# Handyscope HS4

## User manual

TiePie engineering

ATTENTION!

Measuring directly on the **line voltage** can be very dangerous.
The **outside** of the **BNC connectors** at the Handyscope HS4 are connected with the **ground** of the computer. Use a good isolation transformer or a differential probe when measuring at the **line voltage** or at **grounded power supplies**! A short-circuit current will flow if the **ground** of the Handyscope HS4 is connected to a positive voltage. This short-circuit current can damage both the Handyscope HS4 and the computer.

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Despite the care taken for the compilation of this user manual, TiePie engineering can not be held responsible for any damage resulting from errors that may appear in this manual.

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# Safety

1

**When working with electricity, no instrument can guarantee complete safety. It is the responsibility of the person who works with the instrument to operate it in a safe way. Maximum security is achieved by selecting the proper instruments and following safe working procedures. Safe working tips are given below:**

- Always work according (local) regulations.
- Work on installations with voltages higher than 25 $V_{AC}$ or 60 $V_{DC}$ should only be performed by qualified personnel.
- Avoid working alone.
- Observe all indications on the Handyscope HS4 before connecting any wiring
- Check the probes/test leads for damages. Do **not** use them if they are damaged
- Take care when measuring at voltages higher than 25 $V_{AC}$ or 60 $V_{DC}$.
- Do not operate the equipment in an explosive atmosphere or in the presence of flammable gases or fumes.
- Do not use the equipment if it does not operate properly. Have the equipment inspected by qualified service personal. If necessary, return the equipment to TiePie engineering for service and repair to ensure that safety features are maintained.
- Measuring directly on the **line voltage** can be very dangerous. The **outside** of the **BNC connectors** at the Handyscope HS4 are connected with the **ground** of the computer. Use a good isolation transformer or a differential probe when measuring at the **line voltage** or at **grounded power supplies**! A short-circuit current will flow if the **ground** of the Handyscope HS4 is connected to a positive voltage. This short-circuit current can damage both the Handyscope HS4 and the computer.

TiePie engineering
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The Netherlands

# EC Declaration of conformity

We declare, on our own responsibility, that the product

**Handyscope HS4-10MHz**
**Handyscope HS4-25MHz**
**Handyscope HS4-50MHz**

for which this declaration is valid, is in compliance with

EC directive 2011/65/EU (the RoHS directive)
including up to amendment 2021/1980,

EC regulation 1907/2006 (REACH)
including up to amendment 2021/2045,

and with

| | |
|---|---|
| EN 55011:2016/A1:2017 | IEC 61000-6-1:2019 EN |
| EN 55022:2011/C1:2011 | IEC 61000-6-3:2007/A1:2011/C11:2012 EN |

according the conditions of the EMC standard 2004/108/EC,

also with

| | |
|---|---|
| Canada: ICES-001:2004 | Australia/New Zealand: AS/NZS CISPR 11:2011 |

and

| | |
|---|---|
| IEC 61010-1:2010/A1:2019 | USA: UL 61010-1, Edition 3 |

and is categorized as 30 $V_{RMS}$, 42 $V_{pk}$, 60 $V_{DC}$

Sneek, 1-9-2022
ir. A.P.W.M. Poelsma

# Environmental considerations

This section provides information about the environmental impact of the Handyscope HS4.

## End-of-life handling

Production of the Handyscope HS4 required the extraction and use of natural resources. The equipment may contain substances that could be harmful to the environment or human health if improperly handled at the Handyscope HS4's end of life.

In order to avoid release of such substances into the environment and to reduce the use of natural resources, recycle the Handyscope HS4 in an appropriate system that will ensure that most of the materials are reused or recycled appropriately.

The shown symbol indicates that the Handyscope HS4 complies with the European Union's requirements according to Directive 2002/96/EC on waste electrical and electronic equipment (WEEE).

# Introduction 3

Before using the Handyscope HS4 first read chapter 1 about safety.

Many technicians investigate electrical signals. Though the measurement may not be electrical, the physical variable is often converted to an electrical signal, with a special transducer. Common transducers are accelerometers, pressure probes, current clamps and temperature probes. The advantages of converting the physical parameters to electrical signals are large, since many instruments for examining electrical signals are available.

The Handyscope HS4 is a portable four channel measuring instrument. The Handyscope HS4 is available in several models with different maximum sampling rates. The native resolution is 12 bits, but user selectable resolutions of 14 and 16 bits are available too, with reduced maximum sampling rate:

| resolution | Model 50 | Model 25 | Model 10 |
|---|---|---|---|
| 12 bit | 50 MSa/s | 25 MSa/s | 10 MSa/s |
| 14 bit | 3.125 MSa/s | 3.125 MSa/s | 3.125 MSa/s |
| 16 bit | 195 kSa/s | 195 kSa/s | 195 kSa/s |

Table 3.1: Maximum sampling rates

The Handyscope HS4 supports high speed continuous streaming measurements. The maximum streaming rates are:

| resolution | Model 50 | Model 25 | Model 10 |
|---|---|---|---|
| 12 bit | 500 kSa/s | 250 kSa/s | 100 kSa/s |
| 14 bit | 480 kSa/s | 250 kSa/s | 99 kSa/s |
| 16 bit | 195 kSa/s | 195 kSa/s | 97 kSa/s |

Table 3.2: Maximum streaming rates

With the accompanying software the Handyscope HS4 can be used as an oscilloscope, a spectrum analyzer, a true RMS voltmeter or a transient recorder. All instruments measure by sampling the input signals, digitizing the values, process them, save them and display them.

## 3.1 Sampling

When sampling the input signal, samples are taken at fixed intervals. At these intervals, the size of the input signal is converted to a number. The accuracy of this number depends on the resolution of the instrument. The higher the resolution,

the smaller the voltage steps in which the input range of the instrument is divided. The acquired numbers can be used for various purposes, e.g. to create a graph.

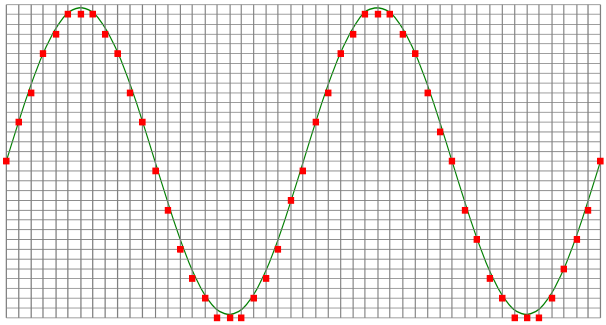

Figure 3.1: Sampling

The sine wave in figure 3.1 is sampled at the dot positions. By connecting the adjacent samples, the original signal can be reconstructed from the samples. You can see the result in figure 3.2.

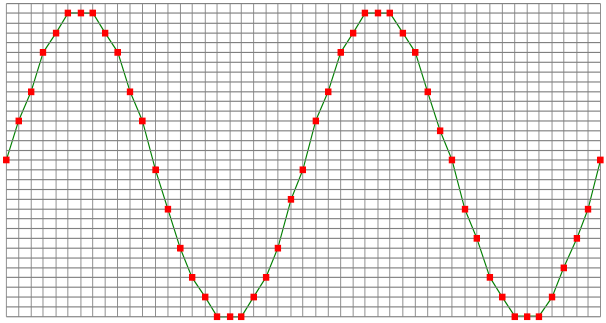

Figure 3.2: "connecting" the samples

## 3.2 Sampling rate

The rate at which the samples are taken is called the **sampling rate**, the number of samples per second. A higher sampling rate corresponds to a shorter interval between the samples. As is visible in figure 3.3, with a higher sampling rate, the original signal can be reconstructed much better from the measured samples.

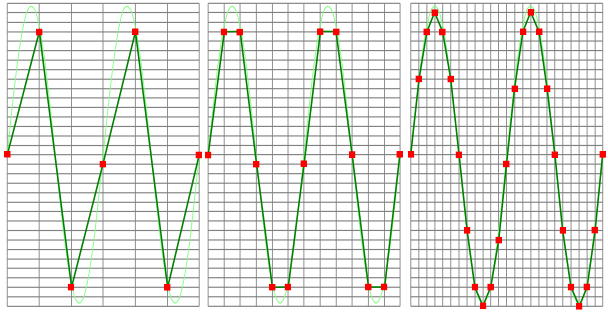

Figure 3.3: The effect of the sampling rate

The sampling rate must be higher than 2 times the highest frequency in the input signal. This is called the **Nyquist frequency**. Theoretically it is possible to reconstruct the input signal with more than 2 samples per period. In practice, 10 to 20 samples per period are recommended to be able to examine the signal thoroughly.

### *3.2.1* Aliasing

When sampling an analog signal with a certain sampling rate, signals appear in the output with frequencies equal to the sum and difference of the signal frequency and multiples of the sampling rate. For example, when the sampling rate is 1000 Sa/s and the signal frequency is 1250 Hz, the following signal frequencies will be present in the output data:

| Multiple of sampling rate | 1250 Hz signal | -1250 Hz signal |
|---|---|---|
| ... | | |
| -1000 | -1000 + 1250 = **250** | -1000 - 1250 = -2250 |
| 0 | 0 + 1250 = 1250 | 0 - 1250 = -1250 |
| 1000 | 1000 + 1250 = 2250 | 1000 - 1250 = -250 |
| 2000 | 2000 + 1250 = 3250 | 2000 - 1250 = 750 |
| ... | | |

Table 3.3: Aliasing

As stated before, when sampling a signal, only frequencies lower than half the sampling rate can be reconstructed. In this case the sampling rate is 1000 Sa/s, so we can we only observe signals with a frequency ranging from 0 to 500 Hz. This means that from the resulting frequencies in the table, we can only see the 250 Hz signal in the sampled data. This signal is called an **alias** of the original signal.

If the sampling rate is lower than twice the frequency of the input signal, **aliasing** will occur. The following illustration shows what happens.

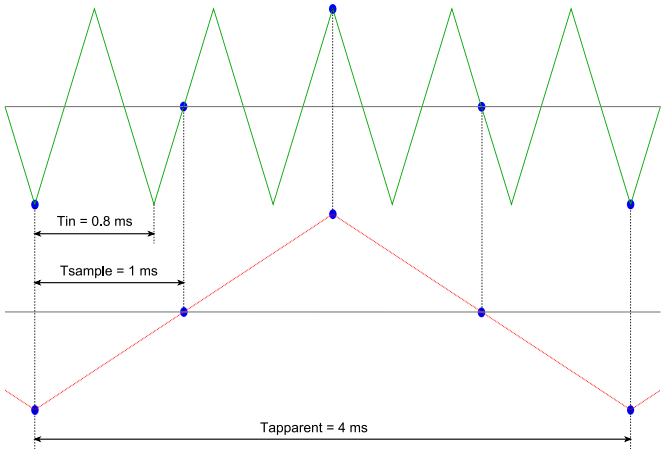


Figure 3.4: Aliasing

In figure 3.4, the green input signal (top) is a triangular signal with a frequency of 1.25 kHz. The signal is sampled with a rate of 1 kSa/s. The corresponding sampling interval is 1/1000Hz = 1ms. The positions at which the signal is sampled are depicted with the blue dots. The red dotted signal (bottom) is the result of the reconstruction. The period time of this triangular signal appears to be 4 ms, which corresponds to an apparent frequency (alias) of 250 Hz (1.25 kHz - 1 kHz).

To avoid aliasing, always start measuring at the highest sampling rate and lower the sampling rate if required.

## 3.3 Digitizing

When digitizing the samples, the voltage at each sample time is converted to a number. This is done by comparing the voltage with a number of levels. The resulting number is the number corresponding to the level that is closest to the voltage. The number of levels is determined by the resolution, according to the following relation: $LevelCount = 2^{Resolution}$.

The higher the **resolution**, the more levels are available and the more accurate the input signal can be reconstructed. In figure 3.5, the same signal is digitized, using two different amounts of levels: 16 (4-bit) and 64 (6-bit).

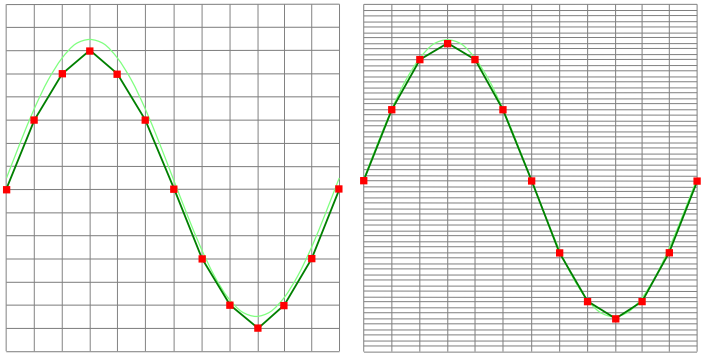

Figure 3.5: The effect of the resolution

The Handyscope HS4 measures at e.g. 12 bit resolution ($2^{12}$=4096 levels). The smallest detectable voltage step depends on the input range. This voltage can be calculated as:

$$VoltageStep = FullInputRange/LevelCount$$

For example, the 200 mV range ranges from -200 mV to +200 mV, therefore the full range is 400 mV. This results in a smallest detectable voltage step of 0.400 V / 4096 = 97.65 $\mu$V.

## 3.4 Signal coupling

The Handyscope HS4 has two different settings for the signal coupling: AC and DC. In the setting DC, the signal is directly coupled to the input circuit. All signal components available in the input signal will arrive at the input circuit and will be measured.

In the setting AC, a capacitor will be placed between the input connector and the input circuit. This capacitor will block all DC components of the input signal and let all AC components pass through. This can be used to remove a large DC component of the input signal, to be able to measure a small AC component at high resolution.

When measuring DC signals, make sure to set the signal coupling of the input to DC.

## 3.5 Probe compensation

The Handyscope HS4 is shipped with a probe for each input channel. These are 1x/10x selectable passive probes. This means that the input signal is passed through directly or 10 times attenuated.

When using an oscilloscope probe in 1:1 the setting, the bandwidth of the probe is only 6 MHz. The full bandwidth of the probe is only obtained in the 1:10 setting

The x10 attenuation is achieved by means of an attenuation network. This attenuation network has to be adjusted to the oscilloscope input circuitry, to guarantee frequency independency. This is called the low frequency compensation. Each time a probe is used on an other channel or an other oscilloscope, the probe must be adjusted.

Therefore the probe is equiped with a setscrew, with which the parallel capacity of the attenuation network can be altered. To adjust the probe, switch the probe to the x10 and attach the probe to a 1 kHz square wave signal. Then adjust the probe for a square front corner on the square wave displayed. See also the following illustrations.

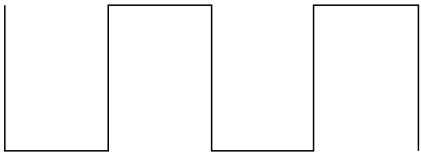

Figure 3.6: correct

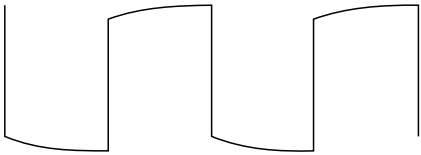

Figure 3.7: under compensated

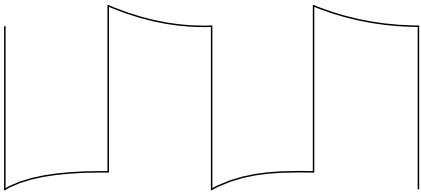

Figure 3.8: over compensated

# Driver installation 4

Before connecting the Handyscope HS4 to the computer, the drivers need to be installed.

## 4.1 Introduction

To operate a Handyscope HS4, a driver is required to interface between the measurement software and the instrument. This driver takes care of the low level communication between the computer and the instrument, through USB. When the driver is not installed, or an old, no longer compatible version of the driver is installed, the software will not be able to operate the Handyscope HS4 properly or even detect it at all.

The installation of the USB driver is done in a few steps. Firstly, the driver has to be pre-installed by the driver setup program. This makes sure that all required files are located where Windows can find them. When the instrument is plugged in, Windows will detect new hardware and install the required drivers.

### 4.1.1 Where to find the driver setup

The driver setup program and measurement software can be found in the download section on TiePie engineering's website. It is recommended to install the latest version of the software and USB driver from the website. This will guarantee the latest features are included.

### 4.1.2 Executing the installation utility

To start the driver installation, execute the downloaded driver setup program. The driver install utility can be used for a first time installation of a driver on a system and also to update an existing driver.

The screen shots in this description may differ from the ones displayed on your computer, depending on the Windows version.

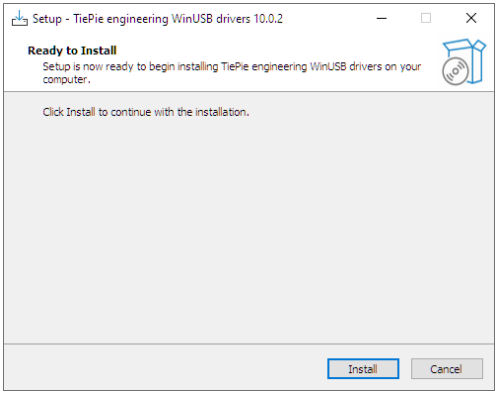


Figure 4.1: Driver install: step 1

When drivers were already installed, the install utility will remove them before installing the new driver. To remove the old driver successfully, **it is essential** that the Handyscope HS4 is disconnected from the computer prior to starting the driver install utility. When the Handyscope HS4 is used with an external power supply, this must be disconnected too.

Clicking *"**Install**"* will remove existing drivers and install the new driver. A *remove entry* for the new driver is added to the software applet in the Windows control panel.

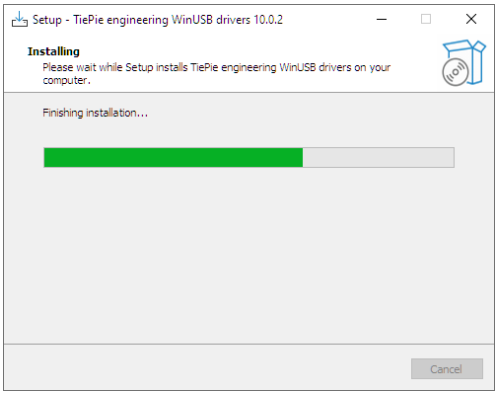


Figure 4.2: Driver install: Copying files

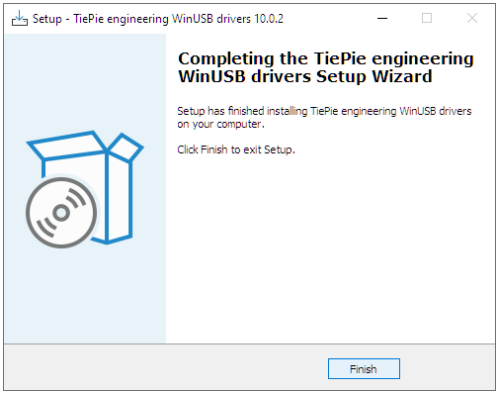


Figure 4.3: Driver install: Finished

# Hardware installation 5

Drivers have to be installed before the Handyscope HS4 is connected to the computer for the first time. See chapter 4 for more information.

## 5.1 Power the instrument

The Handyscope HS4 is powered by the USB, no external power supply is required. Only connect the Handyscope HS4 to a bus powered USB port, otherwise it may not get enough power to operate properly.

### 5.1.1 External power

In certain cases, the Handyscope HS4 cannot get enough power from the USB port. When a Handyscope HS4 is connected to a USB port, powering the hardware will result in an inrush current higher than the nominal current. After the inrush current, the current will stabilize at the nominal current.

USB ports have a maximum limit for both the inrush current peak and the nominal current. When either of them is exceeded, the USB port will be switched off. As a result, the connection to the Handyscope HS4 will be lost.

Most USB ports can supply enough current for the Handyscope HS4 to work without an external power supply, but this is not always the case. Some (battery operated) portable computers or (bus powered) USB hubs do not supply enough current. The exact value at which the power is switched off, varies per USB controller, so it is possible that the Handyscope HS4 functions properly on one computer, but does not on another.

In order to power the Handyscope HS4 externally, an external power input is provided for. It is located at the rear of the Handyscope HS4. Refer to paragraph 7.1 for specifications of the external power intput.

## 5.2 Connect the instrument to the computer

After the new driver has been pre-installed (see chapter 4), the Handyscope HS4 can be connected to the computer. When the Handyscope HS4 is connected to a USB port of the computer, Windows will detect new hardware.

Depending on the Windows version, a notification can be shown that new hardware is found and that drivers will be installed. Once ready, Windows will report that the driver is installed.

When the driver is installed, the measurement software can be installed and the Handyscope HS4 can be used.

## 5.3 Plug into a different USB port

When the Handyscope HS4 is plugged into a different USB port, some Windows versions will treat the Handyscope HS4 as different hardware and will install the drivers again for that port. This is controlled by Microsoft Windows and is not caused by TiePie engineering.

# Front panel

6

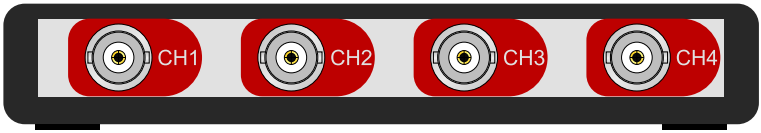


Figure 6.1: Front panel

## 6.1 Channel input connectors

The CH1 – CH4 BNC connectors are the main inputs of the acquisition system. The outside of all four BNC connectors is connected to the ground of the Handyscope HS4. Connecting the outside of the BNC connector to a potential other than ground will result in a short circuit that may damage the device under test, the Handyscope HS4 and the computer.

## 6.2 Power indicator

A power indicator is situated at the top cover of the instrument. It is lit when the Handyscope HS4 is powered.

# Rear panel

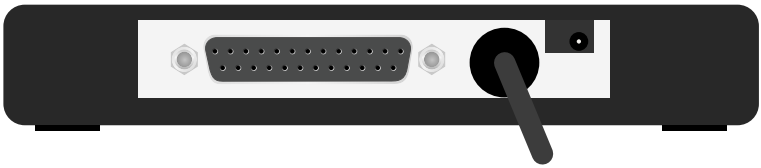

Figure 7.1: Rear panel

## 7.1 Power

The Handyscope HS4 is powered through the USB. If the USB cannot deliver enough power, it is possible to power the instrument externally. The Handyscope HS4 has two external power inputs located at the rear of the instrument: the dedicated power input and a pin of the extension connector.

The specifications of the dedicated power connector are:

| Pin | Dimension | Description |
|---|---|---|
| Center pin | Ø1.3 mm | ground |
| Outside bushing | Ø3.5 mm | positive |

Figure 7.2: Power connector

Besides the external power input, it is also possible to power the instrument through the extension connector, the 25 pin D-sub connector at the rear of the instrument. The power has to be applied to pin 3 of the extension connector. Pin 4 can be used as ground.

The following minimum and maximum voltages apply to both power inputs:

| Minimum | Maximum |
|---|---|
| 4.5 $V_{DC}$ | 14 $V_{DC}$ |

Table 7.1: Maximum voltages

Note that the externally applied voltage should be higher than the USB voltage to relieve the USB port.

### 7.1.1 USB power cable

The Handyscope HS4 is delivered with a special USB external power cable.

Figure 7.3: USB power cable

One end of this cable can be connected to a second USB port on the computer, the other end can be plugged in the external power input at the rear of the instrument. The power for the instrument will be taken from two USB ports of the computer.

The outside of the external power connector is connected to +5 V. In order to avoid shortage, first connect the cable to the Handyscope HS4 and then to the USB port.

### 7.1.2 Power adapter

In case a second USB port is not available, or the computer still can't provide enough power for the instrument, an external power adapter can be used. When using an external power adapter, make sure that:

- the polarity is set correctly
- the voltage is set to a valid value for the instrument and higher than the USB voltage
- the adapter can supply enough current (preferably >1 A)
- the plug has the correct dimensions for the external power input of the instrument

## 7.2 USB

The Handyscope HS4 is equipped with a USB 2.0 High speed (480 Mbit/s) interface with a fixed cable with type A plug. It will also work on a computer with a USB 1.1 interface, but will then operate at 12 Mbit/s.

## 7.3 Extension Connector

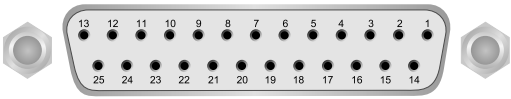


Figure 7.4: Extension connector

To connect to the Handyscope HS4 a 25 pin female D-sub connector is available, containing the following signals:

| Pin | Description | Pin | Description |
|---|---|---|---|
| 1 | Ground | 14 | Ground |
| 2 | Reserved | 15 | Ground |
| 3 | External Power in DC | 16 | Reserved |
| 4 | Ground | 17 | Ground |
| 5 | +5V out, 10 mA max. | 18 | Reserved |
| 6 | Ext. sampling clock in (TTL) | 19 | Reserved |
| 7 | Ground | 20 | Reserved |
| 8 | Ext. trigger in (TTL) | 21 | Reserved |
| 9 | Data OK out (TTL) | 22 | Ground |
| 10 | Ground | 23 | $I^2C$ SDA |
| 11 | Trigger out (TTL) | 24 | $I^2C$ SCL |
| 12 | Reserved | 25 | Ground |
| 13 | Ext. sampling clock out (TTL) | | |

Table 7.2: Pin description Extension connector

All TTL signals are 3.3 V TTL signals which are 5 V tolerant, so they can be connected to 5 V TTL systems.

Pins 9, 11, 12, 13 are open collector outputs. Connect a pull-up resistor of 1 kOhm to pin 5 when using one of these signals.

# Specifications

# 8

The accuracy of a channel is defined as a percentage of the Full Scale range. The Full Scale range runs from *-range* to *range* and is effectively *2 * range*. When the input range is set to 4 V, the Full Scale range is -4 V to 4 V = 8 V. Additionally a number of Least Significant Bits is incorporated. The acuracy is determined in the highest resolution.

When the accuracy is specified as ±0.2% of the Full Scale range ± 1 LSB, and the input range is 4 V, the maximum deviation the measured value can have is ±0.2% of 8 V = ±16 mV. ±1 LSB equals 8 V / 65536 (= number of LSB at 16 bit) = ± 122 $\mu$V. Therefore the measured value will be between 16.122 mV lower and 16.122 mV higher than the actual value. When e.g. applying a 3.75 V signal and measuring it in the 4 V range, the measured value will be between 3.76612 V and 3.73388 V.

## 8.1 Acquisition system

| | | | | |
|---|---|---|---|---|
| Number of input channels | 4 analog | | | |
| CH1, CH2, CH3, CH4 | BNC, female | | | |
| Type | Single ended | | | |
| Resolution | 12, 14, 16 bit user selectable | | | |
| Accuracy | 0.2% of full scale ± 1 LSB | | | |
| Ranges (full scale) | ±200 mV<br>±2 V<br>±20 V | | ±400 mV<br>±4 V<br>±40 V | ±800 mV<br>±8 V<br>±80 V |
| Coupling | AC/DC | | | |
| Impedance | 1 MΩ / 30 pF | | | |
| Noise | 150 $\mu V_{RMS}$ (200 mV range, 12 bit, 50 MSa/s)<br>45 $\mu V_{RMS}$ (200 mV range, 16 bit, 195 kSa/s) | | | |
| Maximum voltage | 200 V (DC + AC peak <10 kHz) | | | |
| Bandwidth (-3dB) | 50 MHz | | | |
| AC coupling cut off frequency (-3dB) | ±1.5 Hz | | | |
| Maximum sampling rate | HS4-50 | HS4-25 | HS4-10 | HS4-5 * |
| 12 bit | 50 MSa/s | 25 MSa/s | 10 MSa/s | 5 MSa/s |
| 14 bit | 3.125 MSa/s | 3.125 MSa/s | 3.125 MSa/s | 3.125 MSa/s |
| 16 bit | 195 kSa/s | 195 kSa/s | 195 kSa/s | 195 kSa/s |
| Maximum streaming rate | HS4-50 | HS4-25 | HS4-10 | HS4-5 * |
| 12 bit | 500 kSa/s | 250 kSa/s | 100 kSa/s | 50 kSa/s |
| 14 bit | 480 kSa/s | 250 kSa/s | 99 kSa/s | 50 kSa/s |
| 16 bit | 195 kSa/s | 195 kSa/s | 97 kSa/s | 48 kSa/s |
| Sampling source | internal quartz, external | | | |
| Internal | Quartz | | | |
| Accuracy | ±0.01% | | | |
| Stability | ±100 ppm over -40°C to +85°C | | | |
| External | On extension connector | | | |
| Voltage | 3.3 V TTL, 5 V TTL tolerant | | | |
| Frequency range | 95 MHz to 105 MHz | | | |
| Memory | 128 kSamples per channel | | | |

* The HS4-5 model is no longer available, its specs remain available here for reference

## 8.2 Trigger system

Triggering is only availabe when the Handyscope HS4 operates in block mode, not when operating in streaming mode

| | |
|---|---|
| System | digital, 2 levels |
| Source | CH1, CH2, CH3, CH4, digital external, AND, OR |
| Trigger modes | rising slope, falling slope,<br>inside window, outside window |
| Level adjustment | 0 to 100% of full scale |
| Hysteresis adjustment | 0 to 100% of full scale |
| Resolution | 0.024 % (12 bits) |
| Pre trigger | 0 to 128 ksamples (0 to 100%, one sample resolution) |
| Post trigger | 0 to 128 ksamples (0 to 100%, one sample resolution) |
| Trigger hold-off | 0 to 1 MSamples, 1 sample resolution |
| Digital external trigger | |
| Input | extension connector |
| Range | 0 to 5 V (TTL) |
| Coupling | DC |

## 8.3 Interface

| | |
|---|---|
| Interface | USB 2.0 High Speed (480 Mbit/s)<br>(USB 1.1 Full Speed (12 Mbit/s) and<br>USB 3.0 compatible) |

## 8.4 Power

| | |
|---|---|
| Input | from USB or external input |
| Consumption | 500 mA max |

## 8.5 Physical

| | |
|---|---|
| Instrument height | 25 mm / 1.0” |
| Instrument length | 170 mm / 6.7” |
| Instrument width | 140 mm / 5.2” |
| Weight | 480 gram / 17 ounce |
| USB cord length | 1.8 m / 70” |

## 8.6 I/O connectors

| | |
|---|---|
| CH1 .. CH4 | BNC, female |
| Power | 3.5 mm power socket |
| Extension connector | D-sub 25 pins female |
| USB | Fixed cable with type A plug |

## 8.7 System requirements

| | |
|---|---|
| PC I/O connection | USB 2.0 High Speed (480 Mbit/s)<br>(USB 1.1 Full Speed (12 Mbit/s) and<br>USB 3.0 compatible) |
| Operating System | Windows 10 / 11, 64 bits |

## 8.8 Environmental conditions

| | |
|---|---|
| Operating | |
| Ambient temperature | 0°C to 55°C |
| Relative humidity | 10 to 90% non condensing |
| Storage | |
| Ambient temperature | -20°C to 70°C |
| Relative humidity | 5 to 95% non condensing |

## 8.9 Certifications and Compliances

| | |
|---|---|
| CE mark compliance | Yes |
| RoHS | Yes |
| REACH | 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 |

## 8.10 Probes

| Model | HP-3250I | |
|---|---|---|
| | X1 | X10 |
| Bandwidth | 6 MHz | 250 MHz |
| Rise time | 58 ns | 1.4 ns |
| Input impedance | 1 MΩ<br>oscilloscope impedance | 10 MΩ<br>incl. 1 MΩ oscilloscope impedance |
| Input capacitance | 56 pF<br>+ oscilloscope capacitance | 13 pF |
| Compensation range | - | 10 to 30 pF |
| Working voltage (DC + AC peak) | 300 V<br>150 V CAT II | 600 V<br>300 V CAT II |

## 8.11 Package contents

| | |
|---|---|
| Instrument | Handyscope HS4 |
| Probes | 4 x HP-3250I X1 / X10 switchable |
| Accessories | USB power cable |
| Software | Windows 10 / 11, 64 bits, via website |
| Drivers | Windows 10 / 11, 64 bits, via website |
| Software Development Kit | Windows 10 / 11 (64 bits) and Linux, via website |
| Manual | Instrument manual and software manual |

If you have any suggestions and/or remarks regarding this manual, please contact:

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