BTE™

EVALUATOR™

OPERATOR'S MANUAL

Original Instructions

Printed in the U.S.A.

This manual supports the BTE Evaluator ™ System - 900 MHz & 868 MHz

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Manufacturer's information

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Product Description, Use, and Application Specification

Product: Evaluator
Model: Evaluator

General Description

The Evaluator is a system used to assess physical capacity of specific human functions. The system can be easily transported from one location to another.

The system includes load cells, mechanical adapters for various applications, tool communication hardware, software, range of motion devices (ROM), and storage/transport cases. Calibration weights and fixtures allowing in-field calibration are also included.

Intended Use

The Evaluator is intended to be used for musculoskeletal testing. Applications include occupational and physical therapy and industrial rehabilitation.

Contraindications for use include conditions where tensile strength of tissues and/or structures is compromised, i.e. healing bone fractures and tendon, ligament, and muscle repairs. Clinical judgment is required to determine whether subject should perform assessments.

Intended Medical Indication

The system is intended to assess strength and range of motion.

Intended Patient Population

General Population; Anyone whose muscle strength or range of motion (ROM) needs to be measured. There are no age, weight, or height restrictions.

Intended Anatomical Applicability

Evaluation of the musculoskelatal system.

Intended User Profile

Medical healthcare professionals

Intended Conditions of Use

Office or clinic setting

Frequency of Use

There is no frequency of use restrictions for this device

Essential Performance

The device does not have any essential performance characteristics.

Use of Energy Source

An electric power source is required to provide power to the tool communication hardware.

Transfer of Energy to Patient

There is no transfer of energy to the patient as the device is only used for measuring isometric forces.

Operating Principle

The Evaluator is a device that supplies a means for assessing strength and range of motion through the use of a hand grip, pinch strength, ROM devices and pull/push devices. The tools include a pinch gauge, hand grip, a portable load cell and other. The Evaluator measures isometric push/pull forces applied to the tool by the client and the duration of time force is applied. The data collected allows the program to track a client's capabilities through multiple calculated variables. Reports are generated from the computer program that can be used to evaluate a client's capabilities over single or multiple uses of the Evaluator.

Applied Parts

Evaluator applied parts include all tools, tool attachments, heart rate monitor, and the Portable Dock and Transmitter or BHU. All applied parts are type B.

Performance Characteristics

- Hand Grip has the capability to measure push forces in range 1 lb to 200 lbs (± 0.75 lb.)
- Pinch Gauge has the capability to measure push forces in range 1 lb to 45 lbs (± 0.2 lb.)
- Portable Load Cell (PLC) has the capability to measure push and pull forces in range 1 lb to 300 lbs. Tolerances are: ± 0.75 lbs in 1 -100 lbs range and ± 2 lbs in 101-300 lbs range
- Goniometer has the capability to measure 0 to 360 degrees of movement in 1 degree increments (± 3 degrees)
- Inclinometer has the capability to measure 1 to 360 degrees of movement in 1 degree increments (± 1 degree)
- Heart rate system allows for constant and real time monitoring during testing. The systems measures the heart rate in beats per minute and functions within 2 feet from Portable Dock and Transmitter and 30 feet from the Hub.
- Functional Range of Motion (FROM) Panels are available with the system.

Basic Safety Testing

There are no tests that have to be performed in the field to ensure basic safety other than preventative inspection described in the Maintenance section.

Operating Voltage

5 VDC

Servicing

- No parts shall be serviced or maintained while in use with a patient
- Upon request BTE will provide circuit diagrams, component parts lists, descriptions, calibration instructions, or other information to assist service personnel to repair parts

Connections

Hosting Device	Port	Connected Device
Computer	USB	Keyboard
		Mouse -or- pointing device
		Printer
		USB Powered Speakers
		BTE Wireless Hub
	VGA video output	LCD -or- LED Monitor
BTE Wireless Hub	SMA Connector	Wired connection to base unit

EXPLANATION OF SYMBOLS AND CERTIFICATION MARKINGS

Manufacturer		Temperature Limit	
Catalogue Number (Product and Model Number)	REF	Humidity Limit	
Serial Number	SN	Atmospheric Pressure Limitation	
Follow instructions for use		Electromagnetic Field	
Type B Applied Part		Direct Current	
European Union Conformity Marking	CE	Safety Certification	SGS C S 710101

CAUTION AND WARNING

Marking on the Equipment

Where Applicable

REF Evaluator

SGS C S 710101

BTE

BTE

SN Serial Number

Permissible Environmental Conditions for Transport and Storage

Important Information for Safety

Prior to Each Use

Check that the Portable Load Cell (PLC) and Portable Load Cell (PLC) Tools are not damaged.

Warnings in the Manual

WARNING

The heart rate system is not intended for use with clients that are in life-threatening circumstances or in condition that precludes performing activities required for physical assessment.

WARNING

Do not modify this equipment without authorization of the manufacturer.

CAUTION

Portable Load Cell (PLC) and PLC attachments shall not be serviced while in use with a client. Inspections of these components shall be performed prior to use.

CAUTION

Anti-virus software is installed on the computer. If the computer is connected to the Internet, the software must be updated regularly to protect the computer against viruses.

ELECTROMAGNETIC FIELD WARNING

The Mio Alpha watch and USB charger contain magnets that could affect pacemakers and implantable cardioverter-defibrillators (ICDs).

Permissible Environmental Conditions for Transport and Storage

Ambient temperature:	-20°C to +40°C
Relative humidity:	30% to 90%
Atmospheric pressure:	550 hPa to 1060 hPA

Permissible Environmental Operating Conditions

Ambient temperature:	+10°C to +38°C
Relative humidity:	30% to 75%
Atmospheric pressure:	700 hPa to 1060 hPa

Electromagnetic Interference

The Equipment needs to be placed into service according to electromagnetic compliance information provided in the manual Appendix.

Environmental Protection

- Dispose of batteries in accordance with all local, state, and federal laws.l
- At the end of the equipment service life, dispose of the device components in accordance with all local, state, and federal laws for electronic recycling.

Interchangeable or Detachable Parts by Service Personnel.

- There are no components that are designated as repairable by service personnel. Components will be replaced if needed in accordance with BTE service policy

Preventative Inspection

Check that the Portable Load Cell (PLC) and Portable Load Cell (PLC) Tools are not damaged.

Maintenance

Calibration should be performed by the operator every two weeks. No components shall be serviced while in use with a client.

Equipment Shut Down
Use the appropriate windows shut down procedures to turn off the computer

IMPORTANT NOTES:

The computer that was shipped with your Evaluator is the brain of the system. Adding other software to this computer will lead to errors in your Evaluator operating system.

DO NOT install any software applications, utilities, or modify the existing software and operating system configurations. Doing so, will void your BTE warranty.

Your Evaluator was shipped with an initial default password enabled. You will not be able to access a patient record without first entering the password.

The initial password is: **BTE**

If you wish to change the password, select **Utilities**, then **Password**.

Information Regarding EC Declaration of Conformity

BTE Technologies maintains the EU Declaration of Conformity. If you have any questions, contact BTE customer service.

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EVALUATOR™

OPERATOR'S MANUAL

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SETUP & GENERAL OPERATION

SETUP & GENERAL OPERATION

I. EVALUATOR CASE

The Evaluator Case is a rolling case that contains three layers of foam, which hold every tool and accessory (Figure 1-1).

Figure 1-1. Evaluator Case

A. PRESS-AND-PULL LATCHES

The case includes five press-and-pull latches, which allow for easy opening and closing. To open a latch, push on the square button in the middle of the latch. While pushing on the button, pull up on the main latch (Figure 1-2).

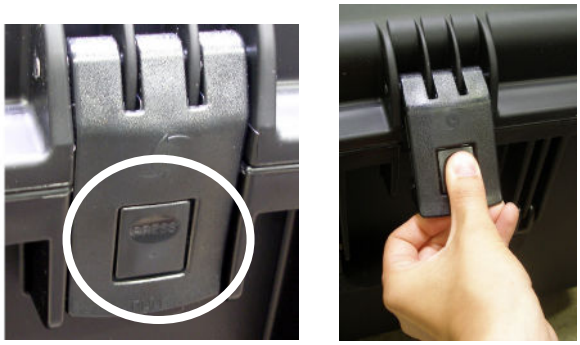


Figure 1-2. Opening the Latches

B. RETRACTABLE HANDLE

The case includes a retractable handle, which allows for easy portability of the system. To release the handle, push the V-shaped lever, which is on the backside of the case, to the right and then pull up the handle (Figure 1-3). Perform the same step to retract the handle.

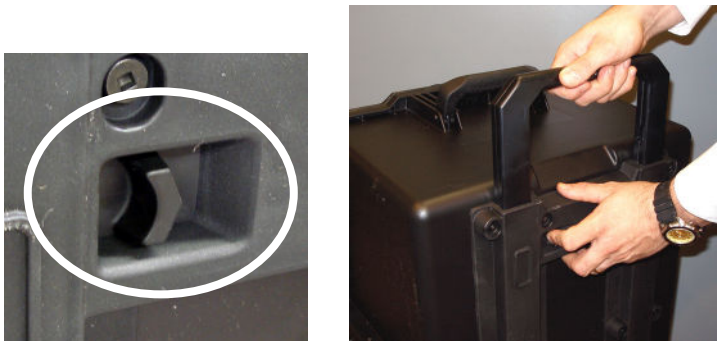
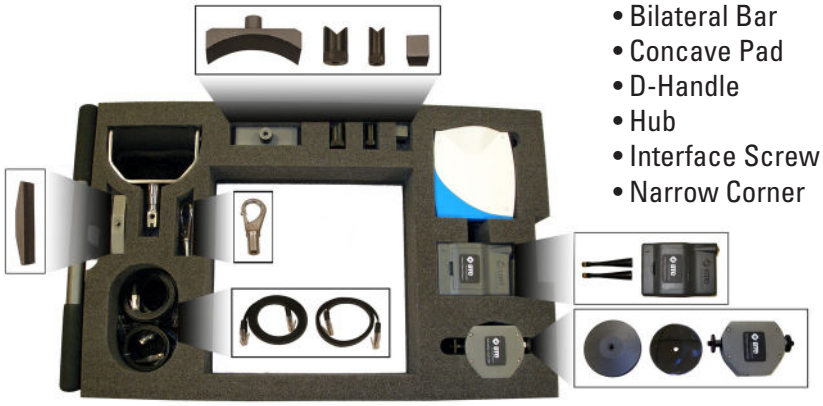


Figure 1-3. Releasing the Retractable Handle

C. LAYOUT OF TOOLS AND ACCESSORIES

Each tool and accessory has a dedicated location in the foam. Please use Figure 1-4 as a guide. This same figure is also on the back of the manual for easy reference.

Top Layer

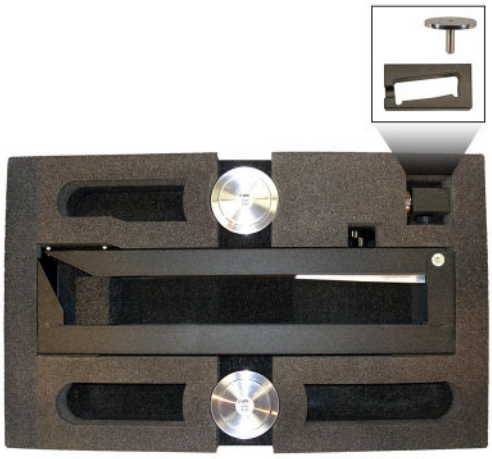


- Antennas
- Bilateral Bar
- Concave Pad
- D-Handle
- Hub
- Interface Screw
- Narrow Corner
- PLC Calibration Disk
- Portable Load Cell
- Portable Dock & Transmitter
- Rectangular Pad
- RJ45 Cables
- Round Pad
- Small Square Pad
- Snap
- Wide Corner

Middle Layer

- Batteries
- Battery Charger
- Battery Charger Power Supply
- Dual Inclinometer & Link Cable
- EvalTech Software Installation CD
- EvalTech Software Operator's Manual
- Evaluator Operator's Manual
- Extension Bar
- Goniometer
- Goniometer Arms
- Hand Grip
- HR Monitor
- HR Monitor Strap
- Pinch Grip
- Velcro Straps
- Wrench

Bottom Layer



- 10 lb Calibration Weight
- 15 lb Calibration Weight
- Hand Grip Calibration Fixture
- Pinch Grip Calibration Block
- Pinch Grip Calibration Fixture

Figure 1-4. Layout of Evaluator Components

II. EVALUATOR COMPONENTS (FIGURE 1-5)

Please inspect all parts for any visible damage from shipping. Notify BTE Technologies upon discovery of any damage.

It is recommended that while unpacking the equipment you review your packing slip to ensure you have received all the required parts. Contact Customer Service immediately if anything is missing so that replacements may be provided.

Data Acquisition Devices & Electronic Tools

Hub w/Antenna

Portable Dock & Transmitter w/Antenna

Portable Load Cell

Goniometer w/Small, Medium, and Long Arms

Hand Grip Dynamometer

Pinch Dynamometer

Dual Inclinometer

Heart Rate System and Portable Dock & Transmitter Accessories

Heart Rate Monitor & Strap

Velcro Straps - Long and Short

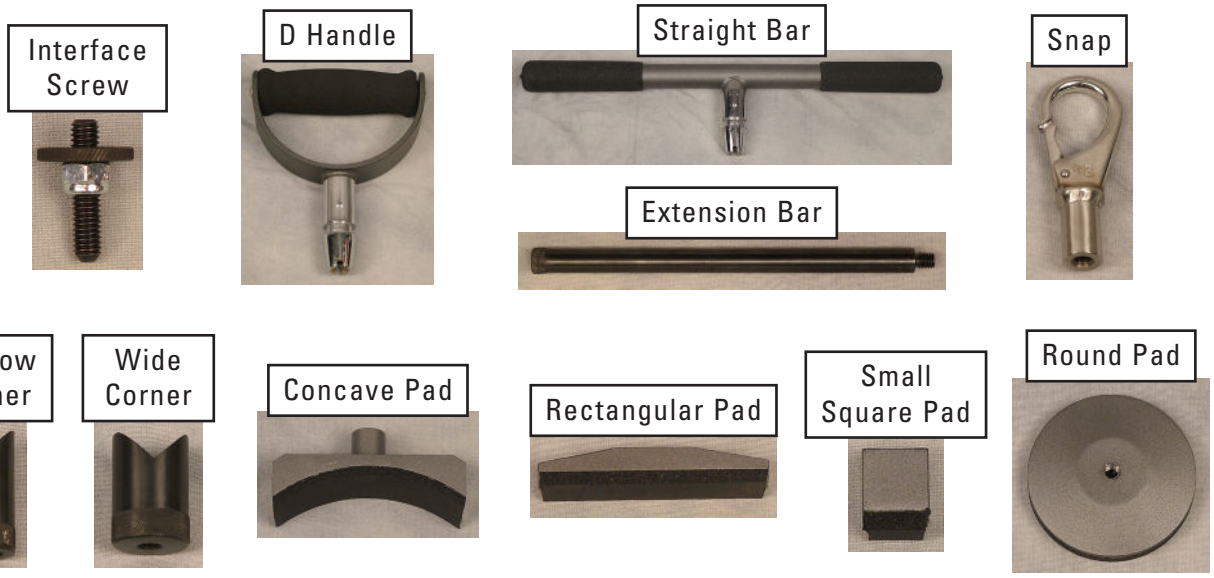
RJ45 Cables 3ft & 5 ft

Rechargeable AA Batteries

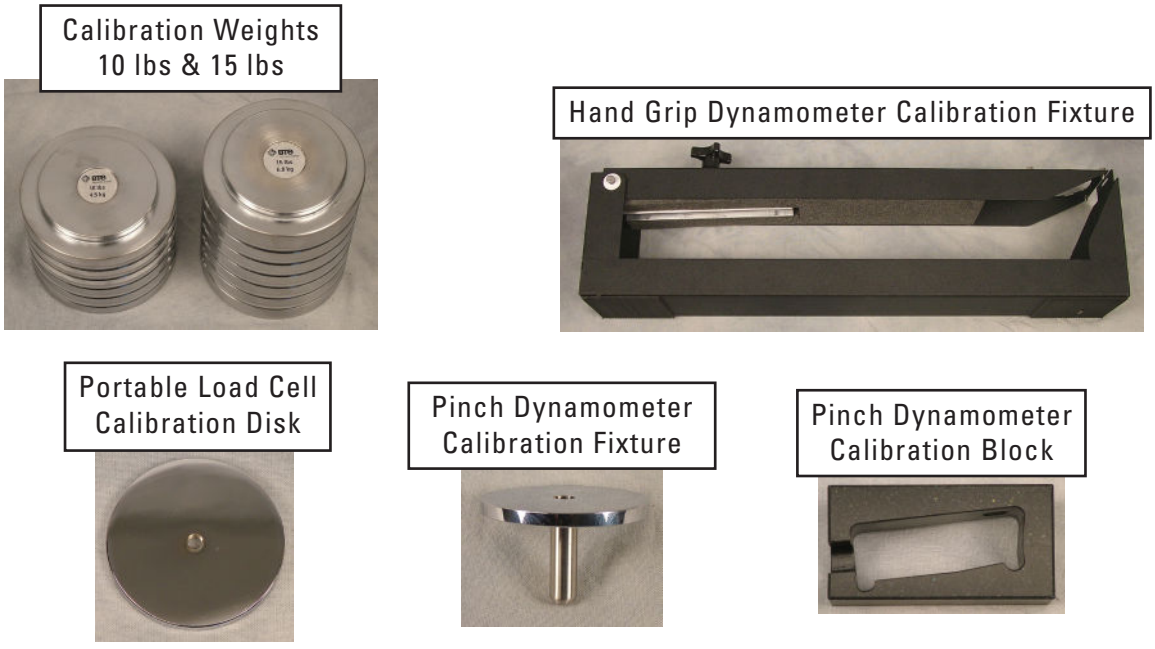
Battery Charger

Figure 1-5a. Evaluator Components

Portable Load Cell Accessories



Calibration Accessories



Support Material

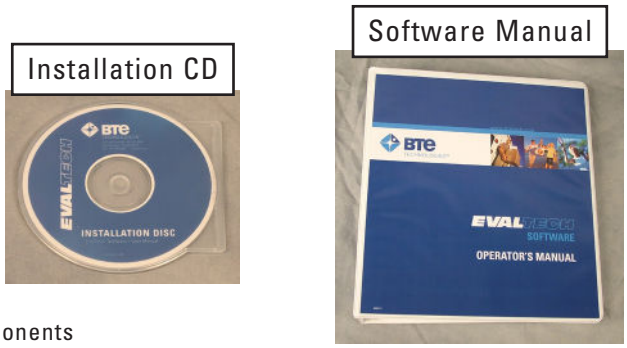


Figure 1-5b. Evaluator Components

DO NOT CHANGE OR MODIFY ANY COMPONENTS

Any changes or modifications, especially to the wireless components, not expressly approved by BTE Technologies, Inc. could void the user's authority to operate the equipment.

III. GENERAL OPERATION OF THE SYSTEM

A. SETUP

Step 1. Attach one of the antennas to the hub and plug the Hub USB cable into the computer (Figure 1-6).

Figure 1-6. Attach Antenna and Plug Cable into Computer

Step 2. Attach the other antenna to the Portable Dock & Transmitter and insert the batteries (Figure 1-7).

Figure 1-7. Attach Antenna and Insert Batteries

IMPORTANT

DO NOT ATTACH any power supply to the Portable Dock & Transmitter.

Note that the batteries are charged before shipping; however, rechargeable batteries will self-discharge over time. It is recommended that you recharge the batteries before using the system for an extended length of time.

ACCEPTABLE ANTENNA(S)

This device has been designed to operate with the antenna(s) listed below and having a maximum gain of 2.7 dBi. Antennas not included in this list or having a gain greater than 2.7 dBi are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

Acceptable antenna(s) include:

1. Linx Technologies 916MHz 1/4 Wave Whip Antenna (ANT-916-CW-QW)

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

B. CONNECTING A TOOL TO THE PORTABLE DOCK & TRANSMITTER

Three 3 ft and three 5 ft RJ45 cables are included with the system (Figure 1-8). These are the only cables that should be used to connect a tool to the Dock.

Figure 1-8. 3ft and 5ft RJ45 Cables

Step 1. Turn on the Dock and verify the green LED, which is to the right of the antenna, is lit (Figure 1-9).

Step 2. Plug one end of the RJ45 cable into any of the ports on the Dock (Figure 1-9).

Step 3. Plug the other end of the RJ45 cable into the desired tool (Figure 1-9).

Figure 1-9. Connect a Tool to the Dock

A maximum of 3 tools may be connected to the Dock at one time (Figure 1-10).

Note that each tool requires power from the Portable Dock - the more tools that are plugged in, the faster the batteries will drain.

Figure 1-10. Dock May Accommodate 3 Tools

C. IDENTIFYING TOOL SERIAL NUMBERS

Each tool is assigned a unique serial number, which is how the calibration data is stored in the software.

The serial number can be found on the label near the RJ45 jack on each tool and on the back of the Portable Dock & Transmitter (Figure 1-11).

Figure 1-11. Serial Number Labels

D. MANAGING TOOLS

The Tool Management feature can be accessed in the software by going to the Administration menu and selecting Manage Tools. Refer to Chapter 02c-V [Administration Menu - Manage Tools] of the EvalTech Software Operator's manual for more information.

The screen includes a snapshot of all the tools which are plugged into a powered Portable Dock (Figure 1-12). Note that the Heart Rate icon will be green whenever the Portable Dock & Transmitter is turned on.

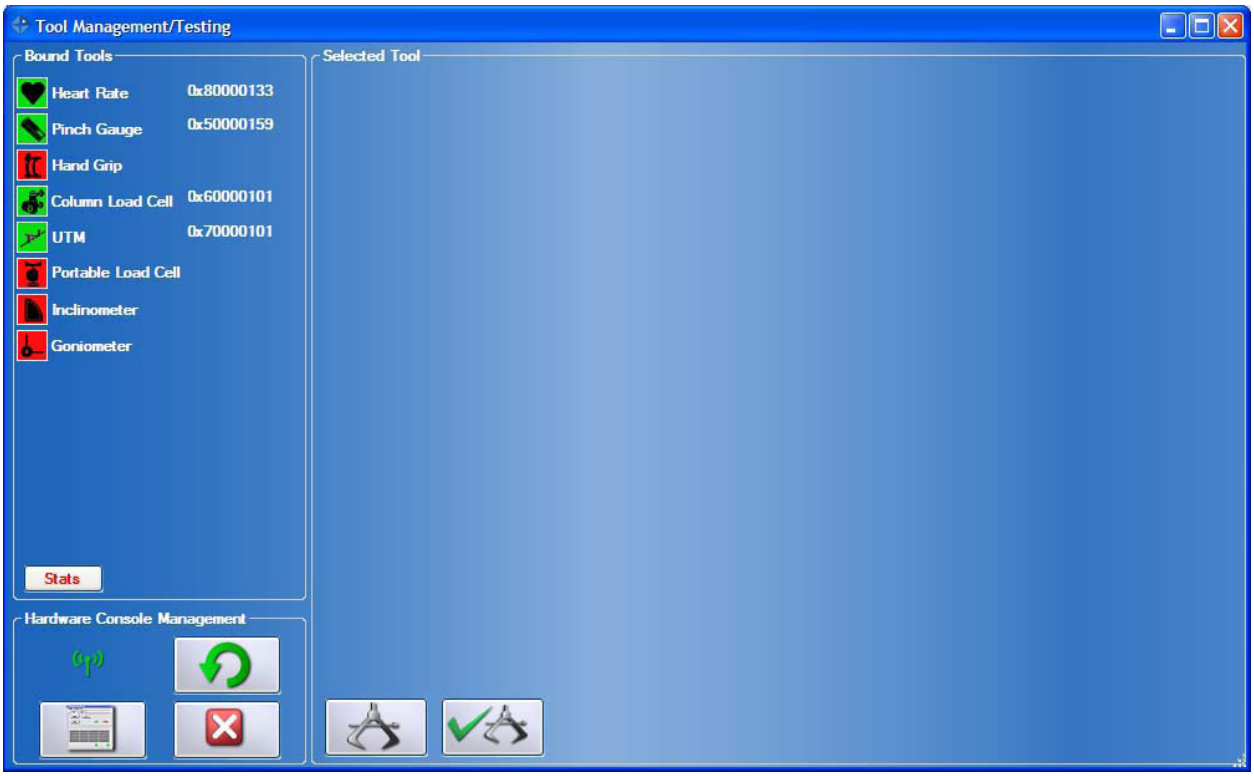


Figure 1-12. Tool Management Screen - Available Tools

In addition, the screen may display the input values whenever a tool name is selected (Figure 1-13). The tool icon must be green in order for the input values to be displayed.

Figure 1-13. Tool Input Values

E. UTILIZING THE WIRELESS SYSTEM WHILE TESTING

Take the following into consideration while testing:

1. The Portable Dock & Transmitter must be turned on and the tool must be connected prior to starting a test. The software will not recognize the tool if it is connected after the test has started or if the Dock is turned on after the test has started.
2. A tool must be calibrated prior to testing with it.

F. BATTERIES

The provided rechargeable batteries are charged before shipping; however, rechargeable batteries will self-discharge over time. It is recommended that you recharge the batteries before using the system for an extended length of time.

When fully charged, the batteries should power the Portable Dock for up to 5 hours of continuous testing. This will vary depending on how much battery capacity is available, how many tools are plugged in at once, and which tools are being used (e.g. the Dual Inclinometer and Goniometer use more battery power than the Hand Grip, Pinch Gauge, and Portable Load Cell).

The amount of charging time depends on the remaining capacity of the battery in addition to the charge rate set on the charger. Refer to the battery charger manual for information on the estimated charge time. Whenever possible, only charge the batteries after they have been drained. Short-charging batteries can degrade them over time.

Since rechargeable batteries degrade over time and after extended use, they should be replaced every year.

Only NiMH type batteries can be charged in the charger provided with the device.

IV. MAINTENANCE & CARE

A. COMPUTER CARE

Since computers are sensitive to extremes of temperature, do not place equipment close to a direct source of heat or cold (for example, in direct sunlight, next to a radiator, or next to an air conditioner).

Do not install any additional software onto the controlling computer. The BTE Technologies Evaluator system is in constant communication with the computer, so a "clean", dedicated computer system is crucial to the integrity of this communication system.

If your computer was purchased through BTE and unapproved software has been installed, the computer will not be covered under the warranty.

1. ANTI-VIRUS SOFTWARE

The BTE warranty is void if the product malfunctions as a result of software virus.

Anti-virus software is installed on the computer. If the computer is connected to the internet, the software must be updated regularly to protect the computer against viruses. In addition, the software must be renewed each year.

If the anti-virus software is not approved by your IT department, contact BTE before making any changes.

2. CHECK COMPUTER CABLES

Check that all cables are securely connected to the computer. Just about every cable connector is made in such a way that it will only attach in its appropriate location. If the cables are not secured properly, there may be an interruption of the data transmission, resulting in error messages.

3. COMPUTER MAINTENANCE

- Using proper Windows shut-down procedures, shut down the computer every night to keep it running smoothly during testing.
- Periodically defragment the computer. Go to Start - Programs - Accessories - System Tools - Disk Defragmenter; note that this process may take several hours.

B. TOOLS AND ATTACHMENTS

- Regularly wipe down the tools and attachments with an alcohol-based solvent.
- Periodically inspect the tools and attachments for any unusual wear or damage.

C. PORTABLE DOCK AND HEART RATE SYSTEM

- Replace the rechargeable batteries every 6 months if used frequently and every year if used occasionally.
- Replace the Polar Heart Rate chest strap every 2 years or 2500 hours of use. Contact BTE at 410-850-0333 or 800-331-8845 for a replacement.

D. CABLES

- Periodically inspect the entire length of the cables used to attach to the tools to the Portable Dock. Replace any that are damaged.

V. STRONGLY RECOMMENDED ADDITIONAL PURCHASES

In addition to the equipment shipped to you from BTE Technologies, the purchase of the following items from a local supplier is strongly recommended for adequate protection of your client data:

- CD-RWs (re-writable compact discs), USB flash drives, or a USB external hard drive for backing up and archiving copies of client data
- Disinfectant wipes to clean the commonly used surfaces on the tools and accessories

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HEART RATE SYSTEMS

SECTION 2a - CHEST STRAP HEART RATE SYSTEM

SECTION 2B - BLUETOOTH 4.0 HEART RATE SYSTEM

HEART RATE SYSTEMS

There are two heart rate system options for the Evaluator; a chest strap system and a bluetooth system utilizing a wrist-watch. The software accomdates both systems, but only one can be used for data collection at a time. Refer to the EvalTech Software Operator's Manual for information on choosing which system to use.

SECTION 2a - CHEST STRAP HEART RATE SYSTEM

I. INTRODUCTION

Unlike other heart rate systems, the BTE Heart Rate System allows for constant monitoring during the tests while remaining fully integrated with the computer. In addition, since it is a radio frequency system, a line-of-sight signal is not required. Therefore, the client is free to move around without having to worry about the signal being blocked. Note that the Transmitter has been tested to perform up to 30 feet from the Hub.

This Heart Rate System is comprised of the Hub, Portable Dock & Transmitter, and Polar Heart Rate Monitor with elastic strap. Additional items include two elastic Velcro straps, AA rechargeable batteries, and a AA battery charger (Figure 2-1).

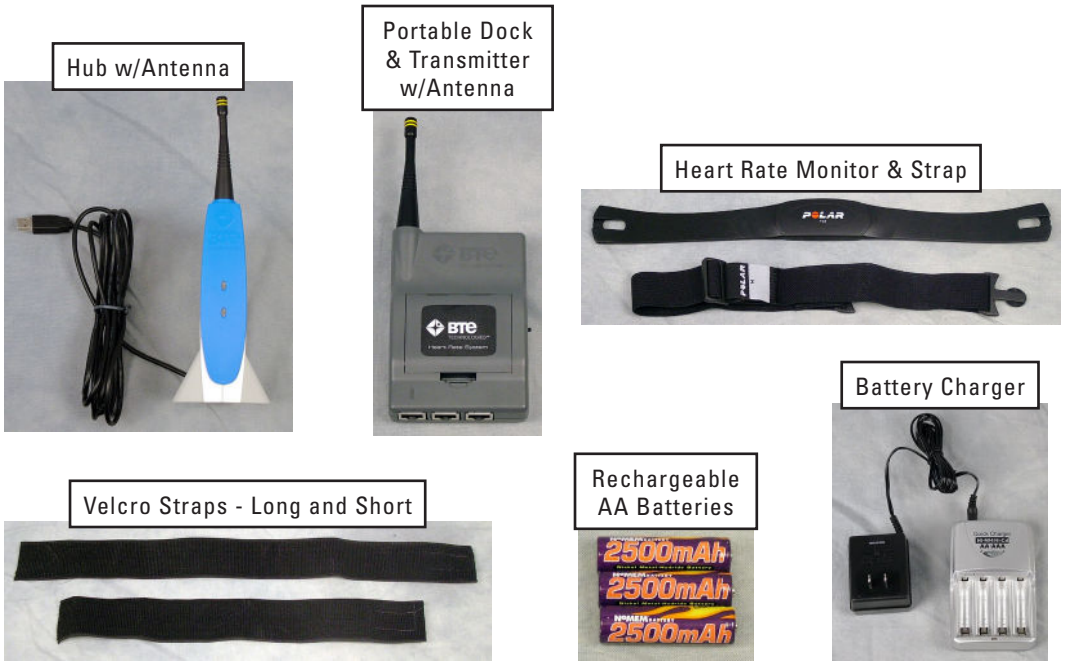

Figure 2-1. Heart Rate System

II. SETTING UP THE HEART RATE SYSTEM

Step 1. With the elastic strap attached, have the client secure the monitor to his or her chest just below the chest muscles and directly against the skin. The Polar logo should be centered on the chest and in an upright position (Figure 2-2).

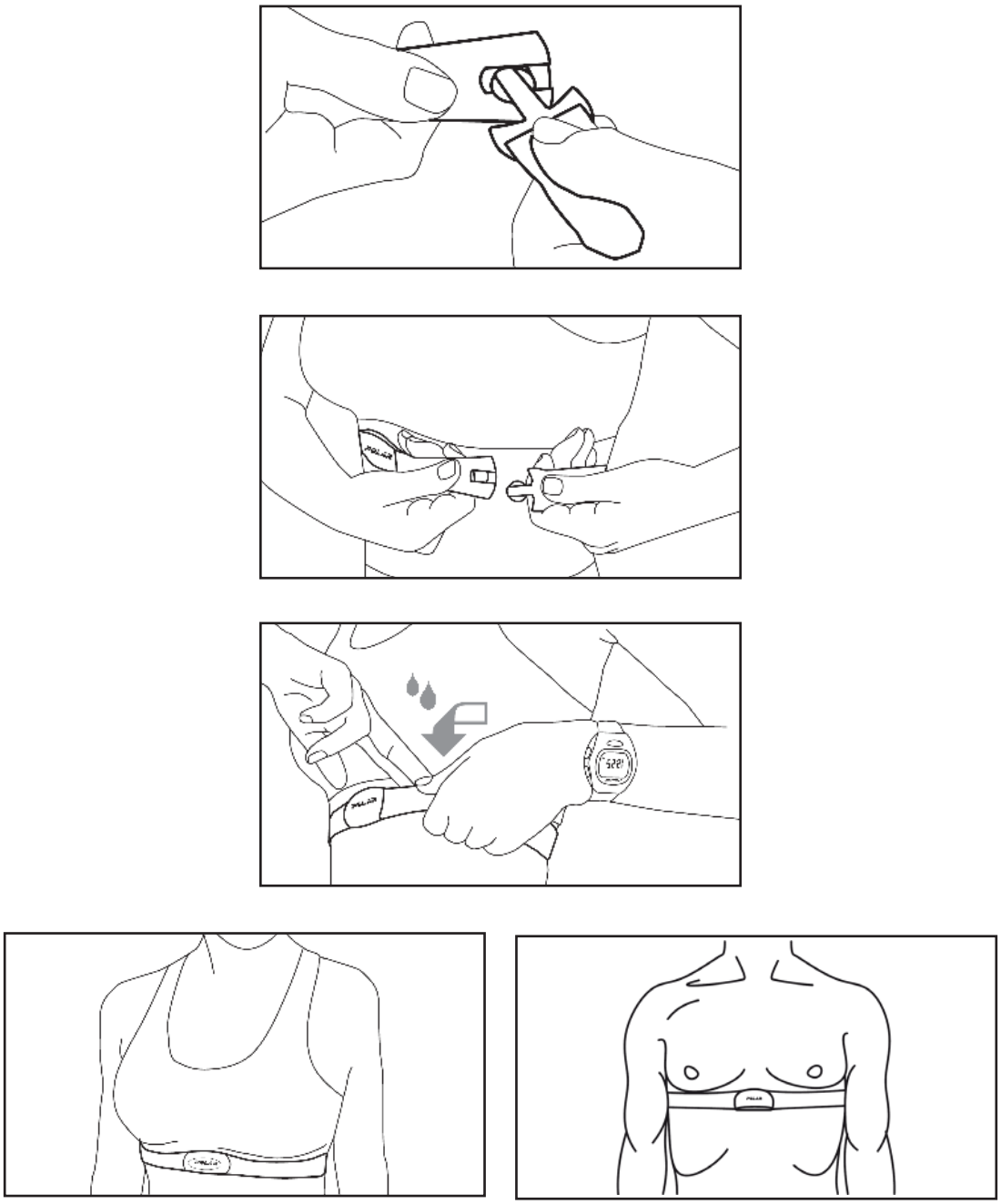

Figure 2-2. Polar Heart Rate Moniter Attached to Client

Tips for obtaining optimal results with the Polar Chest Strap:

1) Use water or electrode conductor gel between the client's skin and the strap

2) Place **one** ply of a damp paper towel between the client's skin and the strap

3) DO NOT USE ultrasound gel; it creates a layer of film that blocks the conductivity

Step 2. If you haven't done so already, attach the antenna to the Portable Dock & Transmitter.

Step 3. Make sure the batteries are in the Transmitter and turn the Transmitter on using the switch on the side farthest from the antenna (Figure 2-3). Be sure the batteries are charged; otherwise, the system will give inconsistent results.

Step 4. Have the client place the Transmitter on the left back of his or her pants at belt-line level or on the upper left arm with a Velcro strap. These are the optimal positions since they prevent the Transmitter from obstructing movement during the tests (Figure 2-3). Ensure that the Transmitter will be less than 2 feet from the Polar Monitor during all activities.

Figure 2-3. Transmitter Power Switch and Attached to Back of Client or Left Arm

Note: the upper left arm is the ideal location for consistent heart rate readings, especially during lift tests.

III. UTILIZING THE HEART RATE SYSTEM

Within the software, the heart rate (in beats per minute) may be actively viewed in the Tool Management screen, Cardiovascular Intake screen, and any applicable Test screen (Figure 2-4). Refer to the EvalTech Software Operator's Manual for information on accessing the screens.

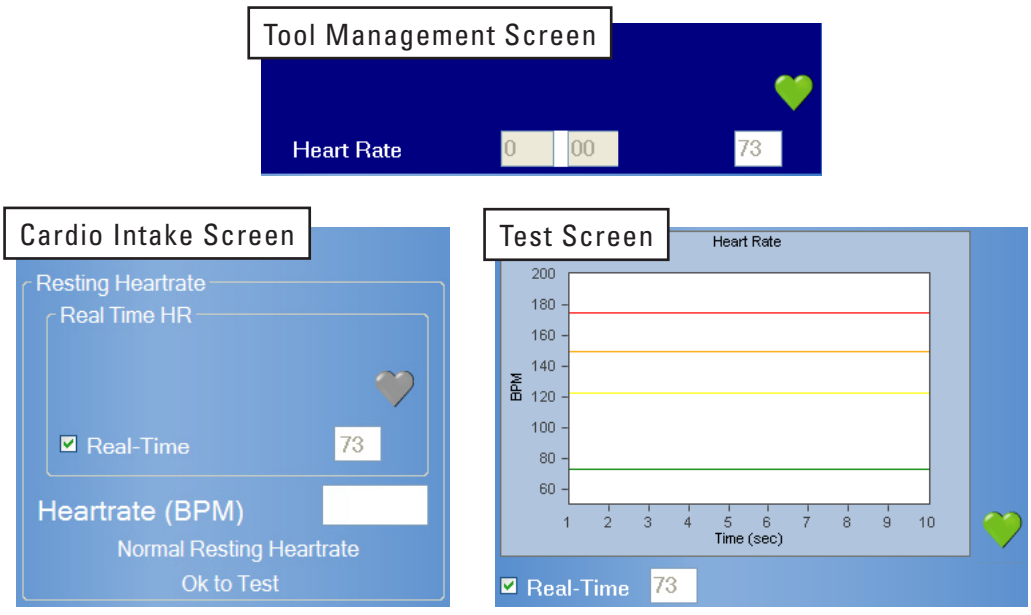

Figure 2-4. Heart Rate Displayed in Various Screens

When you are ready to capture a client's heart rate, make sure the Transmitter is turned on. Once the Hub senses a heart rate, the capture screen will display the beats per minute. Be aware that it may take a couple of seconds for the software to average the heartbeat and give an accurate number.

Please note that the heart rate system does not operate like most Polar systems in that it does not store values; therefore, the readings are more accurate and up to date. However, as a result, if the heart rate is fluctuating too much, the monitor may not be able to pick up a constant value.

Remember that many physiological characteristics (e.g. obesity, skin conductivity, and body hair composition) play a role in obtaining a heart rate and differ from individual to individual. Therefore, you may have to make some modifications in order to obtain the best results.

IV. ELASTIC STRAP

A medium elastic strap is provided with the system. Additional sizes may be purchased from Polar at www.shoppolar.com.

V. MAINTENANCE & CARE

- Store the Polar Heart Rate Monitor in a cool and dry place. Do not store it in a damp environment, in non-breathable material (such as a plastic bag or a sports bag) or with conductive material such as a wet towel. Sweat and moisture can keep the transmitter electrodes wet and the transmitter activated, shortening battery life.
- Keep the Polar Heart Rate Monitor clean. Clean it with a mild soap and water solution. Dry it carefully with a soft towel. Never use alcohol or any abrasive material such as steel wool or cleaning chemicals.
- The operating temperatures are -10 °C to +50 °C / +14 °F to +122 °F.
- Do not bend or stretch the Polar Heart Rate Monitor. This may damage the electrodes.
- Do not dry the Polar Heart Rate Monitor in any other way than with a towel. Mishandling may damage the electrodes.
- Replace the rechargeable batteries every 6 months if used frequently and every year if used occasionally.
- Replace the Polar Heart Rate chest strap every 2 years or 2500 hours of use. Contact BTE at 410-850-0333 or 800-331-8845 for a replacement.

VI. TROUBLESHOOTING

A. UNABLE TO CAPTURE HEART RATE

1. VERIFY THE FOLLOWING

- The batteries in the Portable Dock & Transmitter are charged and less than a year old
- The antenna is properly secured to the Portable Dock & Transmitter and Hub
- The Hub is plugged in and the Portable Dock & Transmitter is powered On
- The channel number on the grey FCC labels on the Hub and the Transmitter are the same (Figure 2-5)

Figure 2-5. Verify Channel Numbers Match

- The Polar Monitor (chest strap) is making a direct and secure contact with the client's skin
- The client's undergarments are not interfering with the placement of the Polar Monitor
- The Transmitter is attached to the client such that it is **less than 2 feet** from the Polar Monitor
- There is no interference between the Hub and Transmitter (see Chapter 12)
- The Hub has not been dropped or hit hard - if so, then unplug and replug the USB cable
- The Transmitter has not been dropped or hit hard - if so, then turn the power off for ~5 seconds and then back on

2. ATTEMPT THE FOLLOWING

- Try a different combination of batteries - if one of the batteries has gone bad, then the Portable Dock will not work properly.
- Refer to the next section to verify the Polar Heart Rate Monitor is properly positioned and secured.
- Attach a Velcro strap around the patient's upper left arm, and secure the Portable Dock to the strap (Figure 2-3).
- If you are in a test, tool management, or calibration screen, exit the screen for ~5 seconds, make sure the Hub is plugged in, turn the Transmitter off and then on, and

then re-enter the screen.

B. ABNORMAL HEART RATE VALUES

There can be several reasons for abnormal or irregular readings during testing. Due to the same reasons, heart rate may stay at the same value for a long time or the heart rate stays at zero (0). The following is information provided by Polar. Visit www.polarusa.com for more support information.

1. POOR CONTACT BETWEEN THE SKIN AND THE ELECTRODES OF THE HR MONITOR

For accurate heart rate measurement, the contact between skin and the electrodes should be as good as possible. Polar monitors measure the ECG signal from the chest, where it is the strongest. The weak heart-generated signals need to be accurately measured before the calculation of the heart rate. It is therefore important to ensure that the contact between the skin and the electrodes is as good as possible. Here are some tips how to ensure good contact:

- Moisten the grooved electrode areas on the back of the HR monitor. At the beginning of the testing session the client's skin may be dry and the moisture will help ensure better contact. When the client starts to sweat the contact will improve because the salt in the sweat conducts the electrical signals very well. Saliva is a good conductor as well.
- Tighten the elastic strap of the monitor. If the monitor is loose, the movement of the electrodes disturbs the detection of the ECG signal. If the standard strap does not fit satisfactorily, larger and smaller elastic straps are available as accessories.
- The type of the ECG signal slightly varies from person to person. The form of the ECG signal can depend on form of the chest, the anatomical location and position of the heart, position of the electrodes and the amount of body fat. If the ECG signal is weak, disturbances can more easily spoil the signal.

Find the best contact by turning the monitor left or right, or place it lower or higher. There have been cases where the monitor detects the heart rate better when it is turned upside down so that the Polar logo is upside down and facing out, or even when attached on the person's back with the Polar logo upside down and facing out.

- A hairy chest may also weaken the contact. Try to find the best possible position for monitor.
- In demanding cases, use conductive electrode lotion or gel to improve the contact. After using them, it is very important to wash the monitor carefully.

2. WEAR AND TEAR OF THE MONITOR

Proper care of the monitor after use ensures longer service life for the monitor.

- Wash the monitor regularly after use. It should be washed with a mild soap and water solution. Dry it carefully with a soft towel after washing.
- If the electrodes appear discoloured, the monitor needs to be washed. Do not use any alcohol or a solvent based detergent.
- Never store the monitor when it is wet. Sweat and moisture can keep the electrodes wet and the monitor activated, which shortens the battery life.
- Store the monitor in a cool and dry place. Make sure that the electrodes do not contact anything damp, such as sport towel or wet elastic strap. Do not store a wet monitor in any kind of non-breathing material, such as a plastic bag or a sports bag.
- Keep the monitor out of extreme cold and heat. The operating temperature is -10 ºC to 50 ºC/ 14 ºF to 122 ºF. Do not expose it to direct sunlight for extended periods, such as leaving it in a car.
- Do not bend or stretch the monitor. This may damage the electrodes.

3. ELECTROMAGNETIC DISTURBANCES

- Electromagnetic disturbances may occur near high voltage power lines, traffic lights, mp3 players, the overhead lines of electric railways, electric bus lines or tram lines, televisions, car motors, bike computers, some motor driven exercise equipment, cellular phones or when you walk through electric security gates. Check the surroundings and move away from the source of interference, or remove the source of the disturbance.
- Exercise equipment with electronic or electrical components such as LED displays, motors and electrical brakes may cause interfering stray signals. To solve these problems, try the following:

  1. Have the client move the monitor around until they find an area in which it displays no stray reading. Interference is often worst directly in front of the display panel of the equipment, while the left or right side of the display is relatively free of disturbance.
  2. Put the monitor back on your chest and keep the running computer in this interference-free area as much as possible.

     If the monitor still does not work with the exercise equipment, it may be electrically too noisy for wireless heart rate measurement.

4. DISTANCE BETWEEN THE MONITOR AND PORTABLE DOCK & TRANSMITTER IS TOO GREAT

The maximum transmission range between the monitor and the unit is 1 meter (3 ft). If the distance is greater, the Portable Dock may not get all the signals sent from the monitor.

5. SIGNALS FROM OTHER POLAR MONITORS WITHIN 1 METER TRANSMISSION RANGE

In cases where there are more than one monitor nearer than 3 ft (1 m), the Portable Dock can pick up the signal from all monitors within the range. This can result abnormal high readings. To avoid signal crosstalk, keep a 6-9 ft (2-3 m) distance from

the other monitors.

6. STATIC ELECTRICITY, TECHNICAL SPORTSWEAR, AND SPECIAL CONDITIONS

If the humidity of the air is low a fluttering shirt may rub the monitor and generate static electricity. This causes additional signals, especially if the contact between skin and monitor is poor. To avoid this:

- Moisten the electrodes before use, or use the conductive lotion or gel
- Use a cotton shirt instead of a synthetic shirt
- Use a tighter shirt to avoid fluttering of the material
- Use the monitor on a wet shirt
- Wet the shirt

7. BATTERY OF THE MONITOR IS GETTING EMPTY

The estimated average battery life of the monitor is 2500 hours of use. If the battery of the monitor is running low, the transmission range decreases and may cause errors similar to the ones listed above. If the battery is low, the monitor must be replaced.

SECTION 2b - BLUETOOTH 4.0 HEART RATE SYSTEM

I. INTRODUCTION

The Bluetooth 4.0 Heart Rate System is comprised of the Mio Alpha Heart Rate Monitor and USB Bluetooth 4.0 low energy radio adapter. Additional item includes the USB charging adapter that comes with the Mio Alpha.

The watch uses two green LEDs and an electro-optical cell which are integrated into the back plate of the watch. The LEDs shine light into the skin, which enables the electro-optical cell to detect the pulsing volume of blood flow.

Figure 2-5. Bluetooth 4.0 Heart Rate System

ELECTROMAGNETIC FIELD WARNING

The Mio Alpha watch and USB charger contain magnets that could affect pacemakers and implantable cardioverter-defibrillators (ICDs).

A. SETTING UP THE BLUETOOTH 4.0 HEART RATE SYSTEM

If not done already, insert the Bluetooth USB adapter into an available USB port on the front of the computer.

Step 1. Fasten Mio ALPHA tightly on your arm above, not on, the wrist bone.

Note: Wear it higher on the forearm you have a small wrist.

Step 2. Press and hold the HR button until the watch beeps and the display says FIND.

Step 3. Hold your arm fairly still until the watch beeps again and displays heart rate.

Notes: 1) It takes a few seconds for heart rate to register.
2) With proper fit, there should be no visible light between the watch and skin. Make necessary adjustments in fit.

B. CHARGING THE HEART RATE MONITOR BATTERY

Battery life of the watch varies from 8-10 hours of continuous heart rate collection. Always turn discontinue off when not collecting Heart Rate data to preserve battery life. The battery in the watch can be recharged with the included USB charger.

Step 1. Make sure that the four connection pads on the back of the watch are dry. If not, dry them with a towel.

Step 2. Insert the USB charger into one of the USB ports of the computer.

Step 3. Attach the Watch to the USB Charger. This is a magnetic fit which will help to two pieces fit.

Step 4. Once charging the LED will indicate that the battery is charging and the blue LED will flash.

Step 5. When the battery is finished charging the display will say FULL.

Note: If you put the watch in heart rate collection mode and the battery charge is below 1/3, the display will say LOW BATTERY. You can still use the heart rate monitor. If the watch says NO BATTERY, you must recharge before using the watch again.

II. MAINTENANCE AND CARE

- Recharge the battery at least once every 6 months.
- Do not expose the watch to high temperatures.
- Use the watch in the temperature range of 5°C to 45°C (41°F to 113°F).
- Store the watch in the temperature range of 0°C to 25°C (32°F to 77°F).
- Do not disassemble, puncture, or incinerate the watch or battery.
- Clean the sensor area and connection pads with mild soap and water as needed.
- Do not expose your watch to strong chemicals such as gasoline, cleaning solvents, acetone, alcohol, or insect repellents. Chemicals can damage the watch's seal, case, and finish.
- Wipe the watch with a damp cloth as needed. Use mild soap to remove oil or dirt
- Do not scratch the sensor area. Protect it from damage.

III. TROUBLESHOOTING

A. UNABLE TO GET THE WATCH INTO FIND MODE WHEN PRESSING THE HR BUTTON

- When pressing HR button on watch ensure that the button is pressed from the center. Pressing from one of the sides may cause this problem.

B. HEART RATE IS READING SEEMS INACCURATE

(e.g. Heart Rate is dropping or remaining stable during exercise)

- Ensure the watch is on tight. The watch should be snug so that if the face is pulled away from the wrist the LED light does not show. There should be no gaps between the underside of the watch and the wrist

C. UNABLE TO FIND HEART RATE ON WATCH / WATCH DISPLAYS "--"

- Verify that the watch is not placed on the wrist bone.
- You may need to tighten MIO Alpha's strap and/or move the watch further up the forearm.
- When pressing HR button on watch that the button is pressed from the center. Pressing from the sides of the HR button is used to toggle settings.

D. WATCH IS SHOWING HEART RATE – EVALTECH SOFTWARE IS NOT

- Go to Administration Menu -> Manage Tools
- Verify that under Heart Rate Use Bluetooth Watch is selected. If it is set to Use Chest Strap – Change to Use Bluetooth Watch.

E. WATCH BEEPING DURING USE

- This will have no impact on data collection in EvalTech. This may occur if the persons heart rate is exceeding the preset factory defaults of “Training zones” on the watch – or if settings have been changed via the Set Toggle button on left side of the watch. Refer to the Mio Alpha User Guide if you wish to change settings to avoid any confusion.
- Avoid contact with the Set/Toggle button.

F. WATCH SCREEN IS NOT DISPLAYING HR AND IS SHOWING THE TIMER OR TIME.

- The Set Toggle button the left hand side was hit to toggle to timer or the time. Press the Set toggle button until Heart Rate is shown again. This will not interfere with data collection.
- Avoid contact with the Set/Toggle button.

G. ERROR INITIALIZING BLUETOOTH USB! IF USB IS PLUGGED IN PLEASE REINSERT USB KEY.

- Press OK; Disconnect the USB adapter from the computer and plug back in.
- Go to Administration Menu -> Manage Tools
- Verify that under Heart Rate Use Bluetooth Watch is selected. If it is set to Use Chest Strap – Change to Use Bluetooth Watch.

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DUAL INCLINOMETER

DUAL INCLINOMETER

I. INTRODUCTION

The Dual Inclinometer is used to evaluate range of motion while allowing for sections to be tested in isolation. This is accomplished by a sensor in each Inclinometer side calculating the rotational displacement and subtracting or adding the two values to arrive at a true range of motion value.

The Dual Inclinometer is comprised of two sensors: the master and the remote. The master side is identified by the button switch on the front side. In addition, the master side is connected to the Portable Dock & Transmitter unit via an RJ45 cable. A link cable then connects the remote to the master (Figure 3-1). Depending on the testing situation, you may choose to use a single Inclinometer side or both Inclinometer sides.

There are two versions of the Dual Inclinometer (Figure 3-1). Both versions operate in the same manner.

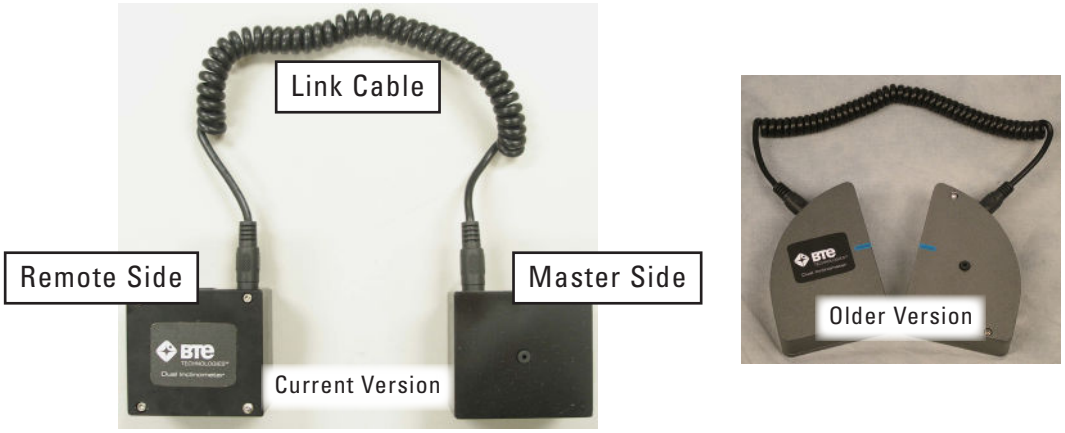

Figure 3-1. Dual Inclinometer - Current and Older Versions

Note that whenever you are testing with the Dual Inclinometer, the sides must always be positioned in the same plane (as shown in the previous figure). The sensors are not able to accurately measure the change in angle if the sides are not properly facing each other.

II. UTILIZING THE DUAL INCLINOMETER

A. CONNECTING TO THE SYSTEM

Always connect the master side to the Dock via the RJ45 jack. Refer to Chapter 01-II-B [Setup & General Operation - General Operation of the System] of this manual for a pictorial example. *Do not attempt to connect the Dual Inclinometer to the column arms - it will not work.*

Remember to verify the tool is plugged in and the Dock is turned on and receiving power before starting a test.

B. COLLECTING DATA

Once the client is in the required initial or final position, press the black button on the front of the master side to obtain the angle.

C. UTILIZING ONE INCLINOMETER SIDE

If you wish to use only one Inclinometer side, then you must use the master side. Simply remove the coiled link cable from the master side and begin testing. Refer to the Cervical Rotation section of this chapter for a pictorial example.

D. UTILIZING BOTH INCLINOMETER SIDES

If you wish to use both Inclinometer sides for the testing, make sure the coiled link cable is properly secured to the master side and the remote side.

III. ADMINISTERING SPINAL RANGE OF MOTION TESTS

Note: All Range of Motion references were obtained from the AMA *Guides to the Evaluation of Permanent Impairment,* Fifth Edition.

The Dual Inclinometer is most useful in its ability to measure spinal range of motion. The most common evaluations are related to the cervical spine, thoracic spine, lumbrosacral spine, sacral hip flexion/extension, gross combined hip and spinal flexion/extension, and straight leg raise.

In order to administer an effective range of motion evaluation, you must make certain the same landmarks are used every time a client is tested.

Table 1 identifies the testing locations and their respective landmarks.

Table 1. Range of Motion Testing Landmarks

Testing Location	Superior Landmark	Inferior Landmark
Cervical Spine	Occiput	T1
Thoracic Spine	T1	T12
Lumbrosacral Spine	T12	Sacral Midpoint
Sacral Hip Flexion/Extension	Sacral Midpoint	Lateral Thigh
Gross Combined Hip & Spinal Flexion/Extension	T1	Sacral Midpoint
Straight Leg Raise	N/A	Anterior Lower Leg

Before beginning an evaluation, it is important to have the client wear appropriate clothing that exposes or provides easy access to the landmarks. You may wish to stock such items as cloth or paper client gowns for this reason.

Guidelines to locating the landmarks:

- **Occiput** – Locate the Occipital protuberance and place the lowest portion of the Inclinometer directly above it.
- **T1** – This is usually the larger of the two protruding spinous processes at the base of the cervical spine near the height of the shoulders. It is easily identified when the client flexes their cervical spine.
- **T12** – Follow the lower ribs posteriorly to the spinous process.
- **Sacral Midpoint** – Follow the iliac crests posteriorly to the PSIS, medially into the sacral sulcus and then medially to the midline. While maintaining one hand at the midline at this level, locate the sacrococcygeal joint. Now locate the midpoint between these two landmarks.

- **Lateral Thigh** – Locate the Greater Tuberosity and place the tip of the Inclinometer just inferior.
- **Anterior Lower Leg** –Locate the Tibial Tubercle and follow the anterior ridge of the tibia inferiorly approximately two-thirds down the lower leg.

For isolated joint movement, use a single Inclinometer side by placing it distally in the plane of movement of the joint being assessed.

For compound joint movement, use both Inclinometer sides by placing one side distally and one side proximally to the joint being assessed. Be sure no other joints are involved in the compound movement and make certain to align the sides in the plane of movement.

Note that these are only guidelines and were developed for the majority of cases. However, there may be clients who have anomalies from birth or injury that may cause these landmark guidelines to be difficult to use. In these cases, document the anomaly and the landmark location so that it may be duplicated in the future.

IV. PRE-DEFINED TESTS & TESTING TEMPLATES

The EvalTech software includes several pre-defined tests and testing templates. For information on assigning and administering tests in the software, refer to Chapters 4 and 5 of the EvalTech Software Operator's Manual.

A. CERVICAL RANGE OF MOTION

1. FLEXION

Step 1. Align the Inclinometer sides in the sagittal plane and place one of the sides on the top of the head (Figure 3-2).

Step 2. Place the other side on T1 (Figure 3-2).

Step 3. Take the initial reading by pressing the black button.

Step 4. Have the client maximally flex the head (Figure 3-2).

Step 5. Take the final reading by pressing the black button.

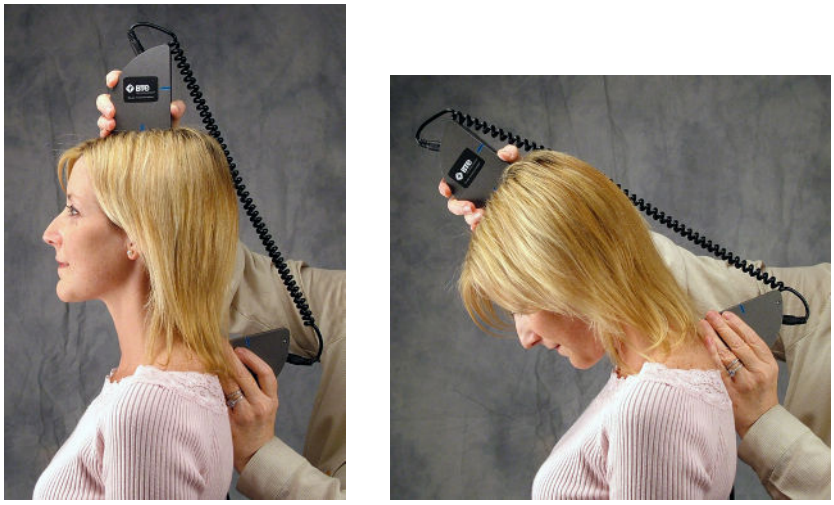

Figure 3-2. Initial & Final Cervical ROM Flexion

2. EXTENSION

Step 1. Align the Inclinometer sides in the sagittal plane and place one of the sides on the top of the head (Figure 3-3).

Step 2. Place the other side on T1 (Figure 3-3).

Step 3. Take the initial reading by pressing the black button.

Step 4. Have the client maximally extend the head (Figure 3-3).

Step 5. Take the final reading by pressing the black button.

Figure 3-3. Initial & Final Cervical ROM Extension

3. LATERAL FLEXION

Step 1. Align the Inclinometer sides in the coronal plane and place one of the sides on the top of the head (Figure 3-4).

Step 2. Place the other side on T1 (Figure 3-4).

Step 3. Take the initial reading by pressing the black button.

Step 4. Have the client maximally laterally flex the head to one side (Figure 3-4).

Step 5. Take the final reading by pressing the black button.

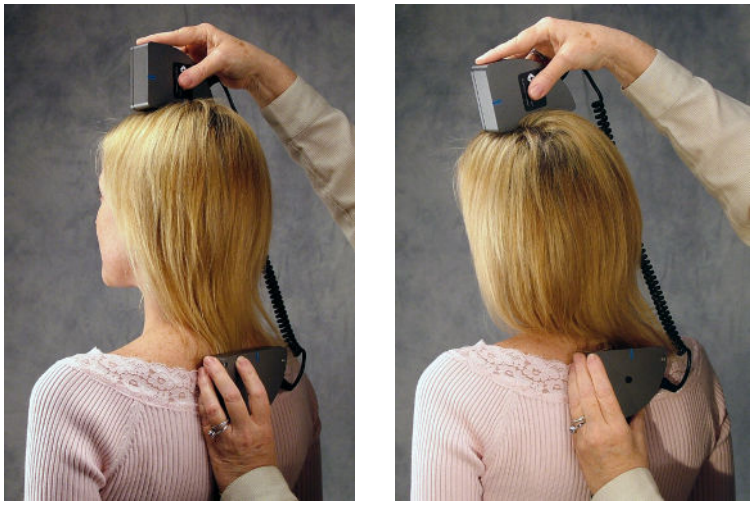

Figure 3-4. Initial & Final Cervical ROM Lateral Flexion

4. ROTATION

Use a single Inclinometer side for cervical rotation testing.

Step 1. Have the client lie in a supine position (this will stabilize the client's shoulders). The shoulders should be exposed in order to allow the evaluator to note any excessive shoulder rotation.

Step 2. Align the Inclinometer side in the transverse plane and place it at the superior portion of the head (Figure 3-5).

Step 3. Take the initial reading by pressing the black button.

Step 4. Have the client maximally rotate the head to one side (Figure 3-5).

Step 5. Take the final reading by pressing the black button.

Figure 3-5. Initial & Final Cervical ROM Rotation

B. THORACIC RANGE OF MOTION

Since evaluating the thoracic spine is quite dependent on the individual's posture, it is best to have the client use a military type stance. This will help to minimize the client's kyphosis.

1. FLEXION

Step 1. Align the Inclinometer sides in the sagittal plane and place one of the sides on T1 (Figure 3-6).

Step 2. Place the other side at T12 (Figure 3-6).

Step 3. Take the initial reading by pressing the black button.

Step 4. Have the client maximally flex the thoracic spine (Figure 3-6).

Step 5. Take the final reading by pressing the black button.

Figure 3-6. Initial & Final Thoracic ROM Flexion

2. MINIMAL KYPHOSIS

Step 1. Align the Inclinometer sides in the sagittal plane. Take the initial reading by zeroing the Inclinometers against a true vertical surface such as a wall.

Step 2. Place one of the Inclinometer sides on T1 spinous process.

Step 3. Place the other side at T12 spinous process.

Step 4. Take the final reading by pressing the black button.

3. ROTATION

Step 1. With the client in a standing position, instruct them to flex forward until the thoracic spine is in as horizontal a position as possible (Figure 3-7).

Step 2. Align the Inclinometer sides in the axial and vertical planes and place one of the sides on T1 (Figure 3-7).

Step 3. Place the other side at T12 (Figure 3-7).

Step 4. Take the initial reading by pressing the black button.

Step 5. Have the client maximally rotate the thoracic spine to one side (Figure 3-7).

Step 6. Take the final reading by pressing the black button.

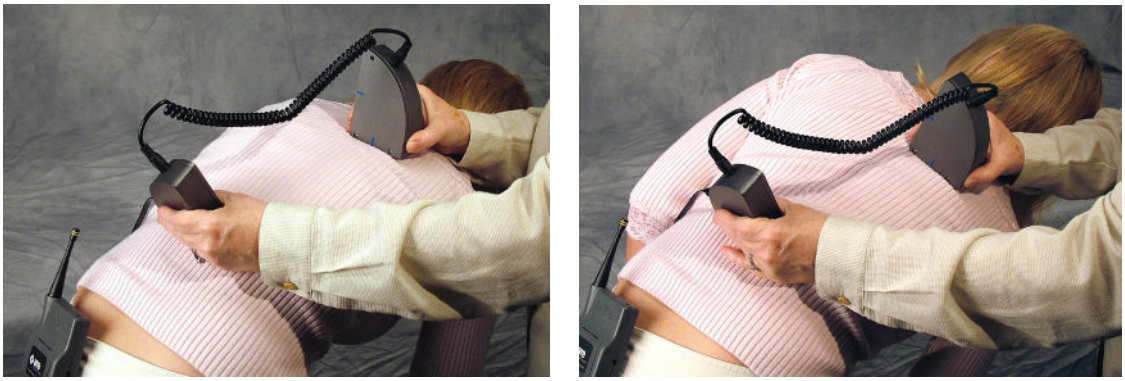

Figure 3-7. Initial & Final Thoracic ROM Rotation

C. LUMBROSACRAL RANGE OF MOTION

1. FLEXION

Step 1. Align the Inclinometer sides in the sagittal plane and place one of the sides on T12 (Figure 3-8).

Step 2. Place the other side at S1 (Figure 3-8).

Step 3. Take the initial reading by pressing the black button.

Step 4. Have the client maximally flex the lumbar spine (Figure 3-8).

Step 5. Take the final reading by pressing the black button.

Figure 3-8. Initial & Final Lumbar ROM Flexion

2. EXTENSION

Step 1. Align the Inclinometer sides in the sagittal plane and place one of the sides on T12 (Figure 3-9).

Step 2. Place the other side at S1 (Figure 3-9).

Step 3. Take the initial reading by pressing the black button.

Step 4. Have the client maximally extend the lumbar spine (Figure 3-9).

Step 5. Take the final reading by pressing the black button.

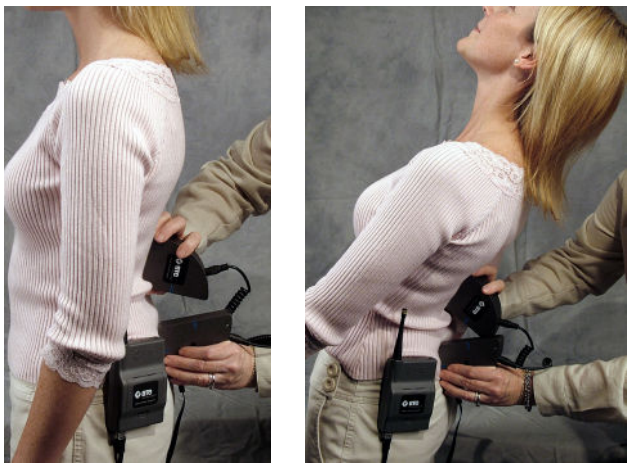

Figure 3-9. Initial & Final Lumbar ROM Extension

3. LATERAL FLEXION

Step 1. Align the Inclinometer sides in the coronal plane and place one of the sides on T12 (Figure 3-10).

Step 2. Place the other side at the sacral midpoint (Figure 3-10).

Step 3. Take the initial reading by pressing the black button.

Step 4. Have the client maximally laterally flex the lumbar spine to one side (Figure 3-10).

Step 5. Take the final reading by pressing the black button.

Figure 3-10. Initial & Final Lumbar ROM Lateral Flexion

4. STRAIGHT LEG RAISE

Use a single Inclinometer side for straight leg raise testing.

Step 1. Have the client lie in a supine position.

Step 2. Align the Inclinometer side in the sagittal plane and place it along the anterior lower third of the tibia (Figure 3-11).

Step 3. Take the initial reading by pressing the black button.

Step 4. Have the client perform a straight leg raise (Figure 3-11).

Step 5. Take the final reading at the end of the range by pressing the black button.

Figure 3-11. Initial & Final Straight Leg Raise

The straight leg raise on the tightest side should be within 10 degrees of the total hip motion (i.e. hip flexion + hip extension).

V. DETERMINING THE DEGREE OF ANKYLOSIS

When the degree of ankylosis needs to be documented, the steps listed above must be slightly adjusted:

Step 1. Take the first reading against a wall or on a tabletop.

Step 2. Place the client in as close to a neutral position as possible.

Step 3. Place the two Inclinometer sides at the appropriate landmarks.

Step 4. Take the second reading. This is the degree of ankylosis.

VI. PERFORMING EXTREMITY RANGE OF MOTION EVALUATIONS

While the Goniometer is the ideal tool for performing range of motion evaluations on extremity joints, the single or dual Inclinometer sides may also be used.

VII. TROUBLESHOOTING

A. TOOL NOT READING ANY VALUE OR NOT RECOGNIZED

There are multiple reasons why the Dual Inclinometer may not be reading any value or is not recognized. Verify and attempt the following:

1. VERIFY THE FOLLOWING

- The batteries in the Portable Dock & Transmitter are charged and less than a year old
- The antennas are properly secured to the Portable Dock & Transmitter and Hub
- The Hub is plugged in to the computer and the Dock is powered On
- There is no interference between the Hub and Dock (refer to Chapter 8)
- The Hub has not been dropped or hit hard - if so, then unplug and replug the USB cable
- The Dock has not been dropped or hit hard - if so, then turn the power off for ~5 seconds and then back on
- The Dual Inclinometer, Portable Dock, and cable are not damaged, dirty at the connections, or have loose components

2. ATTEMPT THE FOLLOWING

- Turn off the Portable Dock, attach a new cable to the Dual Inclinometer and Portable Dock, and then turn the Dock back on.
- Turn off the Portable Dock, plug the cable into another port on the Dock, and then turn it back on.
- Turn off the Portable Dock, insert freshly charged batteries, and then turn it back on.
- Try a different combination of batteries - if one of the batteries has gone bad, then the Portable Dock will not work properly.

B. REMOTE SIDE NOT READING ANY VALUE

Unplug and replug the link cable from *both* the Remote Side and the Master Side.

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GONIOMETER

GONIOMETER

I. INTRODUCTION

The Goniometer is used to evaluate extremity range of motion. The tool uses a sensor to calculate the amount of displacement in degrees and arrive at a true range of motion value.

Included with the Goniometer are three different types of arms: 2 small arms, 1 medium arm, and 1 long arm (Figure 4-1). Through the use of the various lengths of arms, you can evaluate the range of motion of smaller joints, such as in the hand and foot, as well as larger joints, such as the knee, hip, and shoulder.

Figure 4-1. Goniometer and Arms

Note that the American Medical Association states that whenever an impairment evaluation is performed, a goniometer must be used for evaluating the range of motion of extremities.

II. UTILIZING THE GONIOMETER

A. CONNECTING TO THE SYSTEM

Always connect the Goniometer to the Portable Dock & Transmitter via the RJ45 jack and cable. Refer to Chapter 01-II-B [Setup & General Operation - General Operation of the System] of this manual for a pictorial example. *Do not attempt to connect the Goniometer to the column arms - it will not work.*

Remember to verify the tool is plugged in and the Dock is turned on and receiving power before starting a test.

B. COLLECTING DATA

Once the client is in the required initial or final position, press the black button on the side opposite the RJ45 jack to obtain the angle.

C. ATTACHING ARMS

The arms are screwed into the top of the Goniometer so they may be easily removed and attached. Use any combination of the small, medium, and long arms to aid in measuring the extremity's range of motion.

III. PRE-DEFINED TESTS & TESTING TEMPLATES

The EvalTech software includes several pre-defined tests and testing templates. For information on assigning and administering tests in the software, refer to Chapters 4 and 5 of the EvalTech Software Operator's Manual.

The following extremities may be tested with the Goniometer:

- Ankle
- Elbow
- Finger
- Forearm
- Hip
- Knee
- Shoulder
- Thumb
- Toe
- Wrist

Note that the names of the pre-defined tests begin with the name of the extremity that is being analyzed.

In assessing motion, the examiner should first observe what an individual can and cannot do by asking them to move each joint of the extremity, from the shoulder down, through its full range of motion. Both extremities should be compared. Individual joints can then be evaluated separately. In determining the range of motion of individual joints, the examiner must evaluate both the active and passive motion.

A. ADMINISTERING RANGE OF MOTION TESTS

Note: All Range of Motion references were obtained from the AMA *Guides to the Evaluation of Permanent Impairment,* Fifth Edition.

Step 1. For small extremity ROM tests (e.g. finger and toe), attach the small arms. For large extremity ROM tests (e.g. elbow and knee), attach the medium and long arms.

Step 2. Instruct the client to place his/her extremity in the initial position (Figure 4-2).

Step 3. Position the center of the top of the Goniometer in line with the joint and the Goniometer arms along the extremity being measured (Figure 4-2).

Step 4. Take the initial reading by pressing the black button.

Step 5. Instruct the client to place his/her extremity in the final position and rotate the Goniometer arms as needed (Figure 4-2).

Step 6. Take the final reading by pressing the black button.

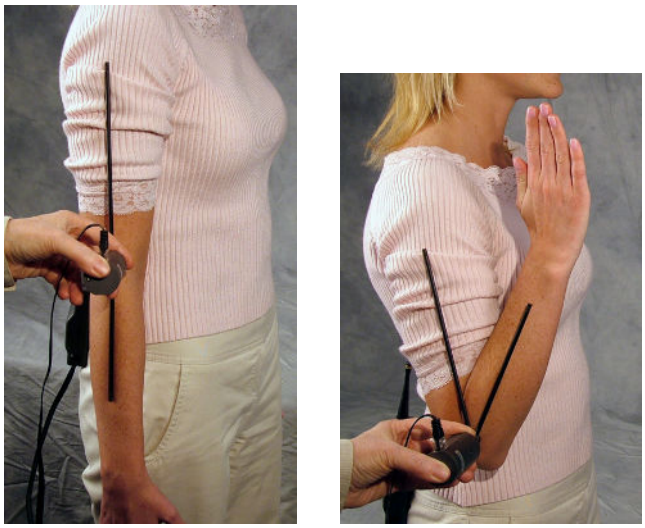

Figure 4-2. Example of Initial & Final Goniometer ROM Positions

B. DETERMINING THE DEGREE OF ANKYLOSIS

When the degree of ankylosis needs to be documented, the testing procedure must be slightly adjusted:

Step 1. Align the Goniometer arms and place them on a wall or tabletop. Take the first reading by pressing the black button.

Step 2. Place the client in as close to a neutral position as possible.

Step 3. Place the Goniometer arms at the appropriate landmarks.

Step 4. Take the second reading by pressing the black button. This is the degree of ankylosis.

IV. TROUBLESHOOTING

A. TOOL NOT READING A CHANGE IN ANGLE

If the top housing of the Goniometer is not properly secured, the Goniometer may not read a change in angle.

Step 1. Attach the long arm to the top of the Goniometer (Figure 4-3).

Step 2. Place the Goniometer in a horizontal position and position the arms parallel to the floor (Figure 4-3).

Step 3. Let go of the top arm - if it falls freely, then the top rotation housing screw needs to be tightened (Figure 4-3).

Figure 4-3. Check if Top Housing is Loose

Step 4. Use a 5/64” Allen key, which is supplied with the system (this is the smallest Allen key in the set), to tighten the top set screw (Figure 4-4).

Figure 4-4. Tighten Set Screw

B. TOOL NOT READING ANY VALUE OR NOT RECOGNIZED

There are multiple reasons why the Goniometer may not be reading any value or is not recognized. Verify and attempt the following:

1. VERIFY THE FOLLOWING

- The batteries in the Portable Dock & Transmitter are charged and less than a year old
- The antennas are properly secured to the Portable Dock & Transmitter and Hub
- The Hub is plugged in to the computer and the Dock is powered On
- There is no interference between the Hub and Dock (refer to Chapter 8)
- The Hub has not been dropped or hit hard - if so, then unplug and replug the USB cable
- The Dock has not been dropped or hit hard - if so, then turn the power off for ~5 seconds and then back on
- The Goniometer, Portable Dock, and cable are not damaged, dirty at the connections, or have loose components

2. ATTEMPT THE FOLLOWING

- While the Goniometer is connected to the Portable Dock, turn the Portable Dock off and then back on.
- Turn off the Portable Dock, attach a new cable to the Goniometer and Portable Dock, and then turn the Dock back on.
- Turn off the Portable Dock, plug the cable into another port on the Dock, and then turn it back on.
- Turn off the Portable Dock, insert freshly charged batteries, and then turn it back on.
- Try a different combination of batteries - if one of the batteries has gone bad, then the Portable Dock will not work properly.

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HAND GRIP DYNAMOMETER

HAND GRIP DYNAMOMETER

I. INTRODUCTION

The Hand Grip Dynamometer, also known as the Hand Grip, is used to measure hand grip strength up to 250 lbs/113 kgs. Through the use of multiple attachments and protocols, a client's hand grip strength can be evaluated through several different scenarios.

The Hand Grip comes with 2 different grips: convex (blue) and concave (grey) (Figure 5-1). The concave grip is used for all of the standardized tests and may be used for custom tests. The convex grip is provided to simulate custom applications.

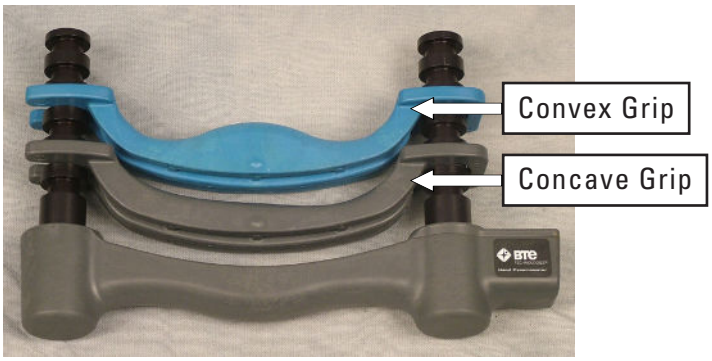

Figure 5-1. Hand Grip Dynamometer

II. UTILIZING THE HAND GRIP DYNAMOMETER

A. CONNECTING TO THE SYSTEM

Always connect the Hand Grip to the Portable Dock & Transmitter via the RJ45 jack. Refer to Chapter 01-II-B [Installation & Setup - General Operation of the System] of this manual for a pictorial example. *Do not attempt to connect the Hand Grip to the column arms - it will not work.*

Remember to verify the tool is plugged in and the Dock is turned on and receiving power before starting a test.

B. HAND GRIP POSITIONS

The Hand Grip was designed such that the detachable grip may be located in 5 different positions (Figure 5-2). Make sure to read each protocol to determine in which position the grip must be.

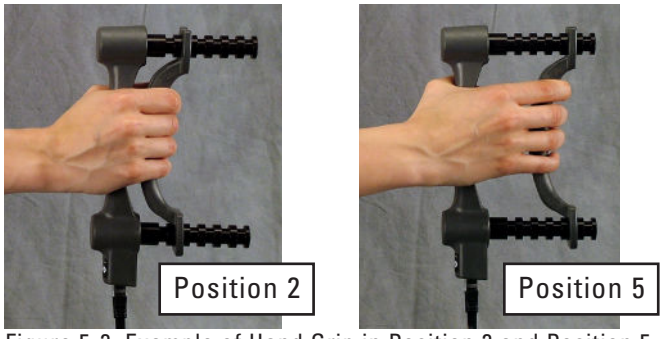

Figure 5-2. Example of Hand Grip in Position 2 and Position 5

Note: Position 1 is closest to the Hand Grip base.

C. HAND GRIP & CLIENT POSITIONING

Verify the grip is properly positioned:

1. The end of the Hand Grip base where the cord attaches should be facing down (Figures 5-3 & 5-4).
2. For the concave grip, the thicker end of the grip, which has the U-shaped end, must be facing up such that the pointer finger comes in contact with it. The convex grip is symmetric, so it may be positioned in either direction.

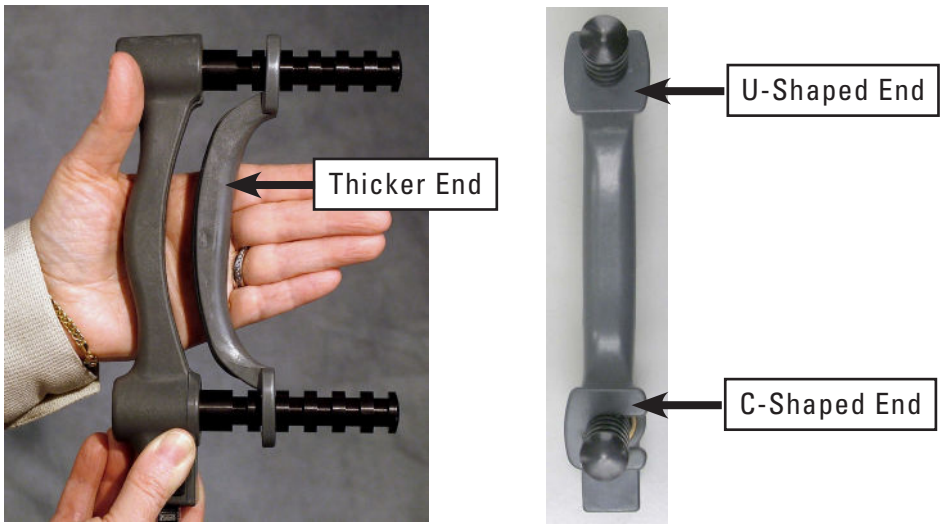

Figure 5-3. Proper Grip Positioning

Prior to testing, the client must be positioned as follows (Figure 5-4):

1. Both feet flat on the floor
2. Upper arm next to body
3. Elbow flexed at 90º
4. Forearm neutral (thumb up)
5. Hand and forearm in slight shoulder internal rotation (toward the center front of the torso)
6. Forearm should not be resting on any surface while gripping

If possible, the client should remove all rings because they may interfere with the performance of the test.


Figure 5-4. Proper Client Positioning

III. PRE-DEFINED TESTS & TESTING TEMPLATES

The EvalTech software includes several pre-defined tests and testing templates. For information on assigning and administering tests in the software, refer to Chapters 4 and 5 of the EvalTech Software Operator's Manual.

A. HAND GRIP - STANDARD

Access this test through the pre-defined test list (refer to Chapter 04a-II-A of the EvalTech Software Operator's Manual).

The Standard Hand Grip Test is optimally used for comparing the client's data to normative data, which is displayed as a solid line (average percentile). This test requires the concave grip to be in position 2 and calls out for the client to maximally grip the tool for 3 seconds on each side for 3 trials each side.

B. HAND GRIP - MAXIMUM VOLUNTARY EFFORT

Access this set of tests through the pre-defined template list (refer to Chapter 04a-II-C of the EvalTech Software Operator's Manual).

The Maximum Voluntary Effort (MVE) Testing Template is optimally used for finding the power position of the client. This template requires the concave grip to be in all 5 positions and calls out for the client to maximally grip the tool for 3 seconds on each side for 3 trials each side.

Generally, the average strength bar graph should represent a bell-shaped curve, thus indicating the client's power position is one of the middle positions. A lack of the bell-shaped curve indicates the client was non-compliant with the strength test. For the COV bar graph, the ideal value should be 15% or below for each side. If the value is higher than 15%, the client did not test consistently across the 3 trials.

C. HAND GRIP - MODIFIED MAXIMUM VOLUNTARY EFFORT

Access this set of tests through the pre-defined template list (refer to Chapter 04a-II-C of the EvalTech Software Operator's Manual).

The Modified Maximum Voluntary Effort (MMVE) Testing Template is the same as the Maximum Voluntary Effort Template except that it differs in the number of trials performed for each position. This template is most helpful when time is a constraint: instead of performing 3 trials for each position and each side, the test only calls out for 1 trial per side in positions 1, 3, 4 & 5, and 3 trials per side in position 2.

D. HAND GRIP - RAPID EXCHANGE

Access this test through the pre-defined test list (refer to Chapter 04a-II-A of the EvalTech Software Operator's Manual).

The Rapid Exchange Test is optimally used for monitoring consistency of the client. The test consists of six 1-second trials per side. If the client has completed the MVE Test, the position of the concave grip should be based on the power position determined from the MVE Test. If the client has not completed the MVE Test, the concave grip should be set to position 2.

When passing the Hand Grip from the client's one hand to the other, hold the Hand Grip at

the base (Figure 5-5). This ensures that the trial won't start prematurely.

Figure 5-5. Hold Hand Grip at Base During Rapid Exchange

IV. CALIBRATION & VERIFICATION

It is recommended calibration is performed on a weekly basis and verification is performed on a daily basis.

A. CALIBRATION EQUIPMENT (FIGURE 5-6)

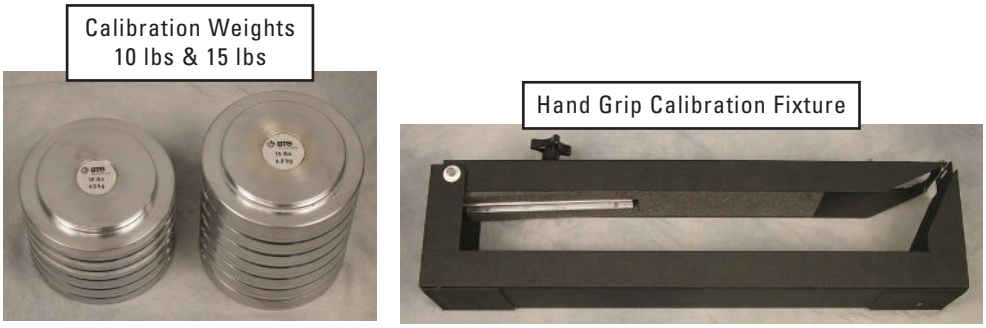

Figure 5-6. Hand Grip Calibration Equipment

B. ACCESSING THE CALIBRATION & VERIFICATION SCREENS

Refer to Chapter 02c-V-C [Administration Menu - Manage Tools - Calibration] of the EvalTech Software Operator's Manual for additional information on the tool management and calibration screens.

The calibration screen may be accessed within the testing screen and within the Tool Management screen.

The verification screen may only be accessed within the Tool Management screen.

1. VIA THE TESTING SCREEN

Click on  , which is typically located in the bottom-center of the screen.

2. VIA THE TOOL MANAGEMENT SCREEN

Step 1. Access the Tool Management screen via one of the following two methods:

a) Within the Test Administration screen, click on  , which is located in the bottom-left corner of the screen.

b) Select the Administration Taskbar Menu and click on Manage Tools.

Step 2. On the left side of the screen, click on Hand Grip. The right side of the screen will show the current input values for the tool.

Step 3a. Click on  in the bottom lower-center to access the calibration screen.

Step 3b. Click on  in the bottom lower-center to access the verification screen.

C. TIPS FOR A SUCCESSFUL CALIBRATION

The following tips are recommended for a successful calibration:

- Ensure that the calibration fixture is placed on a sturdy and level surface during calibration.
- Make sure the calibration fixture lid is not down for the first 2 steps of the calibration.
- After the weight is on the lid, verify the front edge of the lid is visible through the slit, which is at the top front edge of the base (Figure 5-7).

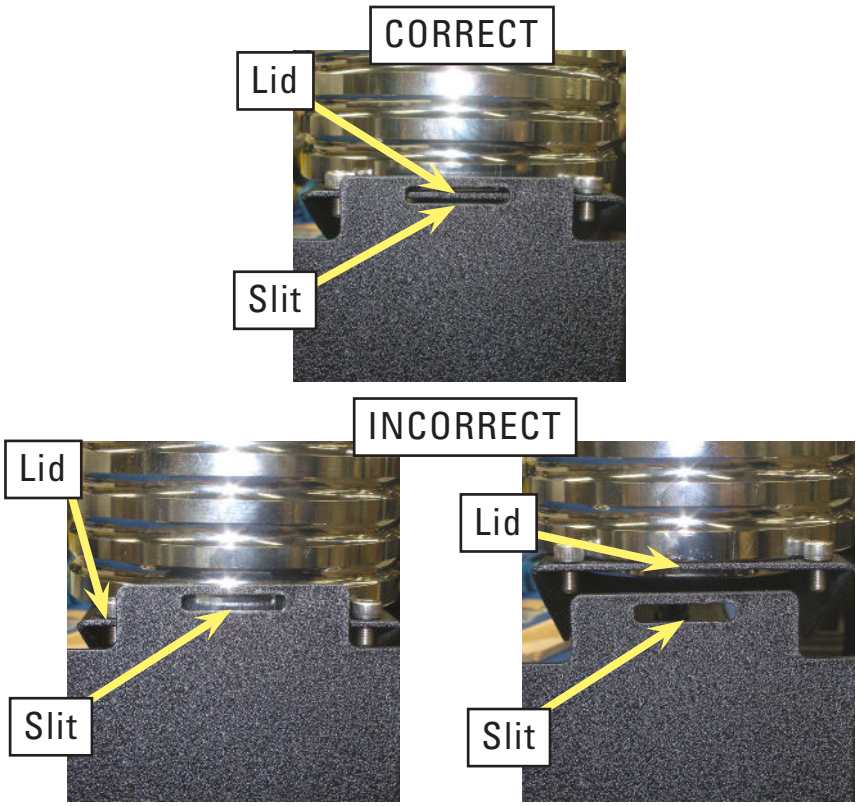

Figure 5-7. Proper Location of Lid after Weight is Applied

If the lid is not visible through the slit, turn the 4-arm knob, which is on the lid above the Hand Grip, in either direction until the lid is visible. This ensures the lid is level with the weight on it and the weight is applied evenly to both rods.

- Lift the lid before placing the 10 lb weight on the fixture. This will allow the Hand Grip to return to a zero weight.
- Push the side of the weight after placing it on the lid but before recording the weight (Figure 5-8). This will slightly shake the Hand Grip and remove any "sticking" in the rods. **Make sure the fixture is not moving when you click the checkmark icon in the software.**

Figure 5-8. Push the Side of the Weight

- If the calibration was not successful, click on  within the calibration screen and repeat the steps, but wait 3 seconds between applying the weight and clicking on the checkmark icon.

D. PERFORMING CALIBRATION

Prior to entering the calibration screen, verify the Hand Grip is connected to the Dock and the Dock is turned on.

The initial calibration screen should look as follows (Figure 5-9):

Figure 5-9. Hand Grip Calibration Screen

Step 1. Remove the detachable grip (i.e. the concave or convex grip) from the Hand Grip and place the Hand Grip in the calibration fixture as shown on the screen.

Step 2. Once the Hand Grip is in place, click on  to set the zero point (Figure 5-10).

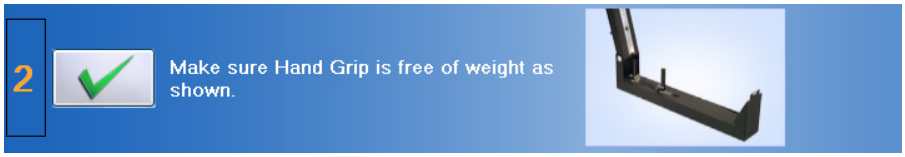

Figure 5-10. Hand Grip - Set the Zero Point

Step 3. Lower the lid of the calibration fixture.

Step 4. Place the 15 lb calibration weight on the calibration fixture. Make sure the lid is

visible through the slit (Figure 5-7).

Step 5. Click on  to set the weight (Figure 5-11).

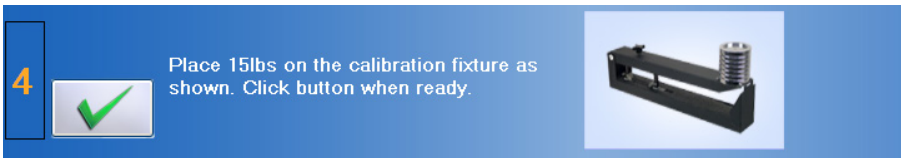

Figure 5-11. Hand Grip - Set the Weight

Step 6. Remove the 15 lb calibration weight and lift the lid up. (Figure 5-10)

Step 7. Place the 10 lb calibration weight on the fixture. Make sure the lid is visible through the slit (Figure 5-7).

Step 8. Click on  to verify the weight (Figure 5-12).

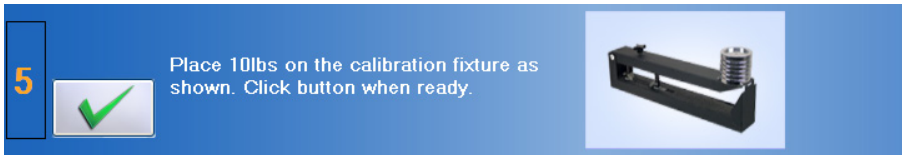

Figure 5-12. Hand Grip - Verify the Weight

If the Hand Grip was properly calibrated, then the screen will say the verification was successful and the measured weight will be in a green box (Figure 5-13).

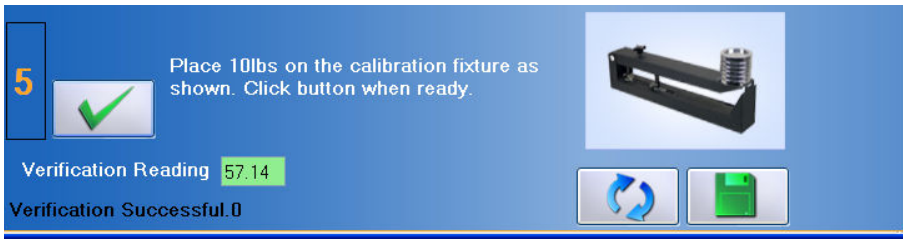

Figure 5-13. Hand Grip - Verification Successful

If the Hand Grip was not properly calibrated, then the screen will say the verification failed and the measured weight will be in a red box (Figure 5-14). You may try re-verifying the weight or re-calibrating the tool until the verification is successful. Also refer to the Troubleshooting section within this chapter for help.

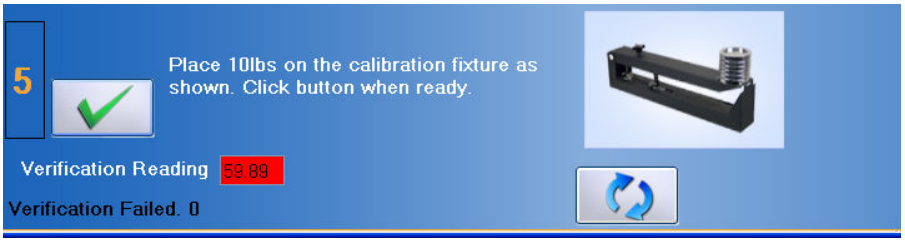

Figure 5-14. Hand Grip - Verification Failed

Step 9. Once the tool has passed verification, click on  to save the data.

E. PERFORMING VERIFICATION

The verification screen allows you to quickly to verify the tool without having to go through the whole calibration. In addition, all verifications performed through the verification screen are included in the tool's calibration report.

Step 1. Place the Hand Grip in the calibration fixture and lower the lid.

Step 2. Place the 10 lb calibration weight on the fixture and click on  to verify the weight (Figure 5-15). Make sure the lid is visible through the slit (Figure 5-7).

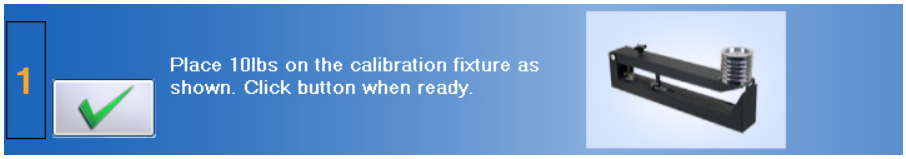

Figure 5-15. Hand Grip - Verify the Weight

If the Hand Grip was properly calibrated, then the screen will say the verification was successful and the measured weight will be in a green box (Figure 5-16).

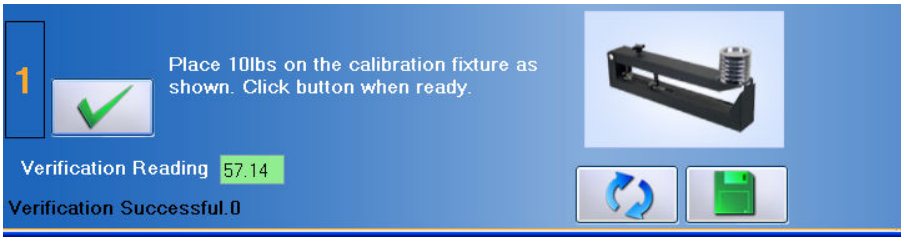

Figure 5-16. Hand Grip - Verification Successful

If the Hand Grip was not properly calibrated, then the screen will say the verification failed and the measured weight will be in a red box (Figure 5-15). You may try re-verifying the weight or re-calibrating the tool until the verification is successful. Also refer to the Troubleshooting section within this chapter for help.

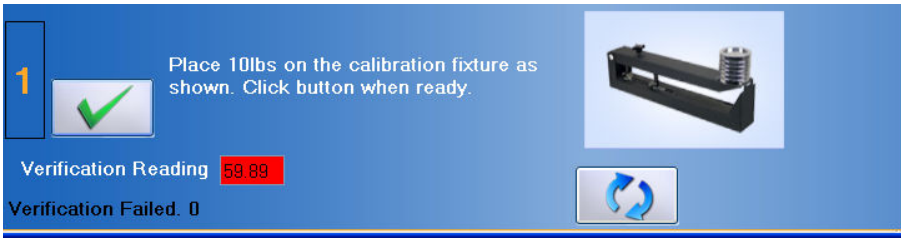

Figure 5-17. Hand Grip - Verification Failed

Step 3. Once the tool has passed verification, click on  to save the data.

V. TROUBLESHOOTING

A. TOOL NOT READING ANY VALUE OR NOT RECOGNIZED

There are multiple reasons why the Hand Grip may not be reading any value or is not recognized. Verify and attempt the following:

1. VERIFY THE FOLLOWING

- The batteries in the Portable Dock & Transmitter are charged and less than a year old
- The antennas are properly secured to the Portable Dock & Transmitter and Hub
- The Hub is plugged in to the computer and the Dock is powered On
- There is no interference between the Hub and Dock (refer to Chapter 8)
- The Hub has not been dropped or hit hard - if so, then unplug and replug the USB cable
- The Dock has not been dropped or hit hard - if so, then turn the power off for ~5 seconds and then back on
- The Hand Grip, Portable Dock, and cable are not damaged, dirty at the connections, or have loose components

2. ATTEMPT THE FOLLOWING

- Turn off the Portable Dock, attach a new cable to the Hand Grip and Portable Dock, and then turn the Dock back on.
- Turn off the Portable Dock, plug the cable into another port on the Dock, and then turn it back on.
- Turn off the Portable Dock, insert freshly charged batteries, and then turn it back on.
- Try a different combination of batteries - if one of the batteries has gone bad, then the Portable Dock will not work properly.

B. UNABLE TO CALIBRATE OR VERIFY

Refer to Section IV-C of this chapter for information.

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PINCH GAUGE

PINCH GAUGE

I. INTRODUCTION

The Pinch Gauge, also known as the Pinch Dynamometer, is used to measure finger strength up to 50 lbs/23 kgs (Figure 6-1).

Figure 6-1. Pinch Gauge

II. UTILIZING THE PINCH GAUGE

A. CONNECTING TO THE SYSTEM

Always connect the Pinch Gauge to the Portable Dock & Transmitter via the RJ45 jack. Refer to Chapter 01-III-B [Setup & General Operation - General Operation of the System] of this manual for a pictorial example. *Do not attempt to connect the Pinch Gauge to the column arms - it will not work.*

Remember to verify the tool is plugged in and the Dock is turned on and receiving power before starting a test.

B. CLIENT POSITIONING

Prior to testing, the client must be positioned as follows:

1. Both feet flat on the floor
2. Upper arm next to body
3. Elbow flexed at 90°
4. Hand and forearm in slight shoulder internal rotation (toward the center front of the torso)
5. Forearm should not be resting on any surface while gripping

III. PRE-DEFINED TESTS & TESTING TEMPLATES

The EvalTech software includes several pre-defined tests and testing templates. For information on assigning and administering tests in the software, refer to Chapters 4 and 5 of the EvalTech Software Operator's Manual.

A. PINCH GAUGE - KEY

The Key Pinch Test is used to measure the strength of the hand in the key (lateral) pinch position. Prior to beginning the test, the client should hold the Pinch Gauge between the thumb and the lateral aspect of the index finger, middle phalanx; the position is intended to simulate the client holding a key (Figure 6-2).

Figure 6-2. Pinch Gauge - Key

B. PINCH GAUGE - TIP

The Tip Pinch Test is used to measure the strength of the hand in the tip-to-tip pinch position. Prior to beginning the test, the client should hold the Pinch Gauge between the tip of the thumb and the tip of the index finger (Figure 6-3).

Figure 6-3. Pinch Gauge - Tip

C. PINCH GAUGE - PALMAR

The Palmar Pinch Test is used to measure the strength of the hand in the palmar pinch position. Prior to beginning the test, the client should hold the Pinch Gauge between the tip of the thumb and the tips of the index finger and middle finger (Figure 6-4).

Figure 6-4. Pinch Gauge - Palmar

IV. CALIBRATION & VERIFICATION

It is recommended calibration is performed on a weekly basis and verification is performed on a daily basis.

A. CALIBRATION EQUIPMENT (FIGURE 6-5)

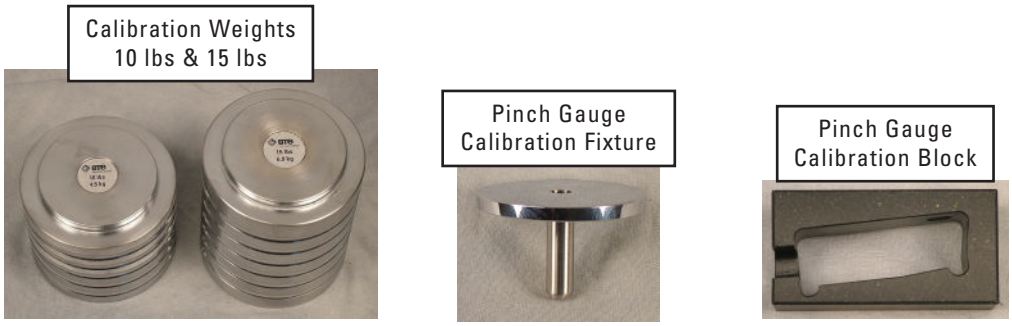

Figure 6-5. Pinch Gauge Calibration Equipment

B. ACCESSING THE CALIBRATION & VERIFICATION SCREENS

Refer to Chapter 02c-V-C [Administration Menu - Manage Tools - Calibration] of the EvalTech Software Operator's Manual for additional information on the tool management and calibration screens.

The calibration screen may be accessed within the testing screen and within the Tool Management screen.

The verification screen may only be accessed within the Tool Management screen.

1. VIA THE TESTING SCREEN

Click on  , which is typically located at the bottom-center of the screen.

2. VIA THE TOOL MANAGEMENT SCREEN

Step 1. Access the Tool Management screen via one of the following two methods:

a) Within the Test Administration screen, click on  , which is located in the bottom-left corner of the screen.

b) Select the Administration Taskbar Menu and click on Manage Tools.

Step 2. On the left side of the screen, click on Pinch Gauge. The right side of the screen will show the current input values for the tool.

Step 3a. Click on  in the bottom lower-center to access the calibration screen.

Step 3b. Click on  in the bottom lower-center to access the verification screen.

C. TIPS FOR A SUCCESSFUL CALIBRATION

The following tips are recommended for a successful calibration:

- Ensure that the calibration block is placed on a sturdy and level surface during calibration.
- During the calibration and verification, gently place the weights on the calibration fixture. This ensures no excessive forces are applied to the load cell.
- Make sure to add the calibration fixture weight to the weight entered in the calibration screen (e.g. 25.6 or 15.6).
- Verify the calibration weight is entered correctly in the text fields.
- Remove the calibration fixture from the block before placing the verification weight on the fixture. This will allow the Pinch Gauge to return to a zero weight.
- If the calibration was not successful, click on  within the calibration screen and repeat the steps, but wait 3 seconds between applying the weight and clicking on the checkmark icon.

D. PERFORMING CALIBRATION

Prior to entering the calibration screen, verify the Pinch Gauge is connected to the Dock and the Dock is turned on.

The initial calibration screen should look as follows (Figure 6-6):

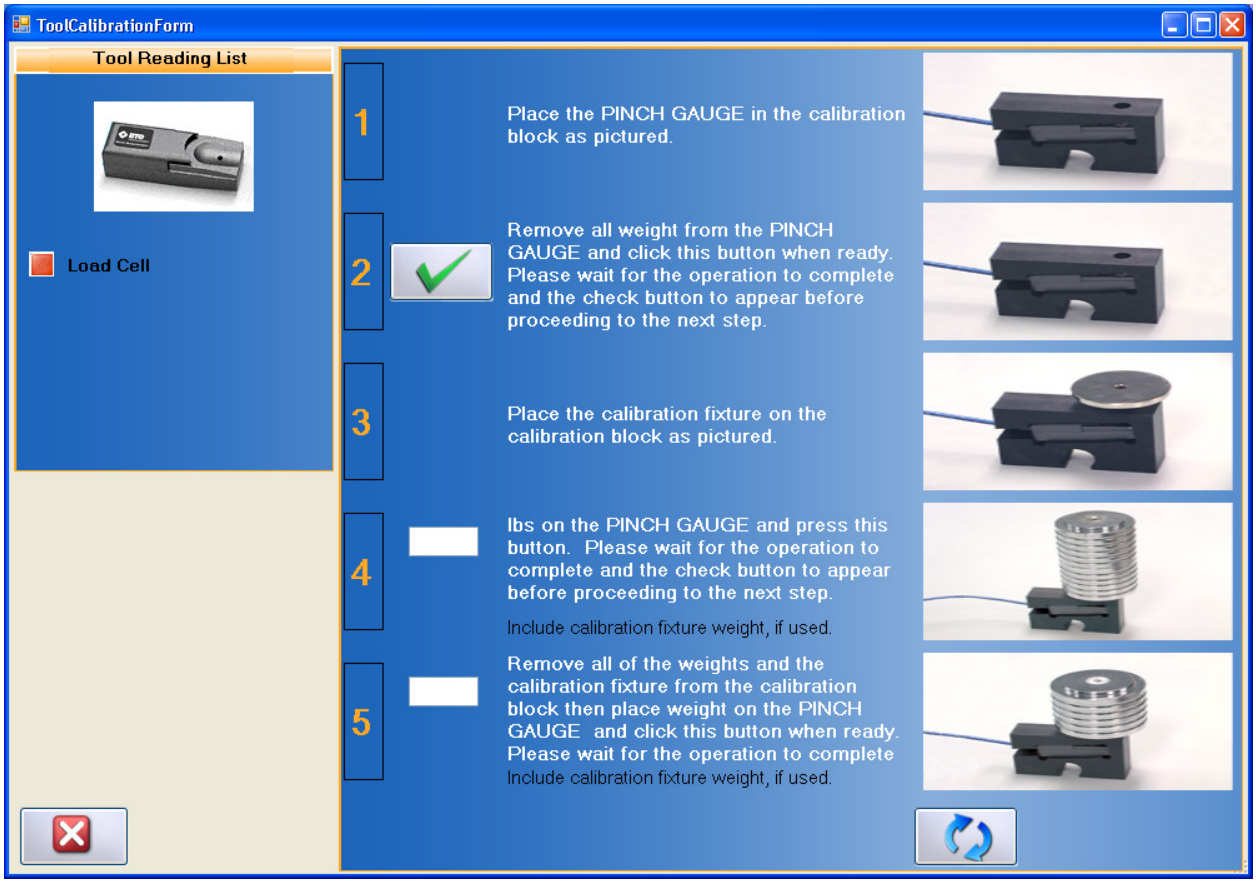

Figure 6-6. Pinch Gauge Calibration Screen

Step 1. Place the Pinch Gauge in the calibration block as shown on the screen.

Step 2. Once the Pinch Gauge is in place, click on  to set the zero point (Figure 6-7).

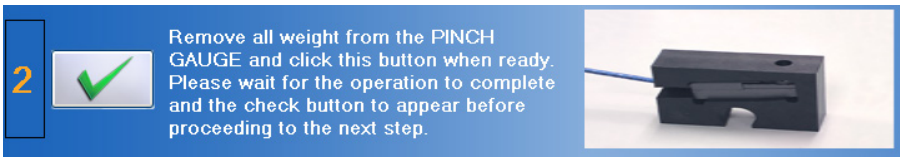

Figure 6-7. Pinch Gauge - Set the Zero Point

Step 3. Insert the calibration fixture into the calibration block.

Step 4. Place both calibration weights on the calibration fixture and type **25.6** (calibration fixture plus calibration weight) in the text field (Figure 6-8).

Step 5. Click on  to set the weight (Figure 6-8).

Figure 6-8. Pinch Gauge - Set the Weight

Step 6. Remove both of the calibration weights and calibration fixture. Re-insert the calibration fixture and then place the 15 lb calibration weight on the fixture. Type **15.6** in the text field (Figure 6-9).

Step 7. Click on  to verify the weight (Figure 6-9).

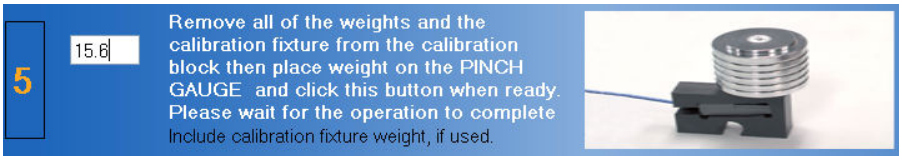

Figure 6-9. Pinch Gauge - Verify the Weight

If the Pinch Gauge was properly calibrated, then the screen will say the verification was successful and the measured weight will be in a green box (Figure 6-10).

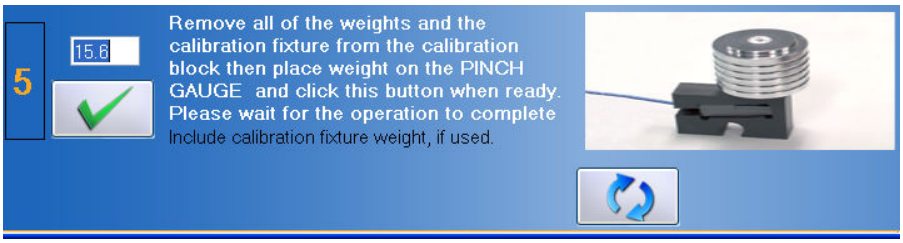

Figure 6-10. Pinch Gauge - Verification Successful

If the Pinch Gauge was not properly calibrated, then the screen will say the verification failed and the measured weight will be in a red box (Figure 6-11). You may try re-verifying the weight or re-calibrating the tool until the verification is successful. Also refer to the Troubleshooting section within this chapter for help.

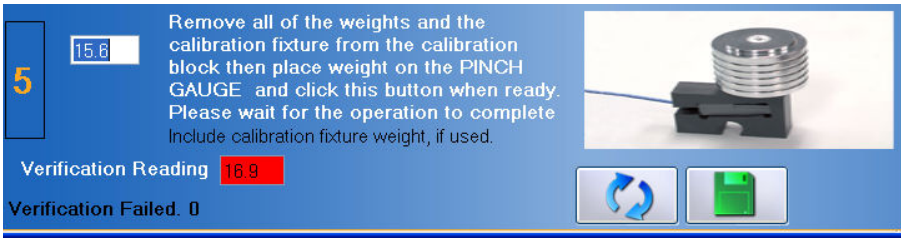

Figure 6-11. Pinch Gauge - Verification Failed

Step 8. Once the tool has passed verification, click on  to save the data.

E. PERFORMING VERIFICATION

The verification screen allows you to quickly to verify the tool without having to go through the whole calibration. In addition, all verifications performed through the verification screen are included in the tool's calibration report.

Note: A tool may not be verified with the same weight that was used during calibration.

Step 1. Place the Pinch Gauge in the calibration block and insert the calibration fixture. Place the 10 lb calibration weight on the calibration fixture and type **10.6** (calibration fixture plus calibration weight) in the text field (Figure 6-12).

Step 2. Click on  to verify the weight (Figure 6-12).

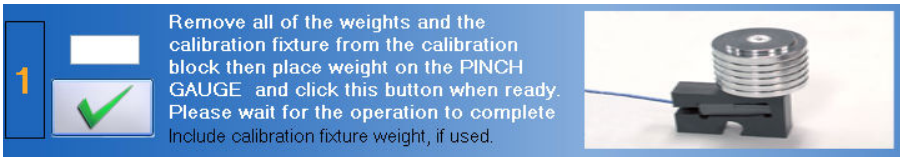

Figure 6-12. Pinch Gauge - Verify the Weight

If the Pinch Gauge was properly calibrated, then the screen will say the verification was successful and the measured weight will be in a green box (Figure 6-13).

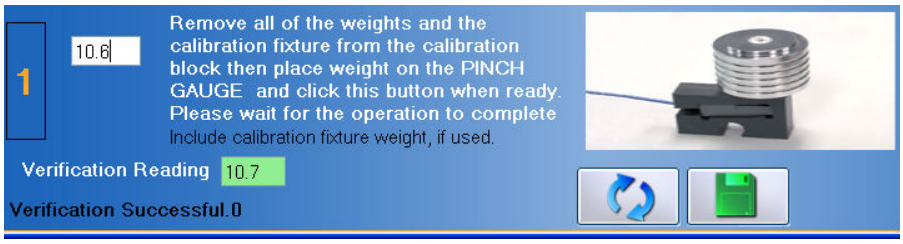

Figure 6-13. Pinch Gauge - Verification Successful

If the Pinch Gauge was not properly calibrated, then the screen will say the verification failed and the measured weight will be in a red box (Figure 6-14). You may try re-verifying the weight or re-calibrating the tool until the verification is successful. Also refer to the Troubleshooting section within this chapter for help.

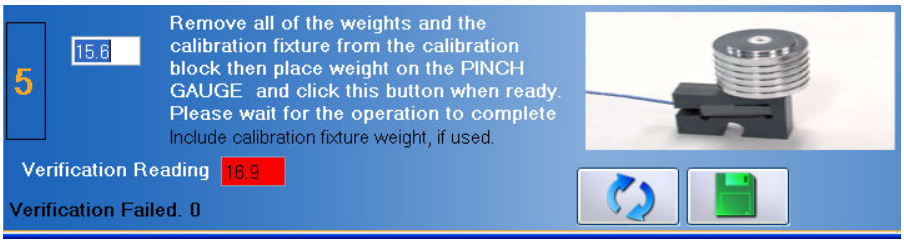

Figure 6-14. Pinch Gauge - Verification Failed

Step 3. Once the tool has passed verification, click on  to save the data.

V. TROUBLESHOOTING

A. TOOL NOT READING ANY VALUE OR NOT RECOGNIZED

There are multiple reasons why the Pinch Gauge may not be reading any value or is not recognized. Verify and attempt the following:

1. VERIFY THE FOLLOWING

- The batteries in the Portable Dock & Transmitter are charged and less than a year old
- The antennas are properly secured to the Portable Dock & Transmitter and Hub
- The Hub is plugged in to the computer and the Dock is powered On
- There is no interference between the Hub and Dock (refer to Chapter 8)
- The Hub has not been dropped or hit hard - if so, then unplug and replug the USB cable
- The Dock has not been dropped or hit hard - if so, then turn the power off for ~5 seconds and then back on
- The Pinch Gauge, Portable Dock, and cable are not damaged, dirty at the connections, or have loose components

2. ATTEMPT THE FOLLOWING

- Turn off the Portable Dock, attach a new cable to the Pinch Gauge and Portable Dock, and then turn the Dock back on.
- Turn off the Portable Dock, plug the cable into another port on the Dock, and then turn it back on.
- Turn off the Portable Dock, insert freshly charged batteries, and then turn it back on.
- Try a different combination of batteries - if one of the batteries has gone bad, then the Portable Dock will not work properly.

B. UNABLE TO CALIBRATE OR VERIFY

Refer to Section IV-C of this chapter for information.

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PORTABLE LOAD CELL

PORTABLE LOAD CELL

I. INTRODUCTION

The Portable Load Cell's primary use is to measure push and pull forces up to 500 lbs/227 kgs. Some of the applications of the Portable Load Cell (aka PLC) are manual muscle testing, evaluating the consistency of a client's self-report of pain, documenting point tenderness, and determining the forces required for specific tasks at the workplace or at home.

All of the attachments (e.g. Box Grip and Straight Bar) can be used with the PLC. In addition, several accessories are provided to help simulate tasks. The figure below shows the most commonly used attachments and accessories (Figure 7-1). Lastly, the 1/2" wrench that is

WARNING

Do not exceed pull forces of 250 lbs/113 kgs when using Snap hook.

Figure 7-1. Portable Load Cell and Commonly-Used Attachments & Accessories

provided with the system can be used to tighten and loosen the nut on the interface screw.

II. UTILIZING THE PORTABLE LOAD CELL

A. CONNECTING TO THE SYSTEM

Always connect the Portable Load Cell to the Portable Dock & Transmitter via the RJ45 jack. Refer to Chapter 01-III-B [Setup & General Operation - General Operation of the System] of this manual for a pictorial example.

Remember to verify the tool is plugged in and the Dock is turned on and receiving power before starting a test.

B. SETTING UP THE PLC

For Manual Muscle Tests, perform the following steps:

1. Attach the Round Pad to the PLC via the Interface Screw (Figure 7-2). If necessary, tighten the knurled nut onto the Round Pad to increase stabilization.
2. Attach the other pad, which the client will push against, on the permanent screw on the PLC (Figure 7-2). If necessary, tighten the knurled nut onto the pad to increase stabilization.
3. Place the Round Pad on the table and once prompted by the software, ask the client to push against the interfacing pad (Figure 7-2).

For all other uses of the Portable Load Cell, attach the accessories as desired.

Figure 7-2. Example of Positioning for Manual Muscle Testing

III. PRE-DEFINED TESTS & TESTING TEMPLATES

The EvalTech software includes several pre-defined tests and testing templates. For information on assigning and administering tests in the software, refer to Chapters 4 and 5 of the EvalTech Software Operator's Manual.

The following extremities are typically tested with the Portable Load Cell:

• Ankle • Elbow • Hip • Knee • Shoulder

Note that the names of the pre-defined tests contain the name of the extremity that is being analyzed.

IV. CALIBRATION & VERIFICATION

It is recommended calibration is performed on a weekly basis and verification is performed on a daily basis.

A. CALIBRATION EQUIPMENT (FIGURE 7-3)

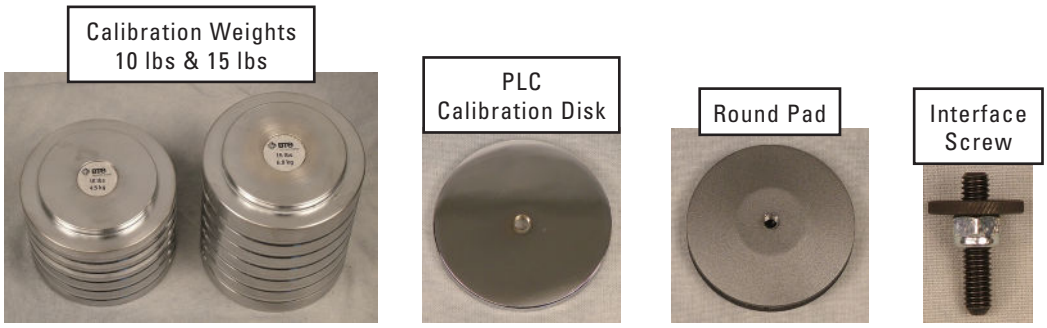

Figure 7-3. Portable Load Cell Calibration Equipment

B. ACCESSING THE CALIBRATION & VERIFICATION SCREENS

Refer to Chapter 02c-V-C [Administration Menu - Manage Tools - Calibration] of the EvalTech Software Operator's Manual for additional information on the tool management and calibration screens.

The calibration screen may be accessed within the testing screen and within the Tool Management screen.

The verification screen may only be accessed within the Tool Management screen.

1. VIA THE TESTING SCREEN

Click on  , which is typically located at the bottom-center of the screen.

2. VIA THE TOOL MANAGEMENT SCREEN

Step 1. Access the Tool Management screen via one of the following two methods:

a) Within the Test Administration screen, click on  , which is located in the bottom-left corner of the screen.

b) Select the Administration Taskbar Menu and click on Manage Tools.

Step 2. On the left side of the screen, click on Portable Load Cell. The right side of the screen will show the current input values for the tool.

Step 3a. Click on  in the bottom lower-center to access the calibration screen.

Step 3b. Click on  in the bottom lower-center to access the verification screen.

C. PERFORMING CALIBRATION

Prior to entering the calibration screen, verify the Portable Load Cell is connected to the Dock and the Dock is turned on.

The initial calibration screen should look as follows (Figure 7-4):

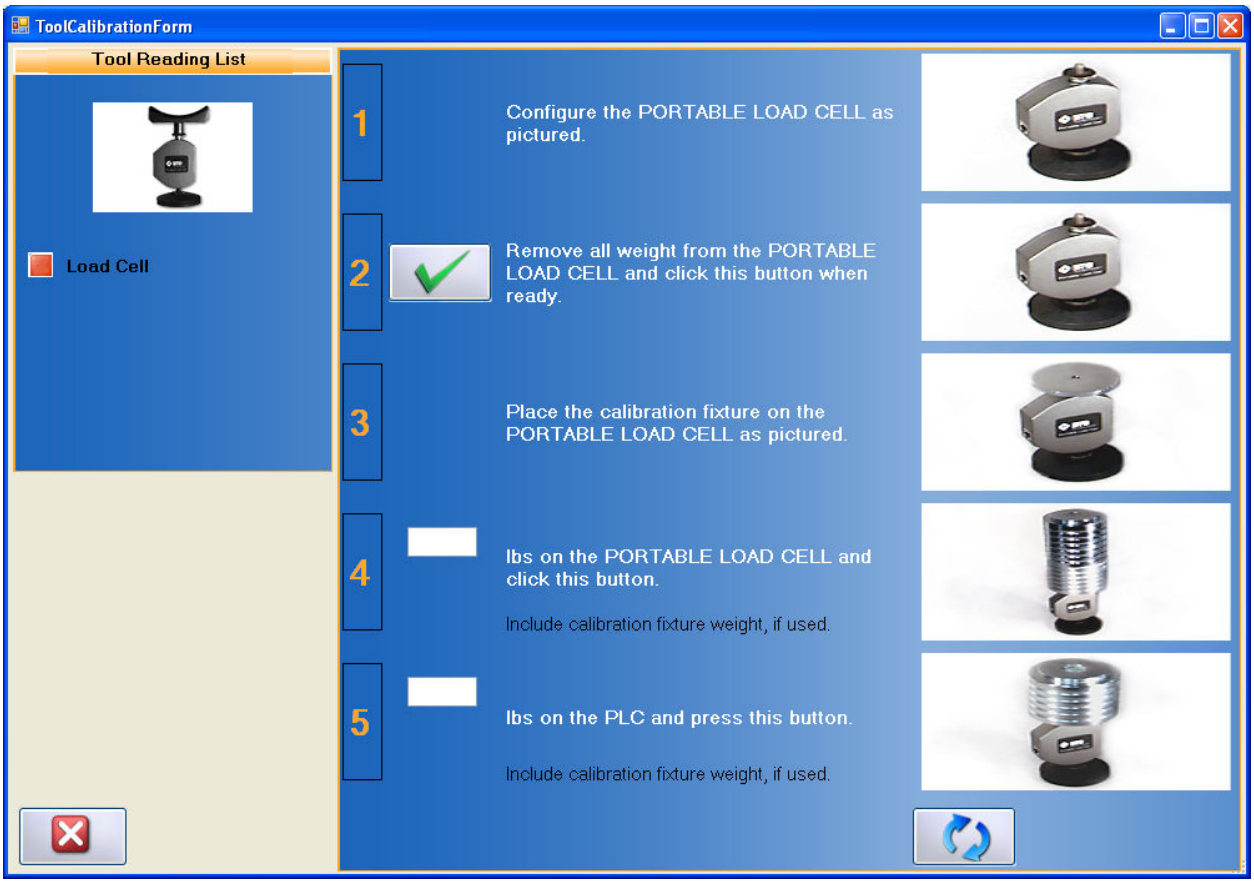

Figure 7-4. Portable Load Cell Calibration Screen

Step 1. Attach the interface screw to the PLC and then attach the Round Pad to the interface screw.

Step 2. Position the Portable Load Cell as shown in the calibration screen and verify the PLC is stable. If necessary, tighten the knurled nut onto the Round Pad to increase stabilization.

Step 3. Click on  to set the zero point (Figure 7-5).

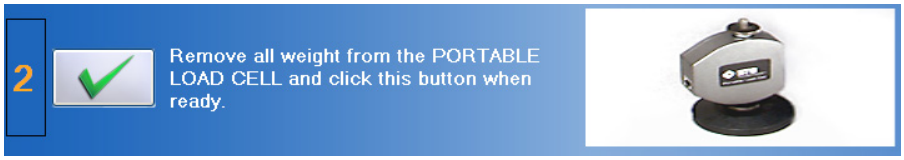

Figure 7-5. Portable Load Cell - Set the Zero Point

Step 4. Attach the calibration disk to the permanent screw on the PLC. Verify the disk is stable and the screw does not extend past the calibration disk. If necessary, tighten the knurled nut onto the disk to increase stabilization.

Step 5. Place both calibration weights on the calibration disk and type **25.5** (calibration disk plus calibration weight) in the text field (Figure 7-6).

Step 6. Click on  to set the weight (Figure 7-6).

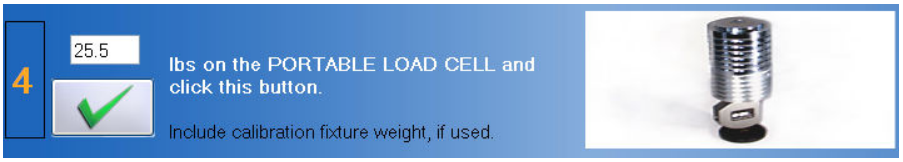

Figure 7-6. Portable Load Cell - Set the Weight

Step 7. Remove both of the calibration weights and then place the 15 lb calibration weight back on the calibration disk. Type **15.5** in the text field (Figure 7-7).

Step 8. Click on  to verify the weight (Figure 7-7).

Figure 7-7. Portable Load Cell - Verify the Weight

If the Portable Load Cell was properly calibrated, then the screen will say the verification was successful and the measured weight will be in a green box (Figure 7-8).

Figure 7-8. Portable Load Cell - Verification Successful

If the Portable Load Cell was not properly calibrated, then the screen will say the verification failed and the measured weight will be in a red box (Figure 7-9). You may try re-verifying the weight or re-calibrating the tool until the verification is successful.

Figure 7-9. Portable Load Cell - Verification Failed

Step 8. Once the tool has passed verification, click on  to save the data.

D. PERFORMING VERIFICATION

The verification screen allows you to quickly to verify the tool without having to go through the whole calibration. In addition, all verifications performed through the verification screen are included in the tool's calibration report.

Note: A tool may not be verified with the same weight that was used during calibration.

Step 1. If they're not already, attach the Round Pad, Interface Screw, and Calibration Disk as described in Steps 1, 2, and 4 of the previous section.

Step 2. Place the 10 lb calibration weight on the calibration disk and type **10.5** (calibration disk plus calibration weight) in the text field (Figure 7-10).

Step 3. Click on  to verify the weight (Figure 7-10).

Figure 7-10. Portable Load Cell - Verify the Weight

If the Portable Load Cell was properly calibrated, then the screen will say the verification was successful and the measured weight will be in a green box (Figure 7-11).

Figure 7-11. Portable Load Cell - Verification Successful

If the Portable Load Cell was not properly calibrated, then the screen will say the verification failed and the measured weight will be in a red box (Figure 7-12). You may try re-verifying the weight or re-calibrating the tool until the verification is successful.

Figure 7-12. Portable Load Cell - Verification Failed

Step 4. Once the tool has passed verification, click on  to save the data.

V. TROUBLESHOOTING

A. TOOL NOT READING ANY VALUE OR NOT RECOGNIZED

There are multiple reasons why the Portable Load Cell may not be reading any value or is not recognized. Verify and attempt the following:

1. VERIFY THE FOLLOWING

- The batteries in the Portable Dock & Transmitter are charged and less than a year old
- The antennas are properly secured to the Portable Dock & Transmitter and Hub
- The Hub is plugged in to the computer and the Dock is powered On
- There is no interference between the Hub and Dock (refer to Chapter 8)
- The Hub has not been dropped or hit hard - if so, then unplug and replug the USB cable
- The Dock has not been dropped or hit hard - if so, then turn the power off for ~5 seconds and then back on
- The Portable Load Cell, Portable Dock, and cable are not damaged, dirty at the connections, or have loose components

2. ATTEMPT THE FOLLOWING

- Turn off the Portable Dock, attach a new cable to the PLC and Portable Dock, and then turn the Dock back on.
- Turn off the Portable Dock, plug the cable into another port on the Dock, and then turn it back on.
- Turn off the Portable Dock, insert freshly charged batteries, and then turn it back on.
- Try a different combination of batteries - if one of the batteries has gone bad, then the Portable Dock will not work properly.

B. FORCE NOT RECORDING IN STRENGTH TEST

- Make sure to secure the attachment to the permanent screw (not the interface screw) - the BTE label should be readable by the clinician.
- Verify the actual test situation (i.e. how the client is performing the test) matches the expected test setup (i.e. what is specified under the EvalTech Test Setup).
- Verify all of the settings within the EvalTech Test Setup are correct (e.g. the test is set properly to push or pull).

C. UNABLE TO CALIBRATE OR VERIFY

If you are having trouble completing calibration or verification of the Portable Load Cell, verify and attempt the following:

- Ensure that the PLC is placed on a sturdy and level surface during calibration.
- Make sure to attach the Round Pad to the interface screw and place the Round Pad on the table; the calibration disk should be attached to the permanent screw.
- Make sure the calibration disk is not on the PLC for the first step of the calibration.
- Make sure to add the calibration disk weight to the weight entered in the calibration screen (e.g. 25.5 or 15.5).

- Verify the calibration weight is entered correctly in the text fields.
- Remove the weights from the calibration disk before placing the verification weight on the disk. This will allow the load cell to return to a zero weight.
- Click on  within the calibration screen and repeat the steps, but wait 3 seconds between applying the weight and clicking on the checkmark icon.

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TROUBLESHOOTING GUIDE

TROUBLESHOOTING GUIDE

I. GENERAL PREVENTION OF INTERFERENCE BETWEEN WIRELESS COMPONENTS

Interference, which can result in an inability to acquire accurate data, may occur in the following scenarios:

- The antennas of any wireless components are within 3 feet of each other (e.g. the antenna on the Hub is within 3 feet of the antenna on the Portable Dock & Transmitter).
- There is not a direct line of sight between the antennas of the wireless components. In addition, any large piece of metal that is between the antennas will cause interference.

You may prevent interference by maintaining your system in the following manner:

- Do not allow the Portable Dock & Transmitter to fall on the floor.
- Regularly check the USB cable that is attached to the Hub.
- Verify the antennas are in good working order and properly secured.

You may also prevent interference by using the following guidelines:

- Place the Hub in a location that ensures the antenna of the Hub will always be at least 3 feet from the antenna on the Portable Dock & Transmitter.
- Verify there is a direct line of sight between the Hub antenna and the Portable Dock & Transmitter antenna.

II. COMMON PROBLEMS AND SOLUTIONS

A. UNABLE TO CAPTURE HEART RATE

Refer to Chapter 02 (Heart Rate System) for extensive troubleshooting information

B. UNABLE TO OBTAIN READINGS FROM A TOOL CONNECTED TO THE PORTABLE DOCK

1. VERIFY THE FOLLOWING

- The batteries in the Portable Dock & Transmitter are charged and less than a year old.
- The antennas are properly secured to the Portable Dock & Transmitter and Hub.
- The Hub is plugged in to the computer and the Dock is powered On.
- There is no interference between the Hub and Dock (see previous section).
- The Hub has not been dropped or hit hard - if so, then unplug and replug the USB cable.
- The Dock has not been dropped or hit hard - if so, then turn the power off for ~5 seconds and then back on.

2. ATTEMPT THE FOLLOWING

- While the tool is plugged into the Portable Dock, turn the Portable Dock off and then back on.
- Turn off the Portable Dock, attach a new cable to the tool and Portable Dock, and then turn the Dock back on.
- Turn off the Portable Dock, plug the cable into another port on the Dock, and then turn it back on.
- Turn off the Portable Dock, insert freshly charged batteries, and then turn it back on.
- Try a different combination of batteries - if one of the batteries has gone bad, then the Portable Dock will not work properly.
- Exit the software, unplug and replug the Hub USB cable, and then restart the software.
- Shut down the software and computer using proper Windows shut-down procedures, unplug the Hub USB cable, plug the cable into another available USB port (the ports on the front may be used), turn on the computer, and restart the software.

III. TECHNICAL SUPPORT

If you are able to verify all of the possible solutions related to the scenario, but the problem still exists, then please use the following avenues for further assistance:

- 800.331.8845 (U.S. & Canada)
- 410.850.0333 (Domestic & International)
- Support Section of www.btetech.com

Appendix A

EMC Guide

Safety with Regard to Electromagnetic Disturbances

- Electromagnetic environment of intended use: Professional healthcare facility environment
- WARNING: Use of this equipment adjacent to or stacked with other equipment should be avoided because it could result in improper operation. If such use is necessary, this equipment and the other equipment should be observed to verify that they are operating normally.
- WARNING: Use of accessories, transducers and cables other than those specified or provided by BTE could result in increased electromagnetic emissions or decreased electromagnetic immunity of this equipment and result in improper operation.
- WARNING: Portable RF communications equipment (including peripherals such as antenna cables and external antennas) should be used no closer than 30 cm (12 inches) to any part of the EvalTech/Evaluator, including cables specified by BTE. Otherwise, degradation of the performance of this equipment could result.
- NOTE: The emissions characteristics of this equipment make it suitable for use in industrial areas and hospitals (CISPR 11 class A). If used in a residential environment (for which CISPR 11 class B is normally required), this equipment might not offer adequate protection to radio-frequency communication services. The user might need to take mitigation measures, such as relocating or re-orienting the equipment.

- Emissions and immunity tests compliance information:
    - Emissions class: Class A
    - The equipment is compliant with the following standards:
        - **IEC 60601-1-2:2014**, Medical electrical equipment - Part 1-2: General requirements for basic safety and essential performance - Collateral standard: Electromagnetic disturbances - Requirements and tests
        - **CISPR 11:2010,** Limits and methods of measurement of radio disturbance; Characteristics of industrial, scientific and medical radio frequency equipment
        - **IEC 61000-4-2:2008**, Electromagnetic Compatibility (EMC) - Part 4: Testing and measurement techniques - Section 2: Electrostatic discharge immunity test
        - **IEC 61000-4-3:2010**, Electromagnetic Compatibility (EMC) - Part 4: Testing and measurement techniques - Section 3: Radiated, radio-frequency, electromagnetic field immunity test

- **IEC 61000-4-4:2012**, Electromagnetic Compatibility (EMC) - Part 4: Testing and measurement techniques - Section 4: Electrical fast transient/burst immunity test
- **IEC 61000-4-5:2005**, Electromagnetic Compatibility (EMC) - Part 4: Testing and measurement techniques - Section 5: Surge immunity test
- **IEC 61000-4-6:2013**, Electromagnetic Compatibility (EMC) - Part 4: Testing and measurement techniques - Section 6: Conducted immunity test
- **IEC 61000-4-8:2009**, Electromagnetic Compatibility (EMC) - Part 4: Testing and measurement techniques - Section 8: Power frequency magnetic field immunity test
- **IEC 61000-4-11:2004**, Electromagnetic Compatibility (EMC) - Part 4: Testing and measurement techniques - Section 11: Voltage dips and interruptions immunity test
- **IEC 61000-3-2:2014**, Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤ 16A per phase)
- **IEC 61000-3-3:2013**, Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16A per phase and not subject to conditional connection

- There are no deviations from the listed collateral standards.
- No precautions are needed for the expected service life to maintain the device basic safety with regard to electromagnetic disturbances.
- RF transmitters and receivers incorporated in the device operate in the following frequencies:
    - Portable Dock and column URFIO 900 MHZ or 868 MHz; The configuration as setup at BTE and cannot be changed by the user. The Effective Radiated Power (ERP) is equal to 12.6mW.
    - Bluetooth Hip Unit (BHU): 2.4 GHz (BHU can be incorporated in the system instead of the Portable Dock.) The Effective Radiated Power (ERP) is equal to 2mW.
    - Polar heart rate monitor; The Effective Radiated Power (ERP) is equal to 2.8mW
    - Bluetooth heart rate monitor: 2.4 GHz; The Effective Radiated Power (ERP) is equal to 1mW