

QCM / 0-300 MHz Qubit Control Module | Pulsar Series

Release November 2021_V1.4

Description

A Qubit Control Module (QCM) hosts 6 sequence processors for flexible multiplexed driving and tracking of up to 6 qubits (or other oscillators). The unlevelled noise performance makes it ideal for high-fidelity single- and two- qubit control.

The extremely low offset and gain drift (a few ppm/K) avoid the need for frequent recalibration. This makes the QCM the ideal baseband signal generator to push gate fidelities to the next level.

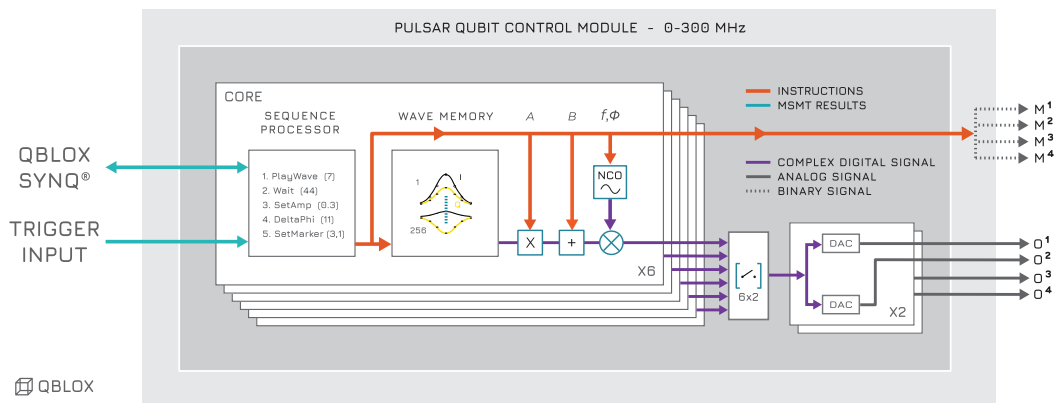
Advanced sequencer capabilities drastically speed up characterization experiments (Spectroscopy, Rabi, Chevron, Charge stability diagrams) by avoiding repeated wave uploading and large overhead in software controlled loops.

During quantum algorithms, it allows for instance arbitrary single-qubit control (phase, amplitude) from a single pulse pair. Qubit phases can be tracked in real time using the NCOs which accept virtual Z-gates through phase updates from the sequence processor.



Features

- Advanced distributed sequence processing
- Multiplexed control of up to 6 frequencies
- Baseband operation (4 independent channels) or IQ-mode (2 channel pairs) for single-sideband upconversion
- Offset instructions allows constructing arbitrarily long (modulated) signals
- Synchronized to other devices with SYNQ protocol.
- Real-time modulation and mixer corrections
- Real-time control: amplitude, offset, modulation frequency, modulation phase (virtual Z-gates)
- External instrument control by 4 marker outputs



Specifications Pulsar QCM

Analog output channels	4	Gain stability, 500 mVpp into 50 Ω , 15-32 $^{\circ}\text{C}$ ambient	2.3 $\mu\text{V/K}$ = 4.6 ppm/K
DAC sample rate	1 GSPS	Offset stability, into 50 Ω , 15-32 $^{\circ}\text{C}$ ambient	5 $\mu\text{V/K}$ = 1 ppm w.r.t full scale
DAC resolution	16 bit	Binary output markers	4
Trigger Latency	95 ns	Driver/API	SCPI / Python / QCoDeS
Analog bandwidth	300 MHz (-3 dB) 400 MHz (-8 dB)	Ethernet data rate	1 Gbit/s
Output range (in a 50 Ω load)	5 Vpp	Max. power consumption	30 W
Rise/fall time (10%-90%)	1.2 ns	Analog Output connector type	SMA
THD (100 MHz, 1 Vpp in a 50 Ω load)	66 dB	Marker connector type	SMP
Voltage noise density (at 1 MHz in a 50 Ω load)	14 nV/ $\sqrt{\text{Hz}}$	Dimensions single module	246 x 106 x 36 mm ³
Voltage noise density (at 1 Hz in a 50 Ω load)	1.0 $\mu\text{V}/\sqrt{\text{Hz}}$	Weight	0.550 kg