

R&S[®] AMU-Z7

Analog I/Q Combiner

Technical Information



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The following abbreviations are used throughout this manual:

R&S® AMU-Z7 is abbreviated as R&S AMU-Z7.

Safety Instructions

The R&S I/Q combiner has been designed and tested in accordance with the EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards.

NOTICE

To maintain this condition and to provide safe operation, observe all instructions and warnings given on this page.

USB Connection to an R&S® Signal Generator

- The USB type B connector at the rear (output panel) is used to power-supply the I/Q combiner by signal generators of the R&S® SMU family. It is recommended to use the cable included in delivery.
- Do not connect to other USB hosts, e.g. a PC, or insert any USB hubs between the generator and the combiner, as they may damage the combiner or the host.

EMC Safety Precautions

- To avoid electromagnetic interference (EMI) double shielded cables must be used at all signal connectors.
- Inputs and outputs have to be terminated with 50 Ohms.
- The USB cable must keep within permissible EMI limits.

Opening the device

- Do not disassemble the R&S AMU-Z7 I/Q combiner. If you need repair of your R&S AMU-Z7, it is recommend to ship the device to our experts in the service centers.
- The original packing should be used when the R&S AMU-Z7 is to be transported or dispatched. If the original packing is no longer available, use a sturdy cardboard box of suitable size and carefully wrap the R&S AMU-Z7 to protect it against mechanical damage.

For service information contact your Rohde & Schwarz support center, provided on the R&S website [Rohde&Schwarz Service and Support](#).

Device damage caused by cleaning agents

- Do not use cleaning agents such as solvents (thinners, acetone, etc), acids, bases, or other substances for they may damage the labeling.
- The outside of the device is suitably cleaned using a soft, line-free dust cloth.

Welcome to R&S®AMU-Z7...

The analog I/Q combiner R&S AMU-Z7 is a compact one box solution for adding analog I/Q signals. The combiner adds two I/Q signals to just one I/Q signal. It is operated for example at the I/Q signal input of an R&S signal generator, to combine overlaid signals coming from different sources.

Thus, e.g. an R&S AMU200A baseband signal generator offering integrated 2-path signal generation, delivers 2 I/Q signals to the combiner, which adds the signal components and outputs to one combined signal. By using two AMU200A signal sources and a second I/Q combiner up to 4 analog I/Q signals can be added and then output as 2 combined signals. These I/Q signals can be transmitted to another R&S instrument, e.g. an R&S SMATE200A. If fully equipped with two paths and a fading simulator, the signals can be further processed in just one instrument.

The I/Q combiner extends signal variety and therefore enables to process more signals simultaneously, as given in real environment. For example, the described test setup is applied in real-time fading simulation for diversity tests on antennas or MIMO receivers.

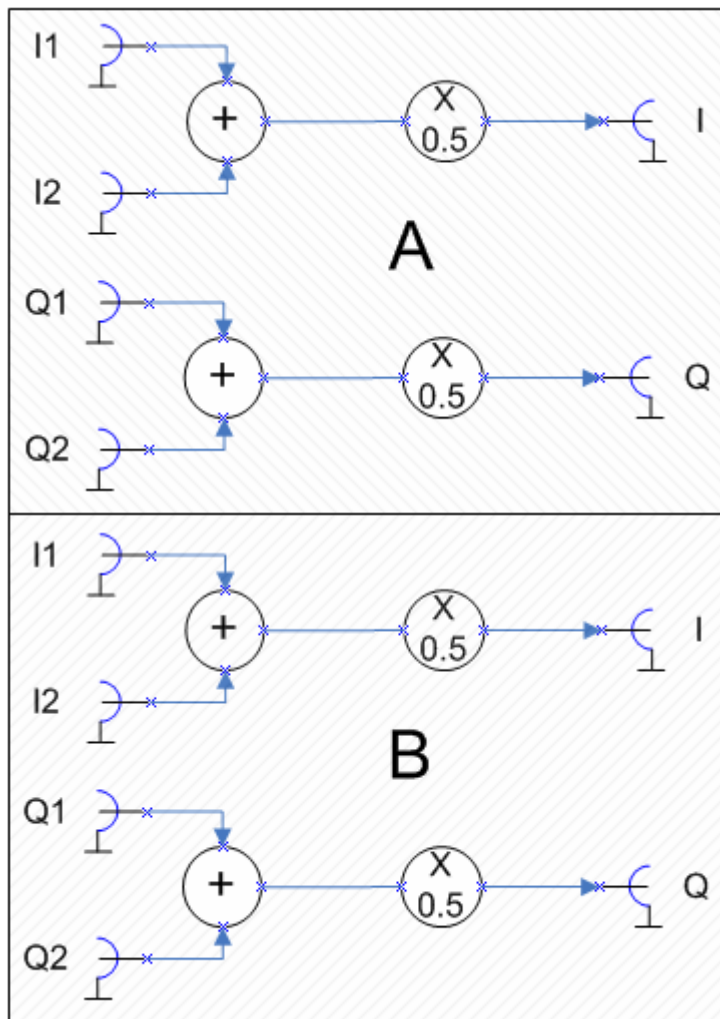
NOTICE

This technical information gives a brief introduction to connection and use of the I/Q combiner R&S AMUZ-Z7. For detailed technical information refer to the data sheet.

For details on settings of the signal generators of the R&S®SMU family refer to the generators' manuals or help systems.

Block Diagram

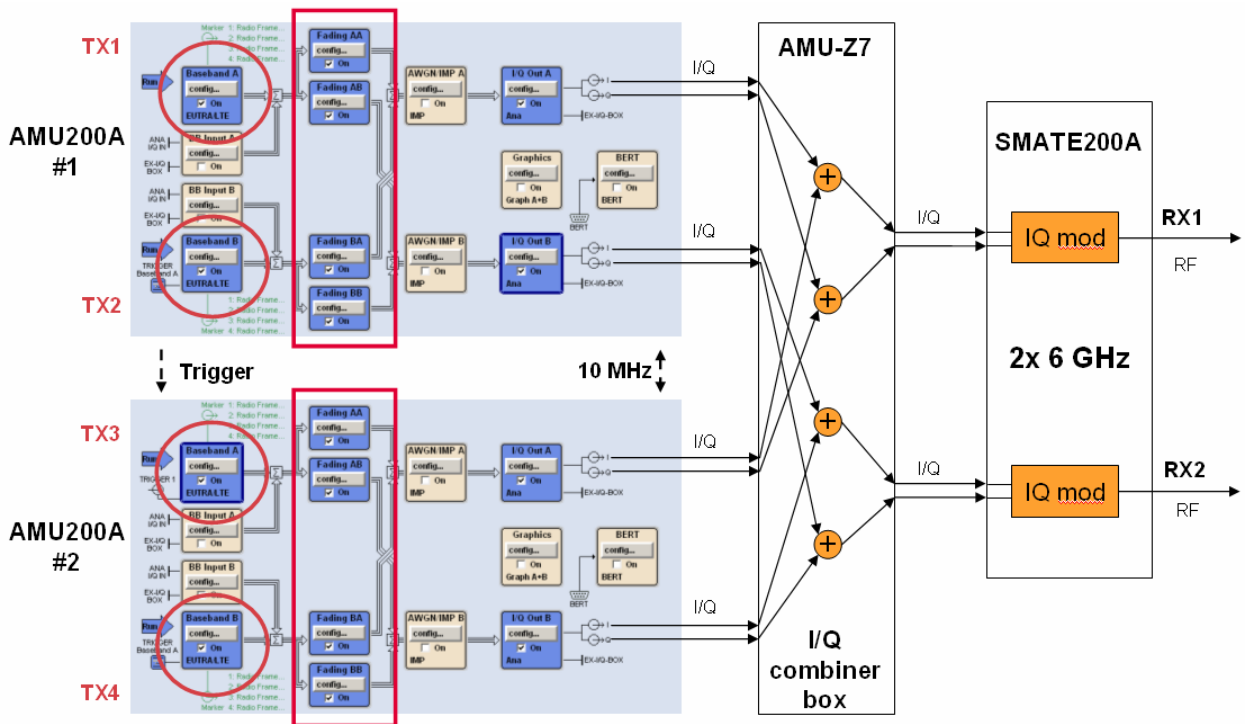
The diagram shows the addition of the input signals in detail. In order to keep the output signal level in the permissible range, the input signals are first attenuated with 6 dB, and then combined for output.



The internal circuit of the analog I/Q combiner.

Test Setup Examples Real-time MIMO Fading

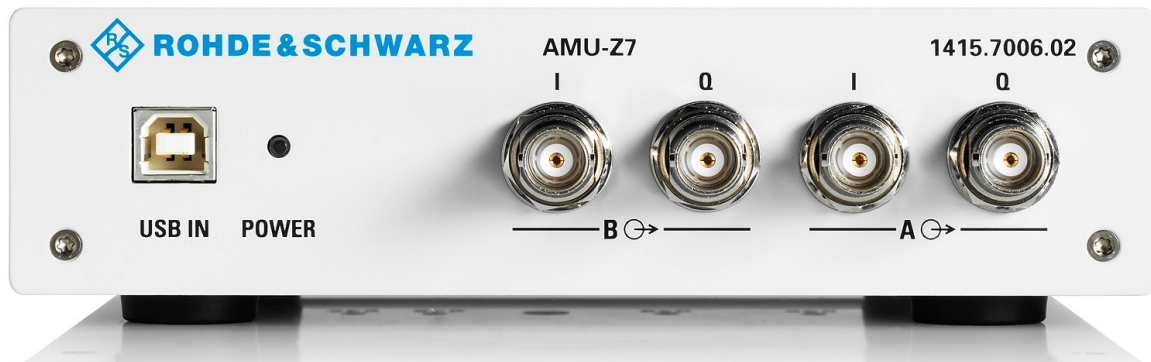
The following test setup shows a MIMO (Multiple-Input-Multiple-Output) fading scenario for application with frequencies higher than 3 GHz. A combination of two fully equipped R&S AMU200A generate the baseband signals and insert MIMO fading. The I/Q outputs are then combined with the aid of the analog combiner box R&S AMU-Z7, with the result that eight fading channels can be simulated. The R&S SMATE200A upconverts the 2x4 MIMO signal to RF.



4x2 MIMO up to 6 GHz (2xAMU + 1xSMATE) application

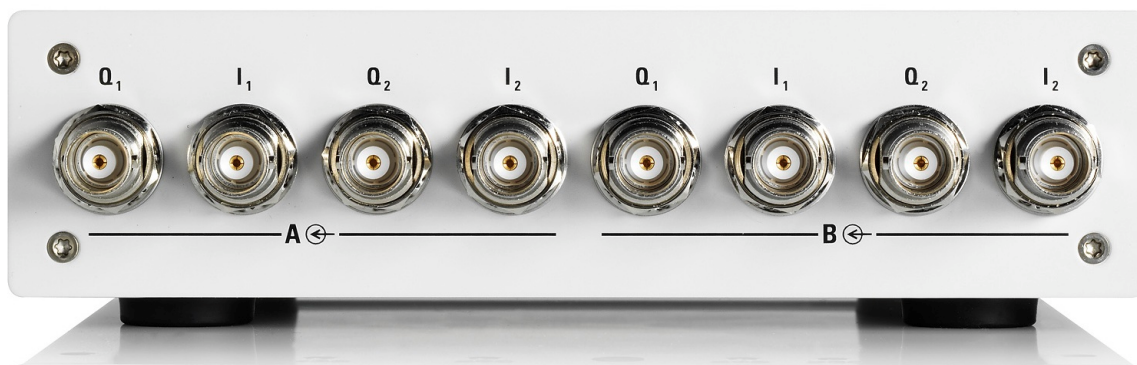
Putting into Operation

Connectors (Front / Rear Panel)



Front panel

- 4 BNC output connectors at the front panel, labeled with **I/Q path A** and **I/Q path B**. Connect these outputs with the analog I/Q signal inputs of the receiving generator.
- A USB type B connector for power supply.



Rear panel

- 8 BNC input connectors at the rear panel. These connectors are labeled with **I1/Q1**, **I2/Q2** of **path A** and **I1/Q1**, **I2/Q2** for **path B**. Connect the analog I/Q signal outputs of the source with these inputs.

Connect the I/Q Combiner

1. Connect the USB port of the I/Q combiner with the R&S signal generator.
2. Connect the I/Q signal outputs of the source with the associated inputs of the combiner and the outputs of the combiner with the I/Q inputs of the generator.
3. Switch on the generators and activate signal generation and measurement.

The I/Q combiner is ready to be used.

Performing a combined I/Q Signal

After connection you can use the I/Q combiner as follows:

1. Perform signal generation for the selected number of paths in the source generator.
2. Configure the settings for the analog I/Q output of the corresponding paths. Select analog single ended.

The analog baseband signals are output at the I/Q output connectors of the corresponding paths (path A and path B).

3. Configure the parameters of the incoming signals in the generator, e.g. analog input settings, signal routing and fading scenarios.



Frequency bandwidth and levels

- The R&S AMU-Z7 provides a frequency range of 40 MHz, which corresponds to the baseband input frequency bandwidth of the signal generators of the R&S[®]SMU family.
- The R&S AMU-Z7 feeds through the input signals to the corresponding outputs with an attenuation of 6 dB. Each signal transmission follows the formula $I=(I_1+I_2)/2$, to keep the signal output in permissible ranges. Otherwise the I/Q inputs of the generator would be overdriven.

Accuracy Considerations

Supplied from the manufacturer the analog I/Q combiner R&S AMU-Z7 is delivered in fully calibrated condition. Further calibration or initialization is not required. To provide accuracy terminate used ports of the I/Q combiner with 50 Ω.