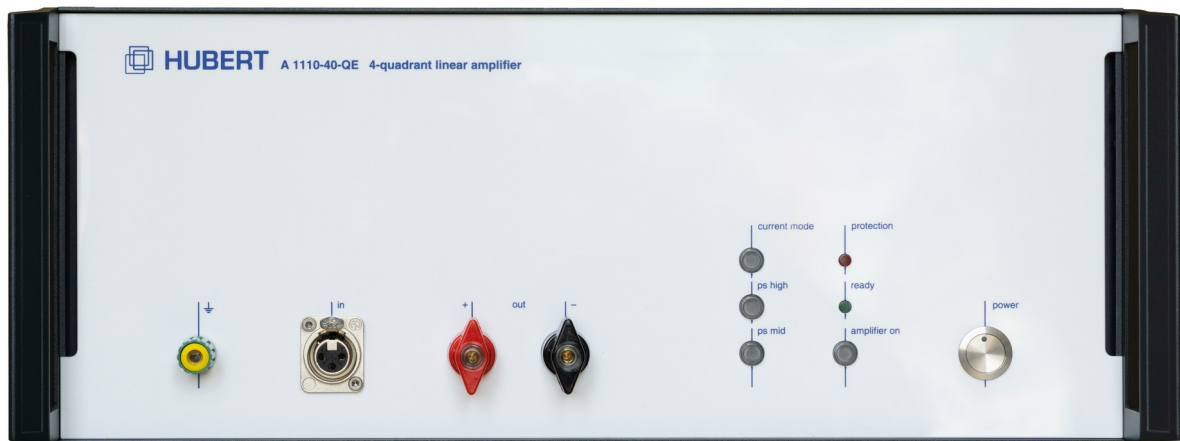


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Datasheet



A1110-40-QE

4-Quadrant Voltage and Current Amplifier
DC – 1 MHz



1 Product Description

The A1110-40-QE is a linear, extreme-broadband, precision power amplifier designed for all applications which require fast-changing signals with high performance.

The A1110-40-QE 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 1/10 which is associated with a corresponding reduction of the power loss.

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

The device is equipped with a temperature-controlled, quietly-running fan. As well as an over-temperature protection, 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 device can be operated by using elements on the front panel. Additionally the device can be controlled with the supplied A1110 Control Software via an USB connection.

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. $40 A_{\text{peak}}$
- Output current $80 A_{\text{peak}} / 10 \text{ ms}$
- 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
- Sensing Inputs
- Up to 6 configurable compensation networks for inductive loads in current amplifier mode. Four general-purpose networks are onboard per default.

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 scope of delivery includes an application software that ensures fully remote-controlled operation and comprehensive configuration of the amplifier via the USB or LAN interface. In this context, disclosure of the line commands guarantee trouble-free integration of existing automated test systems.

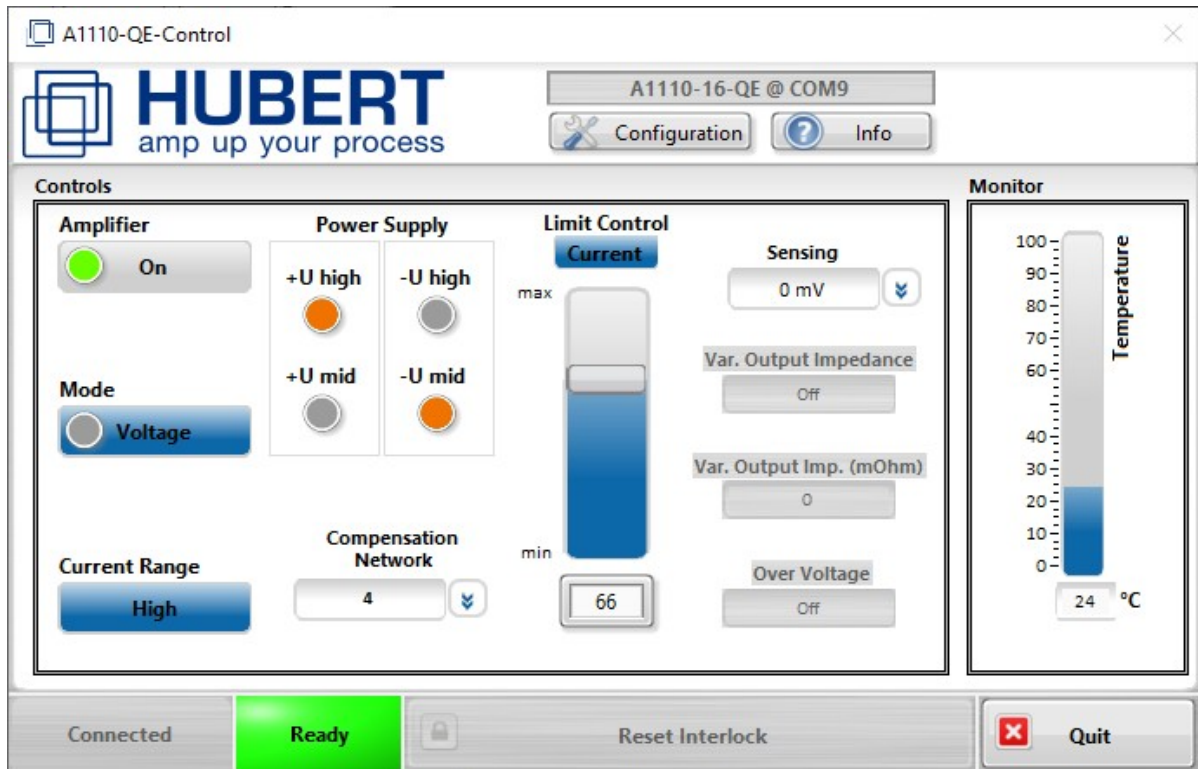


Figure 1: A1110-QE-Control Main Menu

5 Pictures



Figure 2: Back panel elements



6 Current Amplifier

In current control mode, the A1110-40-QE behaves like a voltage-controlled current source and delivers a nearly frequency-independent constant load current to an inductive load.

The following 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-QE-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	10V	< 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, @ 10 kOhm, High Voltage Mode
	DC - 1 MHz	+0, -3.0 dB, @ 10 kOhm, High Voltage Mode
Power Bandwidth	DC – 200 kHz	+0, -3.0 dB
Phase response	+0, -5 degrees	10 Hz - 30 kHz
Max. Output Current	$\pm 40 A_{dc}$	continuous
	$\pm 80 A_{peak}$	Pulse, width=5ms, duty cycle 0.25%, fix or automatic mode
Slew Rate	70 V/uSec	
Output Noise		
10 Hz - 22 kHz	< 354 μ V (< -69 dBV)	All Voltage Modes Input shorted 8 Ohm Load
10 Hz - 200 kHz	< 800 μ V (< -62 dBV)	All Voltage Modes Input shorted 8 Ohm Load
Signal-to-Noise Ratio		
10 Hz - 22 kHz	< -103 dB	re +34.5 dBV, < 1% THD 8 Ohm Load High Voltage Mode
10 Hz – 200 kHz	< -96 dB	re +34.5 dBV, < 1% THD 8 Ohm Load High Voltage Mode
Max. Output Power	1200 W	
Max. Sink Power	600 W	
Voltage Monitor	$\pm 100 \text{ mV} \cong 1 \text{ V} \pm 0.5 \%$	DC – 100 kHz
Current Monitor	High Current Range: $\pm 1 \text{ V} \cong 10 \text{ A} \pm 1 \%$	DC – 100 kHz Shunt = 5.4 mOhm



Parameters	Specification	Conditions / Moments
Gain		
Controlled Voltage Mode	1 V / 10 V; $\pm 0.1\%$ ($\pm 0.01\%/^{\circ}\text{C}$)	Uin / Uout
Controlled Current Mode	1 V / 10 A	Uin / Iout
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 177 x 585.5 mm	
Weight	Approx. 30 kg	

The A1110-40-QE is equipped with three operating voltages and the two auto and manual operating modes.

Mode	+operating voltage	-operating voltage
Auto	10 V, 35 V, 90 V	-10 V, -35 V, -90 V
Manual: + Umid	35 V	auto
Manual: + Uhigh	90 V	auto
Manual: - Umid	auto	-35 V
Manual: - Uhigh	auto	-90 V
Manual: + Umid, -Umid	35 V	-35 V
Manual: + Uhigh, -Umid	90 V	-35 V
Manual: + Uhigh, -Uhigh	90 V	-90 V
Manual: + Uhigh, -Uhigh	35 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 Pulse Response

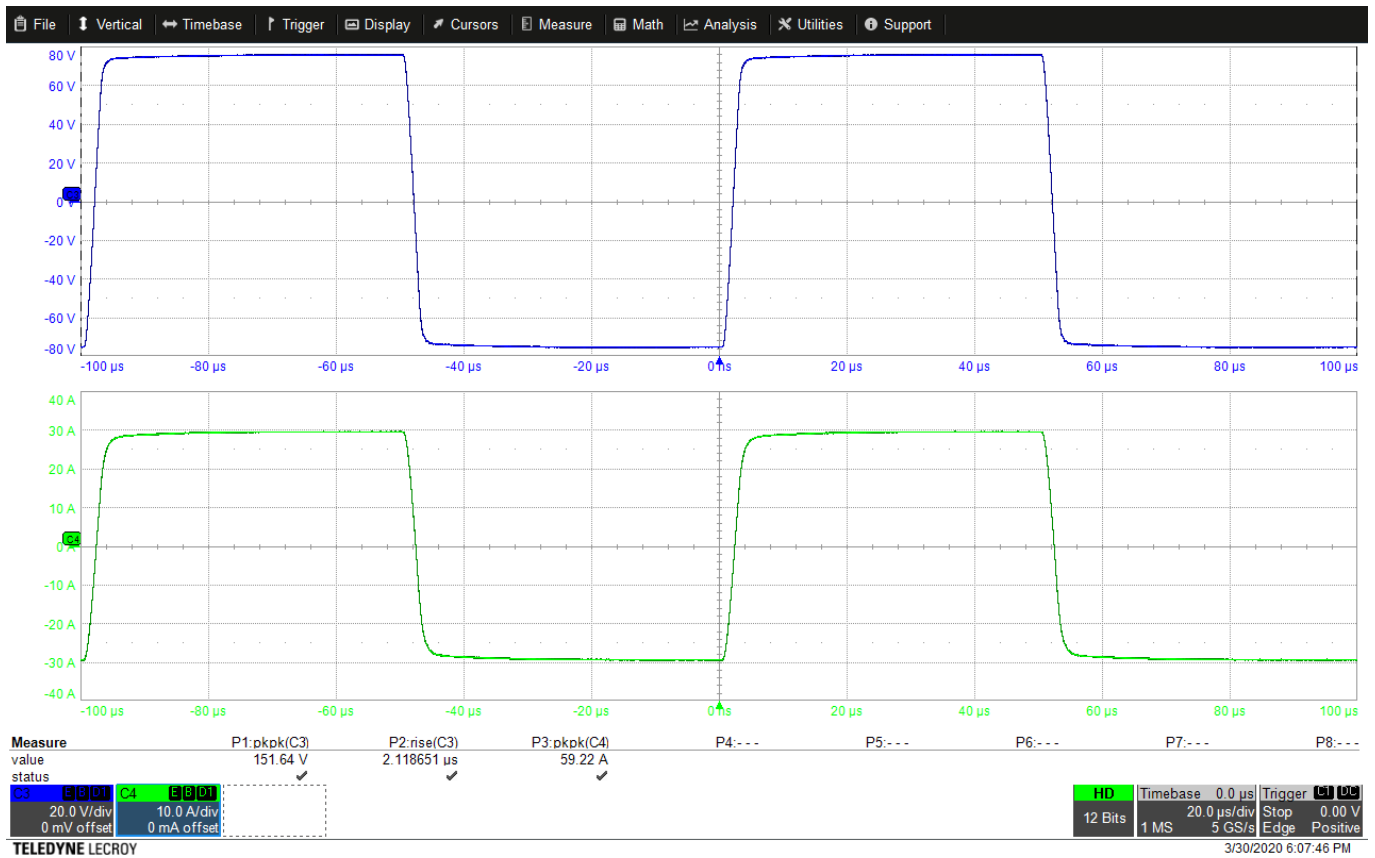


Figure 3: C3: Output Voltage; C4: Output Current
 V_{in} : 10 kHz, Load: 2,5 Ohm



7.2 Frequency Response

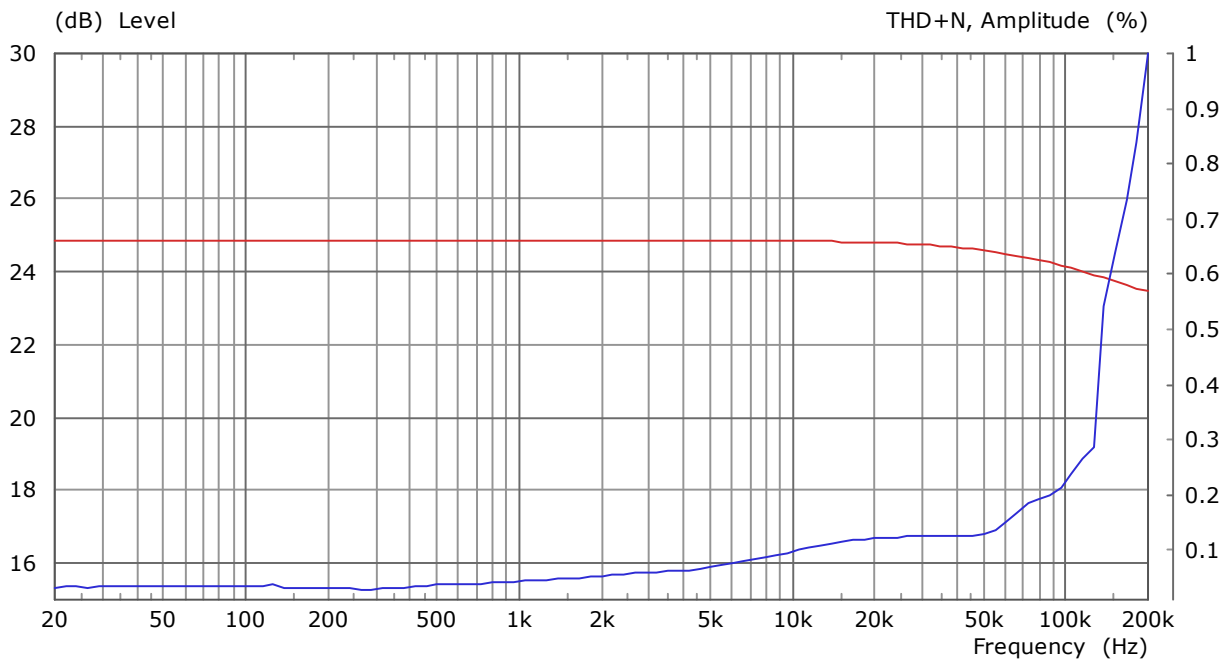


Figure 4: Output Voltage @ 1 Ohm

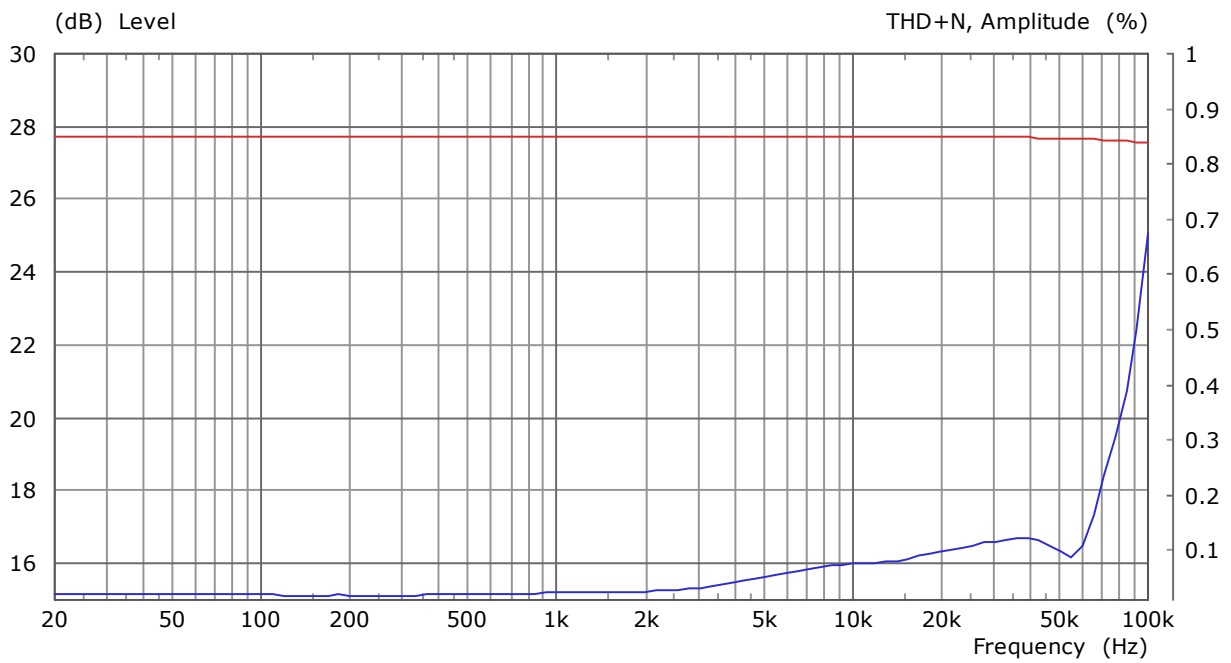


Figure 5: Output Voltage @ 2,5 Ohm



7.3 Output Current Capability via Output Voltage

Conditions	Output Voltage Range:DC, Auto Mode	Output Voltage, [Vpeak]	Max. Continuous Output Current, [Adc]	Peak Output Current for 500ms, dc=5%[Adc]
DC, Auto Mode	1./3. Quadrant	75	16	40
		70	15	40
		65	15	40
		60	15	40
		55	15	40
		50	14	40
		48	12	40
		40	11	40
		35	10	40
		30	10	40
		24	40	80
		20	38	80
		18	35	80
		16	31	80
		14	28	80
		12	26	80
		10	23	80
8	22	80		
6	20	80		
4	19	80		
DC, Auto Mode	2./4. Quadrant	75	7	40
		70	7	40
		65	8	40
		60	8	40
		55	9	40
		50	10	40
		48	10	40
		40	12	40
		35	13	40
		30	15	40
		24	18	80
		20	20	80
		18	22	80
		16	23	80
		14	26	80
		12	28	80
		10	31	80
8	34	80		
6	39	80		
4	40	80		



Conditions	Output Voltage Range:	Output Voltage, [Vpeak]	Max. Continuous Output Current, [Ap]	Peak Output Current for 500ms, dc=5%[Adc]
1Hz-10kHz, Auto Mode	1./3. Quadrant resistive load	75	32	80
		70	32	80
		65	32	80
		60	30	80
		55	34	80
		50	29	80
		48	26	80
		40	23	80
		35	21	80
		30	19	80
		24	40	80
		20	40	80
		18	40	80
		16	40	80
		14	40	80
		12	40	80
		10	40	80
8	38	80		
6	38	80		
4	36	80		
1Hz-10kHz, Auto Mode	2./4. Quadrant inductive load	75	13	80
		70	14	80
		65	16	80
		60	17	80
		55	20	80
		50	21	80
		48	23	80
		40	28	80
		35	34	80
		30	40	80
		24	40	80
		20	40	80
		18	40	80
		16	40	80
		14	40	80
		12	40	80
		10	40	80
8	40	80		
6	40	80		
4	40	80		
1Hz-10kHz, Auto Mode	2./4. Quadrant active load	75	13	40
		70	13	40
		65	14	40
		60	15	40
		55	16	40
		50	18	40
		48	20	40
		40	23	40
		35	26	40
		30	30	40
		24	34	80
		20	37	80
		18	34	80
		16	34	80
		14	40	80
		12	40	80
		10	40	80
8	40	80		
6	40	80		
4	40	80		



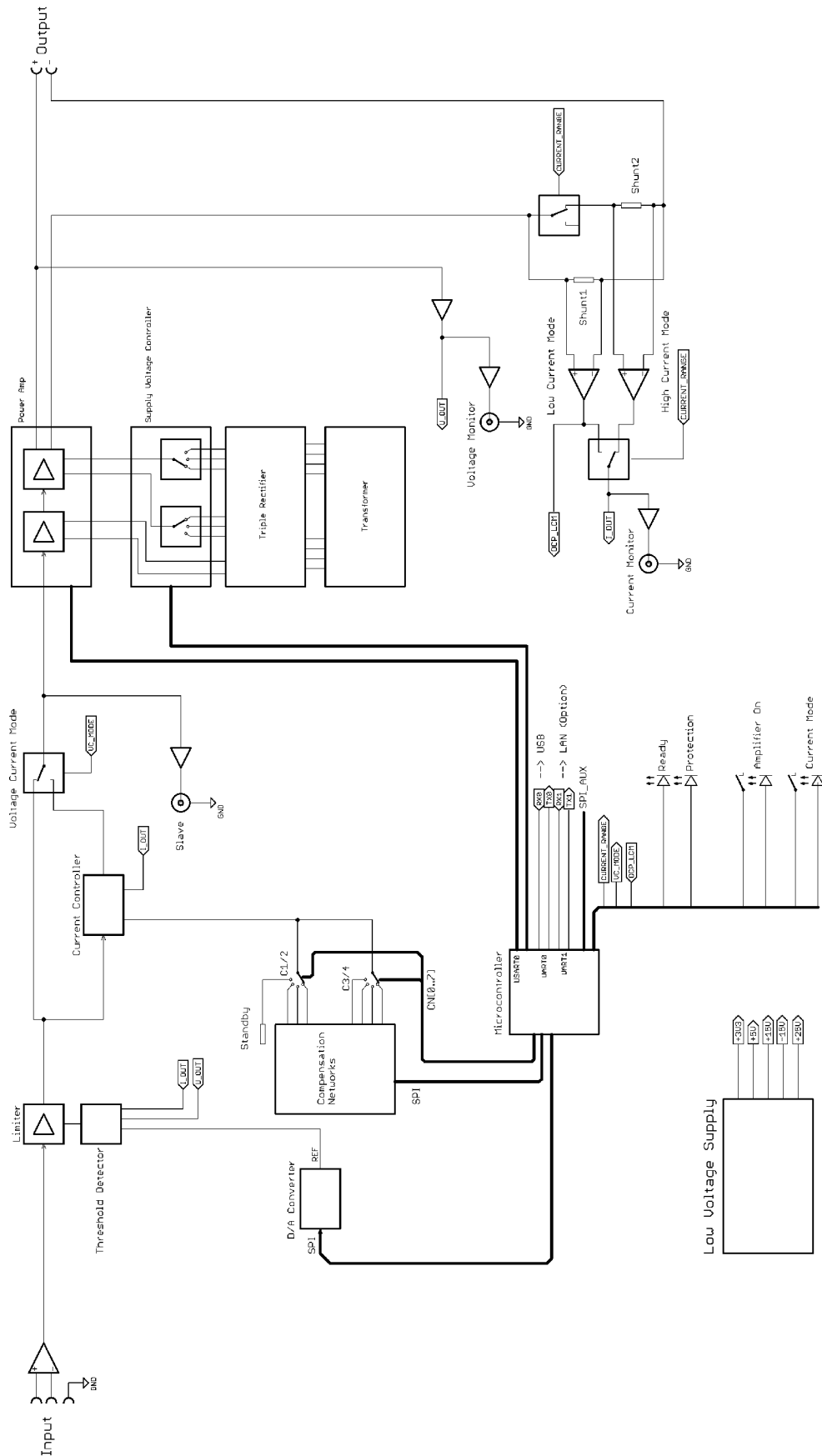
Conditions	Output Voltage Range:	Output Voltage, [Vpeak]	Max. Continuous Output Current, [Ap]	Peak Output Current for 500ms, dc=5%[Adc]
>1Hz, ps mid	1.Range: +30V/-30V			
	1./3. Quadrant	30	40	40
	resistive load	24	40	80
		20	40	80
		18	40	80
		16	40	80
		14	40	80
		12	40	80
		10	40	80
		8	40	80
		6	38	80
		4	38	80
>1Hz, ps mid	2./4. Quadrant	30	19	40
	inductive load	24	20	80
		20	23	80
		18	24	80
		16	28	80
		14	28	80
		12	30	80
		10	32	80
		8	32	80
		6	38	80
		4	38	80
	>1Hz, ps mid	2./4. Quadrant	30	17
active load		24	19	80
		20	20	80
		18	22	80
		16	23	80
		14	24	80
		12	25	80
		10	26	80
		8	27	80
		6	28	80
		4	30	80



	Output Voltage Range:	Output Voltage, [Vpeak]	Max. Continuous Output Current, [A _{dc}], Auto-Mode	Peak Output Current for 500ms, dc=5%[A _{dc}]
>1Hz, ps high	2.Range: +75V/-75V			
	1./3. Quadrant	75	32	60
	resistive load	70	32	60
		65	32	
		60	34	60
		55	32	60
		50	29	60
		48	26	60
		40	23	60
		35	21	60
		30	19	80
		24	18	80
		20	17	80
		18	16	80
		16	16	80
		14	14	80
		12	13	80
		10	13	80
		8	12	80
	6	12	80	
	4	11	80	
>1Hz, ps high	2./4. Quadrant	75	1	40
	inductive/active load	65	1	40
		60	1	40
		55	2	40
		50	2	40
		48	2	40
		40	3	40
		35	3	40
		30	3	40
		24	5	40
		20	5	40
		18	5	40
		16	5	40
		14	6	40
		12	6	40
		10	7	40
		8	7	40
		6	7	40
		4	7	40



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
A1110-40-QE	4-Quadrant Voltage and Current Amplifier	11100080
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-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	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-10: Internal Current Measurement	High-performance current transformer; Precision DC $\pm 0.1\%$; Output BNC bush, galvanically isolated from the amplifier	11101100
Option-11: Voltage and Current Displays	Display in front panel (monitor outputs)	11101110
Option-12: Adjustable Output Resistance	R: 0 m Ω – 200 m Ω ; Resolution 1 m Ω ; Accuracy 0.5%	11101120
Option-14: Overvoltage Protection	For protection of amplifier outputs	11101210

10 Contact

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11 Document History

Revision	Date	Changes
2.0	March 2020	First publication in new layout