

Keysight Technologies

Multi-Instrument Synchronization with the 81180A

Application Note



For applications that require more than 2 channels, a built-in synchronization feature allows for synchronizing two 81180A Arbitrary Waveform Generators to create a fully synchronized 4-channel system.

Connecting the Instruments

Two instruments can be synchronized only when cross-connected with a designated synchronization cable. To connect the cable, turn the power off on both instruments. Locate the rear-panel Master/Slave connector and attach each side of the cable to these connectors. Note that the connectors do not lock into position without screwing in the bolts on each side. Use a flat tip screwdriver to latch the cables into their receptacle housing, making sure the connectors are straight and firmly locked into place. Once the cable is connected, the instruments can be powered on again.

Resetting the Two Instruments

Once the two instruments have been connected using the synchronization cable, the next step is to perform a factory reset. Perform the following steps in both instruments:

1. Press the Utility button
2. Press the Factory Reset soft-key button
3. Use the left key to chose yes
4. Press the Enter button

Selecting Which Channels to Synchronize

When synchronizing two instruments, it is possible to synchronize all 4 channels or only some of the channels. Which channels are synchronized depends on the channel that is active when the synchronization is activated. For example, if the Slave unit CH1 is active and the Master CH1 is active as well, then these two channels will be synchronized. If the couple state on the Slave/Master unit is on, then CH2 will be synchronized as well.

To synchronize all 4 channels, perform the following steps in both instruments:

1. Press the Utility button
2. Press the Clocks soft-key button
3. The Feed field will be highlighted, press the Enter button
4. Using the dial or up cursor key, change the setting from separate to common
5. Press the Enter button

Selecting a Master

After the two instruments have been set to their factory default setting, the next step is to select one instrument as Master and the other as Slave. Perform the following steps:

1. On the designated Slave unit, press the Output button
2. Press the X-Instrument soft-key button
3. Use the dial or the up/down keys to scroll to the Role option
4. Press the Enter button
5. Change the field to "Slave"
6. Press the Enter button
7. Turn on the channel outputs
8. On the designated Master unit, press the Output button
9. Press the X-Instrument soft-key button
10. Use the dial or the up/down keys to scroll to the State option
11. Press Enter, change the field to "ON" and press Enter again
12. Turn on the channel outputs

Operating Synchronized Instruments

When operating two synchronized instruments, there are some important limitations to be familiar with in order to achieve optimal performance.

1. Connecting the synchronization cable is pre-requisite; however, additional steps must be performed to set one unit in Master mode and select the other as Slave.
2. The synchronization must be activated from the Master unit.
3. Sample clock and output frequency must be identical in both units prior to activating the synchronization, and can only be controlled from the Master unit once synchronization has been activated.
4. Both Master and Slave units must be placed in the same run mode to operate synchronously. For example, both units in trigger mode will synchronize; however, one set to continuous and the other to trigger will not synchronize.
5. Both Master and Slave units must be placed in the same waveform mode to operate synchronously. For example, both units in sequence mode will synchronize; however, one set to arbitrary and the other to sequence will not synchronize.
6. In Sequence mode, both Master and Slave units must have a sequence table with the same number of steps.
7. Each instrument can have a unique set of waveforms, active segment, sequence, amplitude, offset parameters and markers.
8. The trigger signal is applied to the Master input and is common to both Master and Slave units.
9. The waveform can be delayed from the Master output by a predefined number of sample clocks or by a set amount of time. Press the Output button and then press the X-Instrument soft-key button. There are two fields: offset and skew. The offset field defines the number of sample clock cycles, or waveform points that the instrument will hold off before it will start generating the output waveform. The resolution is eight waveform cycles and the time is defined as eight clock cycles, which is set on the Master unit. The offset is used for coarse tuning. The skew defines fine offset between the instruments and is set in unit of time. The skew can be varied from -5 to +5 ns at a 10-ps resolution and is used for fine tuning.

Synchronizing Two Instruments Using Remote Programming

The following is an example of how to synchronize 4 channels with two instruments using SCPI commands. The setting of each instrument is as follows:

Master Unit		
Run mode: continuous		
Channel 1 Waveform	standard square waveform, 250 MHz, 50% duty cycle	
Channel 2 Waveform	standard square waveform, 250 MHz points, 25% duty cycle	
Slave Unit		
Run mode: continuous		
Channel 1 Waveform	standard square waveform, 250 MHz, 50% duty cycle	
Channel 2 Waveform	standard square waveform, 250 MHz, 25% duty cycle	
Send to master	*rst	//Resetting both instruments
Send to slave	*rst	
Send to slave	FUNC:SHAP SQU	//setting standard square wave
	FREQ 2.5000e8	//setting frequency to 250 MHz
	OUTP ON	//turning on output of CH1
	INST:SEL 2	//select CH2
	FUNC SHAP SQU	
	SQU:DCYC 25	//setting duty cycle to 25%
	OUTP ON	
	INST:COUP:STAT ON	//turning on channels couple state
	XINS:MODE SLAVE	//selecting instrument as slave
Send to master	FUNC:SHAP SQU	
	FREQ 2.5000e8	
	OUTP ON	
	INST:SEL 2	
	FUNC SHAP SQU	
	SQU:DCYC 25	
	OUTP ON	
	INST:COUP:STAT ON	
	XINS:STAT ON	//activating synchronization
*To adjust the offset between the master and slave waveforms, use the offset command for coarse tuning or the skew command for fine tuning.		
Send to master	XINS:OFFSET 64	//the output of the master unit is //delayed by 64 sample clocks
	XINS:SKEW 1e-9	//the output of the master unit is delayed by //1 ns
*To abort the synchronization		
Send to master	XINS:STAT OFF	
Send to slave	XINS:MODE MASTER	

myKeysight

myKeysight

www.keysight.com/find/mykeysight

A personalized view into the information most relevant to you.



www.lxistandard.org

LAN eXtensions for Instruments puts the power of Ethernet and the Web inside your test systems. Keysight is a founding member of the LXI consortium.



Three-Year Warranty

www.keysight.com/find/ThreeYearWarranty

Keysight's commitment to superior product quality and lower total cost of ownership. The only test and measurement company with three-year warranty standard on all instruments, worldwide.



Keysight Assurance Plans

www.keysight.com/find/AssurancePlans

Up to five years of protection and no budgetary surprises to ensure your instruments are operating to specification so you can rely on accurate measurements.



www.keysight.com/go/quality

Keysight Technologies, Inc.

DEKRA Certified ISO 9001:2008

Quality Management System

Keysight Channel Partners

www.keysight.com/find/channelpartners

Get the best of both worlds: Keysight's measurement expertise and product breadth, combined with channel partner convenience.

www.keysight.com/find/81180

For more information on Keysight Technologies' products, applications or services, please contact your local Keysight office. The complete list is available at: www.keysight.com/find/contactus

Americas

Canada	(877) 894 4414
Brazil	55 11 3351 7010
Mexico	001 800 254 2440
United States	(800) 829 4444

Asia Pacific

Australia	1 800 629 485
China	800 810 0189
Hong Kong	800 938 693
India	1 800 112 929
Japan	0120 (421) 345
Korea	080 769 0800
Malaysia	1 800 888 848
Singapore	1 800 375 8100
Taiwan	0800 047 866
Other AP Countries	(65) 6375 8100

Europe & Middle East

Austria	0800 001122
Belgium	0800 58580
Finland	0800 523252
France	0805 980333
Germany	0800 6270999
Ireland	1800 832700
Israel	1 809 343051
Italy	800 599100
Luxembourg	+32 800 58580
Netherlands	0800 0233200
Russia	8800 5009286
Spain	800 000154
Sweden	0200 882255
Switzerland	0800 805353
	Opt. 1 (DE)
	Opt. 2 (FR)
	Opt. 3 (IT)
United Kingdom	0800 0260637

For other unlisted countries:
www.keysight.com/find/contactus
 (BP-09-23-14)