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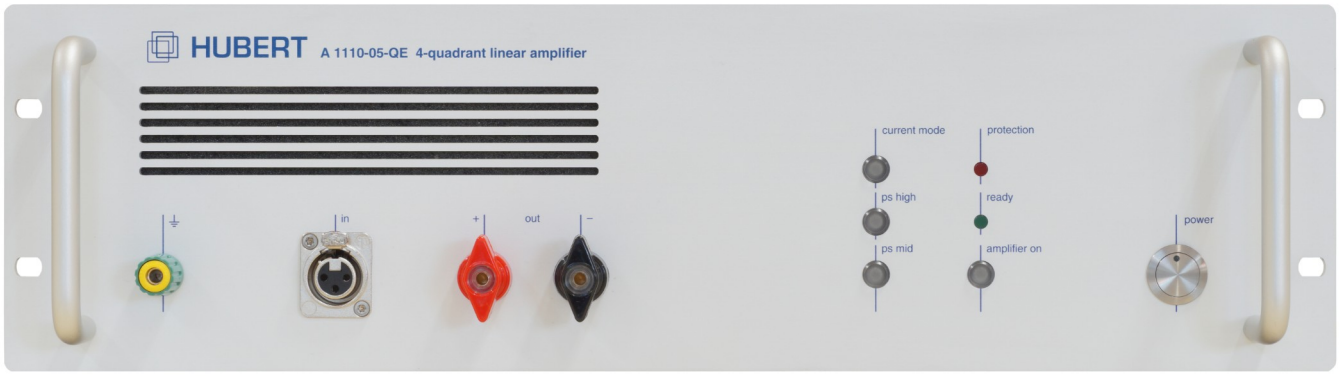
Datasheet



A1110-05-QE

4-Quadrant Voltage and Current Amplifier
DC - 1 MHz

MADE IN GERMANY

Revision 3.1
DS-11100060-08

1 Product Description

The A1110-05-QE is a linear, extreme-broadband, precision power amplifier designed for all applications which require fast-changing signals with high performance.

The A1110-05-QE can be operated as a voltage amplifier or current amplifier. The current amplifier offers a constant, frequency-invariant output current for inductive loads.

The amplifier is equipped with “auto-commutating” voltage supply. Three bipolar supply voltages are automatically or manually switched individually. The amplifier ensures high sink outputs and is also suitable for operation as active load. Three optional operating voltages per polarity are available for high-voltage/low-current or low-voltage/high-current applications. The voltage switch-over can be implemented optionally as manual or automatic. Especially in case of very low-impedance loads, the operating voltage can be reduced to 1/10 which is associated with a corresponding reduction of the power loss.

Output voltage and output current can be limited and observed on low-impedance signal outputs.

The device is equipped with a temperature-controlled, quietly-running fan. An over-temperature disconnection, a power-loss calculation and an absolute-current monitoring guarantees perfect short-circuit and overload protection.

An interlock offers the possibility of a remote-controlled security system.

The operation is implemented over the operating elements on the front panel and over the USB interface by PC with a graphical user interface.

The device’s functionality can even be extended by several product options.

Please find the latest release of this datasheet on our website:
www.drhubert.com

2 Features

- 4-quadrant voltage and current amplifier
- Fully configurable and operable by means of the supplied software
- Output voltage max. 75 V_{peak}
- Output current max. 11 A_{peak}
- Output current 27 A_{peak} / 500 ms
- Symmetrical input
- Series / parallel input connection in case of higher voltage / current requirements
- USB port as standard (LAN interface optional)
- Auto-commutating voltage supply
- Interlock
- Voltage / current monitor output
- 6 configurable compensation networks for inductive loads in current amplifier mode

3 Applications

- General lab applications for research, development and testing
- EMC testing
- Material testing
- MRI
- Component tests
- Plunger coil drives
- Piezo actuation
- Generation of magnetic fields (e.g. with Helmholtz coils)
- Medical engineering
- Laser technology
- Plasma technology

4 Control Software

The device includes an application software that ensures fully remote-controlled operation and comprehensive configuration of the amplifier via the USB interface. A trouble-free integration to existing automated test systems is guaranteed by a complete remote command list.

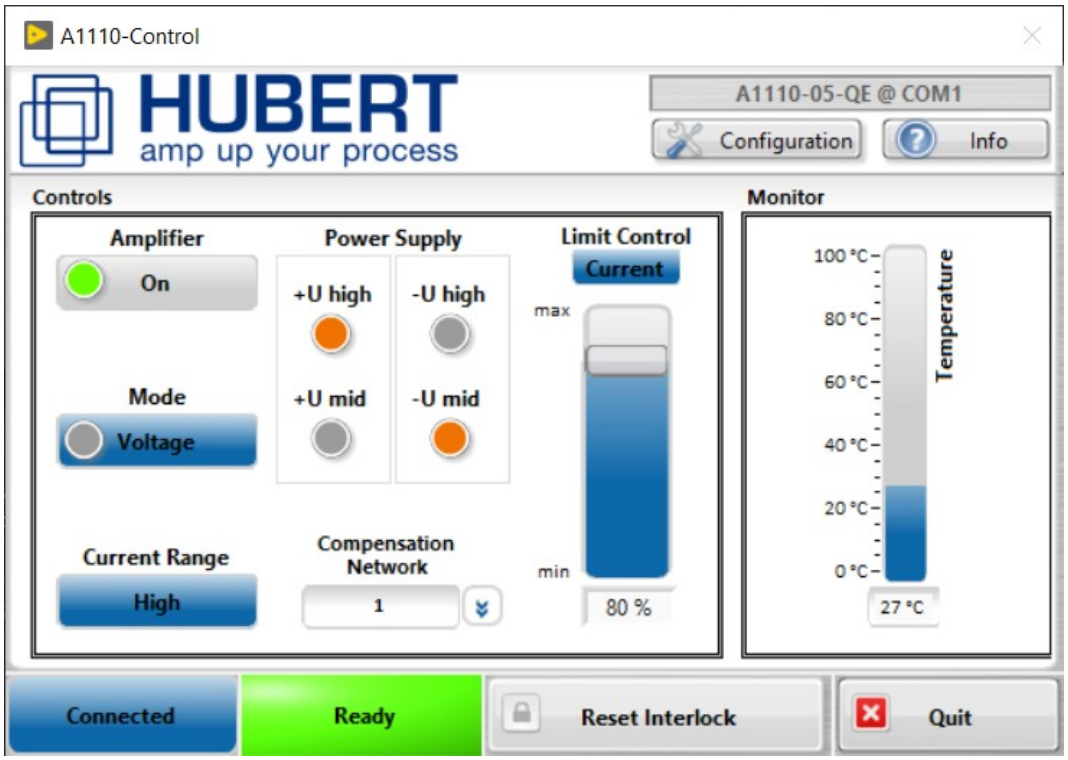


Figure 1: A1110-Control Main Menu

5 Pictures

Figure 2: Back Panel Elements

6 Current Amplifier

In current control mode, the A1110-05-QE behaves like a voltage-controlled current source and delivers a nearly frequency-independent constant load current to an inductive load.

The following five compensation networks are equipped ex works.

No	Load	Rc	Cc	Current Range
1	1 Ohm + 500 uH	100 kOhm	10 nF	high
2	0,1 Ohm + 200 uH	68 kOhm	4,7 nF	high
3	1 Ohm + 1mH	150 kOhm	22 nF	high
4	4 Ohm + 1,8 mH	200 kOhm	1 nF	high
5	0,078 R + 88 uH	80 kOhm	6,8 nF	high
6	*Reserved for Option-01*			

Table 1: Compensation Networks

The selection is made by our A1110-Control software. Please also note the corresponding recommended current measuring range.

If none of the above compensation networks is suitable for your application, please order your amplifier with Option-01: Custom Current Amplifier. Our engineers will design a custom compensation network specific for your needs. Up to 6 custom compensation networks are possible as existing ones can be removed.

We would be pleased to assist you in the realization of a compensation network for your application.

7 Specifications

Parameter	Specification	Conditions/Moments
	Controlled Voltage Mode	25° C ambient temperature
		Continuous operation
Input Impedance	100 kOhm	unbalanced, 1kHz
	200 kOhm	balanced, 1kHz
Maximum Input Level	5.5 V (+14,5 dBV)	< 1 % THD, 1 kHz, 8 Ohm Load
Common-Mode Rejection Ratio	> 60 dB	Rs= 50 Ohm, 10 Hz – 200 kHz, re +34.5 dBV @ Output
Small Signal Frequency Response	DC - 200 kHz	+0, -0.5 dB, 1 W @ 8 Ohm High Voltage Mode
	DC - 1 MHz	+0, -3.0 dB, 1 W @ 8 Ohm High Voltage Mode
Phase response	+0, -5 degrees	10 Hz - 30 kHz
Power Response (continuous)		
8 Ohm Load	400 W	DC - 30 kHz, < 1% THD Auto or High Voltage Mode
	380 W	DC – 100 kHz, < 1% THD Auto or High Voltage Mode
	200 W	DC – 200 kHz, < 1% THD Auto or High Voltage Mode
4 Ohm Load	220 W	DC - 30 kHz, < 1% THD Auto or High Voltage Mode
	200 W	DC - 100 kHz, < 1% THD Auto or High Voltage Mode
	180 W	DC - 200 kHz, < 1% THD Auto or High Voltage Mode
0.55 Ohm Load	27,5 W	DC - 200 kHz, < 1% THD Auto or High Voltage Mode
Slew Rate	80 V/µs	
Residual Noise		
10 Hz - 22 kHz	< 100 uV (< -80 dBV)	All Voltage Modes Input shorted 8 Ohm Load
10 Hz - 80 kHz	< 125.5 uV (< -78 dBV)	All Voltage Modes Input shorted 8 Ohm Load
10 Hz - 200 kHz	< 158.5 uV (< -76 dBV)	All Voltage Modes Input shorted 8 Ohm Load
Signal-to-Noise Ratio		
10 Hz - 22 kHz	< -114.5 dB	re +34.5 dBV, < 1% THD 8 Ohm Load All Voltage Modes

Parameter	Specification	Conditions/Moments
10 Hz - 80 kHz	< -112.5 dB	re +34.5 dBV, < 1% THD 8 Ohm Load All Voltage Modes
10 Hz – 200 kHz	< -108 dB	re +32 dBV, < 1% THD 8 Ohm Load All Voltage Modes
THD+N		
10 Hz – 100 kHz	< 0.15 %	380 W @ 8 Ohm; Auto
10 Hz – 100 kHz	< 0.1 %	380 W @ 8 Ohm High Voltage Mode
Output Offset	< 1.0 mV	DC
Output Impedance	< 80 mOhm	
Power, Pulse, 40ms, 20% Duty Cycle		
Peak output		
10 Ohm	80 V, 8 A	> 10 us rise time / > 10 us fall time, Auto
10 Ohm	80 V, 8 A	> 100 ns rise time / > 100 ns fall time, Uhigh
5 Ohm	52 V, 10.4 A	> 10 us rise time / > 10 us fall time, Auto
5 Ohm	52 V, 10.4 A	> 100 ns rise time / > 100 ns fall time, Uhigh
2.5 Ohm	27.5 V, 11 A	> 10 us rise time / > 10 us fall time, Auto
2.5 Ohm	27.5 V, 11 A	> 100 ns rise time / > 100 ns fall time, Umid
Short-Time Current, Pulse, 500ms, 5% Duty Cycle, unipolar		
Peak Output		
60 mOhm	+ 27 A	+Umid / -Ulow, Auto
60 mOhm	- 27 A	+Ulow / -Umid, Auto
Power, Sinus, 100Hz, continuous		
8 Ohm	57 V, 7.125 A, 406 W	< 1 % THD+N; Auto or Uhigh
0.25 Ohm	1.9 V, 7.6 A, 14.4 W	< 1 % THD+N; Auto
Power, DC		
10 Ohm	72V, 7.2A, 518 W	Auto or Uhigh
5 Ohm	47 V, 9.4 A, 442 W	Auto or Uhigh
2 Ohm	22 V, 11 A, 242 W	Auto or Umid
0.25 Ohm	2.7 V, 10.8 A, 29.2 W	Auto
Sink Power, DC	300 W	see U/I-Plot
Voltage Monitor	± 100 mV ≙ 1 V ± 0.5%	
Current Monitor	High Current Range: ± 400 mV ≙ 1 A ± 1 %	Shunt = 10 mOhm

Parameter	Specification	Conditions/Moments
	Low Current Range: ± 1 V ≙ 100 mA ± 1 %	Shunt = 2.5 Ohm
Gain		
Controlled Voltage Mode	1 V / 10 V	Uin / Uout
Controlled Current Mode	High Current Range: 1 V / 3 A	Uin / Iout
	Low Current Range: n.a.	unspecified
Physical Characteristics		
AC Power	230 VAC / 50 Hz	
Remote control	USB Ethernet (Option)	
Operating Temperature	10 °C to 55 °C	
Humidity	80% or less	non-condensing
Cooling	Forced air	
Dimensions (W x H x D)	449 x 133 x 495.5 mm	
Weight	Approx. 15 kg	

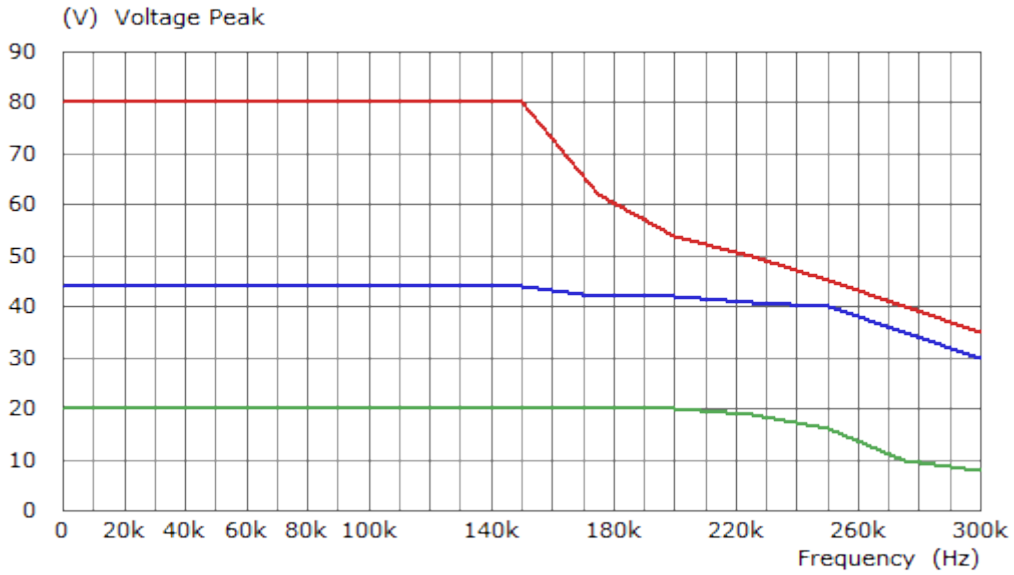
The A1110-5-QE is equipped with three operating voltages and the two auto and manual operating modes.

Modus	+Operating Voltage	-Operating Voltage
Auto	10 V, 45 V, 90 V	-10 V, -45 V, -90 V
Manuell: + Umid	45 V	auto
Manuell: + Uhigh	90 V	auto
Manuell: - Umid	auto	-45 V
Manuell: - Uhigh	auto	-90 V
Manuell: + Umid, -Umid	45 V	-45 V
Manuell: + Uhigh, -Umid	90 V	-45 V
Manuell: + Uhigh, -Uhigh	90 V	-90 V
Manuell: + Umid, -Uhigh	45 V	-90 V

In auto mode the operating voltage is automatically switched on the basis of the signal amplitude. This mode is suitable for real-time applications with DC voltages and sine-wave signals, with which high sink power is required at inductive loads.

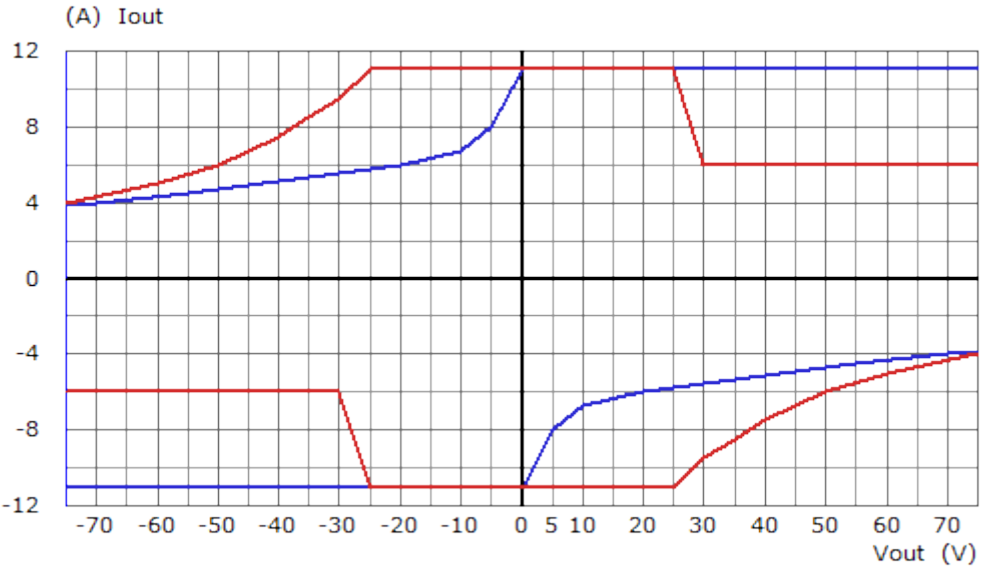
7.1 Output Voltage vs. Frequency (THD + N < 1%)

Red: @ 8 Ohm
Blue: @ 4 Ohm
Green: @ 2 Ohm

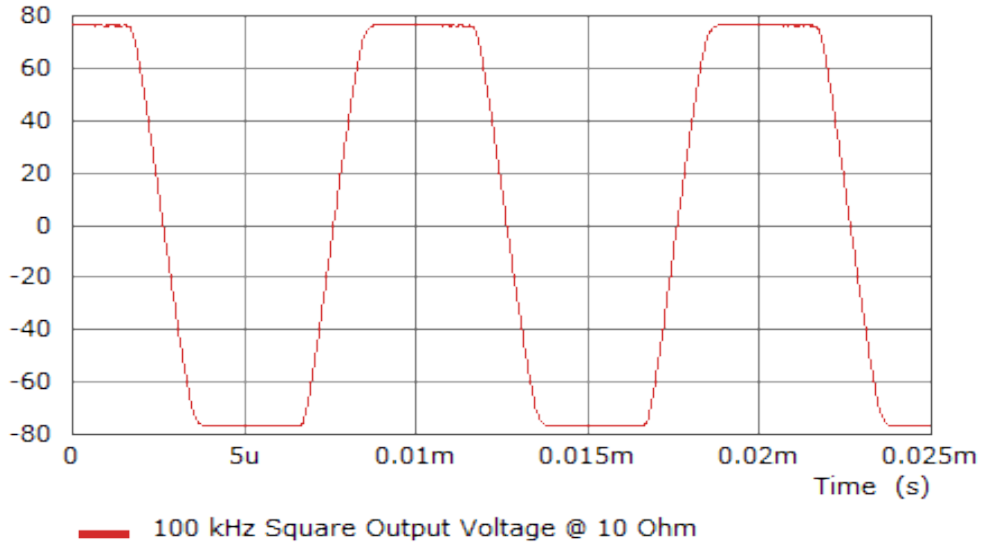


7.2 Output Current vs. Output Voltage (THD + N < 1%)

Supply Voltage: Auto
Blue: AC Limit
Red: DC Limit

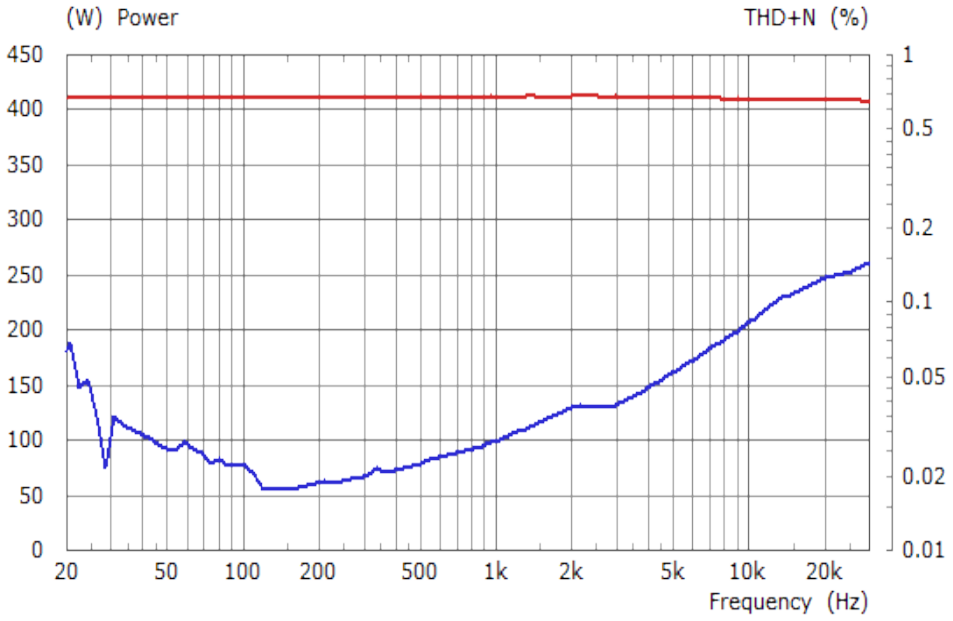


7.3 Square Wave at 100 kHz and 10 Ohm Load



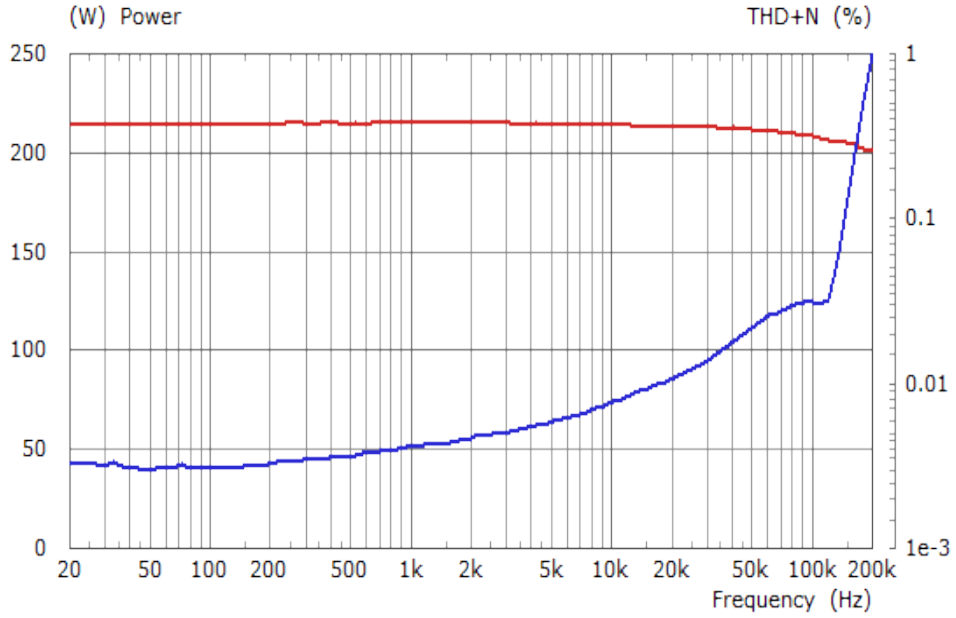
7.4 Power Bandwidth at 8 Ohm Load

Input level normalised to max. output level at 30 kHz; THD+N < 1%



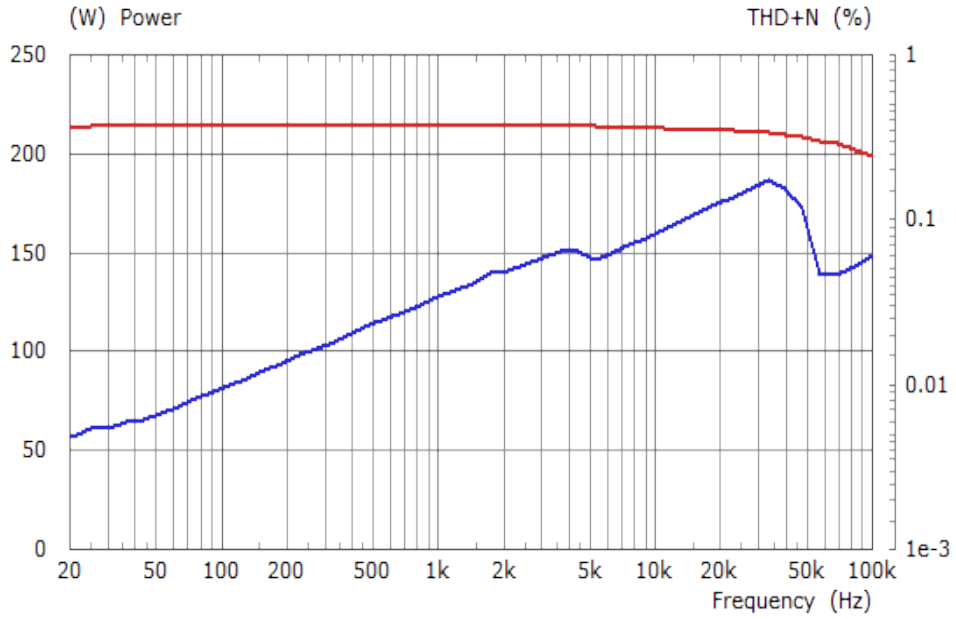
7.5 Power Bandwidth at 8 Ohm Load

Input level normalized to max. output level at 200 kHz; THD+N < 1%



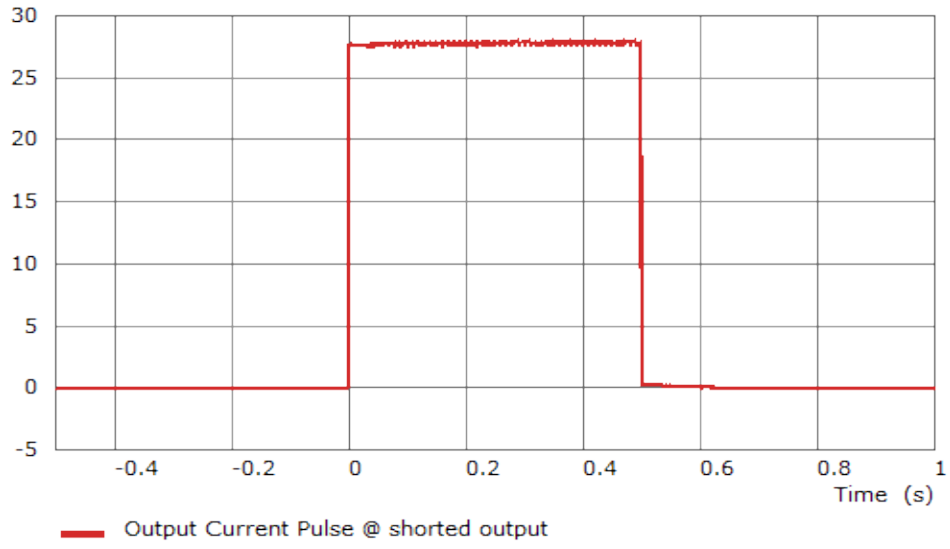
7.6 Power Bandwidth at 4 Ohm Load

Input level normalised to max. output level at 100 kHz; THD+N < 1%)

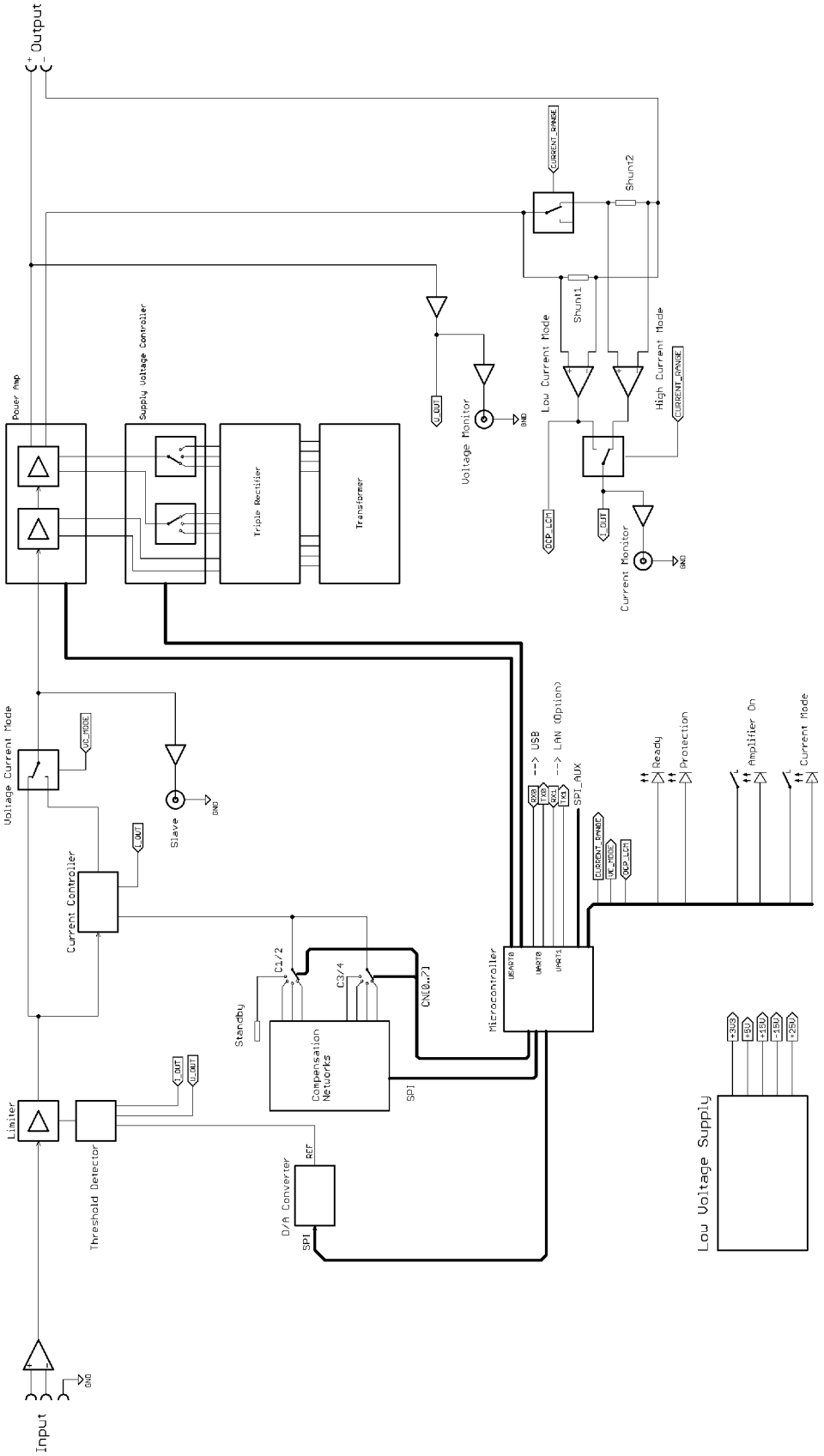


7.7 Current Pulse

27 A/500 ms, 10us rise-/fall time, auto



8 Block Diagram



9 Product Options

The following product options are available at the time of placing the order. Upgrades of existing devices are not possible.

Article Name	Article Description
A1110-05-QE	4-Quadrant Voltage and Current Amplifier
Option: Custom Current Amplifier	Additional compensation network for one specified load. The device is equipped with five general-purpose networks by default.
Option: Basic function generator (*1)	DC, 0.05Hz - 300 kHz, sine, square, triangle
Option: 1-Channel Isolation Amplifier (*2)	For potential isolation of input and output
Option: Ethernet Interface	For connection to a computer (RJ45)
Option: Sensing	Adjustable voltage drop: 500 mV / 1V / 2V
Option: Internal Current Measurement (*4)	Internal current measurement by high-performance current transformer 0-400A; Accuracy DC <+/- 0.1%; Output BNC socket, galvanically isolated from the amplifier
Option: Adjustable Output Resistance	R: 0 mΩ – 200 mΩ; Resolution 1 mΩ; Accuracy 0.5%
Option: 3-Channel Isolation Amplifier (*3)	For potential isolation of input and output
Option: Overvoltage Protection (*4)	For protection of amplifier outputs

(*1) Not available with Option: 1-Channel Isolation Amplifier or Option: 3-Channel Isolation Amplifier.

(*2) Not available with Option: Basic function generator or Option: 3-Channel Isolation Amplifier.

(*3) Not available with Option: Basic function generator or Option: 1-Channel Isolation Amplifier.

(*4) Choose one of these option per device.

10 Contact

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11 Document History

Revision	Date	Changes
2.0	March 2020	First publication in new layout
2.1	July 2020	Changed Low-Current-Monitor Gain Correction of some measurement tolerances
2.2	August 2020	Option-02 is now Option-10 for this device
3.0	April 2021	First release with new housing
3.1	May 2022	Options renamed