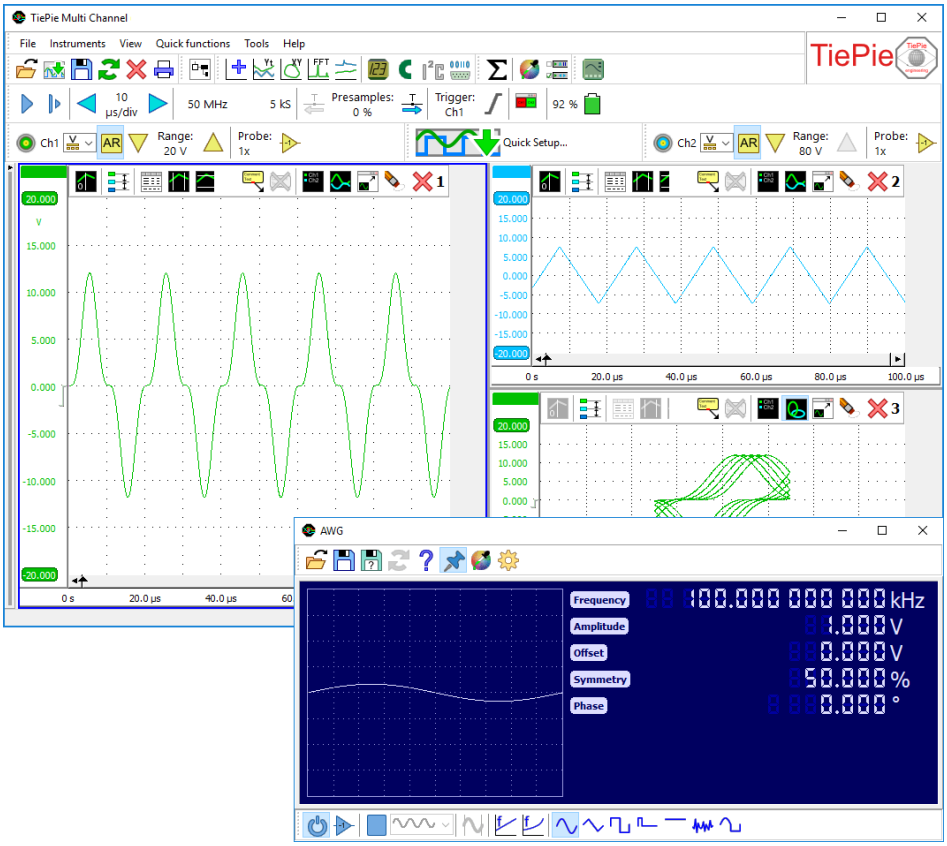
WiFiScope WS5

The world's best 500 MHz, 14 bit WiFi oscilloscope with 40 MHz Arbitrary Waveform Generator

Data sheet

This Best in class High Resolution low noise WiFi oscilloscope features 14 and 16 bit resolution, 256 times more amplitude resolution than an 8 bit oscilloscope, with super zoom up to 32 Million samples per channel. It is also the first WiFiScope to include a low distortion, high accuracy 40 MHz arbitrary waveform generator. That makes the WiFiScope WS5 the most powerful, portable, battery powered and versatile WiFi PC oscilloscope with built in function generator, high resolution multimeter and more..., incorporating innovative technology such as SureConnect and CMI interfacing and universal connection through WiFi, wired LAN and SuperSpeed USB 3.0.



Step into the Next Generation of High Performance WiFi PC oscilloscopes.

The best way to experience that superiority of the WiFiScope WS5 series PC oscilloscopes is by using one.

See www.tiepie.com/WS5

TiePie engineering

WiFiScope WS5, an unbeatable WiFi oscilloscope with Arbitrary Waveform Generator

Key facts of this high sensitivity low noise best in class WiFi oscilloscope:

- WiFi connection, wired LAN connection and SuperSpeed USB 3.0 connection
- Battery powered for hours of fully galvanically isolated measuring
- 500 MSamples per second sample rate WiFi oscilloscope
- Highly accurate 1 ppm timebase
- 14-16 bit High Resolution, 256 times more amplitude resolution than an 8 bit oscilloscope
- DC Accuracy of 0.25 % and 0.1 % typical
- Up to 250 MHz analog bandwidth
- Lowest noise WiFi oscilloscope in the market
- Very fast 40 MSamples per second continuous data acquisition via USB
- Super zoom up to 64 Million samples deep buffer memory
- SureConnect connection test on each channel

- 1 μHz to 40 MHz sine, square, triangular and arbitrary waves
- 240 MS/s, 14 bit, 64 MSamples arbitrary waves
- 0 to ±12 V output (24 V_{pp})
- 8 ns rise and fall time
- Spurious (non harmonic) <-75 dB

- CMI interfacing to combining multiple instruments for fully synchronized measuring
- Spectrum analyzer with 32 million bins
- High Performance Digital Multimeter (DMM)
- Protocol analyzer
- Quick Setup fast to work with all types of measurements
- I/O blocks to build your own measurement
- An API and SDK to build your own software
- Free software and firmware updates
- 2 years warranty, 5 years optional

The WiFiScope WS5 provides the best that is available in industry, for a limited budget. The flexibility and quality that the WiFiScope WS5 offers is unparalleled by any other oscilloscope in its class.

Models

The WiFiScope WS5 is available in three different models with an extended memory option (XM) and with optional SureConnect connection test and resistance measurement (S).

WiFiScope WS5 model		540	530	220
Maximum sampling rate		500 MSa/s	500 MSa/s	200 MSa/s
Maximum streaming rate		40 MSa/s	40 MSa/s	20 MSa/s
Maximum record length	standard model	512 kpts	512 kpts	512 kpts
	XM option	64 Mpts	64 Mpts	64 Mpts
Maximum signal frequency		40 MHz	30 MHz	20 MHz
Generator waveform buffer	standard model	256 kpts	256 kpts	256 kpts
	XM option	64 Mpts	64 Mpts	64 Mpts

The right choice

The WiFiScope WS5 series WiFi PC oscilloscope, fully packed with technology for all your advanced measurements now and in the future.

This small, light and portable WiFi oscilloscope captures and displays significantly more signal to solve your measurement problem. Because of this, the WiFiScope WS5 series is an ideal choice for demanding measurements.

Expand your channels with the CMI interface and build a comprehensive measuring system in seconds with a lot more than 2 channels.

WiFi connected

Using a computer based oscilloscope was never easier than with the WiFiScope WS5: simply switch it on and start the software on the computer:

- no power cables required as it is battery powered and can operate hours on a fully charged battery
- no interface cables required as it uses WiFi to connect to the computer

This allows you to measure fully floating, fully isolated from your computer. The WiFiScope WS5 can be placed near any test subject that may be hard to reach, or on moving objects, where wired connections are not possible.

Because the WiFiScope WS5 is not connected to the computer, there is no risk of damaging the computer.

LAN connected

When measuring in remote locations where a wired network is available, the WiFiScope WS5 can also be used through its LAN port. Measurements can then be performed from any location via the network, without having the computer to be close to the test subject.

Using its 1 Gbit LAN connection, the WiFiScope WS5 can achieve higher streaming performance than via WiFi.

USB 3.0 connected

When wireless measuring or LAN connected measuring is not required or not possible, the WiFiScope WS5 can also be connected via its USB3 port. This gives the benefit of even higher streaming performance. Additionally, when connected via USB, the WiFiScope WS5 can be combined with oscilloscopes via its CMI interface.

Rugged industrial design

The WiFiScope WS5 features a rugged design. Its enclosure is fitted with rubber protectors at the front and the rear. These help absorbing shocks and protect the WiFiScope WS5 against damage by mechanical shocks.

The rubber protects the connectors at the front and the rear of the WiFiScope WS5.

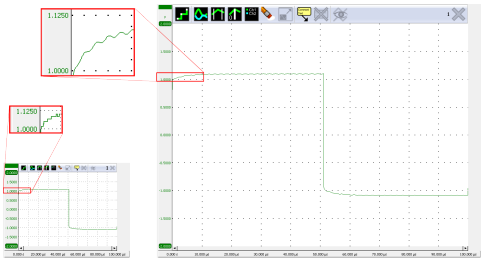
Additionally, the rubber prevents your WiFiScope WS5 from sliding. The rubber protectors have special notches that simplify stacking instruments. Holes are included that allow to connect a strap to hang the instrument near the test subject.

High amplitude resolution, 256 times more than a standard oscilloscope

A standalone oscilloscope usually has a low resolution of 8 or 9 bit, combined with a limited display of just 5.7" or 8.5", displaying the measured signals in their actual resolution. Zooming in will then not reveal more details.

The WiFiScope WS5 has high resolutions of 14 and 16 bit, making it a truly high precision oscilloscope. With a high resolution, the original signal is sampled much more accurate, the quantization error is much lower. The effect of a higher resolution can be clearly seen in the images below:

To display a signal measured with the WiFiScope WS5 High Resolution oscilloscope at the same level of detail as the standalone oscilloscope, the display can be 256 times larger. Viewing the signals on a 24" monitor immediately gives a very detailed impression of the signal. The smallest deviations are very well visible and because of the high resolution, it is still possible to zoom in and reveal additional details.



Shown are two displays, both showing a measurement of the same signal. The left display size corresponds to a size comparable to a standalone oscilloscope; at 8 bit resolution, zooming will not reveal more details. The right display corresponds to a maximized window on a standard PC screen; at 14 bit resolution, zooming will still reveal more details.

Combining multiple instruments for fully synchronized measuring

The WiFiScope WS5 is equipped with the sophisticated CMI bus, allowing to connect multiple WiFiScope WS5's to each other, which then can be used as a combined instrument *. All instruments will measure at the same sample frequency (0 ppm deviation!) Apart from a synchronization bus, the CMI also contains a trigger bus and a detection bus. Multiple WiFiScope WS5's can be connected to each other using a coupling cable. The maximum number of instruments is only imited by the number of available USB ports.

When the Multi Channel software is started, the coupled WiFiScope WS5's are identified and automatically combined to a larger instrument. Both the synchronization bus and the trigger bus are automatically terminated at both ends with the correct impedance. Placing terminators is not required by the user. Combining the instruments is fully automatic. This unique possibility to create e.g. a 12 channel instrument is only available with TiePie engineering oscilloscopes, not with other oscilloscopes.

The WiFiScope WS6 (www.tiepie.com/WS6) is also equipped with the CMI bus. Coupling a WiFiScope WS5 with a WiFiScope WS6 gives a 6 channel measuring system with Arbitrary Waveform Generator.

See the CMI bus in action at https://youtu.be/20L_exU3Reg

** Combining is only available when the WiFiScope WS5 is connected via USB.*

With a WiFiScope WS5 and a WiFiScope WS6 and a coupling cable you get a 6 channel oscilloscope with a high resolution of 14 bits at a maximum sampling rate of 100 MSa/s in a matter of seconds (no special software or hardware modifications required).

Highly accurate 1 ppm oscilloscope timebase

The time base accuracy of the WiFiScope WS5 is 25 to 100 times better than the comparable instruments of the competition. With a time base accuracy of 1 ppm, frequency and timing can be measured very accurately.

Coupling multiple instruments to a large combined instrument does not affect the time base accuracy, the timing deviation between the coupled instruments is 0 ppm.

SureConnect connection test on each channel

TiePie engineering is the first oscilloscope manufacturer to implement **SureConnect** technology. While measuring, the revolutionary SureConnect technology checks in real time whether a test probe is in physical and electrical contact with the test subject.

Assuring a good connection of a probe with a test subject may not always be easy. The subject under measurement may be dirty, oxidized or an (invisible) protective layer may be present. Or, the test subject may be hidden, making visible contact confirmation impossible. Also, capacitive coupling between test probe and test subject can result in measuring a distorted version of the actual signal, wrongly suggesting a connection. Simply activate the SureConnect connection test and you know whether there is contact or not.

SureConnect: no more doubt whether your probe doesn't make contact or there really is no signal.

See a demonstration of SureConnect at https://youtu.be/MinFpSFvtIY

Resistance measurement on each channel

Many sensors are based on variable resistors. Use your WiFiScope WS5 in the resistance setting to test them, no more need to take a separate ohm meter. Resistance values can be displayed as a number, but it is also possible to display the resistance variation in time, in a graph: an **Ohm scope**.

The Ohm scope uses the same inputs as the oscilloscope. Changing the measure leads is not required. The advanced protection against over voltage ensures that the Ohm scope withstands high voltages.

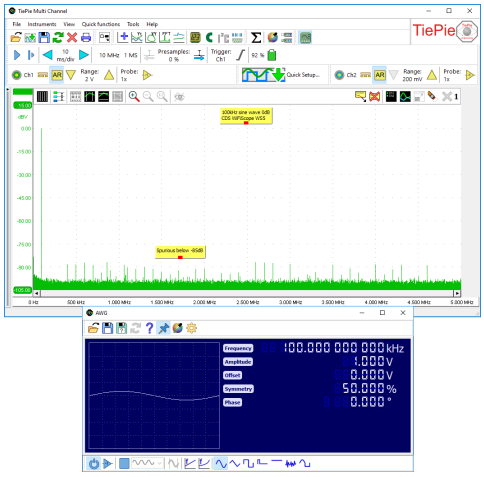
A typical application is to create resistance graphs of special resistors like NTCs and PTCs. Use e.g. channel 1 to measure the resistance of the PTC and channel 2 to measure the temperature. An XY plot will then show the resistance variation as a function of the temperature.

Advantages of the Ohm scope are:

- Capture fast resistance changes in a graph.
- Detect and locate carbon track defects in a variable resistor.

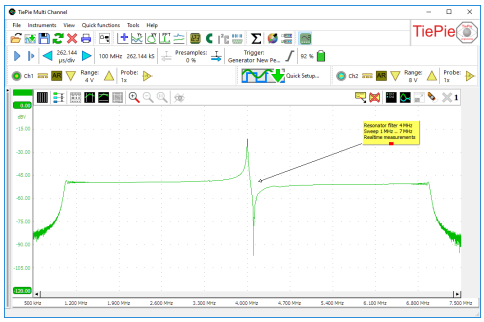
Built-in extremely low distortion USB arbitrary waveform generator

The WiFiScope WS5 is the first High Resolution USB oscilloscope with a built-in 40 MHz signal generator. The built in USB Arbitrary Waveform Generator uses the latest techniques on signal synthesis, developed by TiePie engineering, giving the best signal fidelity in its class. An expensive stand-alone Arbitrary Waveform Generator is easily surpassed. With a spurious distortion as low as -85 dB at 100 kHz signal frequency, a very flat amplitude spectrum and a rise time of 8 ns, the created signals approach perfection. Combined with an output voltage of 24 V_{pp}, a resolution of 14 bit at 240 MS/s and a waveform buffer of 64 MSamples, this makes the WiFiScope WS5 AWG truly a high quality generator. Standard signal shapes like sine wave, square wave, triangle, pulse, DC and noise are available. When a custom signal shape is required, this can be created in the 64 million samples large memory or by loading a previously measured signal from the oscilloscope.



Scope and Arbitrary Waveform Generator synchronisation

With both the High Resolution USB oscilloscope and the USB arbitrary waveform generator in one unit, it is easy to perform a synchronized measurement. It is e.g. possible to perform a sweep and directly measure the frequency spectrum. In the shown measurement a sweep from 1 MHz to 7 MHz is generated and injected in a resonance filter of 4 MHz, the output is directly measured. This is a real time measurement. When the resonance filter is heated, the drop in resonance frequency is immediately visible.



Very fast 20 MSamples per second streaming Data logger

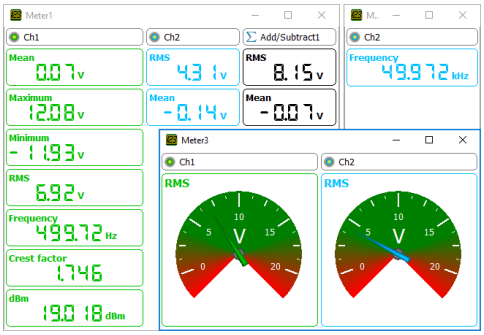
20 MSa/s

When unlimited deep memory is required, it is possible to stream the measured data directly to disk. The WiFiScope WS5 is capable of streaming up to 20 million samples per second, at 12 bit resolution, when measuring 1 channel and connected via USB *. When measuring at 16 bit resolution on all four channels, streaming measurements can be performed up to 6.25 MSa/s. Using streaming measuring, difficult problems can be measured easily and traced back and analyzed.

** When connected via WiFi or LAN, the maximum streaming rate is limited and depends on the network speed and quality.*

High performance digital WiFi multimeter

With the high resolution of 16 bits, the WiFiScope WS5 can be used as a comprehensive and accurate high performance digital multimeter with good specifications (like e.g. RMS, peak-peak, Max, Min, Mean, Variance, Standard deviation, Frequency, duty cycle, Crest factor, Rise time, Fall time, dBm, etc.). Both numerical and gauge displays are available. The stable and very accurate time base of the WiFiScope WS5 of 1ppm make very accurate frequency and time measurements possible. These qualities make an extra multimeter or frequency counter redundant and make the WiFiScope WS5 unique in its class.



Highest DC accuracy in the industry of 0.1 % typical

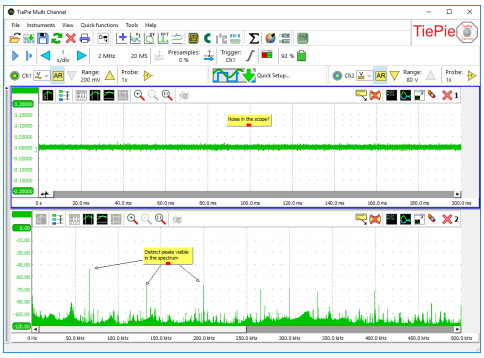
Troubleshooting in the frequency domain

The WiFiScope WS5 definitely brings an end to the idea that spectrum analyzers are expensive, hard to control and difficult to understand. The large flexibility of the spectrum analyzer makes it not just suitable for measuring high frequency signals of transmitters and receivers. A spectrum analyzer displays frequency along the X axis and along the Y axis the magnitude of the signal is displayed. This is called a frequency domain display.

When troubleshooting, usually an oscilloscope is used. But when the disturbance is small in amplitude and contains many frequencies, these signals are badly visible on an oscilloscope. They appear like noise signals. But, when these signals are viewed in the frequency domain, a much better overview is presented of the disturbance signals that are present and which frequencies they contain.

When e.g. measurements are performed on a system that contains switch mode power supplies, the disturbances caused by a power supply are easily detected by measuring in the frequency domain. The switch frequency of the switch mode power supply is measured by holding the probe close to the inductor of the power supply. This unique switch frequency is now known and can be stored in a reference channel. When this frequency is also measured at other locations in the system, the frequency is caused by the power supply. Precautions can be made to suppress the disturbing signal from the switch mode power supply. The suppression can be measured directly by the WiFiScope WS5 WiFi spectrum analyzer.

Because the WiFiScope WS5 measures with a very high resolution in the frequency domain, disturbances can be detected and analyzed at one tenth of a Hertz accuracy. Up to 32 million frequency components can be displayed in a graph. Because of the high resolution of the WiFiScope WS5 (14 and 16 bit resolution and up to 32 MSamples), small disturbances can be easily detected. When a precaution is made to suppress the disturbance, its effectiveness can immediately be checked with the WiFiScope WS5. With the high resolution and the large memory of the WiFiScope WS5, a spectrum with a dynamic range of more than 120 dB can be measured. This is unique in its class. With this large dynamic range, distortion measurements can be well performed.



A spectrum with 10 million points and a real time bandwidth of 0-250 MHz, gives you a bin width of 25 Hz and a pulse detection of 2 nsec.

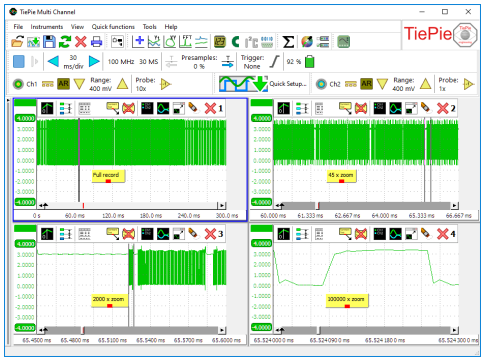
This method of troubleshooting is only possible (and unique for the WiFiScope WS5) because the WiFiScope WS5 contains:

- 250 MHz bandwidth
- 14 and 16 bit resolution
- up to 64 Million samples memory
- very fast FFT calculations

Mega deep memory of up to 64 MSamples per channel

When measuring at high sample rates, a long record length is a must, otherwise the acquisition buffer is full before the signal is measured. Where most oscilloscopes have 2.5 kSamples or 100 kSamples memory, the WiFiScope WS5 has up to 64 MSamples memory per channel, depending on the selected resolution and the number of active channels. When measuring at 14 bit resolution and all four channels, the available memory is 32 MSamples per channel. This gives the user 300 to 10000 times more memory. The advantage of deep memory is that once-only fast phenomena can be measured accurately or complete serial communication signal blocks like CAN Bus signals can be measured all at once.

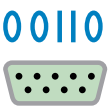
To the right, a 30 million samples long measurement is shown. The same signal is shown four times in different zooming factors, the bottom graph shows just 300 ns of the total 300 ms, a zoom factor of 1 million. It still provides enough detail for accurate signal analysis.



The unlimited super zoom feature of the WiFiScope WS5 allows to zoom in up to one individual sample, no matter what record length was selected.

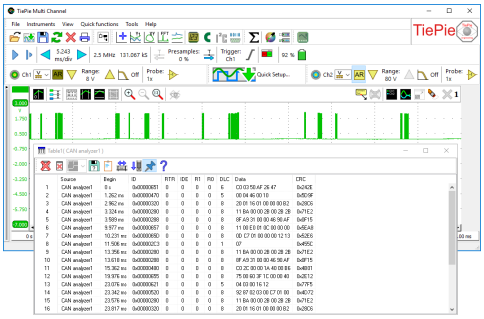
In the WiFi spectrum analyzer, the deep memory gives the advantage that a large dynamic range is created which sets troubleshooting in the frequency domain as a new standard.

Protocol analyzer



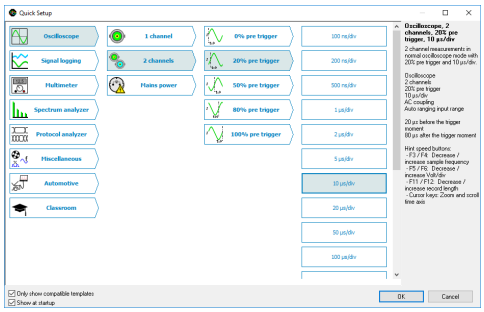
The various serial protocol analyzers of the WiFiScope WS5 can be used to analyze and debug serial data buses. The data is displayed in an elaborate table with information on the serial data. Locating "wrong" data packets has become very easy. For each developer or service technician this is a welcome option. Protocol analyzers for CAN bus data, I^2C communication and various other serial data communications are available.

To the right, decoded CAN bus messages are shown.



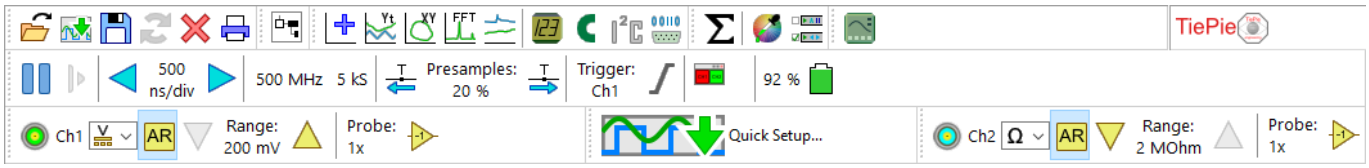
Fast to work with the WiFiScope WS5 and Quick Setups

To simplify setting up measurements, the Multi Channel software contains a large number of Quick Setups, for almost any application. A Quick Setup contains the basic settings for a specific measurement as well as additional information regarding the selected Quick Setup, like e.g. how the instrument and/or accessories need to be connected. Quick Setups can also contain reference signals. After loading the Quick Setup, that specific measurement can be performed and if needed, small adjustments to the setup can be made.



The Quick Setups are carefully organized in a tree structure, ordered by application. Just a few mouse clicks allow to perform a complex measurement.

Ease of use



The convenient toolbars offer many ways to control the WiFiScope WS5. The toolbars are fully customizable to meet the user's demands. The size of the toolbar buttons can be changed to simplify touch screen control. There are toolbars available for common operations like saving or recalling measurements, for each opened instrument, for each channel and for the quick functions. Using quick functions, complex measurements can be performed immediately by a single click.

- Open the Quick Setup screen
- Hide/show the Object Tree
- Create a new graph
- Create an Yt oscilloscope
- Create an XY oscilloscope
- Create a spectrum analyzer
- Create a data logger
- Create a multi meter
- Create a CAN Bus analyzer
- Create an I²C analyzer
- Create a serial analyzer
- Create a math channel
- Select a color scheme
- Select a toolbar scheme
- Open the function generator

With the cursor measurements, individually for each graph, many signal properties can be determined.

- Sample value at the left cursor
- Sample value at the right cursor
- Value difference between right and left cursor
- Value at the top cursor
- Value at the bottom cursor
- Value difference between top and bottom cursor
- Slope between the cursors
- Maximum signal value
- Minimum signal value
- Top-bottom value
- RMS value of the signal
- Mean value of the signal
- Variance of all signal values
- Standard deviation of all signal values
- Frequency of the signal
- Period time of the signal
- Duty cycle of the signal
- Crest factor of the signal
- Rise time of the signal
- Fall time of the signal
- Slew rate of the signal
- Number of periods
- Number of pulses
- Number of rising/falling edges
- dBm value of the signal
- Power of the signal

Library of education

The many measurement examples and technical explanations that are given on the TiePie engineering website give the beginning user much information on how to use the WiFiScope WS5 and in what areas it can be used. Basic information on measuring is given.

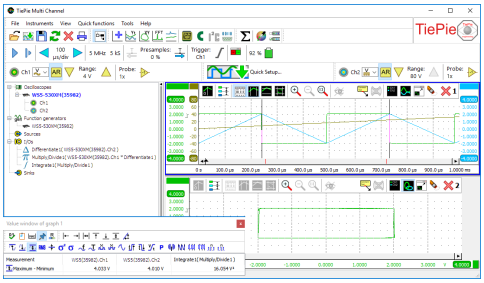
The WiFiScope WS5 gives the user an instrument with a high accuracy both in amplitude (up to 16 bit) and time and frequency (32 MSamples, 1 ppm). The integrated instruments make sure that most measurement problems can be solved and troubleshooting is limited to an absolute minimum. Are you working in research and development, manufacturing, service or education, the WiFiScope WS5 is the instrument to deploy to visualize and analyze your signals. The WiFiScope WS5 offers excellent and sophisticated measurement possibilities for an attractive budget for now and in the future.

A must for the beginning user and a source of inspiration for the experienced measurement specialist.
www.tiepie.com/library

Sophisticated mathematics for in-depth signal analysis

The Multi Channel software for the WiFiScope WS5 offers a large variety of mathematical operations like e.g. adding, subtracting, multiplying, dividing, integrating, differentiating, determining the square root, determining the logarithm, etc. These mathematical operations are available in the form of processing blocks and can be used to process the measured signals and reference signals. Besides the basic mathematical operations, there are also several processing blocks to perform more complex operations on the data, like determining minimum or maximum values, limiting to specified range, averaging, filtering, applying gain and offset, resampling etc.

Combining these mathematical processing blocks gives unrivaled possibilities in constructing complex mathematical operations to analyze your measurements thoroughly and obtain all the information you need from your data. The results can be displayed in graphs, numeric displays and tables and can be written to disk in various common file formats.



This measurement determines the area of an XY graph, using multiplying, integrating and differentiating I/O's. The area is indicated in the Value window: 16 V^2.

- Add or subtract signals
- Multiply or divide signals
- Determine the square root of a signal
- Determine the absolute value of a signal
- Differentiate a signal
- Integrate a signal
- Determine the logarithm of a signal
- Apply gain and offset to a signal
- Average a number of consecutive measurements
- Apply a low pass filter to a signal
- Limit the signal magnitude
- Compare the signal to a level
- Resample a signal to a different size
- Collect streaming data blocks
- Perform a Fast Fourier Transform on a signal
- Determine the duty cycle of a signal

The mathematical processing blocks give unrivaled possibilities in constructing complex mathematical operations.

Specifications

To achieve rated accuracy, allow the instrument to settle for 20 minutes. When subjected to extreme temperatures, allow additional time for internal temperatures to stabilize. Because of temperature compensated calibration, the WiFiScope WS5 will settle within specified accuracy regardless of the surrounding temperature.

Oscilloscope

Acquisition system			
Number of input channels	2 analog		
CH1, CH2	BNC		
Maximum sampling rate	Model 540	Model 530	Model 220
8 / 12 bit			
Measuring 1 channel	500 MSa/s	500 MSa/s	200 MSa/s
Measuring 2 channel2	200 MSa/s	200 MSa/s	100 MSa/s
14 bit			
Measuring 1 channel	100 MSa/s	100 MSa/s	50 MSa/s
Measuring 2 channel2	100 MSa/s	100 MSa/s	50 MSa/s
16 bit			
Measuring 1 channel	6.25 MSa/s	6.25 MSa/s	3.125 MSa/s
Measuring 2 channel2	6.25 MSa/s	6.25 MSa/s	3.125 MSa/s
Maximum sampling rate	Model 540	Model 530	Model 220
8 bit			
Measuring 1 channel	40 MSa/s	40 MSa/s	20 MSa/s
Measuring 2 channel2	20 MSa/s	20 MSa/s	10 MSa/s
12 / 14 bit			
Measuring 1 channel	20 MSa/s	20 MSa/s	10 MSa/s
Measuring 2 channel2	10 MSa/s	10 MSa/s	5 MSa/s
16 bit			
Measuring 1 channel	6.25 MSa/s	6.25 MSa/s	3.125 MSa/s
Measuring 2 channel2	6.25 MSa/s	6.25 MSa/s	3.125 MSa/s
Sampling source			
Internal	TCXO		
Accuracy	±0.0001 %		
Stability	±1 ppm over 0 °C to 55 °C		
Time base aging	±1 ppm per year		
External	LVDS, on auxilary connectors		
Input range	10 MHz		
Memory			
Standard model	128 KiSamples per channel		
XM option	32 MSamples per channel 64 MSamples when measuring one channel		

BNC inputs CH1, CH2				
Type	Single ended			
Resolution	8, 12, 14, 16 bit user selectable			
DC Accuracy	0.25 % (0.1 % typical) of full scale ± 1 LSB			
Ranges (full scale)	±200 mV ±400 mV ±800 mV	±2 V ±4 V ±8 V	±20 V ±40 V ±80 V	
Coupling	AC/DC			
Impedance	1 MΩ / 25 pF			
Maximum voltage	200 V (DC + AC peak < 10 kHz)			
Maximum voltage 1:10 probe	600 V (DC + AC peak < 10 kHz)			
	Ch1		**Ch2**	
Bandwidth at 75 % of full scale input (-3dB)	250 MHz		100 MHz	
Noise (in 200 mV range)	325 μV_{rms}		220 μV_{rms}	
AC coupling cut off frequency (-3dB)	±1.5 Hz			
SureConnect	Optionally available (option S)			
Maximum voltage on connection	200 V (DC + AC peak <10 kHz)			
Resistance measurement	Optionally available (option S)			
Ranges (full scale)	1 kΩ 2 kΩ 5 kΩ	10 kΩ 20 kΩ 50 kΩ	100 kΩ 200 kΩ 500 kΩ	1 MkΩ 2 MΩ
Ranges	100 Ohm to 2 MOhm full scale			
Accuracy	1 %			
Response time (to 95 %)	<10 µs			

Trigger	
System	Digital, 2 levels
Source	CH1, CH2, digital external, OR, generator start, generator new period, generator stop
Trigger modes	Rising / falling / any edge inside / outside window enter / exit window newline pulse width
Level adjustment	0 to 100 % of full scale
Hysteresis adjustment	0 to 100 % of full scale
Resolution	0.024 % (12 bits)/0.006 % (14/16 bits)
Pre trigger	0 to selected record length, 1 sample resolution
Post trigger	0 to selected record length, 1 sample resolution
Trigger hold-off	0 to 63 MSamples, 1 sample resolution
Trigger delay	0 to 16 GSamples, 1 sample resolution
Segmented trigger	Available via LibTiePie SDK
Maximum number of segments	1024
Minimum segment length	1 sample
Maximum segment length	32 M / number of segments 64 M / number of segments measuring 1 channel
Trigger rearm time	Sample frequency dependent, <700 ns on highest sample frequency
Digital external trigger	
Input	Extension connector pins 1, 2, 3
Range	0 to 2.5 V (TTL)
Coupling	DC
Jitter	depending on trigger source and sample frequency
Source = channel	≤ 1 sample
Source = External or Generator	
Sample frequency = 500 MS/s	≤ 8 samples
Sample frequency <500 MS/s	≤ 4 samples
Sample frequency ≤ 100 MS/s	≤ 1 sample

Multi instrument synchronization	
Combining instruments is only available when all instruments are connected via USB. When instruments are connected via LAN or WiFi, combining is not available.	
Synchronization accuracy	0 ppm
CMI interface	2x, CMI 1, CMI 2
Required coupling cable	TP-C50H
Maximum coupling cable length	50 cm

Probes	HP-9250	
	X1	X10
Bandwidth	6 MHz	250 MHz
Rise time	58 ns	1.4 ns
Input impedance	1 MΩ scope impedance	10 MΩ incl. 1 MΩ scope impedance
Input capacitance	47 pF + scope capacitance	17 pF
Compensation range	-	10 to 35 pF
Working voltage (DC + AC peak)	300 V 150 V CAT II	600 V 300 V CAT II

Arbitrary Waveform Generator

Signal characteristics	
Sine	
Frequency range	Depending on model
Model HS5-540	1 µHz to 40 MHz
Model HS5-530	1 µHz to 30 MHz
Model HS5-220	1 µHz to 20 MHz
Amplitude flattness	Relative to 1 kHz, 20 V_{pp}
< 100 kHz	±0.1 dB
< 5 MHz	±0.15 dB
< 20 MHz	±0.3 dB (Amplitude ≤ 11 V (22 V_{pp}))
< 30 MHz	±0.4 dB (Amplitude ≤ 9 V (18 V_{pp}))
< 40 MHz	±1 dB (Amplitude ≤ 7.5 V (15 V_{pp}))
Spurious (non harmonic)	
< 100 kHz	-75 dB_C
100 kHz to 1 MHz	-70 dB_C
1 MHz to 10 MHz	-60 dB_C
10 MHz to 15 MHz	-55 dB_C
15 MHz to 20 MHz	-45 dB_C
20 MHz to 30 MHz	-35 dB_C
30 MHz to 40 MHz	-30 dB_C
Square	
Frequency range	Depending on model
Model HS5-540	1 µHz to 30 MHz, above 30 MHz not specified
Model HS5-530	1 µHz to 30 MHz
Model HS5-220	1 µHz to 20 MHz
Rise/fall time	8 ns
Overshoot	< 1 %
Variable duty cycle	0.01 % to 99.99 %
Asymmetry	< 0 % of period + 5 ns (@ 50 % duty cycle)
Jitter (RMS)	< 50 ps
Triangle	
Frequency range	Depending on model
Model HS5-540	1 µHz to 30 MHz, above 30 MHz not specified
Model HS5-530	1 µHz to 30 MHz
Model HS5-220	1 µHz to 20 MHz
Nonlinearity (of peak output)	< 0.01 %
Symmetry	0 % to 100 %, 0.1 % steps
Pulse	
Period	100 ns to 1000 s
Pulse width	15 ns to 1000 s
Variable edge time	20 ns to 1 s
Overshoot	< 1 %
Jitter (RMS)	< 50 ps
Noise	
Bandwidth (typical)	30 MHz
Arbitrary	
Frequency range	Depending on model
Model HS5-540, model HS5-530	1 µHz to 30 MHz
Model HS5-220	1 µHz to 20 MHz
Waveform pattern length	
Standard model	1 to 256 KiSamples
XM option	1 to 64 MiSamples
Sampling rate	Depending on model
Model HS5-540, model HS5-530	240 MS/s
Model HS5-220	200 MS/s
Rise/fall time	< 8 ns
Nonlinearity (of peak output)	< 0.01 %
Settling time	< 8 ns to 10 % final value
Jitter (RMS)	< 50 ps

Waveforms	
Standard	Sine, square, triangle, pulse, noise, DC

Burst	
Waveforms	Sine, square, triangle, noise, arbitrary
Count	1 to 65535
Trigger	Software, external

Sweep	only available on models with option XM
Waveforms	Sine, square, triangle, noise, arbitrary
Type	Linear, logarithmic
Direction	Up, down
Trigger	Software, external

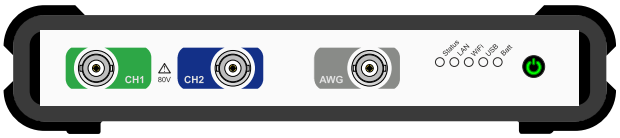
System characteristics	
System	Constant Data Size
Output channel	1 analog, BNC
DAC resolution	14 bit
Output range (open circuit)	-12 to +12 V, frequency ≤ 10 MHz -11 to +11 V, frequency ≤ 20 MHz -9 to +9 V, frequency ≤ 30 MHz -7.5 to +7.5 V, frequency ≤ 40 MHz
Amplitude	
Range	0.12 V, 1.2 V, 12 V (open circuit)
Resolution	12 bit
Accuracy	0.4 % of range
DC offset	
Range	-12 to 12 V (open circuit)
Resolution	12 bit
Accuracy	0.4 % of range
Noise level	
0.12 V	900 μV_{RMS}
1.2 V	1.3 mV_{RMS}
12 V	1.5 mV_{RMS}
Coupling	DC
Impedance	50 Ω
Overload protection	Output turns off automatically when overload is applied. Instrument will tolerate a short circuit to ground indefinitely.
Memory	
Standard model	256 KiSamples
XM option	64 MiSamples
Operating modes	Continuous, triggered, gated
Sampling rate	Depending on model
Model HS5-540, model HS5-530	240 MS/s
Model HS5-220	200 MS/s
Sampling source	Internal TCXO
Accuracy	0.0001 %
Stability	±1 ppm over 0 °C to +55 °C
Time base aging	±1 ppm per year

General

Power	
Power	From USB, external input or built-in battery
Consumption	12 Vdc, 2 A max
External power	From power adapter
Internal battery	Li-ion
Capacity	7000 mAh, 3.7 V
Operating time	Strongly depending on instrument setup, ≥ 3 hours

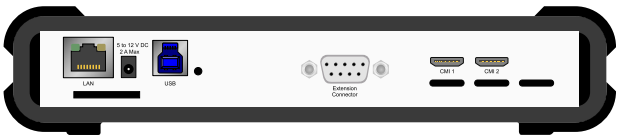
I/O connectors	

Front



CH1, CH2	BNC
AWG	BNC

Rear



LAN	RJ45 socket
USB	USB 3.0 type B Super Speed socket
Extension connector	D-sub 9 pins female
Power	3.5 mm power socket
CMI connectors 1 to 2	HDMI type C socket

Physical	
Height	44 mm (1.7 inch)
Length	187 mm (6.7 inch)
Width	215 mm (5.2 inch)
Weight	791 g (27.9 ounce)

Interface	
USB	USB 3.0 SuperSpeed (5 Gbit/s)
LAN	1 Gbps
WiFi	802.11

System requirements	
PC I/O connection	USB 2.0 USB 3.0 or USB 3.1 RJ45 WiFi
Operating System	Windows 10, 32 and 64 bits Linux (via own software using the LibTiePie SDK)

Environmental conditions	
Operating	
Ambient temperature	20°C to 25 °C 10°C to 40 °C without specifications
Relative humidity	10 to 90 % non condensing
Charging	
Ambient temperature	0°C to 35 °C
Relative humidity	10 to 95 % non condensing
Storage	
Ambient temperature	0°C to 35 °C
Relative humidity	5 to 95 % non condensing

Certifications and Compliances	
CE mark compliance	Yes
RoHS	Yes
EN 55011:2016/A1:2017	Yes
EN 55022:2011/C1:2011	Yes
IEC 61000-6-1:2019 EN	Yes
IEC 61000-6-3:2007/A1:2011/C11:2012	Yes
ICES-001:2004	Yes
AS/NZS CISPR 11:2011	Yes
IEC 61010-1:2010/A1:2019	Yes
UL 61010-1, Edition 3	Yes

Power adapter	TP-UES24LCP-120200SPA		
Input	110 to 240 Vac, 50 to 60 Hz		
Output	12 Vdc, 2.0 A		
Dimension	Height	Width	Length
	88 mm	30 mm	57 mm
Replaceable mains plugs for	EU, US, AU, UK		
Order number	TP-UES24LCP-120200SPA		

Accessories included	
Instrument	WiFiScope WS5 : HS5-xxx-xx (see below)
Measure leads	2 x HP-9250 X1 / X10 switchable oscilloscope probes
Accessories	Power adapter : TP-UES24LCP-120200SPA USB cable, 1.5 m long LAN cable, 3 m long
Software	For Windows 10 via website
Drivers	For Windows 10 via website
Manual	Quick Start Guide Instrument manual Software manual
Carry case	1 x TP-BB452 Carry case

Customer service

TiePie engineering instruments are designed, manufactured and tested to provide high reliability. In the unlikely event you experience difficulties, the TiePie engineering instruments are fully warranted for two years. This warranty includes:

- All parts and labor (excluding probes and/or measure leads **and/or batteries)**
- **Warranty on batteries is 6 months.**
- No charge for return shipping
- Long-term 7-year support
- Upgrade to the latest software at no charge

Ordering information

WiFiScope WS5 Model	Order code
500 MS/s, 40 MHz AWG, 128 kpts, 2 year warranty	WS5-540
500 MS/s, 30 MHz AWG, 128 kpts, 2 year warranty	WS5-530
200 MS/s, 20 MHz AWG, 128 kpts, 2 year warranty	WS5-220

Available options for the WiFiScope WS5 are:

- **XM**: With the extended memory option, 32 MiSamples memory per channel is available. Add **XM** to the order code.
- **S**: With the SureConnect option, connection test and resistance measurement are available on all channels. Add **S** to the order code.
- **W5**: With the extended warranty option, warranty is five years on parts and labor. Add **-W5** to the order code.

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