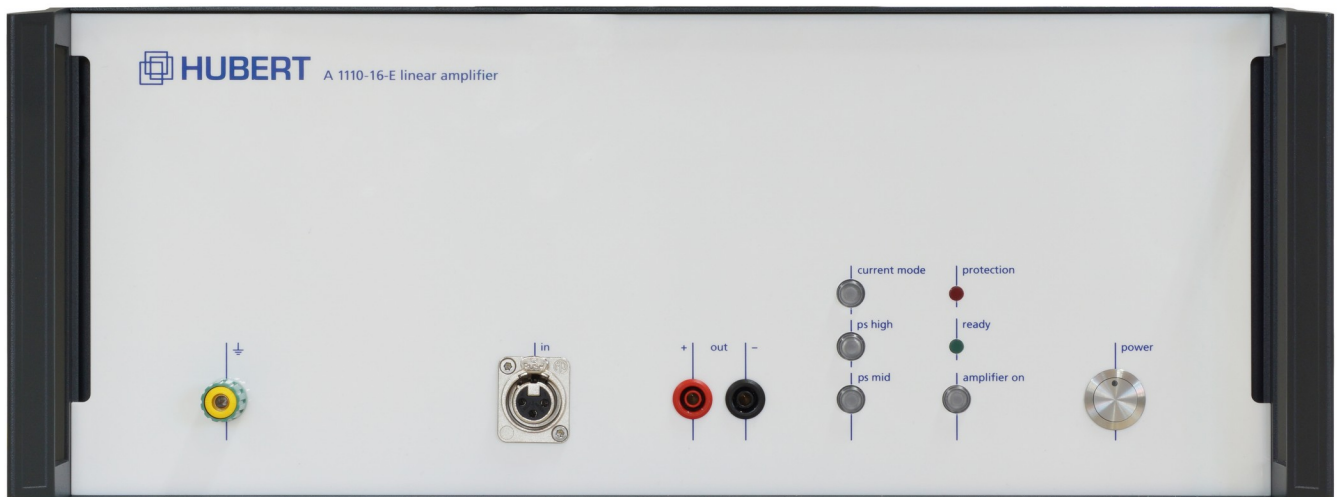


HUBERT

amp up your process

Datasheet



A1110-16-E

**4-Quadrant Voltage and Current Amplifier
DC – 1 MHz**



1 Product Description

The A1110-16-E is a linear, extreme-broadband, precision power amplifier designed for all applications which require fast-changing signals with high performance.

The A1110-16-E can be operated as a voltage amplifier or current amplifier. The current amplifier offers a constant, frequency-invariant output current for inductive loads.

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 1/3 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 guarantee 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. $75 V_{\text{peak}}$
- Output current max. $28 A_{\text{peak}}$
- Output current $55 A_{\text{peak}} / 500 \text{ ms}$
- Symmetrical input
- Series / parallel input connection in case of higher voltage / current requirements
- USB port as standard (LAN interface optional)
- 3 supply voltages
- Interlock
- Voltage / current monitor output
- 6 configurable compensation networks for inductive loads in current amplifier mode

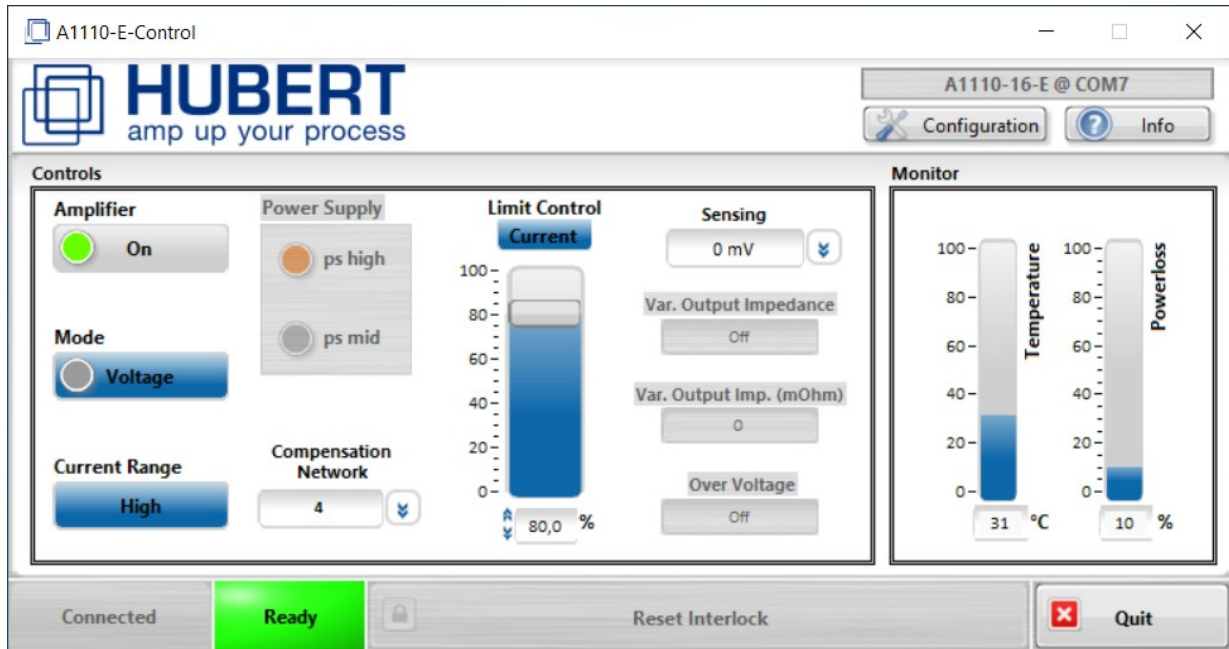
3 Applications

- 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

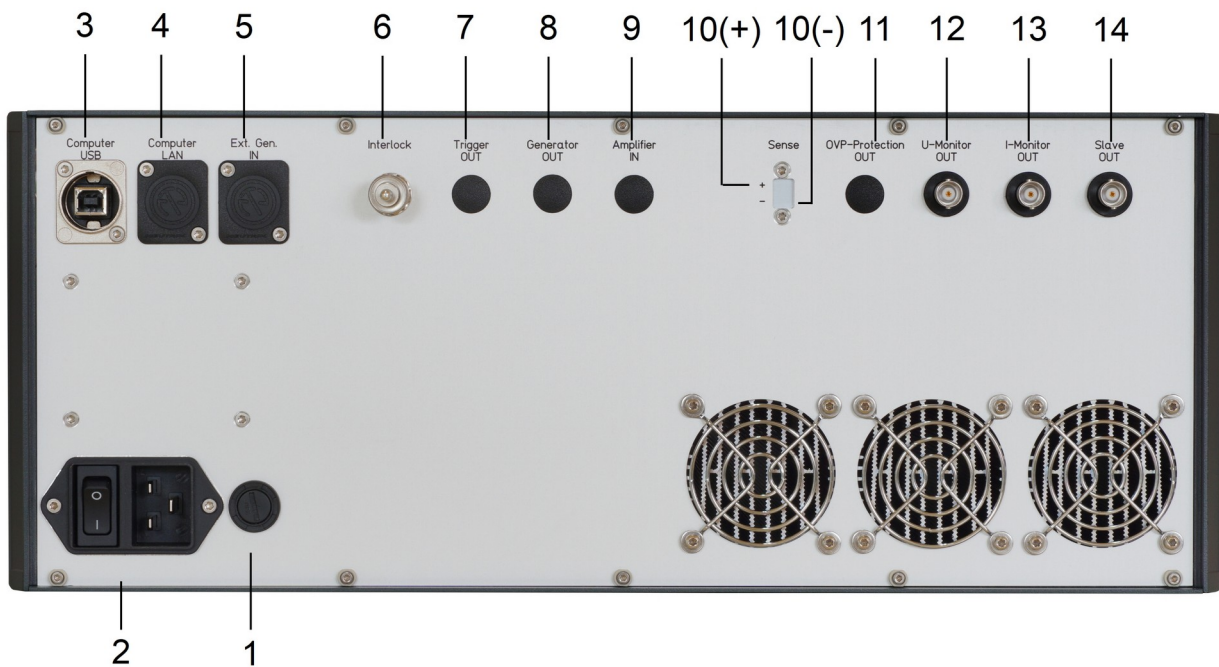


4 Control Software

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.



5 Pictures





6 Current Amplifier

In current control mode, the A1110-16-E 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	<i>Reserved for Option-01</i>			

The selection is made by our A1110-E-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. You can add additional networks to your amplifier. Up to six custom 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

Parameters	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 - 100 kHz, < 0.2% THD High Voltage Mode
	200 W	DC – 200 kHz, < 1% THD High Voltage Mode
3 Ohm Load	1000 W	DC - 30 kHz, < 0.2% THD High Voltage Mode
	800 W	DC - 100 kHz, < 0.5% THD High Voltage Mode
	450 W	DC - 200 kHz, < 1% THD High Voltage Mode
1 Ohm Load	350 W	DC – 200 kHz, < 0.5% THD Mid Voltage Mode
0.5 Ohm Load	175 W	DC – 200 kHz, < 0.5% THD Low Voltage Mode
Slew Rate	100 V/uSec	
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 High Voltage Mode



Parameters	Specification	Conditions/Moments
10 Hz - 80 kHz	< -112.5 dB	re +34.5 dBV, < 1% THD 8 Ohm Load High Voltage Mode
10 Hz – 200 kHz	< -110.5 dB	re +34.5 dBV, < 1% THD 8 Ohm Load High Voltage Mode
THD+N		
10 Hz – 100 kHz All Voltage Modes	< 0.03 %	1 W @ 8 Ohm
Output Offset	< 1.0 mV	DC
Output Impedance	< 60 mOhm	@1 kHz; Instrument: HP8751A, Network Analyzer
Power, Pulse, 40ms, 20% Duty Cycle		
Peak output		
3.1 Ohm	80 V, 25.8 A	High Voltage Mode
0.25 Ohm	7 V, 28 A	Low Voltage Mode
Current, Pulse, 500ms, 5% Duty Cycle, unipolar		
Peak Output		
60 mOhm	+ 55 A	+Umid / -Ulow
60 mOhm	- 55 A	+Ulow / -Umid
Power, Sinus, 100Hz, continuous		
3 Ohm	55.5 V, 18.5 A, 1026 W	< 1 % THD, High Voltage Mode
0.25 Ohm	4.75 V, 19 A, 90 W	< 0.5% THD Low Voltage Mode
Power, DC		
3 Ohm	45 V, 15 A, 675 W	Mid Voltage Mode
0.55 Ohm	13.5 V, 24.5 A, 330 W	Low Voltage Mode
Sink Power, DC	340 W	Low Voltage Mode; see U/I-Plot
Voltage Monitor	$\pm 100 \text{ mV} \cong 1 \text{ V} \pm 2\%$	
Current Monitor	High Current Range: $\pm 200 \text{ mV} \cong 1 \text{ A} \pm 2.5\%$	Shunt = 20 mOhm
	Low Current Range: $\pm 1.2 \text{ V} \cong 100 \text{ mA} \pm 1\%$	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)	



Parameters	Specification	Conditions/Moments
Operating Temperature	10 °C to 55 °C	
Humidity	80% or less	non-condensing
Cooling	Forced air	
Dimensions (W x H x D)	449 x 177 x 585.5 mm	
Weight	Approx. 30 kg	

The E series amplifiers are suitable for operation at three different operating voltages:

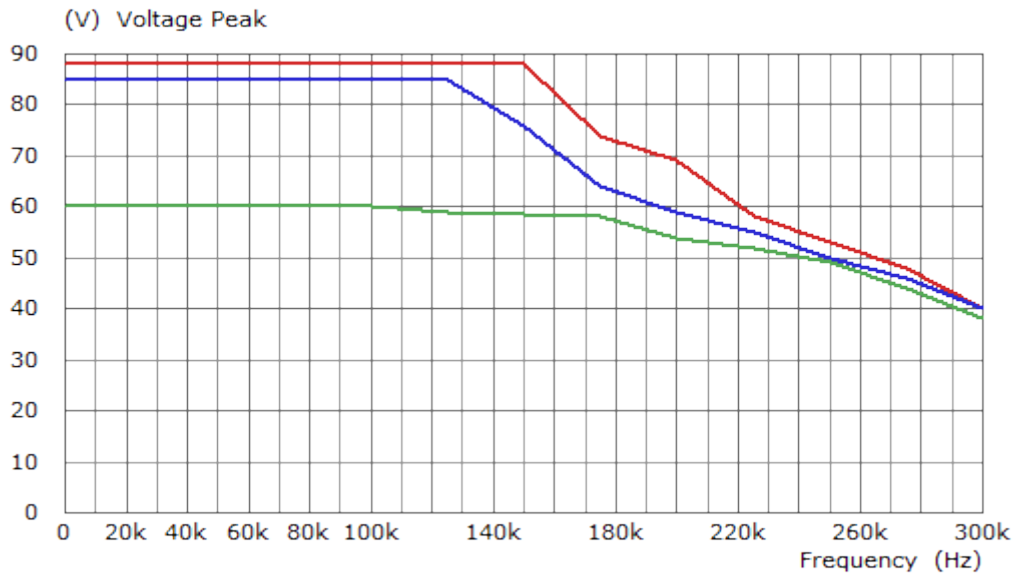
- high operating voltage (± 90 V) for high output voltages and low load currents
- medium operating voltage (± 60 V) for medium output voltages and medium load currents
- low operating voltage (± 30 V) for low output voltages and high load currents

To keep the dissipation power of the amplifier at a minimum the operating voltage should always be selected corresponding to the load.



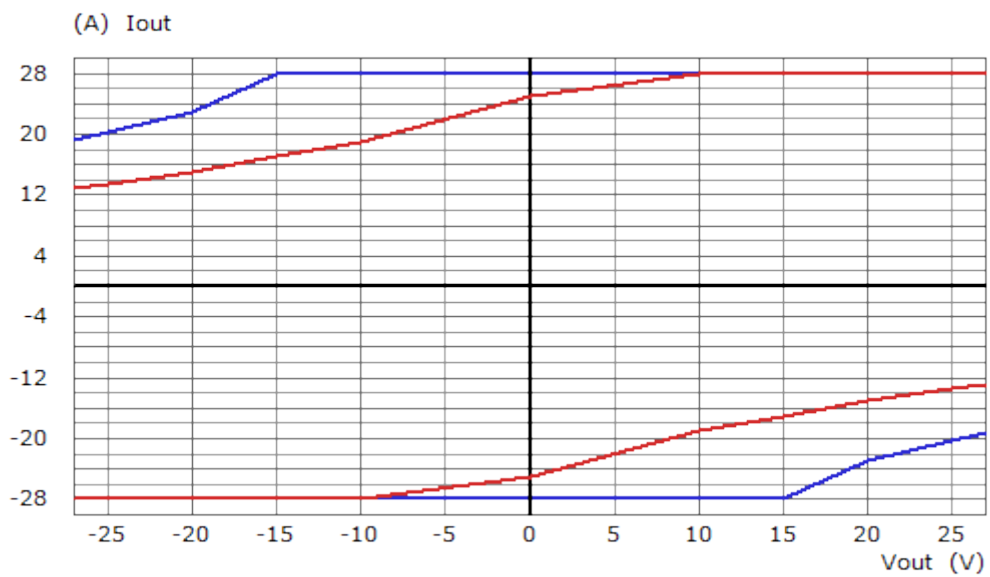
7.1 Output Voltage vs. Frequency (THD + N < 1%)

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



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

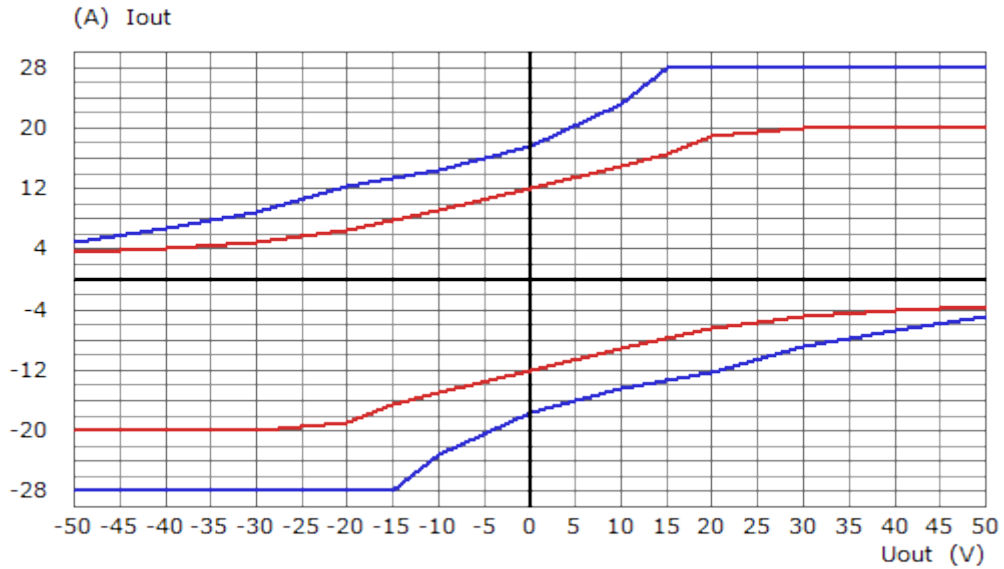
Supply Voltage: Low
Blue: AC Limit
Red: DC Limit





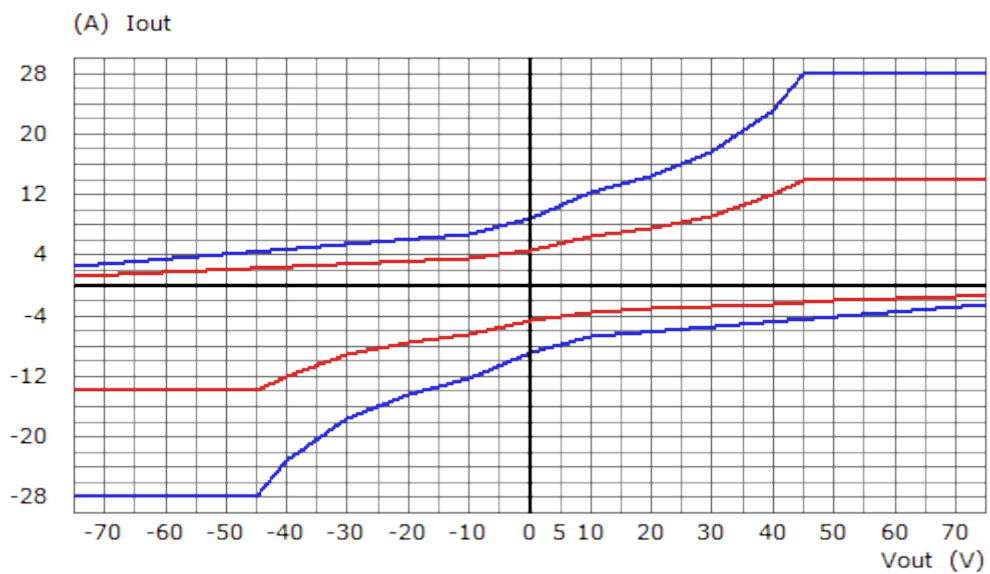
7.3 Output Current vs. Output Voltage (THD + N < 1%)

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



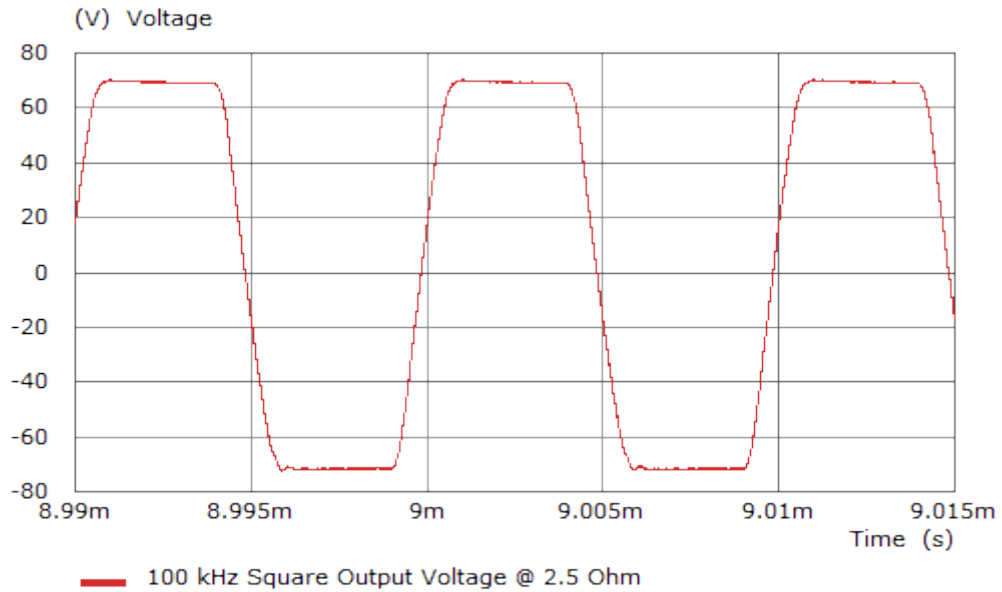
7.4 Output Current vs. Output Voltage (THD + N < 1%)

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



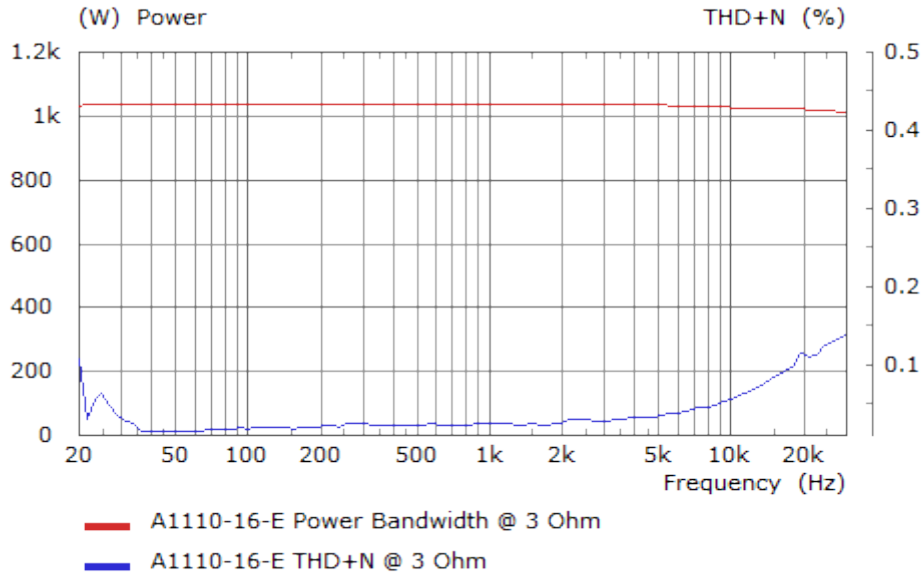


7.5 Square Wave at 100 kHz and 2,5 Ohm Load



7.6 Power Bandwidth at 3 Ohm Load

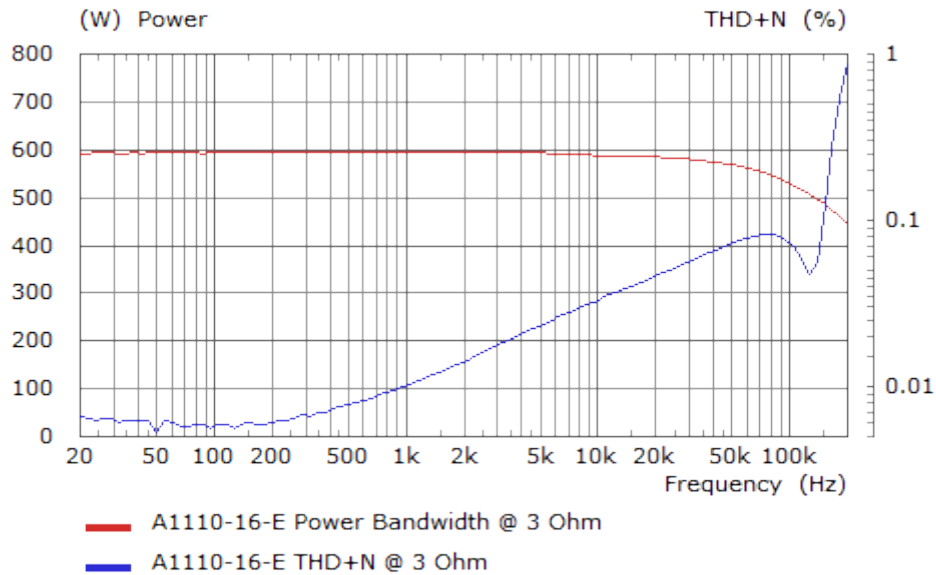
Input level normalised to max. output level at 30 kHz; THD+N < 1%





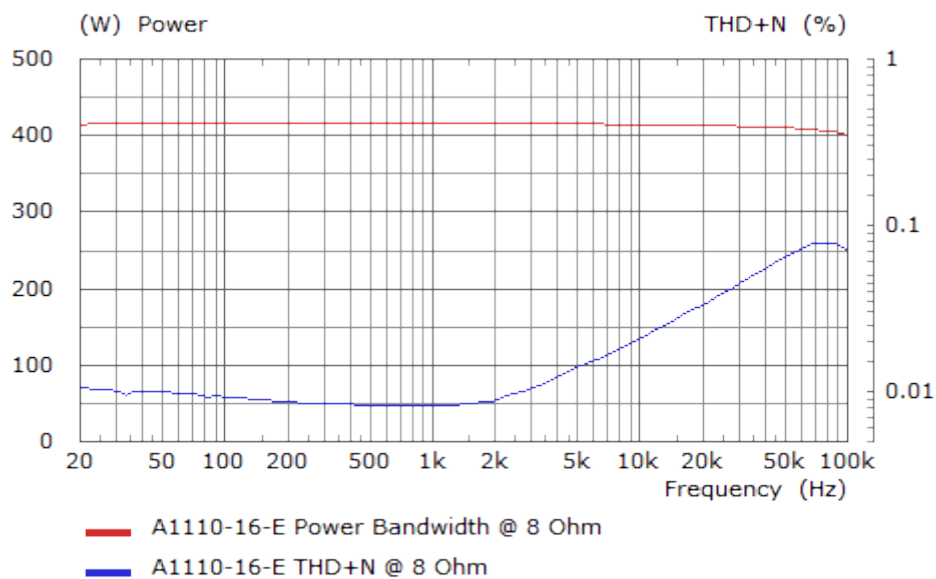
7.7 Power Bandwidth at 3 Ohm Load

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



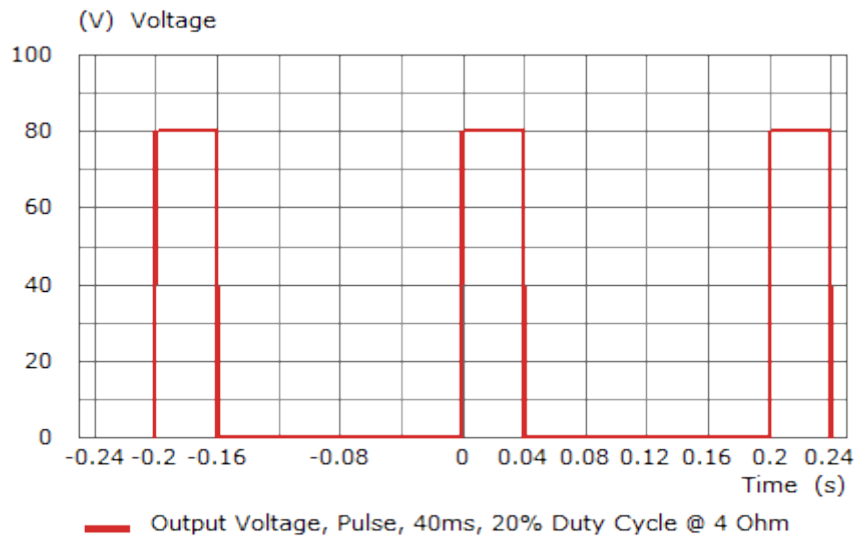
7.8 Power bandwidth at 8 Ohm load

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

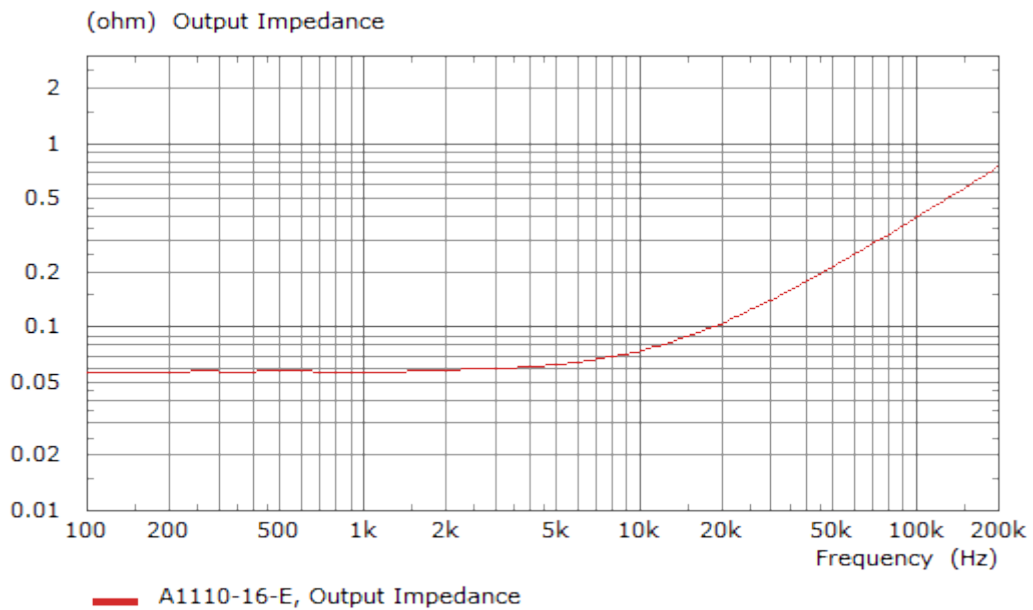




7.9 Pulse at 4 Ohm Load

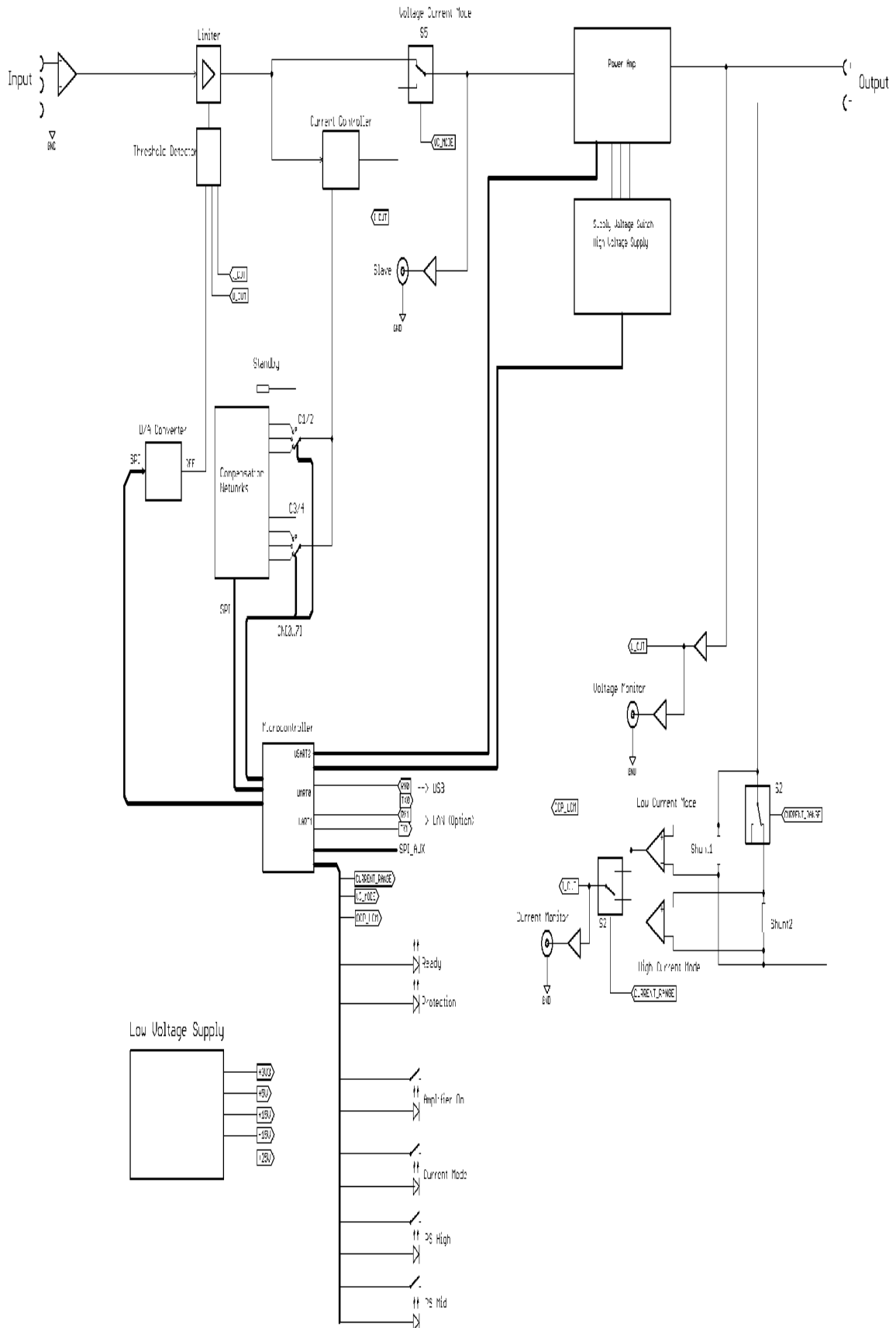


7.10 Output Impedance





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	Order Number
A1110-16-E	4-Quadrant Voltage and Current Amplifier	11100050
Option-01: Custom Current Amplifier	Additional compensation network for one specified load. The device is equipped with five general-purpose networks by default.	11101010
Option-02: Internal Current Measurement	High-performance current transformer; Precision DC +/-0.1%; Output BNC bush, galvanically isolated from the amplifier	11101020
Option-03: Ultra Stable Gain	Gain $10 \pm 0,1\%$ ($\pm 25\text{ppm}/\text{C}^\circ$); Offset $\pm 1\text{ mV}$ ($\pm 25\text{ uV}/\text{C}^\circ$)	11101030
Option-04: Basic Function Generator	DC, 0.05Hz - 300 kHz, sine, square, triangle; For usage with A1110-E-Control only.	11101040
Option-05: Isolation Amplifier	For potential isolation of input and output	11101050
Option-06: Ethernet Interface	For connection to a computer (RJ45)	11101060
Option-07: Displays for voltage and current	Displays for voltage and current (monitor outputs) in front panel	11101070
Option-08: Sensing	Adjustable voltage drop: 500 mV / 1V / 2V	11101080
Option-09: 100 V Output Voltage	Output Voltage up to $\pm 100\text{ V}$	11101090
Option-12: Adjustable Output Resistance	R: $0\text{ m}\Omega - 200\text{ m}\Omega$; Resolution $1\text{ m}\Omega$; Accuracy 0.5%	11101120
Option-14: Overvoltage Protection	For protection of amplifier outputs	11101210



10 Contact

Dr. Hubert GmbH
Dietrich-Benking-Str. 41
44805 Bochum - Germany
Tel. +49 234 970569-0
Fax. +49 234 970569-29
service@drhubert.de

Further information is available on our website www.drhubert.com.



11 Document History

Revision	Date	Changes
2.0	March 2020	First publication in new layout