be avoided. A poorly wrapped cuff will adversely affect PVR testing results.

When wrapping, place the tubing connector of the cuff on the medial side of the limb, this will insure that the bladder of the cuff is covering the area where the vessels are anatomically located. The non-bladder portion of the cuff should be away from this area.

Digital cuffs should be applied with the bladder surrounding the fleshy part of the digit and not toward the bony side or nail bed side. Be cautious of connector hose kinking on these cuffs.

Lift the patient's limb when applying a cuff. If the patient "tries to help you" by lifting their limb, tell them to relax, a contracted muscle during cuff application will usually result in a loose cuff when patient relaxes limb.

The patient should be supine or with head elevated (semi-Fowler) on padded exam table. Avoid having the limb or cuff rest on the edge or crease of stretcher, cot or bed since this will cause an uneven pressure within the cuff.

Cuffs should not be inflated to a pressure of greater than 250mmHg. If vessel is incompressible, "Capture" the pressure reading, and using the "Set Output" function, enter the value as "CNO" ,"250+" or ">250" to avoid erroneous reporting of indices, and to signify limb segment was still pulsatile at that pressure to interpreting physician.

A patient complaint of severe pain during a pressure examination is sufficient reason to terminate the test on that particular cuff. Press "NEXT" and skip to the next segment. Do not press "CAPTURE".

Cuff Application as Related to C-PVR™

The Unetixs' MultiLab features true calibrated PVR (C-PVR™) that allows the technologist to ascertain immediately when there is a cuff miss-selection, wrapping error, or cuff leaks. The PVR waveform, when printed, appears with the "true-scaled" graph and notations on inflating pressure, cuff volume, units of measure, and gain setting.

Cuffs of equal width and in the same limb location (such as 2 thighs) should not have a volume difference greater than 15% (15 cc's per Hundred.) Observe the volume during inflation and at the monitoring pressure. If a discrepancy exists, check the following:

- Ensure cuffs are equally sized left and right.
- Ensure equal wrapping of cuffs in terms of tightness and location on limb.
- Ensure no unusual folding or wrinkling of the cuffs.
- Ensure cuff is not leaking (observable by a slow loss in pressure during acquisition of waveforms.)
- Repeat the test if necessary by pressing "Capture" and "Do Over"

If volume discrepancies are not avoidable, (can be due to limb atrophy, or edematous tissue) then be certain to call attention to the problem when reporting to the reading physician.

CW Doppler Application

The Unetixs' MultiLab comes with two CW Doppler probes – 5MHz and 8MHz. These are also known as the "low frequency" and "high frequency" probes. According to the physical principles of Doppler ultrasound a higher frequency has a greater the sensitivity to flow; and a lower frequency has a lower the sensitivity to flow. However, increasing the frequency of a probe will cause an increased attenuation (Attenuation is the loss of Doppler power as the beam travels through tissue). Thus lowering the frequency will lessen the attenuation. Use the low frequency for deep vessels such as in the groin and the higher frequency for all other applications.

NOTE: You can use the Doppler probes in 2 different ways – to obtain Segmental Pressure measurements, or to record Doppler Waveform tracings. When using the Doppler probe to take pressure measurements, use the 8 MHz probe on all but very heavy patients. When using the Doppler probe to record Waveform tracings, use the 8 MHz probe on the more superficial vessels and the 5 MHz probe on the deeper vessels (commonly Femoral and Subclavian, and sometimes Popliteal).

Illustration of cuff placement and proper Doppler Angle at Brachial artery

Doppler Technique

Doppler probes should always be used with Ultrasound Gel and be held like a pencil with the use of light pressure. Applying too much pressure on the Doppler probe can result in occluding the vessel you are attempting to examine.

The Doppler probe must be held at an angle of less than 60 degrees and pointed in the direction of flow. Ideally an angle of 45 degrees or less will provide the best Doppler detection signal. Since the angle to flow is

"assumed" (you cannot "see" the vessel with CW Doppler) the visual angle of the probe may not be the actual sampling angle. The best technique is to start with a "good" angle and listen for the "best" sound.

Unetixs' Doppler probes are bi-directional and the MultiLab has an Invert Button that allows the Doppler signal to be "flipped". Occasionally the best signal is derived with the probe pointing away from the direction of flow, resulting in a signal that is "upside down" or inverted. Always seek to create a graphic that is consistent with the signal that is heard. (This applies to all CW Doppler regardless of manufacturer.)

Use of filters when acquiring Doppler readings is usually not necessary and these should be set for the lowest setting in the System Configurations. Filters remove artifact but also decrease Doppler sensitivity.

If venous flow is causing artifact (visible or audible) in the arterial Doppler, apply a light pressure proximal or distal to the Doppler site. This will cause the venous flow to cease without affecting the arterial Doppler (in bi-directional CW Doppler, the venous flow can override, add to or subtract from the arterial signal).

PPG Application

The Unetixs PPG probes are light and thin and respond to the pulse volume of a digit very rapidly. The PPG probes can be applied using either the supplied Velcro™ straps, or the supplied PPG Clips. You can also remove the Velcro™ straps and use a short length of double-sided Scotch™ tape on the side of the probe containing the sensors. If Velcro™ is used, avoid excessive pressure during wrapping as this can obliterate arteriolar flow causing an abnormal waveform.

Both sensors should be in contact with the fleshy part of the digit and visually inspected to insure the absence of outside room-light interference.

Secure the PPG wires since wire motion and pulling can cause excessive motion artifact in the PPG graph with a prolongation of the testing time.

Illustration of PPG Sensor and digit cuff on Great Toe

Setting of Gain

The MultiLab has an automatic preset gain that can be altered during testing. Gain affects amplitude of the waveform, which is a diagnostic hallmark during interpretation.

Please note that Gain settings affect different studies in different ways. For example, when using the PPG sensor to obtain digit or segmental pressures, it is advantageous to reduce the gain as much as possible and still see distinct pulses on the MultiLab screen. Other studies may require you to increase the gain for an optimum examination. See the individual studies section to see how the Gain setting can be optimized for every exam. A reduction of Gain can reduce "overshoot" (when the waveform extends past the top and/or bottom of tracing).

Setting of Baseline

The MultiLab has an automatic preset baseline setting that can be altered during testing using the Baseline Up and Baseline Down controls on the touch-screen or the remote control.

The Baseline can be moved up or down without changing the size of the waveform on the display screen. It is advised when performing waveform studies using the Doppler, PVR or PPG sensors that the baseline be adjusted if necessary, so the entire waveform complex (peak to trough) is visible on the screen.

Setting the Volume (Audio)

Set the volume control for the Doppler probe for optimum listening. (NOTE: Remember that Doppler angle will also affect Doppler volume. If you are only hearing a faint Doppler sound, try adjusting the probe's position and angle before automatically reaching for the volume control.)

Optional Headphones can be plugged into the headphone jack on front of MultiLab. Plugging headphones in will disable system speakers, so others in the exam area will not hear the Doppler signals.

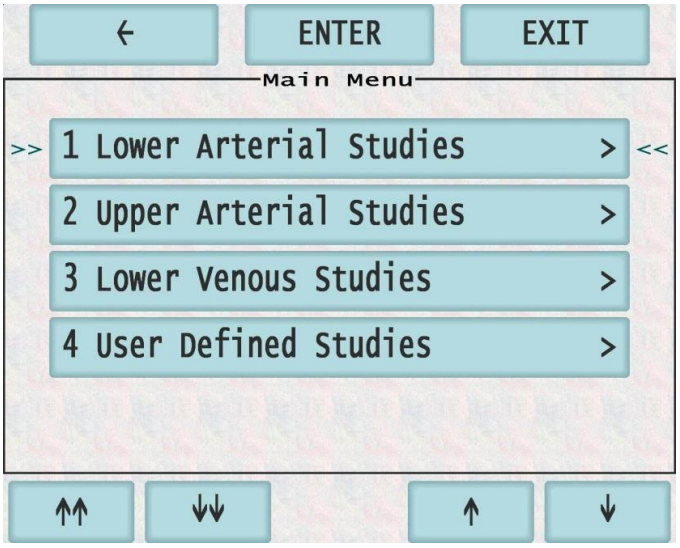
Lower Arterial Studies

NOTE: As the MultiLab instrument is almost infinitely configurable, the following section will pertain to individual types of exams. When any type of action is taken with the MultiLab, it will automatically sequence the user to the next site or even to a different type of study. It is possible to program the MultiLab to perform Segmental Pressures, Doppler Waveforms, PVR Waveforms, Digit Pressures, PPG waveforms and Post-Exercise Pressures all within the same custom program. For this reason we will treat each action separately.

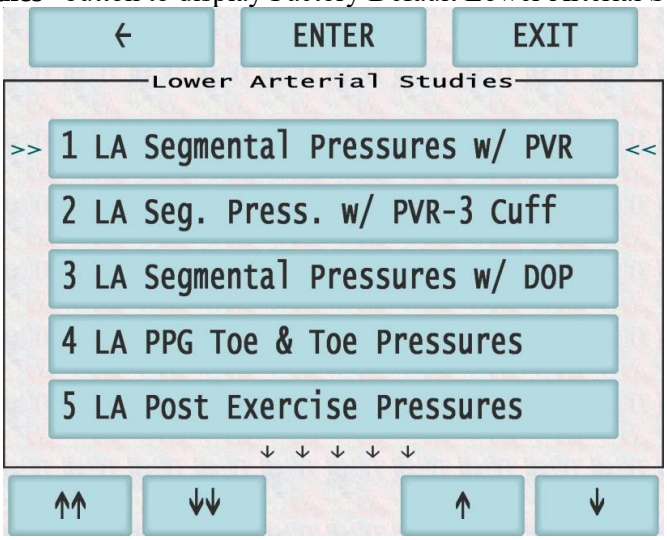
NOTE: Depending on how the instrument has been set-up, the video screen may look different from those displayed below.

History Page

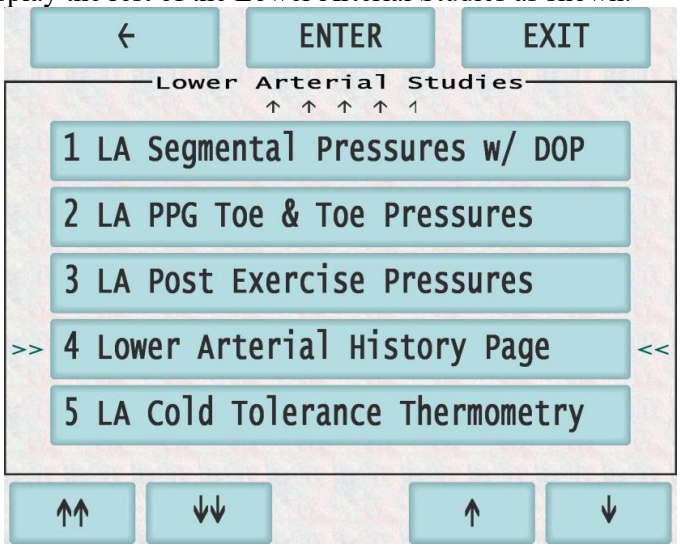
From MultiLab Start screen, press the "**Studies**" button on touch screen to bring up Main Menu Screen as seen below:



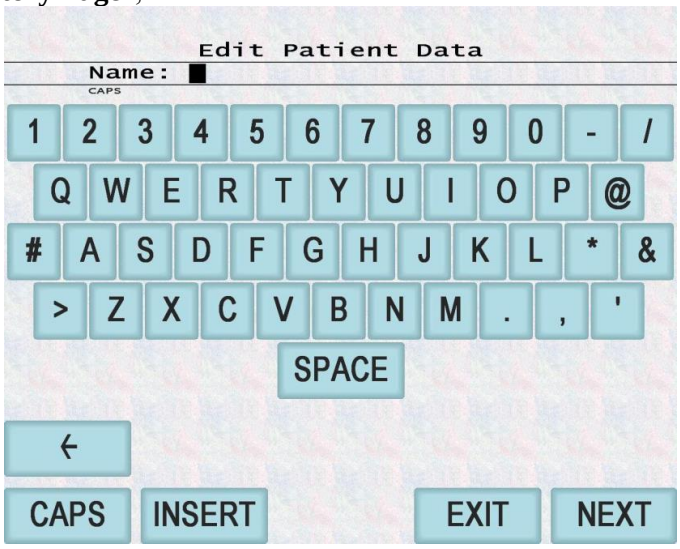
Touch "**Lower Arterial Studies**" button to display Factory Default Lower Arterial Studies Screen as shown:



Touch the "↓↓" button to display the rest of the Lower Arterial Studies as shown:



Touch "**Lower Arterial History Page**", the Edit Patient Data screen will be shown as follows:



Using the Keyboard or Touch-Screen, type in the Patient's name, (typically last name first) and press the "Enter" key or touch the "NEXT" button on the touch-screen. Enter the Patient ID (usually a Social Security or Medical Records number) and press "Enter." Continue to enter data as prompted by the Video Screen.

Patient Data ILR

The ILR for this screen will show all of the Patient Data, not just the line being edited. You may touch the ILR to change the focus for editing to a particular field. The View button is available to see the report view. Press the Info button to return to showing all of the Patient Data.

Patient History

When you get to the Patient History section, you will see a number of questions presented on the screen. A simple "Yes" or "No" can answer most questions, or more data can be entered to provide more detail. You have 1 line of type in which to enter data about a particular question.

Press the "Escape" key on the keyboard to exit the Patient History Page. NOTE: this page is completely user definable, and the factory-preset page is just an example of some of the information commonly gathered before a vascular examination is performed. Please consult the section on Study Configuration or contact Unetixs, for assistance on modifying the report page.

Press the "New Study" button on touch-screen to retain current patient information and to select the examination to be performed, without have to re-enter patient data (name, ID, etc…).

Foreign Language Data

The software will allow the following foreign language characters to be entered as patient data: Ç, ç, Æ, æ, Ä, Å, â, ä, à, å, á, É, é, ê, ë, è, ï, î, ì, í, Ñ, ñ, Ö, ô, ö, ò, ó, Ü, ü, û, ù, ú, and ÿ. If you are using a keyboard for a different language, make sure the default input language is set in Windows™. **NOTE**: Unetixs does not provide keyboards for alternate languages.

History ILR

Only the report view is shown for the history page. The Zoom button is available to expand the report.

Arm Pressures

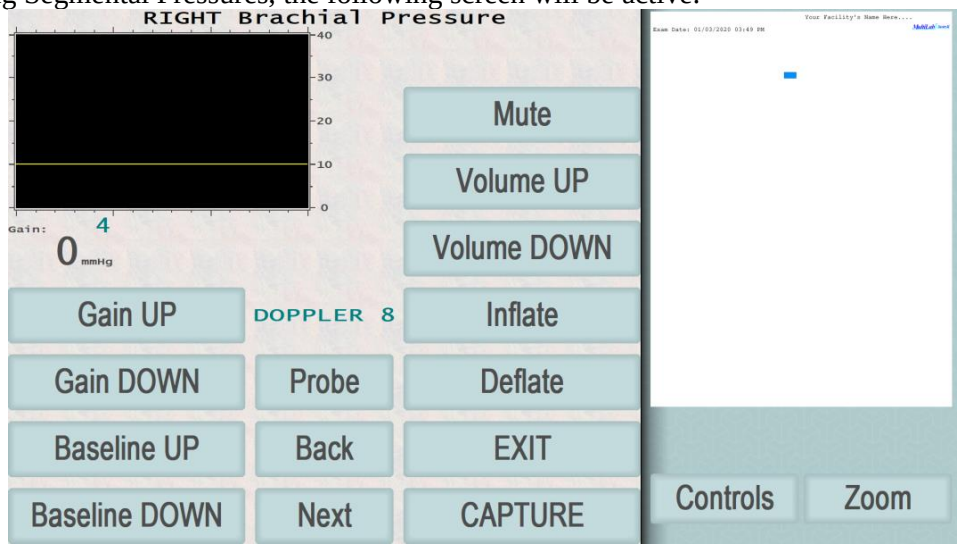
Patient Preparation

Patient should be supine on padded exam table. Have patient remove shoes, socks or stockings and clothing from legs (patient CAN leave undergarments on). It is advisable to have either a gown or some other covering over patient to ensure patient stays warm during exam. A cold examination room can cause vasoconstriction in certain patients, which can negatively affect the examination.

Apply 1 SC-10 blood pressure cuff to each arm (see page 52) and apply SC-10 cuffs at the ankle and calf sites, and SC-12 cuffs above the knee and at the high thigh sites (see page 51).

NOTE: Many technologists prefer to start the segmental pressure examination at the brachial sites to establish a "baseline" pressure then proceed to the ankle to see if ankle pressure equals or exceeds the brachial reference pressure (the higher of both arm pressures).

When performing Segmental Pressures, the following screen will be active:



The functions available on this screen are as follows:

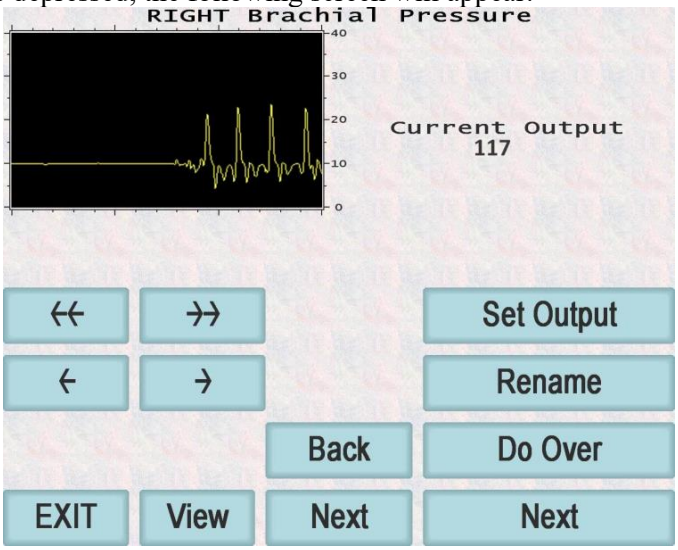
WAVEFORM SCREEN	Displays information from the active probe (see PROBE)
GAIN UP	Increases the size of the waveform from the selected probe.
GAIN DOWN	Reduces the size of the waveform from the selected probe.
BASELINE UP	Will move the waveform UP without changing its size.
BASELINE DOWN	Will move the waveform DOWN without changing its size.
PROBE	Allows user to change active probe.
BACK	Takes user back to previous site.
NEXT	This advances user to next site.
VOLUME / MUTE	This adjusts the volume.
INFLATE	Begins cuff inflation to preset target. **NOTE**: a brief touch of this button will begin automatic inflation. If button is depressed for more than a moment, the unit will switch to manual inflation mode, where pump will continue to operate as long as button is depressed (or until maximum allowed pressure is obtained). Auto-inflation can be resumed by quickly touching the "Inflate" button again. This button can be configured, in the study configuration, for manual inflation only.
DEFLATE	Begins automatic cuff deflation at preset bleed rate. Unit will emit a soft "ticking" sound to indicate deflation is in process. **NOTE**: a brief touch of this button will begin automatic deflation. If the button is depressed for more than a moment, the unit will switch to manual deflation mode, where the cuff is deflated at the maximum rate. Auto deflation can be resumed by touching the "Deflate" button again. This button can be configured, in the study configuration, for manual deflation only.
CAPTURE	Will capture the pressure displayed on the screen to the right of the Waveform Box.
EXIT	Takes operator to the "Edit" screen where user can View, Print or Edit the examination (see EDIT screen section below). **NOTE:** No patient data is saved when 'EXIT' is pressed from this screen.

To begin Segmental Pressure study at Right Brachial site, ensure the Right Brachial cuff is attached to the proper hose on the Cuff Selector and that the proper valve is active. Apply ultrasound gel to the brachial artery, and locate vessel using the Doppler probe at an approximate 45° angle to the surface of the arm (see page 52 for General Doppler positioning).

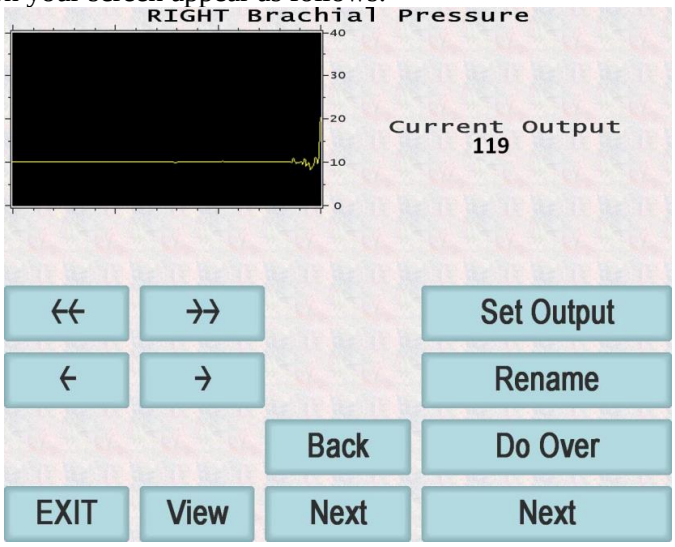
Move probe as necessary to maximize the level of the Doppler sounds. Press "Inflate" button once to begin inflating arm cuff. Inflate the cuff until the Doppler sound ceases (waveform on video screen will "flat-line" at

this point) and then press the "Deflate" button once. Press the "Capture" button when Doppler sound reappears. (NOTE: it is NOT necessary to capture the very first sound you hear – a small movement from the patient may emit a Doppler sound, so better to wait for several "beats" before "Capturing" the pressure.)

Once the "Capture" button is depressed, the following screen will appear:



The pressure displayed under "Current Output" (in this picture, 117 mmHg) represents the pressure in the cuff when the "Capture" button was depressed. To ensure accurate systolic pressures, scroll the pulses back to the first pulse to display the Peak Systolic Pressure. Use the "←←" button to scroll quickly and the "←" key to scroll slowly, so the results on your screen appear as follows:



You can now press the "Next" button to record this pressure and advance to the next site. You may press "Capture" on your remote to advance. The other buttons on this screen function as follows:

SET OUTPUT Use this button to manually enter information – Typically you will use this feature to denote a calcified or incompressible vessel, e.g. you have inflated the cuff to 250 mmHg pressure and you can still hear (and see) a pulse. Press the "Capture" button at this point and then the "Set Output" button. You would then type in "CNO", ">250" or "250+" and then press "OK" or the "Enter" key to denote that the vessel was still pulsatile at this pressure. You could also type "AMP" if limb segment displayed at top of screen had been amputated.

RENAME If for some reason, you have taken a good pressure reading, but realized it did not match up with the site displayed on the MultiLab monitor, you do not need to re-do the

pressure. Instead, press this button and then the up and down arrow keys to display the proper pressure site.

DO OVER If you feel you have made an error after capturing a pressure, press this button to "unfreeze" the screen and repeat pressure reading at that site.

If satisfied with captured pressure, proceed to the next site by pressing "Next" (or "Capture" on remote control). Repeat procedure at Left Arm site.

NOTE: You can view captured pressures at any time by pressing "View"; return by pressing "Exit".

Pressure ILR

The ILR for pressures allows for extra controls for sweep speed, inflation target, and deflation rate. You can also view the report. Use the Zoom button to see the pressures more easily while performing the exam.

Ankle and Leg Pressures

Ensure the Ankle cuff is attached to the proper hose on the Cuff Selector and that the proper valve is active. Locate Posterior Tibial (PT), or Dorsalis Pedis (DP), artery with the 8 MHz Doppler probe. Inflate to occlusion, deflate and capture pressure as in previous section.

NOTE: You can obtain Ankle pressures at both Posterior Tibial AND Dorsalis Pedis Arteries if desired – please refer to Study Configuration section.

NOTE: If artery is still pulsatile when pump reaches target setting, press and HOLD "**Inflate**" button down to continue inflating cuff to occlusion pressure. Do NOT exceed a pressure of 250 mmHg in the cuff unless instructed by your Medical Director.

Use ankle artery with strongest signal (PT or DP) and proceed in taking pressures up the leg. If no Doppler signal can be detected at the PT or DP artery, press the "**Probe**" button to activate the Right or Left PPG sensor and affix to Great Toe of foot being examined (see page 53). If a pulse is observable on-screen, inflate cuff until pulse "flat-lines." Sometimes the flat line will disappear off-screen at point of occlusion. If this occurs, wait several seconds for the flat-line to reappear, press the "**Deflate**" button and "**Capture**" pressure when pulse reappears. Continue taking pressures up the leg using the PPG sensor.

Toe Pressures

Toe pressures can be obtained by applying the DC-2.5 Digit cuff to base of the Great Toe and affixing the Left or Right PPG sensor to the end of the digit. If a pulse is observable on-screen, inflate cuff until the pulse "flat-lines." Sometimes the flat line will disappear off-screen at point of occlusion. If this occurs, wait several seconds for the flat-line to reappear, press the "Deflate" button and "capture" pressure when pulse reappears.

When taking 2 pressures simultaneously, it is possible to capture one side before the other; simply touch the waveform box or the side with the returned pulse. **NOTE**: it is also possible to switch to the Doppler probe after touching the waveform box; but only one size can be activated for Doppler (both boxes must be touched).

NOTE: There is an option to equip the MultiLab with Toe Bleed Valves that are attached to the cuff selector. The Toe Bleed Valve will automatically deflate the cuff; the "**Deflate**" button will not be used.

NOTE: It is desirable to adjust the Gain as low as possible (½" - ¾" tall pulses) when obtaining Toe pressures, as this will result in a "flatter" flat-line and will also be less susceptible to "wander" off the video screen during inflation and deflation.

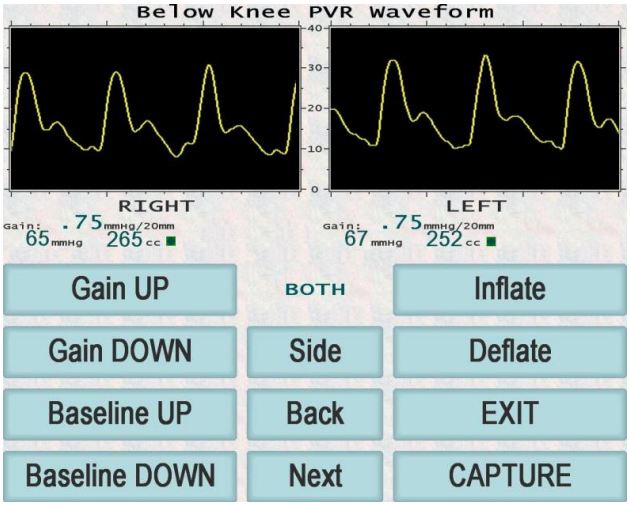
NOTE: If the PPG sensor or Velcro™ strip is touching the toe cuff during cuff deflation, artifact may be observed, resembling small pulses that coincide with the system "ticking." Separate the sensor from the cuff to eliminate this communicating artifact.

PVR Waveforms

Before performing PVR waveforms, please read preceding chapter on "Calibrated PVR" to gain an understanding of how to obtain an optimum result using this modality. NOTE: For proper interpretation of PVR waveforms, ALL gain settings must be the same at all cuff sites. You may adjust the Gain downward to eliminate "overshooting" (tops and bottoms of waveforms out of the waveform box), but any waveforms captured before downward adjustment, must be redone at the new Gain setting.

Position pressure cuffs on Patient legs as shown on page 51. As the MultiLab performs PVR tracings bilaterally, ensure the proper cuffs are attached to the proper hoses on the Cuff Selector and that the proper valves are active. Push "**Inflate**" to begin cuff inflation. The pumps will automatically inflate the cuffs to between 62 and 68 mmHg on both sides.

NOTE: If the pressure in one or both cuffs drops below 62 mmHg, the letters "**UND**" will appear below the pressure reading indicating lower than optimum pressure. (This is not uncommon on patients with leg swelling or large limbs) Press the "**Inflate**" button again, and the MultiLab will automatically add pressure to one or both cuffs as needed.



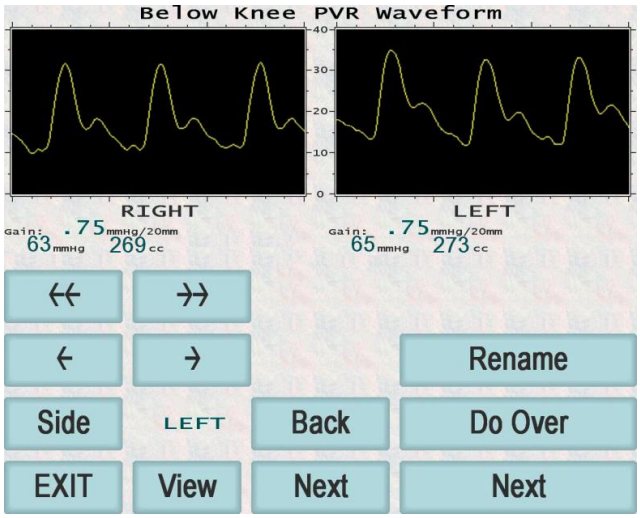
Before capturing the PVR waveforms, ensure cuff volumes are within 15% of each other by observing onscreen lights beneath waveforms. If cuff volumes are within 15%, both lights will glow green as on the screen above. If they are not, re-do the PVR waveforms (see below).

Also ensure that waveform Gain is properly set. The "peaks" and "troughs" of the waveform complex must be visible on the screen. On typical patients, the waveform amplitude will be lower at the ankle and high-thigh sites than at the calf and above-knee sites. If your ankle waveforms are taking up most of the video screen, your calf waveforms will almost certainly have the top and bottom "chopped off" at that gain setting. Use the "**Gain Down**" button to reduce the size of the waveform.

Use the "**Baseline**" buttons to center the Waveforms if needed, without changing the size of the waveform.

NOTE: It is very important for proper interpretation that all PVR waveforms are obtained at the same Gain setting. If you have to lower the Gain so that the calf PVR waveform will fit on the screen, press the "**Back**" button and then the "**Do-Over**" button to re-do the ankle tracing, making sure you lower the Gain to the same setting you used at the calf. It is also NOT advisable to make a PVR waveform "look bigger" by using the "**Gain Up**" button.

Once you observe consistent wave tracings on the screen, press **"Capture"** to freeze the waveforms and bring up the following screen:



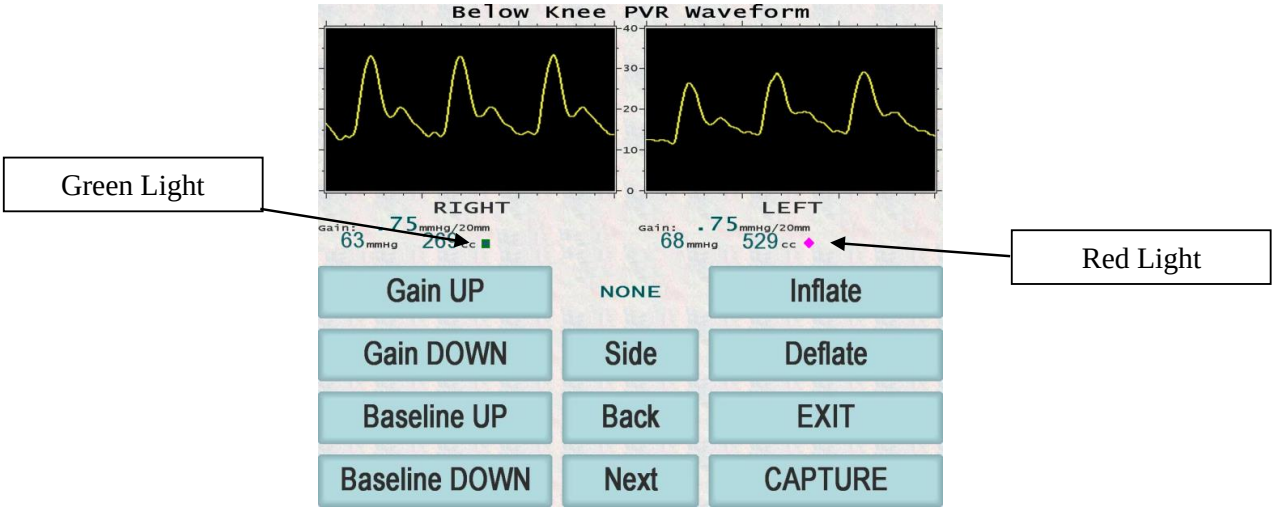
Once you have captured the waveforms, it is possible to "scroll" back up to 30 seconds on both sides or individually. You will notice the button labeled "**Side**" on this screen. The default setting is "Both" meaning both waveforms will be scrolled back together.

If you wish to scroll the waveforms individually press the "**Side**" button once to activate one side. Pressing the "**Side**" button again will activate the opposite side.

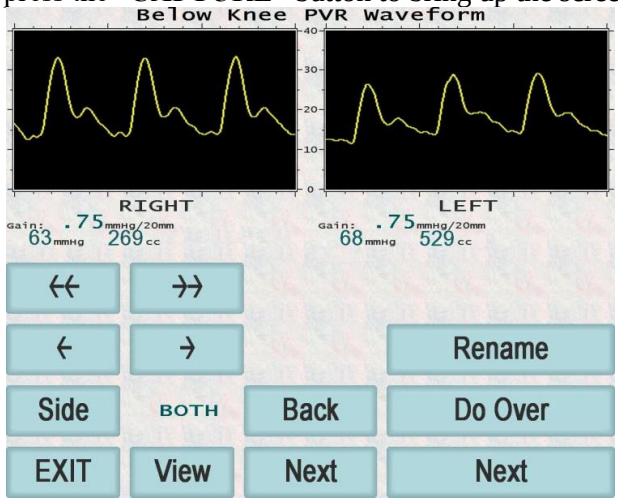
NOTE: you can view captured waveforms at any time by pressing "Exit" and "View". Return to the examination by pressing "Exit" and "Back".

Re-doing PVR Waveforms

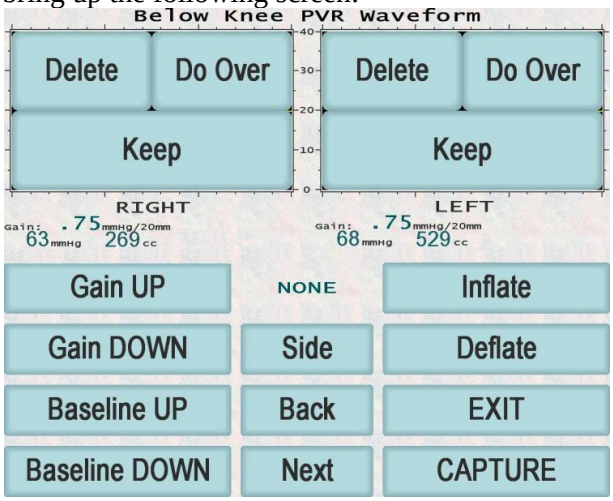
If PVR volumes are not within 15% of each other, a red light will appear underneath the waveform with too much volume. As is shown in the illustration below, an excess of air volume in a cuff can artificially dampen a PVR wave tracing and make it appear abnormal.



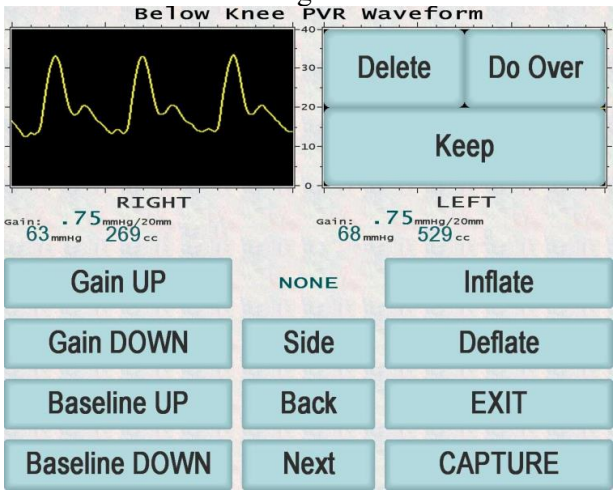
To correct such an occurrence, press the "**CAPTURE"** button to bring up the screen below:



Press the "**Do-Over"** button to bring up the following screen:



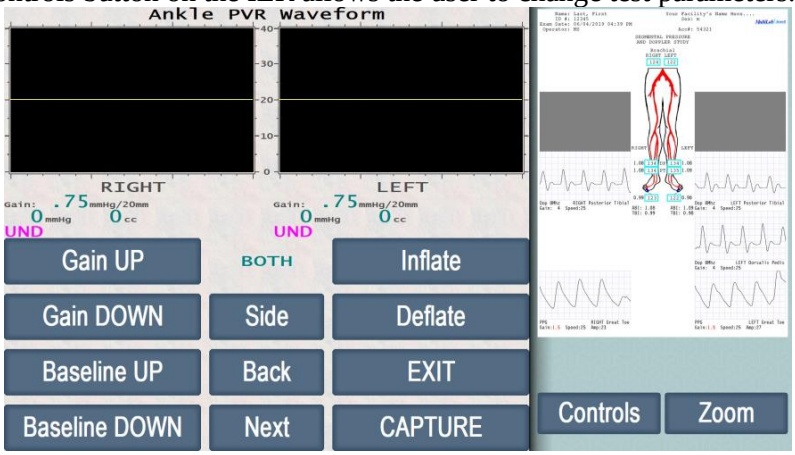
Press the "**Keep**" button on the waveform box containing the lower volume of air as shown below:



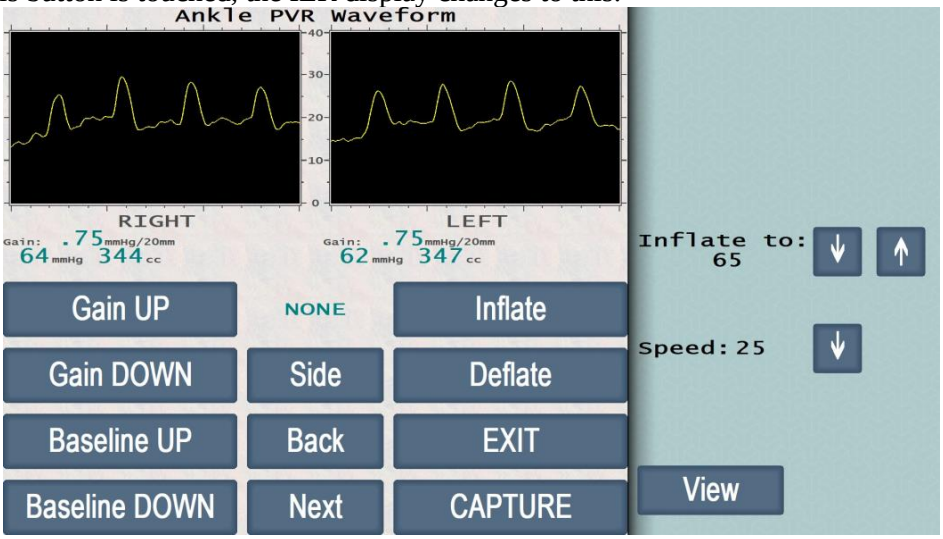
Press the **"Do Over"** button on the box containing the larger volume of air (the one with 529cc above). Disconnect the cuff with the greater volume from the hose, and re-wrap the cuff more snugly. Re-connect the hose, and press **"Inflate"** to continue. Note that it is not necessary to deactivate the frozen cuff when re-doing one waveform as the MultiLab will not port air to the cuff with the "kept" waveform.

ILR PVR Functions

In all modalities, the Controls button on the ILR allows the user to change test parameters.



When the Controls button is touched, the ILR display changes to this:

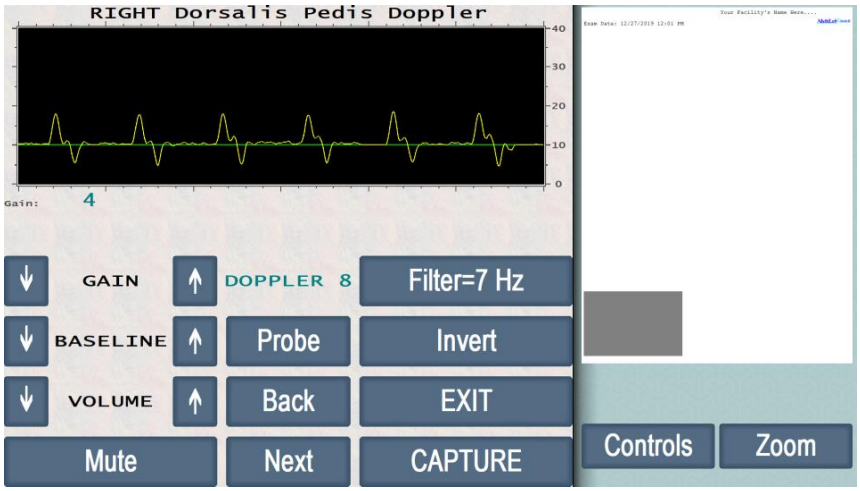


Here, the user can change the target inflation pressure (55 – 75 mmHg). The sweep speed can be slowed to 10 cm/sec.

Doppler Waveforms

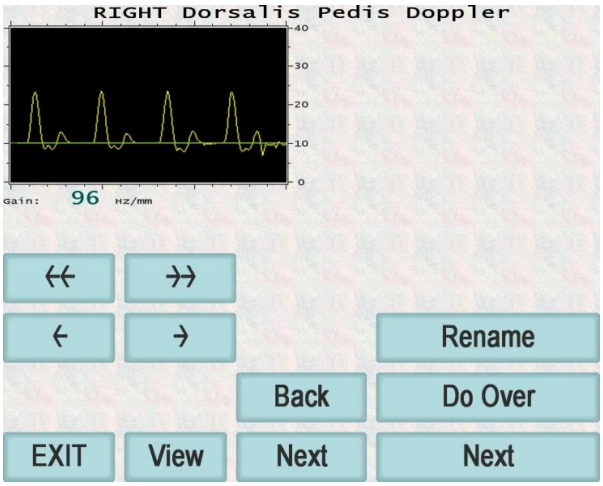
Before performing the Doppler Waveform exam on a patient, please read the information about CW Doppler in the "Modalities" section of the Manual. The Doppler Screen is shown below and contains many of the same buttons as previously discussed studies, with the exception of the "**Invert**" and the "**Mute**" buttons. Occasionally, you may obtain a better Doppler waveform by pointing the Doppler probe AWAY from the heart. Doing so will display flow information "upside down" on the MultiLab screen. Press the "**Invert**" button and the Systolic Flow will appear above the baseline.

The "**Mute**" button will automatically quiet the Doppler Probe, and is helpful when moving from one site to the next. Pressing the "**Mute**" button again will return the Doppler volume to the previous setting.



To obtain Doppler Waveform tracings, locate the vessel identified on the top of the MultiLab Screen with either the 8 MHz or 5MHz Doppler probe. As the vessels are sometimes in places you are not expecting, it is a good idea to apply a liberal amount of Ultrasonic Gel to the area of the vessel. This will allow you to move the probe to find the best signal without having to stop and apply more Gel.

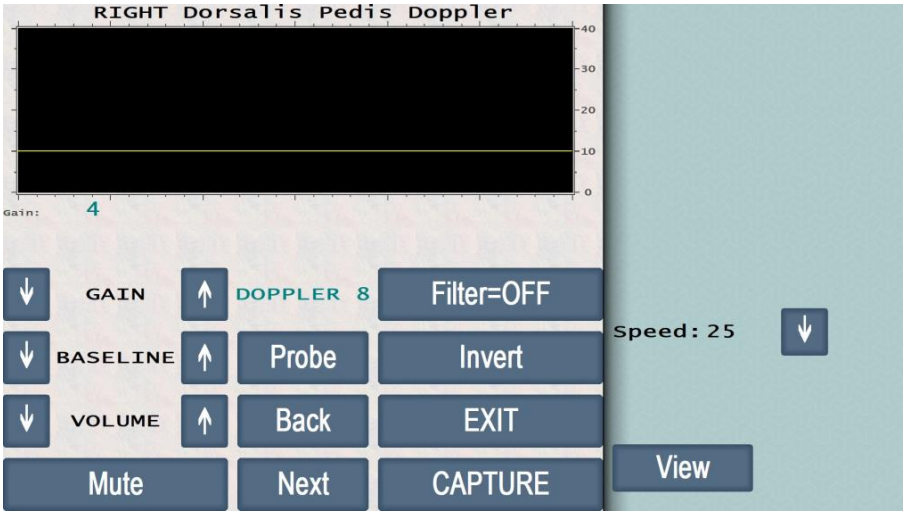
Keep in mind that the MultiLab will store 30 seconds of Doppler waveforms. If you are performing an exam on a patient with severe disease, it can sometimes be difficult to obtain several representative waveforms in a row. Once you have seen what you consider to be the best waveforms obtainable (always strive to display multiple phases on your waveforms) press the "Capture" button to store. As with the other studies, you can scroll the waveforms, rename them, or do them again by pressing the appropriate buttons. You can move to the next site by pressing "**Next**" from the following screen.



Do Over: In the event that scrolling does not provide the desired result of an artifact free waveform, touch Do Over. Obtain another waveform, touch capture. The just acquired waveform will be on the left, the previous waveform on the right. All 30 seconds of scroll time is available on the left side; use the swap button (not shown) to make the previous waveform the active one. Whichever waveform is on the left will be used for the report.

Doppler ILR Function

When the Controls button is touched in the Doppler modality ILR, the user can change the sweep speed of the Waveform from 25 cm/sec to 10 cm/sec.



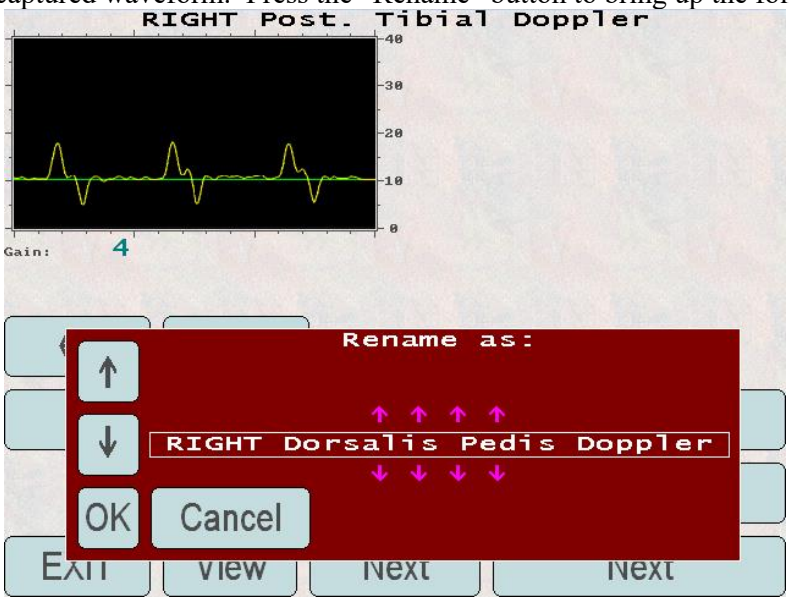
Helpful Hints for Doppler Waveforms

If you are hearing the Doppler sounds but not seeing waveforms on the screen, this usually means that your Doppler angle is 90° (perpendicular) to the vessel. Adjust the probe angle as needed to obtain a visible Doppler tracing.

If you can hear and see the Doppler but the waveform on the screen does not seem to represent what you are hearing; it is possible that the Doppler probe may be too high a frequency to get the sound wave into the center of the vessel (Where the flow is faster). Try switching to the 5 MHz probe, or pressing the probe into the limb (don't press too hard or you may cause your patient discomfort and/or compress the vessel you are attempting to examine.

You can capture and compare 2 waveforms at the same site by using Do-Over. For more than 2 waveforms, do the following (Using the Dorsalis Pedis artery as an example): Capture a waveform tracing at the Dorsalis Pedis artery. The next site that will typically appear will be the Posterior Tibial screen. Continue examining the Dorsalis Pedis artery, (possibly moving the probe to a different spot on the foot) and capture another waveform.

Press the "Exit" and "View" buttons to observe both waveforms on the MultiLab screen. If the second waveform (which in this case will be labeled "Posterior Tibial") looks "better" than the first tracing, press "Exit" and "Back" to return to the captured waveform. Press the "Rename" button to bring up the following screen:



Use the up and down arrow buttons to display the proper artery name on the video screen (in this case "Dorsalis Pedis"), and then press "O.K." The second waveform will automatically "overwrite" the first captured waveform. If upon examination the initial waveform looked "better" simply press the "Do Over" key to continue with the exam.

PPG Digit Waveforms

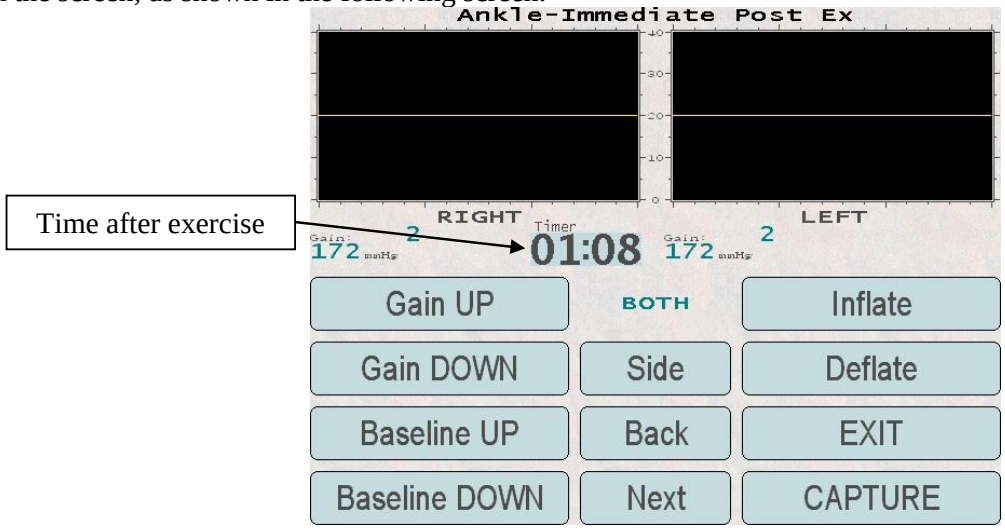
This exam can be performed on the fingers or toes. Apply Right PPG sensor to the Right digit and the Left PPG sensor to the Left digit (see page 53). Adjust the Gain so that waveform occupies a half to two-thirds of the Waveform Box on the MultiLab Screen. Capture waveforms and scroll if necessary to present several consistent waveforms. Repeat on remaining digits. Make sure Gain is set the same for all digits.

PPG Waveform ILR

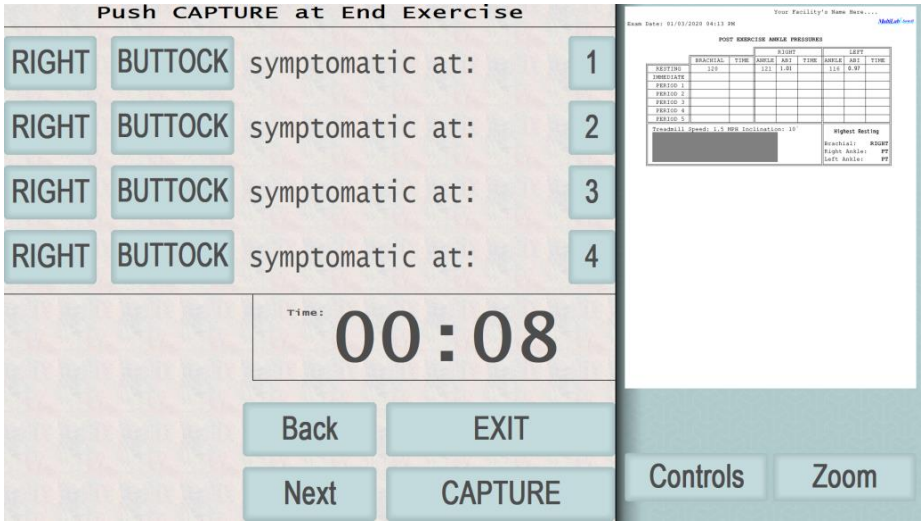
The ILR Controls button allows the user to adjust the sweep speed of the PPG waveform. View allows user to see the report.

Post Exercise Pressures

This exam compares pressures taken at rest (usually brachial and ankle) with pressures taken after exercise (or hyperemia). After the exercise it may take time for the pressures to return to normal, so pressures are usual taken at regular intervals after exercise. To help the technologist keep track of time, the MultiLab will include a timer on the screen; as shown in the following screen:



In addition to showing the time while operating the machine, the MultiLab has a special screen for showing the time during exercise:



1, 2, 3 or 4 If the patient shows symptomatic signs during exercise, press one of these buttons to capture the time that the symptom took place. This time will be placed next to the number pressed.

RIGHT Press this to indicate which side (or both) was symptomatic. Keep pressing this button until the desired side appears.

BUTTOCK Press this to indicate what location was symptomatic. Keep pressing this button until the desired location appears

BACK Takes user back to the previous site.

NEXT Advances user to the next site

EXIT Returns to the "Edit" screen. No symptoms or time is saved.

CAPTURE Will capture the time displayed. In the example above, this would be used to capture the amount of time the patient exercised.

Time Screen ILR

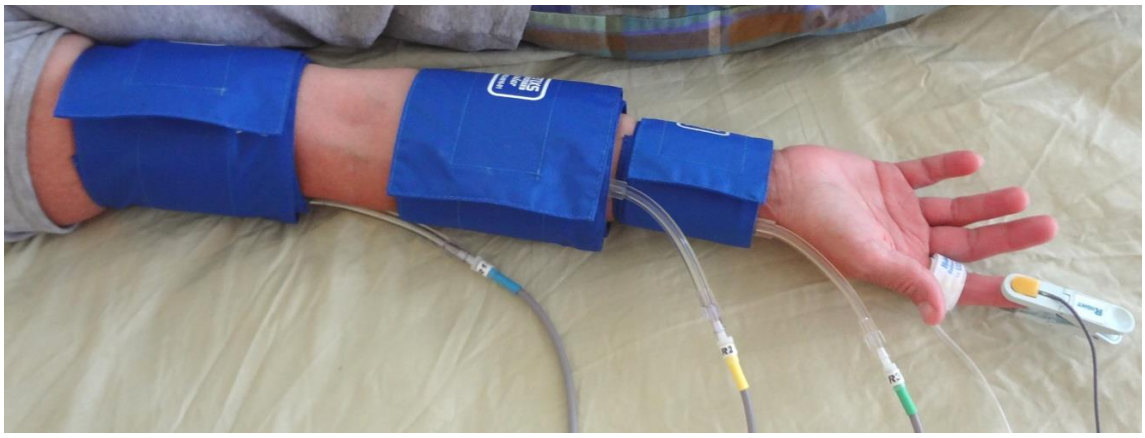
The Controls button offers nothing for the time screen. The report image does show the resting pressures and also indicates the higher pressure for the Brachial and Ankle sites. If you do not have the ILR, you can hit "Back" and "View" to see the report image; simply press "Exit" then "Back" to return to the study. **NOTE**: when taking the post-exercise Brachial pressure, the right hose will always be used.

Upper Arterial Studies

Upper extremity arterial studies are fundamentally similar to the lower arterial studies with the exception of the Thoracic Outlet Syndrome, Raynaud's disease, Allen's Test and Radial Artery Assessment studies, which will be described in detail below.

Segmental Pressures and Waveforms

This exam is indicated when the patient presents with *chronic* arm, hand or finger pain with no visible signs of trauma, swelling or redness. With patient lying supine on exam table, SC-10 cuffs are positioned at the biceps area, the forearm and the wrist, while a DC-2.5 digit cuff is attached to the base of the index finger with the corresponding Right and Left PPG sensors at the tips of both index fingers (see below).



Upper arterial cuff placement, left arm

To obtain pressure from the biceps cuff, use the 8 MHz Doppler transducer at the brachial artery. For the forearm and wrist cuffs, use the 8 MHz Doppler at the radial artery. When doing finger pressures, the MultiLab will automatically activate the Right and Left PPG sensors for this portion of the exam (refer to above section on Toe pressures for obtaining finger pressures).

For a complete upper arterial exam, you will need to obtain waveform tracings of the arms to accompany the pressure readings. You can use PVR or Doppler to obtain these tracings. (Refer to PVR and Doppler Waveform sections above for detailed information.)

Thoracic Outlet Study

This study is indicated when the patient presents with *intermittent* arm, hand or finger pain or numbness. These symptoms can be caused by a mechanical compression of the Subclavian artery and/or attending nerve bundle as they exit the chest cavity, during specific patient movements.

Patient should be seated on exam table for this exam with Right PPG sensor attached to right index or third finger, and Left PPG sensor attached to the corresponding left finger.

Although this exam can be performed with any number of patient maneuvers, the following 5 positions are commonly used for the Thoracic Outlet Examination. We begin the study by recording baseline PPG wave tracings. The Baseline Position is typically hands in lap resting, with palms up.

Adjust the Gain so that the on-screen waveform takes up from ½ to ⅔ of the waveform box. When the waveforms are stable, depress the capture button.

Adson's Maneuver – Have patient take a deep breath and turn head toward the extreme right (or left) side. Typically, the head is turned in the direction of the side being measured. As patient holds breath and has head turned capture wave tracings when stable.

Costoclavicular Maneuver – Have patient take a deep breath and try to touch chin to chest. At the same time ask patient to move both shoulders back as far as possible. Capture wave tracing when stable.

Hyperabduction "A" Maneuver – Have patient sit erect and move arm with active sensor out 90 degrees with the palm facing the floor. Capture waveforms when stable.

Hyperabduction "B" Maneuver – Have patient sit erect and move arm with active sensor straight over head with the palm facing forward. Capture waveforms when stable.

Note that while the above example shows only one active sensor, it is possible to perform this exam with both sensors at the same time. For example, in the case of the Hyperabduction "B" Maneuver show above, it would be done with both sensors and both arms over the head.

Raynaud's Examination (Cold Immersion)

There are various methods for performing the Raynaud's exam. One of the most efficient methods for this evaluation is the use of infrared thermometry (optional accessory for the MultiLab Series II instruments).

Baseline digital temperatures are taken by pointing the temperature sensor directly at the pads of the fingertips, **maintaining a distance of ¼ to ½ inch from digit.** Depress the trigger on the temperature instrument to activate the sensor. Releasing the trigger "captures" the temperature. Repeat this process on the remaining digits.

After all digit temperatures have been obtained, have patient immerse hands (or feet) in an ice-water bath for 30 seconds. After immersion take all digit temperatures quickly after patting the hands dry.

Repeat this procedure at 5, 10, 15, and 20 minute intervals after immersion. Digit temperatures in normal patients will return to or exceed baseline temperatures after 10 minutes. If the temperatures of all digits have returned to or exceeded baseline temperatures, the study can be terminated at that point. Continue temperature measurement until all digits have returned to or exceeded baseline temperatures or until the 20 minute interval has been reached.

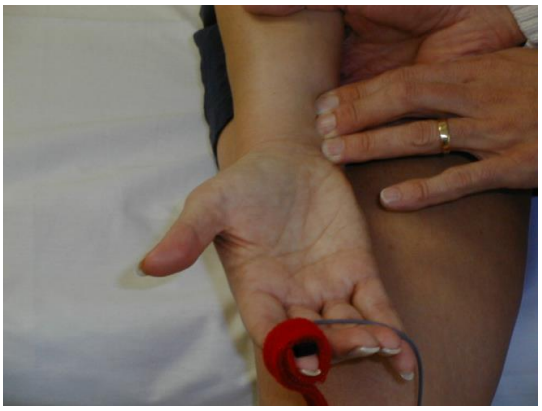
Thermometry ILR

The Controls button offers nothing for the thermometry screen. The report can be viewed and zoomed.

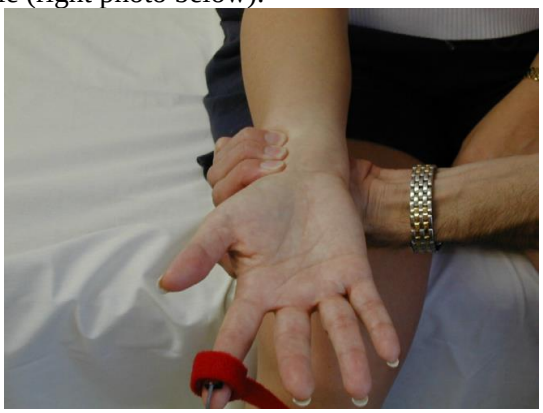
Allen's Test

The Allen's test is useful in assessing arterial contribution to the fingers, and the patency of the Palmar Arch. With patient seated, attach the right PPG sensor to the right index or 3rd finger, and the left PPG sensor to the corresponding left digit.

- Record a "baseline" waveform with patient's hands in lap, palms up (left photo below).
- Compress the Radial artery, and capture on-screen waveform after stabilization. (right photo below)



- Release the Radial Artery; compress the Ulnar Artery. Capture waveform after it stabilizes (left photo below).
- Compress both of the Radial and Ulnar arteries simultaneously, and capture waveform, (or lack thereof) when stable (right photo below).



Radial Artery Assessment Study

This study is useful in ascertaining the suitability of the Radial artery for harvest in Coronary Bypass Graft

surgery. To perform the exam, patient should be seated with hands in lap. Place the PPG sensor on the thumb of the hand to be examined. Adjust Gain so that waveform takes up a half to two-thirds of the on-screen waveform box. Capture waveform when stable. Leaving the sensor in place, compress the radial artery with your index, third and ring fingers (see Allen's Test). The resulting on-screen waveform will reflect the blood flowing to the thumb from the Ulnar Artery through the Palmar Arch. Capture this waveform when stable.

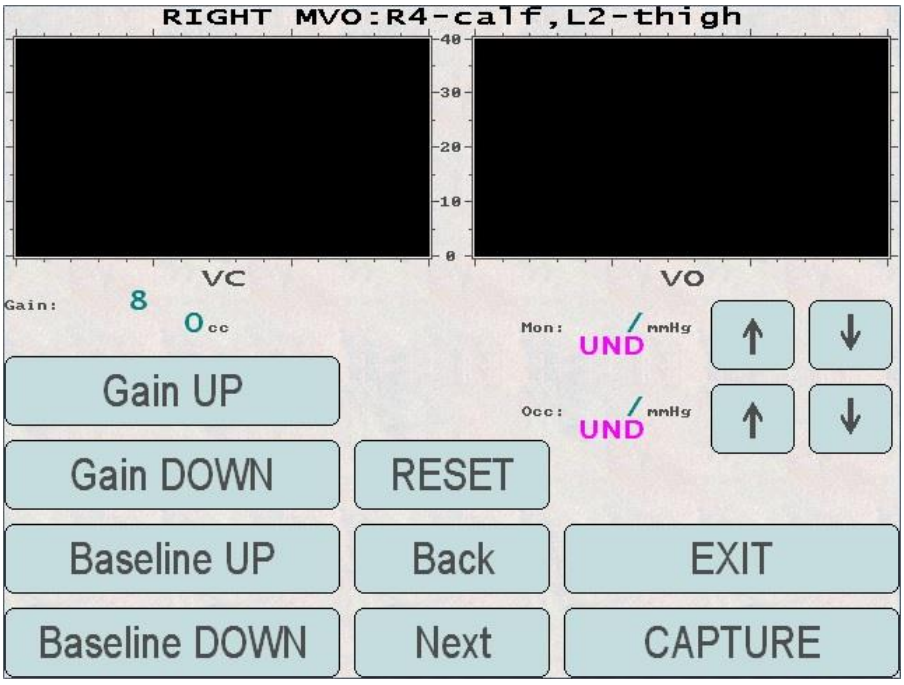
Next, place the PPG sensor on the index finger and capture waveforms with and without Radial artery compression. Repeat on remaining digits.

Lower Venous Studies

MVO/Maximum Venous Outflow Examination

This examination will test for obstruction to venous outflow from the lower leg regardless of the cause. It is a measure of the speed which blood can flow out of a maximally congested lower leg where an occluding thigh cuff is suddenly removed. The advantage of this study is that it is sensitive to obstruction due to any cause at almost any level. It is also capable of detecting obstructing thrombus in the calf veins, iliac veins, and vena cava where ultrasonography and venography are less effective. It also detects venous obstructions due to tumors, and other extrinsic disease processes. The disadvantage to this test is that it is only able to detect significant venous obstructions and will not rule out deep vein thrombosis.

First, raise patient's leg while in supine position, approximately 8" using a pillow or other cushioned material. The knee of the leg to be examined should be flexed and externally rotated. With the patient properly positioned, place a 10 CM cuff around the maximum circumference of the calf and attached the R4 hose. Place a thigh cuff to the high thigh area and attach the L2 hose.



On the screen we will see two waveform tracings: on the left venous capacitance (VC), and on the right venous outflow (VO). Inflate the 10 CM calf cuff pressure to 15 mmHg using the up arrow for "Mon:" on the software screen. Allow for the pressure to stabilize in the cuff and adjust the pressure as necessary to get to 15 mmHg (**NOTE**: do not adjust the "Mon:" cuff for the remainder of the exam). Now press the "Reset" button to calibrate the baseline. Next, inflate the thigh cuff to 60 mmHg using the up arrow for "Occ:" on the software screen. The thigh cuff will then inflate and cause the veins in the thigh area to occlude; the arterial flow into the calf will cause swelling and displace air in the 10 CM cuff (**NOTE**: continue to adjust the pressure in the "Occ:" cuff to

keep the pressure at 60 mmHg). The waveform tracing will rise above the baseline in the VC capture box (If after 30 seconds the tracing goes off the chart, abort the test by removing the hoses from the cuffs and reducing gain). The waveform tracing will rise until it reaches a plateau for a period of 10 seconds with no increase.

When the plateau is reached press "Capture" and then, a second later, release the air pressure in the occluding thigh cuff (**NOTE**: it is advisable to use a rapid deflator on the thigh cuff). This will activate the VO capture box and the waveform tracing will go down toward the baseline. You must press "Capture", again, within 5 to 25 seconds of the first capture. In the VO capture box scroll the point of the pressure release, of the occluding thigh cuff, to the left ⅓ of the box. Position the white vertical line at the point of deflating the cuff. The red line will represent the expected time (typically 1 second) for measurement of venous outflow (after 1 second); the desired result is a percentage of VC to VO1 (venous outflow after 1 second) (**NOTE**: the waveform's trace point at the right size of the VC capture box indicates the value for VC). If the flow returns to baseline within 1-2 seconds, no significant venous obstructions are indicated. If the flow takes longer to return, this will demonstrate that there is a significant venous obstruction.

MVO ILR

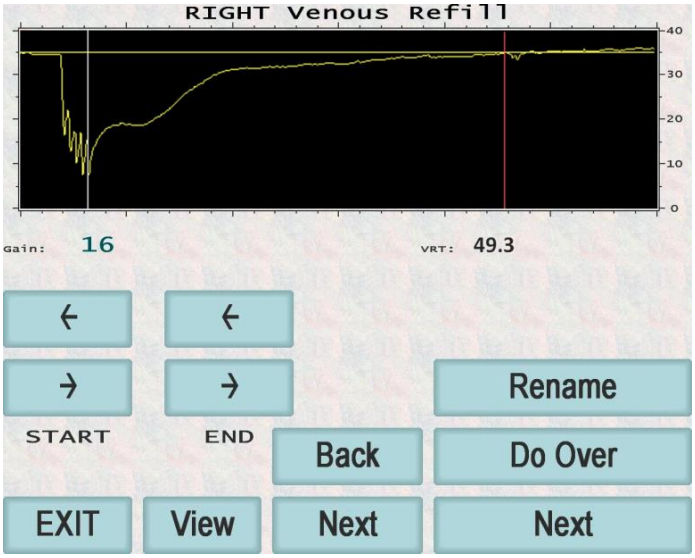
The Controls button offers a change to the sweep speed. The report can be viewed and zoomed.

Venous Refill Examination

This examination will test the competency of the valves in the leg veins. Patient should be seated on padded examination table with legs hanging unsupported (exam can also be performed with patient seated in chair with knee bent and foot slightly forward). It is important that the exam table have adequate padding so as not to compress the Saphenous (SP) Vein.

For right leg examination, place the right PPG sensor approximately 2" above the ankle on the Medial aspect of the leg. Press the "Reset" button on the MultiLab screen to display output from PPG sensor. It is important to have the leg at a stable venous capacitance state before beginning the examination. This is achieved by continuing to press the "Reset" button until the on-screen tracing from the PPG sensor shows no more upward movement.

When on-screen tracing is stabilized, press the "Reset" button once more and wait for 5 – 7 seconds. (This will allow the interpreting physician to see that indeed the patient had achieved a stable venous state before exercise.) After the 5 – 7 second period, have patient dorsiflex and plantar flex the foot 5 to 7 times to empty the calf veins. Have patient relax limb and wait for the screen to auto-capture. (**NOTE:** you can also capture the results by pressing the "Capture" button any time after the deflected tracing re-crosses the baseline.)



Each foot flexion should result in a downward deflection of the PPG tracing. Gain should be adjusted so that the downward deflections measure 15 or more millimeters (total) on the MultiLab screen. Occasionally you will encounter a patient who through arthritis or other motion limiting condition, will not be able to flex the foot deep enough or often enough to produce the vein emptying necessary for a clinically acceptable examination. In these instances, it may become necessary to augment the limb manually to achieve the vein emptying required.

To manually augment the limb, place both hands around the calf of the limb to be examined and squeeze the limb 5 – 7 times within 5 – 7 seconds. Augmentation should produce a downward deflection of the PPG signal like is shown in photo above. Remove hands from limb and wait for screen to auto-capture.

Venous Refill ILR

The Controls button can change the sweep speed and inflation target. The report can be viewed and zoomed.

Calculating the Results

When the capture screen is displayed, you must adjust the timing calipers to calculate an accurate Venous Refill Time (VRT). Using the END "→" key, move the end timing caliper (in Red) to the point at which the deflected PPG tracing crosses the baseline (see previous figure).

Use the START "← →" buttons to move the Start timing caliper (in white) to the end of the last downward deflection as shown above.

The time displayed, between the two timing calipers, is the Venous Refill Time for that limb (shown onscreen).

Use of Tourniquets

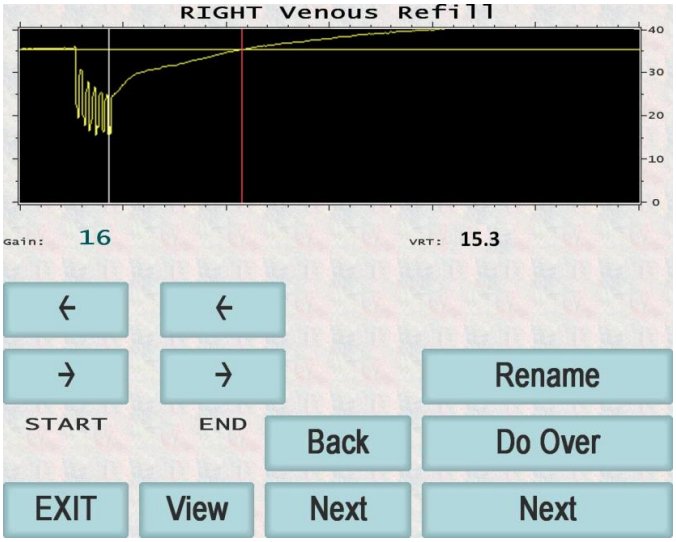
The MultiLab instruments can be configured to print up to five VRT graphs on a single page. Many practitioners like to measure VRT after isolating the superficial or perforating veins using tourniquets above the ankle and above or below the knee. There are two common methods of applying the tourniquets. The first method is to take a wide rubber strip or length of tubing and to tie it around the desired area. The second method involves the use of a tourniquet cuff (typically a 5cm width). This cuff is inflated to 60 mmHg pressure by attaching the appropriate pneumo hose from the MultiLab to the tourniquet cuff and pressing the "Inflate" button once.

Helpful Hints for Venous Refill Exams

As the veins are elastic, it is not uncommon for the veins to expand during the examination. The sign of this occurring is when the venous refilling trace bisects the baseline after the foot exercises, and continues up and off the screen (see photo below). This is an indication that the venous capacitance has increased. To reduce or

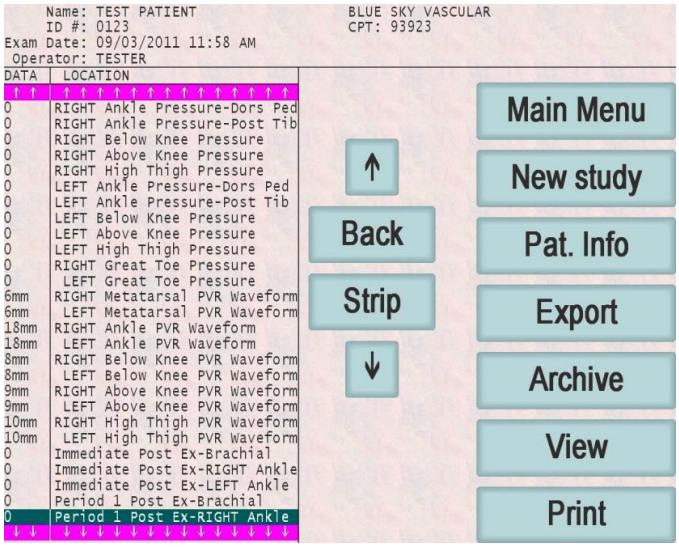
eliminate this artifact, you can "condition" the venous system prior to the examination, by asking the patient to perform 10 – 15 toe raises before applying the sensors and beginning the examination.

If you observe an abnormal tracing (VRT of <20 sec. with increased capacitance) like the one below, press "Do-Over" and repeat the exam.



CHAPTER 10: EDITING EXAM AND PRINTING REPORTS

If you are in the middle of an examination, and wish to jump to the middle or end of the program, press the "**EXIT**" button to bring up the EDIT screen as shown:



The cursor will automatically default to the location you exited from. Using the "↑" and "↓" buttons, you can scroll to any other location quickly by highlighting the desired location and touching the "Back" button. In the event of a power outage, simply move the highlighted cursor to the first blank data field, as shown above, and then press the "**Back**" button to resume the patient study.

The buttons shown on the Edit Screen function as follows:

BACK will return user to the site that is highlighted
STRIP will print (in black and white) JUST the information that the cursor is currently highlighting
UP ARROW will move the cursor bar up
DOWN ARROW will move the cursor bar down

MAIN MENU will exit user to the MultiLab Start Screen
NEW STUDY will allow user to perform another study on current patient without having to re-enter patient name or identification. Note: the name of this button is defined in the System Setup.
PAT. INFO will allow user to add or correct any patient information that is missing or incorrect
EXPORT will bring up the export control menu (see below)
ARCHIVE will bring up the archive control menu (see below)
VIEW will display any captured information, as it will appear on the printed page
PRINT will bring up the print control menu (see below)

Edit Exam ILR

The exam edit ILR defaults to the report view and allows you to touch the report to retake a patient measurement. The controls are the same as "ILR Temp File Functions" on page 44. The following buttons are also provided:

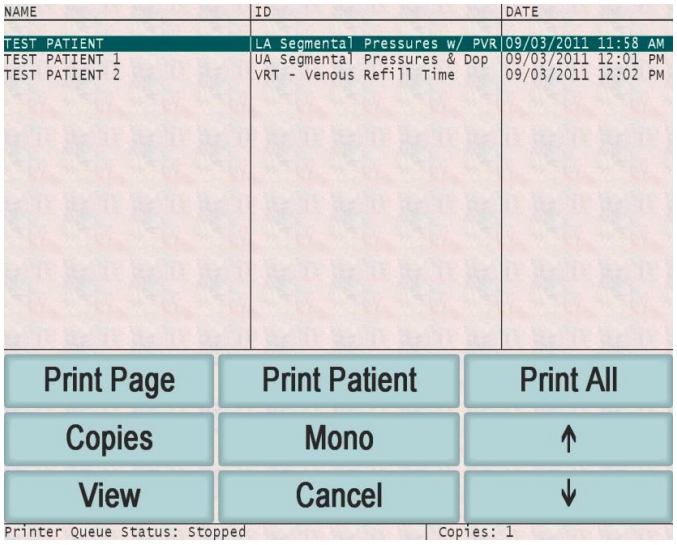
RIGHT ARROW will change the edit focus to the next page of the patient exam.
LEFT ARROW will change the edit focus the previous page of the patient exam.

Printing Patient Reports

The MultiLab software has a sophisticated printing system. It can queue and print multiple report pages while allowing the user to continue operation of the MultiLab. Report pages will print in the background while you operate other functions of the MultiLab. Depending on your usage of the MultiLab printing may temporarily be suspended, but will continue as system resources become available. For example, entering patient information requires fewer resources than inflating cuffs. Note that in the Windows version, the print queue is handled by the operating system.

Note: You should not exit or turn off the MultiLab program (see Exit on the Start Screen) until printing has finished. If this or other incidents, such as a paper jam or paper out, should occur your patient data will be cleared from the printing system, but can be re-printed at any time in the future. Simply select "Temp Files" from the Start screen and re-print any unprinted report pages after any problem is resolved. Also, after clearing problems with a printer (paper out, paper jam, etc…) it is a good idea to power cycle (turn off then turn on) the printer before reprinting any pages.

When you press the print button from a menu screen, the following screen will appear:



The following functions are available from the print control menu screen:

Print Page adds the page that is highlighted to the printing system and exits.
Print Patient adds all pages matching the highlighted patient name to the printing system and exits.
Print All adds all of the listed pages to the printing system and exits.

Copies will allow the user to print multiple copies of the same report. Number is in lower right of screen.
Mono/Color will allow the user to print reports in Color or Monochrome (Black & White), e.g. press Mono if you want a report in Black and White.
View will display the highlighted study, as it would appear on the printed page. Note: the report color in view is set in the System Setup.
Cancel will exit the print control menu. Also resets the number of copies.
Up Arrow will move the cursor bar up.
Down Arrow will move the cursor bar down.

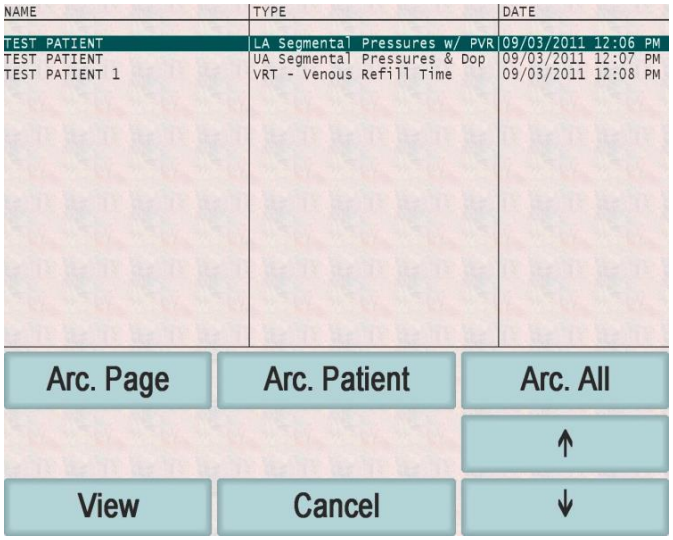
Printing ILR

The ILR will, by default, show the report page for the highlighted line. The INFO button changes the ILR to the name of the printer and its status. Press the Update button to refresh the printer's status as it changes over time.

Archiving Patient Reports

Your MultiLab is capable of storing fifty thousand report pages in its archive. **The limitation is that once a study is archived, it can no longer be changed.** Thus, you shouldn't archive a report page until you are sure that no further changes are needed (say, after a physician signature). Once a report page has been archived, it is permanently removed from the temporary file and then placed into the lookup (see Chapter 4, Lookup Functions).

When you press the archive button from a menu screen, the following screen will appear:



The following functions are available from the archive control menu screen:

Arc. Page archives the page that is highlighted, removes it from the temporary file, and exits.
Arc. Patient archives all pages matching the highlighted patient name, removes them from the temporary file, and exits.
Arc. All archives all of the pages, removes all pages from the temporary file, and exits.
View will display the highlighted study, as it would appear on the printed page.
Cancel will exit the archive control menu.
Up Arrow will move the cursor bar up.
Down Arrow will move the cursor bar down.

Archive ILR

The Archive ILR will show, by default, the destination file paths for the archive. The View button is available.

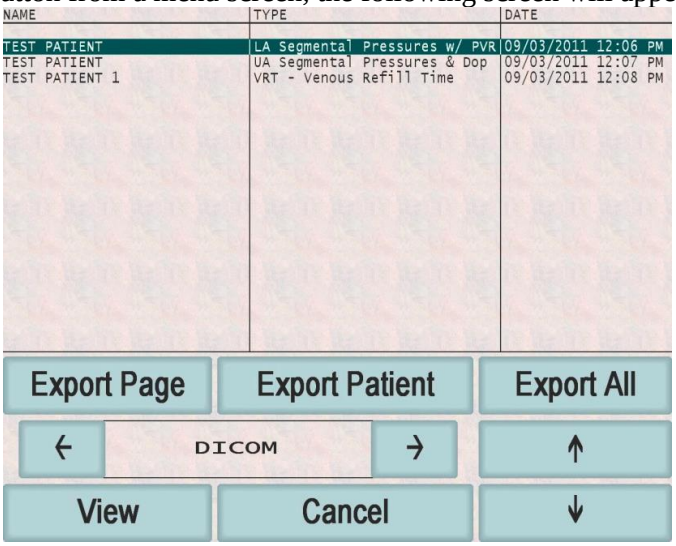
Exporting Patient Reports

The export feature of the MultiLab is designed to be a configurable way of connecting the MultiLab to an external device (not the printer, display, or internal storage of the MultiLab). Some examples of external devices are:

PACS (DICOM)	ZIP Drive	ICAVL Database	CD-R/W
Network Server	Floppy Disk	Facsimile	USB Drive

Note that connectivity is an option for the MultiLab and must be purchased separately. Specific connectivity options are outside the scope of this manual and are typically unique for each user. This section is included here because the export menu is standard, regardless of what device is being exported to.

When you press the export button from a menu screen, the following screen will appear:



The following functions are available from the export control menu screen:

Export Page	exports the page that is highlighted and exits.
Export Patient	exports all pages matching the highlighted patient name and exits.
Export All	exports all of the pages and exits.
View	will display the highlighted study, as it would appear on the printed page.
Cancel	will exit the export control menu.
Up Arrow	will move the cursor bar up.
Down Arrow	will move the cursor bar down.
Right Arrow	change the type of export
Left Arrow	change the type of export

Export ILR

The Export ILR will show, by default, what will be exported and where the export will go. The View button is available.

CHAPTER 11: CONFIGURING STUDIES

Since there are so many variables in the types of vascular studies that are performed, the order in which they are performed, and a multitude of personal preferences in the field of Physiologic Vascular Testing, the MultiLab Series II instruments have been designed to give the user unparalleled flexibility in customizing the MultiLab to each facility or even to each individual within the facility.

Some of the more common items that can be customized are:

Inflation targets	which can be preset for each site (e.g. the Ankle site can be preset to inflate to 165 mmHg, while the calf can be set for 175 mmHg, Thigh – 180 etc…)
Deflation Rates	there are 40 different bleed rates for the pressure cuffs, adjustable in 1/8th mm per second intervals.
Sequencing order	some prefer to do waveforms first, and then finish with Segmental Pressures. Others prefer the opposite. Some like to start at the thigh and work down the leg, while others like to start at the ankle and move up.

Wherever you like to start, and whatever order you like to proceed, the MultiLab can be configured exactly to your liking, even down to how you like your finished printed report to look.

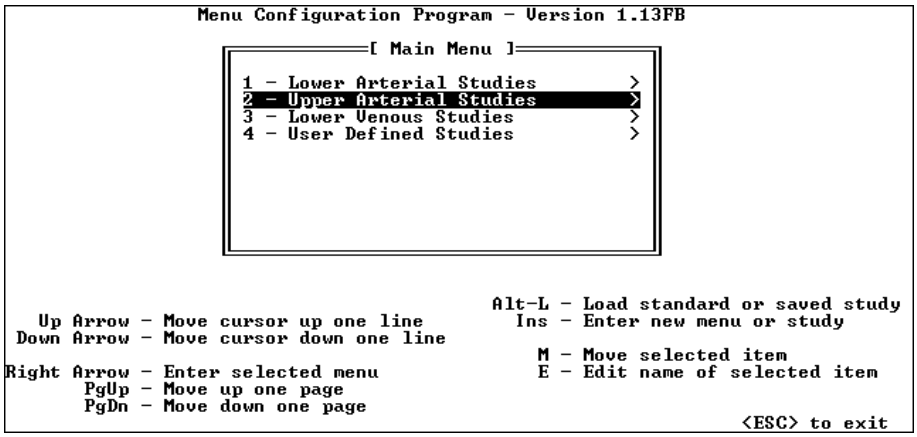
Before you begin, start to think about the protocol that you use for a specific type of study. Whether it is an upper or lower extremity exam, it may consist of any combination of Patient questions, Limb Pressure measurements, Doppler, PVR or PPG wave tracings, Post-exercise measurements, digit pressures, and possibly technologist notes or a physician interpretation. Unlike any instrument ever designed, the MultiLab is not "modality driven" but "protocol driven", meaning that a given study may combine any or all of the above listed components, and that unlike any other vascular instrument available, allows the user to determine what the final exam print-out will look like. For example, you can take a pressure measurement anywhere you desire, follow that with a digit PPG wave tracing, a PVR tracing at the Right and Left Ankles, and then finish with Doppler wave tracings at the Common Femoral sites. You can then press the "Print" button and combine all these various modalities on a 1 page printed report.

Although there are many variables that can be modified, the MultiLab instrument comes pre-loaded with a number of commonly performed standard vascular procedures that are ready to use. If you are an advanced Vascular Specialist, and want to set the instrument up to your exact specifications, this chapter will familiarize you with the basics to really personalize your instrument. Please bear in mind that your instruments' Patient studies can be modified at any time, and if you should require more assistance in customizing any portion of your studies, please do not hesitate to contact Unetixs Vascular. It is a simple matter to call us on the phone, describe the desired modifications, and let us configure custom protocols for you.

The easiest way to custom-configure a study is to choose a pre-loaded MultiLab Standard study which most closely matches your desired protocol. (Please don't be afraid to proceed, as if a mistake is made, the study can be deleted, and a new one loaded an infinite number of times from a directory within the MultiLab software program.)

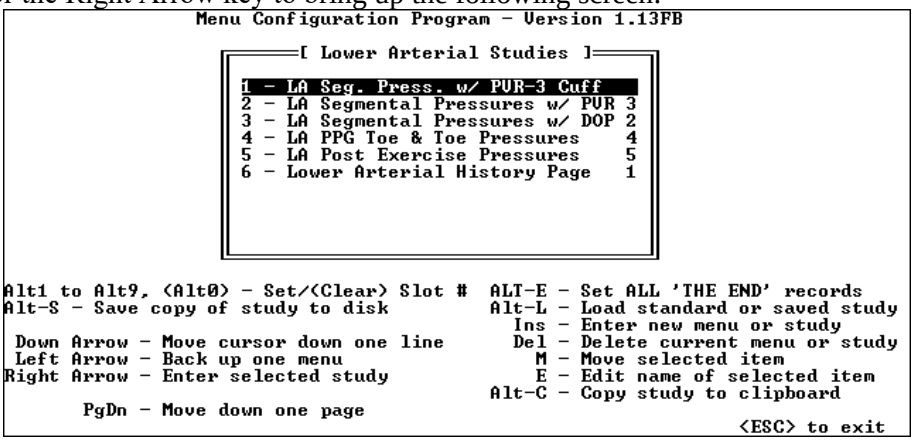
NOTE: Before custom configuring any Patient studies, press the "Temp Files" button on the Start screen and archive any files in the directory. Failure to do so may result in loss of data in an un-archived Patient study.

Press the "Setup" button, followed by the "Configure Studies" button. If there are no studies in the "Temp Files" directory, you will see the following screen, which is a representation of the Main Study Menu as it ships from the factory:

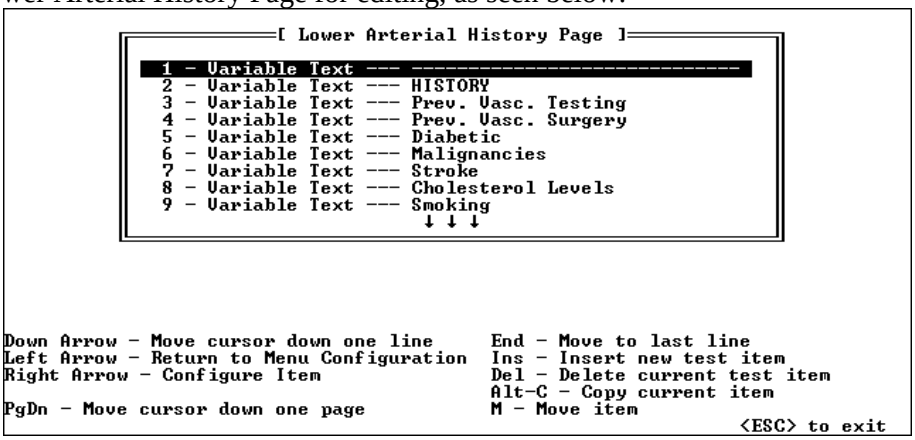


Customizing an Existing Study

The keyboard keys work as stated below the Main Menu box. If, for example, we wished to customize the existing Lower Arterial Patient History Page, you would highlight the "Lower Arterial Studies" entry (#1) and press the "Enter" or the Right Arrow key to bring up the following screen:

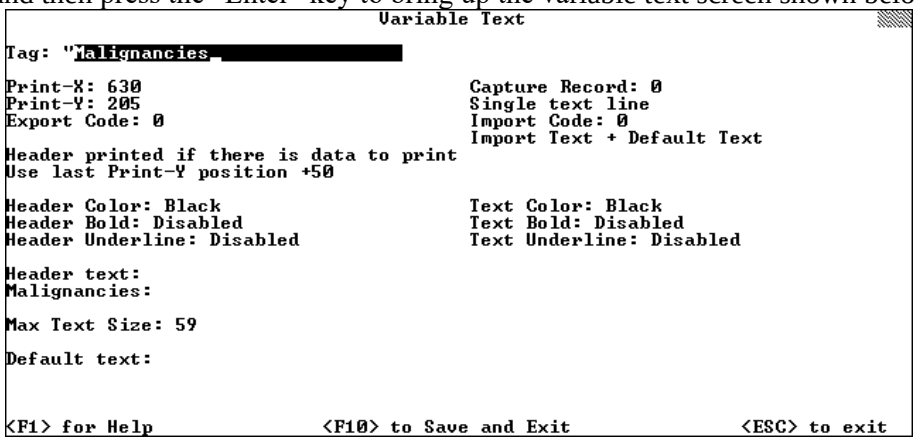


Highlight the "Lower Arterial History Page" entry by using the up and down arrow keys, and press the "Enter" key to open the Lower Arterial History Page for editing, as seen below:



Inside any MultiLab standard or custom studies, you will find a variety of components or "modules" that make up that study. Fixed Text and Variable Text modules are examples of these. These modules are for printing text entries on the report page. As you might imagine, a "Fixed Text" module will place a text entry on the report page that is "Fixed" or in other words, not able to be changed by the operator during the examination. The "Variable Text" module, on the other hand, would allow the user to input text data, such as a Patients name or ID, or whether the patient is diabetic, a smoker, or has a history of Heart Disease.

If for example, you wished to change a question on the Patient History page from "Malignancies" to "Hypertension" you would simply highlight the sixth Variable Text entry that reads "Malignancies" (using the down arrow key) and then press the "Enter" key to bring up the variable text screen shown below:

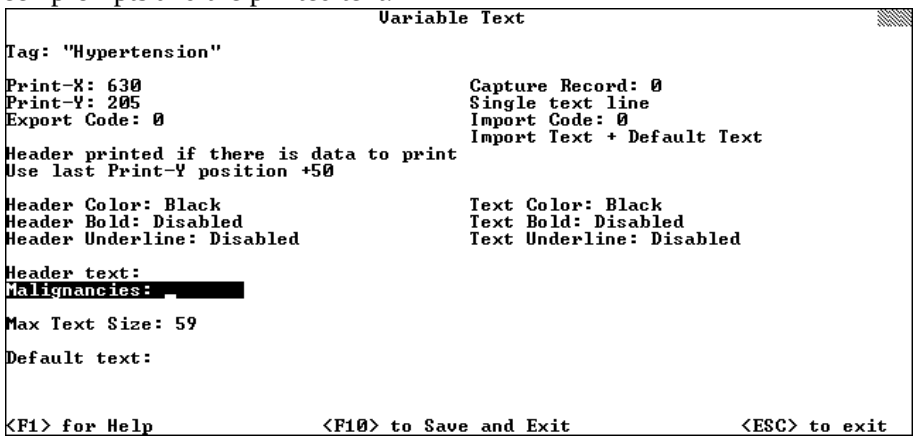


Note: Since this chapter is a basic primer on configuring studies, only some of the properties will be described.

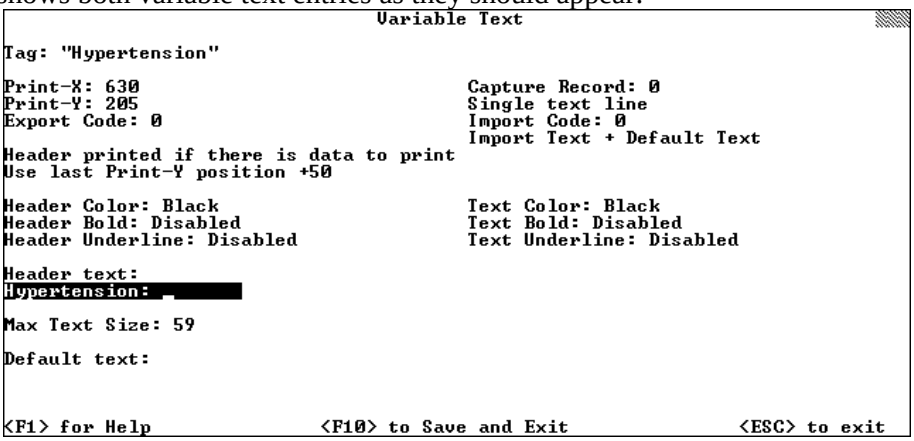
Some various fields and functions of the "Variable Text" entry are described below:

TAG	Will display the text printed in the highlighted text box inside the study configurator and on the MultiLab screen (but WILL NOT be displayed on the printed page.)
PRINT X	Defines where on the page the data will be printed on the horizontal plane (left to right)
PRINT Y	Defines where on the page the data will be printed on the vertical plane (top to bottom)
HEADER TEXT	Will print the text printed in the highlighted text box below on the MultiLab report

In the example below, we have substituted the word "Hypertension" for the previous entry (Malignancies) in "Tag" box but not in the "Header Text" box. Failure to change both field entries will result in a discrepancy between the on screen prompts and the printed text.

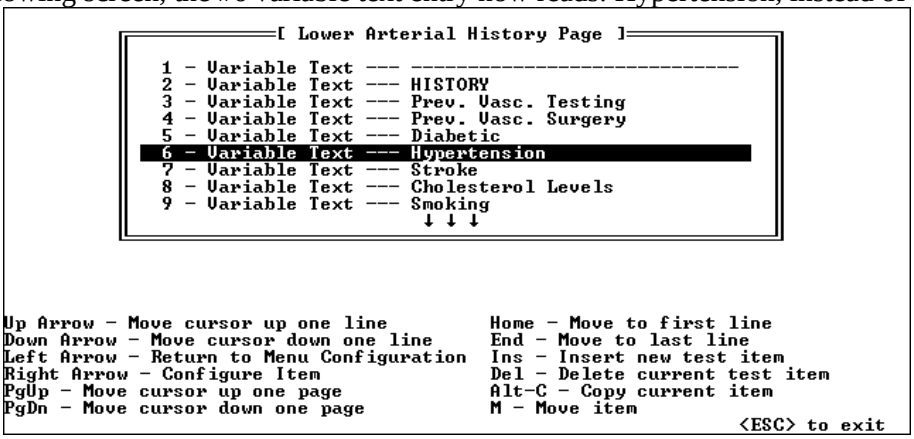


The screen below shows both variable text entries as they should appear:



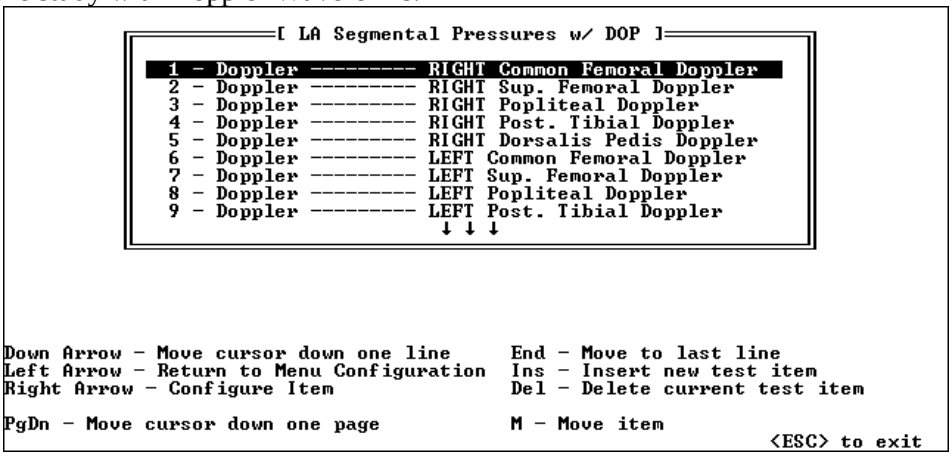
Note: it is necessary to add 1 space after the colon when changing "Header Text" entries, before pressing the "F10" key to save and exit. Failure to do so will result in a text misalignment on the printed report.

As seen by the following screen, the #6 variable text entry now reads: Hypertension, instead of Malignancies:



Changing the Sequence of an Examination

To give an example of how to change the sequence of an exam's components, we'll go into a Lower Arterial Segmental Pressure study with Doppler Waveforms.



You will notice that the first item that will come up is a Doppler waveform at the Right Common Femoral site. If you wanted to rearrange the sequence of the study, and take your Doppler tracings after your pressures, you can simply scroll down to the desired pressure site, and select it by pressing the "M" (for Move Item) key. Once

selected, you can now move the selected pressure site to the number one position, and "paste" it into place by pressing the "Enter" key when it is in its desired location.

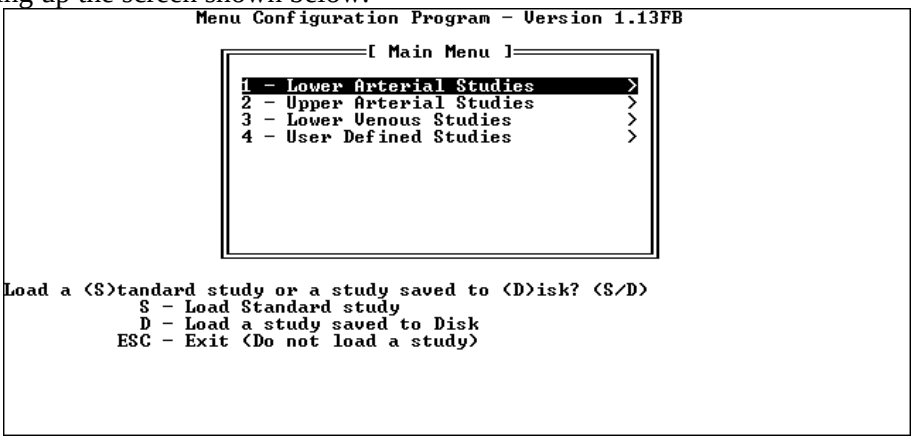
Loading and Customizing a New Standard Study

Again, you can customize an existing patient study as shown above or you can load a standard study. Unetixs' "Standard" studies include almost every aspect or "modality" that someone may wish to perform in a patient encounter. For example the "Segmental Pressures with PVR" standard study includes: Resting systolic pressures at the (Right and Left) Brachial, Ankle DP, Ankle PT, Calf, Above Knee, and High Thigh sites as well as PVR tracings at the Trans-Metatarsal, Ankle, Below Knee, Above Knee and High-Thigh sites.

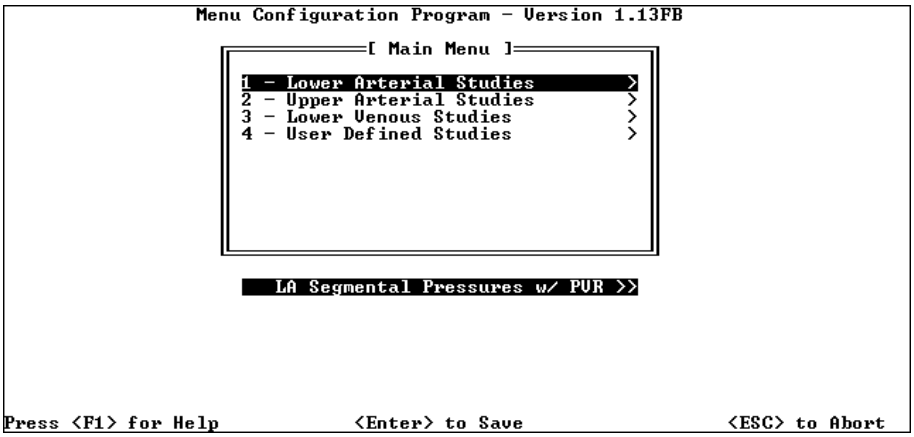
Also included in this "Standard" are Systolic Toe Pressures, immediate Post-Exercise pressures at the Brachial and Ankle sites, and 3 more intervals of Post Exercise pressures after that. As is pre-programmed into this Standard Study, the intervals will read: Period 1, 2, and 3 Post Exercise. If your exam protocol calls for pressures to be taken 3 minutes, 6 minutes and 9 minutes after exercise, the program can be easily modified to reflect these values both on-screen and on the printed report.

If you do not perform Toe Pressures or Post-Exercise Pressures as part of your Lower Arterial protocol, these items can simply be deleted, and will not show up on your on-screen prompts or your printed report. The "Segmental Pressures with Doppler" Standard is similar in configuration, but will prompt the user to obtain Doppler tracings at the Common Femoral, Superficial Femoral, Popliteal, Posterior Tibial, and Dorsalis Pedis arteries. Any one of these Waveform Tracing sites can be deleted or renamed as desired.

To load a new "Standard Study" to modify, simply press the "Alt L" key from anywhere in the study configurator, to bring up the screen shown below:



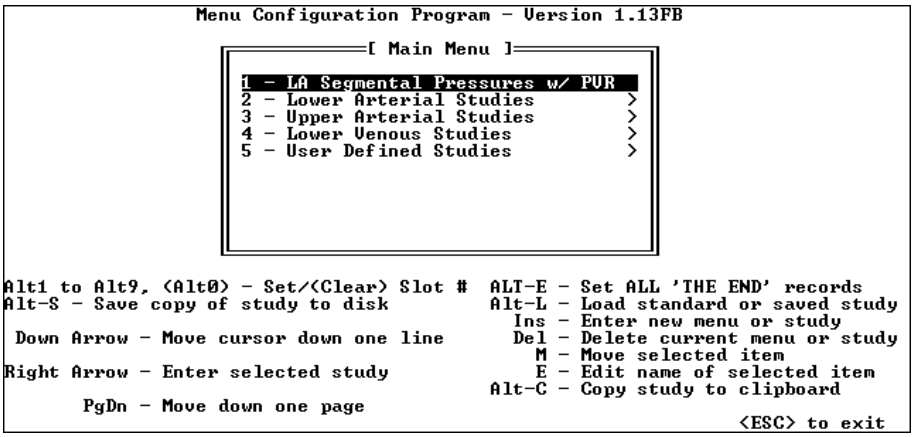
Pressing the "S" key to load one of the standards stored in permanent MultiLab memory will bring up the following screen:



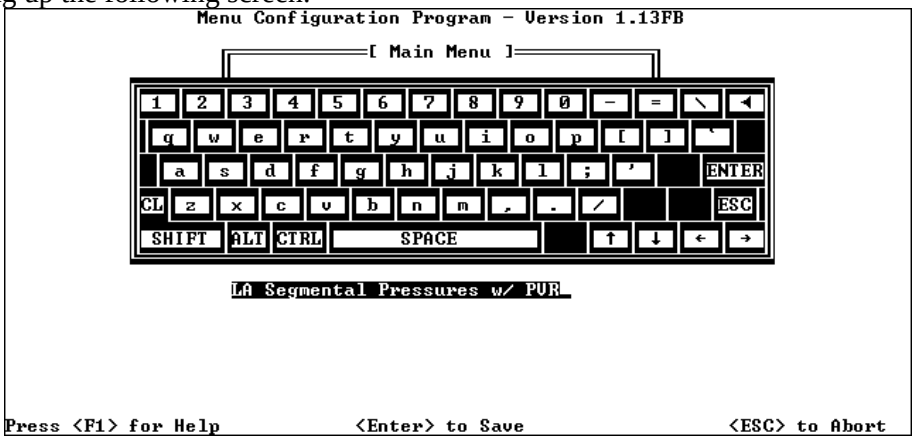
Pressing the "Right Arrow" (→) key will toggle through the following Standard Studies:

1) LA Segmental Pressures w/ PVR
2) LA Seg. Pressures w/ PVR-3 Cuff
3) LA Segmental Pressures w/ DOP
4) LA PPG Toe & Toe Pressures
5) LA Post Exercise Pressures
6) Lower Arterial History Page
7) VRT – Venous Refill Time
8) MVO - Maximum Venous Outflow
9) UA Segmental Pressures & PVR
10) UA Segmental Pressures & DOP
11) UA PPG Fingers & Finger Pres.
12) Upper Arterial History Page
13) Thoracic Outlet Study
14) Allen's Compression Test
15) LA Cold Tolerance Thermometry
16) UA Cold Tolerance Thermometry
17) Impotence Assessment
18) LA Quick Pressures w/ PVR
19) UA Quick Pressures w/ PVR
20) Right Radial Assessment w/PPG
21) Left Radial Assessment w/PPG
22) LA Post Exercise PPG Pressure

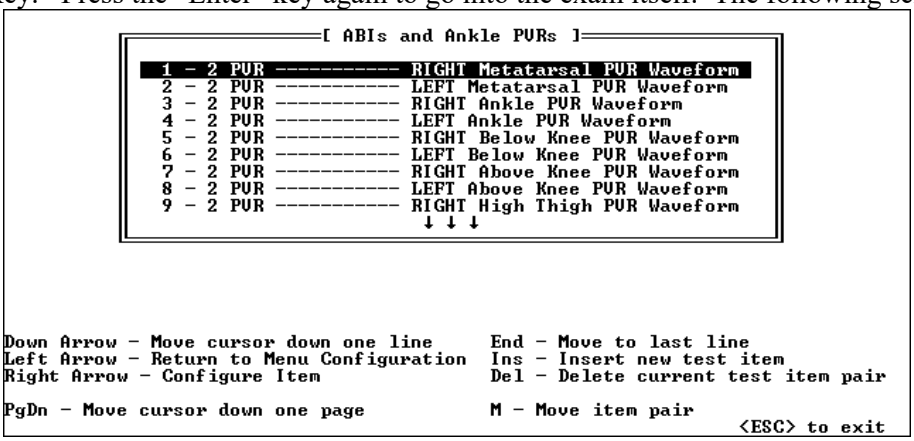
For example, let's make a new custom study that will be a follow-up exam for patients who have had bypass surgery. The new study will be a "limited" exam consisting only of ABIs and PVR tracings at the ankle. Since the standard "LA Segmental Pressures w/ PVR" includes those components, and many more, we will load that standard to begin our new study. Pressing the "Enter" key when that standard is displayed (as above) will load it onto the Main Menu screen as follows:



Let's begin by changing the name of the study. To do this, simply press the "E" key when the desired study is highlighted to bring up the following screen:



Using the "backspace" key, delete the contents of the cell, and then type in "ABIs and Ankle PVRs" and then press the "Enter" key. Press the "Enter" key again to go into the exam itself. The following screen will appear:

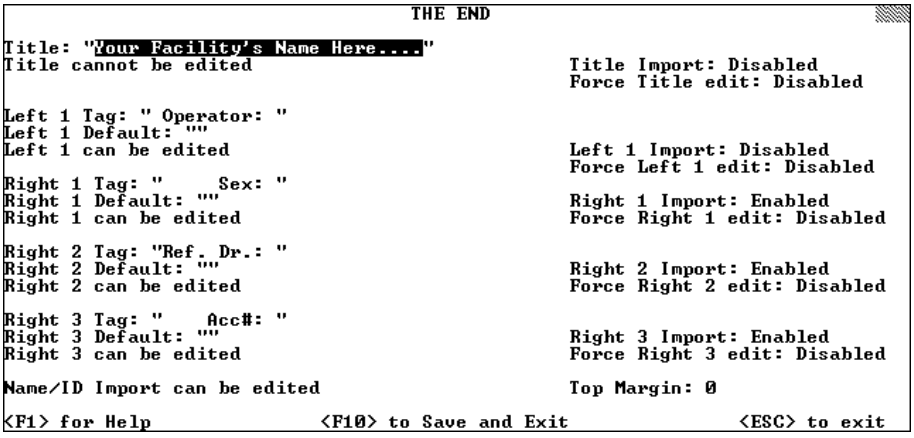


To remove the Metatarsal waveforms, press the "delete" key and then pressing the "Y" key when asked "Are you sure you wish to delete this item?". Note that both the left and right will be removed with a single deletion. Since we wish to keep the Ankle waveforms, we will skip those two sites and continue on by deleting the Below Knee, Above Knee, and High Thigh waveforms the same way.

We will then skip over the Brachial and Right Ankle pressures, now items3, 4, 5, and 6, and delete the Below Knee, Above Knee, and High Thigh pressures leaving the Left Ankle pressures as items 7 and 8. Then delete the Below Knee, Above Knee and High Thigh pressures for the Left side along with the Great Toe pressures (only one delete for the pair!). It will appear at this point that our goal has been accomplished, but there is one more step to perform: removing the Post-Exercise pressures and setting the Facility Name that will print on the top of the report page.

There are two ways to remove the Post Exercise pressures; you can scroll down and manually delete them or put them below the "The End" entry. Since we need to make a modification in "The End" entry any way, we will choose to put them below it. To get to the "The End" entry, simply press the "End" key and your cursor will automatically be moved to that location (#108). We will then proceed by moving the "The End" entry up to position #44 and pressing the "Enter" key to "lock" it in that location. Any item that appears below the "The End" entry will not be a part of the examination.

To finish our custom exam, we will press the "Enter" key on the highlighted "The End" entry to bring up the following screen:

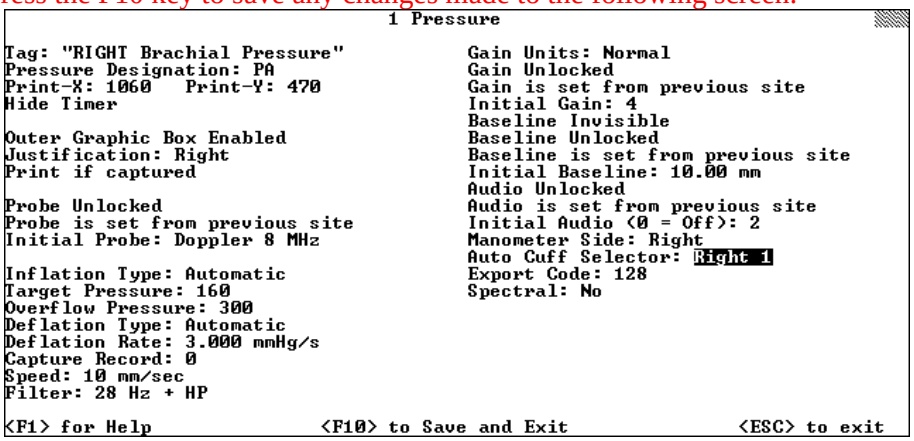


Use the backspace key and keyboard to correct the facility name. Press F10 key to save the change. The new exam is finished. Press the "escape" key several times to return to the MultiLab Start screen to perform the exam.

Customizing Pressure Studies

As mentioned earlier, there are a number of parameters that can be configured within a pressure examination. Below is an example of a single pressure screen. Rather than explain all the parameters in detail, we will instead focus on the most common modified elements.

Note: You must press the F10 key to save any changes made to the following screen:



Changing the Target Pressure

The target pressure is the pressure the MultiLab will inflate the pressure cuff to with one touch of the screen, or remote control. To change the target pressure, simply toggle down to the "Target Pressure" line; then, using the right and left arrow keys, the default value can be increased or decreased. Some users prefer to set the target pressure to 200mmHg, and simply stop the inflation process by pressing the "deflate" button once the vessel is compressed.

Changing the Deflation Rate

By moving your cursor down to the "Deflation Rate" line the deflation rate can be changed by using your left and right arrow keys. The factory preset deflation setting is 3 mmHg deflation per second, but that rate may be increased or decreased by $1/8^{th}$ mmHg increments. The maximum bleed rate available is 5 mmHg of deflation per second.

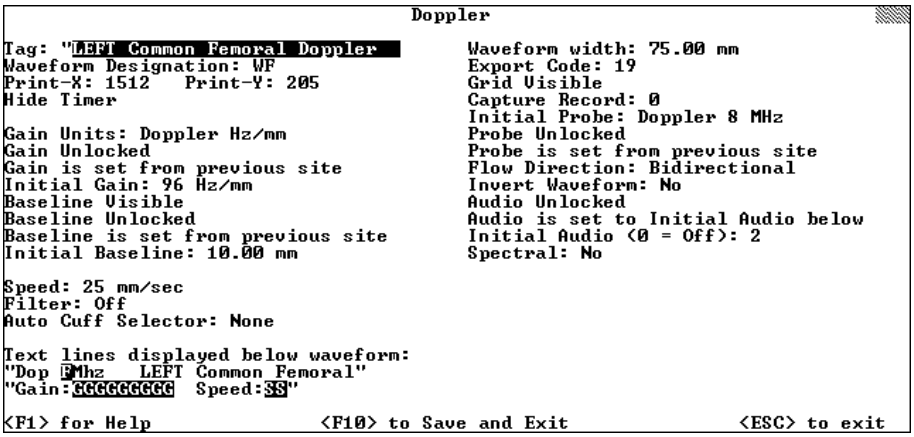
Changing Active Inflation Hoses

You can assign any inflation hose, on a MultiLab with an auto cuff selector, to any cuff site. Move the cursor to the "Auto Cuff Selector" line and using the right and left arrow keys to select Right or Left hoses 1 – 6 to be assigned to the site listed at the top of the screen.

Modifying Doppler Studies

If you are performing a Doppler Waveform study, there are a number of parameters that you can adjust to further customize your instrument.

Some of the more common parameters to modify in a Doppler Waveform Study would be Site to examine, where the waveform is to be printed on the finished report, Gain units, Baseline, and Sweep Speed.



Doppler Gain Units

Doppler gain units can be expressed in "Hz/mm" (Hertz per millimeter) or "Normal" values. The former is a value that describes the frequency shift of the Doppler probe, and the latter would be more a "laymen's" version of this. The factory default setting is "96 Hz/mm". What this means is that a Doppler shift of 96 Hz from the Doppler probe will cause an upstroke of 1 mm (one millimeter) in the on-screen waveform box and on the printed report.

Even though scientifically correct, this display of gain may be counter-intuitive to some, as the smaller the gain units expressed in this fashion, the HIGHER the gain. For example, a gain setting of 48 Hz/mm would require half the amount of Doppler shift to generate the same 1 mm upstroke, effectively increasing the gain by a factor of two.

For those with a more linear mindset, we have the ability to display the Gain units in the "Normal" mode, in which a Gain setting of "4" correlates to the 96 Hz/mm setting described above. With "Normal" Gain units, a doubling of the Doppler gain would be "8" (correlating to 48 Hz/mm), a value that is twice that of 4. Changing these values (by using the Left and Right arrow keys in the configurator) will change how they are displayed on the MultiLab Video Screen and on the printed report.

Doppler Filter

The operator also has the ability to "preset" a Doppler Filter to remove waveform artifact in subjects with very low blood flow at high gain settings. The factory preset for this feature is "Off" as the Unetixs Doppler, while being quite sensitive, is relatively free of artifact. There are four levels of filtering available from 28 Hz (least amount of filtering) to 3.5 Hz (highest level of filtering). As filtering can affect important diagnostic waveform criteria, Unetixs recommends not using Doppler Filters from the preset, but to use only filtering when necessary during patient examinations.

Doppler Baseline

The factory baseline preset for Doppler Waveforms is 10 mm, meaning that of the 40 mm vertical space in the waveform box, the top 30 mm will display flow above the baseline (typically forward flow), while the bottom 10 mm will display flow below the baseline (typically reverse flow). You can change the default baseline settings for each site by using the Left and Right arrow keys. Please note that the baseline can be adjusted "on-the-fly" at any time during a patient examination, so keep that in mind when considering changing this factory preset.

Doppler Sweep Speed

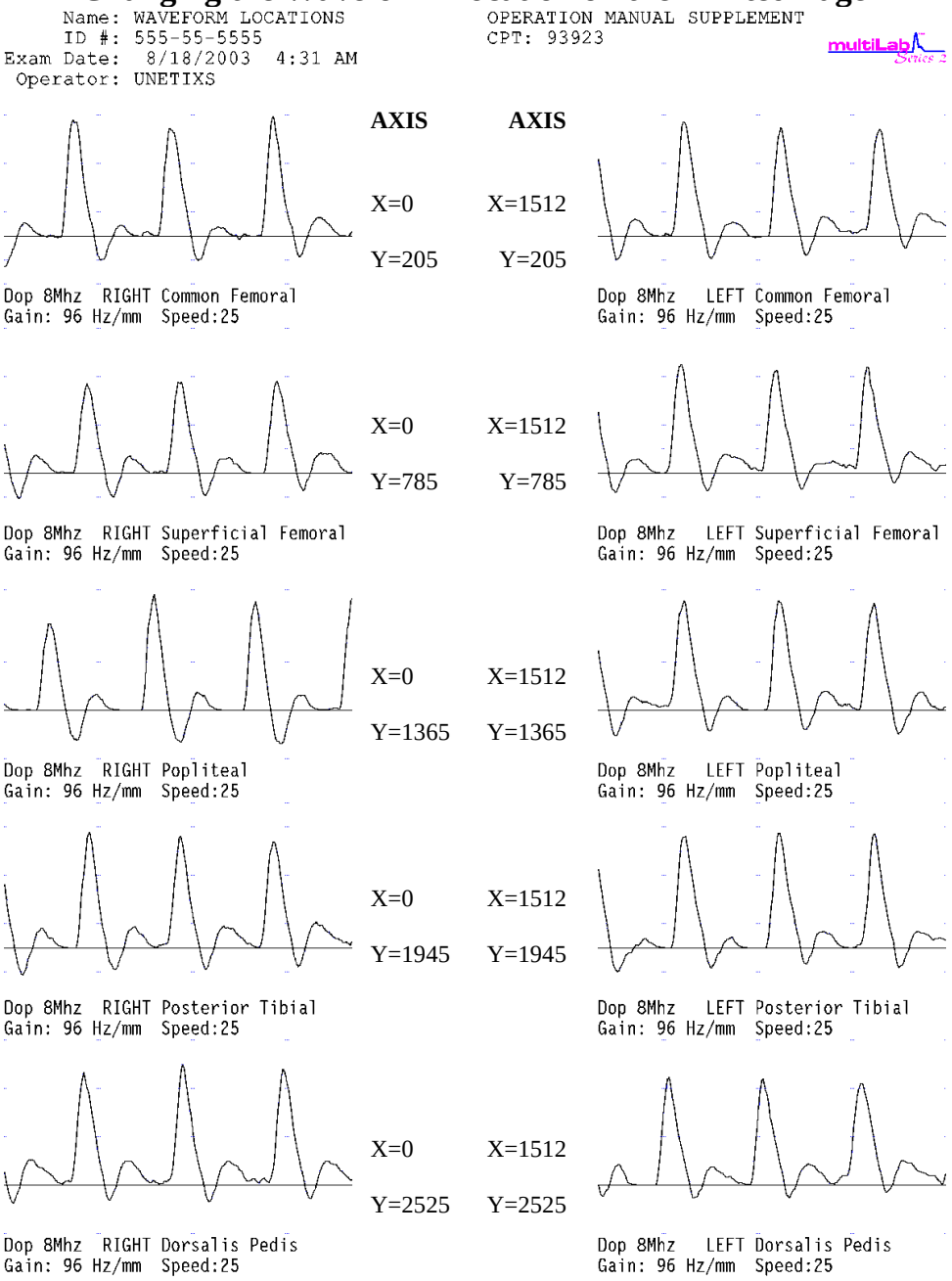
For Doppler Waveform Studies, the default sweep speed is 25 millimeters per second. As the waveform box on the report page is 75 millimeters wide, this will allow you to capture 3 seconds worth of waveform information. If for some reason you wished to "slow" down the sweep speed, you could display more waveforms by reducing the sweep speed using your Left arrow key. A sweep speed of 10 mm/second would allow for the capture of 7.5

seconds of waveforms. Please note, however, that sweep speeds of less than 25 mm/second (which is typically considered "real-time") will result in waveform compression, making waveform analysis more difficult.

Changing Location to Examine

The default settings for Lower Arterial Doppler Wave tracings are the Common Femoral, Superficial Femoral, Popliteal, Posterior Tibial, and Dorsalis Pedis Arteries. Some facilities may not wish to exam the Superficial Femoral Artery, for example. In this instance, the Left and Right Superficial Doppler Waveform entries could simply be deleted. If you wished to substitute one location for another, (like changing the Dorsalis Pedis site to the Peroneal Artery, for instance) this can be accomplished by changing both the "Tag" line and the "Text Line to be displayed below waveform". Change them so that they read, or mean, the same (see the previous example in changing a "Variable Text" item).

Changing the Waveform Location on the Printed Page



You will notice that each Doppler Waveform has a different "X" and "Y" coordinate that determine where it will be printed on the finished report. The MultiLab software will allow for the printing of ten 75mm wide waveform boxes on each report page.

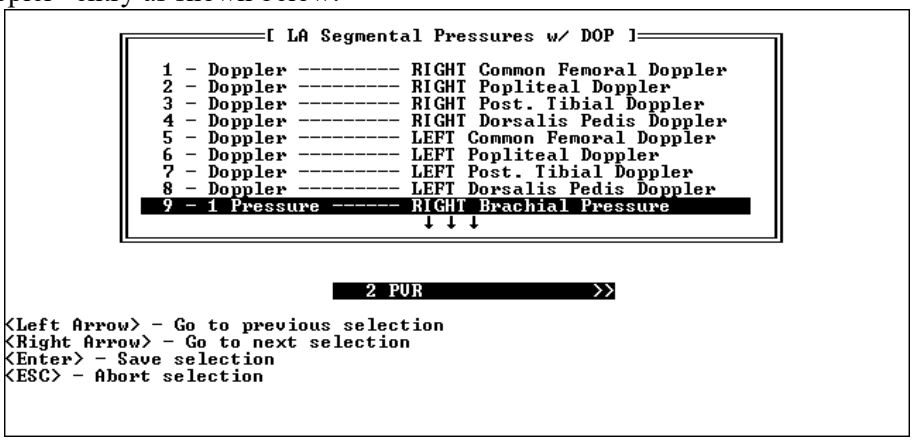
In the example above where we simply deleted the Superficial Femoral Doppler Waveforms, the printed report would have a "hole" where the Superficial Femoral waveforms would normally be printed. To make for a more visually pleasing report page, you could move the Popliteal, Posterior Tibial, and Dorsalis Pedis up, thus leaving the blank space at the bottom of the page. Since there is room on each printed page for ten 75 mm waveform boxes, you could even make use of that space by inserting some Toe Waveforms, for example.

The above page gives the coordinates for the locations of the waveform boxes. Simply change the Print "X" and "Y" coordinates for any waveform you wish to print in other than its default position.

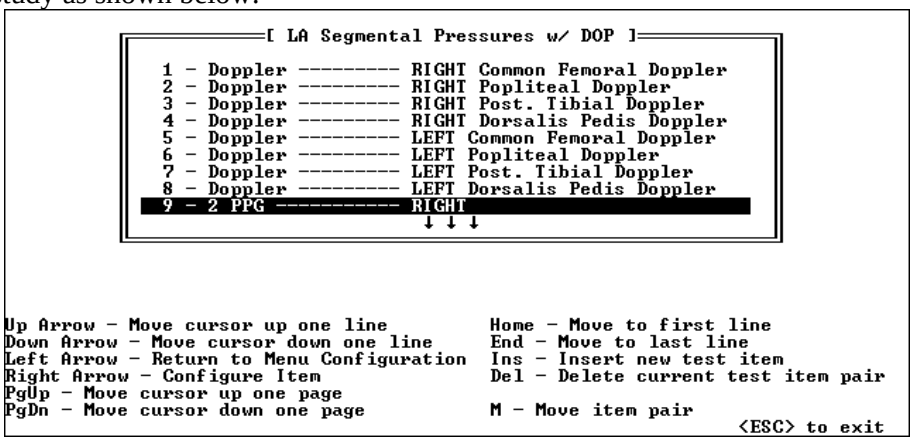
Inserting Waveforms

As was mentioned earlier, it is possible to "mix and match" various waveforms on a single page. In order to do this however, you must have available space on the page you wish to put the waveforms. Looking at the previous page you will notice that there are ten Doppler waveforms already on that page. You would not be able to insert any more waveforms into that study. However as in the previous example of "Changing the Waveform Location on the Printed Page" where we deleted the Superficial Femoral Doppler and moved the remaining sites up, there would be 2 spaces at the bottom of the page (X=0, Y=2525, and X=1512, Y=2525).

If we desired, we might put some Toe PPG waveforms in that space by pressing the "Insert" key after the "Left Dorsalis Pedis Doppler" entry as shown below:



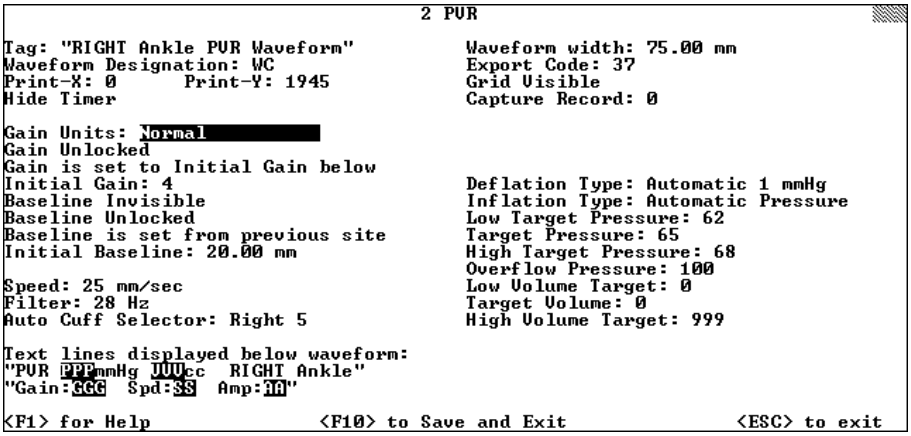
You will then be presented with a number of "modules" that you could insert into the exam you are creating. Press the Right Arrow key to bring up "2 PPG" and press the "Enter Key. This will load the "2 PPG waveform" module into your study as shown below:



Now to complete the exam, highlight the "Right PPG" entry and press the "Enter" key. Then type "Great Toe PPG Waveform" in the Tag line. Using your Down Arrow key move the cursor to the "Print Y" parameter (since the location we wish to insert this new waveform is going to be X=0 and Y=2525, we skipped directly to "Y") and change the value to "2525". To change a number, you may use the Right and Left arrow keys to raise or lower the desired values; add in the "Ctrl" key to go even faster or press "End" to go to the maximum value (In the "Y" axis, one touch of the "End" key will change the value to "2571" and on the "X" axis will take you to "1512".)

Once the print parameters have been properly set, use the "Down arrow" key to move the cursor to the entry that reads: "Text lines displayed below waveform" and type "Waveform Right Great Toe" after the "PPG" entry. Press "F-10" to Save and Exit. Repeat steps for the Left Toe Waveform, but make the Print "X" value "1512" and the "Y" value "2525".

Modifying a PVR Study



If you are performing a PVR Waveform study, there are a number of parameters that you can adjust to further customize your instrument. Most commonly, you may wish to adjust Gain Units, Default Gain settings, and Target Pressures.

Gain Units

PVR Gain units can be expressed in "Pneumo mmHg/20mm" or "Normal" values. The former is an engineering value that describes the sensitivity setting of the PVR sensors, and the latter would be more a "laymen's" version of this. The factory default setting for the Ankle, Calf, Above Knee, and High Thigh sites is ".75 mmHg/20mm". What this means is that a pressure increase of .75 mmHg (three quarters of one millimeter of Mercury) at the internal PVR sensor will cause an upstroke of 20mm (twenty millimeters) in the on-screen waveform box and on the printed report.

Even though scientifically correct, this display of sensitivity may be counter-intuitive to some, as the smaller the gain units expressed in this fashion, the HIGHER the sensitivity. For example, a gain setting of .375 mmHg/20mm would require half the amount of pressure increase to generate the same 20 mm upstroke, effectively increasing the sensitivity of the gain by a factor of two.

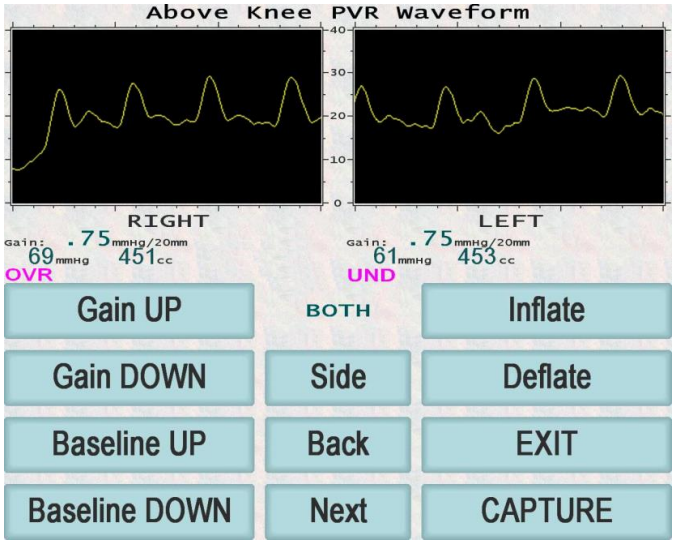
For those with a more linear mindset, we have the ability to display the Gain units in the "Normal" mode, in which a Gain setting of "4" correlates to the .75 mmHg/20mm setting described above. With "Normal" Gain units, a doubling of the PVR sensitivity would be "8" (correlating to .375 mmHg/20mm), a value that is twice that of 4. Changing these values (by using the Left and Right arrow keys in the configurator) will change how they are displayed on the screen and on the printed report.

Default Gain Settings

Default Gain settings can be adjusted individually site by site, either in the "XX mmHg/20" or "Normal" modes by using the Left and Right arrow keys.

NOTE: Be sure to check with your Medical Director and Interpreting physician before altering the factory-preset values.

Target Pressures



The "Target Pressure" is the amount of air pressure (in mm's of Hg) that the blood pressure cuff will automatically be inflated to, with one touch of the on-screen or remote controls. The default factory setting is 65 mmHg, as that is the value most commonly used by the U.S. medical community. This "Target Pressure" can be raised or lowered by using the Left and Right arrow keys. We also allow the user to define "High" and "Low" target pressures as well. These High and Low settings serve two purposes. First, they will alert the MultiLab operator if the desired air pressure in the PVR cuffs should go above or below these values by displaying the letters "OVR" and "UND" in red below the on-screen pressure value as shown below. The second use of these upper and lower targets is for the benefit of the interpreting physician, whereas the cuff pressure will print out in red on a color report page if it does not fall into the range between the "High" and "Low" Target pressures.

Saving Custom Study Configurations

After you have customized your MultiLab protocols to your satisfaction, remember to save a copy of these customized protocols in the event you have a computer problem or a hard disk drive failure. To save your unique studies, get a blank 3 ½" floppy disk (or a USB thumb drive). Label it "MultiLab Custom Studies", and insert it into the "A" drive bay (or USB port). From the MultiLab Start screen, press "Setup", System Setup", "Backup" and then "Backup Study Configuration". Save this disk (or USB drive) in a safe place.

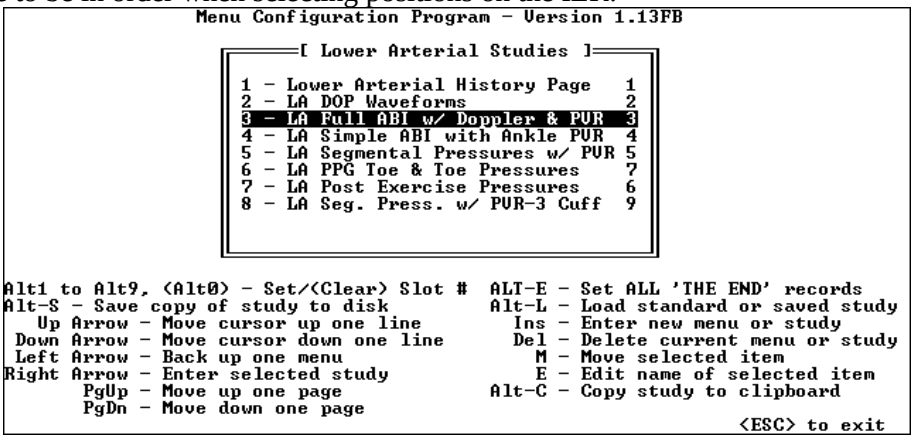
Restoring Custom Study Configurations

Obviously it is a good idea to backup your custom study configuration in the event of a computer problem. This is also an ideal way to "synchronize" one or more MultiLab instruments at either the same or remote locations, thus ensuring standardization of exams from instrument to instrument or location to location. To "restore" or duplicate a custom set of studies, simply place the backup disk (or USB drive) created in the paragraph above into the desired MultiLab system and press "Setup", System Setup", Backup" and "Restore Study Configuration". You may get a request to insert the last disk of the backup set; just answer OK to continue. After this, you may get an overwrite warning; answer "yes to all" to this warning. Remove the floppy disk (or USB Drive) when finished.

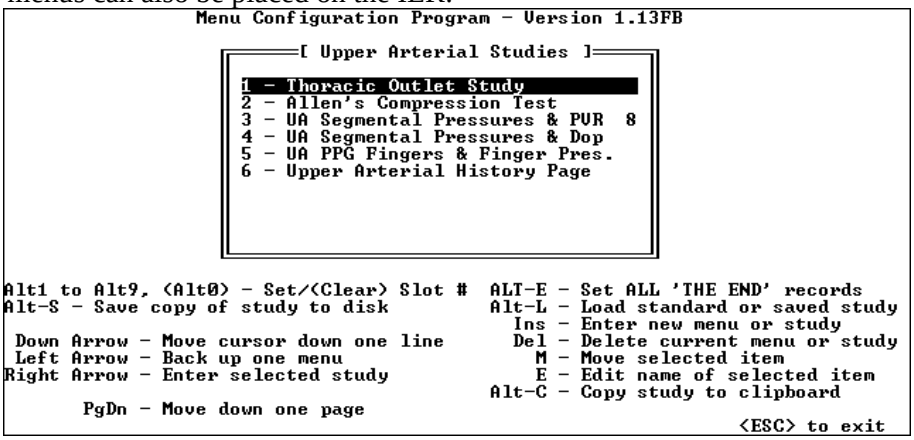
***WARNING** – To prevent data loss in the Temp. Files area, all data should be printed and deleted before restoring a study configuration. You may also Archive the data instead. In either case the Temp. Files must be empty before restoring a study configuration.

Configuring the ILR

Up to 9 study shortcuts can be placed on the ILR Start Screen. To place a study shortcut on the ILR, choose a menu in the study configurator. Highlight the study. Use the Alt key and numbers 1 – 9 (Alt1, Alt2….) to choose a location on the ILR. To remove a study from the ILR, highlight and touch Alt0. As can be seen below, the studies do not have to be in order when selecting positions on the ILR:



Studies from other menus can also be placed on the ILR:



CHAPTER 12: THEORY OF OPERATION

PVR Cuff

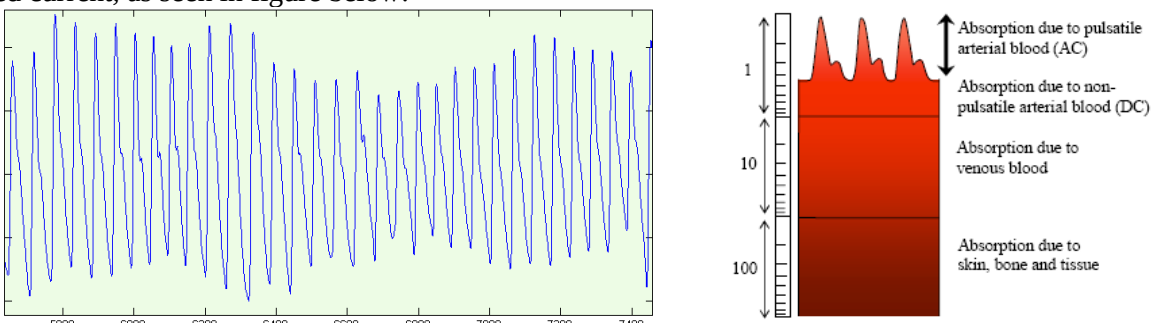
Pulse volume recording or PVR is a test that measures blood flow in the leg arteries. PVR can be used to diagnose PAD in the legs, determine how severe the disease is, and find the general location of the blockage. The PVR test is fast and painless, and does not require entering the body.

Blood does not flow through the body with continuous, uninterrupted flow. Instead, with each beat of the heart blood is pushed through the body in "pulses." The PVR test uses pressurized cuffs to monitor how these pulses travel through the legs, allowing doctors to find blood flow problems that may be caused by PAD. The pulsing of blood is measured at several different parts of the leg; PVR can also show roughly where the blockages are.

PPG

Photoplethysmography (PPG) is optically performed by using IR LED, which monitors the perfusion of blood to the dermis and subcutaneous tissue of the skin. The change in volume caused by the pressure pulse is detected by

Beaming the IR light through the skin using IR LED and then measuring the amount of light either transmitted or reflected to a photodiode. Each cardiac cycle appears as a peak in the waveform of the photodiode's light-generated current, as seen in figure below:

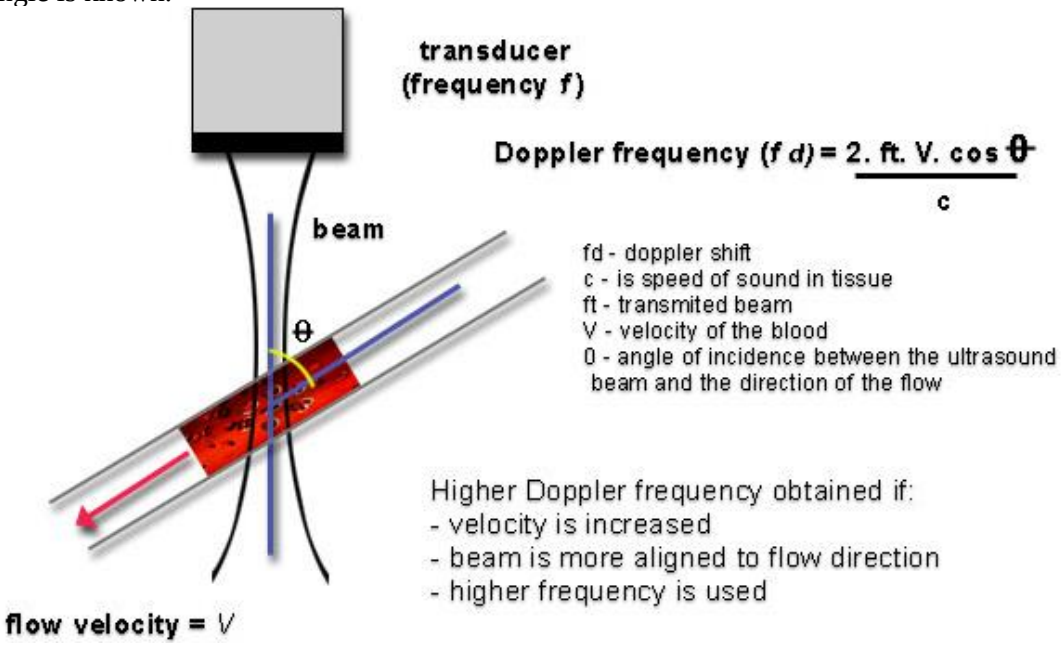


Example of Pulsed IR LED waveform received by the sensor

The DC component of the signal reflects the bulk absorption of the skin tissue, while the AC component is directly attributable to variation in blood volume in the skin caused by the pressure pulse of the cardiac cycle.

Doppler Ultrasound

Doppler ultrasound measures the movement of the scatterers (blood corpuscles) through the beam as a phase and frequency change in the received signal. The resulting Doppler frequency can be used to measure velocity if the beam/flow angle is known.



5MHz probe (TD5) typical values

Acoustic Output			MI	$I_{SPTA.3}$ mW/cm^2	$I_{SPPA.3}$ W/cm^2
Global Maximum Value			0.032	173.13	.18
Associated Acoustic Parameter	P_r. (MPa):		.086		
	W_0 (mW)			25.8	25.8
	f_0 (MHz)		5.09	5.09	5.09
	Z_{sp}		.70	.70	.70
	Beam Dimensions	X_{-6} (mm)		5.30	5.30
		Y_{-6} (mm)		3.21	3.21

8MHz probe (TD8) typical values

Acoustic Output			MI	$I_{SPTA.3}$ mW/cm^2	$I_{SPPA.3}$ W/cm^2
Global Maximum Value			0.02	56.44	0.06
Associated Acoustic Parameter	P_r. (MPa):		.05		
	W_0 (mW)			18.9	18.9
	f_0 (MHz)		7.90	7.90	7.90
	Z_{sp}		1.1	1.1	1.1
	Beam Dimensions	X_{-6} (mm)		6.26	6.26
		Y_{-6} (mm)		1.64	1.64

$I_{SPTA.3}$ Derated Spatial-peak temporal-average intensity
$I_{SPPA.3}$ Derated Spatial-peak pulse-average intensity
MI Mechanical Index
P_r Peak-rarefactional acoustic pressure
W_0 Output power
f_0 Acoustic Center frequency
Z_{sp} Depth at which the reported parameter is measured

Operating Conditions: There are no user controls which affect the ultrasound output.

Measurement Uncertainties: ±19.4 percent for all intensity values reported
±9.7 percent for all the pressure values
±9.7 percent for the Mechanical Index

CHAPTER 13: GLOSSARY OF TERMS

A

ABI: Ankle Brachial Index; the Ankle pressure divided by the Brachial Pressure.

Amplitude: The height of a waveform. This can be affected by changing scale. For a Doppler waveform this can be affected by the angle of approach.

Angle of approach: The angle of the Doppler probe to the vessel being insonated. The amplitude is directly proportional to the cosine of this angle. At 90° to the vessel, the amplitude will approach 0 (cosine of 90° =0).

Artifact: Waveform output that is not generated by the patient. For Doppler signals, this can be reduced by lowering the filter to a value closer to 3.5Hz.

B

Baseline: A center point for a waveform. For Doppler waveforms, the baseline is the point of zero flow. This point can be moved up or down by using the Baseline control.

Bayonet fitting: Used to connect the pneumatic hose to the cuff. The cuff has a male Bayonet fitting and the hose has a male Bayonet fitting.

Brachial artery: A continuation of the axillary artery beyond the lower margin of the teres major muscle.

C

C-PVR™: See Calibrated pulse volume recording.

Calibrated pulse volume recording: A technique for ensuring the accuracy of PVR waveforms by alerting the operator in cuff wrapping issues.

Capture: Operator control to end obtaining patient information and to move on to editing that information.

CNO: Shorthand for "Could Not Occlude". The operator may enter this in lieu of a pressure when said pressure is above safe levels (typically 200 to 250 mmHg).

Control panel: Part of the operating system software that controls facets of its operation. These are not created by Unetixs Vascular Inc.

Cuff: Thin sealed air bladder encased in an elongated cloth covering. The cloth covering contains Velcro to hold the cuff in place when wrapped around a limb segment. The air bladder is connected to a MultiLab hose for taking pressures and PVR waveforms.

D

Default printer: The printer that is selected in the operating system.

Deflation cycle: When taking a pressure measurement, the deflation cycle is initiated after the completion of the inflation cycle (See Inflation cycle). The deflation cycle starts after the press and release of the deflate button which causes the pressure in the cuff to be released in a controlled fashion.

Doppler probe: Ultrasonic device which connects to the MultiLab to display arterial waveforms.

Doppler waveform: Waveform made by Doppler probe.

Dorsalis Pedis artery (DP): Dorsal artery of the foot. It arises at the anterior aspect of the ankle joint and is a continuation of the anterior Tibial artery.

DVT: Deep Vein Thrombosis; the formation of a blood clot in a deep vein.

E

Exam: A collection of measurements performed upon a patient for diagnostic purposes.

F

Facility name: A title line at the top of every MultiLab report; usually the name of the facility where exams are performed.

Flat (or Flat-line): When taking a pressure measurement, a complete and correct inflation cycle (See Inflation cycle) is when the waveform tracing has become flat. This means that the waveform tracing is a horizontal line. It is usually a good idea to see a couple of seconds of flat-line, after the inflation cycle, before starting the deflation cycle (See Deflation cycle).

G

Gain: The amount of amplification applied to the waveform. This directly affects the amplitude of the waveform by using the Gain control. Lower Gain mean lower amplitude.

I

Incompressible: A vessel is considered incompressible when its systolic blood pressure exceeds safe levels (typically 200 to 250 mmHg).

Invert: A Doppler waveform control to reverse the displayed directions. Normally, forward flow (towards the probe) is above baseline. If invert is active then reverse flow (away from the probe) is above baseline.

L

Luer fitting: Previously used to connect the pneumatic hose to the cuff. The cuff has a female Luer fitting and the hose has a male Luer fitting.

M

Medial Malleolus: Protruding bone on the inner side of the ankle

Medial: A position in the middle of a body part.

P

PAD: Peripheral Arterial Disease

Patient data/information/study: Exam results for a patient.

PDF (file): Adobe Portable Document Format. A computer file that is readable across most computer platforms.

PICC line: Peripherally Inserted Central Catheter line for delivery of treatments such as antibiotics or chemotherapy.

Pneumatic hoses: Hoses to connect the MultiLab to a cuff.

Posterior Tibial artery (PT): Artery located on the inside of the ankle behind the medial malleolus.

PPG: Photoplethysmography, or a device to measure arterial flow using a light emitter and sensor.

PPG (toe) waveforms: Arterial waveforms of the toe obtained using a PPG sensor.

PPG clips: Special clip to increase the efficiency of applying a PPG sensor to a toe.

PPG connector: Port on the MultiLab (both right and left) to connect the PPG sensor to the MultiLab.

PPG sensor: See PPG.

Protocol: Sequence of measurements in a patient exam.

Proximal: Nearest to the center of the body.

Pulsatile: Having a pulse.

Pulse: Arterial vibration cause by a bulbous of blood pumped by the heart.

Pulse volume recording: See PVR.

PVR: Pneumoplethysmography, or a device to measure arterial volume through the ankle using a cuff.

PVR (waveform) tracing: Waveform obtained using a Pulse Volume Recorder.

R

Radial artery: A main artery on the lateral side (side with the thumb) of the forearm.

Report: Either a PDF file or a printout of a completed exam.

S

Scroll: Movement of the waveform in either a left to right or right to left direction. After a waveform or pressure has been captured, the Scroll control allows the user to exactly set the waveform position or select the correct pressure measurement point.

Set output: User control to manually set a pressure output. This is especially useful for incompressible vessels (see CNO).

Shutdown: User control to initiate an operating system shutdown. It is strongly recommended to use this control before turning off the system.

Signal: True waveform output from the patient (as opposed to artifact; See Artifact).

Start screen: Main navigation screen for the MultiLab.

Study: See Exam.

Supine: Lying on back with face upwards.

Systolic pressure: The high number of a patient's blood pressure, typically 120mmHg at the arm. This is the type of pressure that the MultiLab measures at the Arm (brachial), Ankle, and Toe.

T

TBI: Toe Brachial Index; the Toe pressure divided by the Brachial Pressure.

Temp. files: The place where the MultiLab stores patient studies that have not been saved or printed (see Storage mode).

Thumb drive: See USB flash (storage) drive.

Touch screen: A user input device which overlays the main output screen. The input device allows the MultiLab to register the exact position that the operator is touching on the screen.

TruDop®: The trademark name of Unetixs Vascular Inc.'s Doppler probe used on the MultiLab.

U

Ulnar artery: A main artery of the medial aspect (side away from the thumb) of the forearm.

Ultrasound gel: A hypoallergenic water based gel used to couple the Ultrasonic transducer of the TruDop® Doppler probe with the arterial vessel of a patient.

USB memory stick: (also USB thumb drive, USB memory device, or USB drive) A file storage device that connects to the MultiLab via its USB port.

V

Vascular studies: Patient exams pertaining to their vascular system. These are the types of studies that the MultiLab performs.

Vasoconstriction: The narrowing of a blood vessel resulting from the contracting of the vessel's muscular wall.

Venous access port: A tube inserted into a vein (typically the Subclavian or Jugular) for the delivery of medicine and the taking of blood samples. The plastic or metal port can be found near the surface of the skin.

W

Waveform box: When taking a pressure or waveform measurement, this is the area at the top of the MultiLab screen with the waveform in it.

Waveform tracing: The patient signal or artifact (See waveform box).

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For Additional Help Contact:

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E-mail: sales@unetixs.com
WWW.UNETIXS.COM

Do not dispose of in municipal waste. Wheeled bin symbol indicates separate collection for electrical and electronic equipment (WEEE Directive 2002/96/EEC)

Dispose of any contaminated/biohazard materials through the proper channels.

Section 4: Maintenance Guide

Maintenance instructions for MultiLab 2000 Series 2 LHS Roodra include the following documents:

11912-0003-01	(IRB)	Infrared Remote PCB Assembly: Assembly Procedure
11919-0006-01	(SSB)	PCB Ass'y, S2 SMT Motherboard: Test/Calibration Procedure
11933-0003-01	(ACB)	Auto Cuff Selector PCB Assembly: Assembly Procedure
11976-0003-01	(ECT)	Ass'y, ESA Cart: Assembly Procedure
11977-0003-01	(MLS2E)	Final Ass'y, ESA: Assembly Procedure
11977-0006-01	(MLS2E)	Final Ass'y, ESA: Test/Calibration Procedure
11982-0003-01	(OCT)	Ass'y, Roodra Cart: Assembly Procedure
11983-0003-01	(OBC)	Ass'y, Roodra Chassis: Assembly Procedure
11983-0006-01	(OBC)	Ass'y, Roodra Chassis: Test/Calibration Procedure
11986-0003-01	(MLS2B)	Final Ass'y, Roodra: Assembly Procedure
11986-0006-01	(MLS2B)	Final Ass'y, Roodra: Test/Calibration Procedure

Step 1: Through Hole Assembly

Assemble and solder components onto the Board (30001-0017-01 rev A).

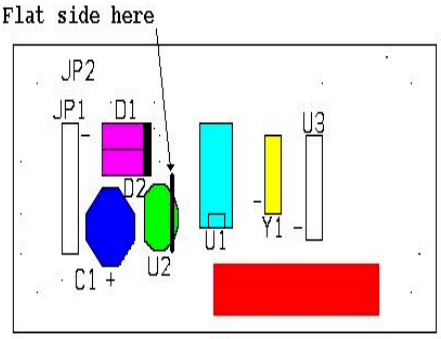


Figure 1

Unetixs Part	Description	Qty	Reference Designators
20007-0000-01	Label, Serial Number	1	
10053-0106-01	Cap. 10uF 16V Electrolytic	1	C1
10612-0914-01	Diode, 1N914	2	D1, 2
10512-0008-01	Socket DIP 8 Pin	1	U1A
10228-0005-01	VREG, 5V LDO (Note: Incorrect silkscreen)	1	U2
10642-4000-01	Resonator 4.00 MHz	1	Y1

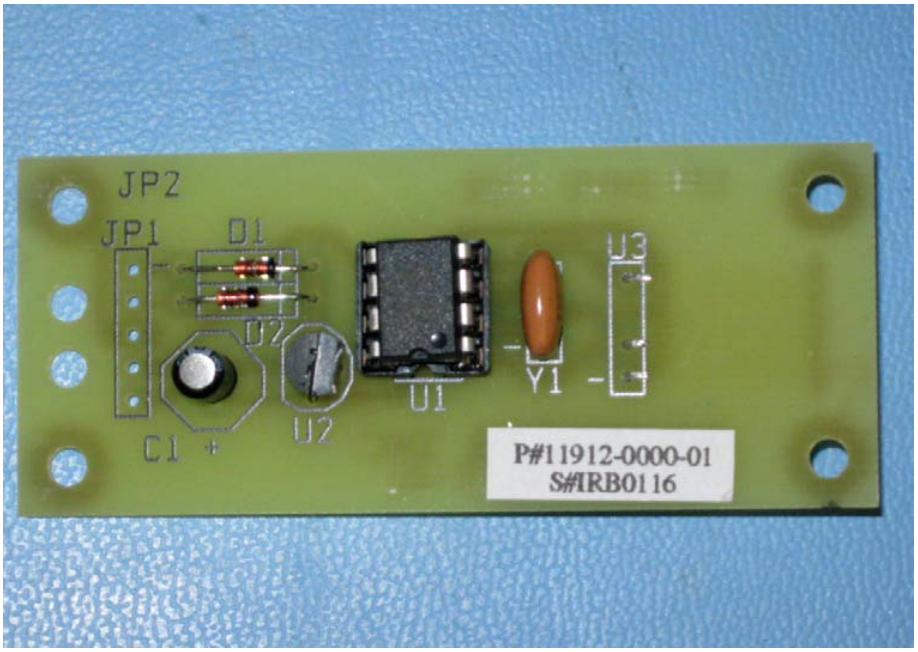


Figure 2

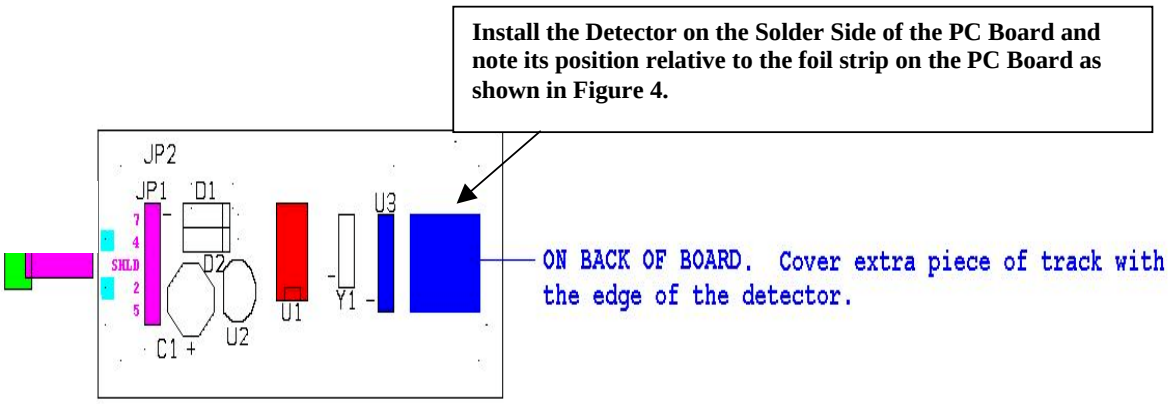


Figure 3

Unetixs Part	Description	Qty	Reference Designators
10145-0000-01	IC, PIC12F509	1	U1, programmed
	Note: Program U1 per SOP-30-004 section 7.0 or equivalent. Place the socket U1A in the board first, and then add the IC.		
10405-0000-01	IR Detector Module	1	U3

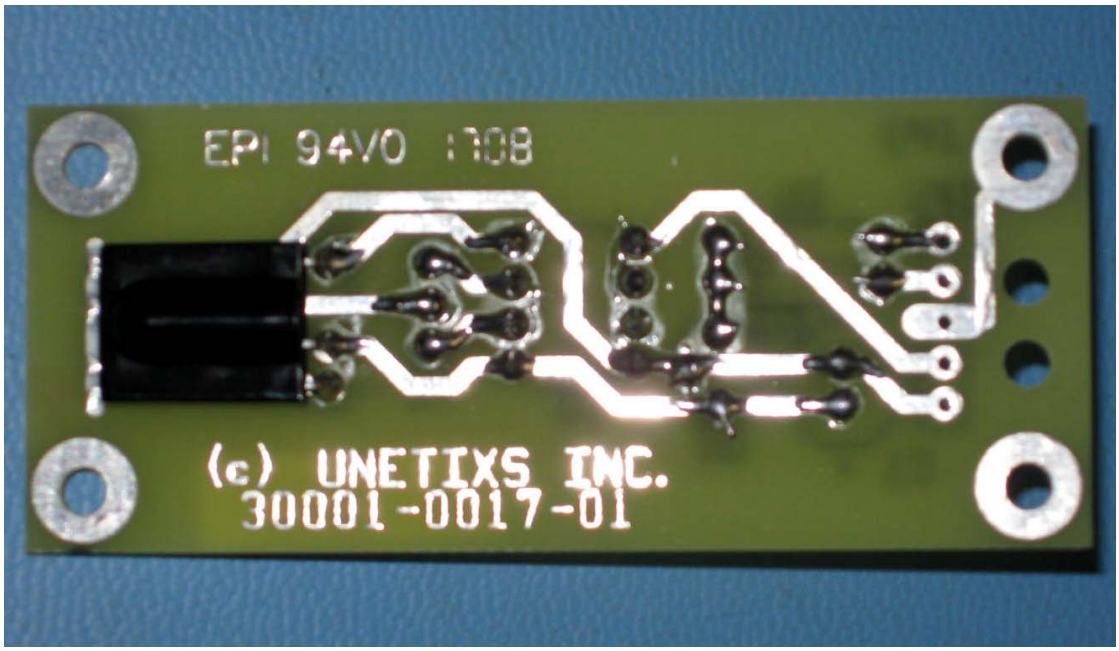


Figure 4

1. Test Equipment Checklist

Gather all the test equipment needed and copy down their control numbers. Check the calibration or maintenance date to confirm that all equipment is good to use, record date below. Have a bottle of ultrasonic gel (10628-0001-01) ready for use.

Test Equipment Name	Control # / Serial #	Due Date
S2 Motherboard Test Fixture P/N: 60001-0000-01		**N/A**
Test Computer P/N: 60007-0000-01		**N/A**
Digital Voltage Meter		
Oscilloscope		
Digital Manometer		
Manometer with Accessories P/N: 60005-0000-01		**N/A**
TruDop 8 Probe P/N: 11963-0000-01		**N/A**
Doppler Cable P/N: 11930-0000-01		**N/A**

2. Install Poly Caps

2.1. If C96-99 are not installed with through hole Cap. 1uf poly (10050-0105-02), install them per SOP-30-030 and record lot numbers. If caps are already installed, enter N/A for lot number.

Lot Number: _____

Step 2 performed by: _____

3. Setup

3.1. Place the S2 SMT Motherboard (referred as **SSB** in the following context) on the S2 Motherboard Test Fixture (referred as **Test Fixture** in the following context).

3.2. Plug the **Power Supply** connector (w/ 2pin-to-4pin adapter) into **JP14**. Connect provided Alligator Clip from **U16 Gnd** to the Ground socket on the right side of the Test Fixture. Set the Digital Voltage Meter (referred as **DVM** in the following context) to

read **DC Volts**. Attach the **DVM ground** lead (black) to another Ground socket on the left side of the Test Fixture.

3.3. Turn on the **AC Power** of the Test Fixture.

3.4. Check the following voltages (tolerances ±10%). Write down the values.

Voltage	Nominal value	Accepting Range (volt)	Measurement (volt)
TJ6 (Analog 5V)	+5V	4.5 ~ 5.5	
TJ4 (VCC)	+5V	4.5 ~ 5.5	
TJ5 (+12V)	+12V	10.8 ~ 13.2	
TJ11 (+2.5V)	+2.5V	2.25 ~ 2.75	
TJ7 (+15V)	+15V	13.5 ~16.5	
TJ10 (-15V)	-15V	-16.5 ~ -13.5	
TJ8 (+8V PPG)	+8V	7.2 ~ 8.8	
TJ9 (-8V PPG)	-8V	-8.8 ~ -7.2	

3.5. Download Software:

3.5.1. Turn the **Test Fixture** power OFF.

3.5.2. Add the provided ISP jumper to **JP18** (shunt ISP on the SSB).

3.5.3. Connect the **USB Download Cable** from the Test Computer to **JP2** (USB).

3.5.4. Turn the Test Fixture power back **ON**.

3.5.5. On the Test Computer desktop, drag the hex file (**11919-0008-01**) to the ISP Programmer software (**SPECPGMR.bat**). Then download of hex file starts and runs automatically.

3.5.6. After a few seconds the program should read "Passed 9". Press any key to continue. The process will continue and then the window will close when finished.

3.5.7. Turn the Test Fixture power **OFF**.

3.5.8. Remove the ISP jumper from shunt ISP on the SSB. Disconnect the USB Download Cable from the SSB.

3.5.9. Turn the Test Fixture power back **ON**. Verify that LED **D10** is flashing.

3.5.10. Record the version of the hex file.

11919-0008-01 Rev_____

3.6. On the Test Computer, ensure that the LHS RJ45 cable is connected to the RS232 to RS422 converter. Ensure the DB25 cable adapter is connected the Module end of the PSC cable. Connect the DB9 end of the DB25 adapter to **JP7**. Connect the **Doppler Cable** on the Test Fixture to **JP15** (pin 1-4 leaving pin 5 & 6 open).

3.7. Start up the Test Computer so that it displays the Desktop. Click the **S2WIN-S** shortcut from the Desktop. Vascular OK will show on Main Menu.

3.8. Connect the oscilloscope to the **Function Generator** BNC jack on the right side of Test Fixture using the provided **BNC cable**. Set the toggle switches on the test fixture to **Test** mode. A steady square waveform will appear on the screen. Measure the clock frequency and copy it down.

Quantity	Nominal Value	Accepting Range	Frequency (kHz)
3.840kHz Square Wave	3.840 kHz	3.821 ~3.859 kHz	

Step 2 tested by: _____

4. Doppler

4.1. Set Baseline

4.1.1. Disconnect **JP15** from the Motherboard. Turn **P11** & **P12** all the way clockwise.

4.1.2. Set the toggle switches on the test fixture to **Probe**. From the Main Menu, click **Setup** --- **Yes** --- **Diagnostics** --- **Calibrate** --- **Zero Dop Baseline**.

4.1.3. Set the following parameter if necessary: **Side** button to **Forward**, **Filter** button to **3.5Hz** and Gain to **24 Hz/mm**.

4.1.4. Click **Forward Clear** button; wait until the waveform has fully crossed the screen and then click **Forward Set** button.

4.1.5. Select **Reverse** side. Click **Reverse Clear** button; wait until the waveform has fully crossed the screen and then click **Reverse Set** button.

4.1.6. Change the Gain to **256 Hz/mm** and repeat steps 4.1.4 and 4.1.5.

4.2. Doppler Frequency

4.2.1. Reconnect Doppler cable to **JP15**. Turn trimpots **P4** and **P5** all the way clockwise. Click **Exit** once and then click **Doppler Frequency**.

4.2.2. Set the toggle switches on the test fixture to **Test** & **R84**. Set the gain to **96 Hz/mm**. Set the **Side** to **R84 SUP**. Adjust **P11** until the Calibration Value is steady at **64**. The waveform should locate below the baseline.

4.2.3. Set the toggle switches to **Test** & **R43**. Set **Side** to **R43 SDW**. Adjust **P12** until the value is steady at **64**. The waveform should locate above the baseline.

4.2.4. Repeat Step 4.2.2 ~ 4.2.3 for a couple of times until Calibration Values are steady at **64**. Exit to Main Menu.

4.3. Doppler Sensitivity

4.3.1. Connect the Doppler Cable (11930-0000-01) to the **Doppler** Lemos connector on the Test Fixture. Connect the TruDop 8 (11963-0000-01) to the Doppler cable.

4.3.2. From the Main Menu, select **Studies --- Lower Arterial Studies --- Lower Segmental Pressure w/ Doppler --- Exit --- Right Common Femoral Doppler --- Back**. Set Gain to **24 Hz/mm**, Filter to **7 Hz**.

4.3.3. Adjust **P4** and **P5** to get a waveform as shown in **Figure 1**. Ticks above and below baseline must be evenly balanced.

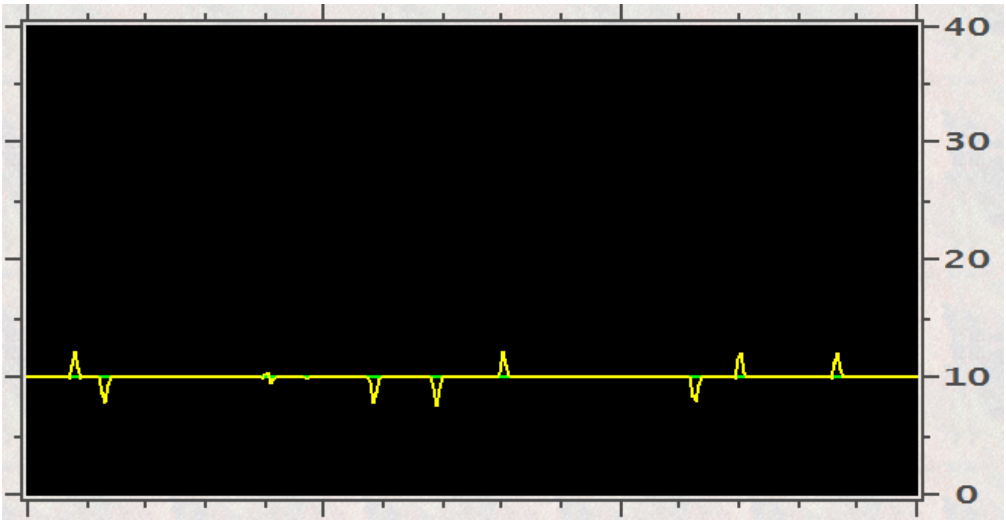


Figure 1 – Ideal Doppler Sensitivity

4.3.4. Connect **Right Speaker** cable (red & black) to **JP12**. Connect the 5-pin connector that is with the speaker cables to **JP8**. Perform a self-test. Check for clear waveforms (Up/Forward flow with small Down/Reverse flow). Verify that the doppler can be heard clearly in the right speaker. Disconnect right speaker.

4.3.5. Connect **Left Speaker** cable (blue & white) to **JP13**. Perform a self-test. Check for clear waveforms (Down/Reverse flow with small Up/Forward flow). Verify that the doppler can be heard clearly in the left speaker. Disconnect left speaker. Disconnect the **TruDop8** Probe from the Doppler Cable. Exit to the Main Menu.

Step 4 tested by: _____

5. Valve and Pump Test

5.1. Connect the Test LED's:

Yellow	JP3
White	JP4
Green	JP5
Blue	JP6

5.2. From Main Menu, select **Studies --- Lower Arterial Studies --- LA Segmental Pressure w/PVR --- Exit --- Right Great Toe Pressure --- Back**.

5.3. Select the **Left** Side and press the **Inflate** key. Verify **Left Pump LED** and **Left Valve LED** are turned **on**. Press **Inflate** again and verify the **Left Pump LED** is turned **off**. Press and hold the **Deflate** key and verify the **Left Valve** is turned **off.**

5.4. Switch to the **Right** Side and press **Inflate.** Verify **Right Pump LED** and **Right Valve LED** are turned **on**. Press **Inflate** again and verify the **Right Pump LED** is turned **off**. Press and hold the **Deflate** key and verify the **Right Valve** is turned **off.**

5.5. Switch to **Both** sides and then **Inflate**. Verify all 4 LED's are **on**. Press the **Capture** key and verify **all** the LED's are turned **off**.

5.6. Exit to the Main Menu.

Step 5 tested by: _____

6. PVR Calibration and Baseline Adjustment

6.1. With DVM Red lead on **TJ1 pin 1 (square),** adjust **P13** to so DVM reads 1V±2mV (0.098-1.002). Connect the Digital manometer to the manometer with accessories and connect open end to **S4 or S5.** Turn Digital Manometer **ON**. Make sure the Digital Manometer is zeroed per the manufacturer's instructions. Inflate to **100.00-100.01 mmHg**. Adjust **P7** so DVM reads 3.978V±5mV (3.973 – 3.983). Release pressure. Re-adjust P13 to 1V±2mV (0.098-1.002). Repeat P13 & P7 adjustments for several times until the DVM readings are stable. Record the final voltages in the chart below.

Quantity	Nominal Value (volt)	Accepting Range (volt)	Voltage (volt)
TJ1 pin 1 (Square) @ 0mmHg (**P13)**	1.000	0.998 ~ 1.002	
TJ1 pin 1 (Square) @ 100mmHg (**P7)**	3.978	3.973 ~ 3.983	
TJ3 pin 1 (Square) @ 0mmHg (**P6)**	4.50	4.49 ~ 4.51	
TJ3 pin 1 (Square) @ 50mmHg	2.68	2.48 ~ 2.88	

6.2. Release the pressure. Attach DVM Red lead on **TJ3 pin 1 (square)**. Adjust **P6** to obtain a reading of **4.50V**±10mV (4.49 – 4.51). Inflate to **50mmHg**. Verify that the reading is within **200mV of 2.68 volts (2.48 – 2.88)**. Copy down these two voltages in the chart above.

6.3. Repeat Steps 6.1 through 6.2 with the open end of the manometer set connecting to **S3 or S6** using potentiometers and test points in the following table. Record your measurements as required in the chart below.

Quantity	Nominal Value (volt)	Accepting Range (volt)	Voltage (volt)
TJ1 pin 2 (Circle) @ 0mmHg (**P14)**	1.000	0.998 ~ 1.002	
TJ1 pin 2 (Circle) @ 100mmHg (**P8)**	3.978	3.973 ~ 3.983	
TJ3 pin 2 (Circle) @ 0mmHg (**P3)**	4.50	4.49 ~ 4.51	
TJ3 pin 2 (Circle) @ 50mmHg	2.68	2.48 ~ 2.88	

6.4. Disconnect the digital manometer and manometer with accessories from the board.

6.5. From the Main Menu, select **Studies --- Lower Arterial Studies --- LA Segmental Pressure w/PVR --- Exit --- Right Metatarsal PVR waveform --- Back**.

6.6. Set the gain to **0.188mmHg/20mm** and adjust **P10** so that the left baseline is on the center (20).

6.7. Repeat Step 6.6 for right side at **P9**.

6.8. Exit to the Main Menu.

Step 6 tested by: _____

7. Calibrate Blood Pressure

7.1. Select **Setup --- Yes --- Diagnostics --- Calibrate --- Blood Pressure**.

7.2. Connect the digital manometer and manometer with accessories to **S1**. Leave the hand pump valve open, press **R 0mm**.

7.3. Close the hand pump valve and pump it manually until the manometer reads 302 ~ 305 mmHG. Manually release the hand pump valve carefully so that digital manometer reads 300.00-300.10 mmHg. When the pressure reaches the target press **R 300mm**.

7.4. Manually release the hand pump carefully so that the digital manometer is within the first range in the table below. Record the value from digital manometer and the value on screen into the table. Verify readings are within 1mmHg of one another. Repeat for the other 2 ranges.

7.5. Connect the digital manometer and manometer with accessories to **S2** and repeat steps 7.2 - 7.4 for the left side (pressing **L 0mm** and **L 300mm**).

7.6. Disconnect the digital manometer and manometer with accessories and click **Save**. Exit to the Main Menu.

Pressure Range	Manometer Reading	Screen Reading
RT 250-270 mmHg		
RT 150-170 mmHg		
RT 70-50 mmHg		
LT 250-270 mmHg		
LT 150-170 mmHg		
LT 70-50 mmHg		

Step 7 tested by: _____

8. PPG

8.1. On the Main Menu, verify the voltages at pin 2 on **JP9** & **JP10** are under 0.1V+10% (typ. 70mV). Record the voltages in the chart below.

Quantity	Nominal Value	Accepting Range	Voltage (V)
JP9 pin 2 (Main Menu)	0.1 V	0 ~ 0.11 V	
JP10 pin 2 (Main Menu)	0.1 V	0 ~ 0.11 V	

8.2. From the Main Menu, select **Studies --- Lower Arterial Studies --- LA PPG Toe & Toe Pressure --- Exit --- Right Great Toe PPG waveform --- Back**.

8.3. Adjust **P1** to set the **Left baseline** to **20**. Adjust **P2** to set the **Right baseline** to **20**. Increase the Gain to **16** and repeat the **P1** & **P2** adjustment if needed.

8.4. Check the voltages at **JP9** pin 2 and **JP10** pin 2 in this study. They should be **2.1V**±50mV (2.05 ~ 2.15). Record the readings as below.

Quantity	Nominal Value	Accepting Range	Voltage (Volts)
JP9 pin 2 (Study)	2.1 volts	2.05 ~ 2.15 volts	
JP10 pin 2 (Study)	2.1 volts	2.05 ~ 2.15 volts	

8.5. Touch the **JP9** & **JP10** connector pins with your fingers. A visible deflection of the waveform should take place on each screen (Right and Left).

8.6. Exit back to the Main Menu. Click **Temp Files --- Delete --- Yes**. Do this for all study files.

8.7. Exit to the Desktop and turn off the power of the Test Fixture. Disconnect all the cables from the SMB and fill out the remaining paperwork.

Step 8 tested by: _____

End of Test

Pass/Fail: _____

Test Performed By: _____ Date: _____

Step 1: Through Hole Assembly

Assemble and Solder Components onto the Board (30001-0018-01 rev A).

Top solder is not mandatory for through hole components as long as the hole is 75% full and there is evidence of good wetting. Flux residue is permitted to be left on the board.

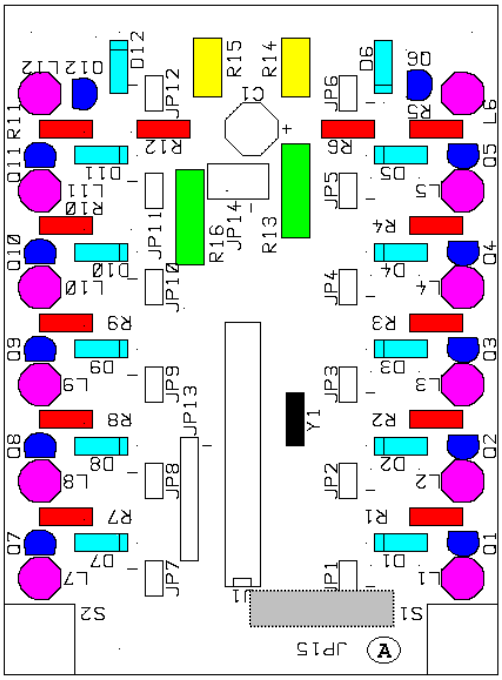


Figure 1

	Unetixs Part#	Description	Qty	Reference
	20007-0000-01	Serial Number Label in this location on back.	1	
	10000-4750-01	Res. 475 ohm 1% 1/4W Metal Film	12	R1 – R12
	10008-0101-01	Res. 100 ohm 5% 1/2W Carbon Film	2	R14, R15
	10000-0000-01	Res. 0 ohm 1/4W Metal film	2	R13, R16
	10612-0914-01	Diode 1N914	12	D1 – D12
	10642-4000-01	Resonator, 4.00MHz	1	Y1
	10644-2222-01	Transistor, 2N2222A	12	Q1 – Q12
	20060-0008-01	Spacer, LED ½"	12	L1 – L12
	10647-0002-01	LED Green T 1¾	12	L1 – L12

Place the spacer between the board and LED. Note polarity when inserting LED wires: the flat (negative) of the LED (short wire) goes toward the flat indicated on PC board silkscreen.

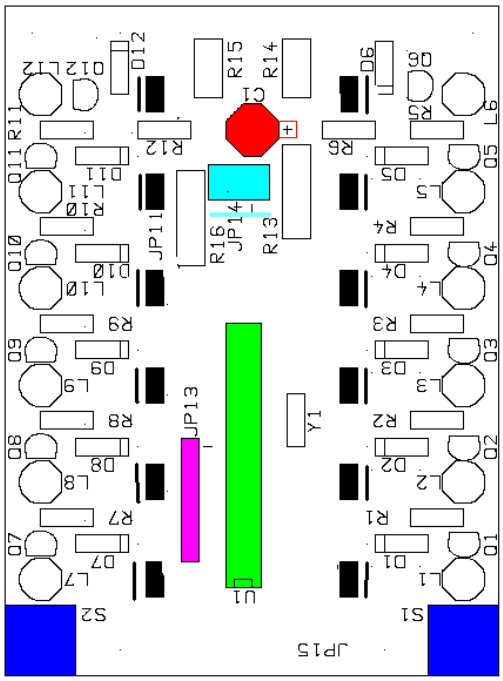


Figure 2

	Unetixs Part#	Description	Qty	Reference
	10053-0106-01	Cap. 10uF 16V Alum Elect. Radial	1	C1
	10512-0028-02	Socket, IC 28pin .300 ctrs.	1	U1A
	10145-0001-01	PIC 16F873 (programmed)	1	U1
		Note: Program U1 per SOP-30-004 section 7.0 or equivalent. Place the socket in the board first, and then add the IC.		
	10502-0002-01	Conn., .156" Header 2 pin	1	JP14
		Place this header on the back of the PC board.		
	10504-0002-01	Conn., .100" Header 2 pin	12	JP1–JP12
		Place these headers on the back of the PC board.		
	10637-0001-01	Switch, pushbutton BLACK	2	S1, S2
	10505-0007-02	Conn. 7p PCB Mt. Housing (make from 10505-0036-01)	1	JP13
		Place this header on the back of the PC Board		

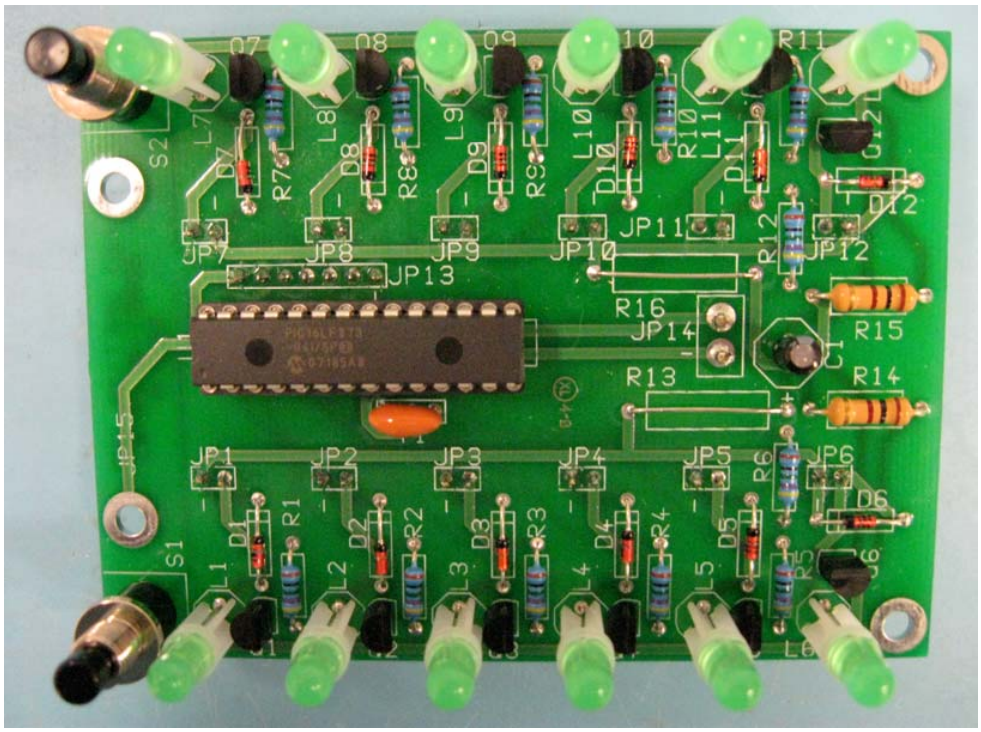


Figure 3

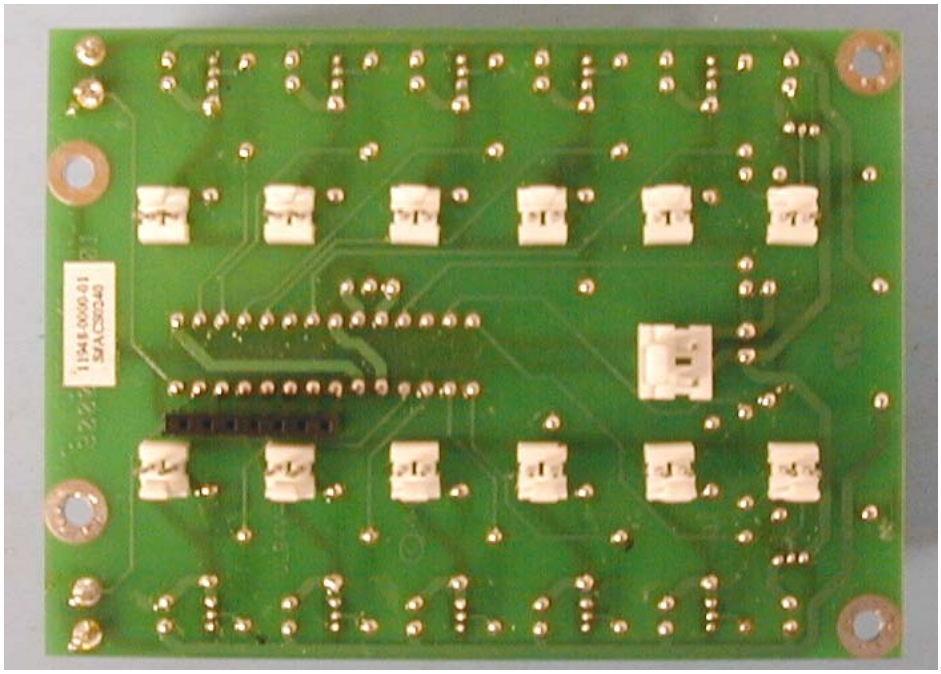


Figure 4

Step 1 Cart Assembly

1.1. If necessary, cut an 8" piece of the plastic channel cover to create the top channel cover. Make a centered top and bottom notch as shown in **Figure 1**. Set it aside for later.

Figure 1

1.2. If necessary, cut a 7.5" piece of the plastic channel cover to create the bottom channel cover. Make a centered top and bottom notch as shown in **Figure 2**. Set it aside for later.

Figure 2

1.3. Remove the top column mount (10679-0011-07) from the Surigmed ESA Cart (10679-0011-01) by removing the 4 Allen screws using a 5mm hex key.

1.4. Remove the storage drawer from the drawer unit with top shelf (10679-0011-04) by pulling the drawer all the way out, pressing tabs near front underside of drawer (see **Figure 3**), and then lifting the drawer from its rails.

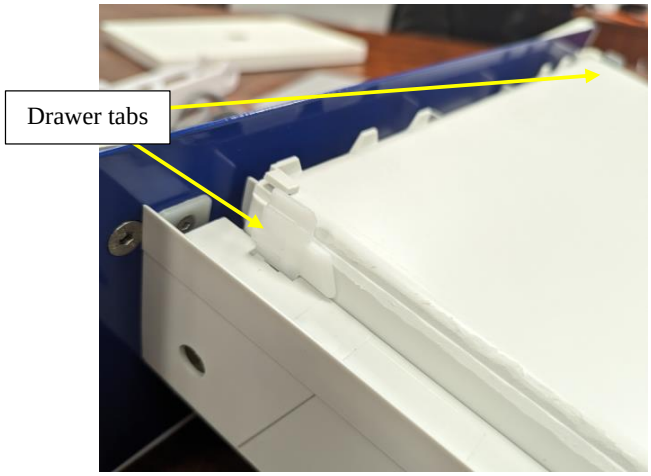


Figure 3

1.5. Remove the two Allen screws (5mm hex key) from underside of top shelf of drawer unit (see **Figure 4**) to remove the drawer unit from column.

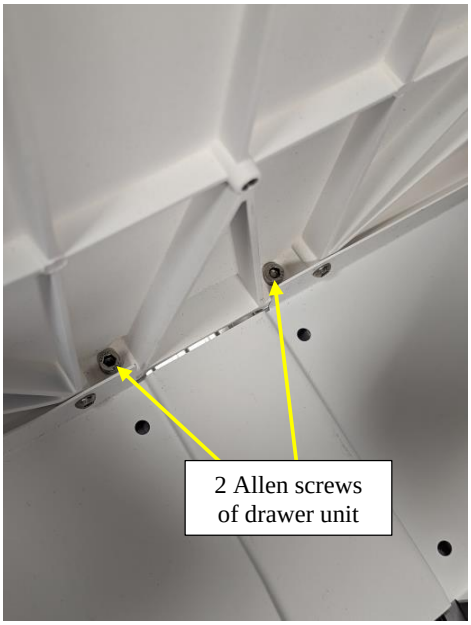


Figure 4

1.6. Drill two holes on the bottom side of the top shelf portion of the drawer unit using a #16 (0.1770") drill bit. See **Figure 5** for drill hole locations.

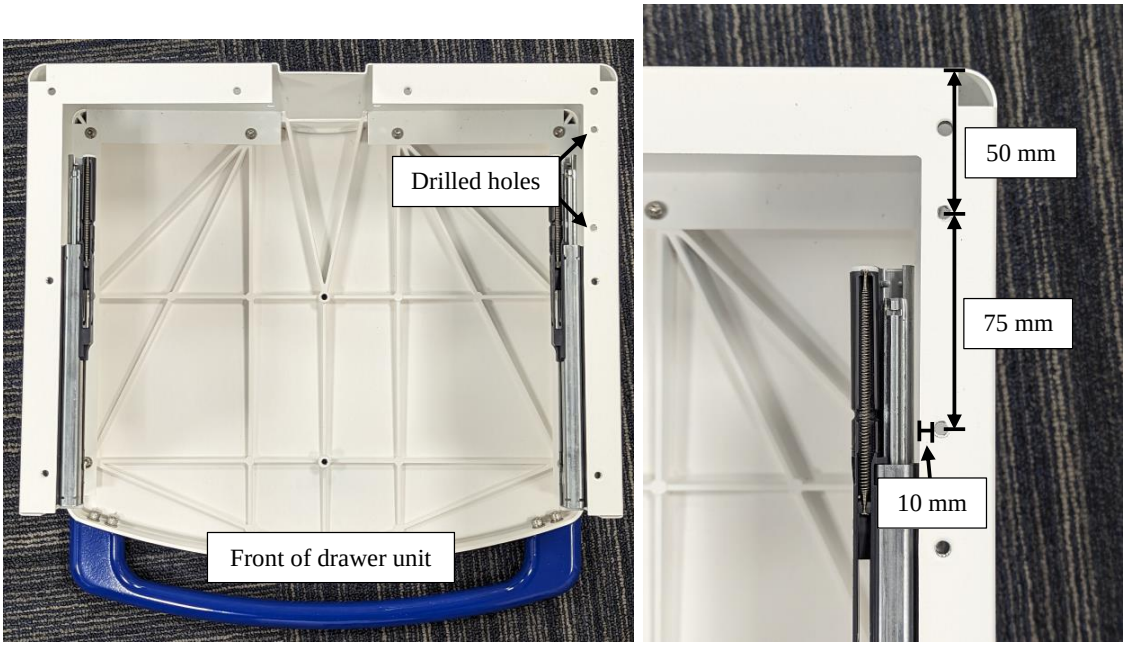


Figure 5

1.7. Drill two holes, one on each drawer rail, as shown in **Figure 6** using a #27 (0.1440") drill bit.

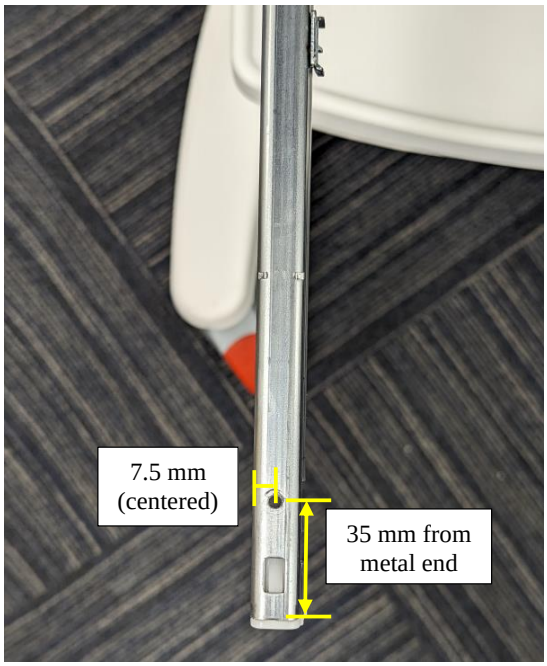


Figure 6

1.8. Reattach drawer to the rails of the drawer unit. Mark the center of the previously drilled holes and then drill two holes into the drawer at hose marks using a #33 (0.1130") drill bit.

1.9. Drill two holes on top side of the top column mount using a #36 (0.1065") drill bit. See **Figure 7** for drill hole locations.

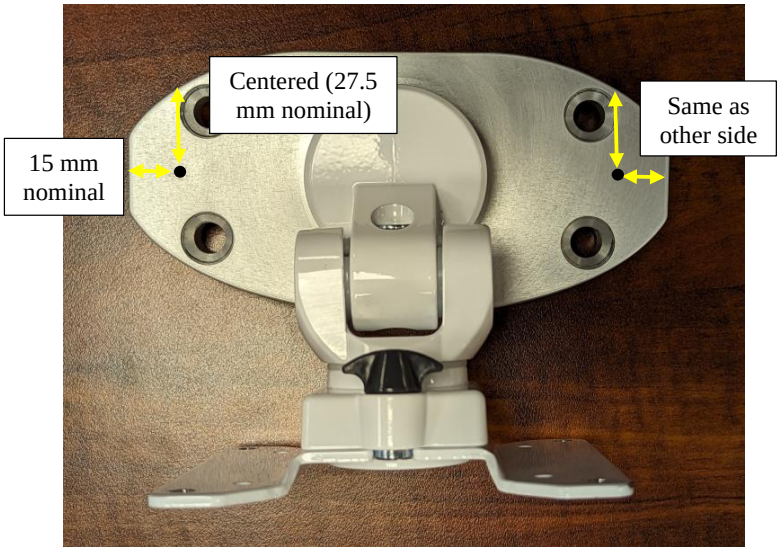


Figure 7

1.10. Remove the middle plastic channel cover from the column.

1.11. Take the med grade power strip (10357-0005-02), and loosely attach (2) M6 T-slot nuts (20003-9006-03), (2) M6x1mm, 16mm, button head screws (20097-0032-04), and (2) 3/8" long nylon spacers (20059-0006-01) to the mounting holes of power strip (see **Figure 9**). Place the AC power cord of the power strip through column and out the bottom of the cart. As shown in **Figure 8**.

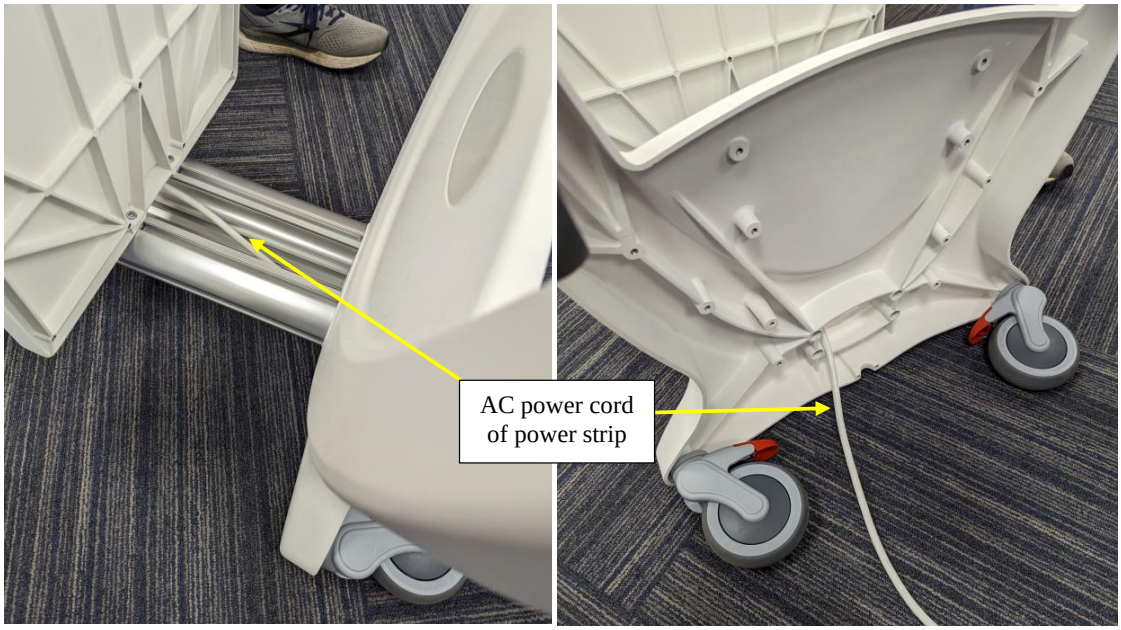


Figure 8

1.12. Slide power strip down the column with the t-slot nuts in the center channel of the column. Ensure that the power cord is routed in the right-side channel. Place power strip centered between the cart base and the bottom shelf (10679-0011-03) (see **Figure 9**). Tighten the button head screws to hold power strip in place.

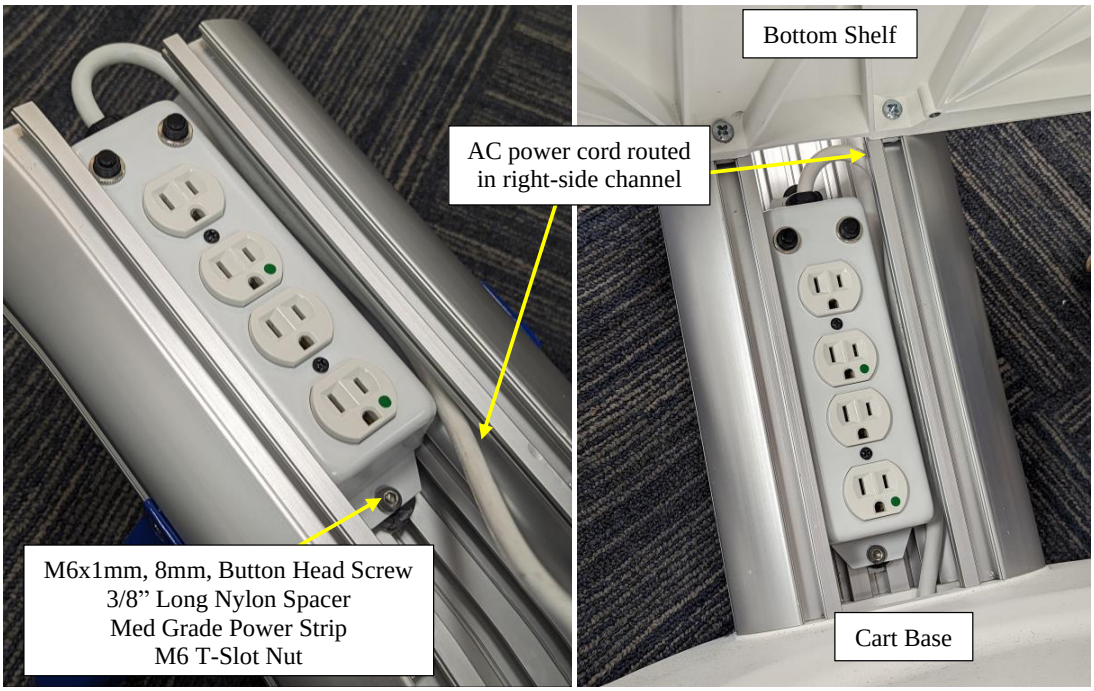


Figure 9

1.13. Attach the strain relief (10679-0011-09) to bottom of cart using the provided screws while routing the AC power cable of the power strip through it (see **Figure 10**).

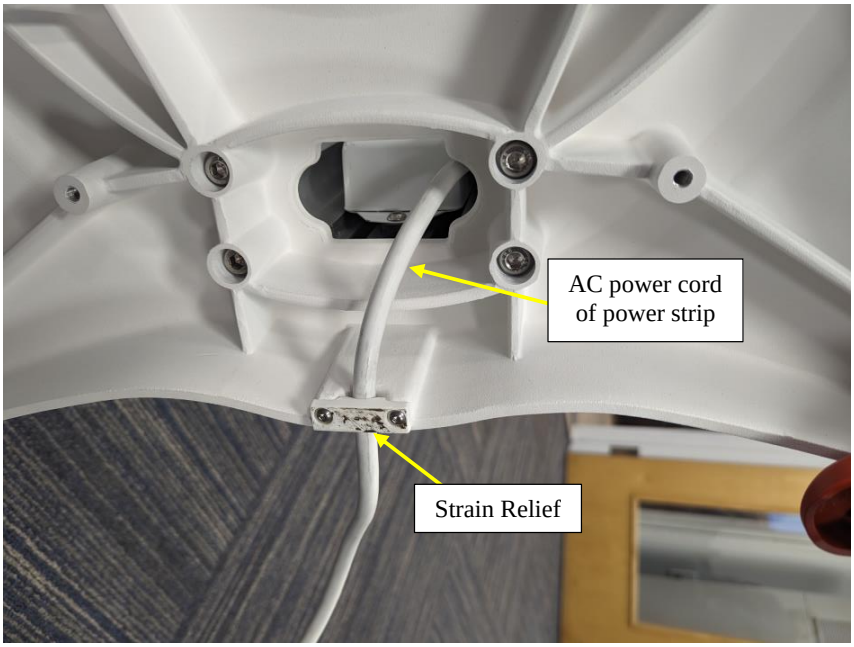


Figure 10

1.14. Mount the USB Dock mounting plate (10383-0004-02) to bottom of the top shelf of the drawer unit in previously drilled holes (step 1.6) using (2) 8-32x½" screws (20016-0008-01), 8-32 lockwashers (20002-0832-01), and 8-32 nuts (20003-0832-01) (see **Figure 11**).

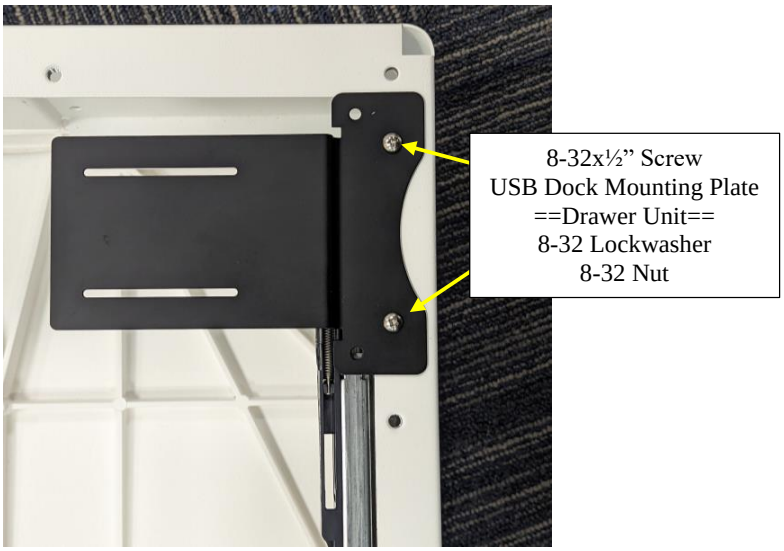


Figure 11

1.15. Mount the USB Dock (10383-0004-01) to the USB dock mounting plate using the two supplied screws that came with the plate. Use the mounting holes on the bottom of the USB dock. The side of the dock with the Ethernet, USB A, and power in ports should be facing outwards as shown in **Figure 12**.

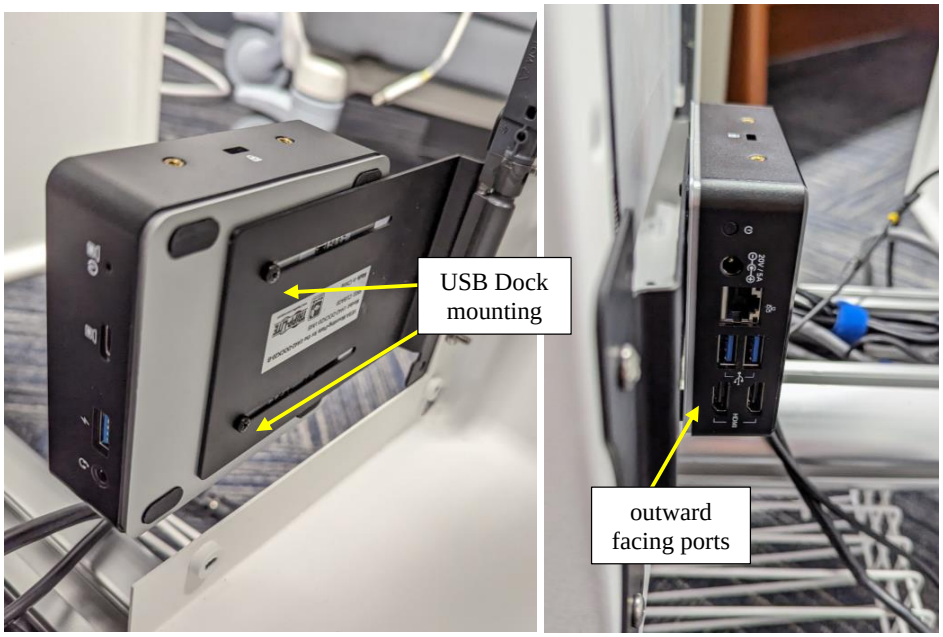


Figure 12

1.16. Take the med grade line cord (10629-0003-01), leave 10" free on both ends then wrap and secure remainder of line cord inside channel above bottom shelf with 6" Velcro (10683-0003-01) as shown in figure. Connect male plug end to second outlet of power strip (see **Figure 13**).

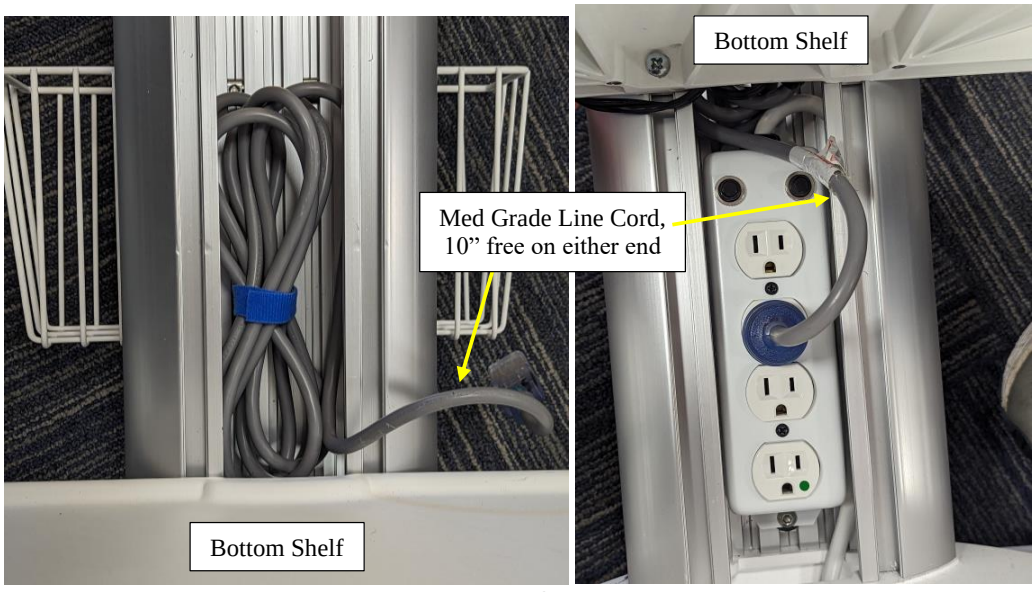


Figure 13

1.17. Insert the NEMA 1-15 to C7 power cord (10629-0011-01) into the med grade AC adapter (10378-0005-01). Attach the 4 pin DIN to 2.5 plug adapter (10378-0005-02) to DIN connector end of the AC adapter as shown in **Figure 14**. Leave 19" free at the

power cord end and 15" free of the 2.5 plug end, wrap the rest inside the channel with the AC adapter above the med grade line cord as shown in **Figure 16**.

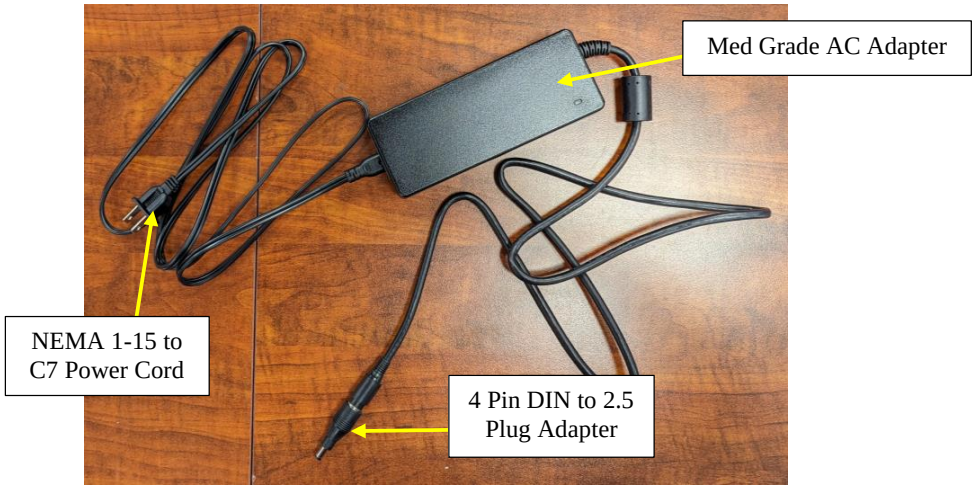


Figure 14

1.18. Pass the power cord end down through channel and connect it to top outlet of power strip (see **Figure 15**).

Figure 15

1.19. Take the 6' USB cable (10326-0006-01) and leave 14" free on the USB B end and 13" free on the USB A end. Wrap and secure the remainder of the cable inside channel above bottom shelf with 6" Velcro as shown in **Figure 16**.

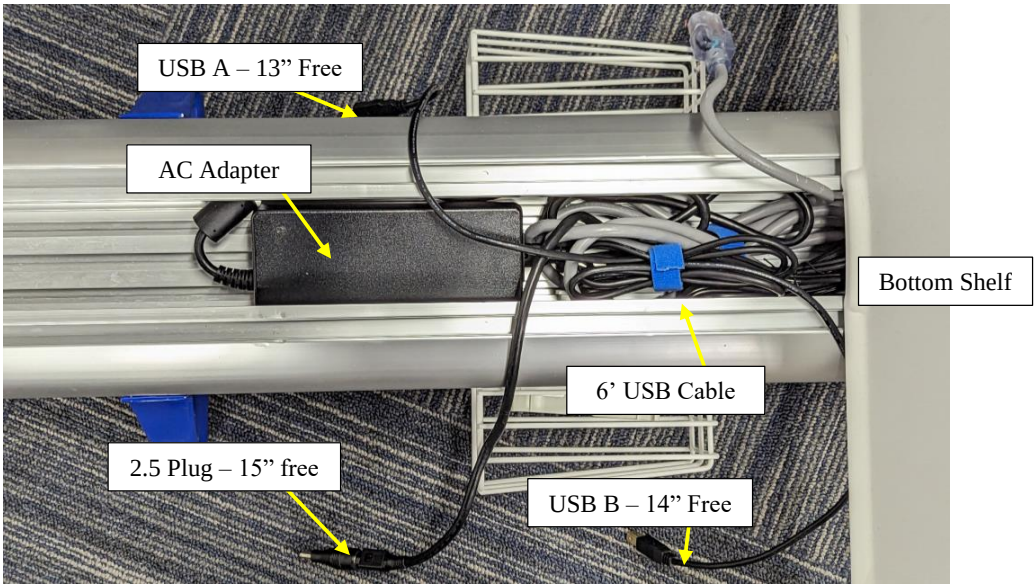


Figure 16

1.20. Reinstall the top shelf of drawer unit into the column. The top of shelf should be 8" from the top of the column. Make sure it is level.

1.21. Place the drawer on the drawer rails, insert a #6x3/8" sheet metal screw (20100-0006-01) into each drill hole.

1.22. Route the USB C to Right Angle USB C cable (10326-0010-01) into the column channel behind the drawer unit. Leave 7" free on the straight end of the cable. The right-angle end of the cable should be at the top of the cart.

1.23. Connect the 2.5 plug end of the AC adapter, the USB A end of the USB cable, and the straight end of the USB C cable to USB dock as shown in **Figure 17**.

Figure 17

1.24. Reattach the top column mount (from step 1.3) to the top of the column of the cart.

1.25. Insert the (2) 6-32x3/8" thumb screws (20051-0006-01) into the drilled holes of the top column mount.

1.26. Place the 2 channel covers, the Doppler gel holder (40002-2047-01), and the 2 hose hooks (10660-0001-01) inside the drawer.

1.27. Type out the part number and serial number on the Serial Number Label (20007-0000-01) and place it inside the drawer unit, behind the drawer as shown in **Figure 18**.

Figure 18

Step 1 Assembly

1.1. Computer & Chassis Mounting

1.1.1. Starting from the top of the drawer unit (part of 11976-0000-01, hereinafter "cart"), feed the USB cable from keyboard (10304-0006-01 from 11987-0000-01) down the column, behind the drawer unit, and connect to the inward facing USB A port on the USB dock as shown in **Figure 1**.

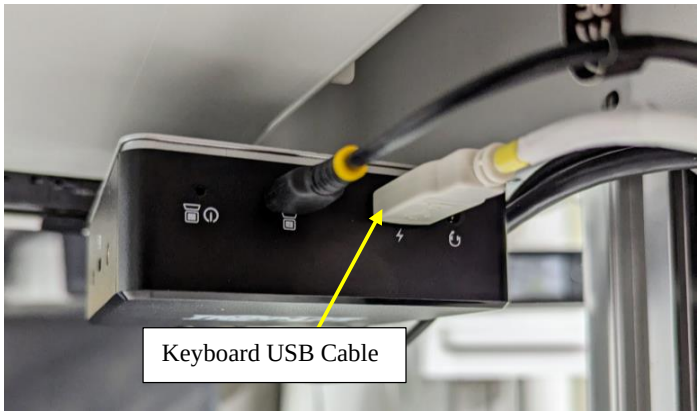


Figure 1

1.1.2. Place keyboard on top shelf of cart and store excess cable inside the channel.

1.1.3. Attach bottom column cover of cart, routing the 2.5 plug end of the AC adapter cable, USB A end of chassis USB cable, keyboard cable, and straight end of USB C cable through the top notch and the line cord and USB B end of the chassis USB cable through the bottom notch as shown in **Figure 2**.

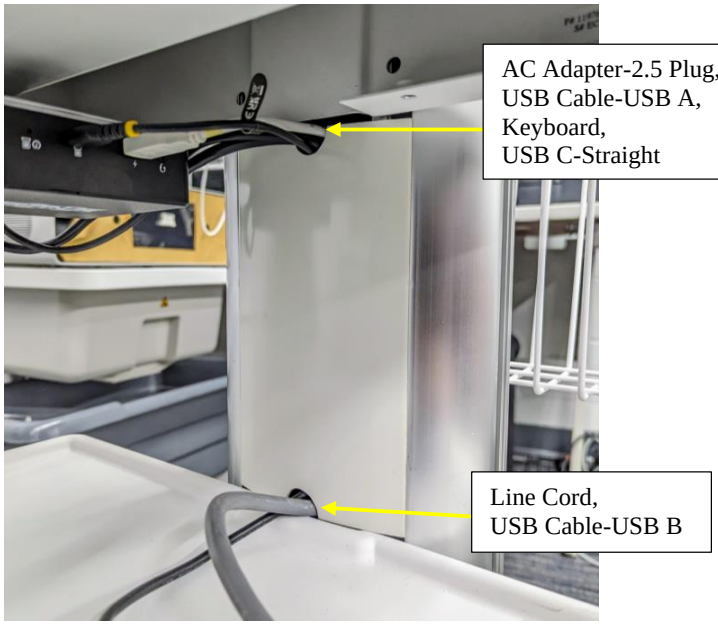


Figure 2

1.1.4. Remove 8 screws from the back side of computer case (10353-0005-02) to separate the front and back halves. Remove the power button cover on the case. See **Figure 3** for reference.

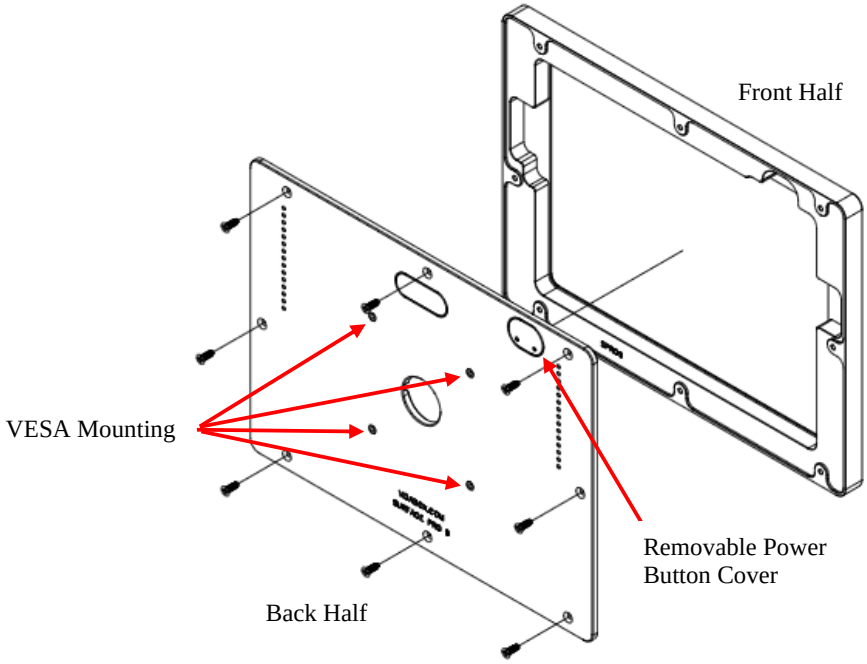


Figure 3

1.1.5. Route the right-angle USB C cable from the cart, through the opening in the back half of the case. Connect the USB C cable to the top USB C port of the touch panel computer (10353-0005-01). Place computer in front half of the case with the screen facing out. See **Figure 4** for reference.

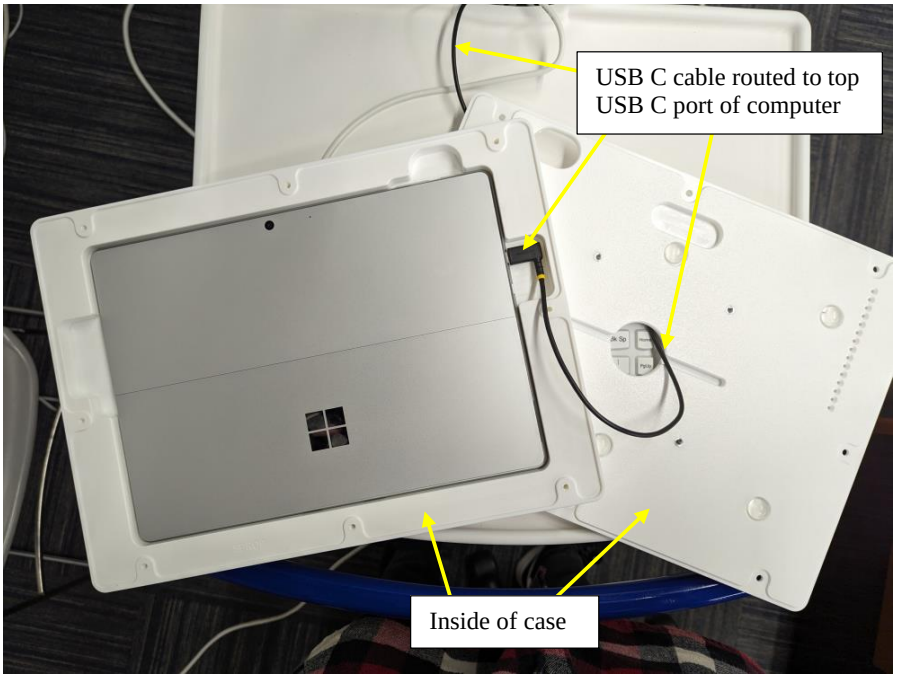


Figure 4

1.1.6. Ensuring the USB C cable is routed towards the center of the case as shown in **Figure 5**, close the case and reattach 6 of the provided screws, leaving the top left and top center open.

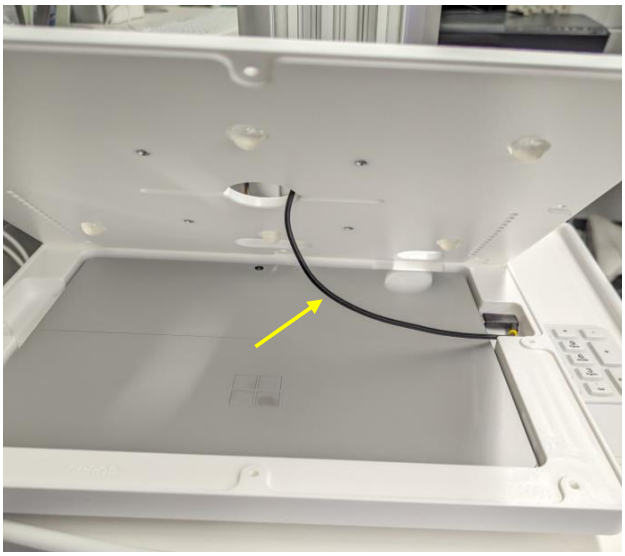


Figure 5

1.1.7. Use (2) 8-18x5/8" Thread Forming screws (20179-0010-03) to mount the Doppler/PPG holder (40001-1005-03) to the top left and top center holes as shown in **Figure 6**.

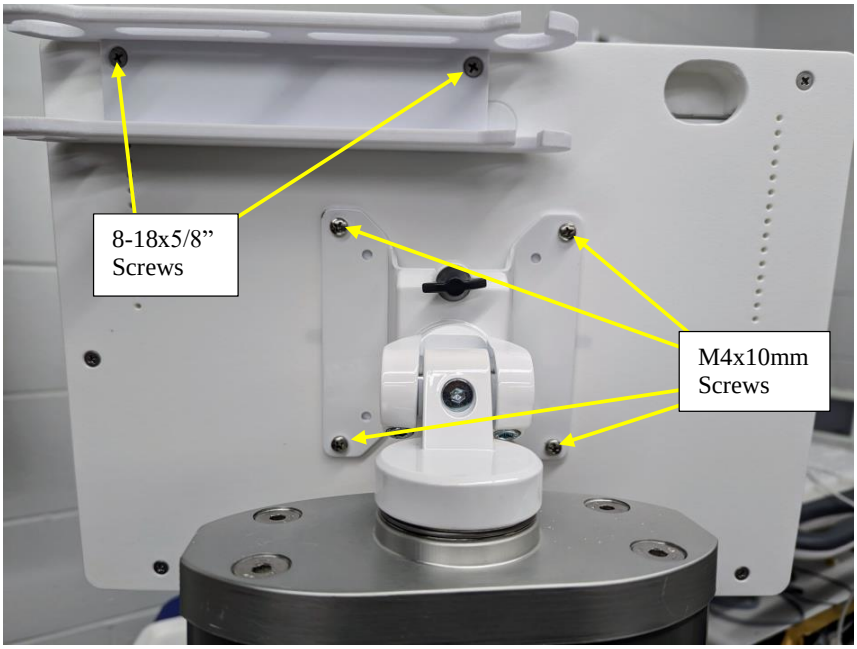


Figure 6

1.1.8. Using the VESA mounting holes on the back of the computer case (see **Figure 3**), mount the case to the Display Mount of the cart using the (4) M4x10mm screws (20095-0020-01) as shown in **Figure 6**.

1.1.9. Put the Roodra chassis (11983-0000-01) on the bottom shelf of the cart. Connect the med grade line cord and the USB cable of cart to the back side of the chassis as shown in **Figure 7**.

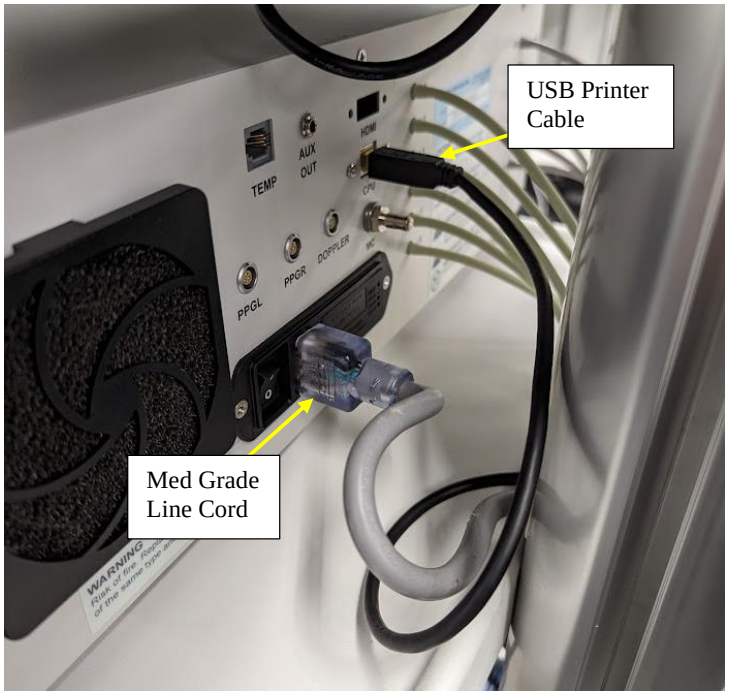


Figure 7

Step 2 Software Setup

2.1. Connect the main AC power cord of the system to power. Ensure there is **NO** network cable connected to the system.

2.2. Turn on the computer, the Windows setup process will begin.

2.3. On the first setup screen that appears, hit Shift + F10 on keyboard to bring up command prompt. Type OOBE\BYPASSNRO and hit enter. The computer will then reboot.

2.4. Once back to the first setup screen complete each setup option by selecting the following (if applicable):

- Language: English
- Region: United States
- Keyboard: US
- Skip second keyboard
- Connect to a network: choose "I don't have internet". Then on the next screen select "Continue with limited setup".
- Accept License Agreement
- Device Username: ESA
- Leave password blank and click Next
- Privacy Settings: Disable all options

2.5. When you reach the Desktop, connect a network cable to the ethernet port on the USB dock of cart as shown in **Figure 8**.

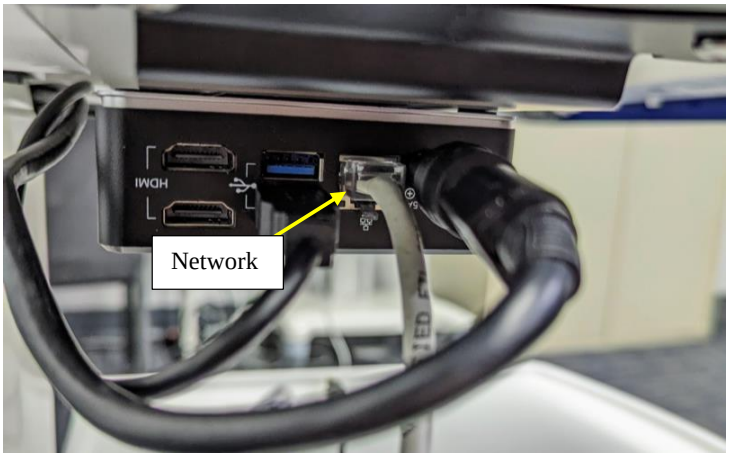


Figure 8

2.6. Navigate to **Start – Settings – System – Power & Battery**. Select **Screen and sleep** and change all options to **Never**.

2.7. Navigate to **Settings --- Windows Update--- Check for updates**. Perform the necessary updates and any restarts to the computer as necessary, repeatedly checking after each restart until there are no more updates. When the updates are completed, you may continue to the next step.

2.8. Navigate to **Settings – System – Display**. Under display resolution, set scale to **100%** and resolution to **1920 x 1200**.

2.9. Navigate to **Settings – Time & Language – Typing**. Select **Touch keyboard** and next to **Show the touch keyboard**, select **Never**.

2.10. Navigate to **Settings - Personalization - Themes - Desktop icon settings**. In the new window that appears, check the box next to Computer then click **Apply --- OK**. Close all open windows, there should be a "This PC" icon located on the desktop now.

2.11. Type **Terminal** in search box and open the terminal app. Click the down arrow at the top and select **Settings**. In the Startup tab, select **Command Prompt** for the default profile and select **Windows Console Host** for the default terminal application. Click **Save** and close the window.

2.12. Right click on the Desktop and select **New --- Folder**. Name the folder **PDF**.

2.13. Press **Crtl + Shift + Esc** on the keyboard to bring up the Task Manager. Select **Startup Apps**. **Disable** every item that is listed. Close the window when done.

2.14. Right click on the speaker icon on the taskbar and select **Open Volume Mixer**. Turn the System Sounds volume down to below 10 and turn the Speakers volume to 100. Close the window when finished.

2.15. Unpin any icon that you can from the taskbar that is not Microsoft Edge or File Explorer. To do this right click the icon and select **Unpin from Taskbar**.

2.16. Open a file explorer window. In the address bar near the top of the window enter:

ftp.unetixs.com

2.17. Double click on the following folders, **pub - multilab**. Check with DMR 11399-00xx-0x to verify that the software revision levels on the FTP site match the current DMR documents. Write down the software revision levels onto the QA Record (11977-0005-01).

2.18. Copy the following installers to the desktop:

- 11399-0000-01 S2 Installer
- 11399-0001-01 DICOM Installer
- 11399-0002-01 Ancillary Installer

2.19. Navigate to **pub – cust**. Copy the **Print Win10** to the **Documents** folder.

2.20. Run the DICOM Installer. Select **Yes - English - Continue - Continue - Continue - OK**.

2.21. Run the S2 Installer. Select **Yes - English - Continue - Continue - Continue - Setup - Install - close the explorer window - OK**.

2.22. Run the Ancillary Installer. Select **Yes - English - Continue - Continue - check the ESA box - Next - OK**.

2.23. Click and drag any icon on top of the S2WIN icon and a window should appear.

2.24. Click **Next** to go through the System Data and make the following changes if necessary:

- Print Control: -
- Start Menu: 4
- Touch Type: 11
- DIO Type: 0
- DIO OUT Port: 0
- DIO IN Port: 0
- Vascular Port: 5
- IR Remote Enabled: 2
- IR Remote Port: 0
- AUTO Cuff Select: 2
- Vascular Module: 3
- Button Color: 1
- Exp. Control 2: C:\programs\unetpdf
- Export Path 2: C:\Users\ESA\Desktop\PDF\
- Export Code 2: 192
- Export Name: PDF File
- Import Control: C:\programs\dicommwl
- Import Code: 131

Click **Exit** when finished.

2.25. Click **Start** and type "run", then press **Enter**. A window entitled "Run" should appear as shown in **Figure 9**.

2.26. Type **shell:startup** into the "Open:" field. Select **OK**. A File Explorer Window named "Startup" should open.

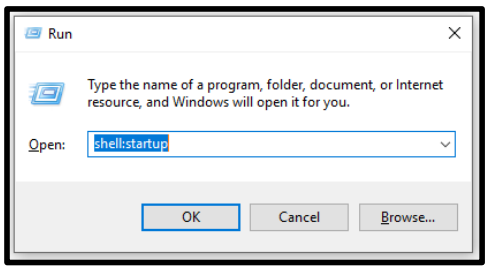


Figure 9

2.27. Copy the **S2WIN** icon on the desktop and paste it into the startup window. The S2WIN application should now appear in the window. Close the window.

2.28. Right click on the **My PC** icon and select **show more options** – **Manage - Device Manager**. Turn on the chassis and check that a new COM port appears (will be labeled USB Serial Device). If the new port is labeled as COM5, you may move on to the next step.
If not, right click on the new COM port and select **properties**. Navigate to the **Port Settings** and select **Advanced**. Set the **COM Port Number** to **COM5**. Click OK on both windows and then close the manager window. Then power cycle the chassis.

2.29. Double click the **S2WIN** icon and verify that it says "Vascular: OK" at the top.

2.30. Click **Setup --- Yes --- Diagnostics --- Reindex Archive --- Full & Compress**. When the process is finished, exit back to Main Menu.

2.31. Click **Setup --- Yes --- Configure Studies**. Press **Alt + Enter** on the keyboard to exit full screen mode.

2.32. Right click the logo in the upper left corner, then left click **properties**. See **Figure 10** for reference.

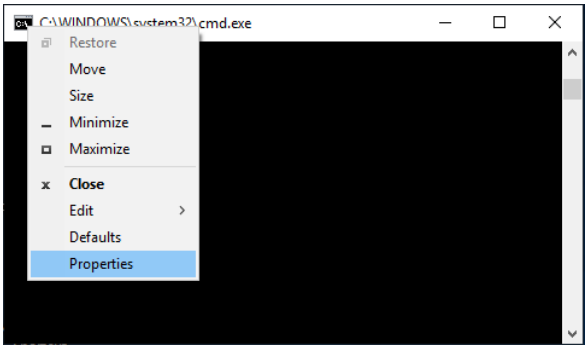


Figure 10

2.33. Open the **Options** tab. Under the "Edit Options" and "Text Selection" sections, make sure all the boxes are NOT checked.

2.34. Once finished click **OK**. Press **ESC** key until you reach the Desktop.

2.35. Delete the 3 installers copied from the ftp site from the Desktop. Right click the Recycle Bin and select **Empty Recycle Bin --- Yes**.

2.36. Restart the Computer.

2.37. Connect the USB flash drive (10383-0001-01 from 11989-0000-01) to the free USB A port on the USB dock.

2.38. Open Windows Explorer and navigate to **C:/programs/Logo**. Run the **ToThumb** batch file. A command window will pop up and run the file. It will give a success message when complete, then press any key to continue and close the window. Close Windows Explorer.

2.39. Eject the flash drive from the computer. Turn off the Roodra chassis. Insert the flash drive into the USB A port on the back side of the Roodra chassis.

2.40. Turn the Roodra chassis on. A command window will appear on the chassis display saying searching for USB. It will find the USB and then the logo folder and logo on it. It will then replace the logo and once complete will say to power cycle the Roodra chassis. Turn off the Roodra chassis. Remove the flash drive from the back of the chassis. Turn the Roodra chassis back on and the new logo will appear on the display.

Step 3 DICOM (11952-0000-01) Installation

3.1. Double click the **Unetixs DICOM** icon on the Desktop.

3.2. Click the **Identifier tab**. Enter the ESA Serial Number "MLS2Exxxx".

3.3. Click on **Generate Product Code**. Write down the letters of the given product code and make sure it consists of 8 letters. DO NOT PRESS ANY KEYS.

3.4. Bring this Product Code and the Serial Number to Engineering to obtain a passcode and license number. Once obtained, move the cursor to enter this passcode. DO NOT CLICK ENTER.

3.5. Click on **Set Machine UID**.

3.6. The license number that Engineering gave will appear in the UID field. Click OK. If it does not appear, repeat step 3.3 through 3.5.

3.7. Enter the license number on the Device Record (11977-0002-01) as a Lot Number.

Step 4 Test

4.1. Test the ESA Final Assembly and all applicable accessories per Test/Calibration Procedure 11977-0006-01.

Step 5 Accessories & Labels

5.1. Attach the Magnetic strip (20072-0002-01 from 11989-0000-01) to the Remote control (10377-0000-01 from 11989-0000-01) per SOP-30-028 and then place it in the Storage Drawer.

5.2. Place the remaining items of the Basic Accessory Kit (11989-0000-01) and the Roodra Accessory Kit (11987-0000-01) in the Storage Drawer.

5.3. Type in the Model Number and Serial Number on the Series 2 Serial Label (40002-2040-05) per SOP-30-003 and apply it on the left side of the drawer unit as shown in **Figure 11**.

Figure 11

5.4. Create an UDI per SOP-30-026 and SOP-30-003 and apply it to the other side of the drawer unit as shown in **Figure 12**.

Figure 12

5.5. Place the Computer Label (40003-3000-01) centered on the front bottom of the computer case as shown in **Figure 13**.

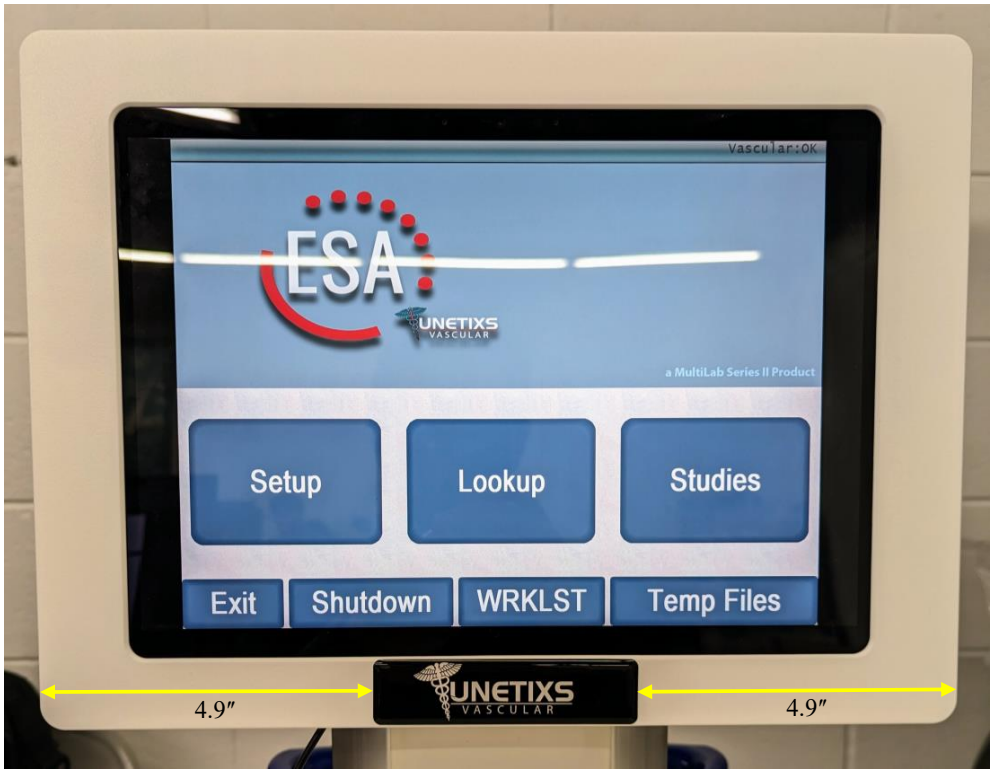


Figure 13

1. Computer/Keyboard

1.1. Turn the Roodra Chassis and the Touch Panel Computer on. Verify that the Unetixs Main Menu screen loads and displays **Vascular: OK** on the top right corner.

1.2. Click **Setup --- Yes --- Diagnostics --- About**. Record the S2 software version number below and on the QA record if applicable.

S2 software version: _____

1.3. Press **ESC** until the S2WIN program closes and you reach the desktop.

1.4. From the system tray, right click on the **Volume** icon. Click **Open Volume Mixer**. Ensure that the system sounds volume is set below 10. Close this window and return to Desktop.

1.5. Double click on the **MLS2 Instructional Video** icon. Click on any entry from the menu to verify speakers are operational. Select **Quit**.

1.6. On the Windows Desktop, touch various points of the screen and ensure the cursor follows your finger. Double tap on the **S2WIN** icon and ensure that the application loads. After verifying, click **Exit**.

1.7. Click **Start**. In the **Search** field, type **notepad** and press **Enter**.

1.8. Start pressing a few keys on the keyboard and verify the character pressed appear on the screen. Close the program, but do not save.

1.9. On the Windows Desktop, conduct a few operations to check if the trackpad works properly including the mouse tracking and the left and right buttons.

1.10. Plug the USB flash drive (10383-0001-01) into the free USB port of the USB hub. Verify that the USB drive can be seen by the computer, either by notification or via the File Explorer.

1.11. Connect a network cable to the ethernet port of the USB hub. Click on the internet icon on the taskbar. Ensure that an in-house Unetixs network is visible.

1.12. Launch Microsoft Edge. Enter "www.unetixs.com" into the address bar and ensure that the page loads. Close the browser when finished.

Step 1 tested by: _____

2. DICOM/PDF/USB Backup

2.1. From the Windows Desktop, double click **S2WIN**. Click **Worklist --- Name,** enter "A" and then click **OK**. Verify that the DICOM service company names show.

2.2. Click **Studies --- Lower Arterial Studies --- LA Segmental Pressure w/ PVR --- Exit --- Back --- Capture --- Exit --- Export --- Export Page**. Check the status to see if **Success** appears.

2.3. Click **Exit --- Export --- Right Arrow** to select **PDF File --- Export Page**. When finished exit back to Main Menu.

2.4. Plug the USB flash drive (10383-0001-01) into the free USB port on the USB hub.

2.5. Click **Setup --- Yes --- System Setup --- Backup – Backup Study Configuration --- Yes**. After a few seconds, the same screen will flash which means the backup file is created in the USB flash drive. Exit to Desktop.

2.6. From the Desktop, open File Explorer and navigate to the USB Drive and verify that the **s2stybk.zip** file is there. **Delete** this file from the USB flash drive.

2.7. Open the PDF folder on the desktop and ensure that the Test patient PDF file is inside. Delete all files in the folder.

2.8. Right click **Recycle Bin** and click **Empty Recycle Bin**. Close all open windows.

2.9. Double click **S2WIN**. Select **Lookup**. Verify that the patient study history window appears, and the log is empty with no errors. Exit back to Main Menu.

Step 2 tested by: _____

3. Accessories Check

3.1. Check that each accessory operates correctly with the system:

Part Number	Description	Pass/Fail
11962-0000-01	Ass'y, TruDop 5 Doppler (TD5)	
11963-0000-01	Ass'y, TruDop 8 Doppler (TD8)	
11928-0000-01	Ass'y, Left Finger Clip (LFC)	
11929-0000-01	Ass'y, Right Finger Clip (RFC)	
11930-0000-01	Doppler Cable Ass'y, Straight VP (VPC)	
11938-0000-01	Ass'y, Left Green PPG (LGP)	
11939-0000-01	Ass'y, Right Yellow PPF (RYP)	
11951-0000-01 10346-0000-01	Ass'y, CP-105 Temp Gun (TMP) (optional) Cable, Telephone (optional)	
11980-0000-01	Ass'y, Left 6 Tube Aqua 8´ Hose (SAH)	
11981-0000-01	Ass'y, Right 6 Tube Grey 8´ Hose (SGH)	
11966-0000-01	Ass'y, ACS Bleed Valve (ABV)	

Step 3 tested by: _____

4. IR/Remote Test

4.1. From the Main Menu, click **Studies --- Lower Arterial Studies --- LA Segmental Pressures w/ PVR --- Exit – Right Brachial Pressure --- Back**.

4.2. Insert batteries into the **Remote Control** (10377-0000-01) and test it, verifying that all buttons work. Then remove the batteries from the Remote Control and put them back in the battery container. Exit to Main Menu.

4.3. Exit to Main Menu. Click **Temp Files --- Delete --- Yes**. Do this for all study files.

4.4. Click **Exit --- Shutdown**.

Step 4 tested by: _____

5. Cart Inspection

5.1. Inspect everything cosmetically.

5.2. Ensure all 4 wheels move freely.

5.3. Ensure all 4 wheel locks function properly.

5.4. Ensure the drawer slides freely.

5.5. Ensure that the display mount can tilt and swivel with the Touch Panel Computer mounted securely.

5.6. Ensure all cart components that are attached to the column are secured in place.

Step 5 tested by: _____

6. Earth Leakage Test

6.1. Record the control number and calibration due date of the Electrical Safety Analyzer.

Control #: _____ Due Date: _____

6.2. Turn Electrical Safety Analyzer on. Push **Setup**, scroll to Standard and press **Enter**. Select IEC60601-1, push **Enter**. Set GFCI to 10 mA. Set Polarity Delay set to 1 sec.

6.3. Connect power cord of the ESA Final Assembly to the Equipment Outlet on the Electrical Safety Analyzer as shown in Figure 1. Ensure Doppler probe, PPG probes, and Temp Gun (if applicable) are connected to chassis.

Figure 1

6.4. Push **µA** button to access the Leakage Current main menu.

6.5. Push the **function button** that corresponds to the **Earth** leakage test to enter the test.

6.6. Push **Polarity** button to switch the polarity of the mains voltage applied to the test receptacle between Off, Normal, and Reverse. Push **Neutral** button to open and close the neutral connection.

Perform all combinations in the table below and record the leakage current for each. Compare the measured leakage to the allowable leakage for each combination and record Pass (P) or Fail (F).

	Polarity	**Neutral**	**Measured Leakage**	**Allowable Leakage**	**Pass / Fail**
1	Normal	Closed		≤10000µA	
2	Normal	Open		≤10000µA	
3	Reverse	Closed		≤10000µA	
4	Reverse	Open		≤10000µA	

Step 6 tested by: _____

End of Test/Calibration

Pass/Fail: _____

Test/Calibration Performed By: _____ Date: _____

Step 1 Cart Assembly

1.1. Attach the two weights from the 25lbs weight kit to the bottom of the cart base using the provided hardware as shown in **Figure 1**.

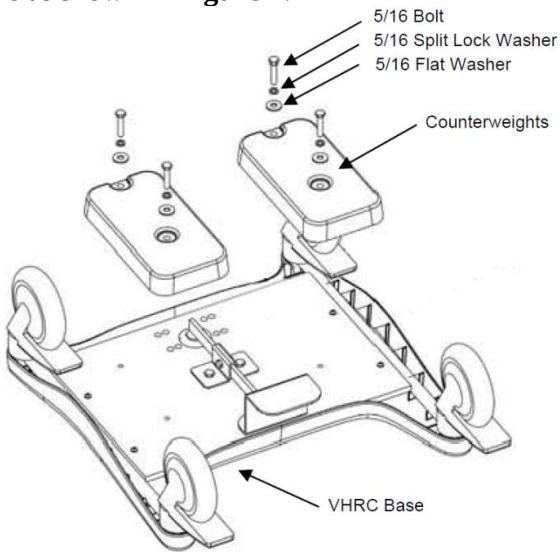


Figure 1 – 25lbs Counterweight Installation

1.2. Attach the 10lbs weight to the two previously installed weights on the bottom of the base using the hardware provided as shown in **Figure 2**.

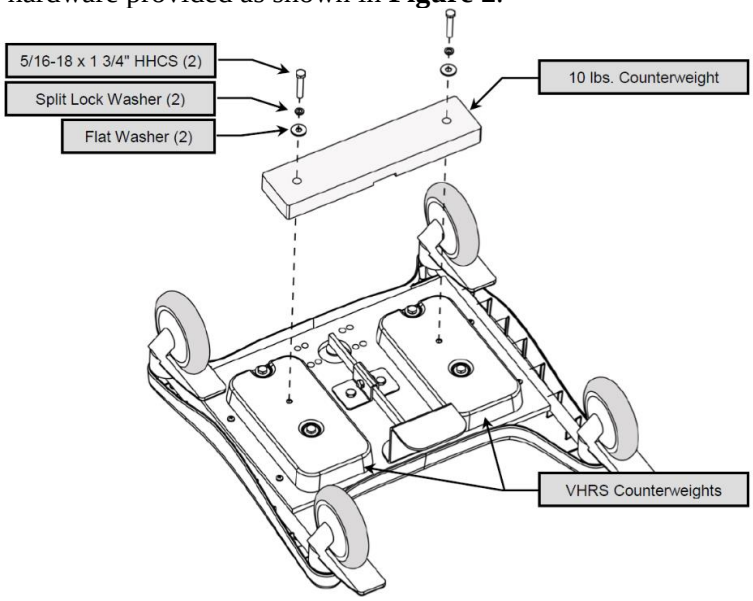


Figure 2 – 10lbs Counterweight Installation

1.3. Attach the column to the base using the hardware provide with 10679-0010-01 as shown in **Figure 3**.

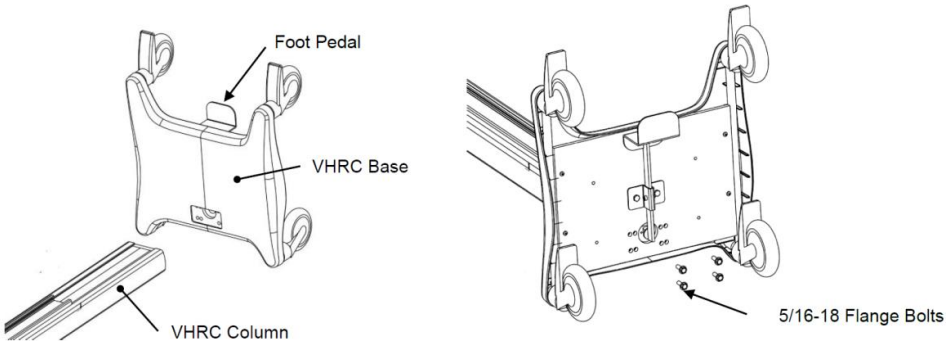


Figure 3 – Column/Base Attachment

1.4. Remove the top plate from the column using a Philips head screwdriver. Remove the plastic cap off the sliding track on the column and set it aside for now.

1.5. Attach each component to the front and back of the column as per **Figure 4**. When installing any piece on to the column, be sure to loosen the set screws first so the bracket can easily slide down the column. Slide each piece into place based on the dimensions in **Figure 4**. Secure each piece in place by tightening the set screws with the wrench provided. Also ensure each piece is straight and level when installed. See steps 1.6 to 1.9 for specific installation instructions.

Note: Front view measurements are based on the adjustable channel. All distances are based on the channel slide of each part.

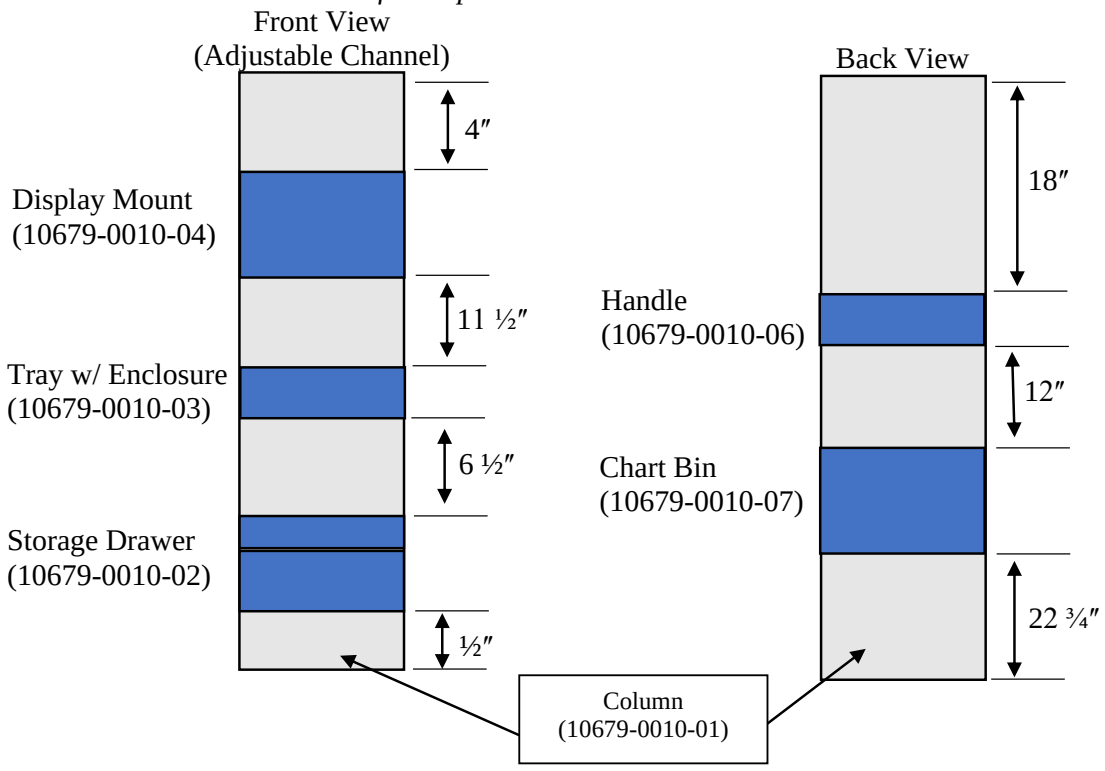


Figure 4 – Cart Assembly Diagram

1.6. When installing the Storage Drawer, first secure the drawer half then secure the tray/cover half level with the drawer half as shown in **Figure 5**.

Figure 5 – Storage Drawer Installation

1.7. When installing the Tray w/ Enclosure, slide it down channel to the proper position and tighten the screw underneath as shown by **Figure 6**.

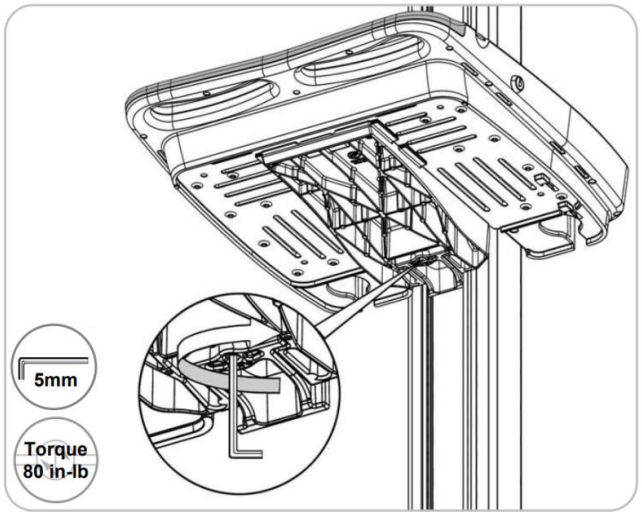


Figure 6 – Tray w/ Enclosure Mounting

1.8. When installing the Display Mount, first install the adjustable stop followed by the Display Mount. Tighten both into place. See **Figure 7** for reference.

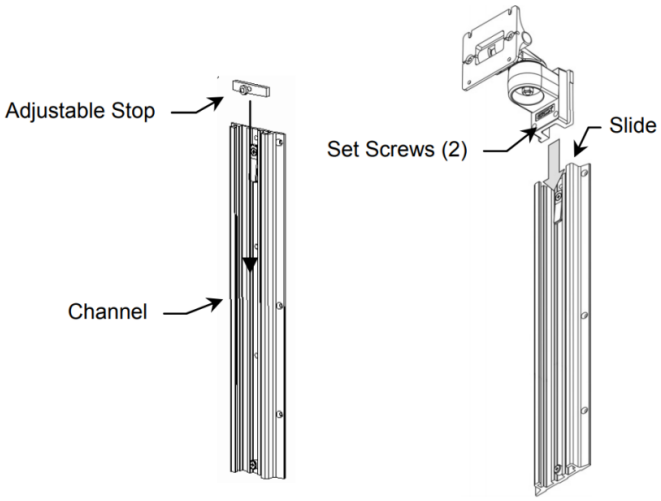


Figure 7 – Display Mount Installation

1.9. When installing the Chart Bin, first secure the channel slide to the appropriate position, then attach the cleat to the channel slide using the hardware provided. Finally snap the chart bin onto the cleat. See **Figure 8** for reference.

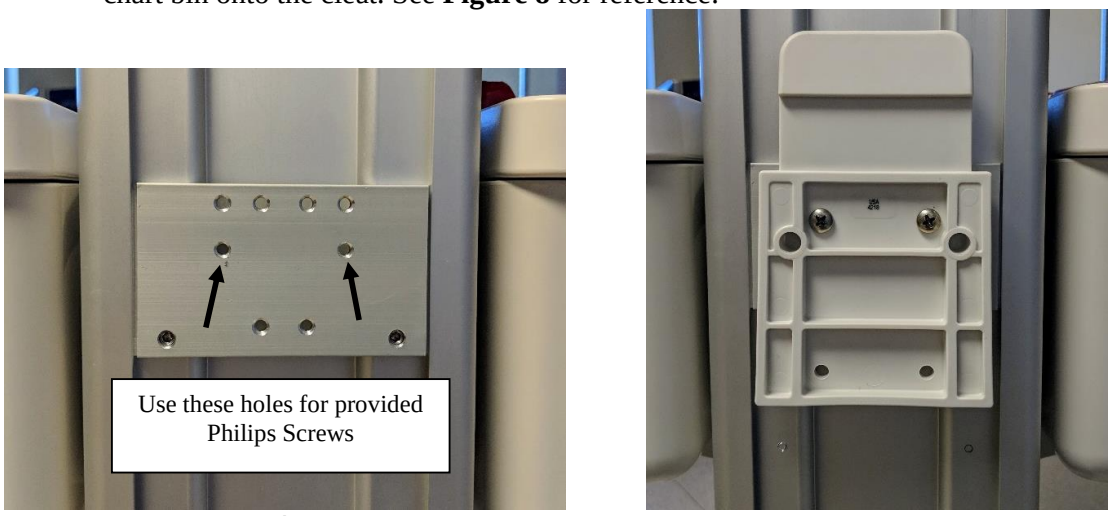


Figure 8 – Chart Bin Installation

1.10. Attach the Hose Hanger on the top of the column in place of the top plate using the original screws. Reattach the plastic cap on top of the adjustable channel of the column.

1.11. Attach the Cable Clip Cover from the Display Mount kit to the adjusting column above the Tray w/ Enclosure. See **Figure 9** for reference.

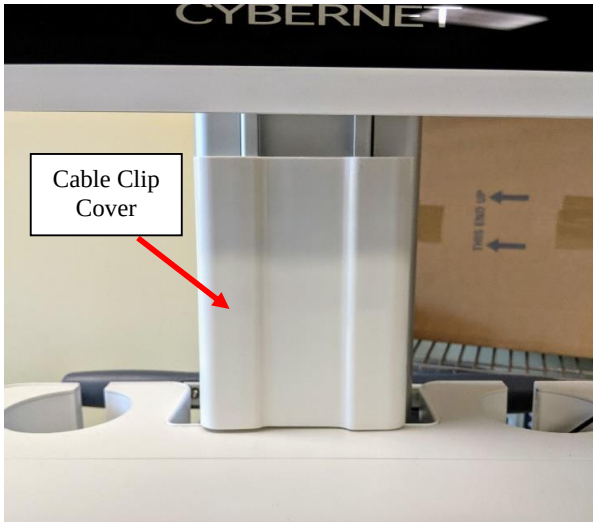


Figure 9 – Cable Clip Cover Install

1.12. Place the hardware from the Display Mount kit into the drawer to be used in the Final Ass'y procedure (11986-0003-01) to mount the computer.

1.13. Place all tools that came with each cart piece for installation into the drawer.

1.14. Place the USB Cable, Cat 6 Net Patch Cable, Power Strip, Line Cord, Doppler/PPG holder, and Velcro into the drawer for later assembly.

1.15. Drill a hole into through the bottom of the Tray w/ Enclosure in the back-right corner, using a 1 1/4" (32mm) hole saw. Clean the hole and enclosure of any loose pieces of plastic.

1.16. Screw in the CAT 6 Coupler into the hole so the bottom end of the coupler is towards the back of the cart. See **Figure 10** for reference.

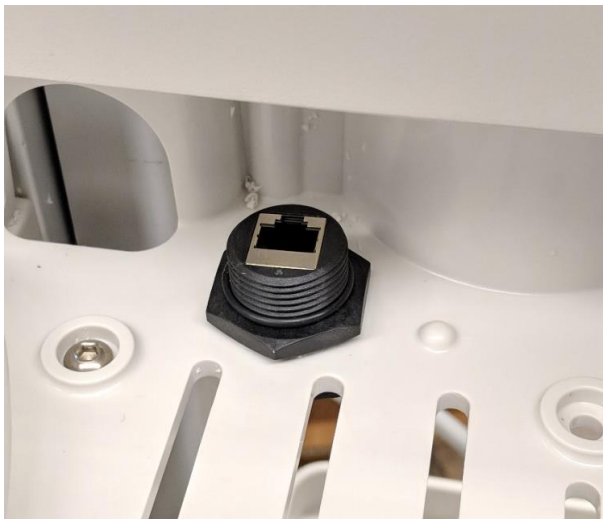


Figure 10 – CAT 6 Coupler Mount

1.17. Type out the part number and serial number on the Serial Number Label (20007-0000-01) and place it inside the Tray w/ Enclosure as shown in **Figure 11**.

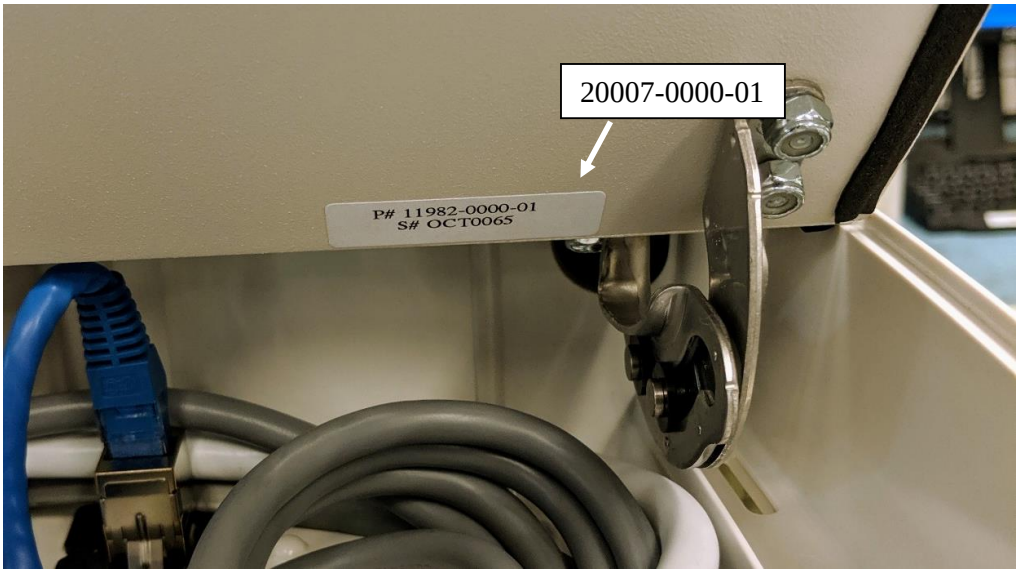


Figure 11 – Cart Serial Label Placement

Step 1 Cable Assemblies

1.1. Speaker assembly – Right and Left

1.1.1. The following parts are needed to assemble the left and right speakers:

Description	Item Number	QTY	Length
Conn. .100" Housing 2 pin Wire Connect	10516-0002-01	2	N/A
Speaker 3 ¼" Rnd.	10609-0002-01	2	N/A
Black Wire – 18 AWG	10706-0001-01	1	20" Length
Black Wire – 18 AWG	10706-0001-01	1	26" Length
White Wire – 18 AWG	10706-0002-01	1	26" Length
Yellow Wire – 18 AWG	10706-0004-01	1	20" Length

1.1.2. Solder the wires and connectors to the speakers from the table above according to **Figure 1**.

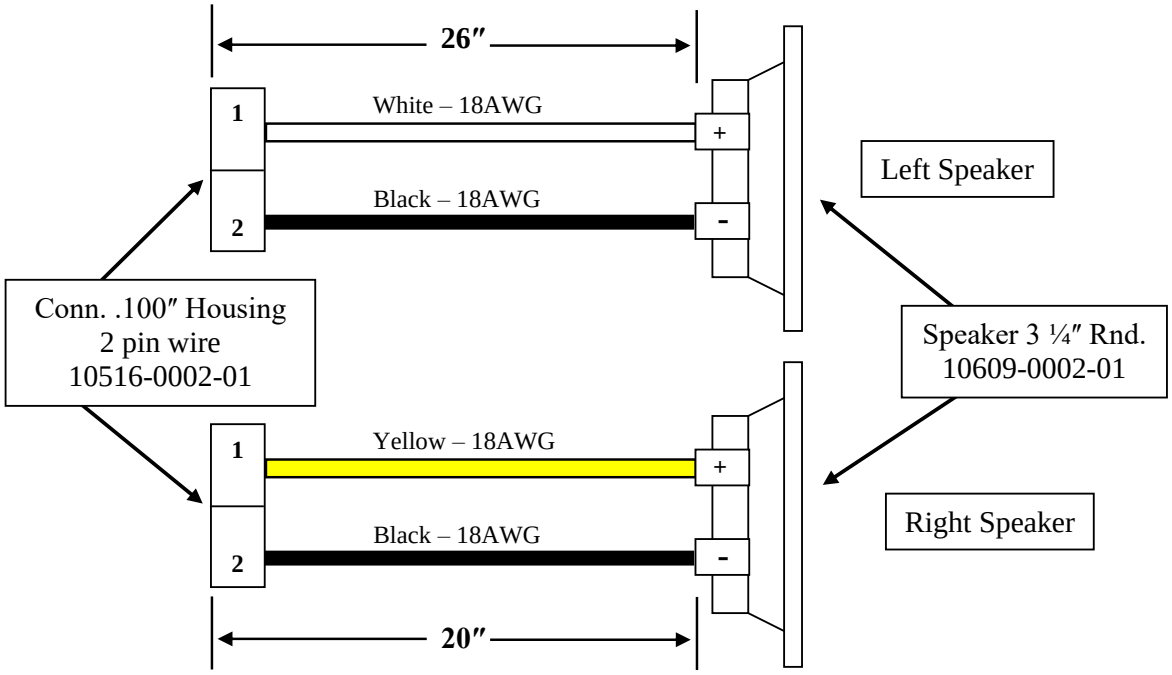


Figure 1 – Speaker Wiring

1.1.3. Set the left and right speaker assemblies aside for later installation in step 5.2.

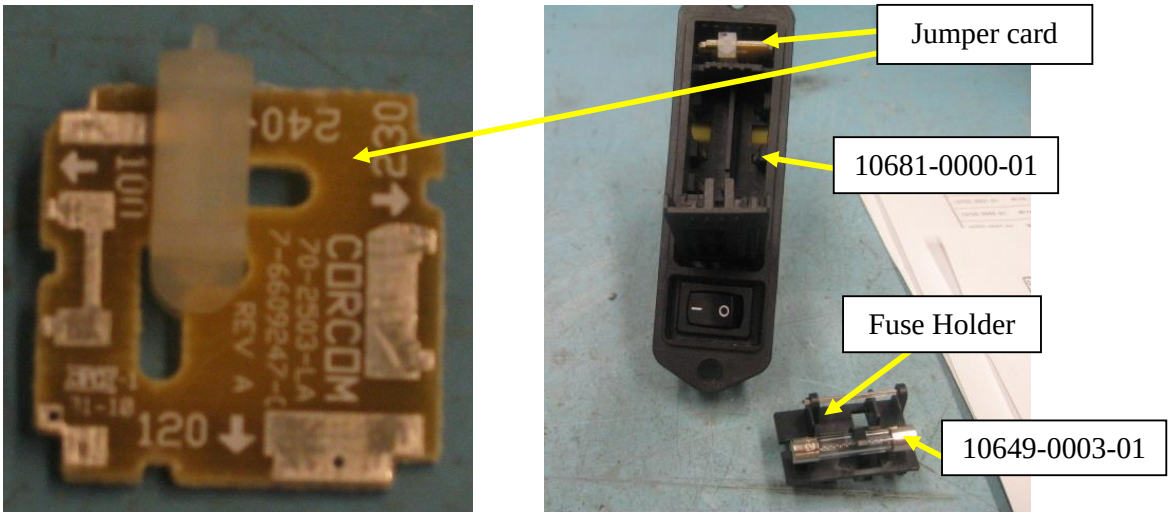
1.2. Power Entry Assembly

1.2.1. The following parts are needed to assemble the power entry assembly:

Description	Item Number	QTY	Length
Conn. .156" Housing 3 pin	10503-0003-01	1	N/A
Ring Terminal, #8, insulated	10548-0008-01	3	N/A
Heat Shrink Tubing 1/8", Black	10621-0002-01	2	1" Length
Fuse, 3 Amp 3AG	10649-0003-01	1	N/A
Power Entry Module Series 2	10681-0000-01	1	N/A
Blue Wire – 18AWG	10706-0006-01	1	15" Length
Brown Wire – 18 AWG	10706-0008-01	1	15" Length
Green/Yellow Wire – 18 AWG	10706-0009-01	1	15" Length
Green/Yellow Wire – 18 AWG	10706-0009-01	1	23" Length
Green/Yellow Wire – 18AWG	10706-0009-01	1	5" Length
Tie Wrap 4"	20008-0004-01	2	N/A

1.2.2. Remove the jumper card from the Power Entry Module. Set it to 120V as shown in **Figure 2**. Reinsert it back into the Power Entry Module.

1.2.3. Remove the fuse holder and install a 3 Amp 3AG Fuse, as shown in **Figure 2**. Replace the fuse holder, with fuse back, into Power Entry Module (Fuse towards the inside).



Jumper card orientation Power Entry Module disassembled

Figure 2 – Power Entry Module

1.2.4. Cut 15" pieces of 18AWG wire in brown, blue, and green/yellow. Cut a 20" piece of green/yellow 18AWG wire. Strip one of the blue and brown wires ¼". Strip both ends of the green/yellow wires ¼".

1.2.5. Cut another 5" piece of green/yellow wire and strip both ends ¼".

1.2.6. Terminate on end of the three green/yellow wires with three #8 Ring Terminals.

1.2.7. Crimp un-stripped end of the brown and blue wires into the 3 pin .156" Housing. Blue to pin 3 and brown to pin 1.

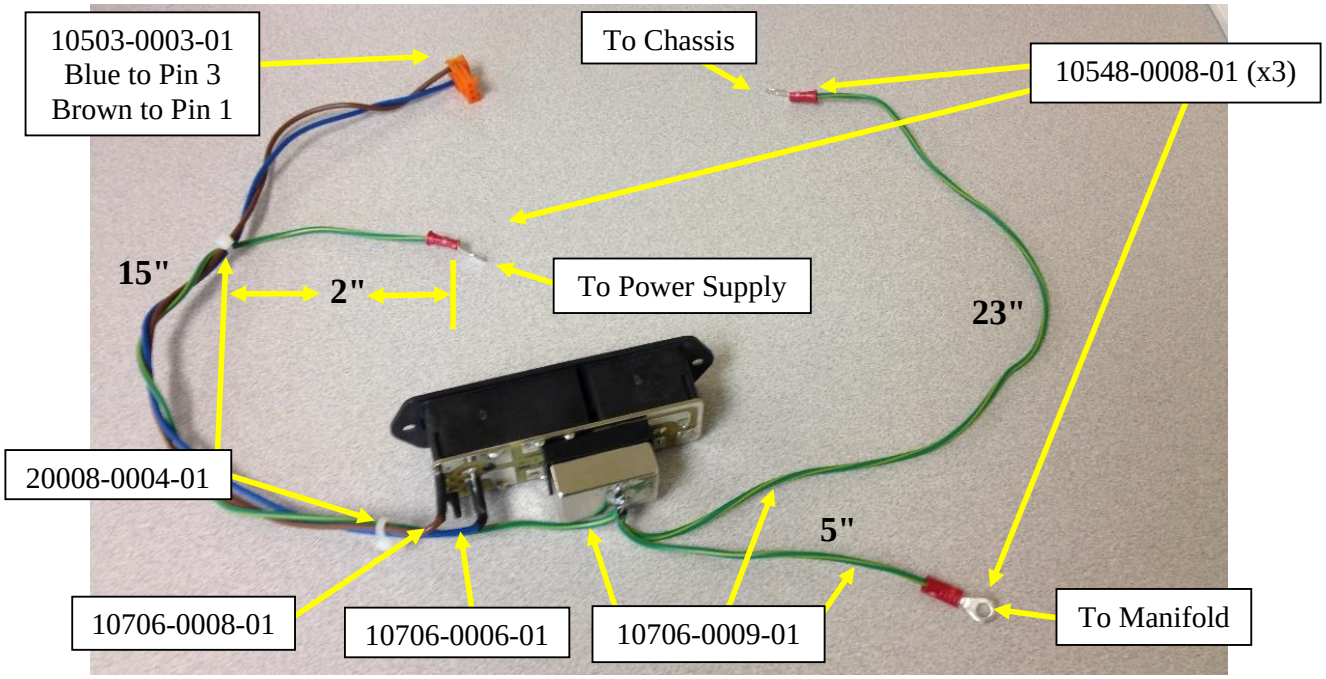


Figure 3 – Power Entry Module Wiring

1.2.8. Tin the other ends of all (5) wires.

1.2.9. Solder all three Green/Yellow wires to the ground terminal of the Power Entry Module as shown in **Figure 4**.

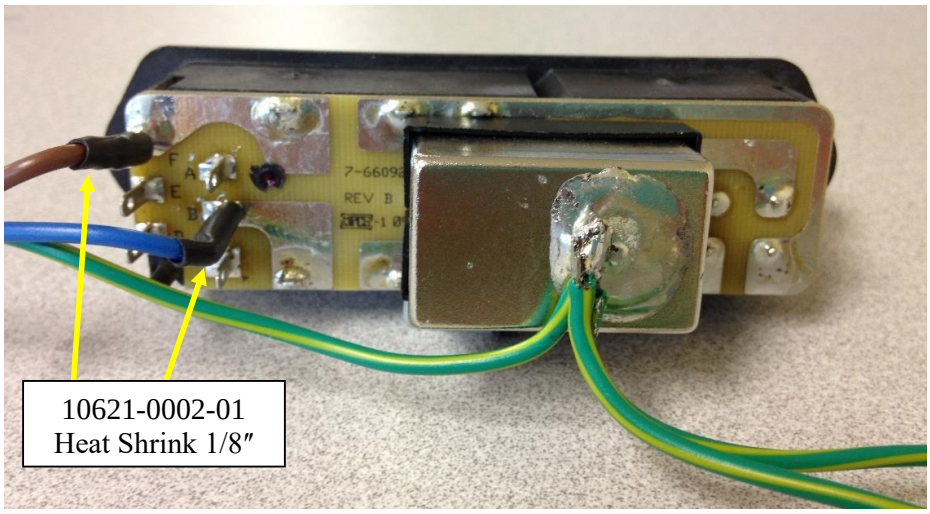


Figure 4 – Power Entry Module Soldering

1.2.10. Cut a 1" piece of 1/8" Heat Shrink Tubing and place it over the Blue Wire. Solder the Blue Wire to position "B" on the Power Entry Module as shown in **Figure 4**. Seal the Heat Shrink.

1.2.11. Cut a 1" piece of 1/8" Heat Shrink Tubing and place it over the Brown Wire. Solder the Brown Wire to position "F" on the Power Entry Module as shown in **Figure 4**. Seal the Heat Shrink.

1.2.12. Attach two 4" Tie Wraps connecting the three 15" wires together. Place the tie wraps two inches from the Ring Terminal and 6 inches from the first tie wrap as shown in **Figure 3**.

1.3. Temperature Cable Assembly

1.3.1. The following parts are needed to assemble the temperature cable assembly:

Description	Item Number	QTY	Length
Conn. .100" Housing 4 pin Wire Connect	10516-0004-01	1	N/A
4pin Phone Jack w/ wires	10528-0003-01	1	N/A
Heat Shrink Tubing 1/16", Black	10621-0001-01	4	½" Length
Black Wire – 26 AWG	10703-0001-01	1	9" Length
Red Wire – 26 AWG	10703-0003-01	1	9" Length
Yellow Wire – 26 AWG	10703-0004-01	1	9" Length
Green Wire – 26 AWG	10703-0005-01	1	9" Length

1.3.2. The phone jack module comes with four 6" wires already attached; however, each wire must be extended by 9" to route properly in the chassis. Strip and tin ¼" from one end of each of the 9" wires.

1.3.3. Solder each tinned wire to the corresponding color wire on the phone jack.

1.3.4. Slide a ½" length of heat shrink over each of the four solder joints and shrink into place.

1.3.5. Crimp the free end of the wires into the AMP 4 Pin connector as shown in **Figure 5**.

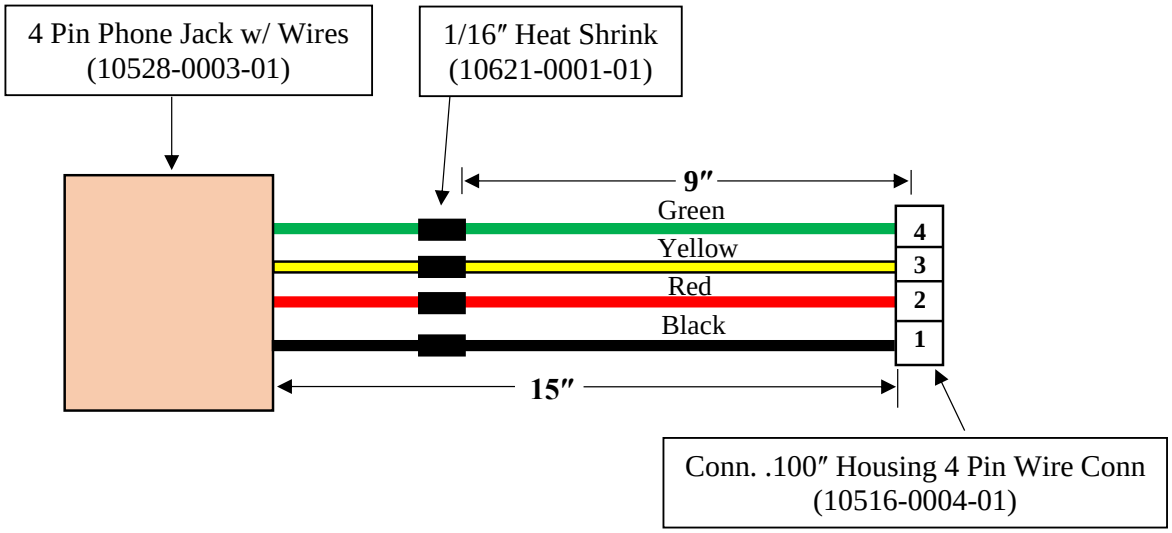


Figure 5 – Temperature cable assembly diagram

1.3.6. Set the temperature cable assembly aside for later installation in step 4.3.

1.4. Control Cable Assembly (ACB to Motherboard)

1.4.1. The following parts are needed to assemble the control cable assembly:

Description	Item Number	QTY	Length
Conn. .100" Header 6p. w/ lckng ramp	10504-0006-01	1	N/A
Conn. .100" Housing 6 pin Wire Connect	10516-0006-01	1	N/A
Heat Shrink Tubing 1/16", Black	10621-0001-01	6	½" Length
Black Wire – 26 AWG	10703-0001-01	1	20" Length
White Wire – 26 AWG	10703-0002-01	1	20" Length
Red Wire – 26 AWG	10703-0003-01	1	20" Length
Yellow Wire – 26 AWG	10703-0004-01	1	20" Length
Green Wire – 26 AWG	10703-0005-01	1	20" Length
Blue Wire – 26 AWG	10703-0006-01	1	20" Length

1.4.2. Solder one end of the wires into the 6 pin connector. On the other end place the heat shrink and then crimp into the 6 pin header. Assemble according to **Figure 6**.

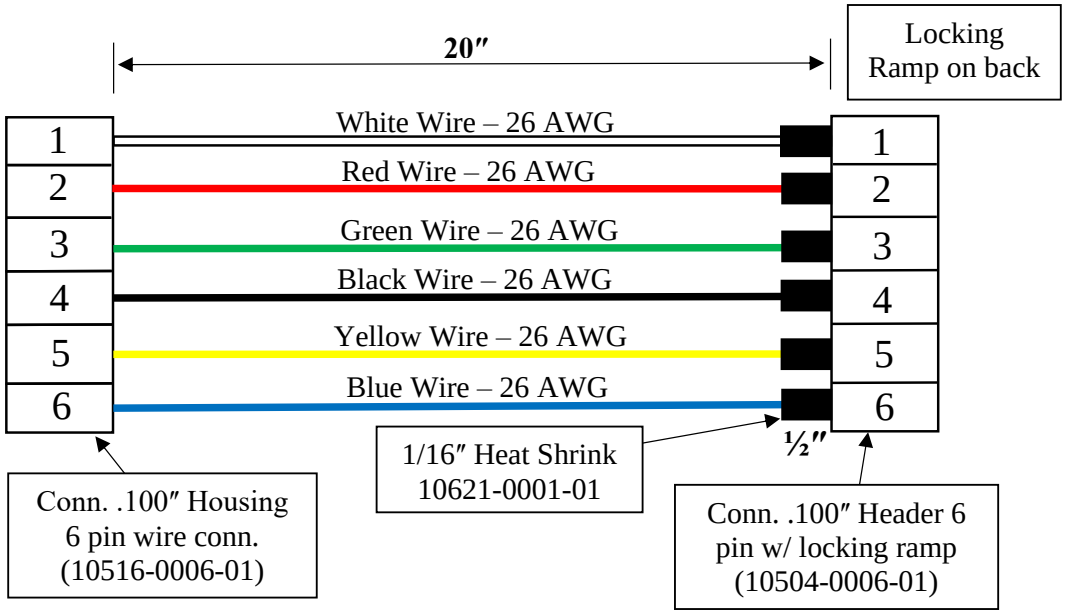


Figure 6 – Control Cable Assembly Diagram

1.4.3. Set the cable aside for later installation in step 4.9.

1.5. PPG Cable Assembly

1.5.1. The following parts are needed to assemble both PPG Lemo cable assemblies:

Description	Item Number	QTY	Length
Conn. .100″ Housing 4 pin Wire Connect	10516-0004-01	2	N/A
Conn. 3 Pin Panel Mount Lemo	10517-0003-01	2	N/A
Heat Shrink Tubing 1/16", Black	10621-0001-01	6	¼" Length
Heat Shrink – 1/8", Black	10621-0002-01	2	1" Length
Wire, 4 Cond. 30 AWG	10701-0001-01	2	15"

1.5.2. Strip outer insulation on one side of the 4 conductor wire by ¾". Pull out white, red, green and black wires from the base of the braided shield. Cut off the green wire.

1.5.3. Strip the white, red and black wires by 1/8"and tin them.

1.5.4. Place a ¼" long pieces of 1/16" heat shrink tubing over each wire.

1.5.5. Solder the wires into the solder cups on the 3 pin panel mount LEMO connector as shown in **Figure 7**. Starting at key going clockwise: white, red, black.

1.5.6. Shrink the heat shrink into place over the solder joints.

1.5.7. Strip the outer insulation of Side 2 by ¾". Pull out the white, red, green and black wires from the base of the braided shield. Cut off the green wire.

1.5.8. Strip the White, Black and Red wires by 1/8" and tin them.

1.5.9. Tin the 4 pins on the 0.100 housing.
Note: You must mount the LEMO connector to the chassis before you attach the AMP connector. (Step 4.1)

1.5.10. Cut and slide a 1-inch piece of 1/8" shrink tubing over the wire.

1.5.11. Solder the white, black, red and shield wires into the housing as shown in **Figure 7**. Shrink the tubing down.

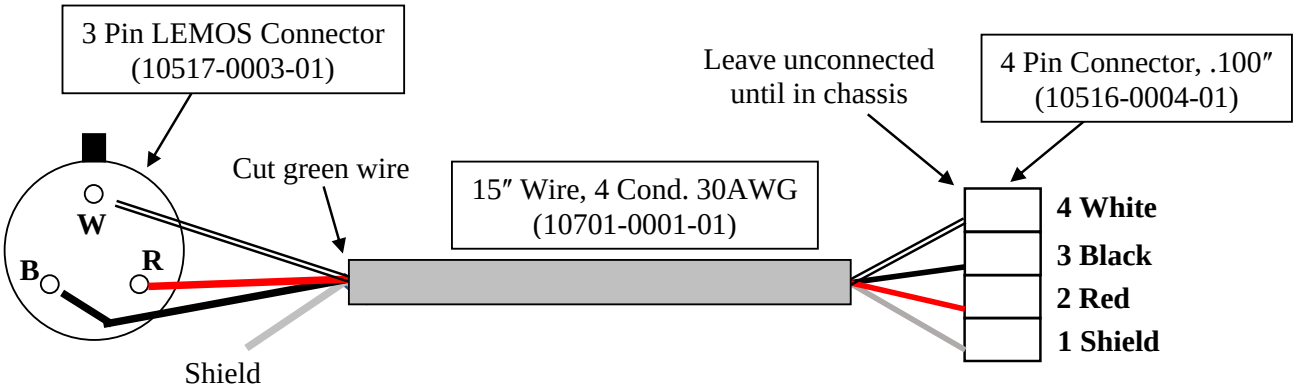


Figure 7 – Wire order on PPG LEMOS connector

1.5.12. Repeat step 1.5.2 thru 1.5.11 to produce a second cable. Verify that the heat shrink is in place.

1.5.13. Set both PPG cables aside for later installation in step 4.1.

1.6. Internal Doppler Cable Assembly

1.6.1. The following parts are needed to assemble the internal doppler cable assembly:

Description	Item Number	QTY	Length
Conn. .100" Housing 4 pin Wire Connect	10516-0004-01	1	N/A
Conn. 4 Pin Panel Mount Lemo	10517-0004-01	1	N/A
Heat Shrink Tubing 1/16", Black	10621-0001-01	4	¼" Length
Heat Shrink Tubing 1/8″, Black	10621-0002-01	1	1″ Length
Wire, 4 Cond. 30AWG	10701-0001-01	1	15" Length
Green Wire – 26 AWG	10703-0005-01	1	10" Length
Lug, Round Solder, 6-32, 22-26ga Wire	20009-1632-01	1	N/A

1.6.2. Strip outer insulation on one side of the 4-conductor wire by ¾". Pull out white, red, green, and black wires from the base of the braided shield. Cut off the green wire.

1.6.3. Strip the white, red and black wires by 1/8" and tin them.

1.6.4. Cut and strip a 10" piece of 26 AWG green wire. Strip ¼" on both sides.

1.6.5. Crimp the 6-32 Solder Lug to one end of the green wire.

1.6.6. Place (4) ¼" long pieces of 1/16" heat shrink tubing over each white, black, red and green wires.

1.6.7. Carefully solder the wires (including the green wire with lug) into the solder cups on the 4-pin panel mount LEMO connector as shown in **Figure 8.**

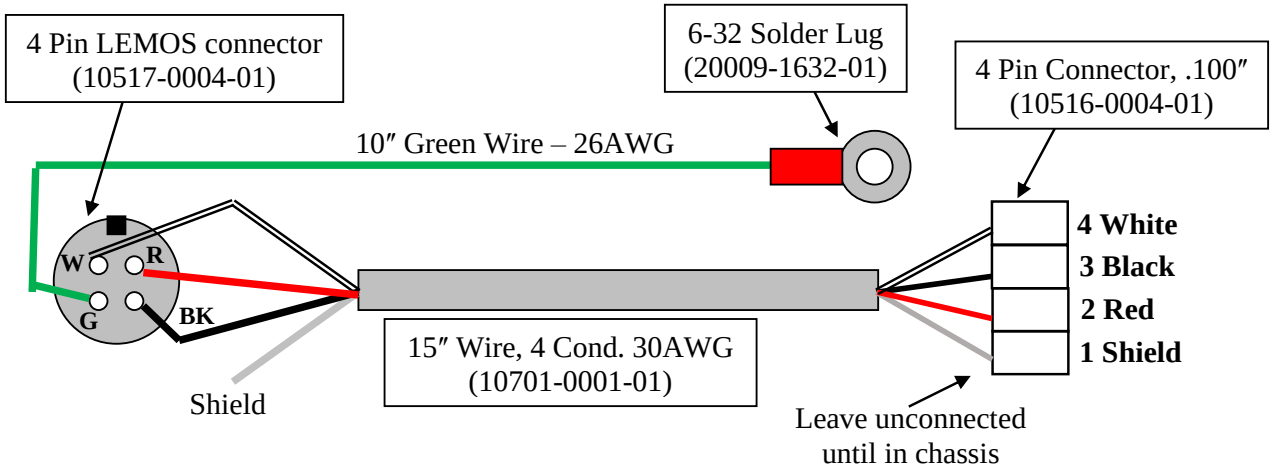


Figure 8 – Doppler Cable Assembly

1.6.8. Heat shrink the tubing into place over the solder joints.

1.6.9. Strip the outer insulation of the free side of the doppler cable by ¾".

1.6.10. Pull out the white, red, green and black wires from the base of the braided shield.

1.6.11. Cut off the green wire from the 4-conductor cable.

1.6.12. Strip the white, red and black wires by 1/8" and tin them.

1.6.13. Tin the 4 pins of the 0.100 connector.
Note: You must mount the LEMO connector to the chassis before you attach the AMP connector. (Step 4.1)

1.6.14. Cut and slide a 1" piece of 1/8" shrink tubing over the wires.

1.6.15. Solder the white, red, black and shield wires into the housing as shown in **Figure 8.** Shrink the tubing down.

1.6.16. Set doppler cable assembly aside for later installation in step 4.1.

1.7. Headphone Cable Assembly

1.7.1. The following parts are needed to assemble the headphone cable assembly:

Description	Item Number	QTY	Length
Conn. 1/8" Stereo Jack N.C.	10511-0002-01	1	N/A
Conn. .100" Housing 5 pin Wire Connect	10516-0005-01	1	N/A
Heat Shrink Tubing 1/16", Black	10621-0001-01	5	¼" Length
Black Wire – 26 AWG	10703-0001-01	1	12" Length
White Wire – 26 AWG	10703-0002-01	1	12" Length
Red Wire – 26 AWG	10703-0003-01	1	12" Length
Green Wire – 26 AWG	10703-0005-01	1	12" Length
Blue Wire – 26 AWG	10703-0006-01	1	12" Length

1.7.2. Add ¼" long, 1/16" heat shrink to each wire. Strip one end of each wire by 1/8″ and solder that end onto the stereo jack. Crimp the other end into the 5 pin connector. Assemble according to **Figure 9**. Heat the heat shrink around the solder connections.

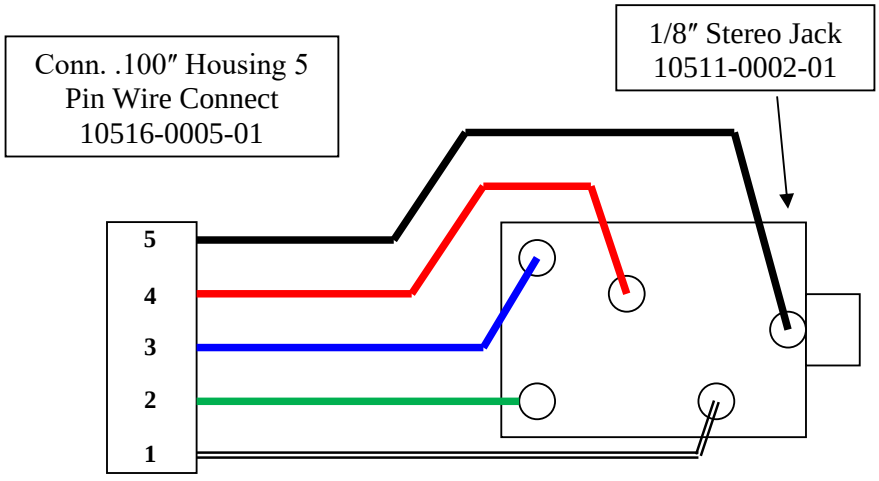


Figure 9 – Headphone cable assembly

1.7.3. Set the headphone cable assembly aside for later installation in step 4.2.

1.8. Power Distribution Cable Assembly

1.8.1. The following parts are needed to assemble the power distribution cable assembly:

Description	Item Number	QTY	Length
Cable, USB Micro Male B to Micro Male B	10326-0007-01	1	9" Length
Conn. .156" Housing 2 pin	10503-0002-01	1	N/A
Conn. .156" Housing 4 pin	10503-0004-01	1	N/A
Conn. .156" Housing 9 pin	10503-0009-01	1	N/A
Ring Terminal, #8, insulated	10548-0008-01	1	N/A
Black Wire – 18AWG	10706-0001-01	2	27" Length
Black Wire – 18AWG	10706-0001-01	1	32.5" Length
White Wire – 18AWG	10706-0002-01	2	27" Length
White Wire – 18AWG	10706-0002-01	1	32.5" Length
Green Wire – 18AWG	10706-0005-01	1	7" Length

1.8.2. Cut the USB Micro Male B to Male B cable to length and strip back the red & black wires by 1/8″.

1.8.3. Strip all wires going to the 9 pin connector by 1/8″ and solder them to the connector. Crimp the wires into the 2 & 4 pin connectors. Use **Figure 10** as reference. For the ring terminal, strip the wire back ¼″ before connecting.

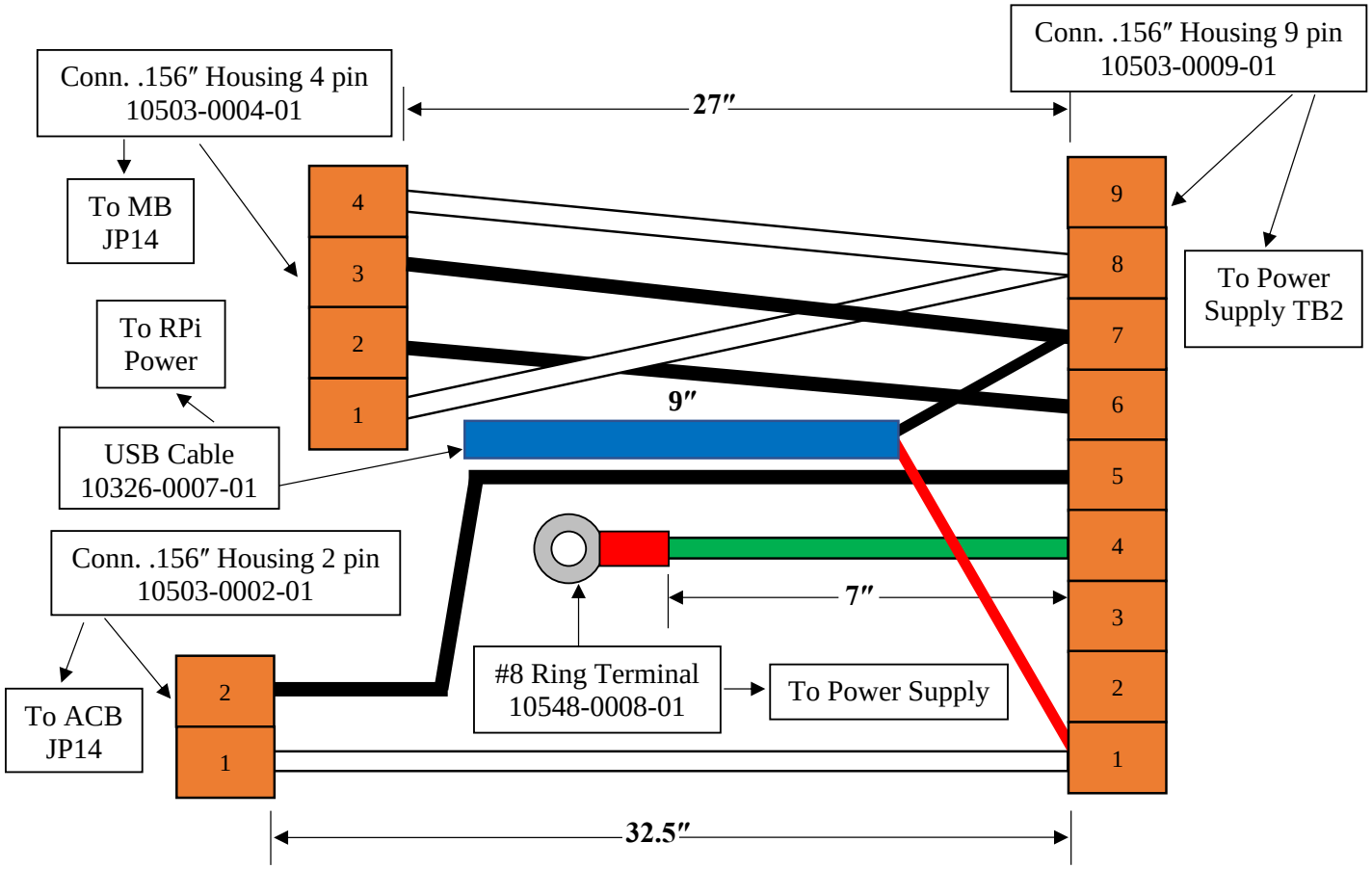


Figure 10 – Power distribution cable diagram

1.8.4. Set the power distribution cable aside for later installation in step 4.7.

1.9. IRB w/ Cable Assembly

1.9.1. The following parts are needed to assemble the IRB w/ Cable assembly:

Description	Item Number	QTY	Length
Conn., DB9 pin male	10546-0009-01	1	N/A
Heat Shrink Tubing 1/16″, Black	10621-0001-01	3	¼″
Black Wire – 26 AWG	10703-0001-01	1	16″
Red Wire – 26 AWG	10703-0003-01	1	16″
Blue Wire – 26 AWG	10703-0006-01	1	16″
Ass'y, Infrared Remote PCB (IRB)	11912-0000-01	1	N/A
Tie Wrap 4″	20008-0004-01	1	N/A

1.9.2. Strip one end of the wires by ¼″. Tin the wires and solder them to JP1 of the IR Receiver PCB Assy as shown in **Figure 11**. Strip and tin the other ends of the wires by 1/8″ and solder them to the DB9 connector with ¼″ heat shrink.

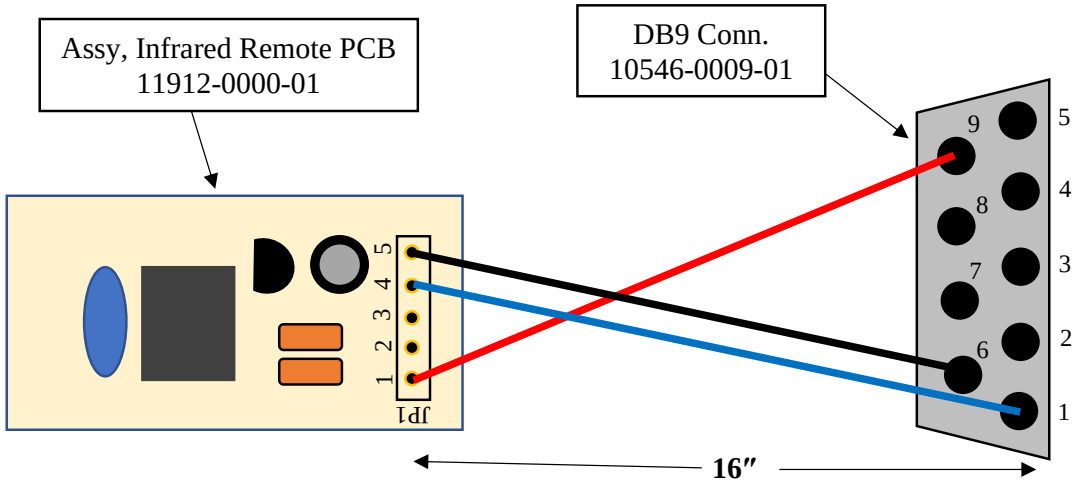


Figure 11 – IRB Cable Wiring

1.9.3. Bring the inner conductors of the wires up over the solder joints and tie wrap the outer cable in place as shown in **Figure 12** in order to give strain relief to the connections. Twist wires to keep them together. Set the cable aside for later installation in step 6.2.

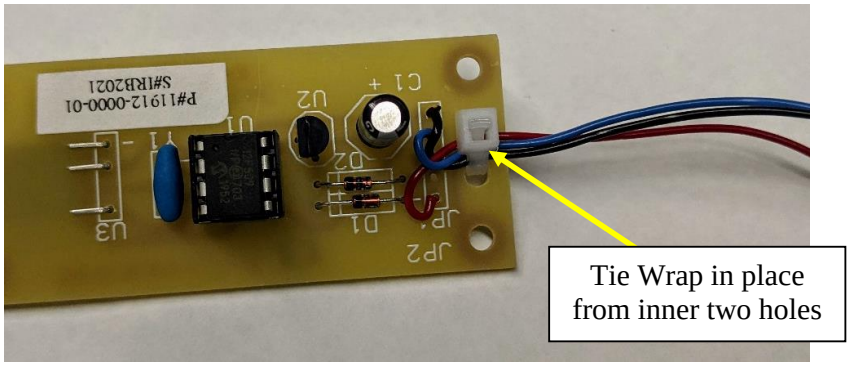


Figure 12 – Tie Wrap strain relief

1.10. Internal CPU Cable Assembly

1.10.1. The following parts are needed to assemble the USB internal cable assembly:

Description	Item Number	QTY	Length
Cable, Panel Mount USB B Female	10326-0009-01	1	N/A
Conn. .100" Housing 4 pin	10516-0004-01	1	N/A
Ring Terminal, #8, insulated	10548-0008-01	1	N/A
Heat Shrink, 1/16″, Black	10621-0001-01	1	1″

1.10.2. Take the 10326-0009-01 cable and cut off the end that does not have USB B Female Panel Mount Connector, keep the cable as long as possible. Keep the provided screws in the panel mount end.

1.10.3. Strip back the cabling 1.5″ to reveal the internal wires and shield.

1.10.4. Crimp the 4 wires into the 4-pin connector as shown in **Figure 13**. Place heat shrink over the shield and then crimp the shield into the #8 Ring terminal.

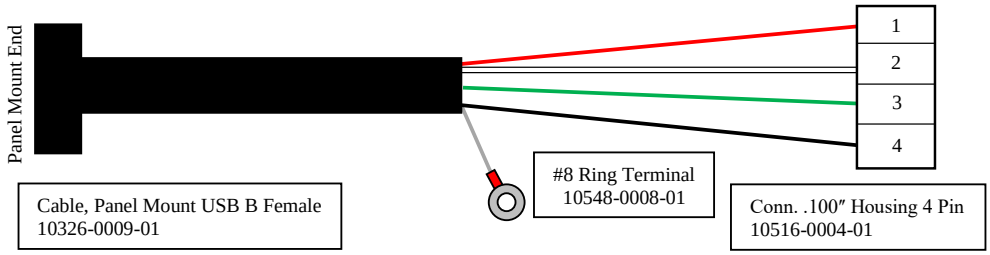


Figure 13 – Internal CPU Cable Assembly

1.10.5. Remove about 1mm from one side of the panel mount end, near the mounting screw (see **Figure 14** for reference).

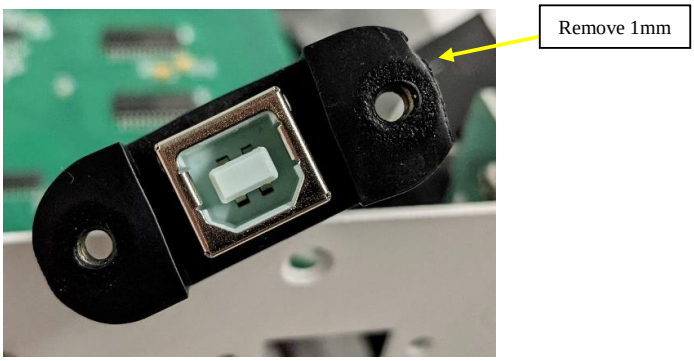


Figure 14 – CPU Panel Mount

1.10.6. Set the internal CPU cable assembly aside for later installation in step 4.5.

Step 2 Pumps, Valves and Internal Hose Assembly

2.1. Left and Right Pump Assembly

2.1.1. The following parts are needed to assemble the left and right pump assemblies:

Description	Item Number	QTY	Length
Air Compressor, Gillian, Freedom V	10328-0001-01	2	N/A
Conn. .100" Housing 2 pin Wire Connect	10516-0002-01	2	N/A
White Wire – 26AWG	10703-0002-01	1	20" Length
Yellow Wire – 26AWG	10703-0004-01	1	20" Length
Green Wire – 26AWG	10703-0005-01	1	20" Length
Blue Wire – 26AWG	10703-0006-01	1	20" Length

2.1.2. Take the white wire and feed one end into the right side of open slot on the pump until it comes out about ¾" near the positive terminal.

2.1.3. Take the blue wire and feed it into the left side of the open slot until it comes out about ¾" past the other solder terminal.

2.1.4. Strip both the white and blue ends by 1/8" near the solder terminals, tin the ends and solder to the terminals as shown in **Figure 15**.

2.1.5. Bend the terminal down on each pump as shown in **Figure 15**.

Figure 15 – Left pump wire colors

2.1.6. Take the yellow wire and feed one end into the right side of open slot on the second pump until it comes out about ¾" near the positive terminal.

2.1.7. Take the green wire and feed it into the left side of the open slot of the second pump until it comes out about ¾" past the other solder terminal.

2.1.8. Strip both the yellow and green ends by 1/8" near the solder terminals, tin the ends and solder to the terminals as shown in **Figure 16**.

Figure 16 – Right pump wire colors

2.1.9. Crimp the free end of the green wire into PIN 2 of a 2 pin connector.

2.1.10. Crimp the free end of the yellow wire into PIN 1 of the same 2 pin connector.

2.1.11. Crimp the free end of the blue wire into PIN 2 of the second 2 pin connector.

2.1.12. Crimp the free end of the white wire into PIN 1 of the second 2 pin connector.

2.1.13. Set the right and left pumps aside for later installation Step 3 .

2.2. Right and Left Valve Assembly

2.2.1. The following parts are needed to assemble the left and right valves:

Description	Item Number	QTY	Length
Conn. .100" Housing 2 pin Wire Connect	10516-0002-01	2	N/A
Air Fitting, SMC M5 1/16	10666-0001-01	2	N/A
Valve, 3-way SMC M5	10667-0002-01	2	N/A

2.2.2. Screw the air fitting into the SMC valve port label E3. See **Figure 17** for reference.

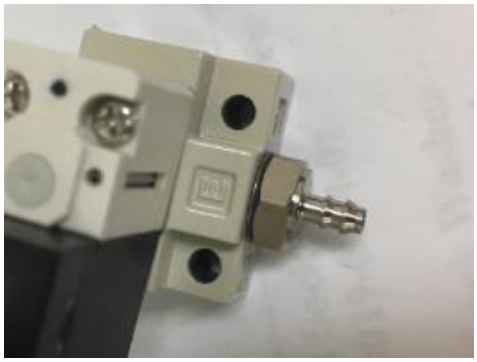


Figure 17 – Air Fitting Placement

2.2.3. Crimp the red wire of one of the valves into Pin 1 of a 2 pin connector and the black wire to Pin 2 as shown in **Figure 18**. Repeat for the second valve.

Figure 18 – Wire order for 2-pin connector

2.2.4. Set aside both valve assemblies for later installation in Step 3 .

2.3. Left and Right Manifold Assembly

2.3.1. The following parts are needed to assemble the Right and Left manifolds:

Description	Item Number	QTY	Length
Tubing, 6 Tube ¼" od, 1/8", Gray	10605-0009-01	1	4" Length

Description	Item Number	QTY	Length
Tubing, 6 Tube ¼" od 1/8", Aqua	10605-0010-01	1	4" Length
Manifold, Electronic 6 pos. Left	10673-0001-01	1	N/A
Manifold, Electronic 6 pos. Right	10673-0001-02	1	N/A
Ass'y, Series 2 Internal Hose (SIH)	11936-0000-01	2	N/A

2.3.2. Separate the joined aqua tubes to obtain 6 individual lengths of 4" tubing.

2.3.3. Carefully place a 4" length of aqua tubing over each of the six brass barb fittings on the left manifold (10673-0001-01).

2.3.4. Attach the Internal Hose Assembly (SIH) to the bottom of the manifold (see **Figure 19**).

2.3.5. Repeat steps 2.3.2 thru 2.3.4, now using the gray tubing on the right manifold (10673-0001-02).

2.3.6. The completed left and right manifolds should look similar to those shown in **Figure 19**. Set both aside for later installation in step 4.10.

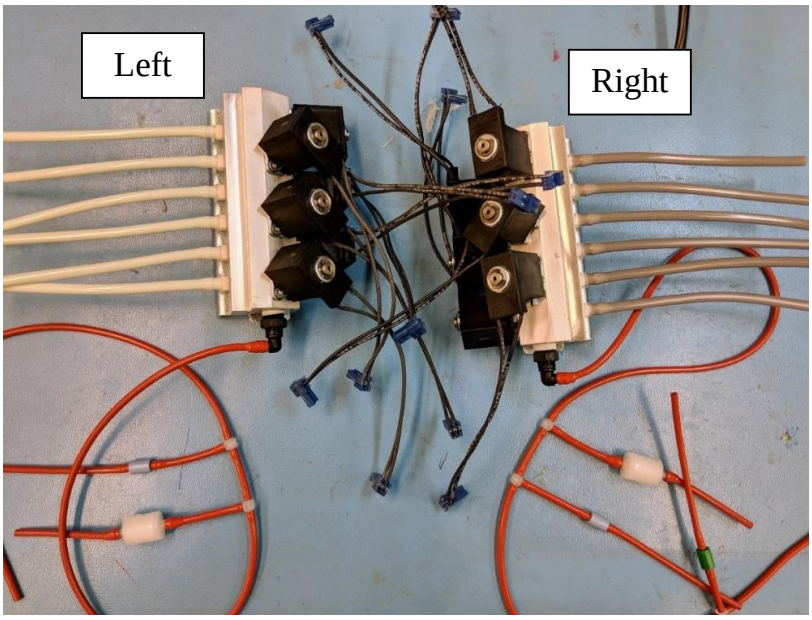


Figure 19 – Completed left and right manifolds

2.4. ACB Board Assembly

2.4.1. The following parts are needed to assemble the ACB board:

Description	Item Number	QTY	Length
Conn. .100" Housing 8 pin Wire Connect	10516-0008-01	2	N/A
Black Wire – 26 AWG	10703-0001-01	2	34.5" Length
Black Wire – 26 AWG	10703-0001-01	2	24.5" Length
White Wire – 26 AWG	10703-0002-01	2	34.5" Length
White Wire – 26 AWG	10703-0002-01	2	24.5" Length

Description	Item Number	QTY	Length
Red Wire – 26 AWG	10703-0003-01	1	34.5" Length
Red Wire – 26 AWG	10703-0003-01	1	24.5" Length
Yellow Wire – 26 AWG	10703-0004-01	1	34.5" Length
Yellow Wire – 26 AWG	10703-0004-01	1	24.5" Length
Green Wire – 26 AWG	10703-0005-01	1	34.5" Length
Green Wire – 26 AWG	10703-0005-01	1	24.5" Length
Blue Wire – 26 AWG	10703-0006-01	2	34.5" Length
Blue Wire – 26 AWG	10703-0006-01	2	24.5" Length
Ass'y, Auto Cuff Selector PCB (ACB)	11933-0000-01	1	N/A

2.4.2. If installed, remove all LEDs, spacers and the S1 & S2 switches from the ACB. If the C1 capacitor is soldered on the front side of the board instead of the back, solder it to the back side.

2.4.3. On the back side of the board, solder the corresponding wires to the LED holes based on **Figure 20**. Make a simple knot at the end of the blue wire for R1 & L1. *Note R1 = Right LED 1.*

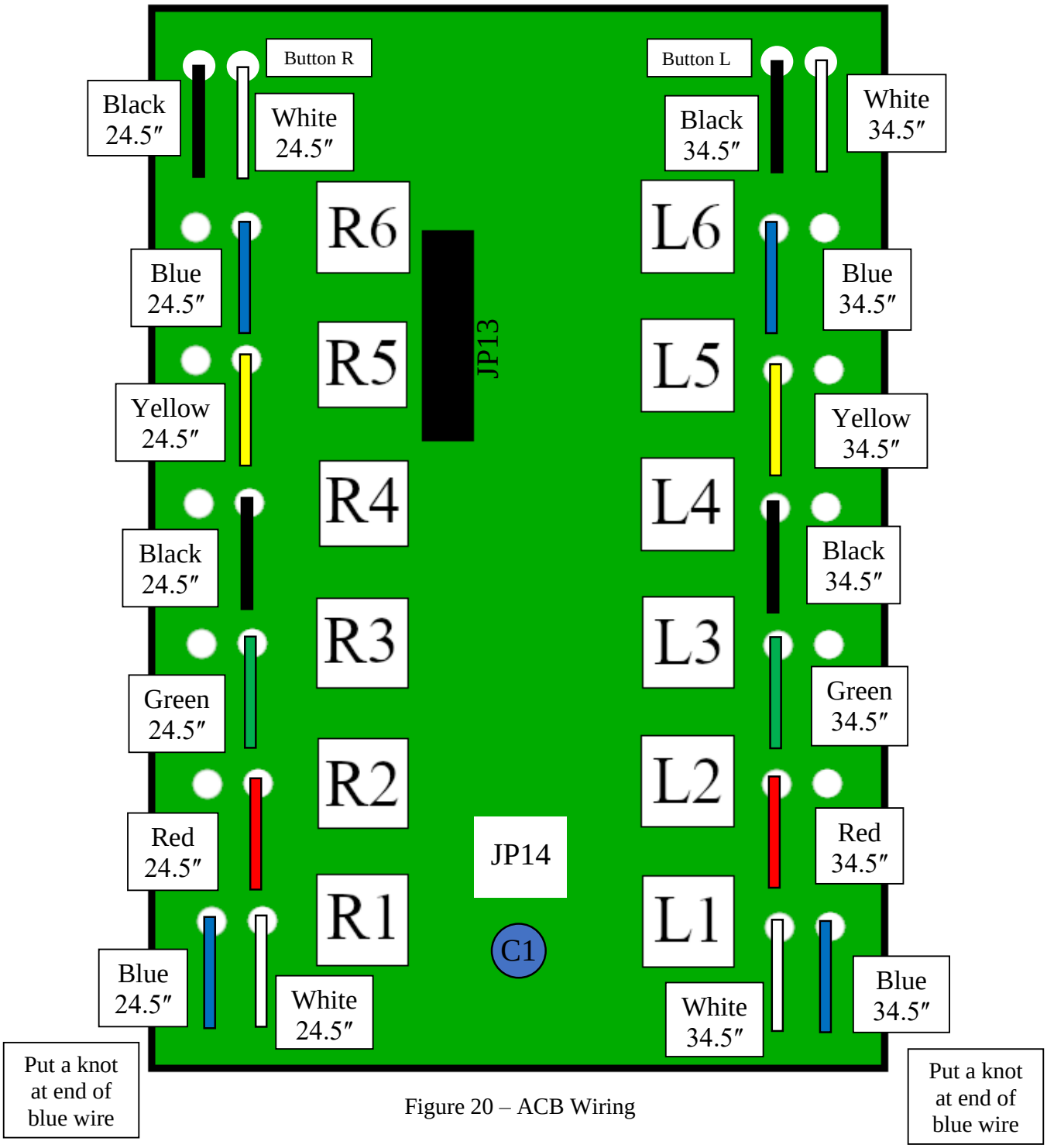


Figure 20 – ACB Wiring

2.4.4. Crimp the left LED wires onto one of the 8 pin connectors, see **Figure 20** and **Figure 21** for labeling/wiring reference. Repeat for the right side.

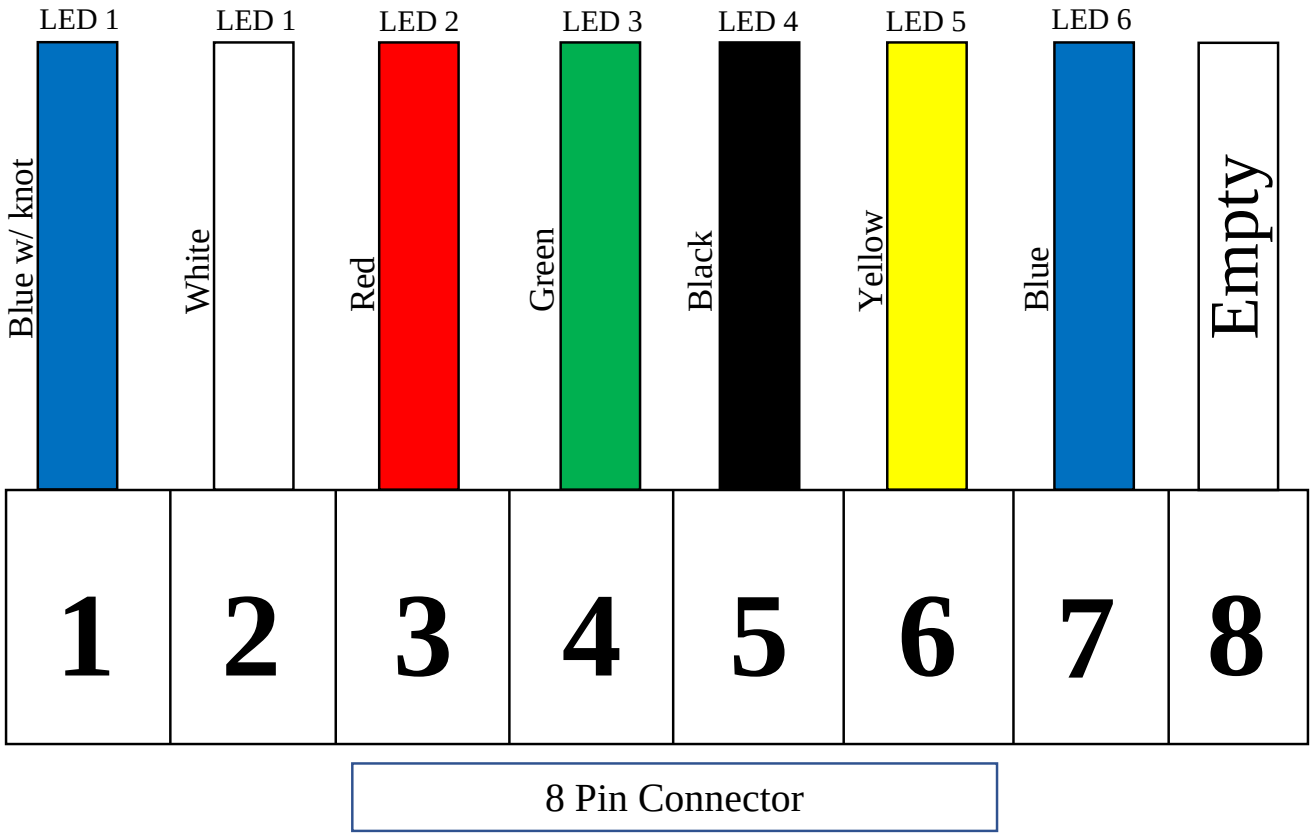


Figure 21 – ACB 8 pin connector wiring

2.4.5. Set the modified ACB board assembly aside for later installation in step 4.9.

Step 3 Pump & Valve Enclosure Assembly

3.1. The following parts will be needed to mount the pumps and valves into the enclosure:

Description	Item Number	QTY	Length
Tubing, 1/16″ ID Silicone	10605-0003-01	2	4″ Length
Tubing, 1/16″ ID Silicone	10605-0003-01	2	4.5″ Length
Tape, Polyester Plastic, 1″ Width	10635-0004-01	1	27″ Length
Lockwasher, 4-40	20002-0440-01	7	N/A
Nut, Machine 4-40	20003-0440-01	1	N/A
Screw, Pan Head Philips 4-40 x 5/8"	20004-0010-01	2	N/A
Screw, Pan PH 4-40 x ¾"	20004-0012-01	4	N/A
Tie Wrap 4"	20008-0004-01	2	N/A
Flatwasher, 6-32	20017-0632-01	16	N/A
Screw, Socket Head Cap, 4-40 x 7/8"	20019-0014-01	1	N/A
Grommet, Rubber	20020-0001-01	4	N/A
Foam, Black 2mm w/ adhesive 9x12	20025-0003-01	1	N/A

Description	Item Number	QTY	Length
Stand Off, Nylon ¾" Rnd 4-40 Thrd.	20035-0012-01	1	N/A
Dual Pump Bracket	40002-2037-01	1	N/A
ORings, Pump Mount	40003-1036-01	6	N/A
Pump Box, Roodra Chassis	40003-3002-01	1	N/A
Left Pump Assembly (previously assembled)	Step 2.1	1	N/A
Right Pump Assembly (previously assembled)	Step 2.1	1	N/A
Valve Assembly (previously assembled)	Step 2.2	2	N/A

3.2. Cut and attach the foam to fit along the inside of the pump box top. Fold and glue the sides together and make cut outs to allow the tubes and wires to leave the box when closed. See **Figure 22** for reference.

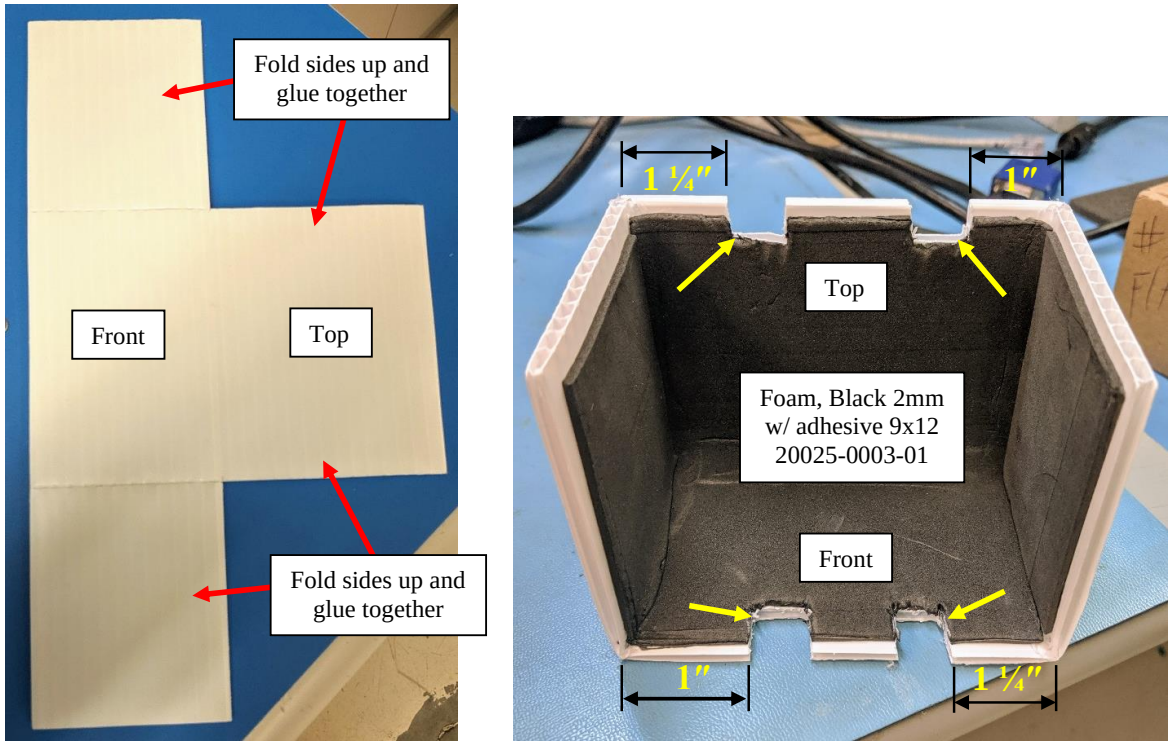


Figure 22 – Top of Pump Box

3.3. Cut and attach more foam to fit the inside of the bottom portion of the box. See **Figure 23**.

3.4. Make two holes in the back of the pump box using the holes of the Dual Pump Bracket as a guide. See **Figure 24** where hardware is attached.

3.5. Attach the pump and valve assemblies to the pump box using the appropriate hardware from the table above according to **Figure 23**, **Figure 24**, and **Figure 25**. Also attach the extra tubing to the pumps.
Note: The nylon standoff is inside the pump bracket and there is a flat washer between the back of the pump bracket and the foam on the back side of the box.

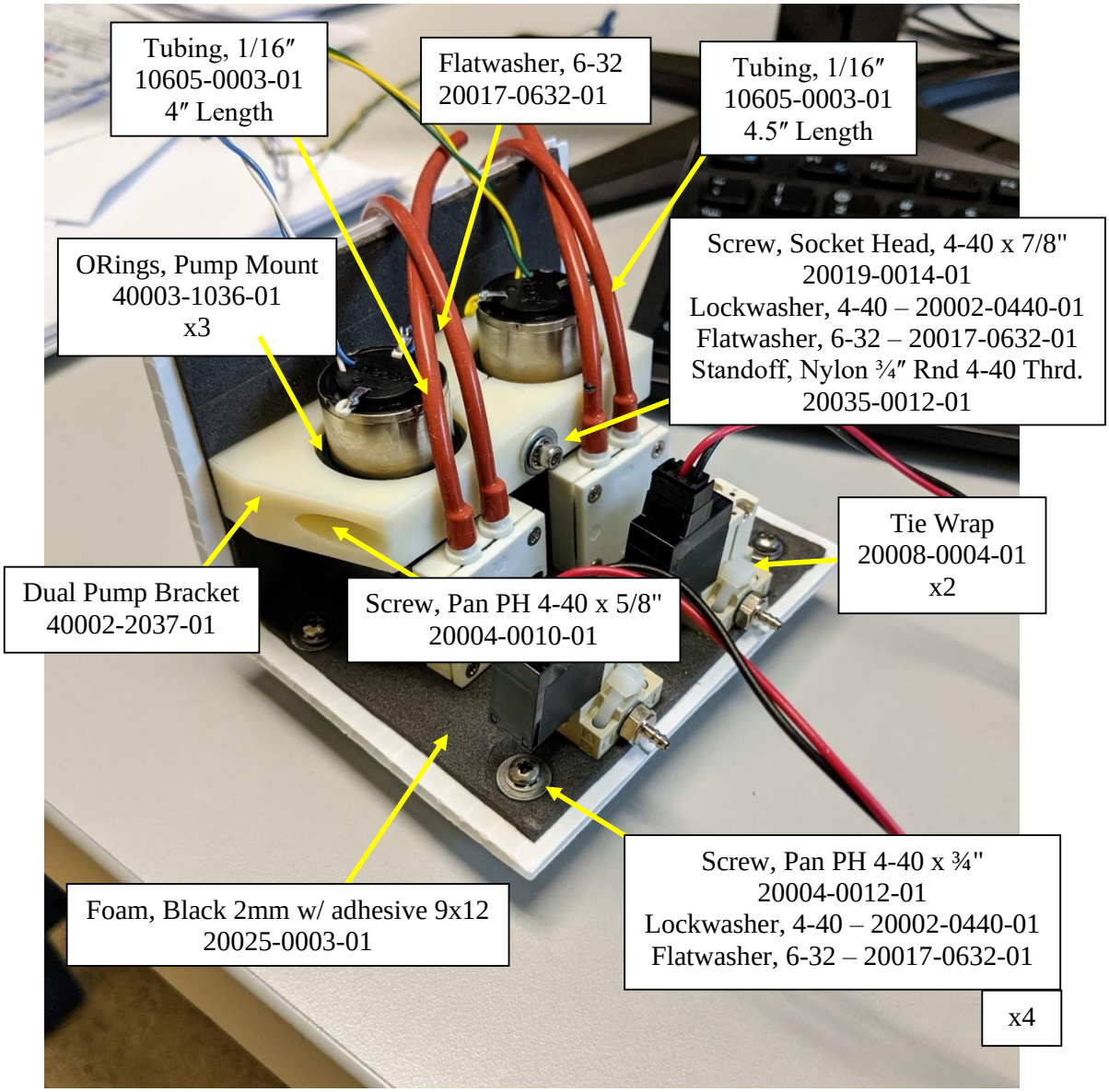


Figure 23 – Pump Box Inside

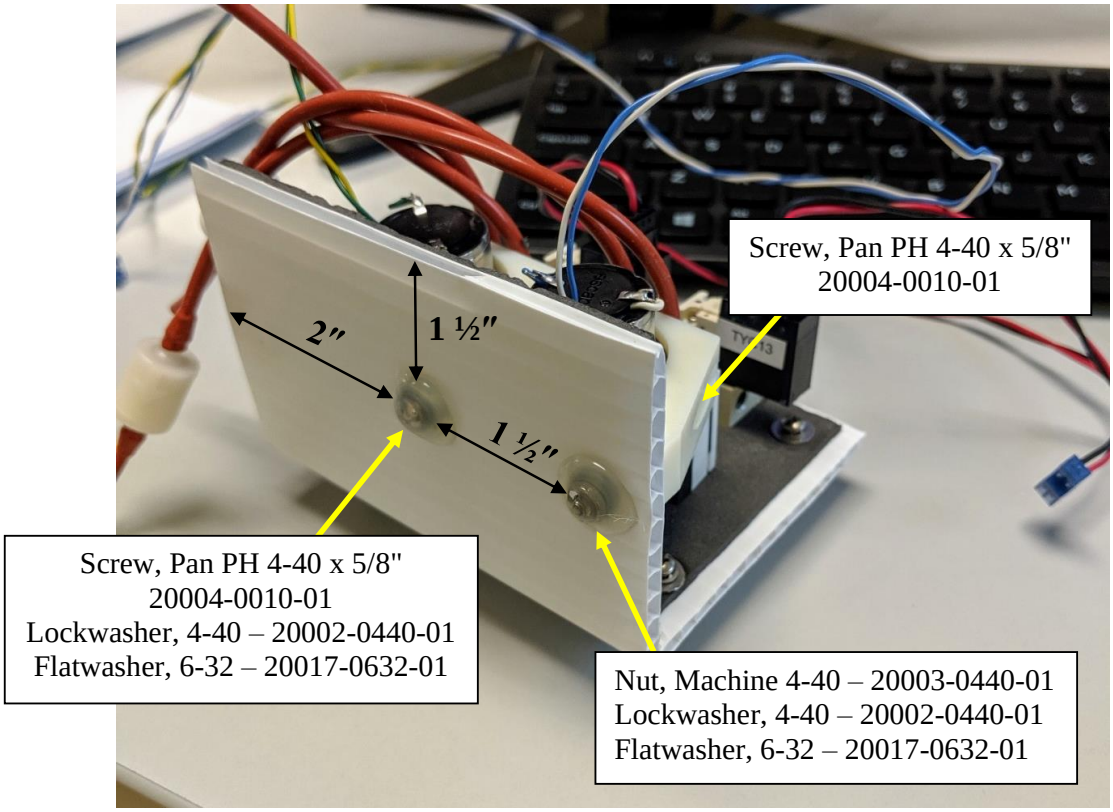


Figure 24 – Pump Box Back Side

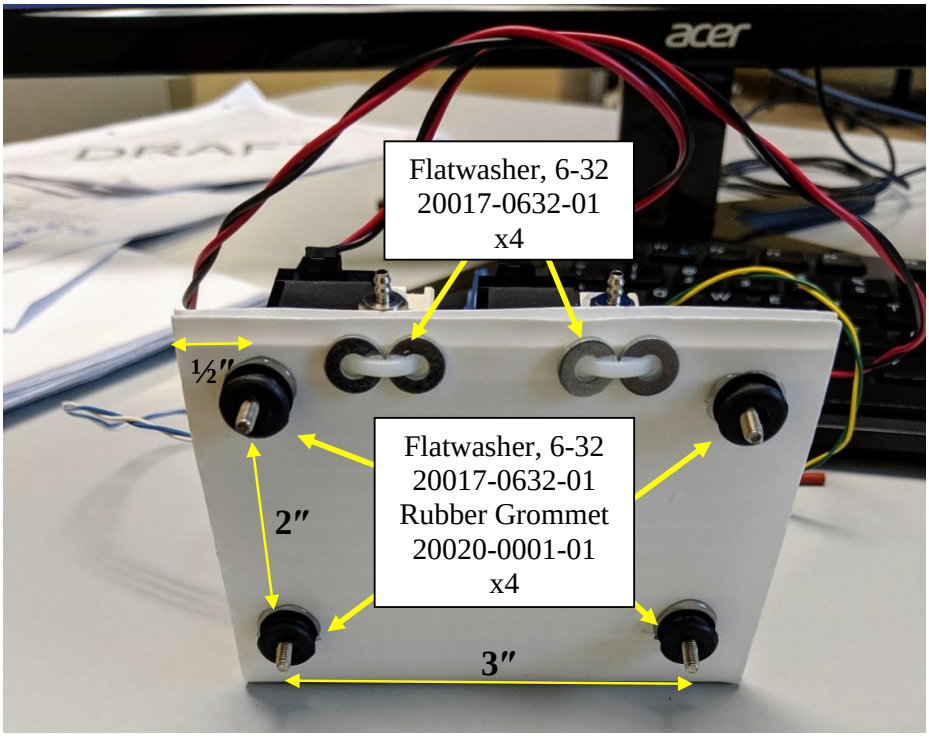


Figure 25 – Pump Box Bottom Side

3.6. Attach the top of the box to the bottom and secure using tape. Ensure that the hoses and wires from the pumps are properly routed out the top of the enclosure and the hoses and wires for the valves are properly routed out of the front bottom of the enclosure.

3.7. Set aside the pump and valve assembly for later installation in step 5.4.

Step 4 Back Panel Component Mounting

4.1. PPG & Doppler Mounting

4.1.1. The following parts are needed to mount both PPG cables to the chassis:

Description	Item Number	QTY	Length
Solder Lug, 3/8"	20021-0006-01	3	N/A
Chassis, Roodra Back Panel	40001-1003-01	1	N/A
PPG Cable Assembly (previously assembled)	Step 1.5	2	N/A
Doppler Cable Assembly (previously assembled)	Step 1.6	1	N/A

4.1.2. Insert one of the PPG assemblies LEMO connector into the hole shown in **Figure 26** on the chassis using a 3/8" solder lug in place of a lock washer (part of LEMO), in between the nut (part of LEMO) and the housing on the inside back.

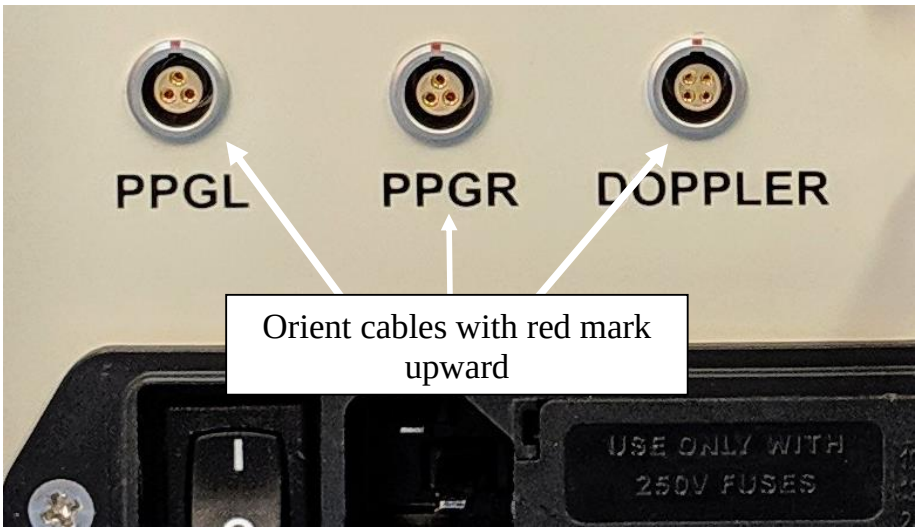


Figure 26 – PPG assemblies mounted to chassis

4.1.3. Bend the solder lug so that the leg part is at a right angle to the lock washer part.

4.1.4. Solder the shield from Side 1 to the solder lug so that the shield will act as a strain relief for the white, red and black wires as shown in **Figure 27**.
Note: After installing the cable to chassis you may now attach the AMP connectors for the 3 cables as shown in steps 1.5 & 1.6.

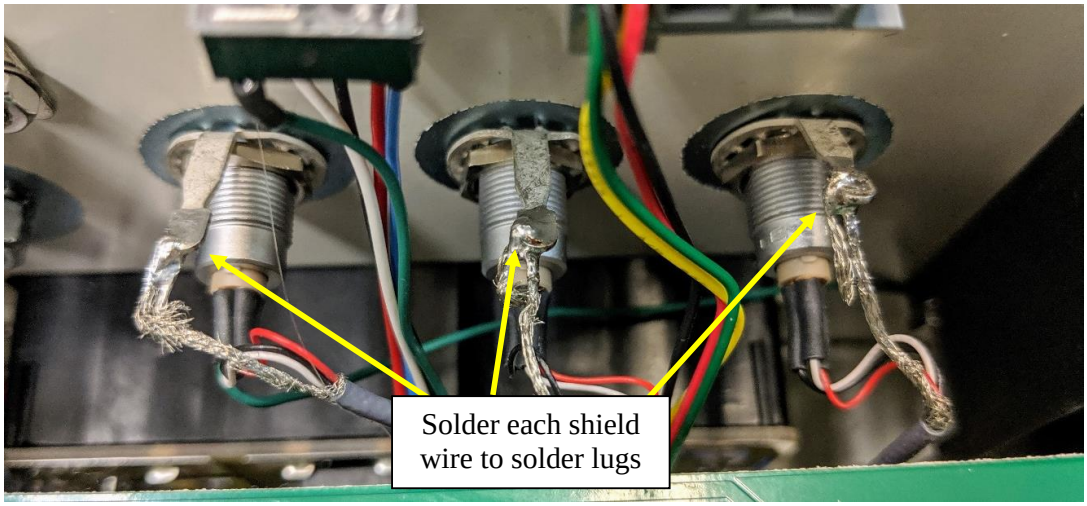


Figure 27 – Wire shields soldered to solder lugs

4.1.5. Repeat Steps 4.1.2 thru 4.1.4 for the second PPG assembly and Doppler Assembly.

4.2. Headphone Mounting

4.2.1. The following parts are needed to mount the headphone cable assembly to the chassis:

Description	Item Number	QTY	Length
Headphone cable assembly (previously assembled)	Step 1.7	1	N/A

4.2.2. Mount the headphone cable assembly by inserting through the headphone mounting hole shown in **Figure 28** from inside the chassis. Secure with the manufacturer supplied nut.

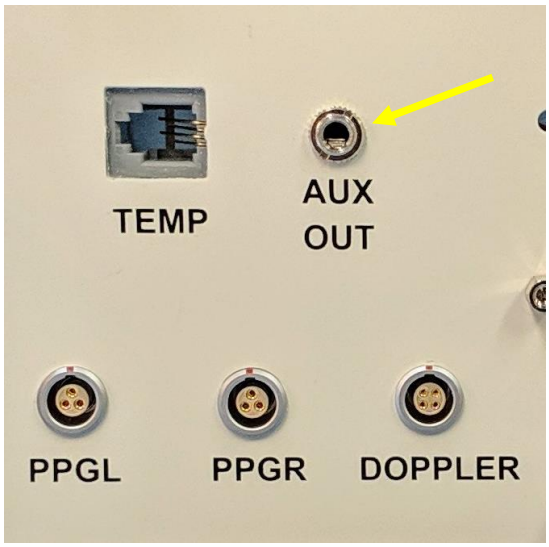


Figure 28 – Headphone mounting hole

4.3. Temperature Jack Mounting

4.3.1. The following parts are needed to mount the temperature cable assembly to the chassis:

Description	Item Number	QTY	Length
Temperature cable assembly (prev. assembled)	Step 1.3	1	N/A

4.3.2. Mount the Temperature Cable phone connector to the chassis as shown in **Figure 29** using super glue.

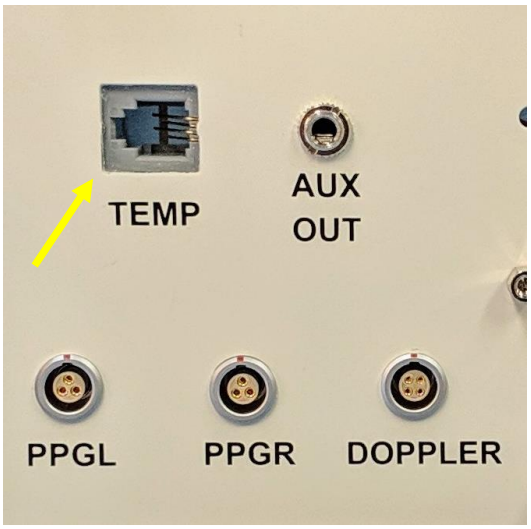


Figure 29 – Temperature connector mounted

4.4. Plug Connector Mounting

4.4.1. The following parts are needed to mount the Grounding Lug to the chassis:

Description	Item Number	QTY	Length
Split Lockwasher, ¼″	20002-0014-02	2	N/A
Nut, KEP M6	20018-9006-01	1	N/A
Screw, Plug Connector, 6 x 15mm	20034-0001-01	1	N/A

4.4.2. Attached the Plug Connector Screw to the back chassis in the slot labeled "MC" according to **Figure 30** and **Figure 31**.

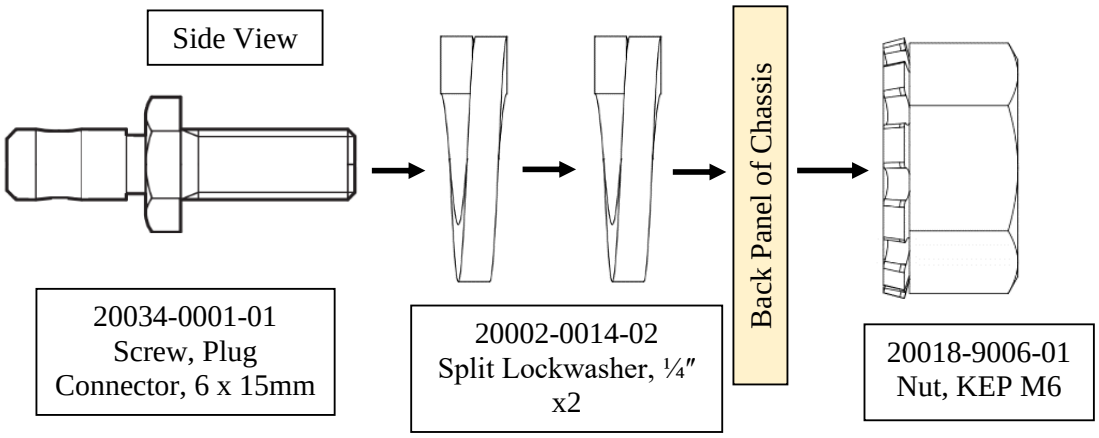


Figure 30 – Plug Connector Mounting

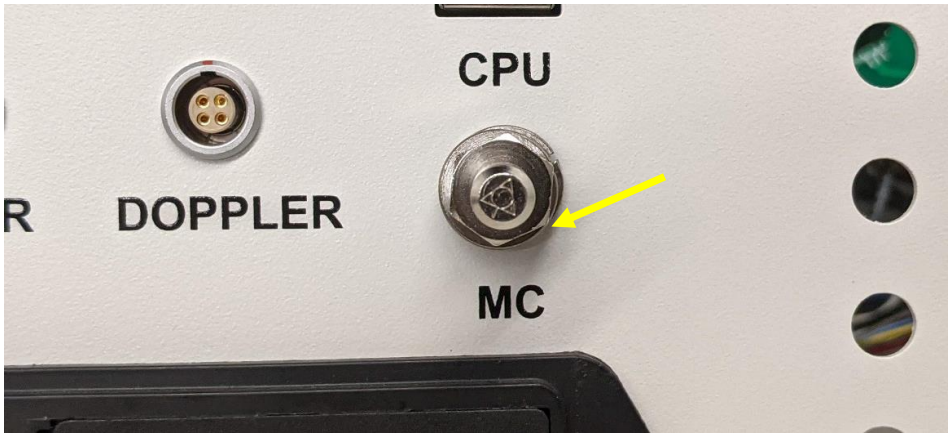


Figure 31 – Plug Connector Installed on Chassis

4.5. Internal CPU Cable Mounting

4.5.1. The following parts are needed to mount the internal DB9 cable to the chassis:

Description	Item Number	QTY	Length
Internal CPU Cable (previously assembled)	Step 1.10	1	N/A

4.5.2. Mount the Internal CPU Cable to the back panel of chassis using the two M3 screws (provided with cable) as shown in **Figure 32**.

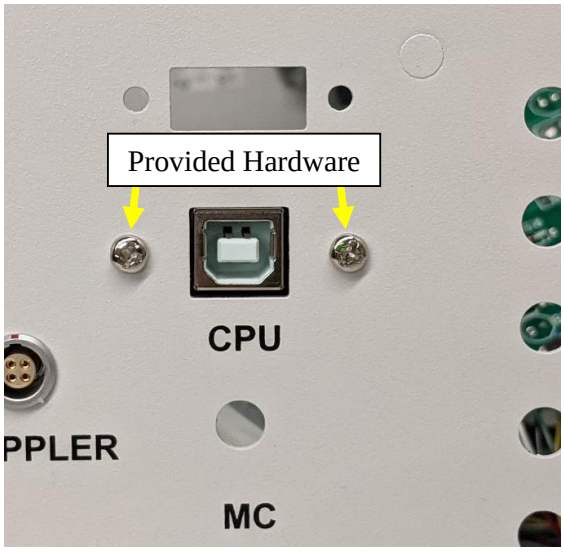


Figure 32 – CPU Cable Mounting

4.6. Power Entry Mounting

4.6.1. The following parts are needed to mount the power entry module to the chassis:

Description	Item Number	QTY	Length
Screw, Mach. 6-32 PH Flat Head ¼"	20011-0004-01	2	N/A
Power Entry Module (previously assembled)	Step 1.2	1	N/A

4.6.2. Mount the previously assembled power entry module by sliding the module through the opening from inside the chassis and secure it in place with the two 6-32 x ¼″ screws as shown in **Figure 33**, taking care to orient the module in the proper direction.

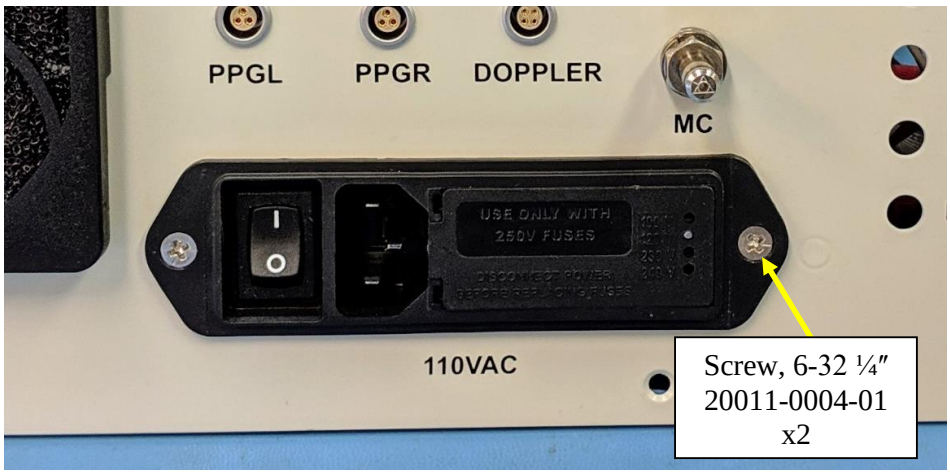


Figure 33 – Power entry module snapped into place

4.7. Fan Mounting

4.7.1. The following parts are needed to mount the fan to the chassis:

Description	Item Number	QTY	Length
Fan Guard w/ Filter 80mm	10342-0003-01	1	N/A
Fan, DC Brushless 12V	10342-0012-01	1	N/A
Lock Washer, 6-32	20002-0632-01	4	N/A
Nut, Machine 6-32	20003-0632-01	4	N/A
Screw, Machine 6-32 PH Pan Head 7/8"	20012-0014-01	4	N/A
Power Distribution Cable (previously assembled)	Step 1.8	1	N/A

4.7.2. Align the fan unit with the four mounting holes on the inside of the chassis and the fan guard on the outside of the chassis. Secure in place with four 6-32 x 7/8" screws, each with a lock washer and hex nut inside the chassis as shown in **Figure 34**. Make sure that the arrow on the fan is pointing inside the chassis.

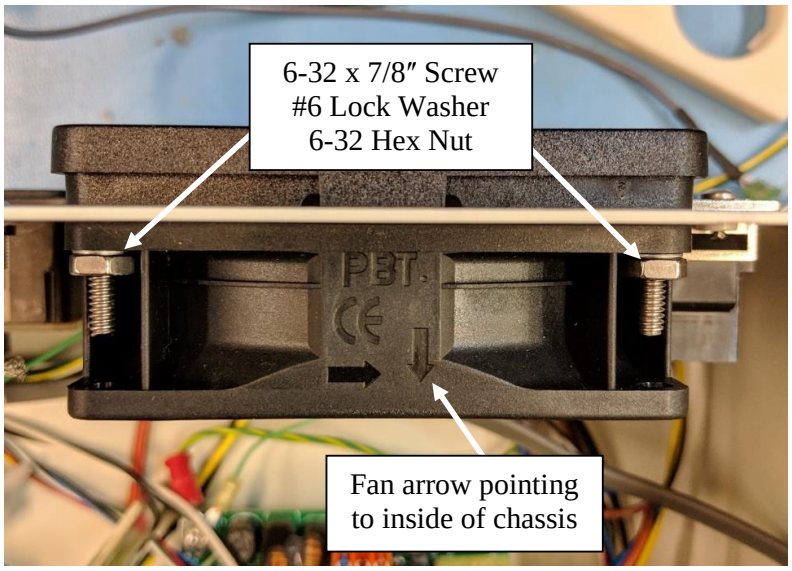


Figure 34 – Fan mounting outside of chassis

4.7.3. Place the fan filter into the guard cover and snap into place as shown in **Figure 35**.

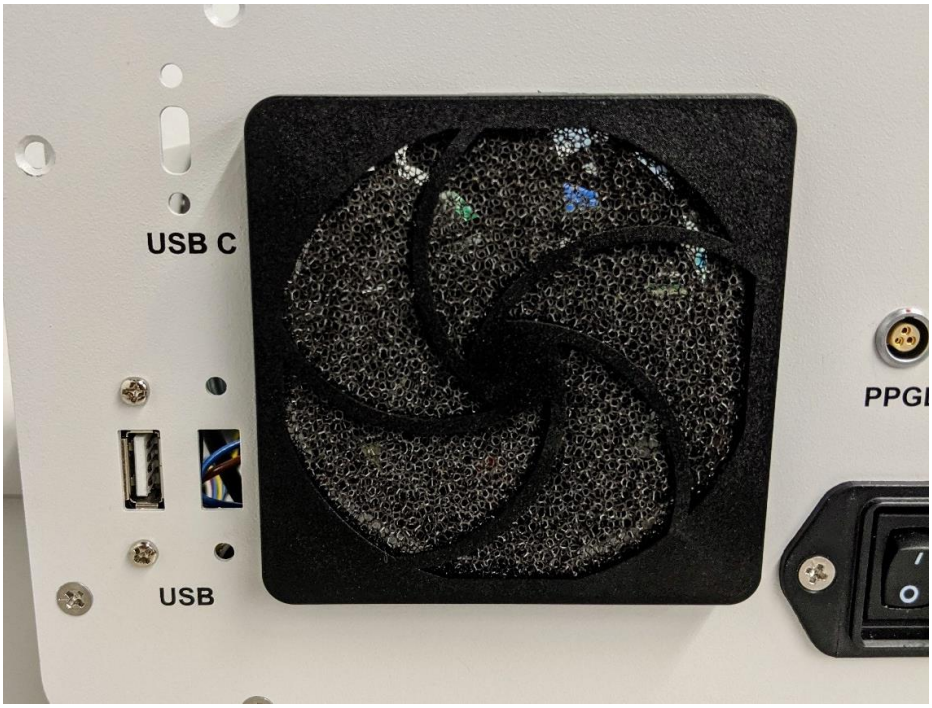


Figure 35 – Guard cover and filter installed

4.7.4. Strip and tin the free end of the fan leads by ¼".

4.7.5. Solder the RED lead to Pin 8 of the 9 Pin Connector on the power distribution cable assembly as shown in **Figure 36**.

4.7.6. Solder the BLACK lead to PIN 4 of the 9 Pin Connector on the power distribution cable assembly as shown in **Figure 36**.

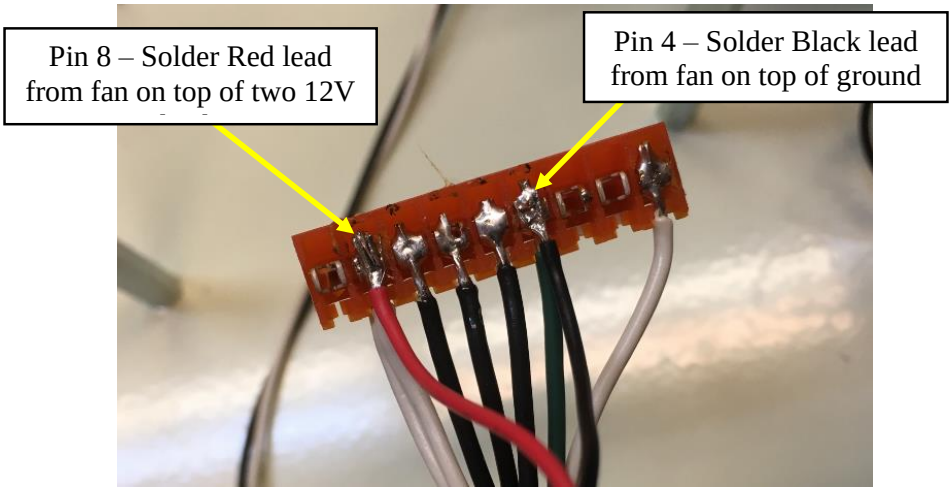


Figure 36 – Fan leads soldered to 9 pin power distribution

4.8. USB Extender Cable Mounting

4.8.1. The following parts are needed to mount the USB cable to the chassis:

Description	Item Number	QTY	Length
Cable, USB Male A to Panel Mount Female A 2.5´	10326-0008-01	1	N/A

4.8.2. Attach the panel mount end of the USB cable to the USB slot on the back panel using the hardware provided. See **Figure 37** for reference.

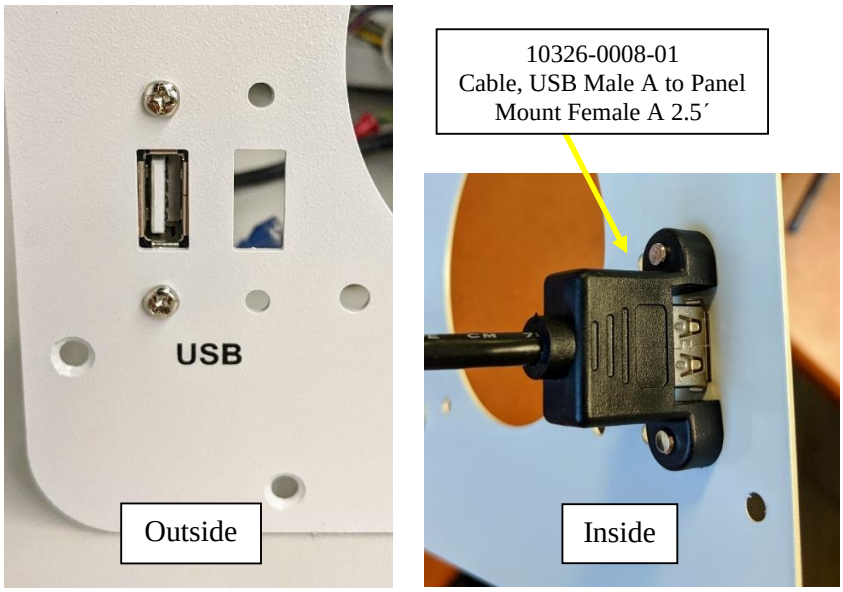


Figure 37 – USB Extender Cable Mounting

4.9. ACB Board Mounting

4.9.1. The following parts are needed to mount the ACB board to the chassis:

Description	Item Number	QTY	Length
Lock Washer, 4-40	20002-0440-01	4	N/A
Screw, Machine 4-40 PH Pan Head 3/8"	20004-0006-01	4	N/A
ACB Control Cable (previously assembled)	Step 1.4	1	N/A
ACB Board (previously assembled)	Step 2.4	1	N/A

4.9.2. Place the previously assembled ACB board onto the 4 stand-offs and mount in place with four 4-40 x 3/8" screws with #4 lock washers. Ensure the board is mounted in the proper direction with the button leads at the bottom. See **Figure 38**.

4.9.3. Route each side of leads downward and connect the 2 pin connector from the Power Distribution cable as shown in **Figure 38**. Connect the ACB Control Cable as shown in **Figure 39**.

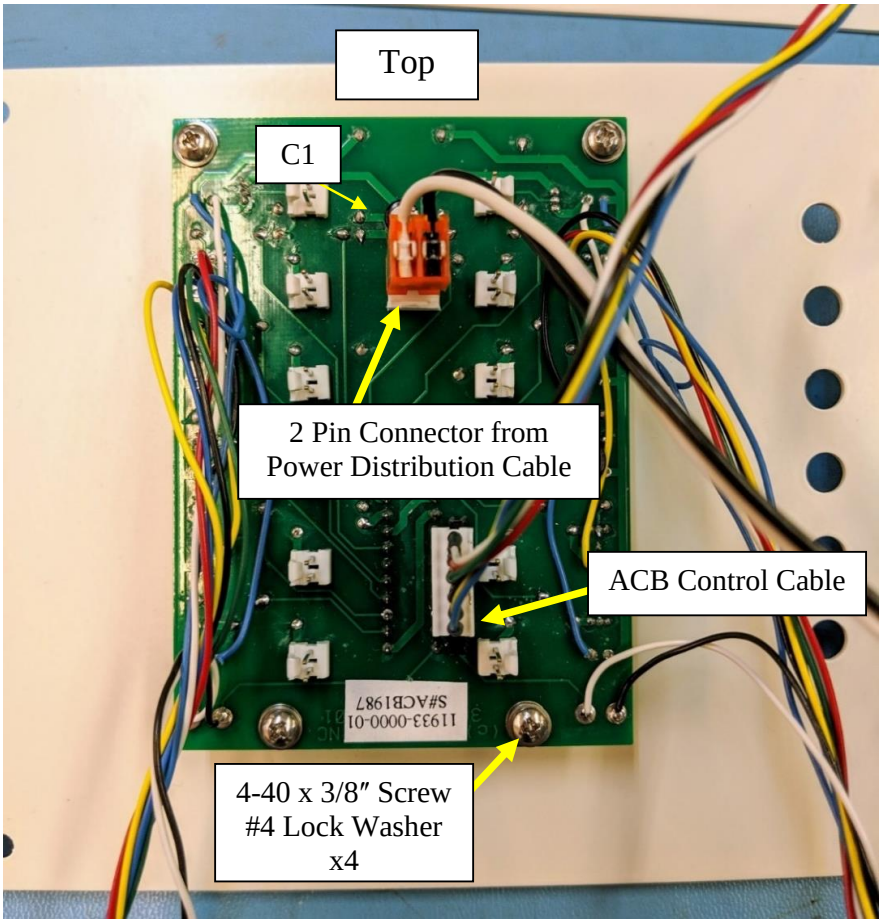


Figure 38 – ACB Board Mounting

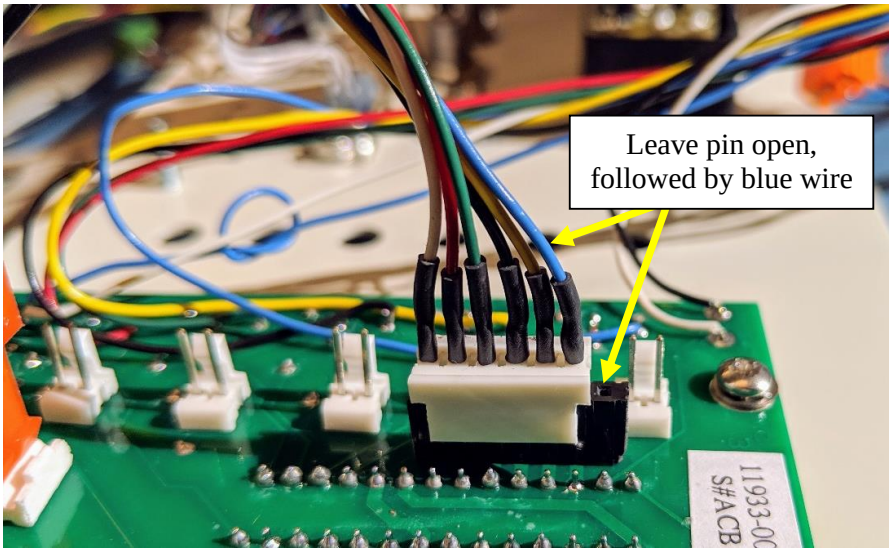


Figure 39 – ACB Cable Connection

4.10. Manifold Mounting

4.10.1. The following parts are needed to mount the left and right manifolds to the chassis:

Description	Item Number	QTY	Length
Fitting, Inline 1/8" Body	10606-0005-01	12	N/A
Lock Washer, 6-32	20002-0632-01	9	N/A
Nut, Machine 6-32	20003-0632-01	5	N/A
Screw, Machine 6-32 PH Pan Head 3/8"	20012-0006-01	4	N/A
Bracket, Roodra Manifold Mounting	40003-3007-01	2	N/A
Left Manifold (previously assembled)	Step 2.3	1	N/A
Right Manifold (previously assembled)	Step 2.3	1	N/A

4.10.2. Attach the manifold mounting brackets to the left and right manifolds using the 6-23 x 3/8″ screws and the #6 lock washers.

4.10.3. Mount the left and right manifolds to the back panel clinch studs using the #6 lock washers and the 6-32 hex nuts. When attaching the bottom of the left manifold, place a #6 lock washer, followed by a 6-32 hex nut, followed by the shorter ring terminal from the Power Entry Module, followed by another lock washer and hex nut. See **Figure 40** and **Figure 41** for reference.

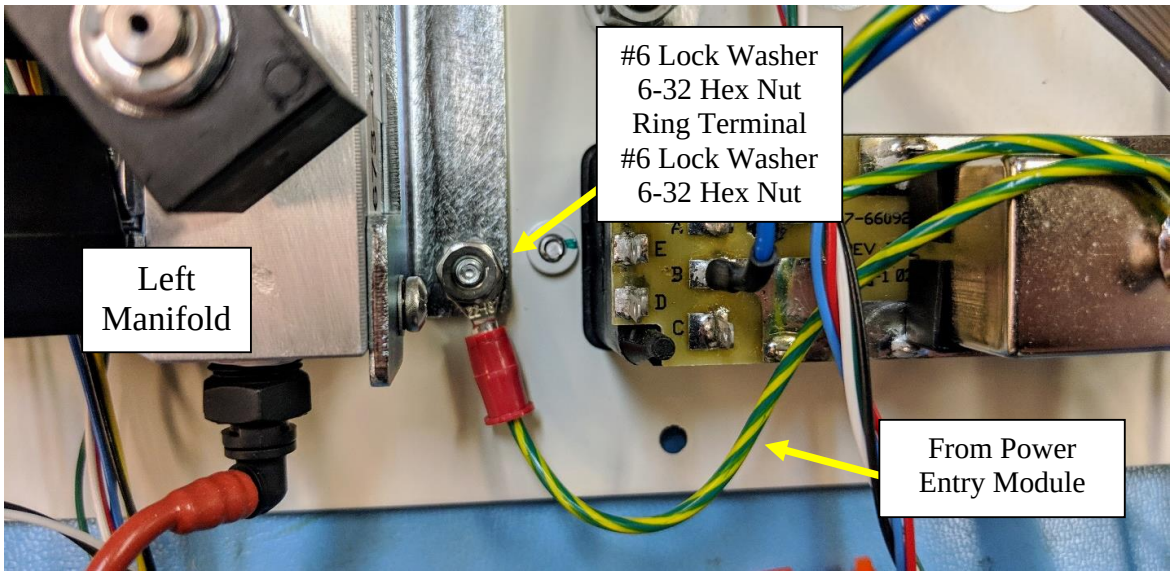


Figure 40 – Power Entry Ring Terminal

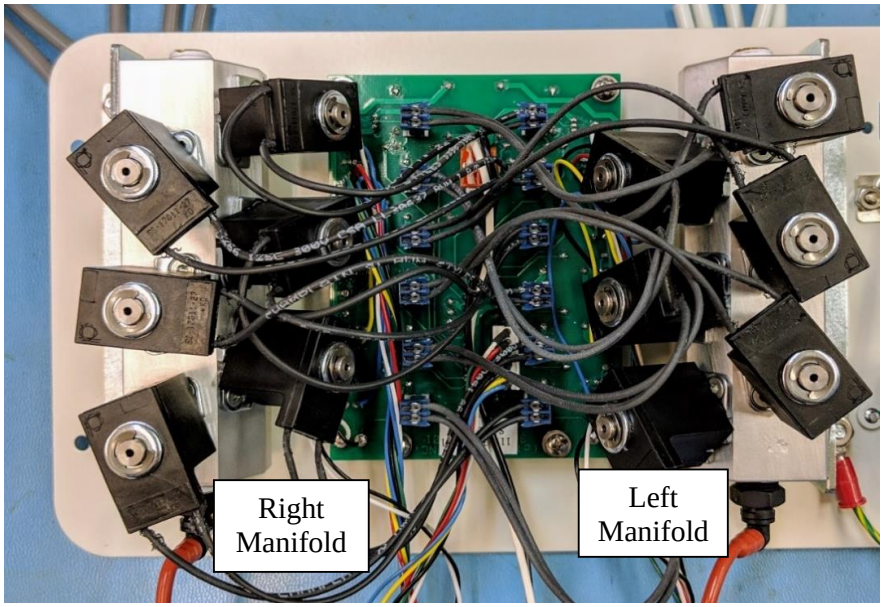


Figure 41 – Left and Right Manifolds Mounted

4.10.4. Connect each 2 pin connector from the manifolds to the ACB board following the diagram in **Figure 42**. For example, R1 on the manifold connects to R1 on the ACB board and so forth.

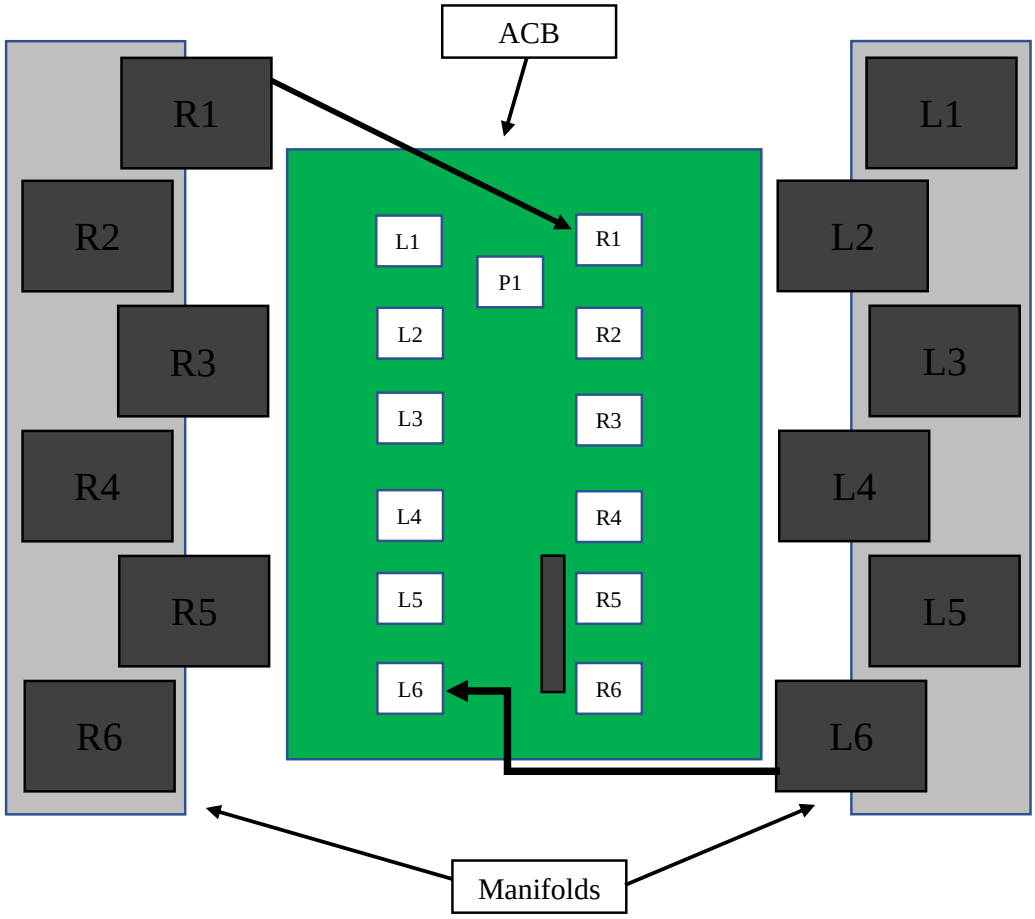


Figure 42 – Manifold connections to ACB board

4.10.5. Place RTV silicon around the barbed fitting of the twelve 1/8" in-line couplers, take care not to get silicon inside of the fitting. Place the in-line air fittings onto the ends of the aqua and gray tubing as shown in **Figure 43**.

Figure 43 – 1/8" in-line couplers installed

Step 5 Base Component Mounting

5.1. Setup

5.1.1. The following parts are needed to start the base component mounting:

Description	Item Number	QTY	Length
Screw, Mach. 6-32 PH Flat Head ¼"	20011-0004-01	5	N/A
Rubber Bumper, Round 0.88"	20096-0880-02	4	N/A
Chassis, Roodra Base	40001-1000-01	1	N/A
Chassis, Roodra Back Panel (w/mounted parts)	Step 4	1	N/A

5.1.2. Attach a rubber bumper 1″ from each corner along the bottom of the chassis base as shown in **Figure 44**.

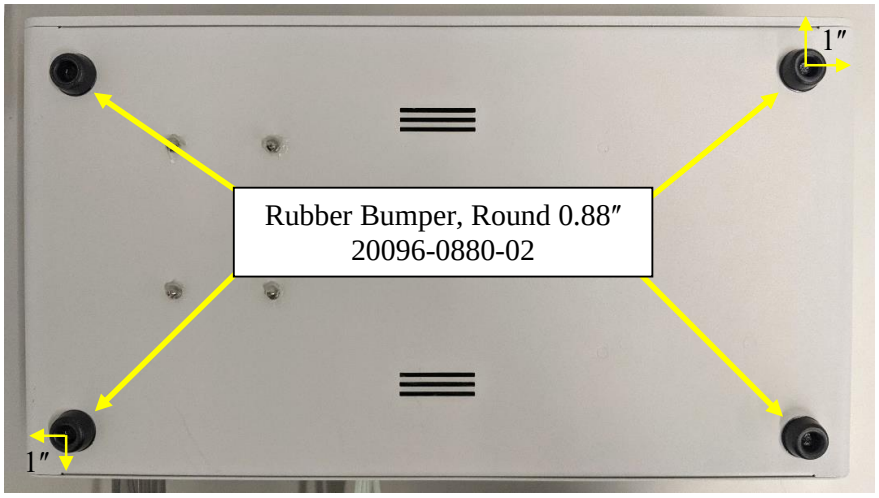


Figure 44 – Rubber Bumper Mounting

5.1.3. Attach the completed chassis back panel to the chassis base using the 6-32 x ¼ screws.

5.2. Speaker Mounting

5.2.1. The following parts are needed to mount the left and right speakers to the chassis:

Description	Item Number	QTY	Length
Lock Washer, 6-32	20002-0632-01	4	N/A
Nut, Machine 6-32	20003-0632-01	4	N/A
Left Speaker (previously assembled)	Step 1.1	1	N/A
Right Speaker (previously assembled)	Step 1.1	1	N/A

5.2.2. Mount the left and right speakers on the speaker mounting studs shown in **Figure 45** and secure in place using (in this order) a #6 lock washer and an 6-32 hex nut on each stud.

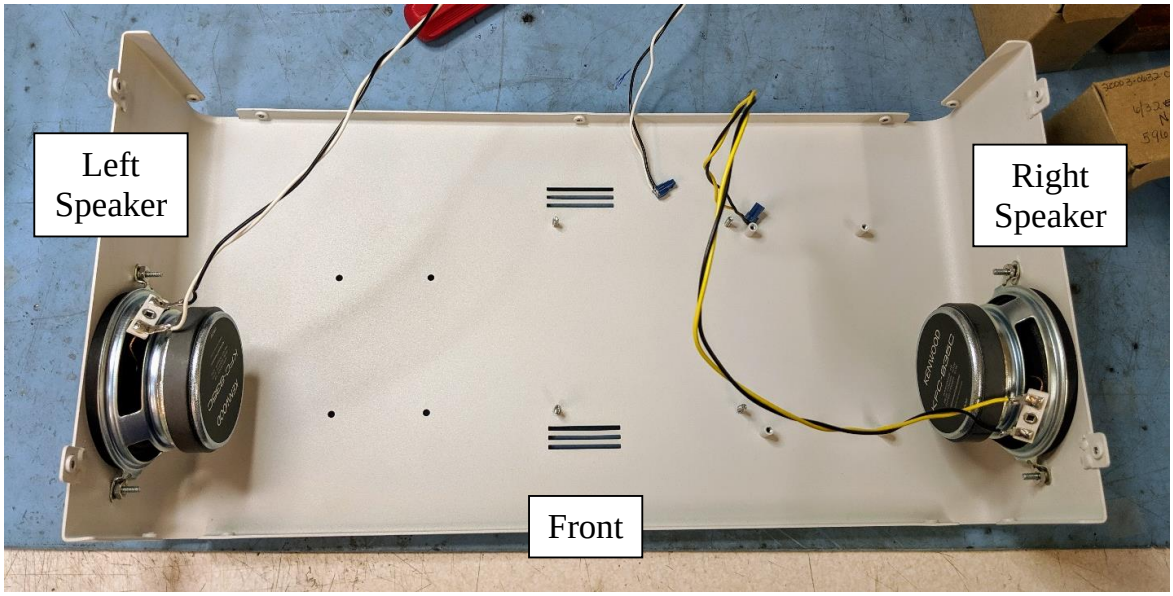


Figure 45 – Mounted left and right speakers

5.3. Power Supply Mounting

5.3.1. The following parts are needed to mount the power entry module to the chassis:

Description	Item Number	QTY	Length
Power Supply, Switcher UL544	10365-0000-01	1	N/A
Lock Washer, 6-32	20002-0632-01	6	N/A
Screw, Machine 6-32 PH Pan Head 3/8"	20012-0006-01	4	N/A
Power Distribution Cable (previously assembled)	Step 1.8	1	N/A

5.3.2. Secure the power supply to the chassis stand-offs using four 6-32 x 3/8" screws with the #6 lock washers. One screw gets a lock washer followed by the ring terminal from the power entry supply, followed by another lock washer, followed by the ring terminal from the doppler cable assembly. A second screw gets a lock washer followed by the ring terminal from the power distribution cable, followed by another lock washer. The other two screws simply get a single lock washer each. See **Figure 46** for reference.

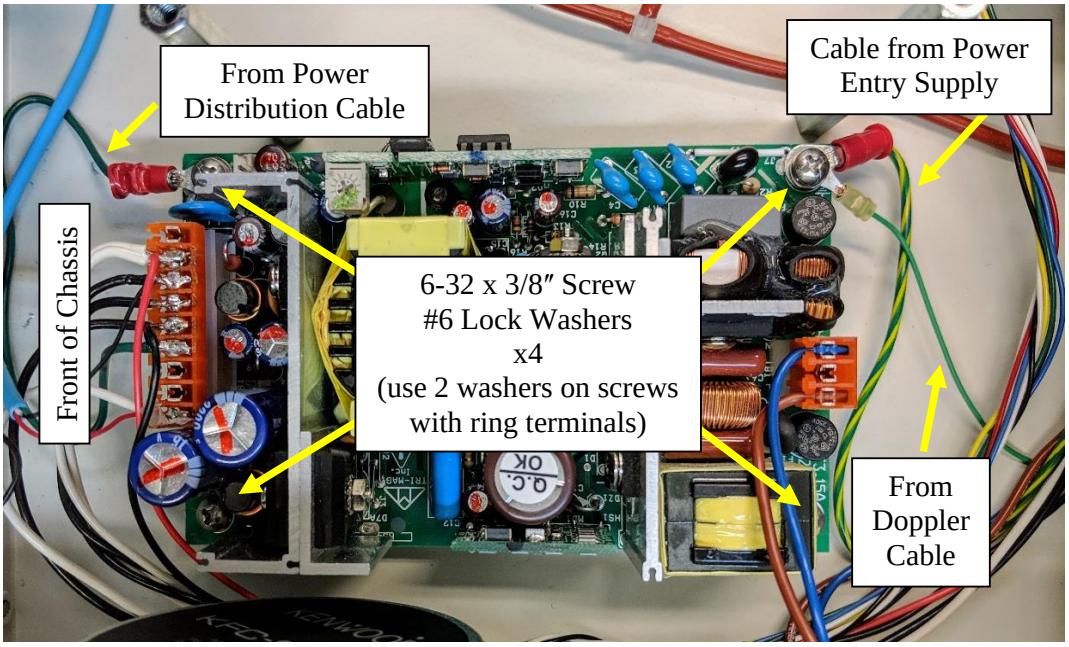


Figure 46 – Securing Power Supply to chassis

5.3.3. Attach the 9 pin from the power distribution cable and the 3 pin connector from the power entry supply to the power supply.

5.4. Pump Enclosure Mounting

5.4.1. The following parts are needed to mount the power entry module to the chassis:

Description	Item Number	QTY	Length
Lock Washer, 4-40	20002-0440-01	4	N/A
Acorn Nut, 4-40	20033-0440-01	4	N/A
Pump & Valve Enclosure (Previously Assembled)	Step 3	1	N/A

5.4.2. Attach the Pump & Valve Enclosure to the bottom chassis through the four holes near the left speaker using the lock washers and the 4-40 acorn nuts.

5.4.3. Ensure the top of the enclosure is on and the tubes and wires are routed properly out of the enclosure.

Step 6 Front Panel Installation

6.1. LED Board Installation

6.1.1. The following parts are needed to install the LED boards:

Description	Item Number	QTY	Length
Conn. .100" Header 8pin	10504-0008-01	2	N/A
LED, Green 7.6mm x 2.5mm	10647-3002-01	12	N/A
Lock Washer, 6-32	20002-0632-01	4	N/A
Screw, Machine 6-32 PH Pan Head ¼"	20012-0004-01	4	N/A

Description	Item Number	QTY	Length
Spacer, LED, 3/16"	20060-0003-01	12	N/A
PCB, Roodra LED	30001-0030-01	2	N/A
Roodra, Front Panel	40001-1002-01	1	N/A

6.1.2. Solder in the green LEDs with spacers and the 8 pin header onto both LED PCBs. The back side of the board should have the header and the LED leads. See **Figure 47** and **Figure 48** for reference.

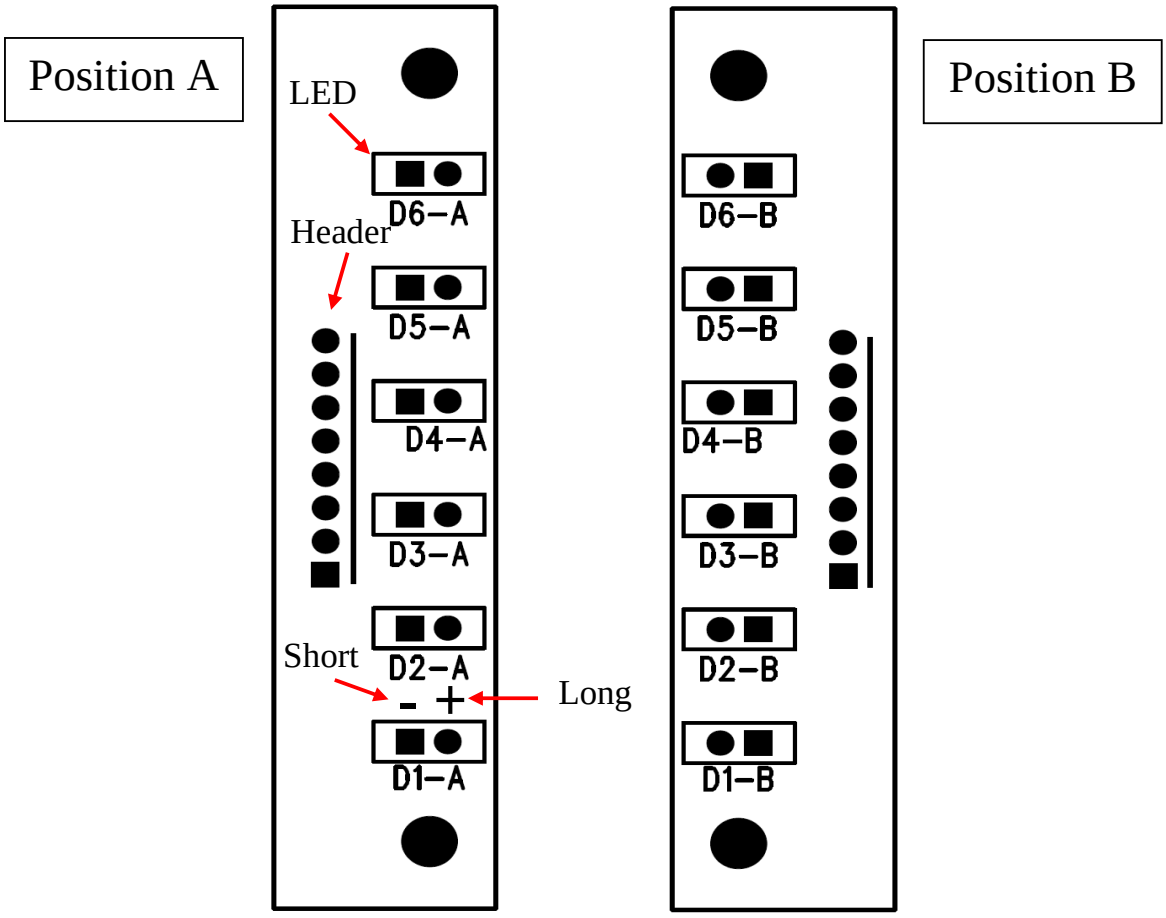


Figure 47 – LED PCB

6.1.3. Mount the two PCB boards on the back of the front panel. The position A board goes on the struts closest to the IRB mount. See **Figure 48** for reference.

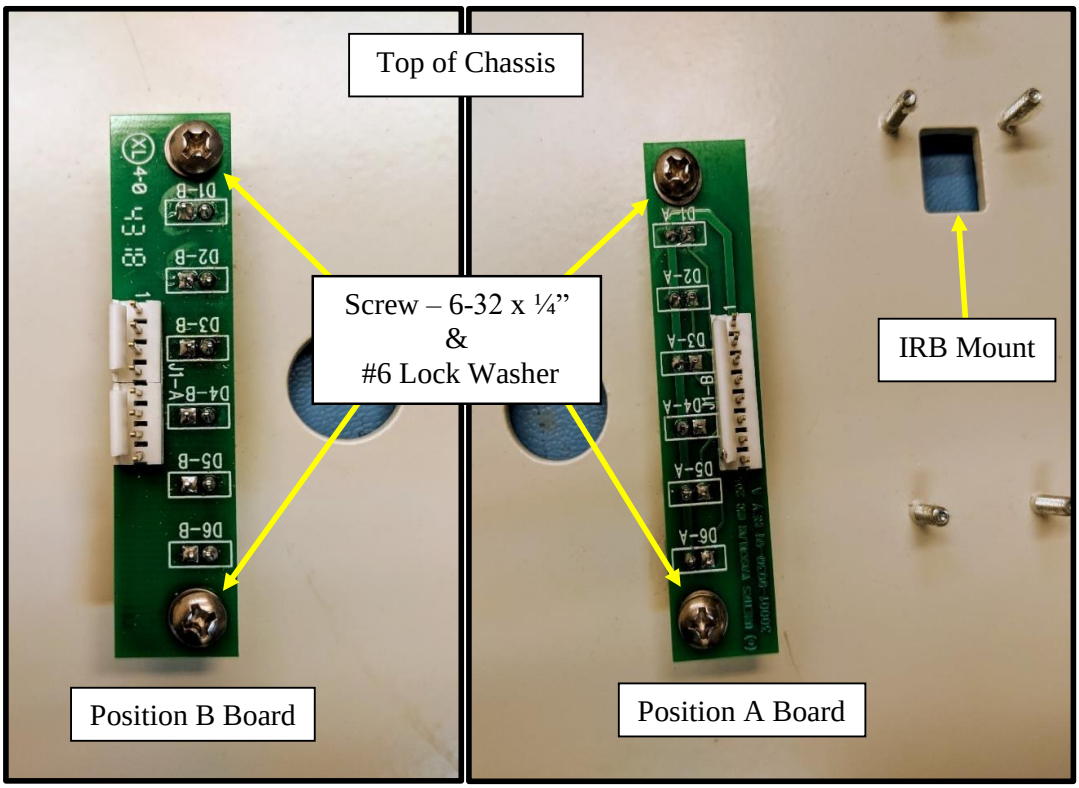


Figure 48 – LED Board Mounting

6.2. IRB Board Mounting

6.2.1. The following parts are needed to mount the IRB assembly to the front chassis panel:

Description	Item Number	QTY	Length
Washer, 1/16" Fiber	20000-0001-01	8	N/A
Lock Washer, 4-40	20002-0440-01	4	N/A
Nut, Machine 4-40	20003-0440-01	4	N/A
IRB w/ Cable Assembly (previously assembled)	Step 1.9	1	N/A

6.2.2. Place two #6 fiber washers on each of the IRB mounting studs as shown in **Figure 49**. These prevent the IRB board from coming into electrical contact with the front panel.

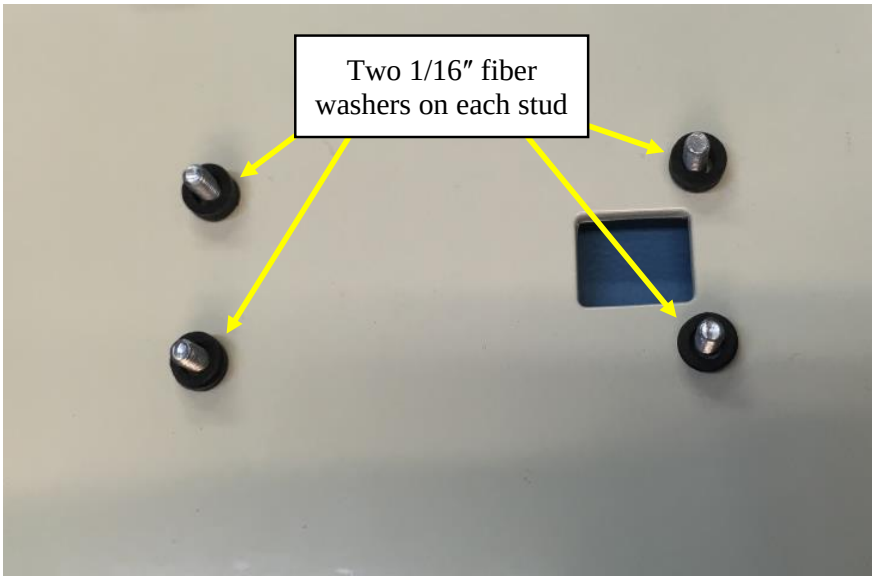


Figure 49 – Fiber washers on IRB studs

6.2.3. Place the IRB assembly onto the studs, ensuring that none of the solder joints are contacting the front panel and the IR sensor is aligned with the front panel cut-out. Secure in place with #4 lock washers and 4-40 hex nuts as shown in **Figure 50**.

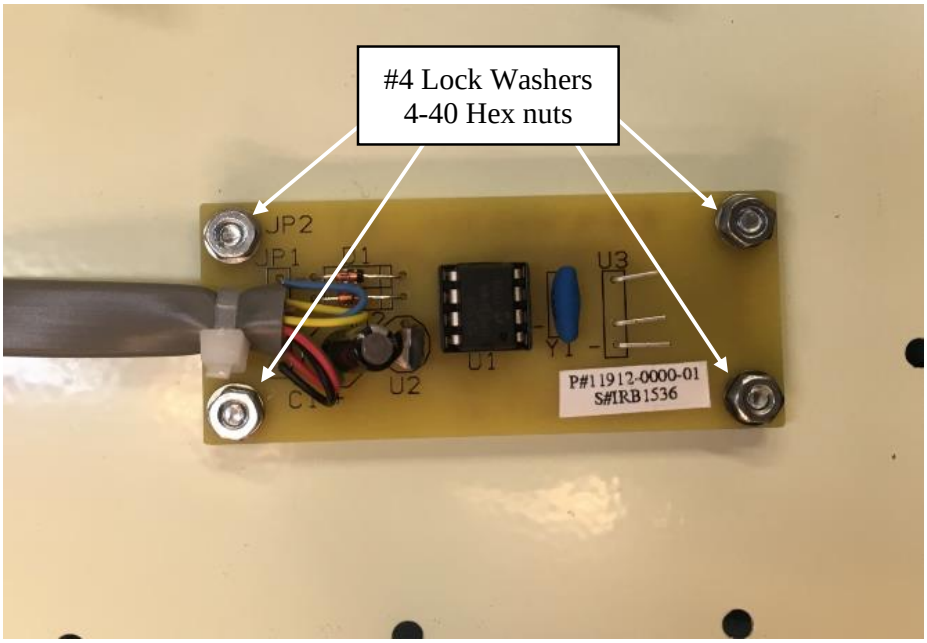


Figure 50 – IRB assembly mounted to chassis front panel

6.3. Raspberry Pi Mounting

6.3.1. The following parts are needed to install the front panel to the chassis:

Description	Item Number	QTY	Length
Computer, Raspberry Pi	10368-0025-01	1	N/A
Touch Screen, 7" Raspberry Pi	10369-0021-01	1	N/A
Tape, Acrylic, Double Sided ½″ Width	10635-0003-01	1	50″ Length
Switch, Panel Mnt. 12mm P.B. Momentary	10637-0005-01	2	N/A
Lock Washer, 4-40	20002-0440-01	4	N/A
Lock Washer, 6-32	20002-0632-01	4	N/A
Nut, Machine 6-32	20003-0632-01	4	N/A
Screw, Pan PH 4-40 3/16"	20004-0003-01	4	N/A
Tie Wrap 4"	20008-0004-01	1	N/A
Screw, Mach. 6-32 PH Flat Head ¼"	20011-0004-01	5	N/A
Chassis, Roodra Acrylic Front Panel	40001-1004-01	1	N/A
Bracket, Roodra Pi Mounting	40003-3009-01	2	N/A

6.3.2. Take the manufacturer supplied white ribbon cable and plug it into the ribbon connector on the Touch Screen with the blue color facing down, towards the LCD as shown in **Figure 51**.

Figure 51 – Attach white ribbon cable to controller board

6.3.3. Mount the computer onto the stand-offs, of the touch screen, with the manufacturer supplied panhead screws and attach the free end of the white ribbon cable to the display port on the computer as shown in **Figure 52**.

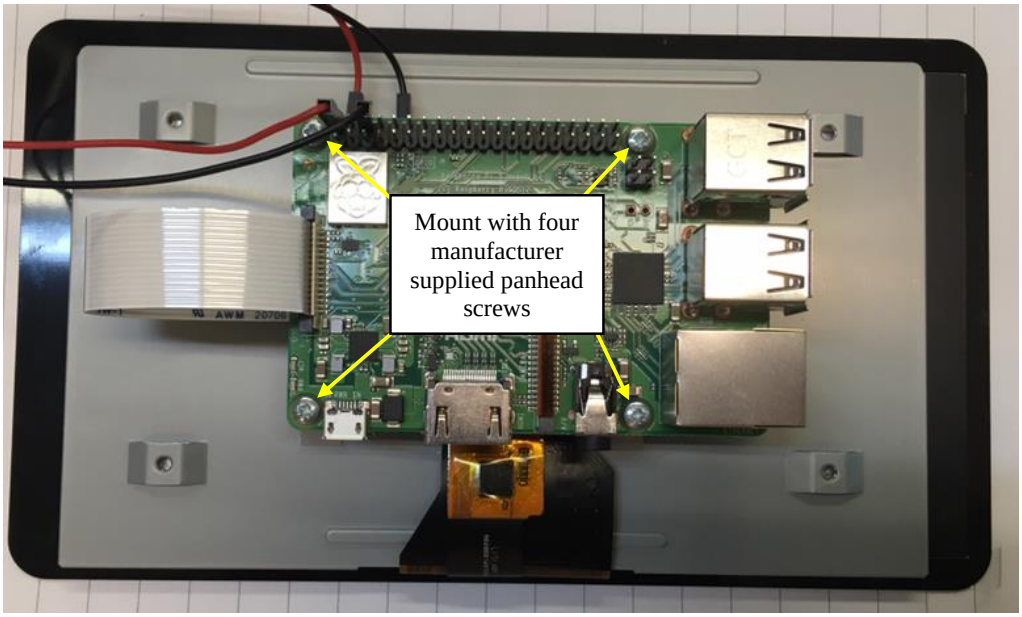


Figure 52 – Computer mounted to Touch Screen with Ribbon attached

6.3.4. Attach the manufacturer supplied RED and BLACK jumper cables to the header pins on the computer as shown in **Figure 53**.

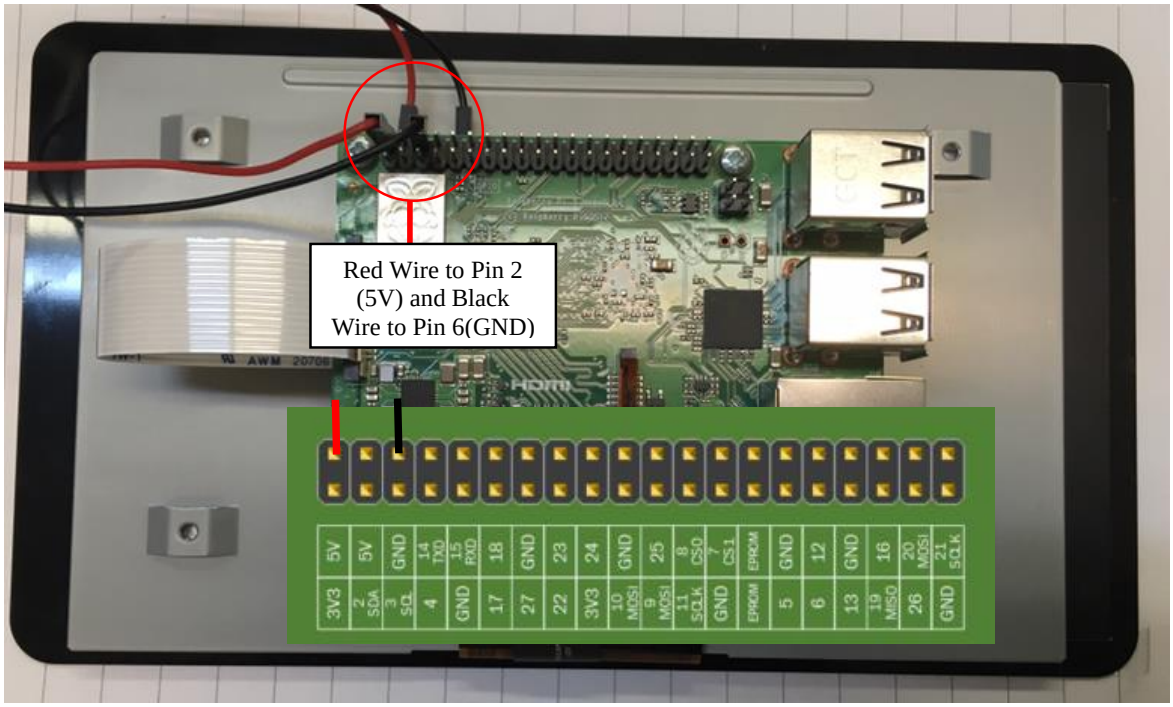


Figure 53 – Connect jumpers to computer

6.3.5. Attach the free end of the RED and BLACK jumpers to the 5V and GND pins on the Touch Screen as shown in **Figure 54**. Zip tie the jumper cables as shown in **Figure 55**.

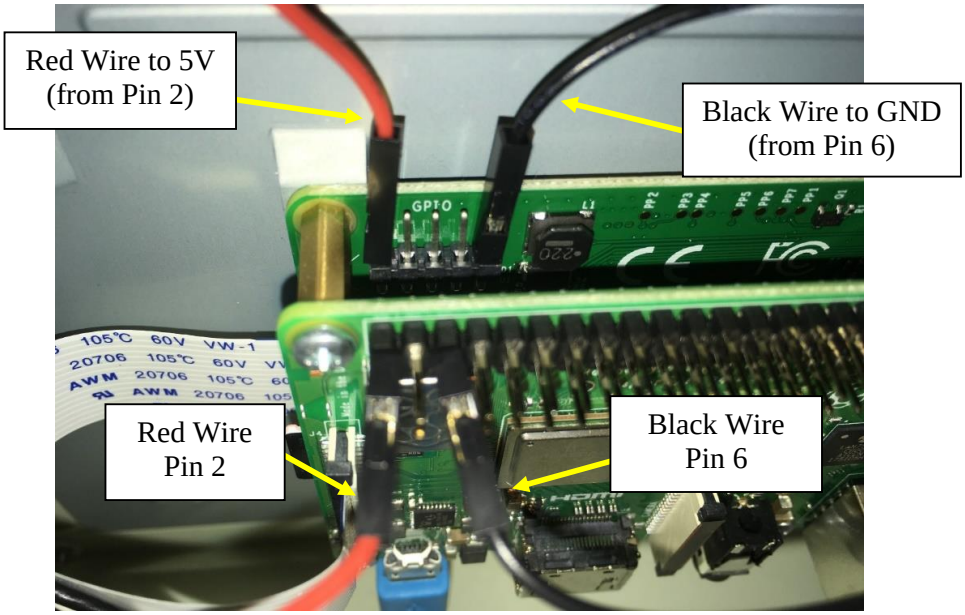


Figure 54 – Connect jumpers to Touch Screen board

6.3.6. Remove the plastic protector on the front of the LCD screen. Mount the LCD to the back of the front chassis panel using the mounting brackets, 4-40 x 3/16 screws, #4 lock washers, 6-32 nuts, and #6 lock washers as shown in **Figure 55**.

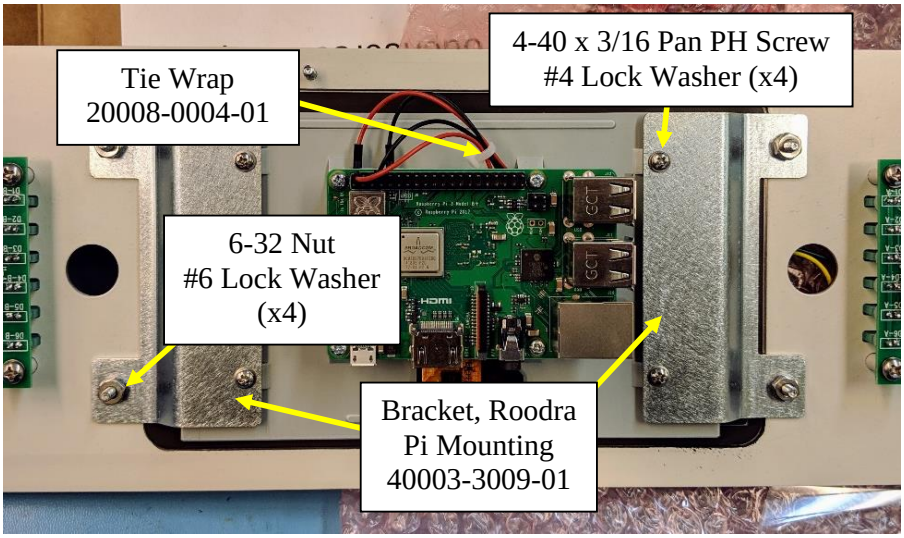


Figure 55 – LCD Mounting

6.3.7. Secure the front panel to the chassis using the five 6-32 x ¼″ flat head screws in the holes. Place the double-sided tape along the front panel as shown in **Figure 56**.

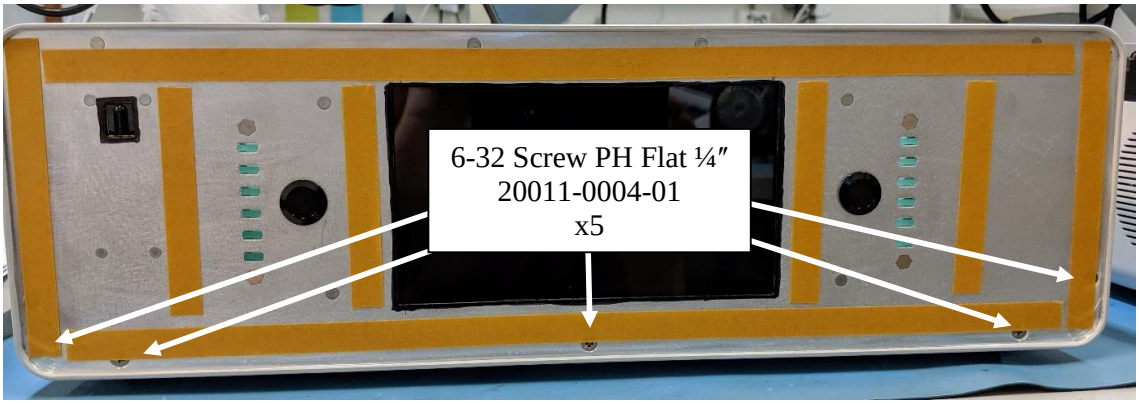


Figure 56 – Screw holes for attaching front panel to chassis

6.3.8. Peel the double-sided tape and place the front acrylic cover onto the chassis front cover taking care to align the edges and the two button holes.

6.3.9. Install both momentary push buttons in the holes shown in **Figure 57**, using the manufacturer provided hardware. Strip black and white wires from ACB board "button R" (see **Figure 20**) back ¼″ and attach to the push button closest to IRB. Repeat for other button using "button L".

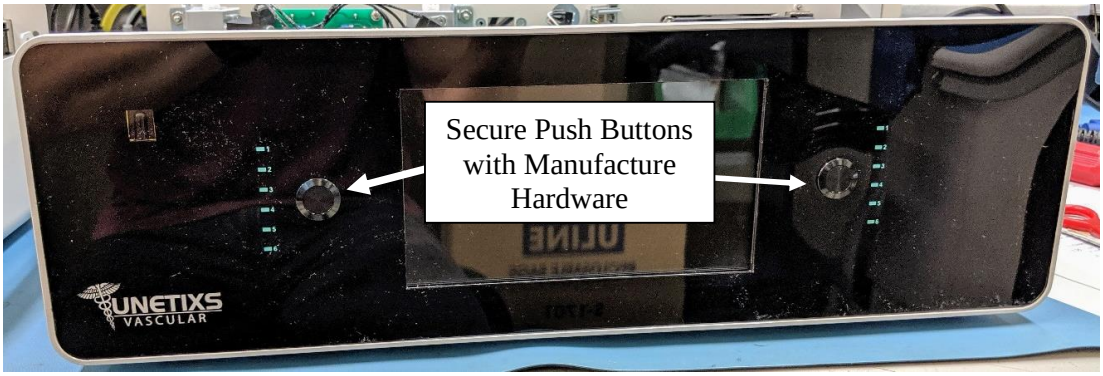


Figure 57 – Momentary push buttons installed

6.3.10. Plug the USB power, from the power distribution cable, into the computer as shown in **Figure 58**.

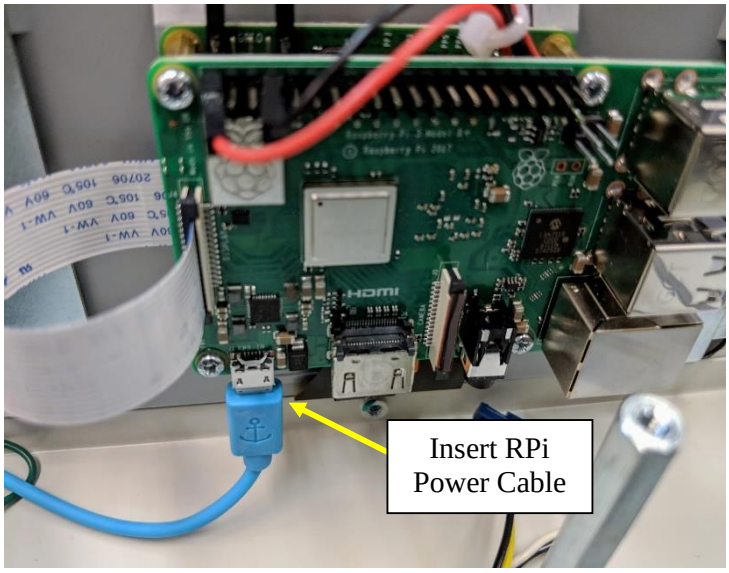


Figure 58 – USB cable installed on Computer

6.3.11. Attach the male end of the USB Extender Cable (10326-0008-01) installed in step 4.8 to a free USB port on the Computer. Route the wire along the inside wall of the chassis to the Pi.

6.3.12. Plug in the right LED wires, from the ACB board, to the Position A LED board and the left LED wires to the Position B LED board routing the wires along the inside wall of the chassis.

Step 7 Raspberry Pi Imaging

7.1. The following parts are needed to image the raspberry pi:

Description	Item Number	QTY	Length
Micro SD Card, 16GBmin	10372-0016-06	1	N/A
Raspberry Pi Imager	60025-0000-01	1	N/A
Micro SD Adapter, USB	65039-0000-01	1	N/A
Computer to format SD card	N/A	1	N/A
USB Keyboard	N/A	1	N/A
USB Mouse	N/A	1	N/A

7.2. Plug the SD reader into the PC. If this is the first time plugging the reader into this computer, a dialogue bubble will show in the bottom right of the desktop saying that the device is being installed and will then tell you that the device is ready to use as shown in **Figure 59**. If there are no dialogue bubbles when you plug the reader in, then you can proceed to step 7.3.

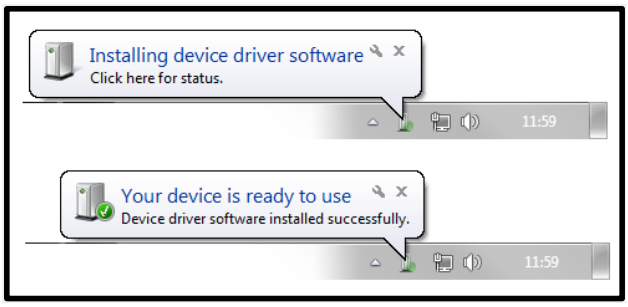


Figure 59 – SD reader driver installation notifications

7.3. Open a windows explorer window and note what drives are listed under "Computer" in the left pane as shown in **Figure 60**. Obtain your SD card and insert it into the reader. If any pop-ups appear to view files or scan/repair card, dismiss them.

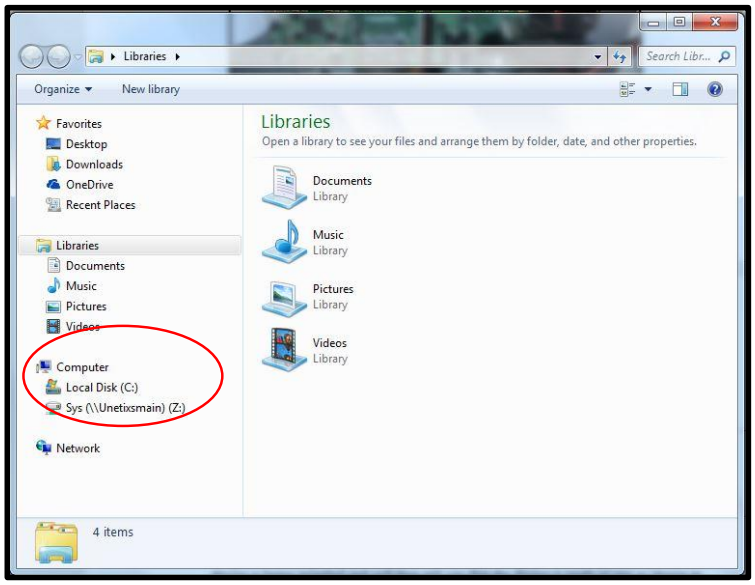


Figure 60 – Windows explorer showing available drives

7.4. Go back to your windows explorer window and note the drive letter which did not previously show under "Computer" as shown in **Figure 61**. This is the drive letter of your SD card and you will need to refer to it several times throughout the rest of the imaging process. *Note: In the images, the drive letter is shown as 'H:'; however, this may not be the case for you. Expect any letter for your SD drive*

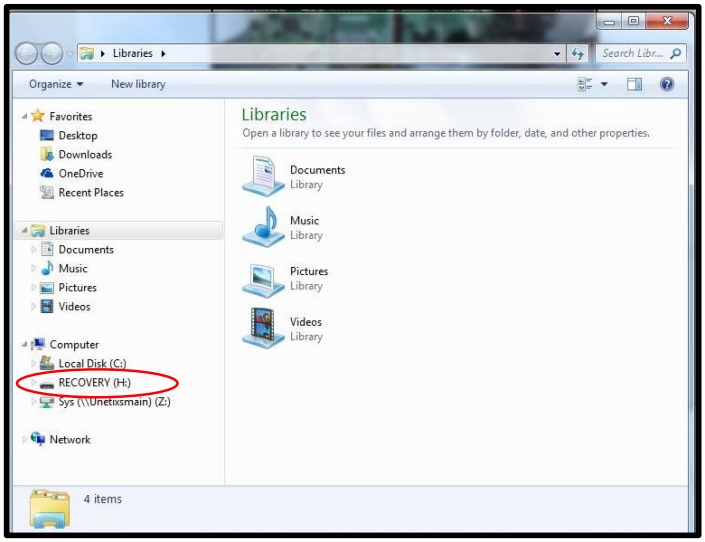


Figure 61 – Windows Explorer showing SD drive letter

7.5. Click the start button

7.6. Right click on "Computer"

7.7. Click "Manage"

7.8. Click on "Storage" in the left pane.

7.9. Click on "Disk Management" underneath "Storage".

7.10. A window will open showing all drives currently mounted on the computer. You should see the SD Card's drive letter listed, as shown in **Figure 62**.

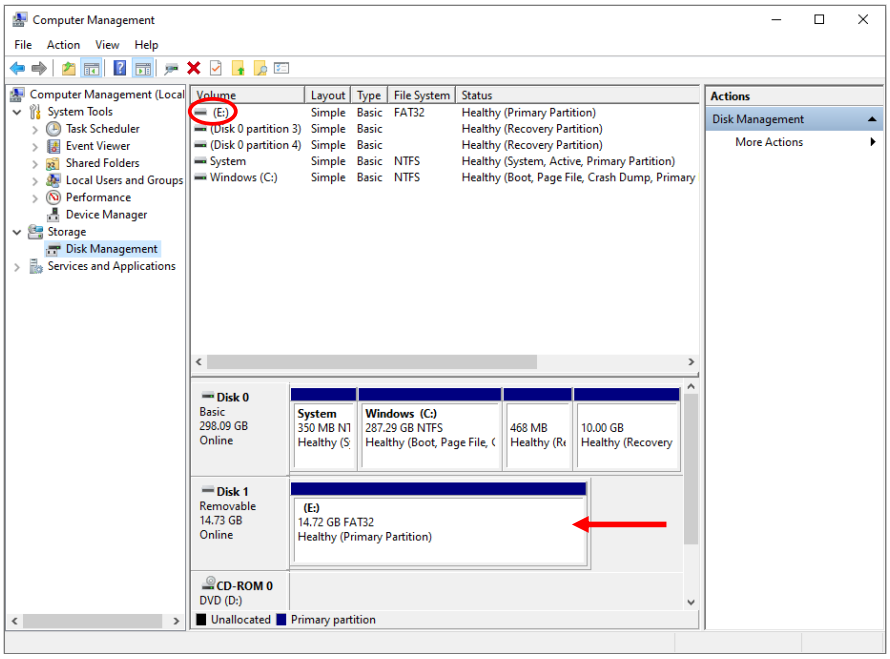


Figure 62 – SD drive letter in Disk Management tool

7.11. Right click on the SD's drive letter in the list and select "Format"

7.12. A pop up will open allowing you to select the desired formatting options; You may leave the volume label as whatever it is currently named, select FAT32 under File system, select "Default" under Allocation unit size as shown in **Figure 63**.

Figure 63 – Format options in Disk Management

7.13. Click the "OK" button. You may not be prompted that the formatting is done; however, you can tell by looking at "status" column in the volume list. When the card is finished formatting, it will say "Healthy" rather than "Formatting"

7.14. Once the card is formatted, insert the Raspberry Pi Imager USB (60025-0000-01) into any free USB slot on the computer. Note: if this is the first time the imager USB has been used on this PC you will have to wait for the drivers to be installed, similar to step 7.2 for the card reader. If a window pops up asking if you want to scan and fix the device, select "Continue without scanning".

7.15. Open the Imager to view its contents. Double click on the executable "Etcher" inside the folder. Click "Run" if necessary.

7.16. Click "Select Image".

7.17. Navigate to the location of the Imager USB and double click on the ZIP file containing the word "Raspbian".

7.18. Ensure that the SD card you formatted in the previous step shows as the drive to flash. If it does not, click "change" to choose the correct drive letter.

7.19. Click "Flash". If a pop-up asks for permission, say "yes". Note: Pop up may only appear as a flashing icon on the task bar at the bottom of the screen.

7.20. The flashing will begin and may take 10+ mins. There will also be an automatic validation phase after the flashing completes which will also take several minutes.

7.21. Upon completion of flashing and validation, close the etcher program. Remove the SD card from the card reader.

7.22. Insert the newly imaged SD card into the raspberry pi SD slot as shown in **Figure 64**. **Ensure the raspberry pi has a keyboard and mouse connected to its USB ports and is connected to the internet through ethernet**.

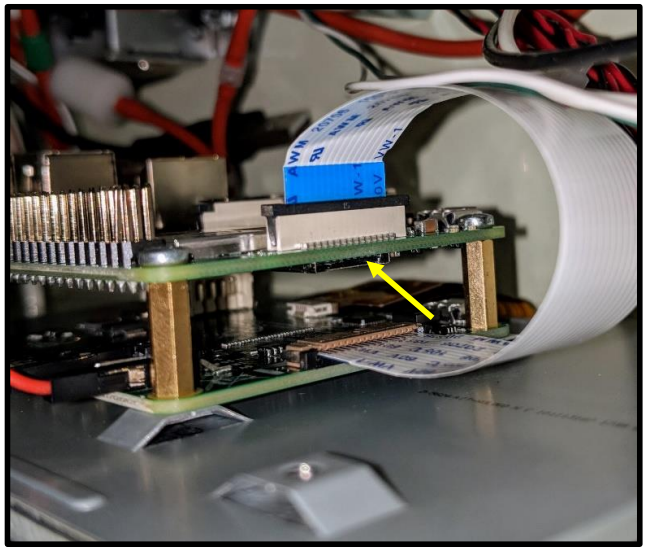


Figure 64 – Raspberry Pi SD slot

7.23. Turn on the module, the raspberry pi should run through its boot process (This could take up to two minutes). When the desktop loads, if there is a setup pop up click "cancel", if not proceed to next step.

7.24. Unplug the Raspberry Pi Imager (60025-0000-01) from the computer and now insert it into any of the free USB slots on the raspberry pi.

7.25. Click "ok" when shown pop-up "Removable medium is inserted" to view the contents of the Imager folder.

7.26. Drag the RoodraLogo.jpg, RoodraRpiSetup, and myomx.sh files to the raspberry pi desktop.

7.27. Click the terminal program icon on the task bar to launch terminal.

7.28. Type:

```
cd Desktop
```

7.29. Press Enter

7.30. Type:

```
chmod +x RoodraRpiSetup
```

7.31. Press Enter

7.32. Type

```
sudo ./RoodraRpiSetup
```

7.33. Press Enter. This executes a script, so you will see a lot of things happening without the need of your input. The script will take about 5 minutes or more to run depending on the internet speed. You will know it is complete when a single line starting with `pi@raspberrypi:~/Desktop $` is printed and the cursor is white.

7.34. Close the terminal window.

7.35. Right click on the RoodraRpiSetup file on the desktop and select "Move to Wastebasket".

7.36. Right click the waste bin from the desktop and click "Empty Wastebasket".

7.37. Remove the waste bin from the desktop by right clicking on the icon and selecting "Remove from Desktop".

7.38. Click the start menu icon and select "preferences" and then select "Screensaver"

7.39. You may get a pop-up asking if you want to load the xscreensaver daemon, select "cancel".

7.40. In the Mode: dropdown, select "Disable Screen Saver".

7.41. Close the screensaver window.

7.42. Click on the start menu and select "Shutdown" and choose "Shutdown". Unplug the mouse, keyboard, ethernet cable, and Raspberry Pi Imager from the raspberry pi.

7.43. Turn off the module.

Step 8 Motherboard Installation

8.1. The following parts are needed to install the motherboard:

Description	Item Number	QTY	Length
PCB Ass'y, S2 SMT Motherboard (SSB)	11919-0000-01	1	N/A
Lock Washer, 6-32	20002-0632-01	5	N/A
Screw, Machine 6-32 PH Pan Head 3/8"	20012-0006-01	4	N/A
Standoff, Hex Threaded, 6-23 x 3"	20015-0048-01	4	N/A

8.2. Attach the four standoffs to the base of the Roodra in between the power supply and the pump enclosure.

8.3. Make the following connections to the motherboard:

Cable	Motherboard Reference
Right Valve Assembly Cable	JP4
Left Valve Assembly Cable	JP3
Left Pump Cable	JP5
Right Pump Cable	JP6
Left Speaker Cable	JP13
Right Speaker Cable	JP12
ACB Control Cable Assembly	JP11 ***see Figure** 65
Headphone Cable	JP8
Right PPG Cable	JP9
Left PPG Cable	JP10

Cable	Motherboard Reference
Doppler Cable	JP15 (Pins 1-4) ***see Figure** 66
Temperature Cable	JP1
Power Distribution Cable	JP14
IRB w/ Cable Assembly	JP7
Internal CPU Cable Assembly	JP2
Right Internal Hose Assembly w/ Orifice Restrictor	S1 *see **Figure 67**
Right Internal Hose Assembly	S6/S3 *see **Figure 67**
Left Internal Hose Assembly w/ Orifice Restrictor	S2 *see **Figure 67**
Left Internal Hose Assembly	S5/S4 *see **Figure 67**

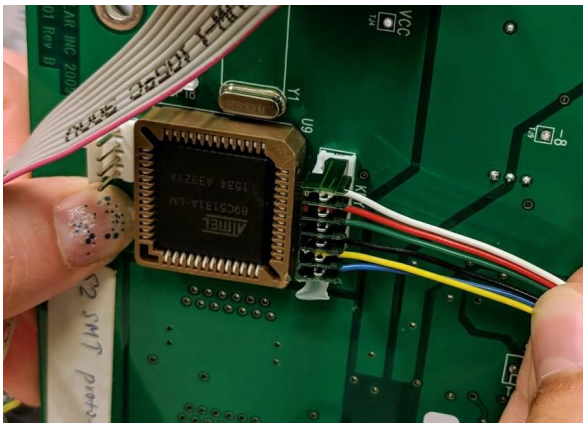


Figure 65 – ACB to Motherboard Connection

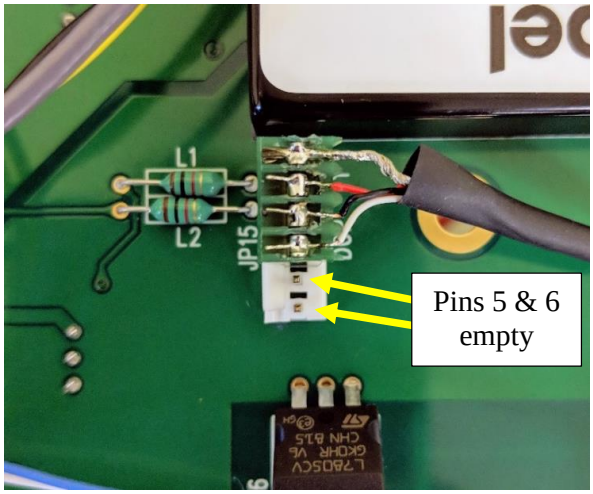


Figure 66 – Doppler to Motherboard Connection

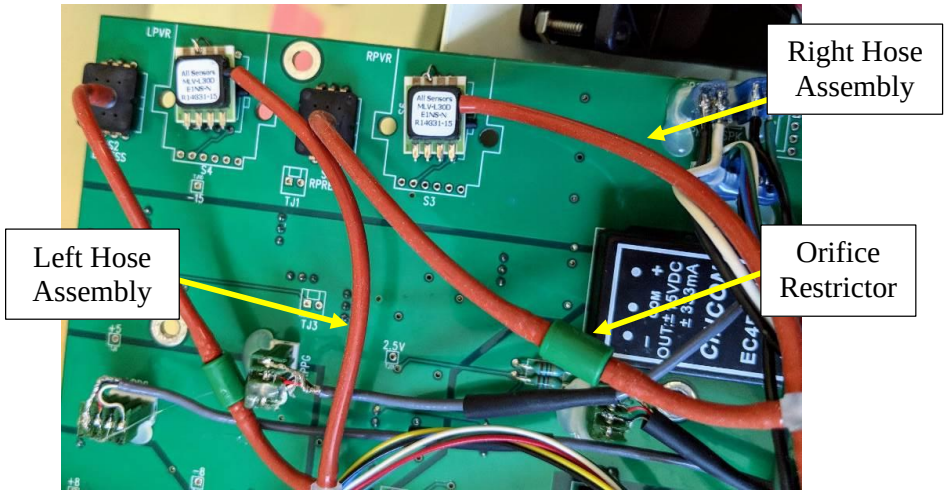


Figure 67 – Internal Hose Assemblies connected to Motherboard

8.4. Attach the S2 SMT Motherboard to the standoffs, with all the connection faced down, using the 6-32 x 3/8" screws and the #6 lock washers. See **Figure 68** for reference.

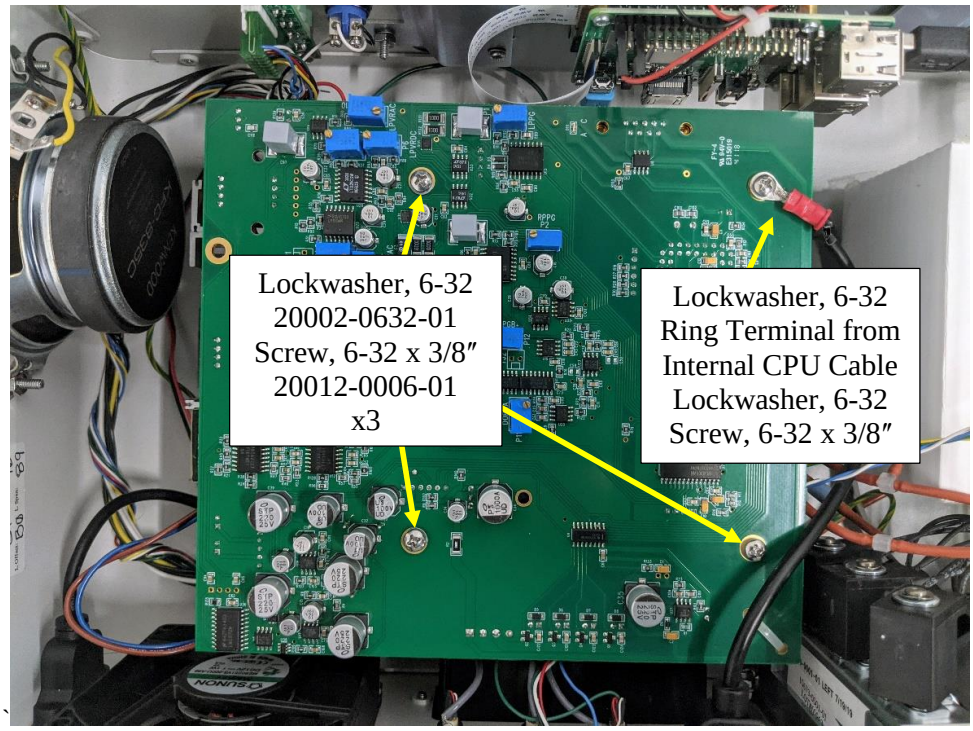


Figure 68 – Mounted Motherboard

Step 9 Test/Calibration

9.1. Perform a Test/Calibration Procedure as per 11983-0006-01.

Step 10 Chassis Top Installation

10.1. The following parts are needed to install the chassis top:

Description	Item Number	QTY	Length
Ring Terminal, #8, insulated	10548-0008-01	2	N/A
Green/Yellow Wire – 18AWG	10706-0009-01	1	12″ Length
Lock Washer, 6-32	20002-0632-01	5	N/A
Nut, Machine 6-32	20003-0632-01	5	N/A
Screw, Mach. 6-32 PH Flat Head ¼"	20011-0004-01	12	N/A
Roodra, Chassis Top	40001-1001-01	1	N/A
Bracket, Roodra Cover Mount	40003-3008-01	1	N/A

10.2. Strip the 12″ green/yellow 18AWG wire by ¼″ and attach a #8 ring terminal on both ends.

10.3. Attach the cover mount bracket to the studs on the back of the front panel and secure it in place using the 6-32 hex nuts and #6 lock washers as shown in **Figure 69**. Also secure the ring terminal from the Power Entry Module and one end of the green/yellow wire to the strut near closest to the power supply, between the Cover Mount and the lock washer.

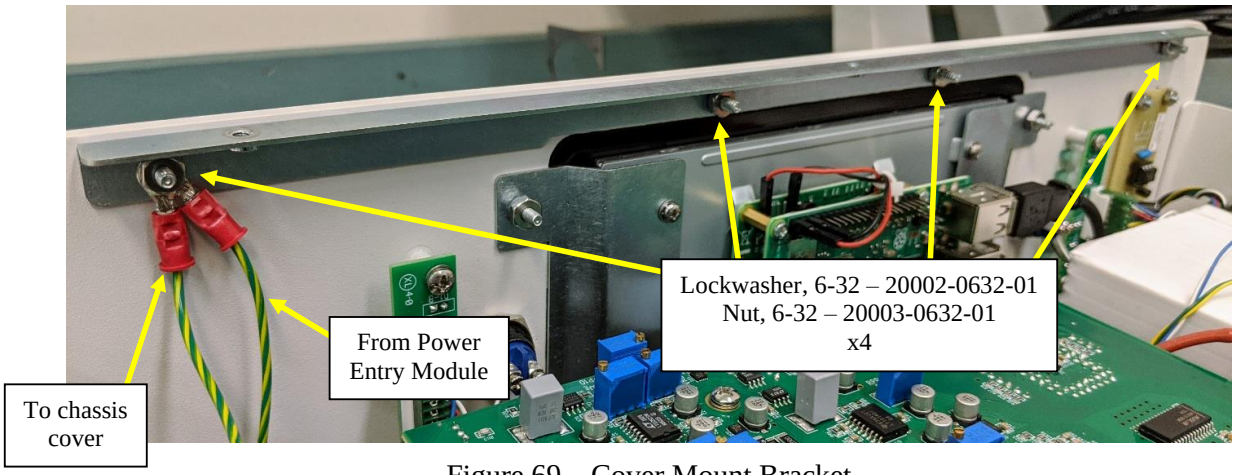


Figure 69 – Cover Mount Bracket

10.4. Connect the other end of the green/yellow wire to the strut on the inside of the chassis top with a #6 lock washer and a 6-32 nut as shown in **Figure 70**.

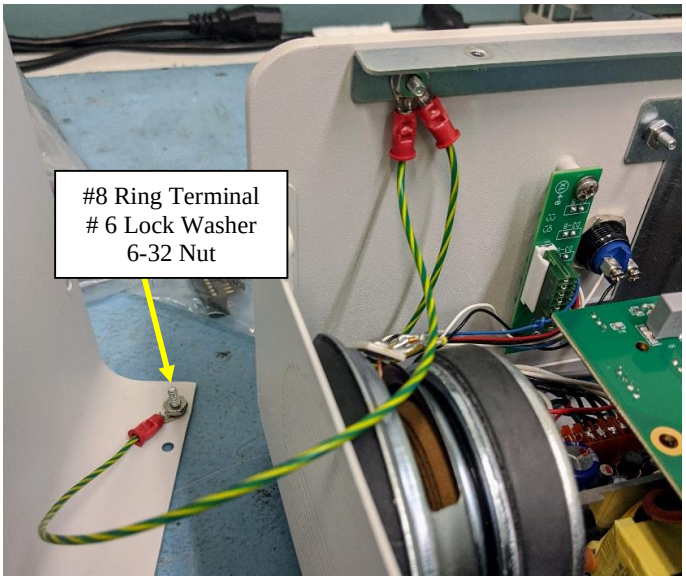


Figure 70 – Chassis Cover Grounding

10.5. Place the chassis top on the Roodra with the lip facing the backside.

10.6. Secure the top to the chassis with the twelve 6-32 x ¼" Flat Head screws.

Step 11 Labels

11.1. The following labels are needed:

Description	Item Number	QTY	Length
Label, Caution Series 2	40002-2040-01	1	N/A
Label, Warning Exp. Series 2	40002-2040-02	1	N/A
Label, Warning Fire Series 2	40002-2040-03	1	N/A
Label, Caution Physician Series 2	40002-2040-04	1	N/A
Label, Serial Series 2	40002-2040-05	1	N/A

11.2. Type in the Model Number (11983-0000-01) and Serial Number (OBCXXXXS-U) on the Serial Number Label (40002-2040-05) per SOP-30-003 and apply it on the back panel of the chassis along with the four safety labels as shown in **Figure 71**.

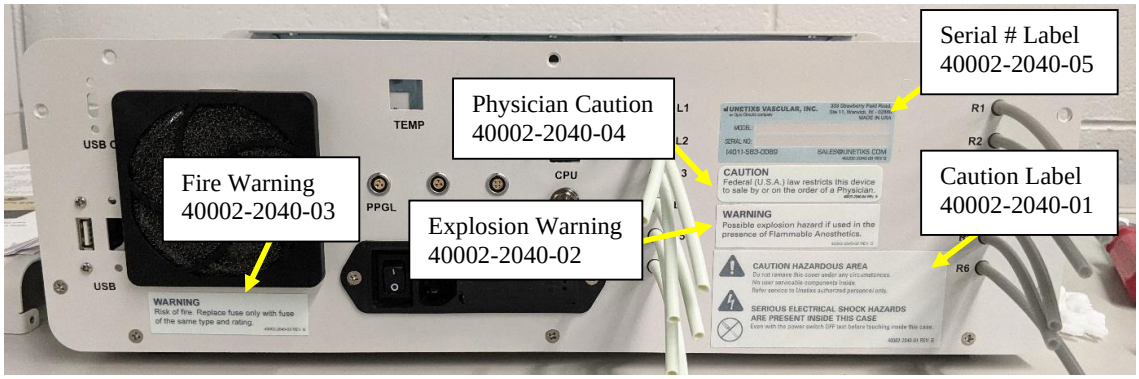


Figure 71 – Chassis Label Placement

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1. Test Equipment Checklist

Gather all the test equipment needed and copy down their control numbers and calibration due dates. Check the calibration or maintenance date to confirm that all equipment is good to use, record date below. Have a bottle of ultrasonic gel (10628-0001-01) ready for use.

Test Equipment Name	Control # / Serial #	Due Date
Digital Manometer		
Scope Meter		
Headphone Jack Test Device P/N: 65033-0000-01		**N/A**
Manometer with Accessories P/N: 60005-0000-01		**N/A**
Test Computer P/N: 60007-0000-01		**N/A**
Doppler Cable P/N: 11930-0000-01		**N/A**
Remote Control P/N: 65022-0000-01		**N/A**
TruDop 8 Probe P/N: 11963-0000-01		**N/A**
PPG Ass'y P/N: 11938/11939/11926-0000-01		**N/A**
Temperature Gun Ass'y P/N: 11951-0000-01		**N/A**
Raspberry Pi Imager P/N: 60025-0000-01		**N/A**

2. Grounding Test

2.1. Touch the ground lead of the digital multimeter to the ground lead of the power entry module and then touch the positive lead of the multimeter to the following positions and check if the resistance is less than 1 ohm:

Testing Point	Resistance Ω
Power Supply Screw – Doppler/Power Entry Cable	
Power Supply Screw – Power Distribution Cable	
Power Entry Supply Screw	
Panel Mount USB Metal – Internal CPU Cable	
Plug Connector (MC)	
PPGL Lemos Connector	
PPGR Lemos Connector	
Doppler Lemos Connector	

Step 2 tested by: _____

3. Setup

3.1. Connect the OBC to the Test Computer (60007-0000-01) using its USB cable. Connect a power cord to the OBC. Turn both the Test Computer and the OBC on.

4. Raspberry Pi

4.1. Connect the OBC to a power outlet. Insert the Raspberry Pi Imager (60025-0000-01) into the USB port on the back of the chassis. Turn on the chassis and watch the LCD screen on the front of the unit as it boots up. Once the Pi boots successfully there should be a window already opened on the screen with the name "myomx" and with the text "searching for usb device". It should find the USB drive followed by the "Roodra Logo Folder" and then begin to replace logo (for the test it will just replace it with the same image). If successful there should be no errors and it should say that the logo is replaced.

4.2. Turn off the chassis, unplug the USB drive, and turn the chassis back on. After booting up, the desktop should display the appropriate logo only on screen. Ensure the taskbar, mouse pointer, or any icons are not visible. (They may appear for a brief second and then disappear during boot up; this is OK.)

4.3. Touch the LCD screen at various points and ensure that the mouse cursor does not appear.

Step 4 tested by: _____

5. Blood Pressure Calibration

5.1. Double click on the "**S2WIN-Roodra USB**" icon on the desktop. The S2 Vascular Software Main Menu will display. Confirm that **Vascular: OK** shows on the screen.

5.2. From the Main Menu, click **Studies --- Lower Arterial Studies --- LA Segmental Pressures with PVR --- Exit**. Then click **Right Brachial Pressure Study --- Back**.

5.3. Connect the Manometer with Accessories (60005-0000-01) and the Digital Manometer to the R1 on the unit. Click **Inflate**. Pump the manometer to a value between 270-250 mmHg and ensure that the value on manometer matches what is displayed on the screen within a 1 mmHg. Repeat process for a value between 170-150 and 70-50.

Pressure Range	Manometer Reading	Screen Reading
RT 70-50 mmHg		
RT 150-170 mmHg		
RT 250-270 mmHg		

5.4. Repeat step 5.3 for the L1 port.

Pressure Range	Manometer Reading	Screen Reading
LT 70-50 mmHg		
LT150-170 mmHg		
LT 250-270 mmHg		

5.5. If the values are within the acceptable range for both the left and right, skip to step 6. If not, recalibrate blood pressure via steps 5.6 – 5.12.

5.6. From the main menu. Click **Setup --- Yes --- Diagnostics --- Calibrate --- Blood Pressure**. Click **Ok** on the warning screen and then click **Yes**.

5.7. Connect digital manometer to R1. With hand pump valve open, press **R 0mm** on screen.

5.8. Close the hand pump valve and start to pump it manually until the Digital Manometer reading reaches 302~310mmHg. Manually release the hand pump valve slowly until the Digital Manometer reads 300+0.10 mmHg (between 300.0 and 300.1). Press **R 300mm** on screen.

5.9. Verify that at least 3 other manometer readings on the screen match the Digital manometer readings.

5.10. Connect digital manometer to L1 port. With hand pump valve open, press **L 0mm** on screen.

5.11. Close the hand pump valve and start to pump it manually until the Digital Manometer reading reaches 302~310mmHg. Manually release the hand pump valve slowly until the Digital Manometer reads 300+0.10 mmHg (between 300.0 and 300.1). Press **L 300mm** on screen.

5.12. Verify that at least 3 other manometer readings on the screen match the Digital manometer readings. Click **Save**. Exit back to the main menu.

Pressure Range	Manometer Reading	Screen Reading
RT 70-50 mmHg		
RT 150-170 mmHg		
RT 250-270 mmHg		
LT 70-50 mmHg		
LT 150-170 mmHg		
LT 250-270 mmHg		

Step 5 tested by: _____

6. Doppler

6.1. Set Baseline

6.1.1. From the Main Menu, click **Setup --- Yes --- Diagnostics --- Calibrate --- Zero Dop Baseline**.

6.1.2. Set the following parameters if necessary: **Side** button to **Forward**, **Filter** to **3.5 Hz** and **Gain** to **24 Hz/mm**.

6.1.3. Click **Forward Clear** button; wait for **at least 3 seconds** and then click **Forward Set** button.

6.1.4. Click **Side** button to change the side to **Reverse**.

6.1.5. Click **Reverse Clear** button; wait for **at least 3 seconds** and then click **Reverse Set** button.

6.1.6. Change the **Gain** to **256 Hz/mm** and repeat step 6.1.3 through 6.1.5. When finished, exit back to main menu.

6.2. Doppler Sensitivity

6.2.1. From the Main Menu screen, click **Studies --- Lower Arterial Studies --- LA Segmental Pressures with Doppler --- Exit --- Right Common Femoral Doppler** --- "**BACK**". Click "Gain ↑" to 24 Hz/mm. Set **Filter** to 7 Hz. Verify that the line is solid Yellow at 10mm.

6.2.2. Connect a TruDop 8 Doppler Probe (11963-0000-01) with a Doppler Cable (11930-0000-01) to the front of the unit. Turn the gain all the way up and set filter to off.

6.2.3. Turn trimpots **P4** and **P5** CW all the way up.

6.2.4. Adjust **P4** and **P5** as shown in **Figure 1**. Ticks above and below baseline must be evenly balanced.

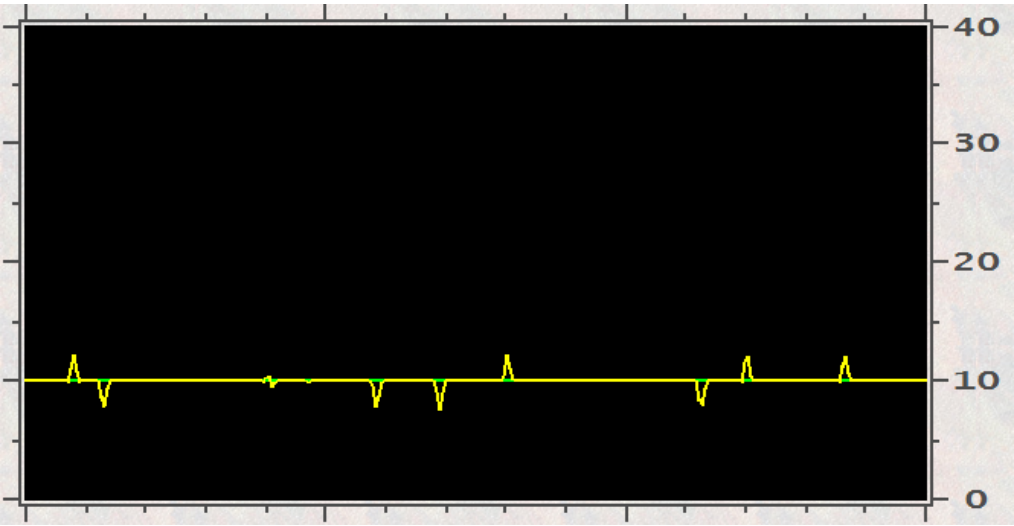


Figure 1 – Ideal Doppler Sensitivity

6.2.5. Set **Gain** to 64 Hz/mm, **Filter** to 7 Hz and turn the volume up. Perform a self-test. Check for clear waveforms. Verify that the Doppler can be heard in both speakers: **Right for up/forward flow** and **Left for down/reverse flow**.

6.2.6. Plug a Headphone Jack Test Device (65033-0000-01). Repeat Step 6.2.5 and verify that the internal speaker is mute and the left and right sound comes from the Headphone Jack Test Device. Click "**Exit**" button to Main Menu.

Step 6 tested by: _____

7. PPG

7.1. From Main Menu, click **Studies --- Lower Arterial Studies --- LA PPG Toe & Toe Pressures --- Exit --- Right Great Toe PPG Waveform --- Back**. Click "**GAIN UP**" to 16.

7.2. Adjust **P1 for left** and **P2 for right** to center baselines at 20 on screen.

7.3. **Verify Correct PPG Sides** – Plug the test PPG Ass'y (11938/11978-0000-01) into Left PPG port. Verify that a clear waveform shows on the Left side.

7.4. Plug the test PPG Ass'y (11938/11978-0000-01) into Right PPG. Verify that a clear waveform shows on the Right side.

7.5. **Verify PPG VRT** – From the main menu, click **Studies --- Lower Venous Studies --- VRT Venous Refill Time --- Exit --- Right Venous Refill --- Back**. Turn **Gain** to 16. With the PPG on your finger and click **RESET** button. Verify that the waveform is present.

7.6. Unplug the test PPG probe from right side and plug it on to the left side. Click **NEXT** and repeat the test on the left side.

7.7. Exit back to **Main Menu**.

Step 7 tested by: _____

8. Pneumo Tests

8.1. Click on **Studies --- Lower Arterial Studies --- LA Segmental Pressures with PVR --- Exit --- Right Metatarsal PVR waveform --- BACK**.

8.2. **Set Baselines** – With the gain at .188mmHg/20mm and 0mmHg of pressure, center PVR baselines to 20. Adjust **P9 for right** and **P10 for left**.

8.3. **Check for Leaks** – Turn off all LED's on front panel. Click **Inflate**. Verify that the baselines remain between 15 and 20 on screen with mmHg between 60-99.

8.4. **Verify Hose Orientation (left/right, up/down)**. Turn on R1 LED. Select **Right** side on screen. Squeeze the R1 hose a few times to verify that the right-side waveform moves accordingly (Up when pinched and Down when released). Right side mmHg number should drop 1 or 2 mmHg.

8.5. Select **Left** side on screen. Repeat step 8.4 on the left using L1.

8.6. Click **Exit --- Right Brachial Pressure --- Back**. Turn off all LED's on front panel. Select **Inflate**. Select **Inflate** again and hold briefly. Unit should now be at 290 mmHg (± 30 mmHg).

8.7. Click **Deflate** once, the unit will slowly deflate **1 or 2 mm at a time.** Pressing and holding **Deflate** should **quickly deflate** the system.

8.8. Repeat at **Left Brachial Pressure** by clicking **Next**. Exit to Main Menu.

Step 8 tested by: _____

9. Temperature Port Test

9.1. Plug a Temperature Gun (11951-000-01) to the OBC.

9.2. From Main Menu, click **Studies --- Upper Arterial Studies --- UA Cold Tolerance Thermometry --- Exit --- Baseline-Right Thumb Study --- Back**. Do 5 readings (pick high and low temperature within range) and verify the reading shown on the Temperature Gun is within 1 degree of the temperature shown on the test computer screen. Click **Capture --- Exit** to go to Main Menu.

9.3. Click "**Start**" --- "**Shut Down**" wait for black screen and turn off the unit. Disconnect all the cables and hoses from the unit if necessary.

Step 9 tested by: _____

10. IR & Front Panel Buttons Test

10.1. From Main Menu, click **Setup --- Yes --- Diagnostics --- Keypad**.

10.2. Press various buttons on the Remote Control and verify that each corresponding button on the screen lights up. Exit to Main Menu when finished.

10.3. Click **Studies --- Lower Arterial Studies --- LA Segmental Pressures with PVR --- Exit --- Right Brachial Pressure --- Back**. The light for **R1** should light up. Click **Next** and verify that the light for **L1** lights up. Click **Back** and verify that the **R1** light turns on and the **L1** light turns off.

10.4. Push the **right** button and verify the lights turn on in sequential order from **R1** to **R6** with each button press. After R6, the next button press should cause none of the right lights to be on, and then the following button press should go back to R1. Repeat with the **left** button and lights.

Step 10 tested by: _____

End of Test/Calibration

Pass/Fail: _____

Test/Calibration Performed By: _____ Date: _____

Step 1 Assembly

1.1. Computer/Chassis Mounting

1.1.1. Mount the Touch Panel Computer (10353-0004-01) to the Display Mount on the Roodra Cart using the (4) M4 x 8mm philips head screws. See **Figure 1** for reference.

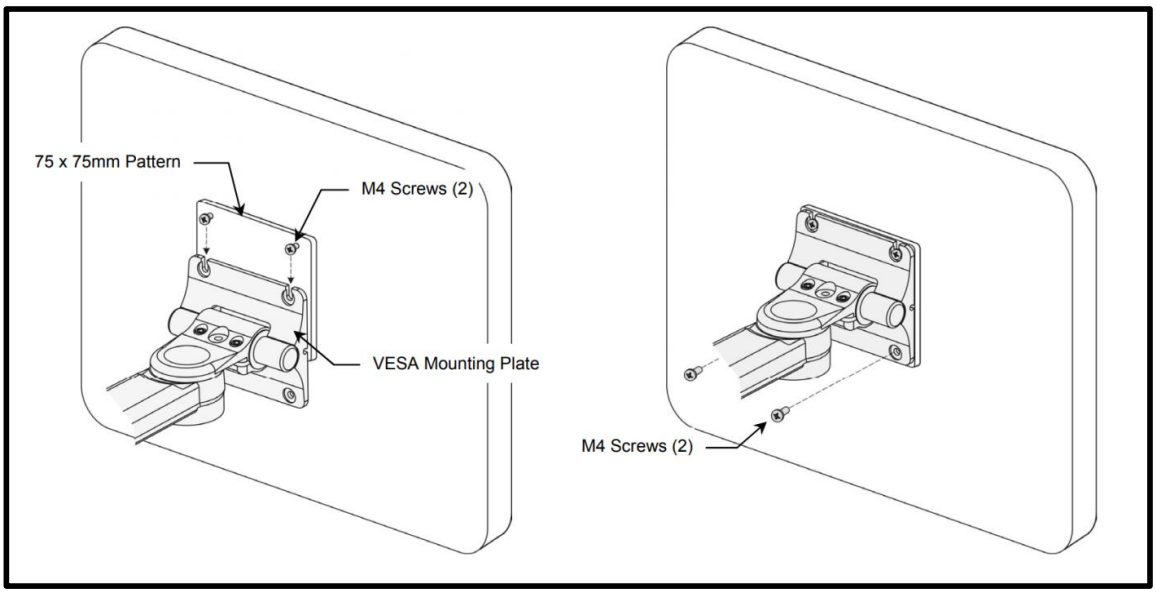


Figure 1 – Touch Panel Mounting

1.1.2. Place the user manual, setup pamphlet, windows disc, and driver disc that come with the computer into the drawer.

1.1.3. Place the Roodra Chassis (11983-0000-01) on top of the Storage Drawer of the cart.

1.2. Wiring

1.2.1. Place two strips of length 6.5" of double-sided foam tape (10635-0002-01) along the back side of the Power Strip (10357-0005-02).

1.2.2. Open the lid of the Tray w/ Enclosure and secure the Power Strip to the front inside of the tray using the double-sided foam tape. Snake the wire of the power strip along the side of the tray and then down and out the center hole near the back. Place the wire that is outside of the tray into the Chart Bin. See **Figure 2** for reference.

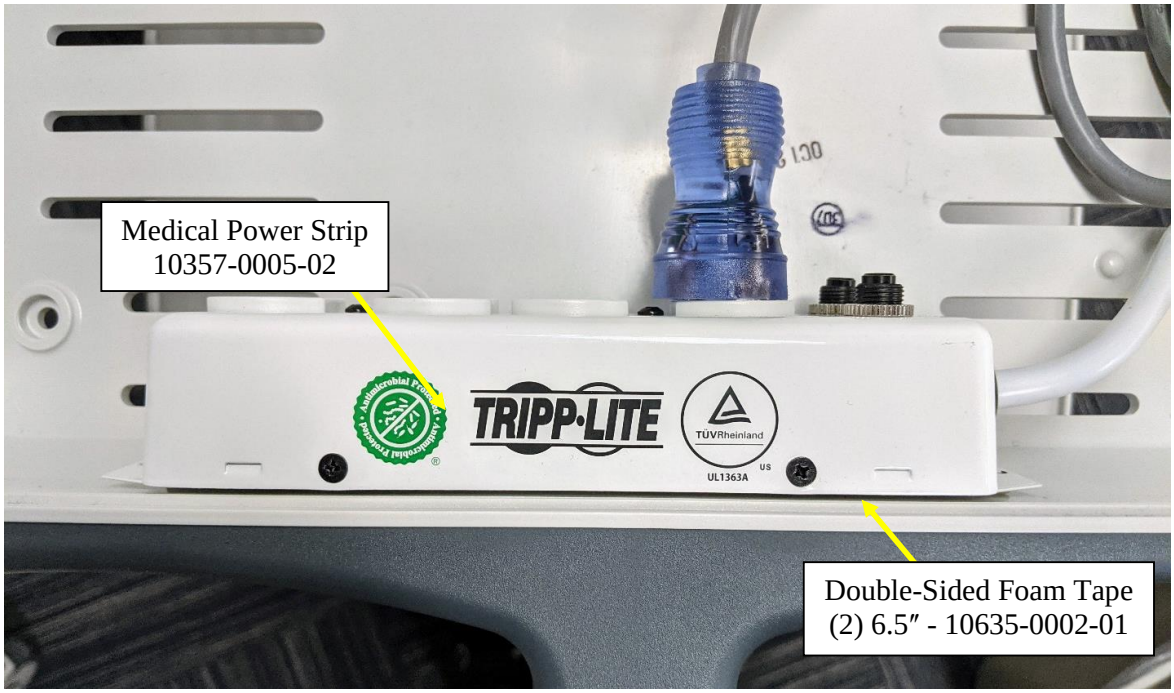


Figure 2 – Power Strip Mounting

1.2.3. Connect the Line Cord (10629-0003-01) to the Power Strip. Snake the other end down and out of the center hole at the back of the tray and connect that end to the back of the Chassis.

1.2.4. Connect the Power Cable from the Touch Panel Computer to the Power Strip. Snake the other end of the computer's power cable up and out of the right back hole of the tray, through the cable cover and connect it to the computer. See **Figure 3** for reference.

1.2.5. Attach one end of the Network Patch Cable (10719-0000-02) to the Cat 6 Coupler inside the tray and snake the other end up and out of the right hole at the back of the tray. Continue to snake it through the wire cover and connect that end to the computer. See **Figure 3** for reference.

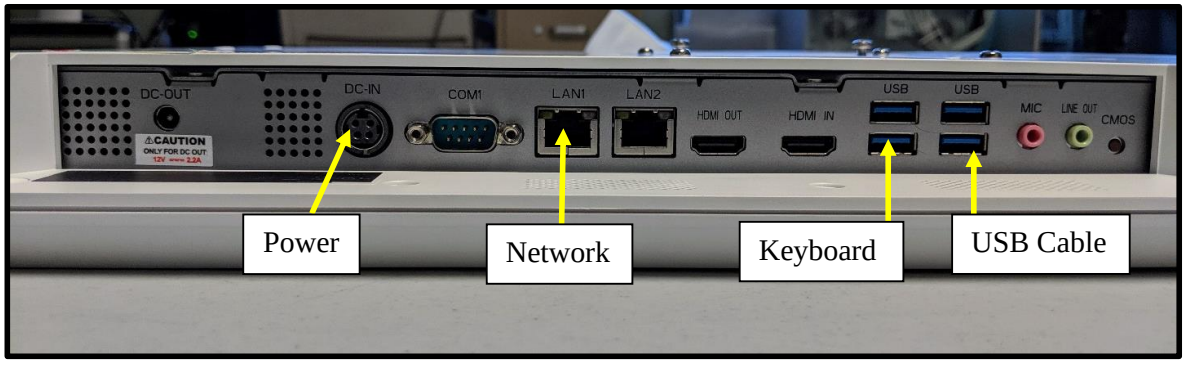


Figure 3 – Touch Panel Computer Ports

1.2.6. Attach the USB Cable (10326-0006-01) to one of the USB ports underneath the PC and snake the other end down through the wire cover and into the keyboard tray. Come back out of the keyboard tray and connect that end to the port on the chassis labeled "CPU".

1.2.7. Take all the loose cables inside the tray and tie them off to the right side using the velcro (10683-0003-01) to hold them in place while still leaving enough slack on the cable at their connection points. See **Figure 4** for reference.

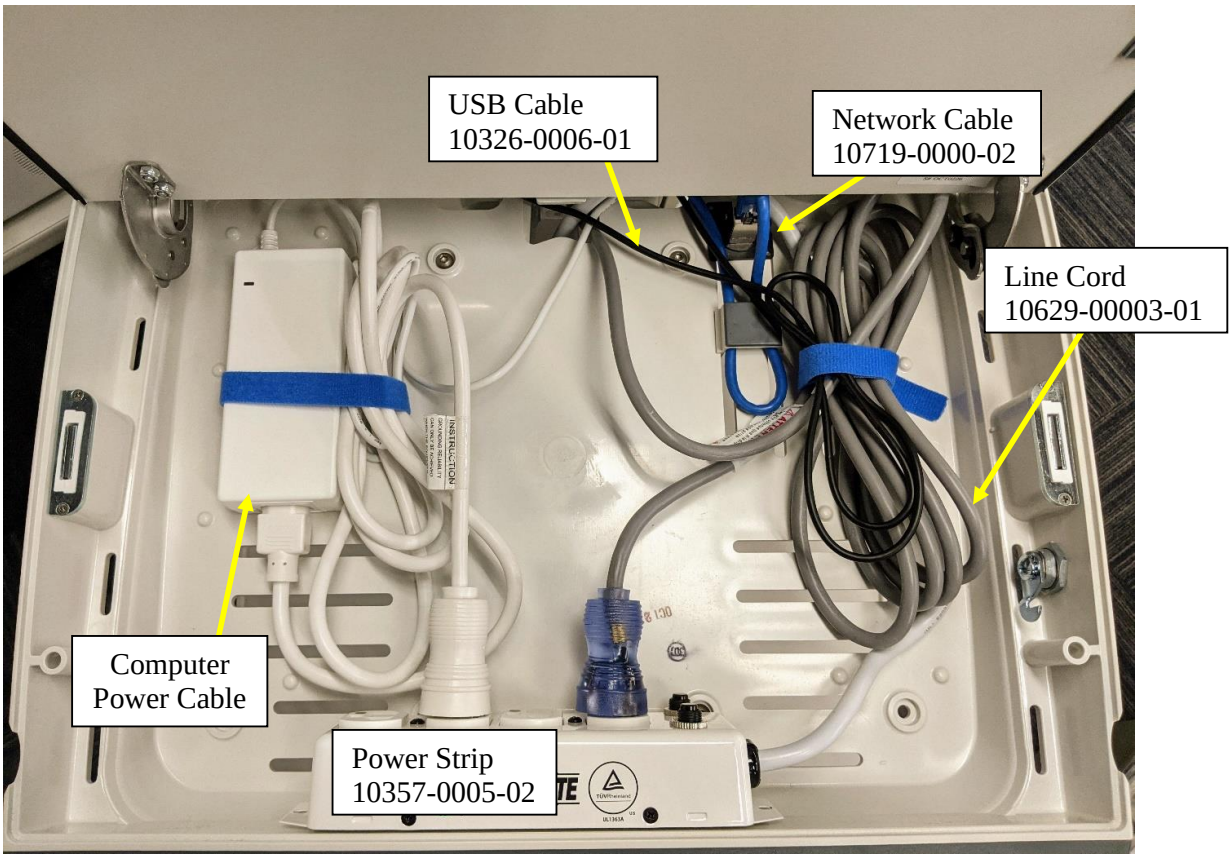


Figure 4 – Cable Wiring

1.2.8. Close the lid on the tray enclosure.

1.2.9. Connect the keyboard (10304-0006-01) to one of the USB ports underneath the computer and place the keyboard on top of the tray w/ enclosure.

Step 2 Software

2.1. Connect a network cable to the Cat6 Coupler underneath the tray w/ enclosure. Also connect the Windows 10 Bootable USB (60026-0000-01) to one of the unused USB ports of the Touch Panel Computer. Record the control number of the 60026 USB on the QA record (11986-0005-01).

2.2. Turn on the Touch Panel Computer. Immediately after turning on the computer, repeatedly press the **F11** key until you see a screen that reads "Please select boot device". Select the USB drive.

2.3. The Windows 10 install process should begin shortly after. Select these options for the following information:

- Language – English (United States)
- Time and currency – English United States
- Keyboard – US

Then click **Next --- Install Now**.

2.4. When prompted, enter the 25 Digit key located on the Windows label on the Touch Panel Computer and then click **Next**.

2.5. **Accept the license terms** and then click **Next**.

2.6. Select **Custom Install**, delete all partitions (if any) until there is just one drive of unallocated space and then click **Next**.

Windows will then begin to install. Once it finishes installing it will restart the computer, when this happens **remove the USB drive** from the computer. If you don't it may try and go through the reinstall process again.

2.7. After the computer finishes loading, it will show more settings to setup. Select the following options (if applicable):

- Region – US
- Keyboard – US
- Skip second keyboard
- Set up – Personal Use
- Sign in with Microsoft – Select Offline account
- Sign in with Microsoft Account – No/Limited Experience
- PC Username – Roodra
- Leave password entry blank and click **Next**
- Privacy settings – Set each option to its off position (no, basic, etc.)
- Decline Cortana
- Use activity history – No

2.8. When you reach the Desktop, Select **Start --- Settings --- Update & Security --- Check for updates**. Perform the necessary updates and any restarts to the computer if necessary, repeatedly checking after each restart until there are no more updates. When the updates are completed, you may continue to the next step.

2.9. Select **Home --- System --- Power & Sleep**. Change each option shown to **Never**.

2.10. Select **Home --- Network & Internet --- Ethernet --- Change adapter options**. In the window that pops up, right click on **Ethernet 2** and select **Disable**. Right click on **Ethernet** and select **Properties**. Uncheck **Internet Protocol Version 6 (IPV6)** and then click **OK**. Close network window when finished.

2.11. Click **Home --- Personalization --- Themes --- Desktop icon settings**. In the new window that appears, check the box next to Computer then click **Apply --- OK**. Close all open windows, there should be a "This PC" icon located on the desktop now.

2.12. Right click on the Desktop and select **New --- Folder**. Name the folder **PDF**.

2.13. Press **Crtl + Shift + Esc** on the keyboard to bring up the Task Manager. Click on **More details**. Open the **Startup** tab. **Disable** every item that is listed. Close the window when done.

2.14. Click the speaker icon and click on the arrow above the volume bar. A menu to select playback device will open. If there is only one option, move on to next step. If there is more than one option, select one and then tap on the volume bar and you should hear a windows notification sound. If you do not, select the other option from the menu and try again to get a sound. Once you have an option that produces a sound, move on to the next step.

2.15. Right click on the speaker icon on the taskbar and select **Open Volume Mixer**. Turn the System Sounds volume down to below 10 and turn the Speakers volume to 100. Close the window when finished.

2.16. Unpin any icon from the taskbar that is not Microsoft Edge or File Explorer. To do this right click the icon and select **Unpin from Taskbar**.

2.17. Open a file explorer window. In the address bar near the top of the window enter:

ftp.unetixs.com

2.18. Double click on the following folders, **pub --- cust --- Drivers**. Copy the "CyberNetDefaultTouch.zip" file to the desktop.

2.19. Go back to the **pub** folder, then double click on the **multilab** folder. Check with DMR 11399-00xx-0x to verify that the software revision levels on the FTP site match the current DMR documents. Write down the software revision levels onto the QA Record (11986-0005-01).

2.20. Copy the following installers to the desktop:

- 11399-0000-01 S2 Installer
- 11399-0001-01 DICOM Installer
- 11399-0002-01 Ancillary Installer

Close the explorer window.

2.21. Right click on the "CybernetDefaultTouch.zip" file and select **Extract All --- Extract**. A new window will appear that shows two folders. Open the **MouseModeDefault** folder and run the application called **WDT8650_PTool_2010**. When the application loads select **START**. Let the application run and when it says "PASS" the update is complete, and you may close the application.

2.22. Click the **back arrow** to return to the two folders again and open the **MouseUtil** folder. Run the application called **MouseUtil**. Check the box next to "Enable Right Click" then click **Write Flash**. When a window pops up saying update complete, click **OK** and then click **OK** once more on the main window. Close the File Explorer window.

2.23. Double click the DICOM Installer.

2.24. Click **Yes --- English --- Continue --- Continue --- Continue --- OK**.

2.25. Double click the Ancillary Installer

2.26. Click **Yes --- English --- Continue --- Continue --- check the Roodra box --- Next --- OK**.

2.27. Double click the S2 Installer.

2.28. Click **Yes --- English --- Continue --- Continue --- Continue --- Setup --- Install --- close the explorer window --- OK**.

2.29. Click and drag any icon on top of the S2WIN icon and a window should appear.

2.30. Click **Next** to go through the System Data and make the following changes if necessary:

- Print Control: -
- Start Menu: 4
- Touch Type: 11
- DIO Type: 0
- DIO OUT Port: 0
- DIO IN Port: 0
- Vascular Port: 5
- IR Remote Enabled: 2
- IR Remote Port: 0
- AUTO Cuff Select: 2
- Vascular Module: 3
- Button Color: 1
- Exp. Control 2: C:\programs\unetpdf
- Export Path 2: C:\Users\Roodra\Desktop\PDF\
- Export Code 2: 192
- Export Name: PDF File
- Import Control: C:\programs\dicommwl
- Import Code: 131

Click **Exit** when finished.

2.31. Click **Start** and type "run", then press **Enter**. A window entitled "Run" should appear as shown in **Figure 5**.

2.32. Type **shell:startup** into the "Open:" field. Select **OK**. A File Explorer Window named "Startup" should open.

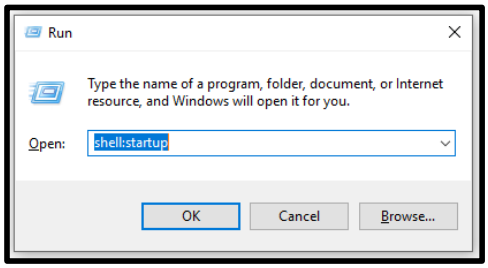


Figure 5 – Run Window

2.33. Copy the **S2WIN** icon on the desktop and paste it into the startup window. The S2WIN application should now appear in the window. Close the window.

2.34. Right click on the **My PC** icon and select **Manage**. Under **Device Manager** expand **Ports (COM & LPT)**. Turn on the chassis and watch to see what new COM port appears (will be labeled USB Serial Device). If the new port is labeled as COM5, you may move on to the next step. If not, right click on the new COM port and select **properties**. Navigate to the **Port Settings** and select **Advanced**. Set the **COM Port Number** to **COM5**. Click OK on both windows and then close the manager window.

2.35. Double click the **S2WIN** icon and verify that it says "Vascular: OK" at the top.

2.36. Click **Setup --- Yes --- Diagnostics --- Reindex Archive --- Full & Compress**. When the process is finished, exit back to Main Menu.

2.37. Click **Setup --- Yes --- Configure Studies**. Press **Alt + Enter** on the keyboard to exit full screen mode.

2.38. Right click the logo in the upper left corner, then left click **properties**. See **Figure 6** for reference.

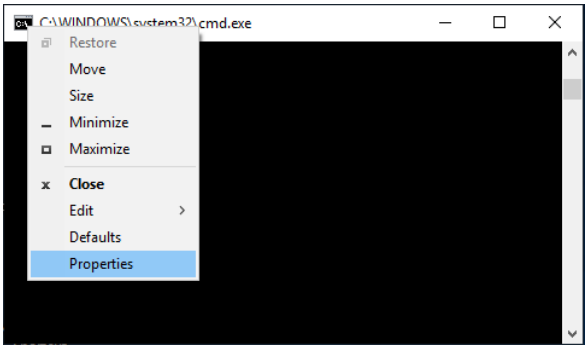


Figure 6 – Configure Studies Windowed

2.39. Open the **Options** tab. Under the "Edit Options" and "Text Selection" sections, make sure all the boxes are NOT checked.

2.40. Once finished click **OK**. Press **ESC** key until you reach the Desktop.

2.41. Delete the 3 installers and the Cybernet Touch folder and zip copied from the ftp site from the Desktop. Right click the Recycle Bin and select **Empty Recycle Bin --- Yes**.

2.42. Restart the Computer.

Step 3 DICOM (11952-0000-01) Installation

3.1. Double click the **Unetixs DICOM** icon on the Desktop.

3.2. Click the **Identifier tab**. Enter the Roodra Serial Number "MLS2Bxxxx".

3.3. Click on **Generate Product Code**. Write down the letters of the given product code and make sure it is consisted of 8 letters. DO NOT PRESS ANY KEYS.

3.4. Bring this Product Code and the Serial Number to Engineering to obtain a pass-code and license number. Once obtained, move the cursor to enter this pass-code. DO NOT CLICK ENTER.

3.5. Click on **Set Machine UID**.

3.6. The license number that Engineering gave will appear in the UID field. Click OK. If it does not appear, repeat step 3.3 through 3.5.

3.7. Enter the license number on the Device Record (11986-0002-01) as a Lot Number.

Step 4 Test

4.1. Test the Roodra Final Assembly and all applicable accessories per Test/Calibration Procedure 11986-0006-01.

Step 5 Accessories & Labels

5.1. Place a strip of double-sided foam tape of length 3.5" on the backside of the Doppler/PPG Holder (40001-1005-01) and then place it in the Storage Drawer.

5.2. Attach the Magnetic strip (20072-0002-01) to the Remote control (10377-0000-01) per SOP-30-028 and then place it in the Storage Drawer.

5.3. Place the remaining items of the Basic Accessory Kit (11989-0000-01) and the Roodra Accessory Kit (11987-0000-01) in the Storage Drawer.

5.4. Type in the Model Number and Serial Number on the Serial Number Label (40002-2040-05) per SOP-30-003 and apply it on the side of the Tray w/ Enclosure as shown in **Figure 7**.

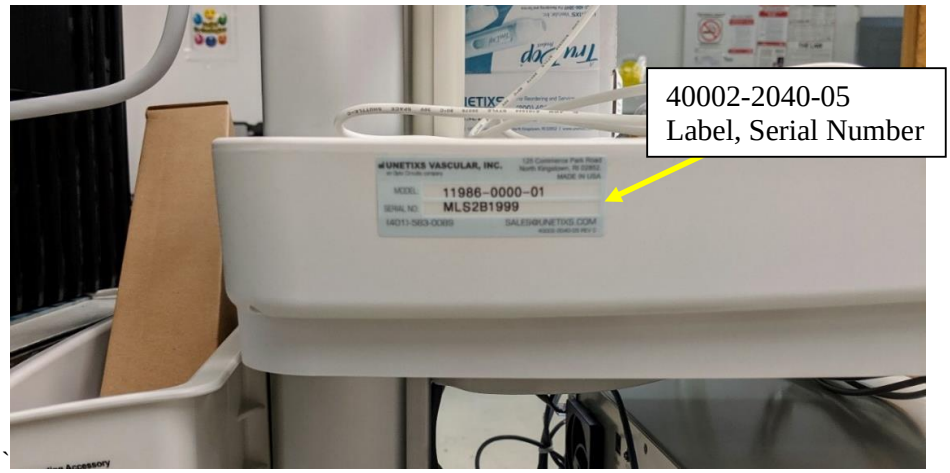


Figure 7 – Serial Number Label Placement

5.5. Create an UDI per SOP-30-026 and SOP-30-003 and apply it to the other side of the Tray w/ Enclosure as shown in **Figure 8**.

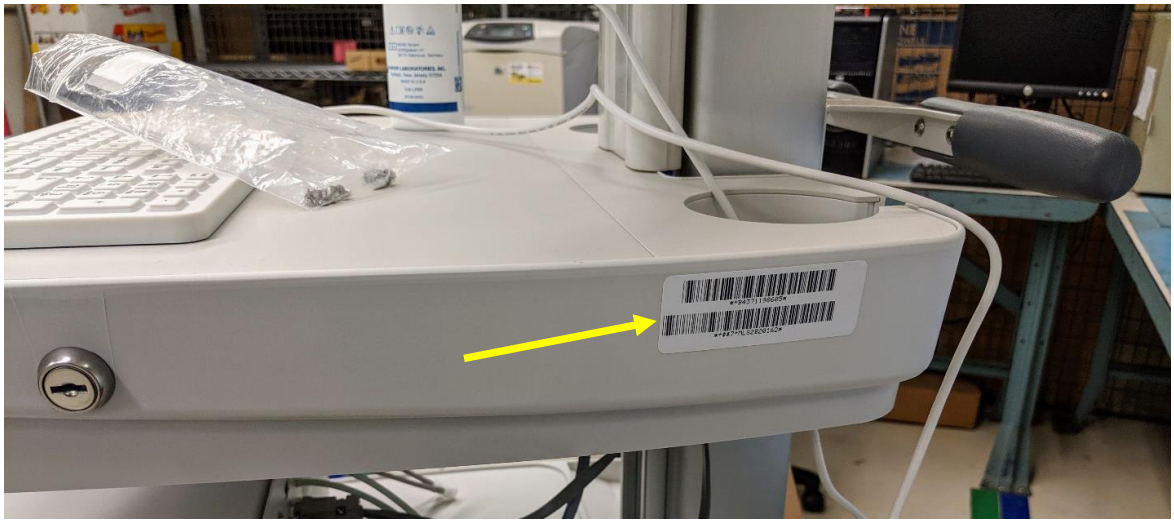


Figure 8 – UDI Label Placement

5.6. Place the Computer Label (40003-3000-01) over the Cybernet logo on the front bottom of the Touch Panel Computer.

1. Computer/Keyboard

1.1. Turn the Roodra Chassis and the Touch Panel Computer on. Verify that the Unetixs Main Menu screen loads and displays **Vascular: OK** on the top right corner.

1.2. Click **Setup --- Yes --- Diagnostics --- About**. Record the S2 software version number below and on the QA record if applicable.

S2 software version: _____

1.3. Press **ESC** until the S2WIN program closes and you reach the desktop.

1.4. From the system tray, right click on the **Volume** icon. Click **Open Volume Mixer**. Ensure that the system sounds volume is set below 10. Close this window and return to Desktop.

1.5. Double click on the **MLS2 Instructional Video** icon. Click on any entry from the menu to verify speakers are operational. Select **Quit**.

1.6. On the Windows Desktop, touch various points of the screen and ensure the cursor follows your finger. Double tap on the **S2WIN** icon and ensure that the application loads. After verifying, click **Exit**.

1.7. Click **Start**. In the **Search** field, type **notepad** and press **Enter**.

1.8. Start pressing a few keys on the keyboard and verify the character pressed appear on the screen. Close the program, but do not save.

1.9. On the Windows Desktop, conduct a few operations to check if the trackpad works properly including the mouse tracking and the left and right buttons.

1.10. Plug the USB flash drive (10383-0001-01) into any of the open USB ports. Verify that the USB drive can be seen by the computer, either by notification or via the File Explorer.

1.11. Repeat step 1.10 for all other USB ports.

1.12. Connect a network cable to the Cat6 coupler underneath the Tray w/ Enclosure. Click on the internet icon on the taskbar. Ensure that an in-house Unetixs Wi-Fi is visible.

1.13. Launch Microsoft Edge. Enter "www.unetixs.com" into the address bar and ensure that the page loads. Close the browser when finished.

1.14. Click **Start --- Settings --- System --- About**. Under the "Windows specifications" section, ensure that the edition is Windows 10 Pro or better and the Version is 1809 or higher. Close the window when finished.

Step 1 tested by: _____

2. DICOM/PDF/USB Backup

2.1. From the Windows Desktop, double click **S2WIN**. Click **Worklist --- Name,** enter "A" and then click **OK**. Verify that the DICOM service company names show.

2.2. Click **Studies --- Lower Arterial Studies --- LA Segmental Pressure w/ PVR --- Exit --- Back --- Capture --- Exit --- Export --- Export Page**. Check the status to see if **Success** appears.

2.3. Click **Exit --- Export --- Right Arrow** to select **PDF File --- Export Page**. When finished exit back to Main Menu.

2.4. Plug the USB flash drive (10383-0001-01) into any free USB port on the computer.

2.5. Click **Setup --- Yes --- System Setup --- Backup – Backup Study Configuration --- Yes**. After a few seconds, the same screen will flash which means the backup file is created in the USB flash drive. Exit to Desktop.

2.6. From the Desktop, open File Explorer and navigate to the USB Drive and verify that the **s2stybk.zip** file is there. **Delete** this file from the USB flash drive.

2.7. Open the PDF folder on the desktop and ensure that the Test patient PDF file is inside. Delete all files in the folder.

2.8. Right click **Recycle Bin** and click **Empty Recycle Bin**. Close all open windows.

2.9. Double click **S2WIN**. Select **Lookup**. Verify that the patient study history window appears, and the log is empty with no errors. Exit back to Main Menu.

Step 2 tested by: _____

3. Accessories Check

3.1. Check that each accessory operates correctly with the system:

Part Number	Description	Pass/Fail
11962-0000-01	Ass'y, TruDop 5 Doppler (TD5)	
11963-0000-01	Ass'y, TruDop 8 Doppler (TD8)	
11928-0000-01	Ass'y, Left Finger Clip (LFC)	
11929-0000-01	Ass'y, Right Finger Clip (RFC)	
11930-0000-01	Doppler Cable Ass'y, Straight VP (VPC)	
11938-0000-01	Ass'y, Left Green PPG (LGP)	
11939-0000-01	Ass'y, Right Yellow PPF (RYP)	
11951-0000-01 10346-0000-01	Ass'y, CP-105 Temp Gun (TMP) (optional) Cable, Telephone (optional)	
11980-0000-01	Ass'y, Left 6 Tube Aqua 8′ Hose (SAH)	
11981-0000-01	Ass'y, Right 6 Tube Grey 8′ Hose (SGH)	
11966-0000-01	Ass'y, ACS Bleed Valve (ABV)	

Step 3 tested by: _____

4. IR/Remote Test

4.1. From the Main Menu, click **Studies --- Lower Arterial Studies --- LA Segmental Pressures w/ PVR --- Exit – Right Brachial Pressure --- Back**.

4.2. Insert batteries into the **Remote Control** (10377-0000-01) and test it, verifying that all buttons work. Then remove the batteries from the Remote Control and put them back in the battery container. Exit to Main Menu.

4.3. Exit to Main Menu. Click **Temp Files --- Delete --- Yes**. Do this for all study files.

4.4. Click **Exit --- Shutdown**.

4.5. Inspect the Roodra Cart:

- Inspect everything cosmetically
- Ensure all 4 wheels move freely
- Ensure all 4 wheel locks function properly
- Ensure the drawer slides freely
- Ensure that the adjustable column can move up and down without any issue and only when the foot pedal is pressed.
- Ensure that the Display mount can move back and forth with the Touch Panel Computer mounted.
- Ensure the Tray w/ Enclosure can be opened and closed properly.
- Ensure all cart components that are attached to the column are secured in place

Step 4 tested by: _____

5. Earth Leakage Test

5.1. Record the control number and calibration due date of the Electrical Safety Analyzer.

Control #: _____ Due Date: _____

5.2. Turn Electrical Safety Analyzer on. Push **Setup**, scroll to Standard and press **Enter**. Select IEC60601-1, push **Enter**. Set GFCI to 10 mA. Set Polarity Delay set to 1 sec.

5.3. Connect power cord of the Roodra Final Assembly to the Equipment Outlet on the Electrical Safety Analyzer as shown in Figure 1. Ensure Doppler probe, PPG probes, and Temp Gun (if applicable) are connected to chassis.

Figure 1

5.4. Push **µA** button to access the Leakage Current main menu.

5.5. Push the **function button** that corresponds to the **Earth** leakage test to enter the test.

5.6. Push **Polarity** button to switch the polarity of the mains voltage applied to the test receptacle between Off, Normal, and Reverse. Push **Neutral** button to open and close the neutral connection.

Perform all combinations in the table below and record the leakage current for each. Compare the measured leakage to the allowable leakage for each combination and record Pass (P) or Fail (F).

	Polarity	Neutral	Measured Leakage	Allowable Leakage	Pass / Fail
1	Normal	Closed		≤10mA	
2	Normal	Open		≤10mA	
3	Reverse	Closed		≤10mA	
4	Reverse	Open		≤10mA	

Step 5 tested by: _____

End of Test/Calibration

Pass/Fail: _____

Test/Calibration Performed By: _____ Date: _____

Section 5: Replacement Parts List

11912-0002-01	(IRB)	Infrared Remote PCB Assembly
11919-0002-01	(SSB)	S2 SMT Motherboard PCB Assembly
11933-0002-01	(ACB)	Auto Cuff Selector PCB Assembly
11976-0002-01	(ECT)	ESA Cart Assembly
11977-0002-01	MLS2E)	Final ESA Assembly
11982-0002-01	(OCT)	Roodra Cart Assembly
11983-0002-01	(OBC)	Roodra Chassis Assembly
11986-0002-01	(MLS2B)	Final Roodra Assembly

A list of accessories can be found on the next page

Part Number	Description
10304-0006-01	Keyboard, w/ touchpad Medical Grade
10308-0000-01	USB Wireless Adapter (for external printer)
10346-0000-01	Cable, Telephone
10353-0004-01	Computer, Cybernet Touch Panel
10353-0004-01	Battery, Cybernet Touch Panel Computer
10377-0000-01	Remote Control Transmitter
10383-0001-01	Flash Drive, USB
10628-0001-01	Ultrasonic Doppler Gel (250 ml)
10632-0007-01	Blood Pressure Cuff, TMC-7
10632-0010-01	Blood Pressure Cuff, SC-10
10632-0012-01	Blood Pressure Cuff, SC12
10632-0012-02	Blood Pressure Cuff, SC-12L
10633-0025-02	Blood Pressure Cuff, PC-2.5
10634-0017-01	Blood Pressure Cuff, CC-17
10635-0001-01	Scotch 667 Double Coated Tape
10638-0000-01	Deskjet Paper
10679-0010-10	Basket, Roodra Cart
10686-0000-01	Battery, Alkaline, 1.5V AAA
11309-0000-01	Manual, Operators Series 2 Roodra
11309-0001-01	Manual, S2 Roodra Installation Guide
11928-0000-01	Left Finger Clip Ass'y
11929-0000-01	Right Finger Clip Ass'y
11930-0000-01	Doppler Cable, Straight VP
11938-0000-01	Right Yellow PPG Ass'y
11939-0000-01	Left Green PPG Ass'y
11951-0000-01	Ass’y, CP-105 Temp Gun (TMP)
11962-0000-01	Ass’y, TruDop 5 Doppler (TD5)
11963-0000-01	Ass’y, TruDop 8 Doppler (TD8)
11966-0000-01	ACS Bleed Valve Ass'y
11980-0000-01	Ass'y, Left 6 Tube Aqua 8' Hose (SAH)
11981-0000-01	Ass'y, Right 6 Tube Grey 8' Hose (SGH)
11984-0000-01	Ass’y, Roodra Serial Cable (OSC)
11985-0000-01	Ass’y, Roodra IR Cable (OIR)
40003-3000-01	Label, Roodra Computer Logo

UNETIXS PART #	DESCRIPTION	QUANTITY	REFERENCE DESIGNATORS	LOT NUMBER
10053-0106-01	Cap. 10uF 16V Alum. Elect. Radial	1	C1	
10145-0000-01	IC, PIC12F509	1	U1	
10228-0005-01	IC, Regulator LDO +5V	1	U2	
10405-0000-01	IR Detector, (TSOP1738/TSOP31238)	1	U3	
10512-0008-01	Socket, 8 pin DIP	1	U1A	
10612-0914-01	Diode 1N914	2	D1, D2	
10642-4000-01	Resonator, 4.00 MHz	1	Y1	
20007-0000-01	Label, Serial Number	1		
30001-0017-01	PCB, IR Receiver	1	rev A)	

UNETIXS PART #	DESCRIPTION	QUANTITY	REFERENCE DESIGNATORS	LOT NUMBER
10001-0000-01	SMT Res., 0ohm 0.33W 0805 ROHS	2	C117-118	
10001-0015-02	SMT Res. .15ohm 1/4w 1% 0805 ROHS	1	R1	
10001-0100-01	SMT Res. 10ohm 1/8w 1% 0805 ROHS	9	R3-11	
10001-0270-01	SMT Res., 27.0ohm 1/8W 1% 0805 ROHS	2	R136-137	
10001-0499-02	SMT Res. 49.9ohm 1/8w 1% 0805 ROHS	2	R82-83	
10001-1000-01	SMT Res. 100ohm 1/8w 1% 0805 ROHS	1	R12	
10001-1001-01	SMT Res. 1.0K 1/8w 1% 0805 ROHS	8	R13-18,133-134	
10001-1002-01	SMT Res. 10.0k 1/8w 1% 0805 ROHS	28	R19-45,140	
10001-1003-01	SMT Res. 100k 1/8w 1% 0805 ROHS	18	R46-63	
10001-1004-01	SMT Res. 1 Meg 1/8w 1% 0805 ROHS	8	R64-71	
10001-1053-01	SMT Res. 105K 1/8w 1% 0805 ROHS	2	R72-73	
10001-1501-01	SMT Res. 1.5K 1/8w 1% 0805 ROHS	3	R74-76	
10001-1873-01	SMT Res. 187k 1/8w 1% 0805 ROHS	2	R77-78	
10001-2001-01	SMT Res., 2.00k 1/8W 1% 0805 ROHS	1	R135	
10001-2003-01	SMT Res. 200K 1/8w 1% 0805 ROHS	3	R79-81	
10001-2211-01	SMT Res. 2.21K 1/8w 1% 0805 ROHS	2	R84-85	
10001-2213-01	SMT Res. 221K 1/8w 1% 0805 ROHS	2	R86-87	
10001-2493-01	SMT Res. 249K 1/8w 1% 0805 ROHS	4	R88-91	
10001-2672-01	SMT Res. 26.7K 1/8w 1% 0805 ROHS	1	R92	
10001-2802-01	SMT Res. 28.0K 1/8w 1% 0805 ROHS	2	R93-94	
10001-3013-01	SMT Res. 301K 1/8w 1% 0805 ROHS	2	R95-96	
10001-3162-01	SMT Res. 31.6K 1/8w 1% 0805 ROHS	1	R97	
10001-3242-01	SMT Res. 32.4K 1/8w 1% 0805 ROHS	1	R98	
10001-3322-01	SMT Res. 33.2K 1/8w 1% 0805 ROHS	2	R99-100	
10001-3901-01	SMT Res. 3.90K 1/8w 1% 0805 ROHS	2	R138-139	
10001-4022-01	SMT Res. 40.2K 1/8w 1% 0805 ROHS	1	R101	
10001-4641-01	SMT Res. 4.64k 1/8w 1% 0805 ROHS	4	R102-105	
10001-4991-01	SMT Res. 4.99K 1/8w 1% 0805 ROHS	3	R106-108	
10001-4992-01	SMT Res. 49.9K 1/8w 1% 0805 ROHS	4	R109-112	
10001-5621-01	SMT Res. 5.62K 1/8w 1% 0805 ROHS	2	R113-114	

UNETIXS PART #	DESCRIPTION	QUANTITY	REFERENCE DESIGNATORS	LOT NUMBER
10001-5622-01	SMT Res. 56.2K 1/8w 1% 0805 ROHS	2	R115-116	
10001-6191-01	SMT Res. 6.19K 1/8w 1% 0805 ROHS	4	R117-120	
10001-6192-01	SMT Res. 61.9K 1/8w 1% 0805 ROHS	1	R121	
10001-6492-01	SMT Res. 64.9K 1/8w 1% 0805 ROHS	2	R122-123	
10001-7682-01	SMT Res. 76.8K 1/8w 1% 0805 ROHS	1	R124	
10001-7871-01	SMT Res. 7.87K 1/8w 1% 0805 ROHS	1	R125	
10001-8252-01	SMT Res. 82.5K 1/8w 1% 0805 ROHS	2	R126-127	
10001-9531-01	SMT Res. 9.53K 1/8w 1% 0805 ROHS	1	R128	
10004-0103-01	Res. 10K POT 3/8" Cermet Multiturn	6	P1-6	
10004-0201-01	Res. 200 ohm POT 3/8" Cermet Multiturn	2	P7-8	
10004-0203-01	Res. 20K POT 3/8" Cermet Multiturn	2	P9-10	
10004-0204-01	Res. 200K POT 3/8" Cermet Multiturn	2	P11-12	
10004-0502-01	Res. 5K POT 3/8" Cermet Multiturn	2	P13-14	
10015-0100-04	SMT Res. 10ohm 1/2w 1% 2010 ROHS	1	R2	
10015-1000-04	SMT Res. 100ohm 1/2w 1% 2010 ROHS	4	R129-132	
10050-0105-02	Cap. 1uf poly	4	C96-99	
10059-0101-11	SMT Cap., 100pF 16V 10% MLCC 0805 ROHS	2	C40-41	
10059-0102-23	SMT Cap., 1nF 16V 5% NP0 MLCC 0805 ROHS	4	C42-45	
10059-0103-11	SMT Cap., .01uF 16V 10% MLCC 0805 ROHS	10	C46-55	
10059-0104-11	SMT Cap., .1uF 16V 10% MLCC 0805 ROHS	39	C60-91,119-125	
10059-0105-11	SMT Cap., 1uF 16V 10% MLCC 0805 ROHS	2	C94-95	
10059-0106-01	SMT Cap. 10uf X5R MLCC 0805 ROHS	2	C56-57	
10059-0220-11	SMT Cap., 22pF 16V 10% MLCC 0805 ROHS	3	C100-102	
10059-0222-11	SMT Cap., 2200pF 16V 10% MLCC 0805 ROHS	2	C103-104	
10059-0472-11	SMT Cap., 4700pF 16V 10% MLCC 0805 ROHS	4	C105-108	
10059-0473-11	SMT Cap., .047uF 16V 10% MLCC 0805 ROHS	8	C109-116	
10059-0474-11	SMT Cap., .47uF 16V 10% MLCC 0805 ROHS	2	C92-93	
10060-0105-03	SMT Cap.,1uF 25V Tnt. 1206 20%<8ESR ROHS	5	C1-5	
10060-0106-04	SMT Cap., 10uF Tnt. 25V 2312 <3ESR ROHS	2	C6-7	
10060-0475-05	SMT Cap,4.7uF 16V Tnt 1206 20%<8ESR ROHS	5	C8-12	

UNETIXS PART #	DESCRIPTION	QUANTITY	REFERENCE DESIGNATORS	LOT NUMBER
10064-0106-01	SMT Cap., 10uF 16V Alum. 20% 5.3mm2 ROHS	18	C13-30	
10064-0107-02	SMT Cap.,100uF 16V Alum. 20% 8.3mm2 ROHS	3	C31-33	
10064-0108-03	SMT Cap., 1mF 10V Alum. 20% 10.3mm2 ROHS	1	C34	
10064-0227-04	SMT Cap.,220uF 25V Alum 20% 10.3mm2 ROHS	5	C35-39	
10103-0132-01	SMT IC, Positive-OR Gate 2IN SOT-23-5	1	U3	
10103-4027-02	SMT IC, 4027 SOIC-16 ROHS	1	U1	
10103-4093-02	SMT IC CD4093BCM SOIC-14 ROHS	1	U2	
10104-0259-02	SMT IC 74HC259 SOIC-16 ROHS	1	U4	
10140-0000-02	SMT IC,MAX197BCWI SOIC-28 ROHS	2	U6-7	
10141-0000-02	SMT IC MAX488 SOIC-8 ROHS	1	U8	
10147-0000-02	IC, AT89C5131A-M 52PLCC ROHS	1	U9	
10200-0000-02	SMT IC LT1014 SOIC-16W ROHS	4	U10-13	
10201-0000-02	SMT IC, OP07CD SOIC-8 ROHS	2	U14-15	
10202-0005-01	VREG. 7805CT	1	U16	
10203-0000-02	SMT IC LM386 SOIC-8 ROHS	2	U17-18	
10207-0000-02	SMT IC LM2907M-8 SOIC-8 ROHS	2	U19-20	
10208-0000-02	SMT IC LM358 SOIC-8 ROHS	3	U21-22,24	
10213-0000-02	SMT IC LM10CWM SOIC-14 ROHS	2	U25-26	
10215-0000-02	SMT IC LM3578A SOIC-8 ROHS	1	U27	
10222-0000-02	SMT IC, LT1125 SOIC-16W ROHS	2	U28-29	
10223-0000-02	SMT IC LT1010CDD DFN-8 ROHS	2	U30-31	
10224-0000-02	SMT IC LTC1451IS8 SOIC-8 ROHS	2	U32-33	
10225-0008-02	SMT IC, VREG +8V 78L08 SOIC-8 ROHS	1	U34	
10226-0008-02	SMT IC, VREG -8V 79L08 SOIC-8 ROHS	1	U35	
10231-0062-01	SMT IC, JFET Opamp TL062CD SOIC8	2	U5,23	
10232-3157-01	SMT IC, SPDT Analog Switch SOT23-6	2	U38-39	
10250-1972-02	SMT IC, LM1972 SOIC-20 ROHS	1	U36	
10364-0000-01	Power Supply +/-15V 10W	1	U37	
10401-0001-02	BP Sensor, Fujikura AP30R-050KG-XBP	2	S1-2	
10401-0004-01	Pressure Sensor, MLV-L30D	2	S5-6	

UNETIXS PART #	DESCRIPTION	QUANTITY	REFERENCE DESIGNATORS	LOT NUMBER
10450-0102-01	Inductor 1000uH	2	L1-2	
10452-0451-01	Inductor 450UH 1.5A Toroidal ROHS	1	L3	
10502-0004-01	Conn. .156" Header 4 pin	1	JP14	
10504-0002-01	Conn. .100" Header 2 pin	7	JP3-6,12-13,18	
10504-0004-01	Conn. .100" Header 4 pin	4	JP1-2,9-10	
10504-0005-01	Conn. .100" Header 5 pin	1	JP8	
10504-0006-01	Conn..100 Header 6 p. w/lckng ramp	2	JP11,15	
10512-0052-01	Socket, 52 pin PLCC	1	U9(S)	
10541-0009-01	Conn. DB-9 Female PCB Mnt.	1	JP7	
10612-4148-02	SMT Diode IN4148 SOD 123 ROHS	8	D1-8	
10612-5818-02	SMT Diode, Schottky 5818 ROHS	1	D9	
10642-1600-01	Crystal, 16.000MHZ HC-49	1	Y1	
10643-0335-02	SMT MOSFET FDN335NCT SSOT-3 ROHS	4	Q1-4	
10647-2002-01	SMT LED, 2.3mmx1.3mmx1.4mm Green	1	D10	
30001-0022-01	PCB, S2 SMT Motherboard	1		

UNETIXS PART #	DESCRIPTION	QUANTITY	REFERENCE DESIGNATORS	LOT NUMBER
10000-0000-01	Res. 0 ohm 1/4W 1% Metal Film	2	R13,R16	
10000-4750-01	Res. 475 ohm 1% 1/4W Metal Film	12	R1-R12	
10008-0101-01	Res. 100 ohm 5% 1/2W Carbon film	2	R14,R15	
10053-0106-01	Cap. 10uF 16V Alum. Elect. Radial	1	C1	
10145-0001-01	IC, PIC 16F873	1	U1	
10502-0002-01	Conn., .156" Header 2 pin	1	JP14	
10504-0002-01	Conn. .100" Header 2 pin	12	JP1-JP12	
10505-0007-02	Conn. .100" 7p housing (PCB Mt.)	1	JP13, made from 10505-00036-01	
10512-0028-02	Socket, IC 28 pin .300 ctrs.	1	U1A	
10612-0914-01	Diode 1N914	12	D1-D12	
10637-0001-01	Switch, momentary pushbutton BLACK	2	S1,S2	
10642-4000-01	Resonator, 4.00 MHz	1	Y1	
10644-2222-01	Transistor 2N2222A	12	Q1-Q12	
10647-0002-01	LED Green T 1 3/4	12	L1-L12	
20007-0000-01	Label, Serial Number	1		
20060-0008-01	Spacer, LED	12	L1-L12	
30001-0018-01	PCB, Electronic Manifold	1		

UNETIXS PART #	DESCRIPTION	QUANTITY	REFERENCE DESIGNATORS	LOT NUMBER
10326-0006-01	USB Printer Cable 6'	1		
10326-0010-01	Cable, USB C Male to Male, RA	1		
10357-0005-02	Power Strip, 15' Med. Grade 1363A	1		
10378-0005-01	AC Adapter, 120W 20V 6A Med Grd	1		
10378-0005-02	Adapter, 4 Pin DIN to 2.5 Plug	1		
10383-0004-01	USB C Dock, TrippLite U442-DOC20-B	1		
10383-0004-02	Mounting Plate, TrippLite U442-DOCK20-B	1		
10629-0003-01	Line Cord, 10ft. Gray Med. Grade	1		
10629-0011-01	Power Cord, NEMA 1-15 to C7, 18AWG, 6'	1		
10660-0001-01	Hose Hook, White	2		
10679-0011-01	ESA Cart, Surgimed Solutions	1		
10683-0003-01	Velcro, One Wrap Strap 5/8" Width Blue	12	Inch	
20002-0832-01	Lockwasher, 8-32	2		
20003-0832-01	Nut, 8-32	2		
20003-9006-03	Nut, T-Slot M6 Spring Tab	2		
20007-0000-01	Label, Serial Number	1		
20016-0008-01	Screw, Machine, 8-32, PH Pan head 1/2"	2		
20051-0006-01	Thumb Screw, 6-32 x 3/8", Plastic Headed	2		
20059-0006-01	Spacer, Nylon 1/4" ID, 3/8" lng	2		
20097-0032-04	Screw, Machine M6x1mm, 16mm, Button Head	2		
20100-0006-01	Screw, Sheet Metal #6 PH, 3/8" SS	2		
40002-2047-01	Doppler Gel Holder	1		

UNETIXS PART #	DESCRIPTION	QUANTITY	REFERENCE DESIGNATORS	LOT NUMBER
10353-0005-01	Touch Panel Computer, MS Surface Pro 9	1		
10353-0005-02	Case, MS Surface Pro 9	1		
11952-0000-01	DICOM Network Package	1		
11976-0000-01	Ass'y, ESA Cart (ECT)	1		
11983-0000-01	Ass'y, Roodra Chassis (OBC)	1		
11987-0000-01	Ass'y, Roodra Accessory Kit (OAK)	1		
11989-0000-01	Ass'y, Basic Accessory Kit (BAK)	1		
20095-0020-01	Screw, Machine M4x0.7 PH Pan Head 10mm	4		
20179-0010-03	Screw, 8-18x5/8" Thrd Frm FH PH SS 82Deg	2		
40001-1005-03	Doppler/PPG Holder, ESA Cart	1		
40002-2040-05	Label, Serial Series 2	1		
40003-3000-01	Label, Roodra Computer Logo	1		

UNETIXS PART #	DESCRIPTION	QUANTITY	REFERENCE DESIGNATORS	LOT NUMBER
10326-0006-01	USB Printer Cable 6'	1		
10357-0005-02	Power Strip, 15' Med. Grade 1363A	1		
10528-0006-01	Conn., RJ45 coupler, Round 1.19"	1		
10629-0003-01	Line Cord, 10ft. Gray Med. Grade	1		
10679-0010-01	Base & Column, Roodra Cart	1		
10679-0010-02	Storage Drawer, Roodra Cart	1		
10679-0010-03	Tray w/ Enclosure, Roodra Cart	1		
10679-0010-04	Display Mount, Roodra Cart	1		
10679-0010-06	Handle, Roodra Cart	1		
10679-0010-07	Chart Bin, Roodra Cart	1		
10679-0010-08	Counterweight, 10lbs Roodra Cart	1		
10679-0010-09	Counterweight, 25lbs Roodra Cart	1		
10683-0003-01	Velcro, One Wrap Strap 5/8" Width Blue	26	Inch	
10719-0000-02	Cable, Net. Patch, Cat 6 3ft.	1		
20007-0000-01	Label, Serial Number	1		
40001-1005-01	Doppler/PPG Holder, Roodra Cart	1		
40003-3001-01	Hose Hanger, Roodra Cart	1		

UNETIXS PART #	DESCRIPTION	QUANTITY	REFERENCE DESIGNATORS	LOT NUMBER
10326-0007-01	Cable, USB Male B to Micro Male B	1	Only use 9" of it	
10326-0008-01	Cable, USB Male A to Panel Female A 2.5'	1		
10326-0009-01	Cable, Panel Mount USB B Female	1		
10328-0001-01	Air Compressor, Gillian, Freedom V	2		
10342-0003-01	Fan Guard w/Filter 80mm	1		
10342-0012-01	Fan, DC Brushless 12V	1		
10365-0000-01	Power Supply, Switcher UL544	1		
10368-0025-01	Computer, Raspberry Pi	1		
10369-0021-01	Touch Screen, 7" Raspberry Pi	1		
10372-0016-06	Micro SD Card, 16GBmin	1		
10503-0002-01	Conn., .156" Housing 2 pin	1		
10503-0003-01	Conn. .156" Housing 3 pin	1		
10503-0004-01	Conn. .156" Housing 4 pin	1		
10503-0009-01	CONN. .156" HOUSING 9 PIN	1		
10504-0006-01	Conn..100 Header 6 p. w/lckng ramp	1		
10504-0008-01	Conn. .100" Header 8pin	2		
10511-0002-01	Conn. 1/8" stereo jack N.C.	1		
10516-0002-01	Conn. .100" Housing 2 pin Wire Connect	6		
10516-0004-01	Conn. .100" Housing 4 pin Wire Connect	5		
10516-0005-01	Conn. .100" Housing 5 pin Wire Connect	1		
10516-0006-01	Conn. .100" Housing 6 pin Wire Connect	1		
10516-0008-01	Conn, .100" Housing 8 pin wire Connect	2		
10517-0003-01	Conn. 3 Pin Panel Mount Lemo	2		
10517-0004-01	Conn. 4 Pin Panel Mount Lemo Connector	1		
10528-0003-01	4pin phone jack w/ wires	1		
10546-0009-01	Conn., DB9 pin male	1		
10548-0008-01	Ring terminal, #8, insulated	7		
10605-0003-01	Tubing, 1/16" I.D. Silicone	17	Inch	
10605-0009-01	Tubing, 6 tube 1/4"od 1/8"id GRY	4	Inch	
10605-0010-01	Tubing, 6 tube 1/4"od 1/8"id AQUA	4	Inch	

UNETIXS PART #	DESCRIPTION	QUANTITY	REFERENCE DESIGNATORS	LOT NUMBER
10606-0005-01	Fitting, Inline 1/8" Body	12		
10609-0002-01	Speaker 3 1/4" Rnd.	2		
10621-0001-01	Heat Shrink Tubing 1/16" i.d., black	11	actually 10.5 Inch	
10621-0002-01	Heat Shrink Tubing 1/8" i.d., black	5	Inch	
10635-0003-01	Tape, Acrylic, Double Sided 1/2" Width	50	Inch	
10635-0004-01	Tape, Polyester Plastic, One Side 1" Wid	27	Inch	
10637-0005-01	Switch, Panel Mnt. 12mm P.B. Momentary	2		
10647-3002-01	LED, Green 7.6mmx2.5mm	12		
10649-0003-01	Fuse, 3 AMP 3AG	1		
10666-0001-01	Air Fitting, SMC M5 1/16	2		
10667-0002-01	Valve, 3-way SMC M5	2		
10673-0001-01	Manifold, Electronic 6 pos. Left	1		
10673-0001-02	Manifold, Electronic 6 pos. Right	1		
10681-0000-01	Power Entry Module Series 2	1		
10701-0001-01	Wire, 4 Cond. 30AWG	45	Inch	
10703-0001-01	Wire, Belden 8505 26AWG BLACK	175	Inch	
10703-0002-01	Wire, Belden 8505 26AWG WHITE	170	Inch	
10703-0003-01	Wire, Belden 8505 26AWG RED	116	Inch	
10703-0004-01	Wire, Belden 8505 26AWG YELLOW	108	Inch	
10703-0005-01	Wire, Belden 8505 26AWG GREEN	130	Inch	
10703-0006-01	Wire, Belden 8505 26AWG BLUE	186	Inch	
10706-0001-01	Wire, Belden 8501 18AWG BLACK	133	actually 132.5 Inch	
10706-0002-01	Wire, Belden 8501 18AWG WHITE	113	actually 112.5 Inch	
10706-0004-01	Wire, 18AWG Yellow	20	Inch	
10706-0005-01	Wire, 18AWG GREEN	7	Inch	
10706-0006-01	Wire, 18AWG BLUE	15	Inch	
10706-0008-01	Wire, 18AWG BROWN	15	Inch	
10706-0009-01	Wire, 18AWG GREEN/YELLOW	55	Inch	
11912-0000-01	Assy, Infrared Remote PCB (IRB)	1		
11919-0000-01	PCB Ass'y, S2 SMT Motherboard (SSB)	1		

UNETIXS PART #	DESCRIPTION	QUANTITY	REFERENCE DESIGNATORS	LOT NUMBER
11933-0000-01	Assy, Auto Cuff Selector PCB (ACB)	1		
11936-0000-01	Assy. Series 2 internal hose (SIH)	2		
20000-0001-01	Washer, 1/16" Fiber	8		
20002-0014-02	Split Lockwasher, 1/4"	2		
20002-0440-01	Lockwasher, 4-40	23		
20002-0632-01	Lockwasher, 6-32	41		
20003-0440-01	Nut, Machine 4-40	5		
20003-0632-01	Nut, Machine 6-32	22		
20004-0003-01	Screw, Pan PH 4-40 3/16"	4		
20004-0006-01	Screw, Machine 4-40 PH PAN HEAD 3/8"	4		
20004-0010-01	Screw, Pan Head Philips 4-40 x 5/8"	2		
20004-0012-01	Screw, Machine 4-40 PH PAN HEAD 3/4"	4		
20008-0004-01	Tie Wrap 4"	6		
20009-1632-01	Lug, Round Solder, 6-32, 22-26ga Wire	1		
20011-0004-01	Screw, Mach. 6-32 PH FLAT HEAD 1/4"	24		
20012-0004-01	Screw, Machine 6-32 PH PAN HEAD 1/4"	4		
20012-0006-01	Screw, Machine 6-32 PH PAN HEAD 3/8"	12		
20012-0014-01	Screw, Machine 6-32 PH PAN HEAD 7/8"	4		
20015-0048-01	Standoff, Hex Threaded, 6-32x3"	4		
20017-0632-01	Flatwasher, 6-32	16		
20018-9006-01	Nut, KEP M6	1		
20019-0014-01	Screw, Socket Head Cap, 4-40 x 7/8"	1		
20020-0001-01	Grommet, rubber	4		
20021-0006-01	Solder Lug, 3/8"	3		
20025-0003-01	Foam, Black 2mm w/adhesive 9X12	1		
20033-0440-01	Acorn Nut, 4-40	4		
20034-0001-01	Screw, Plug connector, 6x15mm	1		
20035-0012-01	Stand Off, Nylon 3/4" Rnd 4-40 Thrd.	1		
20060-0003-01	Spacer, LED, 3/16"	12		
20096-0880-02	Rubber Bumper, Round 0.88"	4		

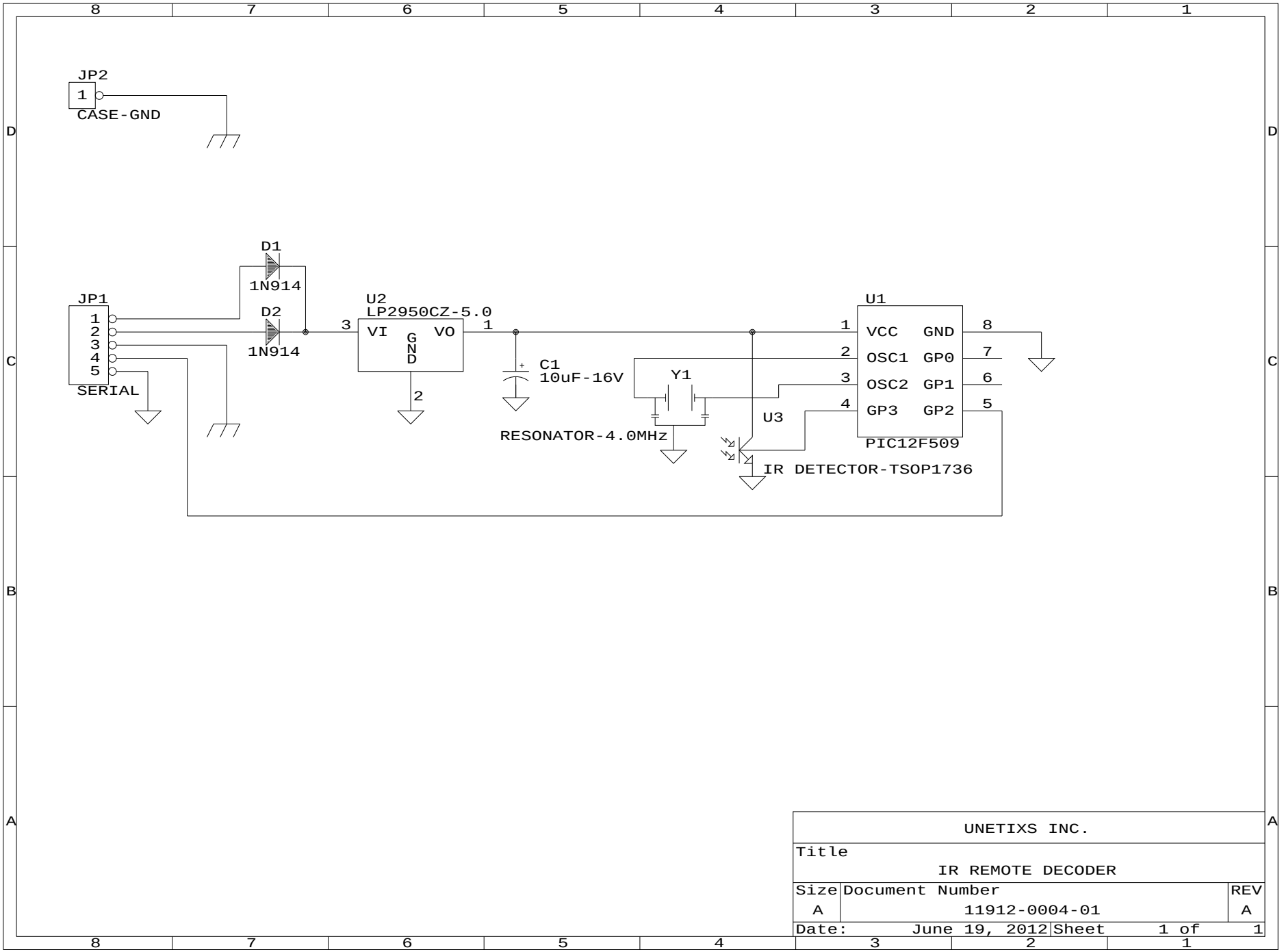
UNETIXS PART #	DESCRIPTION	QUANTITY	REFERENCE DESIGNATORS	LOT NUMBER
30001-0030-01	PCB, Roodra LED	2		
40001-1000-01	Chassis, Roodra Base	1		
40001-1001-01	Chassis, Roodra Top	1		
40001-1002-01	Chassis, Roodra Front Panel	1		
40001-1003-01	Chassis, Roodra Back Panel	1		
40001-1004-01	Chassis, Roodra Acrylic Front Panel	1		
40002-2037-01	Dual Pump Bracket	1		
40002-2040-01	Label, Caution Series 2	1		
40002-2040-02	Label, Warning Exp. Series 2	1		
40002-2040-03	Label, Warning Fire Series 2	1		
40002-2040-04	Label, Caution Physician Series 2	1		
40002-2040-05	Label, Serial Series 2	1		
40003-1036-01	ORings, Freedom Pump Mount	6		
40003-3002-01	Pump Box, Roodra Chassis	1		
40003-3007-01	Bracket, Roodra Manifold Mounting	2		
40003-3008-01	Bracket, Roodra Cover Mounting	1		
40003-3009-01	Bracket, Roodra Pi Mounting	2		

UNETIXS PART #	DESCRIPTION	QUANTITY	REFERENCE DESIGNATORS	LOT NUMBER
10353-0004-01	Touch Panel Computer, 24"min Cybernet	1		
10635-0002-01	Tape, foam 2-side 1"	17	actually 16.5 Inch	
11952-0000-01	DICOM Network Package	1		
11982-0000-01	Ass'y, Roodra Cart (OCT)	1		
11983-0000-01	Ass'y, Roodra Chassis (OBC)	1		
11987-0000-01	Ass'y, Roodra Accessory Kit (OAK)	1		
11989-0000-01	Ass'y, Basic Accessory Kit (BAK)	1		
20007-0000-01	Label, Serial Number	1		
40002-2040-05	Label, Serial Series 2	1		
40003-3000-01	Label, Roodra Computer Logo	1		

Section 6: Schematics

Schematics for MultiLab 2000 Series 2 LHS Roodra include the following documents:

11912-0004-01	(IRB)	Infrared Remote PCB Assembly
11919-0004-01	(SSB)	S2 SMT Motherboard PCB Assembly
11933-0004-01	(ACB)	Auto Cuff Selector PCB Assembly
11977-0004-01	(MLS2E)	Final ESA Assembly
11983-0004-01	(OBC)	Roodra Chassis Assembly
11983-0004-02	(OBC)	Roodra Chassis PCB
11984-0004-01	(OSC)	Roodra Serial Cable Assembly
11985-0004-01	(OIR)	Roodra IR Cable Assembly
11986-0004-01	(MLS2B)	Final Roodra Assembly


JP2
1
CASE-GND
D1
1N914
D2
1N914
JP1
1
2
3
4
5
SERIAL
U2
LP2950CZ-5.0
VI
GND
VO
3
1
2
C1
10uF-16V
RESONATOR-4.0MHz
Y1
U3
IR DETECTOR-TSOP1736
U1
VCC
GND
OSC1
GP0
OSC2
GP1
GP3
GP2
1
2
3
4
8
7
6
5
PIC12F509
UNETIXS INC.
Title
IR REMOTE DECODER
Size
A
Document Number
11912-0004-01
REV
A
Date: June 19, 2012
Sheet 1 of 1

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:
A	Initial Release	AWC	02/2009
B	ECR-097	AWC	10/2016
C	ECR-097	AWC	10/2016
D	ECR-0120	AWC	03/2020

U9(S) PLCC52 Socket

BB1 Bare Board

U9 AT89C5131A-M

U4 74HC259

U3 SN74LVC1G32

U6, U7 MAX197BWCI

U8 MAX488

JP1 Thermo

JP2 USB-B

JP3 LVALVE

JP4 RVALVE

JP5 LPUMP

JP6 RPUMP

JP7

JP11 KEYBOARD

JP17 RESET JUMPER

JP18 ISP JUMPER

Y1 16.0000MHz

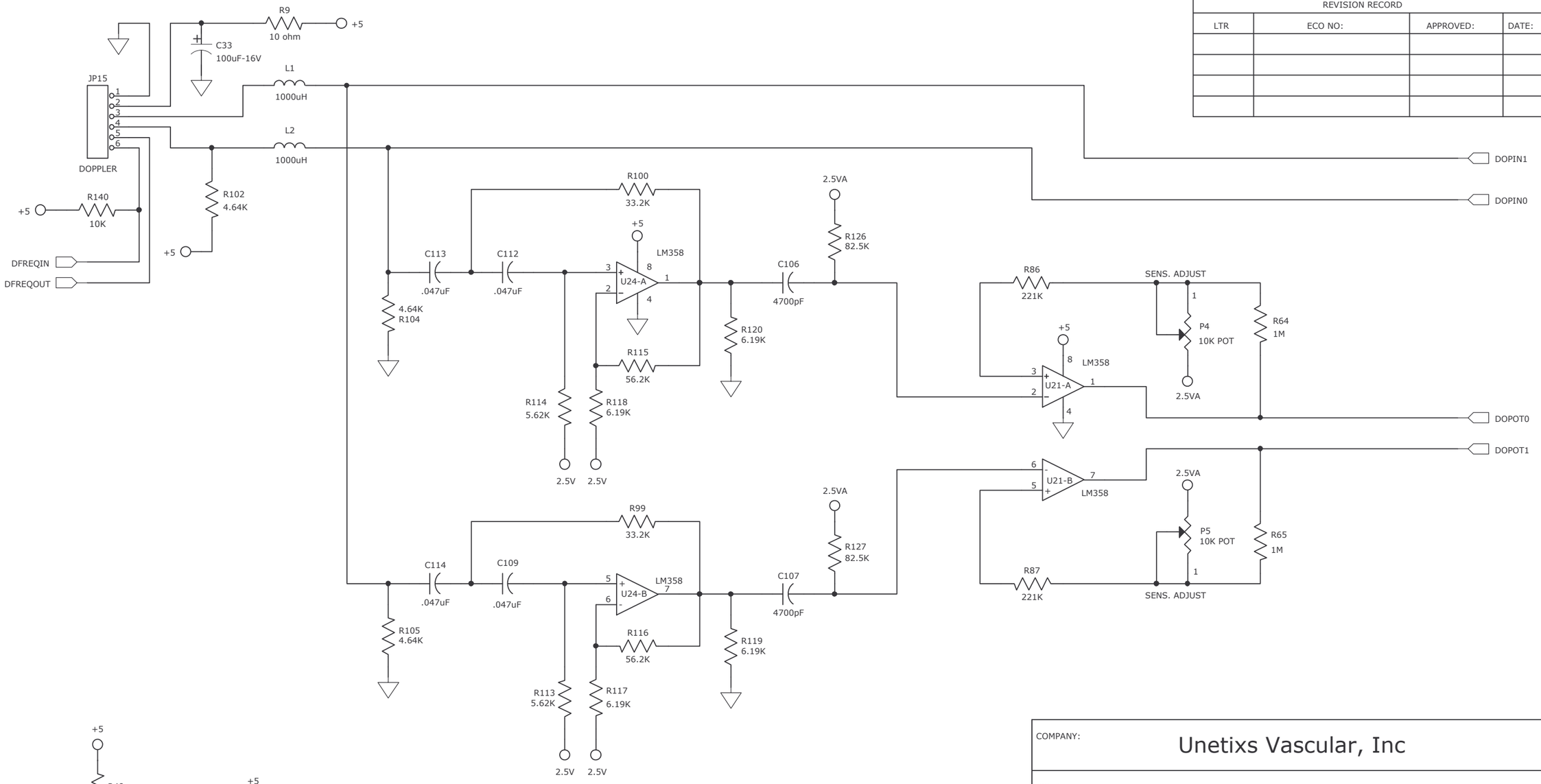
D10

Q1, Q2, Q3, Q4 FDN335N

D5, D6, D7, D8 1N4148

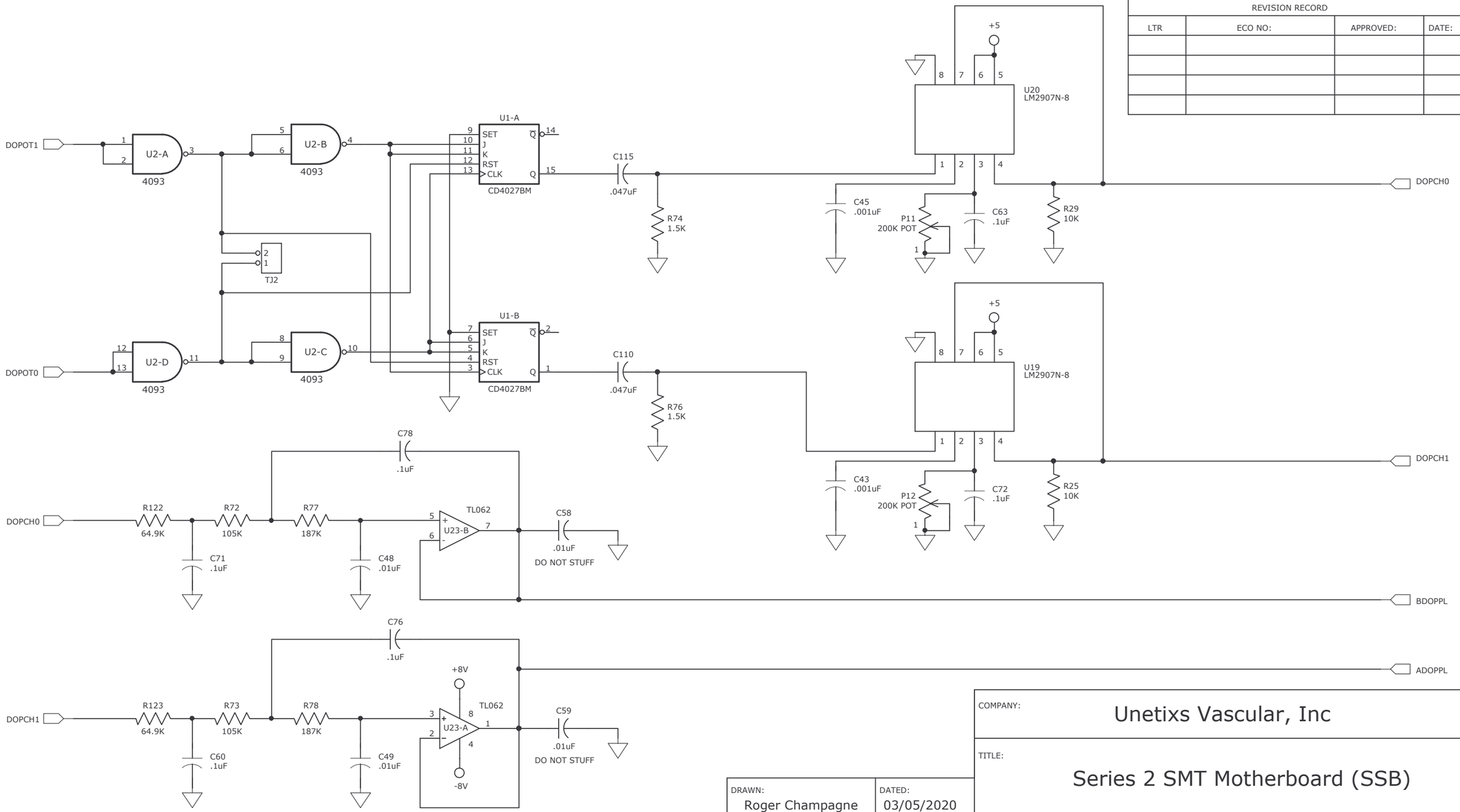
DRAWN: Roger Champagne	DATED: 03/05/2020	COMPANY: Unetixs Vascular, Inc	
CHECKED: Anthony Castillo	DATED: 03/05/2020	TITLE: Series 2 SMT Motherboard (SSB)	
QUALITY CONTROL:	DATED:	CODE:	SIZE: B
RELEASED:	DATED:	DRAWING NO: 11919-0004-01	REV: D
		SCALE:	SHEET: 1 OF 8

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:



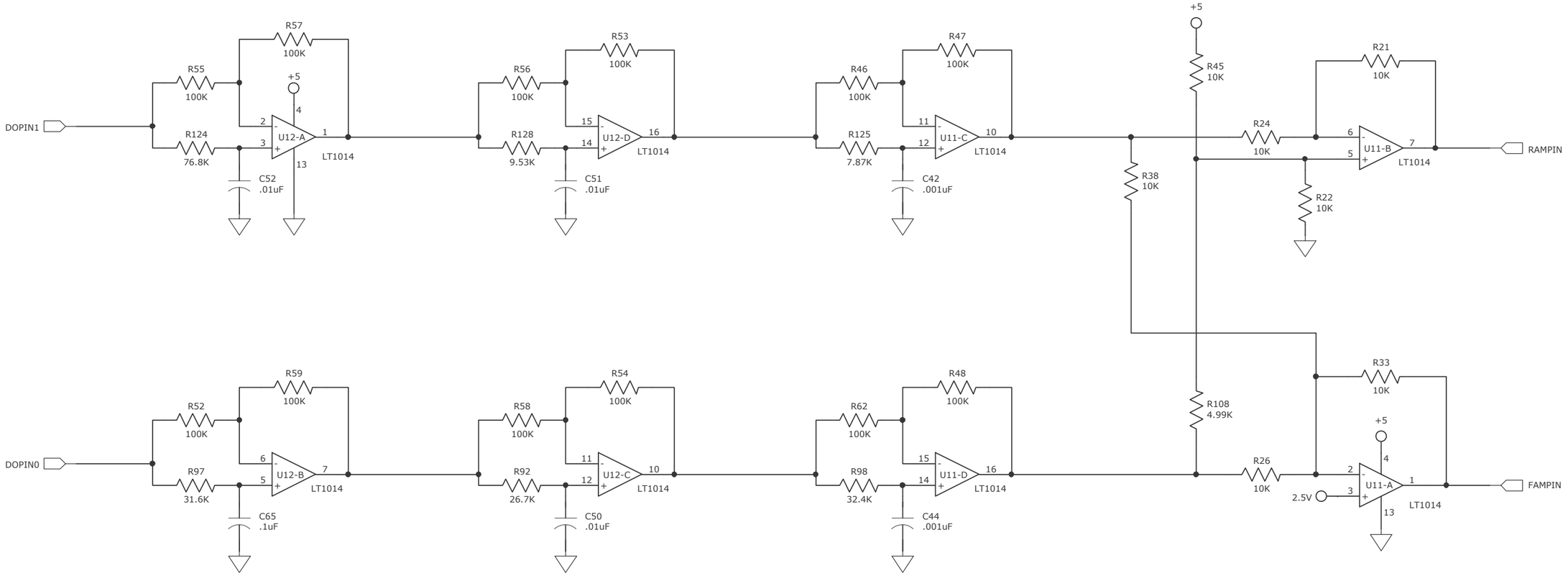
DRAWN: Roger Champagne	DATED: 03/05/2020	COMPANY: Unetixs Vascular, Inc	
CHECKED: Anthony Castillo	DATED: 03/05/2020	TITLE: Series 2 SMT Motherboard (SSB)	
QUALITY CONTROL:	DATED:	CODE:	SIZE: B / DRAWING NO: 11919-0004-01 / REV: D
RELEASED:	DATED:	SCALE:	SHEET: 2 OF 8

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

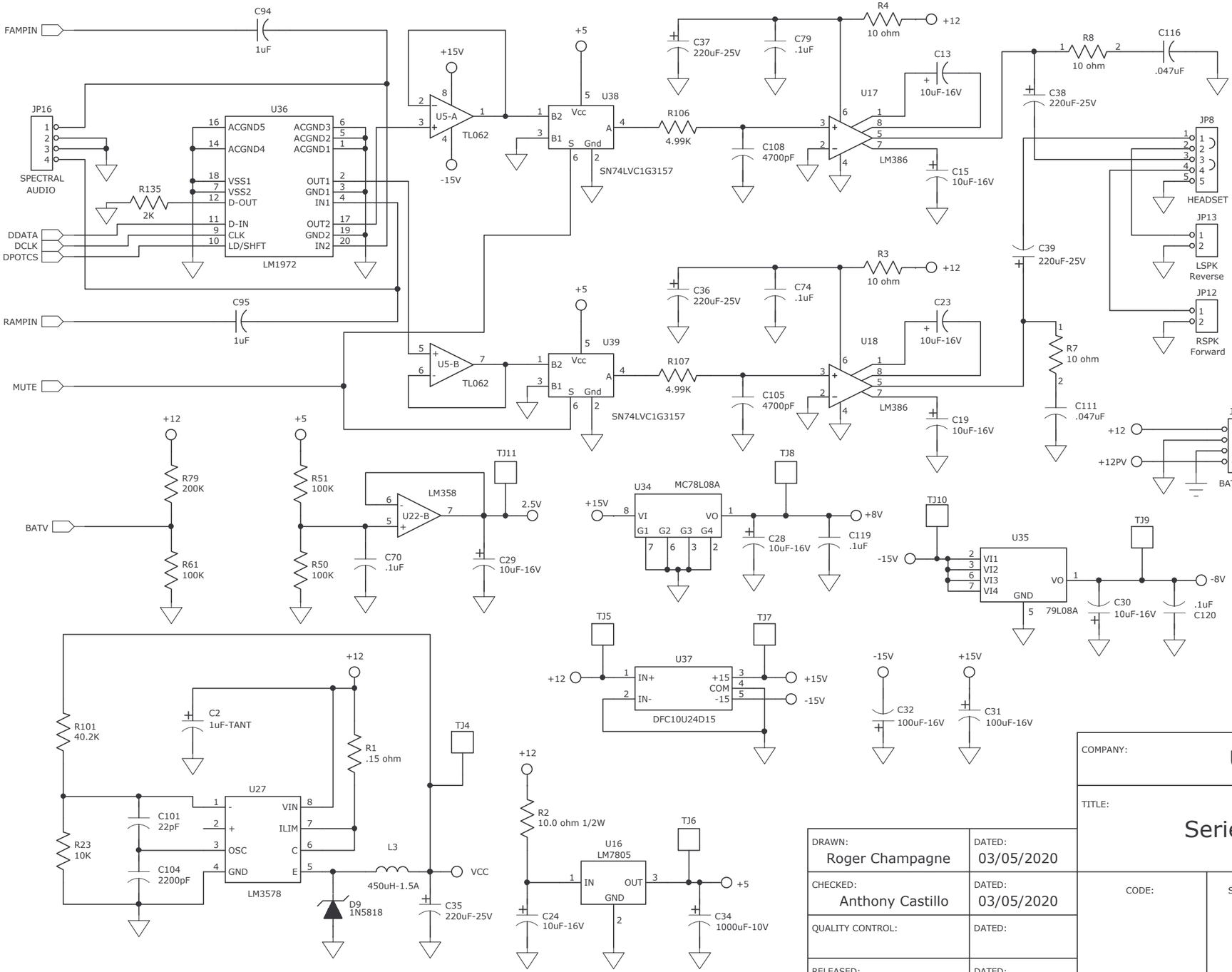


DRAWN: Roger Champagne	DATED: 03/05/2020	COMPANY: Unetixs Vascular, Inc			
CHECKED: Anthony Castillo	DATED: 03/05/2020	TITLE: Series 2 SMT Motherboard (SSB)			
QUALITY CONTROL:	DATED:	CODE:	SIZE: B	DRAWING NO: 11919-0004-01	REV: D
RELEASED:	DATED:	SCALE:	SHEET: 3 OF 8		

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:



DRAWN: Roger Champagne	DATED: 03/05/2020	COMPANY: Unetixs Vascular, Inc	
CHECKED: Anthony Castillo	DATED: 03/05/2020	TITLE: Series 2 SMT Motherboard (SSB)	
QUALITY CONTROL:	DATED:	CODE:	SIZE: B / DRAWING NO: 11919-0004-01 / REV: D
RELEASED:	DATED:	SCALE:	SHEET: 4 OF 8



REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

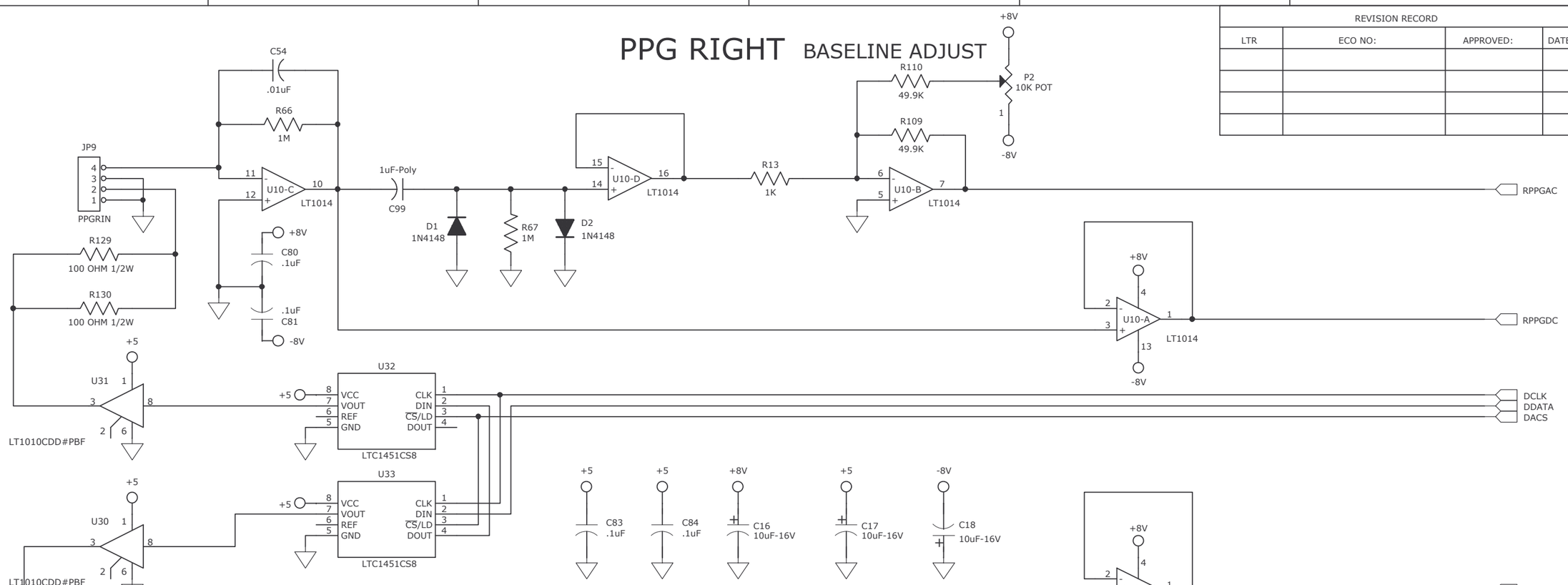
POWER AND GROUND CHART

I.C.	CAP	VCC	GND	+5
U1	C73		8	16
U2	C75		7	14
U3	C125	5	3	
U4	C61	16	8	
U8	C59	1	4	
U9	C68,69,118	16,17	14,19,25	
U36	C62		8	13,15

DRAWN: Roger Champagne	DATED: 03/05/2020	COMPANY: Unetixs Vascular, Inc	
CHECKED: Anthony Castillo	DATED: 03/05/2020	TITLE: Series 2 SMT Motherboard (SSB)	
QUALITY CONTROL:	DATED:	CODE:	SIZE: B
RELEASED:	DATED:	DRAWING NO: 11919-0004-01	REV: D
		SCALE:	SHEET: 5 OF 8

PPG RIGHT BASELINE ADJUST

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:



DRAWN: Roger Champagne	DATED: 03/05/2020	COMPANY: Unetixs Vascular, Inc	
CHECKED: Anthony Castillo	DATED: 03/05/2020	TITLE: Series 2 SMT Motherboard (SSB)	
QUALITY CONTROL:	DATED:	CODE:	SIZE: B
RELEASED:	DATED:	DRAWING NO: 11919-0004-01	REV: D
		SCALE:	SHEET: 6 OF 8

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

R80 200K
U25 LM10CWM
R31 10K
+5
R34 10K
R35 10K
R15 1K
P13 5K POT OFFSET ADJUST
S4 XCX01
S5 MLV-L30D
FULL SCALE ADJUST
P7 200 ohm POT
R82 49.9 ohm
R36 10K
R39 10K
U28-D LT1125
R37 10K
U28-C LT1125
TESTPOINT1
+5 C20 10uF-16V
+15V C21 10uF-16V
-15V C22 10uF-16V
-15V C85 .1uF
+15V C86 .1uF
2.5V C3 1uF-TANT
S2 AP30R-050KG-XBP
VCC VOUT SENS GND
R139 3.9K
LPRESS
C118 0ohm
C56 10uF
C92 .47uF
U14 OP07
1uF-Poly C97
R16 1K
R93 28K
LPVRAC
R70 1M
2.5V
R60 100K
U28-A LT1125
P10 20K POT
BASELINE ADJ.
TESTPOINT4
LPVRDC
R89 249K
P6 10K POT OFFSET ADJ.
R88 249K
R95 301K
C82 .1uF
U28-B LT1125
R84 2.21K
C7 10uF-TANT

DRAWN: Roger Champagne	DATED: 03/05/2020	COMPANY: Unetixs Vascular, Inc	
CHECKED: Anthony Castillo	DATED: 03/05/2020	TITLE: Series 2 SMT Motherboard (SSB)	
QUALITY CONTROL:	DATED:	CODE:	SIZE: B
RELEASED:	DATED:	DRAWING NO: 11919-0004-01	REV: D
		SCALE:	SHEET: 7 OF 8

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

TESTPOINT1

TJ1

R81 200K

U26 LM10CWM

R32 10K

+5

R40 10K

R41 10K

R17 1K

P14 5K POT

OFFSET ADJUST

S3 XCX01

S6 MLV-L30D

FULL SCALE ADJUST

P8 200 ohm POT

R83 49.9 ohm

R42 10K

R44 10K

U29-D LT1125

R43 10K

U29-C LT1125

2.5V C4 1uF-TANT

+5 C25 10uF-16V

+15V C26 10uF-16V

-15V C27 10uF-16V

-15V C91 .1uF

+15V C88 .1uF

S1 AP30R-050KG-XBP

VCC VOUT SENS GND

+5 +5

R138 3.9K

RPRESS

C117 0ohm

C57 10uF

C93 .47uF

U15 OP07

1uF-Poly C98

R18 1K

R94 28K

R71 1M

2.5V

+15V

R63 100K

U29-A LT1125

P9 20K POT

BASELINE ADJ.

-15V

RPVRAC

RPVRDC

R91 249K

P3 10K POT OFFSET ADJ.

R90 249K

R96 301K

C87 .1uF

U29-B LT1125

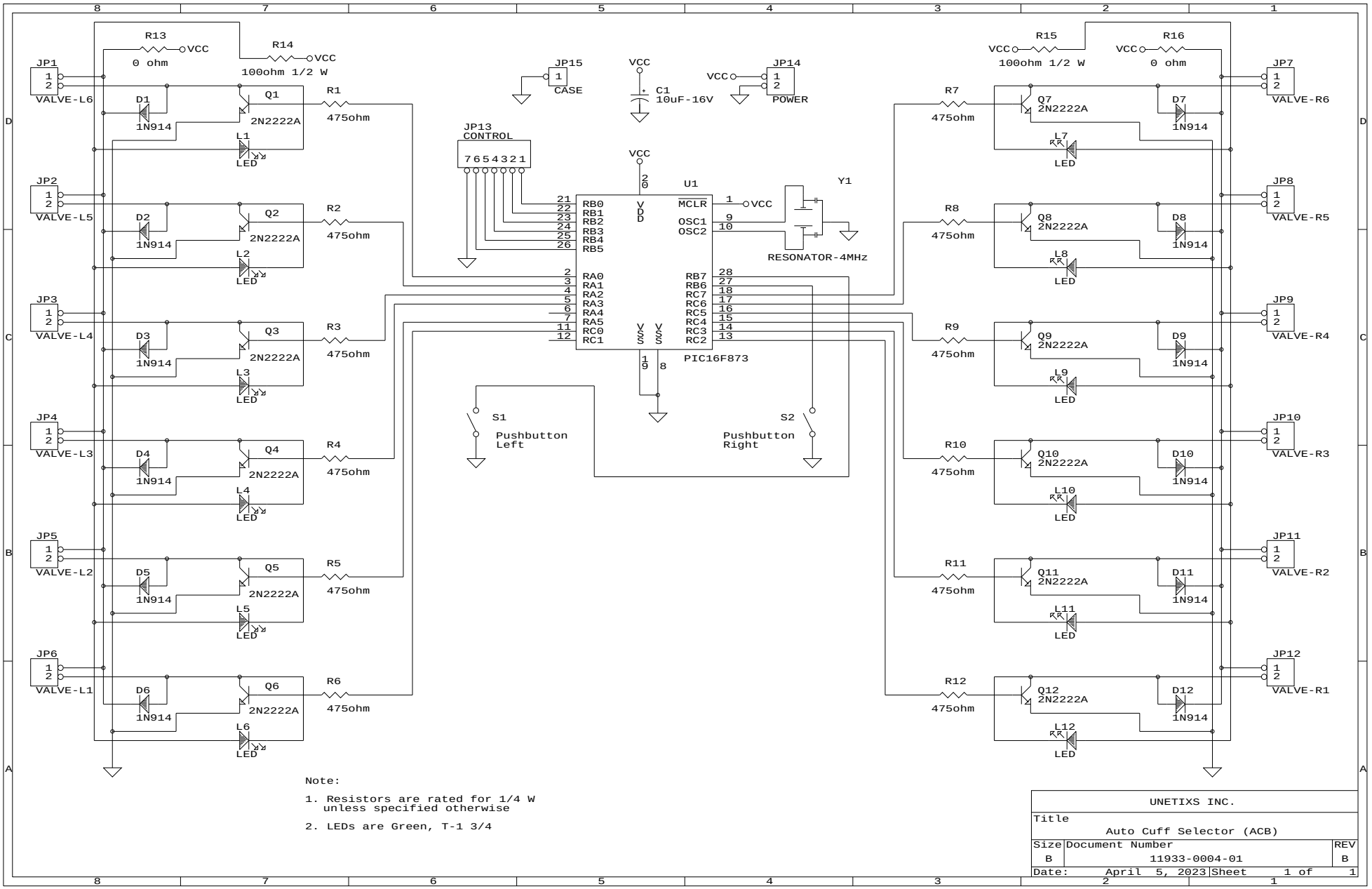
R85 2.21K

C6 10uF-TANT

TJ3

TESTPOINT4

DRAWN: Roger Champagne	DATED: 03/05/2020	COMPANY: Unetixs Vascular, Inc	
CHECKED: Anthony Castillo	DATED: 03/05/2020	TITLE: Series 2 SMT Motherboard (SSB)	
QUALITY CONTROL:	DATED:	CODE:	SIZE: B
RELEASED:	DATED:	DRAWING NO: 11919-0004-01	REV: D
		SCALE:	SHEET: 8 OF 8



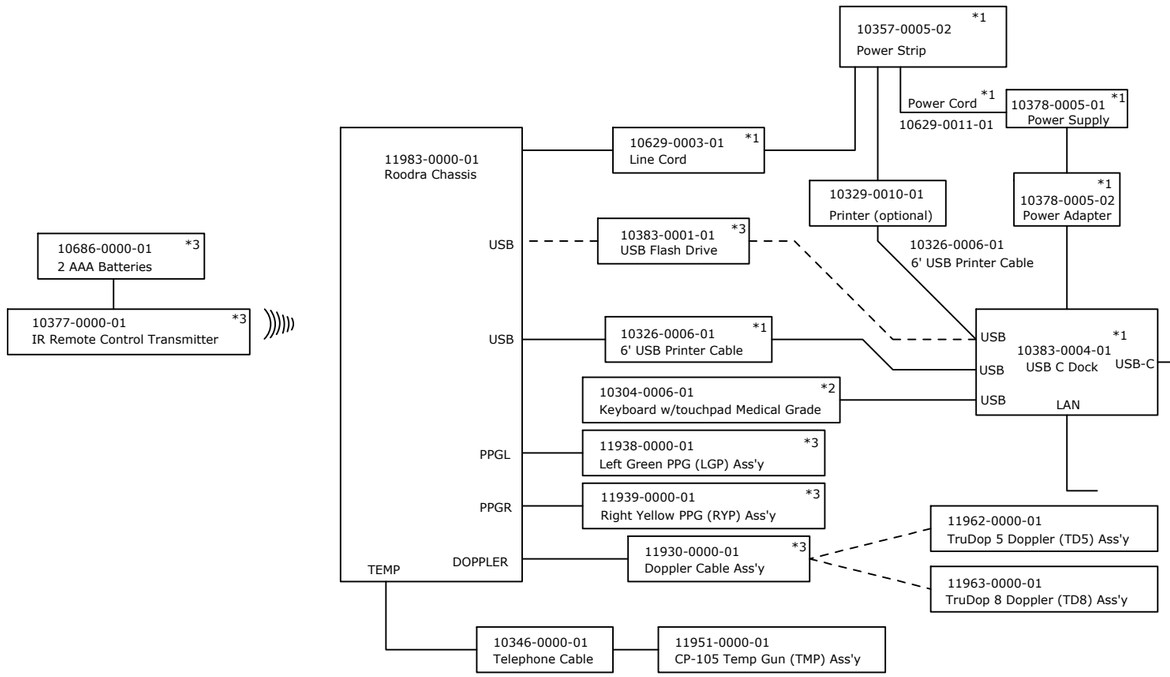
Note:

1. Resistors are rated for 1/4 W unless specified otherwise

2. LEDs are Green, T-1 3/4

UNETIXS INC.		
Title: Auto Cuff Selector (ACB)		
Size: B	Document Number: 11933-0004-01	REV: B
Date: April 5, 2023	Sheet 1 of 1	

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:
A	Initial Release	AWC	11/14/23



*1 - From 11976-0000-01 ESA Cart

*2 - From 11987-0000-01 Roodra Accessory Kit

*3 - From 11989-0000-01 Basic Accessory Kit

DRAWN: R. Champagne	DATED: 11/14/2023	COMPANY: Unetixs Vascular Inc 333 Strawberry Field Rd Suite 11 Warwick, RI 02886			
CHECKED: N. Gomes	DATED: 11/14/2023	TITLE: Ass'y ESA Final-Schematic			
RELEASED: A. Castillo	DATED: 11/14/2023	CODE:	SIZE: B	DRAWING NO: 11977-0004-01	REV: A
		SCALE:	SHEET: 1 OF 1		

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:
A	Initial Release	AWC	02/21/20
B	ECR-0129	NMG	05/19/21

40001-1001-01
Roodra Chassis Top

* (2 places)
10548-0008-01
#8 Ring Terminal

10706-0009-01 Green/Yellow 12"

Roodra Front Panel
40001-1002-01

See 11983-0004-02 for
LED Board Assembly

IRB Ass'y

Qty: 2
10637-0005-01
Momentary Switch
Left Right

LED Board Assembled 'B' Header

LED Board Assembled 'A' Header

White Black White Black

Left LED harness

Right LED harness

Red Black
Video
USB Port
10368-0025-01
Raspberry Pi
Computer
Ribbon Cable
Touchscreen
10369-0021-01
Micro USB Port
Micro USB cable

Roodra Base Chassis
40001-1000-01

Right Speaker Assembly JP12
Left Speaker Assembly JP13
Right Valve Assembly JP4
Left Valve Assembly JP3
Right Pump Assembly JP6
Left Pump Assembly JP5

White
Black
Black
White
JP14

Power Distribution Cable Assembly

123456789
JP7

PCB Ass'y, S2 SMT Motherboard (SSB)

11919-0000-01

10326-0008-01
USB Extender
Panel Mount

Roodra Back Panel
40001-1003-01

JP15
20021-0006-01 Lug
Doppler Cable Assembly
Green

JP10
20021-0006-01 Lug
Left PPG Cable Assembly

JP9
20021-0006-01 Lug
Right PPG Cable Assembly

JP8
Headphone Cable Assembly

10365-0000-01
Power Supply, Switcher UL544

TB2
TB1

* 10548-0008-01 (3 places)
#8 Ring Terminal

* 10548-0008-01
#8 Ring Terminal

USB JP2 1 2 3 4
JP1 1234
JP11 1234 56

Red
Black

Fan
10342-0012-01

Internal CPU Cable Ass'y

Temp. Cable Ass'y

1234 567
JP13
ACB & Manifold Ass'y

JP15

JP14
Buttons
Right Left

Brown
Blue
10706-0009-01 - Green/Yellow (15")
10706-0009-01 - Green/Yellow (23")

Power Entry Assembly
B
F
G

White
Black
To Manifold stud

10706-0009-01 - Green/Yellow (5")

Black White Black White

(Right LED harness)

(Left LED harness)

20034-0001-01
Screw, Plug Connector

Note: All cable assemblies are defined on page 2 of this drawing.

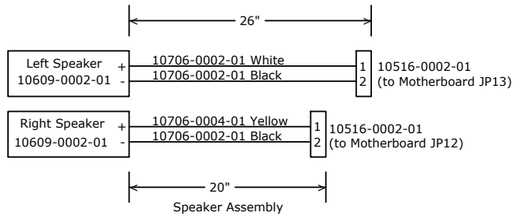
DRAWN: R. Champagne	DATED: 05/19/2021		
CHECKED: N. Gomes	DATED: 05/19/2021		
QUALITY CONTROL:	DATED:		
RELEASED: A. Castillo	DATED: 05/18/2021		

COMPANY: Unetixs Vascular Inc.
333 Strawberry Field Rd Suite 11, Warwick, RI 02886

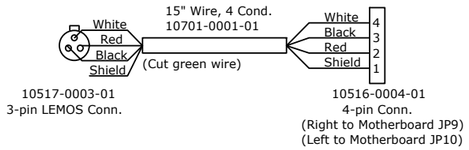
TITLE: Ass'y, Roodra Chassis (OBC)

CODE:	SIZE:	DRAWING NO:	REV:
	B	11983-0004-01	B

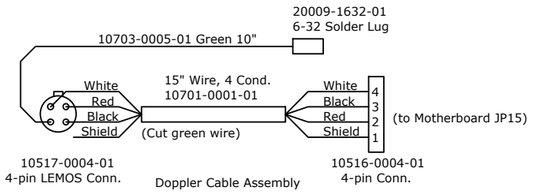
SCALE: | SHEET: 1 OF 2



Speaker Assembly

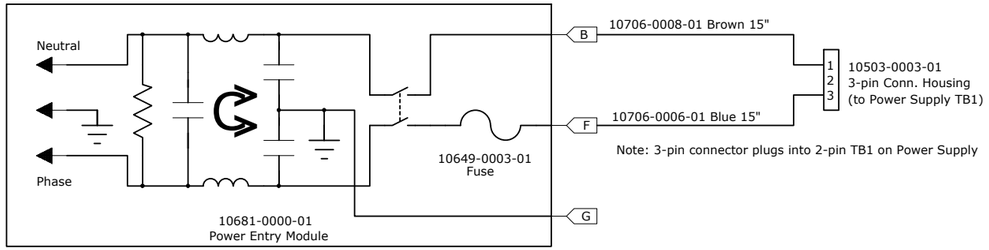


PPG Cable Assembly (Qty: 2)



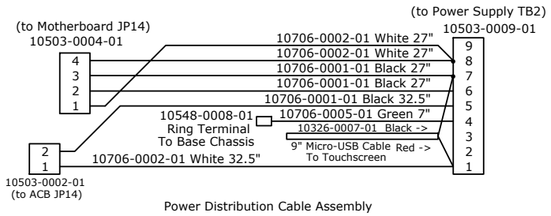
Doppler Cable Assembly

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:
A	Initial Release	AWC	02/21/20
B	ECR-0129	NMG	05/19/21

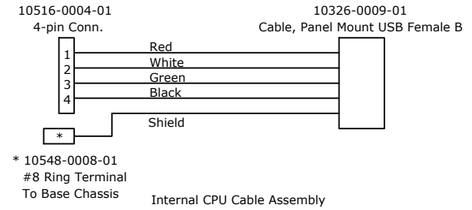


Note: 3-pin connector plugs into 2-pin TB1 on Power Supply

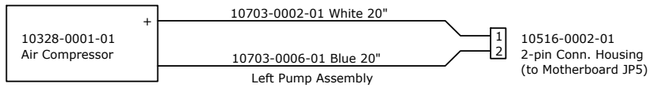
Power Entry Assembly



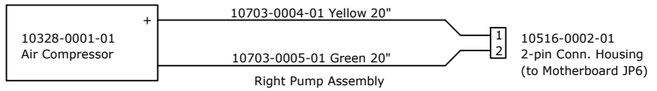
Power Distribution Cable Assembly



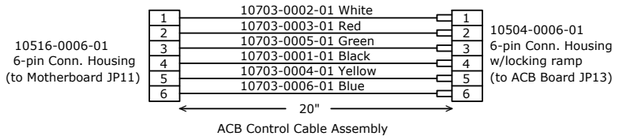
Internal CPU Cable Assembly



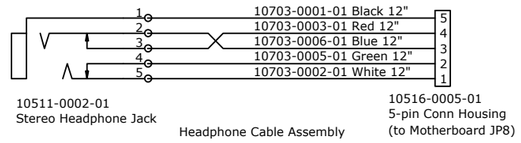
Left Pump Assembly



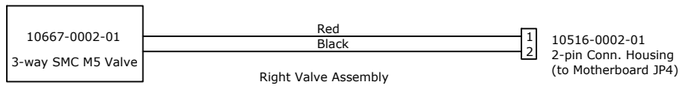
Right Pump Assembly



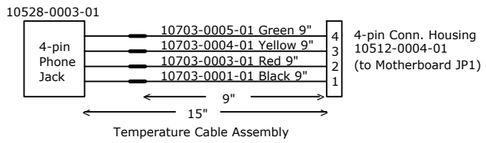
ACB Control Cable Assembly



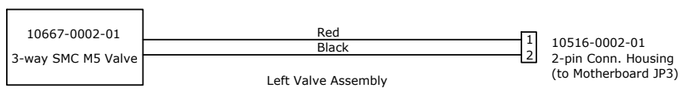
Headphone Cable Assembly



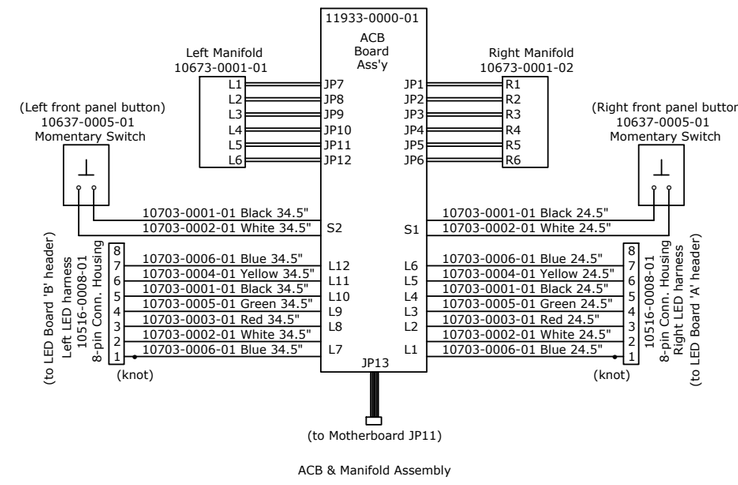
Right Valve Assembly



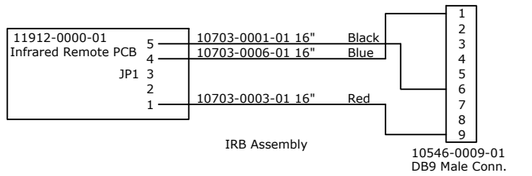
Temperature Cable Assembly



Left Valve Assembly



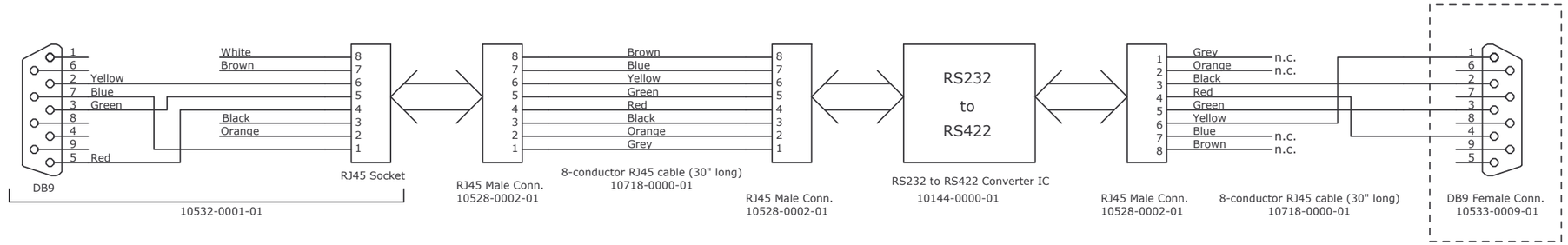
ACB & Manifold Assembly



IRB Assembly

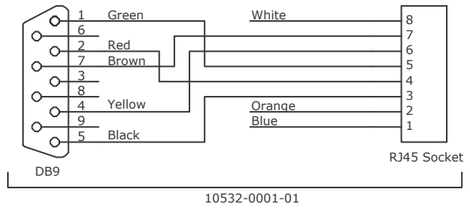
DRAWN: R. Champagne	DATED: 05/19/2021	COMPANY: Unetixs Vascular Inc. 333 Strawberry Field Rd Suite 11, Warwick, RI 02886	
CHECKED: N. Gomes	DATED: 05/19/2021	TITLE: Ass'y, Roodra Chassis (OBC)	
QUALITY CONTROL:	DATED:	CODE:	SIZE: B / DRAWING NO: 11983-0004-01 / REV: B
RELEASED: A. Castillo	DATED: 05/18/2021	SCALE:	SHEET: 2 OF 2

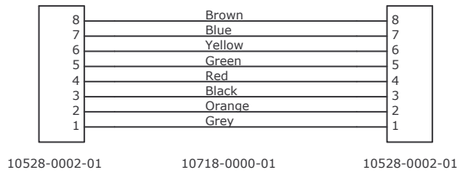
REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:
A	Initial Release	AWC	02/21/20



COMPANY: Unetixs Vascular Inc 125 Commerce Park Rd. North Kingstown, RI 02852						
TITLE: Roodra Serial Cable Ass'y (OSC)						
DRAWN: R. Champagne	DATED: 02/21/2020	CODE:	SIZE: B	DRAWING NO: 11984-0004-01	REV: A	
CHECKED: N. Gomes	DATED: 02/21/2020					
RELEASED: A. Castillo	DATED: 02/21/2020	SCALE:		SHEET: 1 OF 1		

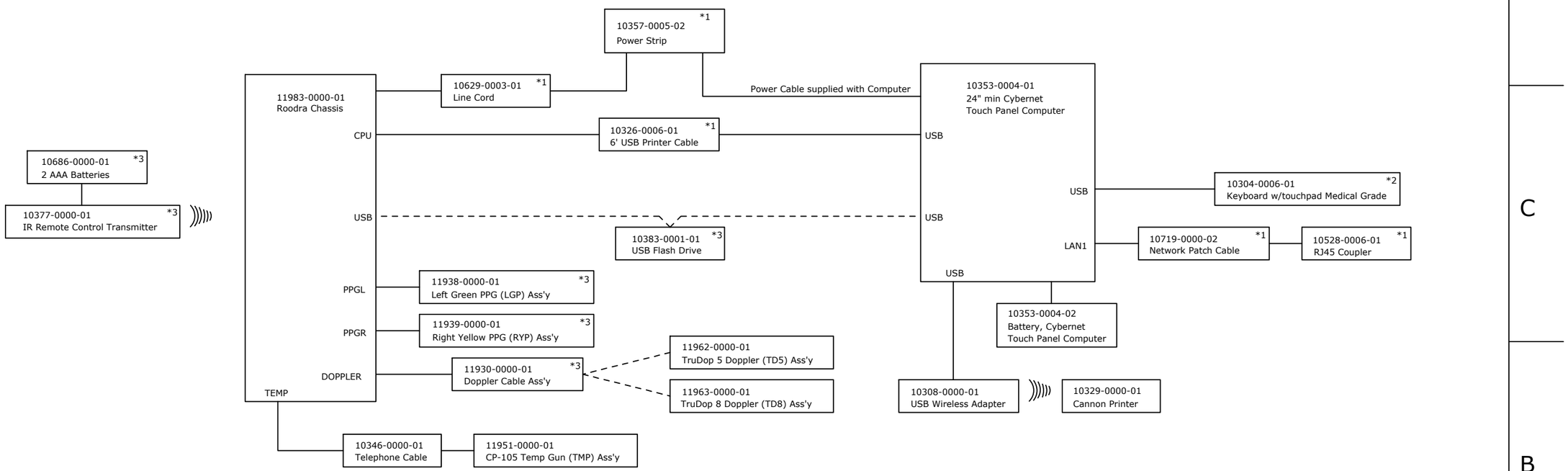
REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:
A	Initial Release	AWC	02/21/20





COMPANY: Unetixs Vascular Inc 125 Commerce Park Rd. North Kingstown, RI 02852					
TITLE: Roodra IR Cable Ass'y (OIR)					
DRAWN: R. Champagne	DATED: 02/21/2020	CODE:	SIZE: B	DRAWING NO: 11985-0004-01	REV: A
CHECKED: N. Gomes	DATED: 02/21/2020				
RELEASED: A. Castillo	DATED: 02/21/2020	SCALE:		SHEET: 1 OF 1	

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:
A	Initial Release	AWC	02/21/20
B	ECR-0129	NMG	05/18/21



*1 - From 11982-0000-01 Roodra Cart

*2 - From 11987-0000-01 Roodra Accessory Kit

*3 - From 11989-0000-01 Basic Accessory Kit

COMPANY:
Unetixs Vascular Inc
333 Strawberry Field Rd Suite 11
Warwick, RI 02886

TITLE:
Roodra Shipment Level

DRAWN:	DATED:	CODE:	SIZE:	DRAWING NO:	REV:
R. Champagne	05/17/2021		B	11986-0004-01	B
CHECKED: N. Gomes	DATED: 05/18/2021				
RELEASED: A. Castillo	DATED: 05/18/2021	SCALE:	SHEET: 1 OF 1		

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