



## 2 Optional Time-Voltage Module to IO-4360

Accessory module increases your troubleshooting effectiveness by adding frequency counter and DC voltmeter capabilities to the IO-4360 Triple Trace Oscilloscope.



## 5 Precision Oscilloscope Calibrator helps maintain scopes at their peak performance level and accuracy

• Provides accurate time and amplitude signals for calibrating most scopes

A laboratory-precise calibrator, the IG-4244 provides a source of accurate time and amplitude signals for making critical oscilloscope adjustments and calibrations. With its range of outputs and accuracy, this quality instrument is exceptionally equipped for calibrating scopes with bandwidths over 100 MHz.

Two crystal oscillators supply twenty-four square wave signals with very accurate times from 0.5 seconds (2 Hz) to 10 nanoseconds (100 MHz) through a 1-2-5 sequenced range switch. The rise time of these signals is less than 1 nanosecond (with less than 2% or 10 mV aberrations) making them very well suited for use in high frequency compensation adjustments on oscilloscope vertical amplifiers. Time accuracy is held to a critical 0.015%.

Sixteen precise square wave voltages, at about 1 kHz, are available for scope vertical calibration and attenuator compensation networks. These voltages range from 1 mV to 100 V peak through a 1-2-5 sequenced switch. Also available is a sine wave signal output of approximately 1 kHz at 1 volt peak-to-peak. This signal is especially useful in adjusting scope trigger circuits.

In addition to its scope calibrator functions, the IG-4244 can be used as a bench standard for calibrating other test equipment. Or, this precise calibrator can be used as a signal source for testing equipment or other experimental projects. The IG-4244 is easily assembled in about 8 hours and uses 120/240 VAC (50/60 Hz). Its dimensions are 3" H x 7 1/4" W x 9 1/2" D (7.6 x 18.4 x 24.1 cm).

Kit IG-4244, Shpg. wt. 6 lbs. .... 149.95  
SG-4244, Assembled and tested, Shpg. wt. 6 lbs. .... 299.95

IG/SG-4244 SPECIFICATIONS: TIME: Range: 0.5 s to 10 ns. Amplitude: 0.5 s to 20 ns, 100 mV to 1 V peak; 10 ns, 100 mV to 0.5 V peak. Rise Time: <1 ns. Leading Edge Aberrations: <2% of peak-to-peak amplitude or 10 mV, whichever is greater. Output Impedance: 50 ohms, nominal. VOLTAGE: Range: 1 mV to 100 V peak in a 1-2-5 sequence. Accuracy:  $\pm 1\%$ . Rise Time: <5  $\mu$ s. Frequency: 1 kHz. Sine Wave Frequency: Approximately 1 kHz. Amplitude: Approximately 1 V P-P. Power Requirements: 120/240 VAC, 50/60 Hz, 25 watts maximum. Dimensions: 3" H x 7 1/4" W x 9 1/2" D.

ideal for the wide range of measurements encountered in electronics, developmental laboratories and scientific research. And it is in the price range of the service technician as well as the part time hobbyist.

Select several methods of displaying a signal on the 8 x 10 cm rectangular viewing area. Either or both channels can be displayed as a function of time or of each other. At lower speeds both channels are displayed in a chopped mode to avoid flickering while at higher speeds both signals are displayed alternately. Front panel X-Y operation uses the scope's matched vertical amps.

A complete trigger system features various trigger signals including the choice of sampling either channel, an externally applied trigger signal or using part of the line voltage. To control the trigger input bandpass, a tri-level mode switch is provided. A special active TV filter cuts off unwanted high frequency signals for easier triggering on TV vertical signals.

Calibrating the IO-4210 requires an accurate source of square waves such as the IG-4505 on page 46 or the IG-4244 Precision Calibrator on this page. A calibrated 1V P-P square wave signal is provided by the scope for checking scope probes. A component tester, included with the scope, allows you to check in-circuit and out-of-circuit electronic components. Use it to check out the IO-4210 during assembly and as a handy tester when the scope is completed.

Kit IO-4210, Shpg. wt. 28 lbs. .... 449.95

IO-4210 SPECIFICATIONS: VERTICAL: Deflection Factor: Sensitivity: 10 mV/cm to 20 V/cm, 11 steps in 1-2-5 sequence. Variable: Continuous between steps to approximately 60 V/cm. Accuracy: 3%. Vertical Response: DC Coupling: DC to 10 MHz. AC Coupling: 2 Hz to 10 MHz. Rise Time: 35 ns. Overshoot: Less than 5%. Attenuator: Vertical Input: Impedance: 1 megohm, shunted by 38 pF. Maximum Input: 400 volts peak, combined AC and DC. Connector: BNC. Modes: Signal, Y1 or Y2 selected by position control; Dual, Chopped (200 kHz) or alternate automatically selected by time/cm switch. HORIZONTAL: Time Base, Ramp: 200 ns/cm to 0.2 s/cm, 19 steps in 1-2-5 sequence. Variable: Continuous between steps to approximately 0.6 s/cm. Accuracy: 3%. Magnifier: X5 (adds additional 2% to sweep accuracy). EXTERNAL: Sensitivity: Approximately 0.1 V/cm. Impedance: 1 megohm. Polarity: Positive input causes right-hand deflection. Frequency Response: DC to 1 MHz. Connector: BNC. Trigger: Internal: Automatic; Adjustable over 10 divisions. Normal: Adjustable over 10 divisions. Slope Selection: + or -. Impedance: 1 megohm, shunted by 40 pF. Connector: BNC. X-Y: Y-Channel: Same as vertical. X-Channel: Same as vertical, except response limited to 1 MHz. GENERAL: Operating Temperature Range: 50-104 degrees F (10-40 degrees C). Power Requirements: 120 VAC, 60 Hz, 70 watts. Overall Dimensions: 6 7/8" H x 12 7/8" W x 19 1/4" D (17.6 x 32.7 x 48.9 cm).



# Versatile oscilloscopes for troubleshooting and a calibrator to maintain their performance

## 1 Triple Trace 60 MHz Oscilloscope available with optional autoranging digital display

**\$999<sup>95</sup>**

A high-performance oscilloscope, the IO-4360 offers triple trace capability with a low input sensitivity up to 60 MHz. And with the optional IOA-4360 Time-Voltage Module, a powerful combination is brought together to increase your troubleshooting effectiveness and cut the time spent on alignments.

**Multi-trace oscilloscope:** Two channels use an attenuator network of 12 calibrated ranges from 2 millivolts/cm to 10 volts/cm. Accuracy of signal measurements in this range is within 3% using either AC or DC coupling. The third trace is available at the external input and can be viewed by pressing the IO-4360's front panel TRIPLE trace button. To add to its versatility, the Channel 2 input of the IO-4360 Oscilloscope can be inverted and "added" to the input of Channel 1 for making differential measurements.

**Extra wide DC to 60 MHz bandwidth:** The high-performance IO-4360 Oscilloscope provides the bandwidth needed to view waveforms in both digital and analog circuits. Even though this multi-trace scope has a specified bandwidth of 60 MHz signals up to and beyond 90 MHz can be displayed on its 8 x 10 cm screen. Intensity, focus and astigmatism control trace brightness and sharpness.

**Sweep control:** Besides providing the sweep speeds to observe fast logic pulses, the IO-4360 also supplies a delayed sweep for fast and accurate timing measurements. Internal vertical delay lines ensure that the horizontal sweep starts at the beginning of the input signal. This permits you to view a complete vertical waveform. With a very fast 7 ns rise time, rapid rise-time signals are faithfully reproduced. Also providing sweep control is the calibrated time base. It ranges from 0.1 s/cm to 100 ns/cm in a 1-2-5 stepped sequence. And, any sweep speed can be expanded 10 times by simply pulling a switch. A delayed sweep allows you to view the leading edge of a waveform, as well as, select the exact portion of a signal for expansion by any factor you desire.

**Complete trigger system:** The IO-4360 can be triggered from either of the two vertical input channels, from the line voltage, or from an external trigger which is also the input for the third viewable trace. A filter network allows a choice of the AC, DDC, low or high frequency component of a signal to be used in triggering the scope. This filter network can also reject either the horizontal or vertical sync pulses of TV signals when using them to trigger video waveforms. Fine trigger adjusting is done with a precise level control. When a trigger signal isn't used, the baseline can be automatically displayed by using the scope's automatic mode.

**Kit IO-4360, Shpg. wt. 41 lbs. .... 999.95**

**SAVER!** Save \$50.00 with a purchase of an IO-4360 and IOA-4200 Module.

**IOS-4360, Shpg. wt. 53 lbs. .... 1299.90**

**IO-4360 SPECIFICATIONS:** Display Modes: Y1, Y2, Add (Y1  $\pm$  Y2), Dual trace, Triple trace, ALT/Chop. Vertical: (Ch. Y1 and Y2) Deflection Factors: 2 mV/cm to 10 V/cm, 12 steps in a 1-2-5 sequence; continuously variable to approx. 30 V/cm. Accuracy: Within 3%. Bandwidth: DC to 60 MHz (5 mV to 10 V/cm); DC to 50 MHz (2 mV/cm). Rise Time: 7 ns or less. Delay Line: Allows at least 20 ns of pretriggered waveform display. Ch. Y3: Sensitivity: 200 mV/cm or 2 V/cm. Response: DC to 25 MHz. Rise Time: <14 ns. Accuracy: Within 3%. **HORIZONTAL:** Display Modes: A, A int. B, and B. Time Base Ranges: 100 ms/cm to 0.1  $\mu$ s/cm, 19 steps in 1-2-5 sequence, continuously variable to approx. 300 ms/cm. Accuracy: Within 3%. Magnifier: Times ten. **TRIGGERING:** Source: Y1, Y2, EXT, Line. Coupling: AC, DC, AC-HF, AC-LF, TV-V, TH-H. Modes: Automatic baseline, Normal, Single Sweep. Hold Off: Variable, including "B-ends-A" position. **GENERAL:** Internal Calibrator Accuracy: IVP-P within 2%. CRT: Mesh-expanded with 8 x 10 cm internal graticule. Accelerating Potential: 10 kV regulated. External Z Axis: Continuously adjustable. **Power Requirements:** 108-132 or 216-264 VAC, 50/60 Hz. Dimensions: 6" H x 11 1/2" W x 18" D, with handle folded. Complete specifications are available by calling Heath Co. at 800-253-0570 or requesting ONLY the IO-4360 specifications on a catalog order form.

## 2 Optional Time-Voltage Accessory Module

- Adds frequency counter and DC voltmeter capabilities to IO-4360

**Automatically analyze any waveform** displayed on the IO-4360 Scope. Specifically designed for the Triple Trace Oscilloscope, the Time-Voltage Module displays time, frequency or  $\pm$  DC voltages at whatever point the scope probe is placed. Just select the desired function on the module and press a button. The autoranging module then indicates the reading in a bright 3 1/2 digit display.

**Measure time intervals** from 1.0 s to less than 20 ns and waveform frequencies from 1 Hz to 19.99 MHz. Read  $\pm$  DC voltages from a low 0.1 mV to 199.9 V with an accuracy of 0.75%. Separate, isolated inputs enable the IOA-4200 to measure voltages up to a higher  $\pm$  1000 volts. Features automatic placement of the decimal point, plus time and frequency unit indicators.

**Mark any portion of a waveform** displayed on the IO-4360 Oscilloscope with

variable scope reference and measurement cursors and easily obtain an instant readout of its period, frequency or pulse width. Just as easily, measure and display risetimes, burst or ringing frequencies, and the time difference between pulses.

**Polarity and overrange indicators** provide even more measuring convenience for the user of this low-profile accessory to the IO-4360 60 MHz Oscilloscope.

**Kit IOA-4200, Shpg. wt. 7 lbs. .... 349.95**

**IOA-4200 SPECIFICATIONS:** TIME: Ranges:  $\pm$ 10 s to  $\pm$ 2.0  $\mu$ s (1, 2, 5 fullscale sequence). Basic Accuracy:  $\pm$ 2% of reading,  $\pm$ 1 count. FREQ: Ranges:  $\pm$ 1.0 Hz to  $\pm$ 0.5 MHz (1, 2, 5 fullscale sequence). Maximum Display: 19.99 Hz on 100 ms to 19.99 MHz on 0.2  $\mu$ s. Accuracy:  $\pm$ 3%,  $\pm$ 1 cm. VDC (internal): Ranges:  $\pm$ 2 V, 2V on 2 mV to 50 mV; 2 V, 20 V on 100 mV to 0.5 V;  $\pm$ 20 V, 200 V on 1 V to 10 V; autoringing. Accuracy:  $\pm$ 1.0% ( $\pm$ 0.75%);  $\pm$ 2 cnts. EXT VDC: Ranges: 2 V to 2000 V; autoringing. Basic Accuracy:  $\pm$ 0.5% ( $\pm$ 0.25%),  $\pm$ 1 cnt. GENERAL: Display: 3 1/2 digit, LED, automatic minus for negative, positive implied. Dimensions: 1 1/2" H x 10 3/4" W x 9 3/4" D. \*Accuracy specs are for built-in calibration. Numbers in ( ) are for laboratory standards calibration.

## 3 5 MHz Dual and Single Trace Oscilloscopes

- Excellent 10 mV/cm input sensitivity with variable attenuation
- Triggered horizontal sweep stabilizes nearly all types of waveforms
- Special TV trigger coupling function allows easier TV signal triggering

**An outstanding value,** the IO-4205 Dual Trace Oscilloscope is a welcome addition to the laboratory, service shop, or home work shop. It is a compact, versatile and easy-to-build test instrument that lets you study waveforms in many different types of electronic circuits. Its many features provide the accuracy and capability found only in higher-priced oscilloscopes.

**The dual trace capability** of the IO-4205 enables you to directly compare two signals, as well as, check phase and other timing functions. And the 10 mV/cm input sensitivity and DC to 5 MHz bandwidth of the IO-4205, allows you to use it in many fast, low-level waveform applications.

**Seven calibrated time bases,** from 200 ms/cm to 0.2  $\mu$ s/cm, is another feature of this value-packed oscilloscope. In addition, each range is variable controlled for added accuracy and user convenience. With the IO-4205, you can even display X-Y signals by applying an external horizontal signal.

**A stable triggering circuit,** a feature found on more expensive scopes, brings the advantages of triggered sweep with automatic sync to the IO-4205. This scope also has a special TV setting in the triggering network which allows low frequencies to pass while rejecting high frequencies.

**Other features include** an 8 x 10 cm graticule and a bright CRT that allows the user to make quick and accurate waveform measurements without eye strain. A precise source of square waves like those provided by the IG-4505 (page 46) or the IG-4244 Calibrator (page 43) is needed to calibrate the IO-4205 Oscilloscope.

**Kit IO-4205, Shpg. wt. 25 lbs. .... 349.95**

**The IO-4105 Oscilloscope** is an excellent, low-priced alternative to situations where only a single trace oscilloscope is needed. It has all the features and performance of the IO-4205 Dual Trace Oscilloscope with only one vertical input channel. Also requires IG-4505 or IG-4244 for calibration.

**Kit IO-4105, Shpg. wt. 25 lbs. .... 279.95**

**IO-4205/IO-4105 SPECIFICATIONS:** Bandwidth: DC to 5 MHz,  $\pm$ 3 dB. Sensitivity: 10 millivolts/centimeter. Attenuator: 1-2-5 sequence, calibrated and variable. Rise Time: 70 nanoseconds. Overshoot: Less than or equal to 5 percent at 1 kilohertz. Impedance: 1 megohm, shunted by 38 picofarads. SWEEP: Type: Triggered. Range: 200 milliseconds to 0.2 microseconds in seven steps, plus variable. Trigger Source: Y1, Y2, External, Line. Trigger Modes: AC, DC or TV; plus or minus slope; automatic or normal. **HORIZONTAL:** Sensitivity: 0.1 volt/centimeter. Bandwidth: DC to 1 megahertz. Impedance: 1 megohm, shunted by 50 picofarads. External Horizontal Input: X1 and X10 attenuator, as well as variable. **GENERAL:** CRT: 5DEP31F, 8 x 10 centimeters viewing area, blue-green medium-persistence phosphor, 5-inch round flat-face tube. Accelerating Potential: Approximately 1.6 kilovolts. Graticule: Screened, 8 x 10 centimeters. **Power Requirements:** 120/240 VAC, 50/60 Hz. Overall Dimensions: 8" H x 13" W x 17" D.

## 4 Dual Trace 10 MHz Oscilloscope offers a wide range of measurement capability in a lab-grade instrument

**\$449<sup>95</sup>**

- Precise performance with a DC to 10 MHz response and a 35 ns rise time to accurately display high-speed square waves
- Two vertical input channels with eleven calibrated ranges from 10 mV/cm to 20 V/cm including variable control
- Calibrated time base ranges from 0.2 s/cm to 0.2  $\mu$ s/cm

**Combining excellent sensitivity, stability and versatility** with most desired features; Heath engineers have developed a laboratory-grade oscilloscope that is





