

Running B&K Developed Simple Recorder MATLAB Application

- Place the app file (HBKLANXIDAQ.mlapp) and all function files (.m extension) in the same directory
- Create the following sub-directories (names must match these exactly, including case, for code to work)
 - Generator Input Files
 - Generator Setup Table Files
 - Input Channel Setup Table Files
 - Measurement Files
- In MATLAB navigate to the directory that contains the app file
- In the command window type 'HBKLANXIDAQ' and then hit enter
- In the Module IP Setup tab:
 - Type in a numeric value for Number of Modules
 - Select Switch or Frame for Hardware if Number of Modules > 1
 - Enter IP addresses for each module in the setup, noting that the app forces the command module to be Module Number 1 the same as a B&K Frame would
 - Click Connect, all selections will be grayed out while the connection sequence executes

Brüel & Kjær LAN-XI Open API Time Data Recorder

Module IP Setup | DAQ Setup | Generator Setup

Number of Modules: 2

Hardware: Frame

Connect

Module Number	Type	IP Address
1	Command	169.254.120.64
2	Service	169.254.101.226

- In the DAQ Setup tab:
 - Select a Frequency Range from the drop-down menu
 - Edit the properties of each channel as needed or load a previously saved input channel setup by clicking 'Load Input Channel Setup Table'
 - Save input channel setup by clicking 'Save Input Channel Setup Table'
 - Run TEDS detect as required
 - TEDS detect occurs automatically during connection sequence and it is only necessary to rerun it if you change, add, or remove transducers after the connection sequence

- Note that running TEDS detect will over-write manually entered data for TEDS transducers

Module Number	Channel Number	Enabled	Range	Filter	Floating	Name	CCLD	Transducer Model	Transducer Serial Number	Sensitivity	Units
1	1	Yes	10 Vpeak	7.0 Hz	No	Sine Wave Receiver	No	None		1.0000	V/V
1	2	Yes	10 Vpeak	7.0 Hz	No	Square Wave Receiver	No	None		1.0000	V/V
1	3	Yes	10 Vpeak	7.0 Hz	No	Microphone	Yes	-4966-H-041	3143673	0.0476	V/Pa
1	4	Yes	10 Vpeak	7.0 Hz	No	Accelerometer	Yes	-4533-B-	32097	0.0010	V/m/s ²
2	1	Yes	10 Vpeak	7.0 Hz	No	Sine Wave Receiver PTP Sync	No	None		1.0000	V/V
2	2	No	10 Vpeak	7.0 Hz	No	Module 2 Channel 2	No	None		1.0000	V/V
2	3	No	10 Vpeak	7.0 Hz	No	Module 2 Channel 3	No	None		1.0000	V/V
2	4	No	10 Vpeak	7.0 Hz	No	Module 2 Channel 4	No	None		1.0000	V/V
2	5	No	10 Vpeak	7.0 Hz	No	Module 2 Channel 5	No	None		1.0000	V/V
2	6	No	10 Vpeak	7.0 Hz	No	Module 2 Channel 6	No	None		1.0000	V/V

- In the Generator Setup tab:
 - Edit the properties of each generator channel as needed or load a previously saved generator channel setup by clicking 'Load Generator Setup Table'
 - In the 'Specify File Path for Inputs' field
 - Enter the full file path to the generator waveform .mat file, e.g. 'C:\Users\mhoutteman\LAN-XI Open API\LANXITimeDataRecorderPTPandSignalGenerator\Generator Input Files\SineWave100Hz.mat'
 - Alternatively, click on 'Load Generator Input Files' and select a folder that contains generator waveform .mat files to create a drop-down menu of file options in the 'Specify File Path for Inputs' field
 - Save generator channel setup by clicking 'Save Generator Setup Table'

Module Number	Output Number	Floating	Gain	Specify File Path for Inputs	Mix Function	Offset
1	1	No	1.0000	C:\Users\mhoutteman\LAN-XI Open API\LANXITime...	Summation	0
1	2	No	0.5000	C:\Users\mhoutteman\LAN-XI Open API\LANXITime...	Summation	0

- When setup is complete return to DAQ Setup tab and click ‘Arm DAQ’
- Click ‘Save Directory’ to choose a folder to save measurement files in
- Enter a recording name
 - No extension, the app will save in .mat format automatically
 - All MATLAB standard file naming rules apply, e.g. no spaces in filename
- Click ‘Start DAQ’ when ready

Frequency Range: 51.2 kHz [Detect TEDS]

Load Input Channel Setup Table

Save Input Channel Setup Table

Disarm DAQ

Save Directory: C:\Users\inhouteman\LAN-XI Open API\LANXI\TimeDataRecorder\PTPandSignalGenerator\Measurement Files

Recording Name: DemoRecording

Start DAQ

Module Number	Channel Number	Enabled	Range	Filter	Floating	Name	CCLD	Transducer Model	Transducer Serial Number	Sensitivity	Units
1	1	Yes	10 Vpeak	7.0 Hz	No	Sine Wave Receiver	No	None		1.0000	V/V
1	2	Yes	10 Vpeak	7.0 Hz	No	Square Wave Receiver	No	None		1.0000	V/V
1	3	Yes	10 Vpeak	7.0 Hz	No	Microphone	Yes	-4966-H-041	3143673	0.0476	V/Pa
1	4	Yes	10 Vpeak	7.0 Hz	No	Accelerometer	Yes	-4533-B-	32097	0.0010	V/m/s ²
2	1	Yes	10 Vpeak	7.0 Hz	No	Sine Wave Receiver PTP Sync	No	None		1.0000	V/V
2	2	No	10 Vpeak	7.0 Hz	No	Module 2 Channel 2	No	None		1.0000	V/V
2	3	No	10 Vpeak	7.0 Hz	No	Module 2 Channel 3	No	None		1.0000	V/V
2	4	No	10 Vpeak	7.0 Hz	No	Module 2 Channel 4	No	None		1.0000	V/V
2	5	No	10 Vpeak	7.0 Hz	No	Module 2 Channel 5	No	None		1.0000	V/V
2	6	No	10 Vpeak	7.0 Hz	No	Module 2 Channel 6	No	None		1.0000	V/V

- Click Stop DAQ when you wish to end data collection

Frequency Range: 51.2 kHz [Detect TEDS]

Load Input Channel Setup Table

Save Input Channel Setup Table

Disarm DAQ

Save Directory: C:\Users\inhouteman\LAN-XI Open API\LANXI\TimeDataRecorder\PTPandSignalGenerator\Measurement Files

Recording Name: DemoRecording

Stop DAQ

Module Number	Channel Number	Enabled	Range	Filter	Floating	Name	CCLD	Transducer Model	Transducer Serial Number	Sensitivity	Units
1	1	Yes	10 Vpeak	7.0 Hz	No	Sine Wave Receiver	No	None		1.0000	V/V
1	2	Yes	10 Vpeak	7.0 Hz	No	Square Wave Receiver	No	None		1.0000	V/V
1	3	Yes	10 Vpeak	7.0 Hz	No	Microphone	Yes	-4966-H-041	3143673	0.0476	V/Pa
1	4	Yes	10 Vpeak	7.0 Hz	No	Accelerometer	Yes	-4533-B-	32097	0.0010	V/m/s ²
2	1	Yes	10 Vpeak	7.0 Hz	No	Sine Wave Receiver PTP Sync	No	None		1.0000	V/V
2	2	No	10 Vpeak	7.0 Hz	No	Module 2 Channel 2	No	None		1.0000	V/V
2	3	No	10 Vpeak	7.0 Hz	No	Module 2 Channel 3	No	None		1.0000	V/V
2	4	No	10 Vpeak	7.0 Hz	No	Module 2 Channel 4	No	None		1.0000	V/V
2	5	No	10 Vpeak	7.0 Hz	No	Module 2 Channel 5	No	None		1.0000	V/V
2	6	No	10 Vpeak	7.0 Hz	No	Module 2 Channel 6	No	None		1.0000	V/V

- At this point you are free to make further recordings by specifying new filenames and/or directories
- To disarm the system click the ‘Disarm DAQ’ button. Note that you must disarm the system to change the sample rate and/or modify the input or generator channel properties

- To disconnect the system go to the Module IP Setup tab and click ‘Disconnect’. Note that disconnecting will reboot all modules in the setup.
- Closing the app at any point will result in all modules being rebooted.
- Allow adequate time for module to display an IP address on the green information panel before attempting to reconnect to module
- Formatting Generator Waveform .mat Files
 - In MATLAB create a cell named ‘Inputs1and2’ using the following command:
`>>Inputs1and2 = {};`
 - Within the cell create two 1x1 structs:
 - Inputs1and2{1,1} contains the properties for Input 1 of the mixer
 - Inputs1and2{2,1} contains the properties for Input 2 of the mixer
 - The result of mixing the two structs, or the cell Inputs1and2, is the waveform for the output channel
 - Refer to the LAN-XI Open API User Guide for available waveforms and their associated properties and please note that these properties will be different depending on the type of waveform generated
 - Check the formatting of waveforms using the MATLAB function ‘jsonencode’ to convert the Inputs1and2 cell to a jsonstring: `>>jsonencode(Inputs1and2)`
 - Several simple waveforms are included with the code as examples

REST Command Chronology

Connecting Sequence (Idle → Connected)

1. Read module information using GET command - `/rest/rec/module/info`
2. Set module time using PUT command - `/rest/rec/module/time`
 - a. Send to command module first then service modules
3. Set synchronization mode using PUT command - `/rest/rec/syncmode`
 - a. Send to command module first then service modules
4. Wait for ptpStatus of “Locked” using GET command - `/rest/rec/onchange`
5. Open recorder application using PUT command - `/rest/rec/open`
 - a. Send to service modules first then command module
 - b. Wait for moduleState to be “RecorderOpened” using GET command - `/rest/rec/onchange`
6. Prepare signal generators using PUT command - `/rest/rec/generator/prepare`
 - a. Send to service modules first then command module
7. Get default set-up for all input channels using GET command - `/rest/rec/channels/input/default`
8. Get default set-up for all signal generators using GET command - `/rest/rec/generator/output`

TEDS Detection (module must be in ‘Connected’ state)

1. Run TEDS detection using POST command - `/rest/rec/channels/input/all/transducers/detect`
 - a. Send to service modules first then command module
 - b. Wait for transducerDetectionActive to be “false” using GET command - `/rest/rec/onchange`
2. Obtain transducer information using GET command - `/rest/rec/channels/input/all/transducers`
 - a. Send to service modules first then command module

Arming Sequence (Connected → Armed)

1. Configure generator using PUT command - /rest/rec/generator/output
 - a. Send to service modules first then command module
2. Start generator using PUT command - /rest/rec/generator/start
 - a. Send to service modules first then command module
3. Synchronize generators using PUT command (this step required only for multi-module systems) - /rest/rec/apply
 - a. Send only to command module
4. Create new configuration using PUT command - rest/rec/create
 - a. Send to service modules first then command module
 - b. Wait for moduleState to be “RecorderConfiguring” using GET command - /rest/rec/onchange
 - c. Apply desired input channel configuration to module using PUT command - rest/rec/channels/input
 - d. Wait for inputStatus to be “Settled” using GET command (this step required only for multi-module systems) - /rest/rec/onchange
5. Synchronize modules using PUT command (this step required only for multi-module systems) - /rest/rec/synchronize
 - a. Send to service modules first then command module
 - b. Wait for inputStatus to be “Synchronized” using GET command - /rest/rec/onchange
6. Start internal streaming (multi-module systems only) using PUT command – rest/rec/startstreaming
 - a. Send to service modules first then command module
7. Get streaming socket using GET command - /rest/rec/destination/socket

Measuring (Armed → Recording)

1. Start streaming using POST command - /rest/rec/measurements
 - a. Send to service modules first then command module
 - b. Wait for moduleState to be “RecorderRecording” using GET command - /rest/rec/onchange
2. Subscribe to binary data stream then run while loop and decode messages until data collection is finished → LAN-XI TCP/IP streaming sequence is as follows
 - a. Message format is header then payload
 - b. Header contains
 - i. Message type
 - ii. Time
 - iii. Length of message content
 - iv. Message data
 - c. Depending on the value received for message type in the header the message is either an interpretation message or a signal data message
 - i. Interpretation messages contain a scale factor to apply to signal data, each channel has its own separate interpretation message
 - ii. Signal data messages contain signal data that needs to be scaled
 - d. Example chronology of messages received for DAQ using three channels
 - i. Interpretation message Channel 1
 - ii. Interpretation message Channel 2
 - iii. Interpretation message Channel 3

- iv. Signal data message Channel 1
- v. Signal data message Channel 2
- vi. Signal data message Channel 3
- vii. Signal data message Channel 1
- viii. Signal data message Channel 2
- ix. Signal data message Channel 3
- x. and so on...

Stop Measuring (Recording → Armed)

1. Stop streaming using PUT command - /rest/rec/measurements/stop
 - a. Wait for moduleState to be “RecorderStreaming” using GET command - /rest/rec/onchange

Disarming Sequence (Armed → Connected)

1. Stop generator using PUT command - rest/rec/generator/stop
2. End current recording session using PUT command - rest/rec/finish
 - a. Wait for moduleState to be “RecorderOpened” using GET command - /rest/rec/onchange

Disconnecting Sequence (Connected → Idle)

1. Close recorder application using PUT command - /rest/rec/close
 - a. Send to service modules first then command module
 - b. Wait for moduleState to be “Idle” using GET command - /rest/rec/onchange
2. Set synchronization mode back to defaults using PUT command - /rest/rec/syncmode
 - a. Send to service modules first then command module

Rebooting

1. Reboot module using PUT command - rest/rec/reboot
 - a. Send to service modules first then command module