User Manual

Allen-Bradley

Enpac 2500 Data Collector

Catalog Numbers 1441-PEN25 and 1441-PEN25-Z

Allen-Bradley • Rockwell Software

Rockwell Automation

Important User Information

Solid-state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication SGI-1.1 available from your local Rockwell Automation® sales office or online at http://www.rockwellautomation.com/literature/) describes some important differences between solid-state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid-state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

	WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
	SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

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This manual contains new and updated information. Changes throughout this revision are marked by change bars, as shown to the right of this paragraph.

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Preface

The content in this manual is based on the following firmware revision and software version.

- Enpac® 2500 data collector, firmware revision 3.10
- Emonitor® software, version 3.4

Using the Manual

This manual covers the Enpac 2500 data collector module which is used for predictive maintenance using noise and vibration analysis. It describes also how to use the Emonitor software to load and unload lists.

When using the Enpac 2500 data collector, you can do the following:

- Create lists of measurement definitions.
- Load lists from Emonitor into the data collector.
- Use a 40 Khz fmax, Route and Offroute.
- Collect magnitude, process, spectrum, time, and phase data.
- View selected alarms.
- Select inspection codes to store with a measurement.
- Define and collect unscheduled measurements
- Unload the data from the data collector directly into the Emonitor database.
- View the high resolution, up to 12,800 lines on the data collector.

Upgrade Options

These are the upgrade options for the Enpac 2500 data collector:

- 1441-PEN25-MOD-2CH 2 - Channel Upgrade Kit

  Two Channel application allows for advanced use of orbits, cross channel phase, and simultaneous data collection in route and off route collection.
- 1441-PEN25-MOD-BMP - Bump Test

  A bump test (or hammer test) determines the natural frequencies of a machine or a structure.
- 1441-PEN25-KIT-BAL - Balancing

  Balancing application resolves single-plane, two-plane, and static-couple balances with high precision.
- 1441-PEN25-MFRF - Frequency Response Function

  The FRF test lets you determine the natural frequencies of a machine as well as sophisticated information about the frequency response of the structure being tested.
- 1441-PEN25-MOD-REC - Time Recorder

  The Time Recorder test uses a the instrument as a data recorder for real-time data acquisition and analysis.
- 1441-PEN25-MOD-RUCD - Run Up Coast Down

  The RUCD test records and analyzes data from intermittent events and transient vibration signals from non-steady state machines.

Enpac 2500 Data Collector and the Emonitor Software

The terminology in the data collector and the software differ in several ways. This table illustrates the differences.

Table 1 - Terminology Differences

Enpac 2500 Terminology	Emonitor Terminology
Offroute Measurements that are taken but are not downloaded on to the instrument from Emonitor. These measurements can be upload to Emonitor.	Unscheduled measurements Measurements that are not defined in the list of measurements downloaded by Emonitor. These measurements are unscheduled.
Route The Enpac 2500 data collector uses the term route to refer to a list loaded in the data collector.	List The Emonitor software uses the term `list for an ordered set of measurement definitions.

Software Compatibilities

The Enpac 2500 data collector requires the following software versions.

USB and Communication Software

These are the supported communication software versions.

- USB communication with Microsoft Windows 2000 and Windows XP is supported using Microsoft ActiveSync software version 4.5 or greater
- USB communication with Microsoft Windows 7 is supported using Microsoft Mobile Device Center
- Microsoft Windows 7 32 bit and/or Microsoft Windows 7 64 bit are supported

Operating System

- Microsoft Windows 2000 (SP4) with ActiveSync software
- Microsoft Windows XP (SP3) with ActiveSync software
- Microsoft Windows 7 with Mobile Device Center software

TIP Microsoft Windows Mobile Device Center replaces ActiveSync for Windows Vista, and Microsoft Windows 7. Windows Mobile Device Center offers device management and data synchronization between a Windows Mobile-based device and a computer. For Windows XP or earlier operating systems, you must use Microsoft ActiveSync.

Document Conventions

These are document conventions used in this manual.

- The Enpac 2500 data collector is referred to as a data collector and an instrument in this manual.
- The different versions of the Emonitor software are Enterprise, Factory, and Workstation. These are all are referred to as the Emonitor software in this manual.

Using Online Help

The Emonitor software and the Enpac 2500 data collector each include online help:

- Emonitor Online Help

  The Emonitor online help is available from the Emonitor Help menu or by pressing F1.

- Enpac 2500 Online Help

  The Enpac 2500 data collector online help is available from any screen where the Help function appears. Press F1 (Help) to access the online help.

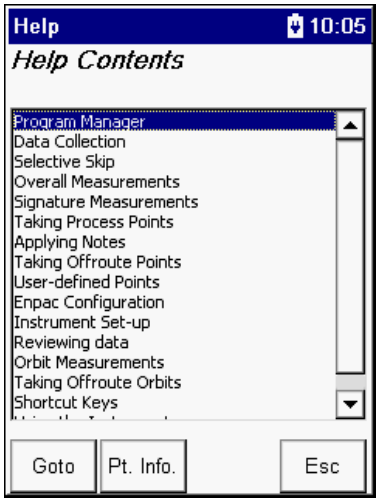
  On some screens that do not display the Help function, pressing Shift(0) provides access also to the Help.

Help Screen

Press F1 (Help) to access online help from any screen where the Help function is displayed on the screen.

1. Press F1 (Help) to access the online help.

   The Help Contents screen appears.



2. Select the topic for which you want to view and press F1 (Goto).

3. When you are finished viewing the topic, press F1 (Contents) to return to the Help Contents screen or press F4 (Esc) to exit the online help.

Organization

To help you navigate through this manual, it is organized in chapters based on these tasks and topics.

Section	Description
Preface	Contains an overview of the manual.
Chapter 1, The Enpac 2500	Describes the Enpac 2500 data collector and covers the basic operations and configuration of the data collector.
Chapter 2, Setting up Measurements	Describes setting up measurement definitions in Emonitor for use with the data collector. It also explains lists, inspection codes, and alarms.
Chapter 3, Loading and Unloading	Describes loading lists and unloading data.
Chapter 4, Collecting and Reviewing Data	Describes the tasks associated with collecting data including list data.
Chapter 5, Multi-channel Measurements	Shows you how to set up and collect dual channel, cross channel phase, and orbit measurements.
Chapter 6, Balancing Application	Describes methods used for performing one- or two-plane balancing by using the data collector coupled with a speed measuring device.
Chapter 7, Time Recording Application	Describes how to set up and collect time recording measurements.
Chapter 8, Bump Test Application	Describes the tasks needed to set up and collect bump test measurements.
Chapter 9, Run Up/Coast Down Application	Describes recording and analyzing run up/coast down measurements.
Chapter 10, FRF Frequency Response Function Extension Module	Describes how to determine the natural frequencies where resonances occur, as well as capturing data about the frequency response of the structure being tested.
Appendix A, Specifications	Lists the technical specifications for the Enpac 2500 data collector.
Appendix B, Frequently Asked Questions	Contains answers to frequently asked questions.
Appendix C, Accessories	Provides a current list of accessories available for the Enpac 2500 data collector. For definitions of terms used in this Guide.
Glossary	Definitions of terms.

Document Conventions

There are several document conventions used in this manual, including the following:

- The Enpac 2500 is referred to as Enpac, instrument, unit, or data collector throughout this manual.
- The different versions of Emonitor (Enshare®, Odyssey Deluxe, and Odyssey Basic) are referred to as Emonitor throughout this manual.
- Emonitor uses the term ‘list’ for an ordered set of measurement definitions. The Enpac uses the term ‘route’ to refer to a list loaded in the Enpac. This manual uses the two terms interchangeably.

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
Emonitor Users Guide, publication EMONTR-UM001	Describes data management for predictive maintenance services.
Enpac 2500 Data Collector Release Notes, publication GMSI10-RN004B	Provides important information on the latest updates, for example, firmware, certifications, warnings, and hardware changes for the data collector.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.ab.com	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at http://www.rockwellautomation.com/literature. To order paper copies of technical documentation, contact your local Allen-Bradley® distributor or Rockwell Automation sales representative.

Notes:

The Enpac 2500 Data Collector

This chapter describes the Enpac 2500 in detail and covers the basic operations and configuration of the data collector.

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The combination of the Enpac 2500 data collector with Emonitor software provides a complete package for predictive maintenance by using noise and vibration analysis. The Enpac can also be used for a variety of other applications, such as Balancing or Bearing Analysis.

A predictive maintenance program helps you decide when equipment needs to be serviced or replaced. Part of a complete predictive maintenance program includes vibration monitoring. Emonitor and the Enpac 2500 allow you to perform vibration analysis by collecting data samples.

With the combination of predictive maintenance software and the Enpac 2500, you can:

- Create lists of measurement definitions for data collection.
- Load lists from Emonitor into the Enpac 2500.
- Collect magnitude, process, spectrum, time, and phase data.
- View selected alarms with the data. The Enpac 2500 alerts you when a measurement exceeds an alarm.
- Select inspection codes to store with a measurement, documenting the condition of the machine.
- Unload the data from the Enpac 2500 directly into the Emonitor database, along with any inspection codes and unscheduled measurements.

In addition, Emonitor can optimize your data collection by combining measurement definitions at a location. For example, Emonitor could combine two magnitude and one spectrum measurement definitions so that the list appears to contain only a single measurement. This allows you to collect all three measurements at one time, minimizing the time you spend collecting data.

The Enpac 2500 is a two-channel, real-time Fast Fourier Transformer (FFT) analyzer and data collector for predictive maintenance and machinery vibration diagnostics. It is capable of measuring, processing, displaying and storing a wide range of analysis functions. It can operate as a stand-alone instrument or you can download your measurements to your software application for program analysis.

Safety Information

Be aware of these safety precautions.

IMPORTANT **Avoid Water**

The Enpac 2500 data collector is splash and dust resistant. However, avoid direct contact with water, wet surfaces, or condensing humidity. Keep this instrument away from wet locations, for example, laundry, wet basements, swimming pools.

If the data collector subject to these conditions, adverse operation may result. Before you use it, let the instrument dry thoroughly before operating.

ATTENTION: To avoid damage or injury, place the Enpac 2500 data collector on a solid stable surface when not in use and do not place any heavy objects on it. Use only the accessories recommended by Rockwell Automation. Keep liquids and foreign objects away from the instrument, and never operate it if any liquid or foreign object has entered it.

Optical Ports

ATTENTION: When the laser on the data collector is active, viewing the laser beam can expose your eyes beyond the maximum permissible exposure recommendations and cause harm.

Laser Radiation Ports

ATTENTION: Class 1 laser product. Laser radiation is present when the system is open and interlocks bypassed. Only trained and qualified personnel should be allowed to install, replace, or service the instrument.

Parts of the Enpac

This section describes the basic components of the Enpac 2500 including key definitions, hardware connections and status indicators. If you are already familiar with the components of the data collector, you may want to skip this section.

Enpac 2500 Diagram and Key Definitions

This is a diagram of the Enpac 2500 data collector showing the keys used for operation.

Figure 1 - Diagram of the Enpac 2500

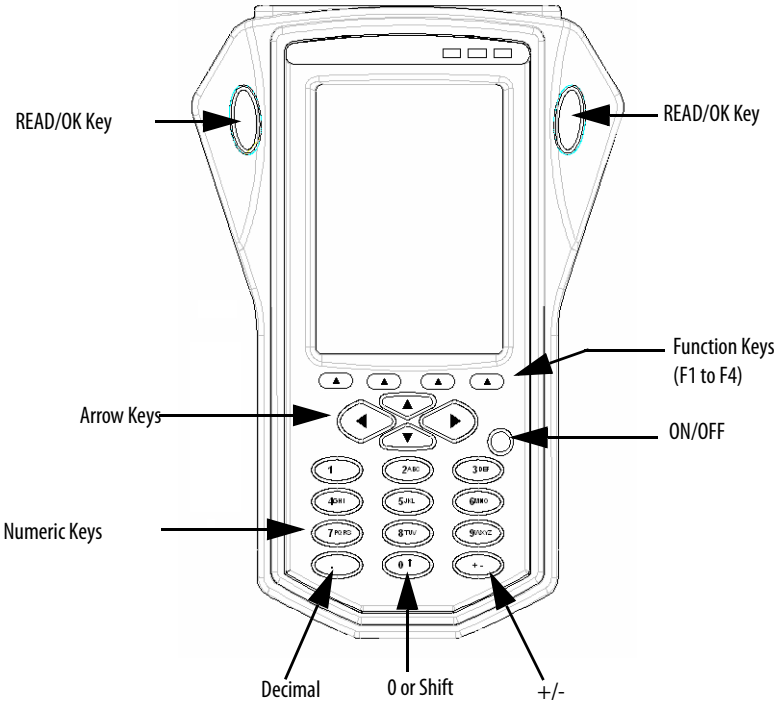


Table 2 - Key Definitions

Keys	Definition
Read/OK	The READ/OK key starts collecting data for the current point or accepts the current measurement. There are two keys so you can use the data collector with either your left or right hand.
Function Keys	Below the display are four function keys referred throughout this manual as F1, F2, F3, and F4. The function keys change depending on the current state of the data collector. The data collector displays the current function of the keys in the display above the key. When no text appears above a function key, the key is inactive in the current window.
Up Arrow	• Moves to the previous field or menu selection. • Decreases the Y-axis scaling in a signature plot.
Down Arrow	• Moves to the next field or menu selection. • Increases the Y-axis scaling in a signature plot.
Left Arrow	• Displays the previous screen of information if there is more than one screen (for example, selecting a point in the Data Collection screen). • Closes the menu selection on the Setup and Instrument Configuration screens. • Moves the signature cursor to the left.

Table 2 - Key Definitions

Keys	Definition
Right Arrow	• Displays the next screen of information if there is more than one screen (for example, selecting a point in the Data Collection screen). • Opens the menu selection on the Setup and Instrument Configuration screens. • Moves the signature cursor to the right.
ON/OFF	The ON/OFF key turns the data collector on and off. To turn the data collector off, press and hold the ON/OFF key for one second.
Numeric	The numeric keys allow you to enter numeric values or move to the appropriate menu selection on the Main Menu screen.
Decimal	The Decimal (.) key allows you check the status of the battery, or enter a decimal point in a numeric field. Refer to Checking Battery Life on page 27 for more information.
+/-	The +/- key allows you to expand or compress a signature plot on the screen.
0	The 0 key acts as a `Shift' key that has multiple uses depending on the current operation. • In a Setup screen numeric input field, the key acts as a zero. • In Setup screens, the key moves the selection to the first parameter when you are not in an input field. • In all other screens, pressing and holding the key displays alternate functions for the function keys.

External Connections

The external hardware connections for communications and data collection are located on the top panel of the Enpac 2500, as illustrated in this figure.

Figure 2 - External Hardware Connections

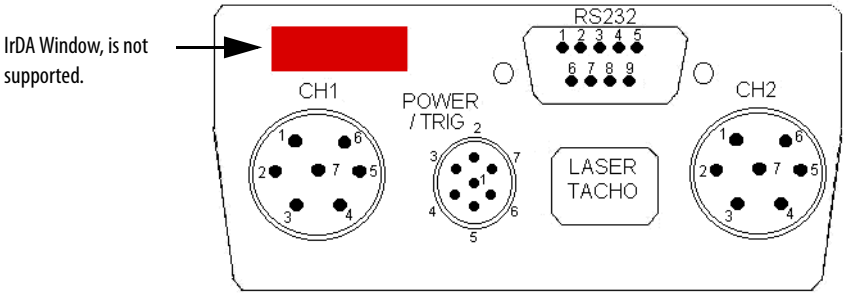


Table 3 - Pin Assignments

Pin No.	CH 1	CH 2	RS-232	POWER/TRIG
1	N/C	N/C	N/C	USBV
2	CHANNEL X	CHANNEL Y	TxD-OUT	USB+
3	CHANNEL Z	N/C	RxD-IN	USB-
4	STORE/FIRE	STORE/FIRE	DTR-OUT	DIGITAL GND
5	ANALOG GND	ANALOG GND	DIGITAL GND	EXT-DC-IN
6	CHANNEL Y	N/C	N/C	EXT-TRIG-IN
7	N/C	N/C	CTS-IN	+5V-TACHO-OUT
8			RTS-OUT	
9			+5V	

CH1 / CH2 Inputs

Signal inputs are made through the LEMO connectors marked CH1 and CH2 on the top of the Enpac.

The maximum measurement range is ±40 V while the minimum full-scale range voltage available is ±10 mV (peak). The inputs are protected against high voltage transients, but sustained over-voltage input levels must be avoided. Voltage can be DC or AC coupled, while the third option, Accel (ICP), is available for direct connection of integrated circuit piezoelectric transducers. These settings are specified in the Emonitor software.

Refer to Setting Up Measurement Definitions on page 78.

POWER / TRIG / USB

This socket connects the Enpac to either an external trigger, power adapter or USB interface. The external trigger enables synchronization of the data acquisition process to external events, such as tachometer inputs for rotational synchronization for balancing applications, or for order normalization of frequency spectrum. The trigger pulse can also be used to collect running speeds of machinery. The pin assignment for the trigger is shown in Pin Assignments on page 23.

The external power adapter can be used to charge the internal battery. This can be connected to the Enpac by connecting the DC output of the mains power supply to the in line socket of the USB Power Splitter cable (Cat. No. 1441-PEN25-COMS-US). Then connect the Fischer plug into the Power socket on top of the Enpac. Only the provided transformer may be used. Any other supply may cause permanent damage to the data collector.

A USB interface is also provided via the POWER/TRIG connector and the USB Power Splitter cable. The interface is configured as a Client to allow automatic connection to a PC through Microsoft ActiveSync™ software. This interface allows you to copy files and transfer data from the data collector to your PC.

Refer to Installing ActiveSync on page 103.

Figure 3 - USB Power Splitter Cable

RS-232 Interface

Data can also be transferred between the Enpac and your computer over an RS-232 interface. The RS-232 interface is provided via a 9-way (Plug) D-connector on the top of the Enpac 2500 data collector. The cable catalog number is 1441-PEN25-COMS-RS.

Status Indicators

The Enpac 2500 has three status indicators located in the upper-right side of the Enpac nameplate.

Figure 4 - Status Indicators

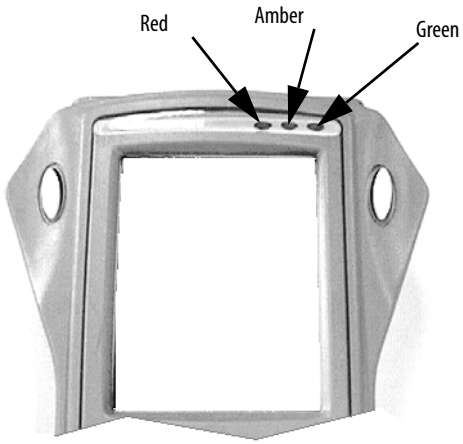


Table 4 - Status Indicators

Status Indicators	Operation	State	Definition
Red	Charging Battery	Flashing	When first connected to the power adapter, the Enpac 2500 tests the condition of the main battery. Within 30 seconds, the status indicators should go to a solid state. If the status indicators continues to flash, the unit has diagnosed a fault in the main battery and it will not charge the battery. The problem may be that the cell temperature is too high or there is a fault with the battery.
		Solid	The main battery is OK. The power adapter is connected to the Enpac 2500 and charging the main battery. The battery will be maintained by a trickle charge from the power adapter for as long as it remains attached to the unit.
	Data Collection	Solid	• An alarm condition has been set. • Input signal is out of range. • ICP Fail is active. • The power adapter is connected to the Enpac 2500.
Amber	Data Collection	Solid	Acquisition sub-system is settling.
Green	Data Collection	Solid	Input signal is stable and data is ready to be stored.

Strap Attachment

The strap can be fitted to either the left or right side of the Enpac 2500.

1. Feed the ends of the strap through the top and bottom corner pillars as shown in the illustration below.

2. Loop the ends of the strap through the buckles and adjust the tightness to suit.

Battery Pack

The Enpac 2500 data collector can be powered either from its own internal Lithium Ion battery or by connecting the DC output of the mains power supply to the in line socket of the USB Power Splitter cable. Then connect the Fischer plug into the Power socket on top of the Enpac. The Enpac also has an internal backup battery which maintains the system settings should the battery become discharged or removed while the unit is not being powered by an external DC supply.

This section describes how to check the battery level information and remove the battery pack from the data collector. The Enpac battery pack is located on the underside of the Enpac.

This table shows the typical battery life for the lithium ion battery, assuming the battery is properly charged.

Table 5 - Battery capacity

Mode	State	Typical Battery Life
On (Windows CE)	Performing typical data collection	8 hours minimum
	Idle mode	14 hours minimum
Off	Main battery & backup battery	14 days minimum
	Main battery removed & instrument running on backup battery	2 days minimum
Main Battery Charge Time	100%	5 hours
	70%	3 hours

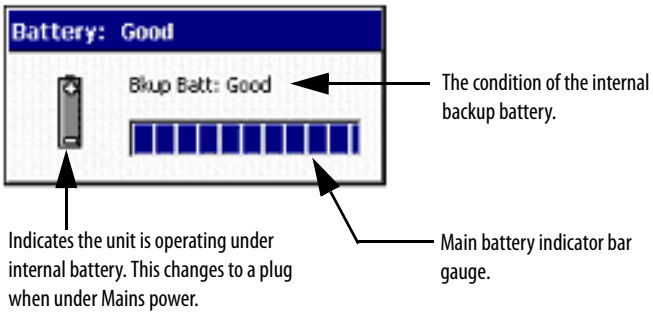
IMPORTANT If the main battery is allowed to discharge completely, the instrument will behave as if it has experienced a hardware reset. When you reapply power, the current date, time and status information will be lost.

Checking Battery Life

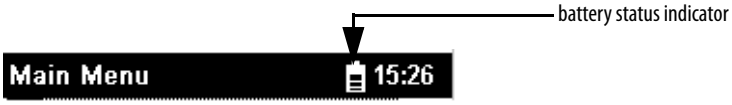
You can check the status of the battery in the Enpac 2500 by pressing the Decimal (.) key. (This function is available on most screens.)

The Battery Status dialog reports the status of the internal battery and the condition of the units backup battery. The backup battery charges while the unit is connected to the external DC power adapter or when the unit is powered on by using the internal battery.

Figure 5 - Battery Status Dialog



The battery status is also displayed in the upper-right corner of the caption bar.



This table shows battery status icons relative strength of the battery.

Table 6 - Battery status icons

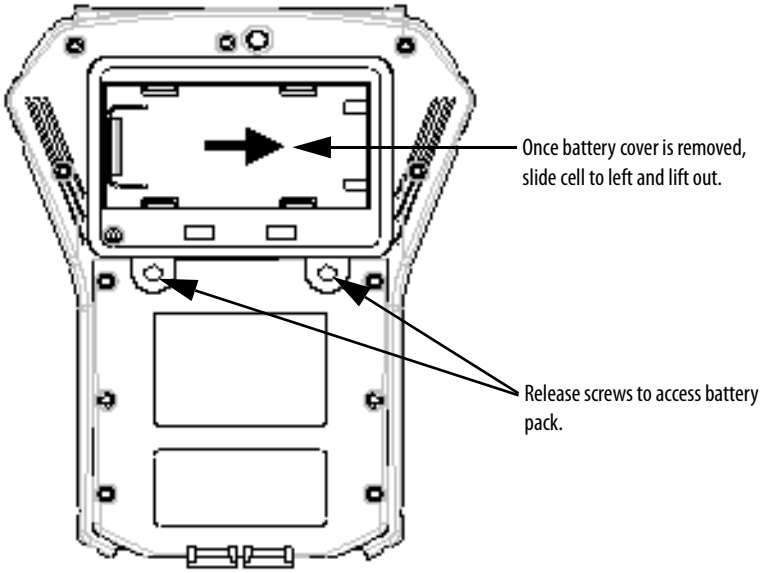
Battery Icon	Meaning
	Battery status is good (>30% life remaining)
	Battery status is low (>10% life remaining)
	Battery status is very low (<10% life remaining)
	Battery charging

IMPORTANT The Enpac 2500 will automatically notify you when the battery status is 30% or lower. To clear the notification, press the Decimal (.) key. The notification will periodically appear until the battery is recharged or the power adapter is attached.

When the battery status is 10% or lower, communications is prohibited.

Inserting and Removing the Battery Pack

1. Using a flat head screwdriver, remove the quick release screws (underside of the data collector).



2. Remove the battery cover.

   TIP The Enpac has a safety switch positioned under the plate of the battery compartment. When you remove this cover, the data collector shuts down (as if the ON/OFF key was pressed.)

3. Slide the cell to the left and lift it out from the data collector.

   The battery is inserted into the data collector by following this process in reverse order.

Powering on the Enpac

The ON/OFF key powers the Enpac 2500 on and off. A single press of the key powers on the data collector. However, to power off the Enpac 2500, press the ON/OFF key for a period of one second. The Enpac 2500 resumes operation at the last screen you viewed when you powered off the unit.

TIP The first time you power on the Enpac 2500 or following a reset, the Instrument Setup screen automatically appears in the display.

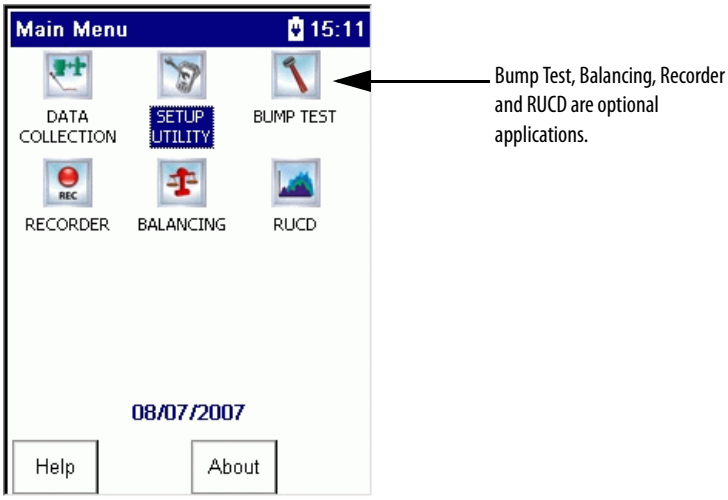
Refer to Set the Date, Time, and Date Format on page 32.

Enpac 2500 Screens

This section introduces you to the main screens that appear when operating the Enpac 2500. There are many other screens that appear while operating the Enpac 2500. These screen are described with the operation.

Main Menu

The Main Menu allows you to navigate to the different programs in the Enpac 2500. Each option in the Main Menu allows you to complete different tasks, such as collecting data, defining the setup options, and reviewing data.



To make a selection from the Main Menu, highlight the option by using the arrow keys and press either of the READ/OK keys.

The Main Menu includes these standard options.

- **Data Collection** - The Data Collection option allows you to collect both route and unscheduled (off route) data. It also allows you to view any data stored in Enpac 2500. The data can be viewed on the screen by using the RS-232 interface.

  Refer to Data Collection Screen on page 33 for more information.

- **Setup Utility** - The Setup option allows you to set up global options for collecting data.

  Refer to Setup Screen on page 30 for more information.

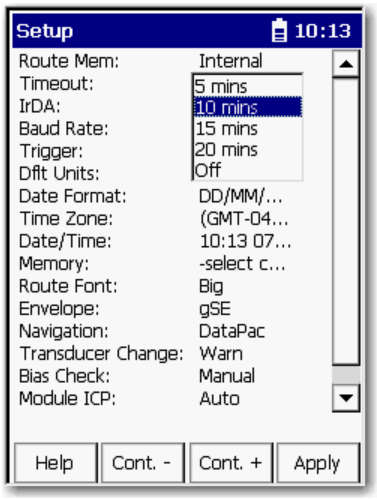
Setup Screen

The Setup screen allows you to set up global options for the Enpac 2500, including date and time. The Enpac 2500 displays the Setup screen when you first power on the instrument or after you reboot or hardware reset the Enpac 2500. You can also access this screen by selecting **Setup Utility** from the Main Menu.

Follow these steps to edit an option.

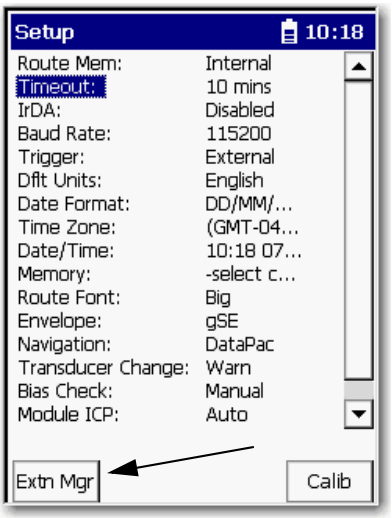
1. Use the up or down arrow keys to select the parameter.
2. Press the right arrow key to open a list of choices.

   This is an example of the timeout list of options.



3. Select the choice by pressing the arrow keys or type in a value using the numeric key pad.
4. Press the left arrow key to make your selection.
5. Press 0 to display the additional options on the Setup dialog box.

The Extension Manager and Calibration buttons appear.



The Extension Manager lists the option extension modules installed on the data collector.

Refer to Install Optional Extension Modules on page 189.

When you are finished, press F4 (Apply) to return to the Main Menu.

Set the Date, Time, and Date Format

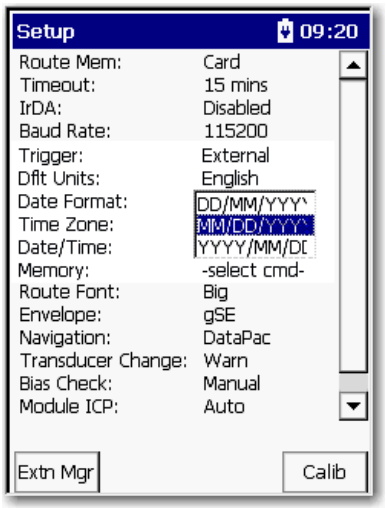
The Enpac 2500 data collector keeps the current date format, date, and time even when the instrument is powered off. However, there may be times when you need to change these settings. For example, after restarting or resetting the Enpac 2500, the date and time get set to 00:00:00.

Follow these steps to set the date, time, and select a date format.

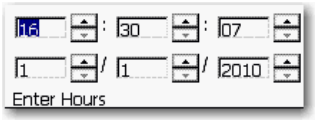
1. Select Setup Utility from the Main Menu and press Enter.

   The Setup screen appears.

   TIP On powering on the Enpac 2500 data collector for the first time or after a restart or hardware reset, the Setup screen automatically appears.



2. To change the format of the date, highlight Date Format and press the Right arrow key to display the format choices.
3. Select the appropriate format and press the Left arrow key to save your choice.
4. To change the date and time, highlight Date/Time and press the Right arrow key to open the date and time window.



5. Enter the current time and date.
6. When you get to the Year field, press the Right arrow key to save your entry.
7. When you are finished, press Enter to return to the Main Menu.

Data Collection Screen

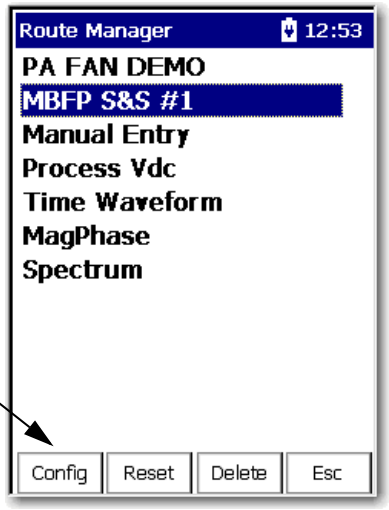
The Data Collection screen allows you to navigate around the Routes loaded in the data collector, collect and store route and off route data, and edit the data collection options.

It also allows you to navigate through the stored data and to review previously collected route and off route data.

When you select Data Collection from the Main Menu, the Route Manager screen appears. All of the routes that you download from Emonitor to the data collector appear on the Route Manager screen.

Follow these steps to open a Route.

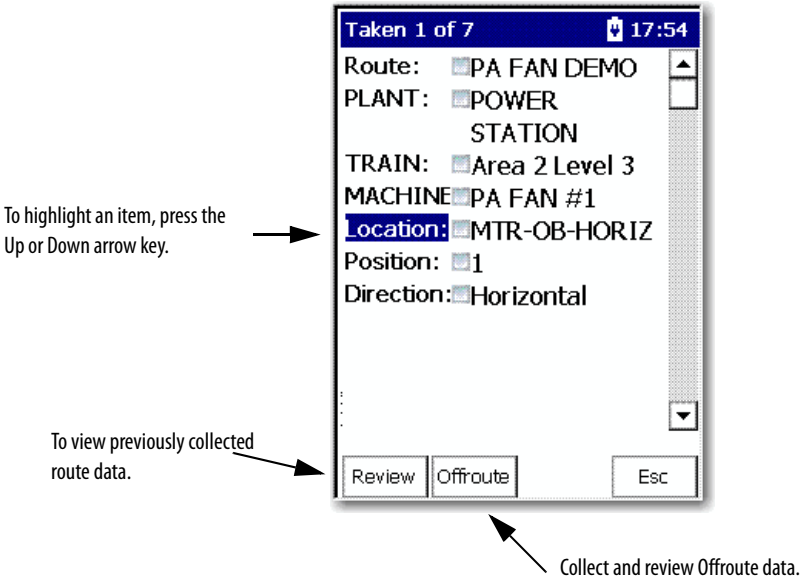
1. Select the route and press Enter.



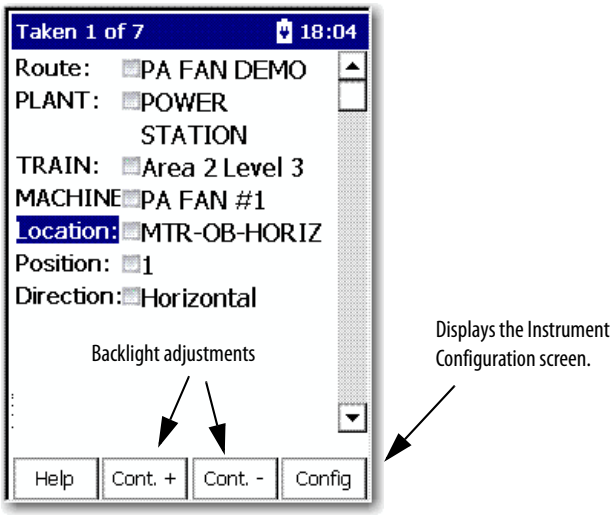
Displays the instrument configuration screen, which lets you access global data collection settings.

If you press 0, the Help button appears in the next level of function keys.

The information for the first point taken appears.



To access four additional functions for the Data Collection screen, press 0.



Follow these steps to move around in the Data Collection screen.

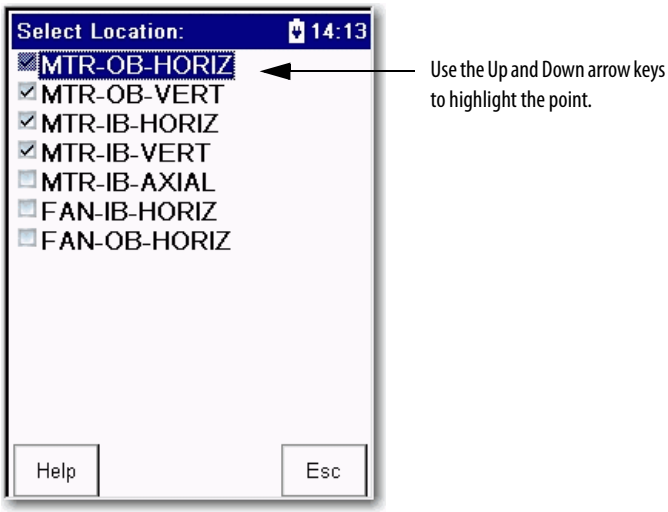
1. Select the hierarchy level, for example, Plant, Train, Machine, and Location.

   The Enpac 2500 supports up to six hierarchy levels for each point. These levels are defined by the structure of the Route database in the Emonitor software. The number and labels of these levels vary according to the way your Route database was set up.

2. Display the next screen of information, for example, a list of location measurement points, press the Right arrow key.

The Select Location screen appears.

TIP The Selection screen does not appear if you set the route Navigation mode to `DataPac' in the Setup Utility menu. Instead, the Enpac 2500 data collector automatically moves to the next point in the route when you press the Right arrow.

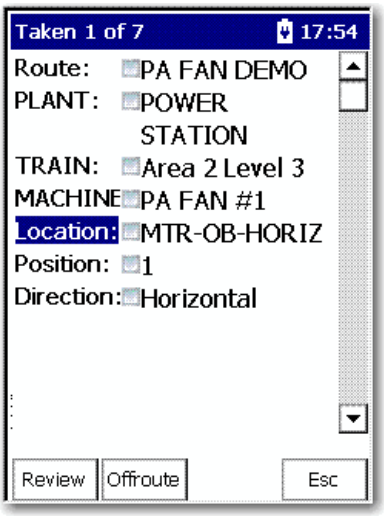


Task	Action
Select an item.	Highlight the item and press the Left arrow key.
Leave the screen without selecting an item.	F4 (Esc)
Start collecting data.	Enter
Review previously collected route data.	F1 (Review)
Collect and review Offroute data.	F2 (Offroute)

See Collecting and Reviewing Data on page 119 for more information.

3. To select an item, highlight the item and press the LEFT ARROW key.

   To leave the screen without selecting an item, press F4 (Esc).



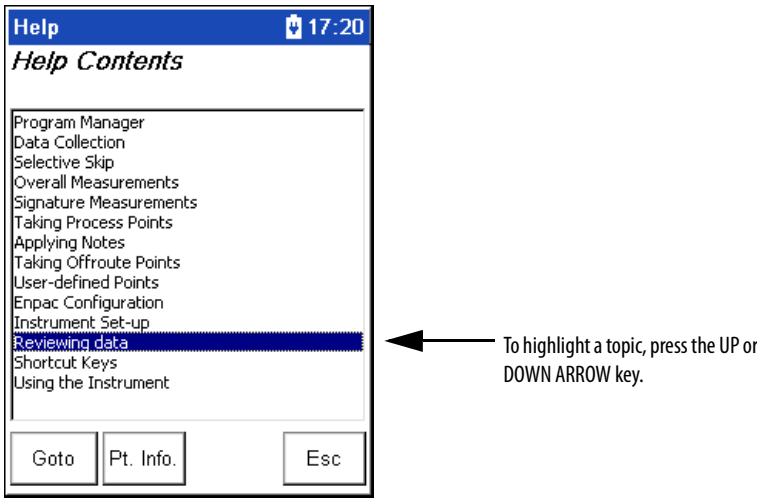
4. To start collecting data, press READ/OK.
5. To review previously collected route data, press F1 (Review).
6. To collect and review off route data, press F2 (Offroute).
7. When you are finished in the Data Collection screen, press F4 (Esc) to return to the Main Menu.

Refer to Collecting and Reviewing Data on page 119 for more information about collecting and reviewing data.

Help Screen

Online help is available from any screen where the Help function is displayed on the screen.

1. Press F1 (Help) to access the online help. The Help Contents screen appears.



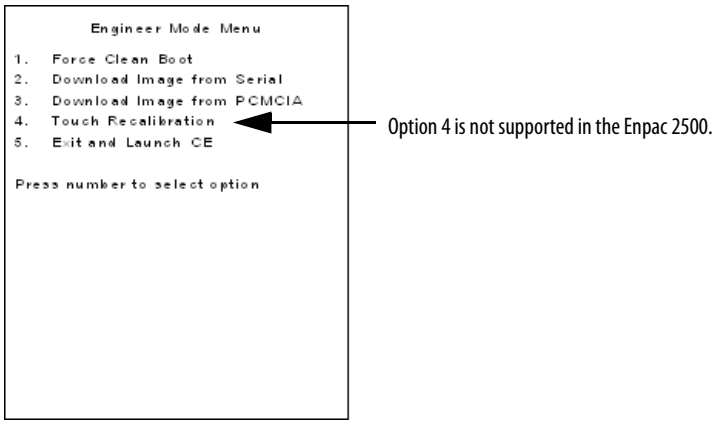
2. Highlight the topic for which you want to view and press F1 (Goto).
3. When you are finished viewing the topic, press F1 (Contents) to return to the Help Contents screen or press F4 (Esc) to exit the online help.

Engineer Mode Menu Screen

The Engineer Mode Menu screen allows you to perform various maintenance operations such as resetting the unit to the default settings, or loading an operating system to the data collector. The Engineer Mode Menu can only be initiated manually.

To initiate the Engineer Mode Menu, perform a hardware reset and hold down the RIGHT and LEFT ARROW keys.

Figure 6 - Engineer Mode Menu Screen



The Engineer Mode Menu provides you the following options. To select one of the options, press the respective numeric key.

1. **Force Clean Boot** - During a normal boot sequence, the unit will automatically update the registry contents into Flash memory so that any changes are permanently stored. Select this option to bypass the normal boot sequence and revert back to a 'clean or default setup.
2. **Download Image from Serial** - Select this option to install a new operating system onto the unit over the RS-232 serial interface. The WinSerDL utility is required with this option.

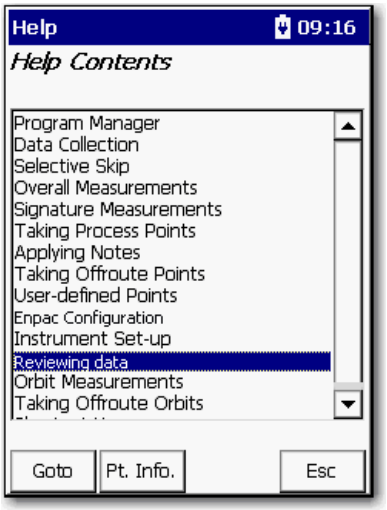
   Refer to Operating System Update Procedures on page 50.
3. **Download Image from PCMCIA** - Select this option to install a new operating system onto the unit using a PCMCIA ATA Flash card (FAT format).
4. **Touch Recalibration** - This option is not supported in the Enpac 2500.
5. **Exit and Launch CE** - Select this option to exit the Engineer Mode Menu and launch the Windows CE operating system.

View Settings for Current Measurement Definition

You can review the measurement definitions for the current active measurement point from the online help.

1. Press F1 (Help) to access the online help.

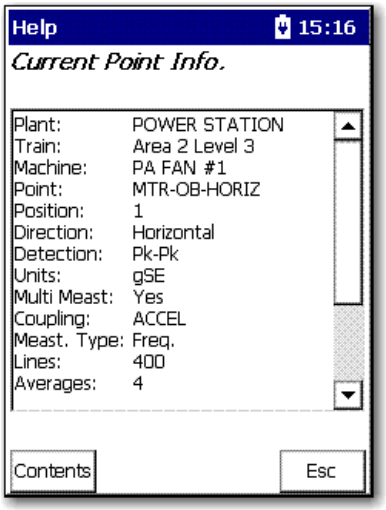
   The Help Contents screen appears.



TIP On some screens, Help is located on the second set of functions, press (shift) to display F1 (Help).

2. Press F2 (Pt. Info.) to view the measurement definition.

   The Current Point Info screen appears.



3. When you are finished, press F4 (Esc) to exit the online help or press F1 (Contents) to return to the Help Contents screen.

Setting Up the Enpac 2500 Data Collector

Before you begin to take readings, you need to configure the instrument parameters by using the Setup Utility, Instrument Configuration and Data Collection screens.

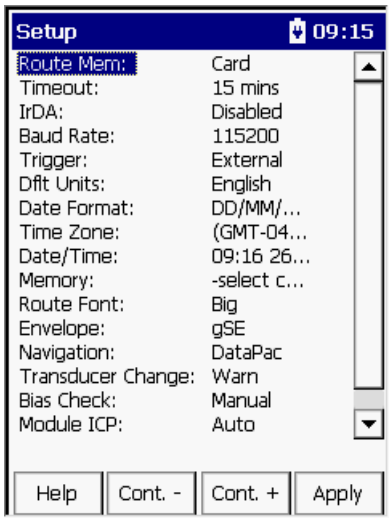
Configure the Data Collector

By using the Setup Utility, you can configure the global options for your data collector.

Follow these steps to configure the data collector.

1. Select Setup Utility from the Main Menu and press Enter.

   The Setup screen appears.



For the Route data to be accurately time based, you must set the date and time before leaving this screen.

2. Review the default values and edit if necessary.

3. When finished, press F4 (Apply) to return to the Main Menu.

Table 7 - Setup Screen Parameter Descriptions

Parameter	Description	Value
Route Mem	Sets the location where the loaded route data is stored.	Internal (default) Storage Card
Timeout	The number of minutes the Enpac 2500 can remain idle before it shuts itself off to conserve battery power. Press On/Off to reactivate the instrument following a timeout. The instrument returns to the point in the program where it was when it shut off. No stored data will be lost.	Off (default) 5 min 10 min 15 min 20 min
Trigger	Sets the Phase/Order input trigger synchronization: • Laser Tach enables the internal Laser Tachometer when a Phase or Order measurement is collected. • External uses the trigger input from the POWER/USB/TRIGGER connector as the trigger source. • RS-232 transfers data can also be transferred between the data collector and your computer.	External (default) Laser Tach RS-232
Dflt Units	Defines the units of measurement for Offroute standard velocity measurements. Important: Used only* for Offroute standard velocity measurements.	English (ips) (default) Metric (mm/s)
Date Format	The format of the date displayed in the Enpac 2500.	MM/DD/YYYY (default) DD/MM/YYYY YYYY/MM/DD
Time Zone	Sets the time zone. Only used when using ActiveSync software data synchronization. The time zone on the instrument must match the time zone on the computer. If you are not using ActiveSync software then the time zone setting has no effect. Important: Always set your instrument to the correct time zone or your files will not be in sync by time zone.	List of 30 time zones
Date/Time	Displays the date and time in the format you select in the Date and Time parameters.	Current data and time
Memory	Configures the memory: • Select cmd to exit this field without selecting an option. • Delete all routes and data from memory. • Initialize formats the memory. Deletes all files from memory including any route files and directories. Important: These commands are performed on the memory location as set by Route Memory.	Select cmd (default) Delete all routes Initialize
Route Font	You can select the font size for the Route.	Big or Small
Envelope	The type of envelope to use for high frequency and rolling element bearing analysis. Determines which pre-defined measurement you can use to collect Offroute data.	gSE (default), collects an Offroute gSE point. ESP, collects an Offroute ESP point
Navigation	Determines how the instrument navigates through the routes in the Data Collection screens when the Right arrow key is pressed: • Enpac- The instrument displays a Selection screen from which you select the item you want to collect or review. • DataPac - The instrument functions like a dataPAC 1500 in that it automatically advances to the next point in the route.	Enpac DataPac (default)
Transducer Change	Notification of a transducer change. If set to Warn, a prompt appears on the screen warning you of the transducer change.	Warn (default) Do not warn

Table 7 - Setup Screen Parameter Descriptions

Parameter	Description	Value
Bias Check	The bias of the transducer before taking the measurement.	Manual (default) Automatic
Module ICP	The Module ICP option allows the manual control of turning off/on ICP power to transducers in application modules.	Never Always Auto
Language	Sets the language for the user interface.	Chinese English Francais Deutsch Italiano Portuguese (Brasil) Russkiy Espanol (Spain, traditional)

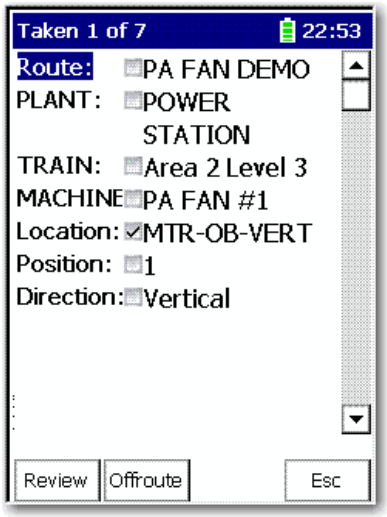
Configure the Data Collection Options

The data collection options affect the measurement, the data collection process, and how the data displays on the Enpac 2500. The instrument stores the data collection settings even when the instrument is powered off. However, you should check these options each time you start data collection.

Follow these steps to download a Route onto the data collector by using the Emonitor software.

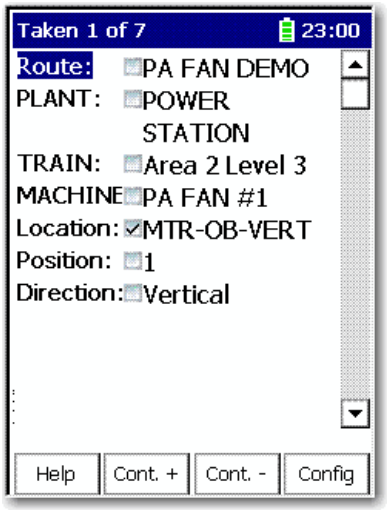
1. Using the Route Manager, select an appropriate route and press Enter.

   The Data Collection screen appears.



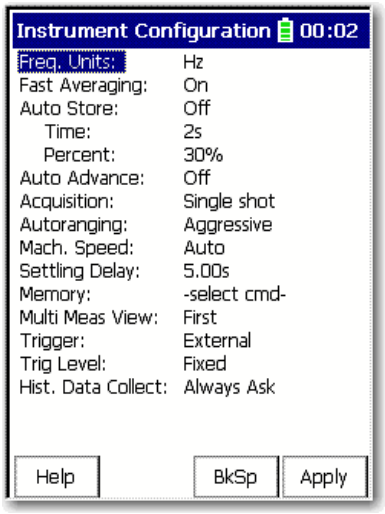
2. Press 0 (Shift) to display the Config function.

The Config function should remain on the screen for approximately three seconds after releasing the 0 key.



3. Press F4 (Config) to display the data collection options.

   The Instrument Configuration screen appears.



4. Review the default values and edit if necessary.

5. When you are finished, press F4 (Apply) to return to the Data Collection screen.

Table 8 - Instrument Configuration Parameters

Parameter	Description	Value
Freq. Units	The frequency units for displaying spectra/FFT data in the data collector. This parameter is initially set to the default frequency (Hz or CPM) in Emonitor when you load a list.	Hz: displays spectra in Hertz, cycles per second. CPM (default): displays spectra in cycles per minute. Orders: spectra in orders of the operating speed. This is used only when order normalized or phase data is collected by using a tachometer or strobe to trigger data collection.
Fast Averaging	Sets the averaging display and overlap processing.	
Auto Store	Controls the number of key presses required to accept data.	
Time	The number of seconds that the input signal must be steady for Auto Store to occur.	2 s (default) This parameter is used only when Auto Store is set to On.
Percent	The fluctuation percent for Auto Store to occur.	30% (default) This parameter is used only when Auto Store is set to On.
Auto Advance	Determines whether the Enpac 2500 automatically moves forward to the next point in the list after collecting data for the current point.	

Fast Averaging

Value	Description
On	Default The display is updated only when the data collector has collected and averaged all the data. For example, if the number of averages is set to 20, then data is displayed only when 20 blocks have been collected and averaged. There is no progress indication during data collection, only a `Collecting data... message. This speeds up the data collection of the spectra by using the percent overlap specified in Emonitor. The interim averages are not displayed.
Off	The display is updated as often as possible while the data collector is collecting and averaging the data. For example, if the number of averages is set to 20, then data might be displayed for averages 1, 6, 12, 18, and 20. The averages that are displayed depends on the Fmax and number of lines selected. If each block is acquired very quickly then only the first and last updates may be seen. Data can be stored at any time once the spectrum has been displayed. Important: The Off option applies only to spectral averaging, not time synchronous averaging. This means it has no effect on Phase points or other time synchronous averaged measurements.

Auto Store

Value	Description
On	The instrument automatically accepts both the overall and signature measurements and proceeds to the next point in the list. The overall measurement is accepted based on an algorithm. The algorithm is based on a percent fluctuation over a period of time (seconds). If the overall stays with the % specified by Percent for the number of seconds specified with Time, the overall magnitude is accepted. You must press Enter to accept the overall measurement, and then press Enter again to accept the signature measurement.
Off	Default

Auto Advance

Value	Description
On	The instrument automatically moves forward to the next point in the list after collecting data for the current point. No spectrum is displayed.
Off	Default The instrument displays a spectrum after collecting data for the current point.

Table 8 - Instrument Configuration Parameters

Parameter	Description	Value
Acquisition	Determines how the Enpac 2500 collects a signature when the measurement definition specifies just one average.	

Value	Description
Single shot	Measures a single average for the signature and then stops.
Continuous	Default Continuously measures the signature until you press Enter to stop the averaging. This will pause the acquisition. Press the Continue function to restart the acquisition. Press Enter a second time to store the data.

Autoranging

Sets the input range during data collection.

Value	Description
Aggressive	Default Limits the auto-ranging to 20 mV level and sets the range limits from 1% to 70% of range. When the input is under-range, the instrument recalculates the most appropriate setting and begin data sampling. The range will not be adjusted a second time or checked prior to data collection. Use Aggressive autoranging when faster data collection is desired. When using Aggressive autoranging, set Auto Store to Off, or set Auto Store Time to 2 seconds when Auto Store is set to On.
Conservative	Allows auto-ranging to go as low as 2 mV and sets the range limits from 10% to 70% of range. The instrument perform a series of checks prior to sampling data. This will result in longer data collection times and potentially lengthy acquisition. When the input is under-range, the instrument recalculates the most appropriate range setting and sample data to make sure the range has been properly selected. In addition, the dynamic range will be adjusted several times prior to data collection. Use Conservative autoranging when large variations in signal amplitude are present for proper input range selection but increases the settling time required.
Fixed	No autoranging measurements are taken. Input range is set based on the transducer type and sensitivity.

Transducer	Input Range (EUs)
Accelerometer	50 g
Velocimeter	50 ips
Displacement probe	200 mils
Volts, A.C.	2 V

For example, an accelerometer, the input range will be 5 V for 100 mV/G sensitivity or 500 mV for 10 mV/G sensitivity.

- If Autoranging is set to Fixed or Aggressive, the software integration is used on all FFT measurements. This is to give improved dynamic range and faster hardware settling times.
- If hardware integration is required, set Autoranging to Conservative.
- For all autoranging settings (including Fixed), the input range is automatically increased and the data retaken if clipping occurs. This means that the final input range used will never be too low for the signal being measured.

Table 8 - Instrument Configuration Parameters

Parameter	Description	Value
Mach. Speed	Controls the amount of time auto-ranging will wait to be sure it has seen the peak signal value of the sample. **Value** / **Description** Normal: Sets the auto-ranging algorithm to only track signals above 120 rpm. Therefore, use this setting when the machine speed is greater than 120 rpm. The normal speed setting guarantees the waiting time be no longer than 0.5 seconds. It will significantly improve auto-ranging times and therefore data collection times for any points that have low filters (<2 Hz) selected. Slow: Sets the auto-ranging algorithm down to the Low Pass Filter setting. (If none, it will track down to approximately 0.33 Hz or 20 CPM.) Therefore, use this setting when the machine speed is less than 120 rpm. The slow speed setting enables low frequency auto-ranging to accommodate collection of low frequency components. For slow speed equipment, this is necessary to be sure adequate sampling and collection of the peak signal. The slow speed setting allows the Enpac 2500 to auto-range on machines running as slow as 20 rpm. The auto-ranging algorithm makes an assumption about the speed of the machine that is being monitored to determine how long to wait for the peak signal value to be seen. With the slow speed setting, the wait-time is calculated as 1 / f_{hpf} where f_{hpf} is the high-pass filter cutoff in Hz for the current point. For example, if a 0.36 Hz filter is selected, the auto-ranging algorithm will wait for 1 / 0.36 = 2.78 seconds to make sure it has seen the peak signal value. Auto (default): Select to have the Enpac 2500 automatically select Normal or Slow depending on the measurements speed setting specified by Emonitor. When faster data collection is desired, set Autoranging to `Aggressive and Mach. Speed to `Normal.	
Settling Delay	The amount of time the instrument should delay data acquisition after applying power to an ICP accelerometer. The specified delay applies only to the first ICP measurement after turning ICP on, for example, the first measurement at the start of a ROUTE or a measurement following a non-ICP measurement After the first measurement, data acquisition times are not affected. If ski slope anomalies occur, try increasing the settling delay by one or two seconds.	0.00…60.00 s 5.00 s (default)
Memory	Configures the data collectors memory. **Value** / **Description** Select cmd: Default: Exit this parameter without selecting an option. Purge: Marks all the points on the route as taken, sets the current reading to be the previous reading for each point, and deletes all the Offroute data. Delete route: Deletes the current route in memory. If you have an internal or SD storage card, the route to be deleted depends on what you have chosen on the Setup Utility screen. Delete all routes: Deletes all routes and data in memory. If you have an internal or SD storage card, the route to be deleted depends on what you have chosen on the Setup Utility screen. Initialize: Formats the active memory. Note this will delete all routes and data in active memory. **TIP** Configure only when you open data collection. You must have a Route open for the memory option to display. A Route must be in active memory.	
Multi Meas View	Determines what is viewed on the screen while taking multiple measurement location.	First (default) Last All None

Table 8 - Instrument Configuration Parameters

Parameter	Description	Value
Trigger	Sets the trigger source.	External (default) Uses the trigger input from the POWER/USB/TRIGGER connector as the trigger source. Laser Tach Enables the internal Laser Tachometer when a Phase or Order measurement is collected.
Trig Level	Sets the trigger level. Applies only to triggered measurements (rpm points, phase points, time-synchronous averaged points). **Value** / **Description** Automatic: Samples the trigger signal before collecting the triggered measurement and sets an appropriate trigger level automatically. When collecting data on a triggered point, a message displays on the screen while the trigger level is being sampled. The length of time for which the trigger is sampled during autotriggering is dependent on two factors: • The high pass filter selected for the point. • The lower the high pass filter cutoff, the longer the trigger will be sampled. Mach. Speed If the Mach. Speed is set to Normal, the maximum trigger sampling time is about one second. If the Mach. Speed is set to Slow, the maximum trigger sampling time is about 10 seconds. The Normal setting supports autotriggering on machines running at speeds down to ~120 rpm. The Slow setting will support autotriggering on machines running at speeds down to ~6 rpm, depending on the width of the trigger pulse. Fixed: Default: The Enpac 2500 data collector uses the signal level entered in the point setup information (either Route or Offroute) as the trigger point.	
Hist. Data Collect	Determines how data is stored in the Enpac 2500 data collector when collecting multiple measurements for a signal point: • If you want to conserve space, you should select Always Overwrite. • If you want multiple data sets to be stored and unloaded, select Always Append.	Always Append: adds the new data for a point to existing data. Always Overwrite: replaces existing data with new data. Always Ask (default): displays a dialog box before attempting to store the data.

Using Memory Cards

The Enpac 2500 can store program information and collected data on memory cards. The Enpac 2500 is configured to accept any standard PCMCIA compact flash (via adapter), Secure Digital (SD) memory card up to 2 GB that is supported with a Microsoft Windows CE driver.

The Enpac 2500 data collector, version 3.10 and later supports the Secure Digital High Capacity (SDHC) storage cards up to storage card up to 16 GB that is supported with a Microsoft Windows CE driver.

IMPORTANT The Enpac 2500 data collector is only certified for use with the Sandisk Secure Digital (SD) card SDSDx-yyy.

PC cards may be inserted when the instrument is powered on or off. If any memory card is not formatted to the correct standard, the instrument automatically opens a dialog prompting you to format the card. We recommend that memory cards be formatted Fat 16.

In this dialog, press either of the READ/OK buttons to format the card for use with the Enpac 2500.

Types of Memory Cards Used with Enpac 2500

Most any PCMCIA adapter and Secure Digital (SD) memory card, up to 2GB can operate with the Enpac 2500.

Table 9 - Types of Memory Cards

Manufacturer	Size	Speed
PQI	1 GB	Hi Speed 60
Transcend	2 GB	40
Kingston	512 MB	40
Sandisk Secure Digital Card, SDSDx-yyy	2 GB	Not compatible with SDHC cards.

The Enpac 2500 also supports the following ATA flash PCMCIA cards.

Table 10 - ATA Memory Cards

Manufacturer	Model
Simple Technology PCMCIA Flash Memory Cards	STI-ATAFL/8A to STI-ATAFL/512
Pretec Compact Flash Memory Cards	(R)CFxxxxx + CF-PC Card adapter

Inserting and Removing a Memory Card

You load the memory card into the Enpac through the base cover at the bottom of the unit. The memory card can be inserted while the Enpac 2500 is powered on or off.

To Insert a Memory Card

1. With the bottom of the Enpac facing you, press down the latches of the base cover.
2. Pull the base cover towards you.
3. Turn the memory card so the logo side of the card is facing you and gently slide the card into the unit until it is firmly seated in place.
4. Close the base cover.

TIP If the memory card has not been formatted or not formatted to the correct standard, the Enpac will open a dialog asking if you wish to format the card. Press READ/OK to format the card so it can be used in the Enpac.

IMPORTANT Formatting the card deletes everything on the card.

TIP The Enpac does not initialize the SD memory card.

To Remove a Memory Card

1. With the bottom of the Enpac facing you, press down the latches of the base cover.
2. Pull the base cover towards you.
3. Press the release button and gently work the card out of its slot.

Operating System Update Procedures

Download the Enpac 2500 .zip upgrade file from http://www.rockwellautomation.com/support/. Click Downloads > Firmware Updates > Condition Monitoring.

IMPORTANT We recommend that you delete all older versions of the installer loader .msi files from your computer before updating the Enpac 2500 data collector's operating system.

Refer to this table when completing the following upgrade sections to determine which Emonitor version and service release correspond to your Enpac 2500 operating system version.

Enpac 2500 Version	Emonitor Version	Service Release
3.10	3.5 Build 12	N/A
3.0	3.4	N/A
2.0	3.3	SR070628
1.03	3.2	SR060222

For instructions on how to upgrade you Emonitor software, refer to one of the Emonitor Installation Instructions.

Table 11 - Emonitor Installation Publications

Publication	Publication Number
Emonitor Gupta Single User Installation Manual	EMONTR-IN001
Emonitor Gupta Multi User Installation Manual	EMONTR-IN002
Emonitor Oracle Multi User Installation Manual	EMONTR-IN003
Emonitor MSSQL Multi User Installation Manual	EMONTR-IN004

Update the Enpac 2500 Data Collector Operating System, Firmware Version 3.10

Follow these instructions to update the data collector operating system.

TIP We recommend that you upload your data to Emonitor before you update the operating system just in case there is an error with the firmware installation, such as a cable disconnect.

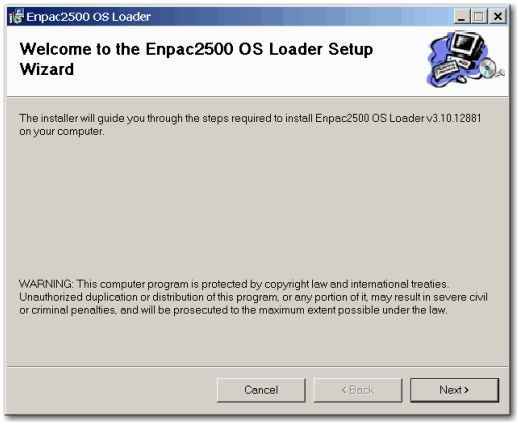
Before performing the 3.10 firmware upgrade, take note of the modules installed on the Enpac 2500 data collector.

TIP To confirm which modules that are installed and the version by press F3 (About) on the Main Screen.

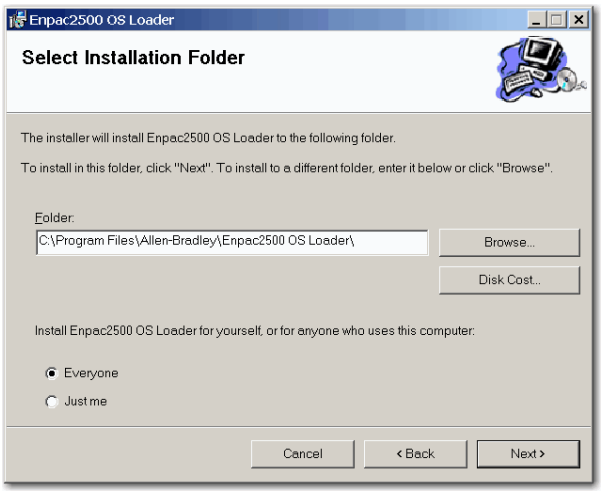
Table 12 - Data Collector Modules

Cat. No.	Module	Version
1441-PEN25-MOD-BAL	Balancing Upgrade	
1441-PEN25-MOD-BMP	Bump Test	
1441-PEN25-MOD-FRF	FRF - Frequency Response Function	
1441-PEN25-MOD-RUCD	RuCD - RunUp CoastDown	
1441-PEN25-MOD-REC	Recorder	

1. After downloading the Enpac 2500 3.10 Upgrade .zip file as instructed in Operating System Update Procedures on page 50, follow these instructions.
2. Connect your data collector to your computer by using the USB connection.
3. Start Microsoft ActiveSync to be connected to the data collector.
4. Extract the .zip file.
5. Double-click the OS Loader.msi file.

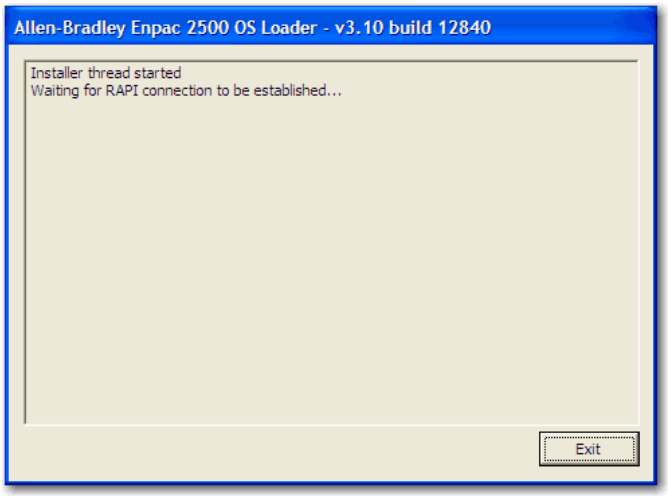


6. Use the default location.

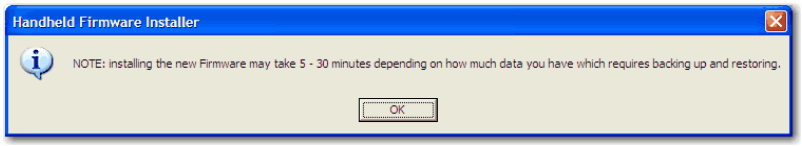


7. Click Next.
8. The installation procedure is ready, click Next.

   The Enpac OS Loader installs.
9. From the Windows Start menu, click Start > Programs > Allen-Bradley > Enpac2500 > Enpac2500 OS Loader.



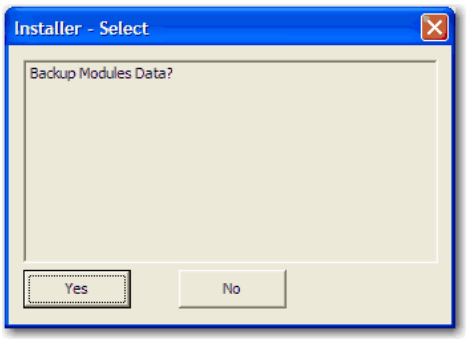
   At the beginning of the upgrade process, a message is shown saying that the upgrade can take a long time, depending on the selections made.



10. Click OK.

    The OS Loader automatically backs up any core files, such as Calibration Data and License Files.

The option to Backup any Module Data, for example, Balance jobs or .wav file recordings.

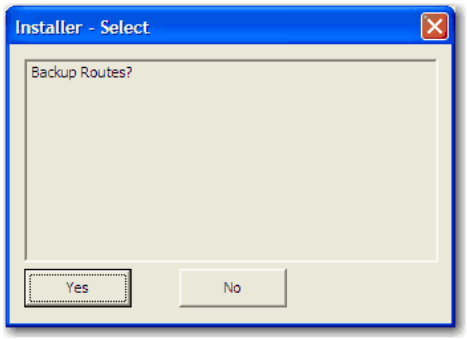


11. Decide if you need to backup data.

TIP We recommend that you click yes to backup your data.

Next, you are given the option to backup any Routes.

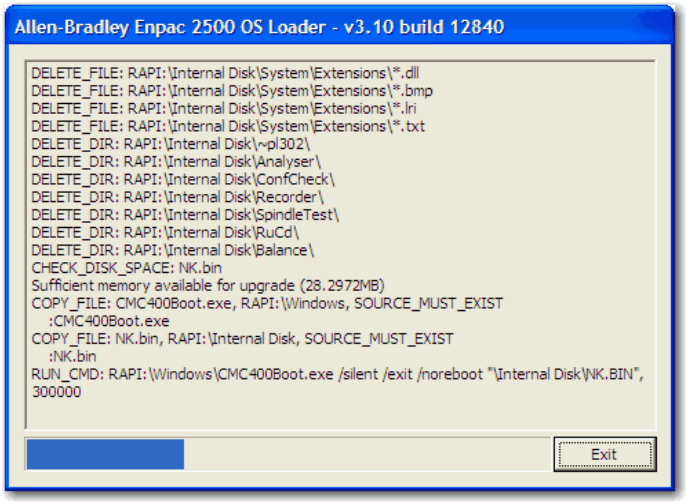
TIP We recommend that before you decide to backup any routes, upload your data to Emonitor just in case there is an error with the firmware installation, such as a cable disconnect.



12. Decide if you need to backup Routes.

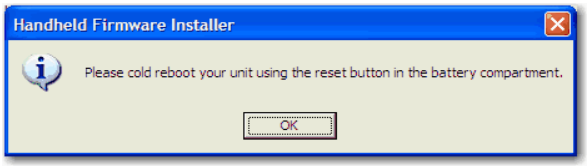
After any requested backups have been completed, the OS Loader will copy on the new NK.bin file and begin programming the new OS.

At this stage, you can see the OS programming occur on the unit.

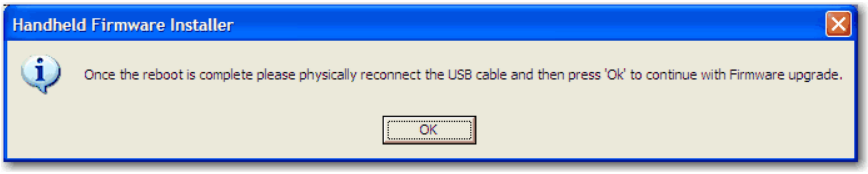


Remember that this process can take some time. You should see the firmware upgrade appear on the Enpac 2500 screen.

Once the programming of the new OS is complete, you need to perform a Hard reset/Cold reboot. See Restarting the Data Collector on page 57.

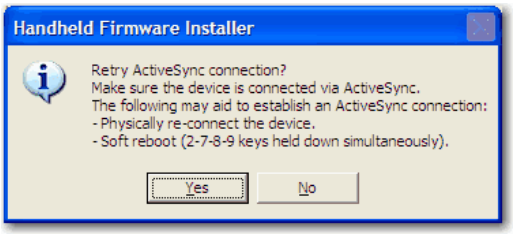


13. Click OK.
14. Disconnect the USB cable.



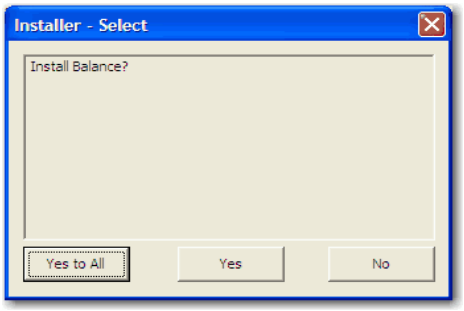
15. Reconnect the USB cable to re-establish ActiveSync.
16. Click OK.

If ActiveSync hasn't been reconnected within a few minutes, the OS Loader will re-prompt for suggested ways to re-connect.



The OS Loader then completes the final stages of the upgrading the Firmware, by automatically restoring any backed up files, for example, Calibration Data, License Files, and Module Data and Routes.

17. Determine if you need to install any modules.

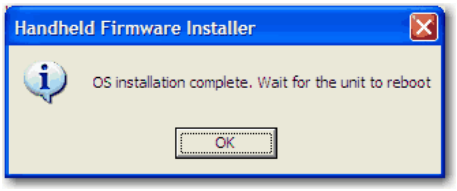


18. Choose to install All Modules (Yes to All) or individually (Yes/No).

TIP We recommend that you select to install modules individually based on the modules you have activations for listed in the table Data Collector Modules on page 51.

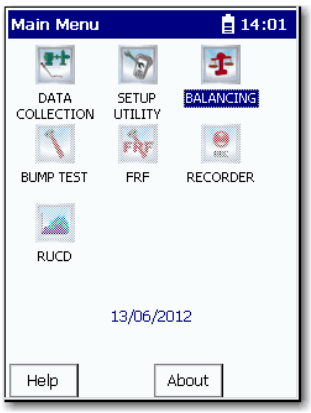
If you click Yes to All, the modules that you have not purchased activations for will appear greyed and are unavailable.

After the Modules have been installed, the OS Loader completes and tells you to wait for the Reboot.



Module Licensing

Any Modules that were licensed prior to the upgrade will still be licensed. Any Modules that are installed, but which have not been licensed will appear greyed out as unavailable.



To active greyed-out modules, contact your contact your local Allen-Bradley distributor or Rockwell Automation sales representative. Use the table Data Collector Modules on page 51 to identify what modules you need to order.

IMPORTANT	It will be necessary to re-enter the date and time in the Enpac 2500 data collector.
TIP	To confirm that the correct version was loaded, press F3 (About) on the Main Screen. The firmware version should match the operating system file just loaded.

Restarting the Data Collector

You should restart the Enpac 2500 data collector if the instrument locks up and does not respond to any key presses including the On/Off key.

When you need to reset the data collector you can perform a hard or soft reset. A hard reset resets the defaults vales of the date, time, and time zone. A soft reset keeps the current values. A reset does not delete data or Routes.

Perform Soft Restart

When doing a soft restart, all files and programs present in memory remain in memory following the restart.

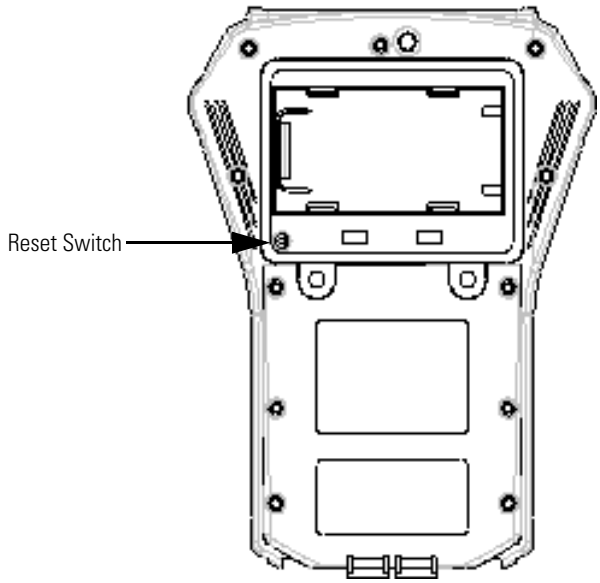
TIP Most of the time, a soft restart will reset any anomalies you are having with the data collector.

With the data collector on, simultaneously hold down the 2, 7, 8, and 9 keys for about a second. The data collector restarts and the Main Screen appears.

Perform Hard Restart

A hardware reset lets you to reconfigure the Enpac 2500 data collector back to the factory default setup. Programs or data files stored in RAM are cleared, but any programs or files stored in internal memory and any registry changes will be maintained.

The reset switch is located behind the battery access panel on the underside of the instrument. The reset switch can only by pressed using a 1/16- in diameter pin or a straightened paper clip.



IMPORTANT A hardware reset can also initiate the Engineer Mode Menu.
See Engineer Mode Menu Screen on page 37 for more information.

Follow these steps to replace the battery.

1. Using a flat head screwdriver, remove the two latch screws on the battery access panel.
2. Remove the battery access panel.
3. Press the Reset button using a 1/16th inch diameter pin or a straightened paper clip.
4. Replace the battery access panel and tighten the two screws.

   The Enpac 2500 data collector automatically powers on.

Allow at least thirty seconds for the instrument to reconfigure and activate the display after the Instrument Setup screen appears.

IMPORTANT The current date, time and some status information will be lost, and the backlight setting will be returned to the default setting following a hardware reset.
See Set the Date, Time, and Date Format on page 32 for more information.

IMPORTANT Any data held in internal memory is secure and will not be lost nor destroyed during a hardware reset.

Adding Applications to the Enpac 2500 Data Collector

The Enpac 2500 data collector uses the Extension Manager to install and uninstall application extensions and functions that are licensed and sold separately from the basic entry level product (for example, Balancing and Two Channel).

The installation cards that you receive from Rockwell Automation will work with any Enpac 2500 data collector. Once an application is installed on an Enpac 2500 data collector, the card is locked so that it can only be used with that unit.

IMPORTANT One installation card is required for each unit that will be upgraded.

You can uninstall applications if required. When uninstalling an application, you have the option to free up the license so that it can be used to install the application on another Enpac 2500 data collector. This allows applications to be transferred between units.

Refer to Installing Optional Extension Modules on page 189 for complete information about installing the extensions.

Setting Up Measurements

This chapter describes setting up the measurement definitions in Emonitor to use with the Enpac 2500. Measurement definitions define how to collect and store measurements. You can create several different types of measurement definitions at each location. Emonitor can then take advantage of the abilities of your data collector by combining some of the measurement definitions when you load them into the data collector. By combining measurements, Emonitor can shorten the data collection time. This chapter describes also how the Emonitor software and the Enpac 2500 handle alarms, lists, and inspection codes.

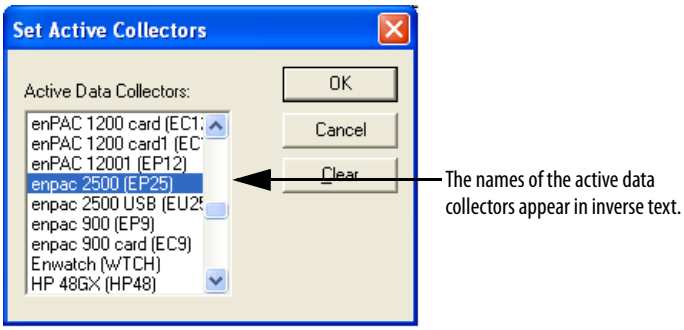
Topic	Page
Measurement Definition Options	62
Setting Up Collection Specifications	69
Setting Up Measurement Definitions	78
Setting Up Alarms, Lists, and Inspection Codes	95

IMPORTANT For complete information on all Emonitor features, tasks, and interface elements, refer to the Emonitor online help.

Measurement Definition Options

These topics describe the available selections for setting up measurement definitions in Emonitor. You determine these selections by choosing Tools > Set Active Collectors in Emonitor.

Figure 7 - Set active collectors



IMPORTANT	If no data collectors are active, the selections that appear in the Measurement Definition pane are the ones available to ALL data collectors. If only the Enpac is active, then only the valid choices for the Enpac appear in the lists. If the Enpac and other data collectors are active at the same time, you see the selections that are common to all data collectors that are active. Therefore, you may not see all the selections available for the Enpac.

In some cases, both Emonitor and Enpac 2500 support certain options. In other cases, Emonitor can support an option that the Enpac 2500 cannot support. For example, Emonitor can apply a software high pass filter to the data after it unloads the data from the Enpac 2500. This allows you to use a filter that is not available in the Enpac 2500.

Measurement Types

Emonitor and Enpac 2500 support the following measurement definition types:

- **Magnitude** - This measurement type is a single value representing the total energy of a measurement. For example, a vibration magnitude represents the total energy in a vibration spectrum. The Enpac 2500 can also collect magnitude+phase measurements, for the first through the eighth orders.
- **Numeric** - Manual entry or DC voltage measurement of an overall value such as temperature, pressure, flow rate, operating speed, or proximity probe gap readings.
- **Spectrum** - Frequency domain measurement of frequency vs. amplitude, usually for velocity or acceleration. The Enpac can collect phase with spectrum measurement definitions.
- **Time Waveform** - Time domain measurement of time vs. amplitude, usually for displacement, velocity, or acceleration.

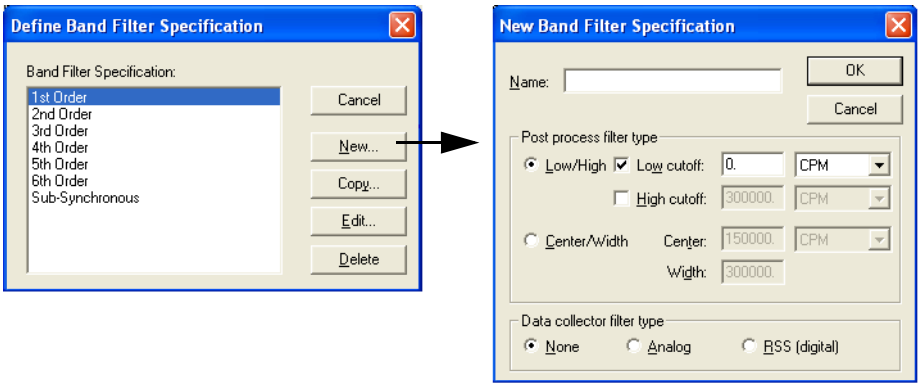
Remember that the available measurement types in Emonitor depend on the active collectors you select with the Tools > Set Active Collectors. If you have two

or more active data collectors, you may not see all the selections available for the Enpac.

Measurement Filters

Emonitor and Enpac 2500 each support certain measurement filters. Some of the filters are supported in both Emonitor and Enpac 2500. You can define custom band filters (high pass, low pass, band pass) by creating a new band filter using Setup > Band Filter. You can choose to use a filter in the Enpac 2500 by selecting the Analog or RSS (digital) option when you define a filter.

Figure 8 - Defining a Band Filter



IMPORTANT

Filters in Emonitor are referred to as software filters. Filters in data collectors are referred to as hardware filters. Hardware filters alter the signal in the Enpac 2500. Emonitor software filters alter the signal (data representing the signal) after you unload the data into Emonitor. In general, if the filter you want to use is available in both Emonitor and in the data collector, it is to your advantage to use the hardware filter in the data collector.

Hardware filters have the following advantage:

They can remove low frequency, high amplitude signal components that would dominate the dynamic range in the data collector. This results in improved amplitude resolution of the remaining signal range.

Software filters have the following advantage:

If there is no corresponding filter in the data collector, or you choose not to use it, Emonitor can apply a digital filter after you unload the data from the data collector.

gSE Filters

Use a gSE filter to detect bearing and other component defects. The gSE filters provide a demodulated measurement similar to the envelope measurements in other instruments. You can use gSE filters with the following measurement definitions:

- Magnitude
- Spectrum

These six gSE filters are available in the Enpac 2500. If you select the Envelope filter, Emonitor automatically picks the 5 kHz gSE filter.

100 Hz gSE	(6000 CPM)
200 Hz gSE	(12000 CPM)
500 Hz gSE	(30000 CPM)
1000 Hz gSE	(60000 CPM)
2000 Hz gSE	(120000 CPM)
5000 Hz gSE	(300000 CPM)

IMPORTANT The Datapac Emulation parameter in the Data Collector Advanced Settings dialog (Setup > Data Collector) in Emonitor must be set to Yes.

See Table 31 on page 100.

ESP Filters

Use an Envelope Spectrum Processing (ESP) filter to detect bearing and other component defects. The ESP filters apply a band pass filter, envelope the time domain signal, and then perform a frequency analysis on the result. ESP filters are built into the Enpac 2500, and you cannot change them in Emonitor. You can use ESP filters with the following measurement definitions:

- Magnitude
- Spectrum

The following ESP filters are available with Emonitor and the Enpac 2500.

0.6 to 1.25 kHz
1.25 to 2.5 kHz
2.5 to 5 kHz
5 to 10 kHz
10 to 20 kHz

TIP Contact Technical Support for assistance in using the ESP filters in Emonitor.

IMPORTANT The Datapac Emulation parameter in the Data Collector Advanced Settings dialog (Setup > Data Collector) in Emonitor must be set to No.

See Table 31 on page 100 for more information.

High Pass Filters

Use a high pass filter to remove high vibration, low frequency signal components that would dominate the signal. Examples include structural vibration or signal components generated by an integrator. The high pass filter excludes all frequencies below a defined frequency. It allows, or passes, frequencies above the defined frequency. You define these and other band filters using Setup > Band Filter. You can use a high pass filter with the following measurement definitions:

- Magnitude
- Spectrum

If you select Analog (as the data collector filter type) when you define a high pass filter, the data collector uses one of the following filters determined by the following formula.

$$\frac{2\ (\text{max frequency})}{\text{number of lines}}$$

Emonitor uses a high pass filter with one of the low frequency cutoff shown in the table below. It uses the filter whose cutoff is greater than or equal to the result of the formula.

Integrated (A to V, A to D, V to D)	Non-integrated (A, V, and D)
0.36 Hz (21.6 CPM)	0.18 Hz (10.8 CPM)
5.30 Hz (318 CPM)	2.67 Hz (160.2 CPM)
23.80 Hz (1428 CPM)	

EXAMPLE

$$\frac{2 \times 120{,}000\ \text{CPM}}{400\ \text{lines}} = \frac{240000}{400} = 600\ \text{CPM} = 10\ \text{Hz}$$

ATTENTION:
Emonitor uses the 5.30 Hz (318 CPM) filter for an integrated measurement. It uses the 2.67 Hz (160.2 CPM) filter for a non-integrated measurement.

Order (magnitude) Filters

Use order filters to define the bands around orders for magnitude and magnitude+phase measurements. You define these filters using Setup > Band Filter. You can use order filters with the following measurement definitions:

- Magnitude
- Spectrum

You can define and use order filters for the first through the eighth orders with the Enpac 2500. If you specify the Maximum frequency in Orders, select Analog and Order normalize when you define the orders filters, then the Enpac calculates the orders from an external trigger.

The Enpac 2500 then uses its own filters to calculate the magnitude and phase for the first through the eighth orders. Emonitor calculates magnitude values (without phase) for additional orders after you unload the data. Emonitor also calculates magnitude values after you unload the data if you select None instead of Analog.

IMPORTANT	If you want phase, remember to specify the Maximum frequency (in Collection Specification dialog) in Orders, select Analog in the Band Filter Specification dialog and Order normalize in the Collection Specification dialog. Emonitor does not select these options by default.

Default Filters

There are also four default filters in Emonitor that map to specific filters in the Enpac 2500. The filters are High Frequency, Envelope, Smart HP, and Overall.

- **High Frequency** - Typically this filter maps to a high frequency filter in the data collector and is available only for magnitude acceleration measurements. In the Enpac 2500, it maps to the 5 kHz gSE filter.
- **Envelope** - Typically this filter maps to one of the gSE filters in the data collector and is available for magnitude and spectrum acceleration measurements. In the Enpac 2500, it maps to the 5 kHz gSE filter.
- **Smart HP** - (Smart High Pass) Typically this filter maps to a specific high pass filter in the data collector and is available for magnitude, spectrum, and time waveform measurements. In the Enpac 2500, it maps to the Enpac filters shown in the table below, depending on the results of comparing the filter choice to the formula below.

  Emonitor uses the following formula.

$$\frac{2\ (\text{max frequency})}{\text{number of lines}}$$

Emonitor chooses an overall filter with one of the low frequency cutoffs shown in the table below. It uses the filter whose cutoff is **less than** the result of the formula.

Integrated (A to V, A to D, V to D)	Non-integrated (A, V, and D)
5.30 Hz (318 CPM)	2.67 Hz (160.2 CPM)
23.80 Hz (1428 CPM)	

EXAMPLE

$$\frac{2 \times 120{,}000 \text{ CPM}}{400 \text{ lines}} = \frac{240000}{400} = 600 \text{ CPM} = 10 \text{ Hz}$$

ATTENTION: Emonitor uses the 5.30 Hz (318 CPM) filter for an integrated measurement. It uses the 2.67 Hz (160.2 CPM) filter for a non-integrated measurement.

- **Overall** - Typically this filter maps to a specific high pass filter in the data collector and is available for magnitude, spectrum, and time waveform measurements. In the Enpac 2500, it maps to the Enpac filters shown in the table below, depending on the results of comparing the filter choice to the formula below.

  Emonitor uses the following formula.

$$\frac{2 \text{ (max frequency)}}{\text{number of lines}}$$

  Emonitor uses an overall filter with one of the low frequency cutoffs shown in the table below. It uses the filter whose cutoff is greater than or equal to the result of the formula.

Integrated (A to V, A to D, V to D)	Non-integrated (A, V, and D)
0.36 Hz (21.6 CPM)	0.18 Hz (10.8 CPM)
5.30 Hz (318 CPM)	2.67 Hz (160.2 CPM)
23.80 Hz (1428 CPM)	

EXAMPLE

$$\frac{2 \times 30{,}000 \text{ CPM}}{400 \text{ lines}} = \frac{60000}{400} = 150 \text{ CPM} = 2.5 \text{ Hz}$$

ATTENTION:
Emonitor uses the 5.30 Hz (318 CPM) filter for an integrated measurement. It uses the 2.67 Hz (160.2 CPM) filter for a non-integrated measurement.

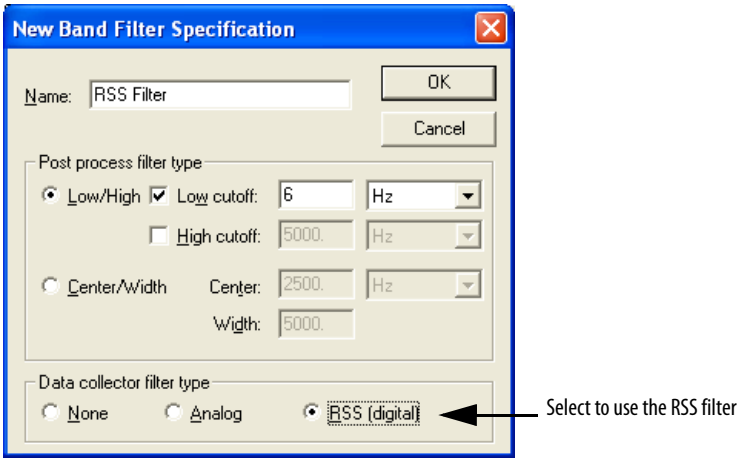
IMPORTANT The available filters in Emonitor depend on the data collectors you select as active data collectors using Tools > Set Active Collectors. If you have two or more active data collectors, you may not see all the selections available for the Enpac. If you have no active data collectors, you see all the selections for every data collector, not just the selections for the Enpac.

RSS Overall

The Enpac 2500 allows you to take a digital overall measurement, instead of analog. This set up makes measurement collection faster. Be aware that this Root Sum Squares (RSS) overall value is not as complete because it does not include the power in the signal from below the first spectral bin or above the highest spectral bin. Please note that the RSS overall values may not trend well with analog overall measurements.

To use the RSS filter, you must create a Band Filter in Emonitor. Choose Setup > Band Filter and click New. Then select RSS (digital) as the filter type.

Figure 9 - RSS Filter



IMPORTANT Using the 0.36 Hz (21.6 CPM) low cutoff filter for integrated measurements or the 0.18 Hz (10.8 CPM) low cutoff filter for non-integrated measurements will always cause the Enpac 2500 to go into a long autorange mode. Only use these filter settings when very low frequency data is required.

Measurement Units

Emonitor and the Enpac 2500 support many different measurement units. The measurement units that appear in the Enpac 2500 are text that depend on:

- the type of measurement definition.
- the units for the measurement definition.
- the transducer specification used in the collection specification for the measurement definition.

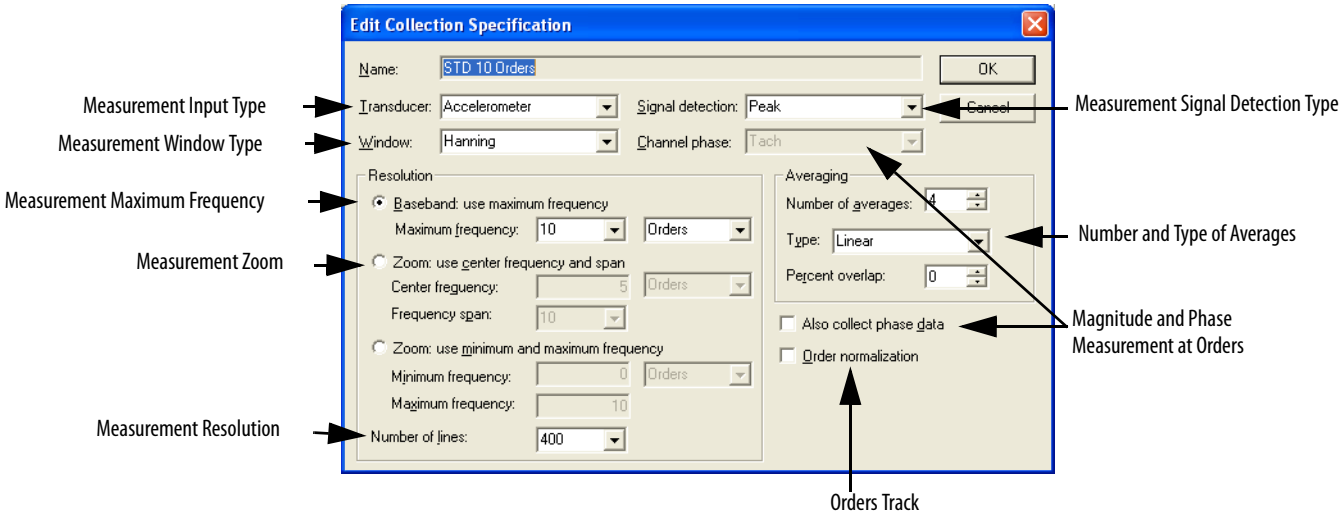
The Enpac 2500 can collect data for English units, Metric units, or Decibels. It uses the units that you select in Emonitor. You can select units from a single system (for example, English g, in/sec, etc.), or you can mix units from different systems (for example, English gs, in/sec and Metric m/s^2, m/sec) in one list. The Enpac 2500 loads the exact text string from Emonitor. The signal detection type (peak, rms, true peak, etc.) is appended to the units on the Enpac 2500 screen.

TIP The measurement units cannot be changed after you collect data for the measurement definition.

Setting Up Collection Specifications

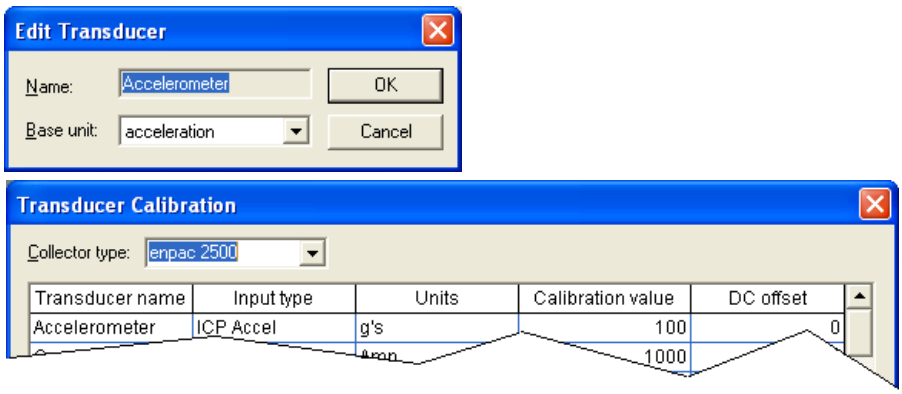
Measurement definitions are controlled in part by the collection specification (Setup > Collection). You select the collection specification when you set up the measurement definition. You can create new collection specifications based on your specific measurement by choosing Setup > Collection.

Figure 10 - Collection Specification dialog



The transducer specification used in the collection specification includes both the base unit and the calibration value.

Figure 11 - Transducer Specification



The figures in a typical measurement setup in the following sections refer to making selections in these dialogs. For example, a table for STD (HZ) 2000 collection specification would look like this.

Table 13 - STD (Hz) 2000 Collection Specification

Transducer	Window	Signal Detection	Fmax	Lines	Phase?	Order Norm?	Averages
Accelerometer	Hanning	Peak	2 kHz	400	No	No	4 linear

The table for the transducer specification in the STD (Hz) 2000 collection specification would look like this.

Table 14 - Transducer specification in STD (Hz) 2000 collection specification

Name	Base Unit	Input Type	Units	DC Offset
Accelerometer	Acceleration	ICP Accel	gs	0

Measurement Input Types

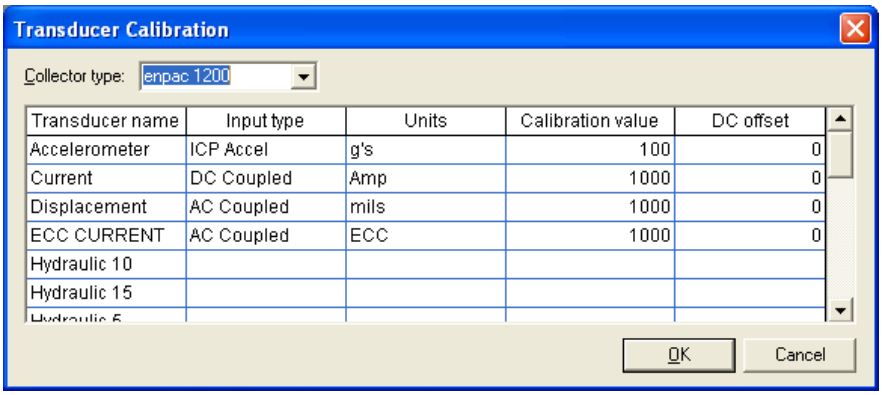
The input type is part of the transducer specification (Setup > Calibration). The transducer is part of the collection specification (Setup > Collection). You select the collection specification when you set up the measurement definition.

Emonitor and the Enpac 2500 support the following input types.

- ICP Accel - Use for ICP accelerometers requiring current from a power supply.
- AC Coupled - Use for AC voltage measurements and non-ICP accelerometers.
- DC Coupled - Use for DC voltage measurements. This includes numeric (process) measurements taken from a DC voltage output.
- **Manual Entry** - Use for numeric (process) measurements where you enter the value for the measurement with the data collector keyboard.

To specify an input type, choose Setup > Calibration, then select the correct Enpac from the Collector list. You can then assign Input types, Calibration, and appropriate Units to the transducer you wish to use.

Figure 12 - Transducer Calibration Dialog Box



Measurement Window Types

The measurement window type is part of the collection specification (**Setup > Collection**). See Setting Up Collection Specifications on page 69. You select the collection specification when you set up the measurement definition.

Emonitor and the Enpac 2500 support the following measurement window types. In general, the Hanning measurement window provides the best compromise of frequency and amplitude accuracy for most predictive maintenance measurements.

- **Hanning** - A general purpose window to use on random type data when frequency resolution is more important than amplitude accuracy. Use this setting for most of your machinery monitoring activities.
- **Rectangular** - The data collector does not apply a window. Use this only for transient signals that die out before the end of the time sample, or for exactly periodic signals within the time sample.
- **Flattop** - Use this when amplitude accuracy is more important than frequency resolution. In data with closely spaced peaks, a Flattop window may smear the peaks together into one wide peak. Use this setting for sinusoidal or calibration signals.
- **Hamming** - A general purpose window that is similar to the Hanning window. It provides better frequency resolution but decreased amplitude accuracy when compared to the Hanning window. You can use it to separate close frequency components.

Measurement Signal Detection Types

The signal detection is part of the collection specification (**Setup > Collection**). See Setting Up Collection Specifications on page 69. You select the collection specification when you set up the measurement definition.

Emonitor and the Enpac 2500 support the following signal detection types.

- **None** - Use for numeric measurements. None defaults to RMS when applied to magnitude or spectrum measurement definition.
- **RMS** - Use for detection of voltage and current. For the frequency domain, the dynamic signal is measured as the square root of the mean of the square of the signal. This is the RMS amplitude of a sine wave at the frequency of interest. For the time domain, the dynamic time signal is squared, integrated over some time period, and then the square root is taken.
- **Peak** - Use for detection of acceleration, velocity, and high frequency energy. This is the peak (0 to maximum) amplitude of a sine wave at the frequency of interest and is calculated from the RMS value.
- **Peak-Peak** - Use for detection of displacement; sometimes used for high frequency energy. This is the peak-to-peak (minimum to maximum) amplitude of a sine wave at the frequency of interest and is calculated from the RMS value.

- **True Peak** - Use to detect impacts and random transients. The dynamic time signal contains the absolute value of the largest peak (positive or negative) within a specified time window. Returns a magnitude value only. If used with a spectrum measurement, Emonitor uses a Peak signal detection type instead. This value is not calculated but is measured directly.
- **True Peak-Peak** - Use to detect impacts and random transients. The dynamic time signal contains the absolute value of the largest peak to peak distance within a specified time window. Returns a magnitude value only. If used with a spectrum measurement, Emonitor uses a Peak-Peak signal detection type instead. This value is not calculated but is measured directly.

Measurement Maximum Frequencies

The measurement maximum frequency is part of the collection specification (Setup > Collection). See Figure on page 69.

You select the collection specification when you set up the measurement definition. Emonitor and the Enpac 2500 support the following maximum frequencies in Hz (CPM).

Table 15 - Maximum Frequencies

Hz	CPM	Hz	CPM	Hz	CPM	Hz	CPM	Hz	CPM
10	(600)	200	(12,000)	1100	(66,000)	3000	(180,000)	12,800*	(768,000)*
20	(1200)	250	(15,000)	1200	(72,000)	3125*	(187,500)*	13,000	(780,000)
25	(1500)	256*	(15,360)*	1250	(75,000)	3200	(192,000)	15,000	(900,000)
32*	(1920)*	300	(18,000)	1280*	(76,800)*	4000	(240,000)	16,000	(960,000)
40	(2400)	320	(19,200)	1300	(78,000)	5000	(300,000)	18,000	(1,080,000
50	(3000)	400	(24,000)	1400	(84,000)	6000	(360,000)	20,000	(1,200,000)
64*	(3840)*	500	(30,000)	1500	(90,000)	6250*	(375,000)*	25,000	(1,500,000)
80	(4800)	600	(36,000)	1600	(96,000)	6400	(384,000)	30,000	(1,800,000)
100	(6000)	625	(37,500)	1700	(102,000)	7000	(420,000)	32,000*	(1,920,000)*
120	(7200)	640*	(38,400)*	1800	(108,000)	8000	(480,000)	40,000	(2,400,000)
125	(7500)	700	(42,000)	1900	(114,000)	9000	(540,000)		
128*	(7680)*	800	(48,000)	2000	(120,000)	10,000	(600,000)		
150	(9000)	900	(54,000)	2500	(150,000)	12,000	(720,000)		
160	(9600)	1000	(60,000)	2560*	(153,600)*	12,500*	(750,000)*		

* These values are available in the Enpac 2500 only in off route data collection

You can either select a value from the drop down list, or you can enter a value in Maximum frequency in the Collection Specification dialog. If you enter a value that does not match one of the values above, Emonitor uses the next higher maximum frequency.

Measurement Resolution

The measurement resolution is part of the collection specification (Setup > Collection). See Setting Up Collection Specifications on page 69. You select the collection specification when you set up the measurement definition.

Emonitor and the Enpac 2500 support the following resolutions.

Table 16 - Measurement Resolutions

Spectral Lines	Time Samples
100	256
200	512
400	1024
800	2048
1600	4096
3200	8192
6400	16,384
12,800	32,768

The values that appear in the Number of lines drop down list in the Collection Specification dialog are those for spectrum measurements. Emonitor uses the corresponding number of time samples from the table above for time measurement definition.

You can calculate the number of time samples from the number of spectral lines using the following formula.

$$\text{time samples} = \text{spectral lines} \times 2.56$$

You can calculate the total time required to collect a time waveform measurement from the Number of lines value and the Maximum frequency value in the Collection Specification dialog (Setup > Collections).

If your Maximum frequency is specified in CPM, convert CPM to Hertz using the following formula.

$$\text{Fmax (Hz)} = \frac{\text{Fmax (CPM)}}{60}$$

Next, find the total collection time for the time waveform measurement using this formula.

$$\text{collection time} = \frac{\text{spectral lines}}{\text{Fmax (Hz)}}$$

EXAMPLE

If you had a **Maximum frequency** value of 7200 CPM and a **Number of lines** value of 400, you would:

ATTENTION: 1. Convert CPM to Hz.

$$\frac{7200\ \text{CPM}}{60} = 120\ \text{Hz}$$

ATTENTION: 2. Find the total collection time.

$$\frac{400\ \text{lines}}{120\ \text{Hz}} = 3.3\ \text{seconds}$$

Number and Type of Averages

The number and type of averages are part of the collection specification (Setup > Collection). You select the collection specification when you set up the measurement definition. See Setting Up Collection Specifications on page 69.

Emonitor and the Enpac 2500 support the following number and types of averages for data collection.

- **Linear** - Up to 4096 averages.
- **Time Synchronous -** Up to 255 averages, and requires a trigger.
- **Exponential -** Up to 99 averages. Uses exponential weighting. Use for measurements on a continuous signal that may be slowly varying. Also use to obtain a uniform statistical error over all frequencies.
- **Peak Hold** - Up to 99 averages. Holds the highest measured value in each bin (line).

Averaging is useful for reducing random errors. Random errors include background vibration due to some source other than the machine being measured. If you collect more averages, you have fewer random errors. However, collecting more averages requires more time.

Overlap processing (Percent overlap) speeds up the averaging process. The overlap amount determines how much of the time samples are overlapped for successive averages. The greater the overlap, the faster the sample can be collected. The disadvantage is that the greater the overlap, the less new data there is, and the greater the influence of random errors.

Order Normalization for Orders Track Spectrum

There are two requirements for implementing Orders Track measurements. The Fmax value must fall within the range of 10...5000 Hz, and the machine speed may not vary by more than 10% during the measurement collection. For example, if you set up a machine that runs at 3500 RPM for an Fmax of 100 Orders, the measurement will not work because the required Fmax is 15,000 Hz.

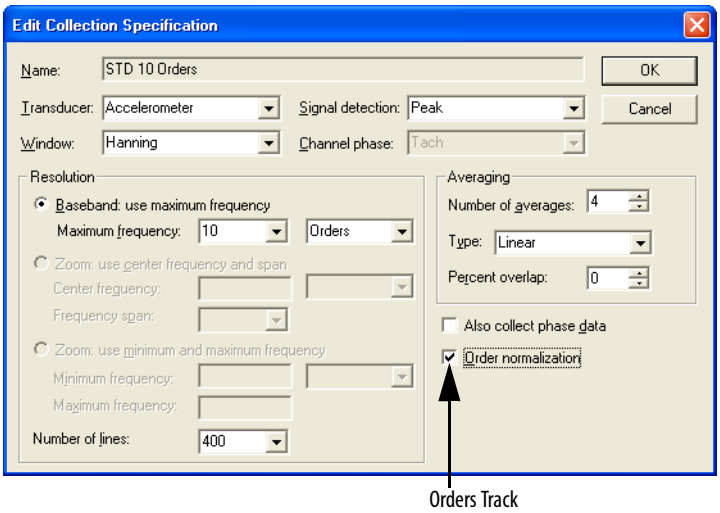
To Set Up Orders Track FFT Collection

The Enpac supports the specification and collection of a spectrum with an Fmax defined in terms of number of orders for a varying machine speed. For Orders Track data collection, you are required to use a trigger to continually determine machine speed.

With orders tracking, the sampling rate is not fixed during the collection period. Instead, the time spacing between the samples may be constantly varying so that a fixed number of samples per shaft revolution is collected. The x-axis of the time waveform is no longer measured in seconds, but instead it is measured in degrees or shaft position. From this, the corresponding spectral information is no longer measured in Hz or CPM, but instead it is measured in orders. Orders tracking removes all non-synchronous frequencies from the spectrum.

To set up route points using Orders Track collection, follow these steps.

1. Create a collection specification in Emonitor that uses Orders for the maximum frequency (Fmax). Also, check the Order Normalization checkbox to signify Orders Track to the Enpac.



2. Create a Spectrum measurement definition that uses the Orders Based collection specification.
3. Tag that measurement and load it to the Enpac with a list.

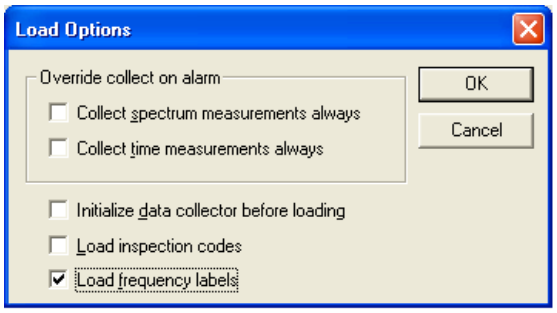
For Orders Track data collection, you are required to use a trigger to continually determine machine speed.

Orders tracking analysis can be used effectively to diagnose the vibrations of variable speed machines. The orders tracking yields data in the revolution domain, not the time domain. In an orders spectrum, signals that are periodic in the revolution domain appear as peaks and orders or harmonic components remain fixed in their position through speed changes. This is a clear advantage when comparing the characteristics of variable speed machines over a period of time.

Using Frequency Items for the Diagnostic Frequency Cursor

Using the Enpac 2500, you set up frequency items in Emonitor and download them to the Enpac. Then, you can review the data using the Diagnostic Frequencies cursor. This feature allows you to diagnose the peaks you see in the Enpac using the frequency items from the host software.

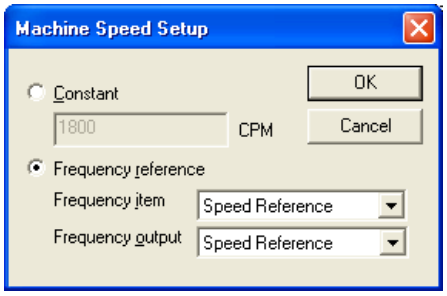
In order to load the Diagnostic Frequency labels, you must check the Load Frequency Labels checkbox in the Load Options dialog.



Setting Up Speed References

The Enpac can determine the speed using speed references in Emonitor. The speed reference value is used by the frequency items to calculate the Fmax of the dependent measurements.

To set up speed references in Emonitor, double-click in the RPM column in the Location pane. The following dialog appears.



You can choose a frequency reference item as your machine speed reference. This allows for machine speeds to be stored and retrieved dynamically. The Enpac supports two types of frequency types: speed reference and linear rotational.

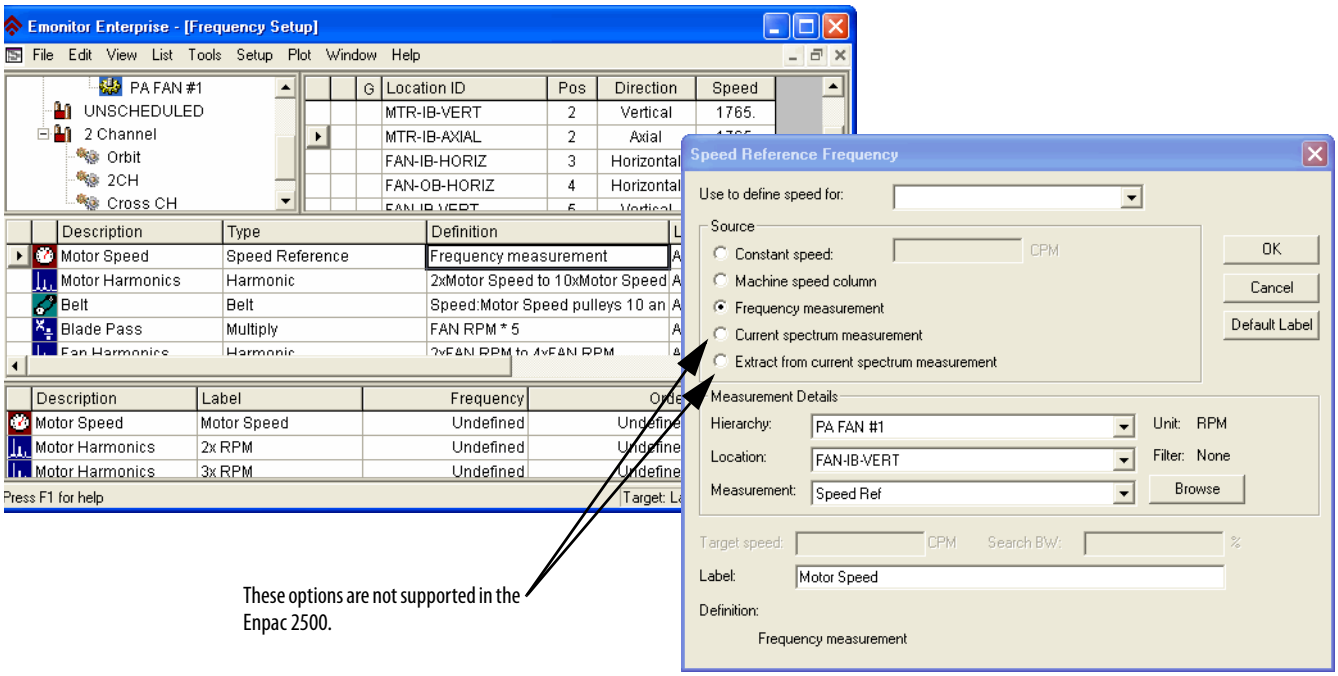
If you want to use a collected measurement from the Enpac to set the machine speed, you have two options.

- Use a manual entry process measurement to enter machine speed by reading it from any instrument in your plant. The measurement can then be referenced for the machine speed, and would be updated every time you unload that measurement.
- Use a measurement with Order normalization checked in the collection specification. The machine speed from an internal or external tachometer will be used for the machine speed. If the Order normalization checkbox is not checked, the Enpac will use a fixed Fmax value and will not calculate the Fmax based on the current speed of the machine.

TIP The Orders normalization checkbox does not produce Orders Tracking measurements when used with speed references.

Emonitor orders all the measurements in the route so that the dependent machine speed measurement is collected first. This way, the route is set up for the most accurate machine speed entry, and the measurements refer to the correct machine speed. The band alarms and frequency labels adjust to changes in the machines speed.

To set up the Speed Reference Frequency for the Enpac, double-click in the Definition column in the Speed Reference row in the Frequency Item pane. The Speed Reference Frequency dialog appears.

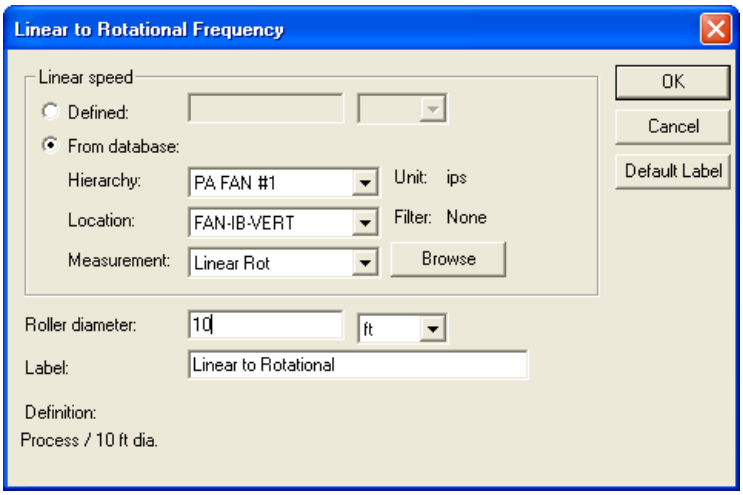


There are three ways to obtain a speed references.

- You can enter a constant for the speed.
- You can use the value in the Machine Speed column for a location on an item in the Hierarchy Tree.
- You can use the value from a process measurement as the speed.

Press **F1** to find out more information about each option in the Speed Reference Frequency dialog.

You can set up the Linear to Rotational Frequency by double-clicking the Definition column in the Linear to Rotational row in the Frequency Item pane. This dialog allows you to set up a rotational frequency item based on a linear speed. .



Press **F1** to find out more information about each option in this dialog.

Setting Up Measurement Definitions

The topics in this section describe setting up different types of measurement definitions in Emonitor for your data collector. The topics describe the way Emonitor works with the Enpac 2500 for each different type of measurement definition. These include answers to questions such as:

- How does Emonitor handle measurement units and alarms available in Emonitor but not supported in the Enpac 2500?
- How many orders of magnitude and phase can the Enpac 2500 collect?
- How does the Enpac 2500 support collecting a spectrum when a magnitude measurement is in alarm?

Emonitor combines measurement definitions when it creates a load file from a list of measurement definitions. For example, Emonitor can combine the measurement definitions at a location so that the data collector collects all the measurements at one time. This makes data collection faster and more efficient since you do not have to start each measurement individually. For more general information on setting up measurement definitions, see the Emonitor online help.

Magnitude Measurement Definitions

Emonitor and the Enpac 2500 support magnitude measurement definitions. This topic lists the unique characteristics of the Enpac 2500 that you may need to know when setting up and collecting magnitude data.

Measurement Units Not Supported in the Enpac 2500 Data Collector

- Magnitude measurement definitions with unit not supported by the Enpac 2500 map to units of USER (eus) in the data collector. This results in a process (DC) voltage measurement.
- For a list of supported measurement units, see Measurement Units on page 68.

Magnitude Alarms in the Enpac 2500 Data Collector

- The Enpac 2500 supports above, below, in window, and out of window magnitude alarms.
- You must set Trigger to Yes for any magnitude alarms you want to appear in the Enpac 2500 during data collection.
- For more on how Emonitor combines alarms before sending them to the Enpac 2500, see Alarms and the Data Collector on page 95.

Collecting Magnitude Measurements in Multiple Frequency Bands

You can set up multiple measurement definitions at a location to collect magnitude values for individual frequency bands. Use band filters to define the different frequency bands in the measurement definitions.

Make sure you select None in the Band Filter dialog. This forces the Enpac 2500 to collect a spectrum measurement. After you unload the measurement, Emonitor calculates the magnitude values in the bands from the spectrum.

If your measurements include both magnitude and phase, the Enpac 2500 can collect up to eight orders. If your measurements include magnitude only, the Enpac 2500 can collect up to 200 orders.

Proximity Probe Measurements

- Proximity probes measure the movement of a shaft within a bearing.
- You usually make two types of proximity probe measurements with magnitude measurement definitions. The dynamic or AC component indicates the changing (dynamic) distance between the probe and bearing shaft. The static or DC component indicates the average distance between the probe and the shaft. This is also referred to as the DC gap.

  Dynamic (AC) component

  - Set up a displacement transducer in the Transducer Calibration dialog with Input type set to AC Coupled and Units set mils or um. Make sure you enter the Calibration value that converts the voltage to a displacement.

- Set up a Collection Specification with Transducer set to the AC displacement and Signal detection set to Peak-peak.
- Finish setting up the dynamic proximity probe measurement by setting Data Type to Magnitude and Units to mils or um. You can use a Filter if desired.

Static (DC) component or gap

- Set up a displacement transducer in the Transducer Calibration dialog with Input type set to 'DC Coupled' and Units set to mils or um. Make sure you enter the Calibration value that converts the voltage to a displacement. If you are using the DC Input Module to remove the AC component and attenuate the signal be a factor of 2.5, then you must divide your transducers calibration by 2.5.
- Set up a Collection Specification with Transducer set to the DC displacement and Signal detection set to 'RMS.'
- Finish setting up the dynamic proximity probe measurement by setting Data Type to 'Magnitude and Units to mils or um.' You must set the Filter to 'None' since any type of high pass filtering removes the DC component.

Typical Magnitude Measurement Definitions

This figure shows the setup for a typical magnitude measurement definition

Figure 13 - Magnitude Measurement Definition

Meas. Name	Data Type	Units	Collection	Filter	Storage	Active
Acceleration Mag	Magnitude	g's	STD (Hz) 2000	None	Always/2 Year	Yes

This table shows the STD (Hz) 2000 collection specification.

Table 17 - Collection Specification for Magnitude Measurement Definition

Transducer	Window	Signal Detection	Fmax	Lines	Phase	Order Norm?	Averages
Accelerometer	Hanning	Peak	2 kHz	400	No	No	4 linear

This table shows the transducer specification in the STD (Hz) 2000 collection specification.

Table 18 - Transducer Specification in STD (Hz) 2000 Collection Specification

Name	Base Unit	Input Type	Units	Calibration Value	DC Offset
Accelerometer	acceleration	ICP Accel	g	100	0

This figure shows the setup for a typical set of measurement definitions with multiple frequency bands. Note that the filter specifications used in the tables are not currently defined in the Emonitor database. To define a new filter specification, choose Setup > Band Filters and click New.

Figure 14 - Magnitude with Multiple Frequency Bands Measurement Definitions

Meas. Name	Data Type	Units	Collection	Filter	Storage	Active
Accel Mag Band 1	Magnitude	g's	STD (Hz) 2000	0.8-1.2 Order	Always/1 Year	Yes
Accel Mag Band 2	Magnitude	g's	STD (Hz) 2000	1.2-3.5 Order	Always/1 Year	Yes
Accel Mag Band 3	Magnitude	g's	STD (Hz) 2000	3.5-8.5 Order	Always/1 Year	Yes
Accel Mag Band 4	Magnitude	g's	STD (Hz) 2000	8.5-50% Fmax	Always/1 Year	Yes
Accel Mag Band 5	Magnitude	g's	STD (Hz) 2000	50%-100% Fmax	Always/1 Year	Yes
Accel Mag Band 6	Magnitude	g's	STD (Hz) 2000	0.8-100% Fmax	Always/1 Year	Yes

The filter specifications are shown in the table below:

Table 19 - Filter Specifications for Magnitude with Multiple Frequencies

Name	Low Cutoff	High Cutoff	Data collector filter type
0.8-1.2 Order	0.8 Orders	1.2 Orders	None
1.2-3.5 Order	1.2 Orders	3.5 Orders	None
3.5-8.5 Order	3.5 Orders	8.5 Orders	None
8.5-50% Fmax	8.5 Orders	50% Max Freq	None
50%-100% Fmax	50% Max Freq	100% Max Freq	None
0.8-100% Fmax	0.8 Orders	100% Max Freq	None

Magnitude and Phase Measurements at Orders

Emonitor and the Enpac support collecting the magnitude and phase at orders. This topic describes the steps to set up measurement definitions to collect magnitude and phase with the Enpac. There are several things you may need to know about collecting magnitude and phase at orders.

- You must select Also collect phase data in the collection specification to collect phase.
- You must select Analog when you define orders filters. The Enpac automatically uses its internal order filters if you are collecting phase. If you are collecting only magnitude values and you do not select this option, the Enpac collects a spectrum and Emonitor calculates the magnitudes after unloading.
- When collecting magnitude and phase at orders, the Enpac always collects a spectrum measurement, and then calculates the magnitude and phase values from the spectrum.
- The Enpac can collect phase only at the first through eighth orders.
- The Enpac can collect magnitude only at the first through the eighth orders. If you request additional orders, Emonitor calculates magnitude values at additional orders from the spectrum after unloading the data.
- The Enpac may collect more orders than requested, but it does not collect fewer than requested. Only the requested values are unloaded into Emonitor.
- The Enpac may display a phase value that differs from the value that appears in Emonitor by up to one degree.

- Phase and magnitude measurements at orders require a trigger signal. This can be from the internal laser tachometer or from an external trigger source such as a key phasor.

To Set Up Multiple Measurement Definitions for Magnitude and Phase

You create only one measurement definition for magnitude and phase at each order. The Also collect phase data checkbox in the Collection Specification dialog determines whether you also want to collect phase as well as magnitude data.

1. Create a new measurement definition by selecting Magnitude in the Data Type column in the Measurement Definition pane.
2. Select the units for the measurement definition, using a dynamic unit such as g, m/s2, ips, mm/s, mils, um, or V.
3. Select the measurement filter. To collect the magnitude and phase at an order, select a band filter centered on the order. For example, select (create if necessary) a first order band filter with a Low cutoff of 0.8 Orders, and a High cutoff of 1.2 Orders.

   Refer to Measurement Filters on page 63 for details and the examples on the following pages.

IMPORTANT	It is very important that order band filters be centered on the order. For example, 0.7…1.3 orders, 0.8…1.2 orders, 0.9…1.1 orders. If you do not center the band filters, magnitude and phase readings may not be accurate.

4. Select the collection specification. You must check the Also collect phase data checkbox in the Collection Specification dialog so the data collector collects phase at orders.
5. Select the storage specification. The first measurement definition is now complete.
6. If you want to create more than one measurement, copy the measurement definition by selecting the correct row and choosing Edit > Copy.
7. Move down to the next empty row in the measurement definition spreadsheet, and choose Edit > Paste to paste the copied measurement definition.
8. Edit the new measurement definition by changing the measurement filter. Select a band filter centered on the next order.
9. Repeat steps 6 and 7 to create measurement definitions for the desired orders. You can then include these measurement definitions in a list and load it to the data collector. Remember that you must have a trigger signal to collect magnitude and phase at an order.

Typical Magnitude and Phase Measurement Definitions

this is what the Measurement Definition pane for one through four orders might look like. All measurement definitions have the same units and collection specification.

Figure 15 - Magnitude and Phase Measurement Definitions

DATA TYPE	UNITS	COLLECTION	FILTER	STORAGE	ACTIVE
Magnitude	g's	Mag & Phase	1st Order	Always/1 Year	Yes
Magnitude	g's	Mag & Phase	2nd Order	Always/1 Year	Yes
Magnitude	g's	Mag & Phase	3rd Order	Always/1 Year	Yes
Magnitude	g's	Mag & Phase	4th Order	Always/1 Year	Yes

The following table shows the collection specification for Mag & Phase.

Table 20 - Collection Specification for Mag & Phase Measurement Definitions

Transducer	Window	Signal Detection	Fmax	Lines	Phase	Order Norm?	Averages
Accelerometer	Hanning	Peak	500 Hz	400	Yes	Yes	4 linear

The transducer specification in the Mag & Phase collection specification is shown in the table below.

Table 21 - Transducer Specification in Mag & Phase Collection Specification

Name	Base Unit	Input Type	Units	Calibration Value	DC Offset
Accelerometer	Acceleration	ICP Accel	g	100	0

The filter specifications are shown in the table below.

Table 22 - Filter Specifications in Mag & Phase Measurement Definitions

Name	Low Cutoff	High Cutoff	Data Collector Filter Type
1st Order	0.8 Orders	1.2 Orders	None
2nd Order	1.8 Orders	2.2 Orders	None
3rd Order	2.8 Orders	3.2 Orders	None
4th Order	3.8 Orders	4.2 Orders	None

Numeric (process) Measurement Definitions

Emonitor and the Enpac 2500 support numeric measurement definitions. This topic lists the unique characteristics of the Enpac 2500 that you may need to know when setting up and collecting numeric data.

Measurements Units Not Supported in the Enpac 2500 Data Collector

- You can make a numeric measurement definition for any available measurement unit by setting Data Type to 'Numeric.'
- Numeric measurement definitions with Input type set to 'DC Coupled' with units not supported by the Enpac 2500 map to units of USER (eus). The input type is part of the transducer specification that you select for the collection specification. This results in a process (DC) voltage measurement in the Enpac 2500.
- For a list of support measurement units, see Measurement Units on page 68.

Full Scale Values for Numeric Measurements in the Enpac 2500 Data Collector

- The full scale value in the Enpac 2500 for a numeric measurement is defined as ten times the value of the alarm or the baseline measurement.
- If no alarm or baseline measurement exists for the measurement in the data collector, the Enpac 2500 assumes a full scale value of 10,000.
- A full scale value of 10,000 can be a problem if you want to enter a very large or very small value for the numeric measurement. For example, you can not enter a value greater than the full scale value. If you enter a value that is very small compared to the full scale, the Enpac 2500 may round the value off. If you enter 0.01 with a full scale value of 10,000, the Enpac 2500 stores it as a 0 (zero).

Temperature Measurements

- Set up a temperature measurement definition by setting Data Type to 'Numeric' and Units to 'RPM,' 'CPM,' or 'deg. C.'
- Set up the temperature transducer in the Transducer Calibration dialog with Input type set to 'DC Coupled' and Units set to 'deg. F' or 'deg. C.' Make sure you enter the Calibration value that converts the voltage to a temperature.
- Set up the collection specification to include a Signal detection of 'RMS.'

Machine Speed (RPM) Measurements

- Set up a tachometer measurement definition by setting Data Type to 'Numeric' and Units to 'RPM,' 'CPM,' or 'Hz.'
- Set up the tachometer transducer in the Transducer Calibration dialog with Input type set to 'ICP Accel' for either the internal laser tachometer or an external TTL device (such as entach laser sensor, an optical trigger, or a strobe light with TTL output). Set the Input type to 'AC Coupled' or 'DC Coupled' if your speed sensor has an AC or DC voltage signal proportional to speed. Set Units to 'RPM,' 'CPM,' or 'Hz.' Make sure you enter the Calibration value that converts the voltage to speed.
- Set up a Collection Specification with Transducer set to the tachometer transducer you set up above, Window set to 'Rectangular,' and Signal detection set to 'None.' Do not fill in any fields in the Resolution area or the Averaging area of the dialog.
- Connect the speed sensor to the trigger connector on the Enpac 2500 when collecting data.

Magnitude Alarms in the Enpac 2500 Data Collector

You can use magnitude alarms with numeric measurements.

- The Enpac 2500 supports above, below, in window, and out of window magnitude alarms with numeric measurements.
- You must set Trigger to 'Yes' for any alarms you want to appear in the Enpac 2500 during data collection.
- For more on how Emonitor combines alarms before sending them to the Enpac 2500, see Alarms and the Data Collector on page 95.

Typical Numeric Measurement Definitions

This figure shows the setup for typical numeric measurement definitions. The first two measurements are numeric (DC) voltage measurements, and the third is a numeric manual entry measurement.

Figure 16 - Numeric Measurement Definitions

Meas. Name	Data Type	Units	Collection	Filter	Storage	Active
None Numeric	Numeric	deg. F	Temperature	None	Always/2 Year	Yes
Frequency None	Numeric	RPM	Tachometer	None	Always/2 Year	Yes
None Numeric1	Numeric	PSI	Manual Entry	None	Always/1 Year	Yes

The collection specifications appear in the table below. N/A means not applied.

Table 23 - Collection Specifications for Numeric Measurement Definitions

Transducer	Window	Signal Detection	Fmax	Lines	Phase	Order Norm?	Averages
Temperature	N/A	RMS	N/A	N/A	No	No	N/A
Tachometer	N/A	None	N/A	N/A	No	No	N/A
Manual Entry	N/A	None	N/A	N/A	No	No	N/A

The following table shows the transducer specifications in the collection specifications.

Table 24 - Transducer Specifications in Numeric Collection Specifications

Name	Base Unit	Input Type	Units	Calibration Value(1)	DC Offset
Temperature	Temperature	DC Coupled	deg. F	See note below.	0
Tachometer	Frequency	DC Coupled	RPM	See note below.	0
Manual Entry	None	Manual Entry	None	See note below.	0

(1) Make sure you enter the Calibration value that converts the voltage to a known unit such as speed.

Spectrum Measurement Definitions

Emonitor and the Enpac 2500 support spectrum measurement definitions. This topic lists the unique characteristics of the Enpac 2500 that you may need to know when setting up and collecting spectrum data.

- The Enpac cannot collect phase with a spectrum measurement definition. In other words, do NOT check the Also collect phase data checkbox in the Collection Specification dialog.
- You can choose to have the Enpac 2500 collect a spectrum only if a magnitude measurement at the same location is in alarm. Set the Collect and store condition in the Edit Storage Specification dialog to 'On Magnitude Alarm' for the storage specification for the spectrum measurement definition.

Time Synchronous Averaging in the Enpac 2500 Data Collector

- Time synchronous averaging cancels out the effects of signals not related to the synchronizing trigger. Time synchronous mechanical effects include imbalance, misalignment, eccentricity of bent shafts, blade passing, and gear meshing.
- Time synchronous averaging requires the internal laser tachometer or external trigger.
- Set up a Collection Specification with the averaging Type set to 'Time Synchronous' and enter the Number of averages. Use a large number of averages (such as 20 or 30) to get the desired reduction in non-synchronous effects.

  For more on supported averaging in the Enpac 2500, see Number and Type of Averages on page 74.

Order Normalized Spectra in the Enpac 2500 Data Collector

- Order normalized spectrum measurements have a frequency axis based on multiples of the running speed (orders). This quickly identifies the frequency relationship between each measured vibration amplitude and the running speed of the machine. It is particularly useful on variable speed machinery.
- An order normalized spectrum measurement requires a trigger input to the Enpac 2500.
- Set up a Collection Specification with Window set to 'Hanning.' Select the Maximum frequency in 'Orders,' and make sure to select the Order normalization option. The Averaging can be either 'linear' or 'time synchronous,' but should include at least four averages.
- The Enpac 2500 may collect more orders than required. For example, if you set the Maximum frequency to '10 Orders,' the Enpac 2500 may collect more than ten orders. The Enpac 2500 always collects at least the number of orders you request in the Collection Specification.
- The Enpac 2500 displays an order normalized spectrum. If the Collection Specification dialog has the Also collect phase data checkbox checked, and if the Maximum frequency is eight orders or less, the table on the Enpac 2500 screen shows the magnitude and phase values at each order. If the Collection Specification dialog does not have the Also collect phase data checkbox checked, or if the Maximum frequency is more than eight orders, the table on the Enpac 2500 screen shows magnitude values only. The Enpac 2500 displays a maximum of eight orders in the table.

  If the table has eight orders or less, the Enpac 2500 arrow keys move the spectrum cursor. If the table has more than eight orders, the Enpac 2500 arrow keys scroll the table values.

Proximity Probe Measurements

- Proximity probes measure the position and motion of a shaft within a bearing.
- You can use a spectrum measurement definition to measure the dynamic or AC component of a proximity probe measurement. This indicates the motion of the shaft within the bearing at each frequency.
- Set up a displacement transducer in the Transducer Calibration dialog with Input type set to 'AC Coupled' and Units set to 'mils' or 'um.' Make sure you enter the Calibration value that converts the voltage to a displacement.
- Set up the Collection Specification to include the displacement Transducer, and set the Signal detection to 'Peak-Peak.' You also need to select the window, frequency range, and averaging options.
- Finish setting up the dynamic proximity probe measurement by setting Data Type to 'Magnitude' and Units to 'mils' or 'um.' You can use a Filter if desired, but make sure it does not interfere with the frequency of interest.

Spectrum Alarms in the Enpac 2500 Data Collector

The Enpac 2500 supports band alarms with up to ten bands.

- You can have the data collector collect a spectrum measurement if a magnitude alarm is in alarm. Set the Collect and store condition in the Edit Storage Specification dialog to 'On Magnitude Alarm' for the storage specification for the spectrum measurement definition.
- You must set Trigger to 'Yes' for any alarms you want to appear in the Enpac 2500 during data collection. If you set Trigger to 'Yes' for two or more alarms for the same measurement definition, Emonitor combines the alarms before sending the combined alarm to the Enpac 2500.

  For more on how Emonitor combines alarms before sending them to the Enpac 2500, see Alarms and the Data Collector on page 95.

The Enpac does not support spectrum alarms. You can still set up the alarms for the spectrum measurement definitions. Emonitor tests the data against the alarms after you unload the data.

Typical Spectrum Measurement Definitions

This figure shows the setup for typical spectrum measurement definitions. The first is a standard spectrum, the second is an order normalized spectrum, and the third is a time synchronous spectrum.

Figure 17 - Spectrum Measurement Definitions

Meas. Name	Data Type	Units	Collection	Filter	Storage	Active
Acceleration Spec	Spectrum	g's	STD (Hz) 2000	Overall	Always/1 Year	Yes
Order Norm Spec	Spectrum	g's	10 orders norm	Overall	Always/1 Year	Yes
Time Sync Spec	Spectrum	g's	2 kHz time sysnc	Overall	Always/1 Year	Yes

The following table shows the collection specifications (in the same order as the measurement definition table above).

Table 25 - Collection Specifications for Spectrum Measurement Definitions

Transducer	Window	Signal Detection	Fmax	Lines	Phase	Order Norm?	Averages
Accelerometer	Hanning	Peak	2 kHz	400	No	No	4 linear
Accelerometer	Hanning	Peak	10 orders	400	No	Yes	4 linear
Accelerometer	Hanning	Peak	2 kHz	400	No	No	4 time synch.

The following table shows the transducer specification in the collection specifications.

Table 26 - Transducer Specification in Spectrum Collection Specifications

Name	Base Unit	Input Type	Units	Calibration Value	DC Offset
Accelerometer	Acceleration	ICP Accel	g	100	0

Time Waveform Measurement Definitions

Emonitor and the Enpac support time waveform measurement definitions. This topic lists the unique characteristics of the Enpac that you may need to know when setting up and collecting time waveform data.

- The Enpac 2500 cannot collect phase with time waveform measurement definitions.
- You can choose to have the Enpac collect a time waveform only if a magnitude measurement at the same location is in alarm. Set the Collect and store condition in the Edit Storage Specification dialog to 'On Magnitude Alarm' for the storage specification for the time waveform measurement definition.
- The Enpac supports integrated time waveform measurements (single integration). This means you can collect a time waveform with velocity units using an accelerometer or displacement units using a velocity transducer.
- The length of the time waveform depends on the maximum frequency you select in the collection specification.
- You can calculate the number of time samples from the number of spectral lines (Collection Specification dialog) using this formula.

$$\text{time samples} = \text{spectral lines} \times 2.56$$

You can calculate the total time required to collect a time waveform measurement from the Number of lines value and the Maximum frequency value in the Collection Specification dialog (Setup > Collection Specification).

If your Maximum frequency is specified in CPM, convert CPM to Hertz using this formula.

$$\text{Fmax (Hz)} = \frac{\text{Fmax (CPM)}}{60}$$

Next, find the total collection time for the time waveform measurement using this formula.

$$\text{collection time} = \frac{\text{spectral lines}}{\text{Fmax (Hz)}}$$

EXAMPLE

If you had a Maximum frequency value of 7200 CPM and a Number of lines value of 400, you would:

ATTENTION: 1. Convert CPM to Hz.

$$\frac{7200\ \text{CPM}}{60} = 120\ \text{Hz}$$

ATTENTION: 2. Find the total collection time.

$$\frac{400\ \text{lines}}{120\ \text{Hz}} = 3.3\ \text{seconds}$$

Time Synchronous Averaging in the Enpac 2500 Data Collector

- Time synchronous averaging cancels out the effects of signals not related to the synchronizing trigger. Time synchronous mechanical effects include imbalance, misalignment, eccentricity of bent shafts, blade passing, and gear meshing.
- Time synchronous averaging requires the internal laser tachometer or an external trigger input to the Enpac 2500.
- Set up a collection specification with the averaging Type set to 'Time Synchronous' and enter the Number of averages. Use a large number of averages (such as 20 or 30) to get the desired reduction in non-synchronous effects.

  For more on supported averaging in the Enpac, see Number and Type of Averages on page 74.

Typical Time Waveform Measurement Definitions

This figure shows the setup for a typical time waveform measurement definition.

Figure 18 - Time Waveform Measurement Definitions

Meas. Name	Data Type	Units	Collection	Filter	Storage	Active
None Time	Time	g's	STD 10 Orders	None	Always/1 Year	Yes

The following table shows the collection specification.

Table 27 - Collection Specification for Time Waveform Measurement Definition

Transducer	Window	Signal Detection	Fmax	Lines	Phase	Order Norm?	Averages
Accelerometer	Hanning	Peak	2 kHz	400	No	No	1 linear

The following table shows the transducer specification in the collection specification.

Table 28 - Transducer Specification in Time Waveform Collection Specification

Name	Base Unit	Input Type	Units	Calibration Value	DC Offset
Accelerometer	Acceleration	ICP Accel	g	100	0

Voltage Measurement Definitions

Emonitor and the Enpac support measurement definitions with units of volts (AC or DC). You can collect several different types of voltage measurements. This topic shows the typical measurement definition setup for three voltage measurements.

Voltage is similar to other units in that you can collect magnitude, numeric, spectrum, and time waveform voltage measurements.

Typical Voltage Measurement Definitions

This figure shows the setup for three typical voltage measurement definitions.

Figure 19 - Voltage Measurement Definitions

Meas. Name	Data Type	Units	Collection	Filter	Storage	Active
None Spec	Spectrum	V	Volts AC	None	Always/1 Year	Yes
None Mag	Magnitude	V	Volts AC	None	Always/1 Year	Yes
None Numeric	Numeric	Vdc	Volts DC	None	Always/1 Year	Yes

The following table shows the collection specifications.

Table 29 - Collection Specifications for Voltage Measurement Definition

Transducer	Window	Signal Detection	Fmax	Lines	Phase	Order Norm?	Averages
Voltage	Hanning	RMS	2 kHz	400	No	No	4 linear
Voltage DC	Rectangular	None	2 kHz	400	No	No	4 linear

TIP The `Voltage' transducer is for Volts AC. The `Voltage DC' transducer is for Volts DC.

The following table shows the transducer specifications in the collection specifications.

Table 30 - Transducer Specifications in Voltage Collection Specification

Name	Base Unit	Input Type	Units	Calibration Value	DC Offset
Voltage	Voltage	AC Coupled	V	1000	0
Voltage DC	Voltage	DC Coupled	Vdc	1000	0

Combining Measurement Definitions for a Location

You can use Emonitor to set up many different measurement definitions for data collection at a location. These can include magnitude, spectrum, time waveform, and numeric measurements. You can then select the measurement definitions you want to load to the data collector by creating a list of those measurement definitions. When you want to load the data collector, Emonitor builds a load file containing the measurement definitions in the list.

Emonitor combines measurement definitions at each location to make data collection more efficient. This allows you to collect two or more measurements automatically, without having to start each measurement separately. The rules for combining measurement definitions depend on several factors. In general, however, Emonitor can combine measurement definitions at the same location when they have the same:

- Measurement units (part of the measurement definition)
- Measurement filter (part of the measurement definition)
- Transducer calibration and input type (from the transducer specification used in the measurement definitions collection specification)

In addition, there are some specialized cases that allow or prevent Emonitor from combining measurement definitions from the same location when they meet the above conditions.

- In general, Emonitor cannot combine a magnitude and a spectrum measurement if they have different measurement filters.
- Emonitor can combine an envelope acceleration magnitude measurement with a spectrum with the same units.
- Emonitor can combine a non-filtered measurement definition with a high pass, low pass, or band filtered measurement when the band filter is applied by Emonitor after the spectrum is unloaded.
- Emonitor can combine two signatures if they are the same type (time, fixed frequency spectrum, order normalized spectrum) and the same resolution.

Setting Up Tri-axial Measurements

You can set up and collect tri-axial measurements with the Enpac 2500 if you have a tri-axial transducer and a special tri-axial cable for your Enpac. This allows you to collect measurements in three directions without moving the transducer.

Tri-axial measurements require setting up separate locations, and measurement definitions for each of the three transducers. This section shows the method for setting up these measurements.

To Set Up Tri-axial Locations and Measurement Definitions

You must set up a different location for each axis of a tri-axial transducer. The tri-axial data is multiplexed one direction at a time.

1. Open the Database window by choosing Window > Database.
2. Select the Measurement view and click OK.
3. Select the machine in the Hierarchy Tree for which you want to set up tri-axial measurements.
4. In the Location pane, choose View > Pane Options to add the Lo. Channel column to the Location pane. Press F1 in the Pane Options dialog for assistance.
5. Create a Location for the first tri-axial measurement and set Lo. Channel to '1X.'
6. In the Measurement Definition pane, create the measurement definition for that location.
7. Select the location you just created. Choose Edit > Copy to copy the location.
8. Move to an empty row in the Location pane and choose Edit > Paste to paste the location into the spreadsheet.
9. Edit the new location to change the Direction and set Lo. Channel to '1Y.'
10. Repeat steps 7 and 8 to copy and paste the third location into the Location pane. Edit the new location to change the Direction and set Lo. Channel to '1Z.'

    TIP The Location ID and Position must be the same for all three tri-axial measurements.

11. Now include these measurement definitions in a list. You can create a new list or recall the current list.

    The locations must be tagged in order to create a group list.
12. Add the three locations to a group list by double-clicking the Group column in the Location pane. The current group number appears in the Group column. Make sure you assign the locations to the same group number. The group is then loaded with the list to the Enpac 2500.

This figure shows the typical measurement location setup for tri-axial measurements.

Figure 20 - Tri-axial Measurement Location Setup

G	Location ID	Pos	Direction	Category	Lo. Channel	Lo. Mach
1	Location 1	1	Axial	Standard Machine	1X	0.
1	Location 1	1	Horizontal	Standard Machine	1Y	0.
1	Location 1	1	Vertical	Standard Machine	1Z	0.

Meas. Name	Data Type	Units	Collection	Filter
Accel Magnitude	Magnitude	ips	STD 10 Orders	None

Setting Up Alarms, Lists, and Inspection Codes

This section describes the way Emonitor loads alarms, lists, and inspection codes into the Enpac 2500. For more information on alarms, lists, and inspection codes, see the Emonitor online help.

Alarms and the Data Collector

Emonitor and the Enpac 2500 support loading alarms with the list of measurement definitions to the data collector.

Selecting Alarms to Load to the Enpac 2500 Data Collector

- If you want to load an alarm to the data collector with a measurement definition, you must set **Trigger** to 'Yes' in the Alarm spreadsheet in Emonitor.
- If you set **Trigger** to 'Yes' for two or more alarms for the same measurement definition, Emonitor combines them to make a single alarm.

Supported Alarms with the Enpac 2500 Data Collector

This list describes alarms the Enpac 2500 supports, alarms it does not support, and substitutes for some of the unsupported alarms.

- The Enpac 2500 supports above, below, in window, and out of window magnitude alarms for magnitude and numeric measurements.
- You cannot select a magnitude out of window alarm in Emonitor. You must create one by combining an above and a below alarm for the same measurement definition. Emonitor creates an out of window alarm when it builds the load file if both alarms are active.
- The Enpac 2500 does not support spectrum (narrowband) alarms for spectrum measurements. You can still set up spectrum alarms with spectrum measurement definitions. Emonitor tests the measurements against the alarms after you unload the data.

For unsupported alarms, Emonitor tests the measurements against the alarms when you unload the data collector. This means that Emonitor always accurately indicates when a measurement is in alarm, regardless of the number or complexity of the alarm(s). This is true for all active alarms, regardless of their trigger status.

Lists and the Data Collector

Emonitor and the Enpac 2500 support loading lists of measurement definitions to the data collector.

Inspection Codes and the Data Collector

Emonitor and the Enpac 2500 support loading inspection codes to the data collector.

Inspection Code Support in the Enpac 2500 Data Collector

- You can load inspection codes into the Enpac 2500 only with a list.
- You can use only the inspection codes loaded with the list with measurements in that list. This includes both measurements in a list and unscheduled measurements associated with that list.
- You can load up to 100 inspection codes into the Enpac 2500. Emonitor numbers the inspection codes from 1...100. The Enpac 2500 numbers the inspection codes from 00...99.
- The Enpac 2500 displays the first 16 characters of each inspection code.

Loading Inspection Codes to the Enpac 2500 Data Collector

You can load and remove inspection codes.

- You must load the inspection codes when you load a list. You do this by selecting **Load inspection codes** in the Load Options dialog. If you do not select this option, no inspection codes are available for measurements from the list or for unscheduled measurements associated with the list.

You can remove the inspection codes from the Enpac 2500 by initializing the data collector.

Loading and Unloading

This chapter describes using the Enpac 2500 with Emonitor to load and unload lists.

Topic	Page
Setting Up for Communication	97
Loading Lists to the Data Collector	106
Unloading Lists from the Data Collector	113

IMPORTANT For more information about loading lists and the Load/Unload dialog, refer to the Emonitor online help.

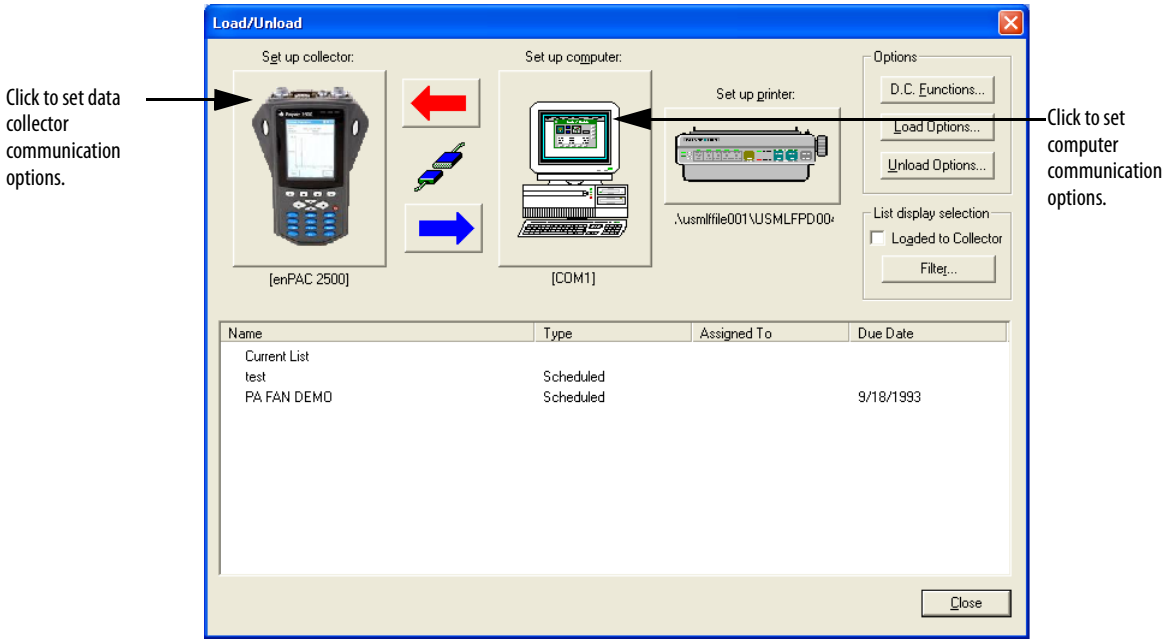
Setting Up for Communication

This section describes the steps to set up communication both in Emonitor and in your data collector. The steps include:

- Selecting the computer communication options in Emonitor.
- Selecting the Enpac 2500 as the current data collector.
- Setting up the data collector to communicate with the computer.
- Installing ActiveSync to communicate through a USB port.
- Connecting the data collector and the computer.

Many of the steps are completed from the Load/Unload dialog (Figure 21). You use the Set Up Collector button and the Set Up Computer button to set up the Enpac 2500 and computer for communication.

Figure 21 - Load/Unload Dialog Box

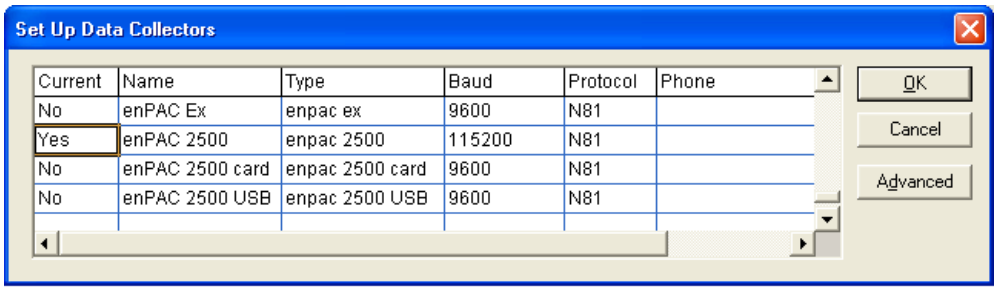


Set Up the Current Data Collector in Emonitor

You can have several active data collectors in Emonitor. However, you must select one specific data collector before you load a list. The data collector you select is called the current data collector. If you use several different models of data collectors, you may need to select the current data collector before unloading and loading. If you use only one model of data collector, you can select the current data collector only once and not change it again.

An icon of the Enpac 2500 appears in the Set Up Collector button in the Load/Unload dialog if it is the current data collector. If not, follow these steps to make the Enpac 2500 the current data collector and select the correct communication settings.

1. Choose Tools > Load/Unload. The Load/Unload dialog appears.
2. Click the large Set Up Collector button in the Load/Unload dialog. The Set Up Data Collectors dialog appears.

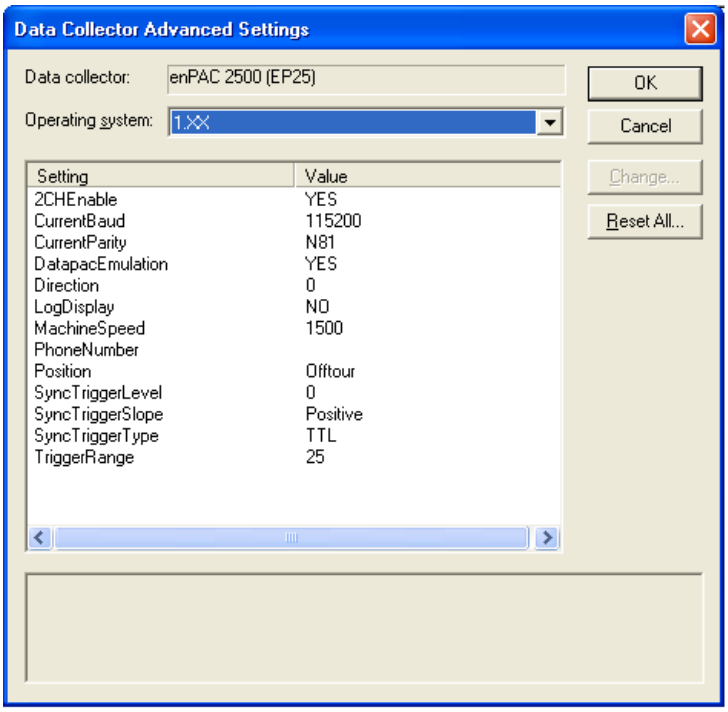


3. The **Current** column shows the word 'Yes' for the current data collector. To make the Enpac 2500 the current data collector, move to the **Current** column for the Enpac 2500. Press Enter or double-click in the column to change the word from 'No' to 'Yes.' The previously selected data collector automatically changes to 'No.'
4. Move to the Baud column in the Enpac 2500 row and set the Baud rate to the same baud rate you select in the Enpac 2500.

   Refer to Set Up the Data Collector for Communication on page 102.
5. Move to the Protocol column and set the Protocol to 'N81.'
6. Click Advanced if you want to change the data/route display and some of the data collection characteristics of the Enpac 2500. You can also select a different version of the data collector operating system.

   The Data Collector Advanced Settings dialog appears.

   See Data Collector Advanced Settings Parameters on page 100 for a description of the parameters.



TIP You must log in with a Supervisor- or Administrator-level user name and password to make any changes to these data collector settings.

IMPORTANT Changing the configuration options for the data collector may prevent Emonitor from communicating with the data collector, or may cause the data collector to malfunction. Make sure you understand a configuration option before you change it.

7. Click OK to close the Data Collector Advanced Settings dialog.

8. Click OK when finished.

Use the descriptions in this table to help you configure the parameters in the Advanced Settings dialog.

Table 31 - Data Collector Advanced Settings Parameters

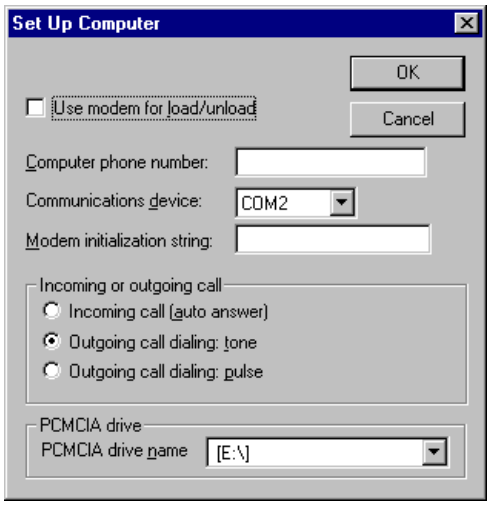
Parameter Name	Description	Values/Comments
Operating System	Sets the operating system version of the data collector.	
2CHEnable	Enables Emonitor to download measurements configured for 2-channel collection.	Options: Yes No
Current Baud	The baud rate for the serial communication.	Recommend setting this to 115200.
Current Parity	The combination of parity, data bits and stop bits. The first letter in the setting is the parity: None, Even, Odd. The first number is the number of data bits. The second number is the number of stop bits. N81 stands for no parity, 8 data bits, and 1 stop bit.	The Enpac uses only N81.
Datapac Enumeration	Configures the Enpac 2500 to collect data the same as the dataPAC.	Options: Yes No
Direction	The default direction to be used for off route measurements. • 0 - None • 1 - Horizontal • 2 - Vertical • 3 - Axial	Options: 0 1 2 3
Log Display	Display plots in log format in the data collector.	Options: Yes No
Machine Speed	The default machine speed to use for off route measurements.	
Phone Number	Not Used	
Position	The default position label to use for off route measurements.	1 to 16 characters
Sync Trigger Level	The amplitude level for externally triggering the measurement.	This parameter is used when you set Trig Level to Fixed in the Instrument Setup screen. Refer to Configure the Data Collection Options on page 42.
Sync Trigger Slope	The input signal slope to be used for externally triggering the measurement.	Options: Positive Negative This parameter is used when you set Trig Level to Fixed in the Instrument Setup screen. Refer to Configure the Data Collection Options on page 42.
Sync Trigger Type	Sets the trigger type.	Options: TTL External
Trigger Range	The maximum range (in Volts) that the trigger signal can produce.	

Set Up Computer Communication Options in Emonitor

Before you can load a list into the Enpac 2500, you must first set up the computer communication options in Emonitor. Once you select these communication options, you should not have to change them again unless you change your computer hardware.

1. Choose Tools > Load/Unload.
2. Click the large Set Up Computer button in the Load/Unload dialog.

   The Set Up Computer dialog appears.



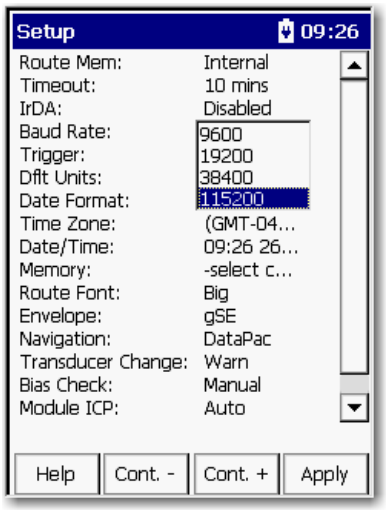
3. Select your Communications Device such as COM1, COM2 or USB.

   Refer to Using the USB Port on page 103 for information on how to connect your computers USB port.
4. Click OK when you are finished.

Set Up the Data Collector for Communication

After setting the computer communication options, you must set the data collector communication options. The baud rate setting in the data collector must match the baud rate setting in Emonitor. The baud rate for the Enpac 2500 is set from the Instrument Setup screen.

1. Power up the Enpac 2500 by pressing the ON/OFF key.
2. Select Setup Utility from the Main Menu and press the READ/OK key. The Setup screen appears.



3. Highlight Baud Rate and press the RIGHT ARROW key.
4. Select the desired baud rate and press the LEFT ARROW key to save your choice.
5. Press **F4** (Apply) when you are finished.

Connecting the Data Collector and Computer (RS-232)

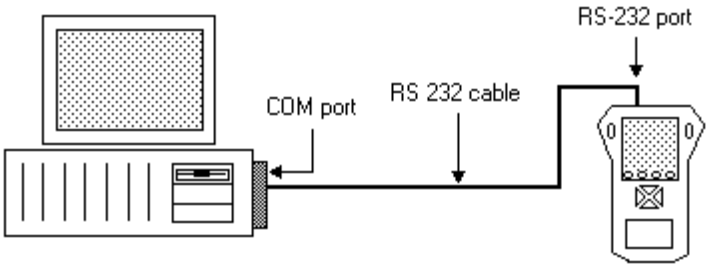
To load and unload data to the Enpac, you must connect the data collector to your computer with a 9-way plug RS-232 cable.

TIP Refer to Using the USB Port on page 103 for information on how to connect the data collector to your computers USB port.

1. Locate the selected serial port (such as COM1) on the back of your computer and insert the connector into it. Tighten the thumbscrews to ensure a reliable connection. Use an adapter if necessary.
2. Insert the other end of the cable into the RS-232 port on top of the Enpac and make sure it is a solid fit. Consult the hardware diagram if needed. Tighten the thumbscrews to ensure a reliable connection.

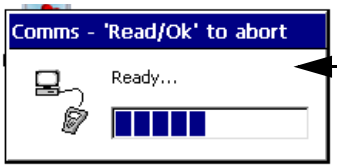
   Figure 22 is a diagram of the hardware connection.

Figure 22 - Diagram of Hardware Connection



3. When the data collector is properly connected to the computer, the cable connection icon in the Load/Unload dialog changes from 'not connected' to 'connected'.

And a communication dialog opens in the Enpac.



This dialog remains open until you close the Load/Unload dialog in Emonitor or press the READ/OK key on the Enpac.

Using the USB Port

You can use your computers USB port to load lists and unload data from the Enpac 2500. This interface requires you to install Microsoft ActiveSync software. It also requires the USB Power Splitter cable (Cat. No. 1441-PEN25-COMS-US).

Installing ActiveSync

If you want to load and unload your Enpac 2500 through your computers USB port, you must install Microsoft ActiveSync. You can download ActiveSync from http://www.microsoft.com/windowsmobile/downloads. Follow the instructions on the website to download and install ActiveSync.

TIP ActiveSync version 4.2 is not supported with the Enpac 2500.

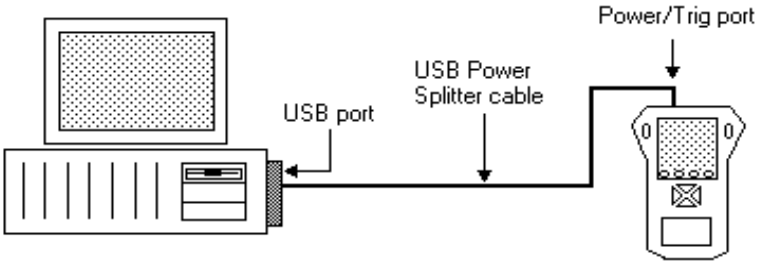
Connecting the Enpac 2500 Data Collector to the Computer

Follow these instructions to connect the Enpac 2500 to your computer by using the USB Power Splitter cable (Cat. No. 1441-PEN25-COMS-US).

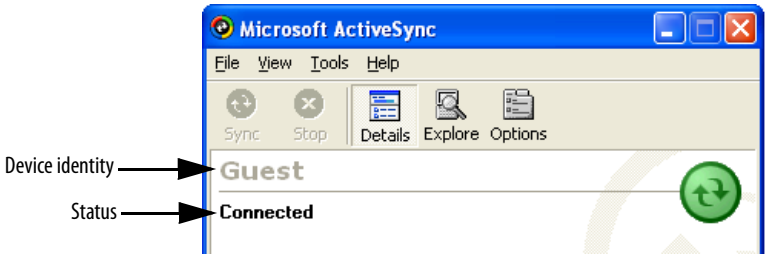
1. Plug one end of the USB Power Splitter cable into the POWER/TRIG connector at the top of the Enpac 2500.

2. Plug the USB end of the power splitter cable into the USB port on your computer.

Figure 23 - Diagram of USB Connection



3. If the ActiveSync or the Get Connected window is not open already on the PC, follow these steps.
   - Select Start > Programs > MicrosoftActiveSync on the computer. The AcitveSync window opens.
   - In the ActiveSync window, select Get Connected from the File menu. The Get Connected window opens.
4. In the Get Connected window, click Next.
5. In the New Partnership window on the computer, click No in response to the question 'Would you like to set up a partnership?' Then, click Next.
6. The New Partnership window closes and the ActiveSync window shows you are connected as 'Guest.'



TIP If the connection fails, try it again, making sure you follow steps 3 and 4 in close sequence. You may need to unplug the USB cable from your computer and reconnect it to the USB port. If the connection still fails, use the ActiveSync Troubleshooter (Help > Microsoft ActiveSync Help) to help you identify and correct problems.

7. When you set up for communication in Emonitor, select Enpac 2500 USB as your current data collector and USB as your communication device.

   See Set Up the Current Data Collector in Emonitor on page 98 and Set Up Computer Communication Options in Emonitor on page 101 for more information.

8. When the data collector is properly connected to the USB port, the cable connection icon in the Load/Unload dialog changes from ‘not connected‘ to ‘connected‘.

TIP If the cable connection icon does not change, try closing and reopening the Load/Unload dialog box.

And the Enpac displays the message ‘Busy... Communications in progress...‘.

TIP The communication message remains on the screen until you close the Load/Unload dialog in Emonitor.

9. Proceed with loading and unloading as you would with a RS-232 connection.

Using a PCMCIA Card Reader

You can use an internal or external PCMCIA card reader to load lists and unload data from a Enpac memory card. The card reader must be capable of using ATA cards as mass storage devices, and must be addressable similar to a floppy drive, such as drive D or drive E.

Using a memory card drive allows you to load lists and unload data directly to the memory card, so you can simply take the card out of the Enpac and put it in your computers card drive. Follow these steps to use a card reader for loading and unloading.

1. The default drive for the card reader is drive E. If this is not valid for your configuration, you can change the drive letter by selecting PCMCIA drive name in the Set Up Computer dialog.

   See Set Up Computer Communication Options in Emonitor on page 101 for more information if needed.

2. When you set up for communication in Emonitor, select Enpac 2500 card as your current data collector. See Set Up the Current Data Collector in Emonitor on page 98 for more information if needed.
3. Proceed with loading and unloading as you would with a data collector.

Loading Lists to the Data Collector

After you connect the data collector to the computer, you can load one or more lists to the data collector. This section discusses preparing and initializing the data collector, loading inspection codes, selecting the list, and other load options.

IMPORTANT	When loading large lists to the Enpac 2500, recommended practice is to connect the power supply to the Enpac 2500. This disables the automatic timeout feature (Instrument Setup) which could cause potential loss of data during the loading process.

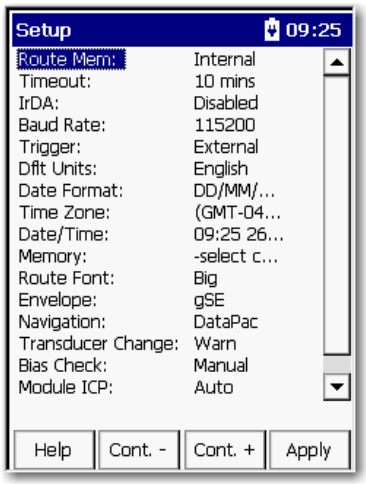
Preparing the Data Collector before Loading

Emonitor can load data to either the Enpac internal memory, or to a memory card. You control the destination for the data with the Route Mem parameter in the Setup screen in the Enpac 2500.

1. Make sure you have correctly connected the data collector to the computer.

   Refer to Connecting the Data Collector and Computer (RS-232) on page 102.

2. Power up the data collector.
3. If you are going to load data to a memory card, insert the card into the PCMCIA slot in the bottom of the Enpac.
4. From the Main Menu screen, select Setup Utility and press the READ/OK key. The Setup screen appears.



5. Highlight Route Mem and press the RIGHT ARROW key to display the following choices:
   - **Internal** - Load the data to the Enpac internal memory.
   - **Storage Card** - Load the data to the memory card in the Enpac.
   - **SD Card** - Load the data to the SD memory card in the Enpac.
6. Select the destination and press the LEFT ARROW key to save your choice.
7. When finished, press F4 (Apply).

Initializing the Data Collector before Loading

If data already exists in the data collector but you do not need it anymore, you can erase the data by initializing the data collectors memory using Emonitor. Make sure that you no longer need the data before deleting it.

TIP You initialize the Enpac internal memory and memory card separately. This is determined by the Route Memory setting in the Setup screen.

Before you initialize the Enpac memory, make sure Emonitor and the data collector are properly connected. If not, see Connecting the Data Collector and Computer (RS-232) on page 102.

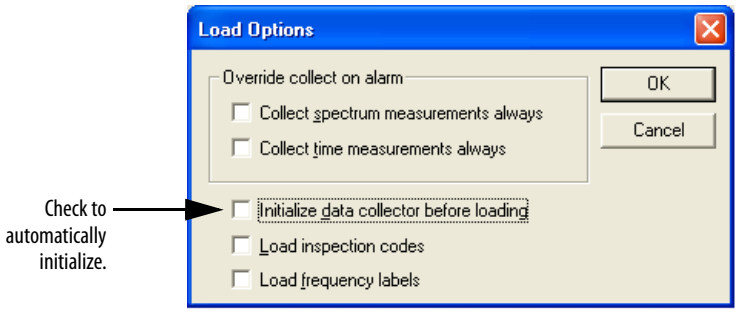
There are two ways you can initialize the Enpac using Emonitor, either automatically before loading a list, or manually at any time. You can also use the Enpac to initialize memory.

Refer to Instrument Configuration Parameters on page 44 for details on how to initialize memory using the Enpac.

IMPORTANT Initializing the data collector memory erases the existing data. Be sure that you no longer need the data before deleting it.

To Automatically Initialize the Data Collector before Loading a List

1. Choose Tools > Load/Unload.
2. Click the Load Options button in the Load/Unload dialog. The Load Options dialog appears.



3. Check the Initialize data collector before loading checkbox.
4. Click OK.

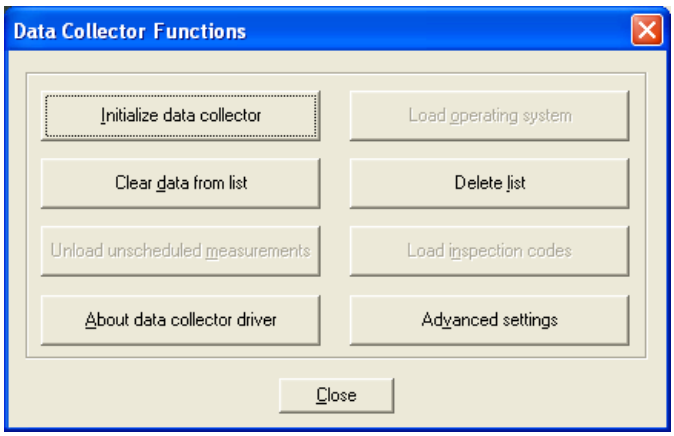
To Manually Initialize the Data Collector Any Time

You must have the Enpac 2500 connected to the computer. You can also use the Enpac 2500 to initialize memory.

TIP If you are manually initializing the memory card, you must also have the card in the drive.

Refer to Inserting and Removing a Memory Card on page 48.

1. Choose Tools > Load/Unload.
2. Click the D.C. Functions button in the Load/Unload dialog. The Data Collector Functions dialog appears.

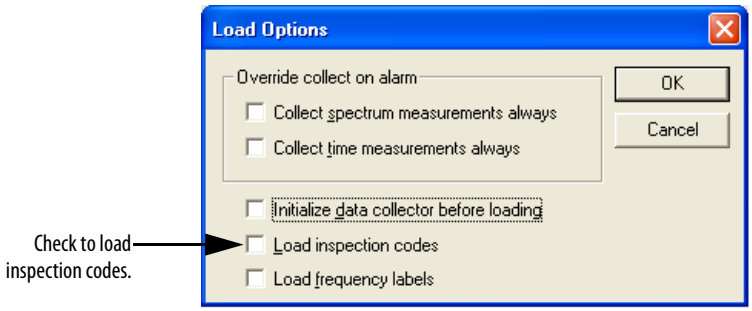


3. Click the Initialize Data Collector button. A progress bar appears providing a status of the initialization.
4. When initialization is complete, click Close.

Loading Inspection Codes

Emonitor and the Enpac support loading inspection codes with a list. The Enpac stores inspection codes with a loaded list. You can only load inspection codes with a list.

1. Choose Tools > Load/Unload.
2. Click the Load Options button in the Load/Unload dialog. The Load Options dialog appears.



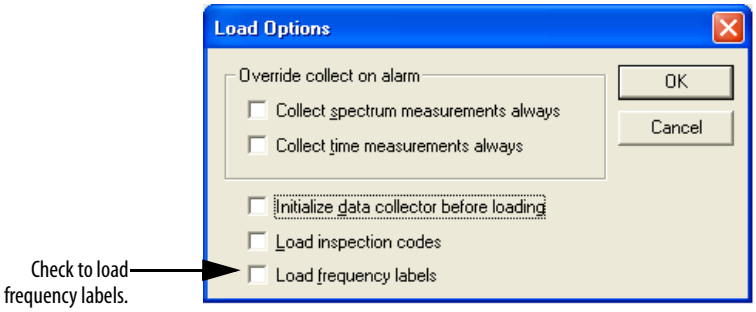
3. Check the Load Inspection Codes checkbox.
4. Click OK. Now inspection codes will be loaded with your lists.

Loading Frequency Labels

With the Enpac and Emonitor, you can load frequency labels so that you can use the Diagnostic Frequency cursor. The frequency labels are the items in the Label column in the Frequency Output pane in the Emonitor.

1. Choose Tools > Load/Unload.
2. Click the Load Options button in the Load/Unload dialog.

   The Load Options dialog appears.



3. Check the Load Frequency Labels checkbox.
4. Click OK.

   The frequency labels will be loaded with your lists.

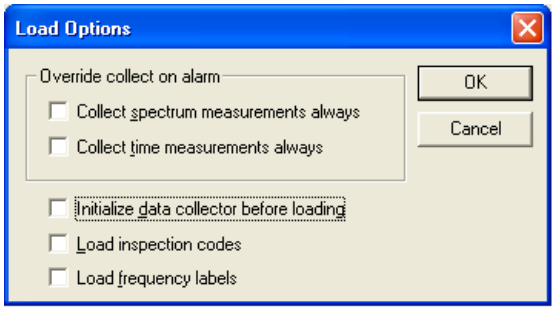
Overriding the Collect on Alarm Setting

Emonitor allows you to collect and store a spectrum or time waveform when a magnitude measurement at the same location is in alarm. You do this by setting the Collect and store condition in the storage specification for a spectrum measurement definition to 'On Magnitude Alarm.'

At some point you may want to collect a spectrum or time waveform even when the magnitude measurement is not in alarm. For example, you may want to collect a spectrum the first time you collect data for the machine. Instead of changing the storage specification, you can Override collect on alarm in the Load Options dialog.

1. Choose Tools > Load/Unload.
2. Click the Load Options button.

   The Load/Unload dialog appears.



3. Check the desired option under Override collect on alarm.
   - Collect spectrum measurements always - Collects all spectrum measurements, regardless of the settings in the storage specification for the measurement definition.
   - Collect time measurements always - Collects all time waveform measurements regardless of the settings in the storage specification for the measurement definition.
4. Click OK. Now you can collect all the spectrum and/or time waveform measurements in the list.

IMPORTANT	You must turn these load options off before loading a list if you want to collect spectrum and/or time waveform only on alarm.

Selecting the List(s)

Emonitor and the Enpac support loading more than one list at a time, so you may select more than one list to load. The size of the lists limits the number of lists you can load at one time.

1. Choose Tools > Load/Unload.
2. Make sure the data collector and computer are connected.

   If not, see Connecting the Data Collector and Computer (RS-232) on page 102.
3. Make sure you have selected the desired destination (internal memory or card) in the Enpac 2500.

   Refer to Preparing the Data Collector before Loading on page 106.
4. Select the list types to show in the list display by clicking Filter in the Load/Unload dialog.

   Lists appear in the order of the next collection date. A red check mark may appear next to the list, indicating that the list has been loaded to a data collector.
5. Select one or more lists from the list display by clicking on the list name.

Loading Selected Lists to the Data Collector

After connecting the Enpac and computer, selecting the correct communication settings, and selecting one or more lists, you are ready to load the data collector.

IMPORTANT	When loading large lists to the Enpac 2500, recommended practice is to connect the power supply to the Enpac 2500. This disables the automatic timeout feature (Instrument Setup) which could cause potential loss of data during the loading process.

TIP	It may take some time for Emonitor to build load files for large lists. You can save time by using Quickload lists and choosing Tools > Update Quickload Files to build the load files when you are not using the computer. For more information on Quickload lists, see Emonitor online help.

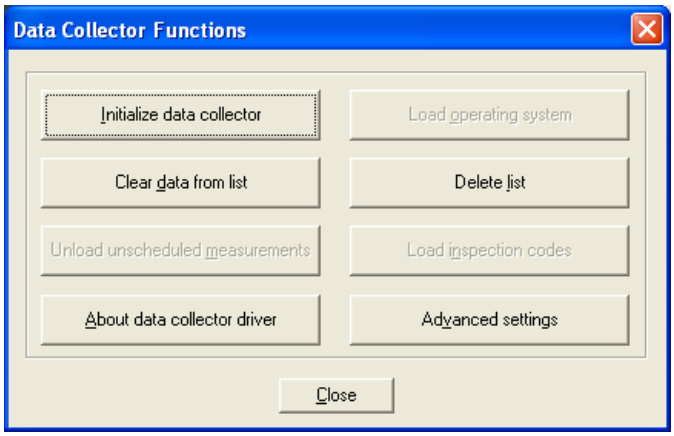
1. Choose Tools > Load/Unload. The Load/Unload dialog appears.
2. Select the desired list or lists.
3. Click the Load button in the Load/Unload dialog. The following series of events occurs.
   - Emonitor builds the load file and shows a progress bar. If you wish to stop the process, click Abort.
   - Emonitor loads the file into the data collector and a second progress bar appears.
4. When finished, click Close.

Displaying the Data Collector Driver Version Number

The data collector driver is the software that allows Emonitor to communicate with the Enpac. You can display the data collector driver version number in Emonitor.

1. Choose Tools > Load/Unload. The Load/Unload dialog appears.
2. Make sure the correct data collector appears in the Set Up Collector button.

   If not, see Connecting the Data Collector and Computer (RS-232) on page 102.
3. Click the D.C. Function button. The Data Collector Function dialog appears.



4. Click the About data collector drive button. This displays the driver version number.
5. Click OK to close the Data Collector Functions dialog.

Unloading Lists from the Data Collector

Once you collect data you can unload it for storage in your Emonitor database by connecting the Enpac and computer and transferring the information. You can unload unscheduled measurements to your Emonitor database at the same time as list data. You can automatically print reports after unloading data from the data collector.

IMPORTANT	When loading large lists to the Enpac 2500, recommended practice is to connect the power supply to the Enpac 2500. This disables the automatic timeout feature (Instrument Setup) which could cause potential loss of data during the loading process.

IMPORTANT	For more information on unloading lists and unload options see the Emonitor online help.

Unloading Lists in Emonitor

1. Choose Tools > Load/Unload. The Load/Unload dialog appears.
2. Make sure the data collector and the computer are connected.

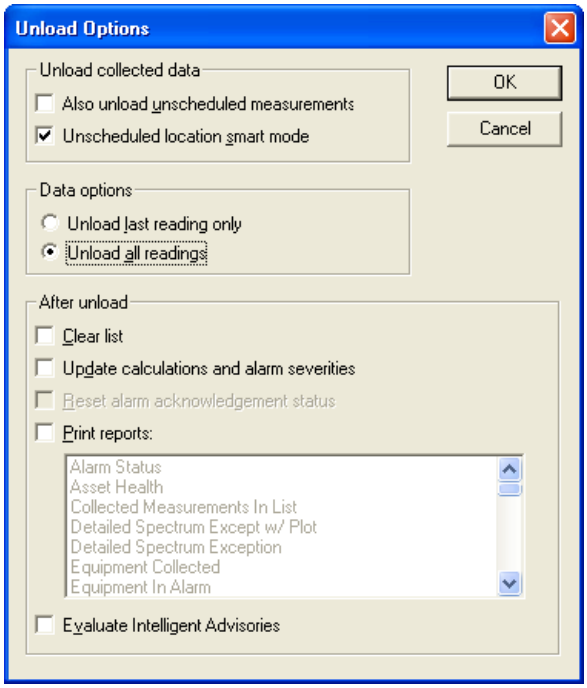
   If not, see Connecting the Data Collector and Computer (RS-232) on page 102.
3. Select the desired list or lists.

   See Selecting the List(s) on page 111.
4. Click the Unload button in the Load/Unload dialog. The following series of events occurs.
   - Emonitor unloads the file from the data collector and shows a progress bar, telling you that it is unloading the file and updating the database.
   - When the unload is complete, the progress bar closes in Emonitor.
5. Click Close.

Unloading Multiple Measurements Points in Emonitor

With the Enpac, you can collect multiple readings for a single measurement definition. All of the data for each measurement definition can be unloaded to the Emonitor database.

1. Click the Unload Options button in the Load/Unload dialog. The Unload Options dialog appears.



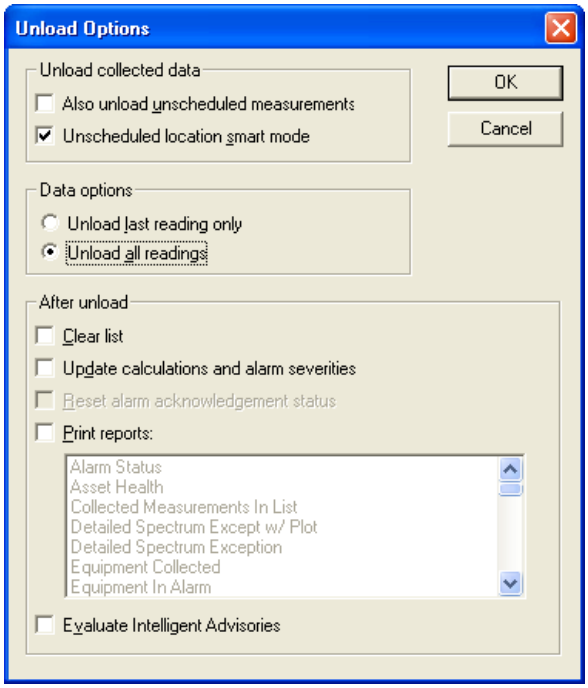
2. Select Unload all readings.
3. Click OK.

Unloading Unscheduled (off route) Data from the Enpac 2500 Data Collector

Unscheduled measurements are measurements that are taken with the Off Route function in the Enpac. They are called off route measurements in the data collector. See the Emonitor online help for more information on setting the Unscheduled Measurement Destination.

You can unload the unscheduled measurements automatically when unloading a list.

1. Click the Unload Options button in the Load/Unload dialog. The Unload Options dialog appears.



2. Check the Also unload unscheduled measurements checkbox.
3. Click OK.

Unloading Measurements using Smart Unscheduled Mode

You can collect off route measurements in the Enpac 2500 that match your existing measurement definitions in Emonitor. This is done by choosing one of the pre-defined measurement icons on the Off Route Measurement screen in the Enpac. When you unload the data, Emonitor stores the data under the correct measurement definition.

TIP To have Emonitor put all unscheduled measurements in one location, open the Load/Unload dialog and click the Unload Options button. Uncheck the Unscheduled location smart mode checkbox.

If Emonitor can match the unscheduled data to an item in the Hierarchy Tree and a location, then it stores the unscheduled data in measurement definitions under that location. If Emonitor cannot match the data with an existing measurement definition, then it creates a new measurement definition and stores the data there.

If Emonitor cannot match an item in the Hierarchy Tree and a location, it stores the data in the unscheduled destination, set with Tools > Set Unscheduled Dest.

Emonitor tries to match the collection specification for the measurement definition. The rules for matching a collection specification are as follows.

Table 32 - Rules for Matching a Collection Specification

	All types	Magnitude	Spectrum	Time Waveform
All these measurement parameters in the collection specification must match:	Transducer Averaging type Number of Averages Percent Overlap Order Normalization	Transducer Averaging type Number of Averages Percent Overlap Order Normalization Fmax (or Frequency Span) Number of lines	Transducer Averaging type Number of Averages Percent Overlap Order Normalization Fmax (or Frequency Span) Number of lines Signal detection	Transducer Averaging type Number of Averages Percent Overlap Order Normalization Signal detection

If Emonitor cannot match the collection specification, it creates a new collection specification using a code. The new collection specification name has the form XXXXLMSWNNEp, where:

XXXX	maximum frequency
L	number of lines
M	transducer type
S	signal detection
W	window type
NN	number of averages
E	average type
p	phase measurement flag

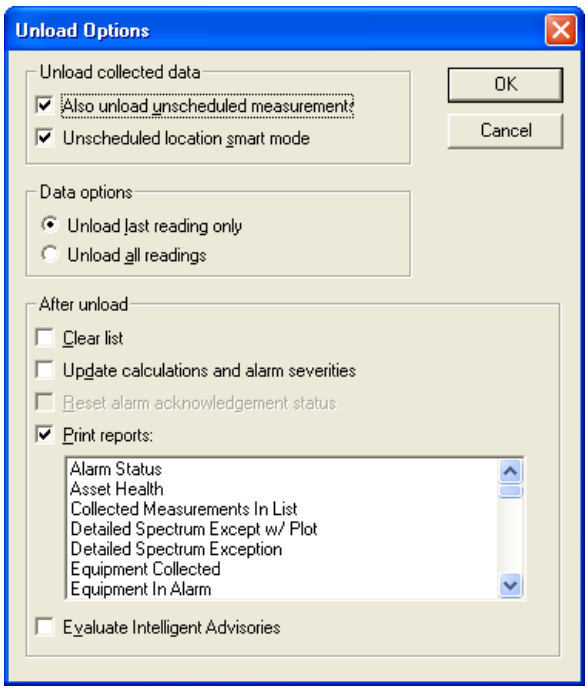
The parameters of the fields in the collection specification name are explained in the Emonitor online help.

Automatically Printing Reports after Unloading

You can select reports to automatically send to a printer after unloading data from the Enpac. The reports contain information on the list of measurements unloaded. See the Emonitor online help for more information on printing reports and plots.

1. Choose Tools > Load/Unload. The Load/Unload dialog appears.
2. Make sure the correct data collector appears in the Set up collector button.

   If not, see Set Up the Data Collector for Communication on page 102.
3. Click the Unload Options button. The Unload Options dialog appears.



4. Check the Print reports checkbox and then select the reports you want Emonitor to run automatically after unloading data.
5. Click OK.

Notes:

Collecting and Reviewing Data

The Enpac 2500 data collector lets you to collect a list of measurement definitions, data for points in a list (route) and for unscheduled data (points not defined in a route). Once you collect your data, you can review the data on the screen or save it to a storage card. You can then unload the data from the route into the Emonitor database for storage and analysis.

Topic	Page
Preparing for Data Collection	119
Collecting Route Data	121
Collecting Offroute Data	138
Reviewing Data	151
Capturing Screens	157

Preparing for Data Collection

There are several things you should do before you start collecting data with the Enpac 2500 data collector, assuming you have already loaded at least one list (route) into the data collector. This section discusses connecting the transducer and setting up the data collector options.

1. Make sure you have a fully charged battery pack.

   See Battery Pack on page 26.

2. Check the date and time on the data collector.

   See Set the Date, Time, and Date Format on page 32.

3. Connect the transducer to the Enpac 2500 data collector.

   See Connect a Transducer to the Data Collector on page 120.

4. Check the data collection options.

   See Select the Data Collection Options on page 120.

Connect a Transducer to the Data Collector

WARNING: To prevent damage to the cable and cable pins, take care when connecting the transducer to the data collector.

Follow these steps to connect a transducer to the data collector.

1. Match the red dot on the connector to the red dot on the data collector.
2. Insert the transducer cable into either Connector CH1 or CH2 on the data collector.

   Do not turn or twist the connector.

   - If you are using an external tachometer signal for phase measurements, connect your tachometer signal to the POWER/USB/TRIGGER connector on the data collector.
   - You must also set the Trigger parameter in the Setup Utility screen to External, otherwise the instrument uses the internal Laser Tachometer to collect the measurement.

See Configure the Data Collection Options on page 42 for more information on setting the Trigger parameter.

Select the Data Collection Options

There are many options that options affect the measurement, the data collection process, and the data display. The Enpac 2500 data collector stores these options even when its powered off. However, you should check these options each time you start data collection. The options are located in the Instrument Configuration screen.

See Configure the Data Collection Options on page 42 for instructions on how to select the data collection options.

Collecting Route Data

This section explains how to collect list (route) data using the Enpac 2500 data collector. Using your predictive maintenance software, you can load a list to the data collector to organize your data collection, then collect data for the measurement definitions in the list (route). Once you have prepared the instrument for data collection you are ready to select a route and collect data.

TIP If you do not use the predictive maintenance software to create and load lists to the data collector, Enpac 2500 data collector automatically creates a route named Default Route for you to use to collect data.

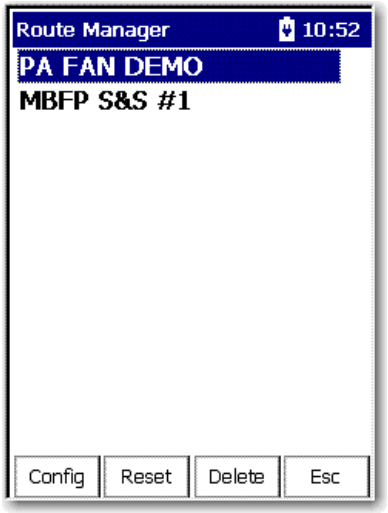
Select a Route

The Enpac 2500 Data Collection program operates on a route. This can be the Default Route or a route you create and unload with your computer software. Routes that you create with your computer software may contain multiple points, and each point may cause the instrument to perform multiple measurements.

TIP If the data collector does not have a route downloaded from the Emonitor software, it lets you create a default route. The default route contains only one measurement point.

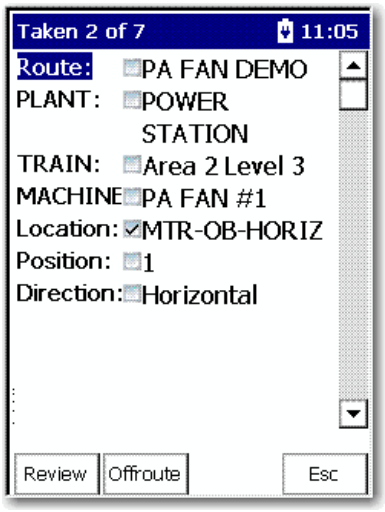
Follow these steps to select a route.

1. Select Data Collection from the Main Menu and press Enter.
2. Select a route from the Route Manager screen and press Enter.



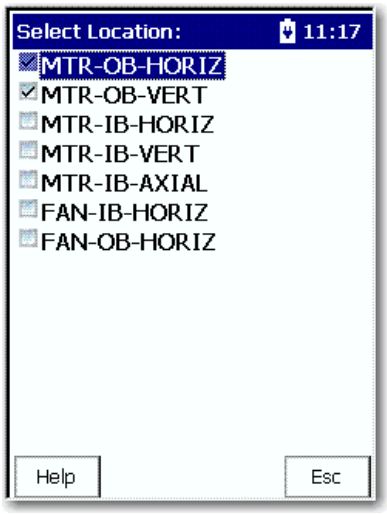
Once you have selected a route, you can open the route by pressing Enter or the Right arrow.

The Data Collection screen appears.



Depending on what you have configured in Emonitor, each of these parameters may offer more selections when you press the Right arrow.

For example, if you select the Location parameter and press the Right arrow you will be taken to the Select Location Screen.



Move through a List

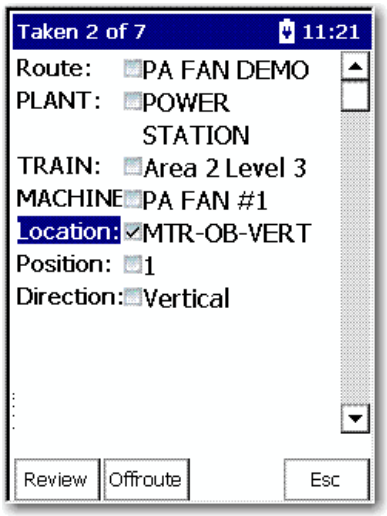
There are several methods for moving through a list:

- If you set Auto Store to On in the Instrument Configuration screen, the data collector automatically goes to the next measurement in the list.
- If you set Auto Store to Off, the data collector goes to the next measurement when you press Enter to accept the measurement.

You can also move between items on a route in the Data Collection window without collecting data. You can skip a measurement point or an entire machine if necessary and continue with the list. You can exit Data Collection mode at any time by exiting the Data Collection screen.

Follow these steps to move to another a measurement or machine.

1. Select the desired hierarchy level (Plant, Train, Machine, and Location).



2. Press the Right arrow key.

   A selection screen appears. A checkmark next to the item indicates that a measurement has been stored.

TIP The Selection screen does not appear if you set Navigation to DataPac in the Setup screen. The Enpac 2500 data collector automatically moves to the next point in the route when the Right arrow key is pressed.

3. Select an item and press the Left arrow.

4. Continue collecting data and move through the list until you reach the end of the list.

Start Data Collection

After setting the data collector options and selecting a route, you are now ready to start data collection.

Follow these steps to start collecting data.

1. Once you have selected a list, you begin collecting data from the designated point on the route.
2. Connect the transducer and press Enter to start a measurement.
3. If necessary, press Enter again to collect a measurement depending on the Auto Store setting in the Instrument Configuration screen.

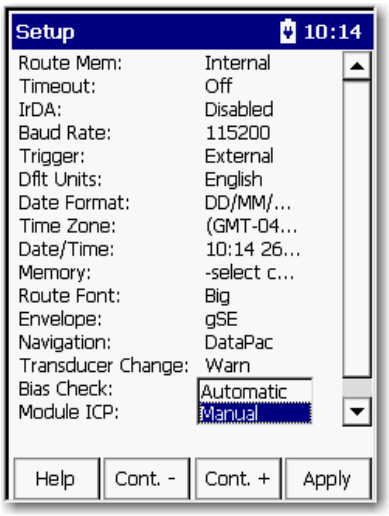
   See Instrument Configuration Parameters on page 44.

IMPORTANT The Enpac 2500 data collector supplies power to ICP accelerometers through CH1 and CH2 connectors. The ICP power turns on prior to collecting the first measurement point and remains on until the following occurs:

- You reach the end of the route.
- The data collector advances to a measurement point that does not require ICP power.
- You exit the route menu.

Do not connect the channel to a BNC panel or non ICP device until the Enpac 2500 data collector advances to a non ICP measurement point. Connecting the channel while collecting a measurement point that requires ICP power may cause undesirable results, damage to the equipment, or unexpected machinery trips.

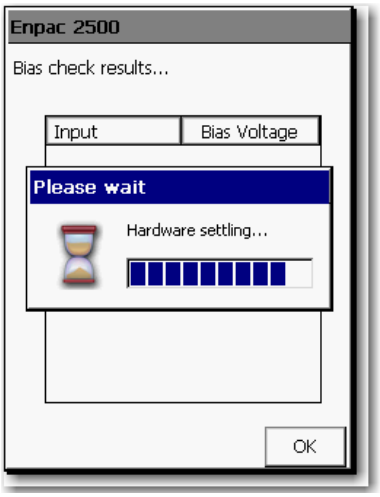
You may notice that a Bias Check is taken if the parameter is set to Auto.



Bias Check

The Bias function checks the bias of the transducer before taking the measurement. There are two options for the Bias Check parameter, Automatic and Manual.

When you are in the Route Hierarchy, you can check the bias voltage for ICP measurements manually by pressing 0 (Shift)+2 (B).

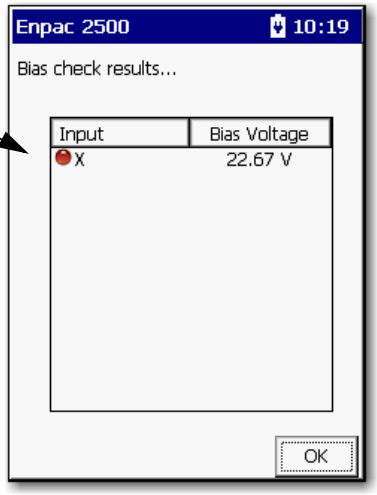


This turns on the ICP supply (if it wasn't already) and measures the DC bias voltage for each channel used by this measurement.

Channel X for single channel points. Typically X and Y is for two-channel points, and X, Y, and Z for Triax points.

The Bias check screen shows the voltages for each channel.

The Bias check results screen displays a red or green input indicator.
Green appears when the bias voltage is between 2V and 18V, which is regarded as normal.
Red appears if it is outside this range.
This can be useful when troubleshooting a cable or accelerometer.



Select Inspection Codes

Inspection codes let you document operating conditions while collecting data. You must load the inspection codes into the Enpac 2500 data collector when you load a list. Only those inspection codes loaded with a list are available for that list.

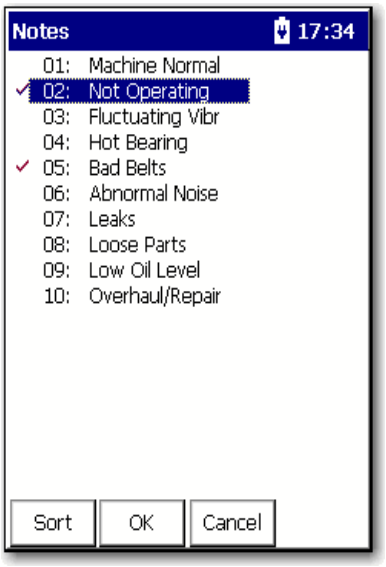
Using the Emonitor software, you can load up to 100 inspection codes per list. The data collector lets you to store up to six inspection codes with each measurement point. The Emonitor software automatically unloads the inspection codes from the data collector when you unload the data.

TIP If you notice an unusual condition prior to data collection, such as bad belts, you can select an inspection code that applies to the current point on the route.

Follow these steps to enter an inspection code while you collect data.

1. Press F3 (Notes) while in any measurement screen.

   The Notes screen appears.



2. Select a code by entering the inspection code number and press Enter.

   A checkmark appears to the left of the assigned inspection code:

   - To clear the checkmark, highlight the inspection code and press Enter again.
   - To save your changes and return to the measurement screen, press F2 (OK).
   - To cancel your changes and return to the measurement screen, press F3 (Cancel).

Manually Enter a Numeric Measurement

Using a route that is configured the Emonitor software, the data collector displays a field on the Collecting Data screen that lets you type in a value for a reading.

Follow these steps to manually enter a numeric measurement.

1. In the Emonitor Software, create a Manual route and upload to the data collector.

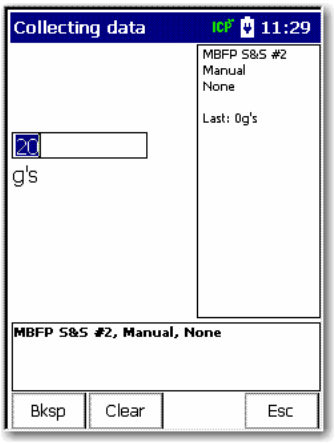
   See the Emonitor User Manual, publication EMONTR-UM001 for information about creating routes and loading them into the data collector.

2. From the Data Collection screen, press Enter.

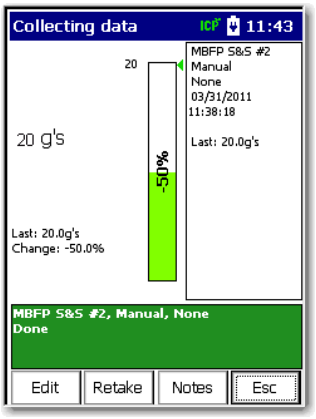
   The Route Manager Screen Appears.

3. Select the manual route that you loaded to the data collector.
4. Press Enter to start your measurement for the current point.

   The Manual Entry Process Measurement screen appears.



5. Type a value between zero and the full scale.
6. Press Enter to accept the value.



- Press F1 (edit) to edit the value.
- Press F2 (Retake), after you have changed the value.
- Press F3 (Notes) to view and Notes that you loaded from the Emonitor software.
- Press F4 (Esc) if you do not want to keep the current measurement.

7. Press Enter to go to the next measurement and continue data collection.

Collect a Process DC Voltage Measurement

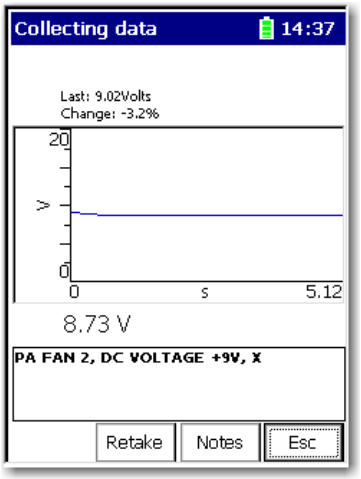
Once you have created a route in the Emonitor Software and uploaded it to the data collector you can begin to take the measurement.

> See the Emonitor User Manual, publication EMONTR-UM001 for information about creating routes and loading them into the data collector.

Follow these steps to collect a Process DC voltage measurement.

1. Attach the DC voltage input to the data collector and correct location.
2. From the Data Collection screen, press Enter.
3. Select the process route you uploaded from the Emonitor software and press Enter to start your measurement for the current point.

   The DC Volts Measurement screen appears.

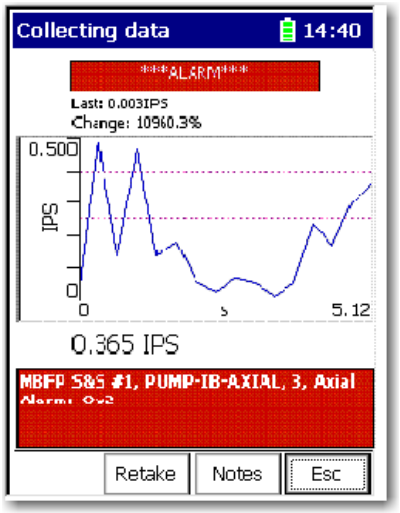


   The instrument continually updates the magnitude value for the measurement.

TIP For DC process measurements, conservative autoranging is always used to minimize the effects of internal DC offsets.

For more information about Autoranging, see Instrument Configuration Parameters on page 44.

Alarms appear when there is an alarm condition, such as the removal of a sensor on Channel X.



4. Once the reading is steady and the input signal is not overloading the data collector, press Enter to accept the measured value.

IMPORTANT You do not need to press Enter if you set Auto Store to On in the Instrument Configuration screen.

The data collector automatically ranges and collects the measurement.

See Instrument Configuration Parameters on page 44.

TIP The green status indicator illuminates when the measurement is complete. See Status Indicators on page 25.

Once the measurement is stored, you are taken back to the Route hierarchy.

Collect a Magnitude Measurement

Once you have created a route in the Emonitor Software and uploaded it to the data collector you can begin to take the measurement.

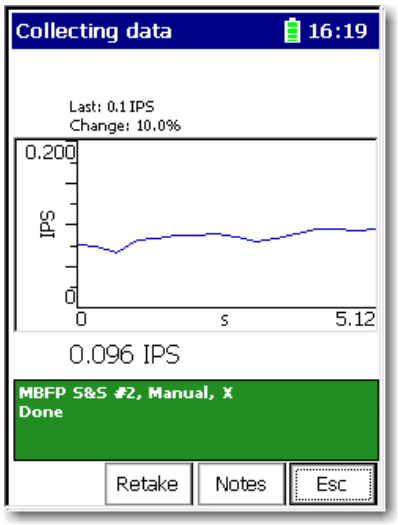
See the Emonitor User Manual, publication EMONTR-UM001 for information about creating routes and loading them into the data collector.

Follow these steps to collect a magnitude measurement.

1. Attach the DC voltage input to the data collector and correct location.
2. From the Data Collection screen, press Enter.

   The Route Manager screen appears.
3. Select the magnitude route you uploaded from the Emonitor software and press Enter to start your measurement for the current point.

The Magnitude Measurement screen appears.



A graphic appears on the screen while the data collector ranges the data. The data collector continually updates the magnitude value for the measurement.

4. Once the magnitude reading is steady and the input signal is not overloading the data collector, press Enter to accept the measured value.

IMPORTANT	You do not need to press Enter if you set Auto Store to On in the Instrument Configuration screen. The data collector automatically ranges and collects the measurement. See Instrument Configuration Parameters on page 44.

Once the data collector stores the measurement, the Data Collection screen displays the next point in the list (route).

Collect a Spectrum Measurement

One of the most useful ways to display vibration signals is in a spectrum. The spectrum displays the vibration signal level in relation to the frequencies at which the vibration occurs.

To display a spectrum, the Enpac 2500 data collector analyzes the frequency components of the signal and breaks this analysis down to a number of frequency bands where the signal level for that band is represented by a single value. These bands are calstatus indicator lines.

A typical spectrum could have 400 lines although the data collector lets you to select a smaller or larger number of lines. The higher the lines, the higher the resolution, and the longer it takes the data collector to acquire the data for a spectrum.

Lines of resolution, Fmax, and number of averages all affect the length of time it takes to acquire and process a spectrum. You can control each of these setup items either in your computer software for route measurements or on the User screen for Offroute measurements.

> See Create and Collect a User-defined Point on page 141 for more information about Offroute measurements.

Once you have created a route in the Emonitor Software and uploaded it to the data collector you can begin to take the measurement.

> See the Emonitor User Manual, publication EMONTR-UM001 for information about creating routes and loading them into the data collector.

Follow these steps to take a spectrum measurement.

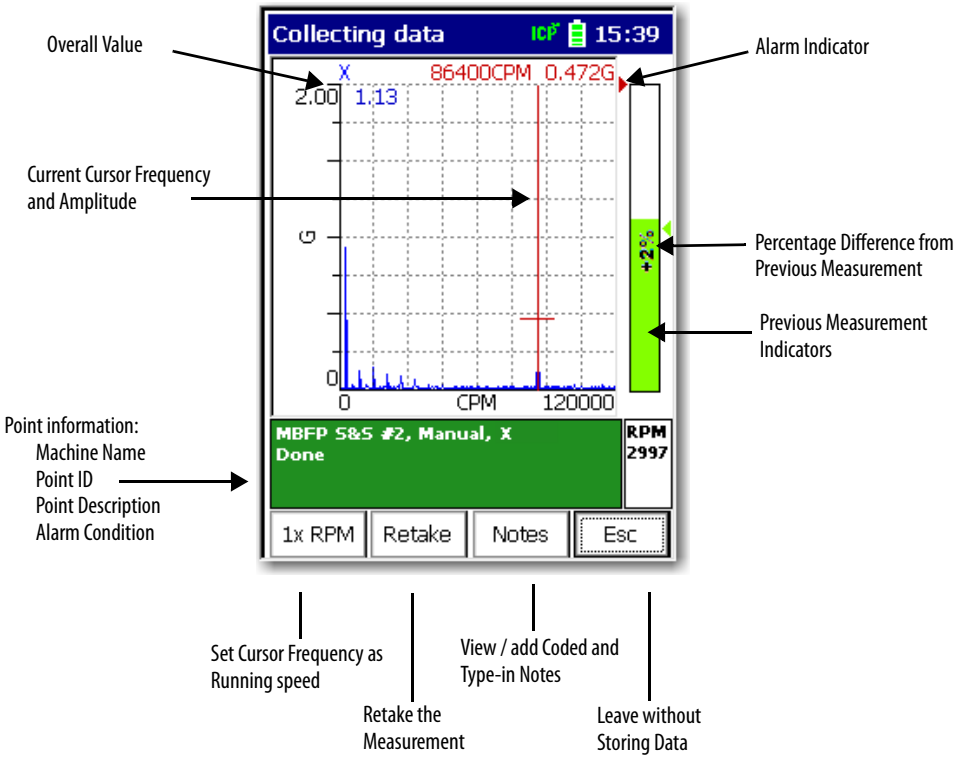
1. Attach the transducer to the current location.
2. From the Data Collection screen, press Enter.

   The Route Manager screen appears.
3. Select the spectrum route you uploaded from the Emonitor software and press Enter to start your measurement for the current point.

Table 33 - Tasks Associated with Ranging the Measurement

If you	Then
Previously collected a magnitude measurement for the point	The spectrum measurement starts automatically after you press Enter to accept the magnitude reading
Set Auto Advance to On in the Instrument Configuration screen	The data collector automatically goes to the next point in the list after it finishes collecting the spectrum
Set Auto Advance to Off	Then the Signature Measurement screen appears
Set Fast Averaging to On in the Instrument Configuration screen	The data collector collects the specified number of averages before displaying the spectrum on the screen
Set Fast Averaging to Off	The data collector displays the spectrum while collecting the averages

Figure 24 - Spectrum



4. When finished viewing the spectrum, press Enter to proceed to the next point in the list.

Table 34 - Spectrum Keying Descriptions

Keying	Description
Percentage changed	The spectrum displays a percentage changed bar. It provides an overall value of the current measurement in comparison to alert and danger alarms. These colored arrows display if the point is in an alarm state (red), in an alert (yellow) or if there is no alarm (green). If the measurement amplitude extends beyond the display, an overall overflow indicator appears at the top of the bar. This bar displays the percentage of change from the previous overall reading: • A positive percentage indicates the measurement is greater than the previous reading. • A negative percentage indicates the measurement is less than the previous reading. • For example, -2% means that the reading is 2% down from the last reading, or 95% of the last reading; while +2% means that the reading is 2% up from the last reading, or 102% of the last reading. • A display of +100% indicates either a 100% increase. • For example, the new reading is twice the old reading, or that there is either no previous reading, or the previous reading was 0%.
Y-Axis Graph Scaling Adjustment	You can use the Up and Down arrows to manually adjust the y-axis graph scaling on the spectrum. This lets you re-scale the plot to get a closer look at low amplitude components: • Up arrow decreases the Y-axis graph scale setting by ½ of its current setting. • Down arrow doubles the Y-axis graph scale setting.
Harmonic Markers	The H key displays harmonic markers for the current cursor position. Harmonic markers rapidly locate integral orders in relation to their fundamental (1X). The H key cycles the three harmonic cursor modes: • Simple, no harmonic cursors. • Harmonic, displays the harmonics of the current cursor position. The spectral cursor acts as the fundamental marker, and is re-positioned. • Fixed, the harmonics remain fixed and cursor can be moved independently. The default is Simple (off).
Peak cursor	The P key lets you quickly jump the cursor to the next highest peak to the right of the cursor.
Display Expansion	The +/- key graphically expands or compresses the frequency domain display range horizontally around the cursor position. It reveals characteristics that may be hidden by the display mode or by the resolution without changing data collection parameters. When using +/-, the spectrums fmax setting expands and the spectrum reforms to the new fmax. You can repeat to continue to expand up to the maximum resolution (based on the number of lines of resolution for the spectrum), after which the function switches to compression. Dot (.) key immediately toggles the +/- key between display expansion and compression.

See Review Data on page 153 for more information on cursor options.

Collect a Time Waveform Measurement

Time waveform plots display a short time sample of a raw vibration signal with vibration amplitude plotted over the time scale. Time waveform data appears on a plot similar to the spectrum display screen.

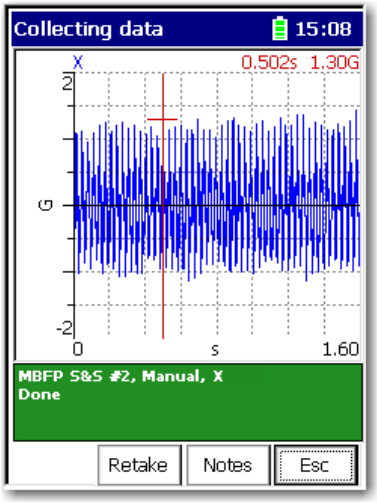
Follow these steps to collect a time waveform measurement.

1. Attach the transducer to the correct location.
2. From the Data Collection screen, press Enter to begin ranging the measurement.

IMPORTANT If you previously collected a magnitude measurement for the point, the time waveform measurement starts automatically after you press Enter to accept the magnitude reading.

If you set Auto Store to On in the Configuration screen on the data collector, you do not have to press Enter.

- If you set Auto Advance to On in the Instrument Configuration screen, the Enpac 2500 data collector automatically goes to the next point in the list after if finishes collecting the time waveform measurement.
- If you set Auto Advance to Off then the Time Waveform Measurement screen appears.



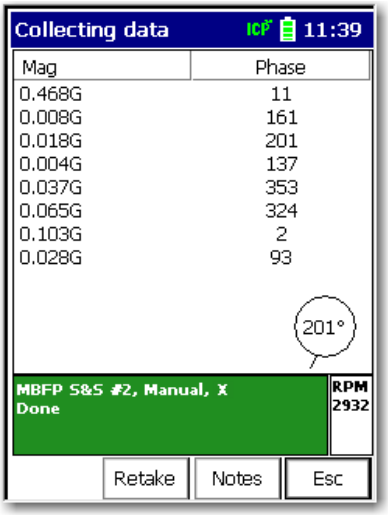
- Use the Left and Right arrow keys to move the frequency and amplitude cursor.
- Press the +/- key to expand and compress the time waveform spectrum plot.
- Press the H key to display the harmonic cursors.
- Press the P key while the harmonic cursors are displayed to move the cursor to the next significant peak.

  See Review Data on page 153 for more information on cursor options.

3. When finished viewing the time waveform, press Enter to continue to the next point.

Collect Magnitude and Phase Measurements at Orders

The Enpac 2500 data collector can collect multiple magnitude and phase at orders of the operating speed. You use a tachometer signal measuring the operating speed to collect phase data.



Follow these instructions to collect a spectrum for calculating additional magnitude and phase values at orders of the operating speed.

1. Align the speed reference device, such as a tachometer, in the correct direction and attach the vibration transducer properly.

2. From the Data Collection screen, press Enter to start ranging the measurement.

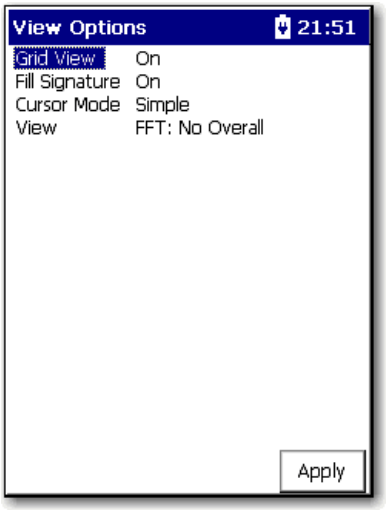
TIP The message No signal appears if the Enpac 2500 data collector cannot trigger off the tachometer signal to calculate the speed. If this happens, fix the speed device signal and connections. The Enpac 2500 data collector resumes data collection once it can trigger off the tachometer signal. You must use a key hole or reflection tape to trigger the tachometer.

The Enpac 2500 data collector calculates the speed from the tachometer signal and adjusts the maximum frequency for measuring the spectrum so that all orders can be calculated from the spectrum:

- If you set Auto Advance to On in the Instrument Configuration screen, the Enpac 2500 data collector automatically goes to the next point in the list after it finishes collecting the spectrum.
- If you set Auto Advance to Off then the Signature Measurement screen appears.
- If you set Fast Averaging to On in the Instrument Configuration screen, the unit collects the specified number of averages before displaying the spectrum on the screen.

- If Fast Averaging is set to Off, the data collector displays the spectrum while collecting the averages. The number of averages appears in the middle of the screen.

3. Press 0 (Shift) to display more functions and press F4 (View).



4. Press Enter to continue to the next point.

   See Review Data on page 153 for more information about the Signature Spectrum.

Exceptions

Two exceptions exist for combining measurement definitions. The Emonitor software and the Enpac 2500 cannot combine magnitude + phase measurements with any other measurements. Nor can they combine manual entry measurements with any other measurements. Both types remain as individual measurements when loaded into the Enpac 2500.

The Emonitor software can calculate an overall value from a spectrum measurement. Under some conditions, this value may not be the same as the magnitude measurement for the same location. These are the common uses:

- The measurement filter is not the same for the magnitude and the spectrum measurement definitions. In this case the two measurement definitions are measuring different frequency ranges.
- The magnitude readings taken by the Enpac 2500 are broadband readings and are not based on the spectrum data.

Collect Multiple Measurements for a Point

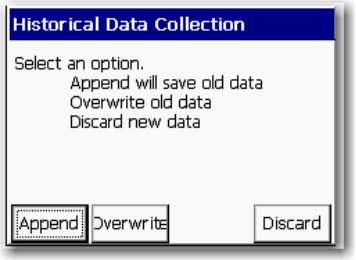
The data collector lets you to collect multiple readings for a single measurement point. When collecting data, its possible to take new data for a point that already has stored data and append it to the existing data records. If more than one data record has been collected for a point, you have the option to review each data record separately, or view all data records simultaneously as a waterfall plot.

Follow these steps to view points with historical data.

1. In the ROUTE hierarchy, select point you would like to review and press F1 (Review).
2. Use F2 (Next) to view the next point.
3. Use F1 (Previous) and F2 (Next) to scroll through points.
   - If you set Hist. Data Collect to Always Append in the Instrument Configuration screen, the new data is appended to the existing data.
   - If you set Hist. Data Collect to Always Overwrite, the new data is replaced with the existing data.

   Configure the Data Collection Options on page 42 for more information.
4. Select the point that you need to collect additional measurements from and press Enter to start the measurement.
5. Once the data collector collects the measurement, press Enter to accept the measured value.

   If you set Hist. Data Collect Always Ask in the Instrument Configuration screen, the following dialog box appears.



6. Do one of the following:
   - Press F1 (Append) to append new data to the existing data.
   - Press F2 (Overwrite) to replace existing data with the new data.
   - Press F4 (Discard) to delete the new data and retain the existing data.

The data collector can store up to ten additional measurements for the same measurement point. The additional measurements will be unloaded to your database when you select Unload all readings in the Unload Options dialog box.

See Unloading Multiple Measurements Points in Emonitor on page 114.

Collecting Offroute Data

The Offroute program lets you to collect data that is not part of a list (route). While collecting list data, you may notice some unusual conditions that you want to analyze further. You may also want to collect data for undefined points (points not in your database), or existing points that are not in your current list (route).

The Enpac 2500 data collector always associates Offroute measurements with a list. If you have not loaded a list into the Enpac 2500 data collector, the Offroute data is associated with the Default Route. Offroute measurements are stored at the current point. The current point is defined by where you leave the regular route to take an Offroute measurement. The Enpac 2500 data collector labels the Offroute measurements as numbers. For example, the first Offroute measurement is labeled as 1. This number increments by one each time you collect an Offroute measurement.

To unload unscheduled measurements into the host software, you must have first loaded a list so that the unscheduled measurements can be unloaded with that list.

Methods for Collecting Offroute Data

There are two methods for collecting Offroute measurements with the Enpac 2500 data collector:

- Choose one of the pre-defined measurements on the Offroute Measurement screen.

  This method provides an easy way to collect Offroute measurements for the current point.

  Enpac 2500 data collector provides seven pre-defined measurements for you to use to collect the Offroute data. You do not need to set any parameters if you use the pre-defined measurements. The Enpac 2500 data collector uses the measurement definitions for the current point.

  See Collect Offroute Data using a Pre-defined Measurement on page 139.

- Create a user-defined measurement point.

  This method lets you to set up and collect any type of measurement.

  See Create and Collect a User-defined Point on page 141.

Collect Offroute Data using a Pre-defined Measurement

The Enpac 2500 data collector provides seven pre-defined measurements for you to use to collect Offroute data. These are the data collectors pre-defined measurements.

Table 35 - Pre-defined Measurements

Measurement	Description
Same	Uses the same setup as the current point.
Opposite	Uses the opposite setup as the current point. For example, spectrum is time, time is spectrum.
Accel	Acceleration spectrum point 10kHZ, 800 lines, 4 averages
Velocity	Accel velocity spectrum point 2kHz, 400 lines, 4 averages
Accel Time	Time point 10kHz, 2046 points
High Res	High resolution point (increase number of lines by a factor of two. For example, the current point having 400 lines becomes 800 lines.
gSE	Spike energy point Envelope parameter in Instrument Setup must be set to gSE. See Instrument Configuration Parameters on page 44.
ESP	Standard Envelope Spectrum Processing (ESP) point Envelope parameter in Instrument Setup must be set to ESP. See Instrument Configuration Parameters on page 44.

You do not set any parameters when you use a pre-defined measurement. The Enpac 2500 data collector uses similar settings as the measurement definitions for the current point.

Follow these steps to collect an Offroute measurement for the current point.

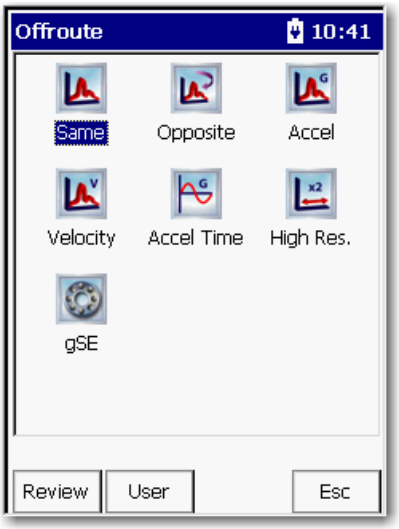
1. From the Main Menu, select Data Collection and press one of the Enter keys.

   The Data Collection screen appears.

2. Select the route and measurement point.

3. Press F2 (Offroute) to collect an Offroute measurement.

The Offroute measurement screen appears.



4. Select the a pre-defined measurement icon to store an Offroute measurement at the current point.

5. Connect the a transducer and press Enter to start the measurement.

   The measurement screen appears.

6. For manual entry points, enter the magnitude value with the numeric key pad.

7. If desired, press F3 (Notes) to assign inspection codes to each point.

   The Enpac 2500 data collector unloads inspection codes when you unload the unscheduled data to Emonitor.

   See Select Inspection Codes on page 126.

8. After the data collector collects the measurement, press Enter to accept the measurement.

   The green status indicator illuminates when the measurement is complete and the Offroute screen appears. The measurement is stored as an Offroute measurement at the current point.

9. Press F4 (Esc) to return to the Data Collection screen.

Create and Collect a User-defined Point

The Offroute program lets set up and collect any type of Offroute measurement point. The Enpac 2500 data collector keeps the user-defined parameters until you collect another measurement point or press F2 (Default) on the Offroute User screen.

Table 36 - Types of Offroute Measurements

Type	Description
Same	The measurement configuration is based upon the most recently selected measurement in the Route Manager. The setup is the same as the active measurement. This lets you collect Offroute measurements that are identical to your active measurement, but from various sensor positions for analysis purposes. If you have setup the active route to collect both FFT and time waveform data, the Offroute Same measurement is FFT only. Measurement parameters are set to: Overlap – 50% Bin Zeroing – On
Opposite	The measurement configuration is based upon the most recently selected measurement in the Route Manager, except it collects the Opposite data format. For example, if the active Route Point collects FFT spectrum data, the Opposite Offroute measurement collects time waveform data, and vice versa. Measurement parameters are set to: Overlap – 50% Bin Zeroing – On
For Accel, Velocity, Accel Time, and gE pre-set measurement types, the following standard settings are taken from the current selected Route measurement: • Sensitivity • Coupling • Detection • Window	
Accel	Performs a standard vibration Acceleration measurement. These are the settings for the measurement parameters.

Parameter	Value
Display Format	Spectrum
Units - Accel	Accel (G)
Input Channel	X
High-pass frequency	1.1 Hz
Fmax	10 kHz
Lines/Samples	800 Lines
Averages	4
Overlap	50%
Type	Spectral
Ext. Trigger Slope	Positive
Trigger Level	2 V
Bin Zeroing	On

Table 36 - Types of Offroute Measurements

Type	Description
Velocity	Performs a standard acceleration to velocity vibration measurement. These are the settings for the measurement parameters.

Parameter	Value
Display Format	Spectrum
Units	A -> V
High-pass frequency	1.1 Hz
Input Channel	X
Fmax	1 kHz
Lines/Samples	400 Lines
Averages	4
Overlap	50%
Type	Spectral
Ext. Trigger Slope	Positive
Trigger Level	2 V
Bin Zeroing	On

Table 36 - Types of Offroute Measurements

Type	Description
Accel Time	Performs a standard vibration Acceleration measurement and collects waveform data. These are the settings for the measurement parameters. **Parameter** / **Value** Display Format: Time Units: Accel (G) High-pass frequency: 1.1 Hz Input Channel: X Fmax: 8 kHz Lines/Samples: 256…32768 samples Averages: 4 (time sync) If a trigger is defined for the active Route point, if no trigger is detected only 1 average is taken. Overlap: 50% Type: Time Ext. Trigger Slope: Positive Trigger Level: 2 V Bin Zeroing: On
High Res.	The measurement configuration is based upon the most recently selected measurement in the Route Manager The setup is identical to the active measurement in the active Route, except the Lines/Samples setting is doubled (increased by a factor of 2) to a maximum of 25,600 lines (up to 12,800 for two-channel measurements and up to 6,400 for three and four-channel measurements). For example, if the active Route Points Lines/Samples setting is 400 Lines, the High Resolution Offroute measurements Lines/Samples setting is 800 Lines. This lets you take a high resolution look at your active Route measurement. Measurement parameters are set to: Overlap – 50% Bin Zeroing – On

Table 36 - Types of Offroute Measurements

Type	Description
gSE	Performs a standard vibration Acceleration measurement and collects waveform data. These are the settings for the measurement parameters.

Parameter	Value
Units	Enveloped Acceleration
Display Format	Spectrum
Band High-pass frequency	gSE BPF 5 kHz
Fmax	10kHz
Lines/Samples	400
Averages	4
Input Channel	X
Overlap	50%
Ext. Trigger Slope	Positive
Trigger Level	2 V
Bin Zeroing	On
Type	Spectral

Create a User-defined Point

Follow these steps to create a user-defined point.

1. Select Data Collection from the Main Menu and press the Enter key.

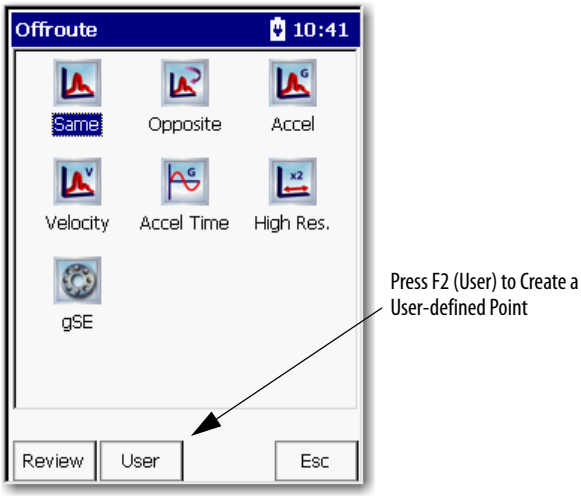
   The Data Collection screen appears.

2. Select the route and press Enter.

   The Enpac 2500 data collector always associates Offroute measurements with a list.

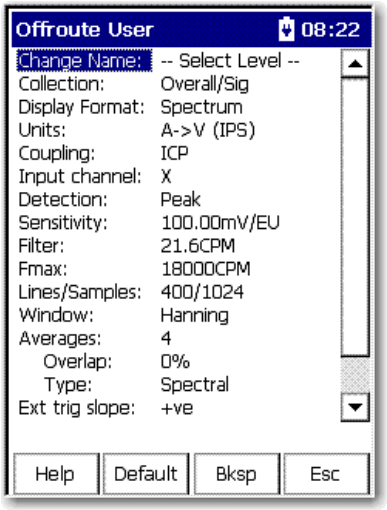
3. Press F2 (Offroute) to collect an Offroute measurement.

The Offroute measurement screen appears.



4. Press F2 (User).

   The Offroute User screen appears.



5. Select a parameter you want to change and press the Right arrow key to open the menu of choices.

6. Select your choice by using the arrow keys, or typing in a value using the numeric key pad.

7. Press the Left arrow key to save your choices.

Use the descriptions in this table to help you configure the parameters in the Offroute User screen.

Table 37 - Offroute User Parameters

Parameter Name	Description	Values/Comments
Change Name	Changes the name of the user-defined measurement point. Select the hierarchy level for which you want to change the name. A window opens at the bottom of the screen. Use the numeric key pad to enter a new name and press F2 (OK).	Select Level (default) Default Locn Default Point 1 Horiz Default
Collection	The type of data to collect with this measurement.	Overall/Signature (default): collect both a magnitude reading and a signature. Overall only: collect a magnitude reading only. Signature only: collect a signature only. RSS Overall: collect a digital overall measurement.
Display Format	The display format of the measurement.	Spectrum (default) Time Phase Order
Units	The measurement units for the transducer. The [S] designation refers to a static measurement that you must manually enter with the numeric key pad. All dynamic measurements and temperature process points require a transducer to make the measurement.	Accel (G) (default) gSE RPM A->V (mm/s) Vel (IPS) Vel (mm/s) A->D (mil) A->D (µm) V->D (mil) V-D> (µm) Disp (mil) Disp (µm) Volts EUs [S] Temperature [S] Current (A) [S] Pressure (PSI) [S] Flow (m^3/s) [S] Rot. Speed [S] Linear Displ (mm) Count [S} Count Rate [S] Volts [S] Accel (G) [S] Vel. (IPS) [S] Vel (mm/s) [S] Disp (mil) [S] Disp (µm) [S]
Coupling	The type of coupling that will be applied to the measurement.	AC: couples the input voltage signal. DC: couples the input voltage signal. ICP: (default) selects a standard ICP accelerometer requiring a current source power supply

Table 37 - Offroute User Parameters

Parameter Name	Description	Values/Comments
Input channel	Maps the input channel to the LEMO connectors on the top of the Enpac 2500 data collector. Input channel X maps to Connector CH1 (pin 2): • Input channel Y maps to Connector CH2 (pin 2); it is also linked to Connector A (pin 6). • Input channel Z maps to Connector CH1 (pin 3); it is also linked to Connector B (pin 7)	X (default) Y Z X & Y Z & Y X, Y & Z
Detection	The measurement (or calculation) performed on the input signal.RMS, Peak, Pk-Pk, True Peak, True Pk-Pk	
Sensitivity	The sensitivity of the transducer. The sensitivity value is included with the transducers documentation or it may be imprinted on the side of the transducer.	Default value is 100m V/EU (Engineering Unit)
Filter	Sets the high pass filter to apply to the measurement. The high pass filter is useful in removing high vibration, low frequency signal components that would dominate the signal.	Off (default) Set Filter to Off if you do not want to use a filter. 10.8 Hz 21.6 Hz (default) 120 CPM 160 CPM 318 CPM 600 CPM 1428 CPM 4200 CPM
Fmax	The maximum frequency for the measurement.	18000 CPM (default)
Lines/Samples	The number of lines or bins in the spectrum measurement and the number of samples in the waveform measurement. This determines the measurement resolution. The data collection time increases as you increase the measurement resolution.	For spectra: 100…12800 spectral lines. For time waveforms: 256…32678 time samples. 400…1024 (default)

Detection	Description
RMS	The Enpac 2500 data collector measures the dynamic signal as the square root of the mean of the square. Use this or the Peak setting for most acceleration and velocity measurements. Use this also for time waveform, voltage, and process (DC) voltage measurements.
Peak	The Enpac 2500 data collector measures the dynamic signal from zero to peak voltage. Use this or the RMS setting for most acceleration and velocity measurements.
Pk-Pk	The Enpac 2500 data collector measures the dynamic signal from the minimum peak to the maximum peak. Use this setting for most displacement measurements.
True Peak	Use to detect impacts and random transients. The dynamic time signal contains the absolute value of the largest peak (positive or negative) within a specified time window. Returns a magnitude value only. If used with a spectrum measurement, Emonitor uses a Peak detection type instead. This value is not calculated but is measured directly.
True Peak Pk-Pk	Use to detect impacts and random transients. The dynamic time signal contains the absolute value of the largest peak to peak distance within a specified time window. Returns a magnitude value only. If used with a spectrum measurement, Emonitor uses a Peak-Peak detection type instead. This value is not calculated but is measured directly.

Table 37 - Offroute User Parameters

Parameter Name	Description	Values/Comments
Window	Type of window to be applied to the waveform measurement prior to computing the spectrum	Hanning (default), Hamming, Flat Top, Rectangular
Averages	Sets the number of individual data sets to be incorporated into the average calculation.	Numeric value 4 (default)
Overlap	The percentage of overlap during the averaging. It can be used to reduce the total time that it takes to collect the data.	Percentage
Type	Sets the type of averaging for the measurement.	Spectral (default) Time Synchronous Peak Hold Exponential
Ext Trig Slope	The input signal slope to be used for externally triggering the measurement. +ve - Defines the trigger event to occur on a rising edge. -ve - Defines the trigger event to occur on a falling edge.	+ve (default) -ve
Level	The amplitude level for externally triggering the measurement. The level is a percentage of the trigger full scale range.	Numeric: 0.0 (default)
Bin Zeroing	Enables/disables bin zeroing. When set to Off, the bins below the selected high pass filter are not zeroed. That is, data still appears but is attenuated by the filter shape. Set bin zeroing to On when you want to be sure unwanted frequencies do not affect data. Set bin zeroing to Off when you want to be aware of the presence of unwanted frequencies.	On (default) Off

Window	Description
Hanning	A general purpose window to use on random type data when frequency resolution is more important than amplitude accuracy. Use this setting for most of your machinery monitoring activities.
Hamming	Another general purpose window with slightly different window characteristics than the Hanning window.
Flat Top	Use this when amplitude accuracy is more important than frequency resolution. In data with closely spaced peaks, a Flat Top window may smear the peaks together into one wide peak. Use this for sinusoidal or calibration signals.
Rectangular	The Enpac 2500 data collector does not apply a window. Use this only for transient signals that die out before the end of the time sample, or for exactly periodic signals within the time sample.

Collect a User-defined Measurement

Follow these steps to collect a user-defined measurement.

1. After setting up the measurement, connect the proper transducer.
2. Press Enter from the Offroute User screen to start the measurement.

   The measurement screen appears. The Enpac 2500 data collector ranges and collects the data.
3. If desired, press F3 (Notes) to assign inspection codes to each point.

   The Enpac 2500 data collector unloads the inspection codes when you unload the unscheduled data to Emonitor.

   See Select Inspection Codes on page 126.
4. If you want to collect data again for this point, press F2 (Retake) to collect the measurement again.

5. Once the Enpac 2500 data collector collects the measurement, press Enter to accept the measurement.

   The green status indicator illuminates when the measurement is complete. The measurement is stored as an Offroute measurement at the current point.

   The Offroute screen reappears.

6. Press F4 (Esc) screen to return to the Data Collection screen.

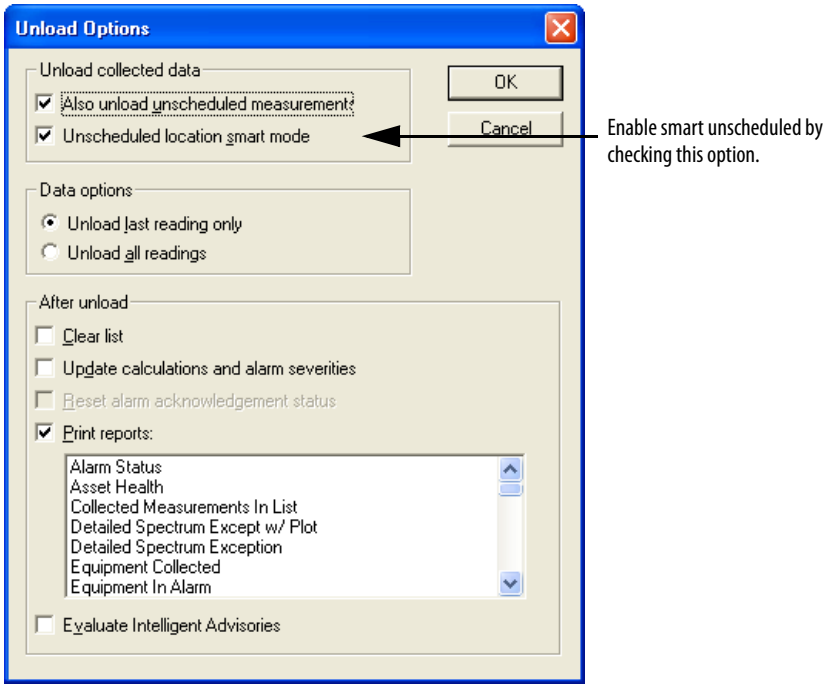
Storing Unscheduled Data

When you unload unscheduled measurements from the Enpac 2500 data collector, The Emonitor software stores it in the database. There are two methods for storing.

Follow these steps to use the Smart Unscheduled mode.

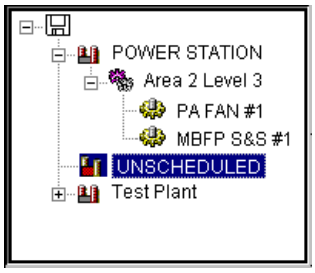
1. Select Tools > Load/Unload.
2. Click Unload Options.
3. Check the Unscheduled location smart mode checkbox.

This lets the Emonitor software to match up measurement definitions with the correct location based on certain rules.



See Unloading Measurements using Smart Unscheduled Mode on page 115.

If you do not have the unscheduled location smart mode checked, Emonitor stores unscheduled data in the unscheduled destination in the hierarchy tree of the database.



You set the unscheduled destination with Tools > Set Unscheduled Dest.

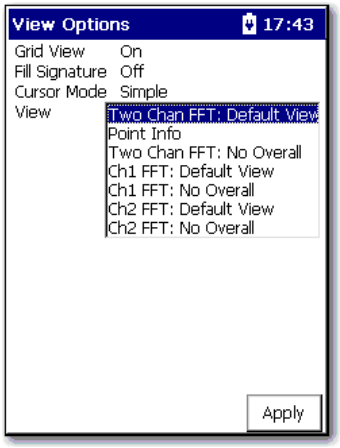
See Emonitor online help for more information.

Changing Display View

Use the View function to determine how to view FFT (Spectrum) and Time waveform data.

Follow these steps to view FFT and Time data.

1. Press (Shift) to display a second set of functions.
2. Press F4 (View).

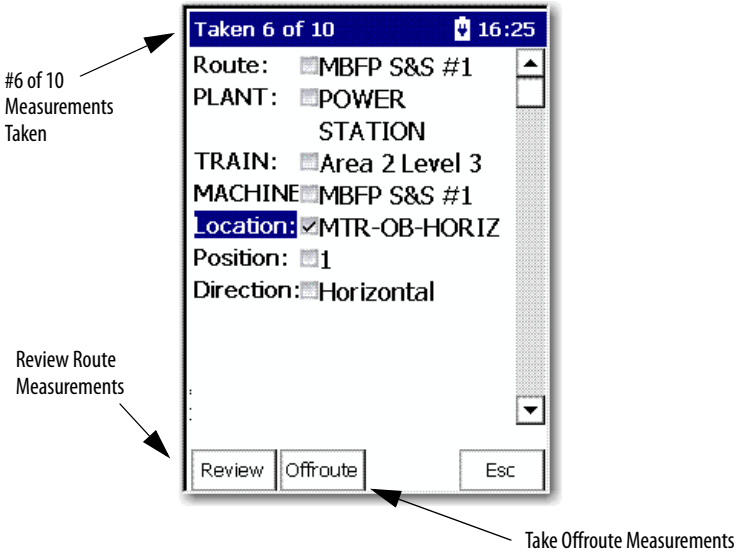


3. Select a view option and press F4 (Apply).

Reviewing Data

There are several functions available for viewing, analyzing overall and signature data in the data collector.

The data collection screen appears after you select a Route to review.



Review Route Data

Follow these steps to review previously collected route data.

1. From the Route Manager screen, select a route and press Enter.
2. Select a hierarchy level (Plant, Train, Machine, and Location).
3. Press the Right arrow key.

   A Selection screen appears.

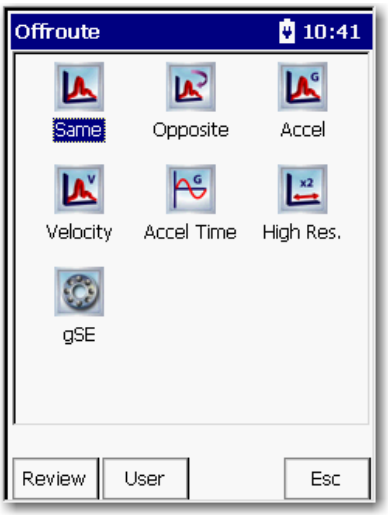
4. Select the item that you want to review and press the Left arrow key.
5. Press F1 (Review) to view the data.

Review Offroute Data

Follow these steps to review previously collected Offroute data.

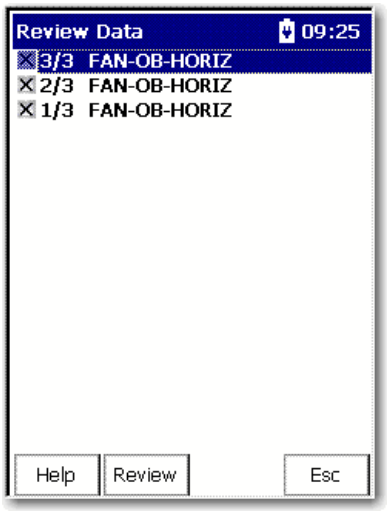
1. From the Route Manager screen, select a route and press Enter.
2. Press F2 (Offroute).

   The Offroute screen appears.



3. Press F1 (Review) to review the Offroute data.

   The Review Data screen appears.



4. Select a point to review and press Enter or F2 (Review).

   If the point has more than one measurement, you can press Enter, F2 (Next) or F1 (Previous) to the next measurement.

Review Data

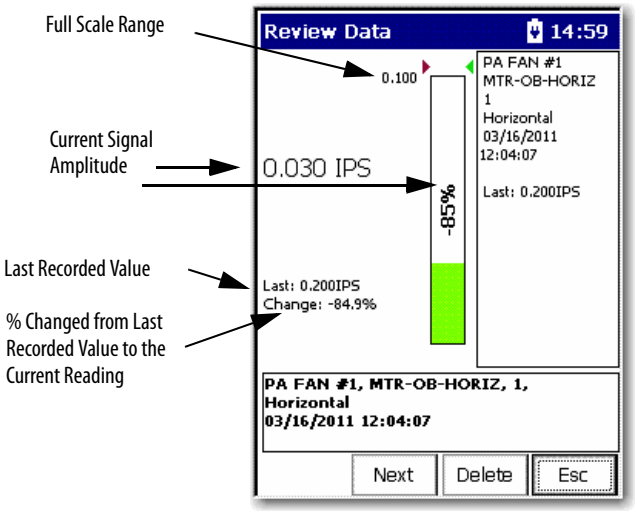
The Review Data screen lets you view the four types of measurements.

- Spectrum
- Time waveform
- Magnitude and phase orders
- Overall value

Follow these steps to the review data.

1. From the Route Manager, select a route and press Enter.
2. Press F1 (Review).

   The Review Data screen appears.

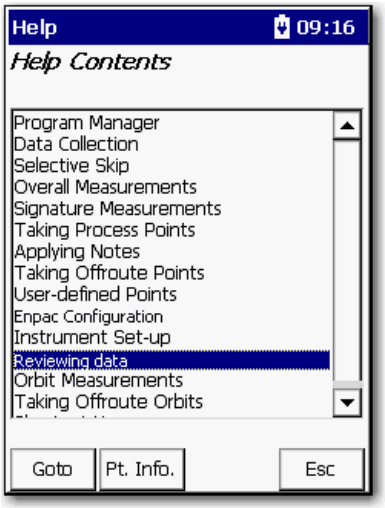


3. Press F2 (Next) or F1 (Previous) to move back and forth through the review data screens.

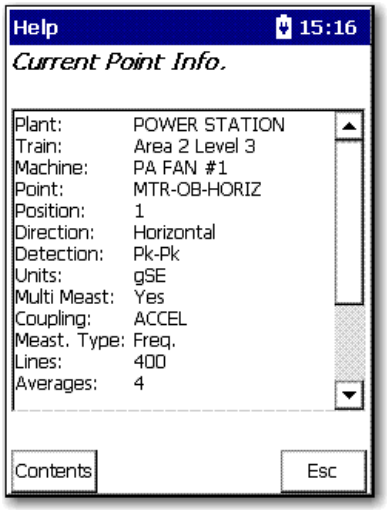
Follow these steps to view the Current Point Info. screen.

1. From the Route Manager screen, select a route and Press Enter.
2. Press Enter to start the measurement.
3. Press 0 (Shift).

4. Press F1 (Help).

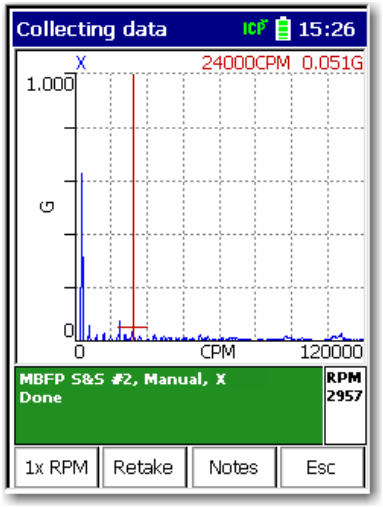


5. Press F2 (Pt. Info).



Use Diagnostic Frequency Cursors with a Spectrum

When frequency items are loaded with a list from Emonitor, the data collector can display the frequency item that goes with the cursor.



Use the Left and Right arrow keys to move to each diagnostic frequency.

See Loading Frequency Labels on page 109 for more information.

Moving around a Review Data Screen

These are the shortcut keys for moving around a Review Data screen.

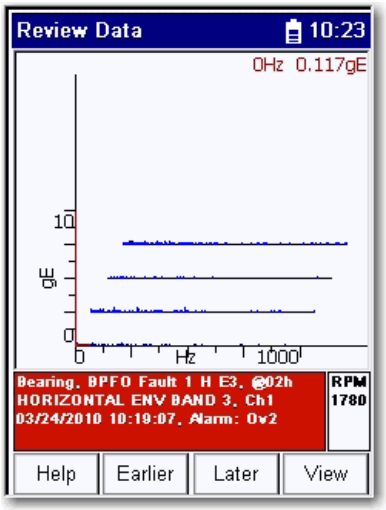
Table 38 - Shortcut Keys on the Review Data Screen

Key	Description
+/-	You can expand and compress the Frequency/CPM axis by pressing the +/- key. When the Enpac 2500 data collector first displays a signature, it displays the entire frequency range or time length of the measurement. If the signature contains detailed resolution (400 lines or more for spectra, 512 samples or more for time waveforms), the data collector automatically compresses the data to show the entire measurement.
Left and Right arrows	Use the Left and Right arrow keys to move the frequency cursor and the Up and Down arrow keys to move the amplitude cursor. The cursor values appear above the signature data.
H	Press the H key to display the harmonic cursors. Each time you press H, it toggles among three functions. **Press H** — **Function** Once — Enables the harmonic cursors. Press the Left and Right arrow keys to move the harmonic cursors. Twice — The cursor line is displayed with the harmonic cursors. Press the Left and Right arrow keys to move only a single cursor, leaving the harmonic cursors locked in position. Thrice — Turn the harmonic cursors off; use only a single cursor.
P	Press the P key to move the cursor to the next significant peak.

Review Waterfall Spectra Data

When you collect more than one spectrum for a point, the Enpac 2500 data collector can display the spectrum in a waterfall mode, one after the other.

Figure 25 - Waterfall Spectral Data



- Press the Left and Right arrow keys to move the frequency cursor within the spectrum plot.
- Use the Up and Down arrow keys to move between the spectrum plots.

TIP The Waterfall spectra data will not appear if you set Hist. Data Review to Always Single in the Instrument Configuration screen.

Delete a Measurement

You can delete a previously collected measurement from the data collector when the Delete function appears on the screen.

Follow these steps to delete a measurement.

1. Review the previously collected route measurement point.

   The appropriate Overall or Signature screen appears.

2. Press F3 (Delete).

   A dialog box appears to confirm the deletion.

3. Press F2 (Yes) to delete the measurement point.

   A warning appears that states that all historical data will be removed.

Capturing Screens

You can capture Enpac 2500 data collector screen images in a bitmap (.bmp) format and store them on the PCMCIA memory card.

Follow these steps to capture an image to an PCMCIA memory card.

1. Display the screen that you want to capture.
2. Press the 0 key and the 7 key.

   The Print dialog box appears.
3. Press F2 (OK) to store the image in a.bmp format on the storage card.

   The Enpac 2500 data collector stores the image in: \Storage Card\dumpn where ‘n is the number of the bitmap. This number gets incremented by one each time you store an image on the card.
4. Press F4 (OK) to return to the screen.

Print Reports and Plots by Using the Emonitor Software

You can use the Emonitor software to print reports.

See Emonitor Users Guide, publication EMONTR-UM001.

Notes:

Multi-channel Measurements

Multi-channel Measurement (1441-PEN25-MOD-2CH) is a 2-Channel upgrade option where you able to set up, collect, and review orbit, cross channel phase, dual channel, and other multi-channel measurements.

Topic	Page
Orbit Measurements	160
Cross Channel Phase Measurements	173
Collect a Cross Channel Phase Measurement	178
Two-channel Measurements	182
Collect an Offroute Two-channel Measurement	183

The Two Channel functionality offers advanced data collection in route and Offroute collection. With two channels, you can take the following measurements:

- Orbits
- Simultaneous 2-channel magnitude, time waveform and spectra
- Cross channel phase
- Tri-axial (XYZ) are created by mulit-plexing the two channel functionality. It is not simultaneous.

Predictive Maintenance Program

An effective predictive maintenance program is typically based on the collection and analysis of routine vibration data, supplemented by other technologies, such as oil analysis, thermography, and motor current analysis. The detection of most common machine faults and the location of faulty components can be accomplished with a single-channel data collector measuring vibration, combined with a personal computer-based trending analysis software package. In many cases, however, a more thorough analysis requiring a dual channel acquisition capability is necessary to accurately identify specific faults.

Having access to two channels of information in simultaneous data acquisition is key to root-cause failure analysis. Making the measurements independently (and asynchronously) and calculating the relationship does not work well because of the effects of signal variations, outside disturbances, and noise in the system.

One key parameter is the measure of relative phase between two points on a machine, which is easily calculated as a cross channel measurement. Phase measurements across a coupling can easily show misalignment. Phase measurements can also be used around a bearing to determine if it is cocked.

It is even possible for a significant loss of mass, such as a thrown blade, to result in little or no change in vibration amplitude, but a very clear shift in phase. With the two-channel cross phase feature, there is no need for a reference mark on the shaft. Therefore, there is no need to stop the machine, nor is there a need for any triggering equipment - unless the requirement is to measure phase relative to a known reference such as a shaft keyway.

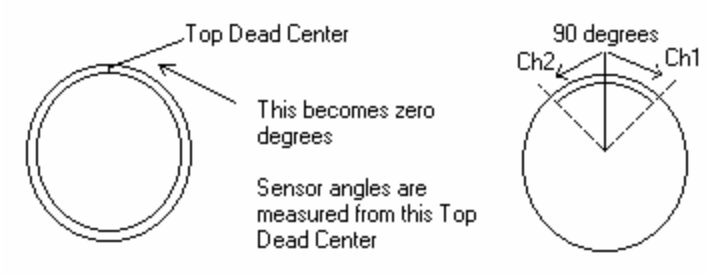
Orbit Measurements

You can set up and collect orbit measurements with the Enpac 2500 using the two input channels and displacement transducers. Because sensor orientation is not loaded and unloaded with routes, the Enpac 2500 data collector assumes the trigger input comes from top dead center. From there, it calculates the relative sensor angles to be 90 degrees apart. The difference between Channel 1 and Channel 2 is always 90 degrees.

Understanding an Orbit Plot

Another set of key measurements with a two-channel collector results in an orbit plot. An orbit plot is derived from the output of two non-contact pickups (proximity probes) mounted radially, 90 degrees apart at the bearing.

Figure 26 - Relative Sensor Angles

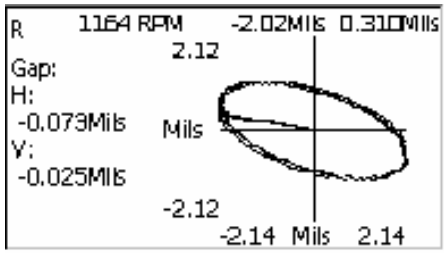


If viewed in real time, the signals produce a trace on the screen of a Lissajous pattern, corresponding to the total shaft motion, which is really the orbit of the shaft in the bearing.

A filtered orbit can help exclude any frequencies not related to running speed or its harmonics. The slight elliptical shape of the 1X orbit plot shown in 1X Orbit Plot on page 161 shows a small unbalance condition.

In this case, a 1X filter was applied to the measurement for isolating potential running speed related anomalies. It is important to note, however, that other non-1X related frequencies may be present that are missed if a filtered orbit is used.

Figure 27 - 1X Orbit Plot



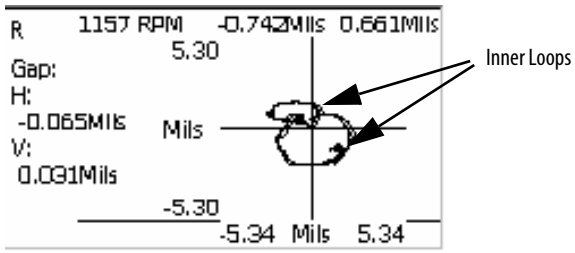
If the machine has unbalance only, the displayed orbit will be dominated by a once-per-revolution signal and have a circular or elliptical shape.

To get a better impression of the actual shaft motion and to identify other common machine anomalies, such as misalignment, shaft whirls, rubs, and looseness, all signal frequencies are required up to several orders of shaft speed. The orbit shape then becomes more complex, and it may be highly elliptical, non-elliptical, or it may have several inner and outer loops.

Inner loops presented in a Lissajous orbit plot can indicate a hit and bounce type condition. This phenomenon occurs when the shaft comes in contact with the bearing surface and bounces off.

In early stages of contact, a flat spot in the orbit plot will be presented. As the condition becomes more severe, the number of loops present will increase and become tighter. Detailed analysis of the orbit plot can indicate exactly where the shaft is coming into contact with the bearing in question. This figure shows a non-filtered orbit plot of the same shaft as discussed above.

Figure 28 - Non-filtered Orbit Plot



In the Filtered plot, only 1X frequency information appears in the orbit. In this case, the rub condition presented would have been overlooked if only a 1X orbit was taken. In general, a filter of OVERALL in the Emonitor software specified for the orbit plots will give the most useful information.

To adequately define an orbit of a machine shaft, it is first necessary to know the approximate shaft speed and how many orders of the shaft speed are to be included in the measurement. A spectrum analysis (FFT) of the signals can be used to determine the number of orders.

Unless the measurement is synchronized with a trigger (or a once-per-rev phase reference pulse), it is not possible to relate the orbit shape to the rotational position of the shaft. There is a mark on the orbit to show the location of the shaft at the time of the trigger event.

Assuming pickups are located 90 degrees apart and there is a phase reference pickup providing a once-per-revolution pulse to trigger the data collection, you can use orbits to distinguish common faults in machines equipped with plain bearings.

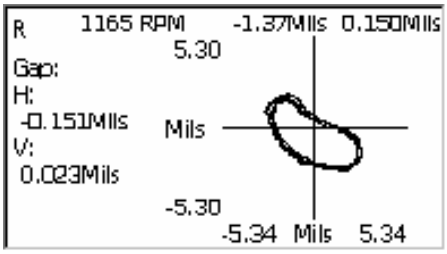
A typical machine with normal to moderate unbalance, and no other major faults, shows a simple orbit, corresponding mostly to the once-per-rev component, which really dominates.

See 1X Orbit Plot on page 161.

Misalignment tends to add significant levels of vibration to the shaft at once-per-revolution, but also at higher orders of running speed. The once-per-revolution component from misalignment is not in phase with the unbalance component. The effect is to make the orbit plot less circular and more elliptical or even non-elliptical, for example, a banana-shape or a figure-eight pattern.

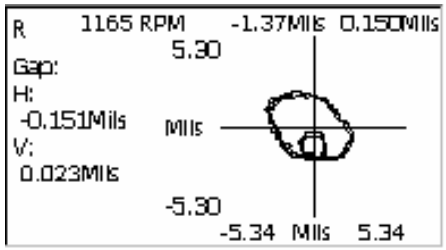
Resonance and excessive bearing wear also tend to produce elliptical orbits. If the contribution is due to resonance, this condition can be pinpointed if the orbit changes noticeably with changes in running speed.

Figure 29 - Resonance and Excessive Bearing Wear



If a shaft comes close to a bearing surface or actually contacts it, the orbit takes on a different set of characteristics. Shaft rub tends to flatten the orbit, associated with the increased resistance to the radial movement of the shaft as it comes close or contacts the bearing surface, once per revolution. The orbit of a shaft with rub has a shape similar to whirl, except that the internal loop remains fixed and does not rotate, as it is occurring at an exact submultiple of the shaft rotation speed.

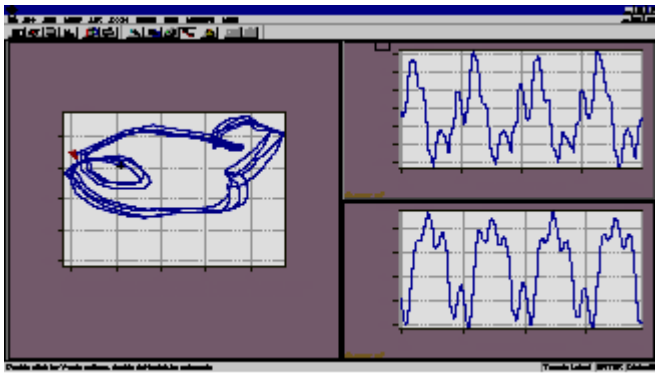
Figure 30 - Complex Orbit



As a rub becomes more severe or continuous, then the orbit becomes more complex and possibly erratic, with bearing structural resonances being excited and multiples of subsynchronous frequencies showing up.

Mechanical looseness caused by excessive wear tends to produce an orbit similar to that of a rub. Subsynchronous effects show up as secondary loops. However, in this case, shaft movement may be in a forward direction, rather than the reverse direction that is typical of a rub.

Figure 31 - Typical Orbit Plot



See the Emonitor software online help for more information.

Set Up Orbit Measurements Definitions in the Emonitor Software

The Emonitor software and the Enpac 2500 support orbit measurement definitions. This topic lists the unique characteristics of the data collector that you may need to know when setting up and collecting orbit data:

- Set up a location in the Location pane for the two input channels.

  The Location IDs must be different. Set the Lo. Channel for the first location to 1. Set the Lo. Channel for the second location to 2.
- Set up a Collection Specification with Transducer set to Displacement.
- Set up a time measurement definition and a numeric measurement definition for both locations.

The measurement definitions must be the same for both locations. The time measurement definition must be the first measurement definition in the spreadsheet. Make sure the numeric measurement definition has the same units, collection specification, and storage as the time measurement definition.

- Make sure to set Data collector filter type to Analog when you define the order filters.

  See Measurement Filters on page 63 for more information.

- Assign the same group number to the locations to collect the measurement properly.

To set up the orbit measurements in the Emonitor software, follow these steps.

1. Select the machine in the Hierarchy Tree for which you want to set up orbit measurements.
2. In the Location pane, create the first location and set Lo. Channel to 1.

   TIP If the Lo. Channel is not in the Location pane, choose View > Pane Options to add the column.

   Press F1 in the Pane Options dialog box for assistance.

3. In the Measurement definition pane, create the time measurement definition by setting Data Type to Time.
4. Set Collection to the collection specification that you created for the orbit measurement.
5. Select the appropriate order Filter.

   TIP An Order-based filter may be used for isolating mechanical defects related to operational running speed. However, in order to see all potential defects, non-harmonic related, an Overall filter must be applied.

   See Non-filtered Orbit Plot on page 161.

6. Select the measurement definition that you just created.
7. Choose Edit > Copy to copy the time measurement definition.
8. Move to an empty row in the Measurement Definition pane and choose Edit > Paste to paste the new measurement definition into the spreadsheet.
9. Edit the new measurement definition. Change Data Type to Numeric and the Filter to None.
10. In the Location pane, select the location that you just created.
11. Choose Edit > Copy to copy the location.

12. Move to an empty row in the Location pane and choose Edit > Paste to paste the new measurement definition into the spreadsheet.

13. Edit the new location.

    Make sure you change the Location ID and set Lo. Channel to 2.

14. Now include these locations in a list.

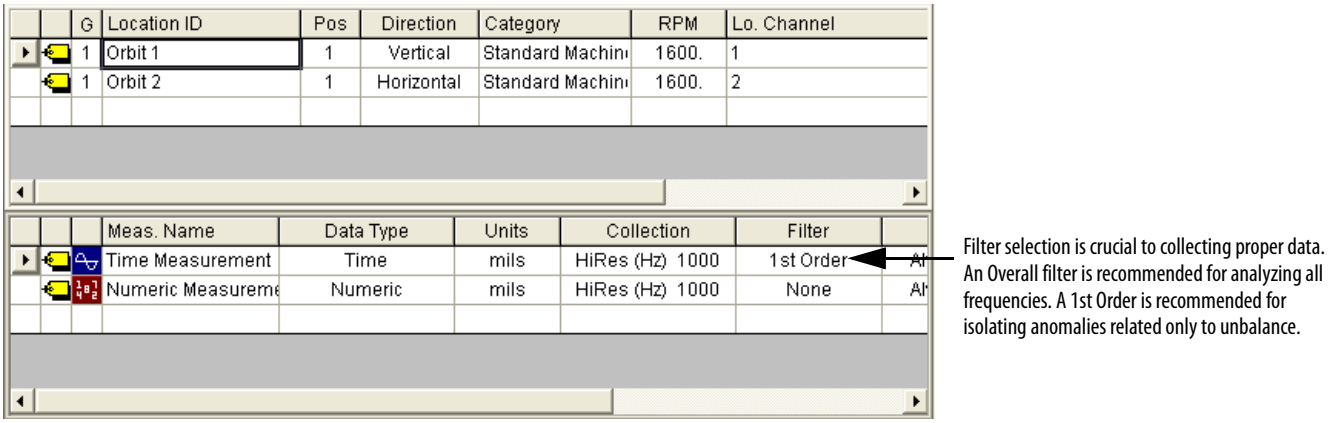
    You can create a new list or recall the current list. The locations must be tagged to create a group list.

15. Double-click the Group column in the Location pane to add the two locations to a group list.

    The current group numbers appears in the Group column.

16. Assign the locations the same group number. The group is then loaded with the list to the Enpac 2500.

Figure 32 - Typical Orbit Measurement Setup



17. Connect the data collector to the computer and load the list to the Enpac 2500.

    See Loading Lists to the Data Collector on page 106 for details.

18. Select the route and collect the orbit measurement.

    See Collect Orbit Measurements on page 168.

    See Select a Route on page 121 for assistance in selecting a route.

Set Up Offroute Orbit Measurements

1. Select Data Collection from the Main Menu and press the Enter key.

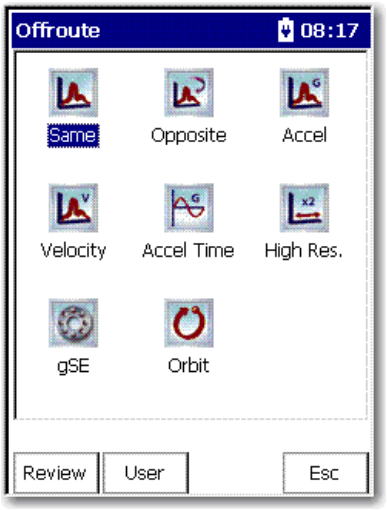
   The Data Collection screen appears.

2. Select the route and measurement point.

   See Select a Route on page 121 for more information.

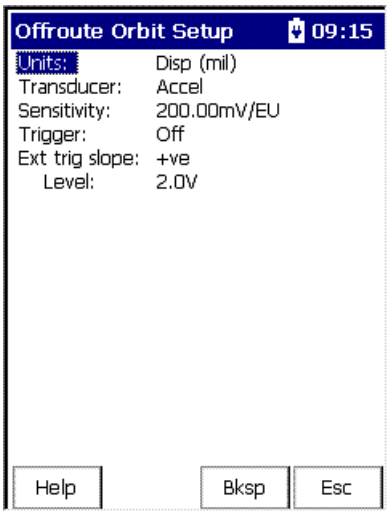
3. Press F2 (Offroute) to collect an Offroute measurement.

   The Offroute screen appears.



4. Select the Orbit icon to store an Offroute orbit measurement at the current point.

   The Offroute Orbit Setup screen appears.



5. Select the parameter and press the Right arrow to display the choices.

6. Select the parameter with the arrow keys, or type in a value.

7. Press the Left arrow to save your choice.

Use the descriptions in the table below to help you configure the options in the Offroute dialog box.

TIP The Units, Transducer, Filter, and Sensitivity apply to both channels. The two input channels are X and Y.

When you are finished setting up the parameters, you can collect the Offroute measurement.

See Collect Orbit Measurements on page 168 for more information.

Table 39 - Offroute Orbit Parameters

Parameter	Description	Values/Comments
Units	Sets the measurement units for the transducer.	Disp (mil) Disp (µm)
Transducer	The transducer used to collect this measurement.	Prox Probe Accel
Sensitivity	The sensitivity of the transducer. The sensitivity value is included with the transducers documentation or it may be imprinted on the side of the transducer.	200 mV/EU (default)
Trigger	Determines whether the trigger is on or off. When Trigger is set to Off the rpm value must be entered during data collection.	On Off
Ext Trig Slope	The input signal slope to be used for externally triggering the measurement +ve Defines the trigger event to occur on a rising edge. -ve Defines the trigger event to occur on a falling edge.	+ve -ve
Level	The amplitude level for externally triggering the measurement. The level is a percentage of the trigger full scale range.	2.0 (default)

Collect Orbit Measurements

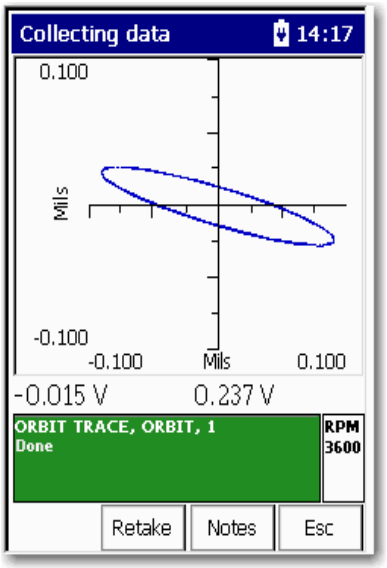
Once you have selected the route and have finished setting up the orbit Offroute parameters, you can begin collecting the data.

Follow these steps to collect data.

1. Attach the transducer to the correct location.
2. Press Enter to start ranging your measurement for the current point.

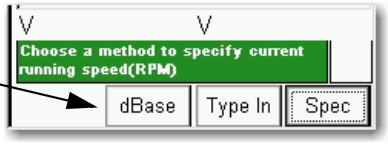
   The Enpac 2500 ranges and collects the data.

   The measurement screen appears.



IMPORTANT If Trigger (Offroute Orbit parameter) is set to Off, the Specify rpm dialog box appears when collecting an Offroute orbit measurement.

The bDase function appears only if a rpm value is downloaded with the route.



You must specify the rpm:

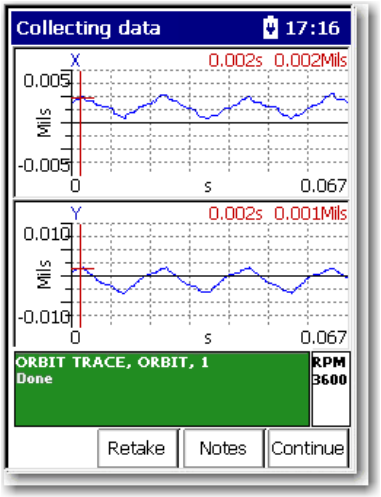
- Press F2 (dBase) to use the rpm downloaded with the route.
- Press F3 (Type In) to manually enter the rpm value
- Press F4 (Spec) to take the rpm from a spectrum.

If you press F4 (Spec), a spectrum appears on the screen. Position the cursor on the peak that represents the machine running speed and press F2 (OK).

The rpm value that is specified is used to set the Fmax appropriately and the order filtering frequency.

3. Use the Up and Down arrows to expand and compress the orbit.
4. Press 0 (Shift) and F4 (View).
5. Select the View option to display the Time Waveform, x1, x2 or x3.
6. Select Timewave and Press F4 (View) to display the time plot.

   The following screen appears.



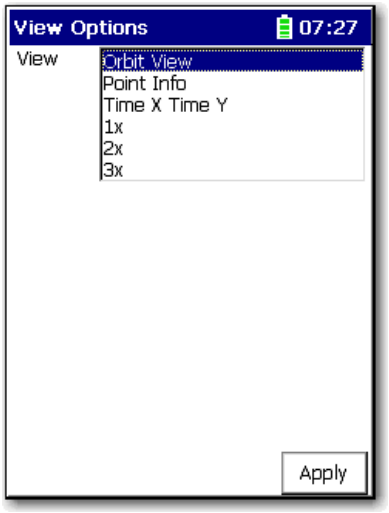
View Options

The View options for orbit points are the following:

- Orbit View (default)
- Point Info
- Time X Time Y
- 1x
- 2x
- 3x

Follow these steps to display the view options for orbit measurements.

1. Press 0 (Shift) to display the second set of functions.
2. Press F4 (View).



3. Select an options and click Apply.
4. Use the Left and Right arrows to move the frequency cursor.
5. Use the Up and Down arrows to move the amplitude cursor.

   The Y-axis and X-axis are synchronized, which means the cursors are in the same position on each trace in the spectrum. The X and Y axis will move together, and magnify as the display is expanded.
6. Press the +/- key to expand and compress the time waveform spectrum plot.
7. If desired, press F3 (Notes) to assign inspection codes to each point.

   The Enpac 2500 unloads the inspection codes when you unload the unscheduled data to the Emonitor software.

   See Inspection Codes and the Data Collector on page 96 for more information.
8. Once the Enpac 2500 collects the measurement, press Enter to accept the measurement.
9. When you are finished viewing the data, press Enter or press F4 (Esc) to return to the Data Collection screen.

Review Route Data

Follow these steps to review route data.

1. From the Route Manager screen, select the route you want to review. and press Enter.

2. Press F1 (Review).

   The Review Orbit screen appears.

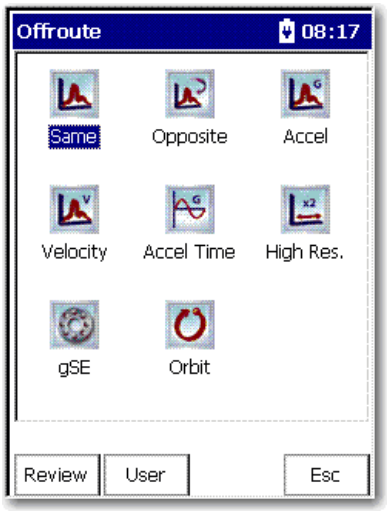
   See Review Orbit Data Screen on page 172 for more information.

Review Offroute Data

1. From the Route Manager screen, select the route you want to review. and press Enter.

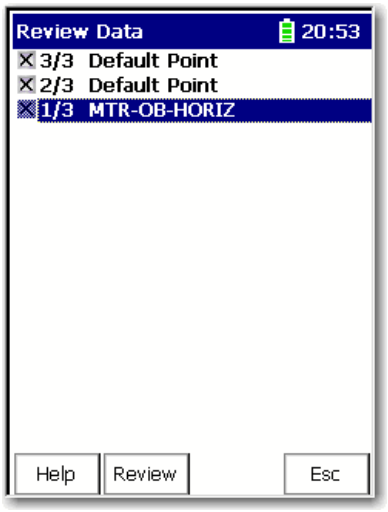
1. Press F2 (Offroute).

   The Offroute screen appears.



2. Press F1 (Review) to review the Offroute data.

The Review Data screen appears.



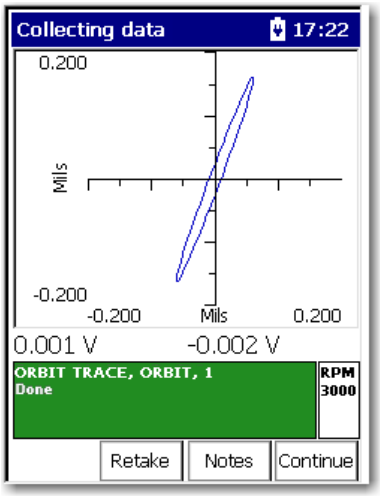
3. Select the point that you want to review and press F2 (Review).

   For information on orbit data, see Review Orbit Data Screen on page 172.

Review Orbit Data Screen

The Review Orbit Data screen lets you view the data in an orbit plot.

See Understanding an Orbit Plot on page 160 for more information about orbit plots.



- To expand or compress the orbit, press the Up and Down arrows.
- To view the data in a time waveform, select Time X & Time Y from the View menu.
- Use the Left and Right arrows to move the frequency cursor.
- Use the Up and Down arrows to move the amplitude cursor.

The cursor values appear above the signature data.

IMPORTANT	The Y-axis and X-axis are synchronized, which means the cursors are in the same position on each trace in the Signature Data screen. The X and Y axis will move together, and magnify as the display is expanded.

Cross Channel Phase Measurements

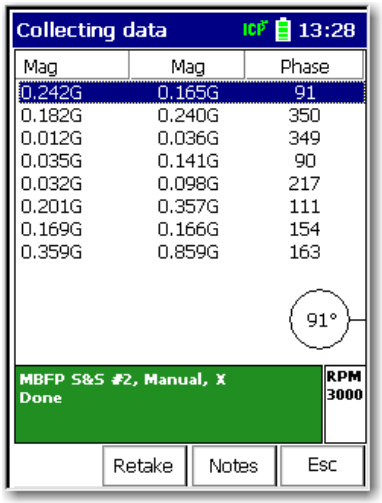
The Emonitor software and the Enpac 2500 support cross channel phase measurement definitions. This topic lists the unique characteristics of the Enpac 2500 that you may need to know when setting up and collecting cross channel phase data:

- Set up a location in the Location pane for the two input channels.
- Set the Lo. Channel for the first location to 1.
- Set the Lo. Channel for the second location to 2.
- Set up a Collection Specification with Transducer set to Accelerometer.
- Check the Also collect phase data checkbox and set Channel phase to Dual Channel.
- Set up a magnitude measurement definition for both locations.

Phase Tables

Phase is displayed as a table of magnitude/phase pairs of up to 8 orders. In a dual channel display, the top trace displays the first channel and the lower trace is the second. Boost values and cursor moves are applied to both traces, whether displayed or hidden.

Use the up/down arrows to scroll through the phase table values. When you are finished collecting and viewing the cross channel phase measurement data, press Enter to store your data.



The measurement definition is the same for both channels.

Multi-channel Cursor, Display Expand, and Full Scale Adjustments

For multi channel measurements, the cursor operates simultaneously on all traces (even if one is hidden). This is also true for Full Scale adjustments using the Up and Down arrows (amplitude axis). You can use the + and - keys to adjust the display and expand (frequency/time axis).

Independent Autoranging

For two channel measurements, autoranging is performed simultaneously on both channels. This lets you use two probes of differing sensitivity. You can analyze two axes of differing amplitudes while ensuring optimum gain setting for each channel.

In all cases, the same filters, integrator, and Fmax are used on both channels. However, input range and coupling are independent.

For cross channel phase, dual time and dual spectrum measurements, if the collection specification is Overall and Spectrum or Overall Only, then the overall value is calculated from the spectrum as an RSS overall. There is no support for two channel analog overalls.

Triggerless Operation

Most two channel measurements use a trigger to establish running speed. However, the running speed can be manually entered, or taken from a spectrum by positioning the cursor on the 1X spectral peak.

Orbits typically require a trigger. If you don't define a trigger, the display shows a random moving cursor around the trace and has no useful meaning. Therefore, the cursor is not displayed when operating in triggerless mode with orbits. With orbits, the specified rpm value is used to set both the Fmax and the frequency used to configure the orbit input filters.

Set Up Cross Channel Phase Measurement Definitions in the Emonitor Software

To set up the cross channel phase measurements in the Emonitor software, follow these steps.

1. Select the machine that you want to set up cross channel phase measurements.
2. In the Location pane, create the first location and set Lo. Channel to 1.
3. In the Measurement Definition pane, create the magnitude measurement definition by setting Data Type to Magnitude.

4. Set Collection to the collection specification that you created for the cross channel phase. Select a band Filter, for example, 1st Order.

5. In the Location pane, select the new location that you just created. Choose Edit > Copy to copy the location.

6. Move to an empty row in the Location pane and choose Edit > Paste to paste the new location into the spreadsheet.

7. Edit the new location. Make sure you set Lo. Channel to 2.

8. Include these locations in a list. You can create a new list or recall the current list. The locations must be tagged to create a group list.

9. Add the two locations to a group list by double-clicking the Group column in the Location pane.

   The current group number appears in the Group column. Make sure you assign the locations the same group number. The group is then loaded with the list to the Enpac 2500.

   This figure shows a typical setup for a cross channel phase measurement.

Figure 33 - Cross Channel Phase Measurement Definitions

G	Location ID	Pos	Direction	Category	RPM	Lo. Channel
1	Cross Ch1	1	Vertical	Standard Machin	1600.	1
1	Cross Ch1	2	Vertical	Standard Machin	1600.	2

Meas. Name	Data Type	Units	Collection	Filter
Magnitude	Magnitude	ips	Cross Channel	1st Order

10. Connect the data collector to the computer and load the list to the Enpac 2500.

    See Loading Lists to the Data Collector on page 106 for details.

11. Once you have prepared the Enpac 2500 data collector for data collection, select the route and collect the cross channel phase measurement.

    See Collect a Cross Channel Phase Measurement on page 178.

Set Up an Offroute Cross Channel Phase Measurement

The Cross Channel Phase Offroute measurement is configured by creating a user-defined measurement point. The Enpac 2500 keeps the user-defined parameters until you collect another measurement point or press F2 (Default) on the Offroute User screen.

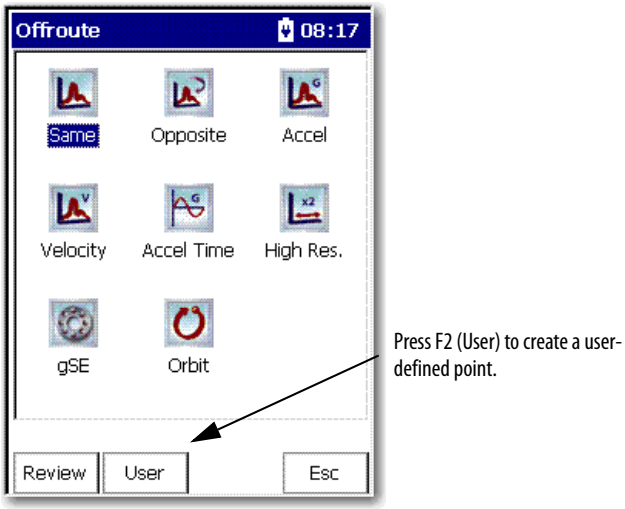
See Create and Collect a User-defined Point on page 141 for more information.

1. Select Data Collection from the Main Menu and press the Enter key.

   The Data Collection screen appears.

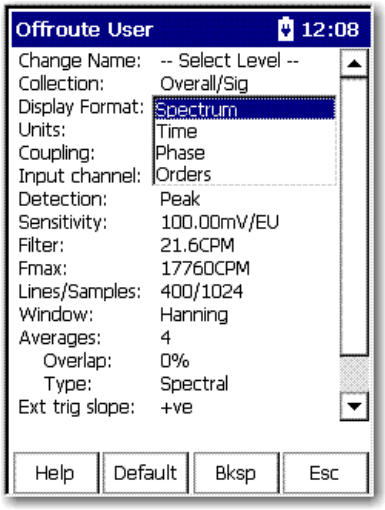
2. Select the route. The Enpac 2500 always associates Offroute measurements with a list.

3. Press F2 (Offroute) to collect an Offroute measurement. The Offroute screen appears.



4. Press F2 (User).

The Offroute User screen appears.

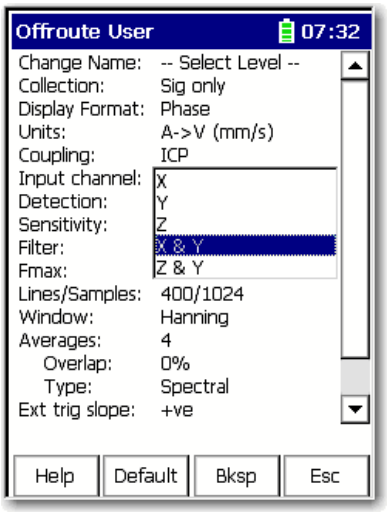


5. Select Display Format and press the Right arrow key to display the format choices.

6. Select Phase and press the Left arrow key to save your choice.

7. Select Input Channel and press the Right arrow key to display the input channel choices.

8. Select X&Y and press the Left arrow key.



9. Change the other parameters as needed.

   See Offroute Orbit Parameters on page 167 for assistance.

10. You are now ready to collect the cross channel phase measurement.

    See Collect a Cross Channel Phase Measurement on page 178.

Collect a Cross Channel Phase Measurement

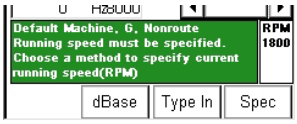
A cross channel phase measurement displays the spectra for input channels X&Y, and the relative phase angle between the two input channels. The phase difference between the two inputs is measured.

This is known as relative phase. Spectra for both input channels are stored, and the relative phase between the two channels is displayed as a table of magnitude/phase pairs of up to 8 orders of running speed.

1. Connect the proper transducer and attach it to the correct location.

2. Press Enter to start the measurement.

   The Specify rpm dialog box appears.

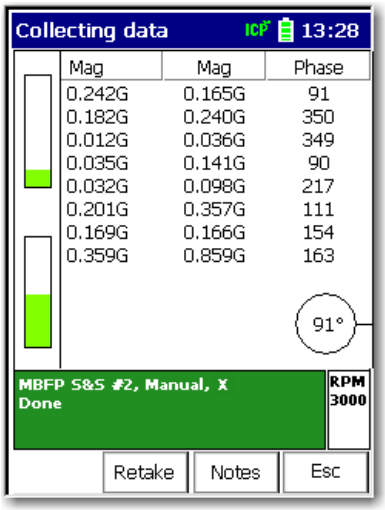


This function appears only if a rpm value is downloaded with the route.

   - Press F2 (dBase) to use the rpm downloaded with the route.
   - Press F3 (Type In) to manually enter the rpm value.
   - Press F4 (Spec) to take the rpm from a spectrum

   TIP If you press F4 (Spec), a spectrum appears on the screen. Position the cursor on the peak that represents the machine running speed and press F2 (OK).

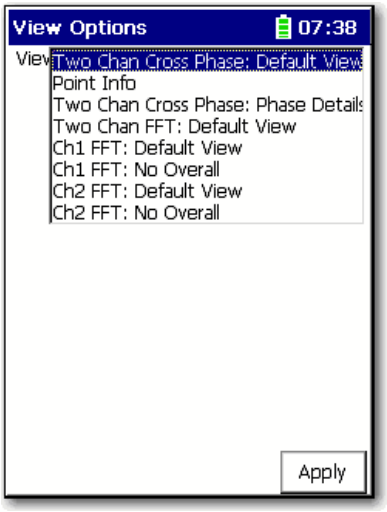
   The data collector ranges and collects the data and the measurement screen (phase table) appears.



View Options

The View options for a cross channel phase point are the following:

- Two Chan Cross Phase: Default View
- Point Info
- Two Chan Cross Phase: Phase Details
- CH1(X) FFT: Default View
- CH1 (X) FFT: No Overall
- CH2 (Y) FFT: Default View
- CH2 (Y) FFT: No Overall



The Y-axis and X-axis are synchronized, which means the cursors are in the same position on each trace in the Signature Data screen. The X and Y axis will move together, and magnify as the display is expanded:

- Press the Left and Right arrow keys to move the frequency cursor.
- Press the Up and Down arrow keys to move the amplitude cursor.
- Press the +/- key to expand and compress the spectrum plot.
- Press F3 (Notes) to assign inspection codes to each point.

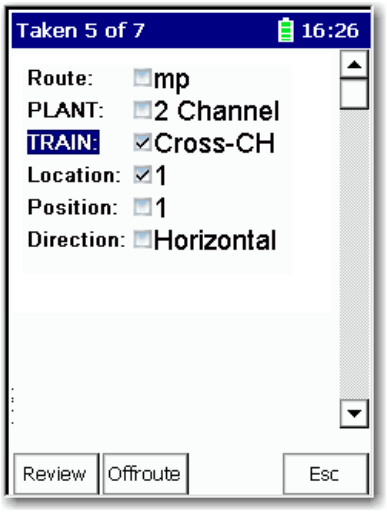
  The Enpac 2500 data collector unloads the inspection codes when you unload the unscheduled data to the Emonitor software.

  See Loading Inspection Codes on page 109.

3. Once the Enpac 2500 data collector collects the measurement, press Enter to accept the measurement.

Review Cross Channel Phase Data

The data for you to review is displayed at the top of the Data Collection screen.



Review Route Data

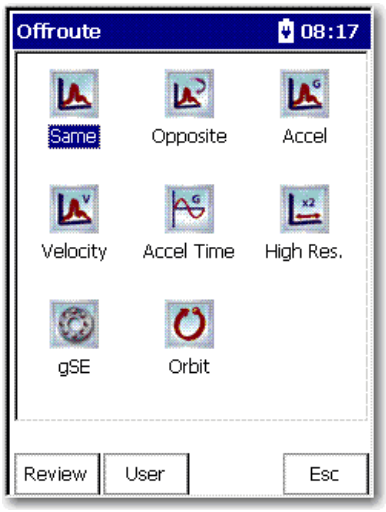
1. From the Route Manager screen, select the route you need to view and press Enter.
2. Press F1 (Review).

IMPORTANT	The Y-axis and X-axis are synchronized, which means the cursors are in the same position on each trace. The X and Y axis will move together, and magnify as the display is expanded.

Review Offroute Data

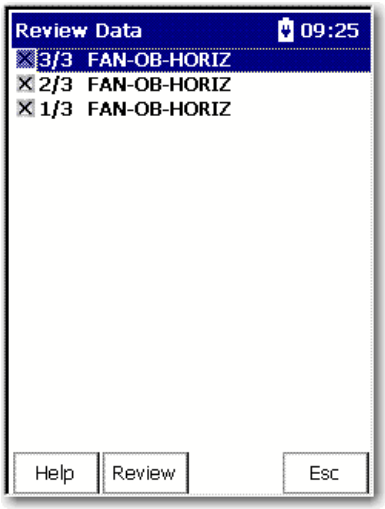
1. From Route Manager screen, select the route to review and press Enter.
2. Press F2 (Offroute).

The Offroute screen appears.



3. Press F1 (Review) to review Offroute data.

   The Review Data screen appears.



4. Select the point that you want to review and press F2 (Review).

IMPORTANT	The Y-axis and X-axis are synchronized, which means the cursors are in the same position on each trace in the Signature Data screen. The X and Y axis will move together, and magnify as the display is expanded.

Two-channel Measurements

The Emonitor software and the Enpac 2500 support two channel measurements definitions.

Set Up Two-channel Measurement Definitions in the Emonitor Software

Follow these steps to set up a two-channel measurement.

1. Set up a location in the Location pane for the two input channels.

   The Location Ids must be different. Set Lo. Channel for the first location to 1. And set Lo. Channel for the second location to 2.

   The measurement definitions must be the same for both locations.

IMPORTANT	Make sure the measurement definitions are not similar to either the orbit measurement definitions or the cross channel phase measurement definitions. You may get unexpected results.

2. Assign the same group number to the locations to collect the measurements properly.

Follow these steps to set up the two-channel measurements in the Emonitor software.

1. Select the machine in the Hierarchy Tree for which you want to set up the dual channel measurements.
2. In the Location pane, create the first location and set Lo. Channel to 1.
3. In the Measurement Definition pane, create the measurement definition.
4. In the Location pane, select the new location that you just created. Choose Edit > Copy to copy the location.
5. Move to an empty row in the Location pane and choose Edit > Paste to paste the new location into the spreadsheet.
6. Edit the new location. Make sure you set Lo. Channel to 2.
7. Include these locations in a list. You can create a new list or recall the current list. The locations must be tagged to create a group list.
8. Add the two locations to a group list by double-clicking the Group column in the Location pane.

   The current group number appears in the Group column. Make sure you assign the locations the same group number. The group is then loaded with the list to the Enpac 2500.

This figure shows a typical setup for a two-channel measurement.

Figure 34 - Two-channel Measurement Definitions

G	Location ID	Pos	Direction	Category	RPM	Lo. Channel
1	mag 1	1	Horizontal		0.	1
1	mag 2	1	Vertical		0.	2
	spec 1	2	Horizontal		0.	1
	spec 2	2	Vertical		0.	2
	time 1	3	Horizontal		0.	1

Meas. Name	Data Type	Units	Collection	Filter
Length Time	Time	um	STD (Hz) 500	None

9. Connect the data collector to the computer and load the list to the unit.

   See Loading Selected Lists to the Data Collector on page 111.

10. Once you have prepared the unit for data collection, select the route and collect the dual channel measurement.

Collect an Offroute Two-channel Measurement

The two-Channel Offroute measurement is configured by creating a user-defined measurement point. The Enpac 2500 data collector keeps the user-defined parameters until you collect another measurement point or press F2 (Default) on the Offroute User screen.

See Create and Collect a User-defined Point on page 141 for more information.

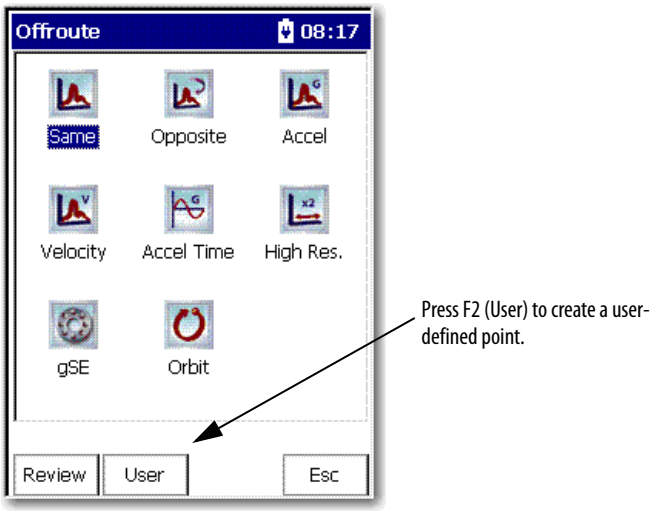
1. Select Data Collection from the Main Menu and press the Enter key.

   The Route Manager screen appears.

2. Select a route.

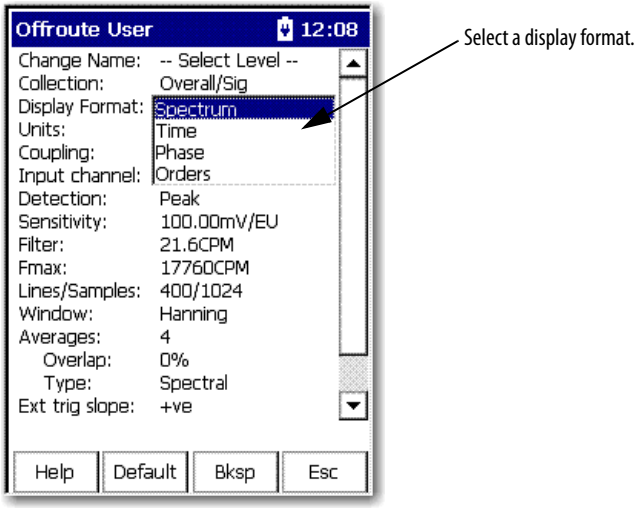
3. Press F2 (Offroute) to collect an Offroute measurement.

The Offroute screen appears.



4. Press F2 (User).

   The Offroute User screen appears.

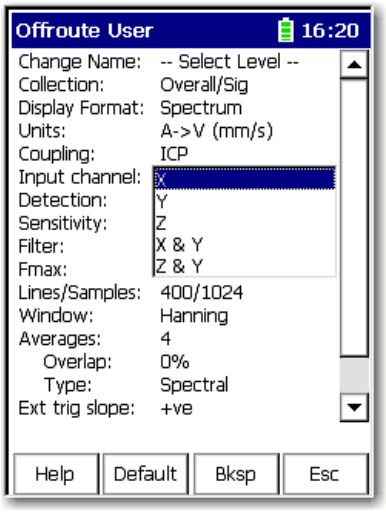


5. Select Display Format and press the Right arrow to display choices.

6. Choose a Display Format and press the Left arrow to save your choice.

   See Offroute User Parameters on page 146 for details about the Offroute User screen.

7. Select Input Channel and press the Right arrow to display the input channel choices.



8. Select the channel and press the Left arrow key.

   See External Connections on page 23 for complete information on the connectors and related channels.

9. Change the other parameters as needed.

   See Offroute Orbit Parameters on page 167 for assistance.

   You can also set the Acquisition parameter in the Instrument Configuration screen to Single Shot or Continuous.

   – In Single Shot mode, the unit halts when the data collector has settled and the data is stable.
   – In Continuous mode, the unit constantly analyzes and displays the moving signals until you store the data by pressing the Enter key.

   See Instrument Configuration Parameters on page 44.

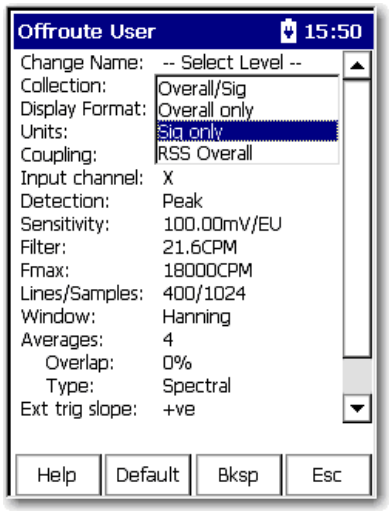
10. You are now ready to collect the dual channel measurement.

    See Collect a Cross Channel Phase Measurement on page 178.

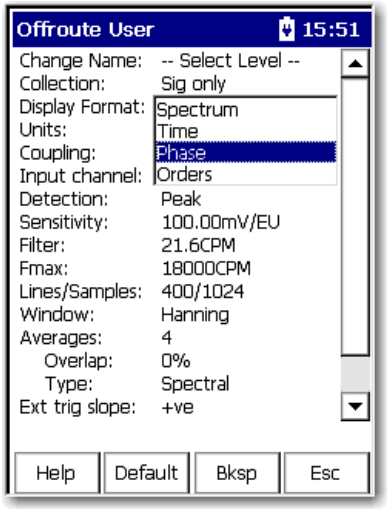
Magnitude and Phase Offroute Measurement

Follow these steps to collect a magnitude and phase measurement Offroute.

1. From the Route Manager screen, select the route that you setup in the Emonitor software as magnitude and phase.
2. Press Enter.
3. Press F2 (Offroute).
4. Press F2 (User).
5. Set Collection to Sig Only.



6. Set Display Format to Phase.



7. Press Enter to start taking the measurement.

TIP You press F1 (Config) on the Route Manager screen to set the trigger. You can also set the trigger on the Instrument Configuration screen by pressing 0 on the Data Collection screen:

- Set the trigger to Laser Tach if using the internal trigger.
- Set the trigger to External if using a external trigger device.

8. Point the data collector.

   Notice that the Laser Tach is operational.

ATTENTION: When the laser on the data collector is active, viewing the laser beam can expose your eyes beyond the maximum permissible exposure recommendations and cause harm.

9. When the measurement stabilizes, press Enter to store the reading.

Notes:

Installing Optional Extension Modules

The data collector uses the Extension Manager to install and uninstall extension modules. These extension modules are licensed and ordered separately from the basic entry level product.

Topic	Page
Install Optional Extension Modules	189
Uninstall an Extension Module	191
Manage Extension Modules	193

Install Optional Extension Modules

The installation PCMCIA cards that you receive work with any Enpac 2500 data collector. Once you have installed an extension module on a the data collector, the card is locked so that it can be used only with that instrument.

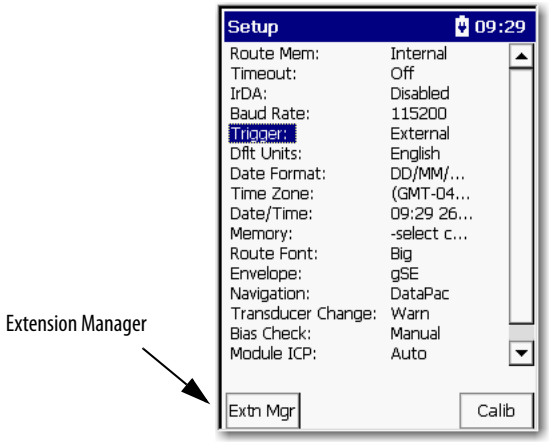
IMPORTANT One installation PCMCIA card is required for each instrument that needs to be upgraded.

You can uninstall extension modules, if required. When uninstalling an extension module, you have the option to free up the license so that it can be used to install the extension module on another data collector. This allows the extension module to be transferred between units.

Follow these steps to install an extension module.

1. Open the base cover at the bottom of the Enpac 2500 data collector.
2. Place the extension module PCMCIA card contact-side-up into the unit until it is firmly seated in place.
3. Close the base cover.
4. Apply power to the data collector.
5. From the Main menu, select Setup Utility and press Enter.

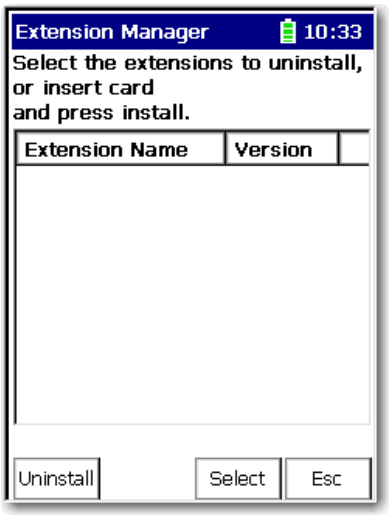
6. Press 0 (Shift) to display the second set of functions.



The Extension Manager function remains on the screen for about three seconds after releasing 0 (Shift Key).

7. Press F1 (Extn Mgr).

The Extension Manager screen appears.



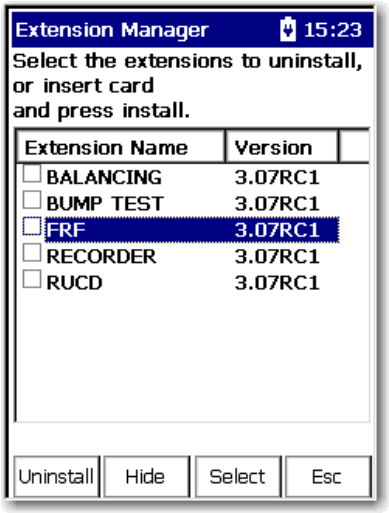
8. Press 0 (Shift) to display the Install Extension function.

9. Press F2 (Install) to install the new extension module.

When the installation is complete, a confirmation prompt appears.

10. Press F4 (OK).

The new extension module appears in the list.



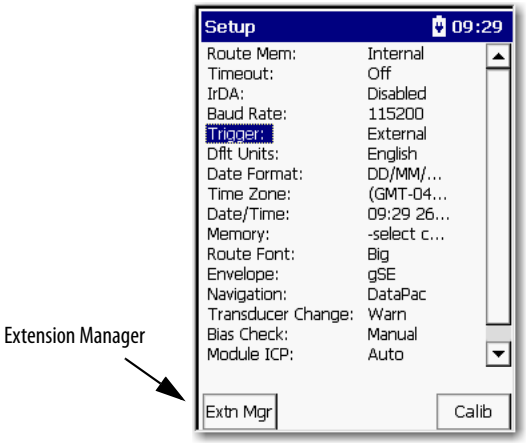
11. Press F4 (Esc) to exit the Extension Manager screen.

Uninstall an Extension Module

Follow these steps to uninstall an extension module.

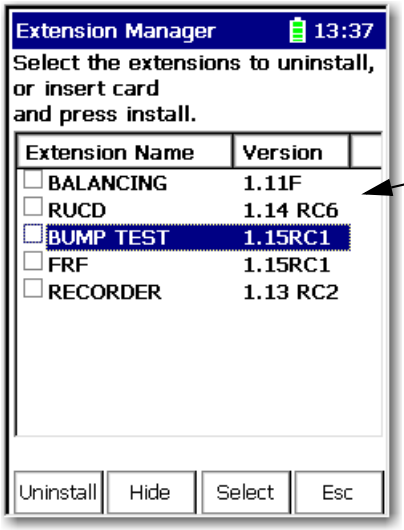
1. Press 0 (Shift) from the Setup Utility screen to display the Extension Manager function.

   The Extension Manager function remains on the screen for about three seconds after releasing 0 (Shift).



2. Press F1 (Extn Mgr).

The Extension Manager screen appears.

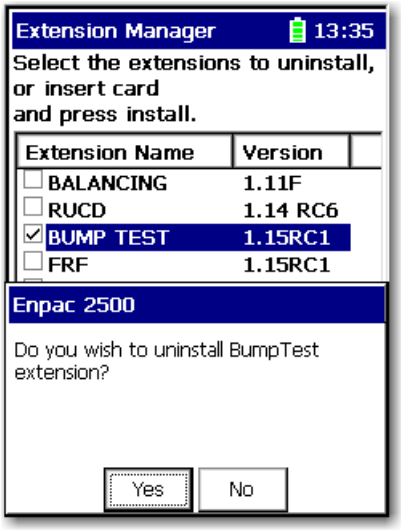


This screen lists the extension modules currently installed and on the unit.

3. Select the extension module you want to uninstall and press F3 (Select).

   F3 (Select) toggles the selection on and off.

   A checkmark appears next to that extension module.



4. Press F1 (Uninstall).

   A confirmation message appears.

5. Make sure your installation card is inserted into the unit.

TIP You must have the correct extension module card inserted to remove that option. If the wrong card or no card is inserted then a message displays telling you to insert the correct card.

IMPORTANT The extension module is uninstalled and the license on the card is released so that the card can be used to install the extension module on another Enpac 2500 data collector.

If the installation card is not inserted in the data collector and no card is found or the card does not have the extension module license for the unit, you are prompted to insert the correct installation card or continue without freeing the license.

6. Press F2 (Yes) to uninstall the extension module.
7. Press F4 (Esc) to exit the Extension Manager screen.

Manage Extension Modules

The Enpac 2500 data collector lets you to hide installed extension modules from the Main menu. You may need to hide an advanced extension module icon from an inexperienced user, for example, RuCD and FRF. Also, you can use the Extension Manager to also show previously hidden icons.

IMPORTANT Once an extension module is hidden, its icon is not represented on the Main Menu or displayed in the Enpac 2500 data collector About screen.

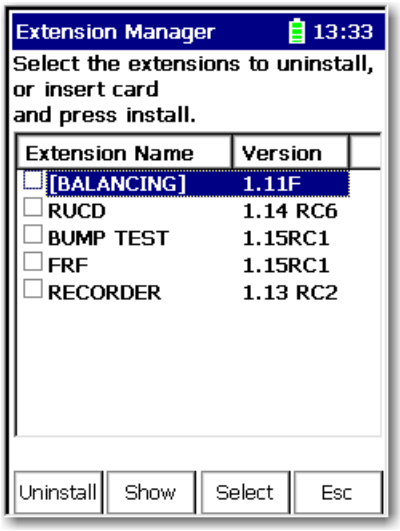
Follow these steps to hide or show an extension module icon on the Main Menu.

1. Press 0 (Shift) on the Setup Utility screen to display the Extension Manager function.

   The Extension Manager function should remain on the screen for approximately three seconds after releasing 0 (Shift).
2. Press F1 (Extn Mgr). The Extension Manager screen appears.

The Extension Manager displays a list of installed extensions module.

The extension modules that are hidden are shown in [square brackets].



The F2 function key toggles between Hide and Show depending if the highlighted extension module is hidden or not.

TIP You have to exit and re-enter the Extension Manager after hiding an extension module to have the Show function appear.

3. Select the extension module that you want to hide or show and press F2 (Show/Hide).

   TIP If you want to show or hide multiple extension modules simultaneously, highlight each extension module and press F3 (Select).

   A checkbox appears next to each selected extension module. If you select multiple extension module and some are hidden while others are shown, F2 (Show/Hide) reflects the status of the highlighted extension module.

4. Press F4 (Esc) to exit the Extension Manager.

Bump Test Application

The Enpac 2500 Bump Test application provides the Enpac 2500 with a simple yet effective way of determining natural (or resonant) frequencies of a machine or structure.

The Bump Test application is an add-on program to the Enpac 2500 and must be installed with the Bump Test PCMCIA card from Rockwell Automation.

Refer to Adding Applications to the Enpac 2500 Data Collector on page 59 for installation instructions.

Topic	Page
Overview of the Bump Test Application	195
Setting Up and Collecting Bump Test Measurements	196
Recalling a Setup	201
Reviewing Bump Test Measurements	202
Backing Up and Deleting Bump Test Files	204

Overview of the Bump Test Application

A bump test (or hammer test) determines the natural frequencies of a machine or a structure. The idea behind the test is that when an object is impacted or 'bumped,' the objects natural or resonant frequencies are excited. If a spectrum is taken while the object is vibrating due to the impact, spectral peaks will result and pinpoint the objects natural frequencies. The Enpac 2500 data collector can be used to capture this frequency response and display a spectrum illustrating the resonant frequencies.

Vibration forces transmitted by rotating machines often excite natural resonance in structures attached to the machine. When these structural resonances appear, vibration levels are amplified and can result in fatigue failures. Structural resonances can also mask the cause of a machines vibration making it difficult to implement corrective machine maintenance. The Bump Test identifies a structures resonant modes and provides a maintenance engineer with the opportunity to change the resonance frequency in order to reduce or eliminate damaging vibration levels.

Setting Up and Collecting Bump Test Measurements

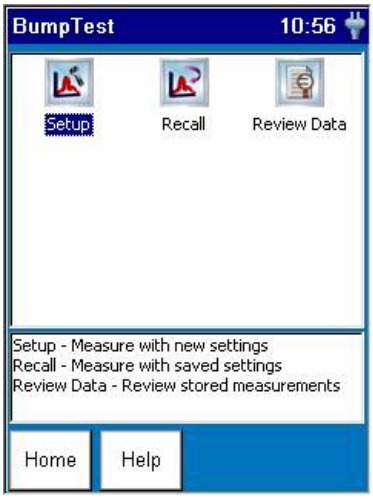
This section discusses how to set up, collect, and save Bump Test measurements.

Setting Up Bump Test Measurements

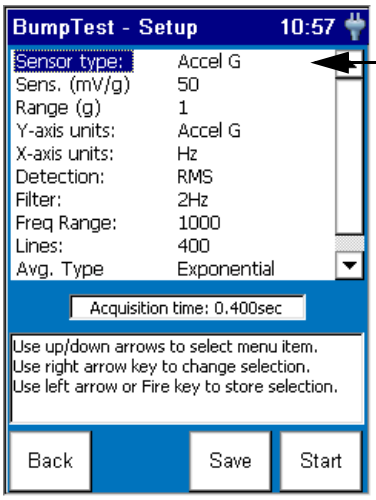
1. Connect the transducer to the Enpac 2500.

   Refer to Connect a Transducer to the Data Collector on page 120.

2. Attach the transducer(s) to the machine case or structure.
3. Select Bump Test on the Main Menu and press the READ/OK key. The Bump Test screen appears.



4. Select Setup and press the READ/OK key to set up the Bump Test parameters and begin data collection. The Bump Test - Setup screen appears.



To select an option use the UP and DOWN ARROW keys.

5. Highlight the option and press the RIGHT ARROW key to open a menu of choices.

6. Select the choice by pressing the arrow keys or type in a value using the numeric key pad.
7. Press the LEFT ARROW key to save your selections.
8. Press F3 (Save) to save the current settings to a file.

Refer to Saving a Bump Test Setup and Measurement on page 200.

Use the descriptions in this table to help you configure the Bump Test parameters..

TIP For the bump test, some of the vibration measurement settings are pre-set to simplify your setup. The FFT window is pre-set to Hanning and the Overlap is pre-set to 50%.

Table 40 - Bump Test Setup Parameters

Parameter name	Description	Values/Comments
Sensor Type	Sets the type of vibration measurement to be used in data collection.	Options: Accel G (default) Accel m/s^2 Vel IPS Vel mm/s Disp um Disp mil Your selection determines the available options and engineering units for subsequent setup parameters.
Sens. (mV/EU)	The transducer sensitivity in millivolts (mV) per engineering unit (EU).	1…2000 mV/EU Default value is 50 mV/EU The sensitivity value is included with the transducers documentation or it may be imprinted on the side of the transducer.
Range (EU)	The expected maximum amplitude range value.	Options: .1 EU .2 EU .5 EU 1 EU (default) 2 EU 5 EU 10 EU 20 EU 50 EU 100 EU 200 EU 500 EU 1000 EU 2000 EU
X-axis units	Set the x-axis frequency units for displaying spectra/FFT data. • Hz - Displays spectra in Hertz, cycles per second. • CPM - Displays spectra in cycles per minute.	Options: Hz (default) CPM
Filter	Sets the high pass filter to be used in data collection.	Options: Off .36 Hz 1.1 Hz 2 Hz (default) 10 Hz 70 Hz

Table 40 - Bump Test Setup Parameters

Parameter name	Description	Values/Comments
Freq Range	The maximum frequency for the measurement.	240000 Hz 120. . . 2400000 CPM Frequency range depends on the X-axis units selection.
Lines	The number of lines (bins) of resolution for the FFT spectra. The larger the number of lines, the better the frequency resolution of the measured data in the spectra. Similarly, the higher the number of lines, the longer it takes to display the spectra in the plot.	Options: 100 200 400 (default) 800 1600 3200 6400 12800
Avg. Type	Sets the type of averaging the Enpac 2500 will perform on collected data. For bump tests, Peak Hold averaging is recommended for holding the highest spectral peak of each hammer hit. When using exponential averaging, the Enpac 2500 averages multiple hits to minimize the noise level. You must pause the averaging process after the final hammer hit.	Options: Peak Hold Exponential (default)
Display Y-axis	Sets the scaling of the y-axis. • Linear - The plot grid centers are linearly spaced in Y between the centers of the first and last grid. • Log - The plot grid centers are logarithmically spaced in Y between the centers of the first and last grid.	Options: Linear (default) Log

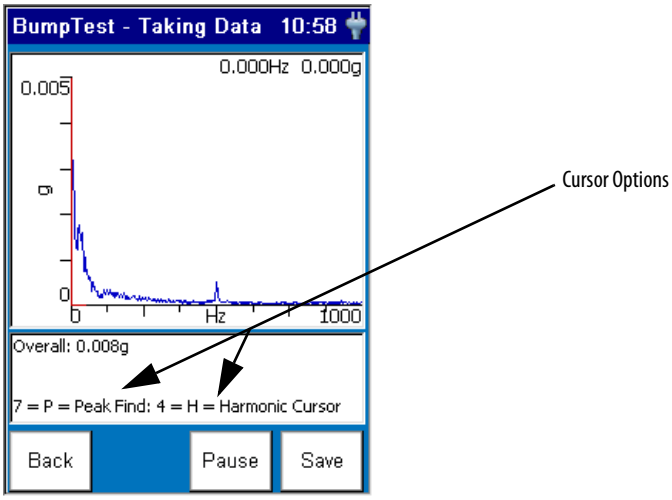
Collecting Bump Test Measurements

When you are finished setting up the options, you are ready to collect Bump Test data.

1. To start collecting data, press F4 (Start) on the Bump Test - Setup screen.

   The Bump Test - Taking Data screen appears.
2. Using an impacting device, hit the machine.

   Notice the natural frequency spectral peaks displayed on the screen.



If you need to pause the data on the screen, press F4 (Pause). The Pause function becomes the Start function. To start collecting data again, press F4 (Start).

Use the LEFT and RIGHT ARROW keys to move the cursor across the X axis to determine the natural frequencies. Use the UP and DOWN ARROW keys to change the scale on the Y axis.

Press the P key to move the cursor to the next significant peak. And to display the harmonic cursors, press the H key. Each time you press H, it toggles among three functions.

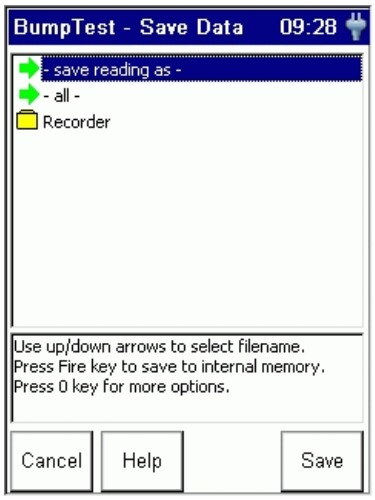
Table 41 - H Functions

On pressing H	Function
Once	Enables the harmonic cursors. Press the LEFT and RIGHT ARROW keys to move the harmonic cursors.
Twice	The cursor line is displayed with the harmonic cursors. Press the LEFT and RIGHT ARROW keys to move only a single cursor, leaving the harmonic cursors locked in position.
Thrice	Turns the harmonic cursors off; use only a single cursor.

Saving a Bump Test Setup and Measurement

The bump test setup parameters and measurements can be saved to a file which can then be recalled at a later time. You can save a bump test setup and measurement anytime the Save function is displayed on the screen.

1. Press F3 (Save). The Bump Test -Save Data screen appears.



2. Do one of the following:
   - To save the data to an existing file, highlight the file, and press F4 (Save). Press F2 (Yes) to overwrite the existing file. Note that you can return to the Save screen without overwriting the file by pressing F3 (No).
   - To save the data to a new file, highlight 'save reading as' and press F4 (Save). Enter a file name using the keypad or accept the default file name (current date timestamp). When the entry is complete, press F4 (OK).

IMPORTANT	The setup parameters are saved along with the measurement when you press F4 (Save) on the Bump Test - Save Data screen.

3. When you are finished, press F1 (Cancel).

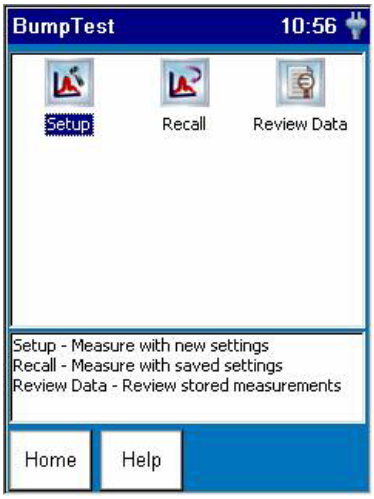
Recalling a Setup

You can recall a previously saved setup and use it to record another measurement. The setup may have been saved only as a setup, or may have been saved with the recorded data. Refer to Saving a Bump Test Setup and Measurement on page 200.

1. Connect the transducer to the Enpac 2500.

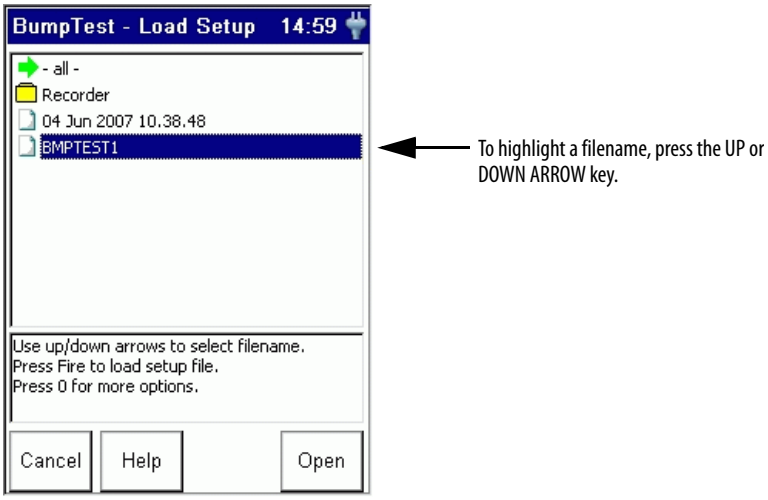
   Refer to Connect a Transducer to the Data Collector on page 120.

2. Attach the transducer(s) to the machine case or structure.
3. Select Bump Test on the Main Menu and press the READ/OK key. The Bump Test screen appears.



4. Select Recall and press the READ/OK key.

   The Bump Test - Load Setup screen appears.



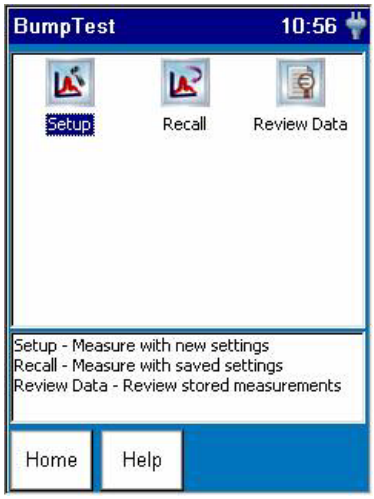
5. Highlight the filename that you want to recall and press F4 (Open).
6. You can edit the settings or start collecting more date.

   Refer to Setting Up and Collecting Bump Test Measurements on page 196.

Reviewing Bump Test Measurements

You can review previously recorded measurements with the Enpac 2500.

1. Select Bump Test on the Main Menu and press the READ/OK key. The Bump Test screen appears.

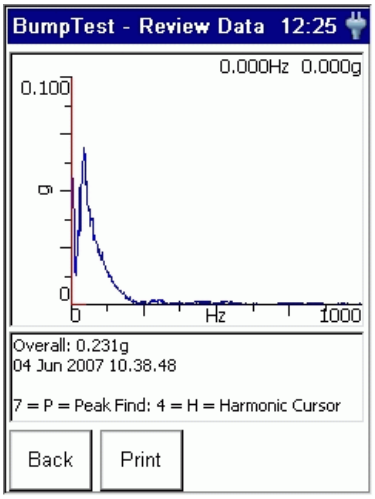


2. Select Review Data and press the READ/OK key.

   The Bump Test - Review Data screen appears.

3. Highlight the filename that you want review and press F4 (Open).

The data is displayed on the screen.



Refer to Collecting Bump Test Measurements on page 199 for information on how to move the cursor.

4. To print the screen, press F2 (Print).

   The Print Setup screen appears.

5. Connect the Enpac 2500 to a serial port on a serial printer with a 9-way plug RS-232 cable.
6. Use the arrow keys to select the desired Printer, Baud rate and image Size, then press F2 (OK).

   The image prints on the printer.

7. To return to the main Bump Test screen, press F1 (Back).

Backing Up and Deleting Bump Test Files

You can backup Bump Test files to a PC card or SD card, or copy the files to a host computer. You can also delete a Bump Test measurement or setup from the Enpac 2500.

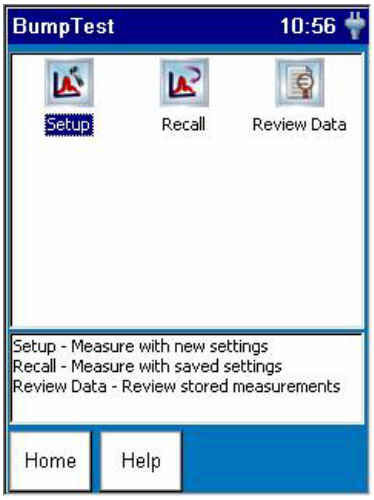
Backing Up Bump Test Files

Follow these instructions to backup Bump Test files.

1. Insert the memory card into the PCMCIA slot in the bottom of the Enpac.

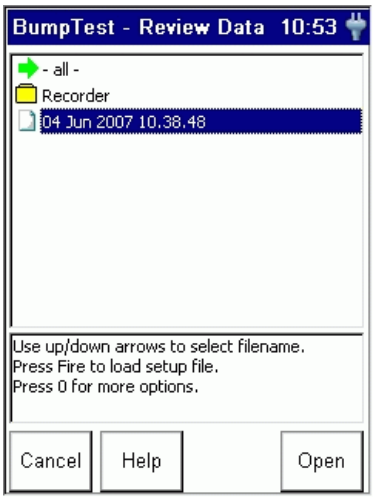
   Refer to Using Memory Cards on page 47.

2. Select Bump Test on the Main Menu and press the READ/OK key. The Bump Test screen appears.

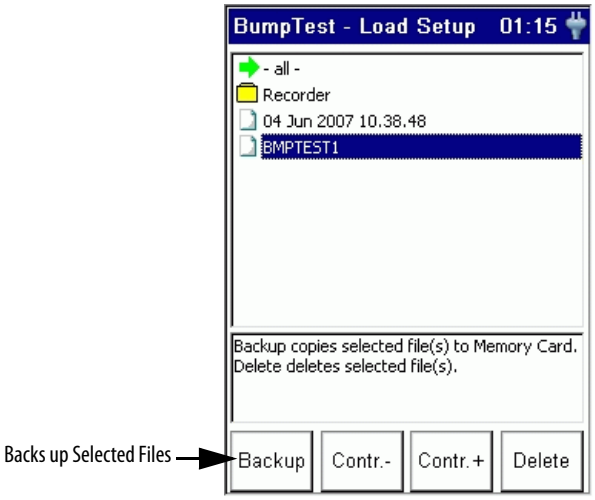


3. Select Review Data or Recall to backup a bump test file and press the READ/OK key.

The appropriate Bump Test screen appears. Below is an example of the Bump Test- Review Data screen.



4. Highlight the appropriate filename or highlight 'all' to backup all the files.
5. Press the 0 (Shift) key and F1 (Backup) simultaneously to backup the selected file(s) to the memory card.



6. The specified files are copied to the memory card (\Storage Card\Analyser\directory).

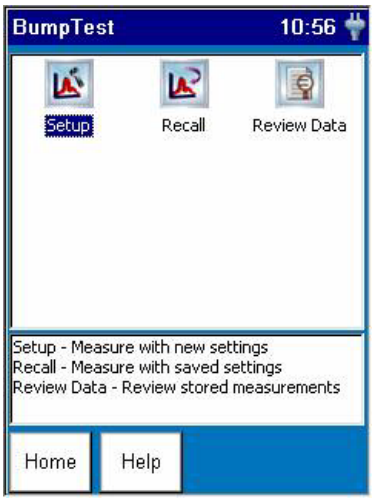
TIP If you are backing up `all' the files, a dialog appears asking if you wish to format the card. Press F2 (Yes) to format the card before backing up the files, or press F3 (No) to back up the files without formatting the card.

A message appears on the screen when the backup is complete.

Deleting a Bump Test Measurement and Setup

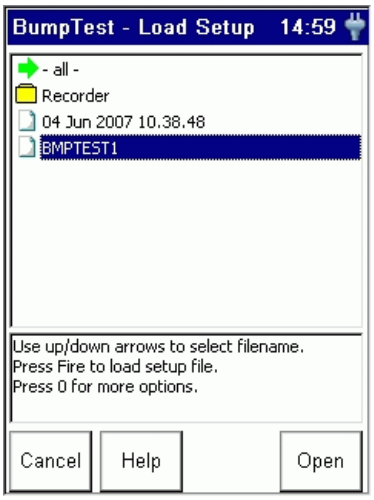
1. Select Bump Test on the Main Menu and press the READ/OK key.

   The Bump Test screen appears.



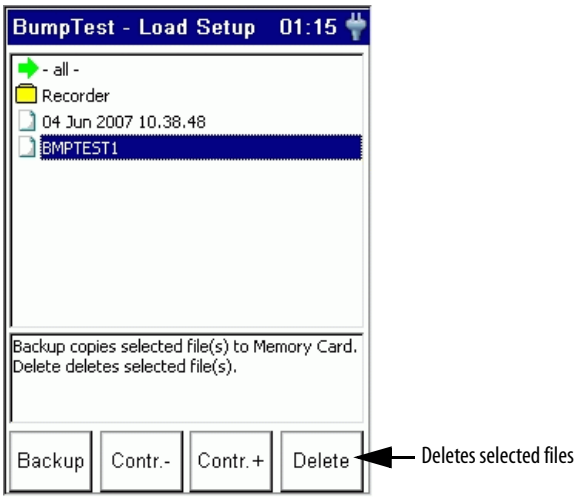
2. Select Review Data to delete a measurement or Recall Data to delete a setup and press the READ/OK key.

   The appropriate Bump Test screen appears. Below is an example of the Bump Test - Load Setup screen.



3. Highlight the appropriate filename or highlight 'all' to delete all the files.

4. Press the 0 (Shift) key and F4 (Delete) simultaneously to delete the selected file(s) from the Enpac 2500.



A dialog appears to confirm the deletion.

5. Press F2 (Yes) to delete.

Notes:

Balancing Application

The Enpac 2500 Balancing application provides a simple, direct method to balance your rotating machinery in one or two planes. You may use the internal laser tachometer in the Enpac or an external laser tachometer, optical tachometer, or strobescope for measuring phase during the balance run.

This chapter describes the balancing procedures and measurements you can take with the Enpac 2500 coupled with a speed-measuring device such as a strobe light or laser tachometer.

The Balancing application is an add-on program to the Enpac 2500 and must be installed with the Balancing PCMCIA card from Rockwell Automation.

Refer to Adding Applications to the Enpac 2500 Data Collector on page 59 for installation instruction.

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Setting Up the Balancing Parameters	210
One Plane Balancing	214
Two Plane Balancing	222
Moving Around in a Balance Run	233
Reviewing Data	233
Saving and Reloading a Balance	236

Overview of Balancing Measurements

Balancing is the technique for determining the amount and location of the heavy spot on a rotating shaft so that you can balance it with an equal amount of weight in the opposite direction. These methods go through the technique, with stopping points where you start and stop the machine to perform weight addition or subtraction.

There are three types of measurements in the balancing process:

- The **initial vibration** measurement is taken without any added weights on the machine. The initial vibration measurement establishes a reference of how the machine vibrates at each plane without any extra weight added. This vibration is what will be corrected by the correction weight.

- The **trial weight** measurements are taken with a single trial weight attached to the machine at one plane or the other. The trial weight measurements are used to determine how the machine is affected by the added weight. The ideal trial weight should produce either a 30 percent change in amplitude or a 30 degree change in phase.
- The **residual measurements** are taken with the correction weight or the correction weight and trim weights attached to the machine. The correction weight should cancel out the initial unbalance. A residual vibration measurement is taken to measure the remaining unbalance. Trim weights are added to the machine to cancel out the vibration measured during a residual measurement.

It is left to you to decide when the machine is sufficiently balanced.

Setting Up the Balancing Parameters

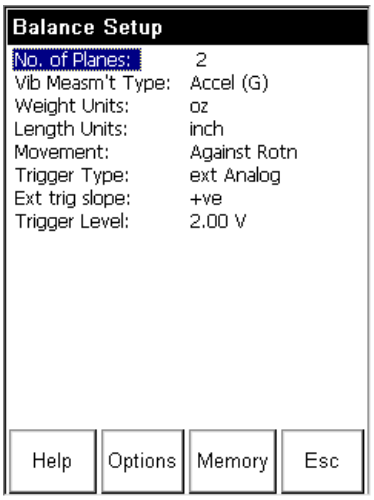
There are two screens for setting up the balancing parameters:

- the Balance Setup screen
- the Advance Setup screen

Both screens are described in this section.

Balance Setup Screen

The Balance Setup screen appears when you choose Balancing from the Main Menu screen.



To edit an option in this screen, follow these steps.

1. Highlight the options and press the RIGHT ARROW key to open a menu of choices.
2. Select the choice by pressing the arrow keys or type in a value using the numeric key pad.

3. Press the LEFT ARROW key to save your selection.

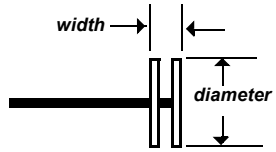
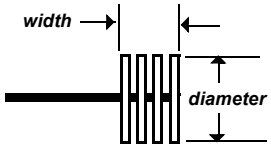
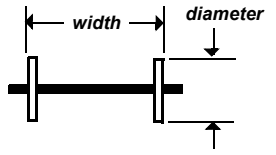
   Use the descriptions in Table 42 to help you configure the parameters in the Balance Setup screen.

4. When you are finished, press F2 (Options) to configure the advanced balancing options.

   Refer to Advanced Setup Parameters on page 213.

Table 42 - Balance Setup Parameters

Parameter Name	Description	Values/Comments
No. of Planes	Determines whether single-plane or two-plane balancing is required. A good rule-of-thumb is the rotors width-to-diameter (W/D) ratio. The W/D ratio is the width (excluding shaft length) of the combine rotors divided by their diameter. The following chart can be used to help determine whether to use one- or two-plane balancing.	Options: 1 2 (default)

	W/D RATIO	1-PLANE	2-PLANE
	Less than 0.5	0 - 1000 RPM	Above 1000 RPM
	More than 0.5 but less than 2	0 - 150 RPM	150 - 2000 RPM or above 70% of 1st critical
	More than 2	0 - 100 RPM	Above 100 RPM to 70% of 1st critical

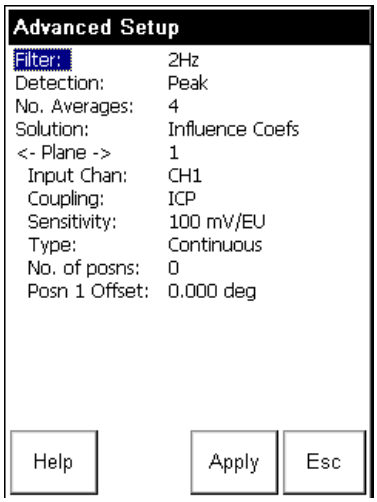
Vib Measmt Type	Selects the vibration measurement type.	Options: Accel (G) (default) A->V (IPS) A->V (mm/s) Vel (IPS) Vel (mm/s) A->D (mil) A->D (um) V->D (mil) V->D (um) Disp (mil) Disp (um) Volts Keypress
Weight Units	Defines the units used in balancing.	Options: g kg oz (default) lb EU

Table 42 - Balance Setup Parameters

Parameter Name	Description	Values/Comments
Length Units	Sets the units used in measuring the distance between the shaft and the weight.	Options: mm cm m inch (default) feet EU
Movement	You place weights on the rotor to balance the machine. The position of this weight is given in degrees or positions (where the total number of positions equals the number of blades or vanes) from the reference notch or mark. You must select whether you are measuring the angle with or against the direction of the shaft rotation. The Movement parameter affects how the angles are measured. If Movement is set to `With Rotn,' angles are measured from the reference mark, in the direction of the machines normal rotation. If Movement is set to `Against Rotn,' angles are measured from the reference mark, in the opposite direction of the machines normal rotation.	Options: With Rotn Against Rotn (default)
Trigger Type	Sets the trigger source. • ext Analog - An external analog trigger will be used to trigger data sampling. You must also set the slope and trigger level. • ext TTL - The signature acquisition process begins when a TTL trigger is applied. A TTL trigger in the range 2.5 V to 5 V will begin signature acquisition. You must also select the slope. • Laser Tach - Enables the internal Laser Tachometer.	Options: ext Analog ext TTL (default) Laser Tach
Ext trig slope	Sets the slope for externally triggering the measurement. Slope is the direction in which the signal is moving, and is either positive (rising) or negative (falling) before a trigger is detected.	Options: -ve +ve (default) This parameter is applicable only when Trigger Type is set to `ext Analog' or `ext TTL.'
Trigger Level	Enter the amplitude level for externally triggering the measurement.	volts This parameter is used only when Trigger Type is set to `ext. Analog.'

Advanced Setup Screen

The Advanced Setup screen appears when you press F2 (Options) on the Balance Setup screen. The Advanced Setup screen is used to set up the measurement and enter the sensitivity of the transducer.



To edit an option in this screen, follow these steps.

1. Highlight the option and press the RIGHT ARROW key to open a menu of choices.
2. Select the choice by pressing the arrow keys or type in a value using the numeric key pad.
3. Press the LEFT ARROW key to save your selection.

   Use the descriptions in Table 43 to help you configure the parameters in the Advanced Setup screen.
4. When you are finished, press F3 (Apply) to return to Balance Setup screen.

Table 43 - Advanced Setup Parameters

Parameter Name	Description	Values/Comments
Filter	Sets the high pass filter to apply to the measurement. The high pass filter is useful in removing high vibration, low frequency signal components, which can dominate the signal.	Options: Off 2 Hz (default) 10 Hz 70 Hz User Defn
Detection	Selects the type of signal detection for the measurement. • Peak - The Enpac 2500 measures the dynamic signal from zero to peak voltage. Use this or the RMS setting for most acceleration and velocity measurements. • Pk-Pk - The Enpac 2500 measures the dynamic signal from the minimum peak to the maximum peak. Use this setting for most displacement measurements. • RMS - The Enpac 2500 measures the dynamic signal as the square root of the mean of the square. Use this or Peak for most acceleration and velocity measurements. Also use this for voltage measurements.	Options: Peak Pk-Pk RMS Defaults to `Peak' for Accel and Vel and `Pk-Pk' for Disp.

Table 43 - Advanced Setup Parameters

Parameter Name	Description	Values/Comments
No. Averages	Enter the number of averages (1 to 8) for the measurement.	Default is 4
Solution	Select the balancing solution. • Dynamic - The correction weights will be calculated for both planes 1 and 2. • Static-Couple - The correction weights will be calculated as a combination of Static and Couple. The Couple balance weights will be presented as the same weight in both planes 1 and 2, with a phase angle of 180 degrees difference. The Static part of the solution will be calculated at the center between planes 1 and 2.	Options: Dynamic (default) Static-Couple The parameter is available only when you are two-plane balancing.
Plane	Sets the plane for which the settings below apply.	Options: A II 1 2
Input Chan	The input channel required for the measurement.	Options: Chn 1 (default) Chn 2
Coupling	The type of coupling to be applied to the measurement. • AC - AC-couples the input voltage signal. Power is not applied to the sensor. • ICP - Provides a constant current power source to the sensor.	Options: ICP AC (default)
Sensitivity	The sensitivity of the transducer. Sensitivity is set as mV/EU, where EU is the base engineering unit of the sensor. A 100m V/G accelerometer would be set as 100m V/EU.	0.010…1000 mV/EU
Type	Select either continuous or fixed. For a rotor without vanes or blades, set Type to `Continuous.'	Options: Continuous (default) Fixed
No. of posns	The number of positions if Type is set to `Fixed.' The number of positions refers to the number of rotor components, such as blades on a fan.	3…360 Enter 0 (zero) for a rotor without vanes or blades.
Posn 1 Offset	The position 1 offset, if necessary.	0…360 This is applicable only when Type is set to Fixed.

One Plane Balancing

This section describes the procedure for balancing a machine in one plane. The entire procedure is divided into taking three measurements:

- the initial measurement
- the trial weight measurement
- the residual measurement

You must complete the entire procedure until the vibration level has been reduced enough for your needs.

Taking the Initial Vibration Measurement

1. If you are using an external tachometer, optical tachometer, or strobescope as the trigger source, connect the tachometer cable (Cat. No. EK-45131) to the POWER/TRIG connector at the top of the Enpac 2500.

   TIP Skip this step if you are using the internal Laser Tachometer as the trigger source.

2. Attach a transducer to a bearing house.
3. Mark the rotor by making a mark on one rotor that will serve as a reference mark.

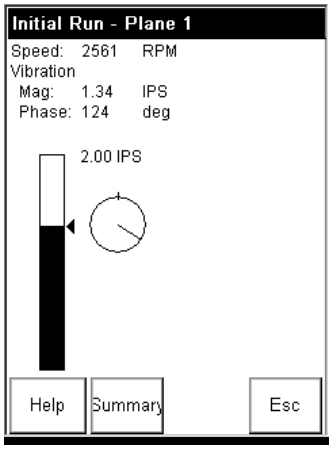
   It is also possible to use an existing mark on the rotor as the reference mark, such as a key or keyway.

IMPORTANT If the rotor has multiple positions (vanes or fan blades), the reference mark must be at one of the blade positions.

4. Start the machine and allow it to reach normal running speed.
5. Press READ/OK to take an initial vibration measurement.

   TIP The Enpac 2500 may ask if the transducer is attached to plane 1. If the transducer is attached, press F4 (OK).

   The data collection will begin as soon as the trigger conditions are satisfied. The Enpac 2500 automatically measures the speed, vibration, and plane. The values are continually updated on the screen.



6. When the speed, vibration, and phase values are stable, press READ/OK to complete the initial measurement.

   The results are stored in the Vibration Summary Table.

   TIP The green status indicator illuminates when the measurement is complete.

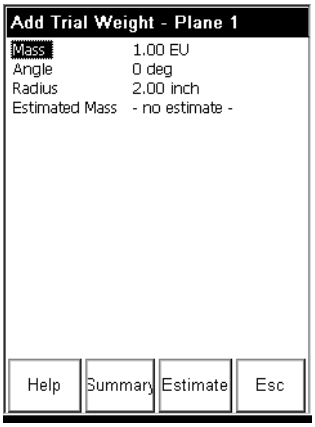
   Refer to Status Indicators on page 25.

7. Shut down the machine and continue the balancing procedure in the next section.

IMPORTANT	Anytime during the initial run, you can do the following: • Press F4 (Esc) to exit the balancing program. • Press the 0 (Shift) key and F1 (Go to) simultaneously to go back to a previous step in the balance run. Refer to Moving Around in a Balance Run on page 233 for details. • Press F2 (Summary) to display the results in the Vibration Summary Table. Refer to Reviewing Data on page 233 for details.

Adding the Trial Weight and Taking a Measurement

The Add Trial Weight screen, as shown below, appears upon completion of the Initial run measurement.



You can manually enter the trial weight, the angle, and the radius, or you can have the Enpac 2500 automatically estimate the trial weight for you.

To Manually Enter the Trial Weight

Use the UP and DOWN ARROW keys to highlight the parameters. Press the RIGHT ARROW key and then enter the trial weight, angle, or radius value using the numeric key pad. When your entry is complete, press the LEFT ARROW key.

1. In the **Mass** parameter, enter the trial weight. This is the amount of weight you will attach to the rotor.
2. In the **Angle** parameter, enter the location (in degrees) of the trial weight on the rotor. The angle is measured from the reference mark in the direction specified in the **Movement** parameter in the Balance Setup screen.

   Refer to Balance Setup Parameters on page 211.

3. In the **Radius** parameter, enter the radius of the trial weight.

To Estimate the Trial Weight

1. Press F3 (Estimate).
2. Enter the mass of the rotor using the key pad and press F2 (OK).

   The Enpac 2500 calculates the trial weight (mass), the angle, and the radius using the following formula.

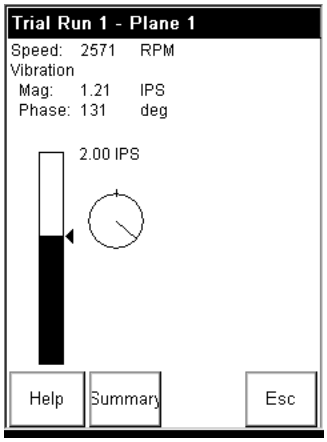
$$\text{Trial Weight} = \frac{.1 \times \text{rotor mass} \times 9.81 \times 900}{radius \times [\text{speed} \times \pi]^2}$$

To Take the Trial Weight Measurement

1. Once the trial weight information has been entered, attach the trial weight to the rotor.
2. Start the machine and let it reach operating speed.
3. Press READ/OK to take a trial weight measurement.

   TIP The Enpac 2500 may ask if the transducer is attached to plane 1. If the transducer is attached, press F4 (OK).

   The Enpac 2500 automatically measures the speed, vibration, and phase. The values are constantly updated on the screen.

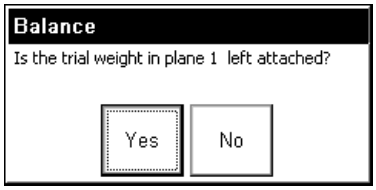


4. When the speed, vibration, and phase values are stable, press READ/OK. The trial weight measurement is complete and the results are stored in the Vibration Summary Table.

   TIP The green status indicator illuminates when the measurement is complete.

   Refer to Status Indicators on page 25.

The following message appears asking if the trial weight is still attached.



5. Press F2 (Yes) if the weight is still attached to the rotor. Press F3 (No) if the weight has been removed from the rotor. Note that it is good practice to remove the trial weight.
6. Shut down the machine.
7. Continue the balancing procedure in the next section.

IMPORTANT Anytime during the initial run, you can do the following:

- Press F4 (Esc) to exit the balancing program.
- Press the 0 (Shift) key and F1 (Go to) simultaneously to go back to a previous step in the balance run.

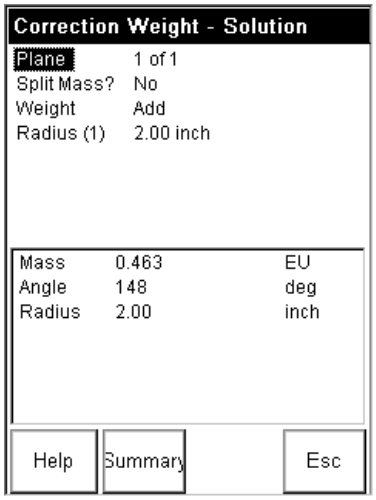
Refer to Moving Around in a Balance Run on page 233 for details.

- Press F2 (Summary) to display the results in the Vibration Summary Table.

Refer to Reviewing Data on page 233 for details.

Adding the Correction Weight and Taking a Residual Measurement

The Enpac 2500 calculates and displays a recommended balancing weight in the Correction Weight - Solution screen.



You can split the correction weight into two distinct angles, as well as modify the radius of the correction weight. Additionally, the Enpac 2500 calculates the amount of weight that might be removed if weights are already attached to the rotor.

To Split the Correction Weight

On many rotors, such as a fan, it is not possible to correct the unbalance at the angle indicated by a measurement run. The Enpac 2500 allows the correction to be split into two components at points where it is possible to add or remove weight.

1. Use the DOWN ARROW key to highlight **Split Mass**, then press the RIGHT ARROW key.
2. Select Yes to split the weight and press the LEFT ARROW key to save your choice.

   The Enpac 2500 calculates the weight and displays the new recommendation at the bottom of the screen.
3. To unsplit the correction weight, repeat steps 1 and 2 and select No.

To Modify the Radius

1. Use the DOWN ARROW key to highlight **Radius**, and press the RIGHT ARROW key.
2. Use the key pad to enter a new radius, then press READ/OK to save your entry.
3. The Enpac 2500 calculates the weight and displays the new recommendation at the bottom the screen.

To Add or Remove Weight

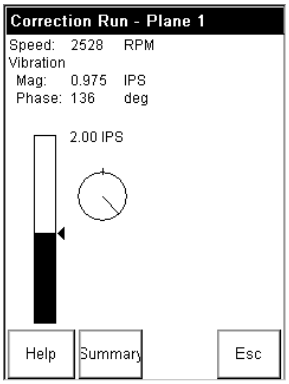
1. Use the UP or DOWN ARROW key to highlight **Weight**, then press the RIGHT ARROW key.
2. Select Add or Subtract, and press the LEFT ARROW key to save your choice.

   The Enpac 2500 calculates the weight and displays the new recommendation at the bottom the screen.

To Take the Residual Measurement

1. Attach the correction weight to the rotor.
2. Start the machine and let it reach operating speed.
3. Press READ/OK to take a residual measurement.

The Enpac 2500 automatically measures the speed, vibration, and phase. The values are constantly updated on the screen.

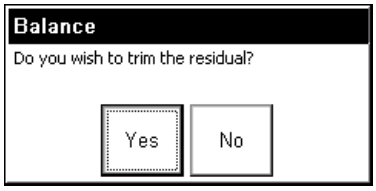


4. When the speed, vibration, and phase values are stable, press READ/OK. The residual measurement is complete.

TIP The green status indicator illuminates when the measurement is complete.

Refer to Status Indicators on page 25.

The following message appears.

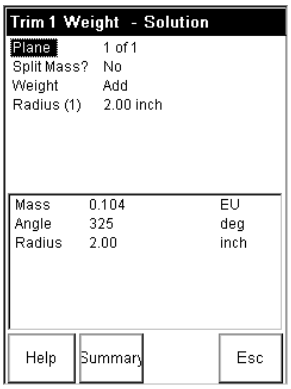


5. Do one of the following.
   - Press F3 (No) if you do not want to trim the residual. The Vibration Summary Table appears.

Refer to Reviewing Data on page 233.

   - Press F2 (Yes) to trim the residual. The Enpac 2500 calculates the trim correction weights and displays the following screen. Note that you can split the trim weight and modify the radius.

Refer to To Split the Correction Weight on page 219 for details.



6. Shut down the machine and attach the trim weight(s) whose weight, angle, and radius are indicated on the screen.

IMPORTANT Do not remove the original correction weight.

7. Start the machine and let it reach operating speed.
8. Press READ/OK. The Enpac 2500 takes vibration readings, calculates new trim weight(s) and displays it as described in steps 5 and 6.

TIP The Enpac 2500 may ask if the transducer is attached to plane 1. If the transducer is attached, press F4 (OK).

- If the rotor is still out of balance, repeat adding the trim weight and taking residual measurements until the rotor is properly balanced.
- If several trim correction runs have been performed (resulting in several trim weights), values may be combined into one permanent trim weight.

See Combining Weights Screen on page 235.

Note that if the balance never improves, check to see if you entered the correct trial weight size and location, or check other factors such as misalignment or a faulty bearing.

However, if the vibration has been reduced to an acceptable level, balancing is complete. Save your balancing data, if desired, by pressing F3 (Memory).

Refer to Saving a Balance on page 236 for details.

Two Plane Balancing

This section describes the procedure for balancing a machine in two planes.

Taking the Initial Vibration Measurement

1. If you are using an external tachometer, optical tachometer, or strobescope as the trigger source, then connect the tachometer cable (Cat. No. EK- 45131) to the POWER/TRIG connector of the data collector.

   TIP You can skip this step if you are using the internal Laser Tachometer as the trigger.

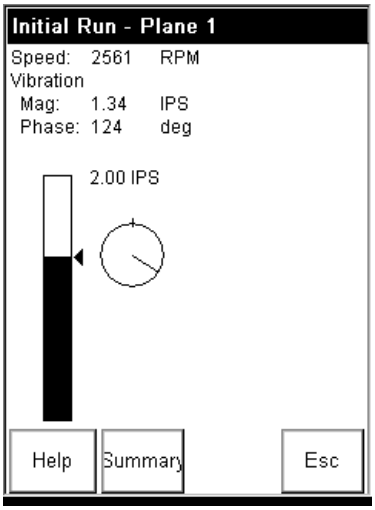
2. Mark the rotor by making a mark on one rotor that will serve as a reference mark. It is also possible to use an existing mark on the rotor as the reference mark, such as a key or keyway.

IMPORTANT If the rotor has multiple positions (vanes or fan blades), the reference mark must be at one of the blade positions.

3. Attach a transducer to a bearing housing in each plane at each end of the shaft. You must have two identical transducers to complete the two-plane balancing.
4. Start the machine and allow it to reach normal running speed.
5. Press READ/OK to take the initial vibration measurement.

   TIP The data collector may ask if the transducer is attached to plane 1. If the transducer is attached, press F4 (OK).

   The data collection will begin as soon as the trigger conditions are satisfied. The data collector automatically measures the speed, vibration, and phase in the first plane. The values are continually updated on the screen.

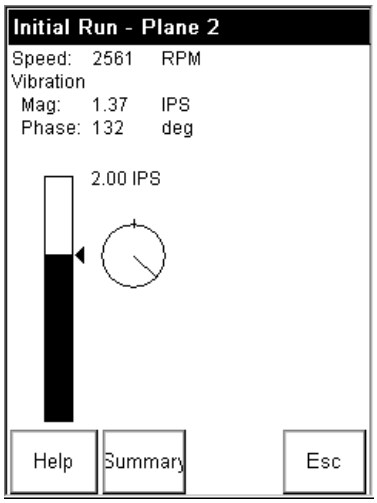


6. When the speed, vibration, and phase values are stable, press READ/OK. This completes the plane 1 measurement.

TIP The green status indicator illuminates when the measurement is complete.

Refer to Status Indicators on page 25.

7. The data collector asks if the transducer is attached to plane 2. If the transducer is attached, press F4 (OK) to begin the plane 2 measurement.
8. The data collector automatically measures the speed, vibration, and phase in the second plane. The values are constantly updated on the screen. Allow these values to stabilize before continuing to the next step.



9. Press READ/OK to complete the initial measurement for plane 1 and plane 2. The results are stored in the Vibration Summary Table.
10. Shut down the machine and continue the balancing procedure in the next section.

IMPORTANT Anytime during the initial run, you can do the following:

- Press F4 (Esc) to exit the balancing program.
- Press the 0 (Shift) key and F1 (Go to) simultaneously to go back to a previous step in the balance run.

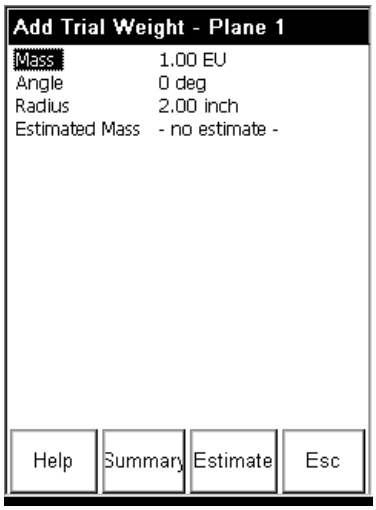
Refer to Moving Around in a Balance Run on page 233 for details.

- Press F2 (Summary) to display the results in the Vibration Summary Table.

Refer to Reviewing Data on page 233 for details.

Adding the Trial Weight and Taking a Measurement in Plane 1

The Add Trial Weight - Plane 1 screen appears upon completion of the Initial run measurement.



You can manually enter the trial weight, the angle, and the radius, or you can have the Enpac 2500 automatically estimate the trial weight for you.

To Manually Enter the Trial Weight

Use the UP and DOWN ARROW keys to highlight the parameters. Press the RIGHT ARROW key and then enter the trial weight, angle, or radius value using the numeric key pad. When your entry is complete, press the LEFT ARROW key.

1. In the **Mass** parameter, enter the trial weight. This is the amount of weight you will attach to the rotor in the first plane.
2. In the **Angle** parameter, enter the angle (in degrees) at which you are about to attach to the rotor in the first plane. The angle is measured from the reference mark in the direction specified in the **Movement** parameter in the Balance Setup screen.

   Refer to Balance Setup Parameters on page 211.
3. In the **Radius** parameter, enter the radius of the trial weight.

To Estimate the Trial Weight

1. Press F3 (Estimate).
2. Enter the mass of the rotor using the key pad and press F2 (OK).

The Enpac 2500 calculates the trial weight (mass), the angle, and the radius using the following formula.

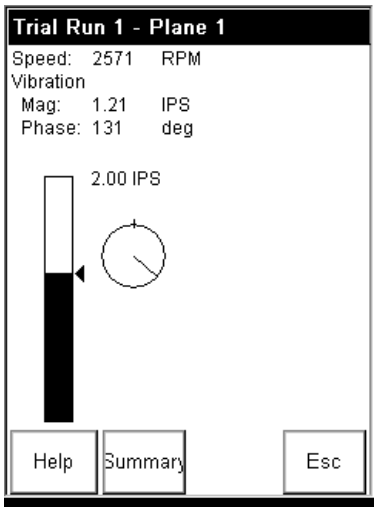
$$\text{Trial Weight} = \frac{.1 \times \text{rotor mass} \times 9.81 \times 900}{radius \times [\text{speed} \times \pi]^2}$$

To Take the Trial Weight Measurement

1. Once the trial weight information has been entered, attach the plane 1 trial weight to the rotor.
2. With the trial weight attached securely, restart the machine and allow it to reach operating speed.
3. Press READ/OK to take a trial weight measurement.

   TIP The Enpac 2500 may ask if the transducer is attached to plane 1. If the transducer is attached, press F4 (OK).

   The Enpac 2500 automatically measures the speed, vibration, and phase in the first plane and constantly updates on the screen.



4. When the speed, vibration, and phase values are stable, press READ/OK. This completes the plane 1 measurement.

   TIP The green status indicator illuminates when the measurement is complete.

   Refer to Status Indicators on page 25.

5. The Enpac 2500 asks if the transducer is attached to plane 2. If the transducer is attached, press F4 (OK) to measure plane 2 speed, vibration, and phase.

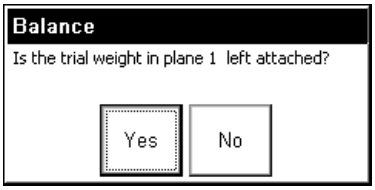
   The Enpac 2500 automatically measures the speed, vibration, and phase in the second plane and constantly updates the values on the screen.

6. When the values stabilize, press READ/OK to complete the measurement.

TIP The green status indicator illuminates when the measurement is complete.

Refer to Status Indicators on page 25.

The following message appears asking if the trial weight is still attached to plane 1.



7. Press F2 (Yes) if the weight is still attached to the rotor. Press F3 (No) if the weight has been removed from the rotor in plane 1.
8. Shut down the machine. Continue the balancing procedure in the next section.

IMPORTANT Anytime during the initial run, you can do the following:

- Press F4 (Esc) to exit the balancing program.
- Press the 0 (Shift) key and F1 (Go to) simultaneously to go back to a previous step in the balance run.

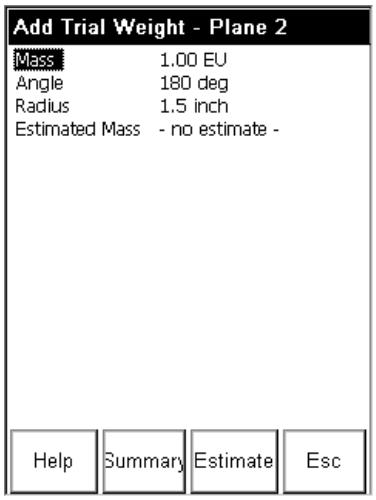
Refer to Moving Around in a Balance Run on page 233 for details.

- Press F2 (Summary) to display the results in the Vibration Summary Table.

Refer to Reviewing Data on page 233 for details.

Adding the Trial Weight and Taking a Measurement in Plane 2

The Add Trial Weight - Plane 2 screen appears upon completion of the plane 1 trial run measurement.



To Manually Enter the Trial Weight

Use the UP and DOWN ARROW keys to highlight the parameters. Press the RIGHT ARROW key and then enter the trial weight, angle, or radius value using the numeric key pad. When entry is complete, press the LEFT ARROW key.

1. In the **Mass** option, enter the trial weight.

   This is the amount of weight you will attach to the rotor in the second plane.
2. In the **Angle** option, enter the angle (in degrees) at which you are about to attach to the rotor in the second plane.

   The angle is measured from the reference mark in the direction specified in the **Movement** option on the Balance Setup screen.

   Refer to Balance Setup Parameters on page 211.
3. In the **Radius** option, enter the radius of the trial weight.

To Estimate the Trial Weight

1. Press F3 (Estimate).
2. Enter the mass of the rotor using the key pad and press F2 (OK).

3. The Enpac 2500 calculates the trial weight (mass), the angle, and the radius using the following formula.

$$\text{Trial Weight} = \frac{.1 \times \text{rotor mass} \times 9.81 \times 900}{radius \times [\text{speed} \times \pi]^2}$$

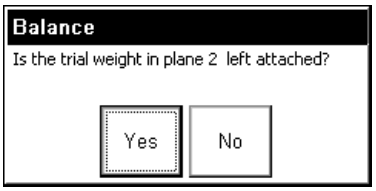
To Take the Trial Weight Measurement

1. Once the trial weight information has been entered, attach the trial weight to the rotor in the second plane.
2. With the trial weight attached securely, restart the machine and allow it to reach operating speed.
3. Press READ/OK to take a plane 2 trial weight measurement.
4. The Enpac 2500 asks if the transducer is attached to plane 1. If the transducer is attached, press the F4 (OK) button to measure plane 1 speed, vibration, and phase.

   The data collector automatically measures the speed, vibration, and phase in the first plane and constantly updates the values on the screen.
5. When the speed, vibration, and phase values are stable, press READ/OK. This completes the plane 1 measurement.
6. The data collector asks you if the transducer is attached to plane 2. If the transducer is attached, press the F4 (OK) to measure plane 2 speed, vibration, and phase.

   The data collector automatically measures the speed, vibration, and phase in the second plane and constantly updates the values on the screen.
7. When the values stabilize, press READ/OK to complete the measurement.

   The following message appears asking if the trial weight is still attached to plane 2.



8. Press F2 (Yes) if the weight is still attached to the rotor in plane 2. Press F3 (No) if the weight has been removed from the rotor in plane 2.
9. Shut down the machine. Continue the balancing procedure in the next section.

IMPORTANT Anytime during the initial run, you can do the following:

- Press F4 (Esc) to exit the balancing program.
- Press the 0 (Shift) key and F1 (Go to) simultaneously to go back to a previous step in the balance run.

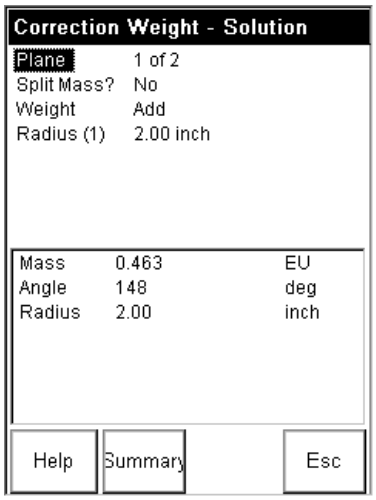
Refer to Moving Around in a Balance Run on page 233 for details.

- Press F2 (Summary) to display the results in the Vibration Summary Table.

Refer to Reviewing Data on page 233 for details.

Adding the Correction Weights and Taking a Residual Measurement

The Enpac 2500 calculates and displays the recommended balancing weight for the two planes in the Correction Weight - Solution screen.



IMPORTANT If you set Solution to `Static-Couple' in the Advanced Setup screen, the Enpac 2500 calculates the correction weight for the shaft and displays it in plane 3.

Refer to Advanced Setup Parameters on page 213.

Use the Plane parameter to toggle between the planes. You can split the correction weight into two distinct angles, as well as modify the radius of the correction weight. Additionally, the Enpac 2500 calculates the amount of weight that might be removed if weights are already attached to the rotor.

To Toggle Between the Planes

Highlight Plane, then press the RIGHT ARROW key to open a menu of choices. Select the desired plane and press the LEFT ARROW key to save the selection.

To Split the Correction Weight

On many rotors, such as a fan, it is not possible to correct the unbalance at the angle indicated by a measurement run. The Enpac 2500 allows the correction to be split into two components at points where it is possible to add or remove weight.

1. Highlight Split Mass and press the RIGHT ARROW key.
2. Select Yes to split the weight, then press the LEFT ARROW key to save your choice.
3. The Enpac 2500 calculates the weight and displays the new recommendation at the bottom of the screen.
4. To unsplit the correction weight, repeat steps 1 and 2 and select No.

To Modify the Radius

1. Highlight Radius and press the RIGHT ARROW key.
2. Use the key pad to enter a new radius, then press LEFT ARROW to save your entry.

   The Enpac 2500 calculates the weight and displays the new recommendation at the bottom the screen.

To Add or Remove Weight

1. Highlight Weight and press the RIGHT ARROW key.
2. Select Add or Subtract, then press LEFT ARROW key to save your choice.

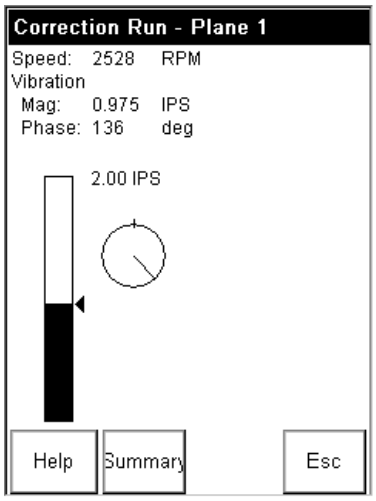
   The Enpac 2500 calculates the weight and displays the new recommendation at the bottom the screen.

To Take the Residual Measurement

1. Attach the correction weights.
2. Start the machine and let it reach operating speed.
3. Press READ/OK to take a residual measurement for plane 1.

TIP The Enpac 2500 may ask if the transducer is attached to plane 1. If the transducer is attached, press F4 (OK).

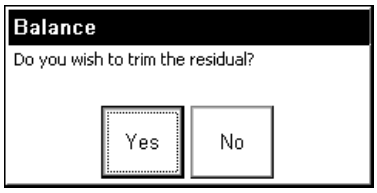
4. The Enpac 2500 automatically measures the speed, vibration, and phase. The values are constantly updated on the screen.



5. When the speed, vibration, and phase values are stable, press READ/OK. This completes the plane 1 measurement.
6. The Enpac 2500 asks you if the transducer is attached to plane 2. If the transducer is attached, press the F4 (OK) to measure plane 2 speed, vibration, and phase.

   The Enpac 2500 automatically measures the speed, vibration, and phase in the second plane and constantly updates the values on the screen.
7. When the values stabilize, press READ/OK to complete the measurement.

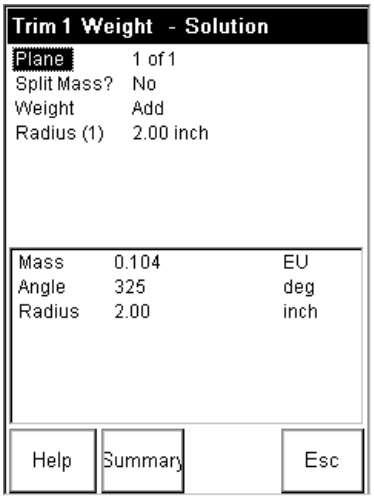
   The residual measurement is complete. The following message appears.



8. Do one of the following.
   - Press F2 (No) if you do not want to trim the residual. The Vibration Summary Table appears.

   Refer to Reviewing Data on page 233.
   - Press F3 (Yes) to trim the residual. The Enpac 2500 calculates the trim correction weights and displays the following screen. Note that you can split the trim weight and modify the radius.

Refer to To Split the Correction Weight on page 230 for details.



9. Shut down the machine and attach the trim weight(s) whose weight, angle, and radius are indicated on the screen.

IMPORTANT Do not remove the original correction weight.

10. Start the machine and let it reach operating speed.
11. Press READ/OK. The Enpac 2500 takes vibration readings, calculates new trim weight(s) and displays it as described above.
12. If the rotor is still out of balance, repeat adding the trim weight and taking residual measurements until the rotor is properly balanced. If several trim correction runs have been performed (resulting in several trim weights), values may be combined into one permanent trim weight.

    See Combining Weights Screen on page 235.

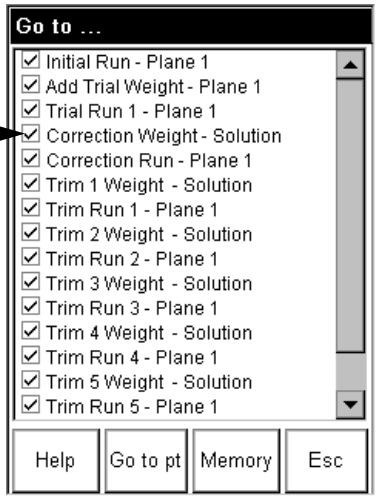
    Note that if the balance never improves, check to see if you entered the correct trial weight size and location, or check other factors such as misalignment or a faulty bearing.
13. However, if the vibration has been reduced to an acceptable level, balancing is complete. Save your balancing data, if desired, by pressing F3 (Memory).

    Refer to Saving a Balance on page 236 for details.

Moving Around in a Balance Run

You can return to a previous step in the balance run by pressing the 0 (Shift) key and F1 (Go To) simultaneously. The Go to screen appears and lists all the steps in the balance run. The steps that are completed have a check mark next to them.

The check mark indicates that the step has been completed. You can go back to any step that has a check mark next to it.



Highlight the step that you want to return to, then press F2 (Go to pt). The Enpac 2500 displays the selected screen. You can then retake a measurement, if necessary.

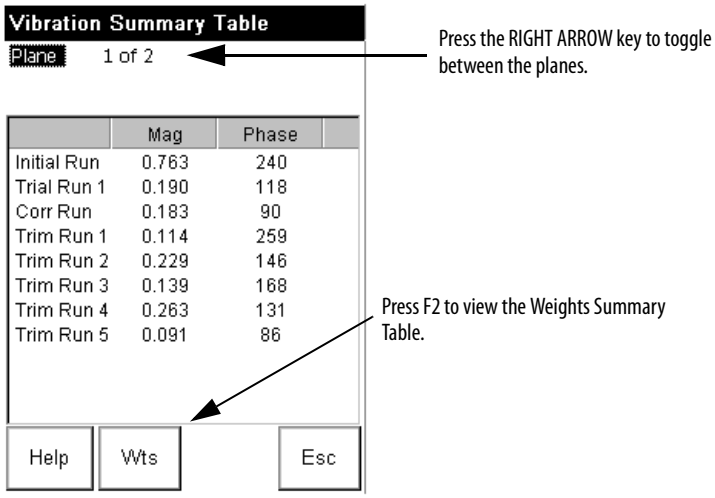
IMPORTANT	You can only return to steps that have check marks next to them.

Reviewing Data

This section describes the Vibration Summary Table and the Weights Summary Table screens. These screens can be used to review the data in the balance run. Additionally, the Combine Weights screen is described. This screen allows you to combine the correction weights into one weight.

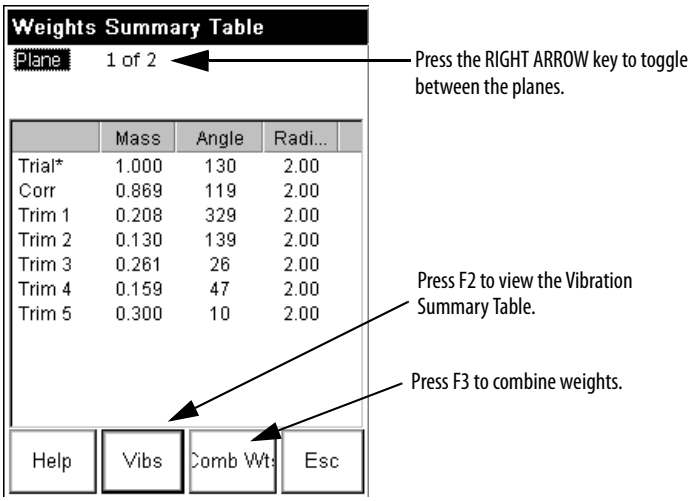
Vibration Summary Table

The results of the Initial run, Trial run, and Correction run are stored in the Vibration Summary Table. To view the Vibration Summary Table, press F2 (Summary).



Weights Summary Table

The Weights Summary Table allows you to view the trial weights attached during the balance run and the correction weights calculated from the initial measurement and the trial measurement. To view the Weight Summary Table, press F2 (Wts) on the Vibration Summary Table screen.



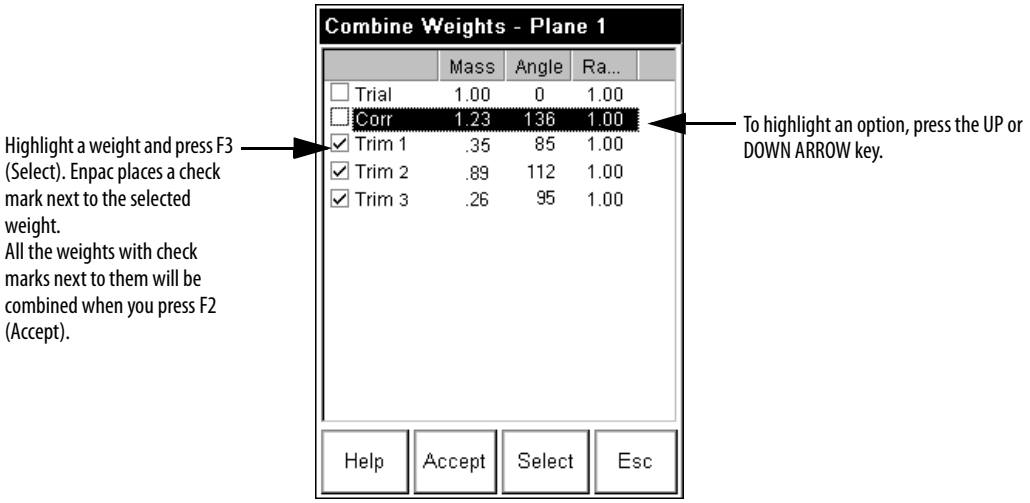
Combining Weights Screen

The Enpac 2500 can combine selected weights into one equivalent weight. The result will have the same effect on balancing the rotor as the multiple weights, provided the same plane and radius are used.

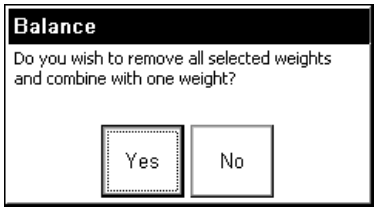
To combine the weights, follow these steps.

1. Press F3 (Comb Wt) on the Weights Summary Table screen.

   The Combine Weight screen appears.



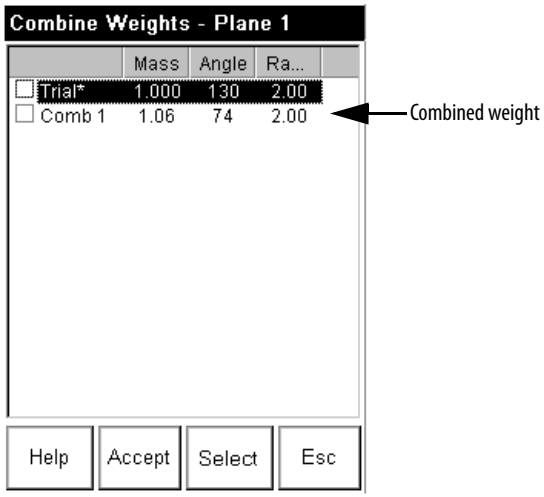
2. Highlight a weight and press F3 (Select). Enpac 2500 places a check mark next to the selected weight.
3. Repeat step 2 until you have selected all the weights you want to combine, then press F2 (Accept).



4. Press F2 (Yes) to combine the weights.

   If you do not want to combine the weights, press F3 (No).
5. Enter the radius (in inches) for the combined weight and press F2 (OK).

The Enpac 2500 combines the weights and displays the results in the Combine Weight screen, as shown below.



6. To return to the Weight Summary Table, press F4 (Esc).

Capturing and Printing the Summary Tables

The Vibration and Weight Summary Table screens can be saved as a bitmap (.bmp) image on a memory card, or printed as a graphic image with a serial connection to a serial printer.

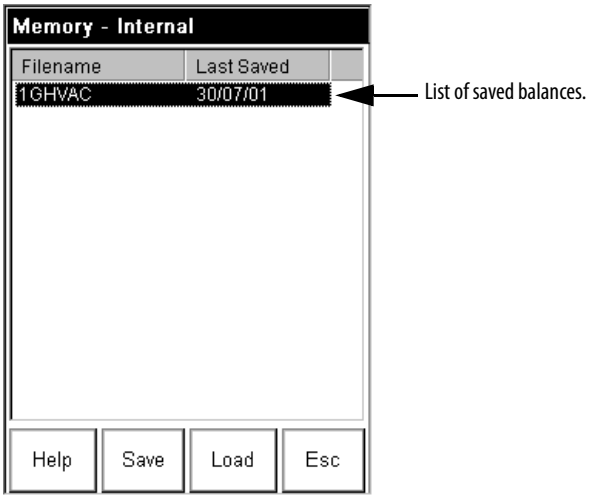
Saving and Reloading a Balance

The balance parameters and balance data can be saved to a file which can then be reloaded at a later date.

Saving a Balance

You can save the current balance setup and data anytime the Memory function is displayed on the screen.

1. Press F3 (Memory). The Memory - Internal screen appears.



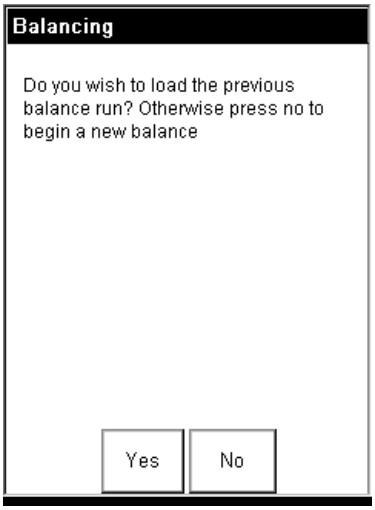
2. Press F2 (Save), then do one of the following:
   - To save the data to an existing file, highlight the file, and press F2 (OK). Press F2 (Yes) to overwrite the existing file. Note that you can return to the Memory - Internal screen without overwriting the file by pressing F3 (No).
   - To save the data to a new file, highlight 'new' and press F2 (OK). Enter a file name using the key pad or accept the default file name ('BALxxx' where the numbers are incremented by one until 999 is reached). When the entry is complete, press F2 (OK).
3. When you are finished, press F4 (Esc).

Reloading a Balance

You can reload a previously stored balance when you first open the Balancing program, or when you press F3 (Memory).

To Load the Previous Balance Run

When you open the Balancing program (choose Balance from the Main Menu screen), the Enpac 2500 may ask if you want to reload the previous balance run, as shown below.

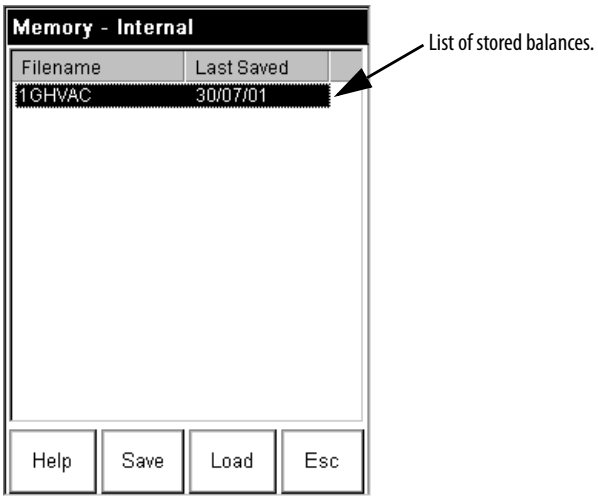


Press F2 (Yes) to load the previous balance. If you want begin a new balance, press F3 (No).

To Reload a Balance with the Memory Function

You can load a previously stored balance anytime the Memory function is displayed on the screen.

1. Press F3 (Memory). The Memory - Internal screen appears.



2. Highlight the balance file that you want to load and press F3 (Load).

IMPORTANT	This will overwrite the current balance setup and data.

Time Recorder Application

The Enpac 2500 Time Recorder application allows the Enpac 2500 to be used as a data recorder for real-time data acquisition and analysis. With the Time Recorder application, you can record data from channel 1, channel 2, or from an internal or external tachometer. The data is stored in a format which can be easily imported into a third party tool for program analysis.

The Time Recorder application is an add-on program to the Enpac 2500 and must be installed with the Time Recorder PCMCIA card from Rockwell Automation.

Refer to Install Optional Extension Modules on page 189 for installation instruction.

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Overview of the Time Recorder Application	239
Setting Up and Collecting Time Recorder Measurements	240
Recalling a Setup	246
Reviewing Time Recorder Measurements	248
Backing Up and Deleting Time Recorder Files	250

Overview of the Time Recorder Application

The Time Recorder application records a machines vibration signal (time waveform) as a Microsoft Windows .wav file. The signals from both input channels or channel 1 and the tachometer channel can be digitally recorded and stored for playback at a later date. The recorded time waveform can be viewed on the Enpac 2500 for onsite analysis or it can be imported into a third party analysis software tool for advanced diagnosis.

Below are examples of how you can use the time recorder application.

- Analyze a very low speed machine.
- Capture startup or coast-down data, intermittent events, and transient vibration signals from non-steady machines.
- Prevent further damage to a problem machine by recording the vibration signal for a short time. Then shut down the machine and play the recorded .wav file to analyze the measurement without the machine running.

- On a ship propulsion system, which uses large amounts of fuel, you can start the time recorder, run the ship up to full speed, run five minutes at full speed, and then coast-down. The measurement analysis is performed on the recorded vibration signal without spending hours of gas turbine drive time collecting data and resulting fuel consumption.

IMPORTANT	For optimized recording, use the Time Recorder application in conjunction with an ultra high speed SD card. Saving data to the card will greatly increase the amount of data you can record.

Setting Up and Collecting Time Recorder Measurements

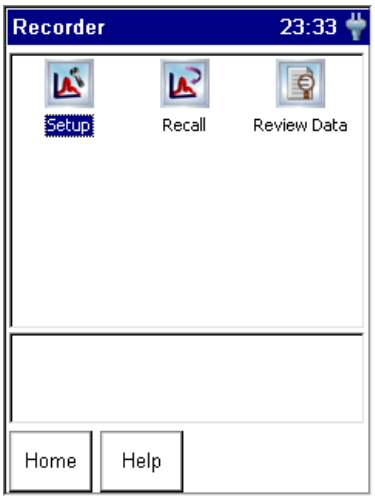
This section discusses how to set up, collect, and save Time Recorder measurements.

Setting Up Time Recorder Measurements

1. Connect the transducer to the Enpac 2500.

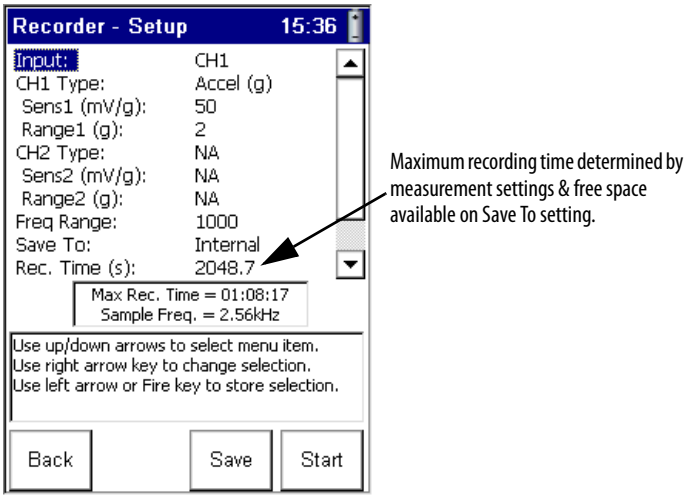
   Refer to Connect a Transducer to the Data Collector on page 120.
2. Attach the transducer(s) to the machine case or structure.
3. Select Recorder on the Main Menu and press the READ/OK key.

   The Recorder screen appears.



4. Select Setup and press the READ/OK key to set up the time recorder parameters and begin data collection.

The Recorder - Setup screen appears.



5. Highlight the parameter and press the RIGHT ARROW key to open the menu of choices.
6. Select the choice by pressing the arrow keys, or typing in a value using the numeric key pad.
7. Press the LEFT ARROW key to save your choices.
8. Press F3 (Save) to save the current settings to a file.

Refer to Saving a Time Recorder Setup and Measurement on page 244.

Use the descriptions in this table to help you configure the Time Recorder parameters.

Table 43 - Time Recorder Setup Parameters

Parameter Name	Description	Values/Comments
Input	The input channel(s) for the recorder measurement. **Important**: Your selection affects the Freq Range maximum frequency setting and the recordings maximum recording time. • CH1 - 20 kHz maximum Freq Range • CH1 & CH2 - 10 kHz maximum Freq Range for each channel • CH1 & Tacho - 10 kHz maximum Freq Range for each channel	Options: CH1 (default) CH1 & CH2 CH1 & Tacho
CH1 Type	Sets the vibration measurement type used on CH1. Your selection determines the available options and engineering units for subsequent setup parameters.	Options: Accel (G) (default) Accel (m/s^2) Vel (mm/s) Vel (ips) Disp (mils) Disp (µm) Volts (V) Volts AC Press. (Pa) Force (N) Force (lBf)*
Sens1	The sensitivity of the transducer in millivolts (mv) per Engineering Units for CH1.	The sensitivity value is included with the transducers documentation or it may be imprinted on the side of the transducer.

Table 43 - Time Recorder Setup Parameters

Parameter Name	Description	Values/Comments
Range1 (Full Scale)	The expected maximum amplitude range value for the CH1 measurement.	
CH2 Type	Sets the vibration measurement type used on CH2. This parameter is available only when Input is set to CH1 & CH2.	Options: NA Accel (G) (default) Accel (m/s^2) Vel (mm/s) Vel (ips) Disp (mils) Disp (µm) Volts (V) Volts AC Press. (Pa) Force (N) Force (IBf)
Sens2	The sensitivity of the transducer in millivolts (mv) per Engineering Units for CH2.	This parameter is available only when Input is set to CH1 & CH2.
Range2 (Full Scale)	The expected maximum amplitude range value for the CH2 measurement.	This parameter is available only when Input is set to CH1 & CH2.
Freq Range (Fmax)	The maximum frequency for the measurement. It affects the maximum recording time and sample frequency. Your Input selection determines the maximum value to be entered. • CH1 - 20 kHz maximum Freq Range • CH1 & CH2 - 10 kHz maximum Freq Range for each channel • CH1 & Tacho - 10 kHz maximum Freq Range for each channel	Hz
Save To	Sets the location where recorded data is saved. We recommend that you save the recorded data to the PC or SD card if the .wav files will be large. Your selection affects the maximum recording time.	Options: Internal (default) PC Card SD Card
Rec. Time (s)	The number of seconds to record the time waveform signal.	
Rec. Mode	The method for initiating the data recording. • Manual - Manually start the data recording by pressing F4 (Rec). • CH1 Level - The recording starts once the unit reaches the amplitude value entered in the Trig. Level parameter. • Tacho - The recording starts as soon at the Enpac 2500 receives the tachometer signal.	Options: Manual (default) CH1 Level Tacho Tacho option is available only when Input is set to CH1 & Tacho.
Trig. Level	Sets the CH1 amplitude to trigger data recording.	This parameter is available only when Rec. Mode is set to CH1 Level.

Recorder Status Indicators

The Recorder status indicators, located at the top of the Enpac 2500, operate differently in the Time Recorder module.

Table 43 - Recorder Status Indicators

Status Indicators	State	Definition
Red	Solid	An error condition has occurred for the current block of data. The status indicator turns off when the error condition disappears.

Table 43 - Recorder Status Indicators

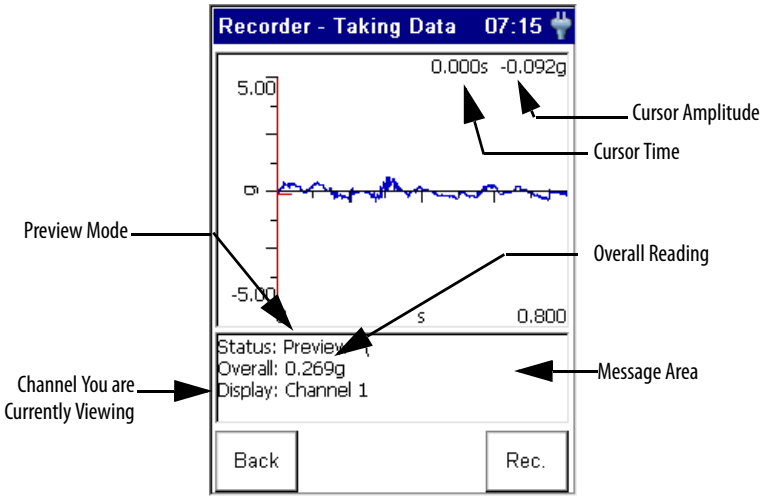
Status Indicators	State	Definition
Amber	Solid	An error has occurred during the recording. The status indicator remains solid even when the error condition disappears. The recorded .csv file also contains a flag indicating that the corresponding .wav file may contain flawed data.
Green	Flashing Green	The status indicator toggles on/off for each new data block.

Previewing the Measurement

You can preview the measurement before you record it to validate the parameter settings.

1. To enter Preview mode, press F4 (Start) on the Recorder - Setup screen.

   The Recorder - Taking Data screen appears.

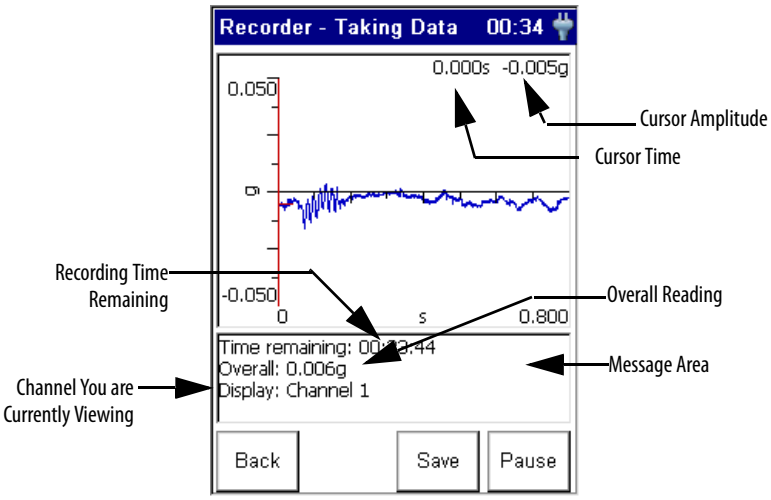


In Preview mode, the screen continuously updates to display the channels live time waveform signal and overall vibration reading. The message area is used to display error messages, such as a clipping error, or to prompt you to press a '1 or 2' to view the other channels time waveform data.

If you need to adjust the setup parameters, press F1 (Back) to return to the Setup screen.

Recording the Measurement

Once you have previewed the measurement and you are satisfied with the parameter settings, you can record the measurement. To initiate data recording, press F4 (Rec.) on the Preview screen.



During data recording, the live time waveform freezes on the screen, and the (recording) time remaining counts down in the message area. If any errors occur during the recording, an error message is displayed in the message area.

Refer to Recorder Status Indicators on page 242.

If you need to pause the recording, press F4 (Pause) on the Recorder - Taking Data screen. While paused, the Enpac 2500 reverts back to Preview mode showing the live time waveform. The Pause function becomes the Resume function. To resume data recording press F4 (Resume). Note that the recorded time signal is not continuous while the recording is paused.

When the recording ends, the Recorder - Save Data screen automatically appears, allowing you to save the recording to a file.

Refer to Saving a Time Recorder Setup and Measurement on page 244.

Saving a Time Recorder Setup and Measurement

The time recorder setup parameters and recorded time waveforms can be saved to a file which can then be recalled at a later time. The recorded time waveforms are stored in a .wav file format, and the last block of the recorded .wav file is saved in a comma separated value (.csv) file format.

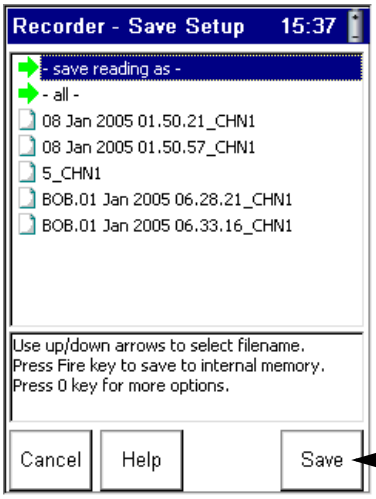
The .csv time waveform files may be reviewed in the field with the Enpac 2500 (Recorder - Review Data). The time waveform .wav audio files can be imported into vibration analysis software for post processing.

IMPORTANT When data is saved to an external memory card, only the .wav file is saved on the card. The .csv file is always saved to the internal disk (Mobile Device/ Internal Disk/Analyser/Recorder directory).

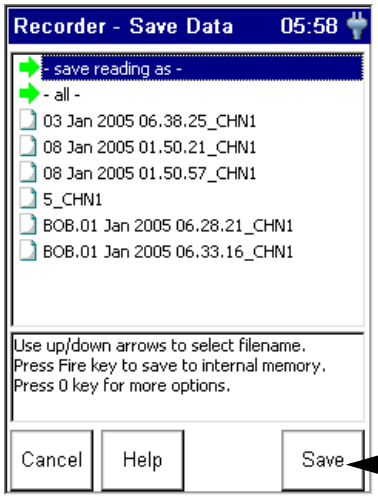
You can save a time recorder setup and measurement anytime the Save function is displayed on the screen.

TIP The Recorder - Save Data screen will automatically appear when the Enpac 2500 has finished recording the measurement. See page 244.

1. Press F3 (Save). The appropriate Recorder - Save screen appears.



Saves only the setup parameters.



Saves the setup parameters along wi the recorded data.

2. Do one of the following:
   - To save the data to an existing file, highlight the file, and press F4 (Save). Press F2 (Yes) to overwrite the existing file. Note that you can return to the Save screen without overwriting the file by pressing F3 (No).
   - To save the data to a new file, highlight 'save reading as' and press F4 (Save). Enter a file name using the keypad or accept the default file name (current date timestamp). When the entry is complete, press F4 (OK).

IMPORTANT The setup parameters are saved along with the measurement when you press F4 (Save) on the Recorder - Save Data screen.

3. When you are finished, press F1 (Cancel).

Recalling a Setup

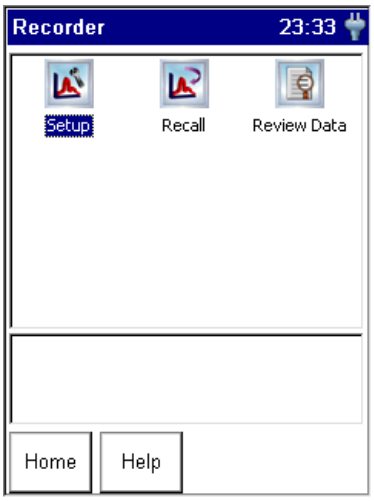
You can recall a previously saved setup and use it to record another measurement. The setup may have been saved only as a setup, or may have been saved with the recorded measurement.

Refer to Saving a Time Recorder Setup and Measurement on page 244.

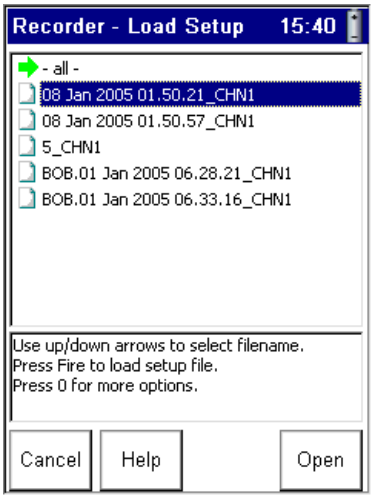
1. Connect the transducer to the Enpac 2500.

   Refer to Connect a Transducer to the Data Collector on page 120.

2. Attach the transducer(s) to the machine case or structure.
3. Select Recorder on the Main Menu and press the READ/OK key. The Recorder screen appears.

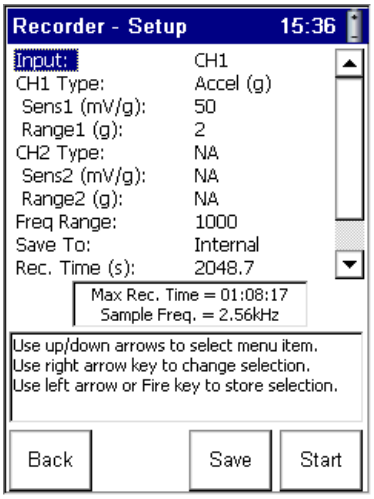


4. Select Recall and press the READ/OK key. The Recorder - Load Setup screen appears.



5. Highlight the filename that you want recall and press F4 (Open).

The Recorder - Setup screen appears.



Refer to Setting Up Time Recorder Measurements on page 240 for assistance in setting up the parameters.

6. To preview the measurement and start recording, press F4 (Start).

Refer to Previewing the Measurement on page 243 and Recording the Measurement on page 244.

Reviewing Time Recorder Measurements

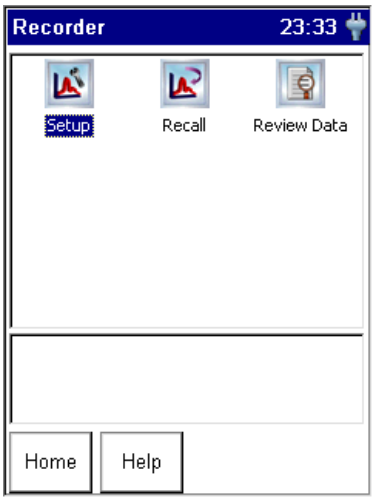
You can review previously recorded measurements with the Enpac 2500. Note that only a small portion from the end of the recorded data can be reviewed with the data collector. To review the entire data file, you must transfer the file to your computer.

See Copying Time Recorder Files to the Host Computer on page 251.

To review recorded measurements with your Enpac 2500, follow these steps.

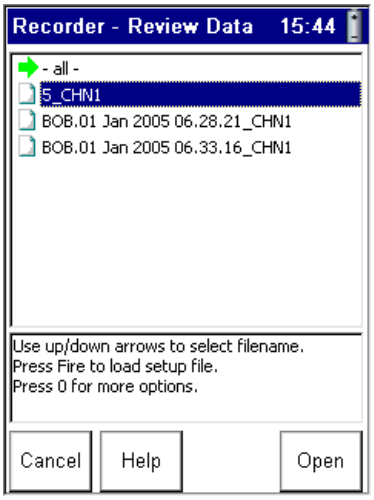
1. Select Recorder on the Main Menu and press the READ/OK key.

   The Recorder screen appears.



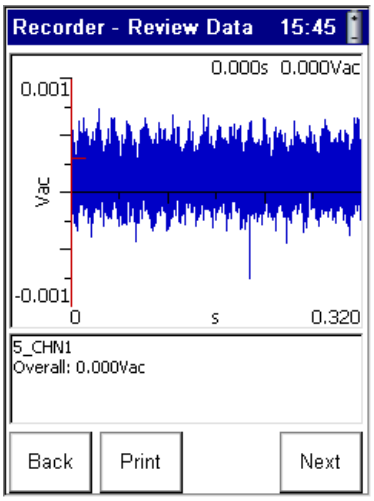
2. Select Review Data and press the READ/OK key.

   The Recorder - Review Data screen appears.



3. Highlight the filename that you want review and press F4 (Open).

The data is displayed on the screen.



4. Press F4 (Next) to review the next saved file. Press F3 (Prev) to review the previous saved file.
5. To print the screen, press F2 (Print).
6. To return to the main Recorder screen, press F1 (Back).

Capturing and Printing the Review Data Screen

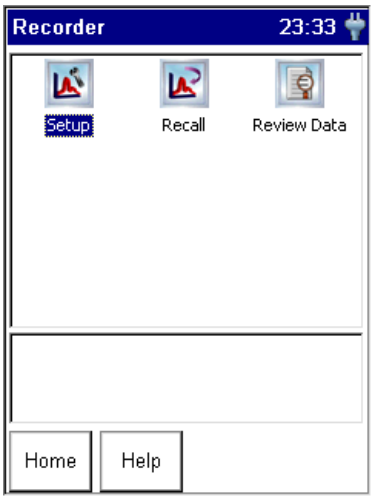
The Review Data screen can be saved as a bitmap (.bmp) image on a memory card, or printed as a graphic image with a serial connection to a serial printer.

Backing Up and Deleting Time Recorder Files

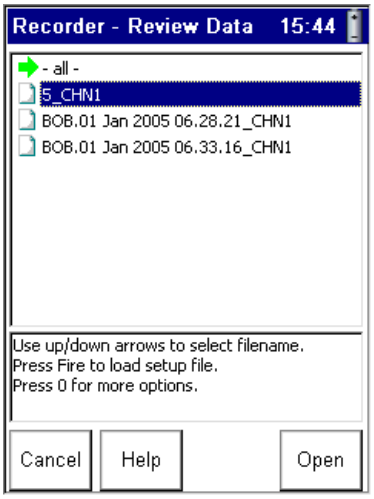
You can backup time recorder files to a PC card or SD card or copy the files to a host computer. You can also delete a time recorder measurement or setup from the Enpac 2500.

Backing Up Time Recorder Files

1. Insert the memory card into the PCMCIA slot in the bottom of the Enpac.
2. Select Recorder on the Main Menu and press the READ/OK key. The Recorder screen appears.



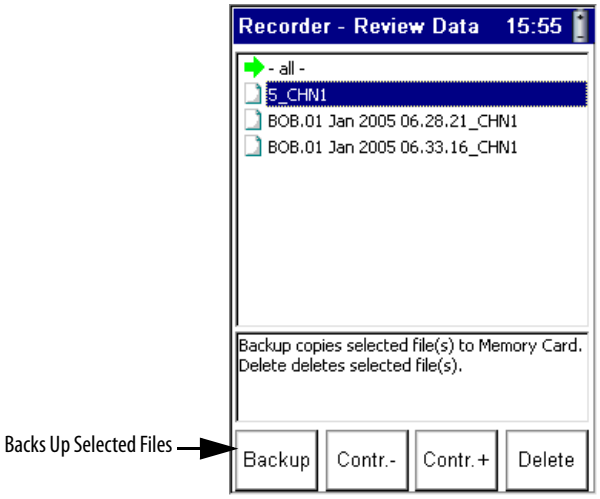
3. Select Review Data or Recall Data to backup a time recorder file and press the READ/OK key. The appropriate Recorder screen appears. Below is an example of the Recorder - Review Data screen.



To highlight a filename, press the UP or DOWN ARROW key.

4. Highlight the appropriate filename or highlight 'all' to backup all the files.

5. Press the 0 (Shift) key and F1 (Backup) simultaneously to backup the selected file(s) to the memory card.



6. The specified files are copied to the memory card (\Storage Card\Analyser\Recorder directory).

TIP If you are backing up `all' the files, a dialog appears asking if you wish to format the card. Press F2 (Yes) to format the card before backing up the files, or press F3 (No) to back up the files without formatting the card.

A message appears on the screen when the backup is complete.

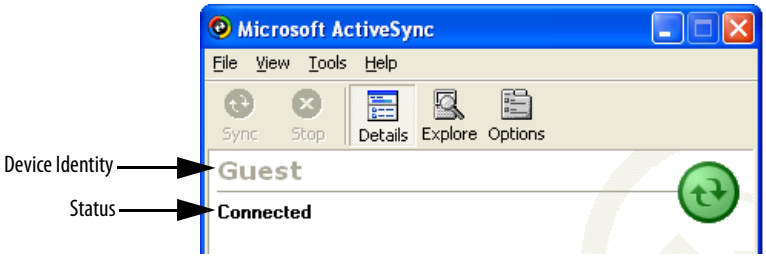
Copying Time Recorder Files to the Host Computer

You can use your computers USB port to copy the time recorder files to your computer. This interface requires you to install Microsoft ActiveSync software.

Refer to Installing ActiveSync on page 103. It also requires the USB Power Splitter cable (Cat. No. 1441-PEN25-COMS-US).

1. Plug one end of the USB Power Splitter cable into the POWER/TRIG connector at the top of the Enpac 2500.
2. Plug the USB end of the power splitter cable into the USB port on your computer.
3. If the ActiveSync or the Get Connected window is not open already on the PC, follow these steps.
   - Select Start > Programs > MicrosoftActiveSync on the computer. The AcitveSync window opens.
   - In the ActiveSync window, select Get Connected from the File menu. The Get Connected window opens.
4. In the Get Connected window, click Next.
5. In the New Partnership window on the computer, click No in response to the question 'Would you like to set up a partnership?' Then, click Next.

6. The New Partnership window closes and the ActiveSync window shows you are connected as 'Guest.'



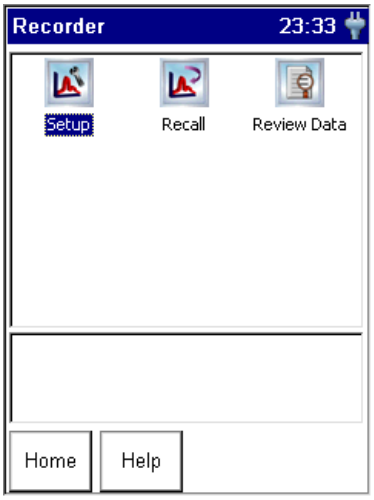
TIP If the connection fails, try it again, making sure you follow steps 3 and 4 in close sequence. You may need to unplug the USB cable from your computer and replug it into the USB port. If the connection still fails, use the ActiveSync Troubleshooter (Help > Microsoft ActiveSync Help) to help you identify and correct problems.

7. Using Windows Explorer, copy the time recording files (.csv and .wav) located in the Mobile Device/Internal Disk/Analyser/Recorder directory on the Enpac 2500 to the host computer.

Deleting a Time Recorder Measurement and Setup

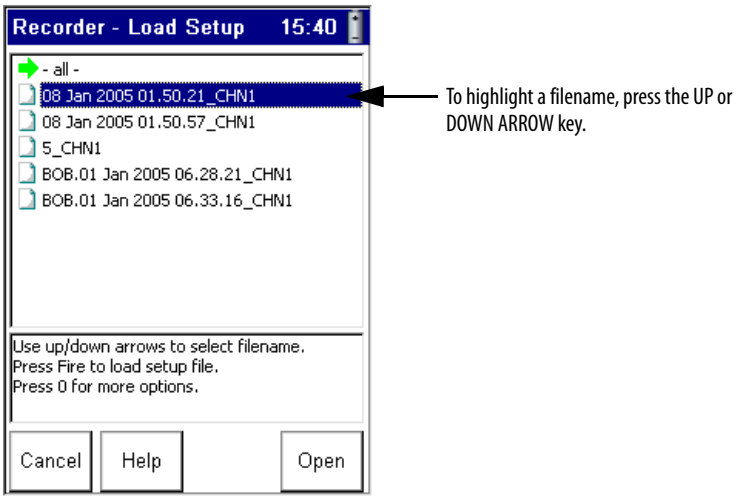
1. Select Recorder on the Main Menu and press the READ/OK key.

   The Recorder screen appears.

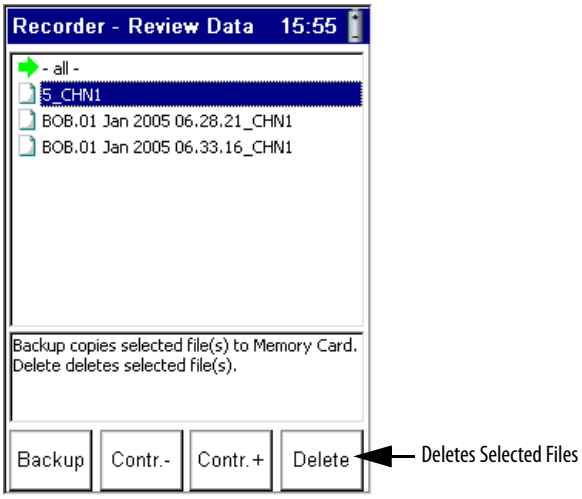


2. Select Review Data to delete a measurement or Recall Data to delete a setup and press the READ/OK key.

The appropriate Recorder screen appears. Below is an example of the Recorder - Load Setup screen.



3. Highlight the appropriate filename or highlight 'all' to delete all the files.
4. Press the 0 (Shift) key and F4 (Delete) simultaneously to delete the selected file(s) from the Enpac 2500.



A dialog appears to confirm the deletion.

5. Press F2 (Yes) to delete.

Notes:

Run Up/Coast Down Application

The Enpac 2500 Run Up/Coast Down application allows the Enpac 2500 to record and analyze data from intermittent events and transient vibration signals from non steady state machines.

The Run Up/Coast Down application is an add-on program to the Enpac 2500 and must be installed with the Run Up/Coast Down SD or PCMCIA card from Rockwell Automation.

Refer to Adding Applications to the Enpac 2500 Data Collector on page 59 for installation instruction.

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Displaying Measurements Using a Bode Plot	262
Displaying Measurements Using a Nyquist Plot	265
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Overview of the Run Up/ Coast Down Application

The Run Up/Coast Down application is used to record and analyze data from machines where noise or vibration levels are changing with speed or time such as during a run up (increase in speed), coast down (decrease in speed), or other applications causing transient phenomena. One of the primary objectives of this application is to establish the critical or resonant speeds of a machine.

The application acquires a simultaneous noise or vibration signal and a tachometer signal. Figure 35 illustrates a typical Run Up/Coast Down setup.

The setup includes an accelerometer attached to channel 1 of the Enpac 2500, an optical tachometer signal connected to the units power socket, a tripod for tachometer signal stability, and a speed reference trigger. A small piece of reflective tape on the part of the shaft can serve as a reference trigger or you can simply pass the laser over a notch in the shaft.

Figure 35 - Run Up/Coast Down Setup

The recorded data is saved in the form of a time waveform (a Microsoft .wav file). It can be analyzed as many times as required and can be viewed in a variety of different formats including:

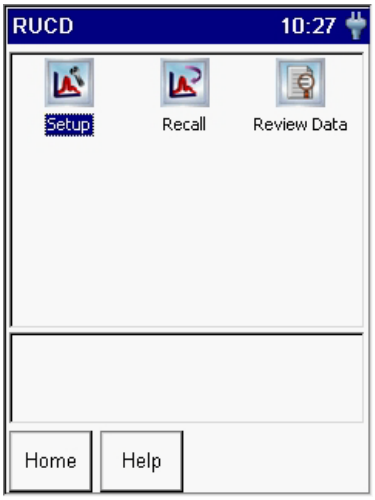
- Bode Plot
- Nyquist Plot
- Table
- Waterfall
- Spectrogram

Setting Up Run Up/Coast Down Measurements

The first step in the Run Up/Coast Down application is to set up how the data will be acquired by the data collector.

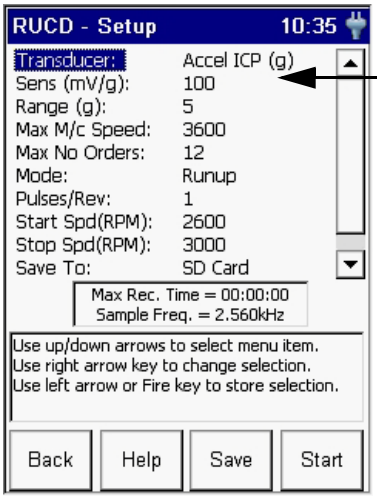
1. Select RUCD on the Main Menu and press the READ/OK key.

   The RUCD screen appears.



2. Select Setup and press the READ/OK key to set up the Run Up/Coast Down parameters.

   The RUCD - Setup screen appears.



3. Highlight the option and press the RIGHT ARROW key to open a menu of choices.
4. Select the choice by pressing the arrow keys or type in a value using the numeric key pad.
5. Press the LEFT ARROW key to save your selections.
6. Press F3 (Save) to save the current settings to a file.

   Refer to Saving Run Up/Coast Down Measurements on page 279.

Use the descriptions in this table to help you configure the parameters in the Run Up/Coast Down Setup screen.

Table 44 - Run Up/Coast Down Setup Parameters

Parameter Name	Description	Values/Comments
Transducer	Type of sensor used on channel 1 of the Enpac 2500. The sensor type determines available options and engineering units for subsequent setup fields.	Options: Accel ICP (g) (default) Accel (g) Accel ICP (m/s^2) Accel (m/s^2) Vel ICP (mm/s) Vel (mm/s) Vel ICP (ips) Vel (ips) Disp (mils) Disp (um) Volts AC User (EU)
Sens (mV/EU)	The transducer sensitivity in millivolts (MV) per engineering units (EU).	1…2000 (mV/EU) Default value is 50 (mV/EU)
Range (EU)	The expected maximum amplitude range value. The range should accommodate for unexpected events; if in doubt, use caution and set the range 10…20 times higher than expected.	Options: .1 EU .2 EU .5 EU 1 EU 2 EU (default) 5 EU 10 EU 20 EU 50 EU 100 EU 200 EU 500 EU 1000 EU 2000 EU
Max M/c Speed	The maximum speed that the shaft will reach in RPM. Used with Max No Orders to determine the sampling rate.	10…60000 RPM Default value is 3600 RPM
Max No Orders	The maximum number of shaft orders of interest during analysis. Used with Max M/c Speed to determine the sampling rate.	1…166 Default value is 32
Mode	The method for initiating the data collection. • Runup - The data collection starts when the machine speed rises above Start Spd. • Coast down -The data collection starts when the machine speed falls below Stop Spd. • Manual - Manually start data collection by pressing F4 (Start). No tachometer signal is required for this mode.	Options: Runup (default) Manual Coastdown
Pulses/Rev	The number of tachometer signal pulses per revolution of the reference shaft. To acquire a suitable tachometer signal, the tachometer signal must be approximately 1.5 volts peak-to-peak. The adverse effect of excessively short tachometer pulse widths can be addressed by setting the Max No Order to a higher value to increase the sampling rate.	.1…1000 Default value is 1 This number can be a multiple or a non-integer to accommodate for gear ratios and others.

Table 44 - Run Up/Coast Down Setup Parameters

Parameter Name	Description	Values/Comments
Start Spd (RPM)	Sets the speed at which the unit should start collecting data.	10…3600 RPM Default value is 60 RPM If Mode is set to `Runup,' this value must be less than the Stop Spd. If Mode is set to `Coast down,' this value must be greater than the Stop Spd. This parameter is not available if Mode is set to `Manual.'
Stop Spd (RPM)	Sets the speed at which the unit should stop collecting data.	10 to 3600 RPM Default value is 300 RPM If Mode is set to `Runup,' this value must be greater than the Start Spd. If Mode is set to `Coast down,' this value must be less than Start Spd. This parameter is not available if Mode is set to `Manual.'
Save To	Sets the location where data is saved. We recommend that you save the data to the SD or PC card if the .wav files will be large. Your selection affects the maximum recording time.	Options: Internal (default) PC Card SD Card
Max Acq Time (s)	The number of seconds to record the time waveform. This limit applies only if the run up or coast down takes longer than the time set here.	1…1131.65 seconds Default value is 1131.65 seconds

Collecting Run Up/Coast Down Measurements

This section describes the Run Up/Coast Down status indicators and how to collect Run Up/Coast Down data.

Run Up/Coast Down Status Indicators

This table describes the status indicators in the Run Up/Coast Down application.

Table 45 - RUCD Status Indicators

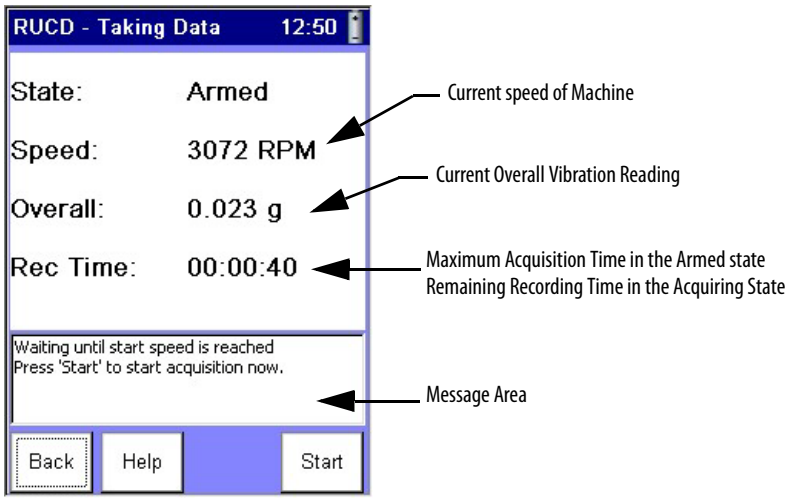
Status Indicators	State	Definition
Red	Solid	An overload error (clipping or streaming error) has occurred during data collection.
Amber	Solid	An error has occurred during data collection The status indicator turns off when the error condition disappears.
Green	Flashing Green	No errors occurred during data collection.

Collecting and Analyzing Run Up/Coast Down

When the setup parameters are complete, you can begin collecting data. The collected data is automatically recorded as a .wav file, which can then be analyzed using several different types of plots.

1. Using the tachometer cable (Cat. No. EK-45131), connect the reference input device to the POWER/TRIG connector at the top of the Enpac. Align the reference input device (tachometer, optical tachometer, or strobescope) to capture shaft speed.
2. Attach a transducer to the bearing house.
3. Start the machine or stop the machine as needed. Press F4 (Start) on the RUCD - Setup screen to begin data collection.

   The RUCD - Taking Data screen appears.

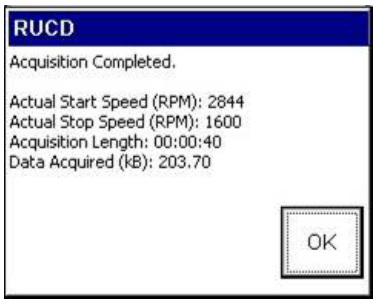


   The Enpac begins collecting run up or coast down data based on the parameters you selected. The state of the machine is indicated on the screen.

State	Description
Armed	The machine speed has not reached the Start Spd and data collection has not yet started. At any time during this state, you can press F4 (Start) to manually start data collection.
Acquiring	The machine speed has reached the Start Spd and data collection has started. At any time during this state, you can press F4 (Stop) to manually stop data collection.
Error-Clipped	An error occurred during data collection. If a sensors Range setting is too small to accommodate the signals amplitude, a message displays in the message error. Press F1 (Back) to return to the RUCD - Setup screen and increase the Range setting.

4. Data collection is complete when the specified Stp Speed or Maximum Acquisition Time is reached, or you press F4 (Stop).

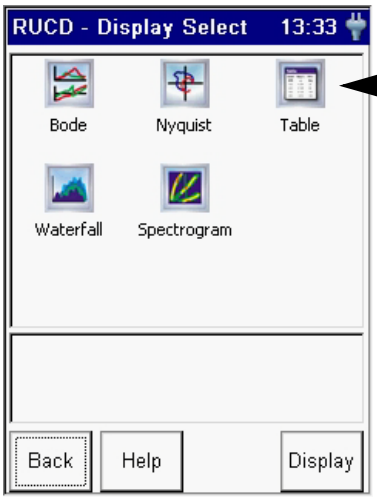
The resulting time waveform is recorded as a Microsoft Windows .wav file and the Acquisition Completed dialog appears on the screen.



TIP If an error occurs during data collection, an error message is displayed in this dialog.

5. Press F4 (OK) to continue.

   The RUCD - Display Select screen appears.



6. The Enpac provides five different formats for you to use to view the newly recorded time waveform. Select the format and press F4 (Display).
   - **Bode** - Display the magnitude and phase over a varying RPM. Refer to Displaying Measurements Using a Bode Plot on page 262.
   - **Nyquist** - Display the selected orders as complex data. Refer to Displaying Measurements Using a Nyquist Plot on page 265.
   - **Table** - Display the magnitude and phase of selected orders at the varied RPM speeds in a table format. Refer to Displaying Measurements in Table Format on page 268.
   - **Waterfall** - Display multiple FFT traces overlaid and offset on one single plot. Refer to Displaying Measurements Using a Waterfall on page 271.
   - **Spectrogram** - Display multiple FFT traces on one single plot, using color to indicate relative magnitude. Refer to Displaying Measurements Using a Spectrogram on page 276.
7. When you are finished analyzing the time waveform, you can save it to a file. Refer to Saving Run Up/Coast Down Measurements on page 279.

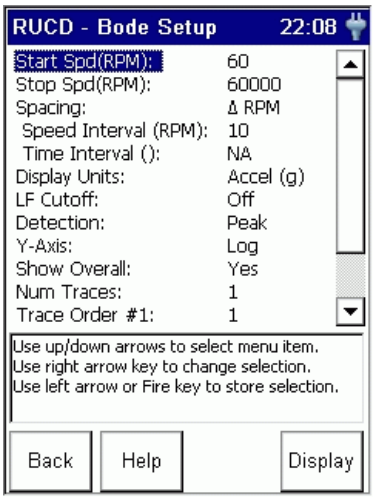
Displaying Measurements Using a Bode Plot

The Bode plot is actually two graphs of 1X RPM amplitude and phase as a function of frequency. The screen shows both plots at the same time. The top plot shows magnitude versus RPM. The bottom plot shows phase versus RPM.

Setting Up the Bode Plot

1. Select Bode on the RUCD - Display Select screen and press F4 (Display).

   The RUCD - Bode Setup screen appears.



2. Highlight the option and press the RIGHT ARROW key to open a menu of choices.
3. Select the choice by pressing the arrow keys or type in a value using the numeric keypad.
4. Press the LEFT ARROW key to save your selection.

   Use the descriptions in Table 46 to help you configure the parameters.
5. When you are finished, press F4 (Display) to display the Bode plot.

Refer to Displaying the Bode Plot on page 264.

Table 46 - Bode Plot Parameters

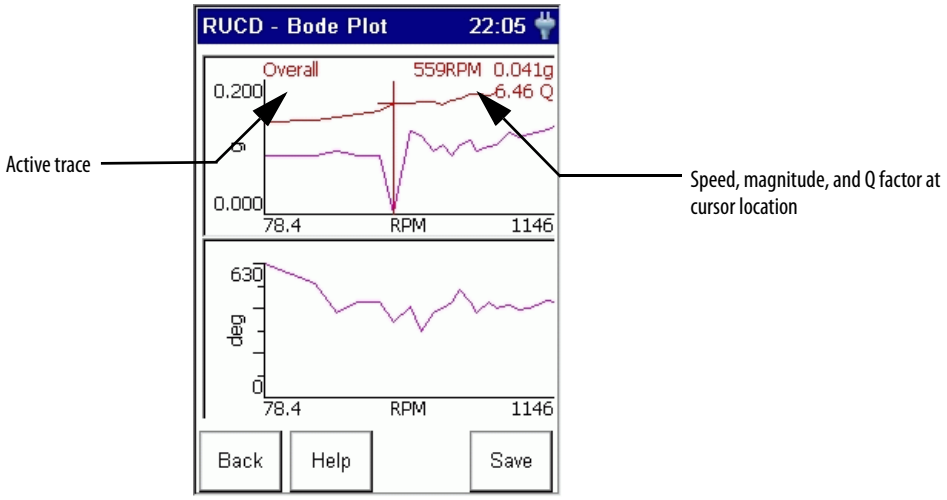
Parameter Name	Description	Values/Comments
Start Spd (RPM)	Sets the start speed of the recorded data for the Bode plot.	10…3600 RPM This defaults to the Start Spd value set in the RUCD Setup screen. See Table 44 on page 258.
Stop Spd (RPM)	Sets the stop speed of the recorded data for the Bode plot.	10…3600 RPM This defaults to the Start Spd value set in the RUCD Setup screen. See Table 44 on page 258.
Spacing	Controls the spacing between collected spectra. • Delta RPM- A fixed speed change between spectra. • % Delta RPM- A percentage speed change between spectra. • Delta Time- A fixed time interval between spectra. • Delta RPM+Delta Time- A combination of speed and time interval settings. If speed stops changing then spectra are calculated using the Time Interval value. • % Delta RPM+Delta Time- A combination of speed and time interval settings. If speed stops changing then spectra are calculated using the Time Interval value.	Options: Delta RPM % Delta RPM Delta Time Delta RPM+Delta Time % Delta RPM+Delta Time Your selection affects the Speed Interval and Time Interval settings.
Speed Interval (RPM)	Sets the speed interval used in calculating FFT spectra.	1…240 RPM or % RPM This parameter not used when Spacing is set to `Delta Time.'
Time Interval (sec)	Sets the time interval used in calculating FFT spectra.	Enter a value from .001…604800 seconds This parameter is not used when Spacing is set to `Delta RPM' and `% Delta RPM.'
Display Units	Sets the Y-axis units.	The available units depends on the transducer used to collect data. See Table 44 on page 258.
LF Cutoff	Determines whether to apply a low frequency filter (0.3 times the running speed) to the data.	Options: Off On
Detection	Sets the signal detection and scaling display for the Bode plot. • Peak - Measured RMS value multiplied by the square root of two (1.4142). • Pk-Pk - Measured RMS value multiplied by two times the square root of two (2.8284). • RMS - Root mean squared signal level of the input signal.	Options: RMS Peak PkPk
Y-axis	Sets the y-axis scaling on the Bode plot. • Linear - The plot grid centers are linearly spaced in Y between the centers of the first and last grid. • Log - The plot grid centers are logarithmically spaced in Y between the centers of the first and last grid.	Options: Linear Log

Table 46 - Bode Plot Parameters

Parameter Name	Description	Values/Comments
Show Overall	Determines whether to display the overall severity as a trace on the Bode plot.	Options: Yes No
Num Traces	Sets the number of traces or order tracks to be displayed on the Bode plot. The number of traces available is determined by the Show Overall parameter. Your selection determines the available number of Trace Order parameters.	Options: 1 2 3 4
Trace Order #1-#4	The order numbers to be tracked and displayed on the Bode plot.	Enter a value from .001…166 orders This value cannot exceed the Max No Orders value set in the RUCD Setup screen. See Table 44 on page 258.

Displaying the Bode Plot

When you are done setting up the Bode plot parameters, you can process the data and display the Bode plot by pressing F4 (Display) on the RUCD - Bode Setup screen.



TIP The larger the .wav file, the longer it takes to process the data and display the plot.

The top of the display shows magnitude versus RPM. The bottom of the display shows phase versus RPM.

To sequence through the traces, press the UP and DOWN ARROW keys. The order number of the current trace is displayed in the top left corner of the screen. To move the cursor along the trace, press the LEFT and RIGHT ARROW keys.

From the Bode plot you can also display the data in a Table format or Nyquist plot. To display the data in a table, press the 0 (Shift) key and F4 (Table) simultaneously. Refer to Displaying the Table on page 270.

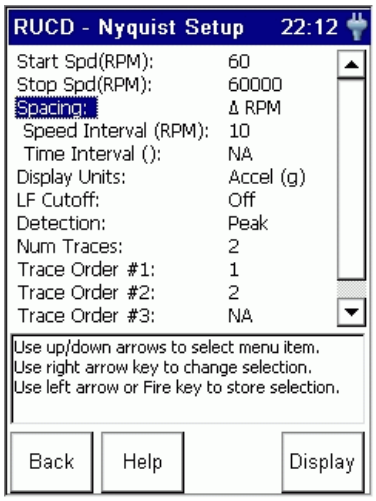
To display the data in a Nyquist plot, press the 0 (Shift) key and F1 (Nyqst) simultaneously. Refer to Displaying the Nyquist Plot on page 267.

Displaying Measurements Using a Nyquist Plot

The Nyquist plot is a polar representation of the amplitude and phase angle as a function of frequency. Three variables are combined into a single plot in polar format.

Setting Up the Nyquist Plot

1. Select Nyquist on the RUCD - Display Select screen and press F4 (Display). The RUCD - Nyquist Setup screen appears.



2. Highlight the option and press the RIGHT ARROW key to open a menu of choices.
3. Select the choice by pressing the arrow keys or type in a value using the numeric keypad.
4. Press the LEFT ARROW key to save your selection. Use the descriptions in Table 47 to help you configure the parameters.
5. When you are finished, press F4 (Display) to display the Nyquist plot. Refer to Displaying the Nyquist Plot on page 267.

Table 47 - Nyquist Plot Parameters

Parameter Name	Description	Values/Comments
Start Spd (RPM)	Sets the start speed of the recorded data for the plot.	10…3600 RPM This defaults to the Start Spd value set in the RUCD Setup screen. See Table 44 on page 258.
Stop Spd (RPM)	Sets the stop speed of the recorded data for the plot.	10…3600 RPM This defaults to the Stop Spd value set in the RUCD Setup screen. See Table 44 on page 258.

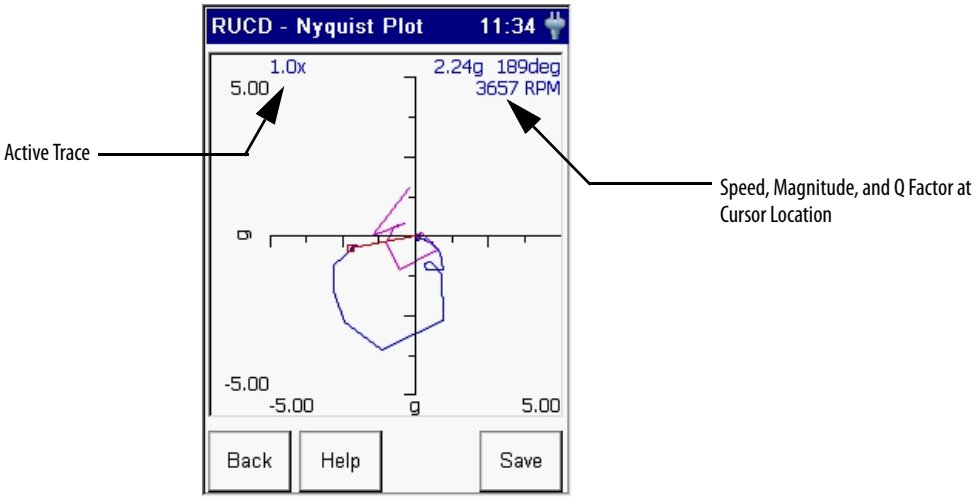
Table 47 - Nyquist Plot Parameters

Parameter Name	Description	Values/Comments
Spacing	Controls the spacing between collected spectra. • Delta RPM- A fixed speed change between spectra. • % Delta RPM- A percentage speed change between spectra. • Delta Time- A fixed time interval between spectra. • Delta RPM+Delta Time- A combination of speed and time interval settings. If speed stops changing then spectra are calculated using the Time Interval value. • % Delta RPM+Delta Time- A combination of speed and time interval settings. If speed stops changing then spectra are calculated using the Time Interval value.	Options: Delta RPM % Delta RPM Delta Time Delta RPM+Delta Time % Delta RPM+Delta Time Your selection affects the Speed Interval and Time Interval settings.
Speed Interval (RPM)	Sets the speed interval used in calculating FFT spectra.	1…240 RPM or % RPM This parameter not used when Spacing is set to `Delta Time.'
Time Interval (sec)	Sets the time interval used in calculating FFT spectra.	.001…604800 seconds This parameter is not used when Spacing is set to `Delta RPM' and '% Delta RPM.'
Display Units	Sets the Y-axis units.	The available units depends on the transducer used to collect data. See Table 44 on page 258.
LF Cutoff	Determines whether to apply a low frequency filter (0.3 times the running speed) to the data.	Options: Off On
Detection	Sets the signal detection and scaling display for the plot. • Peak - Measured RMS value multiplied by the square root of two (1.4142). • Pk-Pk - Measured RMS value multiplied by two times the square root of two (2.8284). • RMS - Root mean squared signal level of the input signal.	Options: RMS Peak PkPk
Num Traces	Sets the number of traces or order tracks to be displayed on the plot.	Options: 1 2 3 4 Your selection determines the available number of Trace Order parameters.
Trace Order #1-#4	The order numbers to be tracked and displayed on the plot.	.001…166 orders This value cannot exceed the Max No Orders value set in the RUCD Setup screen. See Table 44 on page 258.

Displaying the Nyquist Plot

When you are done setting up the plot parameters, you can process the data and display the Nyquist plot by pressing F4 (Display) on the RUCD - Nyquist Setup screen.

TIP The larger the .wav file, the longer it takes to process the data and display the plot.



The display shows the selected orders as complex data with zero degrees along the positive X-axis and 90 degrees along the positive Y-axis.

To sequence through the traces, press the UP and DOWN ARROW keys. The order number of the current trace is displayed in the top left corner of the screen. To move the cursor along the trace, press the LEFT and RIGHT ARROW keys.

From the Nyquist plot you can also display the data in a Table format or Bode plot. To display the data in a table, press the 0 (Shift) key and F4 (Table) simultaneously. Refer to Displaying the Table on page 270.

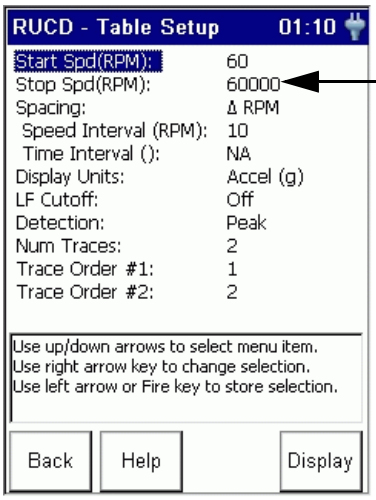
To display the data in a Bode plot, press the 0 (Shift) key and F1 (Bode) simultaneously. Refer to Displaying the Bode Plot on page 264.

Displaying Measurements in Table Format

The magnitude and phase of selected orders at the varied RPM speeds are displayed in a table.

Setting Up the Table

1. Select Table on the RUCD - Display Select screen and press F4 (Display). The RUCD - Table Setup screen appears.



2. Highlight the option and press the RIGHT ARROW key to open a menu of choices.
3. Select the choice by pressing the arrow keys or type in a value using the numeric keypad.
4. Press the LEFT ARROW key to save your selection.

   Use the descriptions in Table 48 to help you configure the parameters.
5. When you are finished, press F4 (Display) to display the table. Refer to Displaying the Table on page 270.

Table 48 - Table Parameters

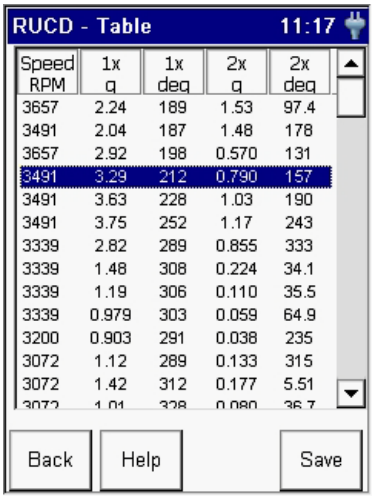
Parameter Name	Description	Values/Comments
Start Spd (RPM)	Sets the start speed of the recorded data for the table.	10…3600 RPM This defaults to the Start Spd value set in the RUCD Setup screen. See Table 44 on page 258.
Stop Spd (RPM)	Sets the stop speed of the recorded data for the table.	10…3600 RPM This defaults to the Stop Spd value set in the RUCD Setup screen. See Table 44 on page 258.

Table 48 - Table Parameters

Parameter Name	Description	Values/Comments
Spacing	Controls the spacing between collected spectra. • Delta RPM- A fixed speed change between spectra. • % Delta RPM- A percentage speed change between spectra. • Delta Time- A fixed time interval between spectra. • Delta RPM+Delta Time- A combination of speed and time interval settings. If speed stops changing then spectra are calculated using the Time Interval value. • % Delta RPM+Delta Time- A combination of speed and time interval settings. If speed stops changing then spectra are calculated using the Time Interval value.	Options: Delta RPM % Delta RPM Delta Time Delta RPM+Delta Time % Delta RPM+Delta Time Important: Your selection affects the Speed Interval and Time Interval settings.
Speed Interval (RPM)	Sets the speed interval used in calculating FFT spectra.	1…240 RPM or % RPM This parameter not used when Spacing is set to `Delta Time.'
Time Interval (sec)	Sets the time interval used in calculating FFT spectra.	.001…604800 seconds This parameter is not used when Spacing is set to 'Delta RPM' and '% Delta RPM.'
Display Units	Sets the Y-axis units.	The available units depends on the transducer used to collect data. See Table 44 on page 258.
LF Cutoff	Determines whether to apply a low frequency filter (0.3 times the running speed) to the data.	Options: Off On
Detection	Sets the signal detection and scaling display for the table. • Peak - Measured RMS value multiplied by the square root of two (1.4142). • Pk-Pk - Measured RMS value multiplied by two times the square root of two (2.8284). • RMS - Root mean squared signal level of the input signal.	Options: RMS Peak PkPk
Num Traces	Sets the number of traces or order tracks to be displayed in the table.	Options: 1 2 Note: Your selection determines the available number of Trace Order parameters.
Trace Order #1-#4	The order numbers to be tracked and displayed in the table.	.001…166 orders This value cannot exceed the Max No Orders value set in the RUCD Setup screen. See Table 44 on page 258.

Displaying the Table

When you are done setting up the table parameters, you can process the data and display the table by pressing F4 (Display) on the RUCD - Table Setup screen.



Speed RPM	1x g	1x deg	2x g	2x deg
3657	2.24	189	1.53	97.4
3491	2.04	187	1.48	178
3657	2.92	198	0.570	131
3491	3.29	212	0.790	157
3491	3.63	228	1.03	190
3491	3.75	252	1.17	243
3339	2.82	289	0.855	333
3339	1.48	308	0.224	34.1
3339	1.19	306	0.110	35.5
3339	0.979	303	0.059	64.9
3200	0.903	291	0.038	235
3072	1.12	289	0.133	315
3072	1.42	312	0.177	5.51

Up to two orders of the magnitude and phase data set is displayed in the table. To scroll through the table, press the UP and DOWN ARROW keys.

You can also display the data in a Bode plot or Nyquist plot. To display the data in a Bode plot, press the 0 (Shift) key and F4 (Bode) simultaneously.

Refer to Displaying the Bode Plot on page 264.

To display the data in a Nyquist plot, press the 0 (Shift) key and F1 (Nyquist) simultaneously.

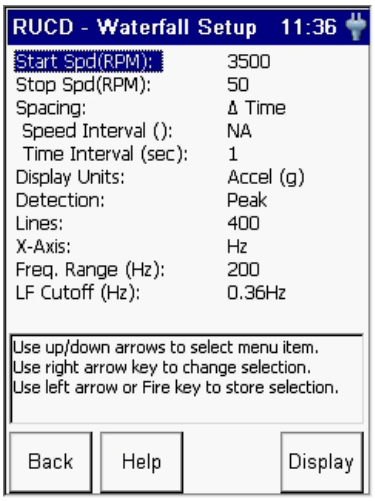
Refer to Displaying the Nyquist Plot on page 267.

Displaying Measurements Using a Waterfall

The Waterfall plot displays the vibration level in relation to the frequencies at which the vibration occurs. It enables you to view several measurements in relationship to each other.

Setting Up the Waterfall

1. Select Waterfall on the RUCD - Display Select screen and press F4 (Display). The RUCD - Waterfall Setup screen appears.



2. Highlight the option and press the RIGHT ARROW key to open a menu of choices.
3. Select the choice by pressing the arrow keys or type in a value using the numeric keypad.
4. Press the LEFT ARROW key to save your selection.

   Use the descriptions in Table 49 to help you configure the parameters.
5. When you are finished, press F4 (Display) to display the Waterfall plot. Refer to Displaying the Waterfall Plot on page 273.

Table 49 - Waterfall Plot Parameters

Parameter Name	Description	Values/Comments
Start Spd (RPM)	Sets the start speed of the recorded data for the plot.	10…3600 RPM This defaults to the Start Spd value set in the RUCD Setup screen. See Table 44 on page 258.
Stop Spd (RPM)	Sets the stop speed of the recorded data for the plot.	10…3600 RPM This defaults to the Stop Spd value set in the RUCD Setup screen. See Table 44 on page 258.

Table 49 - Waterfall Plot Parameters

Parameter Name	Description	Values/Comments
Spacing	Controls the spacing between collected spectra. • Delta RPM- A fixed speed change between spectra. • % Delta RPM- A percentage speed change between spectra. • Delta Time- A fixed time interval between spectra. • Delta RPM+Delta Time- A combination of speed and time interval settings. If speed stops changing then spectra are calculated using the Time Interval value. • % Delta RPM+Delta Time- A combination of speed and time interval settings. If speed stops changing then spectra are calculated using the Time Interval value.	Options: Delta RPM % Delta RPM Delta Time Delta RPM+Delta Time % Delta RPM+Delta Time Your selection affects the Speed Interval and Time Interval settings.
Speed Interval (RPM)	Sets the speed interval used in calculating FFT spectra.	1…240 RPM Note: This parameter not used when Spacing is set to 'Delta Time.'
Time Interval (sec)	Sets the time interval used in calculating FFT spectra.	.001…604800 seconds This parameter is not used when Spacing is set to `Delta RPM' and `% Delta RPM.'
Display Units	Sets the Y-axis units.	The available units depends on the transducer used to collect data. See Table 44 on page 258.
Detection	Sets the signal detection and scaling display for the plot. • Peak - Measured RMS value multiplied by the square root of two (1.4142). • Pk-Pk - Measured RMS value multiplied by two times the square root of two (2.8284). • RMS - Root mean squared signal level of the input signal.	Options: RMS Peak PkPk
Lines	The number of lines (bins) of resolution for the FFT spectra. The larger the number of lines, the better the frequency resolution of the measured data in the spectra. Similarly, the higher the number of lines, the longer it takes to display the spectra in the plot.	Options: 100 200 400 800 1600 3200 6400 12800
X-axis	Sets the x-axis frequency units for displaying spectra/FFT data. • Hz - Displays spectra in Hertz, cycles per second. • CPM - Displays spectra in cycles per minute. • Orders - Displays spectra in orders of the operating speed.	Options: Hz CPM Orders Your selection affects the Freq Range and LF Cutoff parameters.
Freq. Range (EU)	The maximum frequency for the measurement.	10…2000 Hz 600…120000 CPM .001…166 Orders The frequency range is determined by the X-axis parameter.

Table 49 - Waterfall Plot Parameters

Parameter Name	Description	Values/Comments
LF Cutoff (EU)	Sets a low frequency cutoff filter to remove noise from the analysis.	Options: Off 21.6 CPM 66 CPM 120 CPM 600 CPM 4200 CPM .36 Hz 1.1 Hz 2 Hz 10 Hz 70 Hz The available options are determined by the X-axis selection.

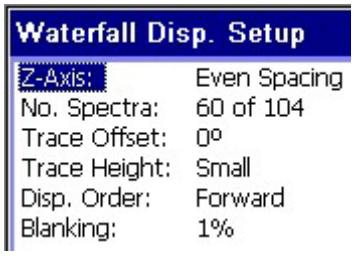
Displaying the Waterfall Plot

When you are finished setting up the plot parameters, you can process the spectral data by pressing F4 (Display) on the RUCD - Waterfall Setup screen.

TIP The larger the .wav file, the longer it takes to process the data and display the plot.

Optimizing the Waterfall Plot

Additional parameters display on the screen by allowing you to control how the spectra appear in the waterfall plot.



1. Highlight the option and press the RIGHT ARROW key to open a menu of choices.
2. Select the choice by pressing the arrow keys or type in a value using the numeric keypad.
3. Press the LEFT ARROW key to save your selection.

   Use the descriptions in Table 50 to help you configure the parameters.

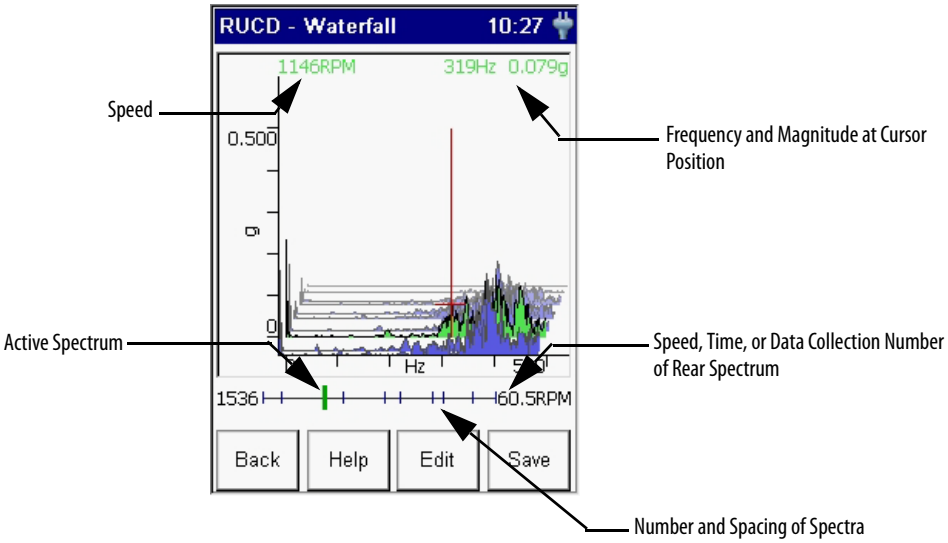
4. When you are finished and ready to display the waterfall plot, press F4 (Display).

Table 50 - Waterfall Plot Setup Parameters

Parameter Name	Description	Values/Comments
Z-axis	Controls the spacing between the collected spectra. • RPM- FFTs spaced depending on the RPM at which they were recorded. • Timestamp- FFTs spaced depending on the time the data was recorded. • Even Spacing- FFTs spaced evenly along the Z-axis.	Options: RPM Timestamp Even Spacing
No. Spectra	Controls the number of spectra to display on the waterfall plot. The spectra are displayed as follows: • The first spectrum is always displayed. • The last spectrum is always displayed. • The other spectra (No. Spectra minus first and last spectrum) are evenly distributed on the plot.	2…60 spectra
Trace Offset	Sets the angle of the Z-axis on the plot.	Options: 0 degrees 22.5 degrees 45 degrees
Trace Height	Controls the height of the spectra on the plot.	Options: Small Medium Large
Disp. Order	Controls the order in which to display the spectra. • Forward- Display spectra from oldest (front of the waterfall) to newest (rear of the waterfall). • Reverse- Display spectra from newest (front of the waterfall) to oldest (rear of the waterfall).	Options: Forward Reverse
Blanking	Eliminates the display of data below a certain level on the Y-axis. This setting helps clarify the presence of machine orders or structural frequencies.	0%…25%

Viewing the Waterfall Plot

After setting up the Waterfall spectra, press F4 (Display) on the Waterfall Display Setup screen.



At the bottom of the waterfall plot is a display area that indicates the active spectrum, and provides information (number of spacing of spectra, speed) on how the spectra are displayed in the waterfall plot.

TIP If more than sixty spectra were collected, the ticks along the line indicate which spectra were selected to be displayed.

See No. Spectra on page 274.

Cursor Movement

Use the UP and DOWN ARROW keys to sequence through the displayed spectra. The active spectrum displays in green. The zero positions of the X and Y-axis move to be relative to the active spectrum.

Use the LEFT and RIGHT ARROW keys to move the cursor on the active spectrum.

TIP Press the P key to quickly move the cursor to the next significant peak.

Z-axis Zoom

The Z-axis zoom allows you to zoom in around the current trace. The display area updates to indicate the number and position of the spectra displayed on the screen. The zoom capability is only available when the No. Spectra parameter is set to a number less than the number of extracted spectra.

See No. Spectra on page 274.

To use the Z-axis zoom feature, press the 0 (Shift) key and the +/- key simultaneously.

Repeat this key sequence to continue zooming in. After the highest zoom level is reached, the above procedure will cause you to zoom out.

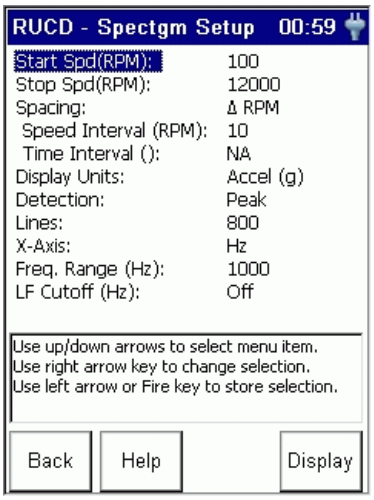
TIP There are more zoom levels available when there are fewer spectra displayed in the plot.

Displaying Measurements Using a Spectrogram

The Spectrogram plot is a three-dimensional color intensity plot displaying the amplitude of spectral components as a function of both time and frequency. Typically the horizontal and vertical axes correspond to time and frequency. The intensity corresponds to amplitude.

Setting Up the Spectrogram Plot

1. Select **Spectrogram** on the RUCD - Display Select screen and press F4 (Display). The RUCD - Spectrogram Setup screen appears.



2. Highlight the option and press the RIGHT ARROW key to open a menu of choices.
3. Select the choice by pressing the arrow keys or type in a value using the numeric keypad.
4. Press the LEFT ARROW key to save your selection.

   Use the descriptions in Table 51 to help you configure the parameters.
5. When you are finished, press F4 (Display) to display the Spectrogram plot.

Refer to Displaying the Spectrogram Plot on page 278.

Table 51 - Spectrogram Plot Parameters

Parameter Name	Description	Values/Comments
Start Spd (RPM)	Sets the start speed of the recorded data for the plot.	10…3600 RPM This defaults to the Start Spd value set in the RUCD Setup screen. See Table 44 on page 258.
Stop Spd (RPM)	Sets the stop speed of the recorded data for the plot.	10…3600 RPM This defaults to the Stop Spd value set in the RUCD Setup screen. See Table 44 on page 258.
Spacing	Controls the spacing between collected spectra. • Delta RPM- A fixed speed change between spectra. • % Delta RPM- A percentage speed change between spectra. • Delta Time- A fixed time interval between spectra. • Delta RPM+Delta Time- A combination of speed and time interval settings. If speed stops changing then spectra are calculated using the Time Interval value. • % Delta RPM+Delta Time- a combination of speed and time interval settings. If speed stops changing then spectra are calculated using the Time Interval value.	Options: Delta RPM % Delta RPM Delta Time Delta RPM+Delta Time % Delta RPM+Delta Time Your selection affects the Speed Interval and Time Interval settings.
Speed Interval (RPM)	Sets the speed interval used in calculating FFT spectra.	1…240 RPM This parameter not used when Spacing is set to `Delta Time.'
Time Interval (sec)	Sets the time interval used in calculating FFT spectra.	.001…604800 seconds This parameter is not used when Spacing is set to `Delta RPM' and `% Delta RPM.'
Display Units	Sets the Y-axis units.	The available units depends on the transducer used to collect data. See Table 44 on page 258.
Detection	Sets the signal detection and scaling display for the plot. • Peak - Measured RMS value multiplied by the square root of two (1.4142). • Pk-Pk - Measured RMS value multiplied by two times the square root of two (2.8284). • RMS - Root mean squared signal level of the input signal.	Options: RMS Peak PkPk
Lines	The number of lines (bins) of resolution for the FFT spectra. The larger the number of lines, the better the frequency resolution of the measured data in the spectra. Similarly, the higher the number of lines, the longer it takes to display the spectra in the plot.	Options: 100 200 400 800 1600 3200 6400 12800
X-axis	Sets the X-axis frequency units for displaying spectra/FFT data. • Hz - Displays spectra in Hertz, cycles per second. • CPM - Displays spectra in cycles per minute. • Orders - Displays spectra in orders of the operating speed.	Options: Hz CPM Orders Your selection affects the Freq Range and LF Cutoff parameters.

Table 51 - Spectrogram Plot Parameters

Parameter Name	Description	Values/Comments
Freq. Range (EU)	The maximum frequency for the measurement.	10…2000 Hz 600…120000 CPM .001…166 Orders The frequency range is determined by the X-axis parameter.
LF Cutoff (EU)	Sets a low frequency cutoff filter to remove noise from the analysis.	Options: Off 21.6 CPM 66 CPM 120 CPM 600 CPM 4200 CPM .36 Hz 1.1 Hz 2 Hz 10 Hz 70 Hz The available options are determined by your X-axis selection.

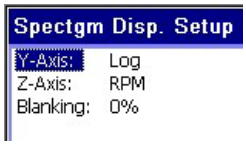
Displaying the Spectrogram Plot

When you are done setting up the plot parameters, you can process the spectral data by pressing F4 (Display) on the RUCD - Spectrogram Setup screen.

TIP The larger the .wav file, the longer it takes to process the data and display the plot.

Optimizing the Spectrogram Plot

Additional parameters display on the screen allowing you to control how the spectra appear in the spectrogram plot.



1. Highlight the option and press the RIGHT ARROW key to open a menu of choices.
2. Select the choice by pressing the arrow keys or type in a value using the numeric keypad.
3. Press the LEFT ARROW key to save your selection.

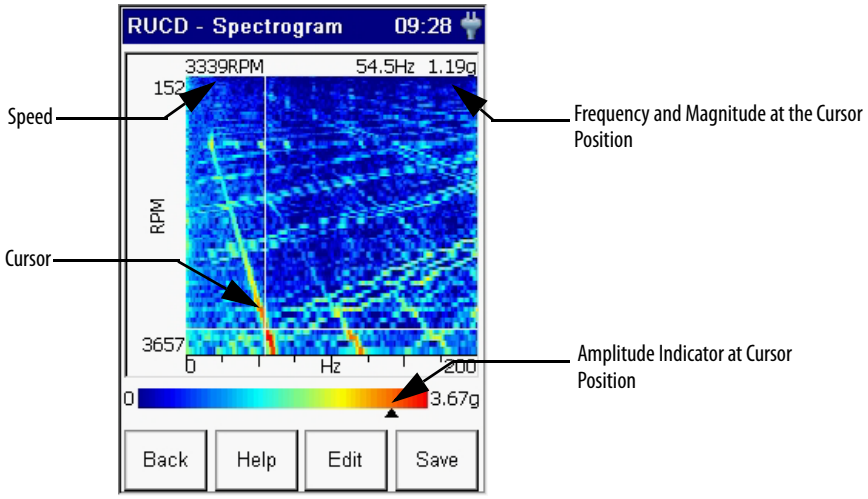
   Use the descriptions in Table 52 to help you configure the parameters in the Run Up/Coast Down Spectrogram Display Setup screen.
4. When you are finished and ready to display data, press F4 (Display) to view the Spectrogram.

Table 52 - Spectrogram Plot Setup Parameters

Parameter Name	Description	Values/Comments
Y-axis	Sets the Y-axis scaling on the spectrogram plot. • Linear - The plot grid centers are linearly spaced in Y between the centers of the first and last grid. • Log - The plot grid centers are logarithmically spaced in Y between the centers of the first and last grid.	Options: Linear Log
Z-axis	Controls the spacing between the collected spectra. • RPM- FFTs spaced depending on the RPM at which they were recorded. • Timestamp- FFTs spaced depending on the time the data was recorded. • Even Spacing- FFTs spaced evenly along the Z-axis.	Options: RPM Timestamp Even Spacing
Blanking	Eliminates the display of data below a certain level on the Y-axis. This setting helps clarify the presence of machine orders or structural frequencies.	0%…25%

Viewing the Spectrogram Plot

After setting up the Spectrogram spectra, press F4 (Display) on the Spectrogram Display Setup screen.



The Spectrogram plot uses color to indicate the amplitude of the signals. Red means a higher amplitude and blue means a lower amplitude.

Use the UP and DOWN ARROW keys to sequence through the displayed spectra. Use the LEFT and RIGHT ARROW keys to move the cursor on the active spectrum.

TIP Press the P key to quickly move the cursor to the next significant peak.

Saving Run Up/Coast Down Measurements

The Run Up/Coast Down setup parameters and measurements can be saved to a file which can then be recalled at a later time. The collected data is saved in the form of a time waveform (.wav file).

You can save the RUCD setup and measurement anytime the Save function is displayed on the screen.

1. Press F3 (Save) if you are saving the data from the Setup screen. Press F4 (Save) if you are saving the recorded data from a plot screen.

   The RUCD - Save Data screen appears.

2. Do one of the following:
   - To save the data to an existing file, highlight the file, and press F4 (Save). Press F2 (Yes) to overwrite the existing file. Note that you can return to the Save screen without overwriting the file by pressing F3 (No).
   - To save the data to a new file, highlight 'save reading as' and press F4 (Save). Enter a file name using the keypad or accept the default file name (current date timestamp). When the entry is complete, press F4 (OK).

IMPORTANT The setup parameters are saved along with the measurement when you press F4 (Save) on the RUCD - Save Data screen.

3. When you are finished, press F1 (Cancel).

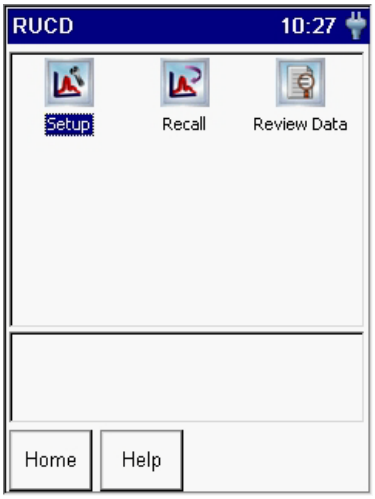
Recalling a Setup

You can recall a previously saved setup and use it to collect another measurement. The setup may have been saved only as a setup, or may have been saved with the recorded data.

Refer to Saving Run Up/Coast Down Measurements on page 279.

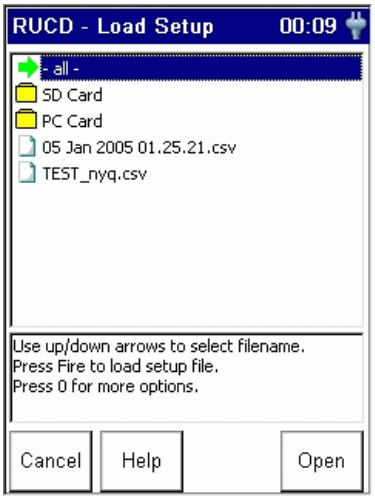
1. Select RUCD on the Main Menu and press the READ/OK key.

   The RUCD screen appears.



2. Select Recall and press the READ/OK key.

   The RUCD - Load Setup screen appears.



3. Highlight the filename that you want recall and press F4 (Open).

   The RUCD - Setup screen appears.

4. You can edit the settings or start collecting data.

   For information on editing the settings, see Setting Up Run Up/Coast Down Measurements on page 257.

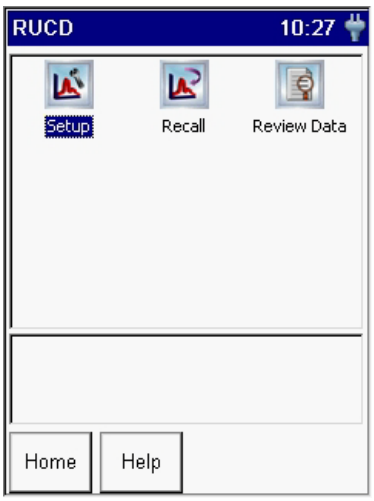
   For information on collecting RUCD measurements, see Collecting Run Up/Coast Down Measurements on page 259.

Reviewing Run Up/Coast Down Measurements

You can review previously saved Run Up/Coast Down measurements with the Enpac 2500. The Enpac saves the recorded data in the form of a time waveform (.wav file).

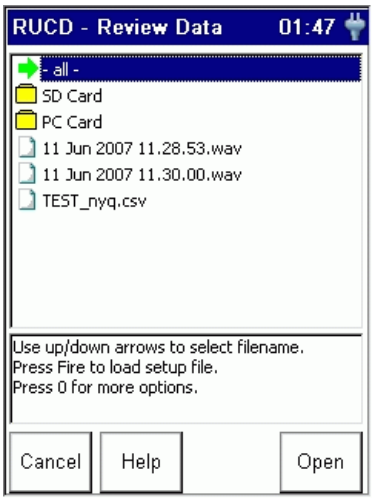
1. Select RUCD on the Main Menu and press the READ/OK key.

   The RUCD screen appears.



2. Select Review Data and press the READ/OK key.

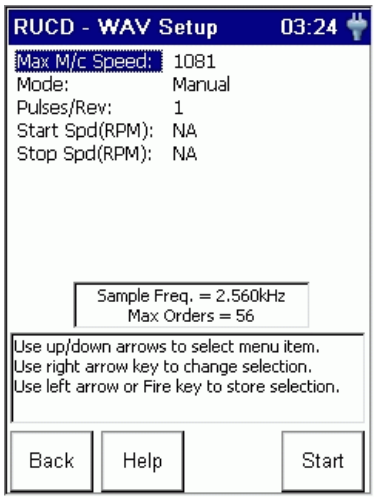
   The RUCD - Review Data screen appears.



3. Highlight the filename that you want review and press F4 (Open).

   If you select a .wav file, the RUCD - WAV Setup screen appears (see below). Otherwise the appropriate plot setup screen appears. Refer to the appropriate section in the chapter for details.

The RUCD - WAV Setup screen allows you to set up the .wav file parameters.



TIP The Enpac reads the .WAV file to determine the maximum speed present. If the number of pulses per revolution is not equal to 1, enter the correct value before processing.

4. Highlight the option and press the RIGHT ARROW key to open a menu of choices.
5. Select the choice by pressing the arrow keys or type in a value using the numeric keypad.
6. Press the LEFT ARROW key to save your selection.

   Use the descriptions in Table 53 to help you configure the parameters.
7. When you are finished, press F4 (Start).

   The Display Select screen appears allowing you to select the appropriate plot to view the recorded time waveform.

Table 53 - WAV Setup Parameters

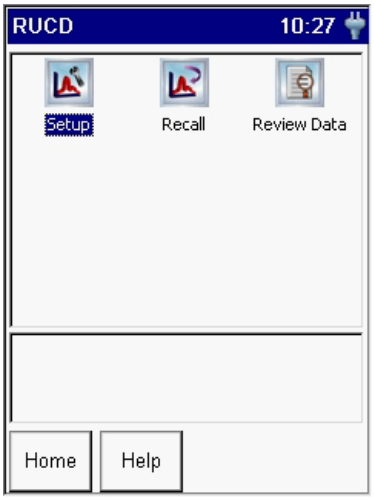
Parameter Name	Description	Values/Comments
Max M/c Speed	The maximum machine speed in the .WAV file.This parameter is set to the highest detected m/c speed.	
Mode	The method used in the .WAV file to initiate data collection. When in doubt, select manual. • Runup - The data collection starts when the machine speed rises above Start Spd. • Coast down -The data collection starts when the machine speed falls below Stop Spd. • Manual - Manually start data collection by pressing F4 (Start). No tachometer signal is required for this mode.	Options: Runup Coast down Manual
Pulses/Rev	The number of tachometer signal pulses per revolution of the reference shaft.	This value may affect the Max M/c Speed value.
Start Spd (RPM)	The speed used in the .wav file to start collecting data.	These parameters are not available if Mode is set to Manual.
Stop Spd (RPM)	The speed used in the .wav file to stop collecting data.	

Deleting Run Up/Coast Down Files

You can also delete a Run Up/Coast Down measurement or setup from the Enpac 2500.

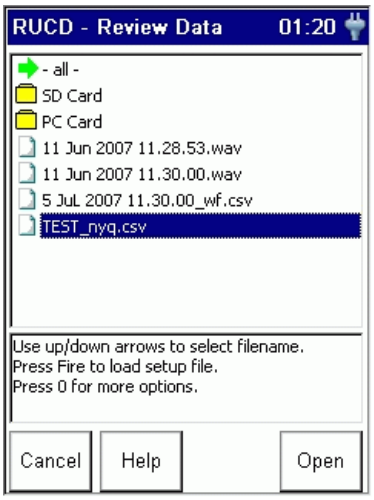
1. Select RUCD on the Main Menu and press the READ/OK key.

   The RUCD screen appears.



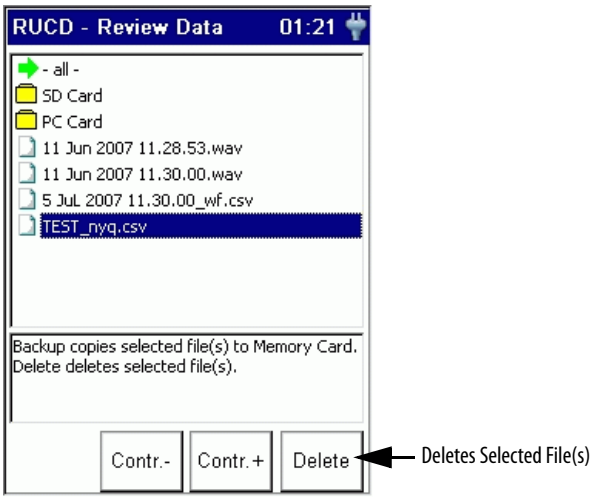
2. Select Review Data to delete a measurement or Recall Data to delete a setup and press the READ/OK key.

   The appropriate RUCD screen appears. Below is an example of the RUCD - Review Data screen.



3. Highlight the appropriate filename or highlight 'all' to delete all the files.

4. Press the 0 (Shift) key and F4 (Delete) simultaneously to delete the selected file(s) from the Enpac 2500.



A dialog appears to confirm the deletion.

5. Press F2 (Yes) to delete.

Notes:

FRF Frequency Response Function Extension Module

The Frequency Response Function (FRF) extension module is an optional module for the Enpac 2500 data collector. You install the extension module with the FRF Frequency Response PCMCIA memory card.

See Installing Optional Extension Modules on page 189 for installation instructions.

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Field Calibration	297
Saving, Reviewing, and Deleting FRF Measurements	299

The Enpac 2500 data collector FRF extension module lets you determine the natural frequencies of a machine or structure in a more sophisticated manner than the Bump Test module. Rather than simply detecting the frequencies where resonances occur, it captures information about the frequency response of the structure being tested.

- You can use the FRF data in conjunction with a modal analysis software package to model the way the structure reacts to forces applied to it.
- You can use the FRF module to capture information about how a machine moves when it is running. You can use this information with the Operation Deflection Shape (ODS) analysis software.

IMPORTANT The FRF extension module is for Offroute/unscheduled measurements only. The Emonitor software does not import this type of data.

The FRF module includes the following features:

- Simple selection of measurement type from a list of predefined options, for example, mobility, stiffness, and apparent mass.
- FRF trace colored green or red to illustrate high or low coherence.
- Optional automatic parameter setting for input ranges, number of lines, and windowing.
- Compatibility with ODS analysis software.

Newtons Law and Apparent Mass

Newtons Law states that force equals mass x acceleration:

$F = ma$

Rearranging this gives:

$m = F/a$

The units for this are N/m/s2. The definition of a Newton:

$N = kg \times m/s2$

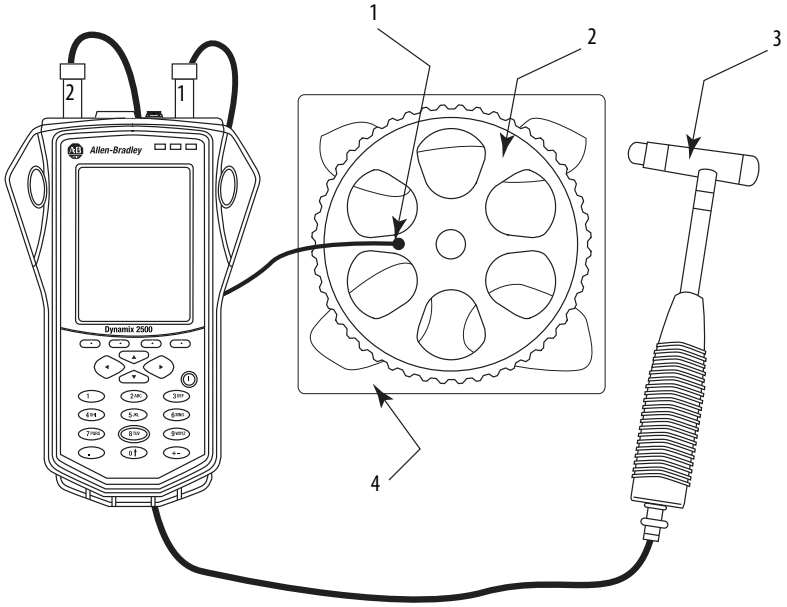
So we can see that:

$N/m/s2 = kg$

Setting Up an FRF Measurement

When setting up an FRF measurement, first set up the test hardware before you configure the parameters for the FRF Module.

Figure 36 - Example FRF Measurement Setup



1 Accelerometer connected to CH2
2 Hardware being tested
3 Modally tuned hammer fitted with correct tip connected to CH1
4 Foam support to allow free movement

Test Hardware Setup

When setting an FRF test, you need this equipment:

- Accelerometer.
- Hammer.
- Object whose FRF measurement you are collecting.
- Support for the object that provides free movement when the object is struck with the hammer, for example, as a foam support.

Follow these instructions to set up the FRF test apparatus.

1. Fit the correct tip to a modally tuned hammer.

   The hammer is used to create the force that is to be measured in the FRF.

   TIP Use a harder tip for higher frequency and a softer tip for lower frequency measurements.

2. Connect the modally tuned hammer to CH1 of the instrument.
3. Support the object being tested, allowing free movement, for example, on a foam support.
4. Select an accelerometer of the correct mass and connect it to CH2 of the instrument.

   TIP The accelerometer is used to measure the response to the hammer input of the FRF. The accelerometer mass should be low in relation to the test piece, that is, less than 10%.

5. Connect the accelerometer to one of the sides of the object you are measuring.

Avoid Bad Data

An FRF measurement involves placing an accelerometer onto the measurement position and pressing Enter the Enpac 2500 data collector. Be aware of these items before placing the accelerometer:

- The magnet should be firmly screwed onto the accelerometer. Any looseness between the magnet and accelerometer will corrupt the measurement.
- Gently slide the accelerometer onto the measurement position. Using too much force while placing the transducer onto the machine may cause data overload.
- The magnet should be in firm contact with machines surface. Any movement of the magnet will be falsely recorded as vibration data. Try sliding or rotating the magnet until a firm seating is achieved.
- Avoid knocking or disturbing the accelerometer while taking the measurement.

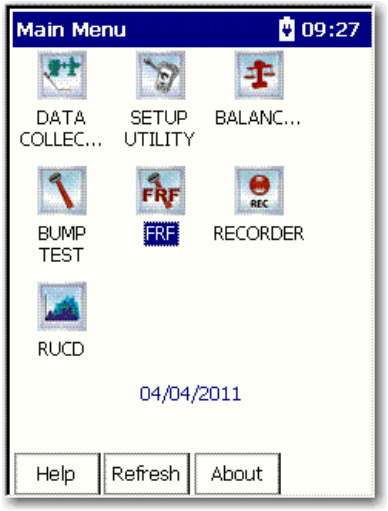
FRF Module Setup

There are three parameters that have already been configured to make the setup easier. These are the measurement parameters that are already configured for you:

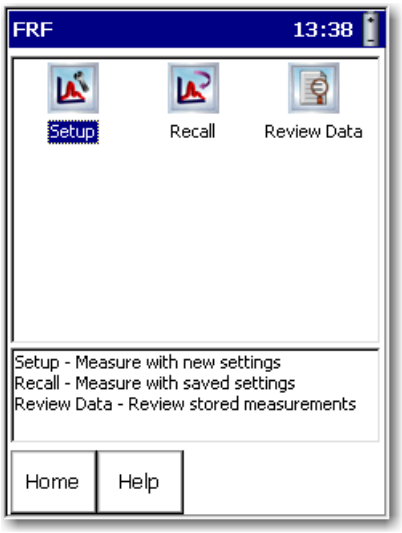
- Pre-trigger delay – set to 10% of block length
- Trigger level – set to 10% of input range
- Good Coherence- 80% threshold

All other settings can be configured on the Setup screen in the FRF extension module.

1. From the Main Menu, select the FRF icon and press Enter.

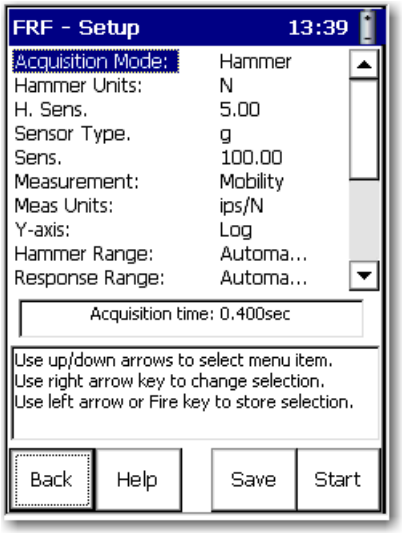


The FRF menu appears.



2. Select Setup and press Enter.

The FRF - Setup screen appears.



FRF Analysis Set-up Parameters

This table describes the FRF set-up parameters.

Table 54 - FRF Analysis Set-up Parameters

Parameter	Description	Value/Comments
Acquisition Mode	Set to Hammer for FRF acquisition and modal analysis, or set to Continuous for ODS analysis. If you are performing ODS analysis, refer to the instructions that accompanied your ODS software for additional information on settings that are required.	Hammer (default) ODS analysis
Hammer Units	This setting does not restrict the Meas Units options, for example, if Hammer Units is lbf, mobility can still be measured in mm/s/N.	N (metric default) lbf (EU)
H.Sens	Enter the sensitivity of the hammer.	5.00 (default) mV/N Vlbf
Sensor Type	Specifies the type of sensor used on Connector B, for example, an accelerometer, velocity transducer, or displacement probe. ODS analysis requires a sensor on both Connector A and B. The sensor type and sensitivity must match on both channels.	Accel G (default) m/s^2 in/s mm/s mils um
Sens.	Enter transducer sensitivity in mV per sensor unit.	100.00 (default) mV/g
Measurement	Sets FRF display type.	Mobility (default) Apparent Mass Accelerance Impedance Stiffness Compliance
Meas Units	Measurement units change to correspond with the measurement display type that has been chosen, but can be set to Imperial or metric units.	ips/N (default) mm/s/N ips/lbf mm/s/lbf
Y-axis	Sets Y axis to linear, logarithmic, or decibel scale.	Linear Log (default) dB
Hammer Range	Sets the hammer input range manually to selected fixed range, or to be set automatically.	Automatic (default) 0.100…220000N
Response Range	Sets response sensor input range manually to selected fixed range, or to be set automatically. If Hammer Range or Response Range is set to Automatic, you are prompted to make three trial hits to establish the range to use.	Automatic (default) 0.100…2000g
Freq Range	Sets the frequency range for the test. The Acquisition time information box changes accordingly.	1000 (default)

Table 54 - FRF Analysis Set-up Parameters

Parameter	Description	Value/Comments
Num of Lines	Sets the number of lines of resolution for the FFT. The Acquisition time information box changes accordingly. When set to Automatic, the FRF module automatically chooses the number of lines after three trial hits. This uses a Uniform window if possible and automatically increases the lines of resolution to accommodate the decay time. If this cannot be achieved, then Force/Exponential is automatically selected. This function is optimized to work for frequency ranges between 200 Hz and 4 kHz. If you select Automatic at a frequency range outside this band, the algorithm attempts to auto select, but may not achieve good results.	400 (default)
Windowing	Sets the FFT window type to Uniform or Force/Exponential.	Force-Exp (default) Uniform
Num of Averages	Sets the number of FFT averages.	5 (default)
Accept/Reject	When performing a hammer test, the setting Accept/Reject to Manual displays a dual time trace and presents the choice to accept or reject control. Setting it to Automatic, automatically rejects overloaded data and double impacts.	Manual (default) Automatic
Invert Phase	Applies a 180° phase offset to the measured data. It is used when the accelerometer or hammer needs to be inverted at a measurement position.	Off (default) On
Save To	You can save to the Internal memory or to the storage card.	Internal (default) Card
Good Coherence	Enter the threshold at which the FRF plot changes from red (bad coherence) to green (good coherence).	80% (default)

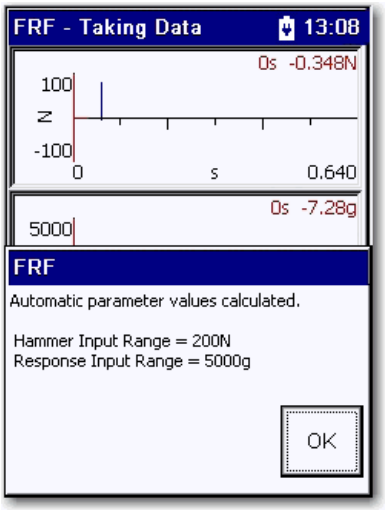
Collect FRF Data

Once the measurement is set up and the transducers are attached correctly, the next step is to start collecting data for the FRF.

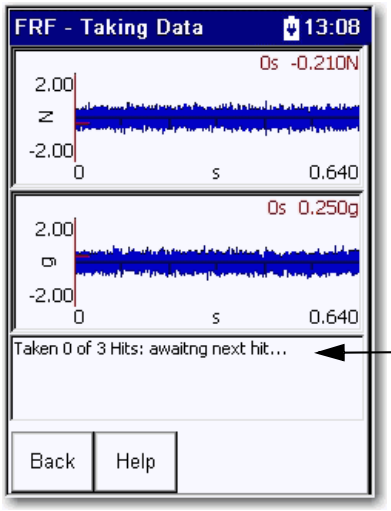
Follow these instructions to collect FRF Data.

1. From the Setup screen, press Start.

   If you have Hammer Range, Response Range, or Num of Lines set to automatic, a message appears advising you that you will be asked to perform three trial hits. The results of these hits are used to automatically determine the best settings for the associated options.



2. Press OK to start taking data.



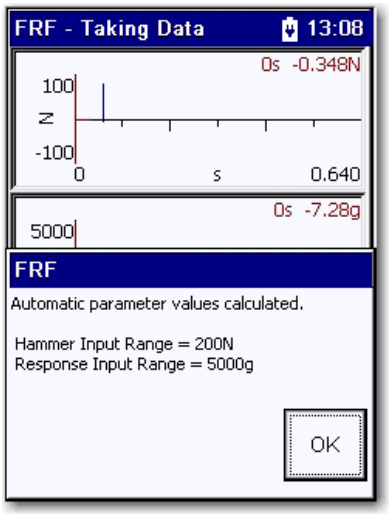
Automatic Parameter Set-up Hit Count and Number-of-hits count.

If you have been prompted to perform automatic parameter setup, hit the object being tested with the hammer at the opposite side from where the accelerometer is attached.

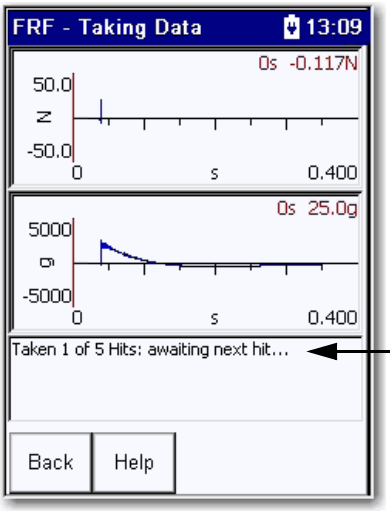
When hitting the object, try to make sure that you have one clean tap and that the hammer hits directly opposite of where the accelerometer is located on the object. If this is done correctly, the instrument registers the hit and increases the number-of-hits count displayed at the bottom of the screen.

3. Perform all three hammer strikes.

   Once complete, a message box appears showing the calculated values for the applicable settings.



After the automatic parameter setup is complete, you are ready to begin capturing the FRF data.



How many hits you need to take, based on the Num of Averages setting in FRF – Setup.

The data is collected in the same way as when setting up the automatic parameters, by hitting the hammer against the object on the side opposite to the accelerometer.

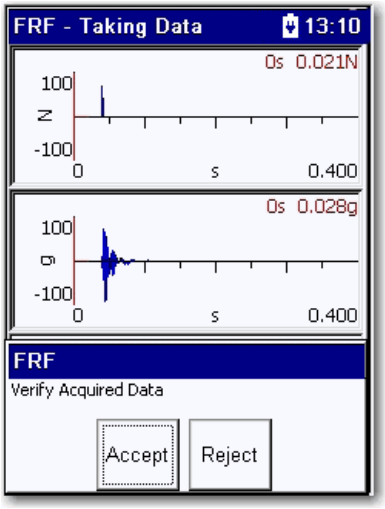
The status indicators provide feedback on the hammer hits.

Table 55 - Status Indicators

Status Indicator	Description
Red	An error, for example, input overrange, during data acquisition.
Amber	Instrument is initializing the measurement.
Green	Instrument is collecting data. In Hammer mode, it is looking for a hit.

See Status Indicators on page 25 for more information about the status indicators:

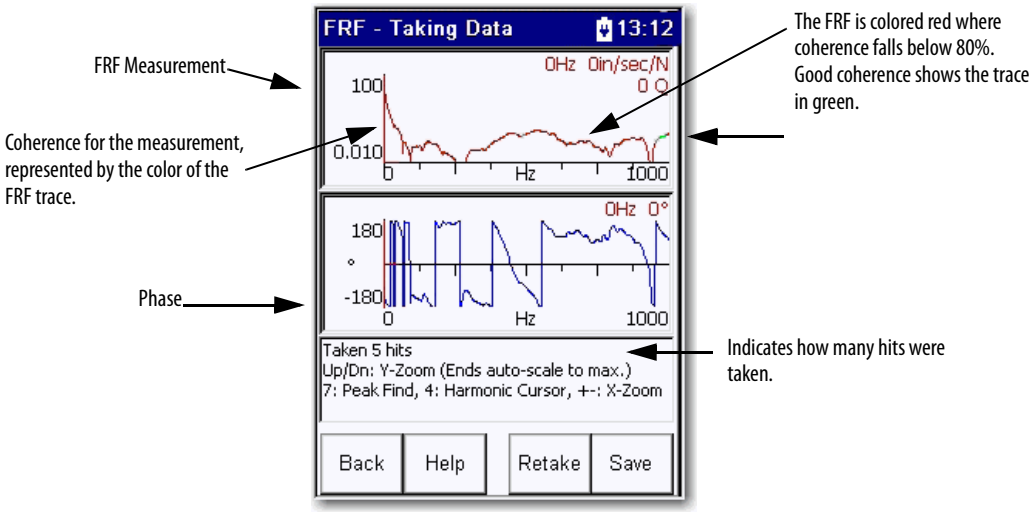
- If the Accept/Reject option in FRF - Setup was set to Automatic, each hammer hit is collected and the Enpac 2500 data collector automatically determines if the data is correct. If it is not, a message appears with details on why the hit was rejected.
- If Accept/Reject was set to Manual, the hammer and response time waveforms display for both the hammer and accelerometer outputs, and then an Accept/Reject prompt appears.



4. Review the FRF data and either Accept or Reject the hit.

   When all the averages are taken, the Taking Data screen updates to show the FRF magnitude/phase traces.

The FRF - Taking Data screen shows frequency, magnitude, phase, and Q factor (where appropriate) at the cursor position.

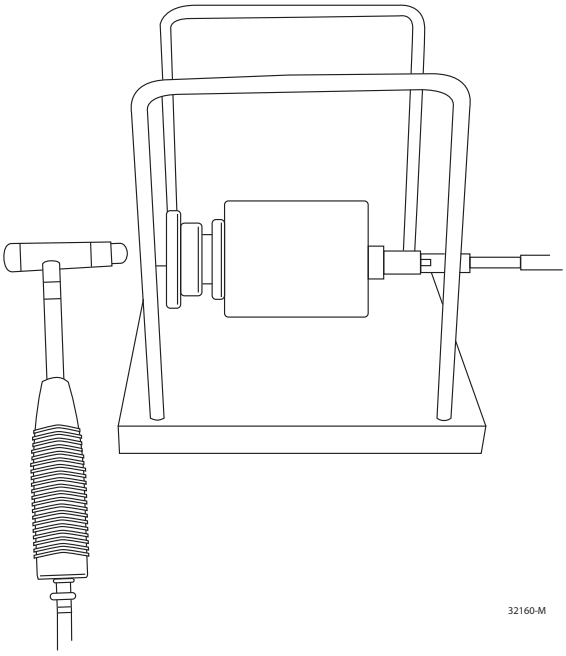


Field Calibration

Data can be checked for calibration and integrity by carrying out a test on a known mass, for example, a calibration weight or steel bar of a measured value.

Use a calibration weight of 1kg or any other known mass.

Figure 37 - Field Calibration Setup



This is an example of a set-up for Field Calibration.

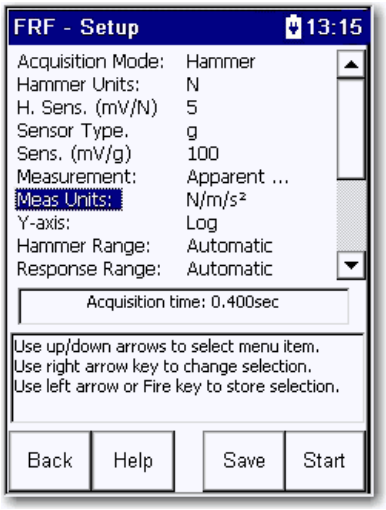
1. Fit the correct tip to the modally tuned hammer.
2. Connect the hammer to CH1.

3. Select an accelerometer of correct mass and connect to CH2.
4. Place the accelerometer on mass.

   The mass can be hand-held. The use of foam or a supporting structure is not necessary.
5. Set the Measurement parameter to Apparent Mass.
6. Set the Meas Units parameter to N/m/s2.

   The instrument displays 1 kg (or other chosen mass), plus the weight of the accelerometer:

   M = calibrated mass + accelerometer mass
   For example: 1 kg + 10.5 g = 1.0105 kg



Saving, Reviewing, and Deleting FRF Measurements

You can save measurement setups and measurement results. You can use these for reviewing and recalling stored measurements.

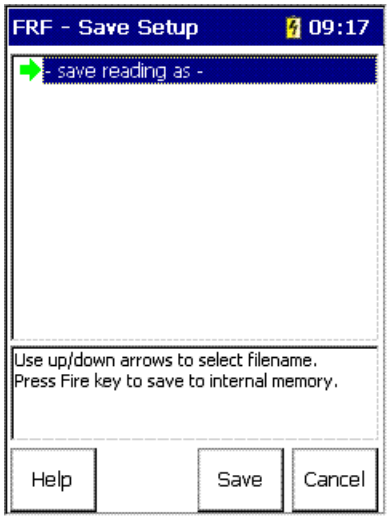
Save an FRF Test Setup and Measurement

You can save the FRF Test set-up parameters and measurements to a file that you can recall at a later time.

Follow these steps to save a file.

1. Press F3 (Save).

   The Save screen appears. Depending on where you are in the measurement process, a Save Setup or Save Reading appears.



2. Save the measurement.
   - Select the file and press F3 (Save) to save the data to an existing file.
   - Press F2 (Yes) to overwrite the existing file.
   - Press F3 (No) to return to the Save screen without overwriting the file.

Follow these instructions to save the data to a new file.

1. Select ‘save reading as and press F3 (Save).
2. Enter a file name by using the keypad or accept the default file name (current date timestamp).
3. When the entry is complete, press F2 (OK).

IMPORTANT	The set-up parameters are saved along with the measurement when you press F4 (Save) on the Bump Test - Save Data screen.

Importing to ODS Analysis Software.

Operating Deflection Shapes (ODS) analysis is used for determination of the vibration pattern of a structure under certain operating conditions. Vibration measurements can be performed at different locations and in different directions on a structure and the vibration pattern can be shown as an animated geometry model of the structure or listed in a shape table.

An ODS is a combination of the forcing function acting on the structure and the dynamic properties of the structure. The forcing function depends on the operating conditions, which for machinery could be influenced by, for example, engine speed, load, pressure, temperature and flow. Ambient forces from waves, wind and traffic may also apply for civil engineering structures.

You can import measurements taken by the FRF extension module into ODS analysis software such as Vibrant Technology, Inc.s MEScope.

Follow these instructions to import FRF data into analysis software.

1. Collect data using the FRF extension module.
2. Create a an FRF Data folder on your computer.
3. Connect the instrument to your computer using the supplied USB cable.

   For information about the USB cable, see POWER / TRIG / USB on page 24 and Using the USB Port on page 103.

   For more information about ActiveSync, see Installing ActiveSync on page 103.
4. Start an ActiveSync session.
5. In the ActiveSync window, select Tools > Explore.
6. Browse to the \Internal Disk\FRF folder on the instrument.

   This is where the Frequency Response Function module data is stored.
7. Select the appropriate data file (*.csv) readings.
8. Copy the data files into the FRF data folder you created on your computer.
9. Select all the (*.csv) files and import them into the ODS analysis software.

TIP The import function in the ODS analysis software may refer to Data Block or DI-440 FRFs (*.csv) file formats.

Specifications

Appendix A lists the technical specifications for the Enpac 2500.

Enpac 2500 Technical Specifications

Product Feature	Specification
Enclosure	
Size	186 x 93 mm (narrowest point) 186 x 134 mm (widest point)
Weight	715 g (1.52 lbs)
Case	Material: 80% ABS & 20% polycarbonate plastic Hand strap fixing either side of unit.
Display	LCD, Backlit Color 1/4 VGA (240 x 320) 58 x 77 mm viewable
Connector	
PC Comms	RS-232 - 9-way D Type (Plug) USB Client IrDA (not currently supported)
Signal Input	Channel 1 6-pin Fischer 3xICP/AC/DC Channel 2 6-pin Fischer ICP/AC/DC
Other I/O	7-pin Fischer Trigger in, Trigger tachometer supply out, Power in/battery charge, USB
System	
Operating System	Microsoft Windows® CE
Processors	Main XScale PXA255 @ 400 MHz, DSP Motorola DSP56L307
Memory	64 MB (total)
Memory available for user date	>40 MB Flash (Max 50 MB)
PC Card Support	Type I or II PCMCIA card, MCC/SD card
Status Indicators	Red, Green, Amber

Enpac 2500 Technical Specifications

Product Feature	Specification
Battery	
Type	Rechargeable Lithium Ion Pack
Capacity	2600 mAHr
Power	>8 hours (typically)
Gauge	Battery capacity indicator
Rechargeable	In unit or via an external DC supply
Environmental	
Sealing	IP65 (Dust and Water Proof)
Drop Test	2 Meter (to Mil-Std 810)
Operating Temperature Range	-10...50 °C (14...122 °F)
Storage Temperature Range	-20...60 °C (-4...140 °F)
Humidity	0 to 95% Relative Humidity
Certification (when product or packaging is marked)	CE CSA Class I, Division 2, Groups A, B, C, D C-Tick UL WEEE Directive

Enpac 2500 Technical Specifications

Product Feature	Specification
Signal Measurement	
Input Signal Types	Accelerometers Velocity Transducers Displacement Probes Photo-optical Pickups Tri-axial Transducers Accel/Velocity Transducers AC/DC Volts Manual Entry
Number of Channels	2 simultaneously Ch1 Tri-axial ICP/AC/DC Ch2 Single ICP/AC/Dc
Signal Inputs	ICP™ (20V norminal @ 2.4 mA) AC Signal DC Signal Tachometer (Trigger input-photo optical/etc.)
Measurement Parameters	Acceleration Velocity Displacement gSE ESP Temperature Phase Voltage User specified
Measurement Types	Overall Spectrum Time Waveform Phase Order Normalized Spectral Band Alarm
Machine Identification	Plant Train Machine and point ID Point description Units Alarm Levels Previous Measurements, Alarm Types

Enpac 2500 Technical Specifications

Product Feature	Specification
Signal Measurement cont.	
Input Signal Range	Non ICP: ±12 V or 0 to 24 V ICP: 0 to +20 V
Transducer Check	Bias Voltage Integrity
Signal	RMS Peak Peak to Peak True Peak True Peak to Peak
Auto Range	Yes
Dynamic Range	90 dB typical
Accuracy	5%
Frequency Range	Upper (Fmax) all inputs = 40 kHz Lower (Fmin) DC input = DC AC/ICP input = 0.16 Hz H/W integrated input = 0.22 Hz
Filters - High Pass	H/W filters are 2nd order 3 dB points 0.22, 0.44, 2, 5.3, 10, 23.1, 70 Hz 2, 10, 70 filter supported in route mode
Bearing Condition	gSE ESP
gSE Filters	100, 200, 500, 1000, 2000, 5000 Hz
ESP Filters	0.6-1.25; 1.25-2.5; 2.5-5; 5-10; 10-20 kHz
Real Time Rate	40 kHz (single channel)
FFT Resolution	100…12,800 lines
Time Block Length	256…16,384 samples
Averaging	Time Spectral Exponential Peak Hold
Alarms	Overall Spectrum
Note Codes	100 note codes (select up to 6) Codes downloaded from Emonitor
Window Types	Rectangular Hanning Hamming Flat Top

Frequently Asked Questions and Answers

This appendix contains the most frequently asked questions about using the Enpac 2500 with Emonitor.

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Loading Lists to the Enpac 2500	306
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Setting Up Measurement Definitions in Emonitor

How do I set up measurement definitions?

Emonitor and the Enpac 2500 can collect and store a wide range of types of measurements. To take advantage of these capabilities, you must understand how to set up the different types of measurement definitions.

For examples of setting up specific types of measurement definitions, see Setting Up Measurement Definitions on page 78.

Why do unsupported selections appear in Emonitor?

Each data collector supports only certain selections in the drop down lists in the Measurement Definition pane. Emonitor automatically displays the correct selections when you select one or more active collectors. You select the active collector or collectors by choosing Tools > Set Active Collectors in Emonitor. If you do not select the Enpac 2500 as the active collector, it can affect the selections in one of two ways:

- If you do not select any collectors, Emonitor displays all possible selections, not just those for the Enpac 2500.
- If you select two or more different collectors, Emonitor displays only the selections that are available for both collectors.

As an example, there are certain filters available in the Enpac 2500. Then there are three possible cases:

- You select the Enpac 2500 as the only active collector. Emonitor displays the correct filters in the measurement filter column of the Measurement Definition pane.
- You do not select any active collectors. Emonitor displays many more filters than are available for the Enpac.
- You select two or more active collectors. Emonitor may display only some, or none, of the filters that are available for the Enpac 2500.

For more information on setting the active collectors, see the Emonitor online help.

Why can't I edit the measurement definitions units?

Emonitor does not allow you to change some of the information for a measurement definition after you collect data for that measurement definition. This prevents you from collecting and then comparing data with different measurement definition selections. You cannot edit the Data Type or Units columns in the Measurement Definition pane after you collect data for the measurement definition. You can, however, change the Collection, Filter, and the Storage columns for a measurement definition after collecting data.

IMPORTANT	Changing the collection specification can make it difficult to compare data after the change with data before the change.

Loading Lists to the Enpac 2500

I think I lost some data. What happened?

See Loading and Unloading on page 97.

There are several common ways you can delete data.

- You set up the Load Options to initialize the memory before loading a list. If you have any lists in the Enpac 2500 with data that has not been unloaded, you will lose all lists and data before loading the specified list.
- Click the D.C. Functions button then click Initialize data collector. If you have any lists in the Enpac 2500 with data that has not been unloaded, you will lose all lists and data.
- Click the D.C. Functions button then click Clear data from list. If the selected list(s) have data that has not been unloaded, you will lose the data for those lists.
- Click the D.C. Functions button then click Delete list. If the selected list(s) have data that has not been unloaded, you will lose both the selected lists and associated data.

Why won't Emonitor load a list to the Enpac 2500?

First, check the communication between Emonitor and the Enpac 2500. Note that the baud rate setting in the data collector must match the baud rate setting in Emonitor.

If the communication link between them is correct, it may be that the list is already loaded in the Enpac 2500. You must either delete the list or initialize the memory before you can reload a list already in the Enpac 2500.

Why does Emonitor rebuild the Quickload files?

Emonitor rebuilds a Quickload file before loading it to the data collector when any one of the following occur.

- The list is not stored with the Use quickload file option selected.
- The measurement definitions in the list change.
- The inspection codes in the list change.
- The locations in the list change.
- The hierarchy level of items in the Hierarchy Tree that affect measurement definitions in the list change.
- The collection specification of a measurement definition in the list changes.
- The Override collect on alarm settings (in the Load Option dialog) are selected.
- The list has been saved since last loaded.

How do I load a list to the PCMCIA card?

Emonitor can load lists to either the Enpac internal memory, or to a memory card. You control the destination for lists with the Route Memory parameter in the Setup Utility screen in the Enpac 2500.

- Set Route Memory to 'Internal' to store lists and data in internal Enpac memory.
- Set Route Memory to 'Card' to store lists and data to the PCMCIA card in the card slot.

TIP The Route Memory parameter is not applicable when unloading data. Emonitor can unload lists from both the Enpac internal memory and the PCMCIA card at the same time.

How do I tell when loading or unloading is done?

Emonitor and the Enpac 2500 establish communication as soon as the following are both true.

- The Enpac 2500 is correctly connected to the computer.
- You choose Tools > Load/Unload in Emonitor.

The communication link remains until you do one of the following to break communication.

- Close the Load/Unload dialog in Emonitor.
- Disconnect the cable between the computer and Enpac 2500.
- Press the READ/OK key on the Enpac 2500.

TIP Emonitor indicates when it completes the loading or unloading process.

Collecting Data with the Enpac 2500

Why does the Enpac 2500 seem to skip measurements at a location?

Emonitor and the Enpac 2500 are designed to make collecting data as quick and efficient as possible. To shorten data collection time, Emonitor combines two or more measurement definitions at a location into a single measurement. This allows you to collect two or more measurements by pressing a single key on the Enpac 2500.

See Collecting and Reviewing Data on page 119.

Why wont the Enpac 2500 combine magnitude and phase or manual entry measurements at a location?

Two exceptions exist for combining measurement definitions. Emonitor and the Enpac 2500 cannot combine magnitude + phase measurements with any other measurements. Nor can they combine manual entry measurements with any other measurements. Both types remain as individual measurements when loaded into the Enpac 2500.

What does the USER (eus) units mean?

Emonitor allows you to create measurement definitions for many different units. Some of these units are not directly supported in the Enpac 2500. When you display a measurement definition in the Enpac 2500 with an unsupported unit, the Enpac 2500 chooses the USER (eus) units. You can still collect and store data using unsupported units.

Why are the alarms in the Enpac 2500 not what I selected?

You select the alarms you want to load with a measurement definition in Emonitor by setting the **Trigger** column to 'Yes' for the alarm. If you select an alarm that the data collector can handle, Emonitor loads that alarm into the data collector when you load the list.

Why aren't inspection codes available for a list?

You must load the inspection codes into the Enpac 2500 before they are available for a list. Emonitor loads inspection codes only when you load a list. To load the inspection codes, you must select **Load inspection codes** in the Load Options dialog in Emonitor. You can have a different set of inspection codes loaded with each list.

For more information on inspection codes, see Select Inspection Codes on page 126.

How can I reduce the ranging time required during collection?

Long ranging times are associated with trying to collect low frequency vibration data. Applying an overall filter helps reduce long ranging times. In particular, overall filters with the highest low frequency cutoff point decrease ranging time the most. Try to set your maximum frequency and lines of resolution such that the formula results in the highest value that would be practical in your application.

Another technique that can reduce ranging time is to only use filters that are built into the data collector.

Unloading Data from the Enpac 2500

How do I unload data from more than one list?

The Enpac 2500 allows you to unload more that one list at a time into the Emonitor database. Simply select the desired lists before clicking the Unload button. For more information, see Selecting the List(s) on page 111.

How do I clear data from lists after unloading?

The Enpac 2500 allows you to clear data from a list in the Enpac 2500 after unloading it to your Emonitor database. This enables you to collect the list again as needed. Simply check the Clear list on unload checkbox in the Unload Options dialog. Another method is to use the Clear data from list function in the Data Collector Functions dialog.

How do I print reports after unloading data?

Emonitor allows you to print reports to a printer immediately after unloading the data to your Emonitor database. This enables you to view the results of the data just unloaded. Check the Print reports checkbox in the Unload Options dialog and highlight the desired reports.

Analyzing Data in Emonitor

Why does the magnitude reading not correspond to the calculated overall value?

Emonitor can calculate an overall value from a spectrum measurement. Under some conditions, this value may not be the same as the magnitude measurement for the same location. The common use for this are:

- The measurement filter is not the same for the magnitude and the spectrum measurement definitions. In this case the two measurement definitions are measuring different frequency ranges.
- The magnitude readings taken by the Enpac 2500 are broadband readings and are not based on the spectrum data.

Notes:

Accessories

Table 56 - Accessories

Cat. No.	Description
1441-PEN25-ACC-AL	Accelerometer Loop with Belt Clip
1441-PEN25-BAT	Enpac 2500 Spare Battery
1441-PEN25-BC	Belt Clip
1441-PEN25-CASE-S	Service Case
1441-PEN25-CASE-T	Enpac 2500 Transit Case
1441-PEN25-CD	Enpac 2500 Operating System & Info CD
1441-PEN25-COMS-RS	Communication Cable RS232
1441-PEN25-COMS-US	USB Power Splitter Cable for USB Communications
1441-PEN25-HS	Hand Strap
1441-PEN25-ISC	Instrument Soft Cover
1441-PEN25-LB	Leather Belt
1441-PEN25-NS	Neck Strap (Leather)
1441-PEN25-PA	Enpac 2500 Power Adapter, use the same as the power
1441-PEN25-RBS	Enpac 2500 Rubber Bump Sleeve
1441-PEN25-SCH	Soft Case Holster
EK-45131	Fischer 102 to BNC Trigger (1M)
EK-45274	ATA Memory Card (16 Mb)
EK-46252	LEMO to BNC, Straight Cable, 4

Upgrade Options

Table 57 - Upgrade Options

Cat. No.	Description
1441-PEN25-MOD-2CH	2-Channel Upgrade Kit (HW Purchase Separately)
1441-PEN25-MOD-BAL	2-Plane Balancing Kit (HW Purchased Separately)
1441-PEN25-KIT-BAL	2-Plane Balancing Kit with Hardware
1441-PEN25-MOD-REC	Time Recorder Kit (HW Purchased Separately)
1441-PEN25-MOD-RUCD	Run Up/Coast Down Kit (HW Purchased Separately)
1441-PEN25-MOD-BMP	Bump Test Kit (HW Purchased Separately)
1441-PEN25-MOD-FRF	different part number than the YURI

Cables and Sensors

Table 58 - Cables and Sensors

Cat. No.	Description
EK-44064	Kit Transducer Accel 9500LF; Including 9500LF Accel, Cable, and Magnet
EK-45131	Fischer 102 to BNC Trigger (1M)
EK-45148	Kit Transducer Accel 9000A; Including 9000A Accel, Cable, and Magnet
EK-46252	LEMO to BNC, Straight Cable, 4
EK-46667	Kit Transducer Accel 9900A; Including 9900A Triaxial Accel, Cable, and Magnet
EK-46668	Kit Transducer Accel 9700A; Including 9700 Accel, Cable, and Magnet (Requires EK-46252 Adapter)

The following terms and abbreviations are used throughout this manual. For definitions of terms not listed here, refer to the Allen-Bradley Industrial Automation Glossary, publication AG-7.1.

active data collector You can define one or more data collectors as active. Emonitor uses the active collectors to determine the valid options when you set up measurement definitions. Suppose you had two active data collectors:

- DC1 can measure velocity in both in/sec and mm/sec
- DC2 can measure velocity only in in/sec

The only choice you would see for velocity units would be in/sec, because that is common to both active collectors. This is true for several options in Emonitor, including the number and length of inspection codes.

active list The list for which you are currently collecting data. You can load multiple lists into the Enpac 2500. You can only collect data for one list at a time.

alarms An alarm alerts you to a change in a measurement. For example, an alarm can notify you when the measured value for a machine exceeds a pre-defined value. You can create one or more alarms for each measurement definition.

archive data The measurement data that you store in Emonitor. It includes all the magnitude, process, time, and spectral data that you have collected and unloaded or entered into the program.

averaging Refers to the process of combining multiple data samples to reduce the random errors and provide a more reliable measurement.

band A frequency range, such as the frequency range between 1,800 and 3,200 Hz. A band set consists of one or more bands. You can use bands to define specific frequency ranges and values used - band maximum amplitude or band sum - for a band alarm.

band alarm An alarm that operates on defined frequency bands in a measurement. Each band can have its own alarm levels. The band definition determines whether the alarm in each band is set on the band maximum amplitude or the band sum.

band filter A filter to use during data collection to help obtain high quality data. You can use a band filter (high pass. low pass, or both) or a percentage filter to remove specific frequency ranges from the measurement.

band maximum amplitude Also known as peak in band and band peak. The maximum amplitude is the highest amplitude at a spectral line in a band.

band set One or more bands, each of which defines a specific frequency range. A band set might contain three bands: from 500 to 1200 Hz, from 2000 to 3800 Hz, and from 3800 to 5000 Hz. You can use a band set to define specific frequency ranges for a band alarm.

band sum Also called band limited overall value. This is the total energy in a spectrum between two frequencies. If the band contains the entire spectrum, the band sum value is the same as the magnitude value for the entire spectrum.

baseline measurement A reference measurement you identify from the archive data for a measurement definition. It indicates the proper operating condition of a piece of equipment. You can use it as a comparison to other measurements, and in alarms.

collection specification The collection specification defines the parameters used when collecting a measurement. This includes the type of transducer, windowing factor, signal detection, frequency range, resolution, number and types of averages, and whether to collect phase and order normalize the measurement.

current data collector Emonitor can communicate with only one data collector at a time. This data collector is called the current data collector. You can select only one current collector for load and unload operations. The current data collector is different from the active data collector.

current list The most recently recalled or created set of measurement definitions held in the computers memory or saved on the computers hard disk. You can load the current list into a data collector for data collection. You can also view plots or create a report from the data associated with the current list.

cursor A line or symbol that traces the data and provides an accurate read out of the X axis (typically time or frequency) and the Y axis (typically vibration amplitude) values.

data collector A data collector is a device that measures and stores vibration and other data. Vibration data may include magnitude, spectrum, time waveform, and phase data. Other data may include process measurements such as pressure, temperature, and operating hours.

database One or more related files that contain information on a common topic. The Emonitor database contains both the hierarchical setup for the machinery as well as the data collected from the machinery.

ESP measurement A magnitude measurement using Envelope Spectrum Processing (ESP). This is a magnitude acceleration measurement with an envelope filter, used to identify faults in rolling element bearings.

enveloping A technique for creating spectrum alarms that lest you allow for variations in the speed of your equipment. Enveloping widens the spectrum alarm around the peaks in the spectrum, either by a constant amount or by a percentage of the frequency. The advantage of using a percentage of the frequency is that the width of the envelope increases with the frequency.

full scale value The maximum expected amplitude (Y-axis) value for the data. If the data exceeds the full scale value, it may not be possible to display or collect the full amplitude range without adjusting the full scale value. In general, the full scale should be the smallest value that is greater than the largest possible amplitude of the data.

harmonic cursors Multiple cursors that are at constant multiples of a fundamental frequency. Typically you position a single cursor at the desired fundamental frequency and then press a key to activate the harmonic cursors. These cursors help identify the related frequency components in a spectrum

Hierarchy Tree A graphic illustration of the database hierarchy in Emonitor. It contains the machines in your predictive maintenance system.

high pass filter A filter that excludes all frequencies below a defined frequency, also called a low frequency corner. It allows, or passes, frequencies above the defined frequency. It is useful for removing high vibration, low frequency signal components that would dominate the signal.

inspection codes Some data collectors allow you to store an inspection code with a measurement. Inspection codes, also called note codes, can e used to indicate the operating condition of a piece of equipment (for example, hot bearings, stopped, etc.). They can also be assigned directly to an item in the Hierarchy Tree or location, or by importing data.

list A set of measurement definitions, also called a route. You can create a list from individual measurement definitions or from other lists. A list can be saved in, and recalled from, the database. The most recently recalled or created list is called the current list. You can load one or more lists into a data collector, and you can plot or report on the data from the items in a list.

list type List types allow you to group lists by their function. For instance, you might group lists like this.

Purpose	List type
Everyday data collection	Scheduled
In-depth assessment	Diagnostic
One-time collection	Temporary

List window A window that contains a display of locations in the current list. A list is a set of measurement definitions. You can open only one List window, and the List window cannot be split into panes.

load file When you load a list into a data collector, Emonitor first creates a load file from the list. The load file contains all the measurement definitions in the list, in a format that can be loaded into the data collector. Emonitor can create load files ahead of time from Quickload lists.

location A location can be a physical point in a plant, in an area, on an equipment train, or on a machine. For vibration measurements, a location is a combination of a physical point and a direction for the measurement. Each location is attached to an item in the Hierarchy Tree.

low pass filter A low pass filter excludes frequencies above a defined frequency. It allows, or passes, frequencies below the define frequency. It is useful as an anti-aliasing filter.

magnitude alarm An alarm that defines the safe operating boundary for magnitude data from a piece of equipment or a process. Magnitude data can be overall vibration, temperature, operating speed, or any other process measurement.

magnitude measurement Single value representing the total energy of a measurement. For example, a vibration magnitude represents the total energy in a vibration spectrum. Trends of magnitude readings are typically used to predict when a machine or process could exceed safe operating conditions.

measurement A measurement is a single reading collected from a location and controlled by a measurement definition. Measurements are usually collected with a data collector, and stored in the database. The measurement may be magnitude data such as an overall displacement value, spectrum data such as a single acceleration spectrum, or some other kind of data.

measurement definition A measurement definition is a set of parameters that controls the collection of a measurement. It defines the type of measurement (for example, magnitude, spectrum, time). It also includes the collection, measurement filter, and storage specifications. Each measurement definition is attached to a location.

measurement filter A filter that is applied when taking a measurement. It is specified as part of a measurement definition, and my be either a band filter or other type of filter such as an envelope or overall filter.

memory card See PCMCIA

note codes See inspection codes

numeric measurement Also called process point. A single value that indicates the general condition of a process or equipment. For example, numeric measurements can be used to record any of the following: temperature, pressure, flow, valve position, operating speed, operational hours.

operating system The internal software of a data collector that determines how the data collector operates. You should always use the most recent operating system version available to you.

orders Multiples of the operating speed of a piece of equipment. The first order is the operating speed. The second order is two times the operating speed, and so on.

overload Occurs when the input signal from your transducer exceeds the current setting of the data collector hardware. You should not collect data when the input signal is generating an overload condition of the data collector; instead, you should adjust the data collector settings for the transducer.

Personal Computer Memory Card International Association (PCMCIA) card A removable hardware card, or memory card, containing non-volatile memory for additional storage, used with a computer or data collector.

plot A plot is a graphical display of data. Some examples are spectrum, trend, and time plots.

process (DC) voltage measurement A single valued measurement taken directly from a DC voltage output. Similar to a process measurement; however you directly measure the value instead of entering it with the data collector keypad.

Quickload list A list of measurement definitions to be loaded into a data collector. Emonitor builds and saves Quickload lists as load files so that they do not have to be rebuilt every time before loading into the data collector.

resolution The accuracy of something based on the number of discrete values used to define it. One example is the resolution of a spectrum measurement. This refers to the number of spectral lines that are combined to display the spectrum data. A higher resolution results in a clearer image due to more discrete values defining the object.

route See list.

signature A signature can be either a time or a spectrum measurement. It is a general term used for multi-valued data, as opposed to single-valued data such as a magnitude or a process measurement.

spectral line A spectral line is an individual discrete frequency in a spectrum measurement. A spectral line is sometimes called a 'bin,' a 'delta f,' a 'line,' or a 'line of resolution.'

spectrum alarm Also called narrowband alarm. It defines the safe operating boundary for spectrum data from a piece of equipment.

spectrum measurement A measure of amplitude versus frequency, typically vibration for monitoring systems. Spectrum measurements are useful for identifying the contribution of individual components (bearings, fans, gears, etc.). It is much easier to separate elements of vibration in the frequency domain than in the time domain.

spectrum plot A spectrum plot is a graph of amplitude versus frequency. Usually the amplitude is a measure of the acceleration, velocity, or displacement at that frequency.

storage specification The storage specification controls when to collect a measurement, and how long to store it on the computers hard disk. You can use the storage specification to force the collection and storage of a measurement at a given time interval, or if a measurement exceeds an alarm.

tachometer A device for measuring the speed of rotation of a machine or component.

time waveform measurement A measure of time along the horizontal axis and amplitude along the vertical axis (similar to oscilloscope readings). It is easy to see the vibration amplitude and general shape of the signal in a time waveform measurement. They are useful for identifying simple vibration signals and viewing impulsive type signals.

time waveform plot A time waveform plot is a graphical display of amplitude versus time for a single measurement.

transducer A transducer is a device for making measurements. These include accelerometers, velocity pickup, displacement probes, and temperature sensors.

transducer specification A transducer specification defines the characteristics of a transducer. These include the transducer name, type, base unit, and calibration.

trend plot A trend plot is a graph of the amplitude of a measurement against time, usually displaying the trend in a magnitude or process measurement over days, weeks, or months.

unload report A report that Emonitor automatically creates after you unload data from a data collector or import data from a file. The report uses the list of measurement definitions unloaded from the data collector or imported from the file.

unscheduled measurement Measurements you make that are not part of a list in the data collector. You can collect and unload unscheduled measurements with the data collector. After unloading, you may want to identify unscheduled measurements to store them with the correct machine in the database.

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Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

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