PINTEK FS-404 OSCILLOSCOPE AND FUNCTION GENERATOR

This guide covers the major features of this product - it does not cover all of the available functions. This guide is not intended to replace the original equipment manual. Please refer to the manual for more detailed operating instructions and safety information.

In this manual, numbers in [] will refer to Figures, while numbers in () will refer to the controls indicated by those numbers in Figures [2] and [3].

EQUIPMENT DESCRIPTION

The Pintek FS-404 Oscilloscope [1] is used to display and measure electrical signals, and is particularly useful for viewing oscillating signals. It is capable of displaying signals that oscillate up to 40 MHz (40 million times per second).

The Function Generator is capable of producing an oscillating signal at a specified frequency (number of oscillations per second) and amplitude (size).

Figure 1: Pintek FS-404 Oscilloscope and Function Generator

CONTROLS

The following pages list the various controls and their functions found on the front [2] and back [3] of the Oscilloscope.

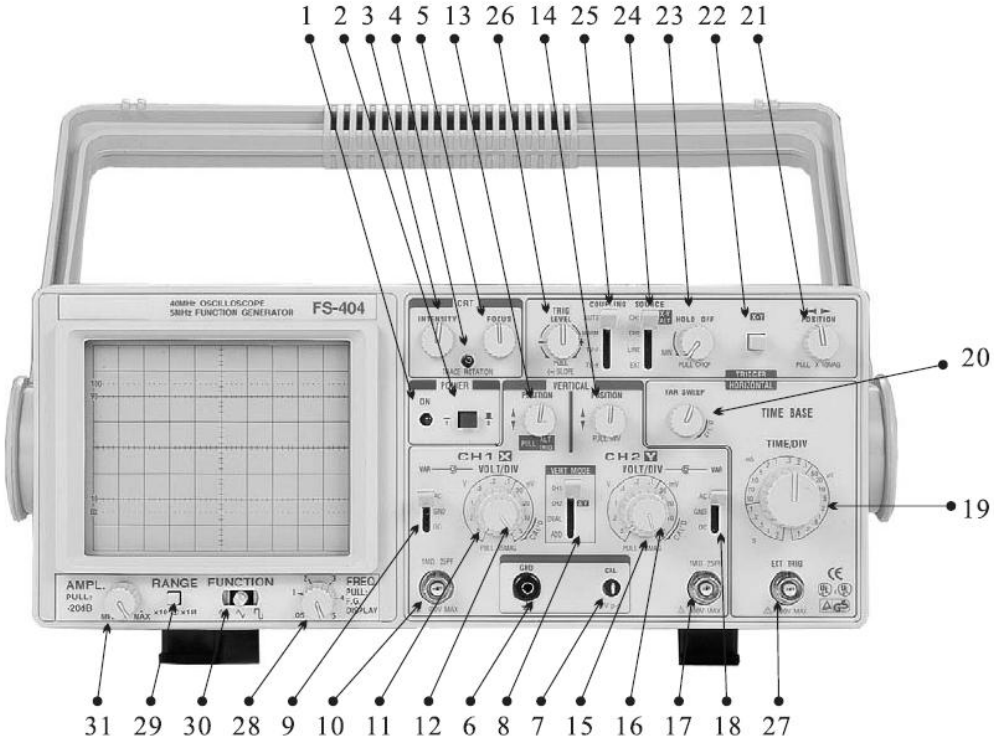

Figure 2: Controls and Indicators on Front of FS-404

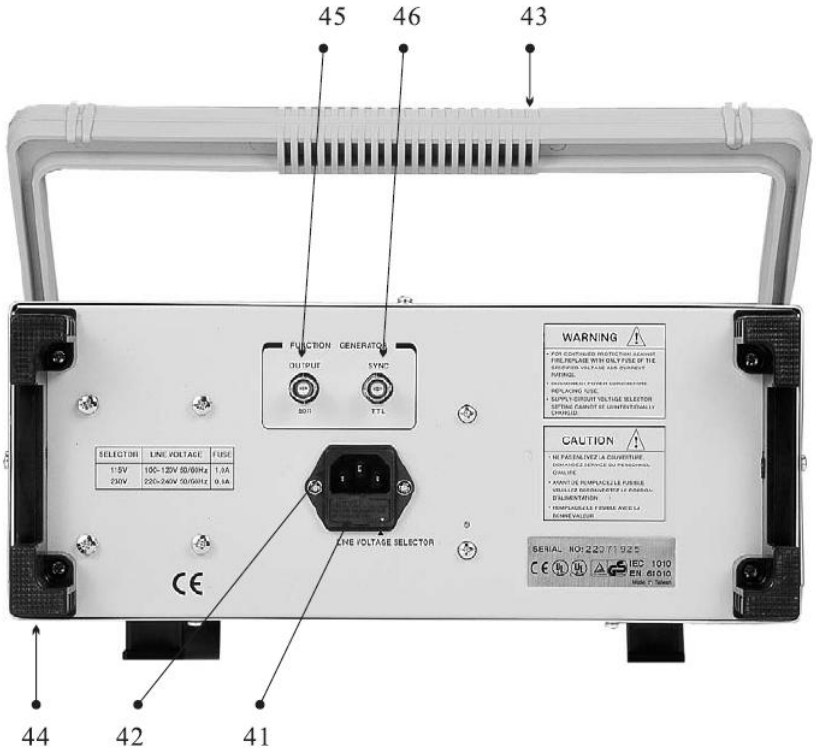

Figure 3: Controls and Indicators on Rear of FS-404

GENERAL FUNCTION CONTROLS

1. **ON Indicator:** Lights when the Oscilloscope is on.
2. **POWER Pushbutton:** Turns the oscilloscope on and off
3. **INTENSITY Control:** Adjusts the brightness of the signal displayed on the screen
4. **TRACE ROTATION Control:** Adjusts the rotation of the signal displayed on the screen to maintain a horizontal position (Adjusted using screwdriver)
5. **FOCUS Control:** Adjusts the focus of the signal displayed on the screen
6. **GND Terminal:** Oscilloscope chassis ground jack and earth ground via the AC power cord.
7. **CAL Terminal:** Provides a calibration signal. This signal is a 2 Volt, peak-to-peak, 1kHz square wave signal

VERTICAL CONTROLS

8. **VERT MODE Switch:** Selects the source of the signal to be displayed
    - **CH1:** Displays Channel 1 signal by itself
    - **CH2:** Displays Channel 2 signal by itself

- **DUAL:** Displays Channel 1 and Channel 2 signals simultaneously
- **ADD:** The signals from Channel 1 and Channel 2 are summed and displayed as a single signal. If **CH2 POSITION** Control (14) is pulled out, then Channel 2 will be subtracted from Channel 1.

9. **CH1 AC-GND-DC Switch:** This three position switch has the following options
   - **AC:** Select when the Channel 1 input is an AC signal
   - **GND:** Ground the Channel 1 input, providing a zero-volt base line signal
   - **DC:** Select when the Channel 1 input is a DC signal
10. **CH1 Input Jack:** Input jack for Channel 1
11. **CH1 VOLTS/DIV Control:** Allows zoom in and zoom out on the Y-axis for the Channel 1 signal. The numbers on the control represent the size of each vertical division (horizontal lines) on the display. This can range from 5mV / division to 5 V per division.
12. **CH1 PULL X5 MAG:**
    - Rotation of this dial on the front of the **CH1 VOLTS/DIV Control** (11) allows adjustment of the sensitivity of the **CH1 VOLTS/DIV Control** (11). ***It should normally be left in the fully-clockwise position.***
    - Pulling this dial out increases the zoom factor on the Y-axis by a factor of five – each setting on the **CH1 VOLTS/DIV Control** (11) effectively becomes 1/5 of its former value (e.g. 5mV becomes 1mV). ***It should normally be left in the in position.***
13. **CH1 POSITION Control:** Allows the vertical position of the Channel 1 signal to be altered on the display
14. **CH2 POSITION Control:** Allows the vertical position of the Channel 2 signal to be altered on the display.
    - When pulled out, the polarity of the Channel 2 signal will be reversed, thus flipping the signal upside down. ***It should normally be left in the in position.***
15. **CH2 VOLTS/DIV Control:** Allows zoom in and zoom out on the Y-axis for the Channel 2 signal. The numbers on the control represent the size of each vertical division (horizontal lines) on the display. This can range from 5mV / division to 5 V per division.
16. **CH2 PULL X5 MAG:**
    - Rotation of this dial on the front of the **CH2 VOLTS/DIV Control** (15) allows adjustment of the sensitivity of the **CH2 VOLTS/DIV Control** (15). ***It should normally be left in the fully-clockwise position.***
    - Pulling this dial out increases the zoom factor on the Y-axis by a factor of five – each setting on the **CH2 VOLTS/DIV Control** (15) effectively becomes 1/5 of its former value (e.g. 5mV becomes 1mV). ***It should normally be left in the in position.***
17. **CH2 Input Jack:** Input jack for Channel 2
18. **CH2 AC-GND-DC Switch:** This three position switch has the following options

- **AC:** Select when the Channel 2 input is an AC signal
- **GND:** Ground the Channel 2 input, providing a zero-volt base line signal
- **DC:** Select when the Channel 2 input is a DC signal

HORIZONTAL CONTROLS

19. **TIME/DIV Control:** Allows zoom in and zoom out on the X-axis (time) for the both Channels. The numbers on the control represent the size of each horizontal division (vertical lines) in seconds on the display. This can range from 0.1 mS / division to 2 S per division.
20. **VAR SWEEP Control:** Rotation of this dial on the front of the **TIME/DIV Control** (19) allows adjustment of the sensitivity of the **TIME/DIV Control** (19). It should normally be left in the fully-clockwise position
21. **POSITION Control:** Allows the horizontal position of both Channels to be altered on the display
    - Pulling this dial out increases the zoom factor on the X-axis by a factor of ten – each setting on the **TIME/DIV Control** (19) effectively becomes 1/10 of its former value (e.g. 0.1mS becomes 0.01mS)
22. **X-Y Pushbutton:** Normally, the signals at Channel 1 and Channel 2 are plotted against time. Instead, by pushing this button in they can be plotted against each other. Channel 1 becomes the X-axis, and Channel 2 becomes the Y-axis. ***This button should normally be left in the out position***

TRIGGERING CONTROLS

23. **HOLD OFF Control:**
24. **Trigger SOURCE Switch:** This four position switch selects the source to use as the trigger
    - **CH1:** Uses the Channel 1 signal for the trigger
    - **CH2:** Uses the Channel 2 signal for the trigger
    - **LINE:** Uses a signal derived from the main power cord as the trigger. ***This is rarely used.***
    - **EXT:** Signal from the **EXT TRIG** (27) jack is used as the trigger. ***This is rarely used.***
25. **Trigger COUPLING Switch:** Four position switch to select the trigger coupling
    - **AUTO:** Signal is displayed on the screen regardless of whether or not the trigger is adequate
    - **NORM:** Signal is not displayed on the screen until an adequate trigger is detected
    - **TV-V and TV-H:** ***These are rarely used.***
26. **TRIG LEVEL Control:** This dial selects the triggering point. When the signal on the display is not in equilibrium, rotate this dial until a static signal is displayed.

27. **EXT TRIG Jack:** This is used for external trigger signals. ***It is rarely used.***

FREQUENCY GENERATOR CONTROLS

28. **FREQ Control:** This dial is used to set the frequency produced by the frequency generator
29. **RANGE Pushbutton:** When pushed in, this changes the range of the **FREQ Control** (28) by a factor of 10. Each push of the button will move the range up (and then back down) the following range scale:
    - 0.5Hz to 50Hz
    - 5Hz to 500Hz
    - 50Hz to 5kHz
    - 500Hz to 50kHz
    - 5kHz to 500kHz
    - 50kHz to 5MHz
30. **FUNCTION Switch:** The function switch selects the shape of the signal to be generated
    - **Sine Wave**
    - **Square Wave**
    - **Sawtooth Wave**
31. **AMPL Control:** This controls the amplitude (vertical size) of the signal being generated.
    - Pulling out this dial will reduce the amplitude by a factor of ten.

REAR PANEL CONTROLS

41. **Fuse Holder / Line Voltage Selector:** Holds the fuse and selects the main power voltage (100-120V or 220 to 240V)
42. **Power Cord Receptacle:** Accepts the main power cord for the Oscilloscope
43. **Handle / Tilt Stand:** Can be rotated to be used as a handle, or as a stand for propping up the Oscilloscope at an angle
44. **Feet / Cord Wrap:** Allows the Oscilloscope to be stood on its back, while doubling as a place to wrap the main power cord during storage
45. **OUTPUT:** Function Generator main output
46. **SYNC:** Square wave output with the same frequency as the main **OUTPUT** (45). Synchronous Output. **This is rarely used.**

OSCILLOSCOPE OPERATION

INITIAL STARTING PROCEDURE

These instructions should be followed every time you start up the Oscilloscope to be used a reference point for obtaining a signal on the display signal. These instructions will also be useful to follow to effectively reset the Oscilloscope in the event that you cannot diagnose the reason for being unable to display a signal on the display.

1. Set **VERT MODE** (8) to **CH1**
2. Set **CH1 AC-GND-DC** (9) and the **CH2 AC-GNC-DC** (18) switches to **GND**
3. Set Trigger **COUPLING** (25) to **AUTO**
4. Set Trigger **SOURCE (24)** to **CH1**
5. Centre all **POSITION** (13, 14 and 21) controls so that the pointers are facing up, and ensure that they are in the pushed in position
6. Set **TIME/DIV** (19) to **1ms / div**
7. Ensure that **CH1 PULL X5 MAG** (12), **CH2 PULL X5 MAG** (16), and **VAR SWEEP** (20) are in the fully clockwise and pushed in position.
8. Set the **X-Y** (22) switch to the pushed out position
9. Ensure that the **HOLD OFF** (23), **TRIG LEVEL** (26) and the **AMPL** (31) controls are all in the pushed in position
10. Press the red **POWER** (2) pushbutton
11. A signal should appear on the display. Adjust the signal brightness with the **INTENSITY** (3) and the **FOCUS** (5) control.

SINGLE SIGNAL DISPLAY

Either Channel 1 or Channel 2 may be used for a single signal operation. The following instructions are for viewing a signal on Channel 1.

1. Perform the Initial Starting Procedure
2. Connect the probe to the **CH1 INPUT** (10) jack.
3. Connect the probe ground clip [4] to the chassis or common of the equipment under test.
4. Connect the probe tip [5] to the point of measurement.

Figure 4: Probe Ground Clip

Figure 5: Probe Tip

5. Move the **CH1 AC-GND-DC** (9) switch out of the **GND** position to either **DC** or **AC** depending on the signal being measured.
6. Set **VERT MODE** (8) to **CH1**.
7. Turn the **CH1 VOLTS/DIV** (11) control until the signal fills an appropriate portion of the screen vertically. This is typically somewhere between 2 and 6 vertical divisions.
8. Position the waveform vertically as desired using the **CH1 POSITION** (13) control.
9. The signal displayed on the screen at this point may be unsynchronized. Refer to the section on **Triggering** for procedures on setting the trigger to obtain a stable signal display.
10. Adjust the **TIME/DIV** (19) control until the signal appears at an appropriate scale on the screen.
11. Position the waveform horizontally as desired using the horizontal **POSITION** (21) control.

DUAL SIGNAL DISPLAY

When viewing two signals simultaneously on Channel 1 and Channel 2, the waveforms are usually related to each in some way. Viewing two unrelated signals simultaneously can be a difficult process due to triggering issues.

To view two related waveforms simultaneously

1. Perform the Initial Starting Procedure
2. Connect the probe to both the **CH1 INPUT** (10) and **CH2 INPUT** (17) jack.
3. Connect the probe ground clips [4] to the chassis or common of the equipment under test.
4. Connect the probe tips [5] to the points of measurement.
5. Move the **CH1 AC-GND-DC** (9) and **CH2 AC-GND-DC** (18) switch out of the **GND** positions to either **DC** or **AC** depending on the signal being measured.
6. To view both signals simultaneously, set the **VERT MODE** (8) switch to **DUAL**.
    a. Position the waveforms vertically so that the Channel 1 signal is displayed above the Channel signal using the **CH1 POSITION** (13) and **CH2 POSITION** (14) controls.
    b. Turn the **CH1 VOLTS/DIV** (11) and the **CH2 VOLTS/DIV** (12) controls until each waveform occupies an appropriate space on the screen. This is typically between 2 and 3 vertical divisions.
7. To the sum or difference of the two signals
    a. Set the **VERT MODE** (8) to **ADD** to display the sum of Channel 1 and Channel 2 (CH1 + CH2)
    b. Set the **VERT MODE** (8) to **ADD** and pull out the **CH2 POSITION** (14) control to display the difference between Channel 1 and Channel 2 (CH1 – CH2). Be sure push the **CH2 POSITION** (14) control back in when finished.
8. The signals displayed on the screen at this point may be unsynchronized. Refer to the section on **Triggering** for procedures on setting the trigger to obtain a stable signal display.
9. Adjust the **TIME/DIV** (19) control until the signal appears at an appropriate scale on the screen.
10. Position the waveform horizontally as desired using the horizontal **POSITION** (21) control.

TRIGGERING

The Oscilloscope is essentially drawing a picture of the waveform each time it cycles through on the display. With a moving (oscillating) signal, there is no guarantee that the Oscilloscope will start drawing that picture at the same point on the waveform each time.

When this happens, the signal displayed on the screen will be unsynchronized and appear to be moving.

Triggering solves this by setting a point on the waveform that will form the starting point for the drawing so that it begins at the same point each time and appears stationary on our screen.

To set the trigger under most circumstances

1. Set the Trigger **COUPLING** switch to **AUTO**
2. Set the Trigger **SOURCE** to either **CH1** or **CH2** depending on which channel you wish to use as a trigger
3. Rotate the **TRIG LEVEL** (26) dial from the extreme counter clockwise position in a clockwise direction until the signal appears stable on the screen. The **TRIG LEVEL** (26) may need to be adjusted if the signal changes.

OSCILLOSCOPE EXAMPLE

1. Follow the Initial Starting Procedure
2. Perform the Initial Starting Procedure
3. Connect the probe to the **CH1 INPUT** (10) jack.
4. Connect the probe ground clip [4] to the **GND** (6) terminal on the Oscilloscope.
5. Connect the probe tip [5] to the **CAL** (7) terminal on the Oscilloscope.
6. Move the **CH1 AC-GND-DC** (9) switch out of the **GND** position to the **AC** position
7. Set **VERT MODE** (8) to **CH1**.
8. Slowly turn the **CH1 VOLTS/DIV** (11) control from the extreme counter clockwise position to the extreme clockwise position. You will see how grows vertically during this process, as we zoom in. Set the dial to the 0.5 V/div setting.
9. Position the waveform vertically using the **CH1 POSITION** (13) control so that the bottom of the waveform rests on a horizontal line on the screen.
10. The signal should cover roughly four vertical divisions from the bottom to the top. Since we have selected 0.5 V/div as the vertical scaling, this means that the signal is 4 x 0.5 = 2 Volts from peak to peak.
11. Set the Trigger **COUPLING** switch to **AUTO**
12. Set the Trigger **SOURCE** to either **CH1** or **CH2** depending on which channel you wish to use as a trigger
13. Slowly rotate the **TRIG LEVEL** (26) dial from the extreme counter clockwise position to the extreme clockwise position. You will notice that the signal displayed is initially unsynchronized, then becomes synchronized when the trigger reaches an appropriate point, and then becomes unsynchronized again. Set the trigger at a point where the signal being displayed is stable.

14. Slowly turn the **TIME/DIV** (19) control from the extreme counter clockwise position to the extreme clockwise position. You will see how grows horizontally during this process, as we zoom in. Set the dial to the 0.2 ms/div setting.
15. Position the waveform horizontally using the horizontal **POSITION** (21) control so that the up-slope of the waveform is resting on a vertical line on the screen.
16. The signal should cover roughly five horizontal divisions from one upslope to the next. Since we have selected 0.2 ms/div as the vertical scaling, this means that the signal has a period of 5 x 0.2ms = 1 ms. We can convert that to a frequency:

$$Frequency\ (Hz) = \frac{1}{Period\ (s)} = \frac{1}{0.001} = 1000\ Hz = 1kHz$$

17. The **CAL** (6) terminal provides a 1kHz, 2 Volt peak-to-peak square wave, so these measurements are consistent with what we should expect. The signal should look something like Figure [6].

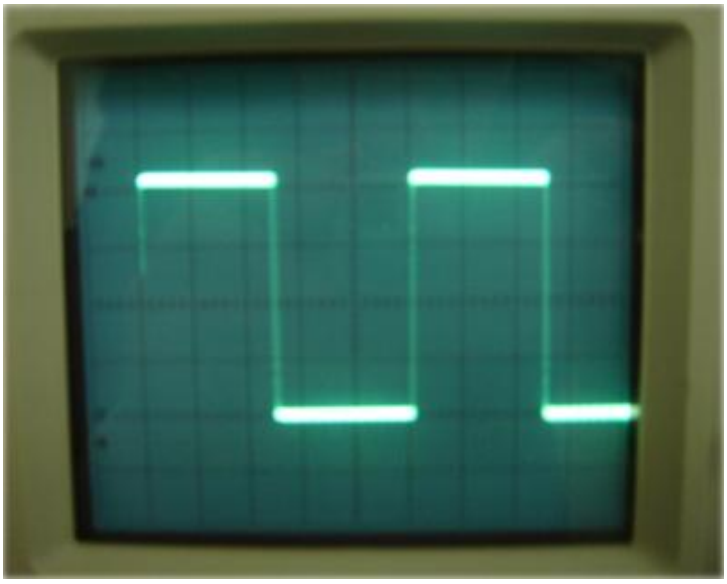

Figure 6: Calibration Signal

FUNCTION GENERATOR OPERATION

The function generator allows the user to produce a signal for output.

1. Follow the Initial Starting Procedure
2. Connect the BNC Cable [7] from the **OUTPUT** (45) jack to the **CH1 INPUT** (10) jack.
3. Move the **CH1 AC-GND-DC** (9) switch out of the **GND** position to the **AC** position

4. Select the shape of waveform that you would like to produce using the **FUNCTION** (30) switch.
5. Use the **FREQ** (28) and **RANGE** (29) controls to set the frequency to the desired level. You will need to adjust the positioning of the waveform, the size of the waveform, and the trigger as outlined in the Single Signal Display section to be able to view the waveform on the display.
6. Use the **AMPL** (31) control to set the desired amplitude (vertical size) of the waveform. You will need to adjust the positioning of the waveform, the size of the waveform, and the trigger as outlined in the Single Signal Display section to be able to view the waveform on the display.
7. Disconnect the cable from the **CH1 INPUT** (10) jack and use as desired.

Figure 7: BNC Cable