

Advanced power analysis

SETUP IN SECONDS AND CAPTURE FOR HOURS



POWER ANALYSIS HAS NEVER BEEN EASIER

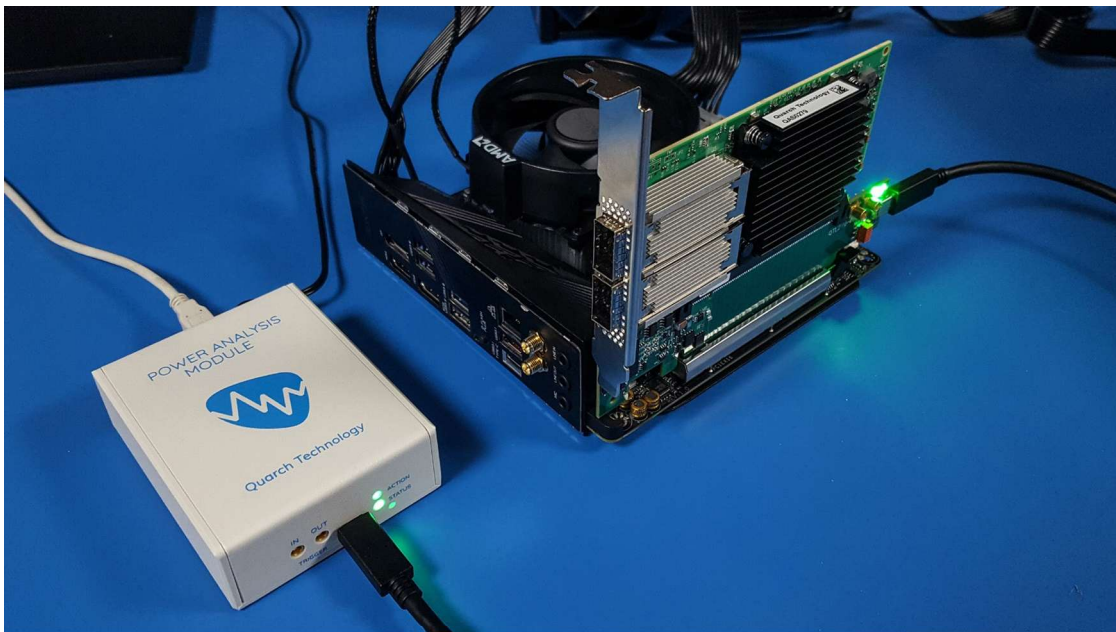
POWER ANALYSIS MODULE (PAM)



USB 2.0 AND 100Mb ETHERNET CONNECTIVITY, 12V EXTERNAL PSU, 3.3V MCX TRIGGER IN AND TRIGGER OUT, FULLY ISOLATED FROM FIXTURE

DC power analysis

DC applications require a power analysis module and a power analysis fixture



Capture analog and digital signals over long time periods

GEN5 SFF PAM FIXTURE (SAS/SATA/U.2/U.3)



SFF PAM: ANALOG CHANNELS: 12V, 5V, 3.3VAUX, SAMPLE RATE 250KS/S, VOLTAGE: 0 - 15V $\pm(2mV+1\%)$, 12V CURRENT: 100uA-1mA $\pm(25uA+1\%)$ 1mA-13A $\pm(2mA+1\%)$, 5V CURRENT: 100uA-1mA $\pm(25uA+1\%)$ 1mA-13A $\pm(2mA+1\%)$, 3.3VAUX CURRENT: 0-85mA $\pm(25uA+1\%)$ DIGITAL CHANNELS: PERST#, CLKREQ#_PERSTB#, WAKE#, SMBCLK, SMBDAT, ACTIVITY#, PWRDIS, PRSNT#, IFDET, IFDET2, HPT0, HPT1, DUAPLORTEN#, P2, SAMPLE RATE 1MS/S

Storage power analysis

GEN5 M.2 M-KEY PAM FIXTURE



M.2 PAM: ANALOG CHANNELS: 3.3V, VIO_1V8, SAMPLE RATE 250KS/S, VOLTAGE: 0 - 15V $\pm(2mV+1\%)$, CURRENT: 0-1mA $\pm(15uA+1\%)$ 1mA-13A $\pm(2mA+1\%)$ DIGITAL CHANNELS: CLKREQ#, PERST#, PEWAKE#, SUSCLK, PEDET, ALERT#, SMB_DATA, SMB_CLK, LED_1#, DEVS_LP, MFG_DATA, MFG_CLK, VIO_CFG, PWRDIS, PLA_S3#, PLN# SAMPLE RATE 1MS/S

GEN5 EDSFF PAM FIXTURE (E1.S/E1.L/E3/E3 2T)

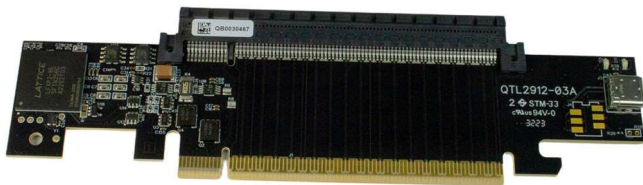


EDSFF PAM: ANALOG CHANNELS: 12V, 3.3VAUX, SAMPLE RATE 250KS/S, VOLTAGE: 0 – 15V $\pm(2mV+1\%)$, 12V CURRENT: 100uA-1mA $\pm(25uA+1\%)$ 1mA-13A $\pm(2mA+1\%)$, 3.3VAUX CURRENT: 100uA-85mA $\pm(25uA+1\%)$ DIGITAL CHANNELS: PRSNT0#, PERST1#_CLKREQ#, LED, SMBRST#, SMBDAT, SMBCLK, PWRDIS, PERST0#, DUALPORTEN#, RFU, MFG, SAMPLE RATE 1MS/S

Storage and beyond

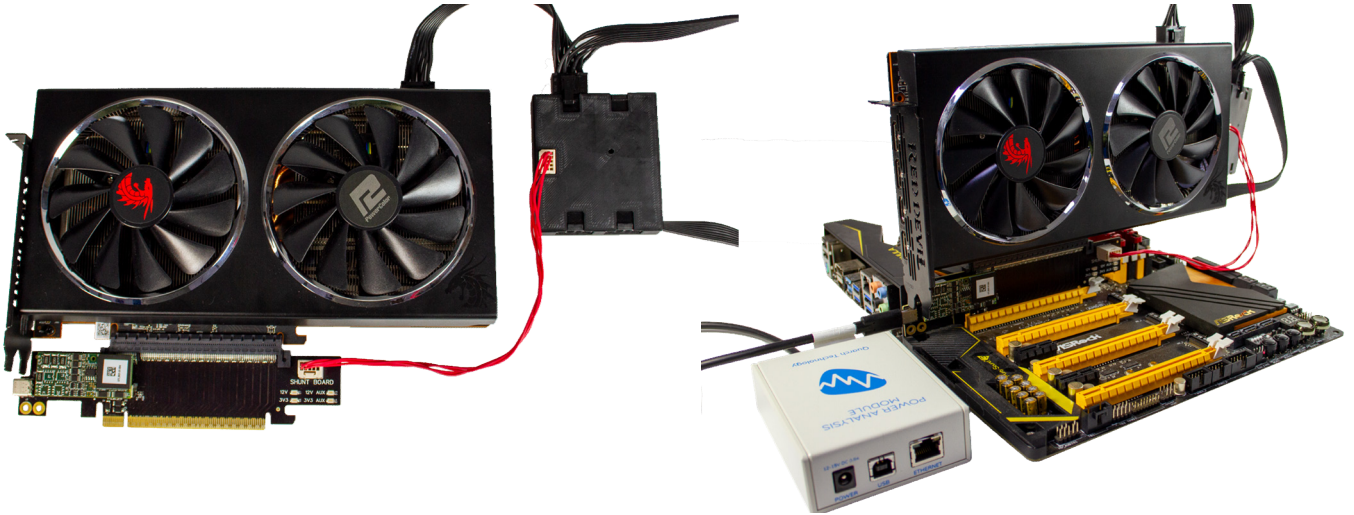
GEN5 AIC/SLOT X16 PAM FIXTURE

Supports all slot powered AIC devices: SSDs, NICs, HBAs and more



AIC PAM: ANALOG CHANNELS: 12V, 3.3V, 3.3VAUX, SAMPLE RATE 250KS/S, VOLTAGE: 0 – 15V $\pm(2mV+1\%)$, 12V CURRENT: 100uA-1mA $\pm(10uA+1\%)$ 1mA-13A $\pm(2mA+1\%)$, 3V3 CURRENT: 100uA-1mA $\pm(10uA+1\%)$ 1mA-13A $\pm(2mA+1\%)$, 3.3VAUX CURRENT: 0-400mA $\pm(10uA+1\%)$ DIGITAL CHANNELS: PERST#, CLKREQ#, WAKE#, SMBCLK, SMBDAT, SAMPLE RATE 1MS/S

GEN5 AIC/SLOT X16 PAM FIXTURE +AUX POWER



AIC +AUX PAM: ANALOG CHANNELS: 12V, 3.3V, 3.3VAUX, 12VAUX, SAMPLE RATE 250KS/S, VOLTAGE: 0 – 15V \pm (2mV+1%), 12V CURRENT: 0-32.5A \pm (5mA+1%), 3.3V CURRENT: 0-13A \pm (2mA+1%), 3.3VAUX CURRENT: 0-3.25A \pm (0.5mA+1%), 12VAUX CURRENT: 0-162.5A \pm (25mA+1%)
DIGITAL CHANNELS: PERST#, CLKREQ#, WAKE#, SMBCLK, SMBDAT, REFCLK_LOS#, SAMPLE RATE 1MS/S

GPU and AI Analysis

AUX FIXTURES (DUAL PCIE, TRIPLE PCIE, 12VHP)



Calibrated fixtures support all major GPU / Accelerator power supplies

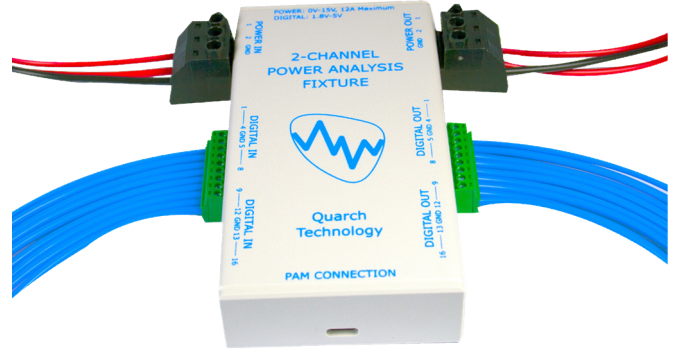
Includes power sequencing

Dual PCIe, Triple PCIe and 12VHP versions





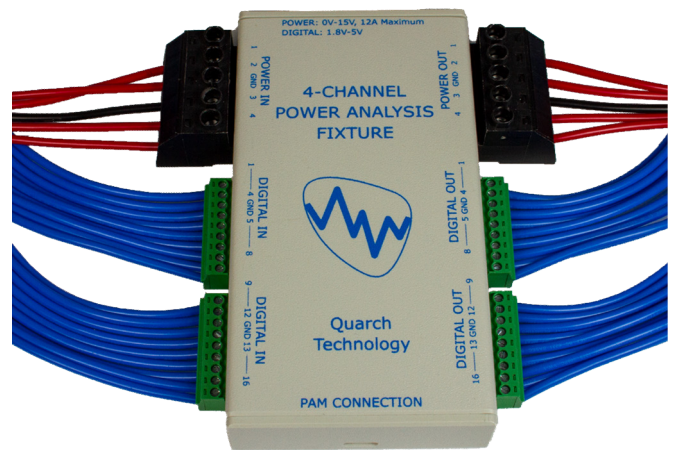
2 CHANNEL PAM



2 CHANNEL: ANALOG CHANNELS: 2 CHANNELS, SAMPLE RATE 250KS/S, VOLTAGE: 0 – 15V $\pm(2mV+1\%)$, CURRENT: 0-1mA $\pm(15uA+1\%)$ 1mA-13A $\pm(2mA+1\%)$ DIGITAL CHANNELS: 16 CHANNELS SAMPLE RATE 1MS/S, VOLTAGE RANGE 1.8-5V

Multi-channel fixtures

4 CHANNEL PAM

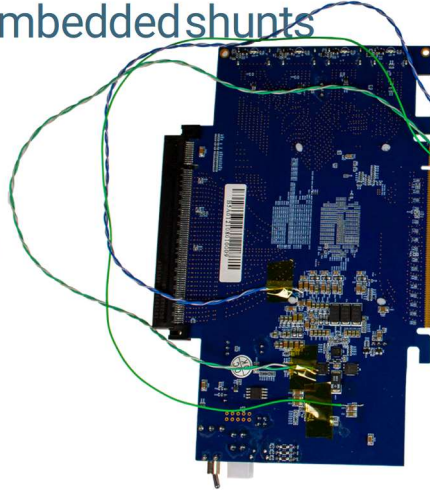


4 CHANNEL: ANALOG CHANNELS: 4 CHANNELS, SAMPLE RATE 250KS/S, VOLTAGE: 0 – 15V $\pm(2mV+1\%)$, CURRENT: 10mA-13A $\pm(10mA+1\%)$ DIGITAL CHANNELS: 16 CHANNELS SAMPLE RATE 1MS/S, VOLTAGE RANGE 1.8-5V



EXTERNAL SHUNT PAM

Connects into a wide range of embedded shunts



EXTERNAL SHUNT: 4 CHANNELS, SAMPLE RATE 250KS/S, VOLTAGE: 0 – 15V $\pm(2mV+1\%)$, CURRENT SENSE: 10uV-65mV $\pm(10uV+1\%)$ DIGITAL CHANNELS: 16 CHANNELS SAMPLE RATE 1MS/S, VOLTAGE RANGE 1.8-5V

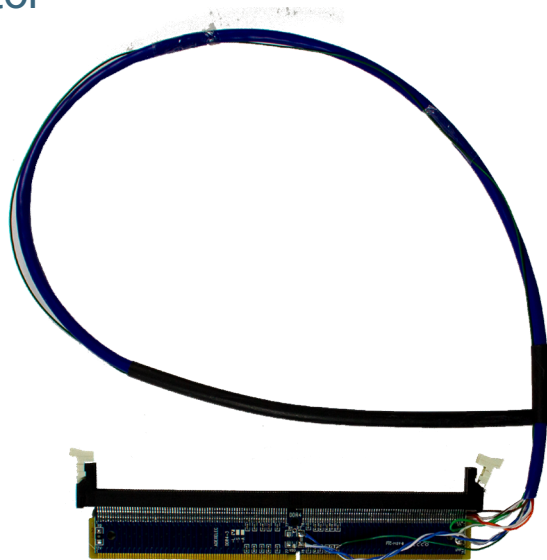
Multi-channel fixtures

EXTERNAL SHUNT PAM WITH DIMM FIXTURE

Connected to DIMM adaptor board

Allowing analysis of RAM power consumption

Supports 50mV current sense resistors





SINGLE PHASE AC PAM (IEC C14 CONNECTORS)

AC analysis devices do not require a PAM module

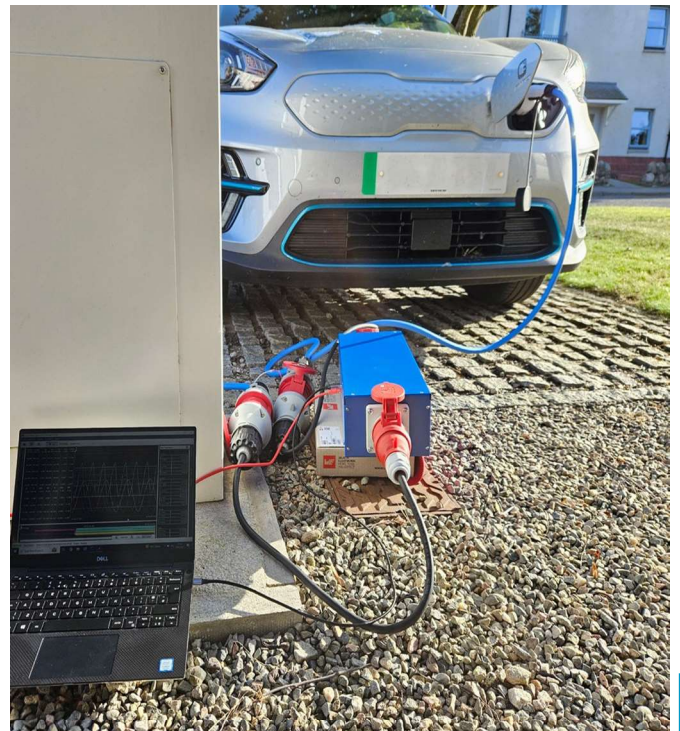


IEC PAM: SINGLE IEC 60320 C14 10A FUSED INPUT, 3 INDIVIDUALLY MEASURED IEC 60320 C13 OUTPUTS, SAMPLE RATE 8KS/S, VOLTAGE: $\pm 495.5V$ PEAK 50VAC-270VAC $\pm 0.5\%$, CURRENT: 100mA-44A $\pm (10mA + 0.5\%)$

AC Power Analysis

3-PHASE AC PAM (16A, 32A AND 63A VERSIONS)

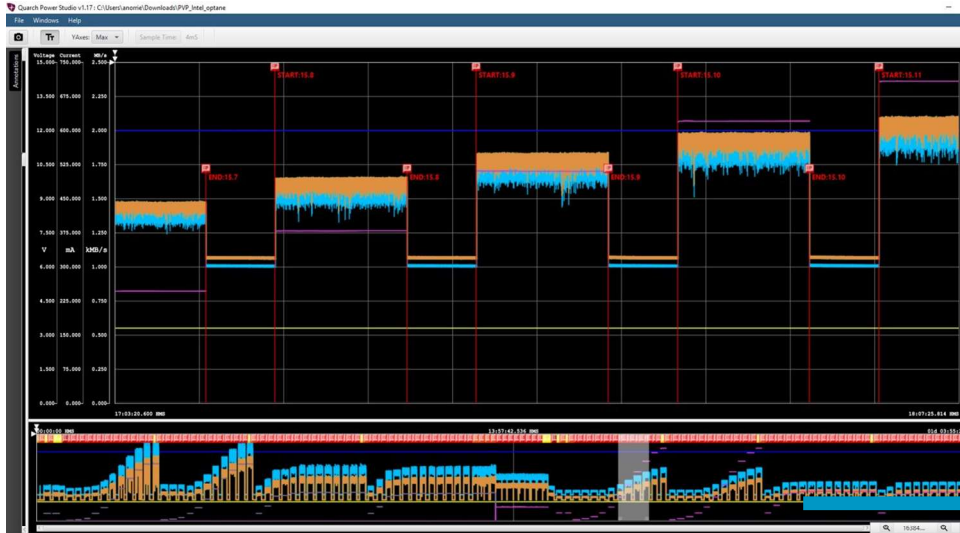
EV charging, AC Motor analysis
and more



AC PAM: SINGLE IEC 60309 INPUT, SINGLE IEC 60309 OUTPUT, 16A/32A/63A VERSIONS AVAILABLE, SAMPLE RATE 8KS/S, VOLTAGE PER PHASE: $\pm 495.5V$ PEAK 50VAC-270VAC $\pm 0.5\%$, CURRENT PER PHASE: 100mA-156A $\pm (20mA + 0.5\%)$

LONG TERM, HIGH RESOLUTION CAPTURE

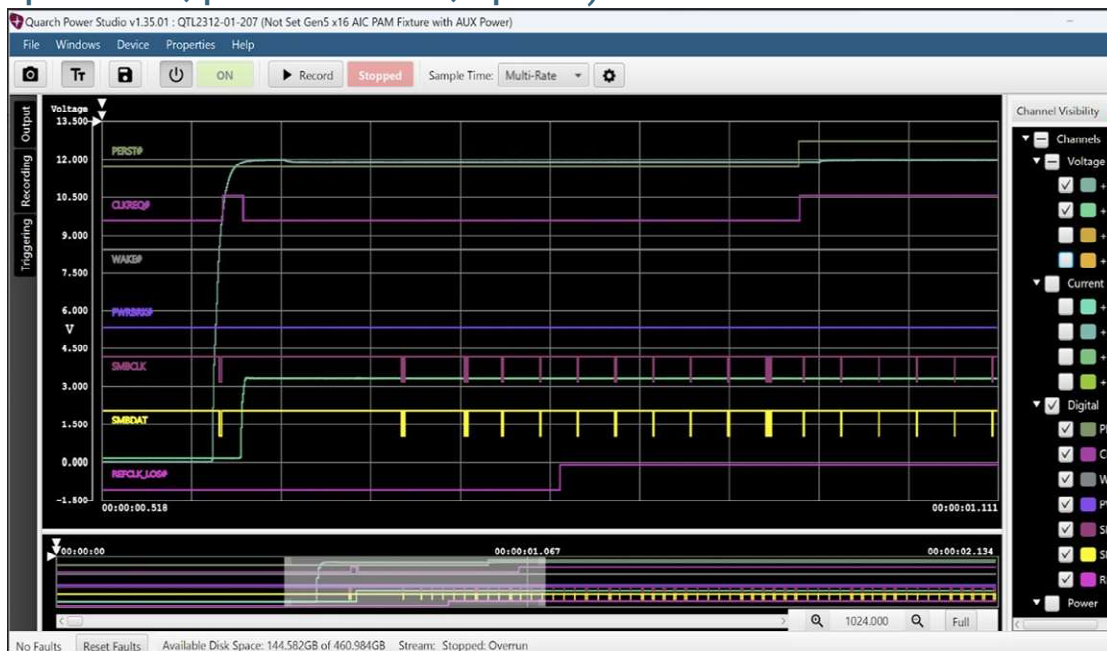
Record for hours or days and still zoom in to the smallest details.
Add annotations and notes



Quarch Power Studio (QPS)

ANALOG, DIGITAL AND CUSTOMER USER CHANNELS

See the entire picture, including custom user channels for your own data (ie: temperature, performance, speed)



SIMPLE AUTOMATION API

Automate capture, annotations, custom channels, statistic calculations and more. Code examples: www.quarch.com/support/application-note

```
# If you know the name of the module you would like to talk to then you can skip module selection and hardcode the string.
moduleStr = "USB:QTL1999-05-005"

# Convert module to Quarch module
print("\n\nConnecting to the selected device")
myQuarchDevice = getQuarchDevice(myDeviceID, ConType="QPS")

# Create the device connection, as a QPS connected device
myQpsDevice = quarchQPS(myQuarchDevice)
myQpsDevice.openConnection()

# Prints out connected module information
print("\n\nConnected to module: " + myQpsDevice.sendCommand("hello?"))

# Setup the voltage mode and enable the outputs
setupPowerOutput(myQpsDevice)

# Set the averaging rate for the module. This sets the resolution of data to record.
# This is done via a direct command to the power module.
print(myQpsDevice.sendCommand("record:averaging 32k"))

# Start a stream, using the local folder of the script and a time-stamp file name in this example
fileName = time.strftime("%Y-%m-%d-%H-%M-%S", time.gmtime())
myStream = myQpsDevice.startStream(os.path.join(filePath, fileName))
print("File output path set: " + str(os.path.join(filePath, fileName)))
```

Quarch Power Studio (QPS)

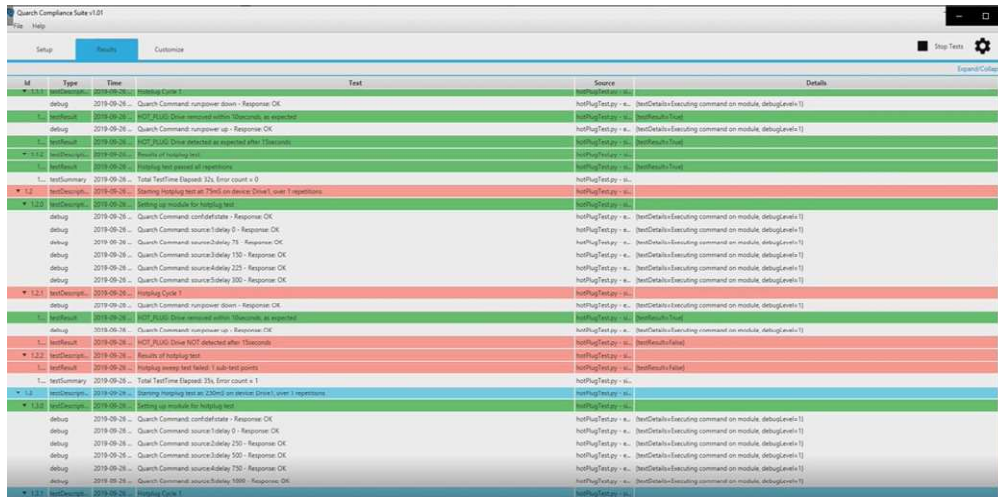
EASY SHARING AND POST PROCESSING

Share full traces or smaller sections. Export to CSV format for custom post-processing

	A	B	C	D	E	F	G	H
1	Time nS	POWER_1 voltage mV	POWER_1 current uA	POWER_2 voltage mV	POWER_2 current uA	POWER_1 power uW	POWER_2 power uW	Tot pov
2	1933312000	11766	446522	4911	591102	5253777	2902901	ξ
3	1933316000	11712	480158	4882	200869	5623610	980642	€
4	1933320000	11577	1785342	4863	260391	20668904	1266281	21
5	1933324000	11761	1771129	4858	352647	20830248	1713159	22
6	1933328000	11544	1616204	4839	283075	18657458	1369799	23
7	1933332000	12094	1986319	4848	565698	24022541	2742503	24
8	1933336000	12026	816755	4902	639467	9822295	3134667	12
9	1933340000	11500	98024	4892	222446	1127276	1088205	25
10	1933344000	11655	1621986	4868	256749	18904246	1249854	26
11	1933348000	11775	1593033	4844	273577	18757963	1325206	27
12	1933352000	11558	1888446	4834	321572	21826658	1554479	28
13	1933356000	11987	1831120	4844	479390	21949635	2322165	29
14	1933360000	12147	1289066	4873	673031	15658284	3279680	18
15	1933364000	11582	158014	4906	353108	1830118	1732347	20
16	1933368000	11775	1083744	4877	264079	12761085	1287913	14
17	1933372000	11529	1585082	4853	214931	18274410	1043060	15
18	1933376000	11630	1997881	4848	326044	23235356	1580661	24
19	1933380000	11809	1708884	4829	352416	20180211	1701816	21
20	1933384000	12127	1804635	4858	663395	21884808	3222772	25
21	1933388000	11756	418725	4911	517335	4922531	2540632	27
22	1933392000	11717	505277	4887	220372	5920330	1076957	€
23	1933396000	11577	1775184	4863	273254	20551305	1328834	21
24	1933400000	11741	1753029	4853	342688	20582313	1663064	22
25	1933404000	11534	1645339	4839	273116	18977340	1321608	23
26	1933408000	12084	2008944	4848	559290	24276079	2711437	24
27	1933412000	12050	828208	4902	655972	9979906	3215574	12
28	1933416000	11500	74000	4807	200000	850000	1000000	1

QUARCH COMPLIANCE SUITE

Run standard automated workload, voltage margining tests and more



ID	Type	Time	Test	Source	Details
1.1.1.1	testSummary	2019-09-26	Running Cycle 1	hotPlugTest.py	testResults:Pass
1.1	testResult	2019-09-26	Quarch Command: runpower down - Response: OK	hotPlugTest.py	testDetails:Executing command on module, debugLevel: 1
1.1	testResult	2019-09-26	DC/PLUG: Drive removed within 15seconds, as expected	hotPlugTest.py	testResults:Fail
1.1	testResult	2019-09-26	Quarch Command: runpower up - Response: OK	hotPlugTest.py	testDetails:Executing command on module, debugLevel: 1
1.1	testResult	2019-09-26	DC/PLUG: Drive detected as expected after 15seconds	hotPlugTest.py	testResults:Pass
1.1	testResult	2019-09-26	Running test passed all repetitions	hotPlugTest.py	testResults:Pass
1.1	testSummary	2019-09-26	Total TestTime Elapsed: 12s, Error count = 0	hotPlugTest.py	testResults:Pass
1.2	testSummary	2019-09-26	Starting Hotplug test at 7500 on device D1041, user 1 repetitions	hotPlugTest.py	testResults:Pass
1.2.1	testSummary	2019-09-26	Setting up module for hotplug test	hotPlugTest.py	testResults:Pass
1.2.1.1	testResult	2019-09-26	Quarch Command: configDefault - Response: OK	hotPlugTest.py	testDetails:Executing command on module, debugLevel: 1
1.2.1.2	testResult	2019-09-26	Quarch Command: source:1delay 5 - Response: OK	hotPlugTest.py	testDetails:Executing command on module, debugLevel: 1
1.2.1.3	testResult	2019-09-26	Quarch Command: source:2delay 75 - Response: OK	hotPlugTest.py	testDetails:Executing command on module, debugLevel: 1
1.2.1.4	testResult	2019-09-26	Quarch Command: source:3delay 150 - Response: OK	hotPlugTest.py	testDetails:Executing command on module, debugLevel: 1
1.2.1.5	testResult	2019-09-26	Quarch Command: source:4delay 225 - Response: OK	hotPlugTest.py	testDetails:Executing command on module, debugLevel: 1
1.2.1.6	testResult	2019-09-26	Quarch Command: source:5delay 300 - Response: OK	hotPlugTest.py	testDetails:Executing command on module, debugLevel: 1
1.2.1.7	testResult	2019-09-26	Hotplug Cycle 1	hotPlugTest.py	testResults:Pass
1.2.1.8	testResult	2019-09-26	Quarch Command: runpower down - Response: OK	hotPlugTest.py	testDetails:Executing command on module, debugLevel: 1
1.2.1.9	testResult	2019-09-26	DC/PLUG: Drive removed within 15seconds, as expected	hotPlugTest.py	testResults:Fail
1.2.1.10	testResult	2019-09-26	DC/PLUG: Drive NOT detected after 15seconds	hotPlugTest.py	testResults:Fail
1.2.2	testSummary	2019-09-26	Results of hotplug test	hotPlugTest.py	testResults:Fail
1.2.2.1	testResult	2019-09-26	Hotplug every test failed: 1 sub-test points	hotPlugTest.py	testResults:Fail
1.1	testSummary	2019-09-26	Total TestTime Elapsed: 13s, Error count = 1	hotPlugTest.py	testResults:Fail
1.1	testSummary	2019-09-26	Starting Hotplug test at 2000 on device D1041, user 1 repetitions	hotPlugTest.py	testResults:Pass
1.1.1	testSummary	2019-09-26	Setting up module for hotplug test	hotPlugTest.py	testResults:Pass
1.1.1.1	testResult	2019-09-26	Quarch Command: configDefault - Response: OK	hotPlugTest.py	testDetails:Executing command on module, debugLevel: 1
1.1.1.2	testResult	2019-09-26	Quarch Command: source:1delay 5 - Response: OK	hotPlugTest.py	testDetails:Executing command on module, debugLevel: 1
1.1.1.3	testResult	2019-09-26	Quarch Command: source:3delay 500 - Response: OK	hotPlugTest.py	testDetails:Executing command on module, debugLevel: 1
1.1.1.4	testResult	2019-09-26	Quarch Command: source:4delay 750 - Response: OK	hotPlugTest.py	testDetails:Executing command on module, debugLevel: 1
1.1.1.5	testResult	2019-09-26	Quarch Command: source:5delay 1000 - Response: OK	hotPlugTest.py	testDetails:Executing command on module, debugLevel: 1
1.1.1.6	testResult	2019-09-26	Hotplug Cycle 1	hotPlugTest.py	testResults:Pass

Automation options

QIS & QUARCHPY

Java Instrumentation Server allowing simple TCP based control of any Quarch Power Device. Full Python API available for fast integration

```

1  from quarchpy.device import *
2
3  # Specify the module to control
4  myDeviceID = "USB:QTL1999-05-005"
5
6  # Connect to the module
7  myQuarchDevice = getQuarchDevice(myDeviceID, ConType = "QIS")
8
9  # Convert the base device class to a power device, which provides additional controls, such as data streaming
10 myPowerDevice = quarchPPM(myQuarchDevice)
11
12 module.startStream('Stream1.csv')
13

```

Download QIS from: quarch.com/downloads

Download quarchpy from: pypi.org/project/quarchpy/



60W DUAL RAIL PROGRAMMABLE POWER SUPPLIES



12V and 3.3V/5V dual rail supply for SSDs, HDDs and beyond

Fully compatible with Power Studio and automated power capture



HD PPM: 2 PROGRAMMABLE OUTPUTS, 0-14.4V AND 0-6V. 1024 PATTERN POINTS PER CHANNEL, 1V/US NO-LOAD SLEW. SAMPLE RATE 250KS/S, VOLTAGE: 0 - 14.4V \pm (1%), CURRENT: 0-1mA \pm (2uA+2%) 1mA-4A \pm (2mA+1%)

Programmable Power Modules

PLUG AND PLAY FIXTURING FOR MANY INTERFACES

