User manual

Handyscope HS3

a multifunctional
PC measuring instrument

TiePie engineering

ATTENTION!

Measuring directly on the LINE VOLTAGE can be very dangerous. The OUTSIDE of the BNC CONNECTORS at the Handyscope HS3 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!

In case this has not been considered and the GROUND of the Handyscope HS3 is connected to a positive voltage, a short-circuit current will be flowing. Because of this short-circuit current both the Handyscope HS3 and the computer can be damaged.

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

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Contents

Safety

Before you start working with the Handyscope HS3, first read these safety rules.

- Avoid working alone.
- Check the probes / test leads for damages. Do NOT use them if they are damaged.
- Take care when measuring at voltages higher than 25V AC or 60 V DC.
- Measuring directly on the LINE VOLTAGE can be very dangerous. The OUTSIDE of the BNC CONNECTORS at the Handyscope HS3 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!
  In case this has not been considered and the GROUND of the Handyscope HS3 is connected to a positive voltage, a short-circuit current will be flowing. Because of this short-circuit current both the HandyscopeHS 3 and the computer can be damaged.

Declaration of confirmity

TiePie engineering
Kopeslagersstraat 37
8601 WL Sneek
The Netherlands

EC declaration of Confirmity

We declare, on our own responsibility, that the product

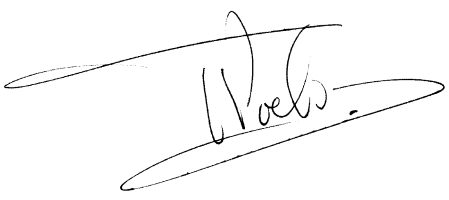
Handyscope HS3

for which this declaration is valid, is in compliance with

EN55011, EN55022, EN50081-1 and EN50082-1

according the conditions of the EMC standard 89/336/EEG, and the amendments 92/31/EEC and 93/68/EEC

Sneek, 1-12-2002 ir. A.P.W.M. Poelsma



Chapter 1
Introduction

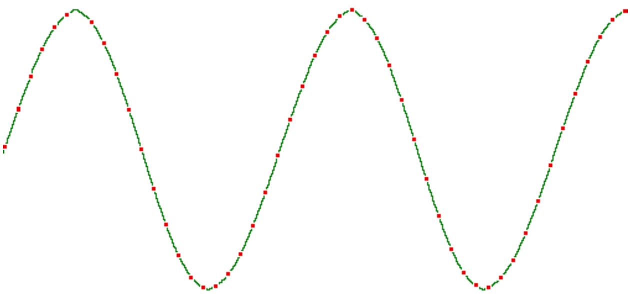
Note before using the Handyscope HS3, first read the chapter about Safety

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 several instruments for examining electrical signals are available.

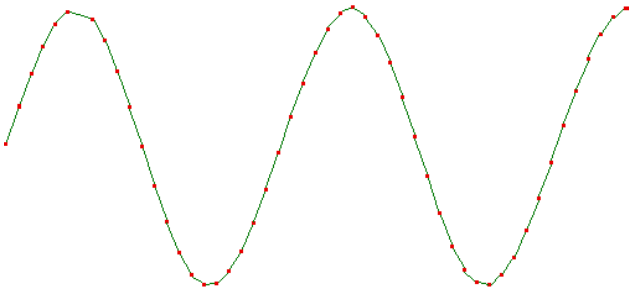
The **Handyscope HS3** is a two channel, 12 bits, 5, 10, 25 or 50 Msamples/sec measuring instrument. With the acompanying software the **Handyscope HS3** can be used as an oscilloscope, a storage oscilloscope, a spectrum analyzer, a true RMS voltmeter or a transient recorder. All instruments measure by sampling the input signals, digitizing the values, process them, save them and display them.

Sampling

When sampling the input signal, samples are taken at certain moments. The frequency at which the samples are taken is called the sampling frequency. By taking a (large) number of samples, the input signal can be reconstructed.



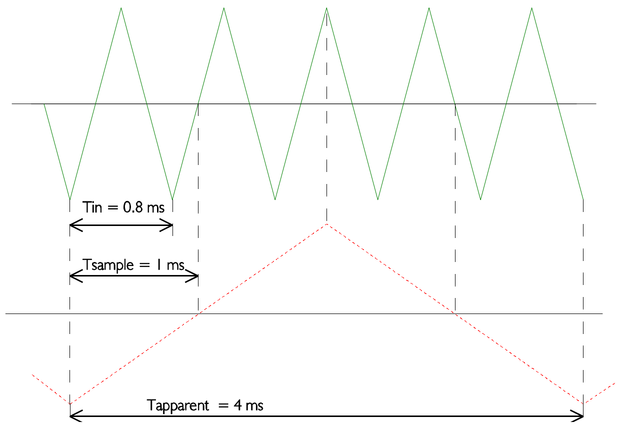
In the latter illustration a sine wave signal is sampled with 50 samples. By connecting the adjacent samples, the original signal can be reconstructed. See also the next illustration.



The more samples are taken, the better the signal can be reconstructed. The sampling frequency 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. In practice, 10 to 20 samples are necessary to be able to examine the signal thoroughly.

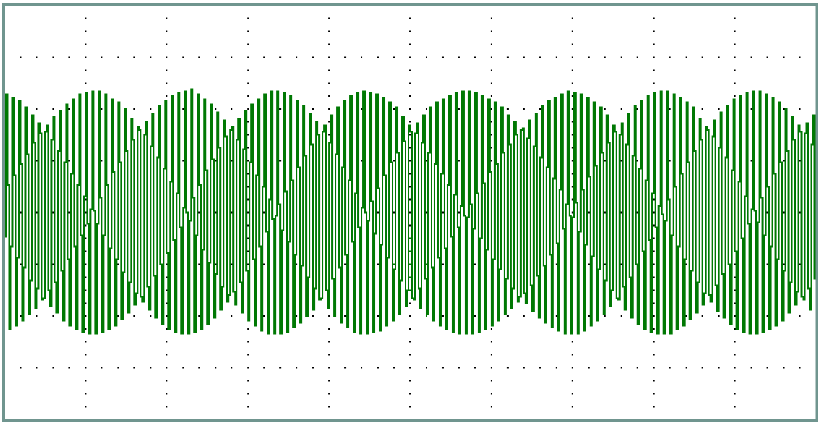
Aliasing

If the sampling frequency is lower than 2 times the frequency of the input signal, 'aliasing' will occur. The following illustration shows how aliasing occurs.



The input signal is a triangular signal with a frequency of 1.25 kHz (upper most in the illustration). The signal is sampled at a frquency of 1 kHz. The dotted signal is the result of the reconstruction. From that triangular signal the periodical time is 4 ms, which corresponds with an apparent frequency (alias) of 250 Hz (1.25 kHz - 1 kHz).
To avoid aliasing, the sample frequency must be higher than 2 times the maximum frequency of the input signal.

Aliasing is not always visible on an oscilloscope. In the latter illustration, it gives a 'good looking' picture. It is not apparent that aliasing occurs. The next illustration gives an example of visible aliasing.



This time it is a sine wave signal with a frequency of 25.7 kHz, which is sampled at a frequency of 5 kHz. The minimal sampling frequency should have been 51.4 kHz. For proper analysis, the sampling frequency should have been 500 khz.

Digitizing

After taking a sample of the input signal, it is digitised. This is done with an Analog to Digital Convertor, ADC. The ADC converts the size of the signal to a digital number. This is called quantifying.

The first condition for accurate measurement is to have as many as possible quantifying steps. This can be realised by using an ADC with a resolution as high as possible.

The resolution of ADC's is often given in bits. The number of bits determines the number of quantifying steps according the formula:

$$\text{number of quantifying steps} = 2^{\text{number of bits}}$$

A 2 bits ADC has 4 quantifying steps. With an input range of 10 Volt, this ADC can divide the input range in 4 parts of each 2.5 Volt.

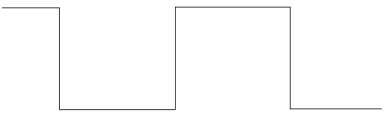
By increasing the number of bits, the resolution increases, the number of quatifying steps increases and the sub-divisions get smaller.

The probes

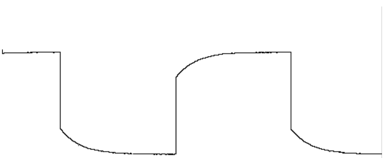
The **Handyscope HS3** is shipped with two probes. These are 1x/10x selectable passive probes. This means that the input signal is passed through directly or 10 times attenuated.

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.

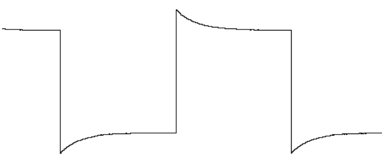
Therefore the probe is equiped with a setscrew, with which the parallel capacity of the attenuation network can be altered. To adjust the probe, switch the probe to the x10 and attach the probe to a 1 kHz square wave signal. Then adjust the probe for a square front corner on the square wave displayed.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



correct



undercompensated



overcompensated

Chapter 2

Hardware installation

The **Handyscope HS3** is an external measuring instrument which can be connected to a PC.

The **Handyscope HS3** is connected to a USB port of the PC using the attached cable.

The **Handycope HS3** does not need an external power supply, but is powered by the computer, through the USB.

The USB can deliver only a limited amount of power. In case the USB can not supply enough power, an extra cable is supplied which can be connected to the **Handyscope HS3** and between the computer and the keyboard cable. In that case the **Handyscope HS3** will be powered by the keyboard connection.

Note The outside of the external power connector is connected to +5 Volt. In order to avoid shortage, first connect the cable to the **Handyscope HS3** and then to the keyboard connector.

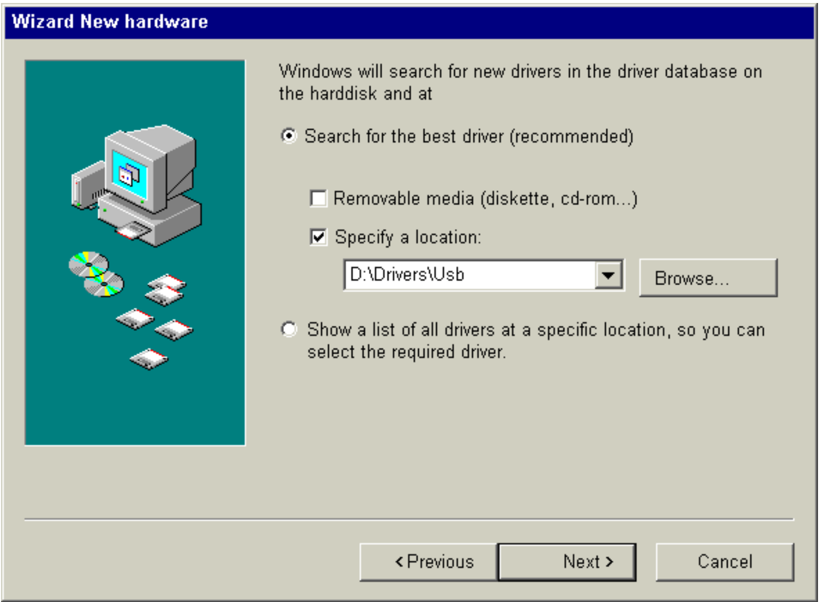
Driver installation

When the **Handyscope HS3** is connected to an USB port of the computer of the first time, Windows will report new hardware.

Windows will request for the location where the drivers can be found. The exact appearance of the dialogs will differ for each windows version and they might be somewhat different on the computer where the **Handyscope HS3** is installed.

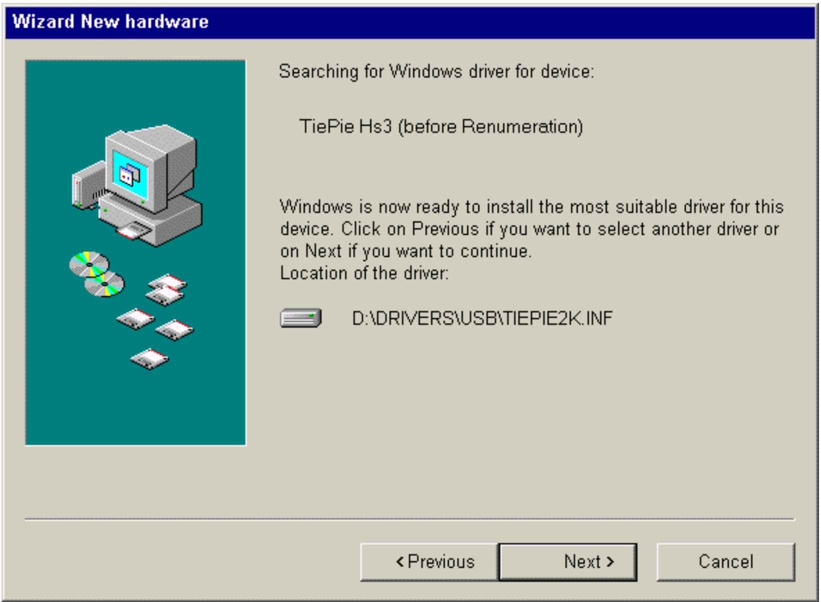
Insert the TiePie software CD in the CDROM drive of your computer. Select **Specify the location of the drivers** and click **Next >**.

Now a location for the drivers has to be specified:



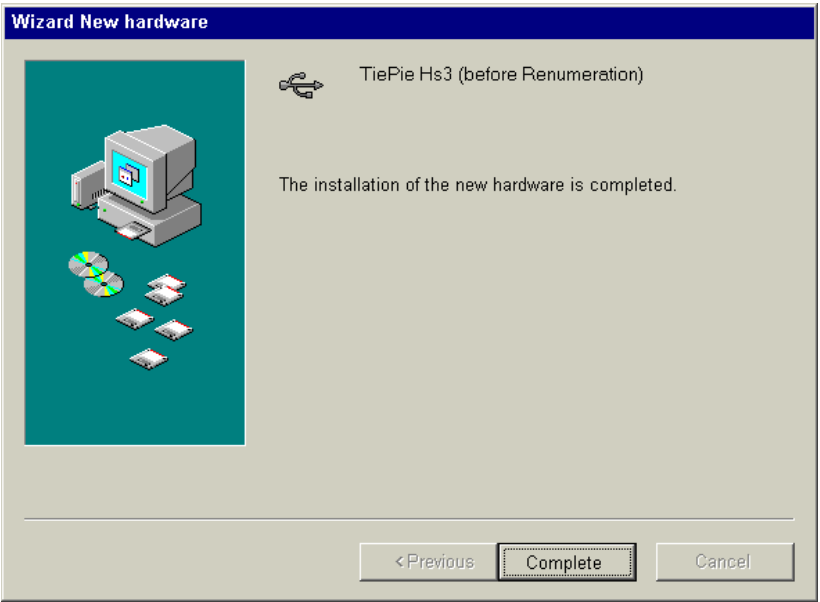
Select **Search for the best driver** and check Specify a location. Use the **Browse** button to browse to the folder Drivers\Usb on the TiePie software CD. Then click **Next >**.

Windows wil now report that it has found the **Handyscope HS3**:



Click **Next >** to install this driver.

Windows will now install the drivers for the **Handyscope HS3**. When the installation is complete, Windows will report:



The **Handyscope HS3** is now known in Windows. After installing the measurement software, it will be ready to use.

When the **Handyscope HS3** is disconnected, the required drivers will be removed from the memory of the computer.

The next time the **Handyscope HS3** is connected, the required drivers will be loaded again. The CD is no longer required for that.

Connections

Extension connector

To connect to the **Handyscope HS3**, a 25 pin female Sub-D connector is available, containing the following signals:

1	Ground	14	Ground
2	Reserved	15	Ground
3	Ext.l power in 5V DC / 0.5A	16	Reserved
4	Ground	17	Ground
5	5 V out, 10 mA max.	18	Reserved
6	Ext. sampling clock in (TTL)	19	Reserved
7	Ground	20	Reserved
8	Ext. trigger in (TTL)	21	Generator Ext Trig in (TTL)
9	Data OK out (TTL)	22	Ground
10	Ground	23	I^2C SDA
11	Trigger out (TTL)	24	I^2C SCL
12	Reserved (TTL)	25	Ground
13	Ext. sampling clock out (TTL)		

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

For instruments with serial number 14266 and higher, pins 9, 11, 12, 13 are open colloctor outputs. Connect a pull-up resistor of 1 kOhm to pin 5 when using one of these signals. For older instruments, the outputs are standard TTL outputs and no pull-up is required.

External power

The **Handyscope HS3** is powered through the USB. If the USB can not deliver enough power, an external power cable, to the keyboard connector, can be connected.

Note The outside of the external power connector is connected to +5 Volt. In order to avoid shortage, first connect the cable to the **Handyscope HS3** and then to the keyboard connector.

Center pin	Ø 1.3 mm	Ground
Outside bushing	Ø 3.5 mm	+ 5 V DC

Chapter 5
Specifications

Hardware

Channels

input	2 analog, BNC
output	1 analog, BNC

Analog input

input sensitivity	200 mV - 80 V full scale, in 2, 4, 8 sequence
resolution	12 bits 0.025 %, 14 bits and 16 bits selectable
maximum voltage	200 volt DC + AC peak, <10 kHz
maximum voltage 1:10 probe	600 volt DC + AC peak, <10 kHz
input impedance	1 Mohm / 30 pF
coupling	AC / DC
accuracy	0.2 % ± 1 LSB
bandwidth	DC to 50 MHz

Analog output

resolution	14 bits
amplitude	- 12 V .. 12 V
amplitude step	0 .. 0.1 V 8192 steps
	0 .. 0.9 V 8192 steps
	0 .. 12 V 8192 steps
DC level	0 .. 12 V 8192 steps
coupling	DC
impedance	50 Ohm
bandwidth	DC .. 2 MHz
sample rate	0 - 50 MHz
record length	1024 / 131060 points
waveforms	sine, triangle, square, DC, noise, user defined
symmetry	0.1 - 99.9%, in 0.1% steps

Trigger system

system	digital, 2 levels
source	Ch1, Ch2, Ch1 AND Ch2, Ch1 OR Ch2, digital external
modes	rising/falling slope, inside/outside window
level adjustment	0 .. 100% of full scale, 12 bit resolution
hysteresis adjustment	0 .. 100% of full scale, 12 bit resolution

Acquisition system

memory depth		128 K samples per channel
max. sampling frequency	12 bit	5 MHz, 10 MHz, 25 MHz or 50 MHz
	14 bit	3.125 MHz
	16 bit	195 kHz
pre/post trigger		0 .. 131060 samples (0 .. 100%)

General

interface	USB 2.0 and USB 1.1
power	from USB, 500 mA @ 5 V
operation temperature	0°C .. +50 °C
storage temperature	-10°C .. +70 °C
relative humidity	5 % .. 90 %
dimensions h x l x b	1.0" x 6.7" x 5.2" / 25 x 170 x 140 mm
weigth	approx. 17 ounce / 480 gram
cable length	approx. 70 " / 1.8 m

Accessories

probes	2, 1:1 - 1:10 switchable
external power cable to keyboard connector	
Connector types	PS2 male, PS2 female
length	70 " / 1.8 m

PC requirements

Windows version	Windows 98 / ME / 2000 / XP

notes

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If you have any suggestions and/or remarks regarding the Handyscope HS3 or the manual, please contact:

✉ TiePie engineering
P.O. Box 290
8600 AG SNEEK
The Netherlands
Fax: +31 515 418 819

⌂ TiePie engineering
Koperslagersstraat 37
8601 WL SNEEK
The Netherlands
Tel.: +31 515 415 416

Web site: http://www.tiepie.nl
Email: support@tiepie.nl

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