Fluke ScopeMeter® 120B Series—A strong automatic event capturing in-field recorder that gives you the data you need, when you need it

Capture intermittent events with ease

The ScopeMeter 120B Series combines the functionality of portable oscilloscope with the functionality of a smart recorder giving you an easy-to-use, robust in-field trouble shooting solution capable of capturing even the most elusive intermittent events.

Recording and logging functionality:

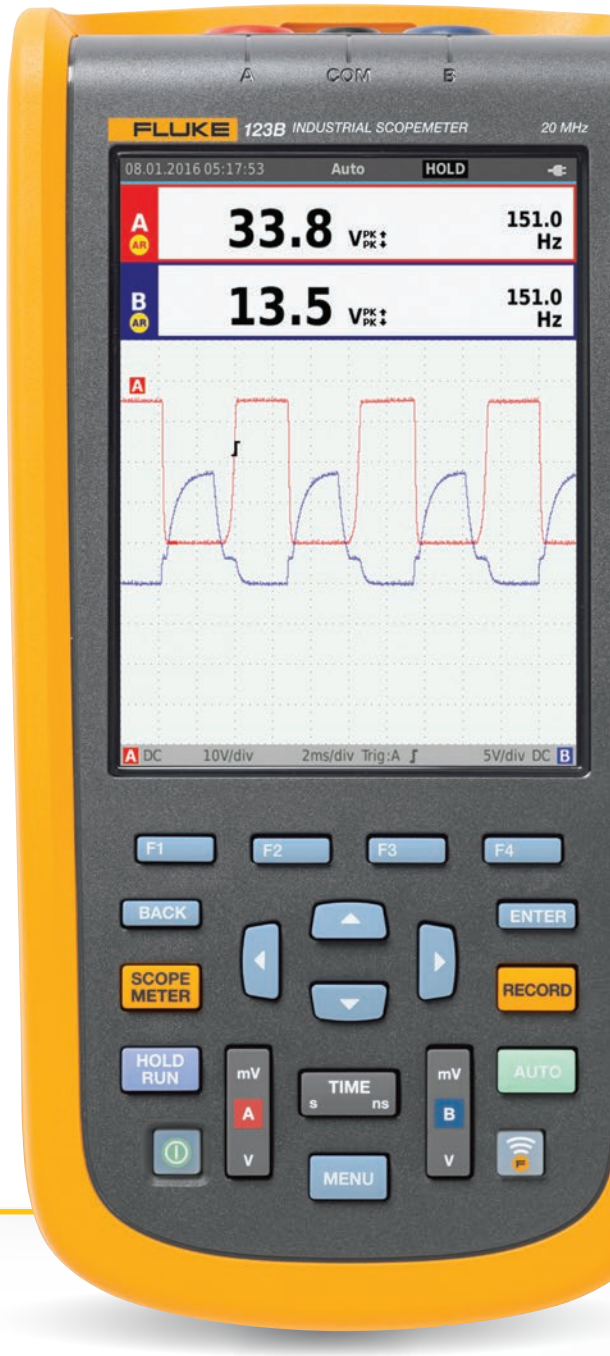
- Meter Recorder to log and trend meter readings over an extended period of time.
- Scope Recorder to continuously log waveforms for a long period without time gaps (as is the case in Scope and Meter mode).

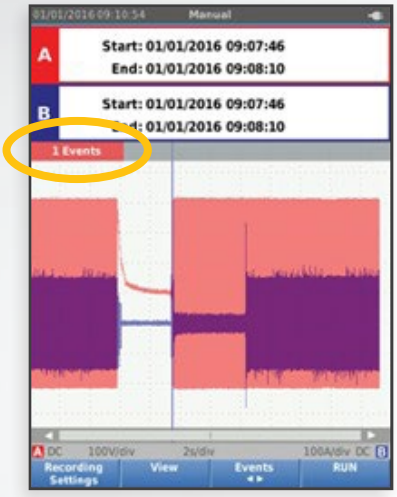
Automatic event capturing—find intermittent events quickly without searching through masses of data.

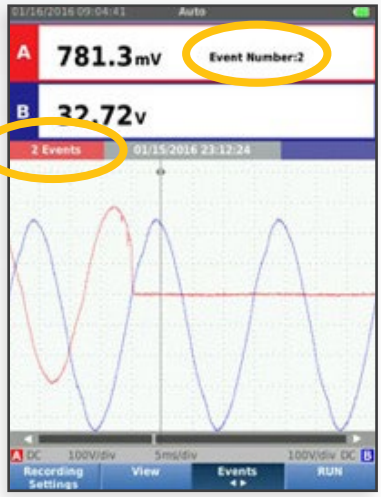
The integrated Meter Recorder allows the ScopeMeter 120B Test Tool to act as a paperless recorder that collects a series of parameter measurements over time, and then shows the result as a graph or a trend-line on screen. The integrated Scope Recorder captures waveforms. Additionally the applied input voltage is registered over time and the resulting waveform is stored in a long term memory record.

The Fluke ScopeMeter 120B Series not only captures critical waveform information, it also delivers the key data with both events incidents and trend data so you can better understand signal characteristics and changes over time.

Automatic event capturing makes detecting and logging of intermittent faults easier than ever. Just set a threshold on a meter or scope trace and deviations are tagged as unique events. You no longer need to search through masses of data to pinpoint faults, and can quickly step from one tagged event to the next while still having access to the full data set.





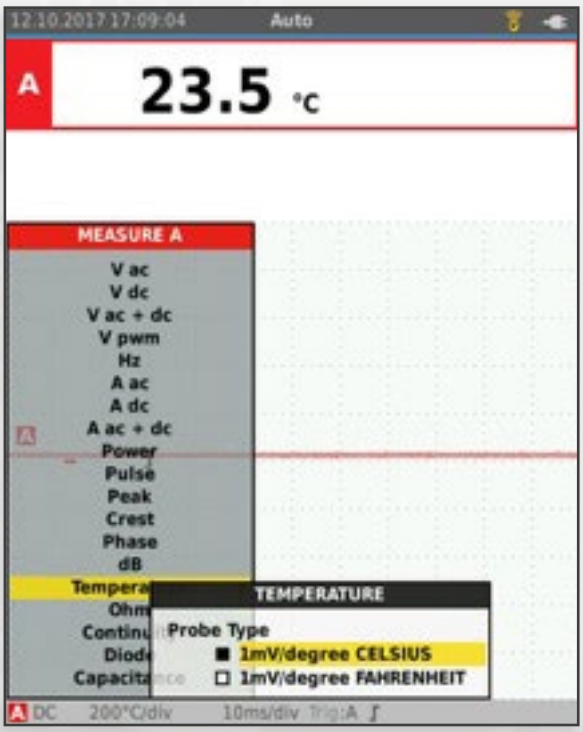


Recording period:

Recording mode	Maximum Number of Events	Internal memory (123B, 124B, and 125B)	32G Micro SD Card (124B, and 125B)
Meter recording	1,024	384 Hours	
Scope recording	64	15 minutes at 500 µs/div 11 hours at 20 ms/div	11 hours at 500 µs/divv 14 days at 20 ms/div

Recording more than electrical signal

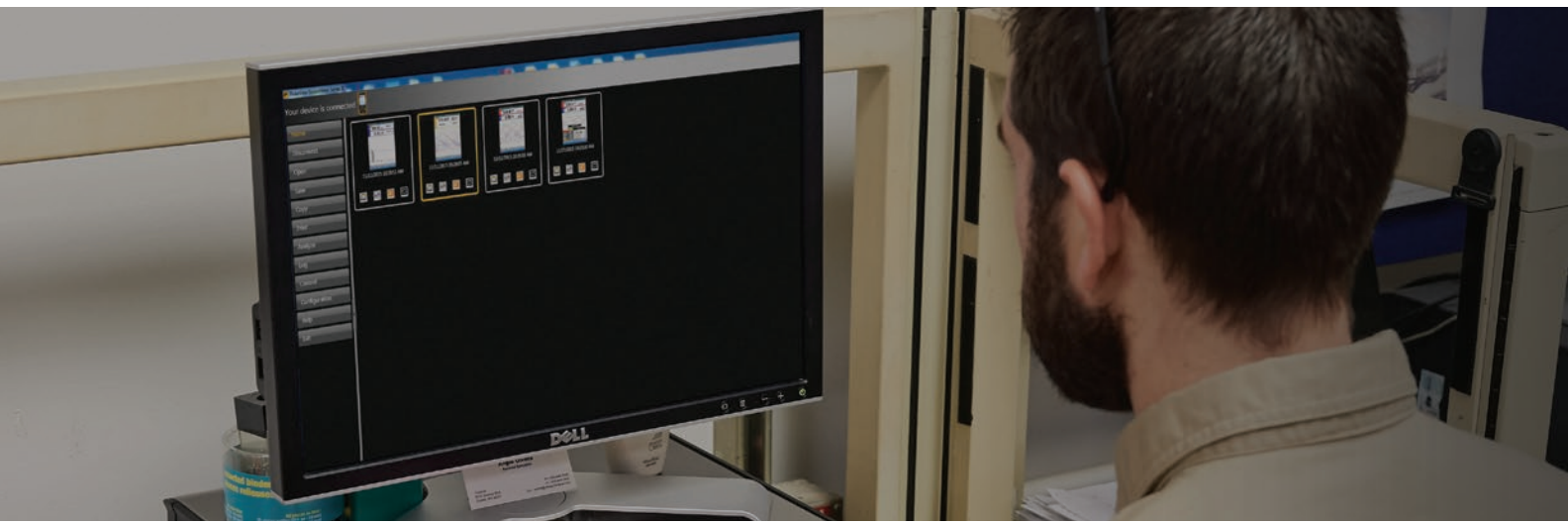
The 120B series can also record and display temperature in either Celsius or Fahrenheit with a temperature module or probe



80TK Temperature Module and
80T-150UA Temperature Probe

Industrial in-field rugged recorder:

- Dual-input waveform and meter reading recorder for trending data over extended periods
- Event Detect captures elusive intermittent signals on repetitive waveforms up to 4 kHz
- Shielded test leads for all measurements
- WiFi adapter connected to internal USB port to wirelessly transfer information to the PC, laptop or Fluke Connect® mobile app
- FlukeView® ScopeMeter Software for Windows®
- Rugged design to withstand 3g vibration, 30g shock, and rated IP51 according to EN/IEC60529
- Highest safety rating in the industry: safety rated for CAT IV 600 V
- Li-Ion rechargeable battery, seven-hours operation (with four-hour charge time)



APPLICATION NOTE

Making sense of electrical signals

Devices that convert electrical power to mechanical power run the industrial world, including pumps, compressors, motors, conveyors, robots and more. Voltage signals that control these electro-mechanical devices are a critical but unseen force. So how do you capture and see that unseen force?

Oscilloscopes (or scopes) test and display voltage signals as waveforms, visual representations of the variation of voltage over time. The signals are plotted on a graph, which shows how the signal changes. The vertical (Y) access represents the voltage measurement and the horizontal (X) axis represents time.

Most of today's oscilloscopes are digital, which enables more detailed accurate signal measurements and fast calculations, data storage capabilities and automated analysis. Handheld digital oscilloscopes such as the Fluke ScopeMeter® Test Tools offer several advantages over benchtop models: They are battery operated, use electrically isolated floating inputs and also offer the advantage of embedded features that make oscilloscope usage easier and more accessible to a variety of workers.

The newest generation of ScopeMeter® Portable Oscilloscopes are designed to be operated quickly and easily in the field and can even share readings in real time over a smartphone app in order to receive consultation from colleagues or other experts, or to save data in the cloud for further analysis.

These designs also make safety-certified measurements possible in CAT III 1000 V and CAT IV 600 V environments—a critical need for safely troubleshooting electrical devices in high-energy applications.

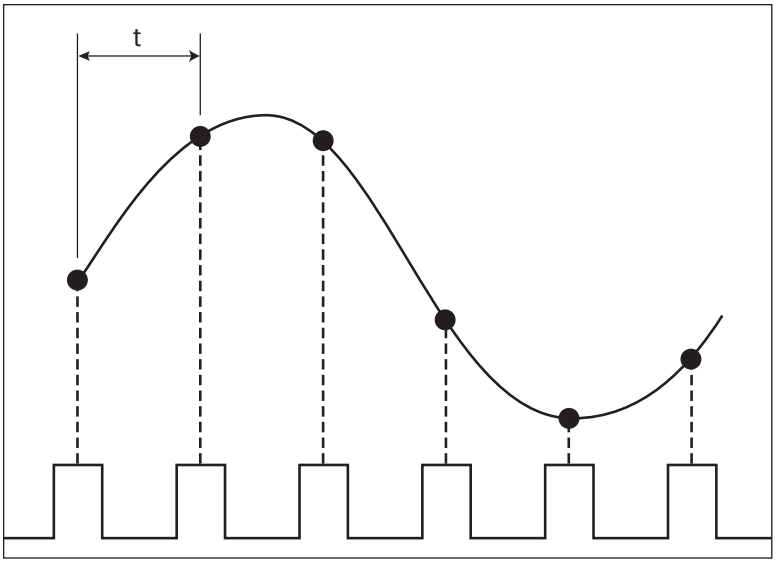
Multimeter vs. oscilloscope

The difference between an oscilloscope and a DMM (Digital Multimeter) can be most simply stated as "pictures vs. numbers." A DMM is a tool for making precise measurements of discrete signals, enabling readings of up to eight digits of resolution for the voltage, current or frequency of a signal. On the other hand, it cannot depict waveforms visually to reveal signal strength, wave shape, or the instantaneous value of the signal. Nor is it equipped to reveal a transient or a harmonic signal that could compromise the operation of a system.

An oscilloscope adds a wealth of information to the numeric readings of a DMM. While displaying the numerical values of a wave instantaneously, it also

The graph on an oscilloscope can reveal important information:

- The voltage and current signals when operating as intended
- Signal anomalies
- Calculated frequency of an oscillating signal and any variations in frequency
- Whether signal includes noise and changes to the noise



Sampling and interpolation: sampling is depicted by the dots while interpolation is shown as the black line.

reveals the shape of the wave, including its amplitude (voltage) and frequency.

With such visual information, a transient signal that may pose a threat to a system can be displayed, measured and isolated.

Reach for an oscilloscope if you want to make both quantitative and qualitative measurements. Use a DMM to make high-precision checks of voltage, current, resistance and other electrical parameters.

ScopeMeter® Hand-Held Oscilloscope functions

Sampling

Sampling is the process of converting a portion of an input signal into a number of discrete electrical values for the purpose of storage, processing and display. The magnitude of each sampled point is equal to the amplitude of the input signal at the time the signal is sampled.

The input waveform appears as a series of dots on the display. If the dots are widely spaced and difficult to interpret as a waveform, they can be connected using a process called interpolation, which connects the dots with lines, or vectors.

Triggering

Trigger controls allow you to stabilize and display a repetitive waveform.

Edge triggering is the most common form of triggering. In this mode, the trigger level and slope controls provide the basic trigger point definition. The slope control determines whether the trigger point is on the rising or the falling edge of a signal, and the level control determines where on the edge the trigger point occurs.

When working with complex signals like a series of pulses, pulse width triggering may be required. With this technique, both the trigger-level setting and the next falling edge of the signal must occur within a specified time span. Once these two conditions are met, the oscilloscope triggers.

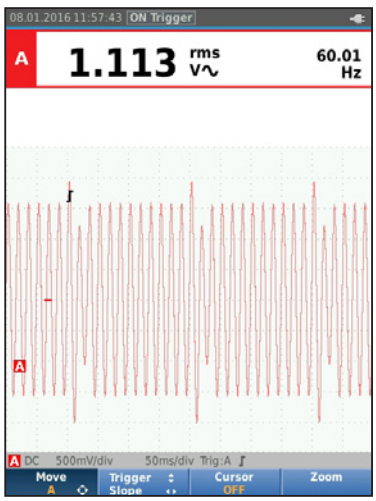
Another technique is single-shot triggering, by which the oscilloscope will display a trace only when the input signal meets the set trigger conditions. Once the trigger conditions are met, the oscilloscope acquires and updates the display, and then freezes the display to hold the trace.

Getting a signal on the screen

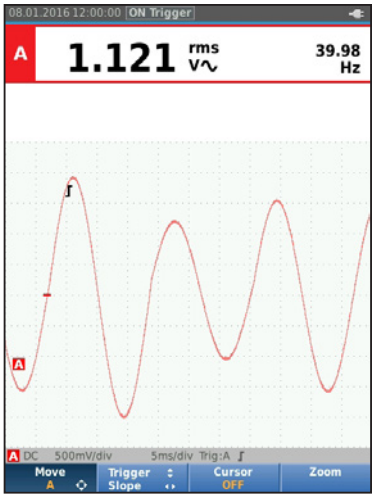
The task of capturing and analyzing an unknown waveform on an oscilloscope can be routine, or it can seem like taking a shot in the dark. In many cases, taking a methodical approach to setting up the oscilloscope will capture a stable waveform or help you determine how the scope controls need to be set so that you can capture the waveform.

The traditional method of getting a signal to show properly on an oscilloscope is to manually adjust three key parameters to try to achieve an optimum setpoint—often without knowing the correct variables:

- **Vertical sensitivity.** Adjusts the vertical sensitivity so that the vertical amplitude spans approximately three to six divisions.

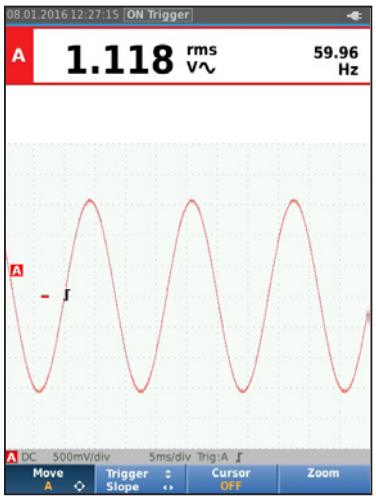


Unknown trace adjusted for 3–6 vertical divisions.

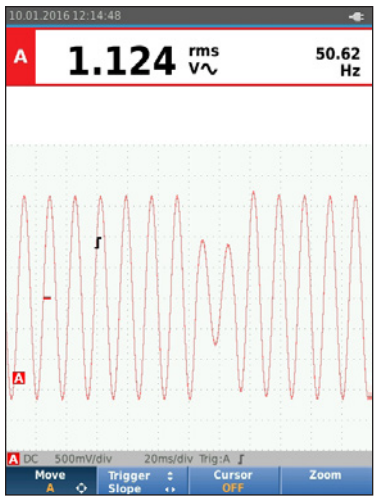


Unknown trace adjusted for 3–4 periods horizontally.

- **Horizontal timing.** Adjusts the horizontal time per division so that there are three to four periods of the waveform across the width of the display.
- **Trigger position.** Sets the trigger position to a point of the vertical amplitude. Depending on the signal characteristics, this action may or may not result in a stable display.



Trigger level adjusted to a unique repetitive position, outside the aberration on the second period.



Trigger point is set to a point but due to the aberration on the leading edge in the second period, an additional trigger results in an unstable display.

Those three parameters, when adjusted properly show you a symmetrical "trace," the line that connects the samples of the signal to create the visual depiction of the waveform. Waveforms can vary indefinitely from the most common sine-wave that ideally mirrors between positive and negative on the zero axis point or a unidirectional square wave typical of electronic pulses, or even a shark tooth form.

The manual setup method often requires tediously adjusting the settings to make the waveform readable in order to analyze it.

Automating setup

In contrast, Fluke ScopeMeter® Hand-held Oscilloscopes include a technology called Connect-and-View™ that automates the process of digitizing the analog waveform to see a clear picture of the signal. Connect-and-View adjusts the vertical and horizontal timing and the trigger position for you, enabling hands-off operation to display complex unknown signals. This function optimizes and stabilizes the display on nearly all waveforms. If the signal changes, the setup will track these changes.

By pressing the AUTO button you enable Connect-and-View. At this point you should see a trace that 1) lies within the vertical range of the display, 2) shows at least three periods of a waveform, and 3) is stable enough to allow you to recognize the overall characteristics of the waveform. Next, you can start fine-tuning the settings.

Understanding and reading waveforms

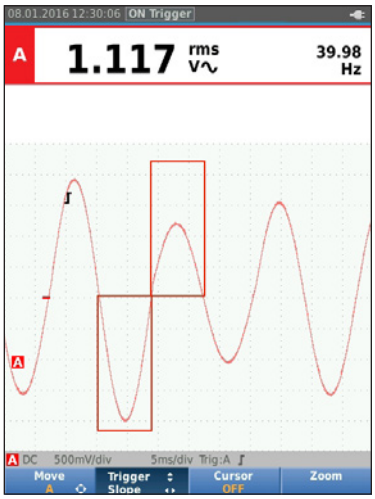
The majority of electronic waveforms encountered are periodic and repetitive, and they conform to a known shape. However, there are several wave characteristics to consider in order to train your eye to look at the various dimensions.

Some Fluke ScopeMeter® Test Tools offer a proprietary onboard algorithm called IntellaSet™ to assist waveform analysis. Once the waveform is displayed on screen, if initiated, the new IntellaSet™ technology evaluates the signal and associated waveform by comparing it against a database of known waveforms. The ScopeMeter® Test Tool then intelligently suggests critical measurements to characterize the unknown signal so potential areas of concern can be identified. As an example, when the measured waveform is a line voltage signal, the V ac + dc and Hz readings are automatically displayed.

While intelligent programs help minimize the time it takes to scrutinize waveforms, it's important to know what to look for when using an oscilloscope.

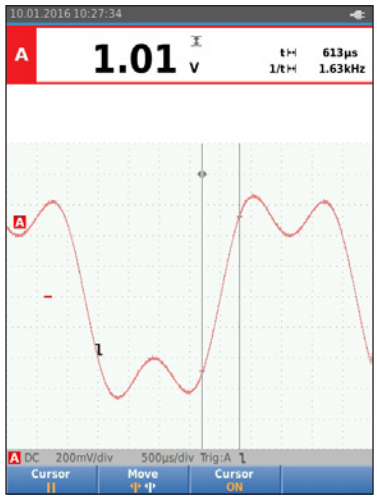
Here are the factors to consider in analyzing waveforms:

Shape. Repetitive waveforms should be symmetrical. That is, if you were to print the traces and cut them in two like-sized pieces, the two sides should be identical. A point of difference could indicate a problem.



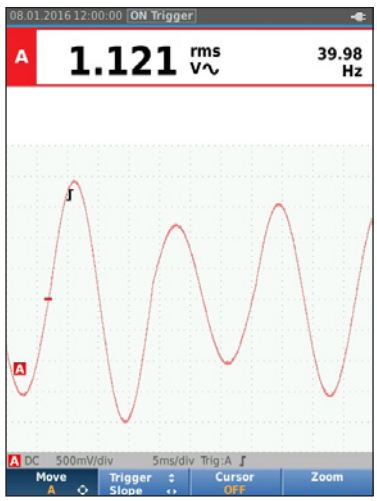
If the two components of the waveform are not symmetrical, there may be a problem with the signal.

Rising and falling edges. Particularly with square waves and pulses, the rising or falling edges of the waveform can greatly affect the timing in digital circuits. It may be necessary to decrease the time per division to see the edge with greater resolution.



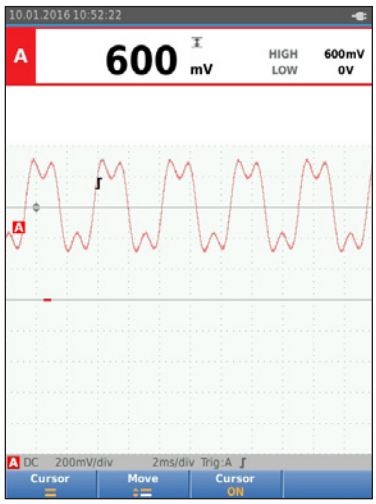
Use cursors and the gridlines to evaluate the rise and fall times of the leading and trailing edges of a waveform.

Amplitude. Verify that the level is within the operating specifications of the circuit. Also check for consistency, from one period to the next. Monitor the waveform for an extended period of time, watching for any changes in amplitude.



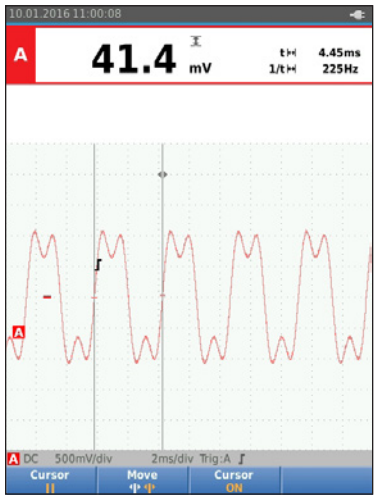
Use horizontal cursors to identify amplitude fluctuations.

Amplitude offsets. DC-couple the input and determine where the ground reference marker is. Evaluate any dc offset and observe if this offset remains stable or fluctuates.



Evaluate waveform dc offsets.

Periodic wave shape. Oscillators and other circuits will produce waveforms with constant repeating periods. Evaluate each period in time using cursors to spot inconsistencies.

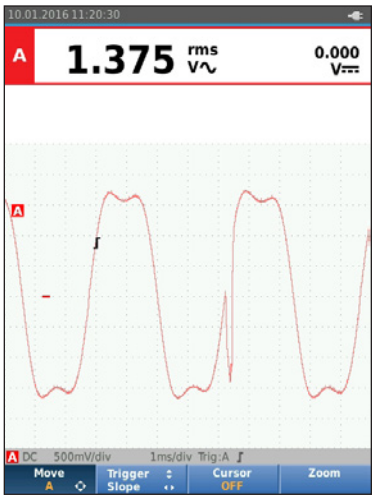


Evaluate period-to-period time changes.

Waveform anomalies

Here are typical anomalies that may appear on a waveform, along with the typical sources of such anomalies.

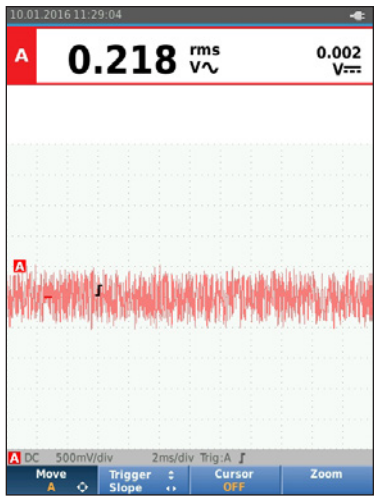
Transients or glitches. When waveforms are derived from active devices such as transistors or switches, transients or other anomalies can result from timing errors, propagation delays, bad contacts or other phenomena.



A transient is occurring on the rising edge of a pulse.

Noise. Noise can be caused by faulty power supply circuits, circuit overdrive, crosstalk, or interference from adjacent cables.

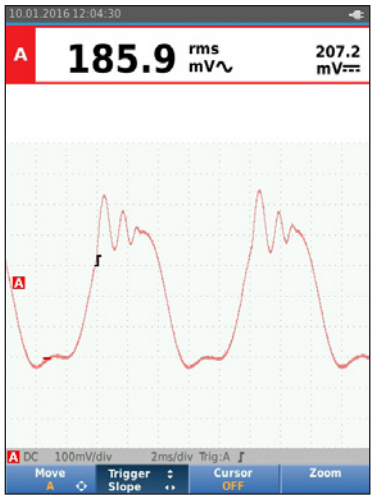
Or, noise can be induced externally from sources such as dc-dc converters, lighting systems and high-energy electrical circuits.



A ground reference-point measurement showing induced random noise.

Ringing. Ringing can be seen mostly in digital circuits and in radar and pulse-width-modulation applications. Ringing shows up at the transition from a rising or falling edge to a flat dc level.

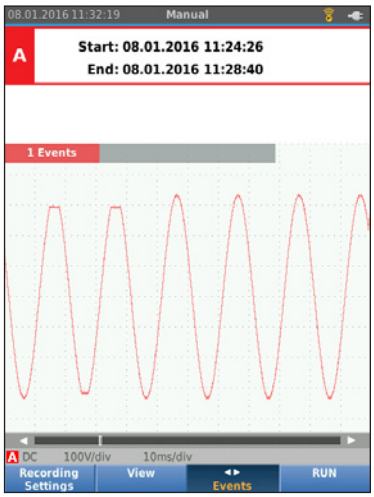
Check for excessive ringing, adjusting the time base to give a clear depiction of the transitioning wave or pulse.



Excessive ringing occurring on the top of the square wave.

Momentary fluctuation

Momentary changes in the measured signal generally result from an external influence such as a sag or surge in the main voltage, activation of a high-power device that is connected to the same electrical circuit, or a loose connection. Use the ScopeRecord function and Event Capture mode of the ScopeMeter Test Tool to monitor the signal over long periods of time to detect the elusive momentary events.



A momentary change of approximately 1.5 cycles in the amplitude of the sinewave.

Diagnosing problems and troubleshooting

Although successful troubleshooting is both an art and a science, adopting a troubleshooting methodology and relying on the functionality of an advanced ScopeMeter® Hand-held Oscilloscope can greatly simplify the process.

Good troubleshooting practices will save time and frustration. The time-tested approach known as KGU, Known Good Unit comparison, accomplishes both goals. KGU builds on a simple principle: an electronic system that is working properly exhibits predictable waveforms at critical nodes within its circuitry, and these waveforms can be captured and stored.

This reference library can be stored on the ScopeMeter Test Tool as a resource or transmitted via the Fluke Connect® app to a smartphone and to the cloud. It can also be printed out to serve as a hard-copy reference document. If the system or an identical system later exhibits a fault or failure, waveforms can be captured from the faulty system—called the Device Under Test (DUT)—and compared with their counterparts in the KGU. Consequently, the DUT can either be repaired or replaced.

To build a reference library, start by identifying appropriate test points, or nodes, on the DUT.

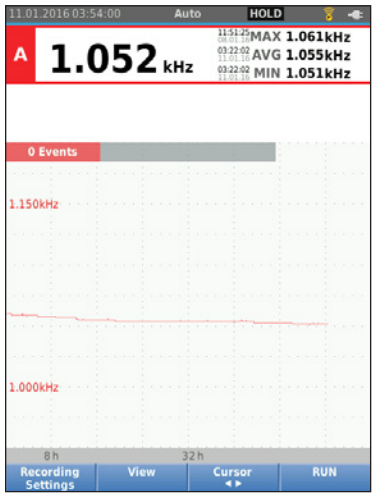
Now, run the KGU through its paces, capturing the waveform from each node. Annotate each waveform as required.

Get into the habit of always documenting key waveforms and measurements. Having a reference to compare to will prove invaluable during future troubleshooting.

When troubleshooting, it's important to inspect waveforms for fast-moving transients or glitches, even if a spot check of the waveform reveals no anomalies.

These events can be difficult to spot, but the high sampling rate of today's ScopeMeter Test Tools, together with effective triggering, make it possible. In addition, the recording capabilities of the latest ScopeMeter Test Tools can trend critical test point electrical signals over time, identifying changes or random events that occur outside of user defined thresholds and cause system shutdowns or resets.

Drift. Drift—or minor changes in a signal's voltage over time—can be tedious to diagnose. Often the change is so slow that it is difficult to detect. Temperature changes and aging can affect passive electronic components such as resistors, capacitors and crystal oscillators. One problematic fault to diagnose is drift in a reference dc voltage supply or oscillator circuit. Often the only solution is to monitor the measured value (V dc, Hz, etc.) over an extended time.



Performing a frequency measurement on a crystal oscillator that has been trend-plotted over an extended period (days or even weeks) can highlight the effect of drift caused by temperature changes and aging.

CAUTION: For the correct and safe use of electrical test tools it is essential that operators follow safety procedures as outlined by their company and local safety agencies.

TECHNICAL DATA

Fluke 120B Series Industrial ScopeMeter® Hand-Held Oscilloscopes

600 V CAT IV

KEY MEASUREMENTS

Voltage, current and power waveforms with numerical values including harmonics, resistance, diode, continuity and capacitance measurements.

AUTOMATICALLY CAPTURE, VIEW AND ANALYZE COMPLEX WAVEFORMS

Fluke Connect and View™ triggering automatically displays waveforms without having to adjust amplitude, timebase and trigger settings, while Intellaset™ technology analyzes the signal and automatically displays critical numerical readings, making troubleshooting faster than ever.

FLUKE CONNECT® COMPATIBLE*

View data locally on the instrument, or via Fluke Connect mobile app.

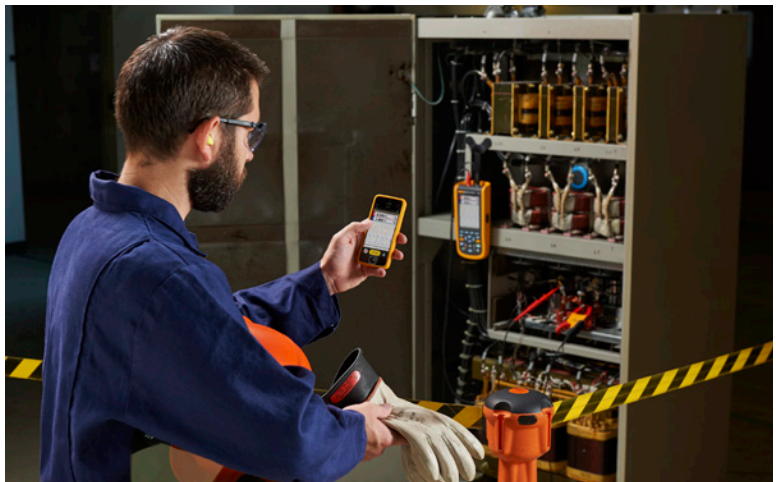
*Not all models are available in all countries. Check with your local Fluke representative.

Simplified testing, more insight and faster electro-mechanical troubleshooting

The compact ScopeMeter® 120B Series, is the rugged oscilloscope solution for industrial electrical and electro-mechanical equipment troubleshooting and maintenance applications. It's a truly integrated test tool, with oscilloscope, multimeter and high-speed recorder in one easy-to-use instrument. The ScopeMeter 120B Series also integrates with Fluke Connect® mobile app and FlukeView® for ScopeMeter software to enable further collaboration, data analysis and archiving of critical test information.

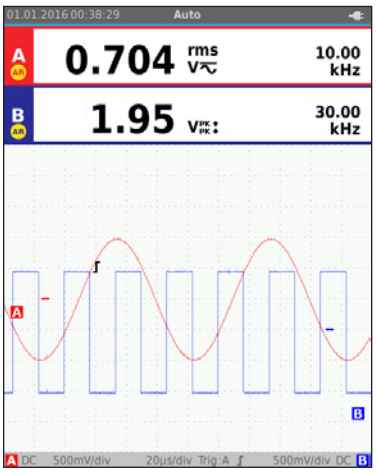
The 120B Series Industrial ScopeMeter Test Tools include innovative functions designed to help technicians troubleshoot faster and get the answers they need to keep their systems up and running. Display waveforms with Connect and View™ trigger and setup technology and automatically view related numerical measurements using Fluke IntellaSet™ technology, all without making manual measurement adjustments. With Recorder Event Detect capabilities, elusive intermittent events are captured and logged for easy viewing and analysis.

- Dual-input digital oscilloscope and multimeter
- 40 MHz or 20 MHz oscilloscope bandwidth
- Two 5,000-count true-rms digital multimeters
- Connect-and-View™ trigger simplicity for hands-off operation
- IntellaSet™ technology automatically and intelligently adjusts numerical readout based on the measured signal
- Dual-input waveform and meter reading recorder for trending data over extended periods
- Recorder Event Detect captures elusive intermittent signals on repetitive waveforms up to 4 kHz



- Shielded test leads for oscilloscope, resistance and continuity measurements
- Resistance, continuity, diode and capacitance meter measurements
- Power measurements (W, VA, VAR, PF, DPF, Hz)
- Voltage, current and power harmonics
- Check Industrial networks with BusHealth physical layer tests against defined reference levels
- Save or recall data and instrument setups
- Store instrument setups defined by a test sequence for routine maintenance or most often used test procedures.
- External optically isolated USB interface to transfer, archive and analyze scope or meter data
- Optional WiFi adapter connected to internal USB port to wirelessly transfer information to the PC, laptop or Fluke Connect® mobile app*
- FlukeView® ScopeMeter® Software for Windows®
- Rugged design to withstand 3g Vibration, 30g shock, and rated IP51 according to EN/IEC60529
- Highest safety rating in the industry: safety rated for CAT IV 600 V
- Li-Ion rechargeable battery, seven-hours operation (with four-hour charge time)

*Not all models are available in all countries. Check with your local Fluke representative.



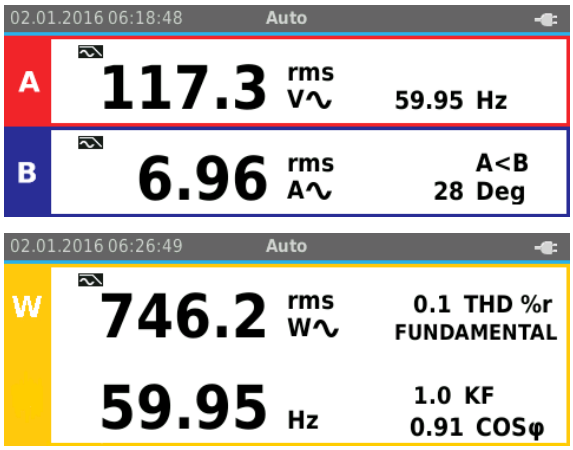
Fluke Connect-and-View™ triggering with Auto Reading function using Fluke IntellaSet™ technology gives you quick access to the data you need.

Connect-and-View™ triggering for an instant, stable display

Oscilloscope users know how difficult triggering can be. Using the wrong settings can lead to unstable waveform captures, and sometimes the wrong measurement data. Fluke's unique Connect-and-View™ triggering technology recognizes signal patterns, and automatically sets up the correct triggering to provide a stable, reliable and repeatable display. Connect-and-View™ triggering is designed to work with virtually any signal, including motor drives and control signals—without adjusting parameters, or even touching a button. Signal changes are instantly recognized and settings are automatically adjusted, providing a stable display even when measuring multiple test points in quick succession.

IntellaSet™/AutoReading

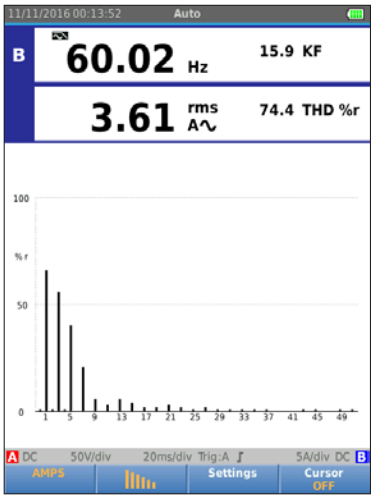
The Auto Readings function with Fluke IntellaSet™ technology uses proprietary algorithms to intelligently analyze the measured waveform and automatically displays the most appropriate numerical measurements on screen, so you can get the data you need easier than ever before. As an example, when the measured waveform is a line voltage signal, the Vrms and Hz readings are automatically displayed, whereas if the measured waveform is a square wave, the Vpeak-peak and Hz readings are automatically displayed. Using IntellaSet™ technology in conjunction with Connect-and-View™ automatic triggering you can be sure you're seeing not only the correct waveform, but the appropriate numerical reading as well. All without touching a button.



Easily obtain key power characteristics to validate a system power.

Industrial equipment needs a reliable power supply to operate properly, use the dual input to obtain key power measurements.

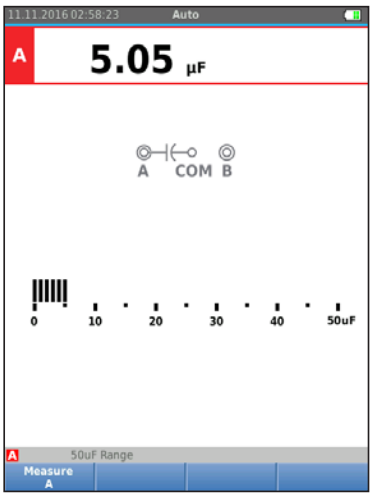
For single phase or 3-phase balanced systems, the dual inputs of the Industrial ScopeMeter® 120B Series can measure ac+dc rms voltage on channel A and ac+dc rms current on channel B. The Fluke 125B can then calculate; frequency, phase angle, active power (kW), reactive power (VA or var), power factor (PF) or displacement power factor (DPF) and can also calculate the power values for a 3-phase system where all phases have equal voltage and currents. This applies to both balanced system and resistive loads.



Harmonic spectrum overview with cursors to measure the distortion as a percentage of the fundamental.

Harmonics measurements

Harmonics are periodic distortions of voltage, current, or power sine waves. Harmonics in power distribution systems are often caused by non-linear loads such as switched mode dc power supplies and adjustable speed motor drives. Harmonics can cause transformers, conductors, and motors to overheat. In the Harmonics function, the Test Tool measures harmonics to the 51st. Related data such as dc components, THD (Total Harmonic Distortion), and K factor are measured to provide a complete insight in to the electrical state of health of your loads.



A single test tool measures volts, ohms, amps or capacitance, in addition to displaying waveforms.

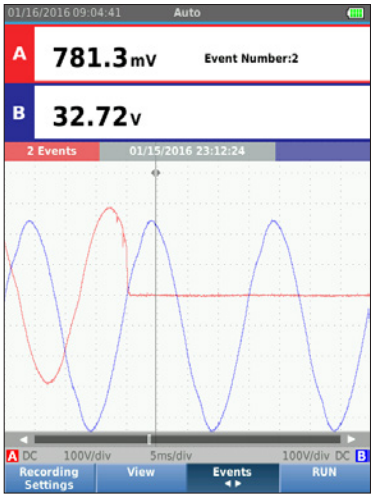
One test lead to measure multiple electrical parameters

High frequency waveform, meter, capacitance and resistance measurements as well as continuity checks are all covered by single set of shielded test leads. No time is wasted finding or swapping leads.

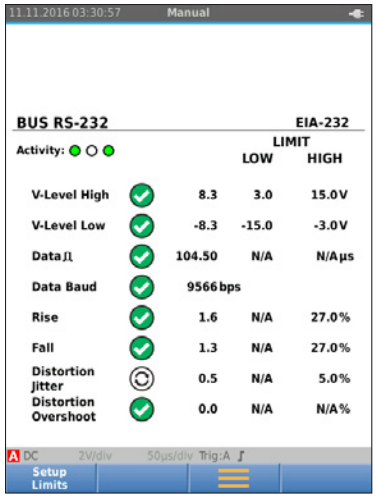
FlukeView® ScopeMeter® Software for Windows®

Get more out of your ScopeMeter 120B with FlukeView® Software:

- Store instrument's screen copies on the PC, in color
- Copy screen images into your reports and documentation
- Capture and store waveform data from your ScopeMeter on your PC
- Create and archive waveform references for easy comparison
- Copy waveform data into your spreadsheet for detailed analysis
- Use cursors for parameter measurement
- Add user text to instrument setups and send them to the instrument for operator reference and instructions



Quickly step through recorded events to identify and troubleshoot intermittent faults.



Quickly understand industrial field bus signal physical layer analog characteristics.

Fluke Connect mobile app compatibility

Automated industrial machinery is harder than ever to trouble shoot. It's not enough to just know where you have to test, you also have to know what to look for—and that can be hard without baseline measurement data or access to subject matter experts. The Fluke Connect® Assets wireless system of software and wireless test tools enables technicians to reduce maintenance costs and increase uptime with accurate equipment records and maintenance data that is easy to interpret, and share. Compare and contrast test point measurement data and trends so you can better understand signal characteristics and changes over time. And, by storing maintenance data on the Fluke Cloud™ you can enable team members to access it from wherever and whenever they need to so you can get advice or approvals in the field and get your systems up and running faster than ever before.

Use the comprehensive recorder modes to help find intermittent faults with ease

The toughest faults to find are those that happen only once in a while—intermittent events. They can be caused by bad connections, dust, dirt, corrosion or simply broken wiring or connectors. Other factors, like line outages and sags or the starting and stopping of a motor, can also cause intermittent events resulting in equipment shutdowns. When these events happen, you may not be around to see it. But, your Fluke ScopeMeter® Test Tool will. You can either plot the minimum and maximum peak measurement values or record the waveform trace. And, with expandable micro SD memory, recording sessions can be done for up to 14 days. This recorder is even more powerful with the addition of Recorder Event Detect, which makes detecting and logging intermittent faults easier than ever. Just set a threshold on a meter reading or scope trace and deviations are tagged as unique events. You no longer need to search through masses of data to pinpoint faults, and can quickly step from one tagged event to the next, while still having access to the full data set.

Industrial Bus Health Test verifies electrical signal quality on industrial buses

Bus Health Test analyzes the electrical signals on the industrial bus or network and gives a clear "Good", "Weak" or "Bad" indication mark for each of the relevant parameters, presented next to the actual measurement value. Measured values are compared to standard values based on the selected bus types (CAN-bus, Profi-bus, Foundation Field, RS-232 and many more), or, unique reference values can be set if different tolerances are required. The Fluke 125B can validate the quality of the electrical signals as soon as they are passed along the network, without looking at the data content. Additionally, the 125B checks the signal levels and speed, transition times and distortion, and compares these to the appropriate standards to help you find errors such as improper cable connections, bad contacts, incorrect grounding or improper terminators.

FLUKE®

Specifications

Oscilloscope mode		
Vertical		
Frequency response – dc coupled	without probes and test leads (with BB120)	123B: dc to 20 MHz (–3 dB) 124B and 125B: dc to 40 MHz (–3 dB)
	with STL120-IV 1:1 shielded test leads	DC to 12.5 MHz (–3 dB) / dc to 20 MHz (–6 dB)
	with VP41 10:1 Probe	123B: dc to 20MHz (–3 dB) 124B and 125B: dc to 40 MHz (–3 dB)
Frequency response – ac coupled (lf roll off)	without probes and test leads	<10 Hz (–3 dB)
	with STL120-IV 1:1 shielded test leads	<10 Hz (–3 dB)
	with VP41 10:1 Probe	<10 Hz (–3 dB)
Rise time, excluding probes, test leads	123B <17.5 ns 124B and 125B <8.75 ns	
Input impedance	without probes and test leads	1 MΩ//20 pF
	with BB120	1 MΩ//24 pF
	with STL120-IV 1:1 shielded test leads	1 MΩ//230 pF
	with VP41 10:1 Probe	5 MΩ//15.5 pF
Sensitivity	5 mV to 200 V/div	
Analog bandwidth limiter	10 kHz	
Display modes	A, -A, B, -B	
Max. input voltage A and B	direct, with test leads, or with VP41 Probe	600 Vrms CAT IV, 750 Vrms maximum voltage.
	with BB120	600 Vrms
Max. floating voltage, from any terminal to ground	600 Vrms CAT IV, 750 Vrms up to 400Hz	
Horizontal		
Scope modes	Normal, Single, Roll	
Ranges (Normal)	Equivalent sampling	123B: 20 ns to 500 ns/div,
		124B and 125B: 10 ns to 500 ns/div
	Real time sampling	1 µs to 5 s/div
	Single (real time)	1 µs to 5 s/div
	Roll (real time)	1s to 60 s/div
Sampling rate (for both channels simultaneously)	Equivalent sampling (repetitive signals)	up to 4 GS/s
	Real time sampling 1 µs to 60 s/div	40 MS/s
Trigger		
Screen update	Free run, on trigger	
Source	A, B	
Sensitivity A and B	@ DC to 5 MHz	0.5 divisions or 5 mV
	@ 40 MHz	123B: 4 divisions
		124B and 125B: 1.5 divisions
	@ 60 MHz	123B: N/A
		124B and 125B: 4 divisions
Slope	Positive, negative	
Advanced scope functions		
Display modes	Normal	Captures up to 25 ns glitches and displays analog-like persistence waveform.
	Smooth	Suppresses noise from a waveform.
	Glitch off	Does not capture glitches between samples
	Envelope	Records and displays the minimum and maximum of waveforms over time.
Auto set (Connect-and-View™)	Continuous fully automatic adjustments of amplitude, time base, trigger levels, trigger gap, and hold-off. Manual override by user adjustment of amplitude, time base, or trigger level.	

Dual input meter		
The accuracy of all measurements is within ± (% of reading + number of counts) from 18 °C to 28 °C.		
Add 0.1x (specific accuracy) for each °C below 18 °C or above 28 °C. For voltage measurements with 10:1 probe, add probe uncertainty +1 %. More than one waveform period must be visible on the screen.		
Input A and input B		
DC voltage (VDC)		
Ranges	500 mV, 5 V, 50 V, 500 V, 750 V	
Accuracy	± (0.5 % +5 counts)	
Common mode rejection (CMRR)	>100 dB @ dc, >60 dB @ 50, 60, or 400 Hz	
Full scale reading	5000 counts	
True-rms voltages (V ac and V ac+dc)		
Ranges	500 mV, 5 V, 50 V, 500 V, 750 V	
Accuracy for 5 % to 100 % of range (DC coupled)	DC to 60 Hz (V ac+dc)	± (1 % +10 counts)
	1 Hz to 60 Hz (V ac)	± (1 % +10 counts)
Accuracy for 5 % to 100 % of range (AC or dc coupled)	60 Hz to 20 kHz	± (2.5 % +15 counts)
DC rejection (only VAC)	>50 dB	
Common mode rejection (CMRR)	>100 dB @ dc	
	>60 dB @ 50, 60, or 400 Hz	
Full scale reading	5000 counts, reading is independent of any signal crest factor.	
Peak		
Modes	Max peak, Min peak, or pk-to-pk	
Ranges	500 mV, 5 V, 50 V, 500 V, 2200 V	
Accuracy	Accuracy Max peak or Min peak	5 % of full scale
	Accuracy Peak-to-Peak	10 % of full scale
Full scale reading	500 counts	
Frequency (Hz)		
Ranges	123B: 1 Hz, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz,1 MHz, 10 MHz, and 50 MHz	
	124B and 125B: 1 Hz, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz, 10 MHz, and 70 MHz	
Frequency range	15 Hz (1 Hz) to 50 MHz in continuous autoset	
Accuracy @1 Hz to 1 MHz	± (0.5 % +2 counts)	
Full scale reading	10 000 counts	
RPM		
Max reading	50.00 kRPM	
Accuracy	± (0.5 % +2 counts)	
Duty cycle (PULSE)		
Range	2 % to 98 %	
Frequency range	15 Hz (1 Hz) to 30 MHz in continuous autoset	
Pulse width (PULSE)		
Frequency range	15 Hz (1 Hz) to 30 MHz in continuous autoset	
Full scale reading	1000 counts	
Amperes (AMP)		
With current clamp	Ranges	same as V dc, V ac, V ac+dc, or PEAK
	Scale factors	0.1 mV/A, 1 mV/A, 10 mV/A, 100 mV/A, 400 mV/A, 1 V/A, 10 mV/mA
	Accuracy	same as V dc, V ac, V ac+dc, or PEAK (add current clamp uncertainty)

Temperature (TEMP) with optional temperature probe		
Range	200 °C/div (200 °F/div)	
Scale factor	1 mV/°C and 1 mV/°F	
Accuracy	as V dc (add temp. probe uncertainty)	
Decibel (dB)		
0 dBV	1 V	
0 dBm (600 Ω /50 Ω)	1 mW referenced to 600 Ω or 50 Ω	
dB on	V dc, V ac, or Vac+dc	
Full scale reading	1000 counts	
Crest factor (CREST)		
Range	1 to 10	
Full scale reading	90 Counts	
Phase		
Modes	A to B, B to A	
Range	0 to 359 degrees	
Resolution	1 degree	
Power (125B only)		
Configurations	1 phase / 3 phase 3 conductor balanced loads (3 phase: fundamental component only, AUTOSET mode only)	
Power factor (PF)	Ratio between watts and VA range – 0.00 to 1.00	
Watt	RMS reading of multiplying corresponding samples of input A (volts) and input B (amperes)	
	Full scale reading	999 counts
VA	Vrms x Arms	
	Full scale reading	999 counts
VA reactive (var)	$\sqrt{((VA)^2-W^2)}$	
	Full scale reading	999 counts
Vpwm		
Purpose	to measure on pulse width modulated signals, like motor drive inverter outputs	
Principle	readings show the effective voltage based on the average value of samples over a whole number of periods of the fundamental frequency	
Accuracy	as Vrms for sinewave signals	
Input A to common		
Ohm (Ω)		
Ranges	123B and 124B	500 Ω , 5 kΩ, 50 kΩ, 500 kΩ, 5 MΩ, 30 MΩ
	125B	50 Ω, 500 Ω , 5 kΩ, 50 kΩ, 500 kΩ, 5 MΩ, 30 MΩ
Accuracy	± (0.6 % + 5 counts) 50 Ω ±(2 % + 20 counts)	
Full scale reading	50 Ω to 5 MΩ – 5000 counts, 30 MΩ – 3000 counts	
Measurement current	0.5 mA to 50 nA, decreases with increasing ranges	
Open circuit voltage	<4 V	
Continuity (Cont)		
Beep	<(30 Ω ± 5 Ω) in 50 Ω range	
Measurement current	0.5 mA	
Detection of shorts of	≥1 ms	
Diode		
Measurement voltage	@0.5 mA	>2.8 V
	@open circuit	<4 V
Measurement current	0.5 mA	
Polarity	+ on input A, – on COM	

Capacitance (CAP)		
Ranges	50 nF, 500 nF, 5 µF, 50 µF, 500 µF	
Full scale reading	5000 counts	
Measurement current	500 nA to 0.5 mA, increases with increasing ranges	
Advanced meter functions		
Zero Set	Set actual value to reference	
AutoHold (on A)	Captures and freezes a stable measurement result. Beeps when stable. AutoHold works on the main meter reading, with thresholds of 1 Vpp for AC signals and 100 mV for DC signals.	
Fixed decimal point	Activated by using attenuation keys.	
Cursor Readout (124B and 125B)		
Sources	A, B	
Single vertical line	Average, min and max readout	
	Average, min, max and time from start of readout (in ROLL mode; instrument in HOLD)	
	Min, max and time from start of readout (in RECORDER mode; instrument in HOLD)	
	Harmonics values in POWER QUALITY mode.	
Dual vertical lines	Peak-peak, time distance and reciprocal time distance readout	
	Average, min, max and time distance readout (in ROLL mode; instrument in HOLD)	
Dual horizontal lines	High, low and peak-peak readout	
Rise or fall time	Transition time, 0 %-level and 100 %-level readout (manual or auto leveling; auto leveling only possible in single channel mode)	
Accuracy	As oscilloscope accuracy	
Recorder		
The recorder captures meter readings in Meter Recorder mode or continuously captures waveform samples in Scope Recorder mode. The information is stored on internal memory or on optional SD card (with the 125B or 124B).		
The results are displayed as Chart recorder display that plots a graph of min and max values of Meter measurements over time or as a waveform recorder display that plots all the captured samples.		
Meter readings		
Measurement Speed	Maximum 2 measurements/s	
Record Size (min, max, average)	2 M readings for 1 channel	
Recorded Time Span	2 weeks	
Maximum number of events	1024	
Waveform record		
Maximum sample rate	400 K sample/s	
Size Internal memory	400 M samples Recorded Time	
Span internal memory	15 minutes at 500 µs/div	11 hours at 20 ms/div
Record Size SD card	1.5 G samples	
Recorded Time Span SD card	11 hours at 500 µs/div	14 days at 20 ms/div
Maximum number of events	64	

Power Quality (125B only)		
Readings	Watt, VA, var, PF, DPF, Hz	
Watt, VA, var ranges (auto)	250 W to 250 MW, 625 MW, 1.56 GW	
	when selected: total (%r)	± (2 % + 6 counts)
	when selected: fundamental (%f)	± (4 % + 4 counts)
DPF	0.00 to 1.00	
PF	0.00 to 1.00, ± 0.04	
Frequency range	10.0 Hz to 15.0 kHz	40.0 Hz to 70.0 Hz
Number of Harmonics	DC to 51	
Readings / Cursor readings (fundamental 40 Hz to 70 Hz)	V rms / A rms /Watt	each harmonic from fundamental maybe selected for individual readings
Includes frequency of fundamental, phase Angle and K-factor (in Amp and Watt)		

Bus health tester (Fluke 125B only)		
Type	**Subtype**	**Protocol**
AS-i	NEN-EN50295	
CAN	ISO-11898	
Interbus S	RS-422	EIA-422
Modbus	RS-232	RS-232/EIA-232
	RS-485	RS-485/EIA-485
Foundation Fieldbus	H1	61158 type 1, 31.25 kBit
Profibus	DP	EIA-485
	PA	61158 type 1
RS-232	EIA-232	
RS-485	EIA-485	

Miscellaneous		
Display	Type	5.7-inch color active matrix TFT
	Resolution	640 x 480 pixels
Waveform Display	Vertical	10 div of 40 pixels
	Horizontal	12 div of 40 pixels
Power	External	via Power Adapter BC430
	Input voltage	10 V DC to 21 V DC
	Power consumption	5 W typical
	Input connector	5 mm jack
	Internal	via Battery Pack BP290
	Battery power	Rechargeable Li-Ion 10.8 V
	Operating time	7 hours with 50 % backlight brightness
	Charging time	4 hours with test tool off, 7 hours with test tool on
	Allowable ambient temp	0 to 40 °C (32 to 104 °F) during charging
Memory	Internal memory can store 20 data sets (screen waveform and setup)	Micro SD card slot with optional SD card (max size of 32 GB)
Mechanical	Size	259 mm x 132 mm x 55 mm (10.2 in x5.2 in x 2.15 in)
	Weight	1.4 kg (3.2 lb) including battery pack

Interface	Optically isolated	Transfer screen copies (bitmaps), settings and data
	USB to PC/laptop	OC4USB optically isolated USB adapter/cable, (optional), using FlukeView® software for Windows®.
	Optional WiFi adapter	Fast transfer of screen copies (bitmaps), settings and data to PC/laptop, tablet, smartphone, etc. A USB port is provided for attaching the WiFi dongle. Do not use the USB port with a cable for safety reasons.
Environmental		
Environmental	MIL-PRF-28800F, Class 2	
Temperature	Battery Operation	0 to 40 °C (32 to 104 °F)
	Power Adapter Operation	0 to 50 °C (32 to 122 °F)
	Storage	-20 to 60 °C (-4 to 140 °F)
Humidity (Operating)	@ 0 to 10 °C (32 to 50 °F)	noncondensing
	@ 10 to 30 °C (50 to 86 °F)	95 %
	@ 30 to 40 °C (86 to 104 °F)	75 %
	@ 40 to 50 °C (104 to 122 °F)	45 %
Storage	@ -20 to 60 °C (-4 to 140 °F)	noncondensing
Altitude	Operating at 3 km (10 000 feet)	CAT III 600 V
	Operating at 2 km (6 600 feet)	CAT IV 600 V
	Storage	12 km (40 000 feet)
EMC electromagnetic compatibility	International	IEC 61326-1: Industrial, CISPR 11: Group 1, Class A
	Korea (KCC)	Class A Equipment (Industrial Broadcasting & Communication Equipment)
	USA (FCC)	47 CFR 15 subpart B. This product is considered an exempt device per clause 15.103.
Wireless radio with adapter	Frequency range	2412 MHz to 2462 MHz
	Output power	<100 mW
Enclosure protection	IP51, ref: EN/IEC60529	
Safety	General	IEC 61010-1: Pollution Degree 2
	Measurement	IEC 61010-2-033: CAT IV 600 V/CAT III 750 V
Max. input voltage input A and B	Direct on input or with leads	600 Vrms CAT IV for derating
	With Banana-to BNC Adapter BB120	600 Vrms for derating
	Max. floating voltage from any terminal to ground	600 Vrms CAT IV, 750 Vrms up to 400 Hz

	Fluke 123B	Fluke 124B	Fluke 125B
Functions			
Full function dual input scope and meter	•	•	•
Oscilloscope bandwidth MHz	20	40	40
Meter and Scope Recorder	•	•	•
Scope cursor measurements		•	•
Power and harmonics measurements			•
Bus health			•
Included accessories			
10:1 voltage probe		•	•
i400S AC Current Clamp			•

Ordering information

Fluke-123B Industrial ScopeMeter® Hand Held Oscilloscope (20 MHz)
Fluke-123B/S Industrial ScopeMeter® Hand Held Oscilloscope (20 MHz)*
Fluke-124B Industrial ScopeMeter® Hand Held Oscilloscope (40 MHz)
Fluke-124B/S Industrial ScopeMeter® Hand Held Oscilloscope (40MHz)*
Fluke-125B Industrial ScopeMeter® Hand Held Oscilloscope (40MHz)
Fluke-125B/S Industrial ScopeMeter® Hand Held Oscilloscope (40MHz)*

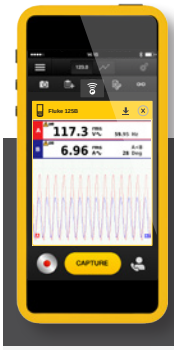
Includes: Li-Ion battery pack, charger/power adapter, 2 shielded test leads with ground leads, black test lead, red and blue hook clips, banana to BNC adapter, and WiFi USB adapter**

***Fluke 120B/S versions also include soft carry case, FlukeView™ for Windows® software, magnetic hanger, and screen protector.**

****WiFi USB adapter NOT available in all countries. Check with your local Fluke representative.**

STL120-IV Shielded Test Lead Set 600 V CAT IV
HC120-II Set of 2 hook clips
BB120-II Set of 2 banana to BNC adapter
VPS41 Voltage probe set 40MHz 600 V CAT IV
C120B Soft Carrying Case For 120B Series
SP120B Screen Protector For 120B Series
SCC120B Accessory Kit 120B Series
OC4USB Fluke OC4USB USB Interface Cable

Fluke 80i 110s Fluke 80i-110s AC/DC Current Clamp
Fluke i1000s Fluke i1000s AC Current Probe
Fluke i1010 Fluke i1010 AC/DC Current Clamp
Fluke i200s Fluke i200s AC Current Clamp
Fluke-i3000s Fluke i3000s AC Current Clamp
Fluke i3000s Flex 24 Fluke i3000s Flex-24 AC Current Clamp, 610 mm (24 in.)
Fluke i3000s Flex 36 Fluke i3000s Flex-36 AC Current Clamp, 915 mm (36 in.)
Fluke i30s Fluke i30s AC/DC Current Clamp
Fluke-i310s Fluke i310s Current Probe
Fluke i400s Fluke i400s AC Current Clamp
Fluke i410 Fluke i410 AC/DC Current Clamp
Fluke i5S Fluke i5S AC Current Clamp



FLUKE CONNECT®

Set up and sustain preventive maintenance practices with ease to help you oversee your complex world with the Fluke Connect® system of software and over 40 wireless test tools.

- Maximize uptime and make confident maintenance decisions with data you can trust and trace.
- Save measurements to the Fluke Cloud™ and associate with an asset so your team can consult baseline, historical and current measurements from one location.
- Collaborate with ease by sharing your measurement data with team members with ShareLive™ video calls and emails.
- Wireless one-step measurement transfer with AutoRecord™ measurements eliminates transcription errors, clipboards, notebooks and multiple spreadsheets.
- Generate reports with multiple measurement types to provide status or next step recommendations.

Download the app at:

Download on the App Store

ANDROID APP ON Google play

Smartphone wireless service and data plan not included with purchase.

Fluke Connect is not available in all countries.

APPLICATION NOTE

Five reasons to upgrade your hand-held oscilloscope

Electro-mechanical equipment is increasingly becoming more and more digital and more sophisticated. In 1997, Fluke launched the ScopeMeter® 120 Series Hand-Held Oscilloscope, which rapidly became the industry standard go-to tool for troubleshooting industrial electro-mechanical systems. Since then, automated machinery has become more efficient, more connected and less likely to break down. But, it's also harder to troubleshoot. It's not enough to know where to test, you also have to know what to look for. So with input from maintenance specialists who deal with a range of digital controls and industrial equipment, Fluke is introducing the new ScopeMeter 120B Series with a range of functions designed to simplify the testing process to help you troubleshoot faster and get the answers you need to keep your systems up and running. Here are reasons to upgrade:

1 Newer digital electro-mechanical equipment

Motors, pumps, turbines and other types of electro-mechanical equipment are more digitized and more complex than ever before. Programmable Logic Controllers (PLCs) can be now be programmed in the field, and many of the newest control devices include networking capabilities. This adds another dimension to troubleshooting that allows input from external devices. Meanwhile, knowledge and training is shifting from analog to digital, creating demand for technology that includes intelligence to assist real-world working conditions. The Fluke 120B Series addresses modern realities with the wireless connectivity to a smartphone, new intelligent functionality to help in waveform analysis as well as color LCD.

2 Complexity of signals/ waveforms

Programmable automated controllers (PACs), PLCs and other industrial digital control devices produce complex signals that are difficult to capture and trigger on an oscilloscope. Indeed, identifying characteristics of signals can be a challenge and even more difficult to determine the root cause of a failure. The Fluke 120B Series Hand-Held Oscilloscopes provide capabilities that help troubleshooting teams diagnose potential issues and uncover root cause in a straightforward manner. Connect-and-View™ triggering automates signal setup, trigger and capture, while a new Fluke innovation called IntellaSet™ technology adds a sophisticated onboard algorithm that analyzes the measured waveform, then intelligently displays critical measurements values associated with that waveform. As an example, when the measured waveform is a line voltage signal, the V ac + dc and Hz readings are automatically displayed for a sine wave V ac and Hz are displayed, for a dc power source, dc volts, and for a square wave VPeak-Peak and Hz. This in turn provides a quicker path to troubleshooting. The ScopeMeter 125B can also help you successfully troubleshoot a range of industrial bus problems. The 125B can verify the electrical signal quality in AS-i, CAN, Foundation Fieldbus H1, Profibus and RS-232/485. With the Bus Health function, a user can provide a health check on a specific bus communication between the control unit and a motor drive, for example, immediately determining if the signal complies with the standards for the particular bus.

3 Difficulty capturing intermittent events

One of the most difficult faults to find and fix, intermittent events can be beyond frustrating, happening only once in a while. They can be caused by bad connections, dust, dirt, or simply broken wiring or connections, and can be particularly hard to find in digital signals involved in control systems. ScopeMeter 120B Series Hand-Held Oscilloscopes can record for long periods of time in memory. Plus, a new automatic Event Detect feature can quickly capture and identify random events that can cause system shutdowns or resets. Just set a threshold on a meter reading or scope trace, and deviations are tagged as events in the full recording but you no longer need to search through masses of data to track down intermittent events. Simply step from one tagged event to the next, all while still having access to the full data set. The 120B Series can take thousands of samples per minute. Other features to help identify intermittents include event tagging and event capture. You can even trend measurements in real time on the screen, and with the Fluke Connect® mobile app capabilities, save measurements to a smartphone and upload to the cloud for sharing or analysis.

4 Getting to root cause may require assistance

Given how difficult it can be to troubleshoot issues in the latest digitized controls for electromechanical equipment, getting to root cause may require additional brainpower from a colleague or manufacturer, or a more sophisticated analysis in software programs. The ScopeMeter 120B Series can communicate with smartphones as part of the Fluke Connect® platform of wireless test tools and software. Fluke Connect mobile app compatibility provides the ability to compare and contrast asset measurement data, communicate with subject matter experts and document test information. By being able to share and communicate, technicians can cut the time it takes to troubleshoot issues and return equipment to full operation.

5 Data storage and management can be a challenge

The Fluke ScopeMeter 120B Series Hand-Held Oscilloscopes are the first Fluke Connect-enabled, cloud-connected portable oscilloscopes. This connectivity opens up a new way of thinking about saving, storing and sharing your waveform and measurement data from the ScopeMeter Test Tool. In addition to opening up the potential of collecting important baseline data on normal operating conditions of electromechanical systems, data is stored securely in the cloud where it is always available and thus can be shared and managed. And, since measurement data can be associated with specific pieces equipment, there is no need to manually record in the field and then transcribe into an office computer. Such information can even be compared against other test instruments in the Fluke Connect family, including industrial infrared cameras, vibration meters and others.