

FLUKE®

190 Series III

ScopeMeter® Test Tool

Models 190-062, -102, -104, -202, -204, -502, -504, MDA-550-III

Product Specifications

July 2021 Rev. B, 11/21 (English)

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Specifications are subject to change without notice.

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General Specifications

Warranty	3 years (battery and accessories not included)
Calibration Cycle.....	specification is based on 1-year calibration interval
Dimensions.....	265 mm x 192 mm x 70 mm (10.5 in x 7.6 in x 2.8 in)
Weight	
FLUKE 190-xx4.....	2.2 kg (4.8 lbs) including battery
FLUKE 190-5xx.....	2.2 kg (4.8 lbs) including battery
FLUKE 190-xx2.....	2.1 kg (4.6 lbs) including battery
FLUKE MDA-550-III	2.2 kg (4.8 lbs) including battery

Environmental Specifications

Environmental.....	MIL-PRF-28800F, Class 2 (unless otherwise specified)
Temperature	
Operating	
Battery discharging	0 °C to 40 °C (32 °F to 104 °F)
Battery charging	0 °C to 40 °C (32 °F to 104 °F)
	battery management is temperature sensor controlled
Storage	-20 °C to 60 °C (-4 °F to 140 °F)
Humidity (Maximum Relative)	
Operating	
0 °C to 10 °C (32 °F to 50 °F).....	noncondensing
10 °C to 30 °C (50 °F to 86 °F).....	95 % (±5 %)
30 °C to 40 °C (86 °F to 104 °F).....	75 % (±5 %)
40 °C to 50 °C (104 °F to 122 °F).....	45 % (±5 %)
Storage	
-20 °C to 60 °C (-4 °F to 140 °F)	noncondensing
Altitude	
Operating up to 2000 m (6 600 ft)	
All terminals to earth.....	CAT IV 600 V, CAT III 1000 V
BNC input shield to center pin	CAT IV 300 V
Operating above 2000 m and up to 4000 m (13 000 ft)	
All terminals to earth.....	CAT IV 300 V, CAT III 600 V, CAT II 1000 V
BNC input shield to center pin	CAT IV 150 V, CAT III 300 V
Storage	12 000 m (40 000 feet)
Vibration (Sinusoidal).....	max. 3 g
Vibration (Random).....	0.03 g ² /Hz
Shock	max. 30 g

190 Series III

Product Specifications

Input Impedance on BNC, DC Coupled,
any scope channel 1 M Ω (± 1 %)//15 pF (± 2.25 pF)

⚠ Max. Input Voltage For detailed specifications, see the printed *Safety Information*
document that ships with the Product and at www.fluke.com.

Vertical Accuracy $\pm(2.1$ % + 0.04 range/div)

@2 mV/div $\pm(2.9$ % + 0.08 range/div)

For voltage measurements with 10:1 probe or 100:1 probe, add probe accuracy, see *10:1 Probe VPS410-II / 100:1 Probe VPS421*.

Digitizer Resolution 8 bits, separate digitizer for each input

Horizontal

Minimum Time Base Speed (Scope Record) 2 min/div

Real Time Sampling Rate

FLUKE 190-50x

1 ns to 4 μ s /div (1 channel) up to 5 GS/s

2 ns to 4 μ s /div (2 channels) up to 2.5 GS/s

5 ns to 4 μ s /div (3 or 4 channels) up to 1.25 GS/s

10 μ s to 120 s/div 125 MS/s

FLUKE190-202, -204

2 ns to 4 μ s /div (1 or 2 channels) up to 2.5 GS/s

5 ns to 4 μ s /div (3 or 4 channels) up to 1.25 GS/s

10 μ s to 120 s/div 125 MS/s

FLUKE 190-102, -104

5 ns to 4 μ s /div (all channels) up to 1.25 GS/s

10 μ s to 120 s/div 125 MS/s

FLUKE 190-062

10 ns to 4 μ s /div (all channels) up to 625 MS/s

10 μ s to 120 s/div 125 MS/s

Glitch Detection 4 μ s to 120 s/div displays glitches as fast as 8 ns

Waveform Display A, B, C, D,
Math (+, -, x, X-Y mode, spectrum-using FFT)
Normal, Average, Persistence, Reference

Time Base Accuracy $\pm(100$ ppm + 0.04 div)

Record Lengths and Acquisition Modes

Scope			
Longer records are displayed on 1 screen 300 min/max pairs. Use ZOOM and Scroll to see waveform detail.		Glitch Detect On	Glitch Detect Off
	Normal	300 min/max samples	3000 true samples
	Fast	300 min/max samples	NA
	Full	300 min/max samples	10 k true samples
Scope Record Roll Mode			
<i>Long records are immediately compressed to suit the user-selected time/div setting.</i>		30 k samples Sample Rate 4x 125 MS/s	
	Normal View	300 min/max samples on screen, subset of long record	
	View All	Long record 100x compressed into 300 min/max samples on screen	
TrendPlot Recording			
Paperless recorder mode, logging up to 5 measurements/second. <i>Measurements made through Scope Readings or through DMM measurements. Graph is automatically compressed when time progresses, to show complete overview within the screen area.</i>		Up to 19 200 min/max/avg values, shared by the selected readings. Max timespan covered: <ul style="list-style-type: none"> • 22 day for single reading • 11 days for 2 readings • 5.5 days for 3 or 4 readings. 	

Trigger and Delay

Trigger Modes.....	Automatic, Edge, Pulse Width, N-Cycle, External (190-xx2)
Trigger Delay	up to +1200 divisions
Pre Trigger View	one full screen length
Delay	-12 div to +1200 div
Max. Delay.....	48 s at 4 s/div

Automatic Connect-and-View Trigger

Source	A, B, C, D, EXT (190-xx2)
Slope	Positive, Negative, Dual

Edge Trigger

Screen Update.....	Free Run, On Trigger, Single Shot
Source	A, B, C, D, EXT (190-xx2)
Slope	Positive, Negative, Dual
Trigger Level Control Range	±4 divisions
Trigger Sensitivity	
DC to 10 MHz at >5 mV/div.....	0.5 divisions
DC to 10 MHz at 2 mV/div and 5 mV/div	1 division
500 MHz (FLUKE 190-50x).....	1 division
600 MHz (FLUKE 190-50x).....	2 divisions
200 MHz (FLUKE 190-2xx).....	1 division
250 MHz (FLUKE 190-2xx).....	2 divisions
100 MHz (FLUKE 190-1xx).....	1 division
150 MHz (FLUKE 190-1xx).....	2 divisions
60 MHz (FLUKE 190-062).....	1 division
100 MHz (FLUKE 190-062).....	2 divisions

Isolated External Trigger (190-xx2)

Bandwidth.....	10 kHz
Modes	Automatic, Edge
Trigger Levels (DC to 10 kHz).....	120 mV, 1.2 V

Pulse Width Trigger

Screen Update.....	On Trigger, Single Shot
Trigger Conditions	<T, >T, =T ($\pm 10\%$), $\neq T(\pm 10\%)$
Source	A
Polarity	Positive or negative pulse
Pulse Time Adjustment Range.....	0.01 div. to 655 div. with a minimum of 300 ns (<T, >T) or 500 ns (=T, $\neq T$), a maximum of 10 s, and a resolution of 0.01 div. with a minimum of 50 ns

Continuous Auto Set

Autorangeing attenuators and time base, automatic Connect-and-View™ triggering with automatic source selection.

Modes

Normal	15 Hz to max. bandwidth
Low Frequency	1 Hz to max. bandwidth

Minimum Amplitude A, B, C, D (at BNC input)

DC to 1 MHz	10 mV
1 MHz to maximum bandwidth.....	20 mV

Automatic Capturing Scope Screens

Capacity.....	100 Scope Screens (<i>For viewing screens, see Replay function in Users Manual.</i>)
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Automatic Scope Measurements

The accuracy of all readings is within \pm (% 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 or 100:1 probe, add probe accuracy, see *10:1 Probe VPS410-II / 100:1 Probe VPS421*. At least 1.5 waveform period must be visible on the screen.

General

Inputs.....	A, B, C and D
DC Common Mode Rejection (CMRR)	>100 dB
AC Common Mode Rejection at 50, 60, or 400 Hz (without power adapter).....	>60 dB

DC Voltage (V_{DC})

Maximum Read-Out Voltage (depends on waveform shape, all voltages must be within CAT-rating)

with 10:1 probe	3000 V
with 100:1 probe	30 kV
direct (1:1).....	300 V

Maximum Resolution

with 10:1 probe	1 mV
with 100:1 probe	10 mV
direct (1:1).....	100 μ V

Full Scale Reading..... \pm 999 counts

Accuracy at 4 s to 10 μ s/div

2 mV/div	\pm (1.5 % + 10 counts)
5 mV/div to 100 V/div	\pm (1.5 % + 6 counts)

Normal Mode AC Rejection at 50 or 60 Hz>60 dB

AC Voltage (V_{AC})

Maximum Read-out Voltage (depends on waveform shape, all voltages must be within CAT-rating)

with 10:1 probe	3000 V
with 100:1 probe	30 kV
direct (1:1).....	300 V

Maximum Resolution

with 10:1 probe	1 mV
with 100:1 probe	10 mV
direct (1:1).....	100 μ V

Full Scale Reading..... \pm 999 counts

Accuracy

DC coupled: DC to 60 Hz..... \pm (1.5 % +10 counts)

AC coupled, low frequencies:

Below 100 Hz there is signal loss that must be included. These are the expected loss at 2 common frequencies.

50 Hz direct (1:1).....	-0.6%
60 Hz direct (1:1).....	-0.4%

Apply this loss and then the dc coupled accuracy. With the 10:1/100:1 probe the low frequency roll-off point will be lowered to 2 Hz, which improves the ac accuracy for low frequencies. When possible use dc coupling for maximum accuracy.

AC or DC coupled, high frequencies:

60 Hz to 20 kHz.....	\pm (2.5 % + 15 counts)
20 kHz to 1 MHz.....	\pm (5 % + 20 counts)
1 MHz to 25 MHz	\pm (10 % + 20 counts)

For higher frequencies the instrument's frequency roll off starts affecting accuracy.

Normal Mode DC Rejection>50 dB

All accuracies are valid if:

- the waveform amplitude is larger than one division
- at least 1.5 waveform period is on the screen

AC+DC Voltage (True RMS)

Maximum Read-out Voltage (depends on waveform shape, all voltages must be within CAT-rating)

with 10:1 probe	3000 V
with 100:1 probe	30 kV
direct (1:1).....	300 V

Maximum Resolution

with 10:1 probe	1 mV
with 100:1 probe	10 mV
direct (1:1).....	100 μ V

Full Scale Reading..... \pm 999 counts

Accuracy

DC to 60 Hz	\pm (1.5 % + 10 counts)
60 Hz to 20 kHz	\pm (2.5 % + 15 counts)
20 kHz to 1 MHz	\pm (5 % + 20 counts)
1 MHz to 25 MHz	\pm (10 % + 20 counts)

For higher frequencies the instrument's frequency roll off starts affecting accuracy.

Amperes (AMP)

With Optional Current Probe or Current Shunt

Ranges same as V_{DC} , V_{AC} , V_{AC+DC}

Probe Sensitivity 100 μ V/A, 1 mV/A, 10 mV/A, 100 mV/A, 400 mV/A, 1 V/A, 10 V/A, and 100 V/A

Accuracy same as V_{DC} , V_{AC} , V_{AC+DC} (add current probe or current shunt accuracy)

Peak

Modes Max peak, Min peak, or peak-to-peak

Maximum Read-out Voltage (depends on waveform shape, all voltages must be within CAT-rating)

with 10:1 probe	3000 V
with 100:1 probe	30 kV
direct (1:1).....	300 V

Maximum Resolution

with 10:1 probe	10 mV
with 100:1 probe	100 mV
direct (1:1).....	1 mV

Full Scale Reading.....800 counts

Accuracy

Max peak or Min peak.....	\pm 0.2 division
Peak-to-peak	\pm 0.4 division

Frequency (Hz)

Range 1.000 Hz to full bandwidth

Full Scale Reading.....9999 counts

Accuracy

1 Hz to full bandwidth..... \pm (0.5 % + 2 counts) (4 s/div to 10 ns/div and 10 periods on the screen).

Duty Cycle (DUTY)

Range	4.0 % to 98.0 %
Resolution.....	0.1 % (when period > 2 div)
Full Scale Reading.....	999 counts (3-digit display)
Accuracy (logic or pulse)	±(0.5 % +2 counts)

Pulse Width (PULSE)

Resolution (with GLITCH off)	1/100 division
Full Scale Reading.....	999 counts
Accuracy	
1 Hz to full bandwidth.....	±(0.5 % +2 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

V/Hz

Purpose	to show the measured Vpwm value (see Vpwm) divided by the fundamental frequency on Variable AC Motor Speed drives
Accuracy.....	%Vrms + %Hz

Note

AC motors are designed for use with a rotating magnetic field of constant strength. This strength depends on the applied voltage (Vpwm) divided by the fundamental frequency of the applied voltage (Hz). The nominal Volt and Hz value are shown on the motor type plate.

Power (A and B, C and D)

Watt	RMS reading of multiplication corresponding samples of input A or C (volts) and Input B or D (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
Power Factor.....	ratio between Watts and VA
Range	0.00 to 1.00

Phase (A and B, C and D)

Range.....	-180 to +180 degrees
Resolution.....	1 degree
Accuracy	
0.1 Hz to 1 MHz	±2 degrees
1 MHz to 10 MHz	±3 degrees

Temperature (TEMP)

With Optional Temperature Probe (°F not for Japan)

Ranges (°C or °F)	-40.0 ° to 100.0 ° -100 ° to 250 ° -100 ° to 500 ° -100 ° to 1000 ° -100 ° to 2500 °
Probe Sensitivity	1 mV/°C and 1 mV/°F
Accuracy	±(1.5 % + 5 counts) (add temperature probe accuracy for overall accuracy)

Decibel (dB)

dBV	dB relative to one volt
dBm	dB relative to one mW in 50 Ω or 600 Ω
dB on	V _{DC} , V _{AC} , V _{AC+DC}
Accuracy	same as V _{DC} , V _{AC} , V _{AC+DC}

Meter Measurements for Fluke 190-xx4

Four of the Automatic Scope Measurements as defined above may be displayed at the same time, using larger screen area for convenient reading, suppressing the scope waveform information. For specifications see Automatic scope Measurements above.

Meter Measurements for Fluke 190-xx2

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.

Meter Input (Banana Jacks)

Input Coupling	DC
Frequency Response	DC to 6 kHz (-3 dB)
Input Impedance	1 MΩ (±1 %) // 14 pF (±1.5 pF)
⚠ Max. Input Voltage	1000 V CAT III 600 V CAT IV (For detailed specifications, see the printed <i>Safety Information</i> document that ships with the Product and at www.fluke.com .)

Meter Functions

Ranging	Auto, Manual
Modes	Normal, Relative

General

DC Common Mode Rejection (CMRR)	>100 dB
AC Common Mode Rejection at 50, 60, or 400 Hz	>60 dB

Ohms (Ω)

Ranges	500.0 Ω , 5.000 k Ω , 50.00 k Ω , 500.0 k Ω , 5.000 M Ω , 30.00 M Ω
Full Scale Reading	
500 Ω to 5 M Ω	5000 counts
30 M Ω	3000 counts
Accuracy	$\pm(0.6\% +6 \text{ counts})$
Measurement Current.....	0.5 mA to 50 nA, $\pm 20\%$ decreases with increasing ranges
Open Circuit Voltage.....	<4 V

Continuity (CONT)

Beep	<50 Ω ($\pm 30 \Omega$)
Measurement Current.....	0.5 mA, $\pm 20\%$
Detection of shorts.....	≥ 1 ms

Diode

Maximum Voltage Reading	2.8 V
Open Circuit Voltage.....	<4 V
Accuracy	$\pm(2\% +5 \text{ counts})$
Measurement Current.....	0.5 mA, $\pm 20\%$

Temperature (TEMP)

With Optional Temperature Probe

Ranges ($^{\circ}\text{C}$ or $^{\circ}\text{F}$)	-40.0 $^{\circ}$ to +100.0 $^{\circ}$ -100.0 $^{\circ}$ to +250.0 $^{\circ}$ -100.0 $^{\circ}$ to +500.0 $^{\circ}$ -100 $^{\circ}$ to +1000 $^{\circ}$ -100 $^{\circ}$ to + 2500 $^{\circ}$
Probe Sensitivity	1 mV/ $^{\circ}\text{C}$ and 1 mV/ $^{\circ}\text{F}$

DC Voltage (V_{DC})

Ranges	500.0 mV, 5.000 V, 50.00 V, 500.0 V, 1100 V
Full Scale Reading.....	5000 counts
Accuracy	$\pm(0.5\% +6 \text{ counts})$
Normal Mode AC Rejection at 50 or 60 Hz $\pm 1\%$	>60 dB

AC Voltage (V_{AC})

Ranges	500.0 mV, 5.000 V, 50.00 V, 500.0 V, 1100 V
Full Scale Reading.....	5000 counts
Accuracy	
15 Hz to 60 Hz	$\pm(1\% +10 \text{ counts})$
60 Hz to 1 kHz	$\pm(2.5\% +15 \text{ counts})$
For higher frequencies the frequency roll off of the Meter input starts affecting accuracy.	
Normal Mode DC Rejection	>50 dB

Current Unbalance Drive Output and Motor Input

Purpose	To show the highest percentage difference of one of the phase vs. average of the 3 ac current values
Accuracy	Indicative percentage based on A ac values

Rise and Fall time

Readings.....	Voltage difference (dV), time difference (dt), voltage vs. time difference (dV/dt), overshoot
Accuracy	Same as oscilloscope accuracy

Harmonics and Spectrum

Harmonics	DC to 51st
Spectrum ranges.....	1 kHz to 9 kHz, 9 kHz to 150 kHz (20 MHz filter on), up to 500 MHz (voltage modulation)

Shaft Voltage

Events / second	Indicative percentage based on rise and fall time (Impulse discharges) measurements
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Report Data Capture

Number of screens.....	Typical 50 screens can be saved in Reports (depends on compression ratio)
Transfer to PC.....	Using USB Drive or mini-USB to USB cable and FlukeView 2 for ScopeMeter. Also supports Fluke Connect app.

Probe Settings

Voltage Probe	1:1, 10:1, 100:1, 1000:1, 20:1, 200:1
Current Clamp	0.1 mV/A, 1 mV/A, 10 mV/A, 20mV/A, 50mV/A, 100mV/A, 200 mV/A, 400 mV/A
Shaft Voltage Probe	1:1, 10:1, 100:1
VPS4xx Probe accuracy when adjusted on the test tool	
DC to 20 kHz.....	±1 %
20 kHz to 1 MHz.....	±2 %
1 MHz to 25 MHz	±3 % (for higher frequencies the probe roll off starts affecting the accuracy)

Miscellaneous

Display

View Area	133 mm x 90 mm (5.3 in x 3.5 in)
View Angle.....	75 ° off-center in all directions
Resolution.....	1120 pixels x 765 pixels
Backlight.....	High brightness LED
Brightness.....	User-adjustable, up to 300 cd/m ²
Display Auto-OFF time (battery saving)	30 s, 5 m, or disabled

Power

FLUKE 190-xx4, -50x, MDA-550-III: Rechargeable Li-ion Battery (model BP291):

Operating Time	up to 7 hours (Low Intensity)
Charging Time.....	5 hours
Voltage.....	10.8 V

FLUKE 190-062, -102, -202: Rechargeable Li-ion Battery (model BP290):

Operating Time	up to 3.5 hours (Low Intensity)
Charging Time.....	2.5 hours
Voltage.....	10.8 V

Battery

BP290	Li-ion, 10.8 V, 2500 mAh, 27 Wh
BP291	Li-ion, 10.8 V, 5000 mAh, 54 Wh

Power AdapterBC190/830

Nominal input voltage	100 V ac to 240 V ac, ±10 %
Input current	0.35 A at max. load
Nominal input frequency	50/60 Hz ±10 %
Mains inlet.....	IEC 60320-1 type C8
Input power, no load.....	<0.1 W (@ 115 / 230 V ac)

Probe Calibration

Manual pulse adjustment and automatic DC adjustment with probe check

Generator Output..... 1.225 Vpp / 500 Hz square wave

Internal Memory

Number of Scope Memories	30	Each memory can contain up to 4 waveforms plus corresponding setups
Number of Recorder Memories.....	10	Each memory can contain: - 1 2/4 channel input TrendPlot - 1 2/4 channel input Scope Record - 100 2/4 channel input Scope screens (Replay)
Number of Screen Image memories	9	Each memory can contain one screen image

External Memory

USB Drive, 32 GB max.

Interface Ports

Two USB ports provided. Ports are fully insulated from instrument's floating measurement circuitry.

- A USB-host port directly connects to external flash memory drive (USB drive) for storage of waveform data, measurement results, instrument settings and screen copies.

The USB-A port is also used to connect a WiFi Adapter for wireless PC connectivity. The test tool supports the D-Link DWA-131 (H/W version E1) and is available as part of SCC-option.

- A mini-USB-B is provided which allows for interconnection to PC for remote control and data transfer using FlukeView® 2 PC-software for Windows®.

10:1 Probe VPS410-II / 100:1 Probe VPS421

VPS421 is included with purchase of the 190-062, 190-10x, and MDA-550 models.

Probe accuracy when adjusted on the test tool:

- DC to 20 kHz±1 %
- 20 kHz to 1 MHz±2 %
- 1 MHz to 25 MHz±3 %

For higher frequencies, the probe roll off starts affecting the accuracy.