

Application Note How to use the TOMBAK as a Pulse-Picker

Multiboard Series

TOMBAK : Synchronization electronic board



Pulse-IN						\square
Pulse-OUT	Adjustable Delay	Adj. Nidth >	K	»«»	<>	()





How to use the TOMBAK as a Pulse Picker

<u>Pre-requirement:</u> Before using the TOMBAK board, make sure you followed all the instructions mentioned in the Operating Manual

1. Introduction / Overview

When someone wants to generate a pulse (open a time domain door) at a low repetition rate (for example Hz/kHz range) which must be synchronized with a high frequency signal/clock (for example 100MHz range), There is two solutions :

- 1. The most immediate is to divide the clock signal frequency. Using the Tombak for that is described in the first part of this document. **See page 3**
- 2. When the low frequency pulse/door must also be synchronized with a low frequency external or internal signal (in other word, when we want a low repetition rate pulse at a repetition rate of a low repetition rate trigger BUT synchronized with a high frequency clock), the solution is to use the PICK mode of the Tombak. Note that in this last case, if the low frequency trigger is not synchronized with the high frequency clock, there will be a unavoidable Jitter which value is 1/clock frequency. **See page 8**

In both case above, the TOMBAK opens a door with adjustable delays and adjustable width.

Another using case is relevant when multiple pulses (Burst) are isolated (pulse picked) and one wants to adjust the power intensity of every pulse independently :

3. When used as an AWG, TOMBAK can generate special pulse waveforms with up to 4000 steps of down to 5 nanosecond. TOMBAK, can also be used to generate Burst pulses with non-repetitive frequency and/or with adjustable amplitude. The Shape-OUT SMA connector can be connected to the analog input of a dedicated external modulation instrument like an AOM (acousto-optic modulator), an EOM (electro-optic modulator), a SOA, a scanning system or a laser...It is thus possible to create some Burst with nearly any shape and number of pulses up to 4000 pulses per Burst. This is particularly interesting within a mode locked laser with MOPA configuration when someone wants to generate some burst from the oscillator part. Generating special exponential Burst shape can precompensate the deformation of the burst through the amplifiers and help maintaining a nice shape at the output of the MOPA laser. See page 13

Mode 1 : Pulse Picking using the Divider mode

1 Timing Diagram



Figure 1 : Frequency divided, delayed and pulse width adjusted signal from input to output



Figure 2 : Main firmware features used in frequency divider mode

3. Cabling

- 1. Plug the USB-Jack cable in the "USB In" connector
- 2. Plug the signal generator (i.e. the signal you want to delay) in the "*Pulse In*" SMA connector
- 3. The software adjustable delay and pulse width signal will output on the "*Pulse Out*" SMA connector
- 4. Finally, plug the power supply to the "*Power In*" connector to power on the board



4. Software configuration

Launch the ALPhANOV Control Software and click on *Connect* to start the TOMBAK hardware detection. The software automatically detects the TOMBAK board.



A window will appear for each TOMBAK connected to the computer.

The main configuration windows must be configured as follow :

PP 17E01 - Line 1 - Alphanov Control Software
Marcana Inte
Board Shaper Inverse
High Pick Gen Sync
Advanced Mode
Input Pulse
2,00 V
Threshold Pulse Freq.
Division Source
Ouput Pulse
1,000 µs 😨 100,00 ns 😨 0,00 ns 💿
Width Delay Auto Fine Delay
Width Delay Auto Fine Delay Synchro Input
Width Delay Auto Fine Delay Synchro Input Int Eate Burst Soft
Width Delay Auto Fine Delay Synchro Input Int Ease Int Ease Burst Source Mode
Width Delay Auto Fine Delay Synchro Input Int Ease Burst Soft Source Mode 100,000 kHz 1 Treater Frequency Burst Size Treater
Width Delay Auto Fine Delay Synchro Input None Gate Burst Int Example Mode Source Mode 100,000 kHz 1 Trease Frequency Burst Size Trease
Width Delay Auto Fine Delay Synchro Input Int Soft Int Ent None Gate Source Mode 100,000 kHz 1 Treater Frequency Burst Size Treater Synchro Output Delay Pulse All DLA NOV
Width Delay Auto Fine Delay Synchro Input Inc Soft Source Mode Inc 100,000 kHz I Inc Frequency Burst Size Inc Synchro Output Sync Trig Source Delay Pulse Auto Fine Delay Source

- Working Mode window :
 - Set the Board On
 - Set the Shaper button to Off
 - Set the **Inverse** button to **Off** unless you need to invert the output signal
 - Unset all Advanced Mode

Working Mode					
On	Off	On	Off	On	Off
Board		Shaper		Inverse	
High	Pick	Gen	Sync		
Advanced I	Mode				

- Input pulse window :
 - Configure the Threshold voltage so that the input pulse frequency is detected and equal to your pulse generator system
 - Set the **Division** factor **according to your application**
 - Set the input pulse **Source** to **Direct**



- Output Pulse window :
 - Choose the output **delay** value
 - Choose the output **pulse width**
 - Auto Fine Delay may be let in auto mode
- Synchro input windows :
 - Source : not used in this mode
 - Mode : None
 - Frequency : not used in this mode
 - Burst size : not used in this mode





Settings):

Synchro ouput window (default settings) :
 Source : Pulse

Don't forget to save the settings by clicking on the "Save" button in the bar menu.



5. Main features

Frequency divider factor	[1 - 10^9]
 Adjustable pulse width resolution (for pulse width [5ns - 510ns]) resolution (for pulse width [511ns - 2⁶²ns]) 	[5ns – >>1000s] 2ns 5ns
Adjustable pulse delay resolution 	[70ns – >>1000s] 10ps
 Jitter for delay < 570ns & pulse width < 510ns for any other delay & pulse width 	<200 ps RMS 1.5 ns RMS
Input PulseIn voltage	30 mV – 3,3V
Input maximum frequency	200 MHz
Output Voltage	1 / 3,3 / 5 Volts (hardware setup)
Output maximum frequency	20 MHz

Mode 2 : Pulse Picking using the Pick mode

1. Timing Diagram



Figure 3 : External or internal signal synchronized with Pulse-In signal.



Figure 4 : Main firmware features used in synchronization mode

3. Cabling

- 5. Plug the USB-Jack cable in the "USB In" connector
- 6. Plug the signal to synchronize in the "Sync Ext in" SMA connector. (only for external signal synchronization). If signal to synchronize is internally generated, no signal needed on "Sync Ext in".

- 7. Plug the reference signal (i.e. the signal on which "Sync Ext In" signal or "internal signal" will be synchronized with) in the "*Pulse In*" SMA connector
- 8. The synchronized signal will output on the "Pulse Out" SMA connector
- 9. Finally, plug the power supply to the "*Power In*" connector to power on the board



4. Software configuration

Launch the ALPhANOV Control Software and click on *Connect* to start the TOMBAK hardware detection. The software automatically detects the TOMBAK board.



A window will appear for each TOMBAK connected to the computer.

The main configuration windows must be configured as follow :

PP 17E01 - Line 1 - Alphan	ov Control Sof	itware		
File Config Info				
Working Mode				
On Off	On	Off	On	Off
Board	Shaper		Inverse	
High Pick	Gen	Sync		
Advanced Mode				
Input Pulse				
2,00 V	÷		100,0 kHz	
Threshold		Pulse Freq		
1	 ▼	Direc	t	Daisy
Division		Source		
Ouput Pulse				
1.000 us	100.00	ns 🗎	0,00	ns 🚔
Ouput Pulse 1,000 µs € Width	100,00 Delay) ns 🔺	0,00 Auto Fine	ns 崇 Delay 🗖
Ouput Pulse	100,00 Delay) ns 🔺	0,00 Auto Fine	ns 💽 Delay 🔲
Ouput Puise 1,000 µs → Width Synchro Input	100,00 Delay	ns 🛓	0,00 Auto Fine	ns 💽 Delay 📄
Synchro Input	100,00 Delay None	ns 👤	0,00 Auto Fine Burst	ns 🔄 Delay 📄
Synchro Input	100,00 Delay None Mode	ns 💌	0,00 Auto Fine Burst	ns 🔄 Delay 📄
Ouput Puise 1,000 µs → Width Synchro Input Int Ext Source 10,000 kHz ÷ Frequency	100,00 Delay None Mode 1 Burst Size	ns v	0,00 Auto Fine Burst	ns 🔄 Delay 💿
Ouput Puise 1,000 µs → Width Synchro Input Int Ext Source 10,000 kHz ÷ Frequency	100,00 Delay None Mode 1 Burst Size	ons 🔍 Gate	0,00 Auto Fine Burst	ns 🔄 Delay 📄
Synchro Input	100,00 Delay None Mode 1 Burst Size	o ns 🔍	0,00 Auto Fine Burst	ns 定 Delay 📄
Synchro Output	100,00 Delay None Mode 1 Burst Size	e ns 🔍 Gate	0,00 Auto Fine Burst	ns 🔄 Delay 📄
Ouput Puise 1,000 µs Width Synchro Input Int Ext Source 10,000 kHz Frequency Synchro Output Source Source	100,00 Delay None Mode 1 Burst Size	e ns 🔍	0,00 Auto Fine Burst Trig	ns 💽 Delay 📄 Soft

- Working Mode window :
 Set the **Board** On

 - Set the Shaper button to Off
 - Set the **Inverse** button to **Off** unless you need to invert the output signal
 - Set Advanced Mode to Pick

Working Mode						
On	Off	On	Off	On	Off	
Board		Shaper		Inverse		
High	Pick	Gen	Sync			
Advanced Mode						

• Input pulse window :

- Configure the Threshold voltage so that the input pulse frequency is detected and the same as your pulse generator system
- Set the **Division** factor to **1**
- Set the input pulse **Source** to **Direct**

Input Pulse						
2,00 V 🚔	100,0 kHz					
Threshold	Pulse Freq.					
1	Direct Daisy					
Division	Source					

- Output Pulse window :
 - Choose the output **delay value**
 - Choose the output **pulse width**
 - Auto Fine Delay may be let in auto mode



- Synchro input windows :
 - Source :
 - Set Int to synchronize an internal generated signal with Pulse-In signal.
 - Set Ext to synchronize an external signal (connected to Ext-In connector) with Pulse-In signal.
 - o Mode : None
 - Frequency :
 - ⇒ If internal source is selected, set the output signal Frequency you need to synchronize.
 - ⇒ If external source is selected, Frequency shows the input Ext-In signal frequency
 - o Burst size : not used in this mode

	Synchro Inpac
Int Ext None Gate Burst Soft	Int Ext None Gate Burst Soft
Source Mode	Source Mode
10,000 kHz 🖈 1 🔄 Trigger	10,000 kHz 1 🔄 Trigger
Frequency Burst Size	Measured Freq. Burst Size

- Synchro ouput window (default settings) :
 - o Source : Pulse



Don't forget to save the settings by clicking on the "Save" button in the bar menu.



5. Main features

 Adjustable pulse width resolution (for pulse width [5ns - 510ns]) resolution (for pulse width [511ns - 2⁶²ns]) 	[5ns – >>1000s] 2ns 5ns
Adjustable pulse delay resolution 	[70ns – >>1000s] 10ps
Input Ext-In Voltage Logic Low Logic High	[0-0.8V] [1.7-3.3V]
Input PulseIn voltage	30 mV – 3,3V
Input maximum frequency	200 MHz
Output Voltage	1 / 3,3 / 5 Volts (hardware setup)
Output maximum frequency	20 MHz

1. Timing diagrams



Figure 5 : Analog (Shape-OUT) and digital (Pulse-Out) outputs with amplitude, delay and pulse width adjusted signals from input



Figure 6 : Main firmware features used in AWG / Burst shaper mode (dashed lines are optional)

3. Cabling

The steps given below in () are optional and link to previous configuration described in § Erreur ! Source du renvoi introuvable. **p.** Erreur ! Signet non défini. (Gate feature), in § Erreur ! Source du renvoi introuvable. **p.** Erreur ! Signet non défini. (Burst generator using the Gate input), and in § Erreur ! Source du renvoi introuvable. **p.** Erreur ! Signet non défini. (Frequency divider).

- 1. Plug the USB-Jack cable in the "USB In" connector
- 2. (Plug your reference signal (clock) in the "Pulse In" SMA connector)
- 3. (Plug your trigger/gate signal in the "Gate In" SMA connector)
- 4. The signal will output on the "Shape Out" SMA connector
- 5. Finally, plug the power supply to the "*Power In*" connector to power on the board



4. Software configuration

Launch the ALPhANOV Control Software and click on *Connect* to start the Tombak hardware detection. The software automatically detects the Tombak board.



<u>A window will appear for each Tombak connected to the computer.</u> The main configuration windows must be configured as follow :

👺 PDG 19E02 - I	ine 1 - Alpha.	nov Control S	oftware			x
File Config In	fo					
Working N	1ode					1
On	Off	On	Off	On	Off	1
Board		Shaper		Inverse		l
High	Pick	Gen	Sync			l
Advanced N	1ode			Centre Technologie	que Optique et Lasers	l
Tanut Dula						1
Input Puis	e				1	l
Threshold	0,000 V	÷	2 Pulse Fred	00,000000 MI	Hz	L
Threshold	-1		Puise Tree			L
Division	8	Ī	Direct	Daisy_Inte	rn Phot.	L
			Cource			J
Synchro I	nput					ł
Int	Ext	None Gate	e Burst	Soft	Trigger	l
Synchro So	urce	Mode				l
100,000	kHz 🗄	SMA	Daisy	1	* *	l
Frequency		Gate Source	3	Burst Size		J
Ouput Pul	se					ì
25 n	s 斗	71,0	0 ns -	0,0	0 ns 🚊	1
Width		Delay		Auto Fir	ne Delay 📘	I
Synchro ()utput	_	_	_	_	í
Bynemo c		L		1		1
Sync	Trig	Delay	Pulse			L

- Working Mode window :
 - o Set the **Board** On
 - Set the **Shaper** button to **On**
 - Set the **Inverse** button to **Off** unless you need to invert the output signal
 - Set Advanced Mode to Nothing (use external clock) or Gen (use 200MHz internal frequency)
- Input pulse window :
 - (Configure the Threshold voltage so that the input pulse frequency is detected and equal to your pulse generator system)
 - Set the **Division** factor **according to your application**

- Set the input pulse **Source** to **Direct**
- Output Pulse window :
 - o Choose the output delay value
 - Choose the output **pulse width**
 - Auto Fine Delay may be let in auto mode or manual if you need to adjust the fine delay from reference signal to each shape point (see Figure 5).
- Configure shape :
 - Open the shaper config window by clicking on the "Shaper Config" in the bar menu



• The following window will appear. Load a .csv file by cliking on Load

0



The .csv file should be like this (example and explanation) : 0 1 4 1 Number of points - 1 2 1000 2 Value in bit for 1st point (from 0 to 4095) 3 3000 3 Value in bit for 2nd point (from 0 to 4095) 4095 4 Value in bit for 3rd point (from 0 to 4095) 4 5 Value in bit for 4th point (from 0 to 4095) 5 500 6 ... 6 0 7 7

Please note that repetitive values of 0 could be used to make non-uniform period between pulses.

The maximum number of points is 4000.

- The **number of points, called steps**, should be automatically detected after uploaded the file
- The step size should be leave to 1 or could be higher if you want to change the point after several reference pulses (for example a step size of 2 will change the level one time for two pulses

Don't forget to save the settings by clicking on the "Save" button in the bar menu.

