stahl-electronics.com

QUAD 1-5b

Rotating Wall Drive

Short Form Data Sheet

Precision Phase Shifter for Ion Compression in Traps

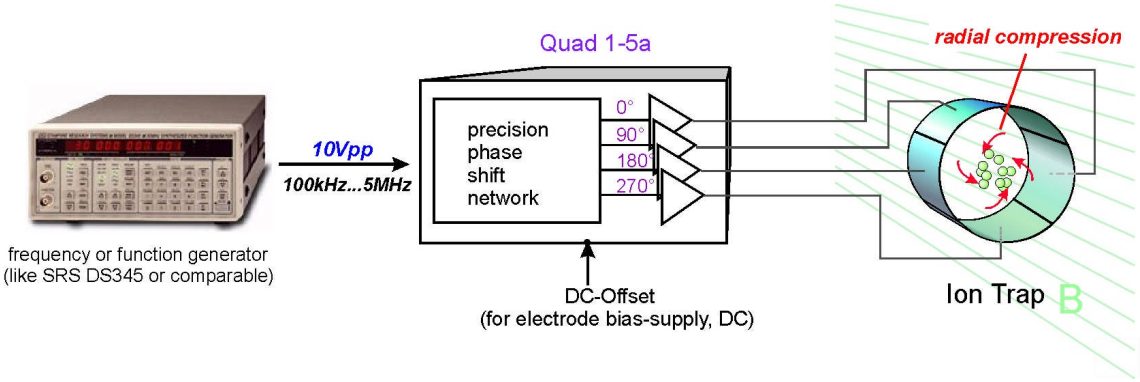
Features:

- 4 Phase Shifted Outputs with up to $20V_{pp}$ Amplitude
- Wide Frequency Range: 100 kHz … 5 MHz
- Small Amplitude and Phase Mismatch Over Entire Frequency Range
- Medium-Impedance Outputs without 50 Ohm Termination
- Upgrade to Different Frequency Ranges is Possible

Description:

The QUAD 1-5b rotating wall drive is intended to create an electric rotating dipole or quadrupole field inside a Penning Ion Trap. The resulting “rotating wall” enables fast compression of big ion clouds (see literature [1], [2], [3]). The QUAD 1-5b is a suitable tool to handle a wide range of ions/plasma rotation frequencies with respect to this novel application.

As can be seen in the diagram below, one can input a sinusoidal wave to the device, which maybe ramped in frequency for convenience, and the QUAD 1-5b will output an amplified 4-channel signal. All 4 channels have a precise relation of 90° and an equal amplitude, and therefore are suited to create a rotating electro-dynamical wall inside a cylindrical trap.



Since the outputs have a medium-impedance of nominally 350 Ohms and require no termination with 50 Ohms, the device is specially suited for ion traps, being located in vacuum setups, where usually no dedicated radio-frequency cables are used. Simple standard vacuum wire-cabling is therefore applicable, making the use of this device very easy and convenient. The outputs can handle a very wide range of impedances and show practically under no conditions danger of oscillation in contrast to standard RF-amplifier outputs.

For further convenience it is possible to add a constant DC-offset of up to +/-150V to all outputs simultaneously. This feature is specially useful with respect to ion traps, since one can float the attached trap electrodes on an arbitrary DC-potential within -150V … +150V, e.g. for ion trapping or ejection. If no external voltage is applied to this input, a default potential of zero is present.

A rotating LED-indicator on the front plate illustrates the function of the device and at the same time works as a display for correct frequency and amplitude range. A 4-bar-LED linear level meter completes the front side, showing the four output leves and indicating shortcuts or other malfunctions. The whole circuitry of the QUAD 1-5 is mounted inside a 19” standard size cartridge, fitting to normal 19 inch racks. A built-in fan ensures sufficient cooling for the medium-power radio-frequency outputs.

Specifications Rotating Wall 4-channel Active Quad-Phase Shifter, type QUAD 1-5b

Parameter	**Spec. value**	**Condition**
Dimensions	width x height x lenght 349mm x 122mm x 300mm	
Weight	approx. 7 kg	
Power Supply	230 V ~ AC	
Inputs (BNC) Impedance Voltage Range Coupling Mode	 100 Ohm 0...10 Vpp AC	
Outputs (BNC) Functionality Voltage Range Amplitude mismatch between outputs Phase mismatch between outputs	 4 Outputs, 90° Phase Shifted 0...20 V_{pp} typ. < 0.5 dB < ± 2°	 open outputs open outputs open outputs
Gain Flatness over freq. range	Nominally 2x (6 dB) better ±2 dB	
Freq. Range	500 kHz...5 MHz	open outputs
Ext. DC-Offset range	± 150 V_{DC}	
remark: the applied external offset (DC) voltage is internally added to the ac output voltages and will appear at the outputs as DC offsets		

Literature

[1] X.-P. Huang, F. Anderegg, et al., Phys. Rev. Lett. **78**, 875 (1997)
[2] E.M. Hollmann et al., Phys. Plasmas **7**, 2776 (2000)
[3] Funakoshi et al.; Phys. Rev. A **76**, 012713 (2007)