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190M/199XRAY Comparison Chart

Oscilloscope modes	199XRAY (discontinued)	190M-2	190M-4
Vertical deflection			
Number of channels	2		4
Bandwidth	200 MHz		
Rise time	1.7 ns		
Number of scope inputs	2 input channels plus external trigger		4 input channels
Channel architecture	All inputs fully insulated from each other and from ground inputs may be activated in any combination		
Input coupling	AC or DC, with ground level indicator		
Input sensitivity	2 mV/div to 100 V/div, plus variable attenuation		
Bandwidth limiter	User selectable: 20 kHz, 20 MHz or full bandwidth		
Normal/invert/variable	On each input channel, switched separately		
Extended offset	Yes	No	No
Input voltage	CAT II 1000 V, CAT III 600 V rated, see general specifications for further details	CAT III 1000 V/CAT IV 600 V rated, see general specifications for further details	CAT III 1000 V/CAT IV 600 V rated, see general specifications for further details
Vertical resolution	8 bit		
Accuracy	± (1.5 % of reading + 0.04 x range/div) @ 5 mV/div to 100 V/div	± (2.1 % of reading + 0.04 x range/div) @ 5 mV/div to 100 V/div	
Input impedance	1 MΩ ± 1 % // 15 pF ± 2 pF		
Horizontal			
Maximum real-time sample rate (sampled simultaneously)	2.5 GS/s (2ch)		2.5GS/s (2ch) 1.25 GS/s (4ch)
Record length	Up to 3000 samples per channel	Up to 10,000 samples per channel	
Time base range	5 ns/div to 5 s/div (in 1-2-5-range) Slower time/division settings using ScopeRecord™ roll mode	2 ns/div to 4 s/div Time base in a 1-2-4-sequence Slower time/division settings using ScopeRecord™ Roll mode (see 'Recorder mode')	
Maximum record length	3000 samples per channel (x2) in scope mode	10,000 samples per channel in scope mode	
	27,000 points per input in ScopeRecord™ roll mode (5 ms/div to 2 min/div)	30,000 points per channel in ScopeRecord™ roll mode (see 'Recorder mode')	
Timing accuracy	± (0.01 % of reading + 1 pixel)		
Glitch capture	50 nsec (5 µsec/div to 1 min/div)	8 ns peak detect on each channel (using real time sampling and data compression, at any timebase setting)	
Display and acquisition			
Display	144 mm full-color LCD, with backlight	153 mm (6 in) full-color LCD with LED backlight	
Display modes	Any combination of channels; average on/off; replay		
Visible screen width	12 divisions horizontally in scope mode		
Digital persistence modes	Off/Short/Medium/Long/Infinite and Envelope mode		
Waveform mathematics	A + B, A – B, A x B, all with user selectable scaling of resultant; A versus B (X-Y-mode); frequency spectrum using FFT analysis		
Acquisition modes	Normal, Averaged, Auto, Single Shot, ScopeRecord™ roll, glitch capture, waveform compare with automatic Pass/Fail testing; Replay		
Trigger and delay			
Source	Input A, B or External (via meter input)		Input A, B, C or D
Modes	Automatic Connect-and-View™, free run, single shot, edge, delay, dual slope, video, video line, selectable pulsewidth (channel A only), N-cycle		
Connect-and-View™	Advanced automatic triggering that recognizes signal patterns, automatically sets up and continuously adjusts triggering, time base and amplitude; Automatically displays stable waveforms of complex and dynamic signals like motor drive and control signals; Can be switched off if preferred		
Video triggering (on ch. A)	NTSC, PAL, PAL+, SECAM; Includes field 1, field 2 and line select		
High-res, non-interlaced video	Non-interlaced video with line-select, for line frequencies in the range 14 kHz up to 65 kHz		
Pulse width triggering (on channel A)	Pulse width qualified by time Allows for triggering <t, >t, =t, ≠ t, where t is selectable in minimum steps of 0.01 div or 50 ns		
Time delay	1 full screen of pre-trigger view or up to 100 screens (=1,200 divisions) of post-trigger delay		
Dual slope triggering	Triggers on both rising and falling edges alike		
N-cycle triggering	Triggers on N-th occurrence of a trigger event; N to be set in the range 2 to 99		
Automatic capture of 100 screens			
When in oscilloscope mode, the instrument ALWAYS memorizes the last 100 screens—no specific user setup required. When an anomaly is seen, the REPLAY button can be pressed to review the full sequence of screen events over and over. Instrument can be set up for triggering on glitches or intermittent anomalies and will operate in "baby-sit" mode capturing 100 specified events.			
Replay	Manual or continuous replay. Displays the captured 100 screens as a "live" animation, or under manual control. Each screen has date and time-stamp		
Replay storage	Two sets of 100 screens each can be saved internally for later recall and analysis		
	Direct storage of additional sets on external flash memory drive through USB host port		

Oscilloscope modes cont.	199XRAY (discontinued)	190M-2	190M-4
FFT–frequency spectrum analysis			
Shows frequency content of oscilloscope waveform using Fast Fourier Transform			
Window	Automatic, hamming, hanning or none		
Automatic window	Digitally re-samples acquired waveform to get optimum frequency resolution in FFT resultant		
Vertical scale	Linear / Logarithmic (in volts or amps)		
Frequency axis	Logarithmic Frequency range automatically set as a function of timebase range of oscilloscope		
Waveform compare and pass/fail testing			
Waveform compare	Provides storage and display of a reference waveform for visual comparison with newly acquired waveforms. Reference is de-rived from an acquired waveform and can be modified in the ScopeMeter® Oscilloscope or externally using FlukeView Software.		
Pass/Fail Testing	In waveform compare mode, the ScopeMeter® Oscilloscope can be set up to store only matching ("Pass") or only non-matching ("Fail") acquired waveforms in the replay memory bank for further analysis		
Automatic scope measurements			
V dc, V ac rms, V ac+dc, Vpeak max, Vpeak min, Vpeak to peak, A ac, A dc, A ac+dc, frequency (in Hz), risetime (using cursors), falltime (using cursors), phase (between any 2 inputs), pulsewidth (pos./neg.), dutycycle (pos./neg.), temperature °C, temperature °F (not for Japan), dBV, dBm into 50 Ω and 600 Ω			
Advanced power and motor drive functions	Power Factor (PF), Watts, VA, VA reac-tive, VPWMac and VPWM (ac+dc) for measurement on pulsewidth modulated motordrives and frequency inverters	V/Hz ratio (190-x02 only), Power Factor (PF), Watts, VA, VA reactive, VPWMac and VPWM (ac+dc) for measurement on pulse width modulated motordrives and frequency inverters	Power Factor (PF), Watts, VA, VA reac-tive, VPWMac and VPWM (ac+dc) for measurement on pulsewidth modulated motordrives and frequency inverters
Advanced functions	mA*s (current-over-time, between cursors) W*s (energy, between cursors)	mA*s (current-over-time, between cursors); V*s (voltage over time, between cursors); W*s (energy, between cursors)	
Cursor measurements			
Source	On any input waveform or on mathematical resultant waveform (excl. X-Y-mode)		
Dual horizontal lines	Voltage at cursor 1 and at cursor 2, voltage between cursors		
Dual vertical lines	Time between cursors, 1/T between cursors (in Hz), voltage between markers, risetime with markers, falltime with markers; Vrms between cursors, watts between cursors		
Single vertical line	Min-Max and Average voltage at cursor position; frequency and rms-value of individual frequency component in the FFT Resultant		
ZOOM	Ranges from full record overview to zoom in up to sample level, at any record length		
X-ray kV			
X-ray kV waveform (with optional 35080M Non invasive kV divider)	22 kV to 150 kV		
X-ray kV measurement	Automatic	Manual	Manual
Meter modes	**199XRAY (discontinued)**	**190M-2**	**190M-4**
Meter inputs	Via 4 mm banana inputs, fully isolated froms cope inputs and scope ground		Via BNC scope inputs
Number of readings	One at a time		Up to 4 simultaneously
Maximum resolution	5,000 counts		999 counts
Input impedance	1 MΩ ± 1 % // 14 pF ± 2 pF		
Advanced meter functions	Auto/manual ranging, relative measurements (Zero reference), TrendPlot™ recording		
	The specified accuracy is valid over the temperature range 18 °C to 28 °C Add 10 % of specified accuracy for each degree C below 18 °C or above 28 °C		
Voltage			
V dc accuracy	± (0.5 % + 5 counts)		Via BNC scope inputs
V ac true rms accuracy	15 Hz to 60 Hz: ± (1 % + 10 counts)		± (1 .5 % + 10 counts)
	60 Hz to 1 kHz: ± (2.5 % + 15 counts)		± (2.5 % + 15 counts)
Vac true rms accuracy	15 Hz to 60 Hz: ± (1 % + 10 counts)		± (1 .5 % + 10 counts)
	60 Hz to 1 kHz: ± (2.5 % + 15 counts)		± (2.5 % + 15 counts)
Voltmeter ranges	500 mV, 5 V, 50 V, 500 V, 1,000 V		
Resistance			
Ranges	500 Ω, 5 kΩ, 50 kΩ, 500 kΩ, 5 MΩ, 30 MΩ		Not available
Accuracy	± (0.6 % + 5 counts)		Not available
Other meter functions			
Continuity	Beeper on < 50 Ω (± 30 Ω)		Not available
Diode test	Up to 2.8 V		Not available
Current (A)	A dc, A ac, A ac+dc using an optional current clamp or shunt Scaling factors: 0.1 mV/A, 1 mV/A to 100 V/A and 400 mV/A		
Temperature	With optional accessories. Scale factors 1 °C/mV or 1 °F/mV		
Recorder modes	**199XRAY (discontinued)**	**190M-2**	**190M-4**
ScopeRecord™ Roll Mode			
Dual or multiple input waveform storage mode, using deep memory			
Source and display	Input A, Input B, Dual All channels sampled simultaneously		Any combination of inputs, up to 4 channels All channels sampled simultaneously
Bandwidth	20 MHz or 20 kHz, user selectable		
Memory depth	27,000 or more data points, each holding min/max. pair of information	30,000 data points, each holding min/max pair of information	
Min/max values	Min/max values are created at samples that are measured at high sample rate ensuring capture and display of glitches		
Recording modes	Single sweep, continuous roll, Start-on-Trigger (through external) and Stop-on-Trigger (through external)		Single sweep, continuous roll, Start-on-Trigger (through any channel), Stop-on-Trigger (through any channel)
Stop-on-trigger	ScopeRecord mode can be stopped by an individual trigger event, or by an interruption of a repetitive trigger signal, through any input channel		
Horizontal scale	Time from start, time of day		
Zoom	Ranges from full record overview to zoom in up to sample level, at any record length		
Memory	Up to 2 dual input ScopeRecord wave-forms can be saved for later recall and analysis	Two multiple input ScopeRecord waveforms can be saved internally for later recall and analysis Direct storage on external flash memory drive through USB host port	

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ScopeRecord™ Roll mode sample rate and recording timespan			
Time base range	5 ms/div to 1 min/div	5 ms/div ~ 2 min/div	
Recorded timespan	6 sec to 24 hr	6 sec ~ 48 hr	
Time/division in 'view all' mode	Not available	0.5 s/div ~ 4 h/div	
Glitch capture	50 ns	8 ns	
Sample rate	20 MS/s	125 MS/s	
Resolution	200 µsec to 2 sec	200 µsec ~ 4.8 sec	
Trendplot™ Recording			
Multiple channel electronic paperless recorder graphically plots, displays and stores results of up to four automatic scope measurements or a DMM-reading over time			
Source and display	Any combination of scope measurements, made on any of the input channels, or DMM reading (2-channel instruments)		
Memory depth	18,000 points (sets) per measurement Each recorded sample point contains a minimum, a maximum and an average value, plus a date-and timestamp		
Ranges	Normal view: 5 s/div to 30 min/div In view-all mode: 5 min/div to 48 hr/div (overview of total record)		
Recorded time span	Up to 22 days, with a resolution of 102 seconds		
Recording mode	Continuous recording, starting at 5 s/div with automatic record compression		
Measurement speed	3 automatic measurements per second or more		
Horizontal scale	Time from start, time of day		
Zoom	Up to 64x zoom-out for full record overview, up to 10x zoom-in for maximum detail		
Memory	Up to 2 TrendPlot recordings can be saved for later recall and analysis.	Two multiple input TrendPlot records can be saved internally for later recall and analysis Direct storage on external flash memory drive through USB host port	
Cursor measurements–all recorder modes			
Source	Any waveform trace in any waveform display mode (Scope, ScopeRecord or TrendPlot)		
Dual vertical lines	Cursors may be used to identify Min, Max or Average value of any datapoint in a record, with time between cursors, time from start or absolute time		

General specifications	199XRAY (discontinued)	190M-2	190M-4
Input voltage range			
Rated maximum floating voltage	CAT II 1000 V/CAT III 600 V	CAT III 1000 V/CAT IV 600 V	
	(maximum voltage between any contact and earth-ground voltage level)		
Maximum probe voltage	CAT II 1000 V/CAT III 600 V	CAT III 1000 V/CAT IV 600 V	
	(maximum voltage between any contact and earth-ground voltage level)		
Maximum BNC input voltage	CAT IV 300 V (maximum voltage on BNC input directly)		
Maximum voltage on meter input	CAT II 1000 V/CAT III 600 V	CAT III 1000 V/CAT IV 600 V (safety designed banana input connectors)	Not applicable
Memory save and recall			
Memory locations (internal)	15 waveform memories plus 2 recording memories		
15 waveform memory locations	Stores Scope-trace waveform data (2 traces each) plus screen-copy plus corresponding setup		
Two recording memories	Each may contain: a 100 Screen Replay sequence, or a ScopeRecord roll-mode recording (2 traces), or a TrendPlot recording of up to 4 measurements		
External data storage	On PC, using FlukeView™ Software	On PC, using FlukeView™ Software, or direct storage on external flash memory drive (maximum 2 GB) through USB host port	
Screencopies	On PC, using FlukeView Software	On PC, using FlukeView™ Software, or internally (in instrument) which can be copied on to external flash memory drive as .bmp file, through USB host port	
Volatility	Data is stored in RAM which is maintained by the instrument's main battery	Measurement data is initially stored in RAM, which is maintained by the main battery with a 30 seconds back-up when battery is exchanged when storing data, this is written in non-volatile flash-ROM	
Real-time clock	Provides date and time stamp information for ScopeRecord, for 100 Screen Replay sequences and for TrendPlot recordings		
Case			
Design	Rugged, shock-proof with integrated protective holster. Handstrap and hangstrap included as standard	Rugged, shock-proof with integrated protective holster. Handstrap and hangstrap included as standard Kensington lock supported to lock down instrument when left unattended	
Drip and dust proof	IP 51 according to IEC529		
Shock and vibration	Shock 30 g, vibration (sinusoidal) 3 g according to MIL-PRF-28800F Class 2		
Display size	115.2 mm x 86.4 mm (4.54 in x 3.4 in); 144 mm (5.67 in) diagonal LCD	127 mm x 88 mm (153 mm/6.0 in diagonal) LCD	
Resolution	320 x 240 pixels		
Contrast and brightness	User adjustable, temperature compensated		
Brightness	80 cd/m2 typical using power adapter	200 cd/m2 typical using power adapter, 90 cd/m2 typical using battery power	
Mechanical data			
Size	256 mm x 169 mm x 64 mm (10.1 in x 6.6 in x 2.5 in)	265 mm x 190 mm x 70 mm (10.4 in x 7.5 in x 2.8 in)	265 mm x 190 mm x 70 mm (10.4 in x 7.5 in x 2.8 in)
Weight (including battery)	2 kg (4.4 lb)	2.1 kg (4.6 lb)	2.2 kg (4.8 lb)

General specifications	199XRAY (discontinued)	190M-2	190M-4
Power			
Line power	Mains adapter/battery charger BC190 included, version depending of country		
Battery power	Rechargeable NiMH BP190 (installed)	Rechargeable double capacity Li-Ion battery (included). Battery swappable through easily accessible battery door at the rear of the instrument	
Battery type (incl.) and capacity [+opt. battery]	BP 190; 3500 mAh	BP290; 2400 mAh [BP291 (4800 mAh) optional]	BP291 (4800 mAh)
Battery charge indicator	Battery status indicator on instrument screen	Battery has built-in status indicator for use with external charger, next to battery status indicator on instrument screen	
Battery operating time (with backlight low)	> 3½ hours	Up to 4 hours using BP290 (included), up to 8 hours using BP291 (optional)	Up to Seven hours using BP291 (included)
Battery charging time	4 hours	2½ hours using BP290; 5 hours using BP291	5 hours using BP291
Battery power saving functions	Auto 'power down' with adjustable power down time. On-screen battery power indicator	Auto 'power down' with adjustable power down time; Auto 'Display off' with adjustable power downtime; On-screen battery power indicator	
Safety			
Compliance	EN61010-1-2001, Pollution Degree 2; UL61010B, with approval; CAN/CSA C22.2, No. 61010-1-04, with approval; ANSI/ISA-82.02.01	EN61010-1-2001, Pollution Degree 2; CAN/CSA C22.2, No. 61010-1-04, with approval; UL61010B; ANSI/ISA-82.02.01	
Environmental			
Operating temperature	0 °C ~ +50 °C	0 °C ~ +40 °C; +40 °C ~ +50 °C excluding battery	
Storage temperature	-20 °C ~ +60 °C		
Humidity	10 °C ~ +30 °C: 95 % RH non-condensing; 30 °C ~ +40 °C: 75 % RH non-condensing; 40 °C ~ +50 °C: 45 % RH non-condensing		
Maximum operating altitude	3,000 m (10,000 ft)	Up to 2,000 m (6666 ft) for CAT IV 600 V, CAT III 1000 V; up to 3,000 m (10,000 ft) for CAT III 600 V, CAT II 1000 V	
Maximum storage altitude	12 km (40,000 ft)		
Electro-Magnetic-Compatibility (EMC)	EN 61326-1 for emission and immunity	EN 61326 (2005-12) for emission and immunity	
Interfaces	Optical port in instrument transfers instrument settings, screen images and waveform data, compatible with FlukeView® software for Windows®, via optional OC4USB or PM9080 (optical to electrical interface cable)	Two USB-ports provided. Ports are fully insulated from instrument's floating measurement circuitry USB-host port directly connects to external flash memory drive (up to 2 GB) for storage of waveform data, complete datasets in which data and setup information is included, instrument settings and screen copies	
		A mini-USB-B is provided which allows for interconnection to PC for remote control and data transfer under PC-control	
Probe calibration output	Through DMM-input banana connectors	Dedicated probe-cal output with reference contact provided, fully insulated from any measurement input channel	
Warranty	Three years (parts and labor) on main instrument, one year on accessories		

About Fluke Biomedical

Fluke Biomedical is the world's leading manufacturer of quality biomedical test and simulation products. In addition, Fluke Biomedical provides the latest medical imaging and oncology quality-assurance solutions for regulatory compliance. Highly credentialed and equipped with a NVLAP Lab Code 200566-0 accredited laboratory, Fluke Biomedical also offers the best in quality and customer service for all your equipment calibration needs.

Today, biomedical personnel must meet the increasing regulatory pressures, higher quality standards, and rapid technological growth, while performing their work faster and more efficiently than ever. Fluke Biomedical provides a diverse range of software and hardware tools to meet today's challenges.

Fluke Biomedical Regulatory Commitment

As a medical test device manufacturer, we recognize and follow certain quality standards and certifications when developing our products. We are ISO 9001 and ISO 13485 medical device certified and our products are:

- CE Certified, where required
- NIST Traceable and Calibrated
- UL, CSA, ETL Certified, where required
- NRC Compliant, where required

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