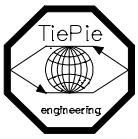
User manual

Handyscope HS4

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 HS4 are connected with the GROUND of the computer.

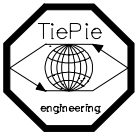
Use a good isolation transformer or a differential probe when measuring at the LINE VOLTAGE or at GROUNDED POWER SUPPLIES!

In case this has not been considered and the GROUND of the Handyscope HS4 is connected to a positive voltage, a short-circuit current will be flowing. Because of this short-circuit current both the Handyscope HS4 and the computer can be damaged.

User manual

Handyscope HS4

a multifunctional
PC measuring instrument



TiePie engineering

Contents

Safety

Before you start working with the Handyscope HS4, 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 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!

  In case this has not been considered and the GROUND of the Handyscope HS4 is connected to a positive voltage, a short-circuit current will be flowing. Because of this short-circuit current both the Handyscope HS4 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

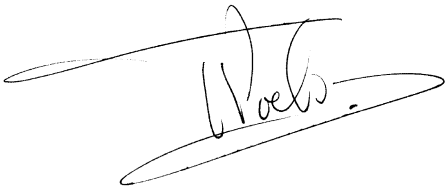
Handyscope HS4

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, 1-2-2005 ir. A.P.W.M. Poelsma



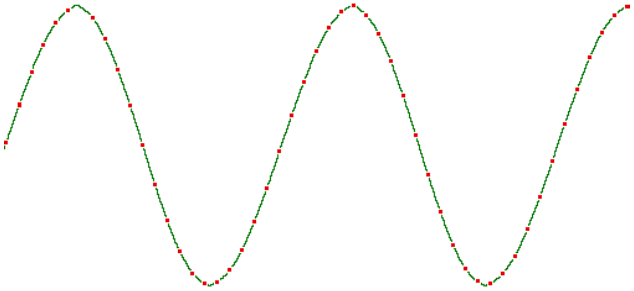
Note before using the Handyscope HS4, first read the chapter about Safety

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.

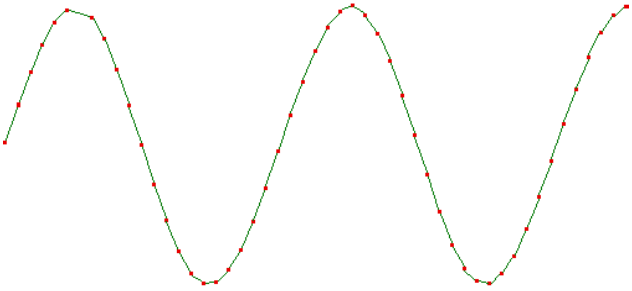
The Handyscope HS4 is a four channel, 12 bits, 5, 10, 25 or 50 Msamples/sec measuring instrument. With the acompanying software the Handyscope HS4 can be used as an oscilloscope, a storage oscilloscope, a spectrum analyzer, a true RMS voltmeter or a transient recorder. All instruments measure by sampling 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.



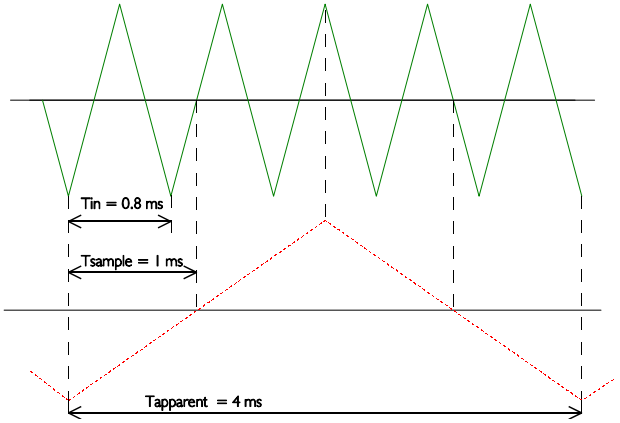
In the latter illustration a sine wave signal is sampled with 50 samples. By connecting the adjacent samples, the original signal can be reconstructed. See also the next illustration.



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.

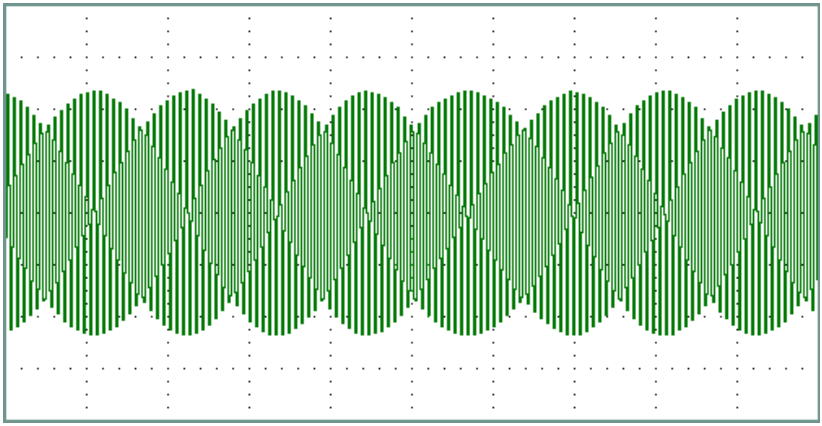
Aliasing

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.

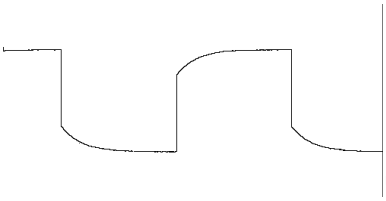
The probes

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

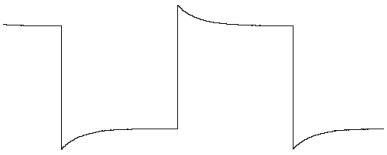
The x10 attenuation is achieved by means of an attenuation network. This attenuation network has to be adjusted to the oscilloscope input circuitry, to guarantee frequency independency. This is called the low frequency compensation. Each time a probe is used on an other channel or an other oscilloscope,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

The Handyscope HS4 is an external measuring instrument which can be connected to a PC.

The Handyscope HS4 is connected to a USB port of the PC using the attached cable.

The Handycope HS4 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 HS4 and between the computer and the keyboard cable. In that case the Handyscope HS4 will be powered by the keyboard connection.

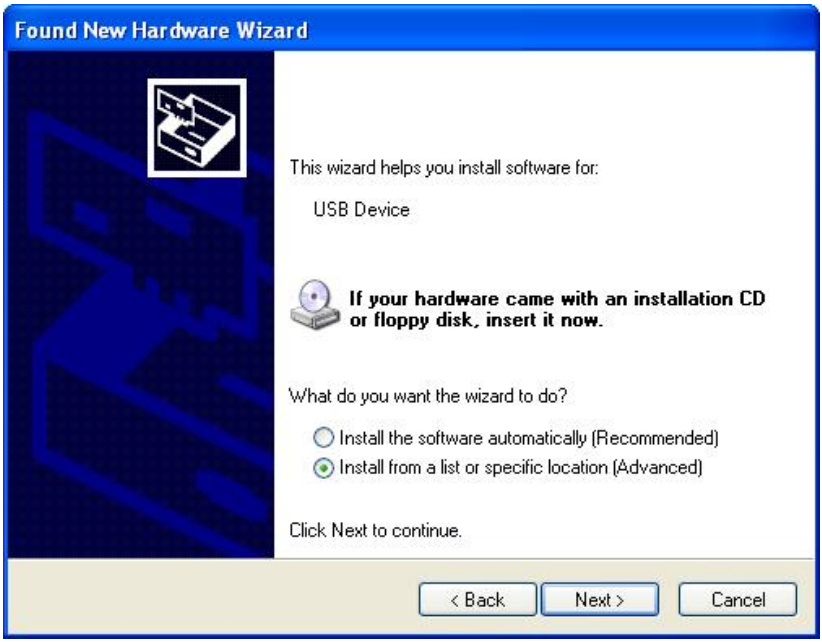
Note The outside of the external power connector is connected to +5 Volt. In order to avoid shortage, first connect the cable to the Handyscope HS4 and then to the keyboard connector.

Before the Handyscope HS4 is connected to the computer, first the software has to be installed. The software can be found on the CDROM that came with the Handyscope HS4. When the software is installed, the Handyscope HS4 can be connected to the computer.

When the Handyscope HS4 is connected to an USB port of the computer of the first time, Windows will report new hardware.

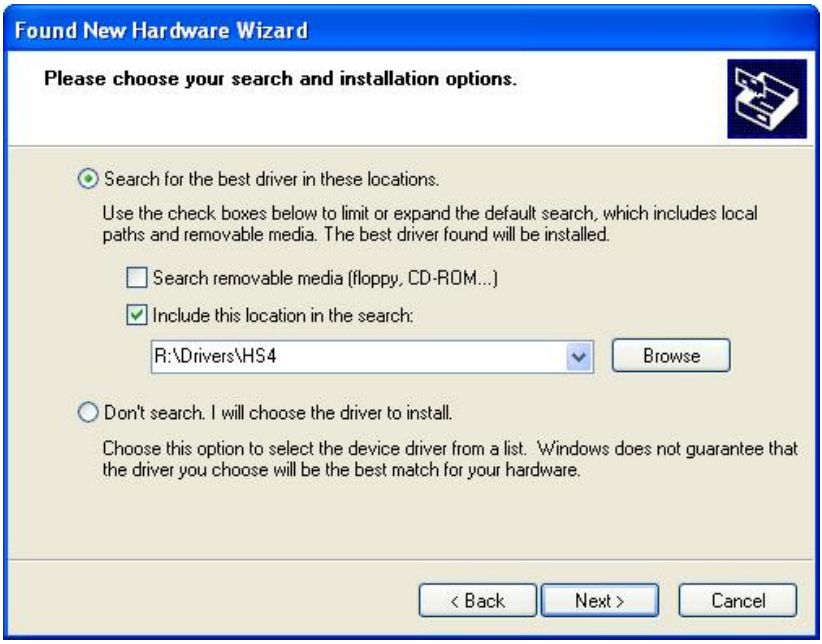
Windows will request for the location where the drivers can be found. The appearance of the dialogs will differ for each windows version and might be different on the computer where the Handyscope HS4 is installed.

There are no drivers for the Handyscope HS4 on the Windows Update Web site, so select "No, not this time" and click Next.



Insert the TiePie software CD in the CDROM drive of your computer. Select Install from a list or specific location and click Next >.

Now a location for the drivers has to be specified:



Select Search for the best driver and check Include this location. Use the Browse button to browse to the folder Drivers\HS4 on the TiePie software CD. Then click Next >.

Windows wil now report that it has found the Handyscope HS4. Windows XP will report that the driver is not certified and warn for possible danger.

The driver is not causing any danger for your system and can be safely installed.

Click Continue Anyway to install this driver.

Windows will now install the drivers for the Handyscope HS4. When the installation is complete, Windows will report:

The driver is built up in two stages. Stage 1 is installed now. Installation of stage 2 follows immediately and requires the same steps as stage one.

When state 2 is installed, the Handyscope HS4 is now known in Windows and ready to use.

When the Handyscope HS4 is disconnected, the required drivers will be removed from the memory of the computer.

The next time the Handyscope HS4 is connected, the required drivers wil be loaded again. The CD is no longer required for that.

Extension connector

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

1	Ground	14	Ground
2	Reserved	15	Ground
3	External power in 5V DC / 500 mA	16	Reserved
4	Ground	17	Ground
5	5 V out, 10 mA max.	18	Reserved
6	External sampling clock in (3.3 V TTL)	19	Data OK in (TTL)
7	Ground	20	Reserved
8	External trigger in (3.3 V TTL)	21	Reserved
9	Data OK out (3.3 V TTL)	22	Ground
10	Ground	23	I^2C SDA
11	Trigger out (3.3 V TTL)	24	I^2C SCL
12	Reserved	25	Ground
13	External sampling clock out (3.3 V TTL)		

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

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

The Handyscope HS4 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. To avoid shortage, first connect the cable to the Handyscope HS4 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	4 analog, BNC
output	-

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

Trigger system

system	digital, 2 levels
source	Ch1, Ch2, Ch3, Ch4, combination of these, 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
sampling frequency	12 bit	5 MHz, 10 MHz, 25 MHz or 50 MHz
	14 bit	3 MHz
	16 bit	200 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	4, 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

notes

If you have any suggestions and/or remarks regarding the Handyscope HS4 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