

Wintriss  
Controls

## **WaveFormPAC®**

**Wintriss® Advanced Load Analyzer**  
**A SmartPAC® 2 Module**

**1109100**

**Rev. G June 2016**

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## **Changes for Revision G of the WaveFormPAC User Manual (1109100)**

This revision of the WaveFormPAC user manual covers WaveFormPAC software version 2.02 and higher and SmartPAC 2 version 9.10 or higher. It includes the following changes:

- Replacement of wiring diagram Figure 1, showing termination of shields to the enclosure.



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# How To Use This Manual

This manual shows you how to install, calibrate, program, run, and troubleshoot WaveFormPAC two- and four-channel load analyzers connected to a SmartPAC 2 control.

Chapter 1 provides an overview of WaveFormPAC features and operation.

Chapter 2 shows you how to mount and wire WaveFormPAC.

Chapter 3 shows you how to enter WaveFormPAC settings in SmartPAC 2 Initialization mode and calibrate WaveFormPAC.

Chapter 4 shows you how to establish WaveFormPAC setpoint percentages and a sample period for each tool in SmartPAC 2 Program mode.

Chapter 5 shows you how to view and adjust programmed WaveFormPAC settings in SmartPAC 2 Run mode. The chapter also provides instructions for creating windows and programming setpoints for them.

Chapter 6 shows you how to respond to WaveFormPAC faults and troubleshoot common WaveFormPAC problems.

Appendix A shows you how to upgrade an AutoSetPAC connected to a SmartPAC 2 to a new WaveFormPAC.

Appendix B shows you how to replace an old WaveFormPAC Processor board.

The Glossary provides definitions of some of the terms used in the manual that may be unfamiliar to you.

Wiring diagrams at the back of the manual show connections between WaveFormPAC and SmartPAC 2 and the connections necessary to conduct a loopback test.

## Important Highlighted Information

Important danger, warning, caution and notice information is highlighted throughout the manual as follows:

### **DANGER**

A DANGER symbol indicates an imminently hazardous situation, which, if not avoided, will result in death or serious injury.

### **WARNING**

A WARNING symbol indicates a potentially hazardous situation, which, if not avoided, could result in death or serious injury.

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### **NOTICE**

A NOTICE symbol indicates important information that you should remember, including tips to aid you in performance of your job.

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WAVEFORMPAC

USER MANUAL

1109100

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# Chapter 1. Introduction

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## NOTICE

### THE NAME “WAVEFORMPAC”

The name “WaveFormPAC” as used in this manual refers to the SmartPAC 2 Press Automation Control with the WaveFormPAC option. A previous version of WaveFormPAC is compatible with the original SmartPAC (see Appendix B). The current version can be used only with SmartPAC 2.

SmartPAC 2 with WaveFormPAC is a powerful, versatile, easy-to-use load monitoring system that accurately monitors press load on every stroke. WaveFormPAC helps to eliminate wear on the press, ensure more accurate operation, reduce unnecessary downtime, and improve overall press control.

WaveFormPAC provides waveform load monitoring analysis not only of peak tonnage but of the tonnage produced during selected segments of the stroke called “windows.” The critical data available in WaveFormPAC is useful in verifying and improving setups and in anticipating the need for tool modifications and repairs.

WaveFormPAC can be used on a wide variety of mechanical power presses, including double-action, straight-side, and gap-frame presses. By measuring the forces loading the press frame during operation, WaveFormPAC provides important information you need to reduce strain on the press without decreasing productivity. Because of its windows capability, WaveFormPAC is ideal in clamping and forming applications where off-bottom load measurement must be made independent of the peak load.

WaveFormPAC provides overload, underload, and “snap-through” reverse loading protection for your press and dies without the need to change settings manually on each die change. WaveFormPAC creates load limits, or setpoints, automatically for each tool. Setpoints are saved with the tool at the end of each job and are automatically re-loaded the next time the tool is run. Setpoints can be changed immediately based on the actual load of your press.

WaveFormPAC also includes the repeatability feature that provides more precise, reliable stroke-to-stroke protection on your press. WaveFormPAC reduces unnecessary downtime and improves process control. SmartPAC 2 with WaveFormPAC comes in two- or four-input options.

## WaveFormPAC Benefits

WaveFormPAC provides the following benefits:

- Provides comprehensive waveform load monitoring, enabling you to view and monitor tonnages during peak load, reverse load, and up to four segments of the stroke called “windows.” Waveforms help to improve process control and regulate tool wear.
- Allows you to create and modify setpoints (high, low, and repeatability) for windows, which monitor identical angle ranges for all strain link inputs. Windows enable you to monitor off-bottom loads independent of the peak load, preventing press overloads and

damage due to reduced press capacity at off-bottom angles. In progressive or transfer die applications, for example, a window could be created to monitor the portion of the stroke during which the blanking punches make contact with the material, which occurs before BDC.

Windows are also useful in clamping and forming applications, such as when the clamping pressure of the outer slide on a double-action press must be monitored.

- Displays a comparison of the current waveform with a WaveFormPAC-generated critical press capacity curve, which allows you to quickly identify at what angles tonnage exceeds the press's off-bottom capacity.
- Identifies machine forward and reverse overloading as well as machine underloading, enabling you to prevent unnecessary wear on load-bearing components.
- Provides repeatability, or stroke-to-stroke, tonnage monitoring. Repeatability setpoints allow you to monitor your stamping process more precisely, enabling you to detect breakage, quality problems, and loss of tonnage due to end of stock. Repeatability setpoints also allow you to relax the high and low setpoint tolerances, thus avoiding nuisance stops due to acceptable variance in material thickness and hardness.
- Stops the press after a bad stroke, preventing successive bad hits and, possibly, catastrophic damage to the die.
- Displays the motor slowdown percentage, an indicator of the flywheel energy used by the press to make a part and, therefore, the energy required by the motor to bring the press back to operating speed after BDC. This feature helps you guard against press stoppage and potential motor damage resulting from an excessive slowdown.
- Allows more accurate tool setups by providing actual tonnage information. Information can be stamped on the die shoe per OSHA regulation 1910.217 (d) (6) (i).
- Monitoring of tonnage variations allows you to detect misfeeds, slug stacking, misuse of stop blocks, changes in material thickness and hardness, broken stripper springs, and broken punches in the die. One operator can monitor several presses at a time because WaveFormPAC stops the press when these and other malfunctions are detected.
- Diagnoses tool wear by monitoring tonnage increases as a die is re-used. This enables you to schedule repairs to dies and punches, resulting in more efficient use of the press, faster parts production, and higher quality parts. In addition, SmartPAC 2 keeps track of the number of hits on the tool being run, aiding in better die maintenance.
- Enables better matching of dies to press capacity. Since WaveFormPAC displays the exact tonnage produced by each die, you can avoid using large-capacity presses for smaller jobs or overloading a small-capacity press with too large a job.
- Maintains part quality while operating the press at optimum speeds and capacity.

## SmartPAC 2 Front Panel

Programming and operation of WaveFormPAC is accomplished via the SmartPAC 2 front panel, which is shown in Figure 1-1, page 1-3. A brief description of each panel component is provided following the figure.

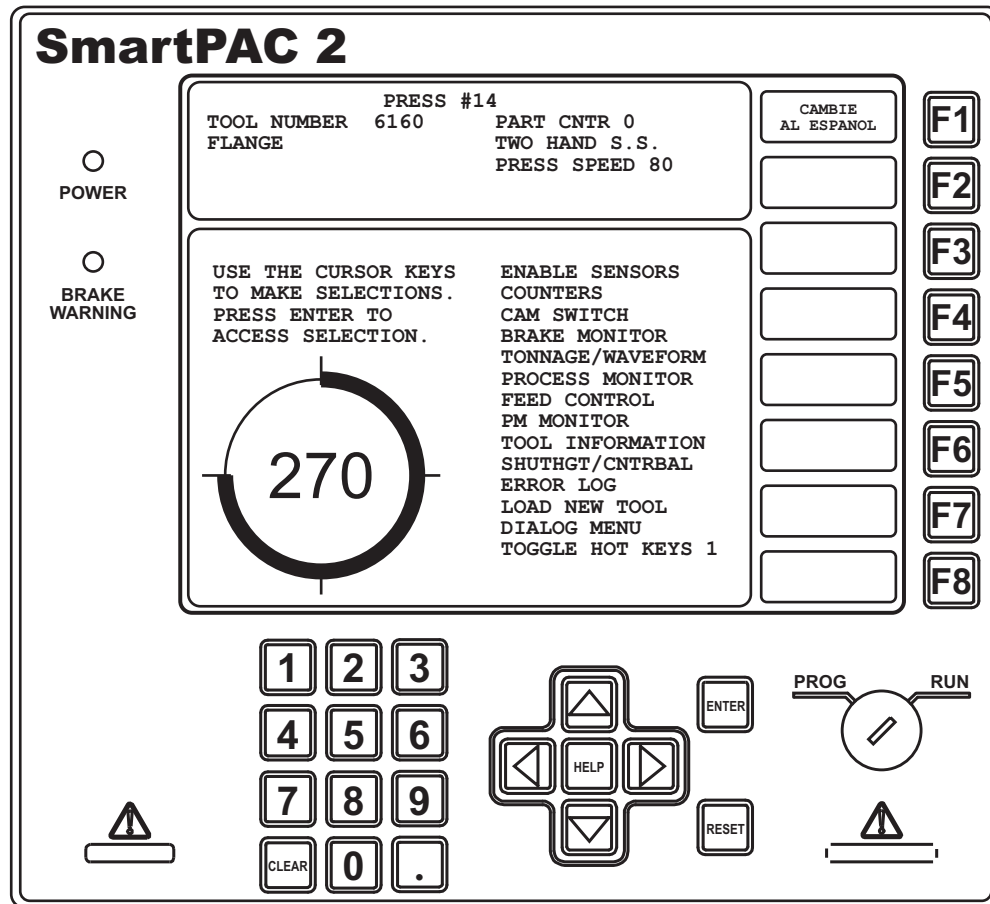


Figure 1-1. SmartPAC 2 Front Panel

### Display

Used with the keyboard to make and adjust settings, load tools, and view diagnostic messages. The display, which measures 10.4 in. (264 mm) diagonally, is a color liquid crystal display (LCD).

### Program/Run key switch

Allows Program mode to be locked so settings cannot be changed by the press operator. Key must be set to “Run” to operate the press. Minor adjustments, including loading an existing tool, can be made in Run mode.

### Keyboard

Consists of cursor keys and a numeric keypad (described below under *Number keys*) that are used with the display to make settings.

### Cursor keys

Enable you to select a display item with the highlight bar. Also allow you to select alphabetic characters and special symbols when naming the press, tools, cam channels, and sensors.

### Number keys

Enable you to input numeric values such as counter presets or tool numbers

<b>Function keys</b>	Eight keys labelled “F1” to “F8” that perform specific tasks. Functions performed by pressing the key are displayed to the left of the key label. Function keys can also be programmed as “Hot keys” that take the user directly to desired screens.
<b>HELP key</b>	Enables you to access a help screen that provides information about the display you are looking at.
<b>ENTER key</b>	When you press this key, SmartPAC 2 accepts the menu item you have selected or the number you have keyed in.
<b>RESET key</b>	You press this key when you are done with a programming or other procedure. Also resets SmartPAC 2 after fault or event messages appear on the display.

Detailed instructions on how to use the keyboard and display are provided in Chapter 3 of the SmartPAC 2 user manual.

## Strain Links

WaveFormPAC receives its tonnage information from strain links, which are mounted to the press frame or other structural members and wired to the load analyzer. Strain links measure the forces acting on the press frame, converting press frame deflection into an electrical signal. This signal is proportional to the load being generated by the press.

Two strain links are used with a two-channel WaveFormPAC, four strain links with a four-channel unit. Instructions on how mount and wire strain links are provided starting on page 2-9. Zeroing strain links is covered starting on page 3-16.

## Calibration

WaveFormPAC must be calibrated before use. To calibrate the unit, you first load the press to a known tonnage, using load cells connected to an independent load monitor that you know will give correct readings. You then adjust the tonnage readings on WaveFormPAC until they match the tonnage readings on the independent load monitor. Instructions for calibrating WaveFormPAC are provided starting on page 3-16.

## WaveFormPAC Operation

Complete instructions for making settings in WaveFormPAC are provided in chapters 4 and 5. The following sections provide an overview of settings and displays.

### Setpoints

WaveFormPAC calculates high, low, and repeatability setpoints automatically based on the setpoint percentage and sample period settings you make for each tool in Program mode (see Chapter 4).

The sample period is the number of strokes during which WaveFormPAC collects tonnage information to use in calculating setpoints. The high setpoint percentage is the percentage above the measured load that WaveFormPAC uses in calculating high tonnage setpoints. The low setpoint percentage is the percentage below the measured load used to calculate low tonnage setpoints. The repeatability percentage is the percent of stroke-to-stroke variation in the measured load used to calculate repeatability setpoints.

Setpoint percentage and sample period settings are easily copied from tool to tool using the SmartPAC 2 Copy Tool function.

WaveFormPAC displays the results of its calculations on the Waveform, Adjust Setpoints, and Tonnage Bar Graph screens in Run mode. Setpoints are shown for two channels on two-channel WaveFormPAC load analyzers and for four channels on four-channel WaveFormPAC units.

During the sample period, setpoints are maintained at 120% of the full-scale capacity of the press to provide overload protection.

## NOTICE

### **WAVEFORMPAC SETPOINTS NEVER EXCEED 120%**

WaveFormPAC will not create setpoints greater than 120% of the full-scale capacity of the press.

WaveFormPAC calculates new setpoints whenever the RECALCULATE SETPOINTS function is selected in Program or Run mode. Setpoints are displayed after the sample period is completed. WaveFormPAC also calculates new setpoints whenever you change any of the setpoint percentages for a tool.

WaveFormPAC provides reverse load protection based on a specified percentage of press capacity. This parameter is set in Initialization mode (see page 3-7).

## Waveforms

WaveFormPAC enables you to display a plot of tonnage for crankshaft angles between 90° and 248° during the current stroke. This plot is called a waveform (see Figure 5-4, page 5-3 for an example). The shape of the waveform is a function of many factors, including press condition, sharpness and accuracy of your tooling, material thickness, hardness, shut height, lubrication, etc.

Waveforms can be stored and, using WaveFormPAC's Compare feature, compared with current waveforms to diagnose potential press and die problems. The Compare feature also helps you to improve part quality, verify setups, effectively manage tool maintenance, and increase productivity. Using the SmartPAC 2 cursor keys, you can display tonnage differences between the two waveforms at any crankshaft angle between 90° and 248°.

Waveforms can be displayed for total tonnage, which is the sum of tonnages for all strain link inputs (two- or four-channel), and for tonnages on individual inputs. Instructions for displaying, updating, storing, and comparing waveforms are provided starting on page 5-3.

## Windows

WaveFormPAC allows you to monitor not only peak forward and reverse tonnage for each strain link input but also tonnages occurring within up to four programmable segments of the stroke called “windows.” Windows are created for a range of crankshaft angles during the forward load portion of the stroke (see Figure 5-13, page 5-16 for an example); they are not used for the portion of the stroke beyond 180°, in which the reverse load occurs. You can create high, low, and repeatability setpoints to monitor the tonnage in each window. Windows and their setpoints apply to all strain link channels.

## Critical Press Capacity Curve

WaveFormPAC’s Compare feature allows you to compare the current waveform to a WaveFormPAC-generated critical press capacity curve, a plot of the press’s rated tonnage capacity at each angle during the load-generating portion of the stroke (see Figure 5-10, page 5-12 for an example). Comparison of the current waveform with the critical curve allows you to verify that the press is operating at the correct capacity throughout the stroke and prevent excessive loads that could catastrophically damage critical structural members of the press.

Information used to generate the critical curve, which you should obtain from your press manufacturer, is entered into a table in SmartPAC 2 Initialization mode (see *Setting Press Parameters*, page 3-8). Instructions for how to generate a comparison between the current waveform and the critical curve are provided on page 5-12.

## Motor Slowdown

Motor slowdown is a metric maintained by WaveFormPAC that tracks the difference between the press’s fastest and slowest speeds and compares it to the fastest speed. Displayed as a percentage on Waveform screens in Program and Run modes (see Figure 5-4, page 5-3), motor slowdown indicates the flywheel energy used by the press to make a part and, therefore, the energy required by the motor to resume operating speed after the die contacts the material before BDC.

When the motor slowdown percentage is low (under 10% for a standard slip motor), motor energy requirements are low. As motor slowdown percentage increases, motor energy requirements increase until a point is reached at which the motor is in danger of an overload resulting from excessive slowdown, potentially leading to press stoppage and motor damage. Presses differ in their motor slowdown allowance, and you should check with your press manufacturer or rebuilder for the acceptable motor slowdown percentage range.

## WaveFormPAC Faults

WaveFormPAC stops the press when the high, low, repeatability, and/or reverse setpoints are exceeded for any of the strain link(s), and SmartPAC 2 displays a fault message on its front panel.

To clear the fault, press the RESET key.

WaveFormPAC fault conditions are covered in Chapter 6.

## Specifications

WaveFormPAC specifications are shown in Table 1-1.

*Table 1-1. WaveFormPAC Specifications*

Equipment	Enclosure: 10.25 in. x 12 in. x 4 in. (260.4 x 304.8 x 101.6 mm), NEMA 12, shock-mounted  Board and power supply on mounting plate or board only available for installation in user's enclosure or console
Electrical	Input 85 to 264 Vac, 110 to 370 Vdc, 50-60 Hz, 30 W. Input check circuit: 12-250 Vac or Vdc.
Power Requirements if not Using Wintriss AC Power Supply	24 $\pm$ 5% Vdc, 0.5 A. Must be certified to CSA C22.2 No. 234 Standard.
Operating temperature	32° to 122° F (0° to 50° C)
Relay contact rating	5 amps @ 120 or 240 Vac Normally open, held closed
Speed	7 to 300 SPM
Setpoints	High, low, repeatability setpoints for peak forward load Four windows set between 90 and 248 (min. window width: 4°) High limit % for reverse load (based on press capacity)
Operator Interface	Through the SmartPAC 2 Press Automation Control
Memory	Allows storage of waveforms and setpoints for 200 tools
Strain links  Size Cable	Two (2-channel WaveFormPAC) or four (4-channel WaveFormPAC) required 3.75 in. x 1.19 in. x 0.75 in. (95.3 x 30.2 x 19.1 mm) 30 ft. (9.1 m) standard, other lengths optional
Drill jig	One provided





# Chapter 2. Installation

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## NOTICE

### THE NAME “WAVEFORMPAC”

The name “WaveFormPAC” as used in this manual refers to the SmartPAC 2 Press Automation Control with the WaveFormPAC option. A previous version of WaveFormPAC is compatible with the original SmartPAC (see Appendix B). The current version can be used only with SmartPAC 2.

This chapter shows you how to mount the WaveFormPAC load monitor (with or without the optional control enclosure) and make wiring connections for AC power, stop circuits, strain links, communications, SmartPAC 2 resolver, and oscilloscope. It is organized in the following sections:

- *Mounting WaveFormPAC*, page 2-1
- *Connecting AC Wiring*, page 2-5
- *Connecting Stop Circuit Wiring*, page 2-7
- *Installing Strain Links*, page 2-9
- *Connecting Communications Wiring*, page 2-15
- *Connecting SmartPAC 2 Resolver to WaveFormPAC*, page 2-16
- *Wiring an Oscilloscope (Optional)*, page 2-17
- *Powering Up WaveFormPAC*, page 2-18
- *Installing New WaveFormPAC Firmware*, page 2-19

## Mounting WaveFormPAC

Mounting procedures vary depending on which of the following WaveFormPAC configurations you ordered:

- Processor board and power supply mounted in an enclosure
- Processor board and power supply installed on a mounting plate (no enclosure)
- Processor board without power supply (no enclosure)

### Mounting the WaveFormPAC Enclosure

To mount the WaveFormPAC enclosure, follow these steps:

1. Determine a convenient mounting location, considering the following factors:
  - Strain link cables must be capable of reaching the mounting site
  - The mounting location must allow enough room for the door to open at least 120°
  - The enclosure can be mounted to the press or on a free-standing pedestal
2. Drill holes for mounting, referring to Figure 2-1, page 2-2. Tap holes and mount the enclosure, using the enclosed shock mounts. Shock mount studs are 1/4–20. Use a No. 7 drill and 1/4–20 tap.

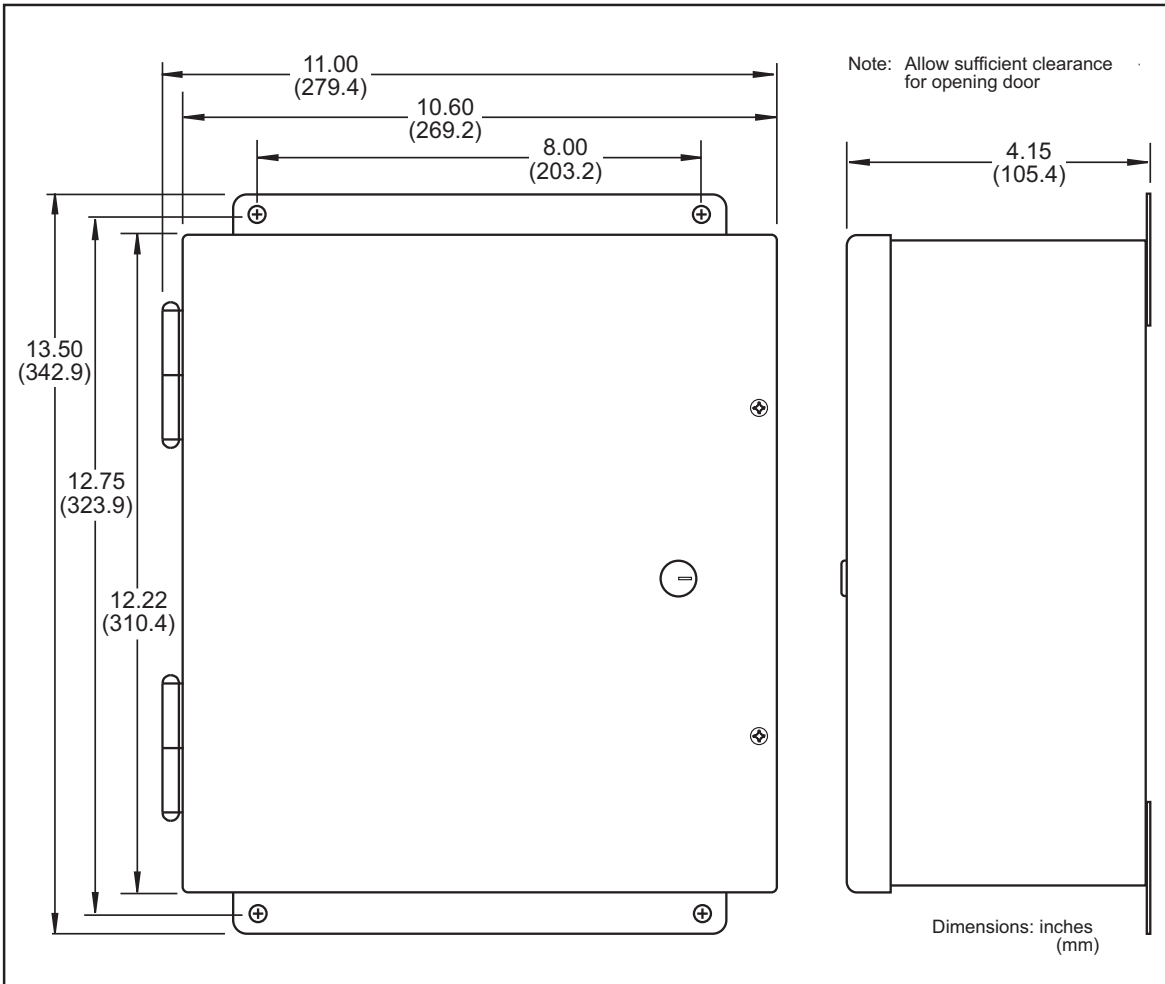


Figure 2-1. WaveFormPAC Enclosure: Mounting Dimensions

## Installing the WaveFormPAC Mounting Plate

If you ordered the WaveFormPAC mounting plate option, you received a Processor board, power supply, and input power terminal block mounted on an aluminum plate (see Figure 2-2 for dimensions).

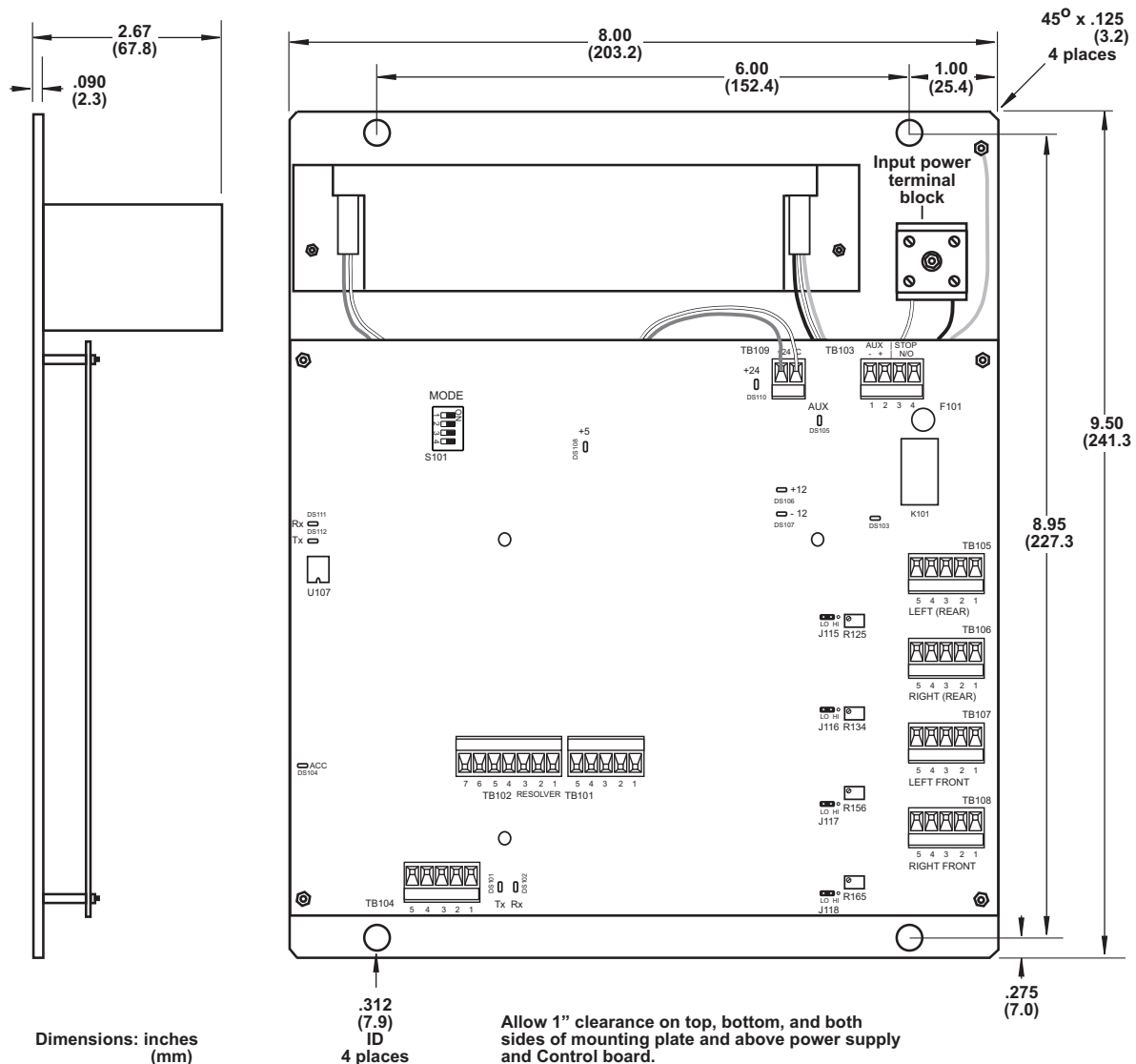


Figure 2-2. WaveFormPAC Mounting Plate: Mounting Dimensions

The plate, which has four mounting holes, facilitates installation of the WaveFormPAC Processor board and related components in your console or enclosure.

The power supply on the mounting plate is pre-wired to the Power terminal, TB109, on the Processor board and to the input power terminal block on the plate. To connect AC wiring to the input power terminal block, follow the instructions starting on page 2-5.

When installing the mounting plate, be sure to allow at least 1 in. clearance on top, bottom, and both sides of the plate and above the power supply and Processor board.

## Installing the WaveFormPAC Processor Board (No Power Supply)

If you ordered WaveFormPAC without an enclosure and without a 110V power supply, you received a WaveFormPAC Processor board. To mount the board in your enclosure or console, do the following:

1. Determine a convenient, accessible location in which to mount the board, allowing enough room for installation and maintenance.
2. Mount the board, using the four (4) standoffs provided, referring to Figure 2-3 for mounting dimensions. Standoffs are 6-32 and 1/2 in. long. Recommended screw size is 6-32 x 3/8 in.

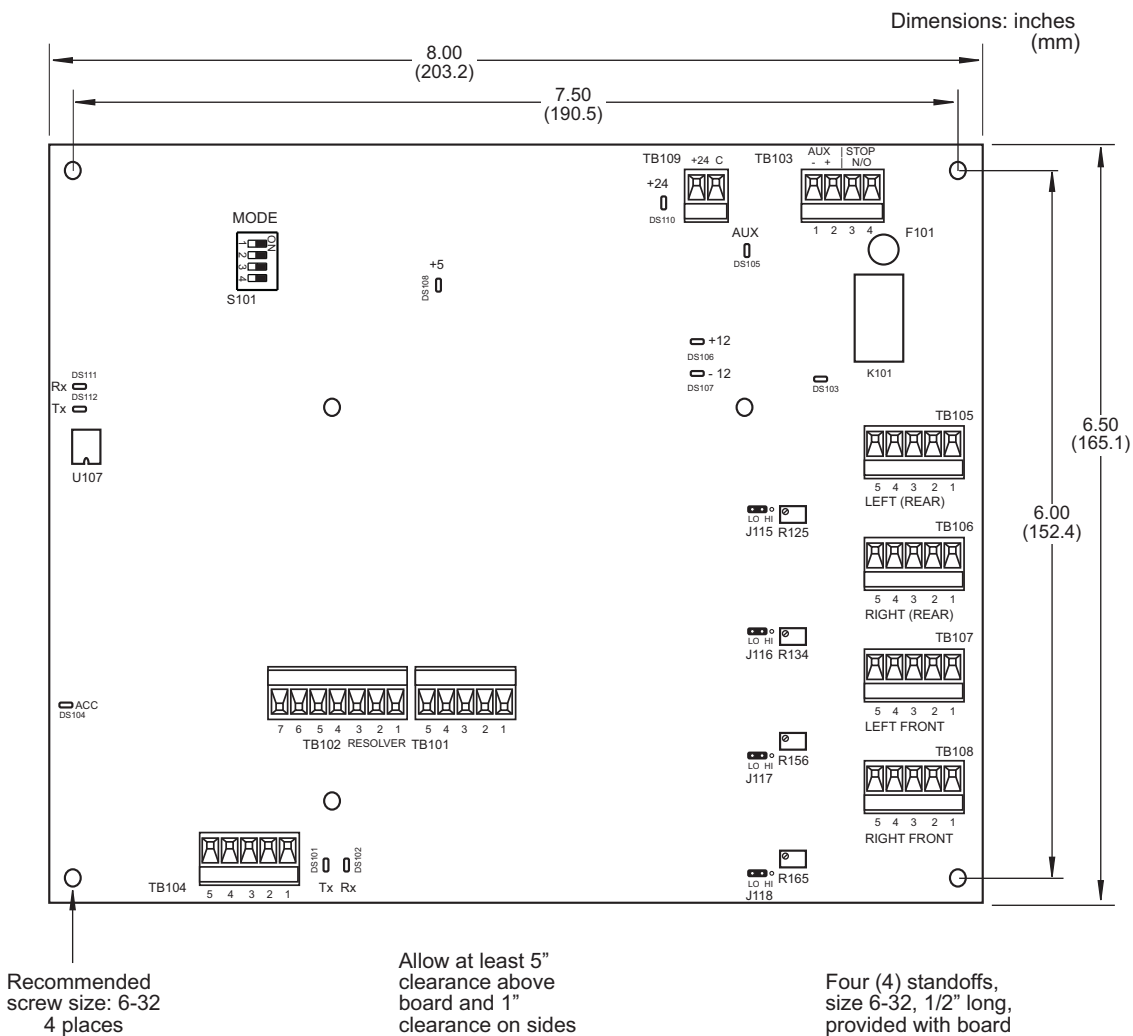


Figure 2-3. WaveFormPAC Processor Board: Mounting Dimensions

## Connecting AC Wiring

### WARNING

#### ELECTRIC SHOCK HAZARD

- Do not connect the AC power source until you are done with all other installation procedures.
- Turn off and disconnect power from the machinery WaveFormPAC is connected to before making any wiring connections. This includes power to the machine control and motor.

**Failure to comply with these instructions could result in death or serious injury.**

To connect AC power to your WaveFormPAC enclosure or to the non-enclosure WaveFormPAC mounting plate, perform the following steps:

### NOTICE

#### IF YOU PROVIDE YOUR OWN POWER SUPPLY

If you ordered the WaveFormPAC Processor board without a power supply, refer to *Specifications*, page 1-7 for power requirements. Wire the +24 Vdc connection from your power supply to the pin labelled “+24” on TB109 at the upper right of the WaveFormPAC Processor board (see Figure 2-5, page 2-7 for location). Wire the ground connection to the pin on TB109 labelled “C.” See Figure 1 at the back of the manual for wiring connections.

1. Locate the input power terminal block at the upper right of the WaveFormPAC enclosure, as shown in Figure 2-4, page 2-6. The terminal block is mounted just above the WaveFormPAC Processor board and to the right of the power supply.
2. Determine how you will bring wiring from your 115 or 230 Vac power source to the enclosure or console. For 115 Vac, you need three wires—black (High), white (Neutral), and green (Ground). For 230 Vac, wires are black (High), red (Neutral), and green or green/yellow (Ground). No. 16 wire is recommended, No. 14 if local codes require it, with a minimum 75° C temperature rating.

### NOTICE

#### WAVEFORMPAC AUTOMATICALLY ADJUSTS TO 115 OR 230 VOLT INPUT POWER

You do not need to use a switch or other device to set the input power level.

3. Run the power wires through flexible, liquid-tight conduit to WaveFormPAC. You can run the wires alone or with other high-voltage cables, but do not run the wires with low-voltage conductors.

If you ordered an enclosure, it is rated NEMA 12 (protected against dust and oil). You must use conduit of the same rating and make proper connections to ensure NEMA 12 protection. Wires go through the top right knockout. Leave a small service loop inside the enclosure.

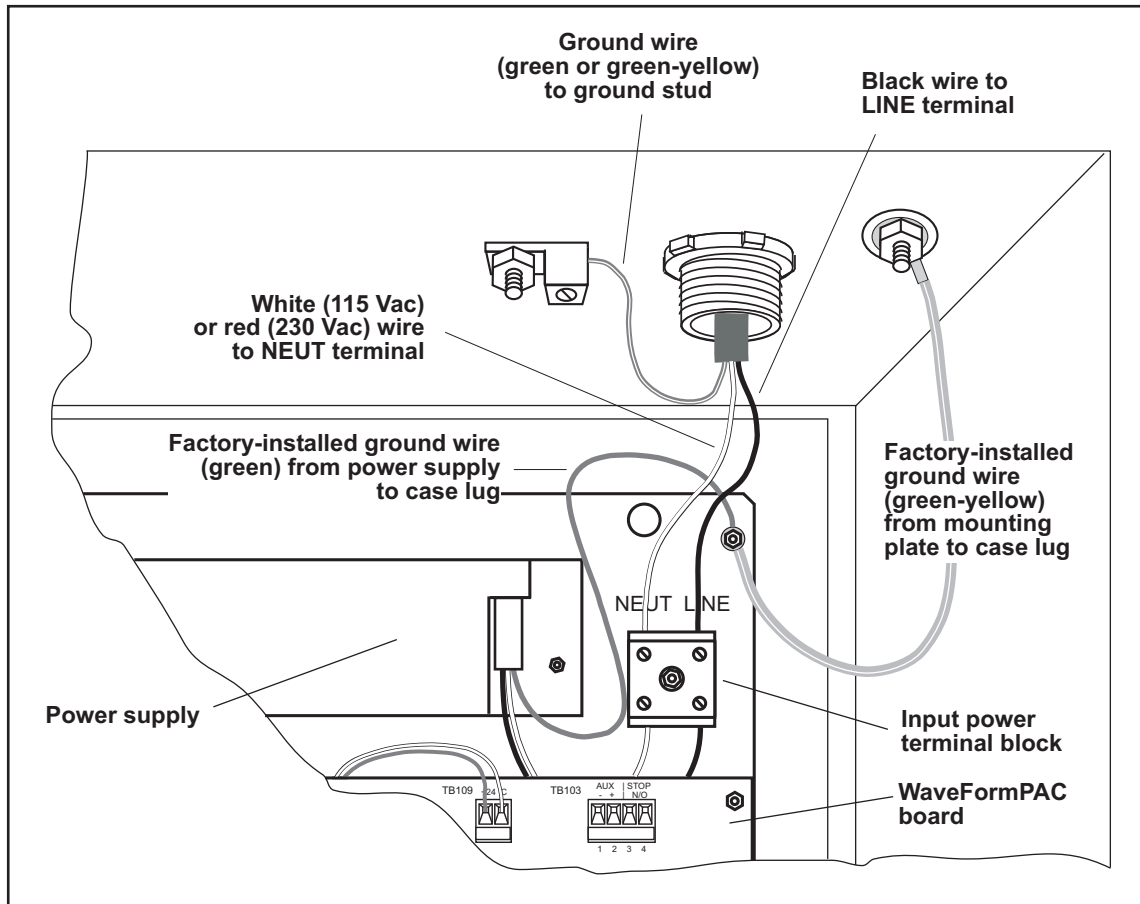


Figure 2-4. AC Power Connections (WaveFormPAC Enclosure)

4. Connect the ground (green or green/yellow) wire to the ground stud on the ceiling at the top right of the enclosure, as shown in Figure 2-4. To make the connection, strip the ground wire about 1/4 in. (6.4 mm) from the end, loosen the screw on the ground stud, slide the wire into the hole, and tighten the screw to pin the wire in place.
5. Connect the power wires.  
 For 115 Vac power, connect the black wire to the LINE terminal on the input power block, as shown in Figure 2-4, and the white wire to NEUT.  
 For 230 Vac, connect the black wire to the LINE terminal and the red wire to NEUT.  
 Strip the wire 1/4 in. from the end. Loosen the screw in the input power terminal block, insert the stripped portion of the wire, and tighten the screw.
6. Double-check connections.
7. Make all necessary conduit connections to ensure NEMA 12 protection.

## Connecting Stop Circuit Wiring

Wiring connections for stop circuits are made on terminal block TB103, which is located at the upper right of the WaveFormPAC processor board (see Figure 2-5). To make wiring connections, do the following:

### NOTICE

WaveFormPAC must be wired into the stop circuit on the press. Otherwise, SmartPAC 2 cannot stop the press if WaveFormPAC detects a tonnage fault.

Wintriss recommends that you connect WaveFormPAC to the top-stop rather than to the E-stop circuit of your press to prevent the press from sticking on the bottom if an overload occurs.

Top-stop circuits are active only in Continuous (automatic) operations on most press controls. If overload protection is required during Inch or Single-stroke mode, you may have to install an additional relay so that WaveFormPAC can stop the press.

1. Determine how you will connect the wires from WaveFormPAC to your press control stop circuit. You need two wires. No. 16 is recommended, No. 14 if local codes require it. Wires should be connected to the top-stop circuit to prevent the press from sticking on the bottom of its stroke when WaveFormPAC stops the press due to an overload.

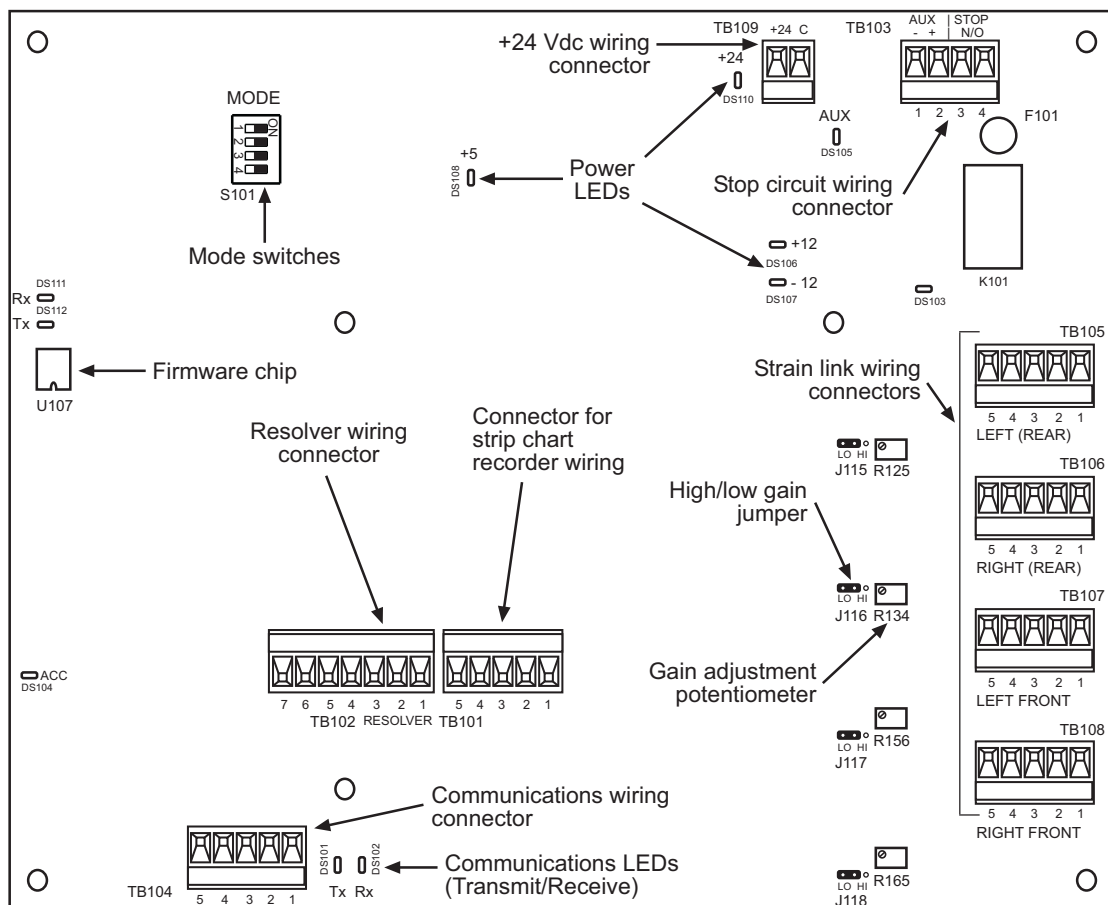


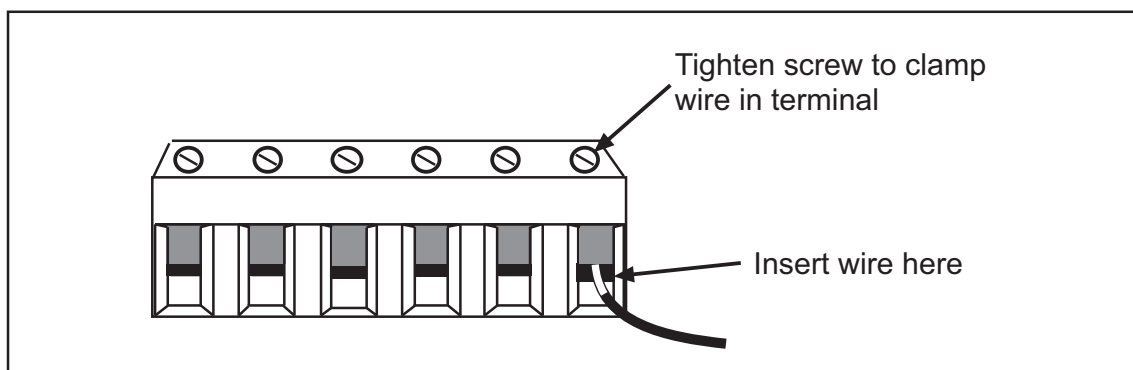
Figure 2-5. WaveFormPAC Processor Board: Location of Important Components

2. Run the stop circuit wires through flexible liquid tight conduit to WaveFormPAC. If you ordered an enclosure, it is rated NEMA 12 (protected against dust and oil). You must use conduit of the same rating and make proper connections to ensure NEMA 12 protection. Wires go through the top right knockout. Leave a small service loop inside the enclosure.
3. Remove the connector from terminal block TB103, and connect the press control stop circuit wires to pins 3 and 4 as shown in Table 2-1. Either wire can be connected to either pin. Pins 1 and 2 on TB103 are not used.

*Table 2-1. Stop Circuit Wiring Connections: TB103*

Pin #	Label	Function
1	Aux -	Not used
2	Aux +	Not used
3	Stop N/O	Stop circuit
4	Stop N/O	Stop circuit

To connect a wire, loosen the screw over the correct slot by turning it counterclockwise (see Figure 2-6). Strip the wire 1/4 in. (6.4 mm) from the end. Insert the bare wire into the slot 90% of the way. Tighten the screw. The metal tooth inside the slot will clamp down on the bare wire for a tight connection. Make sure the metal tooth is clamped down on the bare part of the wire, not on the insulation. If it is on the insulation, you will have a bad connection.



*Figure 2-6. Correct Way to Make Terminal Block Connections*

## NOTICE

### WIRING FOR WINTRISS CLUTCH/BRAKE CONTROL

If you are wiring the WaveFormPAC stop circuits to a WPC II, WPC 1000, or WPC 2000 clutch/brake control, connect the wire from pin #4 on TB103 on the WaveFormPAC processor board to terminal #79 on the WPC processor board and the wire from pin #3 on TB103 to terminal #80 on the WPC board.



**NOTICE**

The TB103 connector can only be plugged in one way. Make sure you do not start at the wrong end when connecting stop circuit wires. Check your wiring against the labels stamped on the processor board, holding the connector against the terminal block the way it will plug in.

4. Plug the connector back into the TB103 terminal block. Double-check connections, referring to the labels stamped on the board.
5. Make all necessary conduit connections to ensure NEMA 12 protection.
6. Do not connect wires to the AC power source until you are done with all other installation procedures. Also make sure you number all wires in a way consistent with your press's electrical prints.

**⚠ WARNING****ELECTRIC SHOCK HAZARD**

Do not connect AC wires to the power source until all other installation procedures have been completed.

**Failure to comply with these instructions could result in death or serious injury.**

## Installing Strain Links

Two or four differential strain links are provided with your WaveFormPAC load analyzer, depending on the WaveFormPAC configuration. Part numbers and corresponding cable lengths or connector type are shown in Table 2-2.

*Table 2-2. Strain Link Part Numbers with Cable Length or Connector Type*

<b>Part Number: Standard</b>	<b>Part Number: Metric</b>	<b>Cable Length or Connector Type</b>
9647101	9647301	30 ft. cable
9647102	9647302	100 ft. cable
9647103	9647303	12 in. cable with MS in-line connector
9647104	9647304	60 ft. cable
9647201	9647305	Hirschman connector

If you plan to use other strain links, contact Wintriss Tech. Support to make sure they are compatible with your WaveFormPAC unit.

## Mounting Strain Links

To mount strain links, follow these steps, referring to Figure 2-7 for mounting dimensions::

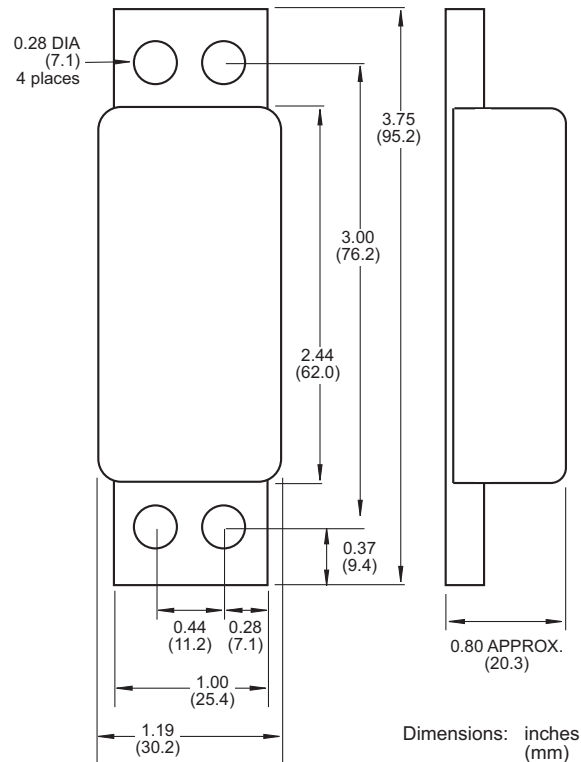


Figure 2-7. Strain Link: Mounting Dimensions

1. Select locations on the press where you plan to mount the strain links.

On gap-frame (OBI or OBG) presses, strain links can be mounted on the front, where they measure tension, or on the rear, where they measure compression (see Figure 2-8, page 2-11). The rear-mounting option is often preferred because the strain links are away from the work area.

On straight side presses, strain links are typically mounted on both front and rear; they measure tension, or stretching of the frame. On two-channel WaveFormPACs, strain links are mounted diagonally—for example, one on the left front, one on the right rear (see Figure 2-9, page 2-12). On 4-channel units, strain links are mounted on all four corners.

Sand down the frame's surface to remove all paint or plastic filler, which will affect strain link readings. Cast frames may need light grinding to provide a flat surface.

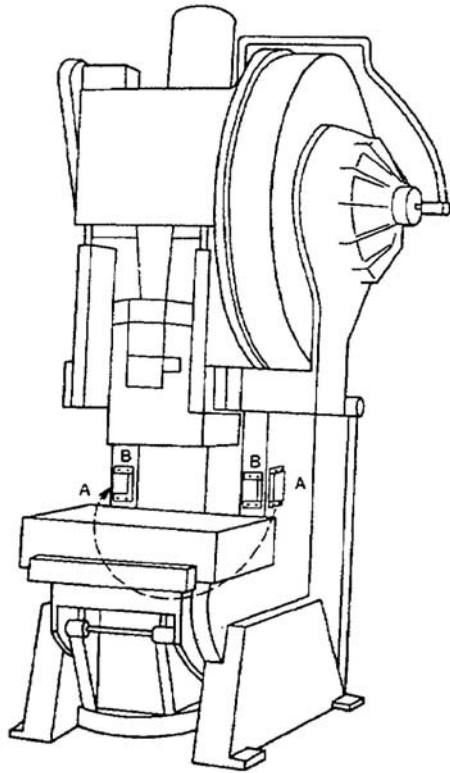
### NOTICE

#### STRAIN LINKS MUST BE MOUNTED ON A FLAT SURFACE

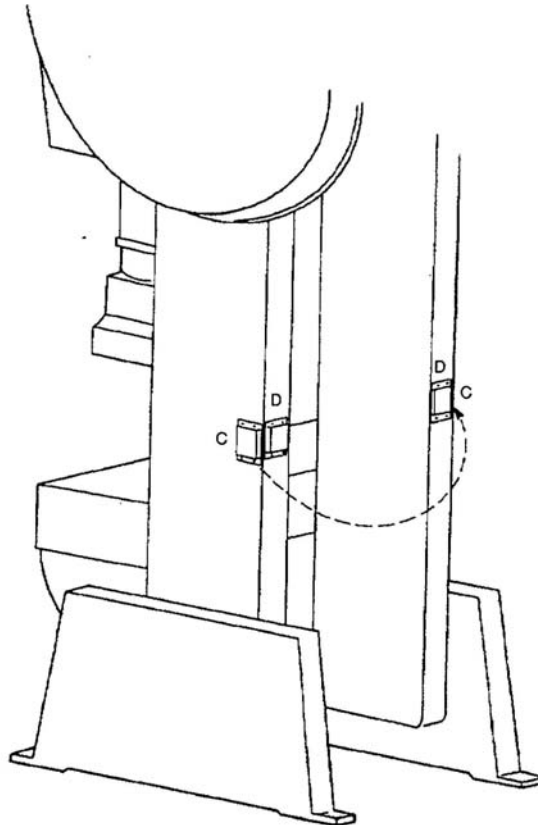
Make sure there are no imperfections, ridges, or cavities on the mounting surface. If strain links are not mounted on a flat surface, they will be difficult or impossible to zero. Irregular surfaces also cause inaccurate tonnage readings.

**⚠ WARNING**

Use caution when determining an appropriate location for each strain link! Do not mount any strain link on the press column above or below a hole 1 in. in diameter or larger. Avoid mounting strain links inside the die area where they will be subjected to harsh chemicals. If necessary, use a cover to protect strain links.

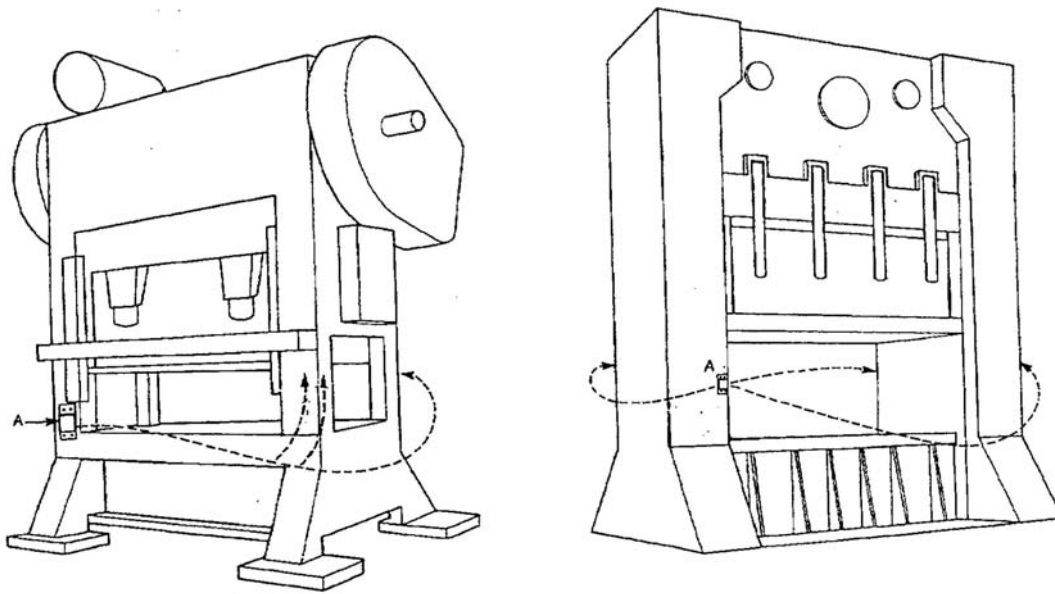


Front-mounting: strain links measure tension  
A—Mounting locations on front sides of press  
B—Mounting locations on front face of press



Rear-mounting: strain links measure compression  
C—Mounting locations on rear sides of press  
D—Mounting locations on rear face of press

*Figure 2-8. Strain Link Mounting Options on Gap-frame Presses*



Column-mounting: strain links measure tension

A—Mounting locations on front and rear of press (either face or sides)

2-channel: strain links mounted diagonally (e.g., left front, right rear)

4-channel: strain links mounted on all four corners

*Figure 2-9. Strain Link Mounting Options on Straight-side Presses*

2. Select the area for the first mounting hole. Using a No. 7 drill bit, drill the hole 1/2 in. deep and bottom tap for a 1/4 x 20 thread.

### **NOTICE**

#### **DRILLING AND TAPPING FOR METRIC SCREWS**

If you are installing metric strain links, use a 5 mm drill bit, drill the hole 12 mm deep, and tap with an M6X1 thread.

### **NOTICE**

When drilling, make sure the holes are at right angles to the surface. The strain link will not work properly if the mounting holes are cocked or angled.

3. Mount the drill jig supplied with the strain links (see Figure 2-10, page 2-13), first aligning the large hole in the jig with the mounting hole you have just drilled and tapped, then securing the jig to the press frame with the long mounting screw. (The four shorter screws are used to mount the strain link).

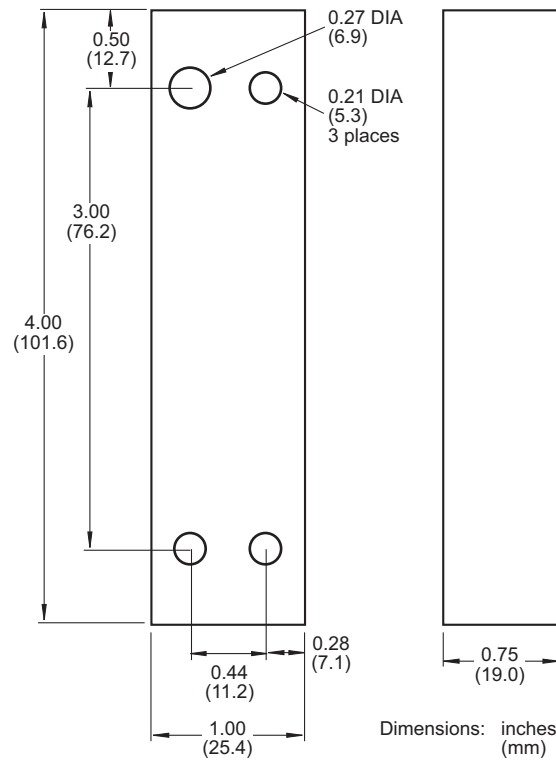


Figure 2-10. Strain Link Drill Jig: Mounting Dimensions

## NOTICE

### INSTALLING METRIC STRAIN LINKS

If you are installing metric strain links, the drill jig includes both a metric and a standard 1"-long screw. The metric screw is M6X1 and is easily identified because it is made of stainless steel and has more threads (25 vs. 20). The standard screw is 1/4-20.

4. Using the three smaller holes in the drill jig as guides, drill the three remaining mounting holes. Drill the holes 1/2 in. deep, using a No. 7 drill bit.
5. Remove the drill jig, and tap the three holes. Bottom tap for a 1/4 x 20 thread.
6. Mount the strain link loosely on the press, using the four shorter mounting screws.

## NOTICE

### STRAIN LINKS SHOULD BE MOUNTED LOOSELY

Do not tighten the screws on the strain links. The strain links are tightened down during the strain link zeroing procedure (see page 3-16).

7. Repeat steps 2 through 6 for the remaining strain links.

8. Tag each strain link cable to identify its position on the press.
  - For 2-channel WaveFormPACs, identify strain links as “Left” and “Right”
  - For 4-channel units, label strain links as “Left Front,” “Right Front,” “Left Rear,” and “Right Rear.”

## Wiring Strain Links

To wire strain links, perform the following steps:

1. Run the strain link cables through flexible, liquid-tight conduit to WaveFormPAC. If you ordered an enclosure, it is rated NEMA 12 (protected against dust and oil). You must use conduit of the same rating and make proper connections to ensure NEMA 12 protection. Wires go through the bottom right knockout on the enclosure.

### NOTICE

Do not run strain link wires through the same conduit as power wires. Strain link wires are sensitive to electrical noise. Separate conduits will provide protection and shielding.

2. Measure cable to length, making sure each cable reaches the appropriate connector on the WaveFormPAC processor board (see Table 2-3) and allowing for a service loop inside the enclosure; then, cut the cable.

*Table 2-3. Strain Link Connections on WaveFormPAC Processor Board*

Terminal Block Connector	Strain Link Connections: 2-Channel WaveFormPAC	Strain Link Connections: 4-Channel WaveFormPAC
TB105	Left	Left Rear
TB106	Right	Right Rear
TB107	Not used *	Left Front
TB108	Not used *	Right Front

\* You must install a jumper from pin 2 to pin 3 on both unused connectors to configure WaveFormPAC as a 2-channel unit. See step 7, below.

3. Strip the outer cable 1 to 2 in. (25.4 to 50.8 mm) from the end so you can easily separate and work with individual wires, then strip wires 1/4 in. (6.4 mm) from the end.
4. Remove one of the strain link connectors (TB105 through TB108), referring to Table 2-3.

### CAUTION

#### INCORRECT WIRING CAN DAMAGE STRAIN LINKS

Make sure to connect the black and red wires to the correct terminals as shown in Table 2-4 or Table 2-5, page 2-15. If you reverse the wiring, the strain link can be damaged.

**Failure to comply with these instructions could result in property damage.**

5. Wire the connector, as shown in Table 2-4 or Table 2-5. If you mounted the strain links to read tension, refer to Table 2-4. If you mounted the strain links to read compression, refer to Table 2-5. Make sure to connect the cable shield to the ground stud on the enclosure nearest the knockout through which you bring the strain link wiring.

*Table 2-4. Strain Link Wiring Connections, TB105 - TB108: Tension*

Pin #	Wire Color *	Function
1		Unused
2	Green	Input +
3	White	Input -
4	Black	Ground
5	Red	Exc +

\* Shield should be connected to ground stud on enclosure nearest entry of strain link wiring.

*Table 2-5. Strain Link Wiring Connections, TB105 - TB108: Compression*

Pin #	Wire Color *	Function
1		Unused
2	White	Input +
3	Green	Input -
4	Black	Ground
5	Red	Exc +

\* Shield should be connected to ground stud on enclosure nearest entry of strain link wiring.

6. When you have finished wiring the connector, plug it back into the terminal block from which you removed it. The connector goes in only one way. Double-check connections.
7. Wire the remaining strain link cables, repeating steps 4 through 6.

If you plan to use WaveFormPAC as a two-channel load monitor, you must install a jumper between pins 2 and 3 on both of the unused strain link connectors (i.e., TB107 and TB108). Also, make sure that switch 2 on S101 on the WaveFormPAC Processor board is set to ON (see *Making Settings on Switch Block S101*, page 3-1).

If you plan to use WaveFormPAC as a four-channel unit, you must wire all four strain link connectors as shown in Table 2-4 or Table 2-5 and set switch 2 on S101 to OFF (Default).

## Connecting Communications Wiring

To connect communications wiring from SmartPAC 2 to WaveFormPAC, do the following:

1. Locate terminal block TB103 on the SmartPAC 2 processor board and terminal block TB104 on the WaveFormPAC processor board (see Figure 2-5).

- Run the four-conductor shielded communications cable through flexible, liquid-tight, low-voltage conduit from SmartPAC 2 to WaveFormPAC. If you have SmartPAC 2 and WaveFormPAC enclosures, they are rated NEMA 12 (protected against dust and oil). You must use conduit of the same rating and make proper connections to ensure NEMA 12 protection. Wiring goes through the bottom right knockout on the SmartPAC 2 enclosure and through the bottom left knockout on the WaveFormPAC enclosure.
- Make communications wiring connections as shown in Table 2-6, referring also to Figure 1 at the back of the manual.

*Table 2-6. Communications Wiring Connections*

<b>WaveFormPAC TB104 Pin #</b>	<b>SmartPAC 2 TB103 Pin #</b>
1 Unused *	240 Unused *
2 (+TXD)	241 (+RXD2)
3 (-TXD)	242 (-RXD2)
4 (+RXD)	243 (+TXD2)
5 (-RXD)	244 (-TXD2)

\* Shield should be connected to ground stud on enclosure nearest entry of communications wiring.

- Verify that switch 1 on Mode switch block S101 on the WaveFormPAC processor board is set to the OFF position, its default setting (see page 3-1).

### **NOTICE**

If you connect a second WaveFormPAC to SmartPAC 2, you must set switch 1 on S101 on the second WaveFormPAC board to the ON position. This setting identifies the second WaveFormPAC to SmartPAC 2.

## **Connecting SmartPAC 2 Resolver to WaveFormPAC**

### **NOTICE**

The resolver must be wired in parallel between SmartPAC 2 and WaveFormPAC.

To connect resolver wiring from SmartPAC 2 to WaveFormPAC, do the following:

- Locate terminal block TB101 on the SmartPAC 2 processor board and terminal block TB102 on the WaveFormPAC processor board (see Figure 2-5).
- Run the four-conductor shielded resolver cable through 1/2-in. flexible, liquid-tight, low-voltage conduit from SmartPAC 2 to WaveFormPAC. If you have SmartPAC 2 and WaveFormPAC enclosures, they are rated NEMA 12 (protected against dust and oil). You must use conduit of the same rating and make proper connections to ensure NEMA 12 protection. Wiring goes through the bottom right knockout on the SmartPAC 2 enclosure and through the bottom left knockout on the WaveFormPAC enclosure.



- Remove the TB101 and TB102 connectors, and make wiring connections as shown in Table 2-7, below, and in Figure 1 at the end of the manual. You must wire in parallel. For counterclockwise rotation, swap the black and yellow wires as directed in the footnote to the table.

*Table 2-7. Resolver Wiring Connections*

WaveFormPAC TB102 Pin #	Wire Color	SmartPAC 2 TB101 Pin #
1 (SHLD)	Shield	212 (SHLD)
2 (S1)	Black *	213 (S1)
3 (S2)	Green	214 (S2)
4 (R1)	Red	215 (R1)
5 (S3)	Yellow *	216 (S3)
6 (R2)	Orange	217 (R2)
7 (S4)	Brown	218 (S4)

\* Shown for clockwise rotation, facing shaft. For counterclockwise rotation, swap black and yellow wires.

### NOTICE

You must zero the resolver even if you have already done so as part of the SmartPAC 2 installation procedure. Zeroing the resolver ensures that WaveFormPAC and SmartPAC 2 are synchronized.

- Zero the resolver, performing the procedure beginning on page 3-11.

## Wiring an Oscilloscope (Optional)

You can connect an oscilloscope to the WaveFormPAC load analyzer to view tonnage waveforms produced at each strain link. The WaveFormPAC outputs for this function are -4.688 to +4.688 Vdc.

At 120% of press capacity, output of each strain link is 4.688 Vdc. Output is ratiometric, so at 100% of press capacity, output of each strain link is 3.907 Vdc.

For example, for a four-channel WaveFormPAC with press capacity of 100 tons, the output for each strain link is 3.907 Vdc at 25 tons of load, 1.563 Vdc at 10 tons, etc.

Follow these steps to connect an oscilloscope.

- Locate terminal block TB101 at the lower left of the WaveFormPAC processor board (see Figure 2-5).
- Run wiring from the oscilloscope through flexible, liquid-tight conduit to the bottom left knockout on the WaveFormPAC enclosure or to the appropriate location on your console. Measure and cut the cable so it reaches TB101 easily.

The optional WaveFormPAC enclosure is rated NEMA 12 (protected against dust and oil). If you have a WaveFormPAC enclosure, you must use conduit rated NEMA 12 and make proper conduit connections to ensure NEMA 12 protection.

3. Remove the connector from the TB101 terminal block, and connect wiring for the oscilloscope as shown in Table 2-8. You will connect five wires, one for each of the four strain links and one for ground.

*Table 2-8. Oscilloscope Wiring Connections, TB101*

WaveFormPAC TB101 Pin #	Oscilloscope Connections
1	Channel 1 (Left Rear)
2	Channel 2 (Right Rear)
3	Channel 3 (Left Front)
4	Channel 4 (Right Front)
5	Ground

4. Plug the connector back into the TB101 terminal block. The connector can be plugged in only one way. Check the wiring connections to make sure they are correct.
5. Connect the wires from TB101 to the oscilloscope, following the manufacturer's instructions for your specific oscilloscope.

## Connecting AC Wires to Power Source

Connect AC wires from the WaveFormPAC control to your AC power source only when you are finished connecting all wiring, including wiring for the optional oscilloscope.

### WARNING

#### **ELECTRIC SHOCK HAZARD**

Make sure main power is off when you connect WaveFormPAC to the main power source.

**Failure to comply with these instructions could result in death or serious injury.**

## Powering Up WaveFormPAC

Once WaveFormPAC is connected to a power source, do the following to power up the unit:

1. Turn on power to SmartPAC 2.
2. Check the Main Program Menu or Main Run Menu to make sure that the TONNAGE/WAVEFORM item appears.
3. If the TONNAGE/WAVEFORM menu item is not displayed, turn off power to the SmartPAC 2. Re-check connections for power, strain links, communications, and resolver. Then turn power on again and check for the TONNAGE/WAVEFORM menu item.

4. If TONNAGE/WAVEFORM still does not display, perform the *Tonnage/WaveForm Menu Option Does Not Display at Power-up (Communications Error)* troubleshooting procedure, page 6-5. Then power up the unit again.
5. If TONNAGE/WAVEFORM still does not display, call Wintriss Tech. Support.

Once you have made all connections and WaveFormPAC has power, you are ready to calibrate your WaveFormPAC. See Chapter 3.

## Installing New WaveFormPAC Firmware

### WARNING

#### ELECTRIC SHOCK HAZARD

- Disconnect main power at SmartPAC 2 and WaveFormPAC before working inside the enclosure(s). All power to the press, press control, and other equipment used with the press must be off when you work inside the enclosure.
- Remove all fuses and “tag out” per OSHA 1910.147 Control of Hazardous Energy (Lockout/Tagout).
- Ensure that this procedure is performed by qualified personnel.

**Failure to comply with these instructions could result in death or serious injury.**

### NOTICE

#### YOU MAY ALSO HAVE TO UPGRADE YOUR SMARTPAC FIRMWARE

If you are upgrading WaveFormPAC from a previous version, your SmartPAC 2 firmware may also have to be upgraded. Call Wintriss Tech. Support for more information.

To install an updated version of WaveFormPAC firmware, perform the following steps:

1. Verify that power has been turned off to SmartPAC 2, WaveFormPAC, the press, and any auxiliary equipment.
2. Verify that all LEDs on the WaveFormPAC Processor board are off (see Figure 2-5, page 2-7 for LED locations).

### CAUTION

#### STATIC DISCHARGE DAMAGE TO CHIP

Ground yourself before touching circuit boards or chips by touching a large metal object such as the press. Static electricity can destroy electronic components.

**Failure to comply with these instructions could result in property damage.**

3. Making sure that you are grounded, open the WaveFormPAC enclosure and locate the firmware chip, labelled U107, on the WaveFormPAC Processor board (see Figure 2-5). Note that the chip has a white label and the semi-circular notch on the chip faces down.

**NOTICE**

The new WaveFormPAC firmware chip must also be installed with the notch facing down.

**CAUTION**

If you use a screwdriver, be careful not to insert the screwdriver under the socket or you may damage the board.

**Failure to comply with these instructions could result in property damage.**

4. Use a chip puller to remove the old chip, or insert a small screwdriver between the bottom of the chip and the socket and carefully pry the chip from the board. Put the chip aside.
5. Making sure you are grounded, open the package containing the new firmware chip, and remove the chip from its holder.

**CAUTION****CHIP INSTALLED INCORRECTLY**

- Install the chip with the notch facing down; otherwise, when you power up the control, the chip will be destroyed.
- Align pins correctly with the socket before plugging chip in.

**Failure to comply with these instructions could result in property damage.**

6. Plug the chip into its socket, inserting the left row of pins first, then aligning the right row of pins over the socket and pushing them in. Make sure that the notch in the chip faces down and that all of the pins are in the socket.

**NOTICE**

If the two rows of pins are spread too far apart to plug easily into the socket, hold the chip on its side on a flat surface with the pins pointing toward you. Being careful not to overbend the pins, gently draw the top of the chip toward you until the pins bend a little. Turn the chip over so that the other row of pins is now flat and pointing toward you. Draw the top of the chip toward you again until the pins bend. When the rows of pins look parallel, plug the chip into its socket again. If the chip still doesn't fit, repeat this procedure.

7. To verify that the chip is installed correctly, close the WaveFormPAC enclosure, and power up the SmartPAC 2 and WaveFormPAC.

- If the SmartPAC 2 powers up normally, go to step 8.
- If the SmartPAC 2 powers up with a fault message like the following

**A 4 CHANNEL WAVEFORMPAC WAS  
INSTALLED THE LAST TIME THE UNIT  
WAS POWERED-UP AND WAS NOT SEEN  
THIS TIME.**

one or more pins may be bent or not plugged in properly. Turn the power off, and repeat the procedure in the Notice for step 6. Power the unit up again. If the same fault message displays, contact Wintriss Tech. Support.

8. Access the List of Installed Options screen in SmartPAC 2 Initialization, referring to your SmartPAC 2 manual if necessary. WaveFormPAC should be displayed in the options list along with its new firmware version number (for example, V2.00).
9. If WaveFormPAC appears in the list, you have completed installation of your new firmware successfully.

If WaveFormPAC is not in the list, contact Wintriss Tech. Support.



# Chapter 3. Initialization and Calibration

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This chapter shows you how to set Initialization parameters for WaveFormPAC in SmartPAC 2 Initialization mode and how to calibrate the WaveFormPAC unit. It is organized in the following sections:

- *Making Settings on Switch Block S101* (next)
- *Accessing the SmartPAC 2 Main Initialization Menu*, page 3-2
- *Making Tonnage/Waveform Initialization Settings*, page 3-3
- *Zeroing the Resolver*, page 3-11
- *Locking Run Mode Actions*, page 3-13
- *Viewing Communications*, page 3-14
- *Calibrating WaveFormPAC*, page 3-16
- *Checking Linearity*, page 3-33
- *Saving the Calibration WaveForm*, page 3-33
- *Final Checkout*, page 3-35

## NOTICE

### REFER TO SMARTPAC 2 USER MANUAL

Instructions for using the screens in Initialization mode are provided in Chapter 4 of the SmartPAC 2 user manual. For help in using the keyboard, refer to Chapter 3 of the manual.

## NOTICE

### USING SMARTPAC 2 HELP

If you need help with an Initialization mode screen, press the HELP key when that screen is displayed.

## NOTICE

### SELECT = HIGHLIGHT + ENTER

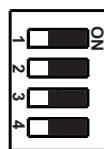
When this manual instructs you to select an item, you should highlight the item, and press ENTER.

## Making Settings on Switch Block S101

Switches 1 and 2 on switch block S101 (located in the upper left corner of the WaveFormPAC Processor board—see Figure 2-5, page 2-7) configures the number of WaveFormPACs connected to SmartPAC 2 (up to two can be connected) and the number of strain link channels on a WaveFormPAC (two or four). Switches 3 and 4 are unused. All four switches on S101 are set to OFF by default, as shown in Figure 3-1, page 3-2.

Switch 1 and 2 settings are shown in Table 3-1, page 3-2.

## MODE



S101

Figure 3-1. Switch Block S101 (Default Settings Shown)

Table 3-1. Switch Block S101 Settings

S101 Switch Number	Setting
1	<p>OFF (Default) Identifies a WaveFormPAC as a single unit connected to SmartPAC 2 or as the first of two connected WaveFormPACs. If a second WaveFormPAC is connected, switch 1 on that unit must be set to ON.</p> <p>ON Identifies a WaveFormPAC as the second of two units connected to SmartPAC 2. Switch 1 on the first unit must be set to OFF.</p>
2	<p>OFF (Default) Configures WaveFormPAC as a four-channel unit.</p> <p>ON Configures WaveFormPAC as a two-channel unit.</p>
3	Unused
4	Unused

## Accessing the SmartPAC 2 Main Initialization Menu

### NOTICE

When switching between operating modes with the Program/Run key, make sure that SmartPAC 2 displays the top-level screen in the current mode (i.e., Main Program Menu or Main Run Menu). To return to the top-level menu, press RESET repeatedly.

To access the SmartPAC 2 Main Initialization Menu, do the following:

1. Turn the Program/Run key switch on the SmartPAC 2 front panel to “PROG.”
2. Press the “1” and “CLEAR” keys simultaneously for one second. The Main Initialization Menu (see Figure 3-2, page 3-3) displays. The screen you see may be slightly different depending on your installed options.



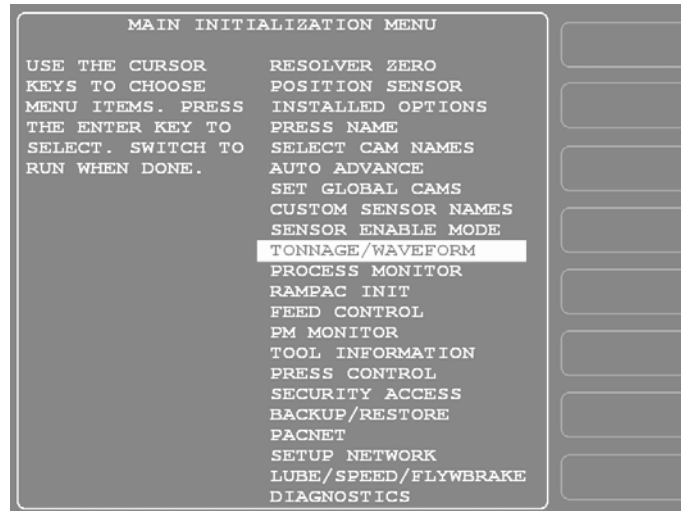


Figure 3-2. Main Initialization Menu

## Making Tonnage/Waveform Initialization Settings

This section shows you how to make settings on the Tonnage/Waveform Initialization Menu (see Figure 3-3), which you access by selecting TONNAGE/WAVEFORM on the Main Initialization Menu.

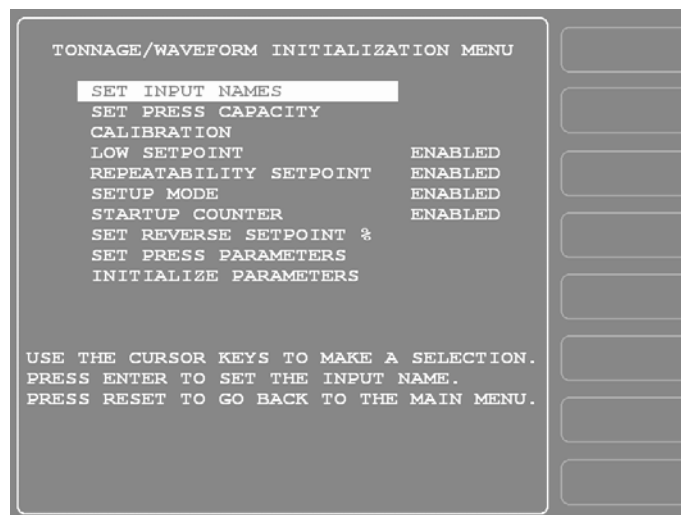


Figure 3-3. Tonnage/Waveform Initialization Menu

The following settings are covered:

- *Initializing Parameters*, page 3-4
- *Setting Input Names*, page 3-4
- *Disabling/Enabling WaveFormPAC Parameters*, page 3-6
- *Setting Reverse Setpoint % of Press Capacity*, page 3-7
- *Setting Press Parameters*, page 3-8

Instructions for setting press capacity are provided in *Setting Full-scale Tonnage on Your WaveFormPAC*, page 3-28. To make calibration settings, refer to *Adjusting WaveFormPAC to Read the Correct Tonnage*, page 3-29.

## Initializing Parameters

Before making Initialization settings, you must initialize WaveFormPAC. This action clears all current Initialization parameters and returns the unit to the default Initialization settings made at the factory. To initialize WaveFormPAC, do the following:

1. Select “INITIALIZE PARAMETERS,” the last item on the Tonnage/Waveform Initialization Menu. The warning message shown in Figure 3-4 will display.

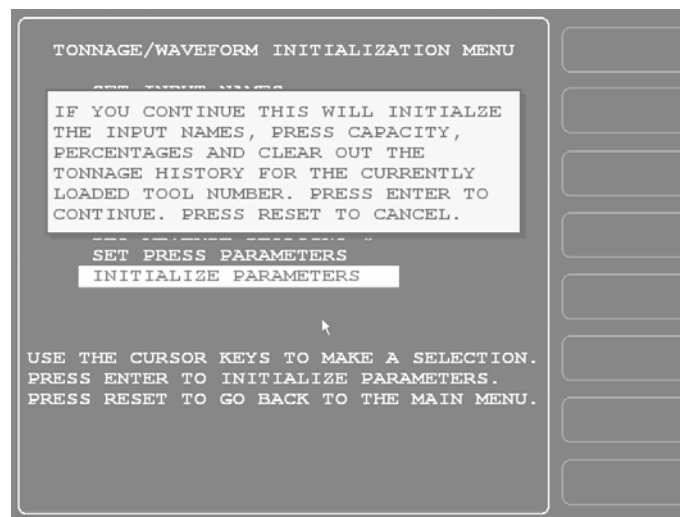


Figure 3-4. Initialize Parameters Warning Message

2. Press ENTER to continue. When the initialization process is complete, the message disappears, and you are returned to the Tonnage/Waveform Initialization Menu.

## Setting Input Names

The SET INPUT NAMES item on the Tonnage/Waveform Initialization Menu allows you to change the default names for WaveFormPAC’s strain link channels. If you have a two-channel WaveFormPAC load analyzer, two input names can be set. If you have a four-channel unit, you can set four input names. To change the Input Name defaults, do the following:

1. Select “SET INPUT NAMES” to display the Load Monitor Input Name Menu (see Figure 3-5, page 3-5). Default input names are as follows:
  - Input 1–Left Rear
  - Input 2–Right Rear
  - Input 3–Left Front
  - Input 4–Right Front

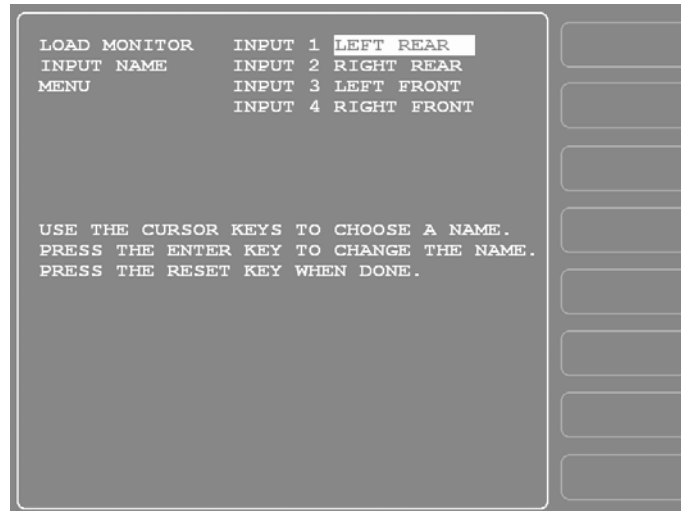


Figure 3-5. Load Monitor Input Name Menu with INPUT 1 Name Highlighted

2. To change an input name, select that entry. The Alphabetic Entry window displays, as shown in Figure 3-6.

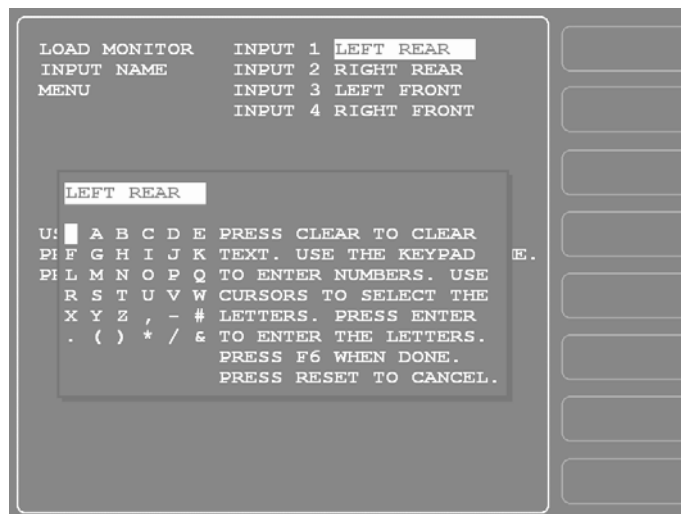


Figure 3-6. Load Monitor Input Name Menu with Alphabetic Entry Window Displayed

3. Follow the directions in the window to key in the name you want. The name can be any combination of alphabetic characters, numbers, and symbols.
  - To key in letters, use the Up (▲), Down (▼), Left (◀), and/or Right (▶) cursor keys to highlight each letter, then press ENTER to select it.
  - To key in numbers, press the desired selection on the numeric keypad, and press ENTER.
  - To clear an entry, press the CLEAR key.
  - To accept your selection, press the **F6** function key.

To cancel your selection, press RESET.

4. When you are finished, press RESET to return to the Tonnage/Waveform Initialization Menu.

**NOTICE**

The Press Capacity and Calibration items on the Tonnage Monitor Initialization Menu are used during the calibration procedure. Instructions for setting them are provided in *Setting Full-scale Tonnage on Your WaveFormPAC*, page 3-28, and *Adjusting WaveFormPAC to Read the Correct Tonnage*, page 3-29.

## Disabling/Enabling WaveFormPAC Parameters

The Tonnage/Waveform Initialization Menu allows you to enable or disable the following WaveFormPAC functions:

- Low setpoint
- Repeatability setpoint
- Setup mode
- Startup counter

When you disable an item, that functionality is no longer available in WaveFormPAC. For example, if you disable the low setpoint, the Low Setpoint field does not appear on Program and Run screens and, therefore, cannot be set.

Low and repeatability setpoints are explained in *WaveFormPAC's Setpoint Calculation Process*, page 4-1. The startup counter is discussed in *Startup Counter*, page 4-3.

Setup mode allows you to operate the press in Inch without generating low setpoint or repeatability faults. When Setup Mode is enabled, WaveFormPAC disables low and repeatability setpoints whenever the press is operated in Inch. In order to be functional, Setup mode also requires that you wire a Setup Mode circuit in SmartPAC 2 (see Chapter 2 in the SmartPAC 2 user manual). No special wiring is required if your WaveFormPAC is being used with SmartPAC 2 integrated with WPC 2000.

The high setpoint does not appear on this screen because the high setpoint cannot be disabled.

To enable or disable one of these items, do the following:

1. Press ENTER with the cursor resting in the desired field until the setting you want is displayed. The setting changes from ENABLED to DISABLED or from DISABLED to ENABLED each time you press ENTER.
2. Move the highlight bar to the next field and repeat step 1 for each of the remaining parameters.

## Setting Reverse Setpoint % of Press Capacity

The SET REVERSE SETPOINT % item on the Tonnage/Waveform Initialization Menu allows you to set the percentage that WaveFormPAC uses to calculate the high setpoint for “snap-through” reverse tonnage. The reverse tonnage setpoint is calculated by multiplying the value you enter in this field by the full-scale capacity of the press, which is also set on the Tonnage Monitor Initialization Menu (see *Setting Full-scale Tonnage on Your WaveFormPAC*, page 3-28). Press manufacturers typically recommend that reverse loads not exceed between 15% and 25% of press capacity. Refer to the manufacturer’s specifications to determine the correct value for your press.

Current reverse tonnage values can be viewed in Run mode (see *Viewing Reverse Tonnage*, page 5-32).

To set the reverse tonnage setpoint percentage, do the following:

1. Select “SET REVERSE SETPOINT %.” When the Numeric Entry window (see Figure 3-7) displays, key in the desired percentage value, following the directions in the window.

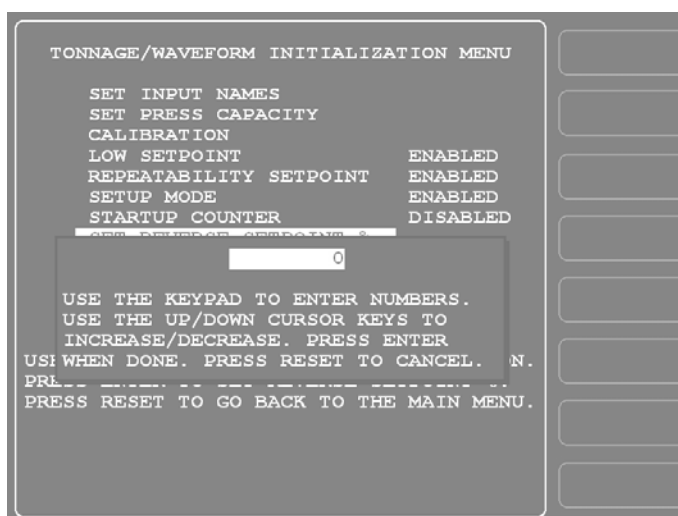


Figure 3-7. Numeric Entry Window Superimposed on Tonnage Monitor Initialization Menu

2. Press ENTER to confirm your entry, or press RESET to cancel.

### NOTICE

#### YOU CANNOT DISABLE REVERSE SETPOINT %

Reverse Setpoint % cannot be disabled. The default for this setting is 50%. However, we recommend that you set this value according to the specifications for your press.

## Setting Press Parameters

The SET PRESS PARAMETERS item on the Tonnage Monitor Initialization menu gives you access to the Press Parameters screen (see Figure 3-8), on which you can make settings needed by WaveFormPAC to calculate and display Distance Off Bottom and Ram Speed values in Run mode. WaveFormPAC can display these values for any angle during the load-generating portion of the stroke (i.e., 90° to 180°). Press Parameters screen items are also needed for completion and generation of the “critical curve,” a plot of press capacity for all angles between 90° and 180° that you can display for comparison with the current waveform in Run mode (see *Comparing the Current Waveform with the Critical Curve*, page 5-12).

```

STROKE LENGTH      = 10.00 INCHES
CONNECTION LENGTH  = 41.0 INCHES
UNITS SELECTION    = INCHES
SET CRITICAL CURVE

USE THE CURSOR KEYS TO SELECT THE VALUE.
PRESS THE ENTER KEY TO CHANGE THE VALUE.
PRESS THE RESET KEY WHEN DONE.
  
```

Figure 3-8. Press Parameters Screen

The first three fields on the Press Parameters screen—STROKE LENGTH, CONNECTION LENGTH, and UNITS SELECTION—are used by WaveFormPAC to calculate the Distance Off Bottom and Press Capacity entries on line 1 of the Critical Curve Table (see Figure 3-10, page 3-9). The Distance Off Bottom value displayed on line 1 is the ram’s vertical distance above the bolster when it has reached the halfway point in its stroke, which occurs at a crankshaft angle of approximately 90°. To calculate this value, WaveFormPAC needs to know the total length of the stroke, which is the sum of the Stroke Length and the Connection Length specified on the Press Parameters screen. The Distance Off Bottom at 180° is zero (0.00).

As shown in Figure 3-9, page 3-9, Stroke Length is the portion of the stroke determined by the length of the crank arm. The Connection Length is the portion of the stroke determined by the length of the member connecting the crankshaft and the ram.

To enter the Stroke Length and Connection Length, select each item, key in the value you want in the Numeric Entry window, and press ENTER. To change the units in which these items are measured from Inches (the default) to Millimeters, highlight UNITS SELECTION, and press ENTER. The units displayed for all three items toggles to “MM.”

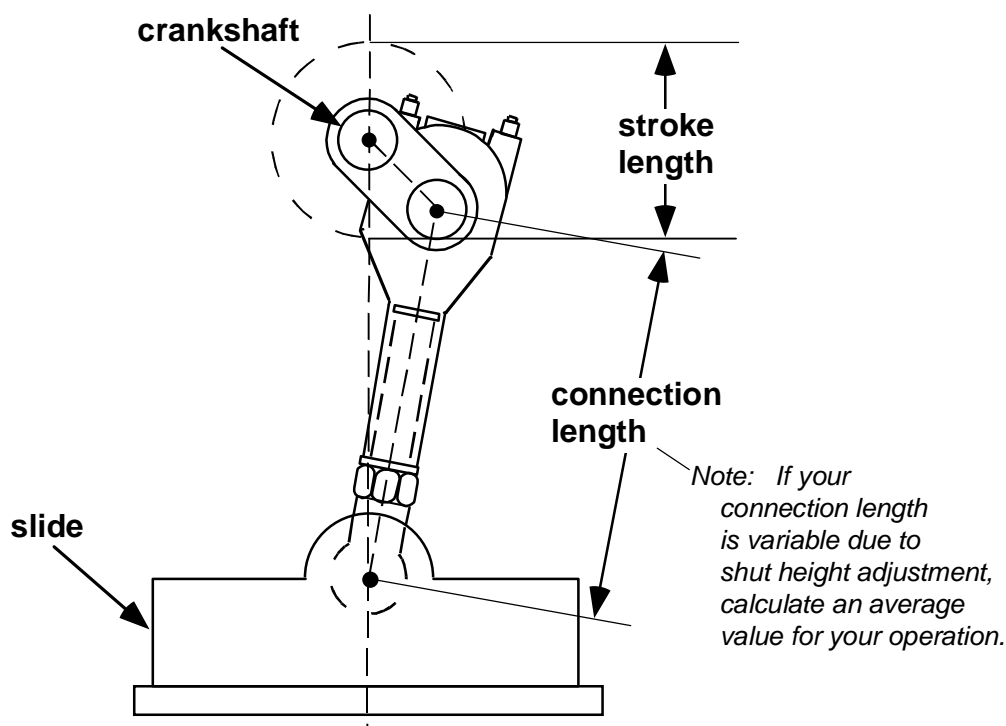


Figure 3-9. Stroke Length and Connection Length Illustrated (Eccentric Drive)

The SET CRITICAL CURVE item on the Press Parameters screen gives you access to the Critical Curve Table screen, an example of which is shown in Figure 3-10.

	DISTANCE OFF BOTTOM (IN)	PRESS CAPACITY
1	5.25	65.0
2	4.50	65.0
3	4.00	66.0
4	3.50	67.0
5	3.00	69.0
6	2.50	73.0
7	2.00	79.0
8	1.50	88.0
9	1.00	104.0
10	0.75	119.0
11	0.62	129.0
12	0.50	143.0
13	0.37	164.0
14	0.25	200.0
15	0.00	200.0

USE THE CURSOR KEYS TO SELECT THE VALUE.  
PRESS THE ENTER KEY TO CHANGE IT. PRESS  
THE RESET KEY WHEN DONE.

CLEAR THE TABLE

F1 F2 F3 F4 F5 F6 F7 F8

Figure 3-10. Critical Curve Table Screen

A critical curve is a plot of the press's tonnage capacity at each angle during the load-generating portion of the stroke (i.e., between 90° and 180°). WaveFormPAC generates the curve using the information you enter on the Critical Curve Table screen, which you, in turn, must obtain from the press manufacturer.

Maximum tonnage capacity is rated by the press manufacturer at a specified “distance off bottom,” such as 1/4 in. or 1/2 in., and decreases as the distance off bottom increases. These data points are used to generate the critical curve.

WaveFormPAC allows you to compare the current waveform with the critical curve in Run mode so you can quickly identify the points in the stroke at which actual tonnage exceeds the press’s off-bottom capacity and prevent critical structural damage to the press as a result of excessive loading.

The Critical Curve Table provides 15 lines of data. WaveFormPAC calculates the Distance Off Bottom on line 1 for you based on the Stroke Length and Connection Length entries on the Press Parameters screen. That leaves 14 lines for you to fill in with Distance Off Bottom and Press Capacity data provided by your press manufacturer. If you are given more than 14 points of data, choose values that satisfactorily represent press capacity throughout the range of Distance-Off-Bottom values. Once you have completed the table, WaveFormPAC calculates the Press Capacity value on line 1 based on your other Press Capacity entries.

**NOTICE**

Make sure that you have already set values for "Stroke Length" and "Connection Length" before starting the critical curve table.

To make entries in the Critical Curve Table, do the following:

**NOTICE**

Do not press F6 unless you intend to delete all previous entries from the table.

1. On the Press Parameters screen, select the SET CRITICAL CURVE item. The Critical Curve Table screen displays with the highlight bar resting on the Distance Off Bottom entry on line 2.
1. Press F6 (Clear the Table) to delete all previous entries. All entries are cleared from the screen, then a new value is displayed in the DISTANCE OFF BOTTOM field on line 1. This value is generated by WaveFormPAC based on your Stroke Length and Connection Length settings on the Press Parameters screen.
2. Press ENTER with the highlight bar in the DISTANCE OFF BOTTOM field on line 2, and when the Numeric Entry window displays, key in the value you want, including a decimal place if appropriate, and press ENTER.

The value you entered is displayed in the DISTANCE OFF BOTTOM field, and the highlight bar moves to the PRESS CAPACITY field on the same line.

3. Press Enter with the highlight bar in the PRESS CAPACITY field, and when the Numeric Entry window displays, key in the value you want, including a decimal point if appropriate, and press ENTER.

The value you entered is displayed in the PRESS CAPACITY field, and the highlight bar moves to the DISTANCE OFF BOTTOM field on line 3.



4. Repeat steps 2 and 3 to complete the rest of the table.

When you have entered the settings on the last line of the table, the PRESS CAPACITY field on line 1 is filled with a value generated by WaveFormPAC.

If you have any problems completing the Critical Curve Table, contact Wintriss Tech. Support.

### NOTICE

You must enter at least three lines of data in the Critical Curve Table to display an adequate critical press capacity curve in Run mode.

## Zeroing the Resolver

The resolver must be zeroed as part of the SmartPAC 2 installation procedure (see your SmartPAC 2 manual), but you must zero the resolver again after connecting SmartPAC 2 resolver wiring to your WaveFormPAC (see *Connecting SmartPAC 2 Resolver to WaveFormPAC*, page 2-16). Zeroing the resolver a second time synchronizes the SmartPAC 2 resolver zero setting with WaveFormPAC's resolver zero.

### NOTICE

The press must be at top dead center (i.e.,  $0^\circ \pm 2^\circ$ ) before you zero the resolver.

To zero the resolver, perform the following steps:

1. Create a test tool in Program mode by programming a few counter settings (see Chapter 4 in your SmartPAC 2 manual for instructions).
2. Load the test tool.
3. Turn the Program/Run key switch to RUN.
4. Inch the press to TDC ( $0^\circ$ ).
5. Access the SmartPAC 2 Main Initialization Menu (see *Accessing the SmartPAC 2 Main Initialization Menu*, page 3-2 for instructions).
6. Select the RESOLVER ZERO item. A screen similar to the one shown in Figure 3-11, page 3-12 displays.

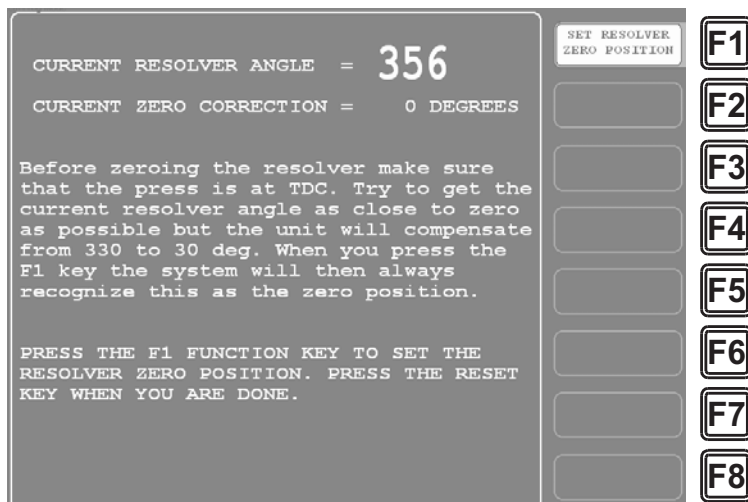


Figure 3-11. Resolver Zero Screen

7. If the value displayed in the CURRENT RESOLVER ANGLE = field falls between 330° and 30°, press F1 (Set Resolver Zero Position) to zero the resolver.

The value displayed in the CURRENT ZERO CORRECTION = field changes to the value shown in the CURRENT RESOLVER ANGLE = field.

#### NOTICE

If the Resolver Zero position is between 330° and 30°, SmartPAC 2 automatically corrects the offset. The angle positions displayed on the SmartPAC 2 crank angle clock will indicate the true angle of the ram.

8. Press RESET to return to the Main Initialization Menu.

## Locking Run Mode Actions

You can prevent unauthorized personnel from recalculating setpoints or making adjustments to setpoint percentages in Run mode. To do so, you “lock out” these capabilities from Run mode on the Security Access Menu and remove the “Program/Run” key when the SmartPAC 2 is switched to Run mode. When setpoint recalculation and adjustment capabilities are locked out of Run mode, they are still functional in Program mode.

To “lock out” one or both of these actions in Run mode, do the following:

1. Select “SECURITY ACCESS” on the Main Initialization Menu (see Figure 3-2). A screen like the one shown in Figure 3-12 displays. (The items on your menu may differ depending on installed options.) Note that the LOAD MONITOR item shown in Figure 3-12 is set to “ALLOW RECALC/ADJUST,” the setting that allows the operator to recalculate and adjust setpoints in Run mode. This is the factory setting.

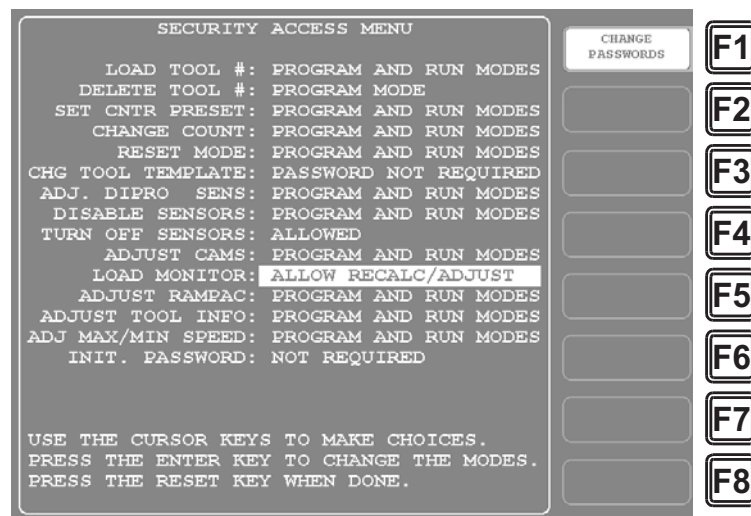


Figure 3-12. Security Access Menu with LOAD MONITOR Setting Highlighted

2. Select the “LOAD MONITOR” item, and press ENTER to cycle through the available settings: ALLOW RECALC/ADJUST, ALLOW RECALC ONLY, NO RECALC/ADJUST, and PASSWORD REQUIRED.

The ALLOW RECALC ONLY setting locks out the setpoint adjustment capability from Run mode. The NO RECALC/ADJUST setting locks out both setpoint recalculation and setpoint adjustment from Run mode. The PASSWORD REQUIRED setting specifies that a password be entered in Run mode in order for the operator to recalculate or adjust setpoints.

3. When the setting you want is displayed, press RESET. You are returned to the Main Initialization Menu.

**NOTICE****LOCKING OUT OTHER FUNCTIONS**

Refer to Chapter 4 in the SmartPAC 2 user manual for information on locking out other functions on the Security Access Menu.

**NOTICE****LOCKING RESET MODE**

If you want to prevent tonnage faults and other errors from being reset in Run mode, you can set the RESET MODE item on the Security Access Menu to “PROGRAM MODE ONLY” and remove the Program/Run key with the press in Run mode.

With this setting selected, all faults, including brake monitor and counter messages and fault conditions associated with optional SmartPAC 2 modules like DiProPAC, ProCamPAC, and WPC 2000, must be cleared in Program mode.

This setting is useful if responsibility for recording SmartPAC 2 faults has been assigned to one person.

## Viewing Communications

The “COMMUNICATIONS” item on the Diagnostic Menu (see Figure 3-13) allows you to verify communications between SmartPAC 2 and WaveFormPAC. To view communications, perform the following steps:

1. Select “DIAGNOSTICS” on the Main Initialization Menu (see Figure 3-2) to display the Diagnostic Menu.

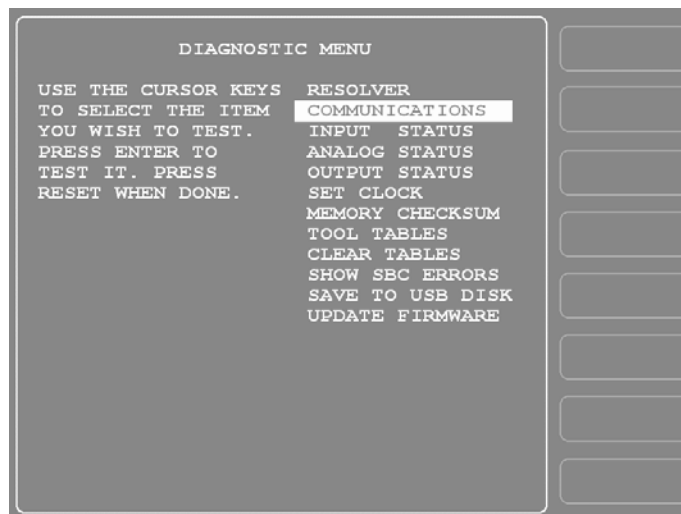


Figure 3-13. COMMUNICATIONS Item on Diagnostic Menu in Initialization Mode

2. Select “COMMUNICATIONS” on the Diagnostic Menu to display the Communication Data Viewer screen, shown in Figure 3-14, page 3-15.

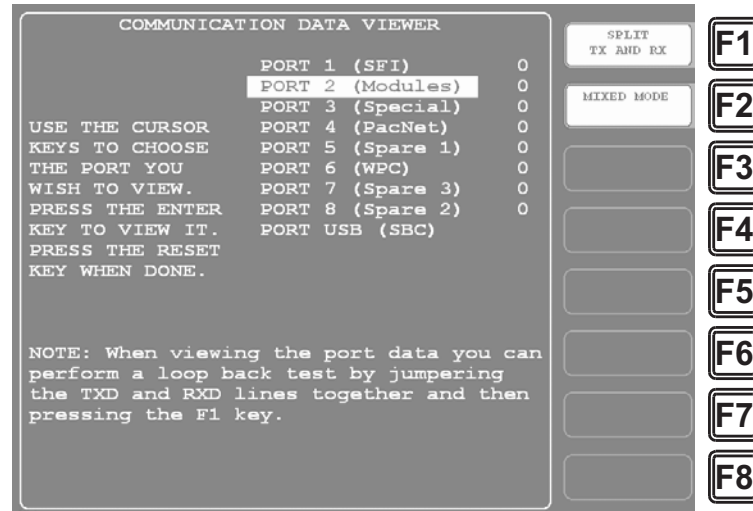


Figure 3-14. Communication Data Viewer Screen

3. Press the F1 function key on the Communication Data Viewer screen to change the F1 label from “Combined Tx and Rx” to “Split Tx and Rx.”
4. Select “PORT 2 (Modules).” A screen like the one shown in Figure 3-15 will appear.

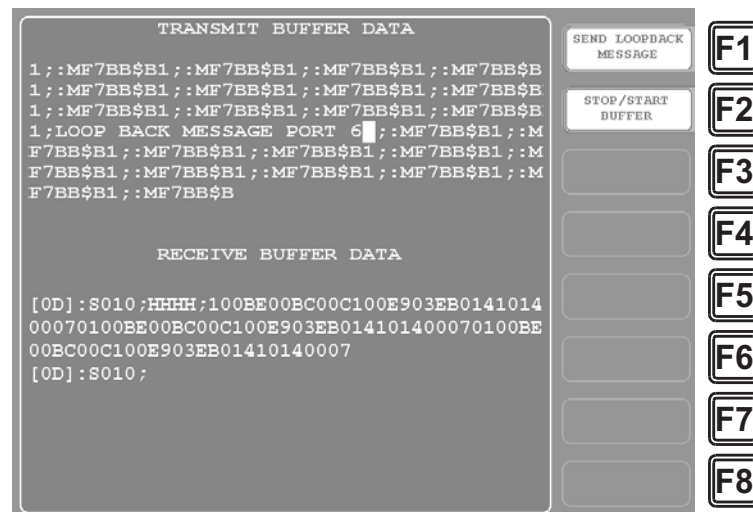


Figure 3-15. Communications Transmit/Receive Screen

If SmartPAC 2 and WaveFormPAC are communicating normally, you should expect to see some text (data) in both the “TRANSMIT BUFFER DATA” and “RECEIVE BUFFER DATA” portions of the screen. If you do not see any data (or only partial data), this means that SmartPAC 2 and WaveFormPAC are not communicating properly.

If there is a communications problem, you may decide to perform a loopback test. In a loopback test, you connect (or jumper) the TXD (Transmit) and RXD (Receive) lines (refer to Figure 2 at the end of this manual), and then press F1 (Send Loopback Message) to check communications. In effect, you are “receiving” the communications data that you are transmitting.

This test is useful when verifying the accuracy of the transmit and receive hardware and wiring. If you need help performing the loopback test, contact Wintriss Tech. Support.

## Calibrating WaveFormPAC

This section shows you how to calibrate a WaveFormPAC load analyzer so that it displays an accurate reading of the tonnage applied by the press. To calibrate your WaveFormPAC, you must do the following:

1. Adjust each strain link until it provides a “zero” signal with no load on the press (see *Zeroing Strain Links*, page 3-16).
2. Using a separate tonnage monitor and one or two load cells, apply a load to the press and measure it. You can use your own calibration gear, or rent an AutoSet 1500 calibration kit from Wintriss Controls. See *Recording Tonnage on an AutoSet Calibration Kit*, page 3-20.
3. Determine the tonnage capacity of your press, and set the full-scale tonnage of your WaveFormPAC to that value. See *Setting Full-scale Tonnage on Your WaveFormPAC*, page 3-28.
4. Adjust your WaveFormPAC until its tonnage displays agree with the tonnage recorded on your calibration unit. See *Adjusting WaveFormPAC to Read the Correct Tonnage*, page 3-29.

WaveFormPAC should be calibrated after installation and whenever

- Strain links are moved to a different location on the press
- Tie rods are restressed
- Major repair work is performed on the press frame

Before starting calibration, make sure the press is adjusted for optimal operation. Check to make sure that the ram is parallel to the bed and that the gib/ways adjustment and tie rod tension are correct.

### Zeroing Strain Links

Before starting this procedure, make sure that the strain links have been mounted loosely on the press and strain link cables have been wired to the appropriate connectors on the WaveFormPAC processor board as described in *Installing Strain Links*, page 2-9. Then, to set the strain links to read zero (0) at no load, do the following:

1. Move the press ram to top dead center.
2. Apply power to SmartPAC 2.
3. Turn the Program/Run key switch to PROG, then press the “1” and “CLEAR” keys simultaneously and hold them down a few seconds until the Main Initialization Menu (see Figure 3-2) appears.
4. Select the TONNAGE/WAVEFORM menu item, and press ENTER to display the Tonnage/Waveform Initialization Menu (see Figure 3-3).

5. Select CALIBRATION and press ENTER to display the Calibration screen (see Figure 3-16 for an example of the screen in Current Zero Offsets view).
6. Press F4 (Zero Offsets). The caption at the top of the screen changes to “CURRENT ZERO OFFSETS” and the values for the two or four channels (depending on the number of strain links installed) change to the current offsets.

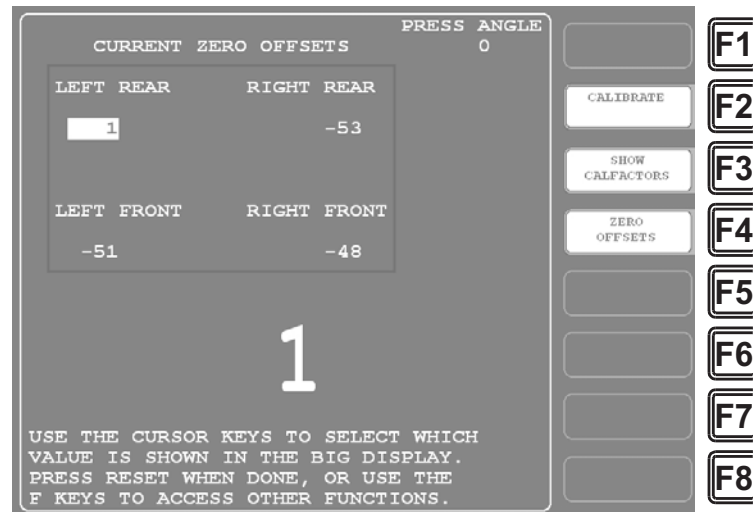


Figure 3-16. Calibration Screen: Current Zero Offsets Display

## NOTICE

If the strain link Zero Offsets reading is greater than  $\pm 99$ , a message like the following displays:

*Offset Error, signal too low on*

*INPUT 1 LEFT*

*The message specifies whether the strain link is set too high (i.e.,  $>+99$ ) or too low (i.e.,  $>-99$ ) and identifies the strain link channel that is out-of-range. If multiple strain links are out-of-range, the message displays for only one channel.*

7. If one of the strain links is generating an offset error, select that strain link to adjust first. Otherwise, select any strain link.
8. If the potentiometer adjustment screw on the strain link is not accessible via a hole in the cover, loosen the two screws securing the cover, and remove it. The adjustment screw is located on the strain link circuit board, as shown in Figure 3-17, page 3-18.

## NOTICE

The potentiometer adjustment screw is accessible through a hole in the cover on strain links with a Hirschman connector (part no. 9641801). Newer versions of other strain links (part nos. 9641601, 9641602, 9641603, and 9641604) may also provide an access hole.

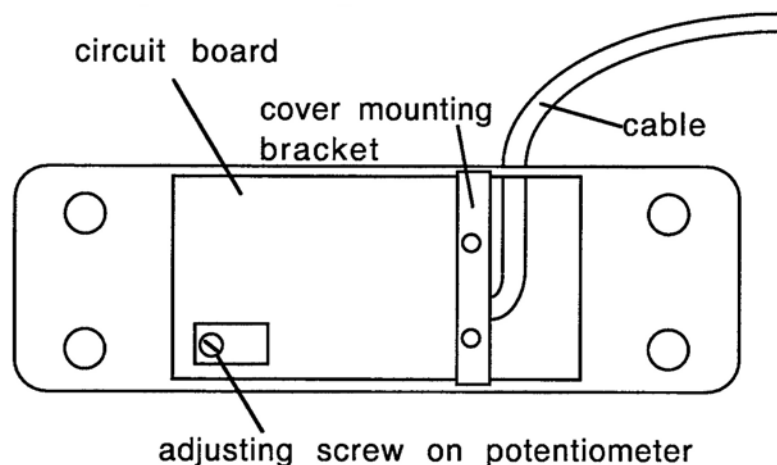


Figure 3-17. Potentiometer Adjustment Screw on Strain Links without Access Hole in Cover

9. Check the value in the Zero Offsets display for the strain link you are zeroing. If the value is greater than  $\pm 5$ , perform step 10. Otherwise, go to step 11.

#### NOTICE

If the zero adjustment reading is greater than  $\pm 99$ , an "Offset Error" message displays for that strain link and remains displayed until you have adjusted the reading to less than  $\pm 99$  and pressed the RESET key. The Zero Offsets display will then show the offset to which you have adjusted the strain link.

10. Turn the potentiometer adjustment screw clockwise or counterclockwise, as shown in Table 3-2, until the Zero Offsets display for that channel reads between +5 and -5. Try to adjust the tonnage reading as close to zero as possible.

Table 3-2. Strain Link Potentiometer: Direction of Screw\* Adjustment

Zero Offsets Display	Potentiometer Adjustment: Tension †	Potentiometer Adjustment: Compression ‡
Positive number	Turn counterclockwise	Turn clockwise
Negative number	Turn clockwise	Turn counterclockwise

\* The adjustment screw has a range of only twelve (12) turns in either direction. After this limit is reached, you can continue to turn the screw, but the tonnage reading will not be affected.

† Strain links measure tension when mounted on straight-side presses or on the front of gap-frame (OBI or OBG) presses (see Figure 2-8, page 2-11 and Figure 2-9, page 2-12)

‡ Strain links measure compression when mounted on the back of gap-frame (OBI or OBG) presses (see Figure 2-8, page 2-11)

#### NOTICE

If you cannot use the Zero Offsets display to zero the strain links (i.e., display is too far away or is obstructed), perform the *Using a Voltmeter to Zero Strain Links* procedure, page 3-20.



**NOTICE**

If you cannot get the Zero Offsets display to read in the  $\pm 5$  range, make sure strain link connections are tight and the connector is firmly seated. If loose connections are not the problem, the strain link may not be working properly. Contact Wintriss Tech. Support for assistance.

**NOTICE**

Make sure to use removable-strength Loctite (i.e., No. 242 or equivalent) on the mounting screws. Do not use permanent-strength Loctite, which will prevent removal of the screws if you need to remount the strain links.

11. Remove the mounting screws, one at a time, from the strain link, apply removable-strength Loctite (i.e., No. 242 or equivalent) to the screw, and re-seat the screw in its tapped hole.
12. Tighten the screws evenly around the perimeter of the strain link to a specification of 150 in./lbs.
13. Check the strain link's Zero Offsets value in SmartPAC 2.
14. Using the potentiometer adjustment screw (refer to Table 3-2), adjust the strain link offset until it falls between +50 and -50. Try to adjust the offset as close to zero as possible.
15. If you cannot adjust the strain link's offset reading to within the  $\pm 50$  window, loosen the mounting screws and repeat steps 12 through 14.

**NOTICE**

If after several attempts you cannot get the Zero Offsets display to read in the  $\pm 50$  range, the strain link mounting holes may not have been drilled at right angles to the mounting surface, or the strain link may not be working properly. Contact Wintriss Tech. Support for assistance.

16. Replace the strain link cover, if necessary, when you have finished zeroing the strain link.

**NOTICE**

When multiple strain links have zero offsets readings outside the  $\pm 99$  window, an Offsets Error message will display for only one strain link channel at a time. When that strain link has been adjusted to a value within  $\pm 99$ , an Offsets Error message will display for one of the remaining out-of-range strain links.

17. Zero the remaining strain links, repeating steps 7 through 16. Start with any strain link that is generating an Offsets Error message on the Current Zero Offsets display. When no strain link is generating an Offsets Error message, proceed with zeroing the strain links that remain.
18. When all the strain links have been zeroed, press RESET repeatedly to return to the SmartPAC 2 Main Initialization Menu.

## Using a Voltmeter to Zero Strain Links

Perform the following procedure if the WaveFormPAC Zero Offsets display cannot be used to zero strain links (i.e., display is too far away or is obstructed).

1. On the WaveFormPAC processor board, place the leads of a voltage meter on the pins holding the white and green wires (i.e., pins 2 and 3) in the cable from the strain link you are having trouble zeroing.
2. Adjust the potentiometer screw on that strain link until the reading shown on the voltmeter is close to 0 Vdc.

### NOTICE

The displayed voltage does not have to be exactly 0 Vdc. If the reading on the voltmeter is between + 0.70 and - 0.70 Vdc, the strain link can be considered zeroed.

3. Check the Zero Offsets display. If it reads between +50 and -50, you are finished.

If the Zero Offsets display continues to show a value outside this range, the strain link is bad and should be replaced. Contact Wintriss Tech. Support for assistance.

## Recording Tonnage on an AutoSet Calibration Kit

### Setting Up and Adjusting the Calibration Kit

This procedure shows you how to set up the AutoSet 1500 calibration kit and adjust it to display the correct tonnage applied to the load cells. If you are using another calibration kit to measure tonnage on the load cells, follow the instructions provided by that manufacturer.

### NOTICE

#### USE OF HYDRAULIC JACK FOR CALIBRATION NOT RECOMMENDED

Wintriss does not recommend use of an hydraulic jack for calibration. An hydraulic jack is much less accurate than load cells and more difficult to use. For more information on hydraulic jack calibration, contact Wintriss Tech. Support.

The AutoSet 1500 calibration kit should contain the following items:

- Calibration modules. These are small enclosures with cables attached. A connector on the end of each cable plugs into one of the strain link connectors on the AutoSet processor board. Each calibration module enclosure provides a screw-in connector for the cable from one of the load cells.
- Up to two load cells and cables. Use one load cell (single-point calibration) if your press has only one connecting rod (Pitman), two load cells (double-point calibration) if you have two (or more) connecting rods. Load cells are placed under the connecting rods.

To adjust the calibration kit to display the correct tonnage applied to the load cells, perform the following steps, referring to Figure 3-18, page 3-22 or Figure 3-19, page 3-23 for location of components on old- and new-style AutoSet 1500 processor boards:

1. Open the cover of the AutoSet 1500 calibration unit enclosure.
2. For one-cell calibration, take one calibration module and plug the connector on the cable into the terminal block labelled “Left Input” (TB6) at the lower right of the AutoSet processor board. The connector plugs in only one way. If a connector is already plugged into this slot, remove it before plugging in the connector from the calibration module.

Connect a jumper wire between terminals 2 and 3 on one of the five-pin connectors supplied with the calibration kit, and plug the connector into the terminal block labelled “Right Input” (TB7) at the lower right of the AutoSet processor board.

### NOTICE

You can use either the left or right strain link input for one-cell calibration. The unused connector in the other slot must have the jumper wires connected.

For two-cell calibration, plug the connector on the cable from the other calibration module into the terminal block labelled “Right Input” (TB7).

3. Screw the connector on one of the load cell cables into the connector on one of the load cells. Screw the connector at the other end of the cable into the connector on the calibration module. If you are using two load cells, repeat this step for the other load cell.

### WARNING

#### ELECTRIC SHOCK HAZARD

If the AutoSet 1500 calibration unit does not have a plug and you wire it to a power source, make sure power at that outlet is off before you connect the wires.

**Failure to comply with these instructions could result in death or serious injury.**

### WARNING

#### MAKE SURE POWER SUPPLY COVER IS IN PLACE ON OLD PROCESSOR BOARDS

On some old-style calibration kit processor boards, there is a cover on the power supply, which helps to prevent shock when personnel are working inside the enclosure with the power on. If you remove this cover to connect 115 or 230 Vac wires, make sure to replace the cover before applying power. The power supply is located at the top center of the processor board.

**Failure to comply with these instructions could result in death or serious injury.**

4. Plug in the AutoSet calibration unit. If your unit does not have a plug, connect AC wiring to terminal block TB3 on the AutoSet processor board, as shown in Table 3-3, page 3-24.

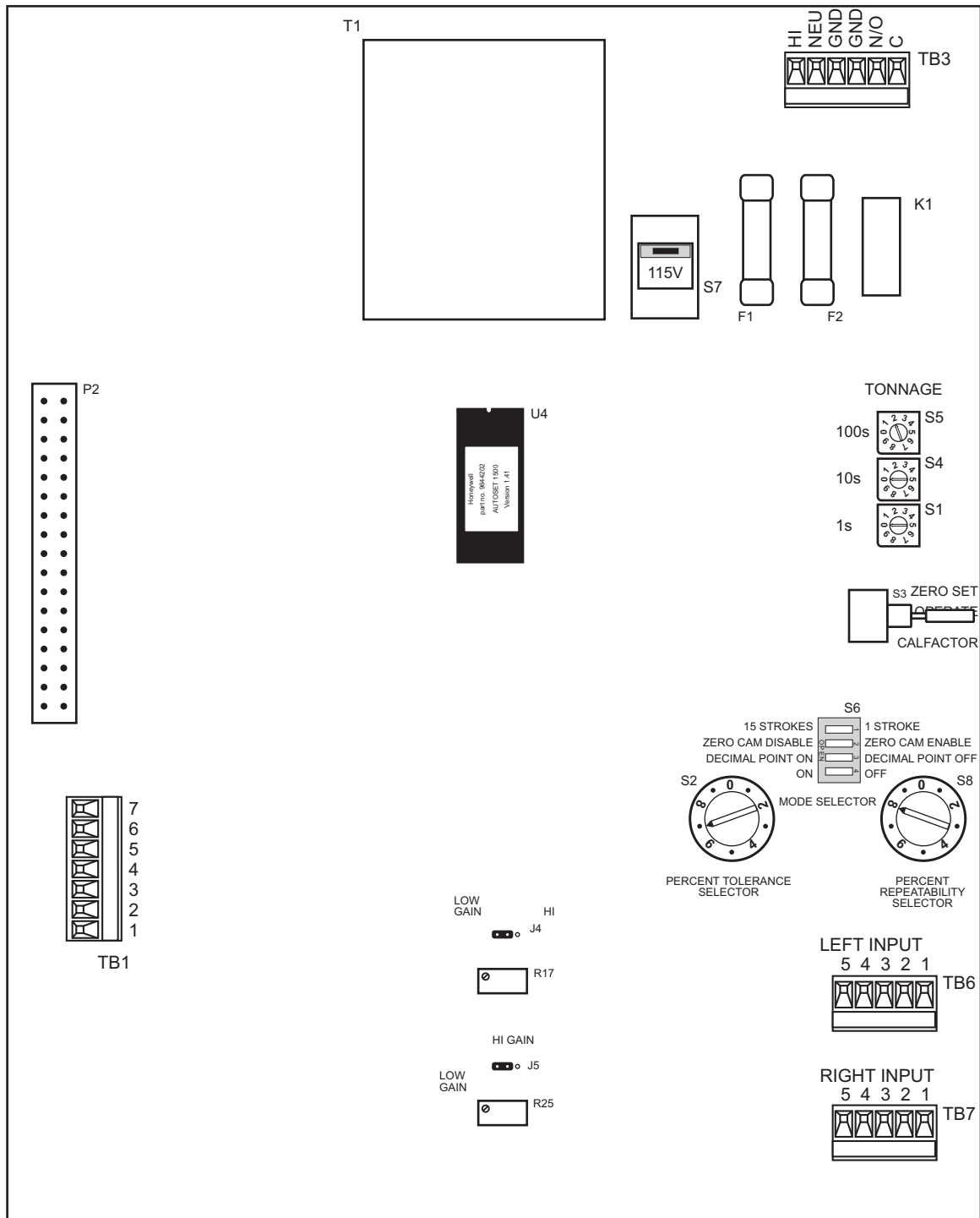


Figure 3-18. AutoSet 1500 Calibration Kit Processor Board: Old Style

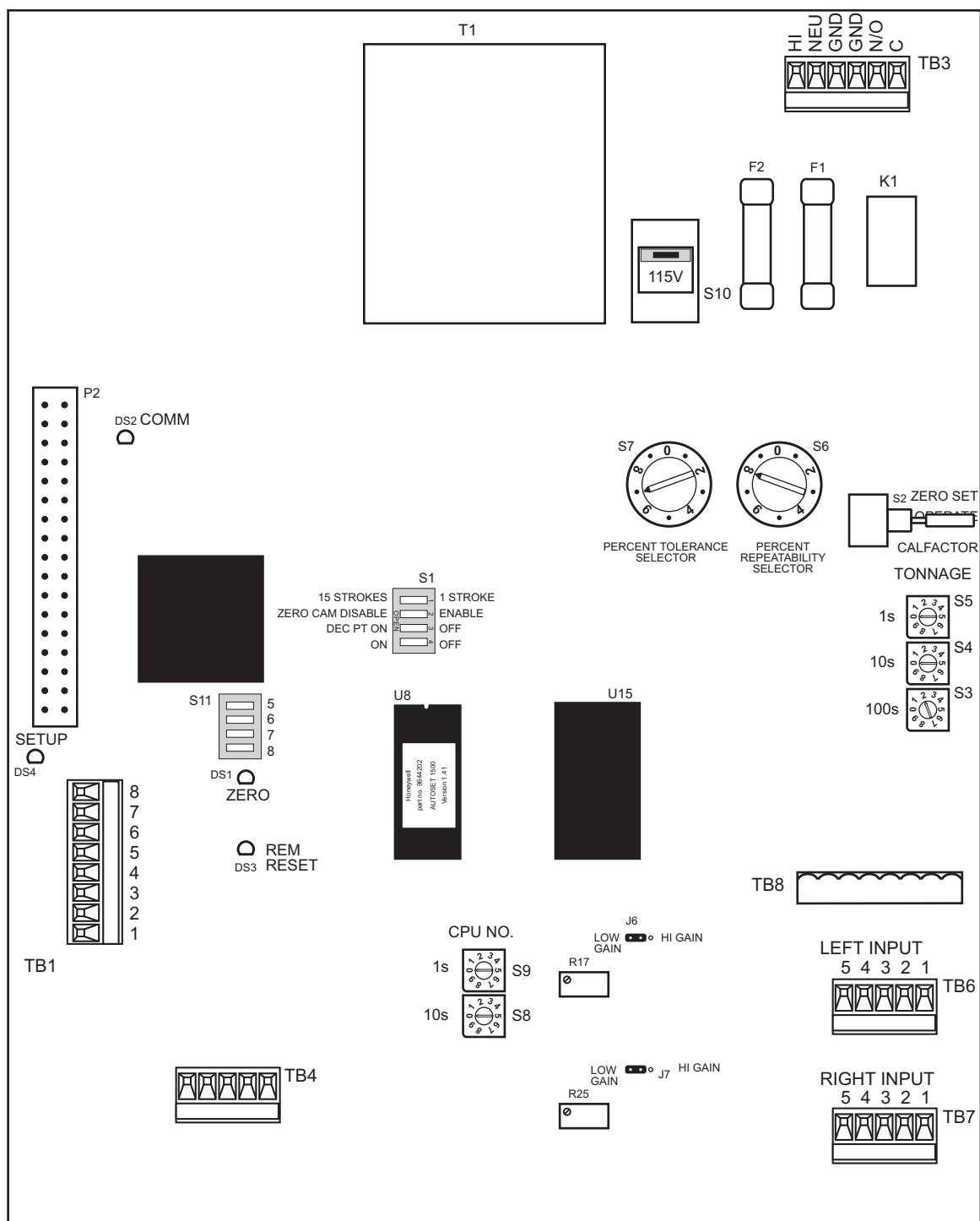


Figure 3-19. AutoSet 1500 Calibration Kit Processor Board: New Style

Table 3-3. AC Power Wiring Connections, TB3 (AutoSet 1500 Calibration Kit)

Pin #	Label	Function	Wire Color *
1	HI	AC power	Black
2	NEU	AC power	White (115 VAC), Red (230 VAC)
3	GND	AC power	Not used
4	GND	AC power	Connected to case lug

5. Check the AutoSet displays. The Load LED displays should show 0's or other numbers. The Setpoint displays should show either numbers, dashes (- - -), or the message "HI" or "LO."
6. If the displays are not active, turn off power to the AutoSet. Re-check the connections for power and strain links. Make sure that the voltage selector switch (S7 in Figure 3-18, S10 in Figure 3-19) is set correctly (either 115V or 230V), and switch S3 (Figure 3-18) or S2 (Figure 3-19) is set to "ZERO SET." Then turn power on again and check the displays. If the displays are still inactive, call Wintriss Tech. Support.
7. Locate the dial indicators labelled "TONNAGE" (S1, S3, and S5 in Figure 3-18, S3, S4, and S5 in Figure 3-19) on the right side of the AutoSet processor board.

Each dial indicator has an arrow you can turn, using a small screwdriver, to the numerical setting you want. The indicator labelled "100s" represents the hundreds position in the full-scale tonnage setting, the indicator labelled "10s" represents the tens position, and the indicator labelled "1s" represents the ones position. To set full-scale tonnage to 200, for example, as illustrated in Figure 3-20, you would turn the "100s" indicator to "2," and turn the "10s" and "1s" indicators to "0."

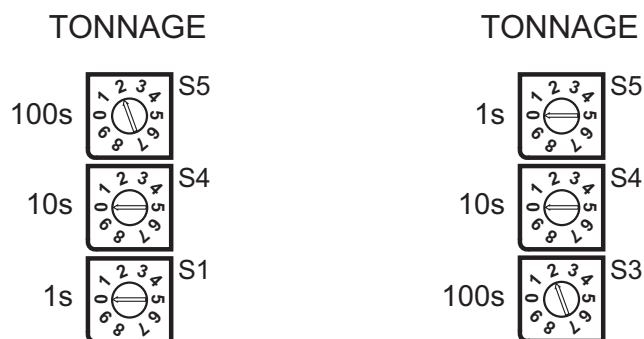


Figure 3-20. Tonnage Dial Indicators: Old-style Board (Left), New-style Board (Right)

8. Set the Tonnage dial indicators to twice the full-scale tonnage of one load cell.

### NOTICE

Even if you are using two load cells for calibration, you still set the Tonnage dial indicators to twice the full-scale tonnage of one load cell.

For tonnages greater than 999 (i.e., with more than three digits), set the dials to one-tenth of the value you want. For example, to indicate a full-scale tonnage of 1200 tons, set the dials to “120” (i.e.,  $120 \times 10 = 1200$ ).

AutoSet Load LED displays format tonnage readings based on two factors: the full-scale tonnage you have specified on the dial indicators and the position of switch #3 on the Mode switch block (S6 in Figure 3-18, S1 in Figure 3-19). Figure 3-21 shows the Mode switch block on old-style AutoSet 1500 calibration kit processor boards. The switch block on new-style boards is identical but labelled differently.

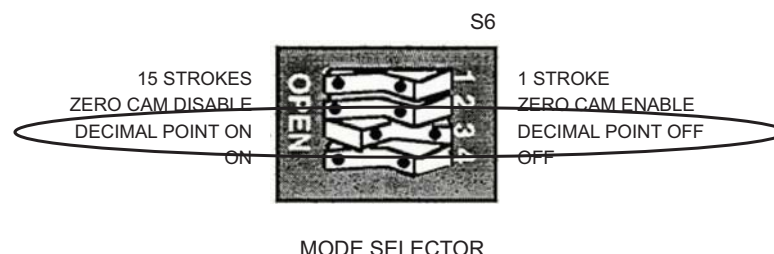


Figure 3-21. Mode Switch #3 Set to “Decimal Point Off” Position (Old-style Processor Board)

When switch #3 is in the OPEN position, AutoSet LED displays include a decimal place. When switch #3 is in the CLOSED position, no decimal point is shown. The decimal point is not active for full-scale tonnage settings between 201 and 1500 tons. Table 3-4 summarizes your tonnage display options.

Table 3-4. AutoSet Load Cell Tonnage Display Formats

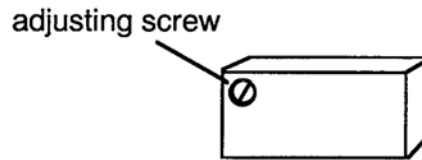
Load Cell Tonnage Range	Mode Switch #3 Setting	Decimal Point ON/OFF	Channel Load LED Display Format
200 tons or less	OPEN	ON	Up to 100 tons: tenths of a ton (e.g., 6.0, 45.5., 99.9)
	CLOSED	OFF	Whole tons (e.g., 6, 46, 100)
201 to 1500 tons	CLOSED	OFF	Whole tons (e.g., 125, 400, 750)
More than 1510 tons	OPEN	ON	Tenths of a ton (e.g., 5.5 = 55 tons, 25.0 = 250 tons, 99.9 = 999 tons)
	CLOSED	OFF	Whole tons (e.g., 6 = 60 tons, 25 = 250 tons, 100 = 1000 tons)

9. Set Mode switch #3 for the display option you want, referring to Figure 3-21 and Table 3-4.
10. Power down the AutoSet calibration kit, then power the unit back up to reset the load monitor and activate your tonnage and decimal point settings.
11. Move the lever on the three-position switch labelled “S3” on old-style boards (see Figure 3-18) or “S2” on new-style boards (see Figure 3-19) to the “ZERO SET” position, and check the channel Load LED displays on the AutoSet front panel.

If you are using one load cell for calibration, the value shown in the left Load display must be between +50 and -50. If you are using two load cells, the number in both left and right Load displays must be within the  $\pm 50$  window.

If the Load displays are not within this range, there is a problem with your calibration unit. Call Wintriss Tech. Support for assistance.

12. Move the lever on switch S3 or S2 to the “CALFACTOR” position.
13. Locate the two load cell gain adjustment potentiometers labelled R17 and R25 to the left of the strain link inputs at the bottom center of the enclosure. A tiny screw protrudes from the upper left corner of each potentiometer (see Figure 3-22).



*Figure 3-22. Load Cell Gain Adjustment Potentiometer with Adjustment Screw*

14. If you are using one load cell for calibration, turn the screw on gain adjustment potentiometer R17 clockwise or counterclockwise until the left channel Load LED display reads  $157 \pm 2$ .

If you are using two load cells for calibration, turn the screws on both gain adjustment potentiometers (R17 and R25) until the displays on both channels read  $157 \pm 2$ .

To calibrate the press in metric tons, set the left channel to  $173 \pm 2$  for one load cell or both left and right channels to  $173 \pm 2$  for two load cells.

15. Move the lever on switch S3 or S2 to the “OPERATE” position. Both left and right channel Load LED displays should now read zero (0) tons.
16. Locate the Percent Tolerance Selector dial, labelled “S2” on old-style boards (see Figure 3-18), “S7” on new-style boards (see Figure 3-19).

Locate the Percent Repeatability Selector dial, labelled “S8” on old-style boards (see Figure 3-18), “S6” on new-style boards (see Figure 3-19).

Set both dials to the zero (0) position, then reset the calibration unit by pressing the RESET button (AutoSet 1500) or turning the DISPLAY switch to “RESET” (AutoSet 1500 Plus) and holding for at least two seconds.

Setting both percent tolerance selector dials to zero (0) disables AutoSet’s automatic setpoint function.

#### **NOTICE**

Setpoint LED displays will show numeric readings after the unit is reset. Ignore these readings. Only the Load LED displays are used in calibration.



## Applying Full-scale Tonnage to the Calibration Kit

To apply full-scale tonnage to the AutoSet 1500 calibration kit, perform the following steps:

1. Make sure that the die is removed from the press and that any bolster/bed openings or ram holes are covered with a plate or plates rigid enough to prevent flexing. Wintriss strongly recommends using steel plates, or parallels, 1 to 2 in. thick above and below the load cells to distribute the load evenly on the bed and ram. Even load distribution helps to improve calibration accuracy and linearity (see *Checking Linearity*, page 3-33).
2. Bring the ram to bottom dead center (BDC) and turn off power to the press. Use a dial indicator, if necessary, to make sure that the press is at 180°.
3. Place the load cell(s) and parallels under the connecting rod(s). Make sure load cells are centered under the connecting rods to ensure even load distribution on the press frame.
4. Determine the load you will put on the load cells. This value should be equal to the tonnage you normally use when making parts. For example, if you usually run between 60–90% of press capacity, then set the press at 75% of capacity. This setting will yield the most accurate tonnage readings within this range. Make sure that you set tonnage to greater than 50% of press capacity. Also, make sure not to exceed the capacity of your press.

### NOTICE

**DO NOT STOP THE RAM ON THE LOAD CELLS. ALWAYS CYCLE THE PRESS THROUGH A COMPLETE STROKE.**

5. Power up the press, and cycle the press through one stroke.

### CAUTION

#### **DO NOT STICK PRESS ON BOTTOM**

Do not overload the press by lowering the ram too quickly. You may stick the press on the bottom. Increase the load gradually. Unlike the softer material used for making parts, load cells are extremely stiff and provide no compressive cushion to bring the ram through bottom dead center if you over-adjust.

**Failure to comply with these instructions could result in property damage.**

6. Continue cycling the press, lowering the ram 0.003 or 0.004 in. (0.076–0.102 mm) on each stroke with your press's shut height adjustment, until the readout on your calibration unit indicates that contact with the load cell(s) is being made at BDC.
7. Keep cycling the press and adjusting the ram downward, checking the Load LED displays on your calibration unit, until you have reached the tonnage you determined in step 4.

If you are using two load cells, make sure both Load LED readouts display equal tonnage. If Load readings disagree by more than  $\pm 2\%$ , add shim stock to the load cell that shows the lower tonnage. Cycle the press, and recheck tonnage. Continue to add shim stock until the tonnage shown in both Load displays is equal.

8. When the tonnage shown on the AutoSet 1500 calibration unit is correct, lock the shut height adjustment.
9. Check to make sure that the load cells, shims, and parallels do not move during calibration, using adhesive tape or equivalent, if necessary, to hold them in place. Double-check the Load LED display(s) on the calibration kit to see if tonnage on the load cells has decreased, and re-adjust tonnage if necessary. Be sure to lock the shut height again if you need to adjust tonnage.

## Setting Full-scale Tonnage on Your WaveFormPAC

### NOTICE

Wintriss recommends that WaveFormPAC be calibrated at the tonnage at which the press will normally operate. If you usually run between 60-90% of press capacity, calibrate at 75% of capacity. For example, if the press is a 100-ton press, calibrate for 75 tons. Do not calibrate at less than 50% of press capacity.

To set your WaveFormPAC to the full-scale tonnage of your press, which is currently being applied to the load cells connected to the calibration unit, do the following:

1. On the SmartPAC 2 Main Initialization Menu, select the TONNAGE/WAVEFORM item, and press ENTER. The Tonnage/Waveform Initialization Menu (see Figure 3-3) displays.
2. Select “SET PRESS CAPACITY,” and press ENTER to display the Numeric Entry window (see Figure 3-23).

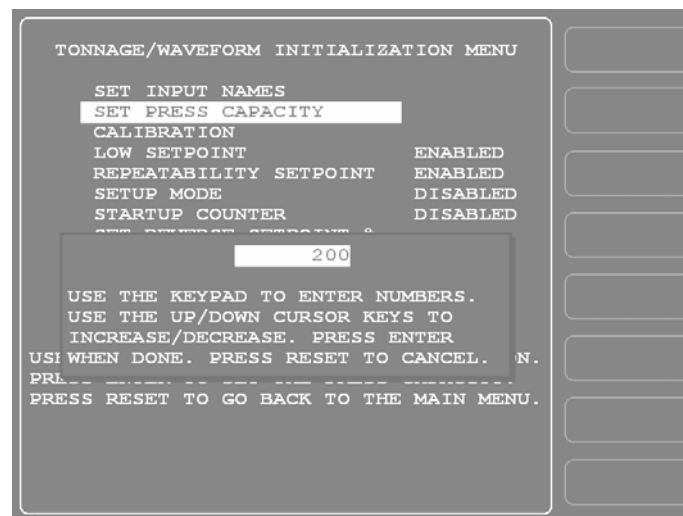


Figure 3-23. Tonnage/Waveform Initialization Menu with Numeric Entry Window Displayed

3. Key in a value (maximum is 3000 tons), following the directions in the window, and press ENTER. You are returned to the Tonnage/Waveform Initialization Menu.

WaveFormPAC tonnage display formats are shown in Table 3-5.

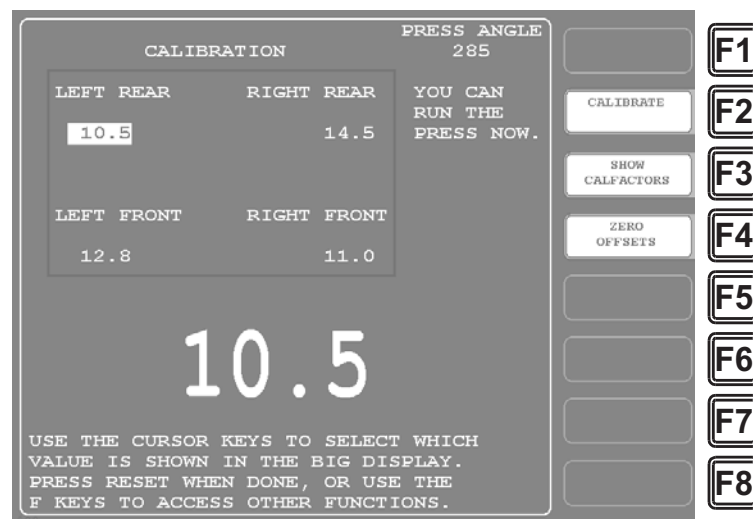
*Table 3-5. WaveFormPAC Two- and Four-channel Tonnage Display Formats*

Tonnage Range WaveFormPAC 2-channel	Tonnage Range WaveFormPAC 4-channel	Channel Load Display Format
200 tons or less	400 tons or less	Up to 100 tons: tenths of a ton (e.g., 6.0, 45.5., 99.9)  From 100 to 120 tons: whole tons (e.g., 100, 109, 120)
More than 200 tons	More than 400 tons	Whole tons (e.g., 125, 400, 750)

## Adjusting WaveFormPAC to Read the Correct Tonnage

To adjust the tonnage displayed in WaveFormPAC so it agrees with the value(s) shown on the calibration unit, perform the following steps:

1. Select CALIBRATION on the Tonnage/Waveform Initialization Menu to display the Calibration screen (see Figure 3-24).



*Figure 3-24. Calibration Screen*

2. Familiarize yourself with the gain adjustment potentiometers and high/low gain jumpers to the left of the strain link inputs at the bottom of the WaveFormPAC processor board (see Figure 2-5, page 2-7). Table 3-6, page 3-30 shows the processor board labels that identify potentiometers and jumpers for two- and four-channel WaveFormPAC configurations.

Table 3-6. Gain Adjustment Potentiometer and High/Low Gain Jumper Identifiers

WaveFormPAC Configuration	Strain Link (Input Connector)	Gain Adjustment Potentiometer	High/Low Gain Jumper
2-channel	Left (TB105)	R125	J115
	Right (TB106)	R134	J116
4-channel	Left Rear (TB105)	R125	J115
	Right Rear (TB106)	R134	J116
	Left Front (TB107)	R156	J117
	Right Front (TB108)	R165	J118

Potentiometers control the factor by which incoming strain link signals are amplified to make tonnage readings on your WaveFormPAC match tonnage readings on the calibration unit. You adjust each potentiometer by turning the small screw in its upper left corner (see Figure 3-25, which shows the potentiometer and jumper for the Left (Rear) strain link input). The potentiometer screw has a 12-turn limit.

Jumpers control the portion of the range within which strain link signals are amplified. Jumpers are factory set to “LO,” which selects the low end of the amplification range (see Figure 3-25). You can change the jumper setting to “HI,” which selects the high end of the amplification range, by removing the jumper from the two leftmost pins and placing it over the two rightmost pins.

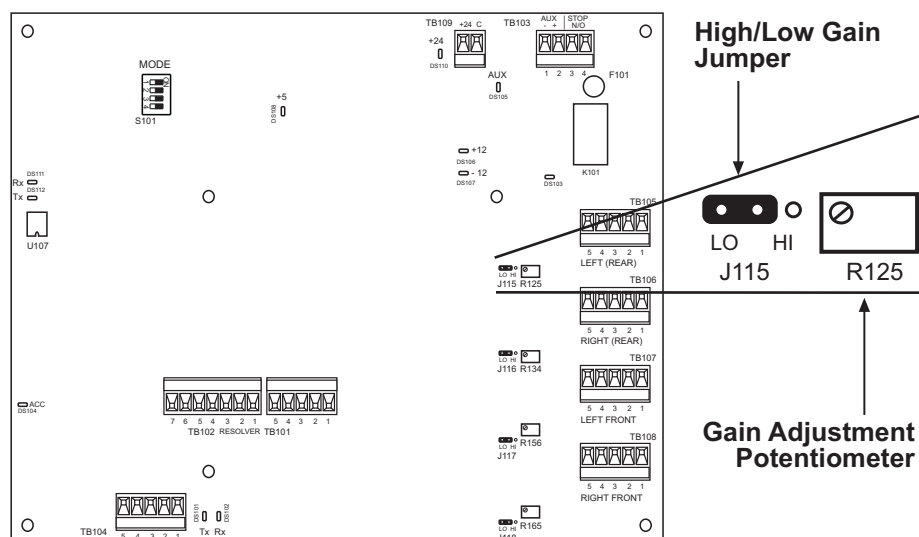


Figure 3-25. WaveFormPAC Processor Board: High/Low Gain Jumper and Gain Potentiometer for Left (Rear) Strain Link

- Cycle the press and compare the reading in the “Left” (two-channel WaveFormPAC) or “Left Rear” (four-channel WaveFormPAC) channel display on the Calibration screen with the tonnage displayed on the calibration unit.

In comparing tonnages, you must factor in the number of load cells used during calibration and the number of strain link channels on your WaveFormPAC. As shown in Table 3-7,

each channel display on a calibrated WaveFormPAC may be the same as the Load reading on the calibration unit or 1/2 or 1/4 of the reading.

*Table 3-7. WaveFormPAC Load Readings: Ratio of Calibration Unit Readings*

No. of Load Cells	No. of Active Displays on Cal. Unit	WaveFormPAC 2-channel Displays: Ratio of Cal. Unit	WaveFormPAC 4-channel Displays: Ratio of Cal. Unit
1	1	1/2 of cal. unit	1/4 of cal. unit
2	2	Same as cal. unit	1/2 of cal. unit

- If the tonnages displayed on your WaveFormPAC and on the calibration unit differ, turn the adjustment screw on gain potentiometer R125 clockwise to increase the tonnage reading on the Left or Left Rear strain link or counterclockwise to decrease the tonnage reading.

### NOTICE

#### PRESS MUST BE STROKED AFTER EACH POTENTIOMETER ADJUSTMENT

You must stroke the press after each adjustment of the potentiometer. Stroking the press clears the previous tonnage reading and refreshes the Calibration display with new values.

- Continue cycling the press and adjusting potentiometer R125 until the tonnage shown in the “Left” (two-channel WaveFormPAC) or “Left Rear” (four-channel WaveFormPAC) channel display in WaveFormPAC matches the tonnage shown on the calibration unit. Then go to step 8.

### NOTICE

Tonnage values may not display immediately on your WaveFormPAC as you make potentiometer adjustments. However, they will appear eventually if you keep turning the potentiometer screw and cycling the press.

- If the channel display on the Calibration screen stops incrementing, indicating that you have reached the 12-turn limit on the adjustment screw, and you have not been able to increase the tonnage on your WaveFormPAC so it matches the tonnage on your calibration unit, you must change jumper J115 to its “HI” setting. To do so:
  - Power down SmartPAC 2
  - Remove the jumper from the two leftmost pins and place it over the two rightmost pins (see Figure 3-25)
  - Power up SmartPAC 2
  - Cycle the press to display a tonnage reading

**NOTICE**

When you cycle the press after repositioning a jumper, a fault message may display on the Calibration screen, indicating that tonnage is now over 120% of full scale. To clear this error, press RESET. When the error is cleared, the reading shown for that strain link on the Calibration screen may be much higher than the tonnage shown on your calibration unit.

7. Turn the adjustment screw on potentiometer R125 counterclockwise and cycle the press again. Compare tonnages on your WaveFormPAC and on the calibration unit. Continue adjusting the potentiometer downward and cycling the press until the tonnage on your WaveFormPAC is identical to the tonnage on the calibration unit.

**NOTICE**

If the fault message indicating that tonnage is above 120% of full scale continues to appear as you make potentiometer adjustments and cycle the press, press RESET each time to reset WaveFormPAC.

8. Cycle the press and compare the reading in the “Right” (two-channel WaveFormPAC) or “Right Rear” (four-channel WaveFormPAC) channel display on the Calibration screen with the tonnage shown on the calibration unit, and repeat steps 4 through 7, making adjustments on potentiometer R134 and jumper J116.
9. If you are calibrating a WaveFormPAC configured as a four-channel unit, cycle the press and compare WaveFormPAC and calibration kit tonnage readings for the “Left Front” and “Right Front” strain links, then repeat steps 4 through 7 for each channel. Refer to Table 3-6 for processor board labels identifying the gain potentiometer and high/low gain jumper for each strain link.
10. When you have finished adjusting the WaveFormPAC so its tonnage readings match those displayed on the calibration unit, press F3 (Show Calfactors) on the Calibration screen. The screen shown in Figure 3-26, page 3-33 displays.

As shown in Figure 3-26, the caption at the top of the screen changes from CALIBRATION to CALFACTORS, and numbers between 40 and 960 are shown in the strain link channel displays. These numbers are the “calfactors,” or calibration settings, for your WaveFormPAC.

11. Record the calfactor and high/low gain jumper setting for each strain link channel, two pairs of settings for a two-channel WaveFormPAC, four pairs of settings for a four-channel WaveFormPAC.

If you need to replace a processor board, you can use these settings to calibrate the new board without repeating the lengthy calibration process documented in this chapter. Simply access the Calibration screen in SmartPAC 2 (Calibration view is the default), move high/low gain jumpers to the correct position, and adjust each potentiometer to the calfactor you have recorded.

12. Press RESET repeatedly to exit from the Calibration screen and return to the Main Initialization Menu. Your WaveFormPAC is now ready to use.



Figure 3-26. Calibration Screen: Calfactors Display

## Checking Linearity

After you calibrate your WaveFormPAC, you can check to see whether tonnage readings increase proportionately with increases in load. For example, if WaveFormPAC reads 40 tons when 40 tons is applied to the load cells, it should read 80 tons when 80 tons is applied to the load cells. The proportional increase of tonnage readings with increasing load is called “linearity.” Linearity is a good measure of how accurately tonnage is being recorded at different loads.

To check linearity, change the load on the press. For instance, if you calibrated WaveFormPAC at 75% of press capacity, reduce the load on the load cells to about 45%. If you calibrated at 50%, decrease the load to about 30%. When you compare the new load readings on the WaveFormPAC with the load displays on the calibration unit, readings should continue to be identical.

If tonnage readings on the WaveFormPAC and calibration unit disagree at the new load settings, there may be a problem with the positioning of your strain links, or the press may be experiencing twisting forces. Consult your service representative, or contact Wintriss Tech. Support. Note, however, that perfect linearity is unachievable. Typically, tonnages are accurate within 5% to 10% at 20-80% of press capacity.

## Saving the Calibration WaveForm

Once WaveFormPAC has been calibrated, you should make sure to save a waveform of the calibrated unit before making parts. You can use this plot as a baseline against which to measure changes in press operation reflected in future waveforms.

To save the calibration waveform, do the following:

**NOTICE**

Make sure to keep a record of the tool number of the tool you use to store the calibration waveform so you don't inadvertently use it to make parts.

1. Create a tool in Program mode, and name it “CAL SETUP” (refer to your SmartPAC 2 manual for help if necessary).
2. Program a counter setting for the tool.
3. Load the tool.
4. Access the Waveform screen (see *Viewing and Managing Waveforms*, page 5-3).
5. With the load cells you used for calibration still in place, run the press for a few strokes, making contact with the load cells.
6. On the Waveform screen, press F3 (Update Waveforms) to update the waveform.
7. If the waveform that displays looks like the example labelled “Normal” in Figure 3-27, store the waveform, following the directions starting on page 5-7.

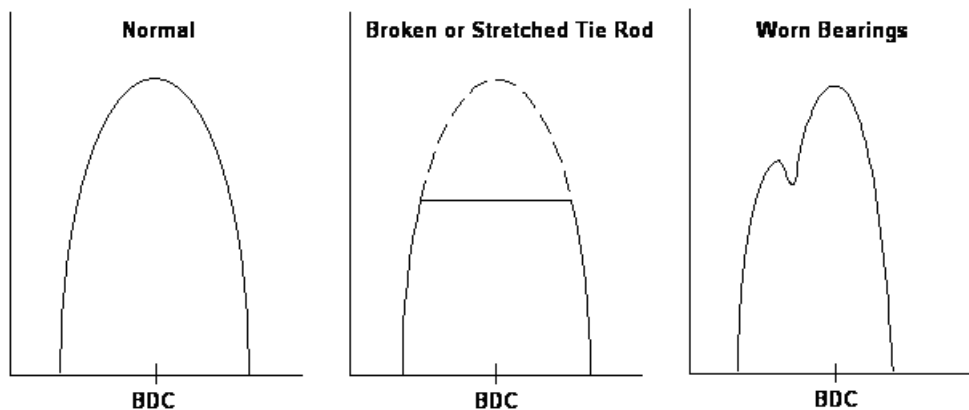


Figure 3-27. Normal (Left) and Abnormal (Center, Right) Waveforms

If the waveform does not look like the “Normal” plot in Figure 3-27, your press needs maintenance.

Whenever you wish to analyze the condition of your press, do the following:

1. Load the “CAL SETUP” tool.
2. Run the press for a few strokes, making contact with the load cells.
3. Update the waveform on the Waveform screen.
4. Compare the current waveform with the stored (i.e., “CAL SETUP”) waveform (see page 5-9).



## Final Checkout

### NOTICE

The Final Checkout needs to be performed after installation (see Chapter 2) and calibration procedures have been completed and before you run the press. Final Checkout ensures that WaveFormPAC will stop the press properly during a tonnage fault.

To perform final checkout, follow these steps:

1. Install a test tool on your press.
2. On the Tonnage Monitor Programming Menu, set the REPEATABILITY % item to 1%, referring to *Establishing Setpoint Percentages and Sample Period*, page 4-6.
3. Run a few parts. The 1% repeatability setting should generate a repeatability fault.  
Check to make sure that the press top stops and that a repeatability fault message displays on the SmartPAC 2 front panel (see Figure 6-1, page 6-1, which shows an example of a fault message).
4. If a fault message displays but the press does not top stop, there is a problem in your top-stop circuit. Recheck all wiring and trace the cause of the problem. Do not continue with this procedure until the press top stops when you trip the repeatability setpoint.
5. If the press is working properly, clear the fault by pressing the RESET key on the SmartPAC 2 front panel.

Your WaveFormPAC is now ready for use. Refer to Chapter 4 to learn how to program setpoints and make other settings for your load analyzer.



# Chapter 4. Using WaveFormPAC in Program Mode

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This chapter shows you how to make the settings that WaveFormPAC uses to calculate setpoints. You make these settings on the Tonnage Monitor Programming screen in SmartPAC 2 Program mode. The chapter also shows you how to copy Program settings from one job to the next, change Program settings, and recalculate setpoints. Instructions are also provided for adjusting setpoints, including setpoints for windows, when this capability is locked out of Run mode.

The chapter is organized in the following sections:

- *WaveFormPAC's Setpoint Calculation Process* (next)
- *Startup Counter*, page 4-3
- *Accessing the Tonnage Monitor Programming Menu*, page 4-4
- *Making Tonnage Monitor Settings*, page 4-6
- *Loading Tonnage Monitor Settings*, page 4-8
- *Copying Tonnage Monitor Settings*, page 4-9
- *Changing Tonnage Monitor Settings*, page 4-10
- *Recalculating Setpoints*, page 4-10.

## NOTICE

### REFER TO SMARTPAC 2 USER MANUAL

Instructions for creating, copying, deleting, and loading tools are provided in Chapter 5 of the SmartPAC 2 user manual. For help in using the keyboard, refer to Chapter 3 of the manual.

## NOTICE

### USING SMARTPAC 2 HELP

If you need help with a Program mode screen, press the HELP key when that screen is displayed.

## WaveFormPAC's Setpoint Calculation Process

WaveFormPAC creates setpoints automatically based on the following settings you make on the Tonnage Monitor Programming Menu in Program mode:

- Sample period
- High setpoint percentage
- Low setpoint percentage
- Repeatability setpoint percentage

The sample period is the number of strokes during which WaveFormPAC collects tonnage information for calculating setpoints, using the highest measured load as a reference tonnage. During the sample period, setpoints are maintained at 120% of the full-scale capacity of the press to provide overload protection.

**NOTICE****WAVEFORMPAC SETPOINTS NEVER EXCEED 120%**

WaveFormPAC will not create setpoints greater than 120% of the full-scale capacity of the press.

High setpoint percentage is the percentage above the reference tonnage at which WaveFormPAC establishes high tonnage setpoints. It is calculated using this formula:

$$\text{High setpoint} = \text{Highest measured load} + (\text{highest measured load} \times \text{high setpoint percentage})$$

Low setpoint percentage is the percentage below the reference tonnage at which WaveFormPAC establishes low tonnage setpoints. It is calculated using this formula:

$$\text{Low setpoint} = \text{Highest measured load} - (\text{highest measured load} \times \text{low setpoint percentage})$$

Repeatability setpoint percentage is the percentage of the reference tonnage at which WaveFormPAC establishes repeatability setpoints. It is calculated as follows:

$$\text{Repeatability setpoint} = \text{Highest measured load} \times \text{repeatability setpoint percentage}$$

WaveFormPAC samples the load at each strain link simultaneously, selecting the highest measured load at each strain link as the reference tonnage. Tonnage is sampled at two strain links in a two-channel WaveFormPAC, at four strain links in a four-channel unit.

**Example**

A two-channel WaveFormPAC load analyzer is installed on a 100-ton press. The high setpoint percentage is set to 15%, the low setpoint percentage to 25%, and the repeatability setpoint percentage to 5%. The sample period is set to 15 strokes.

The highest load measured during the sample period on the left strain link is 38 tons, as shown in Figure 4-1. Setpoints for this strain link are calculated as follows:

$$\text{High setpoint left} = 38 \text{ tons} + (38 \text{ tons} \times .15) = 38 + 5.7 = 43.7 \text{ tons}$$

$$\text{Low setpoint left} = 38 \text{ tons} - (38 \text{ tons} \times .25) = 38 - 9.5 = 28.5 \text{ tons}$$

$$\text{Repeatability setpoint left} = 38 \text{ tons} \times .05 = 1.9 \text{ tons}$$

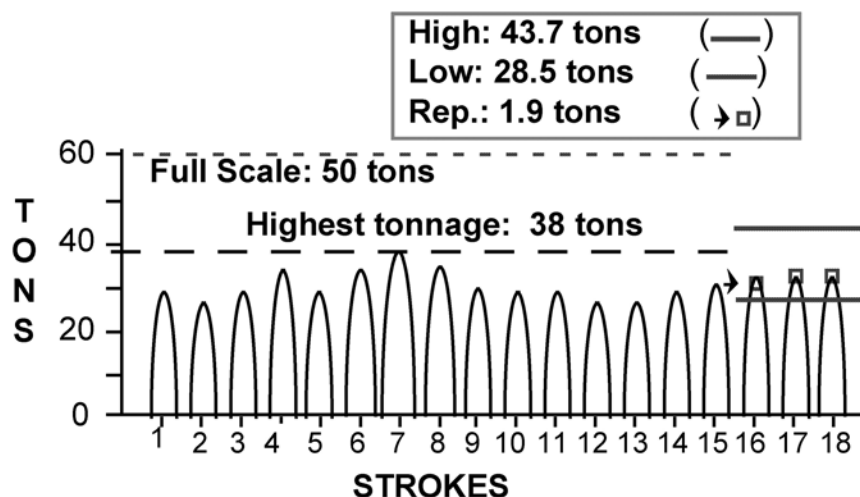


Figure 4-1. Example: Tonnages Produced on Left Strain Link during Sample Period

Reverse setpoints are calculated by multiplying the reverse setpoint percentage set in Initialization mode (see *Setting Reverse Setpoint % of Press Capacity*, page 3-7) by the full-scale tonnage of the press. Therefore, continuing our example, if the reverse setpoint percentage set in Initialization is 15%, the reverse setpoint for both channels would be 7.5 tons (15% of 50 tons, the full-scale tonnage of the press). Whenever the reverse setpoint is exceeded, a fault message displays on the SmartPAC 2 front panel (see Figure 6-1, page 6-1).

WaveFormPAC displays the results of its high, low, and repeatability setpoint calculations on the Adjust Setpoints screen in Run mode (see page 5-24). High and low setpoints are shown both numerically and graphically on peak tonnage and windows Waveform displays when you press the F5 (Adjust Setpoints) function key (see page 5-19). High and low setpoints are also displayed graphically on the Tonnage Bargraph View screen (see page 5-23). Two groups of setpoints are shown for a two-channel WaveFormPAC, four groups of setpoints for a four-channel unit. Setpoint percentages are used to create setpoints for both peak tonnage and windows.

WaveFormPAC calculates setpoints whenever you perform the Recalculate Setpoints function (see page 4-10, 5-27, or 5-31) or load a tool with a new high setpoint, low setpoint, or repeatability setpoint percentage. Setpoints are displayed after the sample period is completed. WaveFormPAC calculates new reverse setpoints whenever the reverse setpoint percentage or full-scale press capacity value is changed in SmartPAC 2 Initialization.

Setpoints can be recalculated even when the press is running.

You can standardize tonnage monitor settings for all your tools, using the SmartPAC 2 Copy Tool function (see *Copying Tonnage Monitor Settings*, page 4-9). If you want to use different settings for some of your dies, refer to *Changing Tonnage Monitor Settings*, page 4-10.

## Startup Counter

The Tonnage Monitor Programming Menu also allows you to set the Startup Counter if this option has been enabled in Initialization mode (see *Disabling/Enabling WaveFormPAC Parameters*, page 3-6). The Startup Counter specifies the number of strokes to allow after startup of the press before WaveFormPAC begins to monitor tonnage or calculate setpoints. During the period defined by the specified number of strokes, WaveFormPAC disables high, low, and repeatability setpoints and suspends calculation of setpoints.

This setting can be used to allow high-speed presses to reach their normal operating speed before monitoring tonnage. The setting can also be used to allow any press to achieve stable tonnages before tonnage monitoring or setpoint recalculation begins.

WaveFormPAC maintains a high setpoint of 120% of press capacity to provide overload protection during the interval specified in the Startup Counter as it does during the sample period. The startup counter is not activated unless the press has been stopped at the top of its stroke for 10 seconds or more.

## Accessing the Tonnage Monitor Programming Menu

The Tonnage Monitor Programming Menu is the screen on which you make settings for setpoint percentages, sample period, and startup counter (if enabled). To access this screen, do the following:

### NOTICE

When switching between operating modes with the Program/Run key, make sure that SmartPAC 2 is displaying the top-level screen in the current mode (i.e., Main Program Menu or Main Run Menu). To return to the top-level menu, press RESET repeatedly.

1. From the main menu of the current operating mode, turn the Program/Run key to “PROG.” The Main Program Menu (see Figure 4-2) displays.

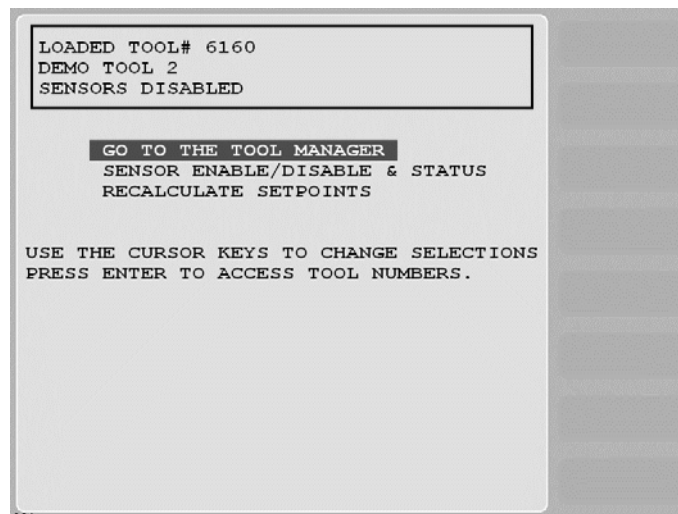


Figure 4-2. Main Program Menu

### NOTICE

#### **SELECT = HIGHLIGHT + ENTER**

When this manual instructs you to select an item, you should highlight the item, and press ENTER.

2. Select “GO TO THE TOOL MANAGER” to display the Tool Manager screen (see Figure 4-3, page 4-5).

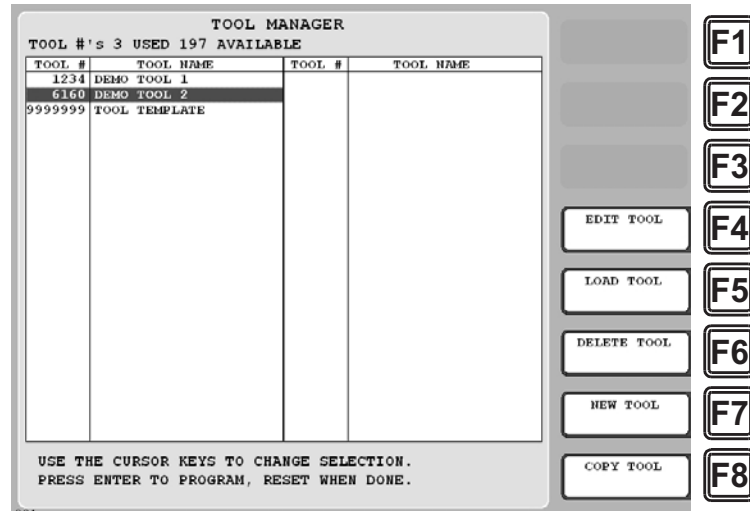


Figure 4-3. Tool Manager Screen

- Highlight the tool you wish to Program, and press F4 (Edit Tool). The Tool Program Menu displays (see Figure 4-4).

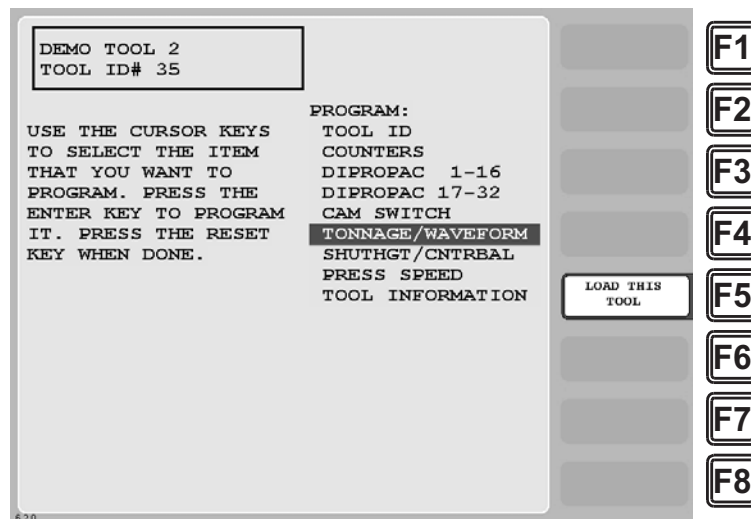


Figure 4-4. Tool Program Menu

- Select "TONNAGE/WAVEFORM." The Tonnage Monitor Programming Menu (see Figure 4-5, page 4-6) displays.

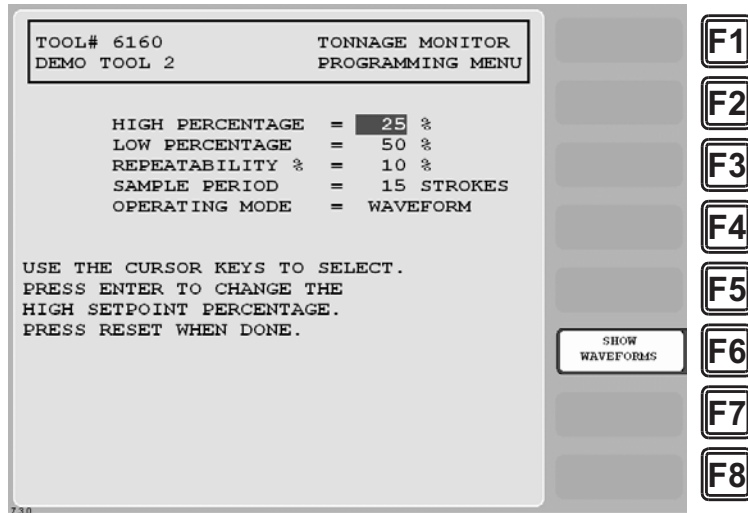


Figure 4-5. Tonnage Monitor Programming Menu

## Making Tonnage Monitor Settings

### Establishing Setpoint Percentages and Sample Period

To enter setpoint percentages and specify a sample period, perform the following steps on the Tonnage Monitor Programming Menu, referring to Figure 4-5 and Table 4-1, page 4-7:

1. Make sure that the die is properly adjusted and ready to make parts.
2. With the cursor resting in the HIGH PERCENTAGE field, press ENTER to display the Numeric Entry window.
3. Key in the value you want, following the directions in the window, and press ENTER. The window disappears, and the value you keyed in is displayed in the HIGH PERCENTAGE field.

#### NOTICE

WaveFormPAC will stop the press if tonnage exceeds 120% of press capacity even if the high, low, and/or repeatability setpoints have been disabled.

4. Move the cursor to the next field.
5. Perform steps 2 through 4 for the LOW PERCENTAGE, REPEATABILITY %, SAMPLE PERIOD, and STARTUP COUNTER (if enabled) items on the Tonnage Monitor Programming Menu.

#### NOTICE

You should only select the AUTOSETPAC operating mode if you are running a job faster than 300 SPM.



6. If you want to change the default OPERATING MODE setting, select “WAVEFORM,” and press ENTER. The setting changes to “AUTOSETPAC.”
7. When you are finished, press RESET to return to the Tool Program Menu.

*Table 4-1. Tonnage Monitor Programming Menu Settings*

Field	Settings
HIGH PERCENTAGE	The percentage above the reference tonnage at which you want WaveFormPAC to establish high tonnage setpoints. Valid range: 1% to 120%. Zero percent (0%) setting disables setpoint. Suggested initial setting: 25%.
LOW PERCENTAGE	The percentage below the reference tonnage at which you want WaveFormPAC to establish low tonnage setpoints. Valid range: 1% to 120%. Zero percent (0%) setting disables setpoint. Suggested initial setting: 50%.
REPEATABILITY %	The percentage of the reference tonnage at which you want WaveFormPAC to establish repeatability setpoints. Valid range: 1% to 120%. Zero percent (0%) setting disables setpoint. Suggested initial setting: 10%.
SAMPLE PERIOD	The number of strokes during which WaveFormPAC collects tonnage information for calculating setpoints. As a general rule, set the sample period to approximately 1/4 to 1/2 of the operating speed (SPM) of the press. For single-stroke operations, set the sample period to 1 stroke.
STARTUP COUNTER	The number of strokes after press startup during which WaveFormPAC disables high, low, and repeatability setpoints. This setting allows high-speed presses to reach a normal operating speed before WaveFormPAC begins to monitor tonnage. The setting is also used to allow presses to achieve a stable operating speed before WaveFormPAC recalculates setpoints. This setting is activated only when the press has been stopped at the top of its stroke for 10 seconds or more. Maximum value: 255 strokes.
OPERATING MODE	The mode in which you want the tonnage monitor to operate. There are two options, which you select by pressing ENTER: WAVEFORMPAC (the default) and AUTOSETPAC. The WAVEFORMPAC setting configures your tonnage monitor with all WaveFormPAC features including the ability to generate, store, and compare waveforms and create windows and window setpoints. The other setting configures the tonnage monitor as an AutoSetPAC, a traditional peak tonnage load monitor. You should only set this field to AUTOSETPAC if you run a job faster than 300 SPM.

## Adjusting Setpoints and Creating Windows

If the capability to adjust setpoints has been locked out from Run mode in SmartPAC 2 Initialization (see *Locking Run Mode Actions*, page 3-13), you can adjust setpoints for the currently loaded tool using the F6 (Show Waveforms) function key on the Tonnage Monitor Programming Menu. Remember that no setpoints exist for a new tool setup until that tool has been run long enough to satisfy the sample period.

## NOTICE

The F6 (Show Waveforms) function key only displays on the Tonnage Monitor Programming Menu when the tool you are programming is loaded.

When you press F6, a screen like the one shown in Figure 4-6 displays.

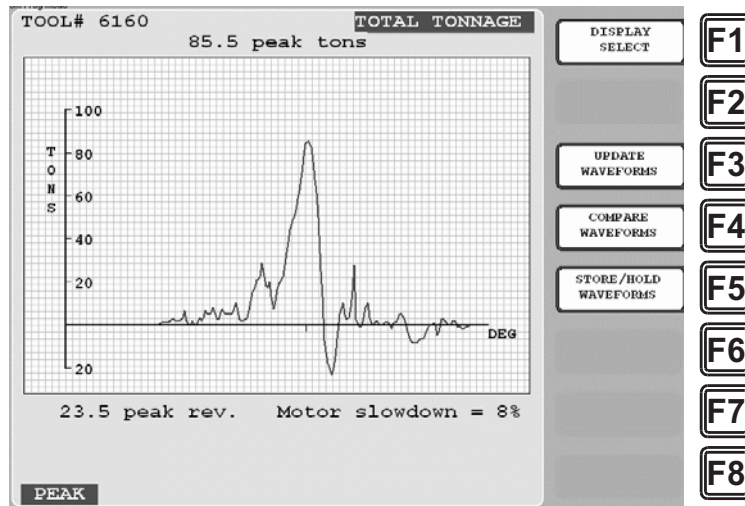


Figure 4-6. Waveform Screen Showing Waveform of Total Tonnage

To adjust setpoints for peak tonnage, create windows, and adjust window setpoints, refer to *Viewing and Managing Waveforms*, page 5-3.

## Loading Tonnage Monitor Settings

When you have finished making tonnage monitor settings for a tool, you must load the tool to make those settings effective. To do so, perform the following steps:

1. On the Tool Program Menu (see Figure 4-4), press the F5 (Load This Tool) function key. The following warning message displays.

```

WARNING!!      WARNING!!
ANCILLARY EQUIPMENT MAY OPERATE
WHEN THIS TOOL IS LOADED. WARN
ALL PERSONNEL TO STAND CLEAR

PRESS ENTER TO LOAD THIS TOOL.
PRESS RESET TO CANCEL.
  
```

Figure 4-7. Load Tool Warning Message

2. Press ENTER to load the tool. (Press RESET if you want to cancel.) The message shown in Figure 4-8, page 4-9 displays briefly; then you are returned to the Tool Program Menu.

```

TOOL NUMBER 6160
.....IS BEING LOADED

```

Figure 4-8. Tool Loading Message

**NOTICE**

You can also load the tool from the Tool Manager screen (see Figure 4-3) by pressing F5 (Load Tool) with the desired tool selected.

## Copying Tonnage Monitor Settings

Once you have established high, low, and repeatability setpoint percentages, you can use these settings for all other dies you run on the press, using the Copy Tool function on the Tool Manager screen. To copy one tool to another, do the following:

1. On the Tool Manager screen (see Figure 4-3), select the tool you want to copy, and press the F8 (Copy Tool) function key. A message and Numeric Entry window display on top of the Tool Manager screen, as shown in Figure 4-9.

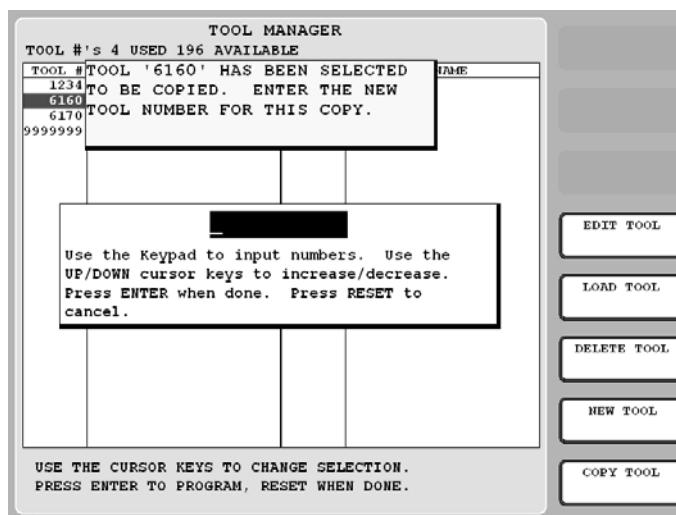


Figure 4-9. Tool Manager Screen with Copy Tool Message and Numeric Entry Window Displayed

2. Key in a new tool number in the Numeric Entry window, and press ENTER. You are taken to the Tool Program Menu (see Figure 4-4) with the tool number you specified in step 1 displayed in the screen header in the upper left corner.

Beneath the new tool number is displayed “COPY OF *tool name*,” where *tool name* is the tool name of the tool you copied. This is the default tool name assigned to copied tools.

3. To change the default tool name, select the TOOL NAME item on the Tool Program Menu, and, when the Alphanumeric Entry window displays, key in the tool name you want to assign, following the directions in the window, then press F6. You are returned to the Tool Program Menu with the tool name you entered displayed in the screen header beneath the tool number.

## Changing Tonnage Monitor Settings

There may be situations in which you will want to program a tool with settings different from those you are using for your other tooling. For example, you may want to create tighter setpoints for some jobs to provide greater protection for the press; on other jobs, looser setpoints may be desired to prevent unnecessary faults and press shutdowns. You may want to change setpoints when a tool runs at a much higher or much lower speed than a previous die, or generates a very different load.

To program a tool with new settings, perform the *Establishing Setpoint Percentages and Sample Period* procedure, page 4-6.

## Recalculating Setpoints

If you have locked out the “Recalculate Setpoints” capability from Run mode, you can recalculate setpoints on the Main Program Menu (see Figure 4-2). Setpoints are recalculated both for peak tonnage and for all windows.

You should always recalculate setpoints when you use the COPY TOOL function to create a new tool number. The copied tool will have the same percentages and the same setpoints as the original tool. If you create a new tool (not copying from an existing one), you do not have to recalculate setpoints. WaveFormPAC will automatically calculate setpoints when you run the press.

### CAUTION

Do not recalculate setpoints immediately after a tonnage fault! Proceed only when you have completely corrected the problem that caused the fault. Failure to do so may result in damage to the press and tooling.

**Failure to comply with these instructions could result in property damage.**

To recalculate setpoints, do the following:

1. Select the RECALCULATE SETPOINTS item on the Main Program Menu. The warning message shown in Figure 4-10, page 4-11 displays.

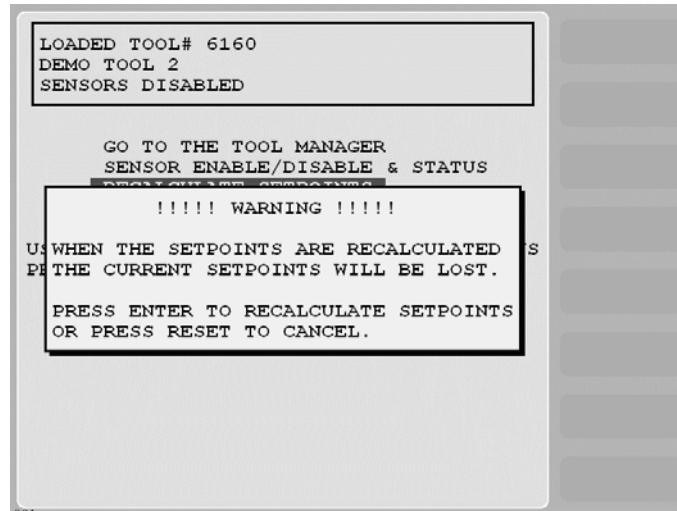


Figure 4-10. Main Program Menu with “RECALCULATE SETPOINTS” Warning Displayed

2. Press ENTER to confirm that you want to recalculate setpoints. The message *SETPOINTS WILL BE RECALCULATED* displays briefly on top of the warning message, and you are returned to the Main Program Menu. Setpoints are recalculated the next time you run the press and will appear on each screen that displays setpoints (e.g., Adjust Setpoints, Waveform, etc.) the next time you access it.



# Chapter 5. Using WaveFormPAC in Run Mode

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This chapter shows you how to use the screens in Run mode to adjust Program tool settings, including setpoints for peak tonnage and windows, recalculate setpoints, display setpoints and current tonnage information, including waveforms, and load a tool. The chapter is organized in the following sections:

- *Accessing the Tonnage Monitor Run Menu* (next)
- *Viewing and Managing Waveforms*, page 5-3
- *Displaying Tonnage in Plan View*, page 5-22
- *Displaying Tonnage in Bargraph View*, page 5-23
- *Viewing and Adjusting Setpoints*, page 5-24
- *Viewing Tonnage History*, page 5-28
- *Recalculating Setpoints*, page 5-31
- *Viewing Reverse Tonnage*, page 5-32
- *Loading a New Tool*, page 5-33

## NOTICE

### REFER TO SMARTPAC 2 USER MANUAL

If you need help using Run mode, refer to Chapter 6 in the SmartPAC 2 user manual.

## NOTICE

### USING SMARTPAC 2 HELP

If you need help with a Run mode screen, press the HELP key when that screen is displayed.

## Accessing the Tonnage Monitor Run Menu

The Tonnage Monitor Run Menu enables you to view tonnage readings, including waveforms, and, if setting adjustments are not locked out of Run mode, to make adjustments to tonnage settings, including setpoints for peak tonnage and windows. To access this menu, do the following:

## NOTICE

A tool number must be loaded before switching to Run mode. If you attempt to switch to Run mode without a tool number loaded, the following message will display:

**NO TOOL NUMBER HAS BEEN LOADED**

To clear the message, turn the Program/Run key to “PROG,” press RESET, and load a tool.

## NOTICE

When switching between operating modes with the Program/Run key, make sure that SmartPAC 2 is displaying the top-level screen in the current mode (i.e., Main Program Menu or Main Run Menu). To return to the top-level menu, press RESET repeatedly.

1. From the main menu of the current operating mode, turn the Program/Run key to the “RUN” position. A screen like the one shown in Figure 5-1 will display:



Figure 5-1. SmartPAC 2 Main Run Menu

The items displayed on the Main Run Menu depend on installed options and security access settings. For example, the LOAD NEW TOOL item does not appear on the Run menu if the LOAD TOOL # item on the Security Access Menu in Initialization mode has been set to “PROGRAM MODE ONLY.”

## NOTICE

### SELECT = HIGHLIGHT + ENTER

When this manual instructs you to select an item, you should highlight the item, and press ENTER.

2. Select “TONNAGE/WAVEFORM.” The Tonnage Monitor Run Menu (see Figure 5-2, page 5-3) displays.

The items displayed on the Tonnage Monitor Run Menu depend on security access settings. The RECALCULATE SETPOINTS item does not appear if the LOAD MONITOR item on the Security Access Menu in Initialization mode has been set to “NO RECALC/ADJUST.”



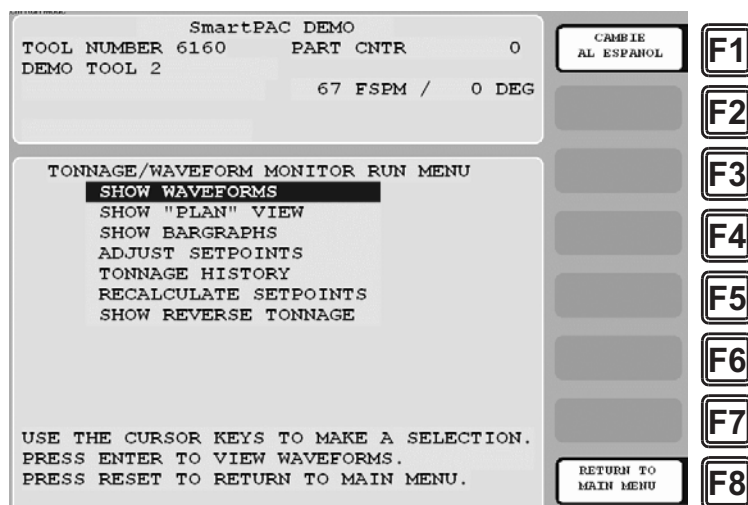


Figure 5-2. Tonnage Monitor Run Menu

## Viewing and Managing Waveforms

When you select SHOW WAVEFORMS on the Tonnage Monitor Run Menu, a message like the one shown in Figure 5-3 displays briefly

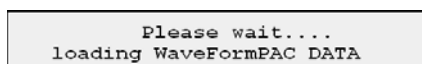


Figure 5-3. Waveform Screen Load Message

then a screen like the one shown in Figure 5-4 displays.

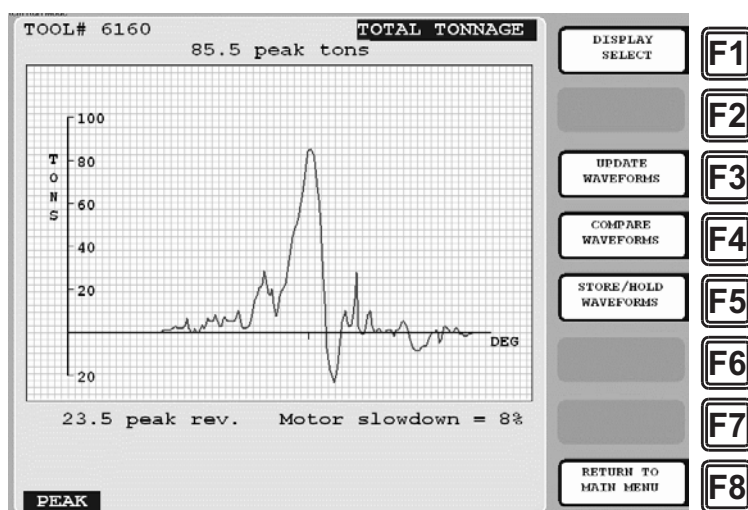


Figure 5-4. Waveform Screen Showing Waveform of Total Tonnage

When you first access the Waveform screen, a waveform of the total tonnage generated during the most recent stroke is displayed. Total tonnage is the sum of tonnages at all strain link

inputs, two inputs for two-channel WaveFormPAC, four inputs for a four-channel system. A waveform is a plot of tonnage at crankshaft angles between 90° and 248°, tonnage being displayed on the Y-axis, crankshaft angle on the X-axis. Tonnage values shown on the Y-axis are scaled to fit the waveform.

The shape of the waveform is a function of many factors, including press condition, sharpness and accuracy of your tooling, material thickness, hardness, shut height, lubrication, etc.

The Waveform screen also displays current values for peak forward tonnage, peak reverse tonnage, and motor slowdown percentage. Motor slowdown percentage is calculated by subtracting press speed at 185°, at which press speed is slowest, from press speed at 90°, at which speed is fastest, and dividing the result by the fastest speed. Speed values are measured at the resolver.

The tonnage view (i.e., Total Tonnage) is identified in the upper right-hand corner of the screen. The portion of the waveform to which the numeric forward and reverse tonnage values displayed on the screen pertain is identified in the lower left-hand corner (e.g., “PEAK,” as shown in Figure 5-4). The tool installed on the press is shown in the upper left corner.

The waveform displayed on the Waveform screen is the waveform currently residing in the waveform buffer, which is continuously refreshed by WaveFormPAC with the most recent waveform information. Each waveform stored in the buffer is successively overwritten by the next captured waveform.

The Waveform screen allows you to manage waveforms in various ways. You can

- Update a displayed waveform (see next section)
- Display a waveform for each strain link input
- Store or hold waveforms
- Compare waveforms
- Create windows
- Adjust setpoints for peak tonnage and windows

## Updating Waveforms

The waveform displayed on the Waveform screen is the waveform residing in the waveform buffer at the time you access the screen from the Tonnage Monitor Run Menu. If you want to view the waveform currently in the buffer, do the following:

1. Press F3 (Update Waveforms).

The message shown in Figure 5-3, page 5-3 appears briefly, then the updated waveform displays. The peak forward, peak reverse, and motor slowdown values are also updated.

### NOTICE

The F3 (Update) function does not overwrite “stored” or “held” waveforms. See *Storing or Holding Waveforms*, page 5-6.

The Update function (F3) is available not only for the Total Tonnage view on the Waveform screen but also for each strain link input view (see next section). Tonnage information for all waveform views is updated at the same time.

## Displaying Waveforms for Each Strain Link Channel

When you access the Waveform screen from the Tonnage Monitor Run Menu, you are shown a waveform of total tonnage, the sum of the tonnages for all strain link inputs (see Figure 5-4). If you want to view waveforms for individual strain link channels, do the following:

1. Press F1 (Display Select).

The Waveform screen is refreshed, and a waveform of the tonnage on the Left strain link (on two-channel systems) or Left Rear strain link (on four-channel units) is displayed (see Figure 5-5 for an example).

2. Press F1 again to display the next strain link channel in the sequence. Repeat this step, if necessary, to cycle through the remaining strain links in a four-channel system.

You are eventually returned to the screen displaying the Total Tonnage waveform view.

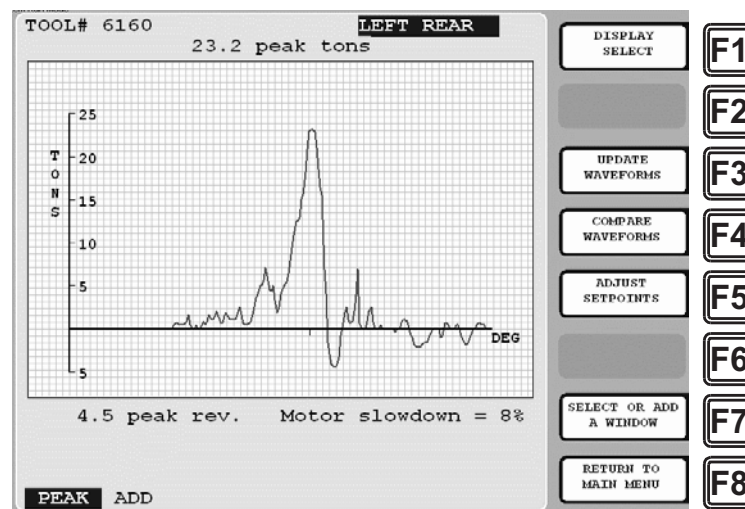


Figure 5-5. Waveform Screen Showing Tonnage for Left Rear Strain Link

As you move from the Total Tonnage to a Channel Tonnage view, the scale on the Y-axis changes to accommodate the lower tonnages on individual strain links, and the peak forward and reverse tonnage values are refreshed. The view identified in the upper right-hand corner (“Left Rear” in the example) is updated. The highlight bar remains on “Peak” (lower left).

Note that the caption “Add” is displayed to the right of “Peak.” This caption becomes highlighted when you add windows (see *Creating Windows*, page 5-15).

Note also that the “Store/Hold Waveforms” label for function key F5 is replaced by “Adjust Setpoints” and that the label “Select or Add a Window” displays to the left of the F7 function key. The Adjust Setpoints and Select/Add Window functions can only be performed from strain link channel views on the Waveform screen.

## Storing or Holding Waveforms

WaveFormPAC allows you to save a waveform for use in comparisons with the current waveform and with other saved waveforms. To save a waveform, press F5 (Store/Hold Waveforms) in Total Tonnage view. (The Store/Hold function is not available in strain link channel views.) The window shown in Figure 5-6 displays superimposed on the current waveform.

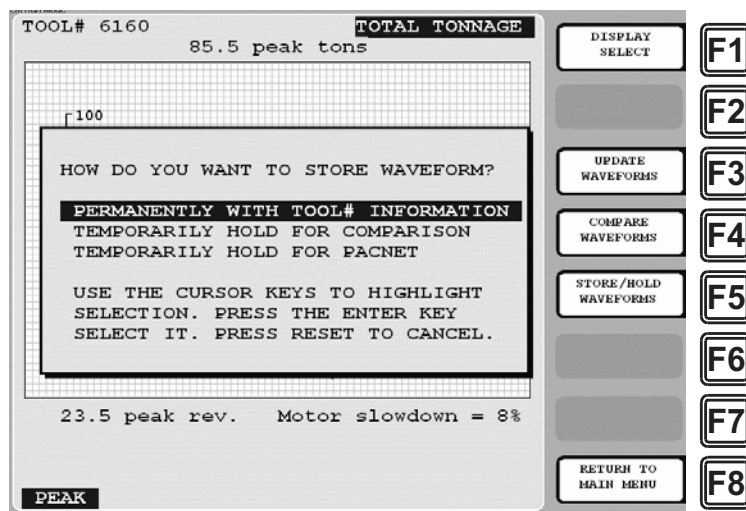


Figure 5-6. Waveform Screen with Store/Hold Waveform Option Window Displayed

### NOTICE

The “Temporarily Hold for PACNet” option is used only if you are running legacy PACNet software with the “Waveform Capture” option.

You have two Save options. You can

- Store the waveform with the tool information for the currently loaded tool. The waveform is saved until it is overwritten at the next Store command or the tool is deleted. The press must be stopped in order to implement this option.
- or
- Hold the waveform temporarily in a buffer. The waveform is held in the buffer until it is overwritten at the next Hold command or the next tool is loaded. The press can be running when you execute this command.

### NOTICE

Make sure to store or hold a waveform before implementing the Compare Waveforms function. If no waveform is stored with the tool or held in the temporary buffer, only the current waveform will display on the Waveform screen.

## Storing a Waveform

The Store option allows you to establish a baseline waveform for each tool that you can use for comparison with the current waveform or a “held” waveform to diagnose problems with the die or press.

To store a waveform, do the following:

### NOTICE

#### **PRESS MUST BE STOPPED TO STORE A WAVEFORM**

The press must be stopped in order for WaveFormPAC to store a waveform. If you attempt to store a waveform while the press is running, an error message will display asking you to stop the press before continuing.

1. Stop the press.
2. Press F3 (Update Waveforms) to display the waveform currently residing in the waveform buffer (see *Updating Waveforms*, page 5-4).

### NOTICE

#### **F5 (STORE/HOLD WAVEFORMS) ONLY FUNCTIONAL IN “TOTAL TONNAGE” VIEW**

The F5 (Store/Hold Waveforms) function is not available in strain link channel views on the Waveform screen.

3. With the “Total Tonnage” view on the Waveform screen displayed, press F5 (Store/Hold Waveforms).
4. When the Store/Hold Waveform Option window displays (see Figure 5-6), press ENTER with the “Permanently with Tool # Information” option highlighted. The window shown in Figure 5-7, page 5-8 displays, reminding you that the waveform should be updated before being stored and warning you that the waveform currently stored with the tool information will be overwritten.

### NOTICE

If you execute the “Permanently with Tool # Information” command while the press is running, a window will open with the following message:

*THE PRESS MUST BE STOPPED TO  
PERMANENTLY STORE TO THE TOOL #.  
PRESS RESET WHEN DONE.*

To respond to the message, stop the press and press RESET. You are returned to the Store/Hold Waveform Option window. Press ENTER with the “Permanently with Tool # Information” item highlighted.

```
UPDATE THE WAVEFORM BEFORE STORING.  
  
THIS WILL OVERWRITE THE CURRENTLY  
STORED WAVEFORM.  
  
PRESS ENTER TO STORE THE NEW  
WAVEFORM OR RESET TO CANCEL.
```

Figure 5-7. Waveform Store Warning Message Window

5. If you haven't updated the waveform (see step 2), press RESET to return to the Waveform screen, then press F3 (Update Waveforms) and repeat steps 3 and 4.

If you have updated the waveform, press ENTER to store the waveform to the current tool number.

## Holding a Waveform

### NOTICE

When you use the Hold option, you do not have to

- Stop the press
- Update the waveform before "holding" it
- Respond to warning messages (see step 4 of the *Storing a Waveform* procedure, page 5-7)

The Hold option allows you to capture a waveform in order to diagnose a problem being experienced by the press. For example, if WaveFormPAC were to report a high setpoint fault, you could Hold a waveform of that incident and compare it with the waveform stored with the tool to determine how much and where in the stroke the tonnage changed during the reported overload.

To hold a waveform, do the following:

### NOTICE

#### **F5 (STORE/HOLD WAVEFORMS) ONLY FUNCTIONAL IN "TOTAL TONNAGE" VIEW**

The F5 (Store/Hold Waveforms) function is not available in strain link channel views on the Waveform screen.

1. With the "Total Tonnage" view on the Waveform screen displayed, press F5 (Store/Hold Waveforms).
2. When the Store/Hold Waveform Option window displays, highlight the "Temporarily Hold for Comparison" option, and press ENTER.

The waveform is held in the temporary buffer.

## Comparing Waveforms

WaveFormPAC's Compare function allows you to compare waveforms captured at two different times or to compare the current waveform with the critical curve. Comparison of waveforms enables you to visualize differences in tonnage at different angles under different conditions. The following comparison options are available:

- Currently displayed waveform and the waveform stored with the tool
- Currently displayed waveform and a waveform you are temporarily holding
- A temporarily held waveform and the waveform stored with the tool
- Currently displayed waveform and the critical curve

Since one of the numeric values displayed on the Waveform Comparison screen is Ram Speed, the Compare function requires that you enter the speed of the press before selecting a comparison option. WaveFormPAC requires press speed in order to calculate ram speed.

You only need to enter the speed of the press once for each loaded tool. The press speed value is maintained until the next tool is loaded.

To display a comparison of two waveforms or of the current waveform and the critical curve, do the following:

### NOTICE

#### **MAKE SURE TO STORE AND/OR HOLD A WAVEFORM BEFORE COMPARING**

A waveform must be stored with the tool in order to successfully implement the "Current to Stored" option. A waveform must be held in the temporary buffer in order to successfully implement the "Current to Held" option. Both a stored and a held waveform must be available in order to implement the "Held to Stored" comparison.

### NOTICE

The "current" waveform used in the Compare function is the waveform displayed on the Waveform screen. To make sure you are using the most recent waveform in your comparison, update the waveform before performing the Compare.

1. Press F3 (Update Waveforms), if necessary, to update the displayed waveform with the waveform stored in the buffer.
2. Press F4 (Compare Waveforms). The window shown in Figure 5-8, page 5-10 displays superimposed on the Waveform screen.



```

WHAT COMPARISION DO YOU WANT TO MAKE?

CURRENT TO STORED WAVEFORM
CURRENT TO HELD WAVEFORM
HELD TO STORED WAVEFORM
CURRENT TO CRITICAL CURVE
SET THE PRESS STROKES/MIN

USE THE CURSOR KEYS TO HIGHLIGHT
SELECTION. PRESS THE ENTER KEY
SELECT IT. PRESS RESET TO CANCEL.

```

Figure 5-8. Compare Waveforms Option Window

3. If you have not previously set the press speed for the currently loaded tool, highlight the “Set Press Strokes/Min” option, and press ENTER.
4. When the Numeric Entry window displays, type the speed (in strokes per minute) at which you are running the tool, and press ENTER. You are returned to the Compare Waveforms Option window.

### NOTICE

The “Press Strokes/Min” setting is maintained until the next tool is loaded.

5. Highlight the comparison option you want to implement, and press ENTER. A screen similar to the one shown in Figure 5-9 displays. Figure 5-9 shows a comparison of the waveform of the current stroke and the waveform stored with the tool.

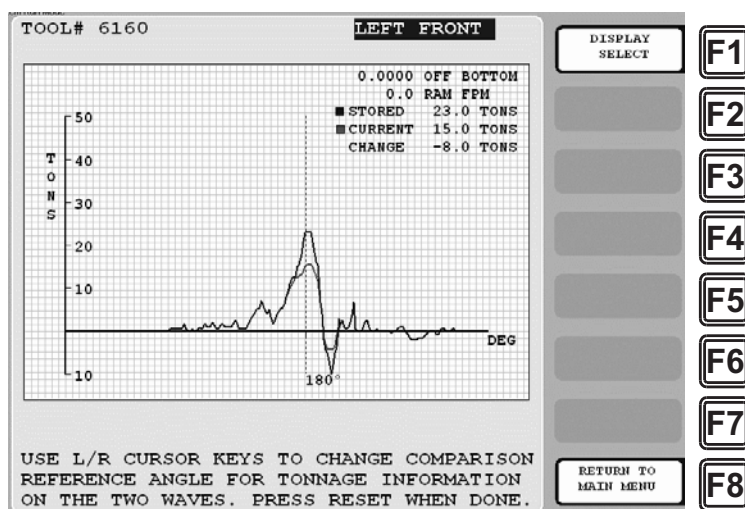


Figure 5-9. Waveform Screen Displaying a Comparison of Two Waveforms

The two waveforms in a comparison view are intersected by a vertical line that represents the crankshaft angle, which is initially 180° by default. The statistical information at the upper right of the screen is tonnage-related measurements taken at that angle. You can display measurements taken at other angles by moving the angle indicator line left or right, using the Left (◀) or Right (▶) cursor key. This information, which is useful in verifying and



improving setups and anticipating the need for tool modifications and repairs, is explained in Table 5-1, page 5-11.

*Table 5-1. Waveform Comparison View Field Descriptions*

<b>Field</b>	<b>Description</b>
<b>OFF BOTTOM</b>	The Distance Off Bottom of the ram at the specified crankshaft angle. The Distance Off Bottom is the vertical distance between the bolster and the ram at that angle measured in the units specified on the Press Parameters screen in Initialization (see page 3-8).
<b>RAM FPM</b>	The vertical velocity of the ram in Feet per Minute (FPM) at the specified crankshaft angle. This value is calculated using the press speed set on the Waveform Comparison Options screen (see Figure 5-8, page 5-10).
<b>STORED or HELD or C.C.</b>	The tonnage generated by the press at the specified crankshaft angle on the stored or held waveform or on the critical curve ("C.C."). This value represents the point at which the crankshaft angle indicator line intersects the plot.
<b>CURRENT</b>	The tonnage generated by the press at the specified crankshaft angle on the current waveform. This value represents the point at which the crankshaft angle indicator line intersects the plot.
<b>CHANGE</b>	The difference in tonnage at the specified crankshaft angle between the two displayed waveforms or between the critical curve and the current waveform. This value represents the vertical distance between the point on each plot intersected by the crankshaft angle indicator line. A positive value indicates that the tonnage displayed last (in the example shown in Figure 5-9, the tonnage on the current waveform) is greater than the tonnage displayed first (the tonnage on the stored waveform in Figure 5-9). A negative value indicates that the tonnage displayed last is less than the other tonnage.

The Distance Off Bottom reading on the Waveform Comparison screen may not match the measurement provided by a dial indicator because of factors such as press condition, bearing wear, etc. The Distance Off Bottom reading is also influenced by the accuracy of the Stroke Length and Connection Length settings on the Press Parameters screen in Initialization (see page 3-8).

The Ram Speed value varies according to the crankshaft angle, being highest at 90° and 270° and decreasing to zero at 0° and 180°. Ram Speed limits during the drawing process have been established for deep drawing applications, in which the material can tear if the Ram Speed is too high. Table 5-2, page 5-12 shows the maximum allowable ram drawing speed for various materials. Material can tear at slower speeds due to a variety of factors including lubrication, die design, and material properties. Consult your material supplier for specifications not provided in the table and for additional ram speed recommendations.

Table 5-2. Maximum Allowable Ram Speed for Drawing Different Materials

Material	Ram Drawing Speed in Feet per Minute (FPM)
Stainless steel	35
Strong aluminum	45
Cold-rolled steel (CRS)	80
Copper	150
Zinc	150
Regular aluminum	175
Brass	200

The Ram Speed reading on the Waveform Comparison screen is influenced by the accuracy of Stroke Length and Connection Length settings on the Press Parameters screen in Initialization (see page 3-8). It is also affected by the Press Strokes/Min. setting in the Compare Waveforms Option window (see Figure 5-8).

### Comparing the Current Waveform with the Critical Curve

The screen that displays when you select the “Current to Critical Curve” item in the Compare Waveforms Option window is slightly different from the other Compare Waveforms views. An example is provided in Figure 5-10.

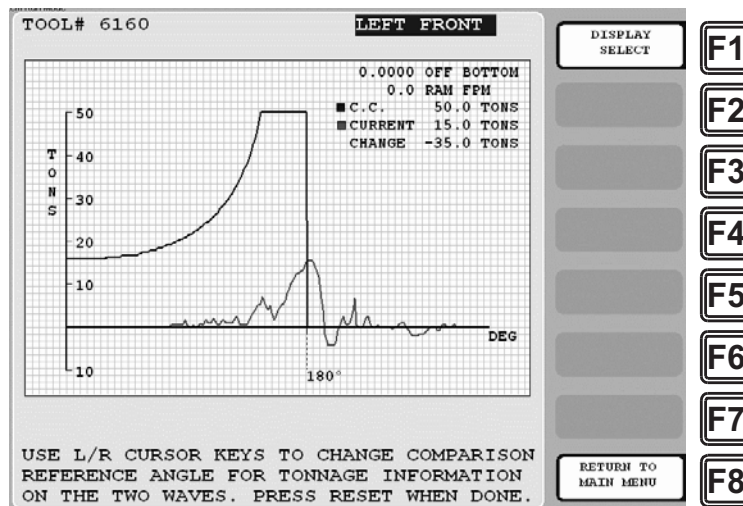


Figure 5-10. Waveform Screen with Comparison of Current Waveform and Critical Curve

A critical curve is a plot of the press’s tonnage capacity at each angle during the load-generating portion of the stroke (i.e., between 90° and 180°). WaveFormPAC generates the critical curve used in waveform comparisons from the information you enter on the Press Parameters screen in Initialization and the Critical Curve Table accessible from it (see page 3-8).

**NOTICE**

If the Critical Curve Table has not been set up in Initialization, an alert message will display on the SmartPAC 2 front panel (see *Critical Curve Table Alert*, page 6-5).

The “Current to Critical Curve” comparison enables you to compare tonnage on the current waveform at each angle between 90° and 180° with the press’s rated tonnage capacity at that angle. This comparison enables you to provide optimum press protection by preventing excessive loads, which can catastrophically damage critical structural members of the press.

To update the tonnage and other statistical information displayed at the upper right of the screen for any angle in the comparison range (i.e., 90° to 180°), press the Left ( ◀ ) or Right ( ▶ ) cursor key to move the angle indicator line left or right. The indicator line does not move beyond (i.e., to the right of) the 180° position on the X axis.

When tonnage generated by the press is within the press’s rated capacity, the current waveform between 90° and 180° should fit within the critical curve, and the Change value shown at the upper right of the screen should be negative at each angle.

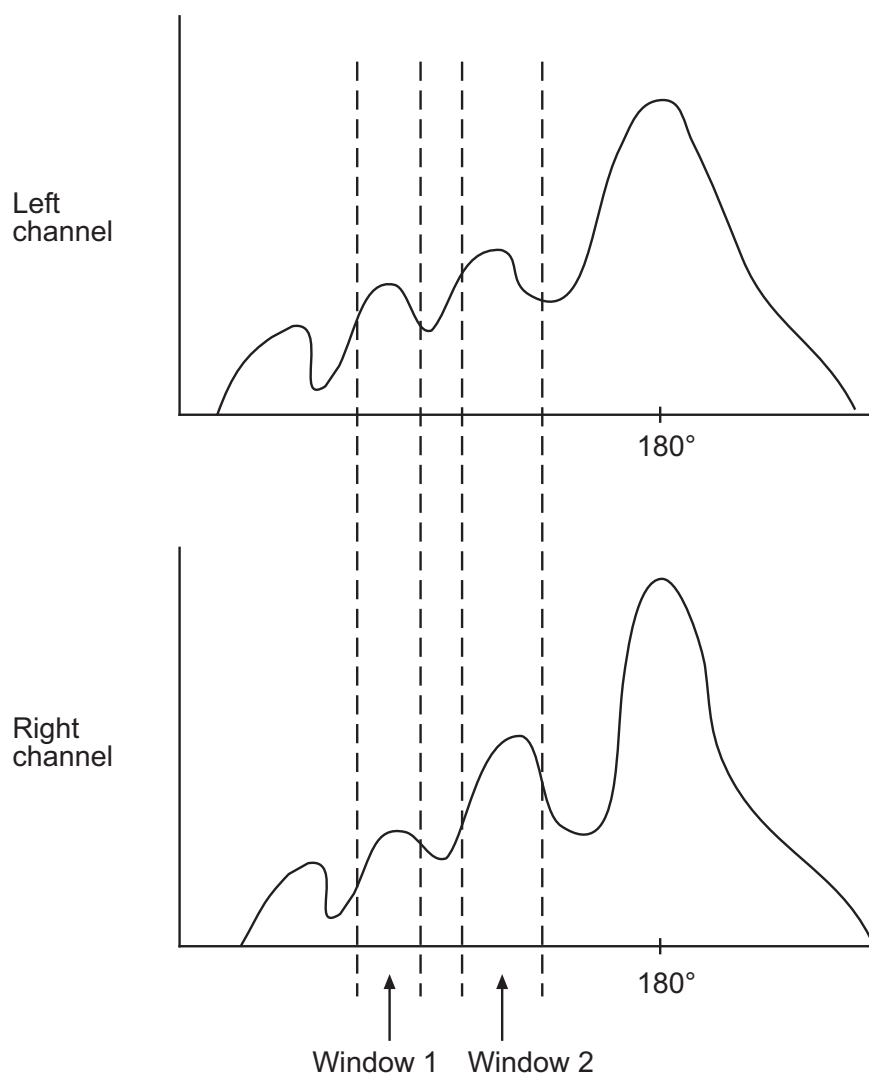
## Creating Windows

WaveFormPAC allows you monitor four additional segments of the waveform in addition to peak forward, which occurs at roughly 180°, and peak reverse, which occurs after 180°. These segments are called windows. You can only create windows for the waveforms displayed in strain link input channel view; you cannot create windows for the Total Tonnage waveform. For each window you create, you establish setpoints to monitor that segment of the waveform. The window monitors that segment for all strain link inputs.

Figure 5-11, page 5-14 shows an example of how two windows might be positioned and sized for waveforms on a 2-input WaveFormPAC. Each window is designed to monitor a tonnage peak in both waveforms that occurs before 180°. Windows could be established in a similar fashion for waveforms in a four-waveform system.

**NOTICE**

Take a few moments to plan the number of windows you need and the positions for each. You should create windows in sequential order from the beginning of the load-generating portion of the stroke to the end. Do not create windows for the reverse load part of the stroke (i.e., after 180°).



*Figure 5-11. Two Windows Created to Monitor Peaks Occurring before 180°: Example*

To create a window, do the following:

### **NOTICE**

#### **PRESS MUST BE STOPPED TO CREATE A WINDOW**

The press must be stopped in order for WaveFormPAC to create a window. If you attempt to create a window while the press is running, an error message will display asking you to stop the press before continuing.

1. Stop the press.

### **NOTICE**

You cannot create a window in the Total Tonnage view on the Waveform screen. The F7 (Select or Add a Window) function is not available for Total Tonnage.

- Press F1 (Display Select) to select the waveform for the desired strain link input.

### NOTICE

You cannot create or delete a window while the press is running. If you attempt to do so, the following message will display:

*THE PRESS MUST BE STOPPED TO ADD  
OR DELETE A WINDOW.*

*PRESS RESET WHEN DONE*

To respond to the message, stop the press, then press RESET.

- Press F7 (Select or Add a Window).

The screen is refreshed, the caption “ADD” appearing to the right of “PEAK” at the lower left of the screen and the highlight moving from “PEAK” to “ADD.” The message “PRESS ENTER TO ADD A WINDOW” appears above these captions.

- Press ENTER.

The screen is refreshed, and two parallel vertical lines with angle captions appearing beneath them are superimposed on the waveform, as shown in Figure 5-12, page 5-15. These lines indicate the start and end angles of the window, 141° and 155° in the example shown in Figure 5-12.

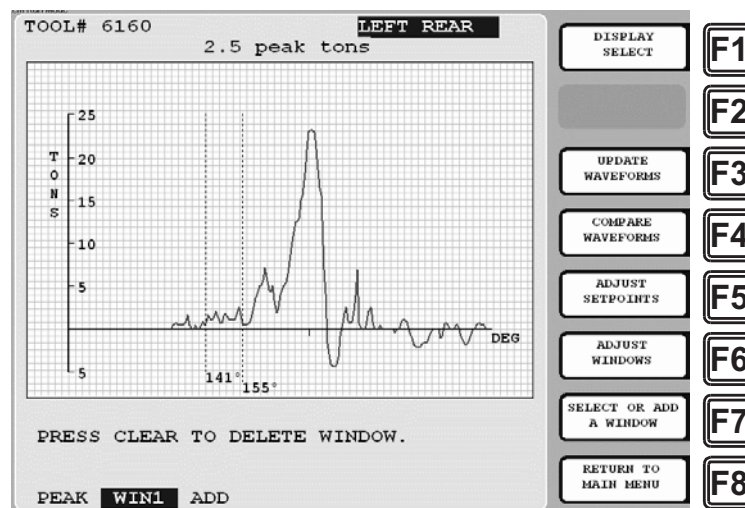


Figure 5-12. Waveform Screen Showing Window 1

The caption “WIN1” displays between the “PEAK” and “ADD” captions, identifying the window as Window 1. The function label “Adjust Windows” appears to the left of the F6 function key.

## Adjusting Window Position and Width

You can change the window's position and width by doing the following:

1. With a window caption highlighted and the waveform associated with it displayed, press F6 (Adjust Window).

The screen is refreshed, and the following prompt appears at the bottom of the screen:

USE L/R CURSOR KEYS TO MOVE THE WINDOW.  
USE U/D CURSOR KEYS TO ADJUST THE WIDTH.  
PRESS RESET KEY WHEN DONE.

All function key labels except "Return to Main Menu" disappear.

2. To change the window's start angle without changing its width, use the Left (◀) or Right (▶) cursor key. Press the Left (◀) cursor to move the window to the left or the Right (▶) cursor to move the window to the right.

To change the window's width, use the Up (▲) and Down (▼) cursor keys. Press the Up (▲) cursor to move the right vertical angle indicator line to the right, increasing the width of the window; press the Down (▼) cursor to move the right angle indicator to the left, decreasing the window's width. Figure 5-13 shows the window (i.e., "WIN1") created in Figure 5-12 repositioned so it brackets one of the peaks that occur before 180°.

### NOTICE

Since the settings for each window apply to all strain link channels, make sure that the window's position and width can be accommodated in all strain link channel views. WaveFormPAC does not allow windows to overlap.

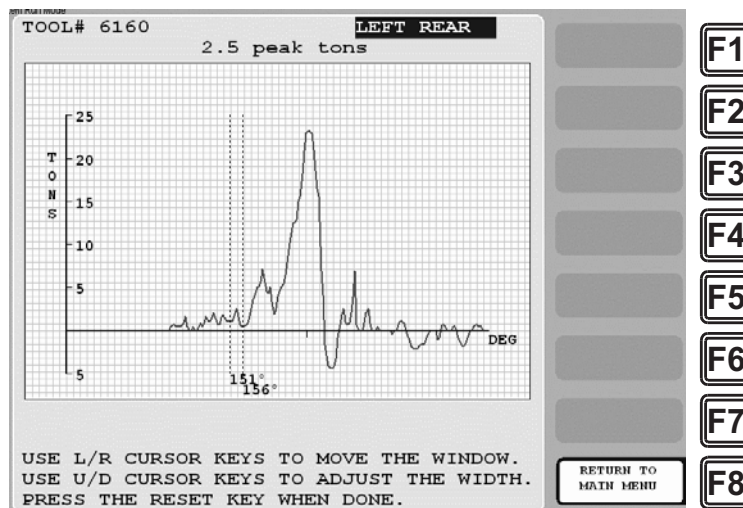


Figure 5-13. Waveform Screen Showing Window 1 Repositioned

3. Press RESET when you are finished adjusting the window.

## Adding Windows

To create up to three additional windows, do the following:

1. With the “WIN1” caption highlighted and the prompt “PRESS CLEAR TO DELETE WINDOW” displayed above the caption, press F7 (Select or Add a Window).

The highlight moves from “WIN1” to “ADD,” and the prompt changes to “PRESS ENTER TO ADD A WINDOW.”

2. Press ENTER.

The screen is refreshed, and two vertical angle indicator lines defining the second window display. The new window is positioned to the right of the first, but this is not obvious since the boundaries of the first window disappear when you add the second. The caption “WIN2” appears to the right of “WIN1,” and the highlight moves to “WIN2.”

### NOTICE

WaveFormPAC automatically sorts windows according to their angle positions, lower angles to the left, higher angles to the right. You may need to move windows to the left as you add them to make room for additional windows.

3. To adjust the starting position or width of the window, perform the *Adjusting Window Position and Width* procedure (above).
4. Repeat these steps to create up to four windows.

## Inserting a Window

When you add a window (i.e., when you press F7 with the “ADD” caption highlighted), the window is placed to the right of the last window you created. You can insert a window to the left of a previously created window (assuming that one of the four windows is still available) by doing the following:

1. With one or more window captions (e.g., “WIN1,” “WIN2,” etc.) displayed beneath the “PRESS CLEAR TO DELETE WINDOW” message, Press F7 (Select or Add a Window) to select the window you want.
2. When that window caption is highlighted, press ENTER.

The screen is refreshed, and two vertical angle indicator lines defining the window you inserted display. The new window is positioned to the left of the window you selected in step 1, but this is not obvious since the boundaries of that window disappear when you insert the new window. The window caption you selected in step 1 moves to the right and is given the next number in the sequence (i.e., 1-4). The highlight remains on the caption of the inserted window, which keeps the number of the window you originally selected.

## Deleting a Window

To delete a window, do the following:

### NOTICE

#### **PRESS MUST BE STOPPED TO DELETE A WINDOW**

The press must be stopped in order for WaveFormPAC to delete a window. If you attempt to delete a window while the press is running, an error message will display asking you to stop the press before continuing.

1. Stop the press.
2. Press F7 (Select or Add Window) to select the window you want to remove.

### NOTICE

Use caution when selecting a window for deletion. When you delete a window, the window's setpoints are also deleted.

3. Press the CLEAR key. The warning shown in Figure 5-14 displays.

### NOTICE

You cannot create or delete a window while the press is running. If you attempt to do so, the following message will display:

*THE PRESS MUST BE STOPPED TO ADD  
OR DELETE A WINDOW.*

*PRESS RESET WHEN DONE*

To respond to the message, stop the press, then press RESET.

```
WARNING!!!! THIS WILL REMOVE A
WINDOW PLUS THE SETPOINTS THAT GO
WITH IT. DO YOU WANT TO DO THIS?

PRESS ENTER TO CLEAR THE WINDOW.
PRESS RESET TO CANCEL.
```

Figure 5-14. Delete Window Warning Message

4. Press ENTER to confirm that you wish to delete the window.

The parallel angle indicator lines defining the window disappear as does the window caption at the lower left of the screen. The remaining window captions are renumbered sequentially from left to right.

### NOTICE

If you want to cancel the deletion, press RESET.



## Selecting Windows for Viewing

To select windows for viewing, do the following:

1. Press F7 (Select or Add a Window) to select the window you want to view.

Each time you press F7, the highlight moves from one window caption to the next, and the parallel angle indicator lines defining that window are superimposed on the waveform. The “ADD” and “PEAK” captions are also included in the selection sequence, but no window angle indicator lines display when you select them.

2. Repeat step 1 for each window you want to view.

## Adjusting Setpoints

### NOTICE

If the ADJUST SETPOINTS function has been locked out of Run mode (see *Locking Run Mode Actions*, page 3-13), the caption displayed next to function key F5 on the Waveform screen will be “VIEW SETPOINTS.” You will only be able to view setpoints; you will not be able to adjust them.

## Adjusting Setpoints for Peak Tonnage

In order to adjust setpoint limits for peak tonnage, you must first load a tool and run enough parts to satisfy the sample period; otherwise, your High, Low, and Repeatability setpoints will default to 120% of the full-scale tonnage of the press. Once the sample period is satisfied, you can adjust setpoints as follows:

1. With one of the strain link channel views displayed on the Waveform screen, press F7 (Select or Add a Window) to select the “PEAK” caption at the bottom left of the screen.
2. With the “PEAK” caption highlighted, press F5 (Adjust Setpoints). The screen is refreshed, as shown in Figure 5-15, page 5-20. The peak High, Low, and Repeatability setpoint percentages are displayed at the upper right of the screen. High and Low setpoints are shown graphically as two horizontal lines; High and Low setpoint values are displayed to the right of these setpoint indicators.

### NOTICE

The setpoints displayed on this screen are those that have been established for the tool in Program mode or adjustments made the last time setpoints were updated in Run mode.

3. Highlight the setpoint you wish to adjust, using the Left ( ◀ ) or Right ( ▶ ) cursor key as instructed in the prompt at the bottom of the screen. The High setpoint is selected by default as shown in Figure 5-15.

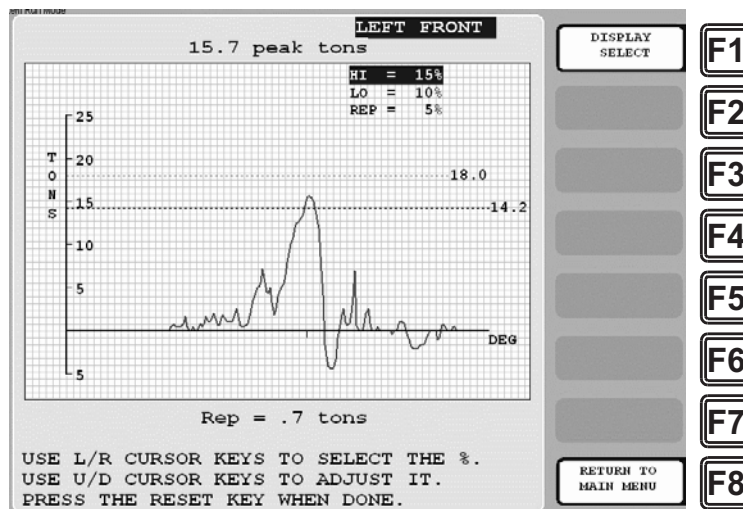


Figure 5-15. Waveform Screen Showing Peak Tonnage Setpoints

4. With the desired setpoint selected, increment or decrement the displayed value, using the Up (▲) or Down (▼) cursor key as instructed in the prompt at the bottom of the screen. The value increases or decreases one unit each time you press the cursor. If you are adjusting the High or Low setpoint percentage, the High or Low setpoint indicator line moves up or down as you increase or decrease the setting.
5. Repeat steps 3 and 4 for each setpoint you wish to adjust.

### NOTICE

Setpoint adjustments are saved to the currently loaded tool, overwriting previous settings.

6. Press RESET when you are finished.

## Adjusting Setpoints for Tonnage in Windows

WaveFormPAC also enables you to set and adjust setpoints for each of four windows you create. Setpoints are specific to each window but apply to all strain link channels.

### NOTICE

When adjusting window setpoints, make sure your changes are acceptable for all strain link inputs. Window setpoints are used to monitor all strain link channels.

In order to adjust setpoint limits for window tonnage, as for peak tonnage, you must first load a tool and run enough parts to satisfy the sample period; otherwise, your High, Low, and Repeatability setpoints will default to 120% of the full-scale tonnage of the press. Once the sample period is satisfied, you can adjust setpoints as follows:

1. With one of the strain link channel views displayed on the Waveform screen, press F7 (Select or Add a Window) to select the caption for the window you want (e.g., “WIN1,” “WIN2,” etc.).

- With the desired window caption highlighted, press F5 (Adjust Setpoints). The screen is refreshed, as shown in Figure 5-16. The High, Low, and Repeatability setpoint percentages for that window are displayed at the upper right of the screen. High and Low setpoints for the window are shown graphically as two horizontal lines; High and Low setpoint values are displayed to the right of these setpoint indicators.

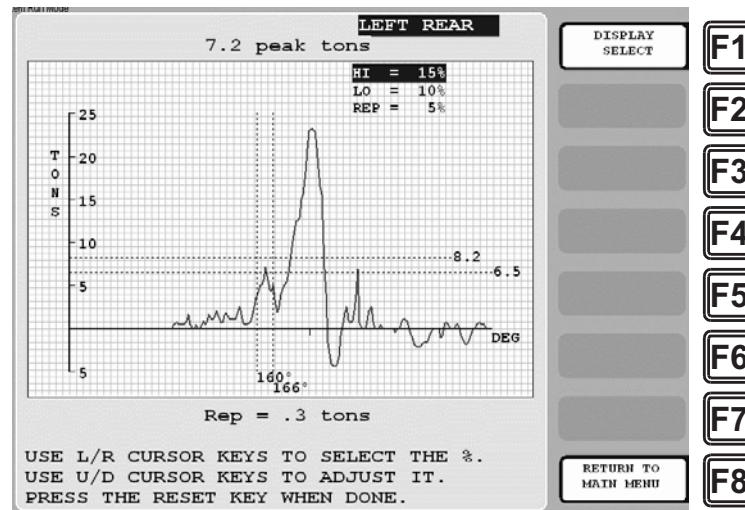


Figure 5-16. Waveform Screen Showing Tonnage Setpoints for a Window

- Highlight the setpoint you wish to adjust, using the Left (◀) or Right (▶) cursor key as instructed in the prompt at the bottom of the screen. The High setpoint is selected by default as shown in Figure 5-16.
- With the desired setpoint selected, increment or decrement the displayed value, using the Up (▲) or Down (▼) cursor key as instructed in the prompt at the bottom of the screen. The value increases or decreases one unit each time you press the cursor. If you are adjusting the High or Low setpoint percentage, the High or Low setpoint indicator line moves up or down as you increase or decrease the setting.
- Repeat steps 3 and 4 for each setpoint you wish to adjust.

### NOTICE

Setpoint adjustments are saved to the currently loaded tool, overwriting previous settings.

- Press RESET when you are finished.

## Displaying Tonnage in Plan View

When you select SHOW “PLAN” VIEW on the Tonnage Monitor Run Menu, the screen shown in Figure 5-17 displays.

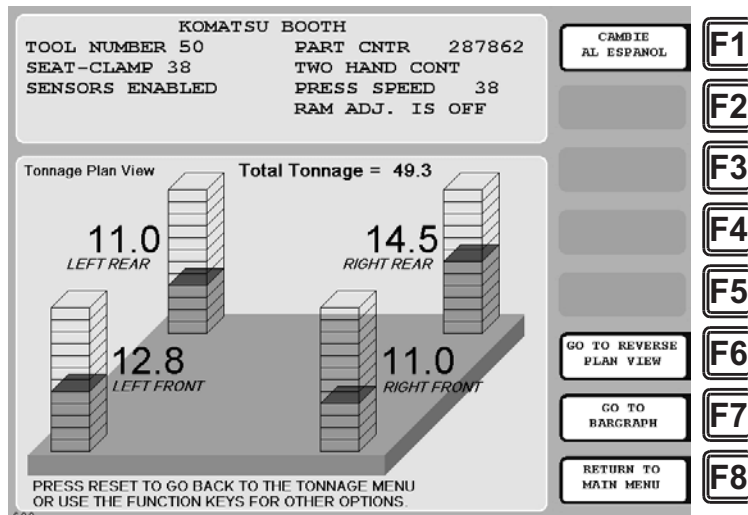


Figure 5-17. Tonnage “Plan” View Screen (Four-channel WaveFormPAC Shown)

The Tonnage Plan View screen displays the current tonnage at each strain link as a colored column filling some fraction of a graduated rectangular container. The total height (or volume) of the container represents 120% of press capacity, so the height (or volume) of the colored column provides a good idea of the ratio of current tonnage to full-scale capacity.

The color of the column indicates the proximity of the tonnage reading to high and low setpoints, as follows:

- Green—Tonnage is safely below high setpoint and safely above low setpoint
- Yellow—Tonnage is within 25% of high or low setpoint
- Red—Tonnage exceeds high or low setpoint

Tonnage is also shown in numerical form next to each rectangular container. Tonnage readings are shown in tenths of a ton (e.g., 27.8 tons) if the full-scale capacity of the press is less than 100 tons per channel, as whole numbers (e.g., 28 tons) if full-scale capacity is 100 tons or greater.

To exit from the Tonnage Plan View screen, do one of the following:

- Press the F6 (Go to Reverse Plan View) function key to go to the Reverse Tonnage Plan View screen (see *Viewing Reverse Tonnage*, page 5-32)
- Press the F7 (Go to Bargraph) function key to go to the Tonnage Bargraph View screen (see next section)
- Press the F8 (Return to Main Menu) function key to return to the Main Run Menu
- Press RESET to return to the Tonnage Monitor Run Menu

## Displaying Tonnage in Bargraph View

When you select SHOW BARGRAPHS on the Tonnage Monitor Run Menu, the screen shown in Figure 5-18 displays.

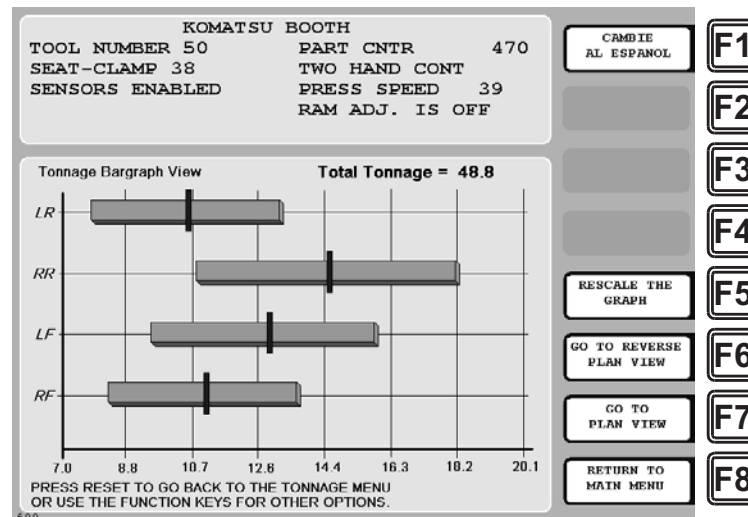


Figure 5-18. Tonnage Bargraph View Screen

The Tonnage Bargraph View screen displays the current tonnage at each strain link as a vertical magenta tick on a colored horizontal bar. The left end of the bar represents the low setpoint, the right end the high setpoint. Tonnage is shown dynamically, the vertical tick mark moving left or right on each bar as the tonnage recorded at each strain link varies from stroke to stroke.

The color of the bar indicates the proximity of the tonnage reading to high and low setpoints, as follows:

- Green—Tonnage is safely below high setpoint and safely above low setpoint
- Yellow—Tonnage is within 25% of high or low setpoint
- Red—Tonnage exceeds high or low setpoint

The scale of the bar graph (for instance, 7.0 through 20.1 in Figure 5-18) is determined by the tonnages recorded during and the setpoint calculations performed at the end of the sample period. If you are viewing the Tonnage Bargraph View screen while WaveFormPAC is calculating setpoints, the bars and graph scale may shrink as setpoints are calculated. You can rescale the graph and expand the bars by pressing the F5 (Rescale the Graph) function key.

To exit from the Tonnage Bargraph View screen, do one of the following:

- Press the F6 (Go to Reverse Plan View) function key to go to the Reverse Tonnage Plan View screen (see *Viewing Reverse Tonnage*, page 5-32)
- Press the F7 (Go to Plan View) function key to go to the Tonnage Plan View screen (see previous section)
- Press the F8 (Return to Main Menu) function key to return to the Main Run Menu
- Press RESET to return to the Tonnage Monitor Run Menu

## Viewing and Adjusting Setpoints

When you select the ADJUST SETPOINTS item on the Tonnage Monitor Run Menu, the screen shown in Figure 5-19 displays.

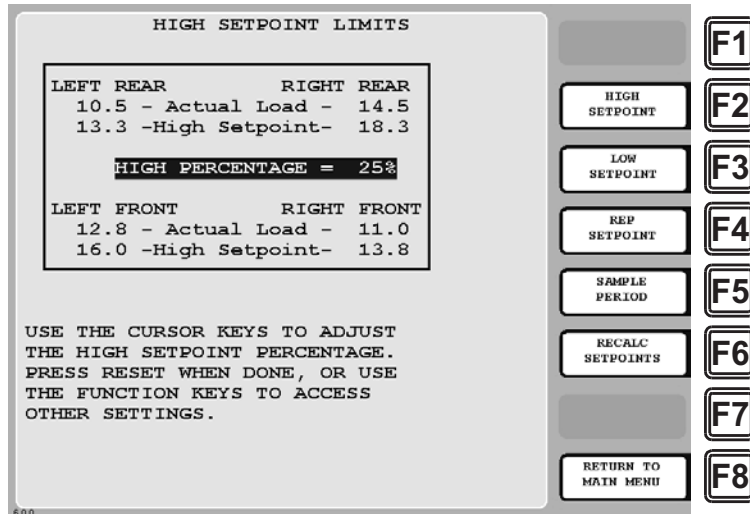


Figure 5-19. Adjust Setpoints Screen: High Setpoint Limits Display

### NOTICE

If the ADJUST SETPOINTS function has been locked out of Run mode (see *Locking Run Mode Actions*, page 3-13), the following message displays at the bottom of the Adjust Setpoints screen, and you will not be able to adjust setpoints:

THE TONNAGE MONITOR ADJUST  
MODE IS LOCKED OUT. PRESS  
THE RESET KEY WHEN DONE.

The Adjust Setpoints screen allows you to make adjustments to the following Program tonnage settings and to recalculate setpoints based on these adjustments:

- High setpoint
- Low setpoint
- Repeatability setpoint
- Sample period

### NOTICE

#### IMPORTANT

Adjustments you make on this screen change the Program settings for the currently loaded tool. Original settings are lost.

Adjustments you make on this screen do not affect setpoints for windows. You adjust windows setpoints on the Waveform screen (see page 5-20).

## High Setpoint Limits

High setpoint values are displayed by default when you select the ADJUST SETPOINTS item (see Figure 5-19), or you can access them by pressing the F2 (High Setpoint) function key.

The High Setpoint Limits display shows the current high setpoint percentage, the most recently calculated high tonnage setpoints for each strain link using the displayed percentage, and the actual tonnage recorded for each strain link. Actual tonnages are updated on each stroke.

To adjust the high setpoint percentage up or down, press the Up (▲) or Down (▼) cursor key. Each keystroke increases or decreases the displayed value by 1 percent. As you adjust the high setpoint percentage, the high tonnage setpoint values for each strain link are updated, allowing you to see the results of your adjustments and to compare them with actual tonnage values.

To recalculate setpoints based on your change(s), refer to *Recalculating Setpoints*, page 5-27.

## Low Setpoint Limits

To display low setpoint values (see Figure 5-20), press the F3 (Low Setpoint) function key.

The Low Setpoint Limits display shows the current low setpoint percentage, the most recently calculated low tonnage setpoints for each strain link using the displayed percentage, and the actual tonnage recorded for each strain link. Actual tonnages are updated on each stroke.

To adjust the low setpoint percentage up or down, press the Up (▲) or Down (▼) cursor key. Each keystroke increases or decreases the displayed value by 1 percent. As you adjust the low setpoint percentage, the low tonnage setpoint values for each strain link are updated, allowing you to see the results of your adjustments and to compare them with actual tonnage values.

To recalculate setpoints based on your change(s), refer to *Recalculating Setpoints*, page 5-27.

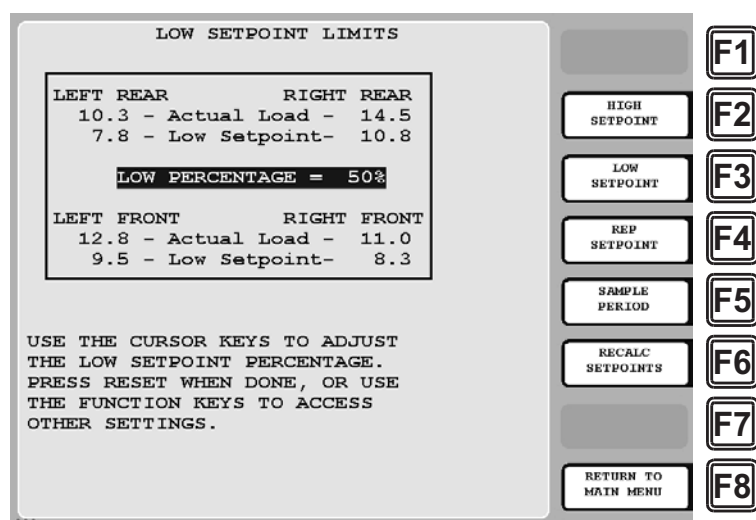


Figure 5-20. Adjust Setpoints Screen: Low Setpoint Limits Display



## Repeatability Setpoint Limits

To display repeatability setpoint values (see Figure 5-21), press the F4 (Rep Setpoint) function key.

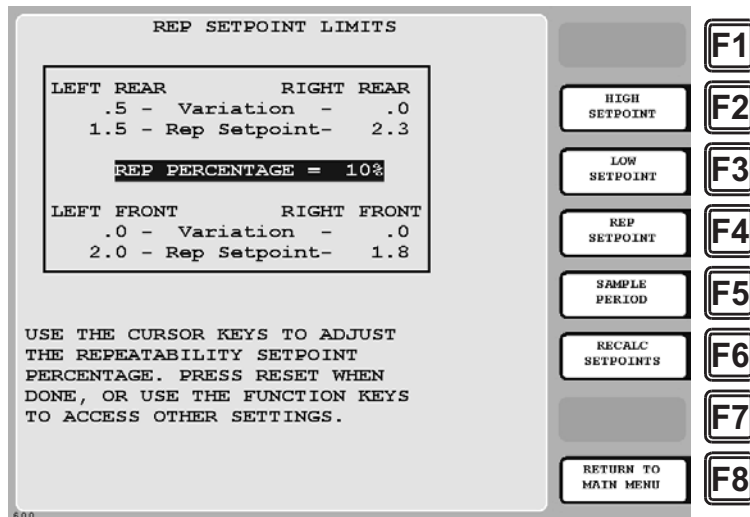


Figure 5-21. Adjust Setpoints Screen: Repeatability Setpoint Limits Display

The Repeatability Setpoint Limits display shows the current repeatability setpoint percentage, the most recently calculated repeatability setpoints for each strain link using the displayed percentage, and the actual stroke-to-stroke tonnage variation recorded for each strain link.

The tonnage variation reading is the highest stroke-to-stroke tonnage variance recorded during the last *n* number of strokes, where *n* is the length of the sample period. For example, if the sample period is set to 15 strokes, WaveFormPAC collects tonnage variance information for the most recent 15 strokes.

To adjust the repeatability setpoint percentage up or down, press the Up (▲) or Down (▼) cursor key. Each keystroke increases or decreases the displayed value by 1 percent. As you adjust the repeatability setpoint percentage, the repeatability setpoint values for each strain link are updated, allowing you to see the results of your adjustments and to compare them with actual stroke-to-stroke tonnage values.

To recalculate setpoints based on your change(s), refer to *Recalculating Setpoints*, page 5-27.



## Setpoint Calculation Period

To display the sample period setting (see Figure 5-22), press the F5 (Sample Period) function key.

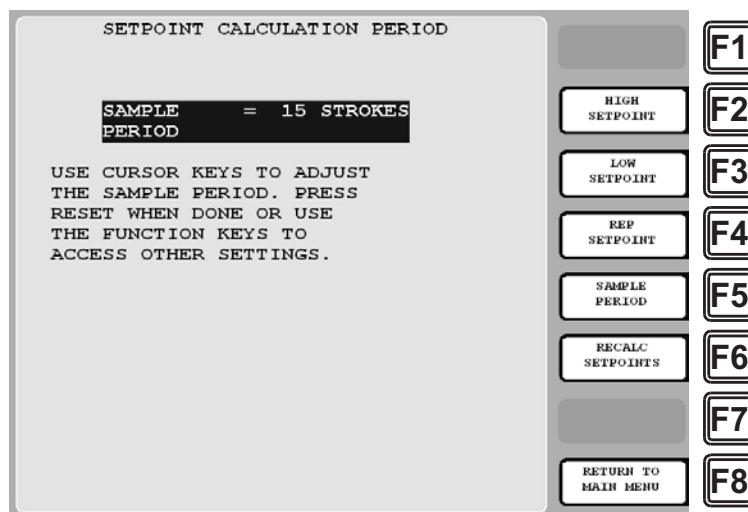


Figure 5-22. Adjust Setpoints Screen: Sample Period Display

To adjust the sample period value up or down, press the Up (▲) or Down (▼) cursor key. Each keystroke increases or decreases the displayed value by 1 stroke. The sample period value is adjustable from 1 to 100 strokes.

To recalculate setpoints based on your change(s), refer to *Recalculating Setpoints*, next.

## Recalculating Setpoints

### NOTICE

If the RECALCULATE SETPOINTS function has been locked out of Run mode (see *Locking Run Mode Actions*, page 3-13), the “RECALC SETPOINTS” caption does not display next to the F6 function key on the Adjust Setpoints screen, and you cannot recalculate setpoints.

To initiate the setpoint calculation process, press F6 (Recalc Setpoints). The following warning (see Figure 5-23) displays.

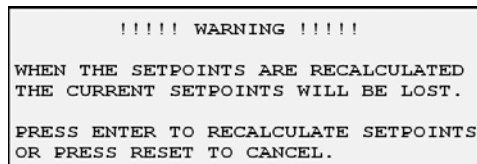


Figure 5-23. Adjust Setpoints Screen: Recalculate Setpoints Warning Message

Press ENTER to confirm that you want to recalculate setpoints. The message  
**SETPOINTS WILL BE RECALCULATED**

displays briefly on top of the warning message, and you are returned to the Adjust Setpoints screen. Setpoints are recalculated the next time you run the press and will appear on the appropriate screen (e.g., Adjust Setpoints, Waveform, etc.) the next time you access it. Setpoints are recalculated both for peak tonnage and for all windows.

## Viewing Tonnage History

When you select “TONNAGE HISTORY” on the Tonnage Monitor Run Menu, the following screen (see Figure 5-24) displays.

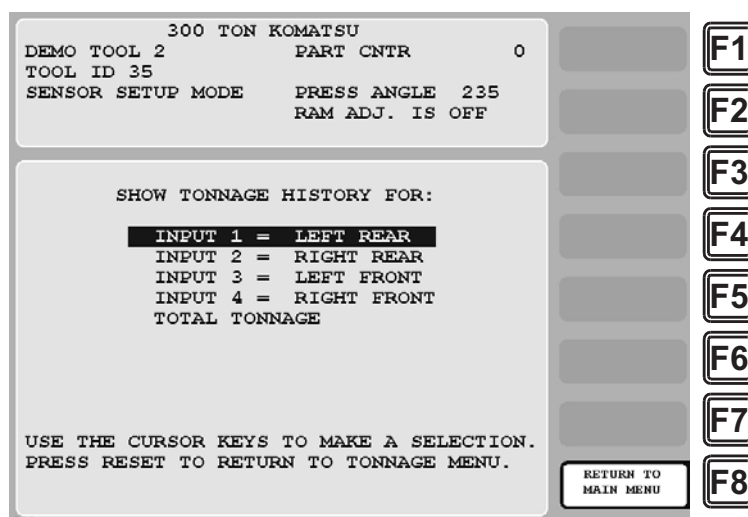


Figure 5-24. Tonnage History Menu

The Tonnage History Menu gives you access to screens that provide tonnage history for each strain link input (first four menu items) and for the strain link total (last menu item). Tonnage history information is stored by tool number and displayed for the current tool.

## Viewing Tonnage History for a Selected Strain Link Input

To view tonnage history for a selected strain link input, select that input on the Tonnage History Menu. A screen like the one shown in Figure 5-25, page 5-29 displays.

The tonnage history display for each strain link input provides statistical information about your process (see Table 5-3, page 5-29 for an explanation of each field) that can help you to improve part quality, achieve more efficient runs, identify tool wear, etc. Displayed values are updated on every hit.

## NOTICE

Tonnage history ignores tonnage information that occurs during the startup counter period or when WaveFormPAC is in Setup mode.

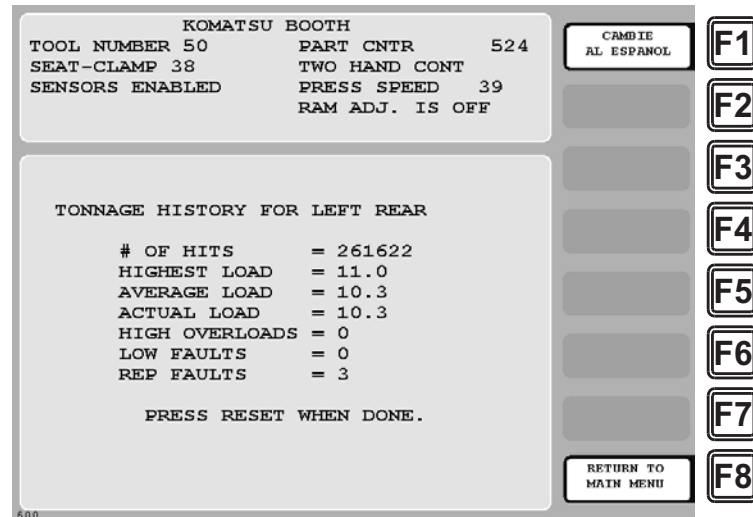


Figure 5-25. Tonnage History Display for “Left Rear” Input

Table 5-3. Tonnage History Information: Strain Link Inputs

Field	Description
# OF HITS	The period of time, measured in number of strokes, during which WaveFormPAC has collected the displayed historical data for the current tool.
HIGHEST LOAD	The highest tonnage recorded during the data collection period. This value is useful in cases of catastrophic damage, or when you need to determine whether tooling components failed due to an overload or other reason.
AVERAGE LOAD	The mean tonnage recorded during the data collection period. This value can be compared to the actual tonnage (see next item) to help estimate tool wear.
ACTUAL LOAD	The current operating tonnage at the selected strain link input.
HIGH OVERLOADS	The number of high setpoint faults recorded during the data collection period. This value in conjunction with the LOW FAULTS and REP FAULTS items helps to determine the “problem” dies.
LOW FAULTS	The number of low setpoint faults recorded during the data collection period. This value in conjunction with the HIGH OVERLOADS and REP FAULTS items helps to determine the “problem” dies.
REP FAULTS	The number of repeatability setpoint faults recorded during the data collection period. This value in conjunction with the HIGH OVERLOADS and LOW FAULTS items helps to determine the “problem” dies.

Highest, average, and actual load values and the high overload count begin accumulating when tonnage history is cleared (see *Clearing Tonnage History*, page 5-31) and are incremented until the next time tonnage history is cleared. Low and repeatability fault values begin accumulating when the tool is loaded and are reset to zero when the tool is reloaded.

## Viewing Tonnage History for All Strain Links

To view history for the total tonnage on all strain link inputs, select the TOTAL TONNAGE item on the Tonnage History Menu. A screen like the one shown in Figure 5-26 displays.

KOMATSU BOOTH

TOOL NUMBER 50      PART CNTR      542

SEAT-CLAMP 38      TWO HAND CONT

SENSORS ENABLED      PRESS SPEED      39

RAM ADJ. IS OFF

CAMDIE  
AL. ESPANOL

F1

F2

F3

F4

F5

F6

F7

F8

TONNAGE HISTORY FOR TOTAL TONNAGE

# OF HITS      = 261640

HIGHEST LOAD      = 49.3

AVERAGE LOAD      = 47.9

ACTUAL LOAD      = 48.6

PRESS RESET WHEN DONE.

CLEAR  
HISTORY

RETURN TO  
MAIN MENU

Figure 5-26. Tonnage History Display for “Total Tonnage”

Tonnage information provided on this screen is explained in Table 5-4.

Table 5-4. Tonnage History Information: Total Tonnage

Field	Description
# OF HITS	The period of time, measured in number of strokes, during which WaveFormPAC has collected the displayed historical data for the current tool.
HIGHEST LOAD	The highest tonnage recorded during the data collection period. This value is useful in cases of catastrophic damage, or when you need to determine whether tooling components failed due to overload or other reasons.
AVERAGE LOAD	The average tonnage recorded during the data collection period. This value can be compared to the actual tonnage to help estimate tool wear.
ACTUAL LOAD	The sum of the current operating tonnages at all strain link inputs.

## Clearing Tonnage History

To delete all the information in tonnage history, press the F6 (Clear History) function key on the Tonnage History for Total Tonnage display. The following warning message (see Figure 5-27) displays, asking you to confirm that you want to clear tonnage history.

```
!!!!!! WARNING !!!!!  
  
THIS WILL CLEAR THE TONNAGE HISTORY  
FOR ALL INPUTS PLUS THE TOTAL. IF  
YOU WANT TO DO THIS THEN PRESS THE  
CLEAR KEY. IF YOU DO NOT THEN PRESS  
THE RESET KEY.
```

Figure 5-27. "Clear Tonnage History" Warning Message

### NOTICE

#### USE CAUTION WHEN CLEARING TONNAGE HISTORY

Do not press the CLEAR key unless you are sure that you want to clear tonnage history. When you press CLEAR, all tonnage history data is deleted and cannot be retrieved.

To confirm that you want to clear tonnage history, press the CLEAR key. (To cancel this action, press RESET.)

Press RESET to return to the Tonnage Monitor Run Menu.

## Recalculating Setpoints

### NOTICE

If the RECALCULATE SETPOINTS function has been locked out of Run mode (see *Locking Run Mode Actions*, page 3-13), that item does not appear on the Tonnage Monitor Run Menu.

When you select RECALCULATE SETPOINTS on the Tonnage Monitor Run Menu, the following warning message displays:

```
!!!!!! WARNING !!!!!  
  
WHEN THE SETPOINTS ARE RECALCULATED  
THE CURRENT SETPOINTS WILL BE LOST.  
  
PRESS ENTER TO RECALCULATE SETPOINTS  
OR PRESS RESET TO CANCEL.
```

Figure 5-28. Tonnage Monitor Run Menu: Recalculate Setpoints Warning Message

Press ENTER to confirm that you want to recalculate setpoints. The message

*SETPOINTS WILL BE RECALCULATED*

displays briefly on top of the warning message, and you are returned to the Tonnage Monitor Run Menu. Setpoints are recalculated the next time you run the press and will appear on the appropriate screen (e.g., Adjust Setpoints, Waveform, etc.) the next time you access it.

Setpoints are recalculated both for peak tonnage and for all windows.

You should always recalculate setpoints when you have used the COPY TOOL function to create a new tool number. The copied tool will have the same percentages and the same setpoints as the original tool. If you create a new tool (not copying from an existing one), you do not have to recalculate setpoints. WaveFormPAC will automatically calculate setpoints when you run the press.

### CAUTION

Do not recalculate setpoints when the press is stopped due to a tonnage fault. Proceed only when you have completely corrected the problem! Failure to do so may result in damage to the press and tooling.

**Failure to comply with these instructions could result in property damage.**

## Viewing Reverse Tonnage

When you select “SHOW REVERSE TONNAGE” on the Tonnage Monitor Run Menu, the screen shown in Figure 5-29 displays.

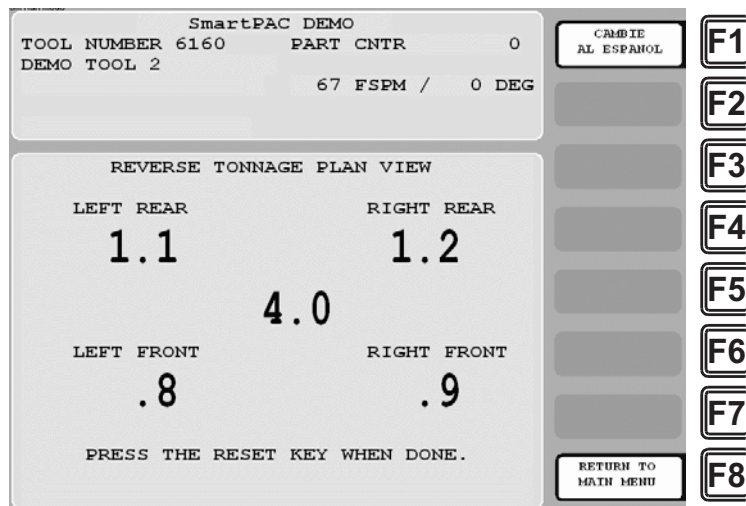


Figure 5-29. Reverse Tonnage Plan View Screen

The Reverse Tonnage Plan View screen displays the reverse “snap-through” tonnage for each strain link input and the total reverse tonnage for all strain link inputs. The reverse tonnage setpoint, which is set in Initialization mode (see *Setting Reverse Setpoint % of Press Capacity*, page 3-7), is not shown on this screen, and cannot be adjusted.

When you are done viewing this screen, press RESET to return to the Tonnage Monitor Run Menu.

## Loading a New Tool

### NOTICE

In order to load a new tool in Run mode, the LOAD TOOL # item on the Security Access Menu in Initialization mode must be set to "PROGRAM AND RUN MODES." If this item has been set to "PROGRAM MODE ONLY," the LOAD NEW TOOL item will not appear on the Main Run Menu.

If the LOAD NEW TOOL function is not locked out of Run mode, you can load any programmed tool from the Main Run Menu. However, a tool number cannot be loaded while the press is running. To load a new tool, perform the following steps.

### NOTICE

If you attempt to load a tool while the press is running, a message will display, indicating that the press must be stopped before a tool number can be loaded.

1. Select LOAD NEW TOOL on the Main Run Menu. The Tool Manager screen (see Figure 5-30) displays.

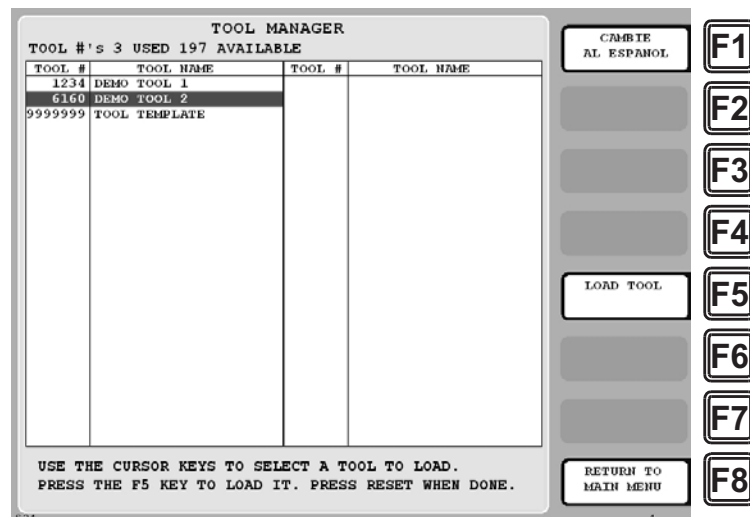


Figure 5-30. Tool Manager Screen

2. Highlight the tool you want, and press F5 (Load Tool). The following warning message displays.

```

WARNING!!      WARNING!!
ANCILLARY EQUIPMENT MAY OPERATE
WHEN THIS TOOL IS LOADED. WARN
ALL PERSONNEL TO STAND CLEAR

PRESS ENTER TO LOAD THIS TOOL.
PRESS RESET TO CANCEL.
  
```

Figure 5-31. Load Tool Warning Message

3. Press ENTER to load the tool. (Press RESET if you want to cancel.) The following message displays briefly; then you are returned to the Main Run Menu.



```
TOOL NUMBER 6160
.....IS BEING LOADED
```

*Figure 5-32. Tool Loading Message*



# Chapter 6. Troubleshooting

This chapter shows you how to respond to WaveFormPAC faults and perform troubleshooting on a few common WaveFormPAC problems. It is organized in the following sections:

- *Responding to WaveFormPAC Faults* (next)
- *Troubleshooting Common WaveFormPAC Problems*, page 6-5
- *Replacing the WaveFormPAC Processor Board*, page 6-7

## Responding to WaveFormPAC Faults

When a setpoint is exceeded or there is an offset error on one or more strain links, WaveFormPAC opens the output relay and stops the press, simultaneously displaying a fault message on top of the SmartPAC 2 Main Run Menu (see Figure 6-1, in which a high setpoint fault message is used as an example).

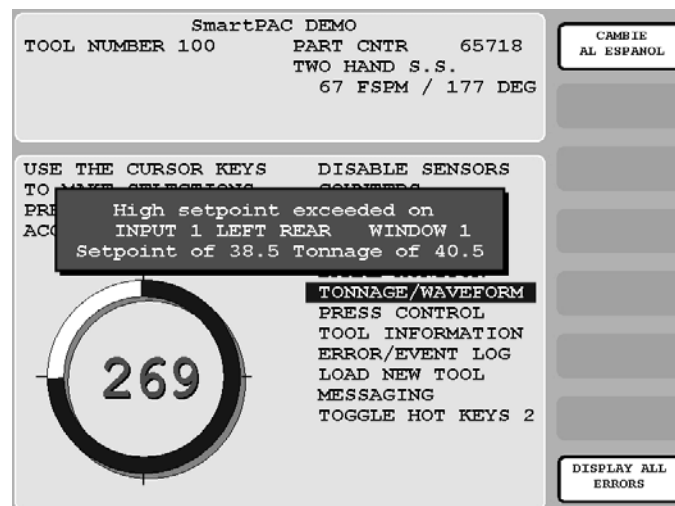


Figure 6-1. WaveFormPAC Tonnage Fault Message: High Setpoint Exceeded

The fault message provides the following information:

- Type of setpoint fault (i.e., high, low, etc.)
- Strain link input (both input number and name are shown) on which the fault occurred
- Window (identified by number) in which the fault occurred if applicable
- Setpoint value that was exceeded
- Tonnage value that generated the fault

Only one faulted channel is identified in a WaveFormPAC message, but setpoints for other strain links or windows may have been exceeded as well and other types of faults may have occurred. You can check to see if other channels are at fault by accessing the Adjust Setpoints screen (see page 5-24) or selecting each input on the Waveform screen (see page 5-5).

Additional windows with faults can be identified by selecting windows in each input channel view on the Waveform screen (see *Adjusting Setpoints for Tonnage in Windows*, page 5-20).

For high and low tonnage faults, you can also refer to the Tonnage Bargraph View screen (see *Displaying Tonnage in Bargraph View*, page 5-23), which shows each channel with a high or low tonnage fault in red and provides a graphical representation of how much the tonnage diverges from the high or low setpoint.

The Tonnage Plan View screen (see *Displaying Tonnage in Plan View*, page 5-22) displays in red each channel with a high tonnage fault.

Before you reset WaveFormPAC, make sure that you have completely corrected the problem. Determine whether the fault was simply a nuisance stop or was caused by an actual press or die malfunction. A nuisance stop occurs when setpoints are so tight that small, normal variations in tonnage cause WaveFormPAC to shut down the press.

If the fault was caused by a nuisance stop, you need to adjust the offending setpoint so that it is higher (or, in the case of a low setpoint, lower) than normal tonnage fluctuations. You may also need to lengthen the sample period to provide WaveFormPAC with a broader range of values from which to select a reference tonnage for calculating setpoints.

### CAUTION

If the press stopped due to a real fault, do not continue until you have completely corrected the problem. Failure to do so may result in damage to the press and tooling.

**Failure to comply with these instructions could result in property damage.**

If the fault was caused by a press or die malfunction, you need to find and correct the problem immediately. Do not clear the fault until you have corrected the problem. Common causes of tonnage faults are shown in Table 6-1:

*Table 6-1. Common Causes of Tonnage Faults*

Stuck part
Variation in shut height
Significant change in material thickness or hardness
Slug stacking
Load imbalance
Misfeed
Broken punch
End of stock

### NOTICE

#### **IMPORTANT INFORMATION TO PROVIDE WHEN CONTACTING WINTRISS TECH. SUPPORT**

When you contact Wintriss Tech. Support for technical assistance, be ready to provide the following information to expedite a resolution to the problem: product name (e.g. SmartPAC 2 standard); installed options (e.g. WaveFormPAC, etc.); and firmware version number (e.g. Vs. 2.00). You can determine the last two items, by accessing the List of Installed Options screen in Initialization mode (see Chapter 4 of your SmartPAC 2 manual for details).

Once you have determined the reason for the fault message and corrected the problem, you can clear the fault by pressing the RESET key on the SmartPAC 2 front panel. The message will disappear, and the press can be restarted.

**NOTICE**

Wintriss recommends that you connect WaveFormPAC to the top-stop rather than to the E-stop circuit of your press to prevent the press from sticking on the bottom if an overload occurs.

Remember that top stop circuits are active only in Continuous (automatic) operations on most press controls. If overload protection is required during Inch or Single-stroke mode, you may have to install an additional relay so that WaveFormPAC can stop the press. Refer to Chapter 2 for more information.

**Setpoint Faults**

This section shows you how to respond to the following setpoint faults:

- Repeatability
- High tonnage
- Low tonnage
- Reverse tonnage
- 120% of press capacity overload

Each of these setpoint fault types has a different constellation of likely causes, but the process by which you respond to the fault is identical. When a message for one of the four setpoint faults displays, do the following:

1. Check to see whether additional channels or window are affected and whether there are other types of faults, referring to the Adjust Setpoints, Waveform, Tonnage Bargraph View, and Tonnage Plan View screens.
2. Determine whether the fault has been caused by a nuisance stop or a press or die malfunction.
3. If the cause is a nuisance stop, loosen the setpoints on the offending strain link or lengthen the sample period.

or

If the cause is a press or die malfunction, check the possibilities shown in Table 6-2.

4. When the problem has been corrected, press RESET and restart the press.

Table 6-2. Setpoint Faults: Possible Causes

Setpoint Fault Type	Possible Cause(s)
Repeatability	Change in the die due to: Slug stacking Misfeed End of stock Broken punch Change in material thickness or hardness
High	Material feed problems Double parts in the die Tool wear Loss of lubrication For presses with column-mounted strain links, high tonnage readings could indicate galled leader pins or bushings. If the press is running without tooling, high tonnage readings may indicate improper lubrication or loss of lubrication in the gibbs or bearings.
Low	End of stock Broken punch
Reverse	Refer to Table 6-1.
120% of Press Capacity	Refer to Table 6-1. Also check the following: Foreign objects (e.g., wrench) in the die Electrical noise in the strain link cables, which can cause false signals If only one input is overloaded, try moving the tool/die away from that input to distribute the load more evenly.

## Offset Errors

WaveFormPAC displays an offset error when one or more strain links transmit a signal that is either too high or too low for the load analyzer to interpret accurately. Offset errors occur when a strain link loosens, is damaged, or otherwise fails.

To correct the problem:

- Check wiring of the strain link(s) on the affected channel(s). Rewire if necessary.
- Check mounting of the strain link. If the strain link has loosened, remount the strain link.
- If neither of the solutions shown above fixes the problem, the strain link may be damaged and should be replaced.

If you remount or replace a strain link, you must rezero the strain link (refer to *Zeroing Strain Links*, page 3-16). When replacing a strain link, you do not have to recalibrate WaveFormPAC unless you move the strain link to a different location.

## Critical Curve Table Alert

WaveFormPAC displays an alert message if you attempt to compare the current waveform with the critical curve (see page 5-12) when the Critical Curve Table in Initialization mode has not been completed (see *Setting Press Parameters*, page 3-8). To respond to this alert, access Initialization mode and complete the Critical Curve Table, then try performing the comparison again.

## Troubleshooting Common WaveFormPAC Problems

The following sections show you how to troubleshoot problems you may encounter as you run the press with WaveFormPAC.

### Tonnage/WaveForm Menu Option Does Not Display at Power-up (Communications Error)

1. Verify that the WaveFormPAC processor board has power by verifying that all of the following LEDs are lit: “+5” (DS108), “+12” (DS106), “-12” (DS107), and “+24” (DS110), referring to Figure 2-5, page 2-7. If power is not present, check AC wiring, referring to *Connecting AC Wiring*, page 2-5.
2. Verify that the SmartPAC 2 and WaveFormPAC boards are communicating by checking the Tx (DS101) and Rx (DS102) LEDs on the WaveFormPAC processor board (see Figure 2-5). If the LEDs are blinking alternately, the two boards are communicating.  
  
If the LEDs are unlit, the boards are not communicating. Check communications wiring, referring to *Connecting Communications Wiring*, page 2-15.
3. Verify that the resolver is wired correctly (refer to *Connecting SmartPAC 2 Resolver to WaveFormPAC*, page 2-16) and that strain links are mounted properly and wired correctly to the WaveFormPAC board (refer to *Installing Strain Links*, page 2-9), performing the following steps:
  - a. Turn off power to SmartPAC 2 and WaveFormPAC.
  - b. Remove the resolver connector (TB102) and all strain link connectors (TB105 and TB106 on 2-channel WaveFormPACs, TB105, TB106, TB107, and TB108 on 4-channel units) from the WaveFormPAC board.
  - c. Power the SmartPAC 2 and WaveFormPAC back up, and see if communications is resumed (i.e., the TONNAGE/WAVEFORM menu item displays).
  - d. If SmartPAC 2 and WaveFormPAC are now communicating properly, perform the following steps in sequence to isolate the specific wiring connection at fault:
    - Plug the resolver connector back into its socket, and power up the units again. If communications are good, go to the next step. Otherwise, check the resolver wiring, referring to *Connecting SmartPAC 2 Resolver to WaveFormPAC*, page 2-16. If wiring is good, go to the next step. If there is a wiring problem, correct it and go to the next step.

- Plug the strain link connectors back into their sockets on the WaveFormPAC board, one at a time, starting with the “Left” connector for a 2-input WaveFormPAC or “Left Front” connector for a 4-input system. Power the units back up. If communications are good, go to the next step. Otherwise, check the wiring for that strain link, referring to *Wiring Strain Links*, page 2-14. If wiring is good, go to the next step. If there is a wiring problem, correct it and go to the next step.
  - Plug the “Right” (2-input WaveFormPAC) or “Right Front” (4-input unit) connector back into its socket on the WaveFormPAC processor board. Power the units back up. If communications are good, go to the next step. Otherwise, check the wiring for that strain link. If wiring is good, go to the next step. If there is a wiring problem, correct it and go to the next step.
  - If you have a 4-channel WaveFormPAC, repeat this process for the remaining two strain link connectors.
- e. If you are still having difficulty, contact Wintriss Tech. Support.

### Displayed Tonnage Is Lower Than It Should Be

If the tonnage displayed for one or more strain links is lower than you think it should be, do the following:

#### *If new installation or calibration:*

1. Check to make sure that the mounting and wiring of the corresponding strain link(s) were performed correctly. Make sure that the strain links are mounted on a clean, flat surface. See *Installing Strain Links*, page 2-9.
2. Check to make sure that the calibration was done properly. Check to see if the cal factors are correct. Make sure that the cal factors you set are the same as the ones you wrote down during the calibration. Refer to Chapter 3.

#### *If existing installation:*

1. Check for a stretched or broken tie rod on straight-side presses.

### Number of Strain Link Inputs Displayed Is Incorrect

If only two strain link inputs display when you have a four-input system, or four inputs display in a two-input configuration, do the following:

1. Check to make sure that switch 2 on switch block S101 is set correctly (see *Making Settings on Switch Block S101*, page 3-1). Switch 2 should be set to ON to configure a two-input WaveFormPAC, to OFF to configure a four-input unit.
2. Check to make sure that you have not installed a jumper from pin 2 to pin 3 on TB107 (Left Front) and TB108 (Right Front) on the WaveFormPAC Processor board. Jumpers should be connected to these pins only when you wish to configure WaveFormPAC as a two-channel tonnage monitor (see *Wiring Strain Links*, page 2-14).

## Peak Tonnage Occurs after BDC

If the peak tonnage displayed on a waveform occurs after bottom dead center (BDC), as shown in the example in Figure 6-2, the resolver has not been zeroed properly. When the resolver is zeroed, peak tonnage should occur exactly at BDC. To correct the problem, re-zero the resolver, following the instructions starting on page 3-11.

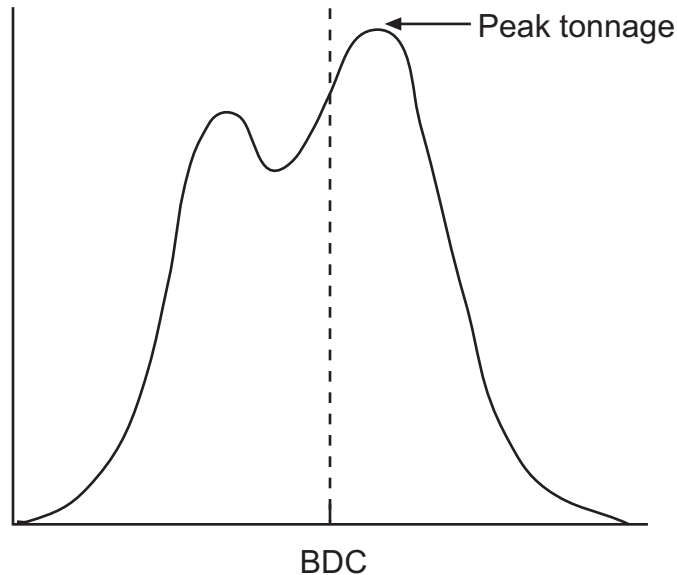


Figure 6-2. Waveform with Peak Tonnage Occurring after BDC

## Replacing the WaveFormPAC Processor Board

If you need to replace your WaveFormPAC Processor board, perform the following steps:

1. On the WaveFormPAC Initialization Parameters form provided at the end of the manual, record the following settings on the Tonnage/Monitor Initialization Menu (locations are shown in parentheses). You will re-enter these settings in step 16.
  - Name for each strain link input (SET INPUT NAMES)
  - Total press capacity (SET PRESS CAPACITY)
  - Calfactor for each strain link input (CALIBRATION, Show Calfactors view)
  - Setting (ENABLED or DISABLED) for REPEATABILITY SETPOINT, LOW SETPOINT, SETUP MODE, and STARTUP COUNTER
  - Reverse setpoint percentage (SET REVERSE SETPOINT %)
  - Stroke Length and Connection Length (SET PRESS PARAMETERS)
  - Critical Curve data points (SET PRESS PARAMETERS, Critical Curve item)

**⚠ WARNING****ELECTRIC SHOCK HAZARD**

- Disconnect main power at SmartPAC 2 and WaveFormPAC before working inside the enclosure(s). All power to the press, press control, and other equipment used with the press must be off when you work inside the enclosure.
- Remove all fuses and “tag out” per OSHA 1910.147 Control of Hazardous Energy (Lockout/Tagout).
- Ensure that this procedure is performed by qualified personnel.

**Failure to comply with these instructions could result in death or serious injury.**

2. Turn off power to SmartPAC 2, WaveFormPAC, the press, and any auxiliary equipment.
3. Verify that all LEDs on the WaveFormPAC Processor board are off (see Figure 2-5 for LED locations).
4. Record the settings on switches 1 and 2 on Mode switch block S101 on the WaveFormPAC Processor board (see Figure 2-5). You must set these switches to the same positions on the replacement board (see step 11).
5. On the WaveFormPAC Initialization Parameters form, record the High/Low Gain jumper setting for each strain link input on the WaveFormPAC Processor board (see Figure 2-5). You must set these jumpers to the same positions on the replacement board (see step 12).

**CAUTION****STATIC DISCHARGE DAMAGE TO CHIP**

Ground yourself before touching circuit boards or chips by touching a large metal object such as the press. Static electricity can destroy electronic components.

**Failure to comply with these instructions could result in property damage.**

6. Making sure that you are grounded, unplug all terminal block connectors from the WaveFormPAC board (see Figure 2-5). Label the connectors so you can identify them when installing them on the replacement WaveFormPAC board in step 10.
7. With a 1/4-in. nut driver, remove the four 1/4-in. nuts holding the board to the mounting plate (see Figure 2-2, page 2-3) or other surface, and carefully lift the board out of the enclosure or console. Put the nuts aside for use in step 9.
8. Remove the replacement board from its anti-static bag, and place it beside the old board.
9. Install the replacement board on the mounting plate or other surface, reusing the nuts you removed in step 7 and tightening them down with the 1/4-in. nut driver.
10. Plug all the connectors you removed in step 6 back into the WaveformPAC board. Double-check to make sure that all connectors are plugged into the correct slots.
11. Set switches 1 and 2 on switch block S101 on the replacement board to the positions you recorded in step 4.
12. Set the High/Low Gain jumper for each strain link input to the position you recorded in step 5.



13. To verify that the board has been installed properly, close the WaveFormPAC enclosure or console, and power up the SmartPAC 2 and WaveFormPAC.

- If the SmartPAC 2 powers up normally, go to step 14.
- If the SmartPAC 2 powers up with a fault message like the following

**A 4 CHANNEL WAVEFORMPAC WAS  
INSTALLED THE LAST TIME THE UNIT  
WAS POWERED-UP AND WAS NOT SEEN  
THIS TIME.**

or you cannot access previously stored waveform data, turn power off to both units, and check all connections on the WaveFormPAC board. When you have made corrections, power the unit up again. If the same fault message displays, contact Wintriss Tech. Support.

14. Access the List of Installed Options screen in SmartPAC 2 Initialization, referring to your SmartPAC 2 manual if necessary. WaveFormPAC should be displayed in the options list along with its firmware version number (for example, V2.00).

If WaveFormPAC appears in the list, go to step 15.

If WaveFormPAC is not in the list, contact Wintriss Tech. Support.

15. Re-initialize WaveFormPAC Initialization settings by accessing the Tonnage/Waveform Initialization Menu and selecting INITIALIZE PARAMETERS.
16. On the Tonnage/Waveform Initialization Menu, re-enter the settings you recorded in step 1.
17. Place the old board in the anti-static bag in which you received the replacement board.
18. Place the anti-static bag with the old board in the box in which you received the replacement board, and ship it back to Wintriss, using the shipping label with the Return Authorization (RMA) number. Contact Wintriss Tech. Support if you have additional questions.



# Appendix A. Upgrading AutoSetPAC to WaveFormPAC

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## NOTICE

You can only upgrade an AutoSetPAC to WaveFormPAC if the AutoSetPAC is connected to a SmartPAC 2 control. You cannot upgrade an AutoSetPAC connected to an original SmartPAC.

Upgrading an existing AutoSetPAC to a WaveFormPAC is easy. The WaveFormPAC Processor board with mounting plate can be installed in the same location as the AutoSetPAC board. Many of the wiring connections are identical, and you don't have to repeat the calibration procedure. To perform the upgrade, do the following:

1. Access SmartPAC 2 Initialization mode, and select “TONNAGE/WAVEFORM” to display the Tonnage/WaveForm Initialization Menu.
2. Record on the WaveFormPAC Initialization Parameters form (see back of manual) the settings (i.e., ENABLED or DISABLED) shown for the following items:
  - LOW SETPOINT
  - REPEATABILITY SETPOINT
  - SETUP MODE
  - STARTUP COUNTER
3. Record the following information on the WaveFormPAC Initialization Parameters form, selecting the appropriate item on the Tonnage/Waveform Initialization Menu or checking jumper positions on the AutoSetPAC board:
  - Input names (select SET INPUT NAMES)
  - Press capacity (select SET PRESS CAPACITY)
  - Cal factors (select CALIBRATION, then press F3 (SHOW CALFACTORS))
  - High/low gain jumper positions (check the AutoSetPAC board)
  - Reverse setpoint percentage (select REVERSE SETPOINT %)

## WARNING

### ELECTRIC SHOCK HAZARD

- Disconnect main power at SmartPAC 2 and WaveFormPAC before working inside the enclosure(s). All power to the press, press control, and other equipment used with the press must be off when you work inside the enclosure.
- Remove all fuses and “tag out” per OSHA 1910.147 Control of Hazardous Energy (Lockout/Tagout).
- Ensure that this procedure is performed by qualified personnel.

**Failure to comply with these instructions could result in death or serious injury.**

4. Verify that power has been turned off to SmartPAC 2, WaveFormPAC, the press, and any auxiliary equipment.

5. Verify that all LEDs on the WaveFormPAC Processor board are off (see Figure 2-5, page 2-7 for LED locations).

## CAUTION

### STATIC DISCHARGE DAMAGE TO CHIP

Ground yourself before touching circuit boards or chips by touching a large metal object such as the press. Static electricity can destroy electronic components.

**Failure to comply with these instructions could result in property damage.**

6. Making sure that you are grounded, open the enclosure or console, and unplug all terminal block connectors from the AutoSetPAC board. Label the connectors for identification when you install them on the WaveFormPAC board in steps 10 through 13.

## NOTICE

### WAVEFORMPAC DOES NOT SUPPORT OPTIONAL 2- OR 4-CHANNEL DISPLAY

The WaveFormPAC board has no ribbon cable connector, so you cannot connect the optional 2- or 4-channel AutoSet display to WaveFormPAC.

7. If your AutoSetPAC uses the optional enclosure with the two- or four-channel AutoSet display, disconnect the ribbon cable from the ribbon cable connectors on both the display board and the AutoSetPAC board.
8. Remove the nuts securing the AutoSetPAC Processor board, setting them aside for use in the next step, and carefully lift the board out the enclosure or console.
9. Install the WaveFormPAC Processor board mounting plate in the location from which you removed the AutoSetPAC board, using the nuts you removed in step 8.
10. Plug the strain link and communications connectors you removed from the AutoSetPAC board in step 6 into the WaveFormPAC board. Double-check to make sure that connectors are plugged into the correct slots.
11. Disconnect the stop circuit wires from the Power terminal block (TB3 or TB103), which you removed in step 6, and connect them to pins 3 and 4 on TB103 on the WaveFormPAC board, referring to *Connecting Stop Circuit Wiring*, page 2-7.
12. Bring wiring from the SmartPAC 2 resolver to the WaveFormPAC enclosure or console, and connect wires to the Resolver connector (TB102) as instructed in *Connecting SmartPAC 2 Resolver to WaveFormPAC*, page 2-16.
13. If you wired an oscilloscope to your AutoSetPAC, remove the wires from TB101, and connect them to the appropriate pins on TB101 on the WaveFormPAC board. See *Wiring an Oscilloscope (Optional)*, page 2-17 for details.
14. Set switches 1 and 2 on switch block S101 on the WaveFormPAC Processor board to the appropriate positions, as instructed in *Making Settings on Switch Block S101*, page 3-1.
15. Upgrade SmartPAC 2 firmware, if necessary, referring to Appendix C in the SmartPAC 2 manual.

16. Power SmartPAC 2 and WaveFormPAC back up again.
17. Access SmartPAC 2 Initialization mode and re-enter the settings you recorded in steps 2 and 3.
18. Enter the Initialization settings described in *Setting Press Parameters*, page 3-8.
19. Perform the *Final Checkout* procedure, page 3-35.
20. Now you are ready to program and operate your WaveFormPAC load monitor as described in chapters 4 and 5.

**NOTICE**

The tool setups you originally created in AutoSetPAC will be automatically transferred to WaveFormPAC when the upgrade is complete. However, it is a good idea to verify your tool setups in Program mode before making parts.



# Appendix B. Replacing Old WaveFormPAC Processor Boards

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## NOTICE

### ORIGINAL SMARTPAC COMPATIBLE ONLY WITH OLD WAVEFORMPAC BOARDS

The original SmartPAC can only be used with the old WaveFormPAC Processor boards. The original SmartPAC is not compatible with the new WaveFormPAC Processor boards.

## NOTICE

### IDENTIFYING OLD BOARDS

Old WaveFormPAC Processor boards are identified by assembly number D42904, which is printed in the lower left corner, as shown in Figure B-1, page B-2. They are approximately 9 x 11 in. and have a built-in "Power Transformer" at the top; new boards are 8 x 6.5 in. and lack the transformer.

If you have an old WaveFormPAC Processor board (see Figure B-1, page B-2 for board layout) and need to exchange it for a replacement board, perform the following steps:

## NOTICE

### MAKE SURE TO SAVE FLASH MEMORY BOARD AND RAM AND FIRMWARE CHIPS

The Flash Memory board and RAM chip on your original board contain all your WaveFormPAC settings. Save the board and chip so you can restore these settings to the replacement board. Otherwise, you will have to re-enter the settings by hand.

1. Before you return your original WaveFormPAC board to Wintriss, do the following:
  - a. Remove the Flash Memory board by loosening the four screws that secure it to the standoffs and unplugging the board from the connectors on the old Processor board. Put the screws and Flash Memory board in a safe place. You will reinstall the board in step 3.

## NOTICE

Wintriss recommends that you store the Flash Memory board in a polyethylene static-shielding bag to prevent data from being lost or corrupted.

- b. Remove the RAM chip (component U115) and put it in a safe place. Note that the semi-circular notch in the chip faces up. You must install the chip with the same orientation on the replacement board (see step 4).

## NOTICE

When you install the RAM chip on the replacement board, the notch in the chip must also face up.

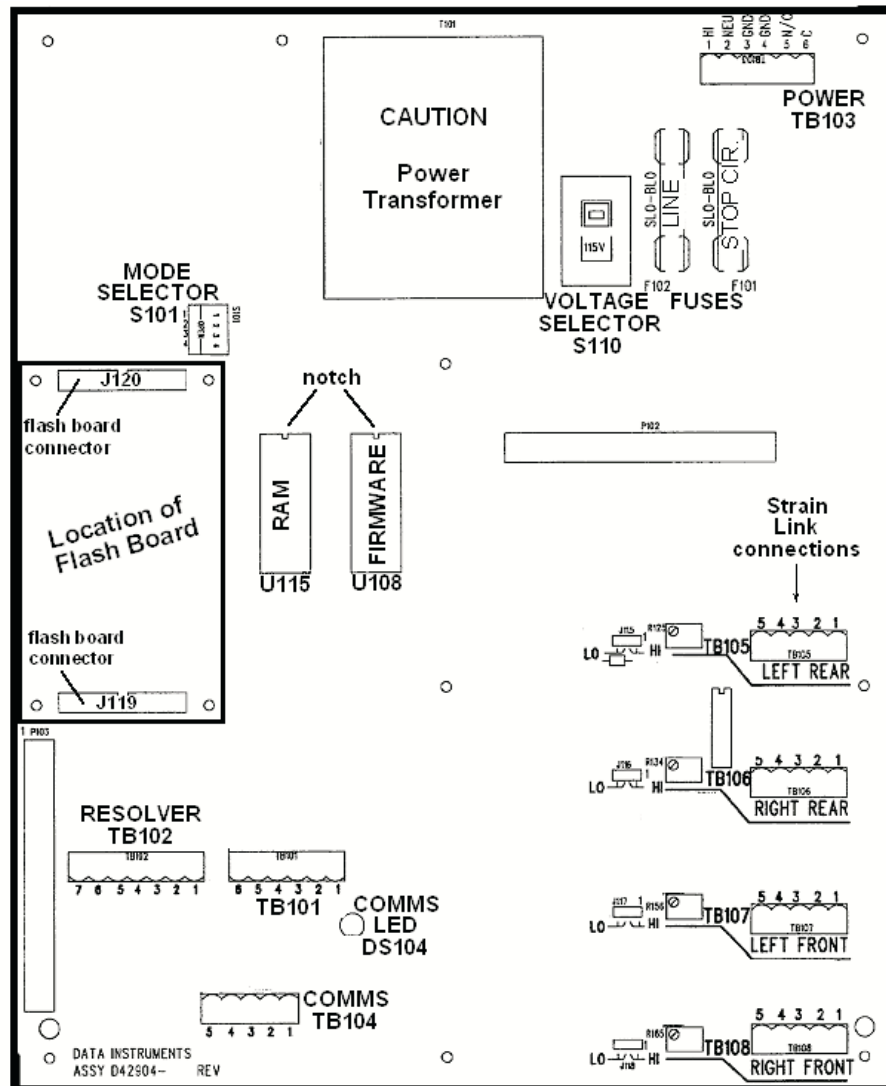


Figure B-1. Old WaveFormPAC Processor Board: Location of Important Components

- c. Remove the firmware chip (component U108) and put it in a safe place. Note that the semi-circular notch in the chip faces up. You must install the chip with the same orientation on the replacement board (see step 5).

### NOTICE

When you install the firmware chip on the replacement board, the notch in the chip must also face up.

- d. Record the settings on switches 1 and 2 on Mode Selector switch block S101. You must set switches 1 and 2 to the same positions on the replacement board (see step 6).
- e. Record the voltage setting on Voltage Selector switch S110, which selects the voltage for AC input power (115 Vac or 230 Vac). You must set switch S110 on the replacement board to the same setting (see step 7).



- f. On the WaveFormPAC Initialization Parameters form provided at the end of the manual, record the High/Low Gain jumper setting for each strain link input. You must set these jumpers to the same positions on the replacement board (see step 8).
  - g. On the WaveFormPAC Initialization Parameters form, record the following Initialization settings (locations on the Tonnage/Waveform Initialization Menu are shown in parentheses). These settings are stored on the RAM chip, but you should keep a record of them in case you need to re-enter them by hand (see step 11).
    - Name for each strain link input (SET INPUT NAMES)
    - Total press capacity (SET PRESS CAPACITY)
    - Calfactor for each strain link input (CALIBRATION, Show Calfactors view)
    - Setting (ENABLED or DISABLED) for REPEATABILITY SETPOINT, LOW SETPOINT, SETUP MODE, and STARTUP COUNTER
    - Reverse setpoint percentage (SET REVERSE SETPOINT %)
    - Stroke Length and Connection Length (SET PRESS PARAMETERS)
    - Critical Curve data points (SET PRESS PARAMETERS, Critical Curve item)
2. When you receive the new board, install it in your enclosure or console.

**NOTICE**

Connectors on the Flash Memory board and WaveFormPAC Processor board are keyed, so the Flash Memory board can be installed in only one orientation.

3. Plug the Flash Memory board you removed in step 1a into the connectors (J119 and J120) on the replacement board, and secure the board to the standoffs, using the four screws from the old board.

**CAUTION****INSTALL CHIP CORRECTLY**

- Install the RAM chip with the notch facing up; otherwise, when you power up the control, the chip will be destroyed.
- Align pins correctly with the socket before plugging the chip in.

**Failure to comply with these instructions could result in property damage.**

4. Insert the RAM chip you removed in step 1b in the U115 socket on the replacement board, inserting the left row of pins first, then aligning the right row of pins over the socket and pushing them in. Make sure that the semi-circular notch in the chip faces up.

**NOTICE**

If the two rows of pins are spread too far apart to plug easily into the socket, hold the chip on its side on a flat surface with the pins pointing toward you. Being careful not to overbend the pins, gently draw the top of the chip toward you until the pins bend a little. Turn the chip over so that the other row of pins is now flat and pointing toward you. Draw the top of the chip toward you again until the pins bend. When the rows of pins look parallel, plug the chip into its socket again. If the chip still doesn't fit, repeat this procedure.

**CAUTION****INSTALL CHIP CORRECTLY**

- Install the firmware chip with the notch facing up; otherwise, when you power up the control, the chip will be destroyed.
- Align pins correctly with the socket before plugging the chip in.

**Failure to comply with these instructions could result in property damage.**

5. Insert the firmware chip you removed in step 1c in the U108 socket on the replacement board, inserting the left row of pins first, then aligning the right row of pins over the socket and pushing them in. Make sure that the notch in the chip faces up.

**NOTICE**

If the two rows of pins are spread too far apart to plug easily into the socket, hold the chip on its side on a flat surface with the pins pointing toward you. Being careful not to overbend the pins, gently draw the top of the chip toward you until the pins bend a little. Turn the chip over so that the other row of pins is now flat and pointing toward you. Draw the top of the chip toward you again until the pins bend. When the rows of pins look parallel, plug the chip into its socket again. If the chip still doesn't fit, repeat this procedure.

6. Set switches 1 and 2 on switch block S101 on the replacement board to the positions you recorded in step 1d.
7. Set switch S110 on the replacement board to the setting you recorded in step 1e.
8. Set the High/Low Gain jumper for each strain link input on the replacement board to the position you recorded in step 1f.
9. Power up SmartPAC and WaveFormPAC.
  - If the SmartPAC powers up normally, go to step 10.
  - If the SmartPAC powers up with a fault message like the following
 

```
A 4 CHANNEL WAVEFORMPAC WAS
INSTALLED THE LAST TIME THE UNIT
WAS POWERED-UP AND WAS NOT SEEN
THIS TIME.
```

one or more pins on the RAM and/or firmware chips may be bent or not plugged in properly. Turn the power off, and repeat the procedure in the Notices for steps 4 and 5. Power the unit up again. If the same message displays, contact Wintriss Tech. Support.
10. Access the List of Installed Options screen in SmartPAC Initialization, referring to your SmartPAC manual if necessary. WaveFormPAC should be displayed in the options list along with its firmware version number (for example, V1.32). If WaveFormPAC appears in the list, go to step 11. If WaveFormPAC is not in the list, contact Wintriss Tech. Support.
11. Access the Tonnage/Waveform Initialization Menu, and verify that all settings are identical to those you recorded in step 1g. Re-enter any settings that are different.

You have successfully completed the board exchange procedure.

# Glossary

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## NOTICE

Cross-references to other glossary entries are shown in *italics*.

critical curve	A WaveFormPAC-generated plot of the press's rated tonnage capacity at each angle during the load-generating portion of the stroke (i.e., 90° to 180°). The critical curve is created from a table of distance-off-bottom tonnage ratings supplied by the press manufacturer and entered in SmartPAC Initialization mode. A comparison of the current <i>waveform</i> with the critical curve can be displayed in Program and Run modes so you can quickly determine whether actual tonnage at any point in the stroke exceeds the press's off-bottom capacity.
high setpoint	The tonnage limit above which WaveFormPAC generates a high tonnage fault, stopping the press and displaying a fault message. WaveFormPAC calculates the high setpoint by multiplying the high setpoint percentage specified in Program mode by the <i>reference tonnage</i> and adding this value to the reference tonnage.
linearity	The proportional increase of tonnage readings with increasing load, a measure of how well the press has been calibrated. When a press has been calibrated for linearity, WaveFormPAC should read 40 tons when 40 tons is applied to the load cells and 80 tons when 80 tons is applied.
low setpoint	The tonnage limit below which WaveFormPAC generates a low tonnage fault, stopping the press and displaying a fault message. WaveFormPAC calculates the low setpoint by multiplying the low setpoint percentage specified in Program mode by the <i>reference tonnage</i> and subtracting this value from the reference tonnage.

motor slowdown	Motor slowdown is a metric maintained by WaveFormPAC that tracks the difference between the press's fastest and slowest speeds and compares it to the fastest speed. Displayed as a percentage on Waveform screens in Program and Run modes, motor slowdown indicates the flywheel energy used by the press to make a part and, therefore, the energy required for the motor to maintain operating speed after the die contacts the material before BDC. A high motor slowdown percentage indicates high motor energy requirements and may signal the possibility of an overload due to excessive slowdown, leading to press stoppage and motor damage. The acceptable motor slowdown percentage range for your press can be obtained from the press manufacturer or rebuilder.
nuisance stop	A press shutdown initiated by WaveFormPAC because setpoints have been set too close to normal tonnage values or normal tonnage variations. As a result, setpoints are regularly exceeded, causing unnecessary press shutdowns.
off-bottom tonnage	The tonnage occurring at any angle other than 180°.
peak tonnage	The highest tonnage recorded during a stroke. Peak forward tonnage usually occurs at 180°, peak reverse tonnage some time after 180°.
reference tonnage	The highest tonnage measured by WaveFormPAC during the sample period.
repeatability setpoint	The limit in tonnage variation from one stroke to the next above which WaveFormPAC generates a repeatability fault, stopping the press and displaying a fault message. WaveFormPAC calculates the repeatability setpoint by multiplying the repeatability setpoint percentage specified in Program mode by the <i>reference tonnage</i> .
reverse setpoint	The reverse tonnage limit above which WaveFormPAC generates a reverse tonnage fault, stopping the press and displaying a fault message. WaveFormPAC calculates the reverse tonnage setpoint by multiplying the reverse setpoint percentage specified in Initialization mode by the Initialization setting for the full-scale capacity of the press.
sample period	The number of strokes during which WaveFormPAC collects and measures press tonnage in order to calculate high, low, and repeatability setpoints. WaveFormPAC calculates setpoints using the highest tonnage measured during the sample period as the <i>reference tonnage</i> .

setup mode	A press operating mode that enables the press to be run in Inch without generating low setpoint or repeatability faults. With this setting enabled, WaveFormPAC disables low and repeatability setpoints whenever the press is operated in Inch.
startup counter	<p>The number of strokes to allow after startup of the press before WaveFormPAC begins to monitor tonnage or calculate setpoints. During the period defined by the specified number of strokes, WaveFormPAC disables high, low, and repeatability setpoints and suspends setpoint calculation. WaveFormPAC provides 120%- of-press-capacity protection during this startup period.</p> <p>The startup counter is used primarily to allow high-speed presses to come up to speed before WaveFormPAC begins to monitor tonnage. It is also used to allow press tonnage to stabilize before calculating setpoints.</p>
tonnage fault	A press shutdown initiated by WaveFormPAC because tonnage has fluctuated enough to exceed the high, low, repeatability, or reverse setpoint. A fault may be caused by a stuck part, significant change in material thickness or hardness, slug stacking, load imbalance, misfeed, broken punch, end of stock, or any die malfunctions.
waveform	A WaveFormPAC-generated plot of tonnage for crankshaft angles between 90° and 248°. Waveforms are captured at regular intervals and stored in a buffer, each successive waveform overwriting the previous one. The waveform currently residing in the buffer is displayed each time you access the Waveform screen and whenever you press the F3 (Update Waveforms) function key on the Waveform screen. Waveforms can be stored for comparison with the current waveform; the current waveform can also be compared with the <i>critical curve</i> .
window	A segment of a waveform that covers an off-bottom angle range during which tonnage can be monitored with high, low, and repeatability setpoints. Windows allow you to monitor portions of the stroke other than those in which peak forward and peak reverse tonnage occur.



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# Wintriss Manuals

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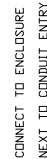
Wintriss Product	Installation Manual Doc. No.	User Manual/CD Doc. No.
AutoSet (1500, 1500 Plus, 1504, 1504 Plus)	DA71747	DA71447
AutoSetPAC (Tonnage Monitor)	DA71413	DA71443
Die Protection Handbook	N.A. *	1130300 *
DiPro 1500	DA71428	DA71447
DSI 2 Sensor Interface	N.A. *	DA66970 *
LETS Machine Interface (LMI)	N.A. **	DA71974 **
MultiPAC Types 1 and 2	DA71409	DA71443
MultiPAC Types 4 and 5	DA71410	DA71443
ProCam 1500	DA71430	DA71447
ProPAC (Process Monitor-In-die Measurement)	DA71411	DA71443
RamPAC (Shut Height, Counterbalance & Cushion Control)	DA71412	DA71443
Servofeed Interface-Coe/Wintriss	DA71415	DA71443
Servofeed Interface-CWP/Wintriss	DA71416	DA71443
Servofeed Interface-DiPro	DA71429	DA71447
Servofeed Interface-Electrocraft/Wintriss	DA71417	DA71443
Servofeed Interface-Indramat/Wintriss	DA71418	DA71443
Servofeed Interface-ProCam	DA71431	DA71447
Servofeed Interface-SmartPAC	DA71420	DA71443
Servofeed Interface-Waddington/Wintriss	DA71419	DA71443
SFC Machine Interface (SMI)	N.A. **	1140800**
Shadow V Safety Light Curtain	DA71433	DA71449
Shadow VI Safety Light Curtain	DA71422	DA71445
Shadow VII Safety Light Curtain	N. A. *	1129400 *
Shadow 8 Safety Light Curtain	N. A. *	1139300 *
SmartPAC (w/ DiProPAC & ProCamPAC)	DA71439	DA71454
SmartPAC Hydraulic	DA71435	DA71451
SmartPAC Run Mode (Spanish)	N. A. *	DA71443 *
SmartPAC w/ WPC II Integration	DA71440	DA71455
SmartPAC 2 (w/ DiProPAC & ProCamPAC)	DA71406	DA71441
SmartPAC 2 Hydraulic	DA71436	DA71451
SmartPAC 2 Servo	DA71437	DA71452
SmartPAC 2 w/ WPC 2000 Integration	DA71407	DA71442
SmartPAC 2 w/WPC 2000 Run Mode (Spanish)	N. A. *	DA71443
WaveFormPAC (Advanced Load Analyzer)	DA71414	DA71443
Wintriss Brake Monitor	DA71432	DA71448
Wintriss Clock Display	N. A. *	DA67206 *
WPC II Wintriss Press Control	DA71438	DA71453
WPC 1000 Wintriss Press Control	DA71423	DA71446
WPC 2000 Wintriss Press Control	DA71421	DA71444
WPC 2000 Option 2	DA71408	DA71442

\* Installation Manual not available; User Manual available in hard copy only. Die Protection Handbook available in hard copy (1102400) and on CD (1130300).

\*\* Installation Manual not available. User Manual available on CD only.



SHOWN FOR CW ROTATION FACING SHAFT.  
FOR CCW ROTATION SWAP THE BLACK/BLACK  
PAIR OF WIRES AND YELLOW/WHITE PAIR OF  
WIRES AT THE SMARTPAC. THEN SWAP THE WHITE  
AND BLACK WIRES AT THE WAVEFORMPAC.



DRAWN		DATE		WINTRISS CONTROLS GROUP		
ADB		2/11/10				
CHK.						
APPROVALS		TITLE				
ENG.		SMARTPAC 2 SYSTEM WITH WAVEFORMPAC SM				
MFG.		WIRING DIAGRAM				
FILENAME		CODE	IDENT NO.	SIZE	DRAWING NUMBER	REV
REL				C	FIGURE 1	
		SCALE			SHEET	OF





