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USBpulse100
USER'S GUIDE
ES380

<mark>**Important Notice: Please refer to Safety Data 4.4.1, before using this instrument**</mark>
All Trademarks are duly acknowledged.
The USBpulse100 is Patent Pending.

REVISION HISTORY

ISSUE	PAGES	DATE	NOTES
1	34	21.02.2006	FIRST ISSUE
2	36	22.02.2006	Add PLL frequency list & other performance specs

CONTENTS

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The models covered by this installation guide are intended only for installation in Listed computers for use in business or home.

1 OVERVIEW

The USBpulse100 is an isolated digital pulse generator that has the following features:

- Single channel pulse generator with BNC output and USB PC interface
- Each USBpulse100 can be stacked to increase channel count (each requires its own USB connection)[1]
- 300V Cat II isolation between BNC ground and USB ground[2] *This means that there is no DC path through the USBpulse100 from the generators output to the PC's ground*
- Up to 100MHz output clock
- 10ns resolution pulse generation
- Single pulse or continuous clock
- 28-bit programmable DIVIDER gives output clock rates from 33.333MHz down to 11.6mHz, with programmable duty cycle
- Programmable PLL from 100MHz down to 3.125MHz
- Also features 128-bit pseudo random bit generator output
- Programmable output high voltage level from 1.5V to 5.0V in 256 steps
- Output can be put into Hi-Z state
- Output can be logically inverted
- Two or more USBpulse100s can be synchronised allowing clock or pulse generation with fixed phase relationships, and programmable delays relative to Channel 1
- Host powered from USB (200mA typ)
- Stacked configurations of 2,3 and 4 channels are supported
- Power/activity LED

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[1] A stacking connector kit is required
[2] In stacked configurations the channels share a common ground at the BNC terminals

2   ABOUT THE USBpulse100

2.1 General

The USBpulse100 has been designed to allow a broad range of output frequencies and pulses to be generated. The amplitude of the output is programmable to allow the generator to work in circuits needing various Vih levels. The generator output can be adjusted from 1.5V to 5.0V in 256 steps.

Each USBpulse100 can be used as an independent single channel generator but to enhance flexibility several USBpulse100s can be stacked together to make a combined 2,3 or 4-channel device. In this case, each generator is synchronised with the others[3] so that the compound device acts like a single multi-channel instrument. Each USBpulse100 still needs its own USB connection and the combined device shares a common ground between all the BNC connectors i.e. the channels are isolated from the USB but not from each other.

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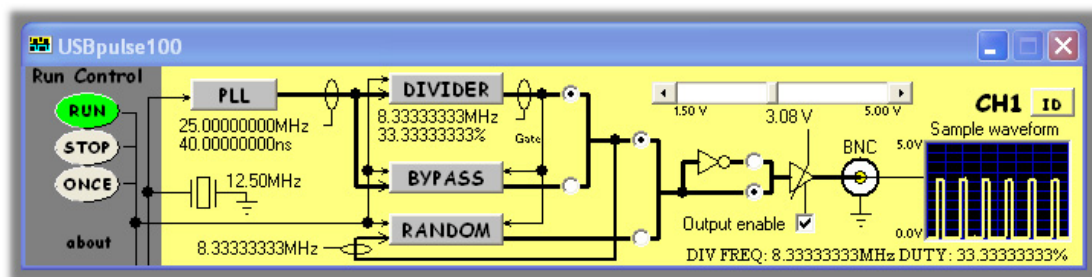
[3] The generators use a common clock but their own internal PLL. Therefore, only PLL outputs that are integer multiples of the common clock will be guaranteed to show repeatable phase relationships.

2.2 USBpulse100 Architecture

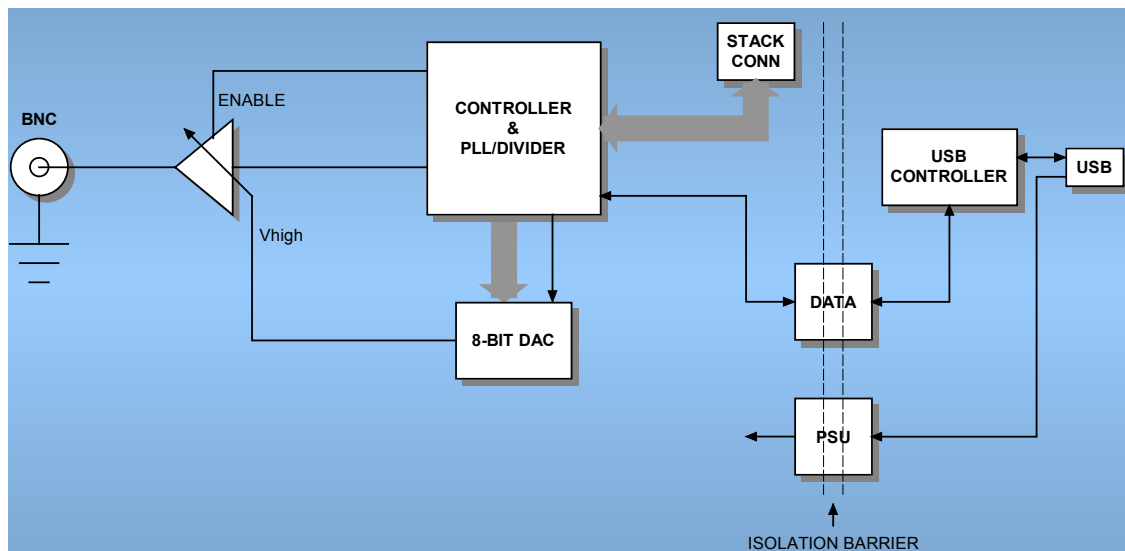The figure below shows a simplified diagram of the USBpulse100.

Figure 2.2-1 USBpulse100 Architecture Diagram

2.3 Using More Than One USBpulse100

2.3.1 Stacked Mode

A unique feature of the USBpulse100 architecture is that up to 4 devices[4] can be stacked to make a multi-channel instrument.

In order to use a stacked configuration, you **must purchase the stacking connector kit**. This kit comprises 3 long lead connectors and 1 short lead connector as shown:
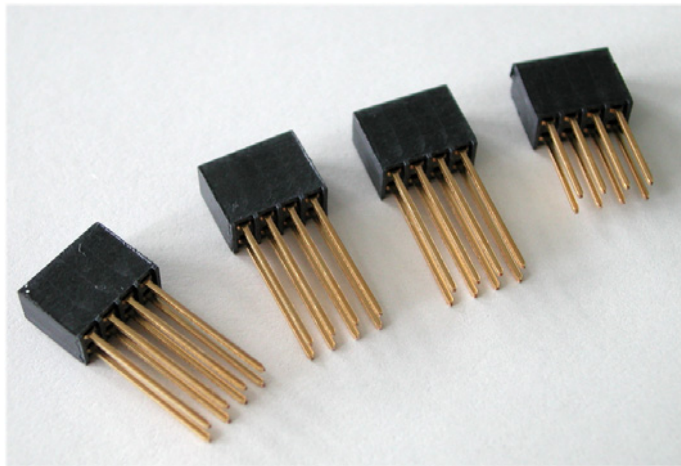
2.3.1.1 Assembling The Stack

To stack the USBpulse100 devices, first be sure that none of them are connected to a USB port.

Before you begin, put the short lead connector to one-side…you'll use that one last.

Now, insert one of the long connectors from the top of one of the generators (it doesn't really matter which one). Push the pins of the connector into the top of the stacking connector from the side where you can see the top of the black connector down inside the generator. Be careful when doing this, don't use too much force or you may damage the connector pins. Push the long connector all the way in until it seats down on the generator's internal connector. You should be able to see the gold pins about 2-3mm beyond the bottom surface of the generator. The connectors have no pin orientation…they can go in 2 possible ways round…both are OK.

---

[4] Don't stack more than 4, the software will reject this.
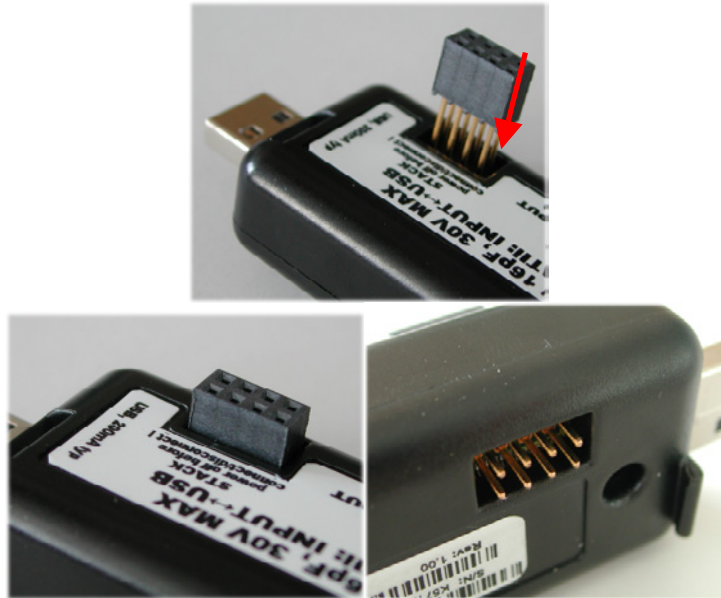
Repeat this for all except the last generator to be stacked.

For the last generator in the stack, do the same as above but use the short length connector. This time, the pins are shorter so they stop well inside the generator's case. **This generator MUST be the bottom generator in the stack**. The reason for this is that if you use the long connector, the pins could be shorted out accidentally, or you may touch the pins when the generator is connected to a high voltage and you could get an electric shock! Similarly, if you plan to use only one generator, make sure there is no stack connector fitted or the shorter connector type is fitted.

 This is a safety critical point so please note it carefully.

Now you can assemble the stack.

Start with the bottom generator. Hold it in one hand, and put the next generator on top of the 1st, the same way around. Align the stacking connectors and when the stacking connectors are partly mated engage the front "P" shaped clip (BNC end) on the 2nd generator into the "P" shaped slot on the 1st generator.
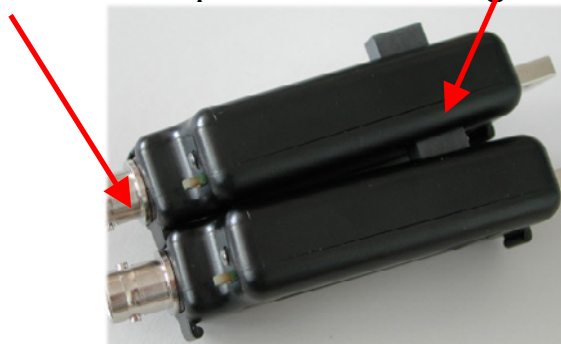
Now, bring the back edge "P" clip (USB end) of the 2nd generator down until it clicks into the 1st generator's slot. These two generators are now mated.
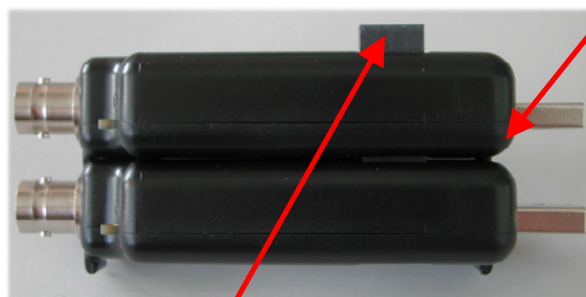
Check that as you pushed the 2nd generator down, the stack connector has not been forced upward…if it has simply press it down until it seats correctly (see picture above for a guide as to the normal exposed connector depth after stacking). Repeat this for each remaining generator, adding each one on top of the previous one.

The generators are now stacked.

2.3.1.2 Disassembling The Stack

Start with the top generator in the stack. Grasp the stack in one hand and with the other hand's thumb and forefinger, pinch between the interface between the top two generators, near the back "P" clip (USB end). With moderate force, the top generator will pop up and come free. Remove the stacking connector from the free generator.

Repeat this for all generators in the stack.

2.3.1.3 USB Connections For Stacked Configurations

All stacked generators need a USB connection. A standard hub may be useful for multi-channel stacks to get enough USB ports.

Each generator needs about 200mA. Plugging more than 2 generators into a hub will mean that the hub may need to be powered externally. Please refer to the hub's documentation for more details about the power available per port.

2.3.1.4 Software For Stacked Configurations

When you run USBpulse100, it will automatically detect the generators connected via USB and will also check to see if the generators are electrically connected together via the stack. It will then initialise all connected generators, one at a time. This may take a few seconds.

If you stack several generators but forget to connect say one of the generators to a USB port, the software will warn you and will not run.

The software will display a channel diagram for each generator in use.
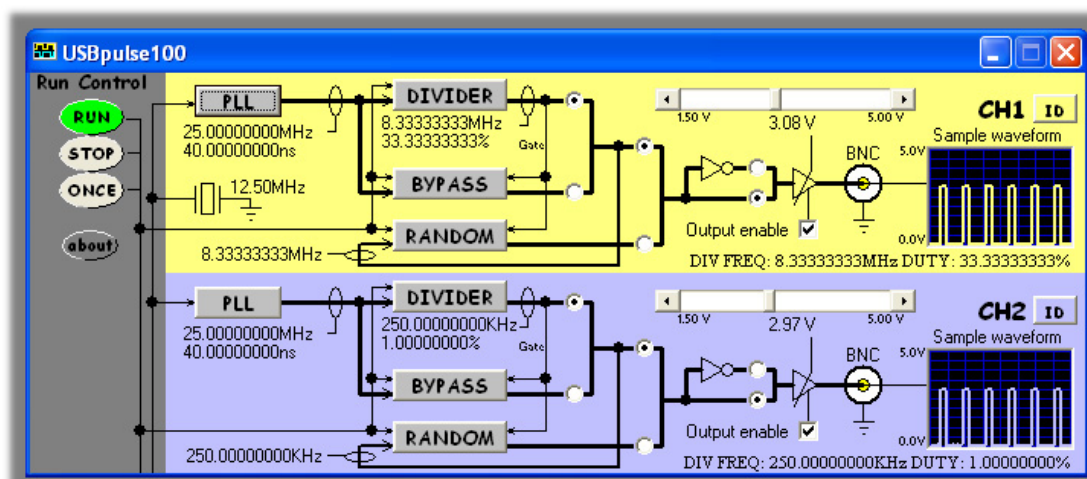
The channel number allocated to each generator depends on its serial number, so the order you stacked them will almost certainly NOT be the same as the channel order allocated by software.

To find out which generator is Channel 1, use the CH1 tab and click the "id" button.
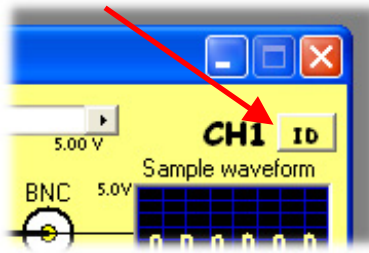
The LED on that generator will blink rapidly for about 4 seconds, or until you click the button again.

Repeat this for each channel in the stack to identify them.

If you like, you can stop the software, and unplug all the generators from their USB connections, and then re-stack them in their channel order.

The "about" tab lists all the generators that have been found. The list shows the serial number and revision data for each generator.
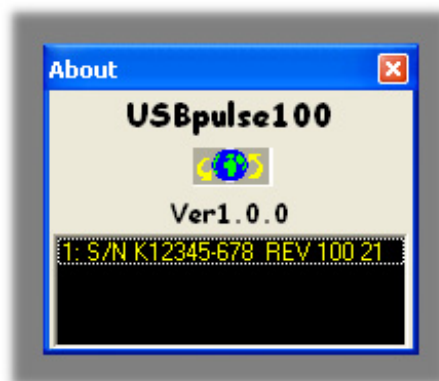
2.3.1.5 Stacking Do's And Don'ts

- Do power off all generators (remove USB lead) before connecting and disconnecting generators from the stack
- Don't remove any generators from the stack while the software is running
- Don't remove any generators from the stack while any of them are powered
- Don't stack several generators and leave one or more generators un-stacked…this configuration will ignore the un-stacked generators
- Don't short circuit any of the stack connector pins, or bend the pins or use excessive force trying to mate the connectors
- Don't probe or drive any of the stack connector signals
- Avoid touching the stack connector pins/signals during stacking
- Do make sure that each stack connector is properly seated in place before trying to stack another channel on top
- Don't allow water or dirt etc to enter the generator via the stack connector access hole
- Do remember that generators in the stack **are NOT isolated from each other, they are only isolated from the USB ports. To re-iterate, stacked generators have their BNC connector bodies connected together through the stack connector.**

2.3.2 Non-Stacked (MIS) Mode

It is also possible to use multiple USBpulse100s as independent instruments. In this mode, the generators are NOT connected together via the stacking interface[5].

This configuration is also termed Multi-Instrument mode or MIS mode.

In MIS mode, each generator can use its own timebase setting, and each generator input will remain electrically isolated from the others (unless you connect their BNC grounds together).

2.3.2.1 USB Connections For Non-Stacked Configurations
All generators need a USB connection. A standard hub may be useful for multi generator use to get enough USB ports.

Each generator needs about 200mA. Plugging more than 2 generators into a hub will mean that the hub may need to be powered externally. Please refer to the hub's documentation for more details about the power available per port.

2.3.2.2 Software For Non-Stacked Configurations
By default when you run USBpulse100, it will automatically detect all the generators connected via USB and will also check to see if the generators are electrically connected together via the stack. To run in Non-Stacked MIS mode, the software must be "told" to drive one particular generator. You can then simply run multiple copies of the USBpulse100 software, one copy for each particular generator.

In order to achieve this mode of operation, USBpulse100 accepts a command line parameter

<div align="center">

"USBpulse100 /MISp:c"

</div>

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[5] They can of course still be snapped together, but remember NOT to fit any of the stacking connectors so that the generators remain electrically independent of each other.

where "p" is the COM port number and "c" is the assigned channel number.

For example, if you want to run 2 generators in MIS mode, use Window's Device Manager to get the two COM port numbers for the two generators (see 3.2). Lets assume they are COM4 and COM5.

Next, locate the USBpulse100.exe program (normally under "Program Files\USBpulse100") and highlight the file. Right click the file and use "Create Shortcut" to make TWO shortcuts to the program. Then for the first shortcut, right click it and bring up "Properties". In the "Target" field, add " /MIS4:1" to the end of the line[6]. Do the same for the second shortcut but add " /MIS5:2".

Now, double click the first shortcut. An instance of USBpulse100 will run and configure the generator on COM4. Next, double click the second shortcut and this will launch a second instance of USBpulse100 but this time configuring the generator on COM5, and also note that this second generator appears as a "CH2" tab. This way you can easily identify which instance of software is for which generator.

Note that you could also have chosen /MIS4:1 and /MIS5:1. Both generators would then act like a CH1 tab. Its up to you how you choose to configure the system.

In MIS mode, the settings for a particular software instance will be saved when you exit, and will be separate to any other generator's settings.

You can run up to 4 generators in MIS mode and you can assign channel numbers from 1 to 4.
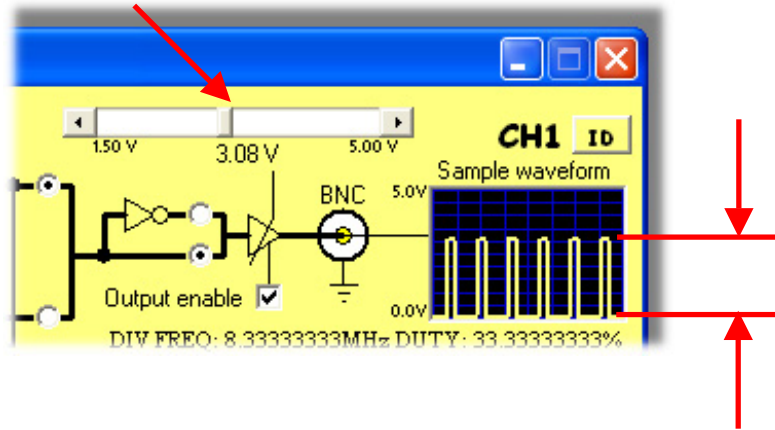
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[6] Note the space

2.4 Output Control

2.4.1 Output Amplitude

The USBpulse100 supports programmable output amplitude via the slider control.

When you adjust the slider, the on-screen waveform adjusts to show the approximate amplitude you have selected.

Amplitudes from 1.50V to 5.00V are possible, and the slider control adjusts in 256 steps of 13.67mV per step.

2.4.2 Output Enable

The output of the generator can be placed into a Hi-Z mode using the button shown. In Hi-Z mode the output impedance is >>10Meg. In enabled mode the output impedance is approximately 50ohms at DC.
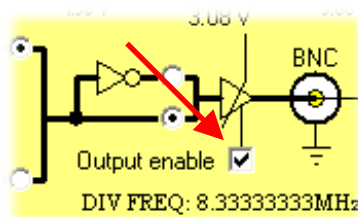
2.4.3 Output Invert

The logical state of the output can be inverted using the button shown. In Hi-Z mode this button has no effect. Note that the inversion happens before the output buffer meaning that you will get the same output high level as before…the inversion is a digital inversion not an analog inversion.
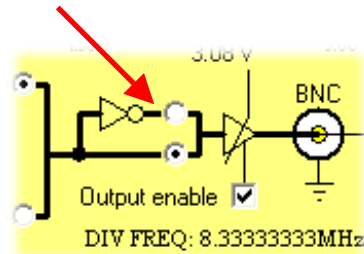
2.5 Generator Modes

2.5.1 Continuous Clock
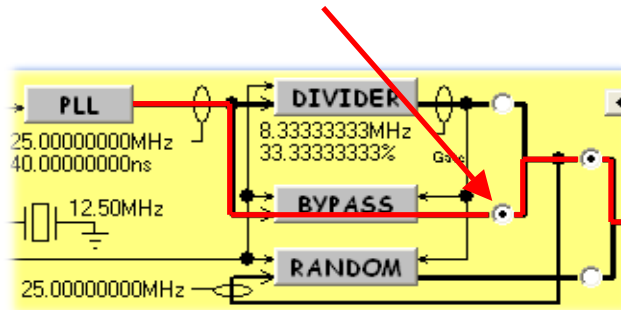
There are two ways to output a continuous clock pulse train from the generator. Both use the RUN mode, which sets all channels into a free run mode.

2.5.1.1 Direct PLL output or "BYPASS" mode

This mode allows the programmable PLL to be fed directly to the output. It offers the highest frequencies[7]. The output clock is fixed at approximately 50% duty cycle.

The PLL is programmable itself by clicking on the PLL button
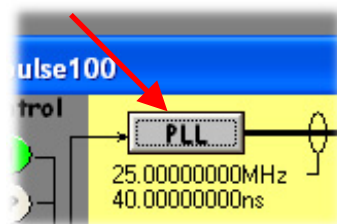
This will cause the PLL configuration box to appear

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[7] At frequencies above 50MHz, the output waveform may attenuate relative to the slider setting and may also exhibit some DC offset and greater ringing at the edges.

There are many possible output frequencies, ranging from 100MHz down to 3.125MHz. Note that when using 2 or more generators, only combinations where each generator uses a frequency entry with **lock** along side, will have outputs that will be guaranteed to be in ph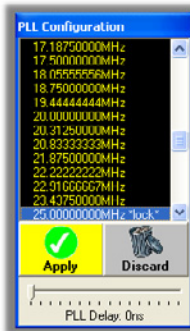ase lock with each other. This is because all generators use a common 12.5MHz master clock to drive their PLLs. So only PLL outputs that are integer multiples[8] of 12.5MHz will guarantee to have phase lock with other similarly configured PLLs.

Note that the PLL also has a configurable delay from 0ns to 3.75ns in 250ps steps. This is of little use for a single generator but for 2 or more channels it allows some fine (if limited) control over the relative timings between channels. For internal reasons the delay is not available for PLL outputs of 3.125MHz, 4.166MHz, 6.250MHz or 12.500MHz

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[8] Some jitter between generators is inevitable due to the PLL . Some combinations are worse than others depending on the internal PLL DIVIDER ratios required. You are advised to check the performance between channels using an oscilloscope.

2.5.1.2 DIVIDER Output

In this mode, a 28-bit DIVIDER is used to generate a more flexible output range but with lower frequencies.
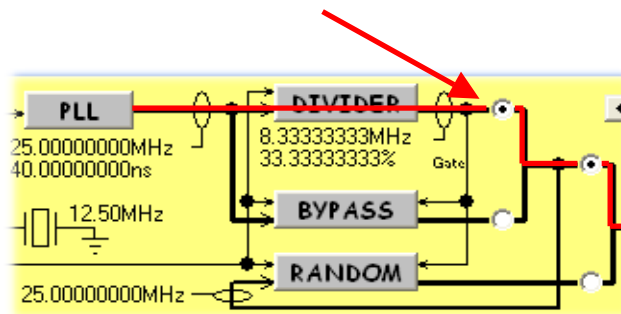
The DIVIDER is clocked by the PLL and the full range of PLL frequencies and phase locking are available as described in 2.5.1.1.

The DIVIDER can be configured to divide the PLL input frequency by a factor of 3 up to 268,435,457 in integer steps. This DIVIDER is called "X" for the sake of further discussions.

The DIVIDER can also be configured to vary the duty cycle and relative start time of the pulse. The start time is programmable from (0 to 268,435,454 x PLLperiod) in integer steps and will be referred to as "Y". The pulse end time is programmable from ("Y" to "X-2" x PLLperiod) in integer steps.

Clicking on the DIVIDER button reveals the DIVIDER configuration.
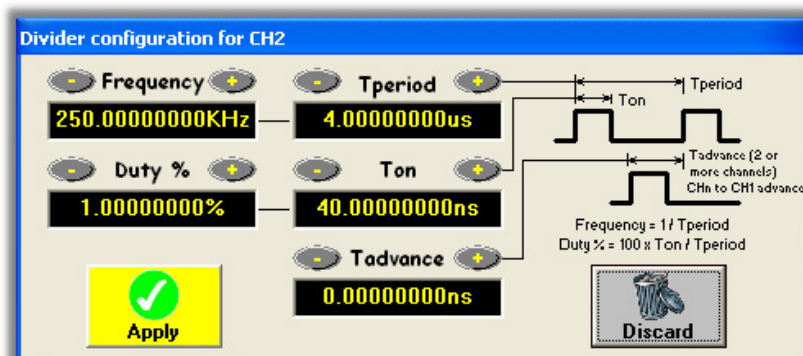
To simplify the configuration, the control panel does not use the X, Y and Z terms as they are too low-level to aid understanding. Instead, you can simply enter your desired frequency and duty cycle directly. For even greater flexibility you can choose to enter

frequency **or** period, and likewise you can enter duty cycle **or** pulse ON time. Note that the example panel shown includes the Tadvance selection (equivalent to "Y" in the above discussion) because the panel is for Channel 2. Channel 1 will not show the Tadvance selection as this setting is specifically to change the pulse position with respect to Channel 1 and so only applies for Channel 2 and higher.

When entering values into the various boxes, the following qualifiers apply:

Frequency box	Range
No qualifier or H or h or invalid	Hertz
m	MilliHertz
K or k	KiloHertz
M	MegaHertz

Time/period box	Range
No qualifier or S or s	Seconds
M or m	MilliSeconds
U or u	MicroSeconds
N or n	NanoSeconds

Duty box	Range
Any or no qualifier	percent

By way of illustration, here are the ranges possible with the limiting DIVIDER and PLL combinations:

PLL Frequency MHz	DIVIDER Frequency Fmax	DIVIDER Frequency Fmin	DIVIDER Duty Max @ Fmax	DIVIDER Duty Min @ Fmax	DIVIDER Duty Max @ Fmin	DIVIDER Duty Min @ Fmin
100MHz	33.333333333MHz	372.52902846mHz	33.33333333%	33.33333333%	99.99999925% Ton=2.68435455s	0.00000037% Ton=10ns
3.125MHz	1.04166667MHz	11.641532214mHz	33.33333333%	33.33333333%	99.99999925% Ton=85.89934560s	0.00000037% Ton=320ns

As can be seen, when the DIVIDER output frequency is only a small factor down on the PLL frequency, only a very limited duty cycle selection becomes possible.

2.5.2 Continuous Random Bit Stream

The USBpulse100 can generate a pseudo random bit stream output. It is generated from a linear feedback shift register with 128 bits. The shift register is clocked from either the PLL or the DIVIDER output as shown below.
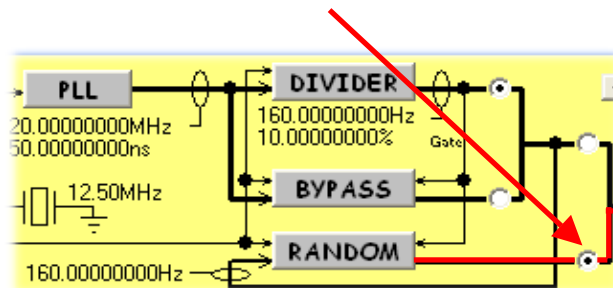
The random bit generator has no configuration settings itself but can use the PLL or DIVIDER as its clock source.

The minimum high or low bit time at the output is equal to the period of the clock driving the random bit generator (which could be the PLL or the DIVIDER). The maximum high bit time is 128 bit times but the maximum low bit time is 127 bit times (the shift register will never go to code 0x0000000). The distribution of the high bit times is pseudo random, as is the distribution of the low bit times.

2.5.3 Single Clock Burst

In this mode, the ONCE button is used. Each press of the button makes a burst of clock pulses. Note that using the ONCE button affects all generators…it is not possible to have a mixture of free running clocks and one shot events unless MIS mode is used (see 2.3.2) and in this case the generators will be un-synchronised.
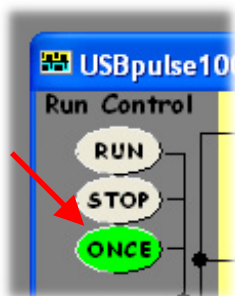
To set the burst duration, use the DIVIDER settings to configure Ton. This will be the gating time for the PLL output. The output will N clock pulses at the PLL frequency where N= Ton*PLLfreq.

The overall configuration looks like this
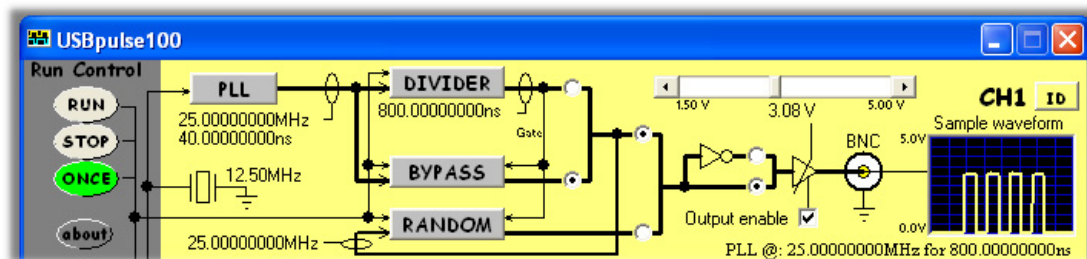
In this example, there will be a burst of **20**[9] PLL clock pulses each time ONCE is pressed.

---

[9] Note that the diagram on the main panel is only an approximation of the output waveform…it does NOT attempt to show the exact wave-shape.

2.5.4 Single Pulse

Again, the ONCE button is used but this time to make a single pulse from the DIVIDER.
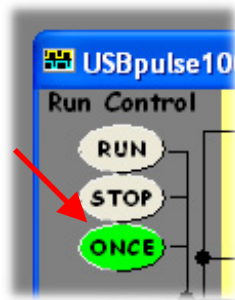
To set the pulse duration, use the DIVIDER settings to configure Ton.

The overall configuration looks like this

In this example, there will be a single 800ns wide pulse each time ONCE is pressed.

2.5.5 Single Random Burst

Again, the ONCE button is used but this time to make a single burst of random bits.
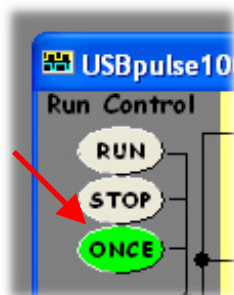
This mode is identical to the Single Clock Burst except that rather than outputting the PLL clock it outputs the RANDOM bit generator for Ton. In this mode, the DIVIDER makes a gating pulse and hence the RANDOM bit generator has to use the PLL as its clocking source (which is enforced by the software).
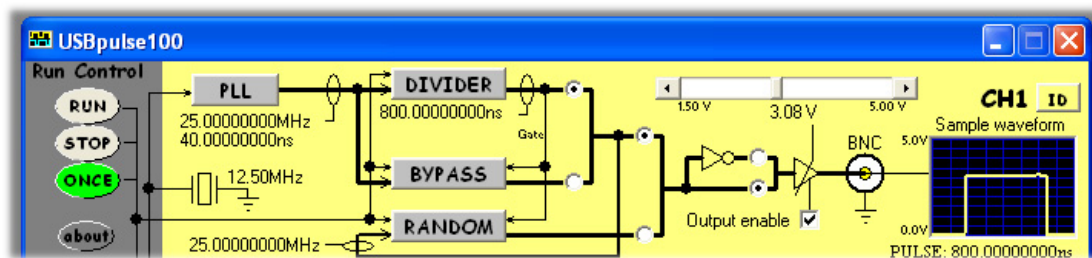
The overall configuration looks like this
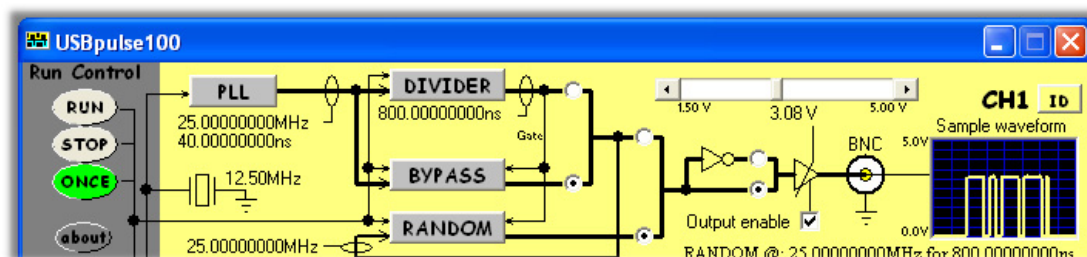
In this example, there will be an 800ns wide burst of random bits each time ONCE is pressed. The random bit generator is clocked by the PLL and behaves as described in 2.5.2 for the 800ns duration. Note that the gating function means that at the end of the 800ns, the output[10] will **always** return to a low regardless of the final random bit generated.

---

[10] The "output" in this context means the signal driving the programmable inverter.

3   SOFTWARE INSTALLATION

3.1 Windows 98SE and Windows Me

Before plugging in the hardware:

Use the supplied install CD and run the setup program. This will copy all the required files and drivers to your PC.

After running the setup program:

Insert the USBpulse100 into a free USB socket, or into a USB hub port. A USB extension cable can be used if needed.

During installation, **three** new hardware devices are detected: The "*USBpulse100 Composite Device*" first, followed (twice) by the "*USBpulse100 Controller*" itself. **The installation is automatic and requires no user input.** After the drivers have started, you will not get any indication that everything went OK except by checking the device manager. After installation the device manager will look like this[11]:

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[11] The COM port number will be platform specific, this is just an example

Once the hardware has installed, there is no need to make any settings for the allocated COM port…the software takes care of all this at run time.

Start the USBpulse100 software and you will see the following display[12]:

To find out what the various buttons and knobs do, simply hover over them for a brief explanation.

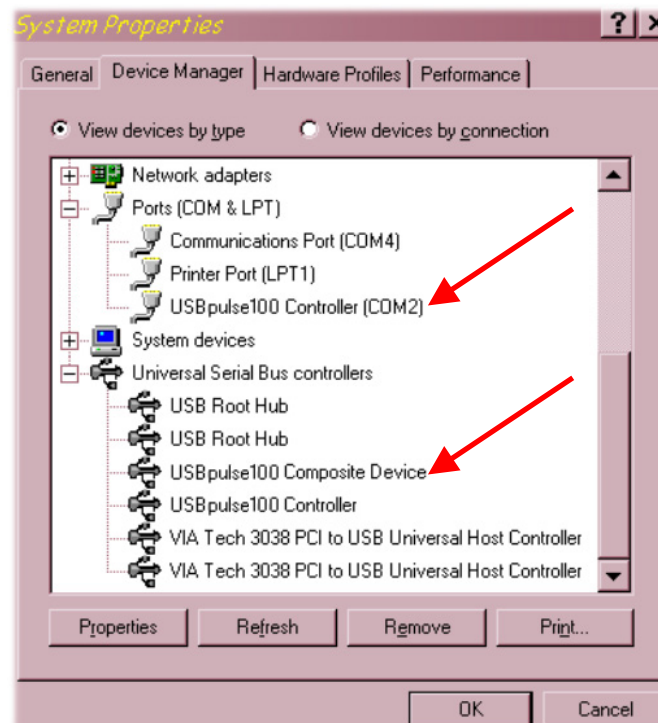[12] A 2 channel example is shown

3.2 Windows 2K and XP[13]

Before plugging in the hardware:

Use the supplied install CD and run the setup program. This will copy all the required files and drivers to your PC.

After running the setup program:

Insert the USBpulse100 into a free USB socket, or into a USB hub port. A USB extension cable can be used if needed.
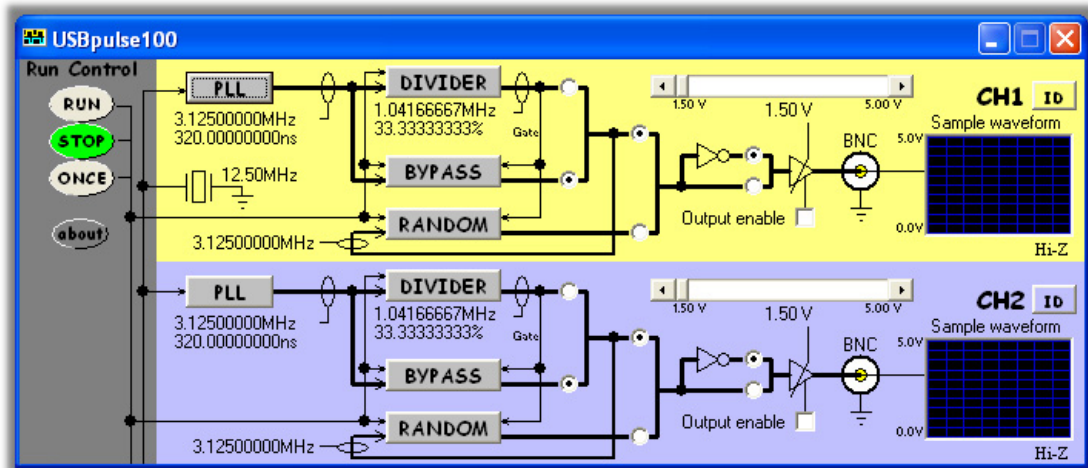
During installation, **two** hardware devices are detected: The "*USBpulse100 Composite Device*" first, followed by the "*USBpulse100*" itself. **It is vital to complete the installation of both devices[14].** After installation the device manager will look like this[15]:

---
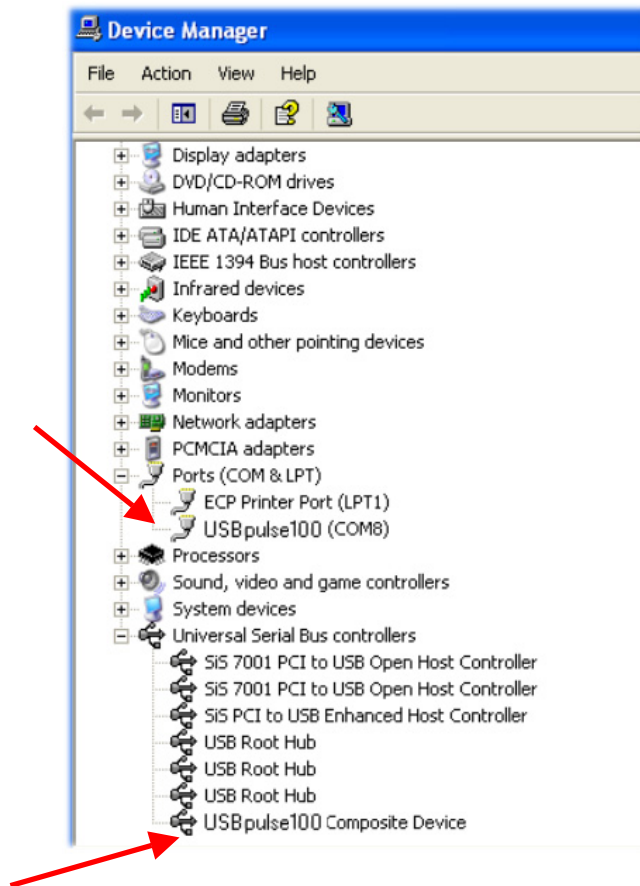
[13] Include Language variants using the DBCS character mappings e.g. Chinese, Japanese, Korean etc
[14] **If Windows prompts to search the Internet for a driver, select "Not this time", and when it warns about Unsigned Drivers you MUST click on "Continue Anyway"**
[15] The COM port number will be platform specific, this is just and example

Once the hardware has installed, there is no need to make any settings for the allocated COM port…the software takes care of all this at run time.

Start the USBpulse100 software and you will see the following display[16]:
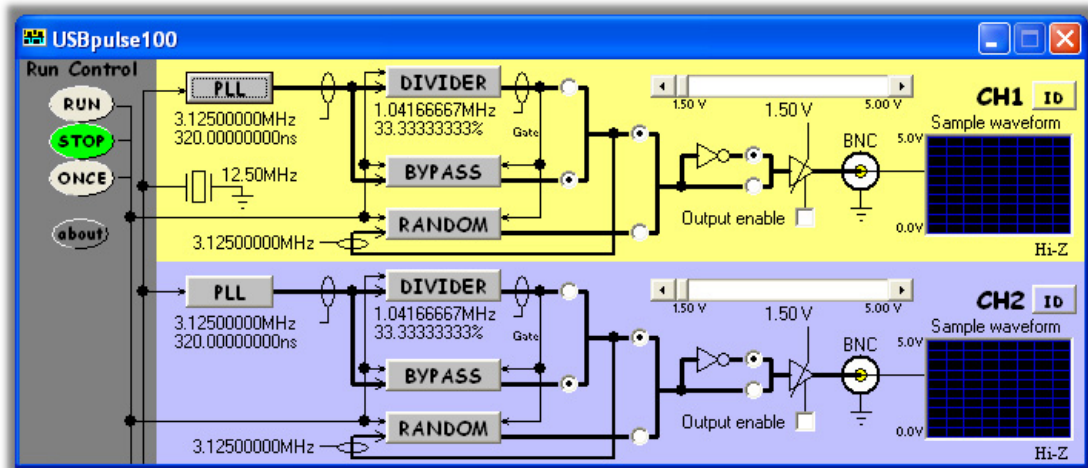
To find out what the various buttons and knobs do, simply hover over them for a brief explanation.

---

[16] A 2 channel example is shown

3.3 Troubleshooting

- Check that the generator hardware installed properly. Use the device manager as shown above and check that there are no yellow exclamation marks on any of the USBpulse100 devices. If there are, try deleting that device, then un-plug and re-plug the generator.
- Make sure that you do not press cancel or stop during any part of the hardware installation. If you did, use the device manager to delete any USBpulse100 devices shown, the re-plug the device and try again
- When you run the software you get a run time error. This could be caused by a much older version of the USBpulse100 software that was installed previously but did not un-install its registry hive settings. To correct this, go to the USBpulse100 install directory and double click the "**remove_settings.reg**" file and click OK when prompted. This will remove the registry hive associated with USBpulse100[17]. Now try running the software again.
- If you are still having problems please use the Windows "PrtScr" button to make a screen capture of the application. Then paste this into a Word or Paint document and send it to tech support.

---

[17] This is where USBpulse100 saves the generator settings.

4 HARDWARE SPECIFICATION

All parameters typical @ 20°C unless otherwise stated

4.1 Power Requirements

Supply Voltage: 5.0V ⎓ ±10% from host USB bus
Total Supply Current: 200mA avg

4.2 Mechanical

Mass: 42g typ.
Case Material Data: Polycarbonate (UL94V rated)
Size (typical in mm):   99.6[18] x 30.6 x 17.5[19]

4.3 Environmental

Humidity: <80% non condensing
General Operating Temperature: -10°C to +45°C Ambient
Storage Temperature: -40°C to +80°C Ambient
Operating Location: Indoor or under-cover use only
Operational Category: Cat II
Pollution Degree: 2

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[18] From BNC end to USB end
[19] Not including "P" clips on base

4.4 Performance

4.4.1 Safety Data and Maximum Ratings

⚠ **Important Safety Precautions**
Always observe these when using the USBpulse100

The USBpulse100 contains no user serviceable parts inside. Do not open the plastic housing.

There may be lethal voltages inside the plastic housing. Do not use the instrument if the housing is damaged or is poorly fitting. In such a case do not connect anything to the USBpulse100 to avoid a hazard. The USBpulse100 will have to be repaired or replaced in such a situation.

Do not exceed the maximum ratings listed below.

Never use the instrument if it becomes damp for any reason. This includes situations were condensation has formed on the unit due to sudden temperature or humidity changes.

Never use test leads that are damaged or have insufficient or incomplete insulation.

Never allow any conductive part of any test lead to contact the host computer ground. Doing so will bypass the safety isolation in the USBpulse100 and could cause a lethal hazard.

Remember that the isolation is between the BNC and the USB connectors. The BNC is, of course, at the same potential as the test lead ground clip to which it is connected. Be careful when measuring hazardous voltages not to touch the BNC connector ground for this reason.

Only use the shorter length stack connector in the bottom generator of the stack, and if using a single generator, don't fit any stack connector at all. This is to avoid touching the contacts

Isolation rating:	300V CAT II, 500V CAT I between BNC ground and USB ground
Transient isolation[20]:	BNC ground to USB ground +/-2.5KV

4.4.2 Performance

Operating modes:	Continuous stream (RUN), halted (STOP) or one-shot (ONCE)
RUN mode:	PLL output direct (50% duty typ), DIVIDER output or RANDOM output
STOP mode:	Output is de-asserted[21]
ONCE mode:	Single pulse from DIVIDER, PLL clock burst gated by DIVIDER or RANDOM burst clocked by PLL and gated by DIVIDER
Output states:	**Hi-Z** (disabled) Zout >> 100MegOhms, **Normal** (enabled and non-inverted) asserted state is high, **Invert** (enabled and inverted) asserted state is low
Output DC resistance:	50ohms typical when enabled
Output rise/fall times:	4ns typical into 10pF at 3V amplitude
Output delay skew:	For 2 or more stacked USBpulse100s running with identical settings[22], 10ns typ[23] between units
Output frequency range:	100MHz max[24], 11.6mHz min
Output amplitude:	1.50V to 5.00V in 256 steps of 13.7mV
Output amplitude accuracy:	±5% of indicated value typical[25]
Output protection:	Short circuit to ground for 1-minute max
Master clock:	12.50MHz, initial accuracy ±0.01%, ageing and drift after 1 year ±0.005%, temp coefficient ±0.005% /oC
Master clock skew:	For 2 or more stacked USBpulse100s, typical 2ns between units
PLL:	VCO type with programmable dividers and delay
PLL clock input:	Master clock
PLL output frequencies:	

3.12500000MHz	17.18750000MHz
4.16666667MHz	17.50000000MHz
6.25000000MHz	18.05555556MHz
6.69642857MHz	18.75000000MHz

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[20] This figure derives from the 300V CAT II isolation rating and defines the peak transient voltage that can be safely tolerated between the BNC ground and the USB ground.

[21] State depends on Invert select and Enable select

[22] All units using a **lock** PLL frequency selection

[23] The majority of this delay comes from the output buffer stage

[24] The quality and amplitude of signals above 50MHz degrades and is not guaranteed to function well at amplitudes below 2.5V

[25] Not including overshoot and undershoot

6.77083333MHz	19.44444444MHz
6.87500000MHz	20.00000000MHz
7.03125000MHz	20.31250000MHz
7.14285714MHz	20.83333333MHz
7.29166667MHz	21.87500000MHz
7.50000000MHz	22.22222222MHz
7.81250000MHz	22.91666667MHz
8.12500000MHz	23.43750000MHz
8.33333333MHz	25.00000000MHz *lock*
8.59375000MHz	26.78571429MHz
8.75000000MHz	27.08333333MHz
8.92857143MHz	27.50000000MHz
9.02777778MHz	28.12500000MHz
9.16666667MHz	28.57142857MHz
9.37500000MHz	29.16666667MHz
9.52380952MHz	30.00000000MHz
9.72222222MHz	31.25000000MHz
10.00000000MHz	32.50000000MHz
10.15625000MHz	33.33333333MHz
10.41666667MHz	34.37500000MHz
10.83333333MHz	35.00000000MHz
10.93750000MHz	37.50000000MHz *lock*
11.11111111MHz	40.00000000MHz
11.45833333MHz	40.62500000MHz
11.66666667MHz	41.66666667MHz
11.71875000MHz	43.75000000MHz
12.50000000MHz *lock*	45.83333333MHz
13.33333333MHz	46.87500000MHz
13.39285714MHz	50.00000000MHz *lock*
13.54166667MHz	54.16666667MHz
13.75000000MHz	56.25000000MHz
13.88888889MHz	58.33333333MHz
14.06250000MHz	62.50000000MHz *lock*
14.28571429MHz	66.66666667MHz
14.58333333MHz	68.75000000MHz
15.00000000MHz	75.00000000MHz *lock*
15.27777778MHz	81.25000000MHz
15.62500000MHz	87.50000000MHz *lock*
16.25000000MHz	93.75000000MHz
16.66666667MHz	100.00000000MHz *lock*

PLL lock: Frequencies shown with **lock** will be in phase lock with other stacked USBpulse100s that also have a **lock** PLL frequency selected

DIVIDER: 28-Bits, configurable for period, pulse start time and pulse end time

DIVIDER clock input: PLL

DIVIDER output range: 33.3333MHz down to 11.6mHz

RANDOM: 128-bit LFSR ($> 3.40 \times 10^{38}$ states) pseudo random generator

RANDOM clock input: PLL or DIVIDER

4.4.3 Miscelaneous

USB transfer rate: USB 1.1[26] Full Speed 12MBits/sec

USB device ID: 10C4 F003

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[26] Works in USB 1.1 or USB 2.0 hosts using the 12MBits/sec full speed mode

4.4.4 Software

USBpulse100 support:	Win98SE/Me/2000/XP
Recommended system:	Pentium Class 600MHz or better, 16-Bit colour depth graphics or better with graphics acceleration, 800x600 min screen resolution, 256MBytes RAM
USBpulse100 registry hive:	

HKEY_CURRENT_USER\Software\VB and VBA Program Settings\USBpulse100
(this key is deleted during un-install)