User Manual

TP801 PCI

a multifunctional
PC measuring instrument

TiePie engineering

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PC measuring instrument

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Contents

TiePie engineering
Koperslagersstraat 37
8601 WL Sneek
Nederland

EG-verklaring van overeenstemming

Wij verklaren geheel onder eigen verantwoordelijkheid, dat het produkt

TP801 PCI

waarop deze verklaring betrekking heeft, in overeenstemming is met de geharmoniseerde Europese normen

EN55011, EN55022, EN50081-1 en EN50082-1

Volgens de bepalingen van de EMC-richtlijn 89/336/EEG, gewijzigd door de richtlijn 92/31/EEG en 93/68/EEG

Sneek, 12-5-2002 ir. A.P.W.M. Poelsma

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The Netherlands

EC declaration of Confirmity

We declare, on our own responsibility, that the product

TP801 PCI

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, 12-5-2002 ir. A.P.W.M. Poelsma

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EG - Konformitätserklärung

Wir erklären, in Eigenverantwortlichkeit, hiermit, daß das Produkt

TP801 PCI

für das diese Erklärung gültig ist, mit

EN55011, EN55022, EN50081-1 und EN50082-1,

gemäß den Anforderungen des EMC-standards 89/336/EEC, und den Zusatzbestimmungen 92/31/EEC und 93/68/EEC übereinstimmt.

Sneek, 12-5-2002 ir. A.P.W.M. Poelsma

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Déclaration de conformité C.E.

Nous déclarons, sous notre responsibilité, que le produit

TP801 PCI

pour lequel cette déclaration est valide, est conforme aux:

EN55011, EN55022, EN50081-1 et EN50082-1

selon les conditions du standard CEM N° 89/336/EEC, et les amendements 92/31/EEC et 93/68/EEC

Sneek, 12-5-2002 ir. A.P.W.M. Poelsma

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Dichiarazione di Conformita' CE

Dichiariamo sotto la nostra esclusiva responsabilitià che il prodotto:

TP801 PCI

per il quale vale la presente dichiarzione, è conforme alle norme

EN55011, EN55022, EN50081-1 e EN50082-1

conformente alle condizioni della normativa EMC 89/336/EEC, e successive modifiche 92/31/EEC e 93/68/EEC.

Sneek, 12-5-2002 ir. A.P.W.M. Poelsma

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EC-declaración de conformidad

Nosotros declaramos, bajo nuestra propia responsabilidad, que el producto

TP801 PCI

para el cual esta declaración es válida, está en relación con

EN55011, EN55022, EN50081-1 y EN50082-1

Según las condiciones del EMC estándar 89/336/EEC, y los movimientos 92/31/EEC y 93/68/EEC

Sneek, 12-5-2002 ir. A.P.W.M. Poelsma

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EF-Overensstemmelseserklæring

Undertegnede erklærer herved, at følgende apparat overholder beskyttelseskravene i Rådets direktiv 89/336/EØF om elektromagnetisk kompatibilet (EMC).

Identification af apparat:

Kategori: Måleinstrument
Model/type: TP801 PCI

Standarder der er anvendt som grundlag for erklæring, eller henvisning til den prøvningsrapport, der er udstedt af et bemyndiget laboratorium:

EN55011, EN55022, EN50081-1 og EN50082-1

CE-mærket angiver kun overensstemmelse med EMC-direktiv 89/336/EØF

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EC Hyväksyntäilmoitus

Velvollisuutenamme on ilmoittaa, että tuotteemme

TP801 PCI

jota tämä selvitys koskee, on huväksytty

EN55011, EN55022, EN50081-1 ja EN50082-1

EMC standardien 89/336/EEG, ja lisästandardien 92/31/EEC ja 93/68/EEC mukaisesti

Sneek, 12-5-2002 ir. A.P.W.M. Poelsma

Chapter 1
Introduction

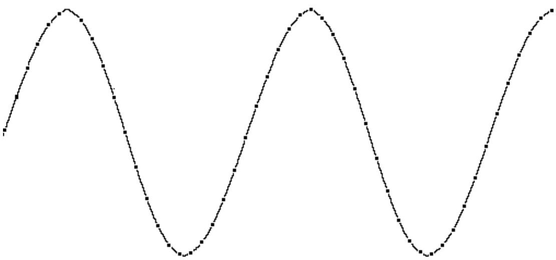
NOTE **Before using the TP801 PCI, first read chapter 2, about Safety.**

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.

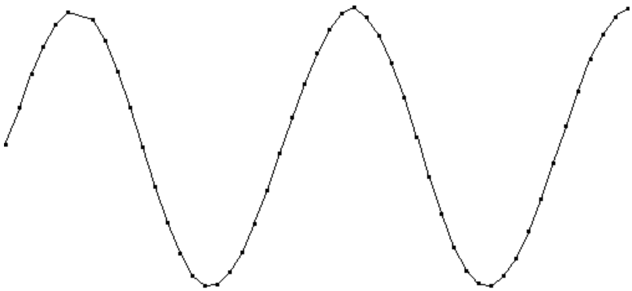
The TP801 PCI is a 2 channel, 8 bits, 100 Msamples/sec interface card, which can, with the acompanying software, be used as a digital storage oscilloscope, a spectrum analyzer, a voltmeter or a transient recorder. All instruments measure by sampling the input signals, digitalize the values, process them, 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.



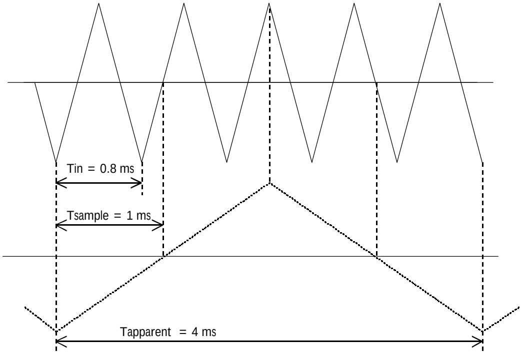
In the latter illustration a sine wave signal is sampled with 50 samples. By connecting the adjacent samples, the original signal can be reconstructed. See also the next illustration.



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.

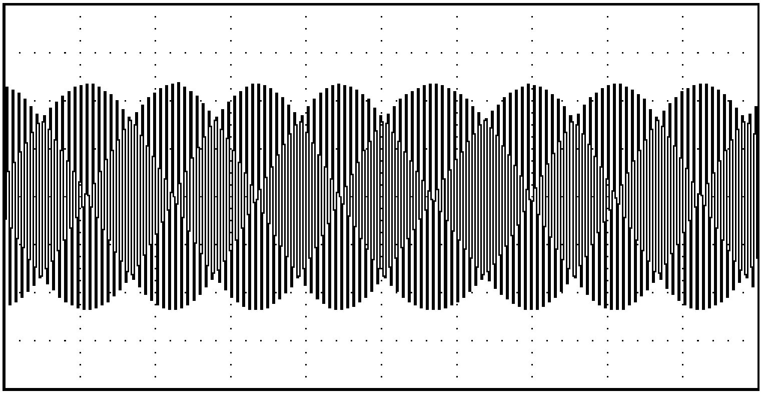
Aliasing

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 257 kHz, which is sampled at a frequency of 50 kHz. The minimal sampling frequency should have been 514 kHz. For proper analysis, the sampling frequency should have been 5 Mhz.

Digitising

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.

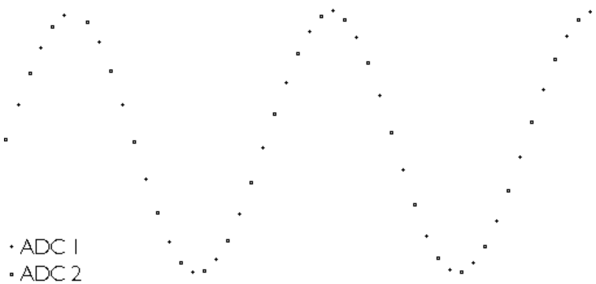
By increasing the number of bits, the resolution increases, the number of quatifying steps increases and the sub-divisions get smaller.

The measuring system of the TP801 PCI

The TP801 PCI uses an 8 bits ADC with a maximum sampling frequency of 50 MHz for each channel.

The TP801 PCI can sample 2 channels simultaneously with a maximum speed of 50 million samples per second. By using a special technique, it is also possible to measure one channel at a speed of 100 million samples per second.

The two ADC's are switched to channel 1. One ADC starts sampling at 50 MHz. The other ADC will also sample at 50 MHz, but at intervals exactly between the moments the first ADC is sampling. By putting the samples of both ADC's together, it is possible to sample a signal at 2 x 50 MHz = 10 MHz. See also the next illustration.

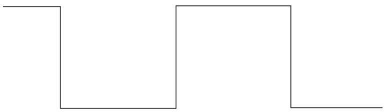


This can only be done with channel 1 of the TP801 PCI.

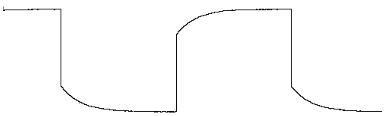
The TP801 PCI is shipped with two probes. These are 1x/10x selectable passive probes. This means that the input signal is passed through directly or 10 times attenuated.

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.

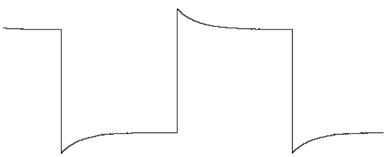
Therefore the probe is equiped with a setscrew, with which the parallel capacity of the attenuation network can be altered. To adjust the probe, switch the probe to the x10 and attach the probe to a 1 kHz square wave signal. Then adjust the probe for a square front corner on the square wave displayed.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



correct



undercompensated



overcompensated

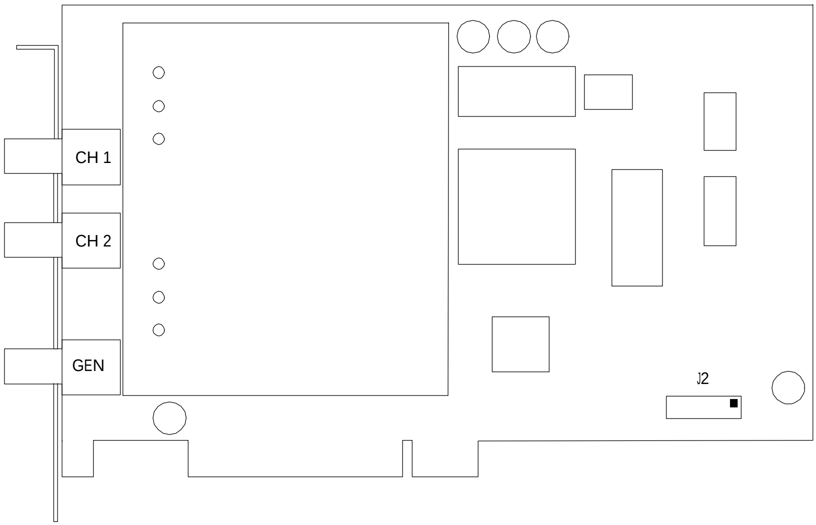
Safety

Before you start working with the TP801 PCI, first read these safety rules.

- Avoid working alone.
- Check the probes/testleads for damages. DO NOT use them if they are damaged.
- Take care when measuring voltages higher than 25 V AC or 60 V DC.
- The maximum input signal size is 200 V (DC + AC.peak < 10 kHz) Applying more than these voltages may damage your TP801 PCI.
- Always choose the right function and range when measuring.
- The TP801 PCI is grounded through the grounding conductor of the power cord of the PC it is placed in. Plug the power cord in a proper, grounded outlet before making connections to the inputs and outputs of the TP801 PCI. Proper grounding is essential for safe measuring.
- If the PC with the TP801 PCI is not grounded, all accessible conductive parts can render an electrical shock.

Chapter 3
Hardware installation

The TP801 PCI is an interface card which can be placed in any free PCI slot of an IBM compatible AT. The card uses Plug and Play, so installation is quite simple.



Switch the power of your computer off, and remove the cables.

Before opening the computer and handling the card, be sure to remove any static electricity by touching a grounded metal part or wear a grounding strap.

Then open the computer and locate a free PCI slot. Remove the slot cover and insert tha TP801 PCI card. Then replace the cover of the computer, reconnect the cables and switch the power back on.

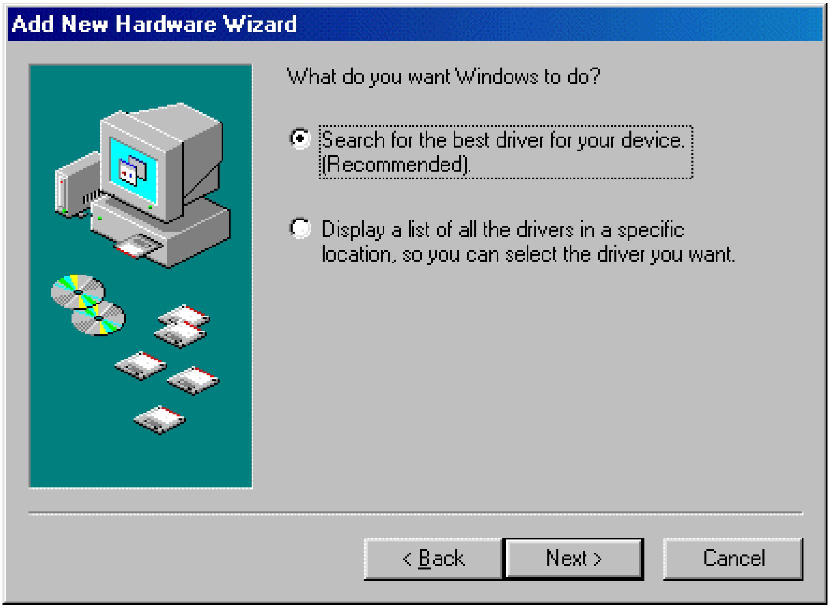
Driver installation

After installing the TP801 PCI in the computer and powering up the computer, Windows will report that new hardware is found. Then it will start the New Hardware wizard to install the driver for the TP801 PCI.

The following steps are required, the images show the operations to perform. The driver software is delivered on the CD that came with the TP801 PCI. In the images is assumed that the drive letter for the CDROM is D:.

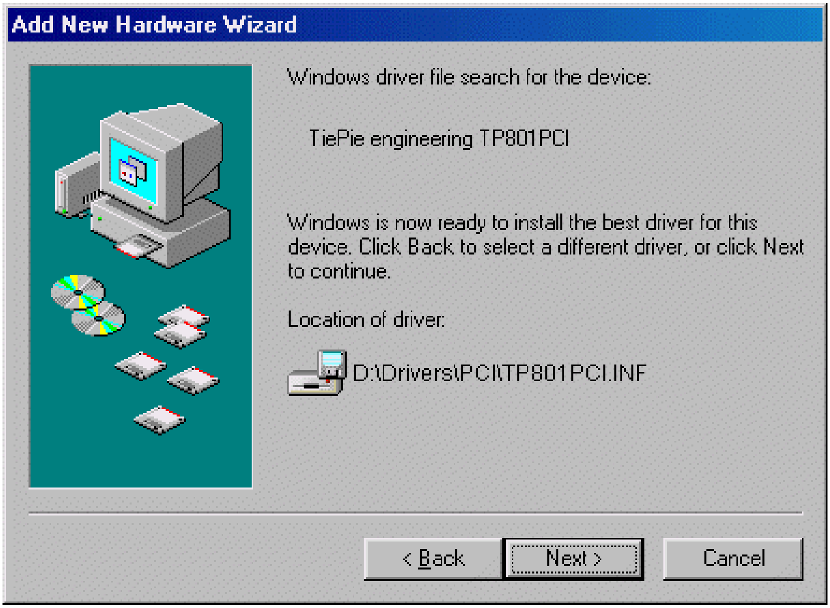
Step 1

Step 2

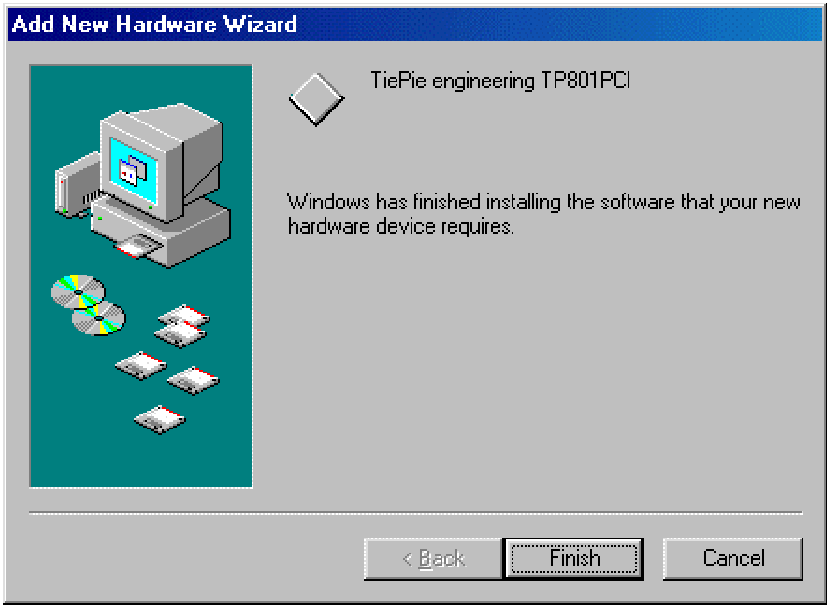

Add New Hardware Wizard
What do you want Windows to do?
Search for the best driver for your device. (Recommended).
Display a list of all the drivers in a specific location, so you can select the driver you want.
< Back
Next >
Cancel

Step 3


Add New Hardware Wizard
Windows will search for new drivers in its driver database on your hard drive, and in any of the following selected locations. Click Next to start the search.
Floppy disk drives
CD-ROM drive
Microsoft Windows Update
Specify a location:
D:\Drivers\PCI
Browse...
< Back
Next >
Cancel


Add New Hardware Wizard
Windows driver file search for the device:
TiePie engineering TP801PCI
Windows is now ready to install the best driver for this device. Click Back to select a different driver, or click Next to continue.
Location of driver:
D:\Drivers\PCI\TP801PCI.INF
< Back
Next >
Cancel

Step 5



The driver installation is now ready and the TP801 PCI is ready to use.

Pin assignments of the connectors

16 pin header (J2)

1	:	Ground	
2	:	+5 Volt	
3	:	Reset out	
4	:	Data OK	(TTL)
5	:	External trigger IN	(TTL)
6	:	External trigger Out	(TTL)
7	:	External clock in	(TTL)
8	:	External clock out	(TTL)
9	:	not used	
10	:	not used	
11	:	not used	
12	:	not used	
13	:	- 5 Volt	
14	:	Ground	
15	:	+ 5 Volt	
16	:	Ground	

The signals of header J2 are TTL compatible, except for the power lines.

External 15 pin sub-D connector

1	:	Ground	
2	:	Reset out	
3	:	External trigger input	(TTL)
4	:	External clock in	(TTL)
5	:	not used	
6	:	not used	
7	:	- 5 Volt	
8	:	+ 5 Volt	
9	:	+ 5 Volt	
10	:	Data OK	(TTL)
11	:	External trigger output	(TTL)
12	:	External clock out	(TTL)
13	:	not used	
14	:	not used	
15	:	Ground	

The signals of the 15 pin sub-D connector are TTL compatible and coming from the 16 pin header J2.

BNC connectors

The BNC connectors at the back of the TP801 PCI have the following function:

- the upper BNC connector is the input of channel 1
- the middel BNC connector is the input of channel 2
- the lower BNC connector is the output of the generator

Appendix B

Specifications

A/D converter

resolution	8 bits = 0.39%
effective data throughput	50 000 000 samples/sec
	100 000 000 samples/sec on one channel
conversion time	20 nsec, 10 nsec on one channel

Analog input BNC

sensitivity	100 mvolt .. 80 volt full scale
maximum voltage	200 volt (DC + AC peak < 10 kHz)
impedance	1 MS / 30 pF
coupling	AC / DC
accuracy	1% ± 1 LSB
bandwidth	DC to 50 Mhz
SNR	7.3 bit / 43 dB

Digital external trigger

Levels	0 - 5 Volt TTL

Arbitrary Waveform Generator

sample rate	0 - 25 MHz
resolution	10 bit
bandwidth	DC to 2 MHz
impedance	50 Ohm
coupling	DC
output amplitude	-10 volt .. 10 volt
amplitude step	0 - 10 V in 65535 steps, resolution 0.2 mV
DC level	0 - 10 V in 65535 steps, resolution 0.2 mV
Waveforms	sine, triangle, square, DC, noise and user defined
Symmetry	1 - 99%, 1% steps

Trigger system

system	digital, 2 levels
trigger modes	edge, window, peak, TV, external
level adjustment	0 - 100% of full scale
resolution	0.39% (8 bits)
pre trigger	0 - 65520 samples (0 - 100%)
post trigger	0 - 65520 samples (0 - 100%)

Maximum sample rate

50 MHz on 2 channels, 100 MHz on 1 channel

Memory

64 KWord per channel

General

Ambient temperature	10 °C - 35 °C
dimensions	
height	126 mm (5.0")
length	200 mm (7.9")
width	22 mm (0.9")
weight	166 gram (5.9 ounce)
accessories	2 oscilloscope probes 1:1 - 1:10 switchable

Notes

If you have any suggestions and/or remarks concerning the program, the TP801 PCI or the manual, please contact:

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