



E.H. Wachs
600 Knightsbridge Parkway
Lincolnshire, IL 60069
www.ehwachs.com

VITALS™-Ready Handheld Valve Exerciser

User's Manual



Model P2, VITALS™-Ready

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Chapter 1

About This Manual

PURPOSE OF THIS MANUAL

This manual explains how to operate and maintain your WAVE™ (Wachs Automated Valve Equipment) handheld valve exerciser. It includes instructions for assembly, set-up, operation, and maintenance. It also contains parts lists, assembly diagrams, and troubleshooting instructions to help you order replacement parts and perform user-serviceable repairs.

Before operating your WAVE™ handheld unit, you should read through this manual and become familiar with all instructions. At a minimum, make sure you read and understand the following chapters:

- Chapter 1, About This Manual
- Chapter 2, Safety
- Chapter 3, Introduction to the WAVE™ Handheld
- Chapter 5, Operating Instructions.

If you will be performing service or repairs, make sure you read and understand these chapters:

- Chapter 1, About This Manual
- Chapter 4, Assembly and Disassembly
- Chapter 6, Routine Maintenance
- Chapter 7, Service and Repair.

You will also want to refer to Chapter 8, Parts Lists and Drawings.

In This Chapter

PURPOSE OF THIS MANUAL
HOW TO USE THE MANUAL
SYMBOLS AND WARNINGS
MANUAL UPDATES

Throughout this manual, refer to this column for warnings, cautions, and notices with supplementary information.

HOW TO USE THE MANUAL

This manual is organized to help you quickly find the information you need. Each chapter describes a specific topic on using or maintaining your WAVE™ handheld valve exerciser.

Each page is designed with two columns. This large column on the inside of the page contains instructions and illustrations. Use these instructions to operate and maintain your WAVE™ valve exerciser.

The narrower column on the outside contains additional information such as warnings, special notes, and definitions. Refer to it for safety notes and other information.

SYMBOLS AND WARNINGS

The following symbols are used throughout this manual to indicate special notes and warnings. They appear in the outside column of the page, next to the section they refer to. Make sure you understand what each symbol means, and follow all instructions for cautions and warnings.



WARNING

This symbol indicates a safety warning. A **warning** means that there is a risk of operator injury.



CAUTION

This symbol indicates a caution alert. A **caution** means that there is a risk of damage to the equipment or to the component being serviced.



NOTE

This symbol indicates a user notice. **Notices** provide additional information to supplement the instructions, or tips for easier operation.

MANUAL UPDATES AND REVISION TRACKING

Occasionally, we will update manuals with improved operation or maintenance procedures, or with corrections if necessary. Revised chapters will be available for customers. If you receive revised chapters for your manual, remove the old chapters from your binder and replace them with the new chapters.

When a manual is revised, we will update the revision history on the title page and at the bottom of the pages in the revised chapters. It is important to put the current title page with the revision history in your manual. This will help you make sure you have all current information.

You may have factory service or upgrades performed on your WAVE™ handheld exerciser. If this service changes any technical data or operation and maintenance procedures, we will include revised sections of the manual when we return the equipment to you. Remove the old chapters from your manual and replace them with the revised chapters.

Current versions of E.H. Wachs Company manuals are also available in PDF format. You can request an electronic copy of this manual by emailing customer service at sales@wachsco.com.



Chapter 2

Safety

The E.H. Wachs Company takes great pride in designing and manufacturing safe, high-quality products. We make user safety a high priority in the design of all our products.

Read this chapter carefully before operating your WAVE™ handheld valve exerciser. It contains important safety instructions and recommendations.

OPERATOR SAFETY

Follow these guidelines for safe operation of your WAVE™ handheld system.

- **READ THE OPERATING MANUAL.** Make sure you understand all setup and operating instructions before you begin.
- **INSPECT MACHINE AND ACCESSORIES.** Before starting the machine, look for loose bolts or nuts, leaking lubricant, rusted components, and any other physical conditions that may affect operation. Properly maintaining the machine can greatly decrease the chances for injury.
- **ALWAYS READ PLACARDS AND LABELS.** Make sure all placards, labels, and stickers are clearly legible and in good condition. You can purchase replacement labels from E.H. Wachs Company.
- **KEEP CLEAR OF MOVING PARTS.** Keep hands, arms, and fingers clear of all rotating or moving parts.

In This Chapter

OPERATOR SAFETY

SAFETY LABELS

MACHINE SAFETY



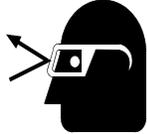
Look for this symbol throughout the manual. It indicates a safety warning.

Always turn machine off before doing any adjustments or service.

- **SECURE LOOSE CLOTHING AND JEWELRY.** Secure or remove loose-fitting clothing and jewelry, and securely bind long hair, to prevent them from getting caught in moving parts of the machine.
- **KEEP WORK AREA CLEAR.** Keep all clutter and nonessential materials out of the work area. Only people directly involved with the work being performed should have access to the area.

	<p style="text-align: center;">WARNING</p> <p>When using the electric powered WAVE™ handheld system, avoid standing water whenever possible. To avoid electrical shock, do not expose electrical cord to water.</p>
---	--

Protective Equipment Requirements

	<p style="text-align: center;">WARNING</p> <p>Always wear impact resistant eye protection while operating or working near this equipment.</p>
---	--

For additional information on eye and face protection, refer to Federal OSHA regulations, 29 Code of Federal Regulations, Section 1910.133., Eye and Face Protection and American National Standards Institute, ANSI Z87.1, Occupational and Educational Eye and Face Protection. Z87.1 is available from the American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.

	<p style="text-align: center;">CAUTION</p> <p>Personal hearing protection is recommended when operating or working near this tool.</p>
---	---

Hearing protectors are required in high noise areas, 85 dBA or greater. The operation of other tools and equipment in the area, reflective surfaces, process noises, and resonant structures can increase the noise level in the area. For additional information on hearing protection, refer to Federal OSHA regulations, 29 Code of Federal Regulations, Section 1910.95, Occupational Noise Exposure and ANSI S12.6 Hearing Protectors.

Operating Recommendations

	<p style="text-align: center;">CAUTION</p> <p>Some people experience chronic pain in their hands and arms when performing repetitive tasks or operating vibrating equipment. Repetitious, forceful exertion of the hands and arms can cause or aggravate disorders such as carpal tunnel syndrome and tendonitis.</p>
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- Use minimum hand grip force.
- Keep your wrists straight.
- Avoid prolonged, continuous exposure to vibration.
- Avoid repeated bending of your wrists and hands.
- ~~Keep your hands and arms warm and dry.~~

SAFETY LABELS

The operator position label is affixed to the handle of the WAVE™ handheld system. It shows where you should stand depending on direction of rotation.

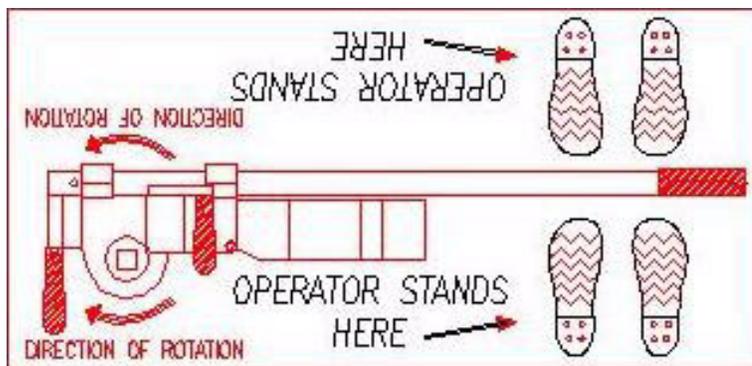


Figure 2-1. Operator Position Label

MACHINE SAFETY

To avoid damaging your WAVE handheld valve exerciser, follow these usage guidelines.

- Check gearbox oil level at least once every month.
- Don't store any other equipment in the WAVE handheld system's storage box.
- Keep the end cap tightly screwed into the end of the handle to keep out dirt and moisture.

Electric System

- Make sure that the voltage output from your electrical power supply is correct for requirements of your WAVE™ handheld system.
- Do not submerge the electric motor or allow it to get excessively wet.

Hydraulic System

- Do not exceed hydraulic flow of 8 gallons per minute (gpm)/30 liters per minute (lpm).
- Do not exceed hydraulic pressure of 1800 psi/124 bar.
- Every time you connect hydraulic power to the machine, check hoses and fittings to make sure there are no leaks.

Pneumatic System

- Use an inline filtration system to prevent water and airborne contaminants from getting into the air motor.
- Use an inline oiling system to lubricate the motor.
- Use antifreeze oil when operating the system under continuous load and high torque settings to reduce ice buildup.

Chapter 3

Introduction to the WAVE™ Handheld Valve Exerciser

Read this chapter carefully to become familiar with the components of your WAVE™ handheld valve exerciser.

For convenient access to a power source, the WAVE™ handheld valve exerciser is available with three different motor drives: electric, hydraulic, and compressed air. This manual provides instructions for all three power versions.

USAGE AND APPLICATIONS

The WAVE™ line of handheld valve exercisers redefines portable valve exercising and testing. This versatile unit is light enough to be used by one operator, yet is rugged enough to operate valves up to 60 inches. It's designed for efficient valve exercising and testing, and is perfect for hard-to-reach valves.

The WAVE™ handheld systems provide you with the following capabilities:

- Operation of 3 times more valves per day in your valve exercising program.
- Readiness for fast emergency shut-offs.
- Elimination of operator fatigue and back injury.
- Reduced valve damage during exercising.
- Operation of valves where access is limited.
- Easy storage and transport.
- Easy use by one operator.

In This Chapter

USAGE AND APPLICATIONS
 MECHANICAL OVERVIEW
 SAFETY LABELING
 CONTROL UNIT AND KEYPAD
 VITALS™ DATA LOGGER
 BATTERY-POWERED
 COMPONENTS
 PACKAGING
 MACHINE SPECIFICATIONS

When a valve that has not been operated for a long time is turned continuously in the closing direction, the tuberculation and sediment built up inside it get compacted. This causes the torque to increase as the valve is turned. As a result, the valve stem can break, or the sediment can jam the gates or slides before the valve is fully closed.

The “back and forth” approach recommended here is much like operating a hand tap or die. Backing the tap out clears chips between the cutting surface and the new threads. Likewise, backing up the valve releases debris that has been loosened from the gates, stem, and slides inside it. Water in the system can then flush this debris away.

Once the valve has been fully closed, it should be opened a few turns so that the higher velocity water flowing under the gates can move the remainder of the sediment downstream.

Valve Maintenance Program

A valve that has not been operated for a number of years needs to be closed by using a series of up and down motions. Occasionally, crews attempting to close a difficult valve use a T-handle or a cheater bar, applying a great deal of pressure in one direction simply to force the valve closed. This approach can break the valve stem and make the valve inoperable, requiring expensive repairs.

The correct way to exercise a valve is to begin with a steady amount of torque in the direction necessary to close the valve, moving through five to ten rotations. Then reverse the direction for two or three revolutions, followed by up to ten more turns in the closing direction. This procedure, illustrated in Figure 3-1, should be repeated until the valve is fully closed.

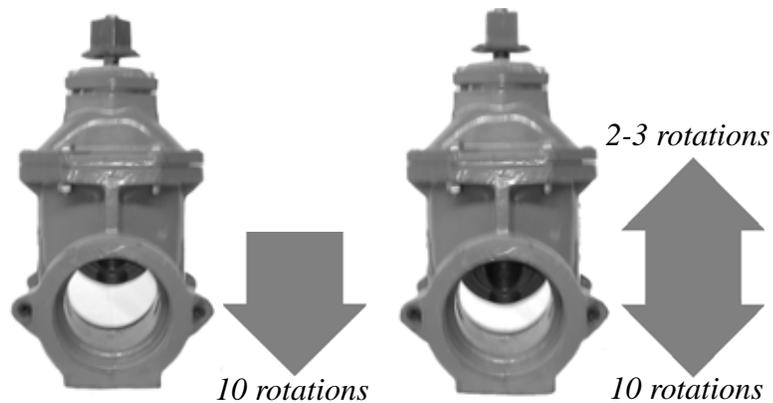


Figure 3-1. Closing a valve using a “back and forth” process to prevent jamming.

After the valve is reopened, turn it in the closing direction one or two revolutions. The next time the valve is operated, the nut and stem will not be jammed against the bonnet and the valve will be free. (If the operator trying to close the valve turns it the wrong way, a positive stop will occur after one or two turns. The operator can then reverse direction to fully operate the valve.)

The steady torque applied by the WAVE™ handheld system is less likely to damage valve components than turning the valve by hand. With the optional VITALS™ data logger, detailed information on torque and valve position can be stored for each valve that is exercised.

MECHANICAL OVERVIEW

Electric Drive

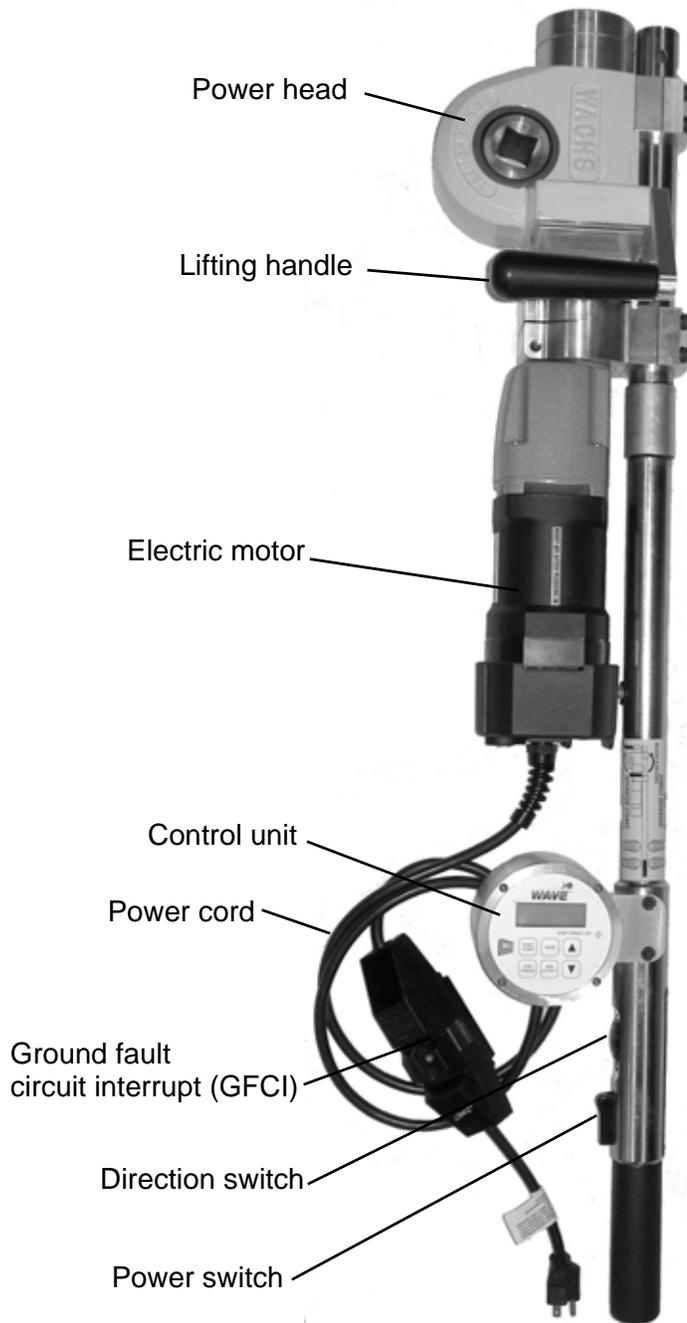


Figure 3-2. WAVE™ handheld system mechanical components—electric motor drive.

The pressure gauge only displays the hydraulic pressure to the pump. Use the torque display on the control unit for an accurate reading of torque being applied to the valve.



Hydraulic Drive

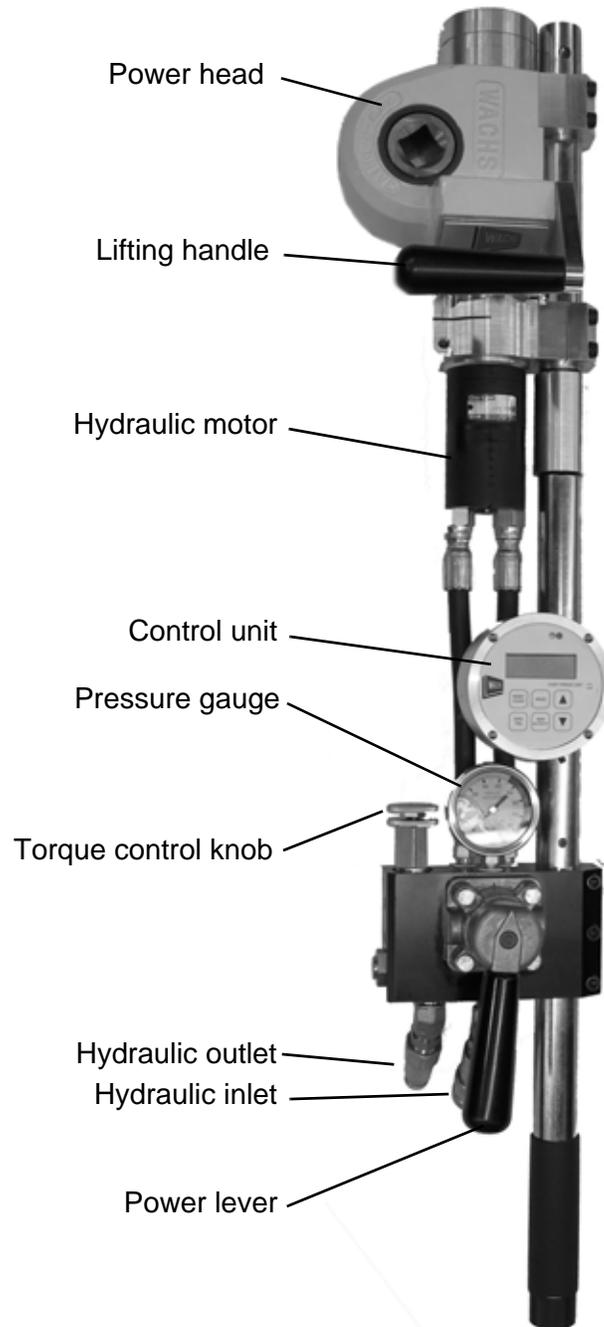


Figure 3-3. WAVE™ handheld system mechanical components—hydraulic motor drive.

Pneumatic (Air) Drive

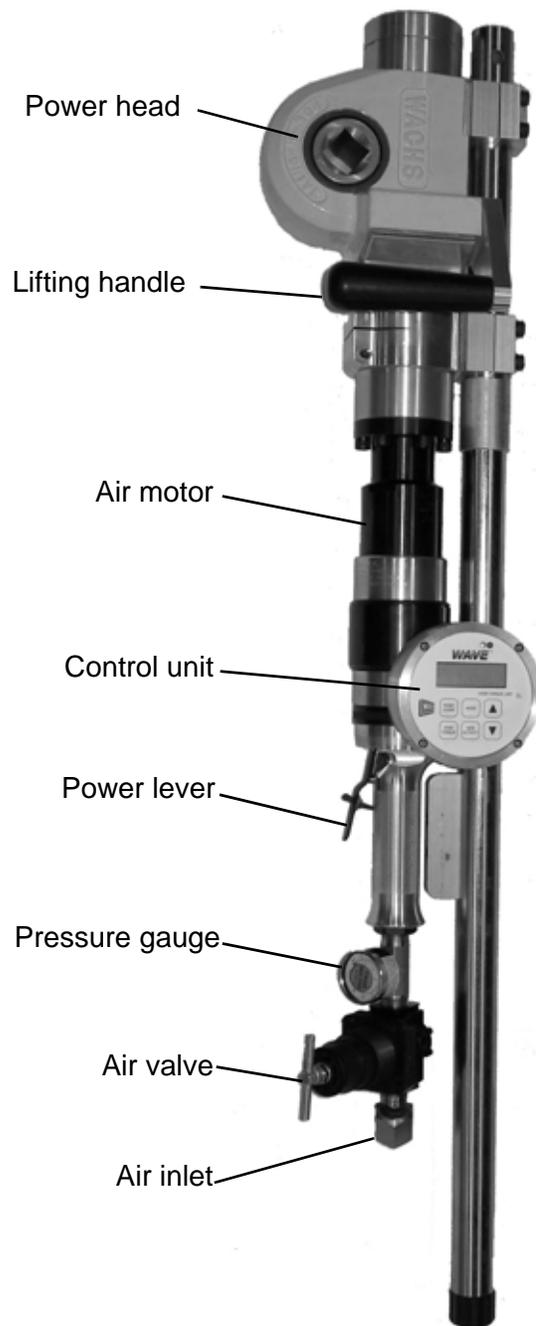


Figure 3-4. WAVE™ handheld system mechanical components—pneumatic motor drive.

To avoid injury, it is important that the operator stands so that the rotation of the machine pulls the handle away from his body when turning the valve key.



SAFETY LABELING

The operator position label, shown in Figure 3-5, is affixed to the handle of the WAVE™ handheld system to indicate where the operator should stand during use.

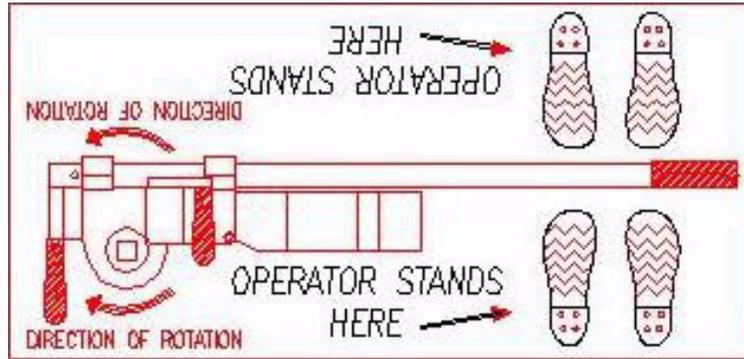


Figure 3-5. Operator position label

CONTROL UNIT AND KEYPAD

Use the electronic control unit to monitor torque and revolutions, and to change data collection settings. Figure 3-6 illustrates the controller keypad. Chapter 5, “Operating Instructions”, explains how to use the controller.

The controller stores revolution and torque data for the current valve operation. You can save this data for later analysis using the optional VITALS™ data logger. See “Storing and Transferring Data” in Chapter 5.

NOTE: Torque values on the control unit display are in the currently selected units—lb-ft or N-m. Current units are displayed on the start-up screen when you power up the controller.

To switch torque units between lb-ft and N-m, press the RESET COUNT and ZERO TORQUE buttons together.



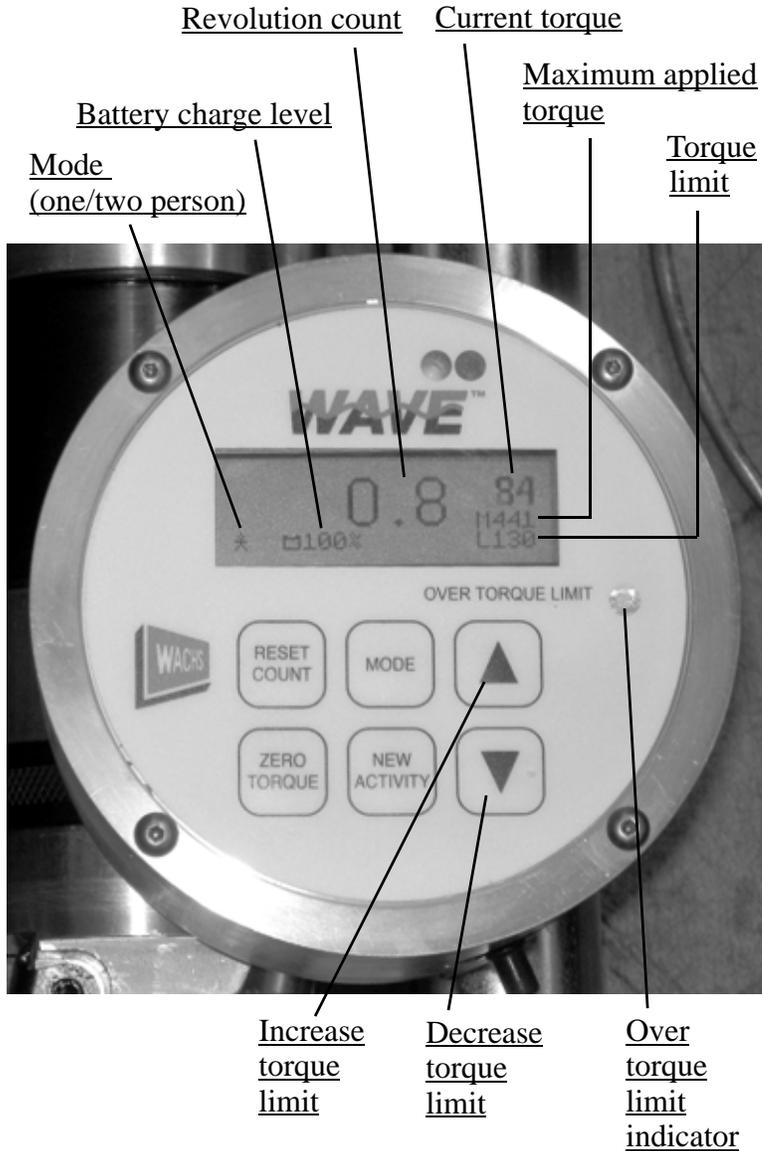


Figure 3-6. WAVE™ Control Unit

Special Functions

- Press RESET COUNT and ZERO TORQUE together to switch torque units (lb-ft or N-m).



Display Window Features

- Mode**—Displays if controller is in one-person or two-person mode.
- Revolution count**—Number of revolutions in the current operation (since last reset). The number can be positive or negative. Positive indicates right-hand (clockwise) direction.
- Battery charge level**—Displays remaining battery charge in percentage.
- Current torque**—Shows currently applied torque in lb-ft or N-m.
- Maximum applied torque**—Shows the maximum torque applied during the current operation.
- Torque limit**—Shows the current torque limit setting.

Keypad Features

- RESET COUNT**—sets the counter back to zero.
- MODE**—Toggles between one-person and two-person mode.
- ZERO TORQUE**—Sets the current torque display to zero.
- NEW ACTIVITY**—Resets activity data in memory.
NOTE: all data for the current activity is lost when you push this button.
- Increase torque limit**—Increases the current torque limit by 10 lb-ft or N-m.
- Decrease torque limit**—Decreases the current torque limit by 10 lb-ft or N-m.
- Over torque limit indicator**—Lights when current torque exceeds torque limit.

Data Entry Functions

BACK—Goes to the previous data entry screen.

NEXT—Goes to the next data entry screen.

Left arrow/right arrow—Highlights characters for editing in menu selections.

Up arrow/down arrow—Scroll up and down through selections in a menu.

MENU—Displays/closes system menu.

POWER—Turns controller on and off.

NOTE: Not all functions of the VITALS™ Data Logger are used for data transfer from the WAVE™ handheld system. (These are machine control functions for other valve exercising systems.) The following buttons are not used:

STOP
START
DIR
MODE
NEW ACTIVITY
RESET COUNT

- Press Increase Torque Limit and Decrease Torque Limit together to turn LCD backlight on and off.



VITALS™ DATA LOGGER

The optional VITALS™ controller/data logger stores data from up to 100 valve operations (maximum of 3000 revolutions) for transfer to a PC application. It attaches directly to the WAVE™ control unit for data transfer. Figure 3-7 illustrates the features of the VITALS™ data logger.



Figure 3-7. VITALS™ controller/data logger

Data Logger System Menu

Press the MENU button to display the system menu on the data logger screen.



To exit the menu, press the Menu button again.

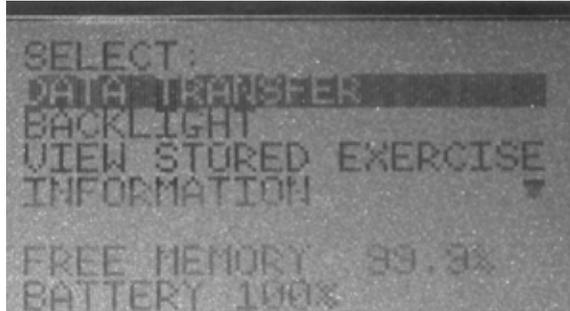


Figure 3-8. Data logger system menu. Use the up and down arrow buttons to highlight the options. Scroll past the bottom of the menu to display the second screen of commands. Press the NEXT button to select the highlighted option.

- **DATA TRANSFER**—Puts the controller into data transfer mode for transferring data to or from a PC.
- **BACKLIGHT**—Turns the LCD backlighting on and off.
- **VIEW STORED EXERCISE**—Displays a list of valve operation datasets in memory.
- **INFORMATION**—Displays system information.

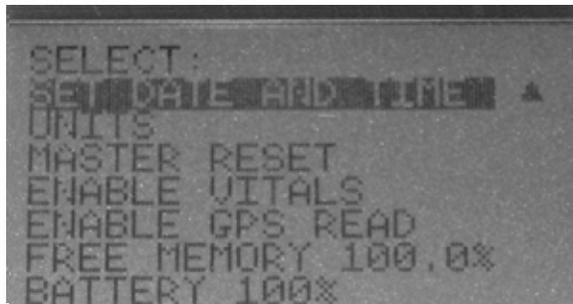


Figure 3-9. Data logger system menu (screen 2). Use the up arrow to scroll back up to the first menu screen.

- **SET DATE AND TIME**—Lets you change current date and time settings.
- **UNITS**—Lets you change units between lb-ft and N-m.
- **MASTER RESET**—Erases all stored datasets from memory.

The electric-powered system does not have a control unit battery. The control unit is powered on when power is supplied to the entire system.



The operating time on a battery charge will be reduced if you use the backlight on the control unit screen.



The temperature should be between 32° and 104° F (0-40° C) when charging the battery.



- **ENABLE VITALS**—Allows you to turn data logging features on and off. With VITALS data logging off, the controller/data logger is used only for control of the TM valve exerciser.
- **ENABLE GPS READ**—Allows you to turn GPS data logging on and off. With GPS Read off, the data logger will not display the READING GPS screen.

BATTERY-POWERED COMPONENTS

The WAVE™ handheld system's control unit and the optional VITALS™ data logger are powered by built-in rechargeable batteries. There are also non-rechargeable memory backup batteries in the control unit and data logger, which maintain data in memory when the units are turned off.

The following sections describe the battery care procedures.

Control Unit Battery (Hydraulic/Pneumatic)

NOTE: Only the hydraulic and pneumatic powered systems include the integrated battery for powering the control unit.

The WAVE™ control unit is powered by a 7.2 V rechargeable NiMH battery in the end of the machine's handle. The control unit will operate about 20 hours on a full charge.

Two chargers are available to charge the battery: a 110/220 V AC adapter, and a 12 V DC cigarette lighter adapter. Use the same procedure below for either adapter.

Charging Procedure

1. If the control unit is on, press the power switch to turn off power.

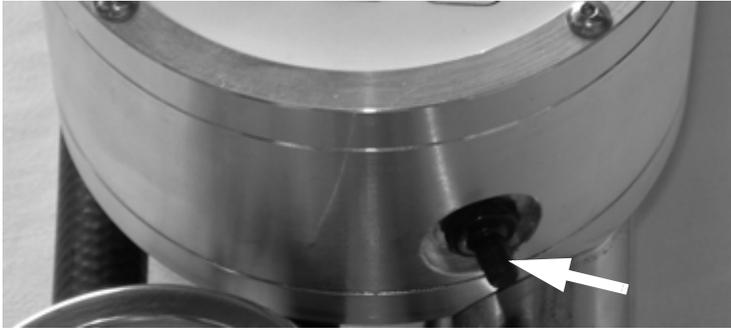


Figure 3-10. Control unit power switch (hydraulic and pneumatic systems only). Press the button and release it to toggle the control unit on and off.

2. Unscrew the cap on the end of the WAVE™ handle to access the battery charging connector.



Figure 3-11. The cap on the end of the handle unscrews to charge the battery.

3. Connect the charger cable to the battery charging connector.



Figure 3-12. Charger plugged into the battery charging connector. Note that the connector must be aligned correctly to line up the pins with the sockets.

4. Connect the power cable from the charger to the power source.



Figure 3-13. Plugging in the charger will start charging the battery.

5. Charging a fully drained battery takes about 2-4 hours. The charger will automatically shut off when the battery is fully charged.
6. When you are finished charging, remove the charger cable from the battery charging connector. Replace the cap on the WAVE™ system's handle.

If you do not have time for a full charge, you can partially charge the battery without damaging it.



Control Unit Memory Backup Battery

A standard size 3 V watch battery (CR1632 or equivalent) maintains data in memory when the control unit is turned off. This keeps your settings as well as the valve operation data from the most recent activity.

Replacement Procedure

1. If the control unit is on, turn off power to it:
 - On electric powered systems, press the OFF button on the GFI.
 - On hydraulic and pneumatic systems, press the power switch on the side of the control unit.



Figure 3-14. Control unit power switch (hydraulic and pneumatic systems only). Press the button and release it to toggle the control unit on and off.

2. Remove the 4 screws on the face plate of the control unit.



If the control unit starts to lose data or revert to its default settings when it is turned off, replace the memory backup battery.



Data stored in the control unit will be lost when you remove the battery. Transfer any data you need to the VITALS™ data logger before turning off the control unit.



Use a 5/64" hex wrench to turn the screws.

CAUTION:
Make sure the
control unit is
turned off before
opening it.



Figure 3-15. Remove the screws on the control unit face plate to open the control unit.

3. Carefully remove the face plate and turn it over to access the circuit board inside the control unit. The battery is in a socket mounted on the circuit board, as shown in Figure 3-16.

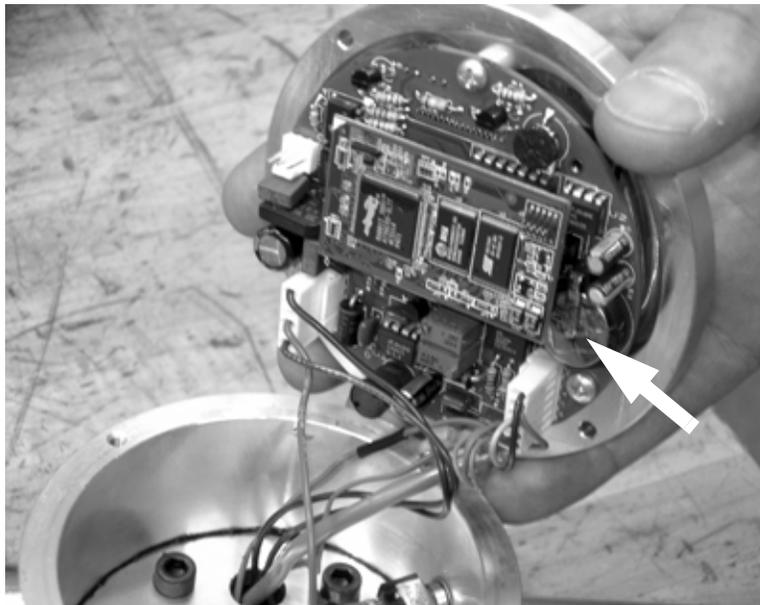


Figure 3-16. The replaceable battery is mounted in a socket on the control unit circuit board.

4. Using your fingernail or a non-metallic tool, remove the battery from the socket.



Figure 3-17. Remove the old battery from the socket.

5. Press a new battery into the socket, with the plus side facing up.



Figure 3-18. Slide the new battery into the socket, with the plus side (+) up.

6. Replace the face plate on the control unit and insert the screws.

VITALS™ Data Logger Battery

The VITALS™ data logger is powered by a 7.2 V rechargeable NiMH battery pack. It will operate about 6-8 hours on a full charge.

Two chargers are available to charge the battery: a 110/220 V AC adapter, and a 12 V DC cigarette lighter adapter. Use the same procedure below for either adapter.



CAUTION:
Do not touch any other components on the circuit board, or use any metallic tools.



Use a standard CR1632 3 V (or equivalent) watch battery.



Some WAVE™ units have gaskets and some have silicone sealer. Make sure you put on the gasket or re-apply the sealer when replacing the face plate.

The temperature should be between 32° and 104° F (0-40° C) when charging the battery



Charging Procedure

1. If the VITALS™ data logger is on, press the power button to turn it off. 
2. Connect the charger cable to the battery charging connector on the front side of the VITALS™ data logger.



Figure 3-19. Plug the charger cable into the VITALS™ connector.

3. Connect the power cable from the charger to the power source.



Figure 3-20. Plugging in the charger will start charging the battery.

4. Charging a fully drained battery takes about 2-4 hours. The charger will automatically shut off when the battery is fully charged.
5. When you are finished charging, remove the charger cable from the battery charging connector.

VITALS™ Data Logger Memory Backup Battery

A standard size 3 V watch battery (CR1632 or equivalent) maintains data in memory when the data logger is turned off. This keeps your settings as well as the stored valve operation data.

Replacement Procedure

1. If the data logger is on, turn off power using the power button. 
2. Remove the 4 screws on the back of the data logger.
3. Carefully remove the back cover and turn it over to access the circuit board inside the data logger. The battery is in a socket mounted on the circuit board, as shown in Figure 3-21.



Figure 3-21. The memory battery is in a socket on the circuit board.



If you do not have time for a full charge, you can partially charge the battery without damaging it.



If the data logger starts to lose data or revert to its default settings when it is turned off, replace the memory backup battery.



Any data stored in the data logger will be lost when you remove the battery. If you need to keep data stored in the data logger, transfer it to your PC before removing the battery.



Use a 5/64" hex wrench to turn the screws.

CAUTION:

Do not touch any other components on the circuit board, or use any metallic tools.



Use a standard CR1632 3 V (or equivalent) watch battery.

**CAUTION:**

Make sure you re-install the gasket before replacing the cover.



4. Using your fingernail or a non-metallic tool, remove the battery from the socket.

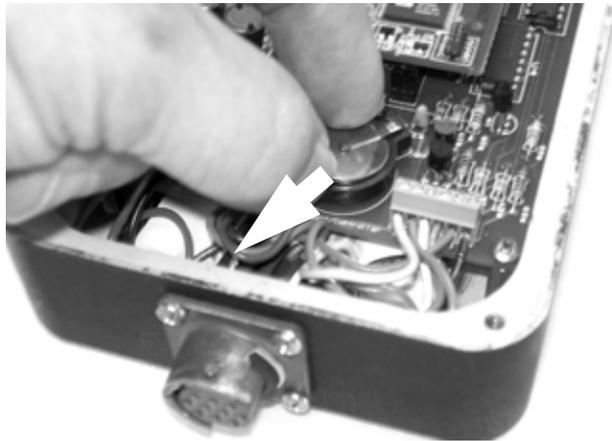


Figure 3-22. Remove the old battery from the socket.

5. Slide a new battery into the socket, with the plus side up.

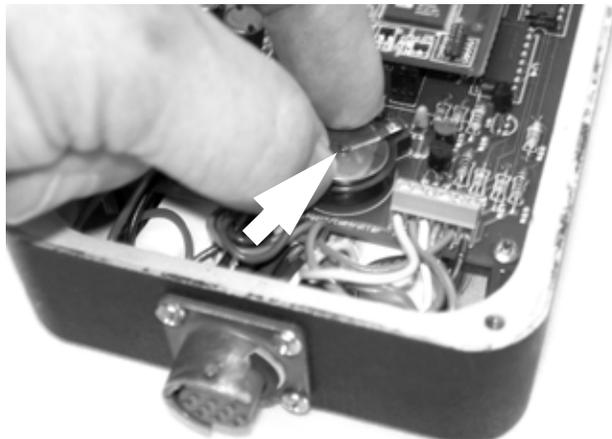


Figure 3-23. Slide the new battery into the socket, with the plus side (+) up.

6. Replace the back cover on the data logger and insert the screws.

PACKAGING

The WAVE™ handheld valve exerciser is shipped and stored in a custom steel case. Figure 3-24 shows the WAVE™ system in the case with the extension handle. Use the storage case to transport your WAVE™ system.



Figure 3-24. WAVE™ handheld system in its storage case.

MACHINE SPECIFICATIONS

Electric Drive Torque Performance

The torque performance in Table 1 is for WAVE™ handheld systems equipped with 110 V electric power. Table Figure 2 presents torque performance for systems with 220 V electric power.

lb-ft (N-m)	High speed/low torque setting		Low speed/high torque setting	
	RPM	AMPS	RPM	AMPS
100 (136)	10	8.6	6	4
200 (271)	8	8	6.5	6
300 (407)	7	11	4	7
375 (509)	6	12	4	8
500 (678)	5	15	4	10
600 (813)			3.6	12
700 (949)			3	12.5
800 (1084)			3	13.5

Table 1: WAVE™ 110 V Electric Power Handheld Torque Performance

Shaded rows are factory rated continuous loads

lb-ft (N-m)	High speed/low torque setting		Low speed/high torque setting	
	RPM	AMPS	RPM	AMPS
100 (136)	10	8.6	6	4
175 (237)	8	8	6.5	6
300 (407)	7	11	4	7
375 (509)	6	12	4	8
500 (678)	5	15	4	10
600 (813)			3.6	12
700 (949)			3	12.5
800 (1084)			3	13.5

Table 2: WAVE™ 220 V Electric Power Handheld Torque Performance

Shaded rows are factory rated continuous loads

Hydraulic Drive Torque Performance

The torque performance in Table 1 is based on hydraulic flow of 8 gpm at 1800 psi. (30 lpm at 124bar).

lb-ft (N-m)	RPM
100 (136)	24
200 (271)	22
300 (407)	20
400 (542)	17
500 (678)	10
600 (813)	8
700 (949)	6
800 (1084)	1

**Table 3: WAVE™
Hydraulic Power Handheld
Torque Performance**

Shaded row is factory
rated continuous load

Pneumatic Drive Torque Performance

The torque performance in Table 1 is based on hydraulic flow of 8 gpm at 1800 psi. (30 lpm at 124

lb-ft (N-m)	RPM
100 (136)	13
200 (271)	11
300 (407)	7
400 (542)	5
500 (678)	4
600 (813)	3
700 (949)	2
800 (1084)	1

**Table 4: WAVE™
Pneumatic Power Handheld
Torque Performance**

Shaded row is factory
rated continuous load

Physical Specifications

Capacity:	Operates all gate valves 6" to 60" (15.3 to 152.4 cm) and other equipment requiring mechanized turning.
Drive:	High durability bronze/steel gear train
Power Requirements:	<p>Electric: options for 110 V 60 Hz; 110 V 50 Hz; 220 V.</p> <p>Hydraulic: 8 gpm (30 lpm) hydraulic flow @ 1800 psi (124 bar).</p> <p>Pneumatic: 90 psi (6.2 bar) air supply at 60 cfm (1,700 lpm).</p>
Peak Torque:	800 lb-ft (1084 N-m)
Motor Control:	<p>Adjustable torque setting valve from 0 to 800 lb-ft with pressure gauge and electronic torque indicator.</p> <p>Reversing valve, spring-loaded self centering automatic stop after release.</p>
Revolution Counter:	<p>Built in electronic counter display; counts in 1/10 revolution increments, forward and reverse automatically.</p> <p>Electronic keypad button reset.</p>
Torque Display	Electronic readout of current and maximum torque, with torque limit display and warning indicator.
Valve Operation	Storage of torque values for 5000
Data Storage:	rotation positions (in increments of 1/10 rotation). Push-button memory reset.
Pressure Gauge:	0 to 800 lb-ft
Finish:	Powder coated casting, nickel plated handles and accessories.

Valve Key Size: 1" square solid (2.54 cm)

Socket: 2" square. AWWA standard (5 cm).

Dimensions: Length: 40" (102 cm)
Width: 7-3/4" (20 cm)
Height: 7-1/4" (18 cm)

Weight: 36 lbs (16 kg)—Electric
40 lbs (18 kg)—Hydraulic
37 lbs (17 kg)—Pneumatic

Storage Case: Length: 42" (107 cm)
Width: 11-1/2" (29 cm)
Height: 8-1/2" (22 cm)

Accessories

Standard Torque arm extension for two operators

Optional

- 8 ft. (244 cm) valve key
- 4 ft. (122 cm) valve key extension
- 2" square AWWA standard ductile iron socket
- Stop collar
- 15/16" drive socket
- Control unit battery charging kit
- VITALS™ controller/data logger
- Cigarette lighter adapter to charge controller/data logger
- VITALS™ 2.0 valve performance analysis software



Chapter 4

Assembly, Disassembly, and Storage

.....

Your WAVE™ handheld valve exerciser is shipped fully assembled from the factory. It is ready to operate as soon as you remove it from its storage case.

Use of some optional equipment requires that you install it onto the WAVE™ system:

- For instructions on transferring data to the VITALS™ data logger, see “Storing and Transferring Data” in Chapter 5.
- For instructions on installing the extension handle, see “Two-Person Operation” in Chapter 5.

ENVIRONMENTAL REQUIREMENTS

Machine operation-4° to 158° F
(-20° to +70° C)

Battery charging 32° to 104° F
(0° to +40° C)

LONG-TERM STORAGE

The WAVE™ handheld system should be kept in its storage case when not in use. Environmental requirements for storage are as follows:

In This Chapter

ENVIRONMENTAL
REQUIREMENTS

LONG-TERM STORAGE

SHIPPING

Machine -22° to 176° F
(-30° to +80° C)

Batteries -4° to 113° F
(-20° to +45° C)

SHIPPING

Before transporting or shipping the WAVE™ handheld system, secure it in its storage case using the fasteners provided. Figure 4-1 indicates the fastener locations.

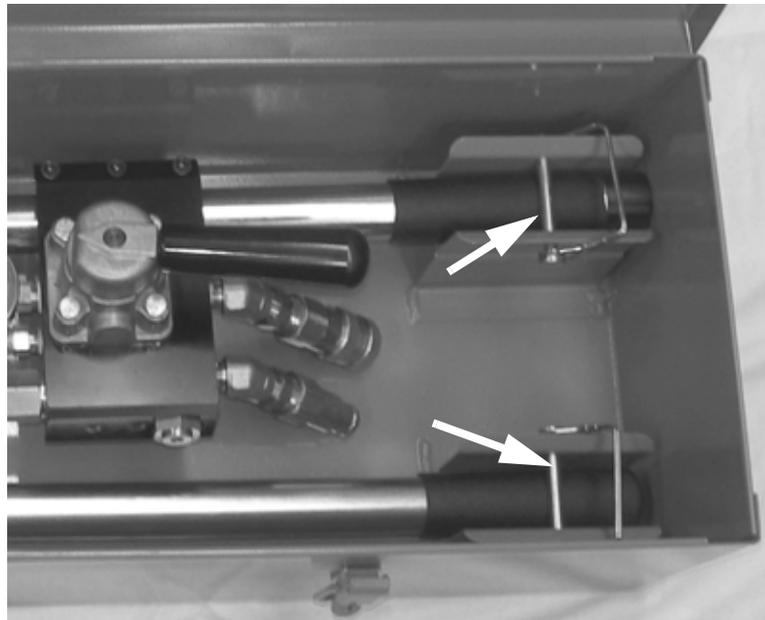


Figure 4-1. Insert the pins to secure the WAVE handheld system and the extension handle into the storage case.

Chapter 5

Operating Instructions

SITE PREPARATION

Select the appropriate length valve key so that the top of the key is at least waist-high when inserted on the valve nut. If necessary, use the optional valve key extension.

Make sure you have a place to stand with sure footing for both feet. If you have the electric drive WAVE™ handheld system, make sure that you are not standing in water when plugging in or operating the machine.

Keep vehicles and any other equipment far enough away so that the handle of the WAVE™ handheld system can rotate around the valve key without obstruction.

In This Chapter

SITE PREPARATION

SET-UP

OPERATION

STORING AND TRANSFERRING DATA

LOGGING DATA MANUALLY

SET-UP

1. Insert the socket onto the end of the valve key and insert the pin.



Figure 5-1. Install the socket onto the end of the valve key and insert the pin through the socket and key.

2. Insert the valve key and socket onto the drive nut on the valve.



Figure 5-2. Put the socket onto the valve nut.

3. Loosen the locking knob on the stop collar and slide the collar to a comfortable working height for the WAVE™ exerciser. Tighten the locking knob.

Typically, the most comfortable height is between your waist and shoulders.





Figure 5-3. Slide the stop collar onto the key and use the set knob to fasten it at an appropriate height.

4. Remove the WAVE™ handheld system from its case and place it on the valve key, as shown in Figure 5-4. Slide the head of the machine down onto the stop collar.



Figure 5-4. Slide the WAVE™ handheld system down onto the valve key and rest it on the stop collar.

WARNING:

The WAVE™ handheld system can produce up to 800 lb-ft (1085 N-m) of torque. To avoid possible injury, always stand so that the torque pulls the handle **away** from your body.



You can operate the WAVE™ handheld exerciser without turning on the control unit. However, you will not be able to monitor torque or rotations, or save any data.



OPERATION

Operator Position

Always stand so that the rotation of the valve pulls the handle of the WAVE™ system away from you. If you are standing on the wrong side of the machine and the valve sticks, the increase in torque can knock you off balance or pin you against an obstacle, causing injury. Refer to the Operator Position label on the handle during use.

When standing on the correct side of the machine, you will always push the power handle away from you. To drive the valve key in a right-hand (clockwise) direction, stand on the motor side of the handle. To drive the valve key in a left-hand (counter-clockwise) direction, stand on the side opposite the motor. Figure 5-5 illustrates the correct operator position.

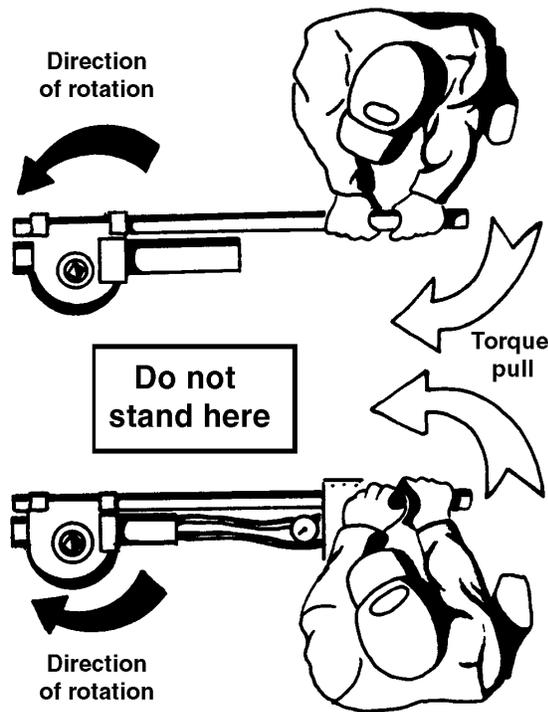


Figure 5-5. The operator should always stand so that the handle of the WAVE™ machine pulls away from his body.

Powering on the System

Electric Drive

1. Plug the power cord into the appropriate electric source (110 V or 220 V).
2. Press the reset button on the ground fault interrupt (GFI) to power up the system.



If the GFI “pops” while operating the machine, reset it and try turning the valve again. If the GFI still pops, switch to the low speed/high torque setting.

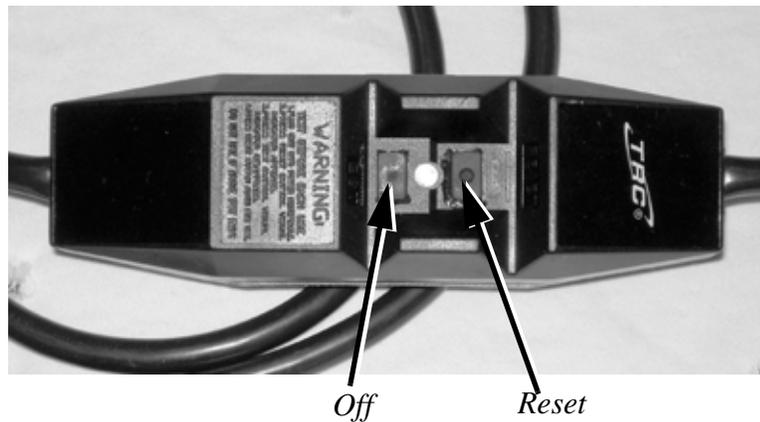


Figure 5-6. Press the reset button on the GFI to power on the electric WAVE handheld.

Hydraulic Drive

1. Connect the hydraulic hoses as shown in Figure 5-7.



Figure 5-7. Attach the return hydraulic hose first. (The photo shows quick-fit connectors installed. These connectors are optional, or you can install your own.)

2. Turn on the WAVE™ control unit by pushing the power button on its side (Figure 5-8). The start-up screen will appear, and then the data display screen will indicate that the control unit is ready.

CAUTION:
Do not connect or disconnect the hydraulic hoses while the machine is operating.





Figure 5-8. Press the power button on the control unit to turn it on.

Pneumatic Drive

1. Connect the air hose to the fitting on the WAVE™ system.
2. Turn on the WAVE™ control unit by pushing the power button on its side (Figure 5-8). The start-up screen will appear, and then the data display screen will indicate that the control unit is ready.



You should use an in-line oiling system with the pneumatic WAVE™ handheld system. Use an antifreeze oil when operating with continuous load and high torque.



Figure 5-9. Press the power button on the control unit to turn it on.

Direction and Torque Control

Electric Drive

1. Set the direction of rotation using the direction control switch on the handle. Push the switch forward (toward the control unit) to set the rotation in the right-hand direction. Push the switch backward to set the rotation in the left-hand direction.

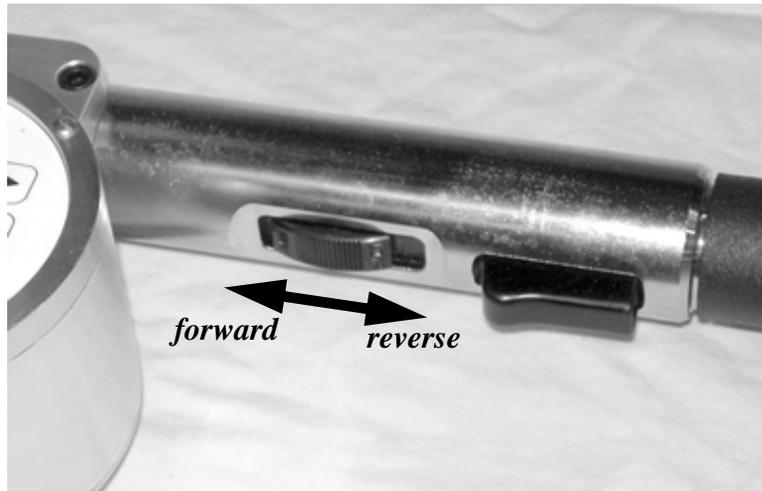


Figure 5-10. Set the direction of rotation using the direction control switch. The forward position sets the rotation in the right-hand direction. The reverse position sets the rotation in the left-hand direction.

You may have to engage the power switch when changing the speed switch setting. Press the power switch briefly while moving the speed switch into the other position. The switch is seated when the screw head retracts into the switch.



2. There are two speed/torque settings on the electric motor. For normal operation, keep the speed switch in the high speed/low torque position (see Figure 5-11). If higher torque is required (for instance, when unseating a valve), use the low speed/high torque setting.

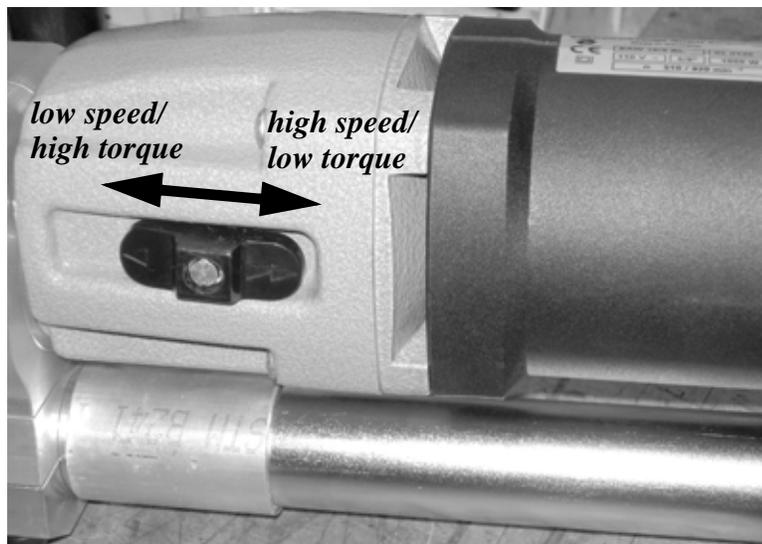


Figure 5-11. The speed switch is on the bottom of the electric motor housing.

- Torque is controlled using the torque control buttons on the control unit. Increase torque with the up arrow, or decrease torque with the down arrow.

Hydraulic Drive

- Direction of rotation is controlled by the power lever. Push the lever toward the handle to rotate the head in the right-hand direction. Push the lever away from the handle to rotate the head in the left-hand direction.



*Forward (right-hand)
direction*



*Reverse (left-hand)
direction*

Figure 5-12. Direction control on the hydraulic powered WAVE™ handheld system.

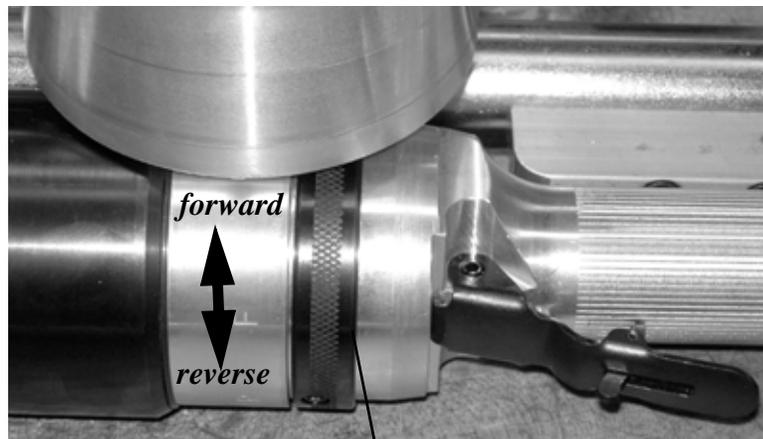
- Torque is controlled using the torque knob on the hydraulic motor. Turn the torque knob counter-clockwise to increase torque. Turn the knob clockwise to decrease torque.



Figure 5-13. Set the torque using the torque controlled knob. Before starting, turn the knob to the lowest torque setting.

Pneumatic Drive

1. Direction of rotation is set by the direction control ring on the air motor. Turn the indicator on the ring to the “F” position (up) to set the rotation to the right-hand direction. Turn the indicator to the “R” position (down) to set the rotation in the left-hand direction.



Direction control ring

Figure 5-14. Setting the direction of rotation on the air motor. Forward is right-hand rotation; reverse is left-hand rotation.

- Torque is controlled using the air valve on the handle. Turn the valve handle out to decrease torque; turn it in to increase torque.

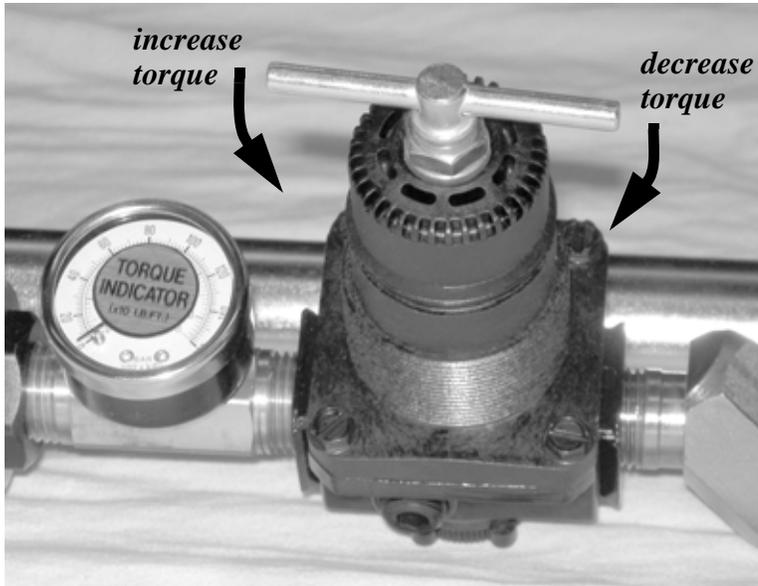


Figure 5-15. Use the air flow valve to adjust the torque.

Starting a New Activity

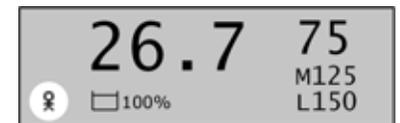
- Press and hold the NEW ACTIVITY button on the control unit for two seconds.



- Check the mode indicator to make sure it is correct for one-person operation. (If you are using the machine in two-person mode, see “Two-Person Operation” later in this chapter.)



The New Activity button resets the revolution count and torque settings to 0. **It also erases the previous activity from memory.** If you need to save the activity data, transfer it to the VITALS™ data logger first.



Control unit screen showing one-person mode.

WARNING:

The WAVE™ handheld system can produce up to 800 lb-ft (1085 N-m) of torque. Make sure you stand so that the torque pulls the handle **away** from your body. Always move to the other side of the machine before reversing the direction of operation.



If you do not know the rotation direction of the valve, see “Logging an Unknown Valve Rotation Direction” later in this section.



Performing the Valve Operation

Before starting, make sure the torque is set to the lowest setting. Be sure to read the “Direction and Torque Control” section in this chapter for instructions on machine control for the power version of your WAVE™ handheld system.

Zeroing the Valve Position

1. Stand on the correct side of the WAVE™ system for the direction you are turning the valve. Refer to the Operator Position label on the handle.
2. Engage the power in the direction you are turning the valve.
3. If the valve does not move, disengage power. Switch position and apply power in the opposite direction.
4. If the valve does not move, increase the torque and apply power again.
5. Continue this process—increasing the torque and applying power in both directions—until the valve stem breaks free.
6. When the valve starts turning, reduce torque to the lowest setting that will keep the machine running.
7. Rotate the valve to the fully open position.



Figure 5-16. Open the valve completely to set the start position.

Exercising the Valve

1. When the valve is fully opened, press the RESET COUNT button. 
2. Set the torque limit to a reasonable value, depending on the size and condition of the valve. Press the up arrow to increase the torque limit. The torque limit setting will increase by 50 units (either lb-ft or N-m) each time you press the button. 
 NOTE: On hydraulic and pneumatic WAVE™ systems, setting the torque limit is optional. Exceeding the torque limit will not stop the machine. You can use the torque limit feature to activate the Over Torque Limit Indicator.
3. Stand in the correct position to rotate the valve in the closing direction.
4. Apply power. Use the minimum torque setting required to keep the valve turning.
5. Watch the Current Torque reading on the control unit screen. As you turn the valve, the torque level will probably increase as loosened debris builds up in the valve gate slides.
6. Turn the valve for about 10 rotations in the closing direction, then disengage power. If the torque limit indicator lights before 10 rotations, disengage power immediately. 



If the valve's manufacturer provides a specification for maximum torque, you can use this value for the torque limit.



To switch torque units between lb-ft and N-m, press the Reset Count and Zero Torque buttons together.

**WARNING:**

Stand so that the torque pulls the handle **away** from your body. Always move to the other side of the machine before reversing the direction of operation.



The WAVE™ control unit will store all forward and reverse motion data. The rotation counter displays absolute rotations from the starting point.

This “back and forth” process allows water flowing through the valve to clear away loosened debris.



10 rotations

Figure 5-17. Drive the valve about 10 rotations in the closing direction.

7. Switch sides and apply power to turn the valve back in the other direction. Turn it for 2-3 rotations.



2-3 rotations

Figure 5-18. Back the valve up 2-3 rotations.

8. Continue this back-and-forth procedure until you reach the end of travel.

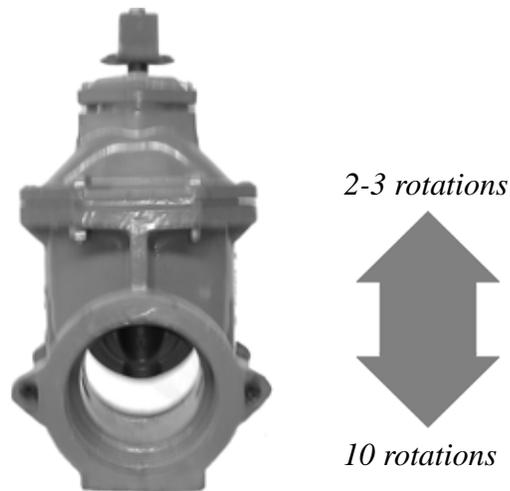


Figure 5-19. Continue driving the valve down. Turn 10 rotations in the closing direction, then 2-3 in the opening direction.

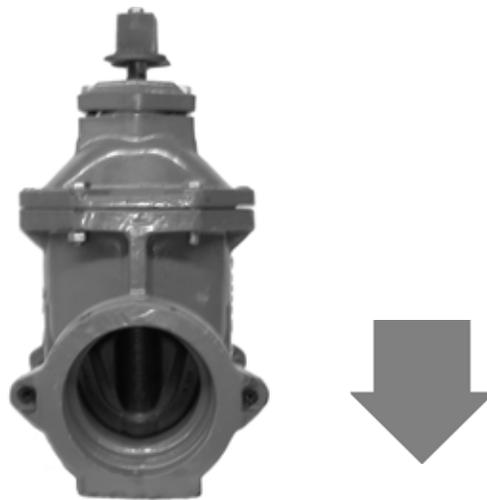


Figure 5-20. Continue until the valve is completely closed, without exceeding the maximum torque setting.

9. Switch sides and back the valve off 2-3 rotations.

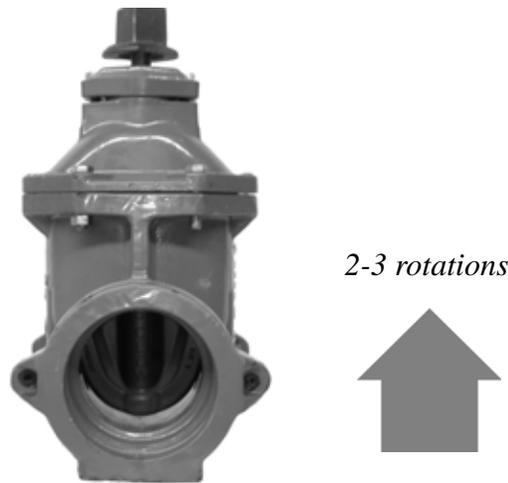


Figure 5-21. Turn the valve back up 2-3 rotations to clear loosened debris.

10. Switch sides and drive the valve back to the end of travel. Repeat the back-and forth motion two more times to make sure all debris is cleared from the slides and the valve is fully seated at the end of travel.

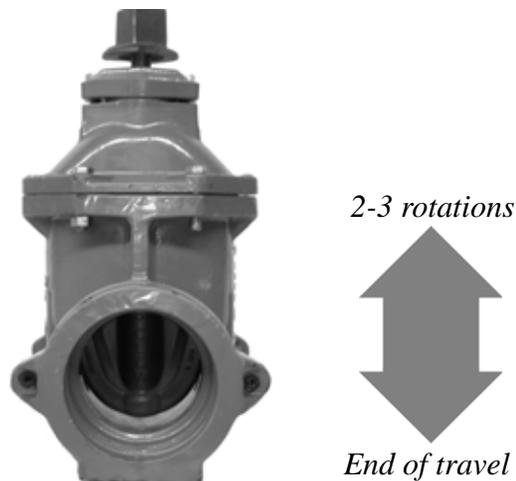


Figure 5-22. Turn the valve up and down two times against the end of travel to fully seat it in the closed position.

Resetting the Valve

1. When you have driven the valve to the end of travel in one direction, press the RESET COUNT button.



2. Start turning the valve back in the other direction. It should operate freely.

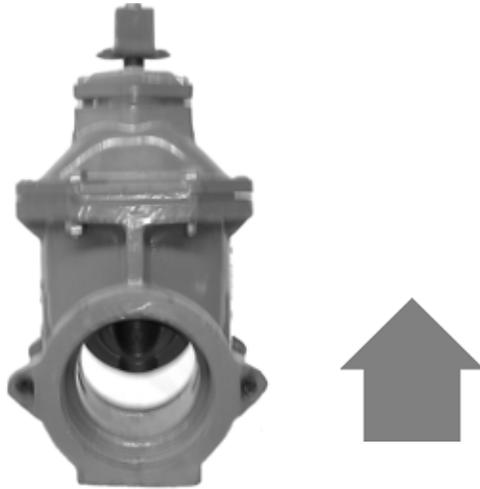


Figure 5-23. Turn the valve continuously in the opening direction.

3. When you approach the opposite end of travel, the torque may begin to increase. If it exceeds the torque limit, use the back-and-forth process to drive the valve to the end of travel.

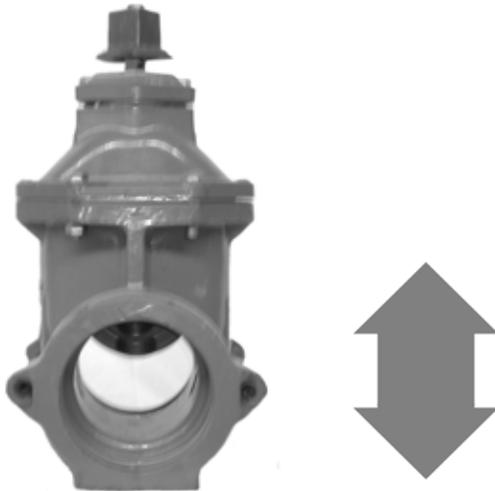


Figure 5-24. If necessary, turn the valve back and forth to loosen it as you approach the end of travel.

4. When you have reached the end of travel, back the valve up 2-3 rotations and drive it to the end again. Repeat this step two more times.

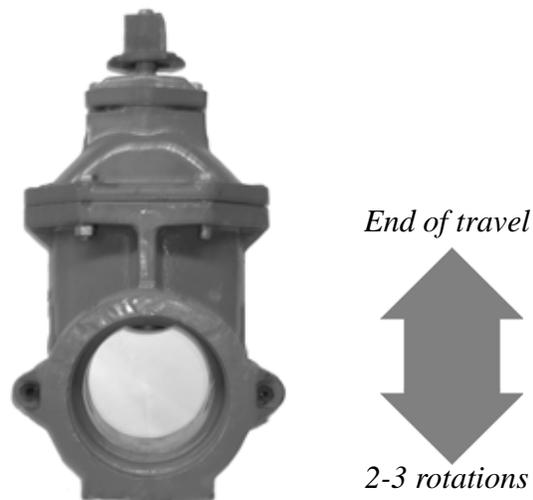


Figure 5-25. Turn the valve up and down two times against the end of travel to fully seat it in the open position.

5. Write down the total number of rotations, or transfer the valve data to the VITALS™ data logger.

Logging an Unknown Valve Rotation Direction

If you do not know the rotation direction for closing the valve, use the following procedure to document the operation.

1. Press the NEW ACTIVITY button and hold it for two seconds until the rotation and torque reading reset to zero. 
2. Select a direction and apply torque at the lowest torque setting.
3. If you feel resistance, stop and reverse direction.
4. If necessary, increase by the torque by turning the torque knob clockwise one-half turn. If you feel resistance, reverse direction again and apply the same amount of torque.
5. Continue this procedure, reversing direction when you feel resistance, until you get the valve turning freely in one direction.

6. Turn the valve to the end of travel in this direction.
7. Document the direction of rotation and number of turns required.
8. Turn the valve back in the opposite direction to its original position (when the revolution counter returns to zero).
9. You can transfer the data to the VITALS™ data logger and record an “UNKNOWN” valve position.

Two-Person Operation

Read the previous sections of this chapter before using the WAVE™ handheld exerciser in two-person mode. This section describes only the procedure for setting up the machine for two-person mode.

1. Insert the extension handle into the side of the WAVE™ head opposite the handle, as shown in Figure 5-26.
2. Insert the attached pin through the handle and extension.

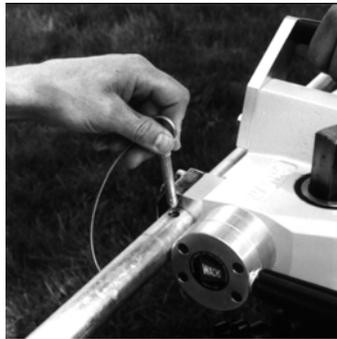


Figure 5-26. Attaching the extension handle.



When the extension handle is attached, the WAVE™ handheld system can be used as a manual “T” wrench.

Torque is measured in the main handle of the WAVE™ handheld system. When two people are operating the machine, this reading is only half the total torque. Putting the control unit in two-person mode doubles the measured torque to accurately display total torque being applied to the valve key.



- The second operator should stand on the opposite side of the machine as the primary operator, as shown in Figure 5-27. The torque should be pulling the handle away from both operators.



Figure 5-27. Operating the WAVE™ handheld system in two-person mode.



Control unit screen showing two-person mode

- Start the valve operation as described under “Starting a New Activity” earlier in this section.
- After pressing the NEW ACTIVITY button, press the MODE button to switch to two-person mode. The mode indicator on the LCD will show the current mode.



STORING AND TRANSFERRING DATA

Using the VITALS™ Data Logger

If you have the optional VITALS™ data logger, you can transfer valve exercising data from the control unit and store it for later analysis. The data logger will hold datasets from up to 100 valve operations (maximum of 3000 turns), allowing you to save data in the field and download it at a convenient time to a PC-based application such as VITALS™ valve performance analysis software.

The VITALS™ data logger fits onto the front of the WAVE™ control unit. Four holes in the back of the data logger align with the four screw heads on the front of the control unit. Data is transferred through the two infrared ports on the face of the control unit to two ports on the back of the data logger.

You can enter valve and operator information on the data logger before you attach it to the WAVE™ control unit.

1. Press and hold the POWER button on the VITALS™ data logger until the power-up screen appears.

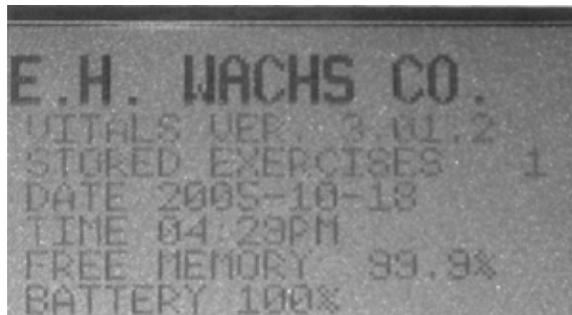


Figure 5-28. VITALS™ data logger power-up screen.

2. Release the power button. The SELECT OPTION screen appears.



The control unit on the WAVE™ handheld system only stores the most recent dataset. Transfer the data to the VITALS™ data logger after each valve operation.



If you are unable to transfer data successfully, the windows on the infrared ports may be dirty. Wipe them clean with a soft, dry cloth and try the transfer again. Clean the ports on both the data logger and the control unit. You can use glass cleaner if necessary. **DO NOT USE SOLVENTS OR OTHER CLEANERS ON THE INFRARED PORT WINDOWS.**

Use the RESUME command to continue completing and storing the last dataset that was in the controller/data logger.



You must select or create a valve ID in order to transfer data. If there are no valve IDs in the list, you must create one on the ENTER VALVE ID screen below.



You can enter new valve IDs at the VITALS™ data logger, or download them to the data logger from a PC using the VITALS™ valve performance software.

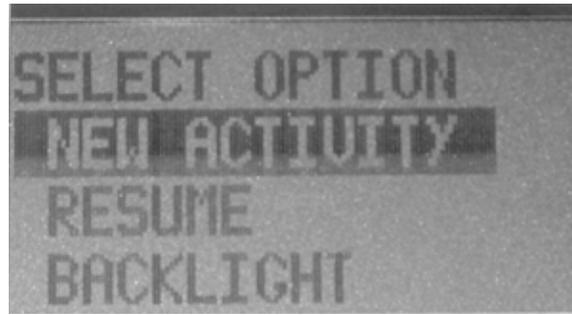


Figure 5-29. SELECT OPTION screen.

3. Use the up or down arrow to highlight NEW ACTIVITY, then press the NEXT button. The SELECT VALVE ID screen appears.

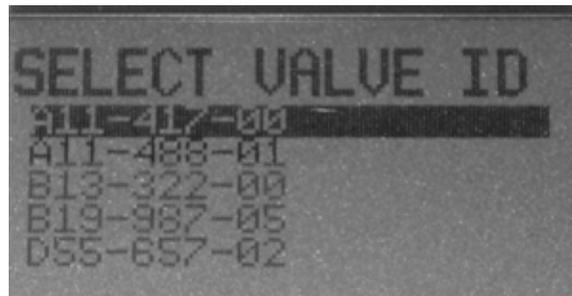


Figure 5-30. SELECT VALVE ID screen

4. Use the up and down arrows to highlight the valve ID. (If you need to create a new valve ID, select any ID in the list.) Press the NEXT button to continue.

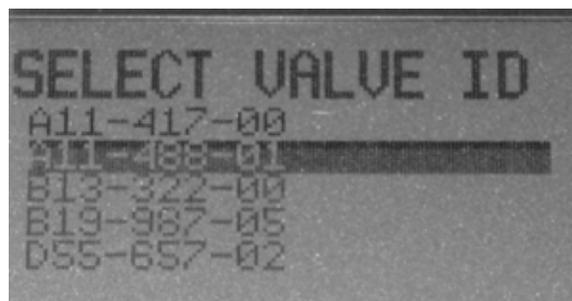


Figure 5-31. Selecting a valve ID

5. The ENTER VALVE ID screen appears.

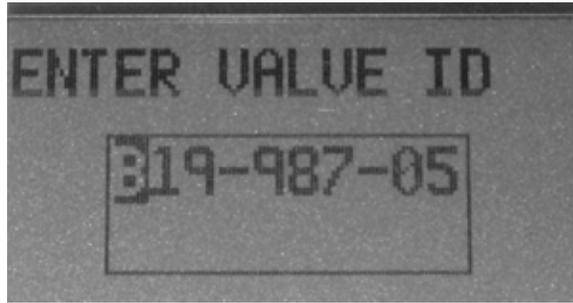


Figure 5-32. ENTER VALVE ID screen

- To continue with the selected valve ID, push the NEXT button.
- To create a new valve ID, edit the ID on the screen. Use the left and right arrows to highlight a character, and use the up and down arrows to change the value of the highlighted character.

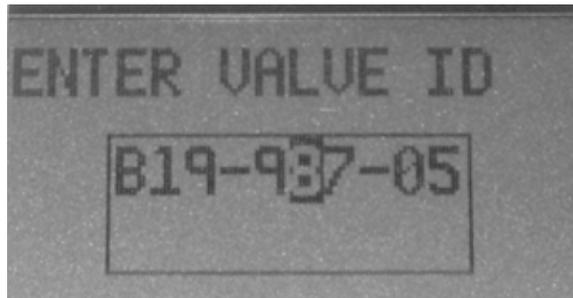


Figure 5-33. Creating a new valve ID

6. When you have edited the valve ID, push the NEXT button. The ENTER OPERATOR screen appears. The most recent operator is displayed.



  Use the left and right arrows to highlight characters.

  Use the up and down arrows to change the value of the current character.

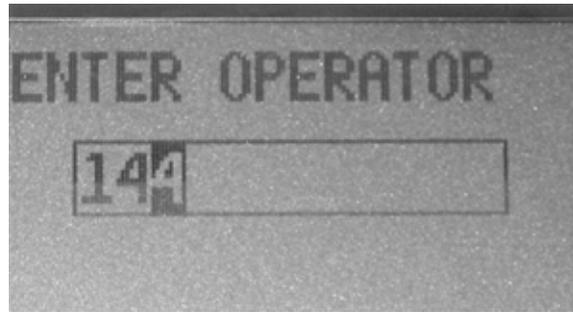


Figure 5-34. ENTER OPERATOR screen

- To continue with the displayed operator, push the NEXT button.
 - To change the operator, edit the operator ID on the screen. Use the left and right arrows to highlight a character, and use the up and down arrows to change the value of the highlighted character. Push the NEXT button when you are finished.
7. The DOWNLOAD screen appears. The data logger is now ready to download data from the WAVE™ system.



Figure 5-35. DOWNLOAD screen

Make sure the WAVE™ control unit is powered on before you connect the data logger.



8. Align the data logger in the same direction as the control unit, as shown in Figure 5-36. Four holes in the back of the data logger fit onto the four screw heads on the front of the control unit.

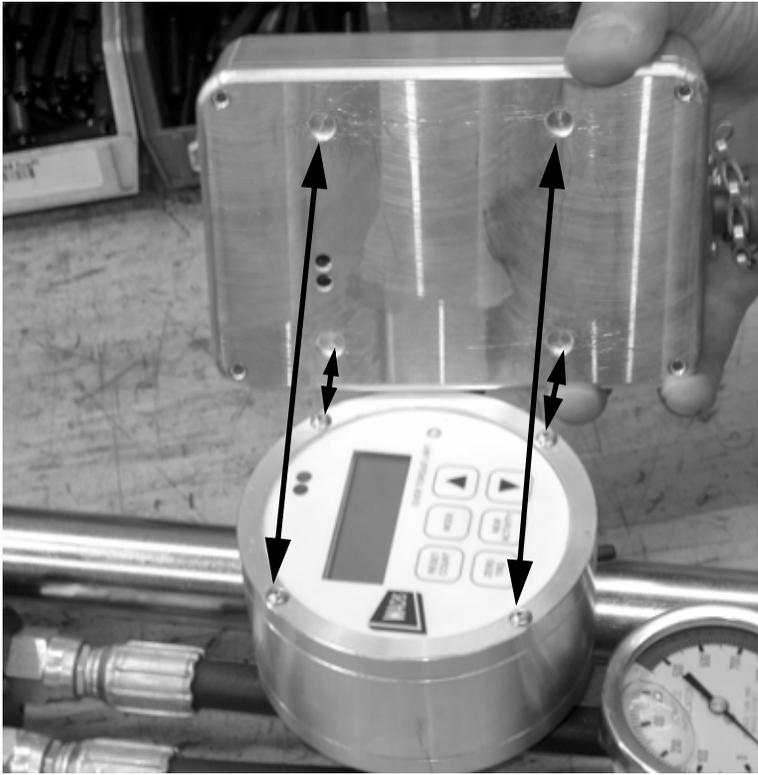


Figure 5-36. Aligning the VITALS™ data logger with the WAVE™ handheld control unit. The four holes in the back of the data logger fit onto the screws on the face plate of the control unit.

9. Set the data logger onto the control unit and hold it firmly in place while performing the download.



Figure 5-37. Downloading data to the data logger.

If you did not select a valve ID at the beginning of the data transfer, you will have to go back (using the left arrow button) to the ENTER VALVE ID screen and create a valve ID. You can then go forward (with the right arrow button) to this point. All data will be saved.



10. Press the right arrow button. The RETRIEVING DATA screen will appear while data is downloaded to the data logger.

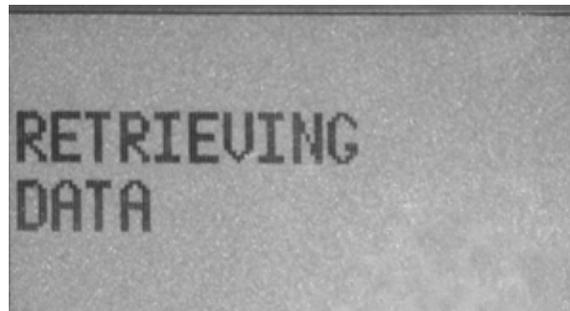


Figure 5-38. RETRIEVING DATA screen

11. When the data transfer is finished, the TURNS data screen appears with the number of turns recorded. Push the NEXT button to continue.

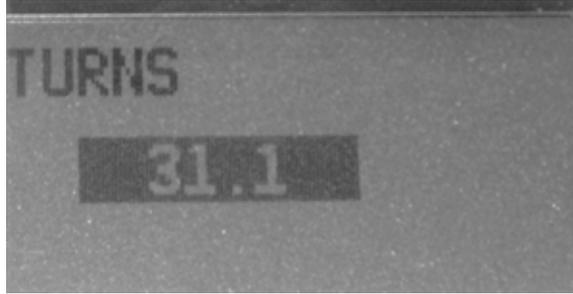


Figure 5-39. TURNS data screen

12. The MAX TORQUE data screen appears with the maximum torque value recorded. Push the NEXT button to continue.



Figure 5-40. MAX TORQUE data screen

13. The VALVE POSITION screen appears. Use the up and down arrows to highlight the position the valve was left in. Push the NEXT button to continue.



If the data logger returns to the "PRESS > TO DOWNLOAD" screen, the data transfer was unsuccessful. Reposition the data logger on the control unit and try the transfer again.



If there is no TURNS or MAX TORQUE data in the data set from the WAVE™ handheld (or if you turned the valve manually), you can enter TURNS and MAX TORQUE values manually. Use the up arrow on the keypad to increment the values on each screen.



Use the up and down arrows to select the valve position.

Remarks can be defined using the VITALS™ valve performance analysis software and downloaded to the data logger.



 Use the up and down arrows to highlight remarks.

 Use the right arrow to select the highlighted remark.

A separate cable (Wach part no. 17-234-00) is required to connect a GPS receiver to the data logger.



You can turn off the READING GPS feature. Press the MENU button and scroll down to the ENABLE GPS command; press NEXT and then select the OFF option.

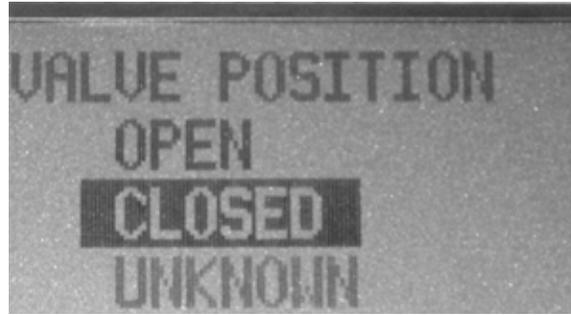


Figure 5-41. VALVE POSITION screen

14. The REMARKS screen appears. Use the up and down arrows to highlight remarks. Press the right arrow button to select the currently highlighted remark. You can select up to 10 remarks for an activity. Selected remarks are indicated with an asterisk (*). When you are finished selecting remarks, push the NEXT button to continue.

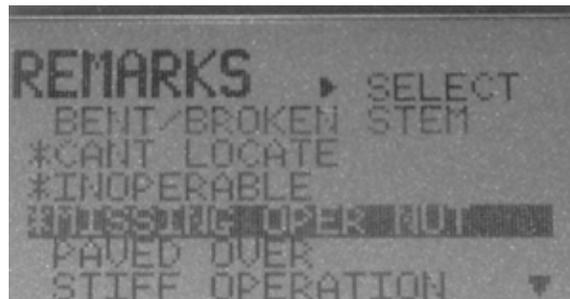


Figure 5-42. REMARKS screen. Selected remarks are indicated by asterisks (*).

15. The READING GPS screen appears. If you are storing GPS data and have not yet connected your GPS receiver to the data logger, connect it now.
- If you are not storing GPS data, press the NEXT button and skip to step 17.

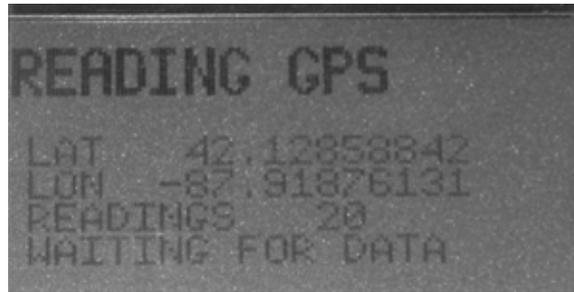


Figure 5-43. *READING GPS* screen, showing readings for latitude and longitude. (*READINGS* is the number of GPS data samples integrated by the data logger.)

16. The data logger and GPS receiver will take about 30-60 seconds to synchronize. When the values for latitude and longitude appear on the data logger screen, press the NEXT button to continue. 
17. The **PRESS > TO STORE** screen appears. Push the right arrow button to save the dataset. The data logger will return to the **SELECT VALVE ID** screen. 



The data logger will continue receiving GPS data until you press the NEXT button. However, only the first 99 readings will be averaged.

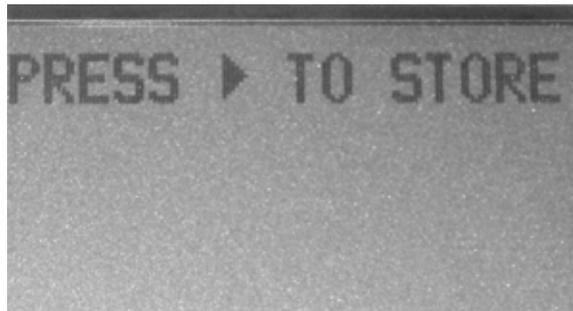


Figure 5-44. *PRESS > TO STORE* screen

You can download
a copy of the log
sheet from our
website at
www.ehwachs.com.



LOGGING DATA MANUALLY

If you are logging valve operations manually, a valve exercising log sheet is provided in Appendix A.

Chapter 6

Routine Maintenance

WAVE™ GEARBOX LUBRICATION

Once a month, check the oil level in the gearbox.

1. Lay the WAVE™ handheld system upside down, as shown in Figure 6-1.
2. Using a 3/16" hex wrench, remove the filler plug and vent hole plug, as shown in Figure 6-1.

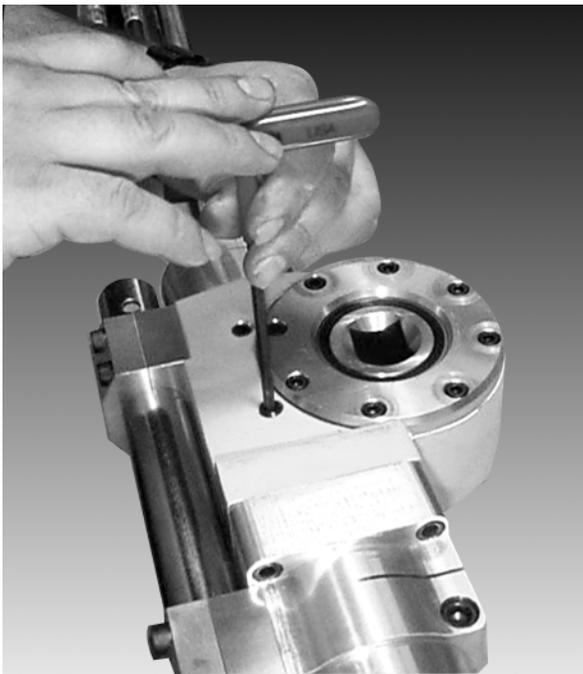


Figure 6-1. Removing the filler and vent plugs.

In This Chapter

GEARBOX LUBRICATION

CALIBRATING THE TORQUE
SENSOR

The maximum capacity of the gearbox is 5 oz (148 ml).



The recommended oil is 123 Kent Gear Oil with Moly (90 wt.), part no. 02-401-00.

3. Look into either hole to check the oil level. Oil should be visible in the hole.
4. If no oil is visible, pour oil into either hole until you can see oil in the other hole. See Figure 6-2.



Figure 6-2. Adding oil to the gearbox.

5. Replace both plugs.

CALIBRATING THE TORQUE SENSOR

Normally, the torque sensor will not need to be recalibrated. However, if the handle has been over-extended, the sensor may become mis-calibrated. (If this has happened, the “Current Torque” reading on the control unit display screen will not return to 0 when you press the RESET TORQUE button.)

Calibration of the sensor is a factory service procedure. See Chapter 10, Ordering Information, for requesting factory service.

Chapter 7

Service and Repair

MECHANICAL PROBLEMS

PROBLEM: There is fresh oil in the bottom of the storage box or on the gear head of the machine.

CAUSE: An oil seal in the gear head is leaking. There are seals on the top and bottom of the head. You can replace them if you have machine press equipment to insert the new seal. Otherwise, return the machine for factory service.

Oil seals are part number 05-014-00.

1. Using a small flat-blade screwdriver, pry out the leaking seal. You may have to pry alternately on opposite sides of the seal to remove it.



Figure 7-1. Pry out the old oil seal with a flat-blade screwdriver.

In This Chapter

MECHANICAL PROBLEMS

ELECTRICAL PROBLEMS

2. Select a press fitting that fits snugly inside the new seal, and the appropriate sleeve for the fitting.
3. Lay the WAVE™ system on a solid workbench or other level surface and put the press fitting in place.



Figure 7-2. Put the press fitting in place over the bearing.

4. Slide the seal down over the fitting, with the flat side of the seal facing up.



Figure 7-3. Slide the seal down onto the fitting.

5. Slide the sleeve over the press fitting.



Figure 7-4. Put the appropriate sized sleeve over the press fitting onto the top of the seal.

6. Tap the sleeve down onto the seal with a hammer until the sleeve is flush with the machine surface.



Figure 7-5. Tap the seal into place with a hammer until the sleeve is flush against the housing.

PROBLEM: The current torque reading on the WAVE™ control unit doesn't go to zero when you press the Reset Torque button.

CAUSE: The torque sensor is mis-calibrated. You can return the WAVE™ machine to the factory for calibration. (See Chapter 10 for ordering information.)

ELECTRICAL PROBLEMS

PROBLEM: The control unit screen displays nonsense characters.

CAUSE: The control unit may have lost battery power. If you have valve operation data you want to save, transfer it immediately to the VITALS™ data logger.

1. Press and hold the NEW ACTIVITY button for two seconds. The screen should return to normal.
2. If pushing the NEW ACTIVITY button does not correct the problem, power the control unit off and then power it on again.

PROBLEM: Valve operation data is being lost before you can transfer it to the VITALS™ data logger.

CAUSE: The memory backup battery is running dead. Replace the battery using the following procedure.

3. If the control unit is on, turn off power to it:
 - On electric powered systems, press the OFF button on the GFI.

Data stored in the control unit will be lost when you remove the battery. Transfer any data you need to the VITALS™ data logger before turning off the control unit.

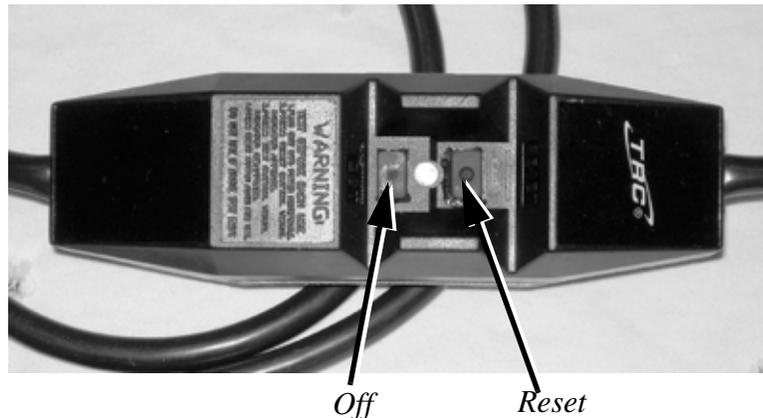


Figure 7-6. Press the Off button on the GFI to power down the electric WAVE handheld.

- On hydraulic and pneumatic systems, press the power switch on the side of the control unit.



Figure 7-7. Control unit power switch (hydraulic and pneumatic systems only). Press the button and release it to toggle the control unit on and off.

4. Remove the 4 screws on the face plate of the control unit.



Figure 7-8. Remove the screws on the control unit face plate to open the control unit.

5. Carefully remove the face plate and turn it over to access the circuit board inside the control unit. The battery is in a socket mounted on the circuit board, as shown in Figure 7-9.



Use a 5/64" hex wrench to turn the screws.



CAUTION:
Make sure the control unit is turned off before opening it.

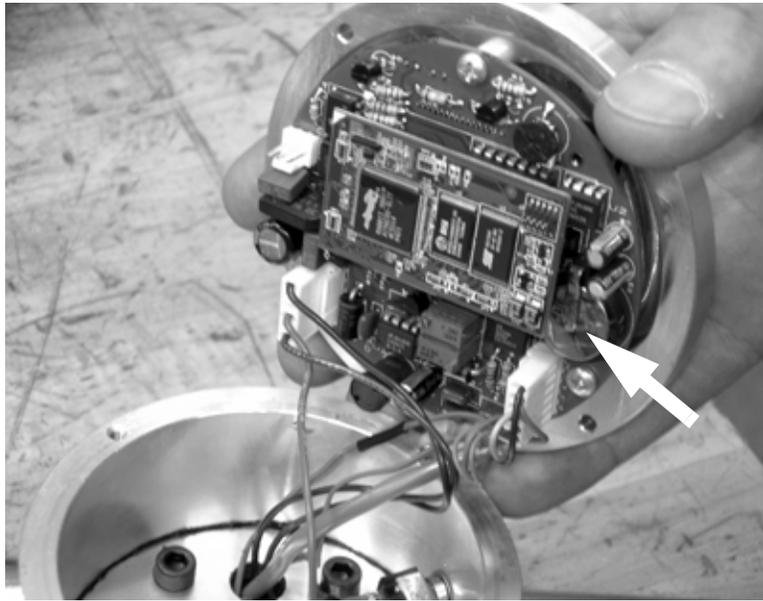


Figure 7-9. The replaceable battery is mounted in a socket on the control unit circuit board.

CAUTION:

Do not touch any other components on the circuit board, or use any metallic tools.



Use a standard CR1632 3 V (or equivalent) watch battery.



6. Using your fingernail or a non-metallic tool, remove the battery from the socket.



Figure 7-10. Remove the old battery from the socket.

7. Press a new battery into the socket, with the plus side facing up.



Figure 7-11. Slide the new battery into the socket, with the plus side (+) up.

8. Replace the face plate on the control unit and insert the screws.

PROBLEM: The VITALS™ data logger loses settings or data when it is powered off.

CAUSE: The memory backup battery is running dead. Replace the battery using the following procedure.

9. If the data logger is on, turn off power using the power button. 
10. Remove the 4 screws on the back of the data logger.
11. Carefully remove the back cover and turn it over to access the circuit board inside the data logger. The battery is in a socket mounted on the circuit board, as shown in Figure 7-12.

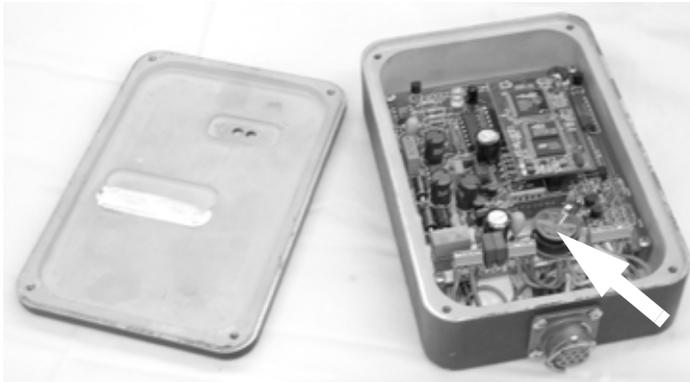


Figure 7-12. The memory battery is in a socket on the circuit board.

12. Using your fingernail or a non-metallic tool, remove the battery from the socket.



Some WAVE™ units have gaskets and some have silicone sealer. Make sure you put on the gasket or re-apply the sealer when replacing the face plate.



Any data stored in the data logger will be lost when you remove the battery. If you need to keep data stored in the data logger, transfer it to your PC before removing the battery.



Use a 5/64" hex wrench to turn the screws.



CAUTION: Do not touch any other components on the circuit board, or use any metallic tools.

Use a standard CR1632 3 V (or equivalent) watch battery.

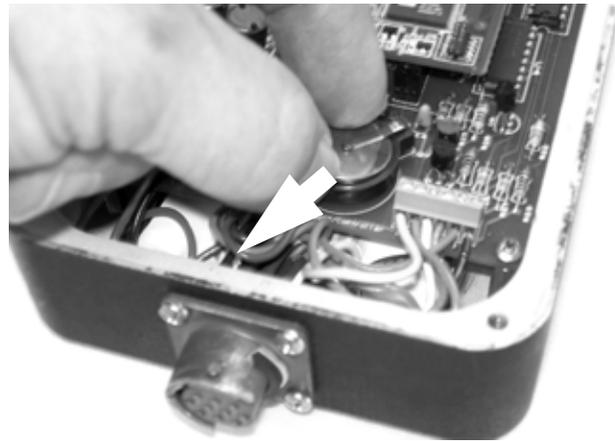


Figure 7-13. Remove the old battery from the socket.

13. Slide a new battery into the socket, with the plus side up.

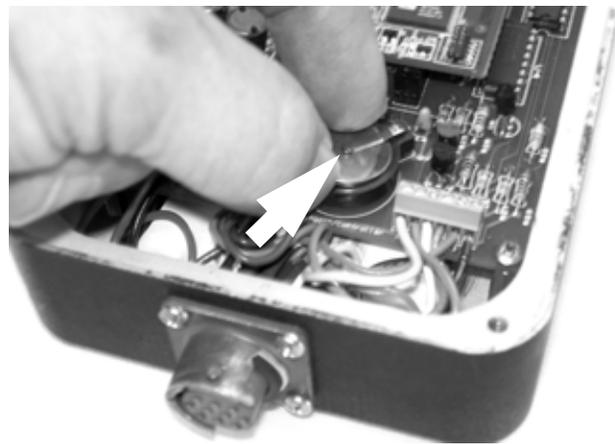


Figure 7-14. Slide the new battery into the socket, with the plus side (+) up.

14. Replace the back cover on the data logger and insert the screws.

CAUTION:
Make sure you re-install the gasket before replacing the cover.



PROBLEM: The control unit battery does not fully charge (the battery indicator won't go to 100%), or it loses its charge quickly.

CAUSE: The battery needs to be replaced. Contact E.H. Wachs Company to arrange for factory service. (See Chapter 10 for ordering information.)

Chapter 8

Parts Lists and Drawings



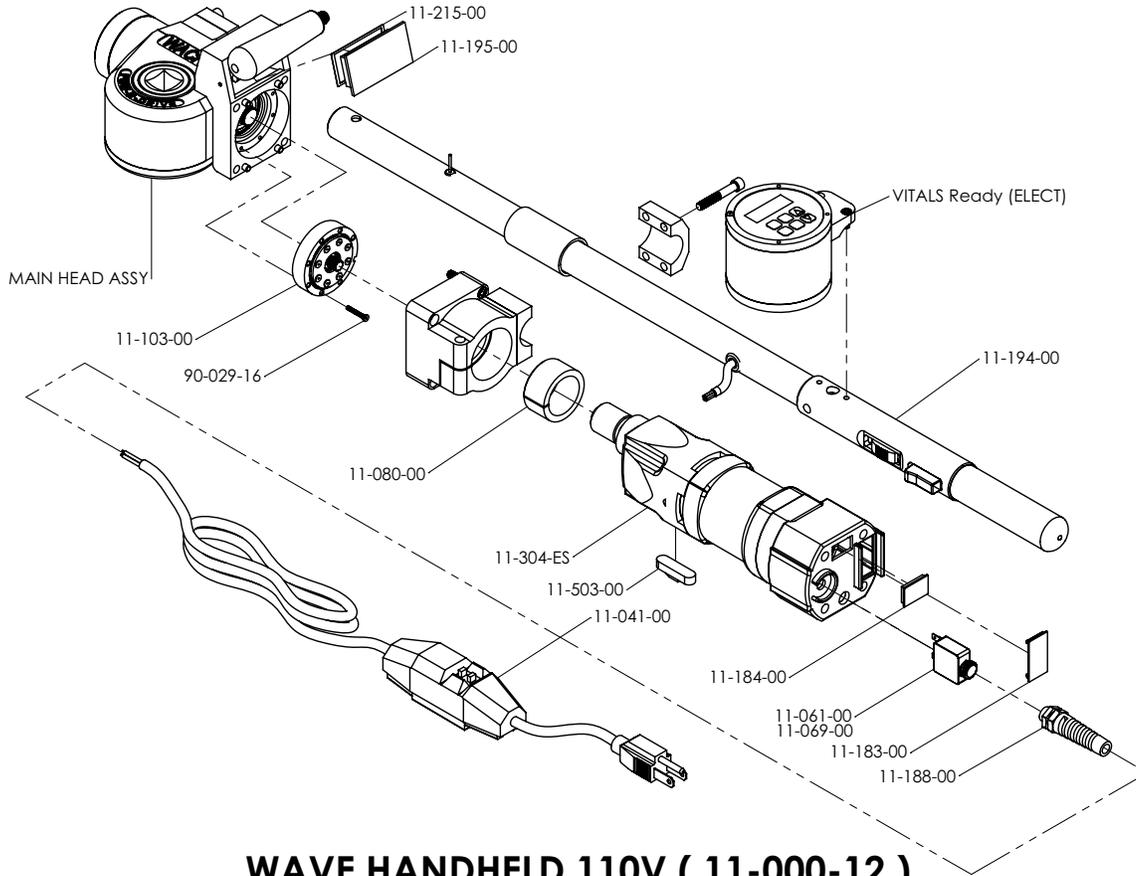
Refer to the parts lists and associated drawings in this chapter for ordering and maintenance.

There are separate sets of drawings with BOMs for the electric, hydraulic, and pneumatic versions of the WAVE™ handheld exerciser. There is also a section of this chapter for common assemblies, which are the same for versions of the machine.

In This Chapter

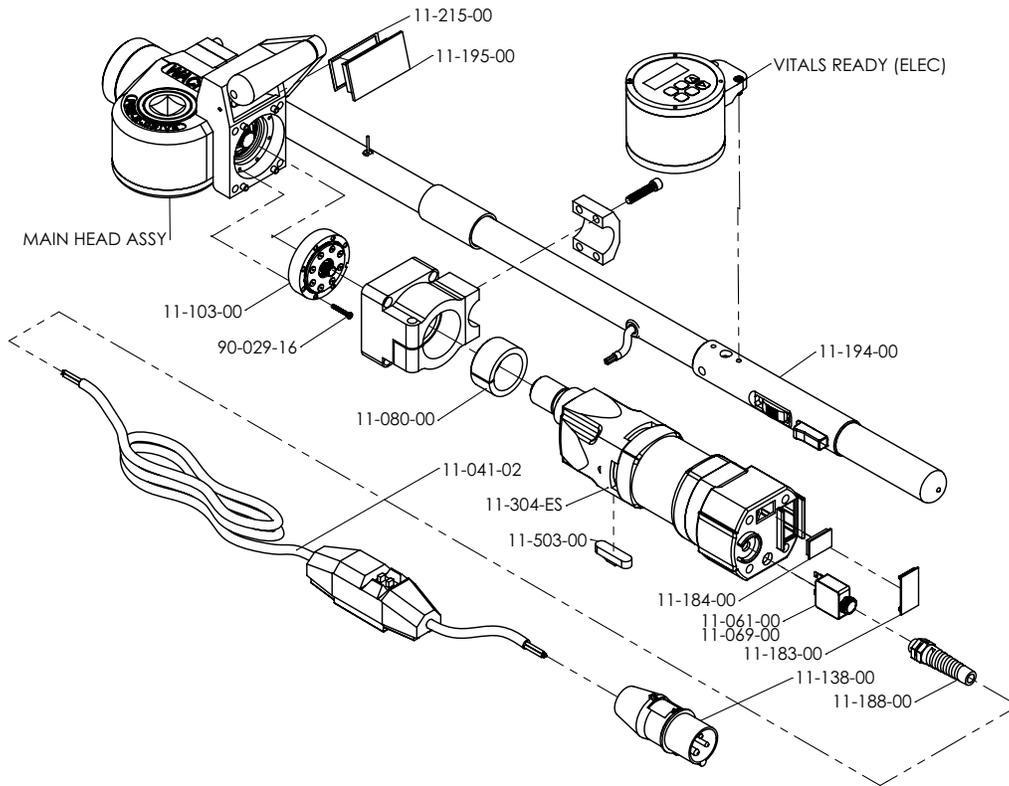
ELECTRIC DRAWINGS/BOMS
HYDRAULIC DRAWINGS/BOMS
PNEUMATIC DRAWINGS/BOMS
COMMON ASSEMBLIES

ELECTRIC SYSTEM ASSEMBLIES



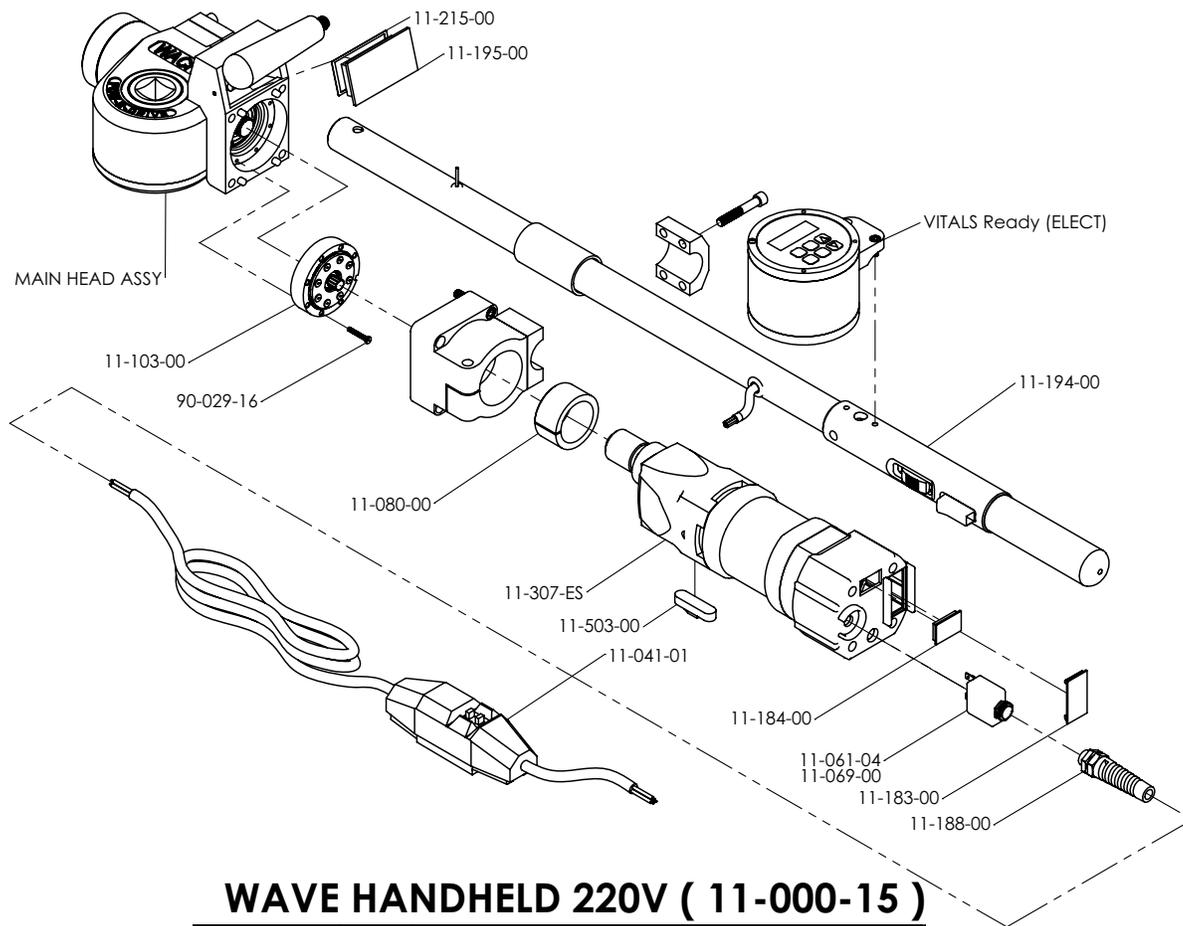
WAVE HANDHELD 110V (11-000-12)

Part No.	Qty.	Description
11-041-00	1	Gfi, 110v
11-061-00	1	Breaker, 8 Amp
11-069-00	1	Label, Gfi Reset
11-080-00	1	Bushing
11-103-00	1	Gear, Planetary
11-183-00	1	Plate, Blanking
11-184-00	1	Plate, Blanking
11-188-00	1	Relief, Strain
11-195-00	1	Plate, Blanking
11-215-00	1	Gasket
11-304-ES	1	110v Assy,Eibenstock
11-400-00	1	Case, Storage NOT SHOWN
11-501-00	2	Brush, Eibenstock 16/2 R/L NOT SHOWN
11-503-00	1	Switch, Gear
11-MAN-02	1	Manual NOT SHOWN
90-029-16	7	LHCS, 8-32 X 1
90-042-06	1	BHCS, 10-32 X 3/8 NOT SHOWN
90-501-01	1	Terminal, Ring #10 18-14GA NOT SHOWN
90-501-42	1	Terminal, Bullet-M 16GA NOT SHOWN
90-501-49	2	Terminal, Flag 1/4 16-14 GA INSULATI NOT SHOWN



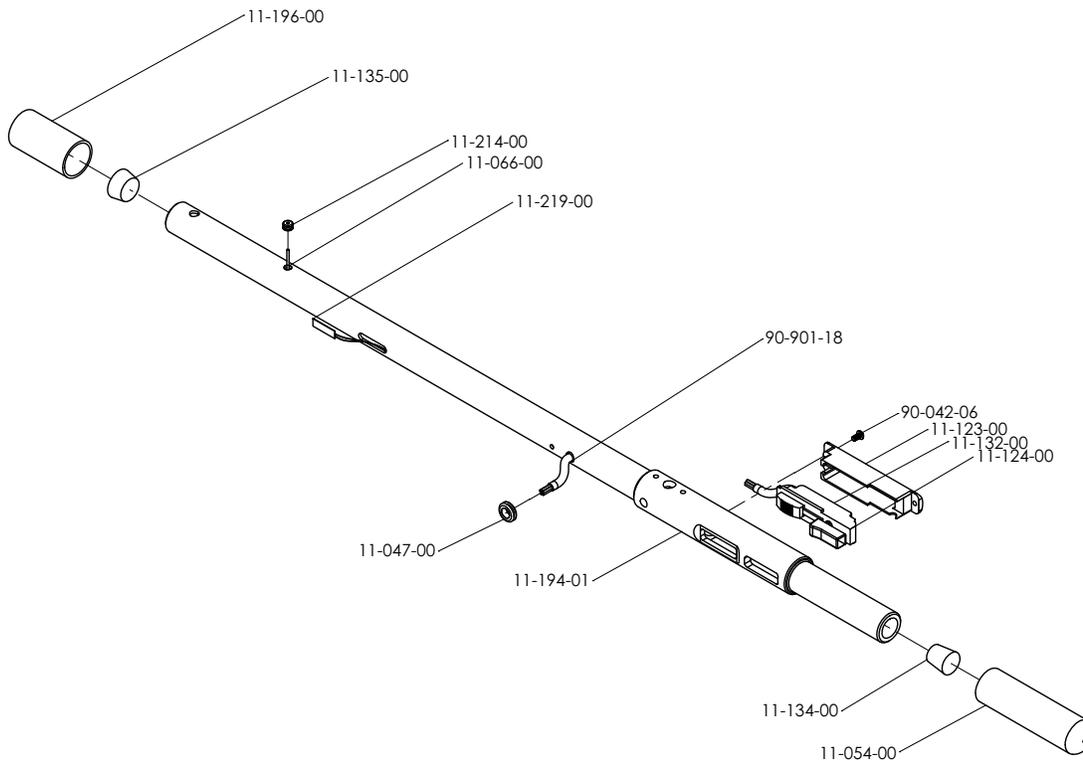
WAVE HANDHELD 110v U.K. (11-000-16)

Part No.	Qty.	Description
11-041-02	1	GFI, 110v (EXPORT)
11-061-00	1	Breaker, 8 AMP
11-069-00	1	Label, GFI Reset
11-080-00	1	Bushing
11-103-00	1	Gear, Planetary
11-138-00	1	Plug, U.K.
11-183-00	1	Plate, Blanking
11-184-00	1	Plate, Blanking
11-188-00	1	Relief, Strain
11-195-00	1	Plate, Blanking
11-215-00	1	Gasket
11-304-ES	1	110v Assy, Eibenstock
11-400-00	1	Case, Storage NOT SHOWN
11-501-00	2	Brush, Eibenstock 16/2 R/L NOT SHOWN
11-503-00	1	Switch, Gear
11-MAN-02	1	Manual NOT SHOWN
90-029-16	7	LHCS, 8-32 THD. X 1" LNG.
90-501-01	1	TERMINAL, RING #10 16-14GA, NOT SHOWN
90-501-42	4	TERMINAL, BULLET-M 16GA, NOT SHOWN
90-501-43	4	TERMINAL, BULLET-F 16GA, NOT SHOWN
90-501-49	2	TERMINAL, FLAG 1/4 16-14 GA INSULATED, NOT SHOWN



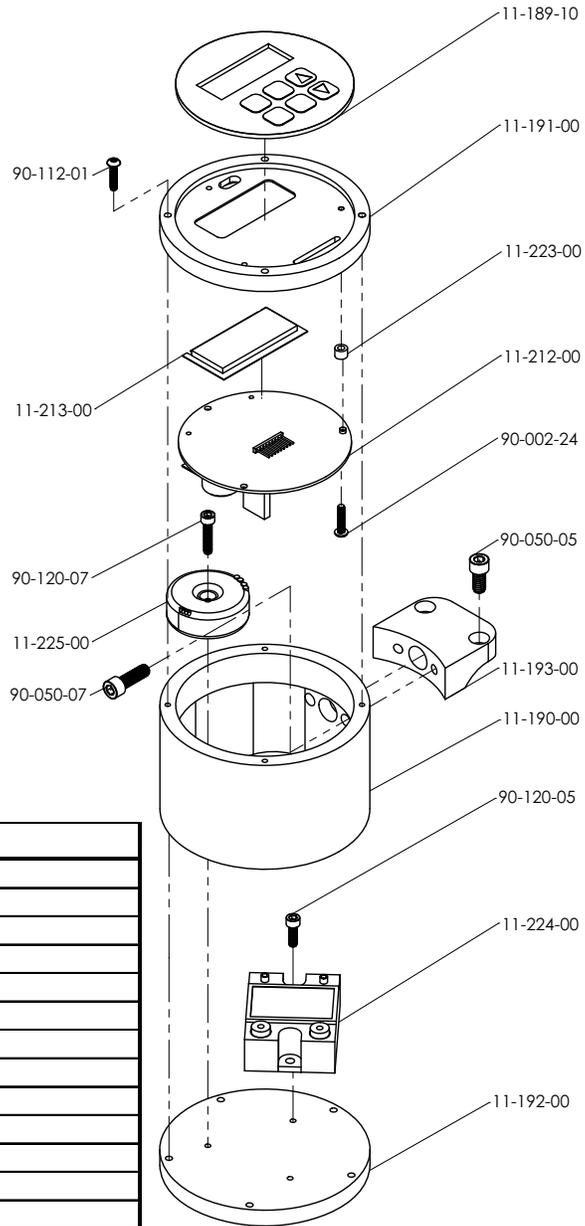
WAVE HANDHELD 220V (11-000-15)

Part No.	Qty.	Description
11-041-01	1	Gfi, 240v
11-061-04	1	Breaker, 4 Amp
11-069-00	1	Label, Gfi Reset
11-080-00	1	Bushing
11-103-00	1	Gear, Planetary
11-183-00	1	Plate, Blanking
11-184-00	1	Plate, Blanking
11-188-00	1	Relief, Strain
11-195-00	1	Plate, Blanking
11-215-00	1	Gasket
11-307-ES	1	220v Assy, Eibenstock
11-400-00	1	Case, Storage NOT SHOWN
11-MAN-02	1	Manual NOT SHOWN
11-501-00	2	Brush, Eibenstock 16/2 R/L NOT SHOWN
11-503-00	1	Switch, Gear
90-029-16	7	LHCS, 8-32 X 1
90-042-06	1	BHCS, 10-32 X 3/8 NOT SHOWN
90-501-01	1	Terminal, Ring #10 18-14GA NOT SHOWN
90-501-42	1	Terminal, Bullet-M 16GA NOT SHOWN
90-501-43	4	TERMINAL, BULLET-F 16GA NOT SHOWN
90-501-49	2	Terminal, Flag 1/4 16-14 GA INSULATI NOT SHOWN



HANDLE, ELECTRIC - ASSEMBLY (11-194-00)

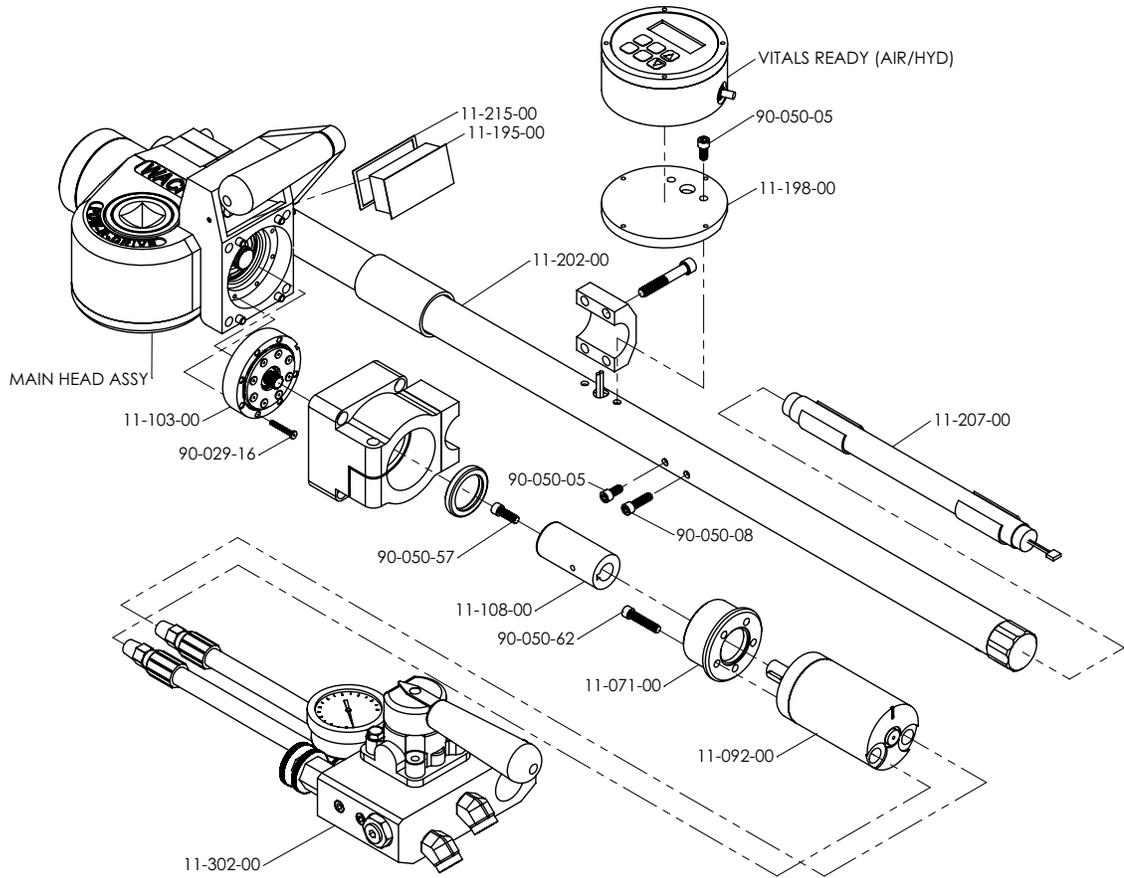
Part No.	Qty.	Description
11-047-00	1	Grommet, 7/16 ID x 9/16 Grip OD x 1/8 Grip Thk
11-054-00	1	Grip, Rubber
11-066-00	35"	WIRE, BELL 3-WIRE
11-123-00	1	Housing, Switch
11-124-00	1	Switch, Modified
11-132-00	6	Terminal, End
11-134-00	1	Plug, #4 Rubber
11-135-00	1	Plug, #6 Rubber
11-194-01	1	Weldment, Switch Handle - DT
11-196-00	1	Cover, Strain Gages
11-214-00	1	Grommet, 3/16 IDx 5/16 Grip OD x 1/8 Grip Thk
11-219-00	2	Strain Gauge
90-042-06	2	BHCS, 10-32 X 3/8
90-501-01	3	TERMINAL, RING #10 16-14GA NOT SHOWN
90-501-04	1	TERMINAL, Closed End 16-20 GA Insulated NOT SHOWN
90-501-14	1	TERMINAL, RING 1/4 YEL NOT SHOWN
90-501-17	1	TERMINAL, Spade .250 Female 2-10 GA Insulated NOT SHOWN
90-501-19	1	TERMINAL, Flag .250 12-10 Insulated NOT SHOWN
90-501-42	3	TERMINAL, BULLET-M 16GA NOT SHOWN
90-501-49	1	TERMINAL, FLAG 1/4 16-14 GA INSULATED NOT SHOWN
90-501-50	1	TERMINAL, SPADE 1/4" MALE 16 AWG INSULATED NOT SHOWN
90-901-18	20"	Wire, 16 GA 10 Cond. Cable



VITALS READY - (ELECTRIC)

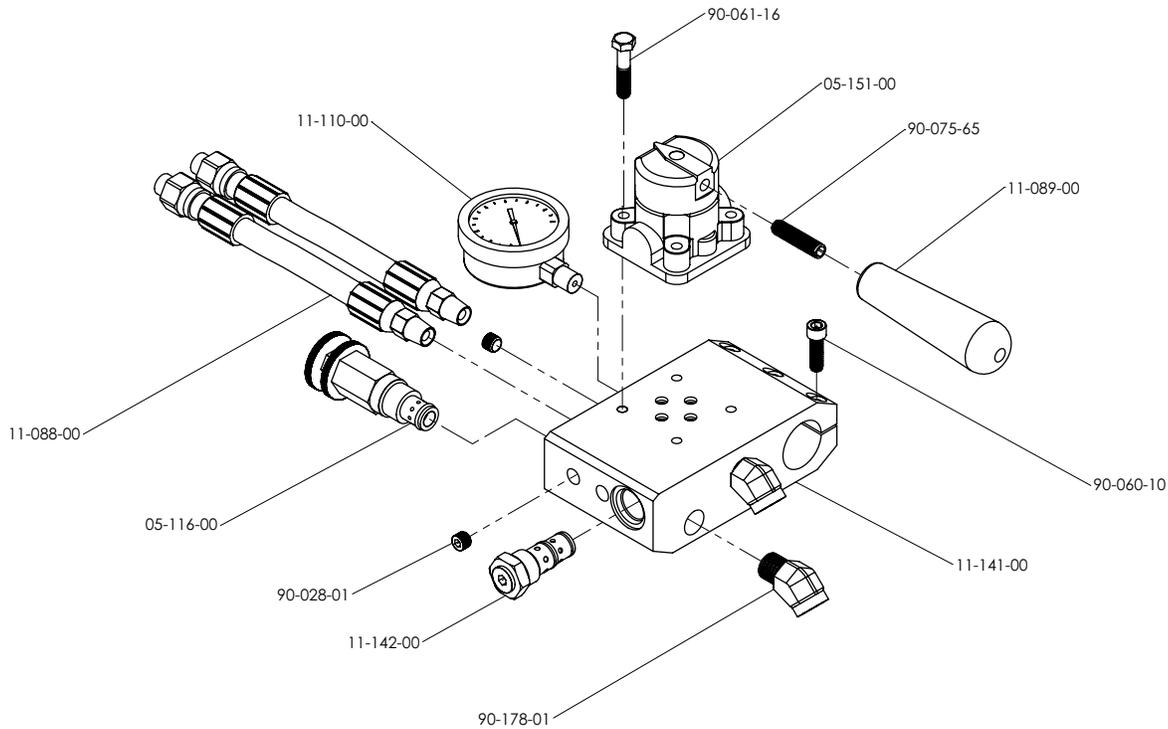
Part No.	Qty.	Description
11-100-00	1	Holder, Fuse NOT SHOWN
11-101-00	1	Fuse, 1/2 AMP NOT SHOWN
11-153-00	1	CPU, P2 VITALS NOT SHOWN
11-189-10	1	Keypad, P2-DT
11-190-00	1	Housing, Controller
11-191-00	1	Cover, Top
11-192-00	1	Plate, Cover
11-193-00	1	Bracket
11-212-00	1	Board, Round Control
11-213-00	1	Display Assembly
11-220-00	2	Connector, 6 Plc NOT SHOWN
11-221-00	1	Connector, 3 plc NOT SHOWN
11-222-00	15	Terminal NOT SHOWN
11-223-00	3	Stand Off
11-224-00	1	Relay
11-225-00	1	Transformer
90-002-24	3	PHMS, 6-32 x 7/16 - Phillips
90-050-05	2	SHCS, 1/4-20 X 1/2
90-050-07	2	SHCS, 1/4-20 X 3/4
90-112-01	9	BHCS, 6-32 x 5/8 - SS
90-120-05	2	SHCS, 8-32 X 1/2 - SS
90-120-07	1	SHCS, 8-32 X 3/4 - SS
90-501-36	2	Terminal, Buttsplice 16-14 GA NOT SHOWN
90-901-12	4"	Wire, 22 GA Red NOT SHOWN
90-901-21	4"	Wire, 22 GA Black NOT SHOWN
90-901-22	4"	Wire, 22 GA White NOT SHOWN
90-901-23	4"	Wire, 22 GA Yellow NOT SHOWN

HYDRAULIC ASSEMBLY DRAWINGS



Wave Handheld Hyd (11-000-14)

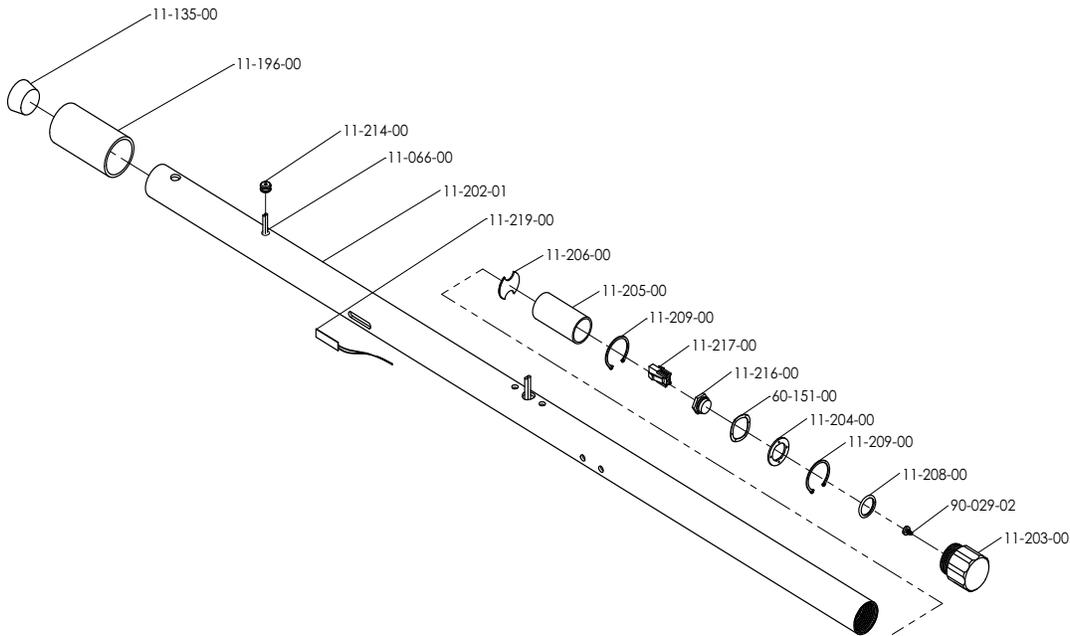
Part No.	Qty.	Description
11-071-00	1	Adaptor, Hyd. Motor
11-092-00	1	Motor
11-103-00	1	Gear, Planetary
11-108-00	1	Coupler, Hyd. Motor
11-195-00	1	Plate, Blanking
11-198-00	1	Plate, Base (Hyd)
11-207-00	1	Battery Assembly
11-215-00	1	Gasket
11-302-00	1	Manifold Assembly
11-400-00	1	Case, Storage NOT SHOWN
11-MAN-02	1	Manual NOT SHOWN
90-029-16	7	LHCS, 8-32 X 1
90-050-05	3	SHCS, 1/4-20 X 1/2
90-050-08	1	SHCS,
90-050-57	1	SHCS, 1/4-28 X 3/4
90-050-62	5	SHCS, 1/4-28 X 1-1/4



MANIFOLD ASSEMBLY 11-302-00

Part No.	Qty.	Description
05-116-00	1	Relief Valve
05-151-00	1	Reversing_valve
11-088-00	2	Hose, Hydraulic
11-089-00	1	Handle, Tapered
11-110-00	1	Gauge, Torque (Replaces P/N 05-115-00)
11-141-00	1	Manifold
11-142-00	1	Regulator, Priority Flow
90-028-01	6	SPP, 1/8 X 1/4 DRYSEAL
90-060-10	3	SHCS, 5/16-18 X 1
90-061-16	4	HHCS 5/16-18 X 1-3/4
90-075-65	1	SSS, 3/8-16 X 1-1/2
90-178-01	2	ADAPTER, 3/8 NPT F X 3/8 NPT MHP - 45

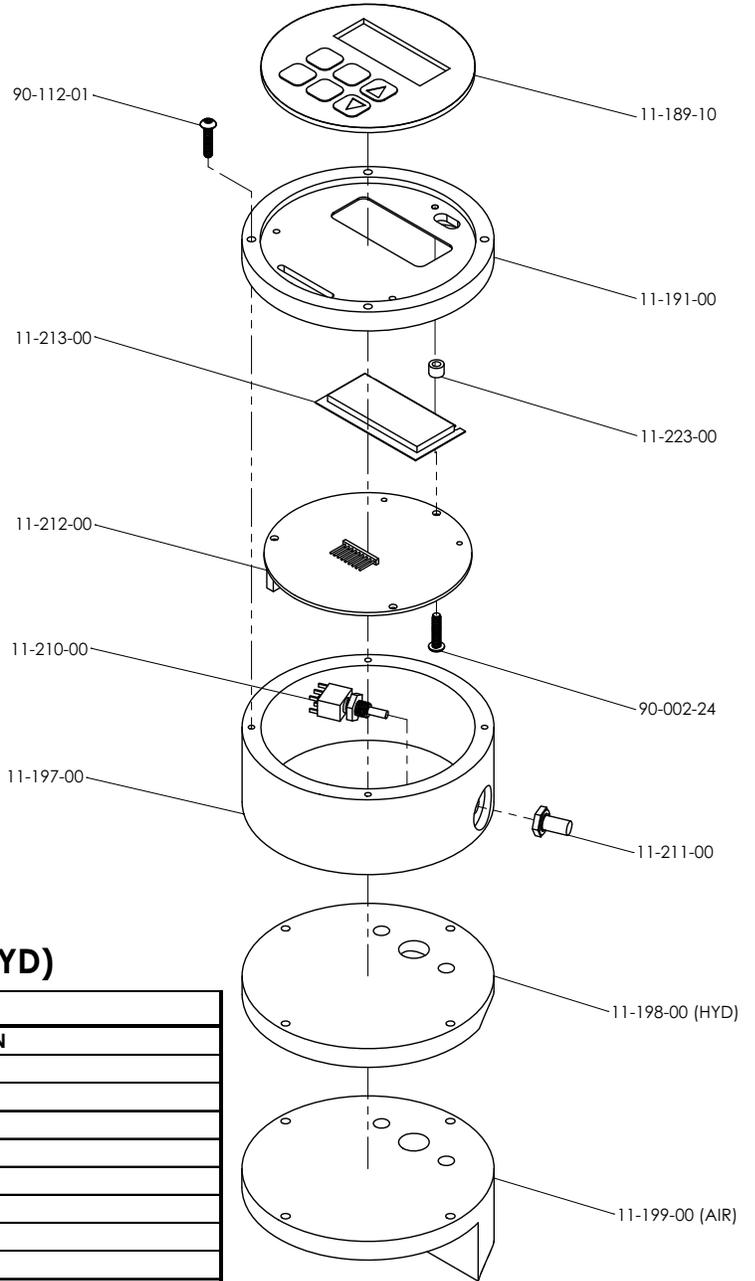
(Note that the same handle assembly is used for both hydraulic and pneumatic systems.)



HANDLE, AIR-HYD ASSEMBLY (11-202-00)

Part No.	Qty.	Description
11-066-00	35"	Wire, Bell 3-Wire
11-135-00	1	Plug, #6 Rubber
11-196-00	1	Cover, Strain Gages
11-202-01	1	Handle, Hyd, Air - DT
11-203-00	1	Cap, Handle
11-204-00	1	Panel, Connector
11-205-00	1	Spacer
11-206-00	1	Stop, Bulkhead
11-208-00	1	O-Ring (-023)
11-209-00	2	Ring, Snap
11-214-00	1	Grommet, 3/16 IDx 5/16 Grip OD x 1/8 Grip Thk
11-216-00	1	Connector, DIN 3 Pin
11-217-00	1	Molex Shell
11-218-00	2	Molex Terminal NOT SHOWN
11-219-00	2	Strain Gauge
21-025-01	4	Cable, .034 Od Nylon NOT SHOWN
21-025-02	2	Cable Loop Sleeve NOT SHOWN
60-151-00	1	Washer, Spring
90-029-02	1	PHMS, Type 25 Phillips
90-901-12	32"	Wire, 22 GA Red NOT SHOWN
90-901-21	32"	Wire, 22 GA Black NOT SHOWN
90-901-23	32"	Wire, 22 GA Yellow NOT SHOWN

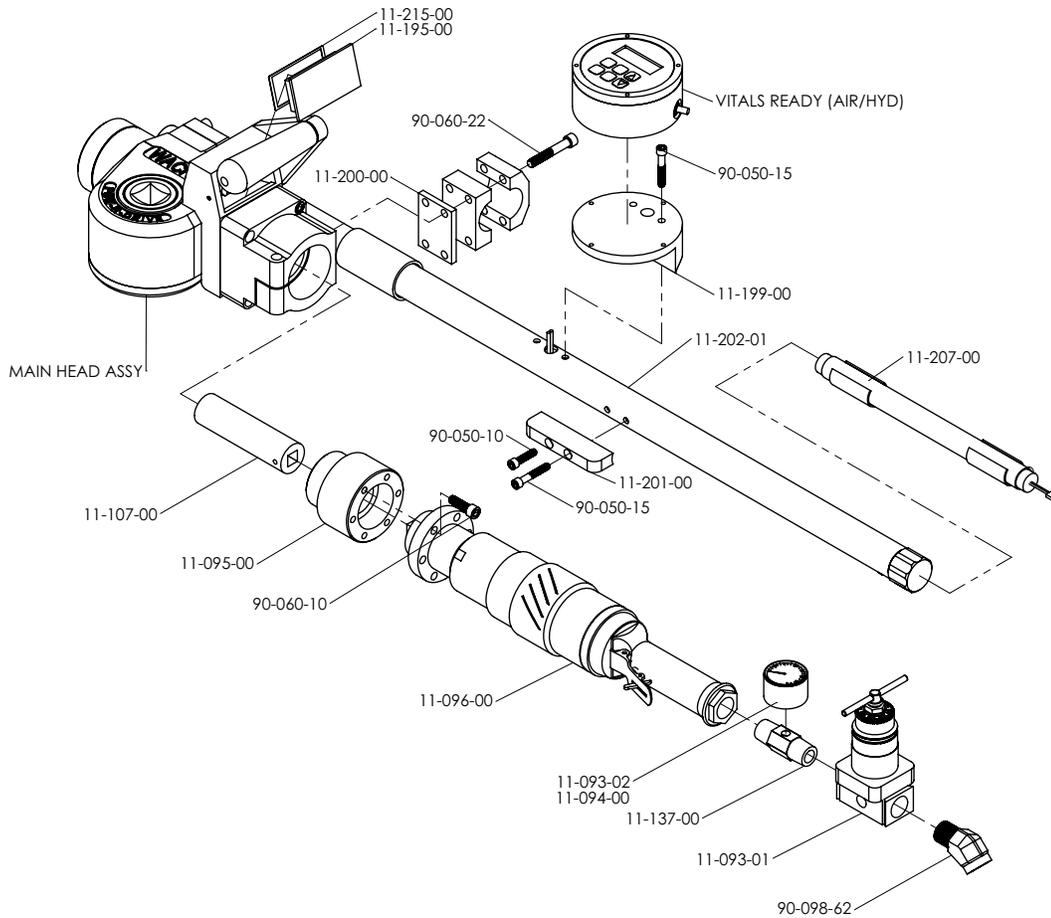
(Note that the same control unit assembly is used for both hydraulic and pneumatic systems.)



VITALS READY (AIR/HYD)

Part No.	Qty.	Description
11-153-00	1	CPU, P2 VITALS NOT SHOWN
11-189-10	1	Keypad, P2-DT
11-191-00	1	Cover, Top
11-197-00	1	Housing, Controller (Air/Hyd)
11-198-00	1	Plate, Base (HYD)
11-199-00	1	Plate, Base (AIR)
11-210-00	1	Switch
11-211-00	1	Boot
11-212-00	1	Board, Round Control
11-213-00	1	Display Assembly
11-220-00	2	Connector, 6 Plc NOT SHOWN
11-222-00	12	Terminal NOT SHOWN
11-223-00	3	Stand Off
90-002-24	3	PHMS, 6-32 x 7/16 - Phillips
90-112-01	8	BHCS, 6-32 x 5/8 - SS

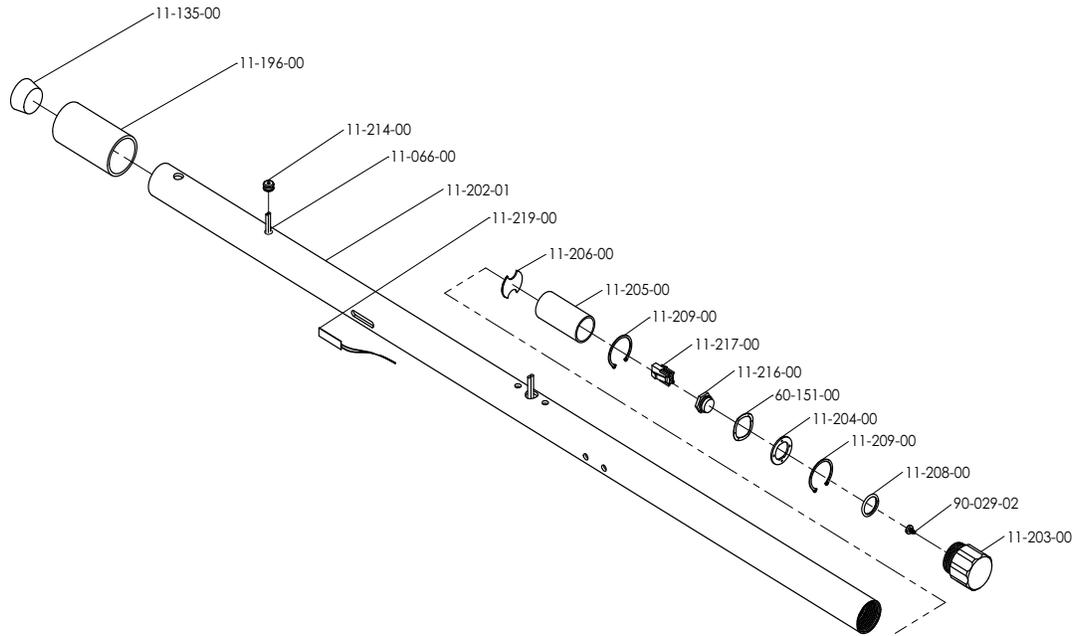
PNEUMATIC ASSEMBLY DRAWINGS



WAVE HANDHELD AIR (11-000-13)

Part No.	Qty.	Description
11-199-00	1	Plate, Base (Air)
11-200-00	2	Spacer, Handle - DT Air
11-201-00	1	Guard, Finger - DT Air
11-093-01	1	Regulator*
11-093-02	1	Gauge, 1.5"X1/8"Pipe
11-094-00	1	Label, Gauge Overlay
11-095-00	1	Adapter, Motor
11-096-00	1	Motor, Pneumatic
11-107-00	1	Coupler
11-137-00	1	Nipple
11-195-00	1	Plate, Blanking
11-207-00	1	Assembly, Battery
11-215-00	1	Gasket
11-400-00	1	Case, Storage NOT SHOWN
11-MAN-02	1	Manual NOT SHOWN
90-050-10	1	SHCS, 1/4-20 X 1
90-050-15	3	SHCS, 1/4-20 X 1-1/2
90-060-22	8	SHCS, 5/16-18 X 2-1/4
90-060-10	6	SHCS, 5/16-18 X 1
90-098-62	1	ADAPTER, 1/2 NPT MX 1/2 NPT F - 45

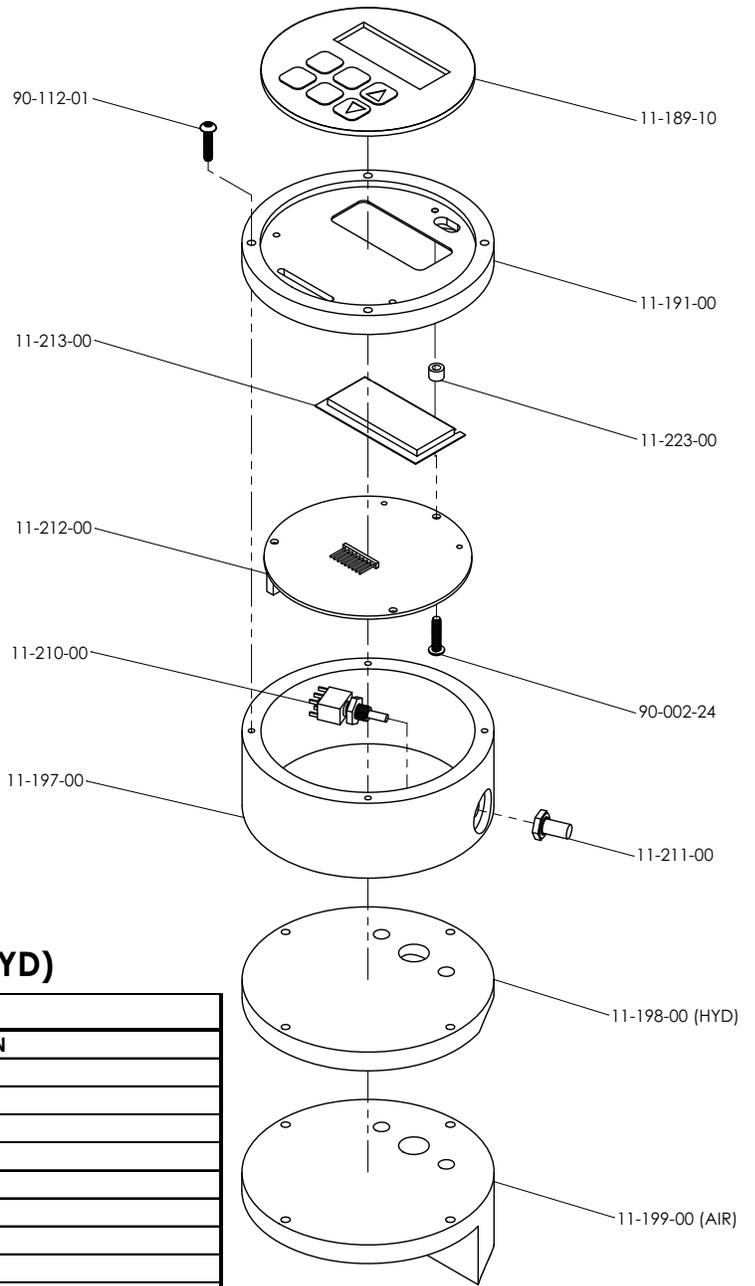
(Note that the same handle assembly is used for both hydraulic and pneumatic systems.)



HANDLE, AIR-HYD ASSEMBLY (11-202-00)

Part No.	Qty.	Description
11-066-00	35"	Wire, Bell 3-Wire
11-135-00	1	Plug, #6 Rubber
11-196-00	1	Cover, Strain Gages
11-202-01	1	Handle, Hyd, Air - DT
11-203-00	1	Cap, Handle
11-204-00	1	Panel, Connector
11-205-00	1	Spacer
11-206-00	1	Stop, Bulkhead
11-208-00	1	O-Ring (-023)
11-209-00	2	Ring, Snap
11-214-00	1	Grommet, 3/16 IDx 5/16 Grip OD x 1/8 Grip Thk
11-216-00	1	Connector, DIN 3 Pin
11-217-00	1	Molex Shell
11-218-00	2	Molex Terminal NOT SHOWN
11-219-00	2	Strain Gauge
21-025-01	4	Cable, .034 Od Nylon NOT SHOWN
21-025-02	2	Cable Loop Sleeve NOT SHOWN
60-151-00	1	Washer, Spring
90-029-02	1	PHMS, Type 25 Phillips
90-901-12	32"	Wire, 22 GA Red NOT SHOWN
90-901-21	32"	Wire, 22 GA Black NOT SHOWN
90-901-23	32"	Wire, 22 GA Yellow NOT SHOWN

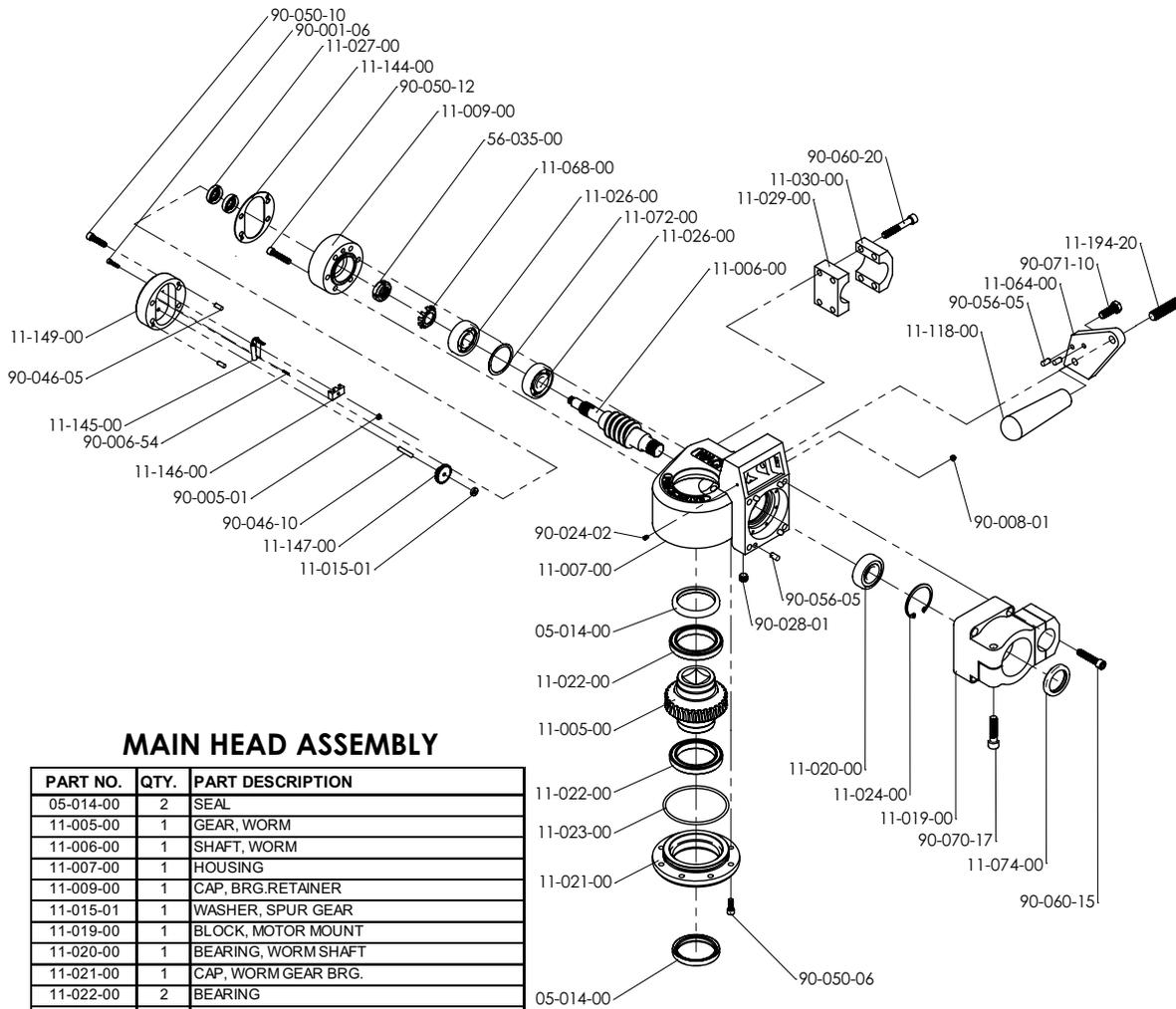
(Note that the same control unit assembly is used for both hydraulic and pneumatic systems.)



VITALS READY (AIR/HYD)

Part No.	Qty.	Description
11-153-00	1	CPU, P2 VITALS NOT SHOWN
11-189-10	1	Keypad, P2-DT
11-191-00	1	Cover, Top
11-197-00	1	Housing, Controller (Air/Hyd)
11-198-00	1	Plate, Base (HYD)
11-199-00	1	Plate, Base (AIR)
11-210-00	1	Switch
11-211-00	1	Boot
11-212-00	1	Board, Round Control
11-213-00	1	Display Assembly
11-220-00	2	Connector, 6 Plc NOT SHOWN
11-222-00	12	Terminal NOT SHOWN
11-223-00	3	Stand Off
90-002-24	3	PHMS, 6-32 x 7/16 - Phillips
90-112-01	8	BHCS, 6-32 x 5/8 - SS

COMMON ASSEMBLIES



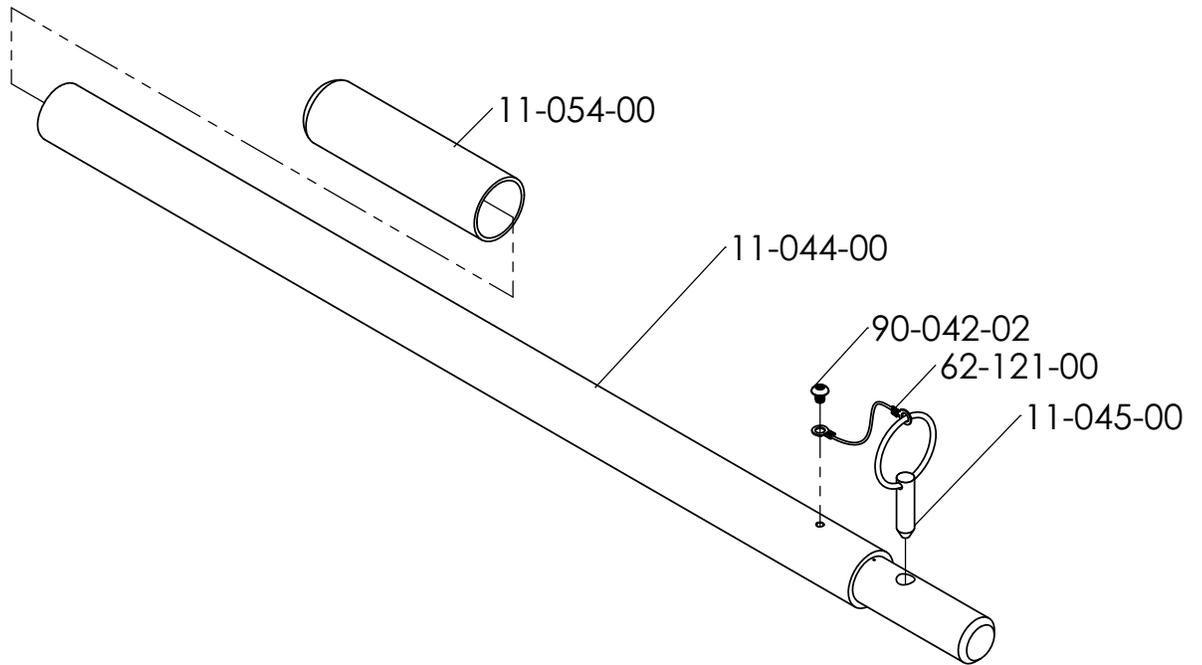
MAIN HEAD ASSEMBLY

PART NO.	QTY.	PART DESCRIPTION
05-014-00	2	SEAL
11-005-00	1	GEAR, WORM
11-006-00	1	SHAFT, WORM
11-007-00	1	HOUSING
11-009-00	1	CAP, BRG.RETAINER
11-015-01	1	WASHER, SPUR GEAR
11-019-00	1	BLOCK, MOTOR MOUNT
11-020-00	1	BEARING, WORM SHAFT
11-021-00	1	CAP, WORM GEAR BRG.
11-022-00	2	BEARING
11-023-00	1	O-RING
11-024-00	1	RING, SNAP
11-026-00	2	BEARING
11-027-00	2	SEAL
11-029-00	2	CLAMP, LOWER
11-030-00	2	CLAMP, TOP
11-064-00	1	PLATE, HANDLE
11-068-00	1	WASHER, LOCK
11-072-00	1	SHIM, BEARING
11-074-00	1	SEAL, DRIVE ADAPTOR
11-118-00	1	HANDLE, TAPERED
11-144-00	1	GASKET
11-145-00	2	SENSOR, POSITION
11-146-00	1	CLIP, SENSOR RETAINER
11-147-00	1	GEAR, COUNTER
11-149-00	1	COVER, COUNTER SENSR
56-035-00	1	LOCKNUT, BEARING
90-001-06	1	SHCS, 6-32 THD X 5/8" LNG.
90-005-01	1	NUT, 6-32 HEX
90-006-54	2	PIN, 5/64 DIA. X 7/16" LNG ROLL
90-008-01	1	SPP, 1/16-27 Dryseal
90-024-02	2	SSS, 8-32 X 14
90-028-01	2	SPP, 1/8 X 1/4 DRYSEAL
90-046-05	2	PIN, 3/16 DIA X 1/2 LNG DOWEL

PART NO.	QTY.	DESCRIPTION
90-046-10	1	PIN, 3/16 DIA X 1" LNG DOWEL
90-050-06	8	SHCS, 1/4-20 THD. X 5/8" LNG.
90-050-10	4	SHCS, 1/4-20 THD. X 1" LNG.
90-050-12	6	SHCS, 1/4-20 THD. X 1-1/4" LNG.
90-056-05	6	PIN, 1/4 DIA. X 1/2" LNG. DOWEL
90-060-15	4	SHCS, 5/16-18 THD. X 1-1/2" LNG.
90-060-20	8	SHCS, 5/16-18 THD. X 2" LNG.
90-070-17	1	SHCS, 3/8-16 THD. X 1 3/4" LNG.
90-071-10	1	HHCS, 3/8-16 THD. X 1" LNG.
90-194-20	1	SSS, 1/2-13 THD. X 2" LNG.

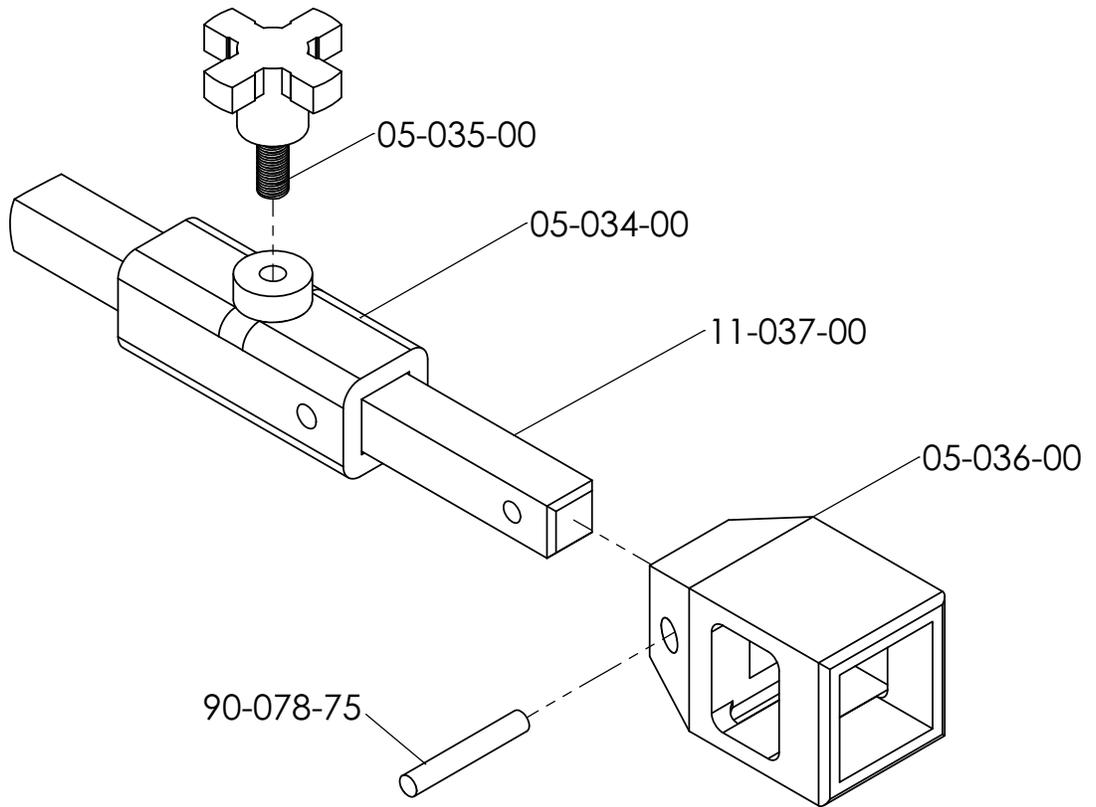
NOT SHOWN

PART NO.	QTY.	PART DESCRIPTION
11-070-00	1	LABEL, OPERATOR POS.
90-501-36	1	BUTTSPLICE 16-14 GA. TERMINAL
90-900-01	1	LABEL, MAUNUAL INSTR.
90-901-13	6"	WIRE, 24 GAUGE, BLACK
90-901-14	.5"	SHRINK-TUBING, BLUE
90-901-15	.5"	SHRINK-TUBING, RED



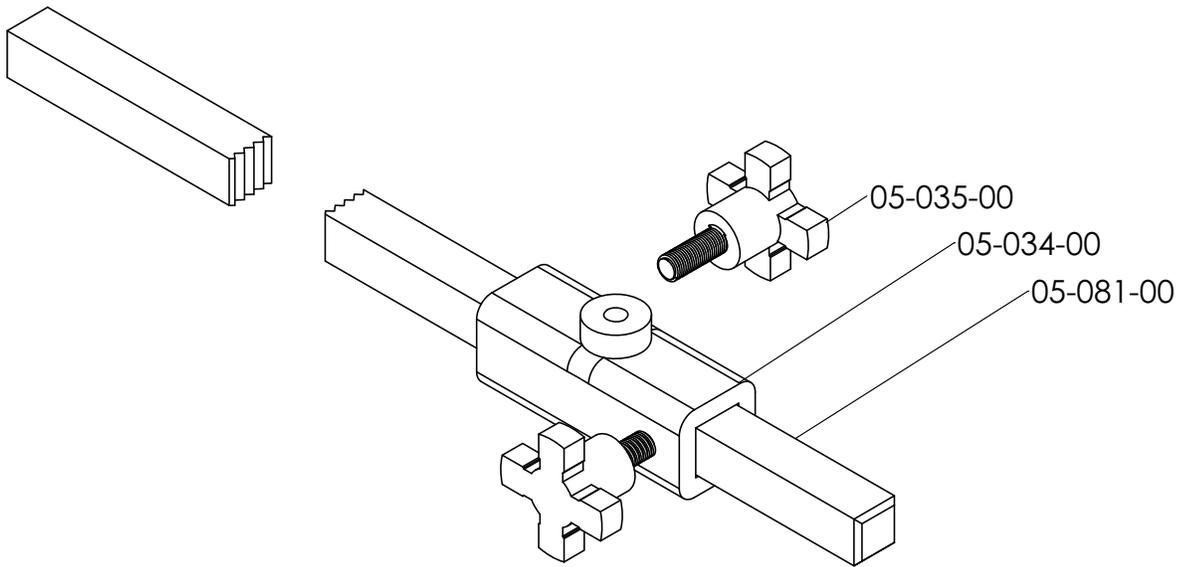
HANDLE EXTNSN ASSY (11-303-00)

Part No.	Qty.	Description
11-044-00	1	Assy, Handle EXT
11-045-00	1	Pin, Quick 3/8 X 1-1/2
11-054-00	1	Grip, Rubber
62-121-00	1	Lanyard 6"Lg
90-042-02	1	BHCS, 10-32 X 1/4



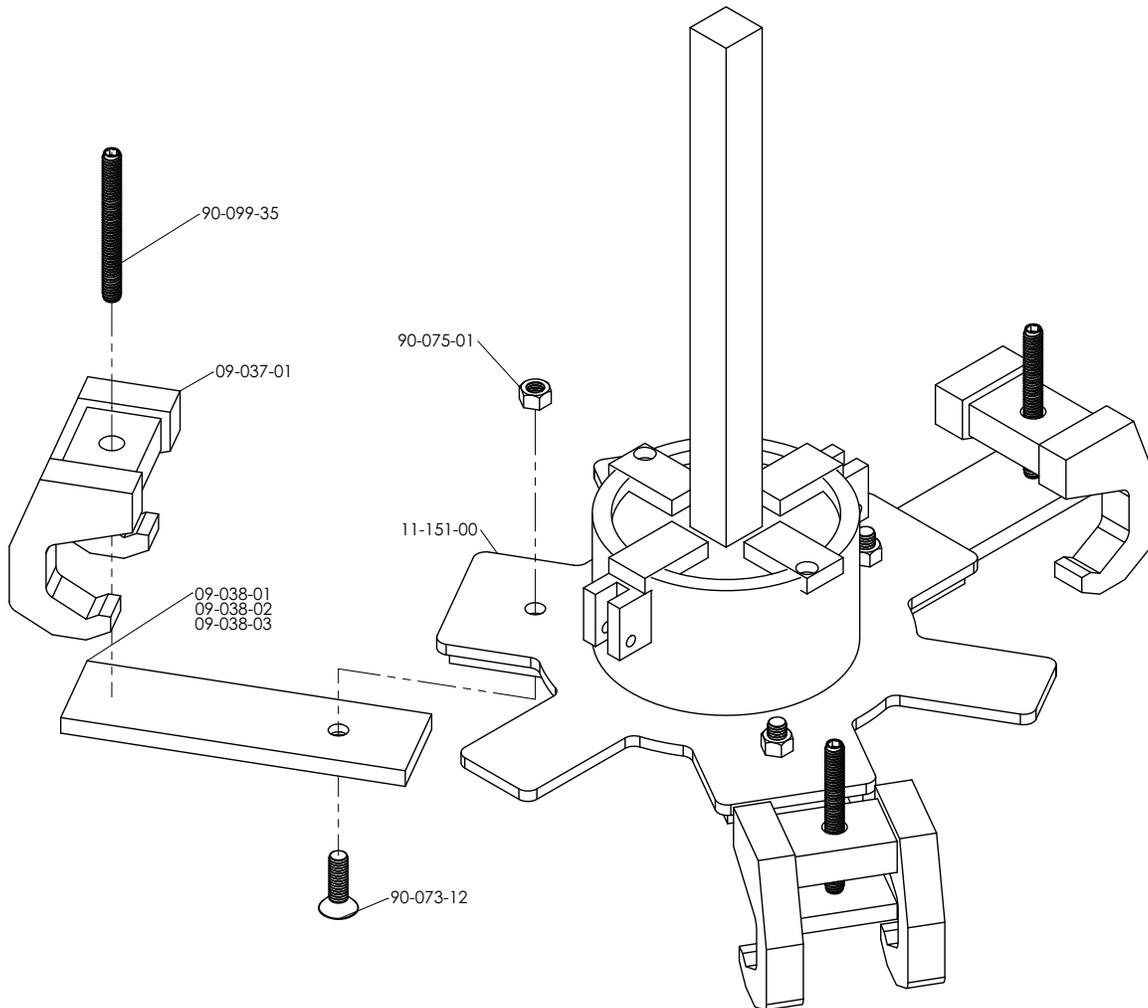
8' VALVE KEY (05-402-00)

Part No.	Qty.	Description
05-034-00	1	Stop Collar
05-035-00	1	Locking Screw
05-036-00	1	Socket 2" Opening
05-037-00	1	Key, 1" Square - 8 Feet Long
90-076-75	1	PIN, ROLL 3/8 X2-1/2



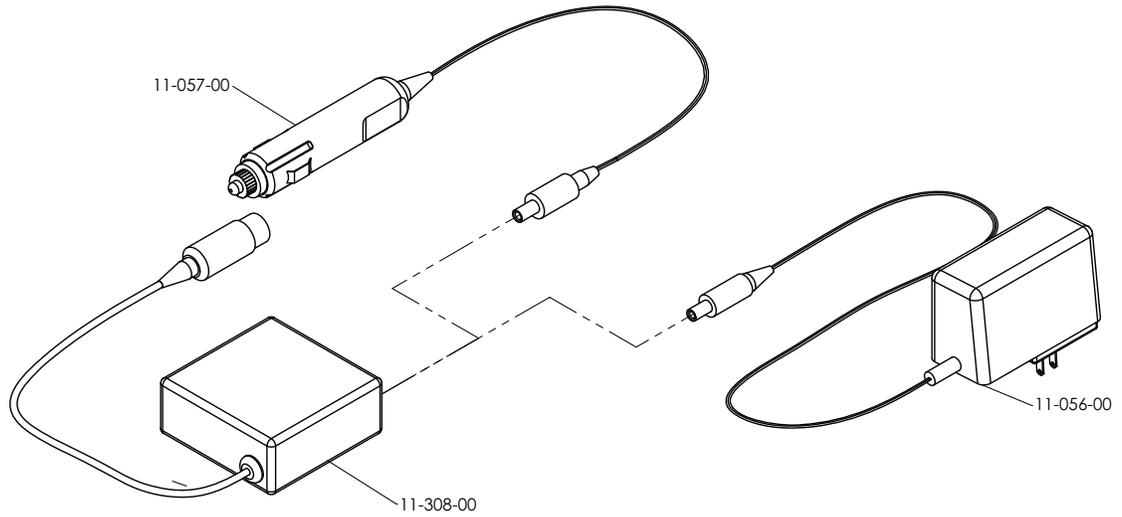
4' KEY EXTENSION (05-403-00)

Part No.	Qty.	Description
05-034-00	1	Stop Collar
05-035-00	2	Locking Screw
05-081-00	1	4 Ft. X 1" Key Coupling



UNIV HANDWHEEL ADAPTER (11-401-00)

Part No.	Qty.	Description
09-037-01	3	Clamp, Straddle - Large
09-038-01	3	Torque Arm - Short
09-038-02	3	Torque Arm - Medium
09-038-03	3	Torque Arm - Long
11-151-00	1	Adapter, Univ Hndwhl
90-073-12	3	FHCS, 3/8-16 X 1-1/4
90-075-01	3	NUT, 3/8-16 HEX
90-099-35	3	SSS, 1/2-13 X 3-1/2 CP.PT



CHARGING KIT (11-406-00)

Part No.	Qty.	Description
11-056-00	1	Adaptor, AC power for Charger
11-057-00	1	Cable, Vehicle Accessory for Charger
11-308-00	1	Charger, P2-DT (Air, Hyd)

Chapter 9

Accessories

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Table 1 lists accessories available for the WAVE™ handheld valve exerciser.

Part No.	Description	
05-402-00	4' Valve key extension assembly (includes stop collar)	
05-403-00	8' Valve key assembly (includes 2" socket and stop collar)	
07-408-00	2" square AWWA standard ductile iron socket	
05-034-00	Stop collar	
17-304-01	VITALS™ data logger/controller for capturing and entering valve information	

Table 1: Accessories for WAVE™ Handheld Valve Exerciser

Part No.	Description	
17-227-00	VITALS™ 110/220 V charger and data transfer cable with transfer program and download access code	
17-409-00	VITALS™ 2.0 valve performance analysis software for Windows	
11-406-00	Charger kit for WAVE™ control unit battery (includes AC and 12 V DC chargers)	
17-228-00	Cigarette lighter adapter to charge/power VITALS™ data tracking and logging controller during independent use	
17-234-00	GPS receiver interface cable	
11-401-00	Universal Valve Handwheel Adapter	

Table 1: Accessories for WAVE™ Handheld Valve Exerciser

Chapter 10

Ordering Information

To place an order, request service, or get more detailed information on any E.H. Wachs Company products, call us at one of the following numbers:

U.S. 800-323-8185

International: 847-537-8800

ORDERING REPLACEMENT PARTS

When ordering parts, refer to the parts lists in Chapter 8. Please provide the part description and part number for all parts you are ordering.

REPAIR INFORMATION

Please call us for an authorization number before returning any equipment for repair or factory service. We will advise you of shipping and handling. When you send the equipment, please include the following information:

- Your name/company name
- Your address
- Your phone number
- A description of the problem or the work to be done.

In This Chapter

REPLACEMENT PARTS

REPAIR INFORMATION

WARRANTY INFORMATION

RETURN GOODS ADDRESS

Before we perform any repair, we will estimate the work and inform you of the cost and the time required to complete it.

WARRANTY INFORMATION

Enclosed with the manual is a warranty card. Please fill out the registration card and return to E.H. Wachs Company. Retain the owner's registration record and warranty card for your information.

RETURN GOODS ADDRESS

Return equipment for repair to the following address.

E.H. Wachs
600 Knightsbridge Parkway
Lincolnshire, Illinois 60069 USA



600 Knightsbridge Parkway • Lincolnshire, IL 60069
847-537-8800 • www.ehwachs.com