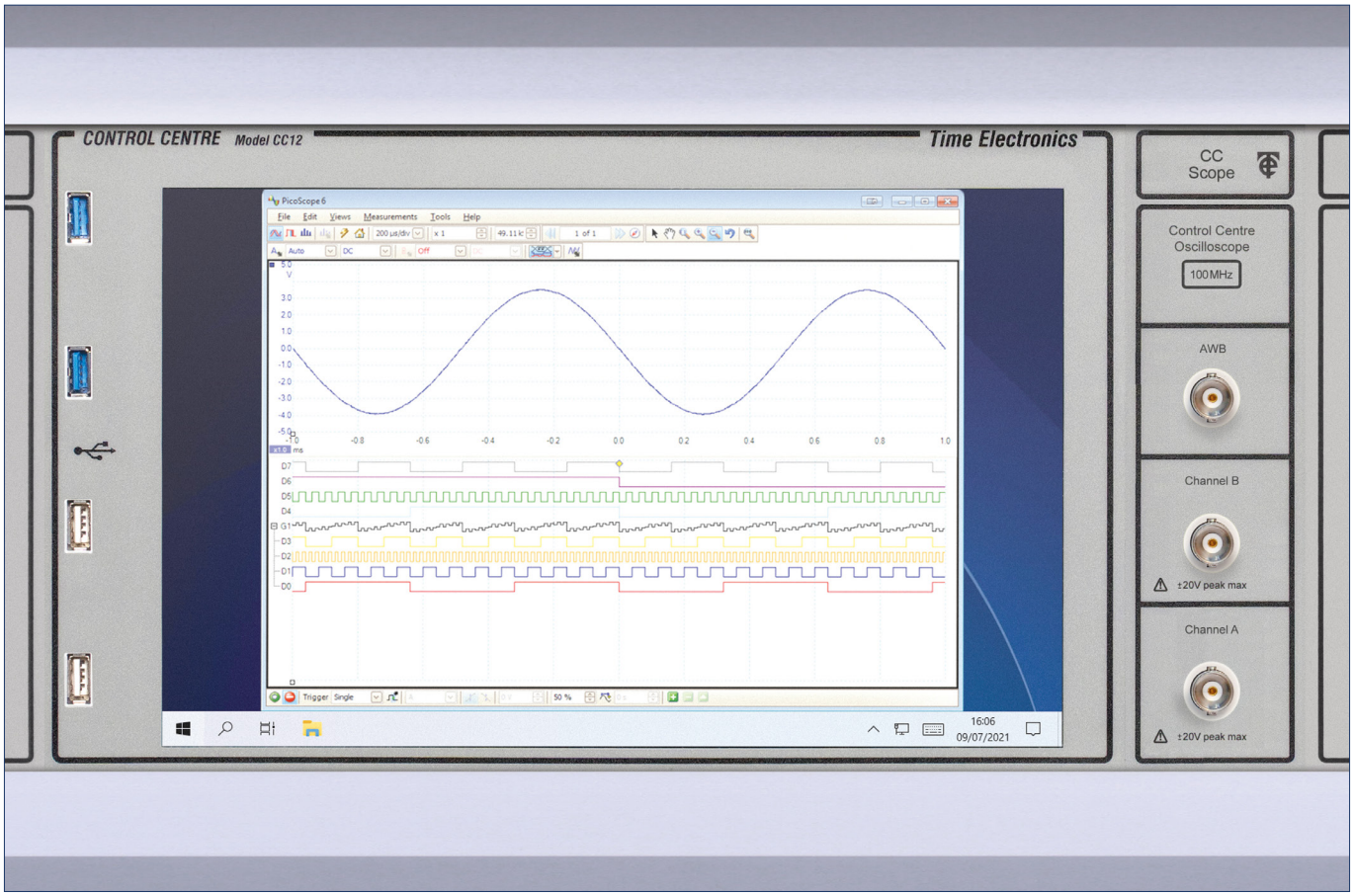
Time Electronics
CCSCOPE Control Centre Integral Oscilloscopes

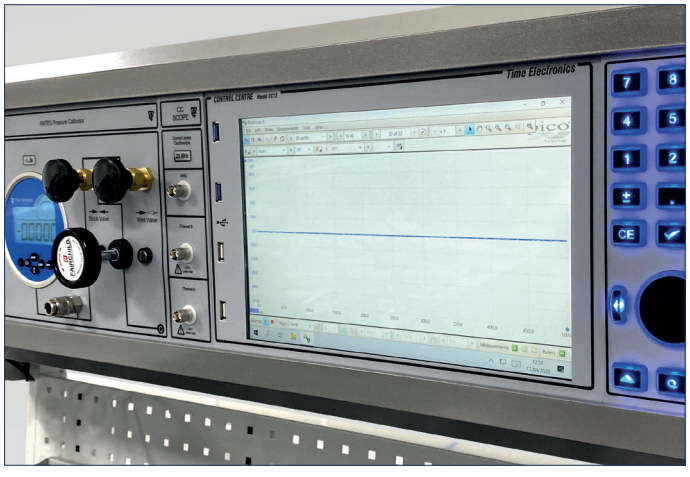


Description

The CCSCOPE range provides a convenient solution to housing oscilloscopes within the Time Electronics CalBench. The scope is situated inside the primary or secondary console with connection via BNC terminals on a 50 mm wide module panel.

Each scope features internal communication to a control centre (standard with 8060 or 7051) and operation is via a dedicated software application. This software is pre-loaded on the control centre. The interface provides the user with a large display that is easy to use and control the scope.

Standard modules are available with versions up to 100 MHz. The advanced models provide a higher performance solution with 60, 100 and 200 MHz versions available. Advanced models feature a 20 MHz function generator.



Features

- 22X series - Standard models up to 100 MHz bandwidth
- 52X series - Advanced models up to 200 MHz bandwidth
- 2 channels (4 channels optional)
- Advanced digital triggers
- Persistence display modes
- Integrally fitted and operated via the control centre
- Supplied with software application for operation
- Mask limit testing
- Serial bus decoding

Standard Modules

CCSCOPE-2204A: Control Centre Oscilloscope (10 MHz, 2 channel)
CCSCOPE-2205A: Control Centre Oscilloscope (25 MHz, 2 channel)
CCSCOPE-2206B: Control Centre Oscilloscope (50 MHz, 2 channel)
CCSCOPE-2207B: Control Centre Oscilloscope (75 MHz, 2 channel)
CCSCOPE-2208B: Control Centre Oscilloscope (100 MHz, 2 channel)

Advanced Modules

CCSCOPE-5242D: Control Centre Oscilloscope (60 MHz, 2 channel)
CCSCOPE-5243D: Control Centre Oscilloscope (100 MHz, 2 channel)
CCSCOPE-5244D: Control Centre Oscilloscope (200 MHz, 2 channel)

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CCSCOPE Specifications: Standard Models

Module	CCSCOPE-2204A	CCSCOPE-2205A	CCSCOPE-2206B	CCSCOPE-2207B	CCSCOPE-2208B
VERTICAL					
Bandwidth (–3 dB)	10 MHz	25 MHz	50 MHz	70 MHz	100 MHz
Rise time (calculated)	35 ns	14 ns	7 ns	5 ns	3.5 ns
Software lowpass filter	Not applicable		Configurable software lowpass filter		
Vertical resolution	8 bits		8 bits		
Enhanced vertical resolution	Up to 12 bits		Up to 12 bits		
Input ranges	±50 mV, ±100 mV, ±200 mV, ±500 mV, ±1 V, ±2 V, ±5 V, ±10 V, ±20 V		±20 mV, ±50 mV, ±100 mV, ±200 mV, ±500 mV, ±1 V, ±2 V, ±5 V, ±10 V, ±20 V		
Input sensitivity	10 mV/div to 4 V/div (10 vertical divisions)		4 mV/div to 4 V/div (10 vertical divisions)		
Input coupling	AC / DC		AC / DC		
Input connector	Single-ended, BNC(f)		Single-ended, BNC(f)		
Input characteristics	1 MΩ ± 1% ‖ 14 pF ± 2 pF		1 MΩ ± 1% ‖ 16 pF ± 1 pF		
Analog offset range (vertical position adjustment)	None		±250 mV (20 mV to 200 mV ranges) ±2.5 V (500 mV to 2 V ranges) ±25 V (5 V to 20 V ranges)		
Analog offset control accuracy	Not applicable		±1% of offset setting, additional to basic DC accuracy		
DC accuracy	±3% of full scale ±200 µV		±3% of full scale ±200 µV		
Overvoltage protection	±100 V (DC + AC peak) up to 10 kHz		±100 V (DC + AC peak) up to 10 kHz		
HORIZONTAL (TIMEBASE)					
Maximum sampling rate (real-time) 1 ch. / 2 ch.	100 MS/s / 50 MS/s	200 MS/s (Ch. A) / 100 MS/s	500 MS/s / 250 MS/s	1 GS/s / 500 MS/s	
Equivalent-time sampling rate (ETS)	2 GS/s	4 GS/s	5 GS/s	10 GS/s	
Maximum sampling rate (USB streaming)	1 MS/s		9.6 MS/s (31 MS/s with SDK)		
Shortest timebase	10 ns/div	5 ns/div	2 ns/div	1 ns/div	
Longest timebase	5000 s/div		5000 s/div		
Buffer memory (block mode, shared between active channels)	8 kS	16 kS	32 MS	64 MS	128 MS
Buffer memory (USB streaming mode, PicoScope software)	100 MS (shared between active channels)		100 MS (shared between active channels)		
Buffer memory (USB streaming mode, SDK)	Up to available PC memory		Up to available PC memory		
Waveform buffers (PicoScope software)	10 000		10 000		
Maximum waveforms per second	2000		80 000		
Initial timebase accuracy	±100 ppm		±50 ppm		
Timebase drift	±5 ppm/year		±5 ppm/year		
Sample jitter	30 ps RMS typical		20 ps RMS typical	3 ps RMS typical	
ADC sampling	Simultaneous sampling on all enabled channels		Simultaneous sampling on all enabled channels		
DYNAMIC PERFORMANCE (typical)					
Crosstalk (full bandwidth, equal ranges)	Better than 200:1		Better than 300:1		
Harmonic distortion	< –50 dB at 100 kHz, full-scale input, typical		< –50 dB at 100 kHz, full-scale input, typical		
SFDR (100 kHz, full-scale input, typical)	> 52 dB		±20 mV range: > 44 dB ±50 mV range and higher: > 52 dB		
Noise	< 150 µV RMS (±50 mV range)		< 220 µV RMS (±20 mV range)	< 300 µV RMS (±20 mV range)	
Bandwidth flatness	(+0.3 dB, –3 dB) from DC to full bandwidth		(+0.3 dB, –3 dB) from DC to full bandwidth		
TRIGGERING					
Sources	Ch A, Ch B		Ch A, Ch B		
Trigger modes	None, auto, repeat, single		None, auto, repeat, single, rapid (segmented memory)		
Advanced triggers	Edge, window, pulse width, window pulse width, dropout, window dropout, interval, logic		Edge, window, pulse width, window pulse width, dropout, window dropout, interval, runt pulse, logic		
Trigger types, ETS	Rising or falling edge		Rising or falling edge (available on Ch A only)		
Segmented memory buffers (SDK)	N/A		128 000	256 000	500 000
Segmented memory buffers (PicoScope software)	N/A		10 000		
Trigger sensitivity, real-time	Digital triggering provides 1 LSB accuracy up to full bandwidth		Digital triggering provides 1 LSB accuracy up to full bandwidth		
Trigger sensitivity, ETS	10 mV p-p, typical, at full bandwidth		10 mV p-p, typical, at full bandwidth		
Maximum pre-trigger capture	100% of capture size		100% of capture size		
Maximum post-trigger delay	4 billion samples		4 billion samples		
Trigger rearm time	PC-dependent		< 2 µs at 500 MS/s sampling rate	< 1 µs at 1 GS/s sampling rate	
Maximum trigger rate	PC-dependent		10 000 waveforms in a 12 ms burst, at 500 MS/s sampling rate, typical	10 000 waveforms in a 6 ms burst, at 1 GS/s sampling rate, typical	

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Module	CCSCOPE-5242D	CCSCOPE-5243D	CCSCOPE-5244D
Oscilloscope - vertical			
Input type	Single-ended, BNC connector		
Bandwidth (−3 dB)	60 MHz	100 MHz[1]	200 MHz[1]
Rise time (calculated)	5.8 ns	3.5 ns[1]	1.75 ns[1]
Bandwidth limiter	20 MHz, selectable		
Vertical resolution[2]	8, 12, 14, 15 or 16 bits		
LSB size[2] (quantization step size)	8 bit mode: < 0.6% of input range 12 bit mode: < 0.04% of input range 14 bit mode: < 0.01% of input range 15 bit mode: < 0.005% of input range 16 bit mode: < 0.0025% of input range		
Enhanced vertical resolution	Hardware resolution + 4 bits		
Input ranges	±10 mV to ±20 V full scale, in 11 ranges		
Input sensitivity	2 mV/div to 4 V/div (10 vertical divisions)		
Input coupling	AC / DC		
Input characteristics	1 MΩ ± 1% || 14 ±1 pF		
Gain accuracy	12 to 16 bit modes: ±0.5% of signal ±1 LSB[3] 8 bit mode: ±2% of signal ±1 LSB[3]		
Offset accuracy	±500 µV ±1% of full scale[3] Offset accuracy can be improved by using the “zero offset” function in PicoScope software.		
Analog offset range (vertical position adjust)	±250 mV (10, 20, 50, 100, 200 mV ranges), ±2.5 V (500 mV, 1 V, 2 V ranges), ±20 V (5, 10, 20 V ranges)		
Analog offset control accuracy	±0.5% of offset setting, additional to basic DC offset accuracy		
Overvoltage protection	±100 V (DC + AC peak)		

[1] In 16-bit mode, bandwidth reduced to 60 MHz and rise time increased to 5.8 ns.
[2] On ±20 mV range, in 14 to 16-bit modes, hardware resolution reduced by 1 bit. On ±10 mV range, hardware resolution reduced by 1 bit in 12-bit mode, 2 bits in 14 to 16-bit modes.
[3] Between 15 and 30 °C after 1 hour warm-up.

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CCSCOPE Specifications: Advanced Models 5242D / 5243D / 5244D

Module	CCSCOPE-5242D	CCSCOPE-5243D	CCSCOPE-5244D
Horizontal			
Max. sampling rate Any 1 channel Any 2 channels Any 3 or 4 channels More than 4 channels	8-bit mode 1 GS/s 500 MS/s 250 MS/s 125 MS/s	12-bit mode 500 MS/s 250 MS/s 125 MS/s 62.5 MS/s	14-bit mode 125 MS/s 125 MS/s 125 MS/s 62.5 MS/s 15-bit mode[4] 125 MS/s 125 MS/s 16-bit mode[4] 62.5 MS/s "Channel" means any analog channel or 8-bit digital port [4]Any number of 8-bit digital ports can be used in 15-bit and 16-bit modes without affecting the maximum sampling rate
Maximum equivalent sampling rate (repetitive signals; 8-bit mode only, ETS mode)	2.5 GS/s	5 GS/s	10 GS/s
Maximum sampling rate (continuous USB streaming into PC memory)[5]	USB 3, using PicoScope software: 15 to 20 MS/s USB 3, using PicoSDK: 125 MS/s (8-bit) or 62.5 MS/s (12 to 16 bit modes) USB 2, using PicoScope software: 8 to 10 MS/s USB 2, using PicoSDK: ~30 MS/s (8-bit) or ~15 MS/s (12 to 16 bit modes)		
Timebase ranges (real time)	1 ns/div to 5000 s/div in 39 ranges		
Fastest timebase (ETS)	500 ps/div	200 ps/div	100 ps/div
Buffer memory[6] (8-bit mode)	128 MS	256 MS	512 MS
Buffer memory[6] (≥ 12-bit mode)	64 MS	128 MS	256 MS
Buffer memory[7] (continuous streaming)	100 MS in PicoScope software		
Waveform buffer (no. of segments)	40 000 in PicoScope software		
Waveform buffer (no. of segments) when using PicoSDK (8 bit mode)	250 000	500 000	1 000 000
Waveform buffer (no. of segments) when using PicoSDK (12 to 16 bit modes)	125 000	250 000	500 000
Initial timebase accuracy	±50 ppm (0.005%)	±2 ppm (0.0002%)	±2 ppm (0.0002%)
Timebase drift	±5 ppm/year	±1 ppm/year	±1 ppm/year
Sample jitter	3 ps RMS, typical		
ADC sampling	Simultaneous on all enabled channels		

[5]Shared between enabled channels, PC dependent, available sample rates vary by resolution.
[6]Shared between enabled channels.
[7]Driver buffering up to available PC memory when using PicoSDK. No limit on duration of capture.

Module	CCSCOPE-5242D	CCSCOPE-5243D	CCSCOPE-5244D

Dynamic performance (typical; analog channels)	
Crosstalk	Better than 400:1 up to full bandwidth (equal voltage ranges)
Harmonic distortion	8-bit mode: −60 dB at 100 kHz full scale input. 12-bit mode or higher: −70 dB at 100 kHz full scale input
SFDR	8 to 12-bit modes: 60 dB at 100 kHz full scale input. 14 to 16-bit modes: 70 dB at 100 kHz full scale input.
Noise (on most sensitive range)	8-bit mode: 120 µV RMS 12-bit mode: 110 µV RMS 14-bit mode: 100 µV RMS 15-bit mode: 85 µV RMS 16-bit mode: 70 µV RMS
Bandwidth flatness	(+0.3 dB, −3 dB) from DC to full bandwidth

Triggering (main specifications)	
Source	Analog channels, plus: MSO models: Digital D0 to D15. Other models: Ext trigger.
Trigger modes	None, auto, repeat, single, rapid (segmented memory).
Advanced trigger types (analog channels)	Edge, window, pulse width, window pulse width, dropout, window dropout, interval, runt, logic.
Trigger types (analog channels, ETS)	Rising or falling edge ETS trigger available on ChA only, 8-bit mode only.
Trigger sensitivity (analog channels)	Digital triggering provides 1 LSB accuracy up to full bandwidth of scope.
Trigger sensitivity (analog channels, ETS)	At full bandwidth: typical 10 mV peak to peak
Trigger types (digital inputs)	MSO models only: Edge, pulse width, dropout, interval, logic, pattern, mixed signal.
Maximum pre-trigger capture	Up to 100% of capture size.
Maximum post-trigger delay	Zero to 4 billion samples, settable in 1 sample steps (delay range on fastest timebase of 0 – 4 s in 1 ns steps)
Trigger rearm time	8-bit mode, typical: 1 µs on fastest timebase 8 to 12 bit modes: < 2 µs max on fastest timebase 14 to 16 bit modes: < 3 µs max on fastest timebase
Maximum trigger rate	10 000 waveforms in a 10 ms burst, 8-bit mode

External trigger input	CCSCOPE-5242D	CCSCOPE-5243D	CCSCOPE-5244
Connector type	Front panel BNC		
Trigger types	Edge, pulse width, dropout, interval, logic		
Input characteristics	1 MΩ ± 1% || 14 pF ±1.5 pF		
Bandwidth	60 MHz	100 MHz	200 MHz
Threshold range	±5 V		
Threshold range	±5 V, DC coupled		
External trigger threshold accuracy	±1% of full scale		
External trigger sensitivity	200 mV peak to peak		
Coupling	DC		
Overvoltage protection	±100 V (DC + AC peak)		

CC-AFG20: Function generator	
Standard output signals	Sine, square, triangle, DC voltage, ramp up, ramp down, sinc, Gaussian, half-sine
Pseudorandom output signals	White noise, selectable amplitude and offset within output voltage range. Pseudorandom binary sequence (PRBS), selectable high and low levels within output voltage range, selectable bit rate up to 20 Mb/s
Standard signal frequency	0.025 Hz to 20 MHz
Sweep modes	Up, down, dual with selectable start / stop frequencies and increments
Triggering	Can trigger a counted number of waveform cycles or frequency sweeps (from 1 to 1 billion) from the scope trigger, external trigger or from software. Can also use the external trigger to gate the signal generator output.
Output frequency accuracy	Oscilloscope timebase accuracy ± output frequency resolution
Output frequency resolution	< 0.025 Hz
Output voltage range	±2 V
Output voltage adjustments	Signal amplitude and offset adjustable in approx 0.25 mV steps within overall ±2 V range
Amplitude flatness	< 1.5 dB to 20 MHz, typical
DC accuracy	±1% of full scale
SFDR	> 70 dB, 10 kHz full scale sine wave
Output resistance	50 Ω ±1%
Connector type	BNC(f)
Overvoltage protection	±20 V

Arbitrary waveform generator	
AWG update rate	200 MHz
AWG buffer size	32 kS
AWG resolution	14 bits (output step size approximately 0.25 mV)
AWG bandwidth	> 20 MHz
AWG rise time (10% to 90%)	< 10 ns (50 Ω load)

Additional AWG specifications including sweep modes, triggering, frequency accuracy and resolution, voltage range, DC accuracy and output characteristics are as the function generator

Spectrum analyzer	CCSCOPE-5242D	CCSCOPE-5243D	CCSCOPE-5244
Frequency range	DC to 60 MHz	DC to 100 MHz	DC to 200 MHz
Display modes	Magnitude, average, peak hold		
Y axis	Logarithmic (dbV, dBu, dBm, arbitrary dB) or linear (volts)		
X axis	Linear or logarithmic		
Windowing functions	Rectangular, Gaussian, triangular, Blackman, Blackman–Harris, Hamming, Hann, flat-top		
Number of FFT points	Selectable from 128 to 1 million in powers of 2		

Math channels	
Functions	−x, x+y, x−y, x*y, x/y, x^y, sqrt, exp, ln, log, abs, norm, sign, ceiling, floor, top, base, amplitude, derivative, integral, rise time, fall time, RMS, RMS ripple, phase, delay, deskew, true power, apparent power, reactive power, power factor, DC power, crest factor, area AC, positive area at AC, negative area at AC, absolute area at AC, area at DC, positive area at DC, negative area at DC, absolute area at DC, sin, cos, tan, arcsin, arccos, arctan, sinh, cosh, tanh
Filter functions	Low pass, high pass, band stop, band pass
Graphing functions	Frequency, duty cycle (positive and negative)
Buffered functions	Min, max, average, peak
Operands	A, B, C, D (input channels), T (time), reference waveforms, pi, D0–D15 (digital channels), constants
Automatic measurements	
Scope mode	Amplitude measurements: Minimum, maximum, base, top, negative overshoot, positive overshoot, peak to peak, amplitude, mean, RMS, RMS ripple Time measurements: Frequency, cycle time, negative duty cycle, positive duty cycle, edge count (rising, falling, either) high pulse width, low pulse width, rise time, fall time, rising rate, falling rate Multi-channel measurements: Phase, delay Power measurements: True power, apparent power, reactive power, power factor, DC power, crest factor, area at AC, positive area at AC, negative area at AC, absolute area at AC, area at DC, positive area at DC, negative area at DC, absolute area at DC
Spectrum mode	Frequency at peak, amplitude at peak, total power, THD %, THD dB, THD+N, SFDR, SINAD, SNR, IMD
Statistics	Minimum, maximum, average, standard deviation
DeepMeasure™	
Parameters	Cycle number, cycle time, frequency, low pulse width, high pulse width, duty cycle (high), duty cycle (low), rise time, fall time, undershoot, overshoot, max. voltage, min. voltage, voltage peak to peak, start time, end time
Serial decoding	
Protocols	1-Wire, 10BASE-T1S, ARINC 429, BroadR-Reach, CAN, CAN FD, CAN J1939, CAN XL, DALI, DCC, DMX512, Ethernet (10Base-T), Fast Ethernet (100Base-TX), FlexRay, I²C, I²S, I³C BASIC v1.0, LIN, Manchester (single ended and differential), MIL-STD-1553, MODBUS (ASCII and RTU), NMEA-0183, Parallel bus, PMBUS, PS/2, PSI5 (Sensor), Quadrature, SBS Data, SENT (Fast, SPC, Slow), SMBUS, SPI (SDIO and MISO/MOSI), UART/RS-232, Extended UART, USB (1.0/1.1), Wind sensor. Subject to number of channels available and oscilloscope bandwidth.
Inputs	All input channels (analog, digital if available) with any mixture of protocols
Mask limit testing	
Statistics	Pass/fail, failure count, total count
Mask creation	User-drawn, table entry, auto-generated from waveform or imported from file
Display	
Interpolation	Linear or sin(x)/x
Persistence modes	Digital color, analog intensity, custom, fast