

**Tektronix**

**222PS  
PowerScout  
Power Systems Oscilloscope  
Operator Manual**

**070-8097-02**

**Please check for change information at the rear  
of this manual.**

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eingehalten werden.

# Welcome

This manual contains the following sections:

- *Overview* describes the 222PS PowerScout and provides safety information.
- *At A Glance* describes the controls and connectors for the 222PS.
- *In Detail* provides further detail on some aspects of the 222PS, building on the information contained in *At A Glance*. The 15 topics of this chapter are in alphabetical order for your convenience:
  - Acquisition Modes
  - Auto Setup
  - Calibration
  - Capturing Random Events
  - Channels
  - The Display
  - Horizontal Operation
  - Maintenance and Repair
  - Power
  - Probes
  - Saving and Recalling Data
  - Store Mode
  - Triggering
  - Vertical Operation
  - XY Mode
- *Tutorial: Measuring Signals* provides step-by-step instructions to get you started making measurements quickly.

# Contents

- *Remote Communication* provides information on RS-232 communication procedures between the 222PS and a PC.
- *Performance Verification* describes the procedures necessary to verify that the 222PS is performing according to specifications.
- *Specifications* provides complete specifications for the 222PS PowerScout.
- *Accessories* describes the standard and optional accessories available for the 222PS.
- *Glossary* defines various words used in the text.
- The *Index* helps you locate information quickly.

## NOTE

*If you have never used an oscilloscope before, please read the tutorial in Appendix A before using the 222PS.*



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# Overview

# Overview

This section summarizes the product features and safety precautions of the 222PS PowerScout.

---

## About the 222PS PowerScout

The Tektronix 222PS PowerScout is a portable digitizing oscilloscope. It has two **fully isolated, independently floatable** channels rated to 600 VAC<sub>RMS</sub>. The 222PS/224 digitizing oscilloscopes are the only oscilloscopes in the world with this feature.

The 222PS also has these features.

- light weight with a battery power source for field operations
- automatic setup button
- automatic triggering modes
- averaging and enveloping acquisition modes
- remote operation capabilities via the RS-232 communications port
- internal memory for saving up to four waveforms and four instrument setups
- DC-to-10 MHz signal bandwidth
- 10 MS/s digitizing rate
- 1 MHz single pass storage bandwidth
- Motor trigger

If you need more information about your Tektronix 222PS PowerScout or other Tektronix products, contact the nearest Tektronix sales office or distributor, consult the Tektronix product catalog, or, in the U. S., call the Tektronix National Marketing Center toll-free at 1-800-426-2200.

### Safety

You may be eager to begin using your Tektronix 222PS but please take a moment to review these safety precautions. We provide them for your protection and to prevent damage to the 222PS PowerScout. This safety information applies to all operators and service personnel.

#### WARNING

To avoid personal injury or damage to the 222PS, do not apply more than 850 V peak between probe tip and earth ground, between probe tip and probe common, or between probe common and earth ground.

#### WARNING

To avoid injury, use caution when working on equipment with voltages above 42 V peak. Such voltages pose a shock hazard.

#### WARNING

Do not float the external trigger common connector, the RS-232 communications port, or the external power input above 42 V peak. These inputs are not electrically isolated from each other.

### Symbols and Terms

These two terms appear in manuals:

- **CAUTION** statements identify conditions or practices that could result in damage to the equipment or other property.
- **WARNING** statements identify conditions or practices that could result in personal injury or loss of life.

These two terms appear on equipment:



- **CAUTION** indicates a personal injury hazard not immediately accessible as one reads the marking or a hazard to property including the equipment itself.
- **DANGER** indicates a personal injury hazard immediately accessible as one reads the marking.

This symbol appears in manuals:



Static-Sensitive Devices

These symbols appear on equipment:



DANGER High Voltage



Protective ground (earth) terminal



ATTENTION Refer to manual

### Specific Precautions

Observe all these precautions to ensure your personal safety and to prevent damage either to the 222PS or to equipment connected to it.

**Power Source** — The 222PS can use its self-contained sealed lead acid battery as a power source. It can also operate using power supplied to the external power input. Power supplied to this input must be 12 to 28 VDC or 16 to 20 VAC<sub>RMS</sub>. Do not force either external power conductor negative by more than 0.5 V with respect to chassis ground. Both conductors of the external power input are fused internally. These fuses are not user accessible.

You can operate the instrument with external power operation from local 110 V or 240 V power supply using the appropriate external power AC adapter. Use only external power AC adapters specified for this instrument.

## Overview

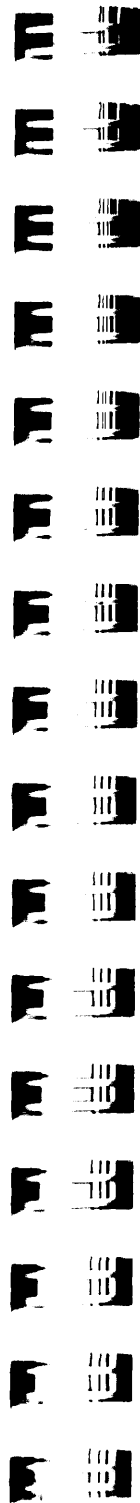
**Grounding the PowerScout** — The channel 1 and channel 2 measurement inputs of the 222PS are doubly insulated from each other and all other accessible portions of the instrument cabinet. It is not necessary to ground the instrument to avoid electric shock.

**Fuse** — The 222PS has no user-replaceable fuses.

**Do Not Disassemble the Cabinet** — To avoid personal injury, do not operate the instrument without a properly assembled cabinet. The cabinet of the instrument should be disassembled only by qualified service personnel.

**Do Not Operate in Explosive Atmospheres** — The 222PS provides no explosion protection from static discharges or arcing components. Do not operate the 222PS in an atmosphere of explosive gasses.

**Electric Overload** — Never apply a voltage to a probe or connector on the 222PS that is outside the range specified for that probe or connector.



# At a Glance



## At a Glance

This chapter describes the controls, connectors, and display readouts of the 222PS PowerScout. It is intended to help orient you and to provide basic information. For more detailed operating instructions for various features, see the appropriate section in the chapter entitled *In Detail*.

This section provides page references to the *In Detail* chapter for further information.

## Front Panel Controls

The front panel for the 222PS PowerScout appears as shown in Figure 2-1.

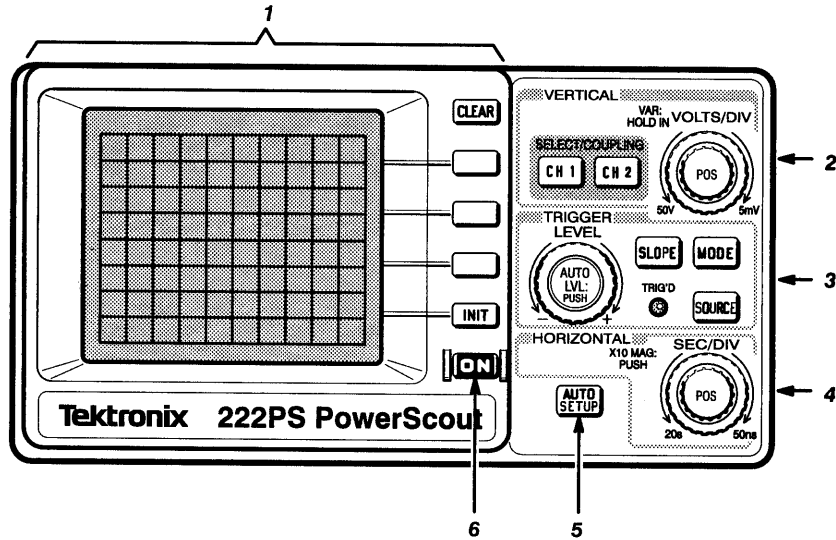


Figure 2-1: 222PS Front Panel

1. The display area includes the screen and associated buttons. The screen shows signal traces, readouts, and menu items. Buttons along the side of the screen allow you to manipulate menus. See page 2-6 for a more complete description of the display area.
2. The vertical controls allow you to manipulate the vertical aspects of your signal. See page 3-75 for a more complete description of the vertical controls.
3. The trigger controls allow you to manipulate the aspects of your signal having to do with triggering. See page 3-63 for a more complete description of the trigger controls.
4. The horizontal controls allow you to manipulate the horizontal aspects of your signal. See page 3-25 for more information on the horizontal controls.

*marking, readout, post access*

5. **AUTO SETUP** allows you to set up the instrument with the push of a single button. Press this button for a quick, informative display of any signal between 20 Hz and 1 MHz. See page 3-5 for more information on the **AUTO SETUP** button.
6. The **ON** button toggles the instrument on or off. The instrument beeps when it is turned on.

## Vertical Controls

Figure 2-2 shows the vertical controls that are located on the front panel.

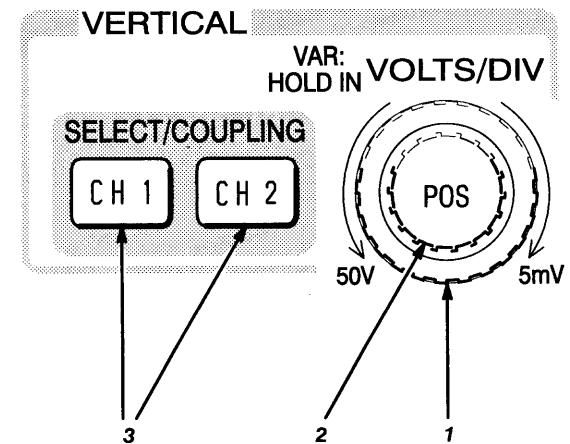


Figure 2-2: Vertical Controls

1. The outer knob sets the volts per division, which is the vertical scale of your display. Turn the knob clockwise to decrease the volts per division and counterclockwise to increase the volts per division. See page 3-76 for more information on setting the volts per division.
2. The inner knob sets the vertical position of the signal. Turn the knob clockwise to move the signal towards the top of the screen and counterclockwise to move the signal towards the bottom of the screen. For more information on setting the vertical position see page 3-75.

*smile in k*



You can also use this knob to change the size of a signal to an arbitrary number of divisions. To do so, see page 3-76.

3. The 222PS can display signals acquired through either or both of its two channels. The channel selector buttons allow you to select the channel that is affected by changes to the controls. With these buttons you can also select channel coupling or turn a channel off so that the signal it is measuring is not displayed. For more information on channels, see page 3-17.

### Trigger Controls

The trigger controls are on the front panel of the 222PS PowerScout. They appear as shown in Figure 2-3.

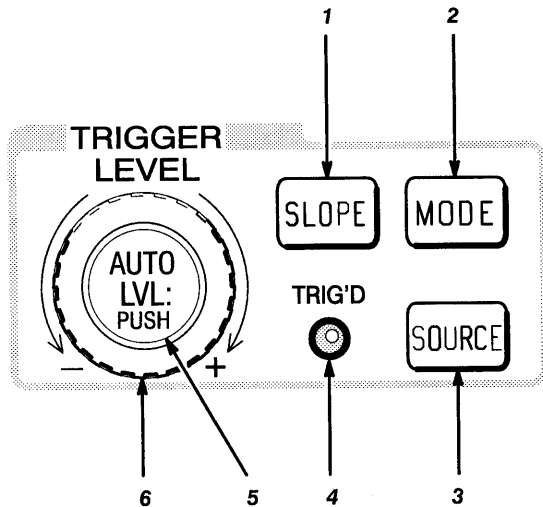
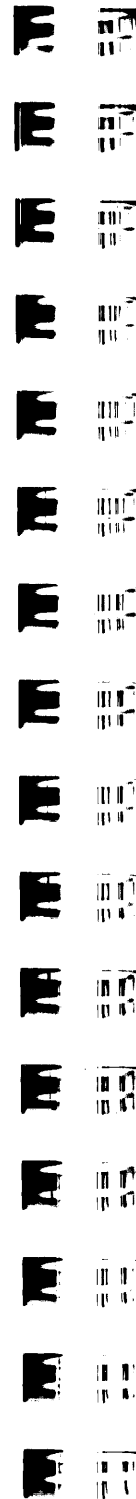


Figure 2-3: Trigger Controls

1. When you push the button labeled **SLOPE**, you toggle between a positive- and negative-trigger slope. For more details, see page 3-69.
2. When you push the button labeled **MODE**, you invoke a menu that allows you to specify the trigger mode. For a complete explanation of trigger modes, see page 3-71.



3. When you push the button labeled **SOURCE**, you invoke a menu that allows you to specify the trigger source. For a complete explanation of trigger sources, see page 3-64.
4. The light labeled **TRIG'D** turns on when the instrument is triggered. See page 3-63 for more details.
5. The inner button, labeled **AUTO LVL: PUSH**, sets the trigger level automatically. When you push it, it determines the peak values and sets the trigger level to the midpoint of the signal. For more information on this button, see page 3-70.
6. The outer knob sets the trigger level — the threshold voltage the signal must cross in order to trigger the instrument. Turn it clockwise to raise the trigger level; turn it counterclockwise to lower the trigger level. For more information on the trigger level see page 3-69.

### Horizontal Controls

The horizontal controls are on the front panel of the 222PS PowerScout. They appear as shown in Figure 2-4.

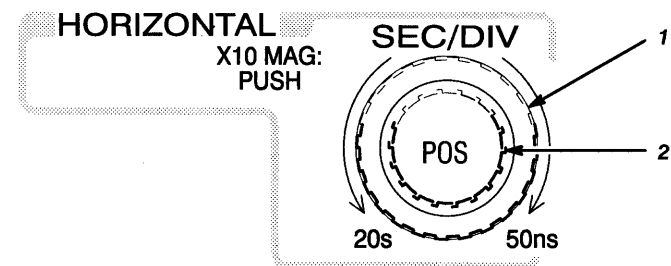


Figure 2-4: Horizontal Controls

1. The outer knob sets the seconds per division. This is the horizontal scale of your display. Turn the knob clockwise to decrease the seconds per division; turn it counterclockwise to increase the seconds per division. Setting the seconds per division is discussed in more detail on page 3-26.

- The inner knob sets the horizontal position of the signal. Turn the knob clockwise to move the signal to the right. Turn it counter-clockwise to move the signal to the left. For more information on setting the horizontal position see page 3-25.

You can also use this knob to magnify the signal by ten times. To do so, see page 3-29.

## The Display

The 222PS display shows waveforms that represent electrical signals. However, it also shows two other kinds of information—readouts and menus.

### Readouts

*Readouts* are numeric or symbolic information associated with a signal.

The 222PS displays readouts at three places on the screen: along the top, along the bottom, and slightly above the bottom.

Readouts along the top show information associated with the vertical controls. Readouts along the bottom show information associated with the trigger and horizontal controls. The readouts just above them show information associated with saved waveforms. Figures 2-5, 2-6, and 2-7 show these readouts.

**Vertical Readouts** — Figure 2-5 shows the vertical readouts along the top of the display. The readouts on the left refer to channel 1. The readouts on the right refer to channel 2.

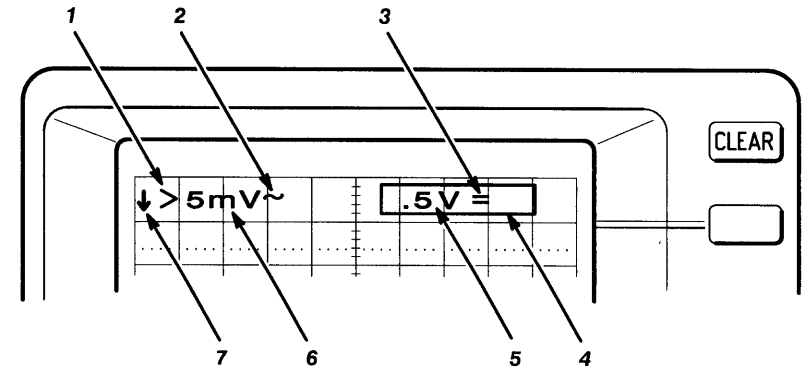


Figure 2-5: Vertical Readouts

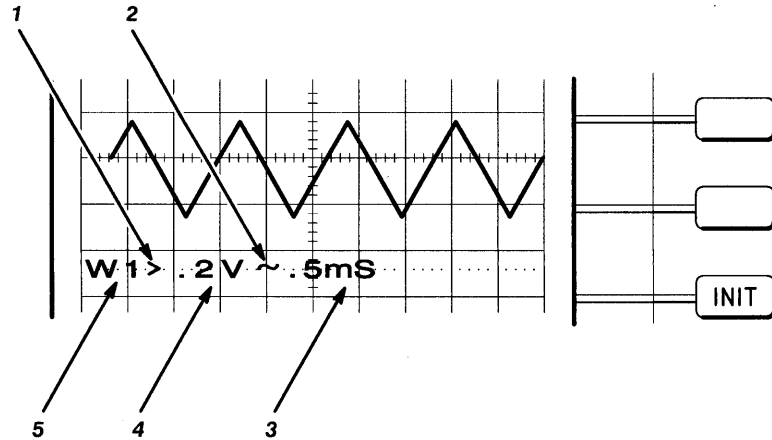
- The > indicates that the waveform is uncalibrated. For more information on uncalibrated waveforms, see page 3-76.
- The ~ indicates AC coupling. For more information on coupling, see page 3-19.  
A  $\downarrow$  indicates ground coupling.
- This is the channel 2 coupling. The = indicates DC coupling.
- The box around the channel information indicates that this channel is selected.
- This number is the volts per division for channel 2 — its vertical scaling. For more details on vertical scaling, see page 3-76.
- This number is volts per division for channel 1.

### NOTE

*If either channel is off, the volts-per-division number is replaced by an OFF.*

- The downward-pointing arrow indicates that the channel is inverted. For more information on inverting a channel, see page 3-22.

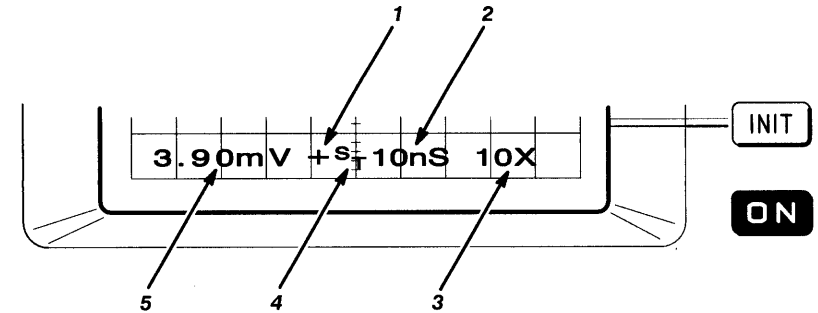
**Saved Waveform Readouts** — Figure 2-6 shows the saved waveform readouts above the bottom of the display. The readouts refer to the last saved waveform displayed. For more information on saved waveforms, see page 3-51.



**Figure 2-6: Saved Waveform Readouts**

1. This indicates that the waveform is uncalibrated. For more information on uncalibrated waveforms see page 3-76.
2. This is the channel coupling for the saved waveform. For more information on coupling see page 3-19.
3. This is the seconds per division setting for the saved waveform.
4. This is the volts per division setting for the saved waveform.
5. This is the memory location to which the waveform was saved. In this case, the waveform is saved in memory location 1. See page 3-51.

**Trigger and Horizontal Readouts** — Figure 2-7 shows the horizontal and trigger readouts along the bottom of the display.



**Figure 2-7: Trigger and Horizontal Readouts**

1. The second from the left readout is the trigger slope. A + indicates that triggering occurs on a rising edge. A - indicates that triggering occurs on a falling edge. For more information on trigger slope, see page 3-69.
2. The second from the right readout is the seconds per division — the horizontal scale factor. For more information on horizontal scaling, see page 3-26.
3. At the right is the magnification indicator. For more details on the magnification feature, see page 3-29.
4. The middle readout indicates that the instrument is in store mode. For more information on store mode, see page 3-61.
5. At the left is the trigger level in volts. For more details on trigger level see page 3-69.

**Menus and Menu Buttons**

*Menus* are lists of choices that you can select in order to perform some action, such as placing the instrument in XY mode or turning off the time-out feature.

A number of buttons on the front and top panels of the 222PS invoke menus when pressed. When a menu is on the display, you can select one of its items to perform an action. Figure 2-8 illustrates the parts of a menu.

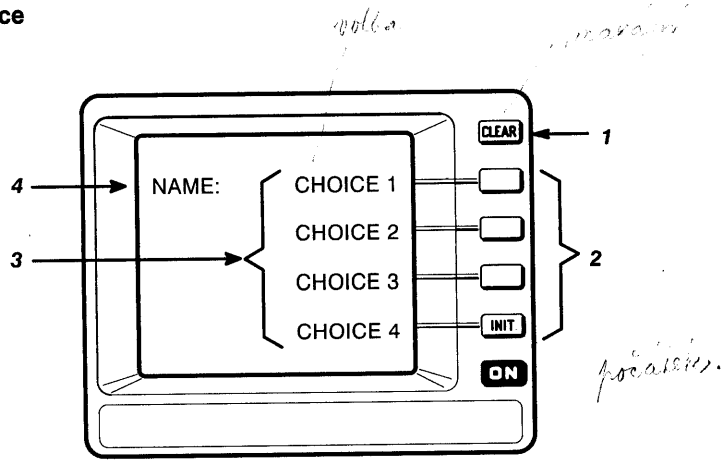


Figure 2-8: Parts of a Menu

1. The button labeled **CLEAR** erases the menu from the display.
2. The menu buttons are next to the screen, along its right edge. Pressing the button next to a menu item performs the action represented by that item.
3. The menu items appear along the right edge of the display. Up to four items can appear on a menu. Each represents a possible action you can perform.
4. The name of the menu appears at the top left of the display, followed by a colon.

### Top Panel Controls

The top panel for the 222PS PowerScout appears as shown in Figure 2-9.

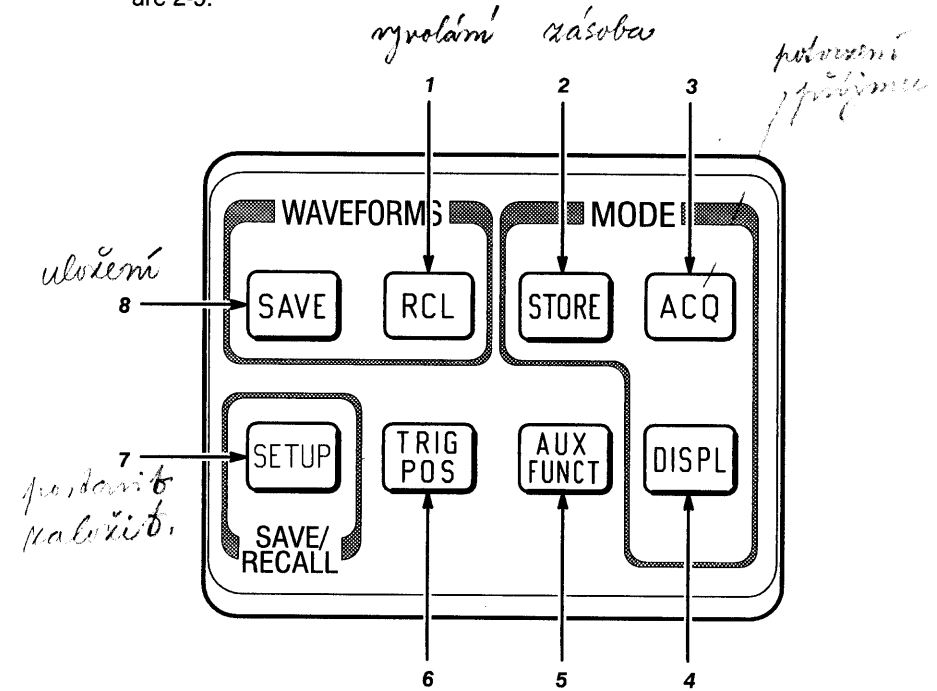


Figure 2-9: 222PS Top Panel

1. Pressing this button invokes a menu that allows you to recall saved waveforms. See page 3-53.
2. Pressing this button toggles the instrument in or out of store mode. For more information about store mode, see page 3-61.
3. Pressing this button invokes a menu that allows you to specify the acquisition mode of the instrument. For more information about acquisition modes, see page 3-1.

4. Pressing this button invokes a menu that allows you to specify whether to invert a channel, display signals in XY mode, or display signal readouts. For more information about inverting channels, see page 3-22. For more information about XY mode, see page 3-79. For more information about displaying or clearing signal readouts, see page 3-21.
5. Pressing this button invokes a menu that allows you to execute a variety of special functions. In some cases, you may execute items from two or three layers of menus.
  - You can check the display alignment and view the instrument identification and firmware number. See page 3-9.
  - You can start self-calibration routines for either channel or the external trigger input. See page 3-9.
  - You can enable or disable the time-out feature, set the baud rate, activate the modem, or select different probe types. For more information about the time-out feature, see page 3-37. For more information about setting the baud rate or activating the modem, see page A-11. For more information about configuring the 222PS for the correct probes, see page 3-45.
  - You can enable or disable MOTOR TRIG, which places a special filter in the trigger path to allow triggering on motor drive signals that are pulse-width modulated and on 50/60 Hz line signals. See page 3-67.
6. Pressing this button invokes a menu that allows you to specify the trigger position. See page 3-70.
7. Pressing this button invokes a menu that allows you to save or recall front-panel setups. See page 3-55.
8. Pressing this button invokes a menu that allows you to save waveforms. See page 3-51.



## Side Connectors

The right side of the 222PS PowerScout appears as shown in Figure 2-10.

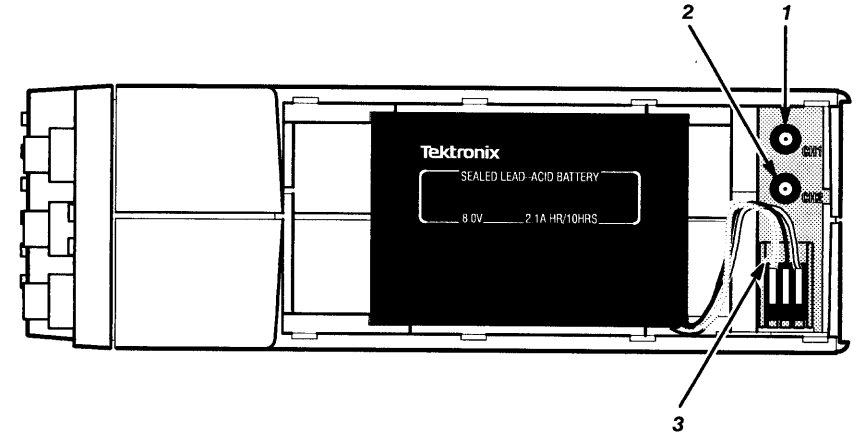


Figure 2-10: Side of 222PS, Storage Pouch Removed

1. This is the probe connector for channel 1.
2. This is the probe connector for channel 2.
3. This is the battery connection. See page 3-35 for more information on connecting the battery.

The 222PS comes with an attached storage pouch. Store the probes in the pouch when you are not using them. You do not need to disconnect the probes before you store them.

## Rear Panel Controls and Connectors

The rear panel for the 222PS PowerScout appears as shown in Figure 2-11.

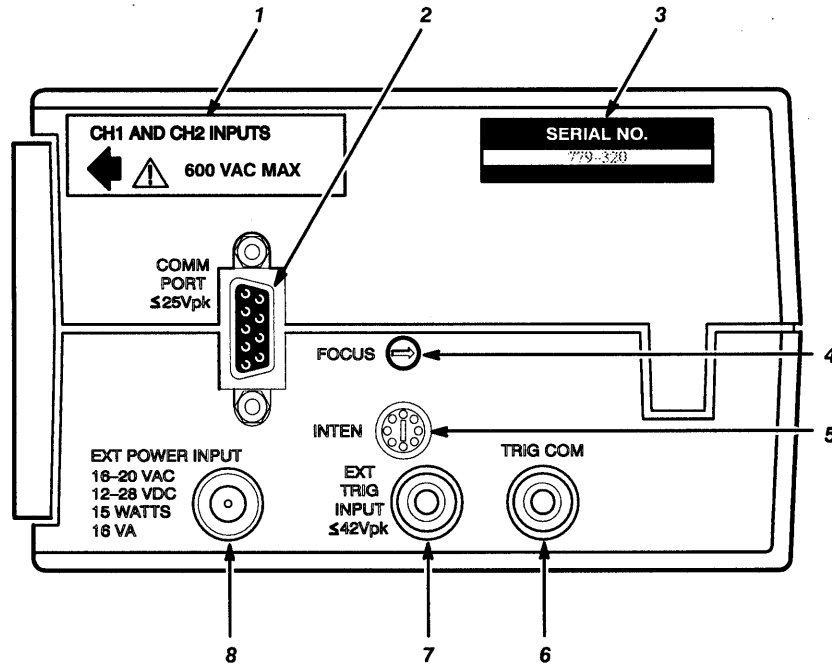


Figure 2-11: 222PS Rear Panel

1. This panel points to the probe inputs on the instrument's side and indicates the 222PS maximum input voltage rating.
2. This is the RS-232 connection port for remote communications. For more information on remote communications, see page A-9.
3. This is the instrument serial number. You will need it if you must ever arrange to ship the instrument back for maintenance. For more maintenance information, see page 3-31.
4. This knob focuses the 222PS screen. Insert a small screwdriver into the slot and turn it to adjust the focus.

5. This knob varies the brightness of the 222PS screen. See page 3-23 for more information on screen brightness.
6. This is the external trigger common reference connector. To use a grounded reference with your external trigger source, connect the reference signal here. See page 3-65.

**WARNING**

To avoid possible injury, do not connect the trigger common reference input to voltages greater than 42 V peak. The trigger common reference input is not insulated.

7. This is the external trigger input connector. To use an external signal as a trigger source, connect the external trigger signal here. For more information on external triggering, see page 3-65.

**WARNING**

To avoid possible injury or damage to the 222PS or equipment connected to it, do not float the external trigger common connector, the RS-232 communications port, or the external power input above 42 V peak. These inputs are not electrically isolated from each other.

8. This is the external power input. Connect the External Power AC Adapter to the input to run the instrument from line voltage. See page 3-41 for more information on external power.

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### The Tilt Stand

The 222PS PowerScout comes with a tilt stand so that you can view the front-panel and screen more easily. The tilt stand folds under the instrument when not in use. To use it, lift the instrument and pull the tilt stand forward until the instrument rests on it.

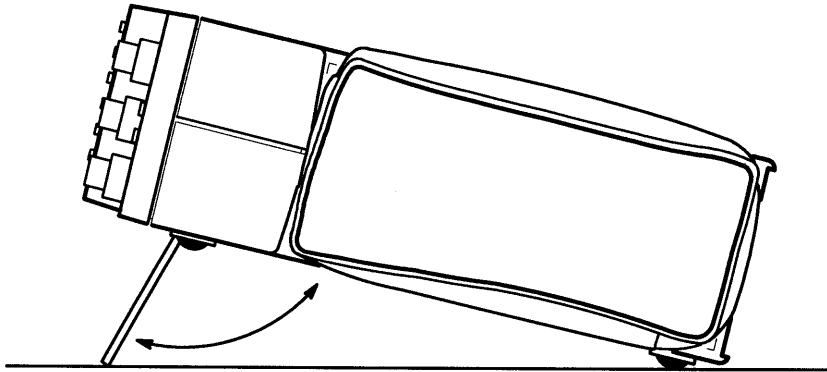


Figure 2-12: The 222PS With Tilt Stand

# In Detail

