HUBERT
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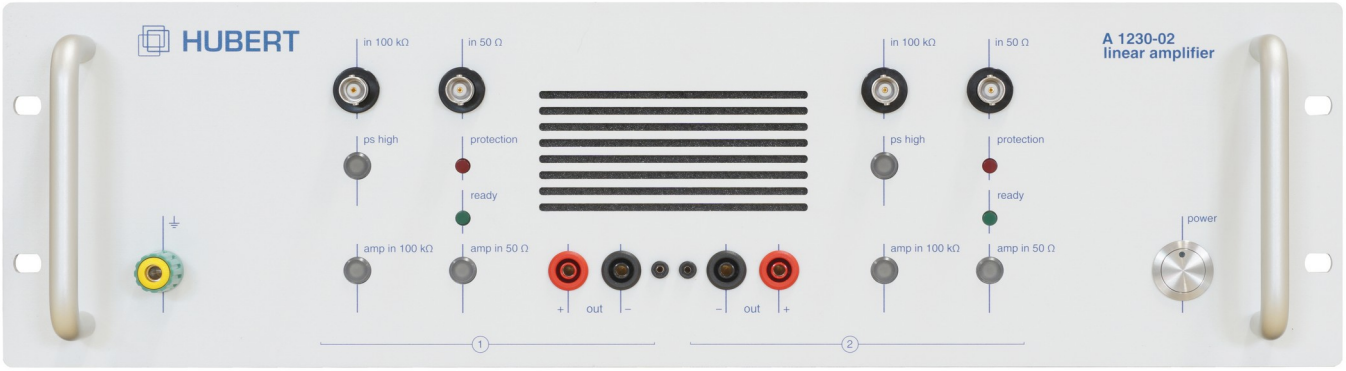
# Operating Manual




# A1230-02

## 4-Quadrant Voltage Amplifier (2-Channel)

MADE IN GERMANY

v5

# Contents

# 1 Introduction

## 1.1 Product Description

The A1230-02 is a linear, extremely wideband precision power amplifier. It is ideal for all applications that require fast changing signals at any purely resistive and complex loads.

The A1230-02 has two summable inputs per channel with 50 Ω and 100 kΩ input resistance; the 50 Ω input makes it the ideal downstream equipment for conventional function generators.

Two optional operating voltages are available for high-voltage/low-current or low-voltage/high-current applications. Especially in case of very low-impedance loads, choosing the low operating voltage leads to a considerable reduction of the power loss and a higher output current.

If higher output voltages are required, the preamplifier output ( Bridge Out ) allows a simple set-up of a bridge circuit with the second channel of the A1230-02 for doubling the output voltage.

Use the plug-on adapter box to easily connect both channels in parallel if more current is required. Operation with equal output signals is strictly required in this setup.

The device is equipped with a temperature-controlled, low noise fan. It also features an over-temperature protection. A power-loss calculation and an absolute-current monitoring guarantee perfect short-circuit and overload protection. The operation is implemented over the operating elements on the front panel. In addition, the amplifier is fully remote controllable via the USB port using a simple byte protocol.

If even higher output voltages or higher output currents are required, configurations with series or parallel connections of several A1230-02 are possible.

**NOTICE**

**Always read the enclosed data sheet**

The separate data sheet is part of these operating instructions and must also be read and understood. Device-specific modifications on customer request can only be found in the data sheet! The data sheet is part of the scope of delivery of the device and can be downloaded from our website www.drhubert.com.

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## 1.2 Scope of Delivery

- USB thumb-drive including
  - These operating instructions
  - Datasheet
  - Application software A1230-Multichannel-Control
- Power cable
- USB cable
- BNC wire (ca. 8 cm) for bridge operation
- connection cable for bridge operation
- Adapter box for parallel operation
- BNC wire (ca. 18 cm) for parallel operation
- BNC T-piece adapter for parallel operation

# 2 For Your Safety

## 2.1 Used Symbols and Notations

### 2.1.1 Warning Level

**DANGER**

Type and source of danger

Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

**WARNING**

Type and source of danger

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

**CAUTION**

Type and source of danger

Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury or property damage.

**NOTICE**

Type and source of danger

Indicates important information about the product or procedures that should be considered for the correct functioning of the device.

### 2.1.2 Used Warning Symbols

Warning about a dangerous voltage

Warning about general danger

Description of what should be done or what to pay attention to

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## 2.2 General Safety Advice

The following general safety instructions must be observed during the use of this device. Disregarding this advice or specific warnings in this manual will violate safety standards in the intended uses of this equipment.

The manufacturer is not responsible for consequences resulting from disregarding the advice and warnings.

**DANGER**

**Electrical voltage – Danger of electric shock**

**Parts under voltage:**
Always cover all parts under voltage that inevitably arise during operation.

**Touching of cables, sockets and plugs:**
Never touch the contacts of cables, sockets or plugs directly after disconnecting them, as there is a risk of electric shock.

**Contact between amplifier outputs and PE:**
Touching an amplifier output and PE at the same time can result in a life threatening electric shock.

**Earth the device:**
The device fulfills the requirements for protection class I. To avoid the risk of electric shock, the device housing must be earthed and therefore always operate the device via the supplied three-core power cable with protective conductor. The mains cable may only be plugged into a grounded socket with a protective earth contact. An interruption of the protective earth conductor inside or outside the device reduces the safety of the device and is prohibited.

**Safety Regulations for the work with electrical equipment:**
- Disconnect mains!
- Prevent reconnection!
- Test for absence of harmful voltages!
- Ground and short circuits!
- Cover or close of nearby live parts!

**Do not open the housing:**
Covers must not be removed by the operating personnel. Maintenance and repair work is reserved exclusively for qualified service personnel.

**CAUTION**

**Important notes**

The device must be used exclusively for its intended purpose.

The device is only approved for operation within the connected loads specified on the type label.

Do not insert any mechanical parts, especially metal parts, into the device through the ventilation slots.

Protect the unit from moisture, humidity and condensation. Avoid using liquids near the device.

Never connect loads while the amplifier outputs are switched on.

Operate the device exclusively on the public power supply system (no generators/UPS).

To avoid personal injury and property damage, make sure that the equipment and components used in the test are not overloaded. Read all operating instructions for the devices used thoroughly and ensure that all defined device limits are adhered to. If there are doubts about the suitability of the devices for the test to be performed, contact the manufacturer of the device.

## 2.3 Intended Use

### 2.3.1 Hardware

The device is intended exclusively for use as an LF power amplifier. Typical applications is the operation as voltage amplifier on passive loads. Active loads are only permitted under certain conditions in agreement with the manufacturer.

**CAUTION**

**Operation on active loads**

Active loads are only permitted under certain conditions in agreement with the manufacturer.

The device may only be operated within the technical data and under the ambient conditions specified in this manual.

Changes to the device are not permitted without the consent and release of the manufacturer. Proper and safe operation of the device requires correct installation and careful operation. This manual is part of the device and must always be accessible to the user. Observe all safety regulations listed in this manual.

**CAUTION**

**The improper use leads to the exclusion of any liability claims.**

The operator alone is liable for all damage caused by improper use.

### 2.3.2 Software

'A1230 Control' is software developed to control and configure HUBERT power amplifier. Take into account technical data and applications described in this manual. Changes to the software are not permitted without the consent and release of the manufacturer. Proper and safe operation of the software requires correct installation and careful operation. This manual is part

of the software and must always be accessible to the user. Observe all safety regulations listed in this manual.

## 2.4 User

Operation may only be performed by qualified persons.

**CAUTION**

**Reading and understanding the operating instructions**

Never use the device without having read and understood the operating instructions. Always contact the manufacturer if you have any questions.

Qualified persons within the meaning of the safety instructions in this manual are authorized persons for commissioning and operating systems in accordance with the standards of safety technology.

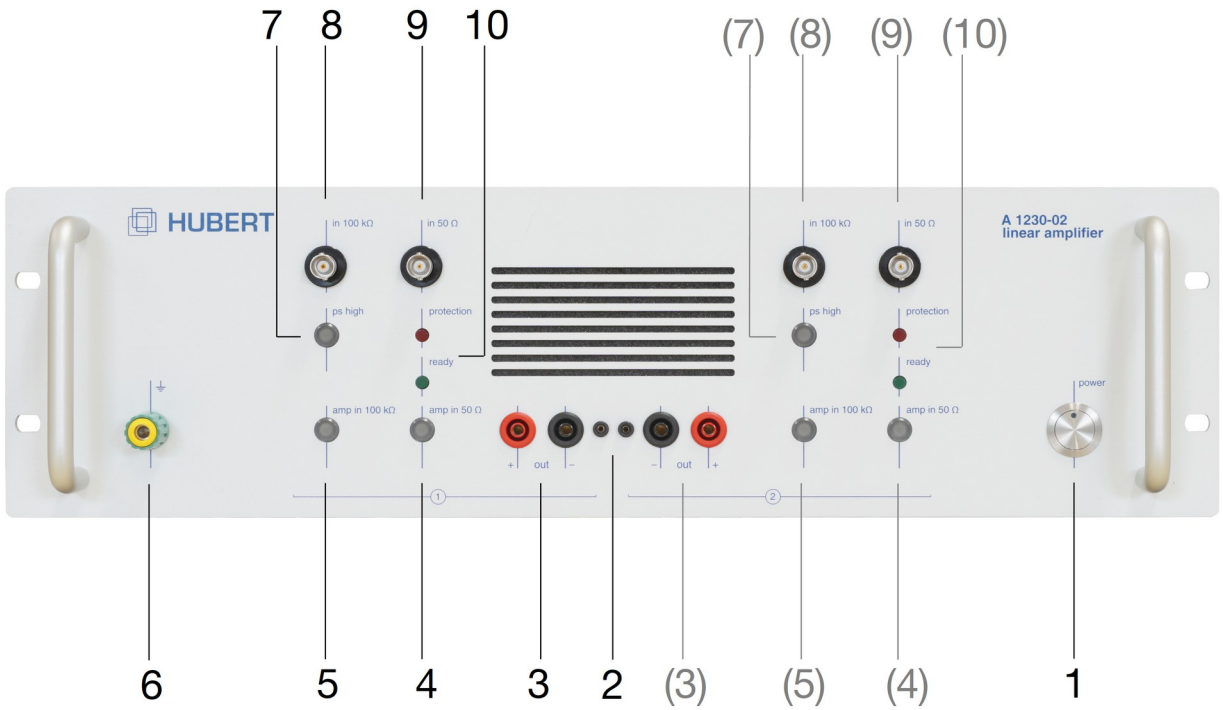
**DANGER**

**Risk of injury in case of insufficient qualification**

Improper work can lead to personal injury and damage to property. Any work may only be carried out by persons who have the necessary training, knowledge and experience.

# 3 Operating Elements

## 3.1 Front Panel Elements




Each of the two amplifier channels has its own front panel elements (3, 4, 5, 7, 8, 9, 10).

### [1] POWER BUTTON

On / Off switch.

(The switchover between ready to operate / standby is implemented here. The standby mode is signaled by the weakly-lit, blue LED. The main power supply disconnection is done with the switch on the rear side.)

### [2] SAFETY SHUTDOWN 1 / 2

2 mm jacks to connect the safety shutdowns of both channels. If connected, a safety shutdown on one channel triggers the safety shutdown on the other channel. This shutdown is indispensable and is provided automatically if the adapter box for parallel operation is used. Using the safety shutdown is recommended in series operation as well.

### [3] OUT+ / OUT-

4 mm safety sockets, amplifier output
Reference potential (negative-socket) is connected to protective earth via 1 MΩ.

### [4] AMP IN 50 Ω BUTTON

OFF: 50 Ω input is switched off
ON: 50 Ω input is switched on

### [5] AMP IN 100 KΩ BUTTON

OFF: 100 kΩ input is switched off
ON: 100 kΩ input is switched on

### [6] GROUND SOCKET

Connection to the protective conductor potential.

### [7] POWER SUPPLY HIGH / LOW BUTTON

Changing of the operating voltage

| | |
|---|---|
| HIGH (LED on): | High operating voltage (ca. ± 90 V) |
| LOW (LED off): | Low operating voltage (ca. ± 45 V) recommended for low-impedance loads |

### [8] IN 100 KΩ

100 kΩ Signal input; isolated BNC socket
Reference potential is connected to protective earth via 1 MΩ.

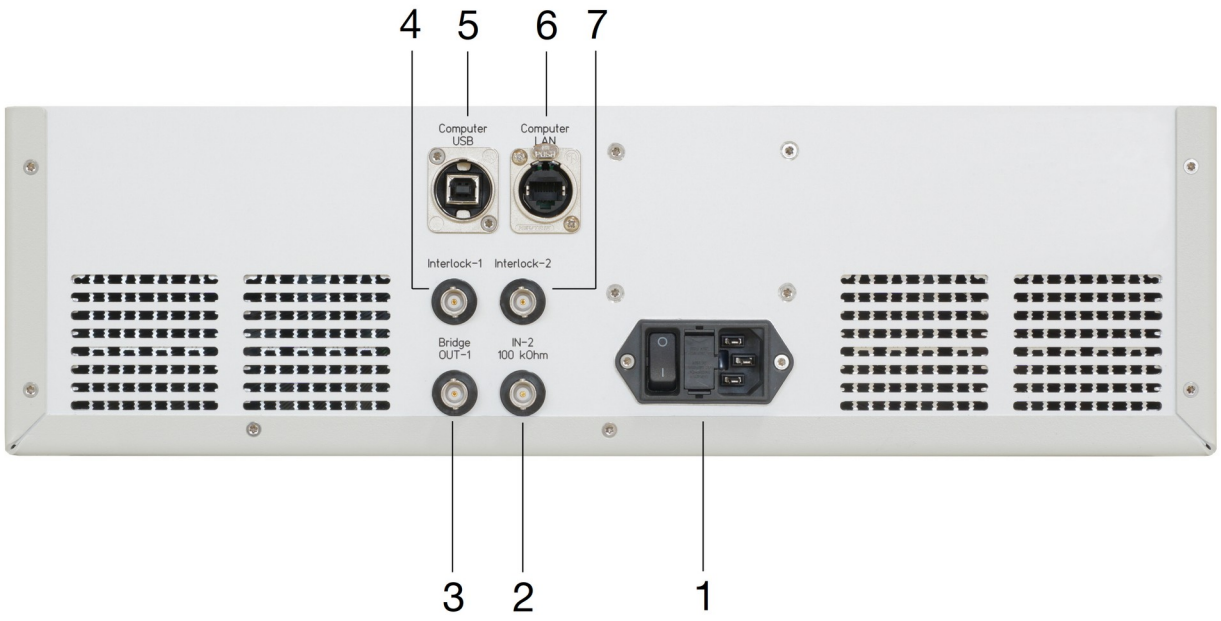
### [9] IN 50 Ω

50 Ω Signal input; isolated BNC socket
Reference potential is connected to protective earth via 1 MΩ.

### [10] READY/PROTECTION LED

| | |
|---|---|
| Green: | Indicates ready for operation |
| Green LED lights up constantly: | Amplifier is ready for operation. |
| Green LED flashes slowly (≈1/s): | Output relay is switched off |
| Red: | Signals the intervention of a protection mechanism. |
| Red LED lights up constantly: | Over-temperature protection; the device switches on automatically after a drop in temperature. |
| Red LED flashes slowly (≈1/s): | Shutdown because of exceeding the permissible power loss or output current. |
| Red LED flashes rapidly (≈3/s): | Hardware fault. The device must be sent to the manufacturer |

## 3.2 Rear Panel Elements




### [1] PLUG FOR NON-HEATING APPARATUS (C13) WITH MAINS SWITCH AND FUSEHOLDER

Fuse 4AT (5x20 mm)

### [2] IN-2 100 KΩ BNC SOCKET

100 kΩ signal input; isolated BNC socket
Reference potential is connected to protective earth via 1 MΩ.
Connect to socket [3] in bridge operation.

### [3] BRIDGE OUT BNC SOCKET

Inverted preamp output for simple setup of bridge circuits

### [4] INTERLOCK 1

BNC socket with shorting plug

Remote-controlled safety shutdown allows to turn off the amplifier via an external switch (breaker, normally closed contact)

If safety shutdown was triggered: AMPLIFIER ON LED is OFF and READY LED is ON

### [5] COMPUTER USB

USB-socket for connecting to a computer (emulated COM-Port)

### [6] COMPUTER LAN

Ethernet socket (RJ-45) for connecting to a computer

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## [7] INTERLOCK 2

BNC socket with shorting plug

Remote-controlled safety shutdown allows to turn off the amplifier via an external switch (breaker, normally closed contact)

If safety shutdown was triggered: AMPLIFIER ON LED is OFF and READY LED is ON

# 4 Operating Instructions

## 4.1 General Notes

Provide for sufficient space behind and in front of the amplifier, so that air can circulate through the device unobstructed. Cool air is sucked through the slots at the left and right side of the front panel. First connect the amplifier with the mains power connection after input/output are wired. Allow the amplifier a warm-up phase of 15 minutes after switching on, for the stabilization of its operating points.

## 4.2 Operating Voltages

Before the *amplification* begins, some considerations relating to the selection of the operating voltage are recommended for an effective and safe operation of the A1230-02 (see also White Paper No.1: HUBERT Power Amplifier on our website).

The amplifiers have two operating voltages:

- High operating voltage (±90 V) for high output voltages and low load currents
- Low operating voltage (±45 V) for low output voltages and high load currents

In order to keep the power loss of the amplifier low, the operating voltage should always be selected according to the load.

**Example:**

The load current $I_L$ should be 2 $A_{DC}$.

Load 1: $R_L$ = 25 i

For $I_L$ = 2 $A_{DC}$ an output voltage $U_A$ = 50 $V_{DC}$ is required ($U_A = I_L * R_L$). The power loss $P_V$ at the power amplifier results from the voltage drop at the power stage multiplied by the current through it.
$P_V = (U_B - U_A) * I_L = ( 90 V - 50 V_{DC}) * 2 A_{DC} = 100 W$

Load 2: RL = 5 i

For the same load current $I_L$ = 2 $A_{DC}$ an output voltage $U_A$ = 10 $V_{DC}$ is required. The power loss at high operating voltage is thus:
$P_V = (U_B - U_A) * I_L = ( 90 V - 10 V_{DC}) * 2 A_{DC} = 160 W$

If a change is now made to the operating voltage $U_{low}$, the following display results:
$PV = (U_B - U_A) * I_L = ( 45 V - 10 V_{DC}) * 2 A_{DC} = 70 W$

As you can see from this example, it makes more sense to use the amplifier at low-impedance loads with low operating voltage. For AC signals, the calculations would be much more complicated, but the ratios remain basically the same. Particularly with complex loads, a phase shift between output voltage and current is an aggravating factor, which leads to additional losses in the amplifier. For high impedance loads usually an operation with high operating voltage is required in order to reach the maximum output voltage.

A diagram with the maximum output voltages and output currents ( UI plot ) is located in the data sheet. For frequencies > 10 Hz, the permissible output currents are higher, since the load is

distributed over both power amplifier sides here. However, a general statement about the permissible currents is very difficult, since there is a great dependence on the connected load.

## 4.3 Connecting the Signal Source (Single Channel)

The A1230 has two unbalanced signal inputs with BNC connector and different input resistances of 50 Ω and 100 kΩ. Connect a 50 Ω signal source (for instance Function Generator), the output voltage is the same at both inputs, since the gain at 100 kΩ input v = 10 and at 50 Ω input
v = 20, and thus the voltage halving by source and input resistance compensates. In short signal lines < 2 m it does not matter which input you choose. For longer lines the 50 Ω input is recommended in order to avoid reflections and to ensure signal integrity. However, the source must provide the necessary output power available to drive the 50 Ω input load (3,75 V / 50 Ω = 75 mA → 3,75 V * 75 mA = 281,25 mW).

## 4.4 Connecting the Load (Single Channel)

The output of the A1230 is provided with 4 mm safety sockets at the power output. With the cabling of your load, please also ensure sufficient contact protection; life-threatening voltages can occur.

For safe and stable operation, the cables should be as short as possible and of similar length. The cable cross section should not fall below 1.5 $mm^2$.

The A1230 is a fast broadband amplifier that can deliver fast pulses with very high currents. Please remember that the wiring can contribute a significant proportion to the inductance of your load. In critical cases you should draw a coaxial wiring into consideration.

The A1230 is stable at all complex loads. Since the output impedance of the amplifier will get inductive at higher frequencies, this may lead to a significant overshoot with capacitive loads only. This behavior does not indicate a possible instability of the amplifier, but is established due to an excited series resonant circuit of output- and line-inductance and the connected capacity. A damping of the resonant circuit by series resistors is recommended in this case.

## 4.5 Operational Startup

Connect the mains cable and switch on the mains voltage at the mains switch. The illuminated **Power** button signals *Standby* and you can switch on the device.
After a short time, **ready** lights up and the amplifier is now ready to operate.

Select the best operating voltage for your load and connect it to one or both signal inputs of your source(s). You can activate the respective input(s) with the illuminated 50 i and 100 ki buttons to start the signal processing.

Start the software when needed and establish a data connection to the amplifier. You will receive additional data/information concerning the operating status of your amplifier.

The software also allows you to switch off the output relay to separate the amplifier from your load with high impedance (100 ki to signal ground).

You can also activate the slew rate limiter via the software. If the amplifier is fast enough for your input signal, you should deactivate the slew rate limiter to have the maximum of large signal bandwidth available. If the slew rate limits the output signal, significant overshoot may occur. This is for example the case when using fast square wave signals. An active slew rate limiter will limit the drive signal in such a way that no significant overshoots will occur.

## 4.6 Safety shutdown

The amplifier has a multi-stage safety concept, which permanently monitors the permissible limits of the amplifier and immediately switches off the amplifier if they are exceeded!

**NOTICE**

A safety shutdown is always an emergency and not a normal case!

Each safety shutdown means a limit exceeding of the permissible parameters and thus stress for the amplifier. Therefore, any safety shutdown should be avoided and should under no circumstances represent a planned **limit** for a test!

The amplifier is protected against overtemperature of the heat sink. The amplifier switches off at a temperature of 75 $^{0}$C and switches on again automatically when it cools down to 50 $^{0}$C. If an overtemperature shutdown occurs, it should be checked that the amplifier can draw sufficient cooler air and that the ventilation openings are not blocked. An overtemperature of the transformer does not actually occur in practice and is rather an indication of a defect.

The strain on the amplifier is monitored by measuring the supply current of each side of the output stage. For signal frequencies below 10 Hz, the permissible limit value is halved, since especially with DC only one side of the output stage is loaded. For frequencies above 10 Hz, the strain is divided between both sides, and the permissible current is therefore correspondingly higher. In addition to this relatively slow shutdown, which is performed by a microprocessor, there is also a fast short-circuit current detection. If the current exceeds 7.5 A at high operating voltage and 15 A at low operating voltage, the amplifier switches off within 1 µs. Nevertheless, depending on the load case and the input signal, current peaks of 80 A and more can occur! As already mentioned, this means stress for the power amplifier. Too much stress can eventually lead to a defect.

To record the thermal load of the output stage, the measured supply current is multiplied by the transistor voltage applied. Thus, the instantaneous power dissipation on each output stage side

is recorded and integrated via a low-pass filter. This power value is also measured by the microprocessor and rated depending on the heat sink temperature. It can therefore happen that an initially permissible load leads to a shutdown due to the gradual warming of the amplifier. The advantage of this rather complex power dissipation measurement is that loads caused by a large phase angle between output voltage and current can be reliably detected and rated.

If a shutdown occurs, all input signals are switched off and the amplifier regulates its output voltage down to zero. But the output stage is still connected to the load with low impedance! This is a very safe method for almost all passive loads. For active loads, such as a battery, it would now feed a current back into the amplifier. This would be a safe method to destroy the amplifier!

**NOTICE**

The amplifier is only designed for the connection of passive loads!

If an active load is to be connected, it is mandatory to design and implement a concept for safe shutdown beforehand. In case of doubt, we are pleased to assist with advice and action.

Normally, the amplifier switches back to the Ready state approx. 10 s after shutdown. If the start configuration is set accordingly, the input may also be enabled again. To avoid endless loops of switch-on and switch-off, the error state will not be left again after six switch-offs. The device must be restarted for normal operation.

## 4.7 Interlock

The interlock is used to establish an externally controlled safety shutdown. Normally, the interlock is short-circuited via a direct connection between the inner conductor and the ground ring of the BNC-socket. If this connection is opened, e.g. by an opening door contact, the amplifier switches off the inputs directly. A restart by keystroke or remote control command is prevented.

If the contact is closed again, the further behavior depends on the settings. With Live, the input can be switched on again directly. With Latching, the internally stored interlock event must first be reset before the amplifier input can be enabled again. If the start configuration of the amplifier is defined in such a way that an input is to be switched on directly, this takes place after an interlock as well.

The interlock connection is switched off at the factory and must first be activated in the software or via a remote control command in order to be used. The selected setting is stored in the amplifier.

## 4.8 Bridged Operation

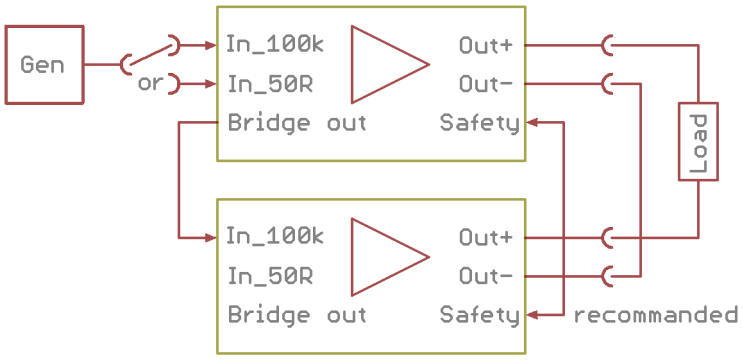


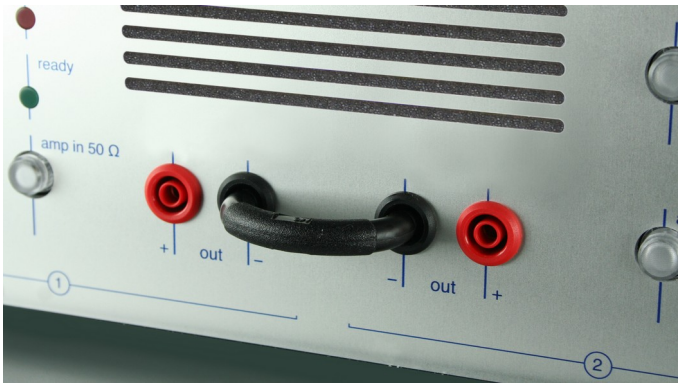

*Figure 1: Bridged Mode*

If the output voltage of the amplifier is not sufficient or if you need even higher slew rate the amplifier channels can be placed in a bridged mode. For this purpose the rear "Bridge Out-1" output of the first channel is connected to the 100 kΩ input of the second channel. In addition, the two OUT sockets on the front panel are connected with the shortest possible cable.

The 2 mm sockets between the OUT sockets connect the safety shutdowns of both amplifiers together. Although not absolutely necessary, this coupling is also recommended for the bridge circuit.

Connect "Bridge OUT-1" and "IN-2" with the supplied bridge cable:

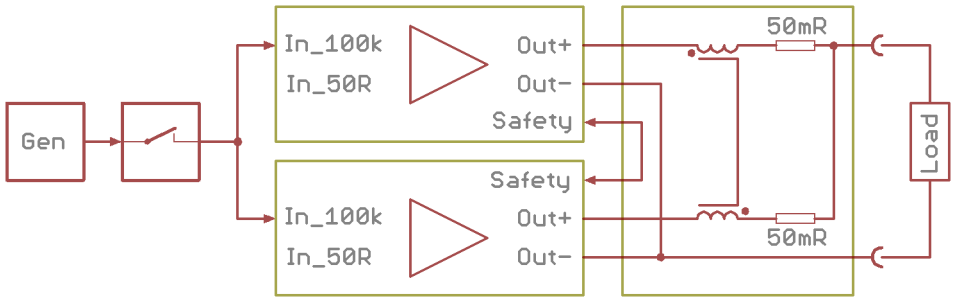

Also on the front panel connect both “minus-out” jacks via the supplied short cable.




Pay attention to identical settings of operating voltage and slew rate limiter of both amplifiers. If you switch on the 100 kΩ input of the second amplifier, you can control the complete output signal via the button of the selected input of the first amplifier.

In bridged mode each amplifier delivers half of the output voltage, since the second amplifier is driven inverted to the first. Thereby, the voltage at the load is no longer based on the rest potential!
A direct measurement of e.g. a grounded oscilloscope is no longer possible. In this case, a differential probe or similar must be used. In many cases, the missing resting potential is not a disadvantage, since the load requires no reference potential (for example, magnetic field coil, ultrasonic transducers, etc.)

## 4.9 Parallel Operation




If the output current of the amplifier is not sufficient, both amplifier channels can be placed in a bridged mode. The provided adapter box combines both outputs via 50 mΩ. These resistors are required to prevent unnecessarily high balancing currents caused by small differences in the output voltages (e.g. a DC offset).


At all times both amplifier channels must be operated with identical input signals. Therefore only use one signal generator and connect both 100kΩ inputs in parallel.

To prevent an overload at the generator, do not use the 50 Ω inputs. With the generator turned off start switching on the 100kΩ inputs. Do not use the 100 kΩ input switches or a remote control command but instead turn off your generator.

In parallel operation, always choose the same operating voltage and slew rate limiter settings for the amplifiers. Avoid exceeding the modulation limits. Small imbalances, e.g. in the limiting circuit, can otherwise lead to high equalizing currents and to a safety shutdown of the amplifiers!

If one amplifier switches off, the coupling of the safety shutdown ensures that the other amplifier also does not provide an output signal. Nevertheless, the amplifier is still switched on by its setting. If the first amplifier is now ready again after approx. 10 seconds and deactivates the safety shutdown, the second amplifier switches through again. In case of an applied generator signal, high equalizing currents would immediately drive the amplifier into safety shutdown. Consequently, you must switch off the generator signal within 10s after the first safety shutdown to prevent this problem.

# 5 A1230-MultiChannel-Control Software

## 5.1 Hardware and Software Requirements

To run the software, you need a computer running Windows 10/11 and a free USB port.

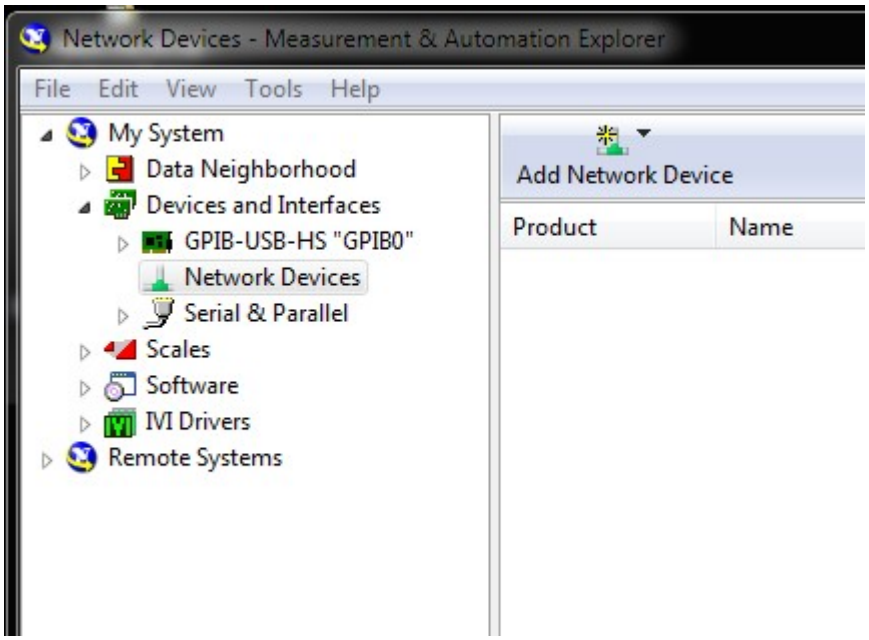
## 5.2 Installation of the Software

Insert the supplied USB stick into a USB port on your computer. Open the drive in Windows Explorer and locate to setup.exe.

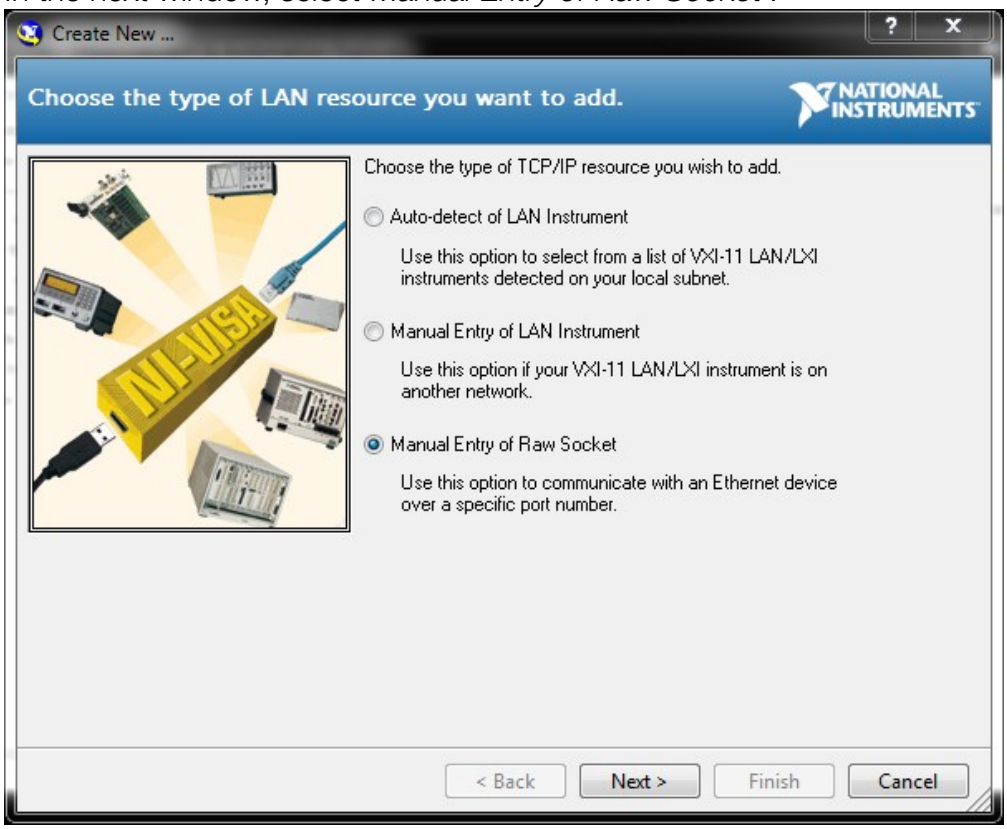
- Additional drivers and required additional programs are installed within the framework of the installation routine and require administrative access rights.
- The driver devices required for the device are tested and do not represent any security risk! The possible security risks documented by your operating system due to non-certified drivers can be ignored.
- Continue to follow the instructions on the screen.
- The installation program generates the directory A1230-MultiChannel-Control.
- To use LAN, the interface must be installed as a so-called raw device in NI Measurement and Automation Explorer.

## 5.3 Configuring LAN in Measurement and Automation Explorer

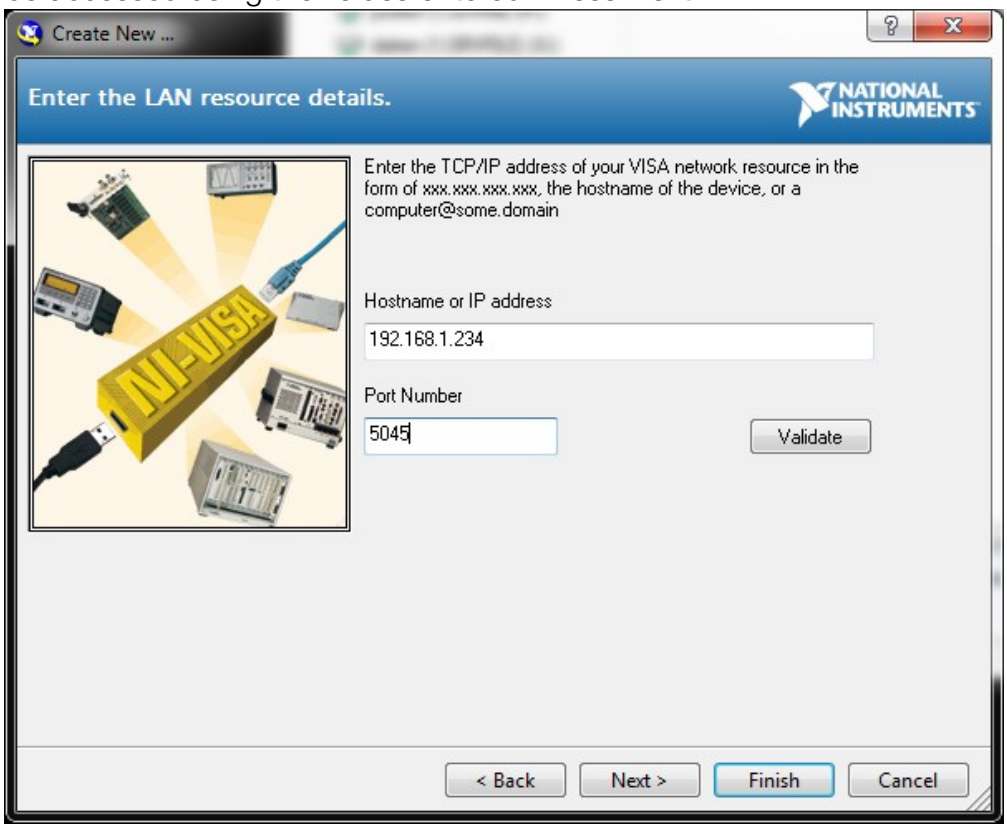
Under *Devices and Interfaces,* select the sub-item *Network Devices*.

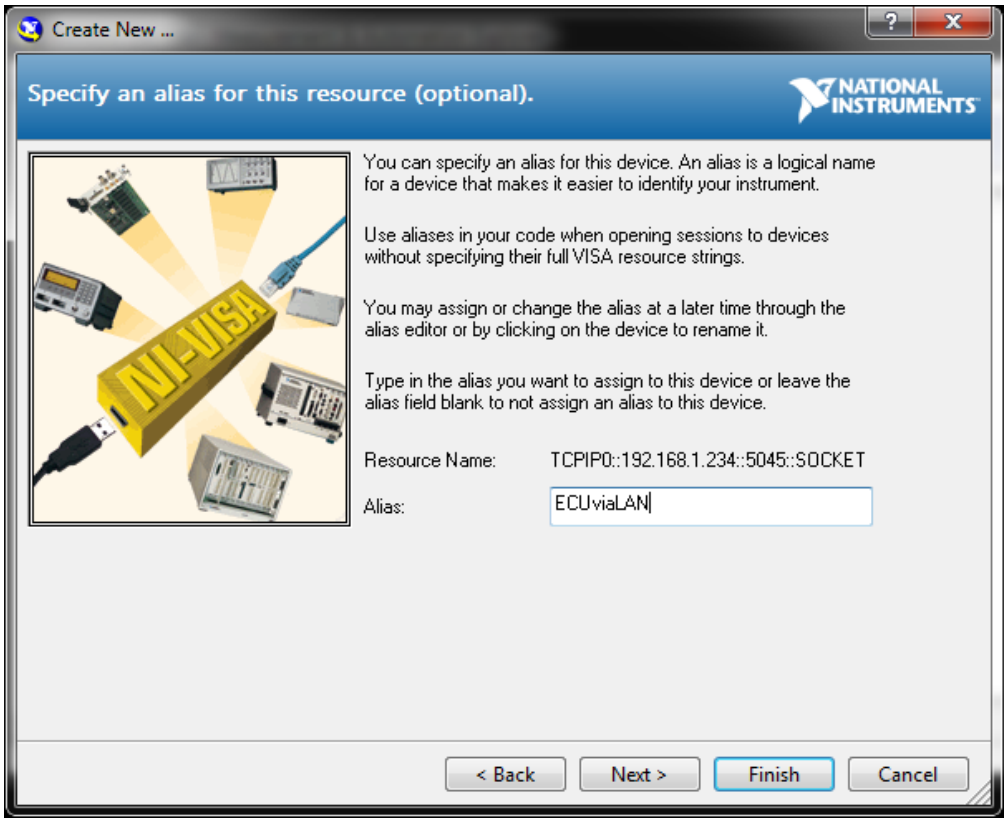


In the next window, select *Manual Entry of Raw Socket* .




Enter the *IP Adresse* and *Port number* . Under *Validate* , you can check whether the device can be accessed using the values entered. Press *Next*.

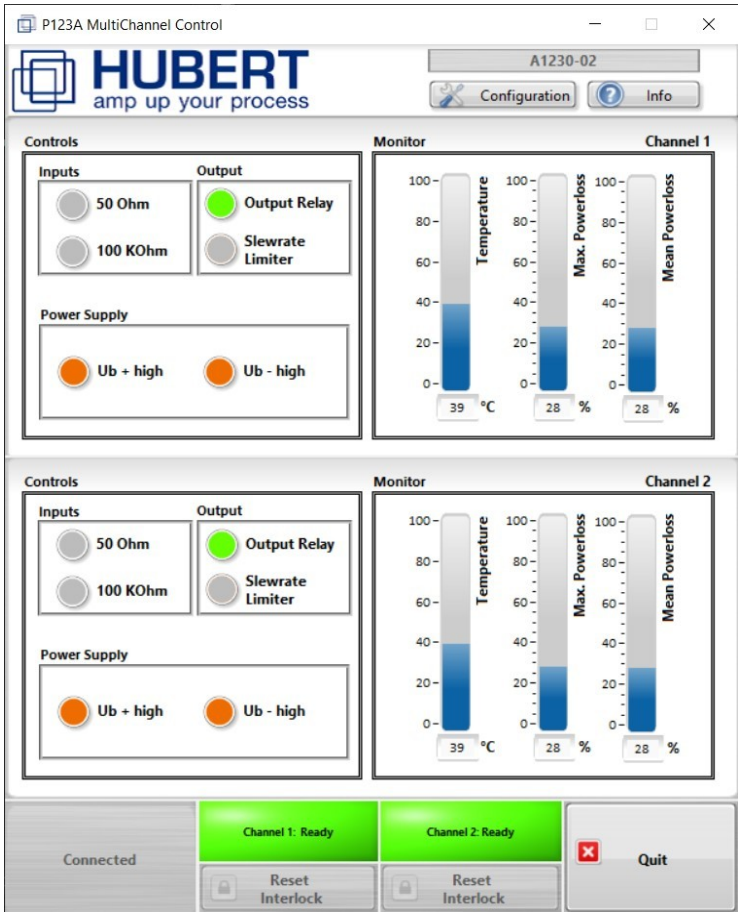





In the last window, you can give the A1230 an alias. This can be helpful for assigning the device later under VISA. Press Finish to complete the LAN setup.

To change the IP address or port number, please install the *Device Installer* from Lantronix's https://www.lantronix.com/products/deviceinstaller. Be sure to only adjust the LAN settings according to your needs. Do not change the settings of the serial interface (UART) under any circumstances, as this will prevent communication via LAN!

## 5.4 Operation of the Software




The above software A1230-MultiChannel-Control always shows both amplifier channels. The following buttons and indications are identical and available for each channel separately.

### [1] CONFIGURATION

The configuration menu is called up.

The following characteristics of the A1230-02 can be preset with the aid of the configuration menu (startup configuration). The amplifier then starts after the repeated switching on with the adjusted options.

### [2] DEVICE

Show the connection status (device name and used port), if a connection was established.

### [3] INFO

Here you find information about your GUI software version, as well as the amplifier firmware and the amplifier hardware.

### [4] TEMPERATURE

The heat sink temperature is displayed in °C. At 70 °C the amplifier switches off and at a temperature of 50 °C on again.

### [5] MAX. POWERLOSS

The maximum power dissipation of the power semiconductors is displayed in %. At 100% the amplifier switches off. For short signals the maximum power dissipation can be significantly higher than the average power dissipation. The displayed values are rated with the heat sink temperature and therefore greater at higher temperatures.

### [6] MEAN POWERLOSS

The average power dissipation of the power semiconductors is displayed in %. It is a measure of the long-term warming of the amplifier. At 100% the amplifier switches off. For short signals the maximum power dissipation can be significantly higher than the average power dissipation. The displayed values are rated with the heat sink temperature and therefore greater at higher temperatures.

### [7] QUIT

Quits the application.

### [8] RESET INTERLOCK

Only possible if the interlock-mode latching is configured (see page 17). After safety shutdown has taken place, the interlock function must be reset manually. The amplifier can now be switched on again (Amplifier On).

### [9] STATUS INDICATION

**Green, Ready:**
Signals the operational readiness of the amplifier.

**Red, short-circuit_current exceeded**
The short-circuit current cut-off has been activated.

**Red, Current + exceeded**
The permissible positive transistor current has been exceeded

**Red, Current – exceeded**
The permissible negative transistor current has been exceeded

**Red, Power Loss + exceeded**
The permissible operating range of the positive side of the power semiconductors has been exceeded.

**Red, Power Loss – exceeded**
The permissible operating range of the negative side of the power semiconductors has been exceeded.

**Red, Temperature exceeded**
The permissible temperature of the heat sink has been exceeded.

**Red, Transformer temperature exceeded**
The permissible temperature of the power transformer has been exceeded.

**Red, Hardware Error:**
An amplifier error was detected.

### [10] CONNECT

Selection and activation of the device interface.

### [11] POWER SUPPLY

Selecting the operating voltage of the amplifier.

| Operating voltage | Ub - high | Ub + high |
|---|---|---|
| ca. +/-45 V | Off | Off |
| ca. +/-90 V | On | On |

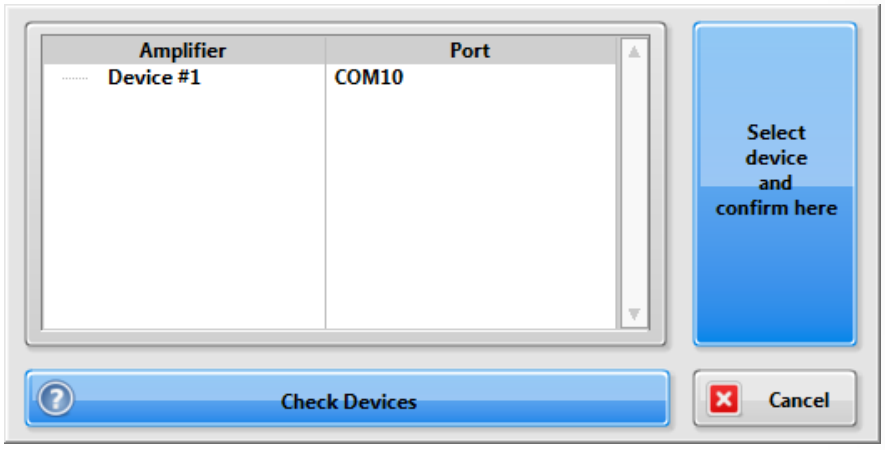
### [12] INPUTS 50 OHM / 100 KOHM

The signal inputs of the amplifier can be switched on and off by clicking on the box.

### [13] OUTPUT RELAY

The signal output of the amplifier can be turned on and off by clicking the appropriate box.

## 5.4.1 Connect Menu



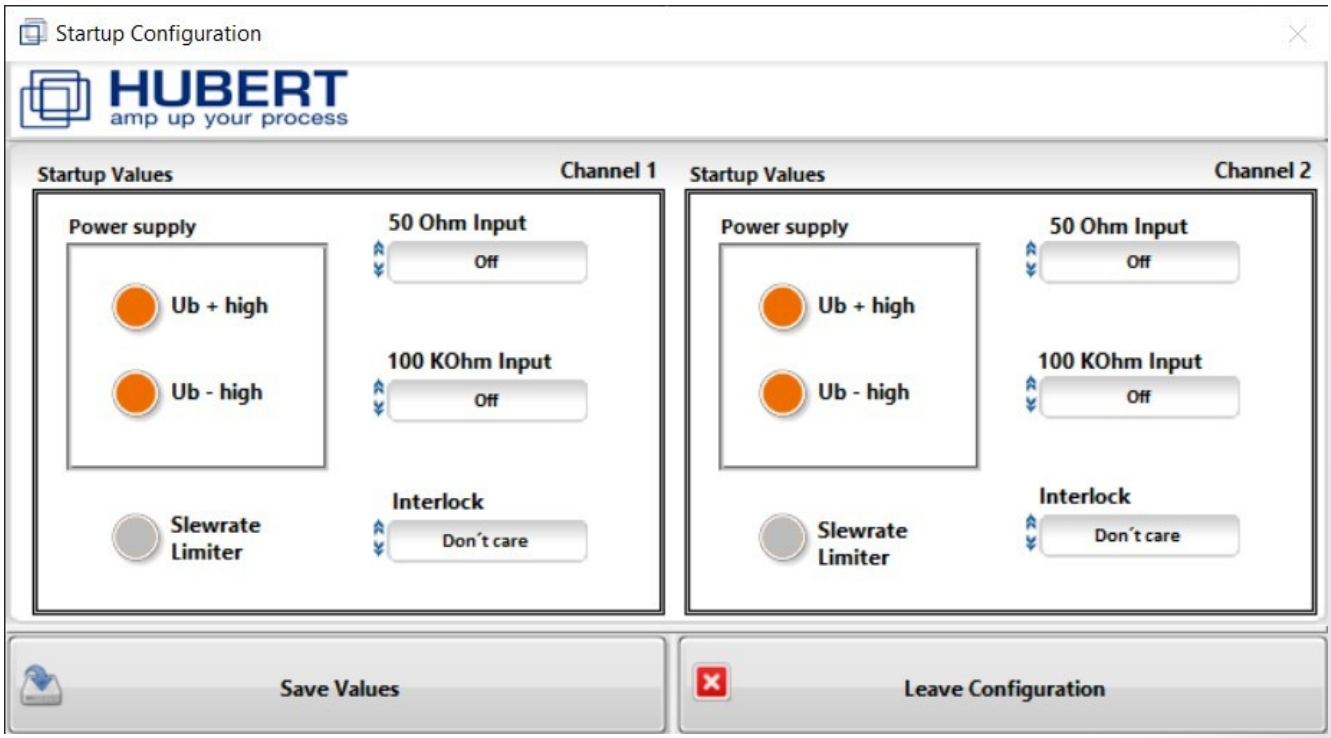

The available amplifiers are listed with their corresponding port. A connection is established after clicking on '**Select device and confirm here**'.

The device name can be freely changed by a double-click on a list entry (please note tool tip).

With the aid of '**Check Devices**', connected devices can be searched for renewed.

### 5.4.2 Configuration Menu

Here the default values for some parameters can be changed. These values are read when the software starts.




[1] POWER SUPPLY

Selecting the operating voltage of the amplifier. The operating voltages can also be set unbalanced by remote commands.

[2] 50 OHM INPUT

Selection of the state of the 50Ω input.

[3] 100 KOHM INPUT

Selection of the state of the 100 kΩ input.

[4] INTERLOCK

Setting the interlock mode.

LATCHING: After an interlock, the interlock state must be reset by a remote command before the amplifier can be operated as usual again.

LIVE: The amplifier can be operated as usual again immediately after the interlock state has ended.

OFF: Interlock deactivated (default)

[5] SAVE VALUES

The configuration data is stored as initial values in the amplifier.

[6] LEAVE CONFIGURATION

Exit the configuration menu and return to the control menu.

# 6 Integration into Automated Test Systems

For integration into automated test systems the commands of the USB interface are described in the following. The USB interface is installed as a virtual COM port at 9600 baud, 8 data bits, 1 stop bit and no parity.

The LAN interface is accessible ex works under the fixed IP address 192.168.1.234 with port 5045. To change the IP address or the port number, please install the *Device Installer* from Lantronix. Make sure that you only change the LAN settings according to your needs. Do not change the settings of the serial interface (UART), otherwise the communication via LAN is no longer possible!

The command frame consist of a length byte (entire frame) followed by an address byte. Then there is a command byte and optional parameters. Only command frames corresponding to its own address will be considered. There is a timeout of 500 ms, that is, if after 500 ms the required number of bytes hasn't been sent, the previous bytes are ignored!

The feedback frame corresponds to the command frame, e.g. length, address, command and optional parameters. The feedback is always carried out *after* execution of the command! When an unknown command occurs, the feedback is 0xFE, and with a timeout 0xFD.

Both amplifiers can be controlled via one COM or LAN interface. In this case, each amplifier requires its own address (1 ... 99), which is determined by a command. Ex factory the first amplifier has the address 1 and the second amplifier has the address 2.

## 6.1 List of Remote Commands

| Command | Note and parameter description |
|---|---|
| 0x01 | Status query, parameters: no,<br>answer: 1 Byte status:<br>Bit 0: Ready<br>Bit 1: Overload shutdown current/power loss<br>Bit 2: Overtemperature heatsink/transformer<br>Bit 3: Output relay (0: off, 1: on)<br>Bit 4: 50R-Input relay (0: off, 1: on)<br>Bit 5: 100k-Input relay (0: off, 1: on)<br>Bit 6: operating voltage + (0: low, 1: high)<br>Bit 7: operating voltage – (0: low, 1: high) |
| 0x02 | Set 50R-Input , Parameter: 1 Byte (0: off, 1: on) |
| 0x03 | Set 100k-input , Parameter: 1 Byte (0: off, 1: on) |
| 0x04 | Set Output relay , Parameter: 1 Byte (0: off, 1: on) |
| 0x05 | Set operating voltage, Parameter: 1 Byte<br>(0: low, 1: high, 2: only UB+ high, 3: only UB– high) |
| 0x06 | Query temperature, Parameter: no,<br>Answer: 1 Byte temperature in 0C |
| 0x07 | Query max. power loss, Parameter: no,<br>Answer: 1 Byte Power loss in % of the current threshold (maximum since last query) |
| 0x08 | Query average power loss, Parameter: no,<br>Answer: 1 Byte power loss in % of the current threshold |

| Command | Note and parameter description |
|---|---|
| 0x09 | Query error, Parameter: no;<br>Answer 1 Byte Error:<br>Bit 0: short circuit-current<br>Bit 1: Overcurrent +<br>Bit 2: Overcurrent –<br>Bit 3: power loss +<br>Bit 4: power loss –<br>Bit 5: Heatsink overtemperature<br>Bit 6: Overtemperature transformer<br>Bit 7: Hardware failure |
| 0x10 | Set start configuration, Parameter: 1 Byte configuration (default 0x0C):<br>Bit 0: 50R-input relay (0: off, 1: on)<br>Bit 1: 100k-input relay (0: off, 1: on)<br>Bit 2: operating voltage + (0: low, 1: high)<br>Bit 3: operating voltage – (0: low, 1: high)<br>Bit 4: slew rate limiter (0: off, 1: on) |
| 0x11 | Query start configuration, Parameter: no,<br>Answer: 1 Byte configuration |
| 0x12 | Set address, Parameters: 1 Byte address (1...99) |
| 0x13 | Query address, Parameters: no,<br>Answer: 1 Byte address |
| 0x14 | Query amplifier type, Parameters: no,<br>Answer: 1 Byte type (0x10) |
| 0x15 | Query firmware revision, Parameters: no,<br>Answer: 1 Byte revision |
| 0x16 | Set hardware revision, Parameters: 1 Byte revision (e.g. 0x29 = 2.9) |
| 0x17 | Query hardware revision, Parameters: no,<br>Answer: 1 Byte revision |
| 0x20 | Set Slew Rate Limiter, Parameter: 1 Byte (0: off, 1: on) |
| 0x21 | Query slew rate limiter, Parameter: no<br>Answer: 1 Byte (0: off, 1: on) |
| 0x53 | Set interlock mode, Parameter 1 Byte (0: Latching, 1: Live, 2: Off) |
| 0x54 | Reset interlock, Parameter 1 Byte (0: Reset at Latching Mode) |
| 0x55 | Query interlock mode, Parameter: no,<br>Answer: 1 Byte (0: Latching 1: Live 2: Off) |
| 0x56 | Query interlock signal, Parameter: no,<br>Answer 1 Byte (0: off, 1: on) |

## 6.2 Remote Command Examples

Frame: <length> <address> <command> <parameter>

### 6.2.1 Setting 50 Ω Input on (Amplifier address: 1)

Command frame: 0x04 0x01 0x02 0x01 (all values are in hexadecimal notation)

Response frame: 0x03 0x01 0x02

### 6.2.2 Query Heatsink Temperature

Command frame: 0x03 0x01 0x06

Response frame: 0x04 0x01 0x06 0x28 (e.g. 40 °C)

## 6.3 Error Codes

| Code | Description |
|---|---|
| 0xFD | Timeout. An incomplete command frame was received. |
| 0xFE | Unknown command. |

## 6.4 TCP/IP Settings

To set and read the TCP / IP parameters, use the manufacturer's interface listed below!

Current devices: https://www.lantronix.com/products/deviceinstaller/

(Older Devices: https://www.eztcp.com/en/download/ezmanager.php)

Drivers and product information on the currently used interfaces can be found at:

USB: https://ftdichip.com/drivers/vcp-drivers/

LAN: https://www.lantronix.com/products/xpico/

# 7 Maintenance and Support

## 7.1 Maintenance and Calibration

The device is maintenance-free.

Factory calibration can be performed if necessary. The frequency of factory calibration is determined by the operator.

## 7.2 Cleaning

Clean the device only with a damp cloth. Use only solvent-free cleaning agents without aggressive components.

## 7.3 Support

If you have further questions about this product, please visit the support area on our website www.drhubert.com.

# 8 Decommissioning and Disposal

## 8.1 Decommissioning

- Turn off the device.
- Unplug the power plug.
- Remove all cables.
- Store the device in its original packaging or equivalent.

## 8.2 Disposal

Dispose of the device in accordance with local regulations for the disposal of electrical and electronic components.

# 9 Warranty and Disclaimer

Dr. Hubert GmbH warrants this amplifier product for normal use and operation within specifications for a period of two (2) years from date of shipment and will repair or replace any defective product which was not damaged by negligence, misuse, improper installation, accident or unauthorized repair or modification by the buyer. This warranty is applicable only to defects due to material or workmanship. Dr. Hubert GmbH disclaim any other implied warranties of merchantability or fitness for a particular purpose. Dr. Hubert GmbH will not be liable for any indirect, special, incidental, or consequential damages (including damages for loss of profits, loss of business, loss of use or data, interruption of business and the like), even if Dr. Hubert GmbH has been advised of the possibility of such damages arising from any defect or error in this manual or product.

# 10 Directives

This device complies with the relevant European Union harmonisation legislation:

- EMC Directive
- Low Voltage Directive
- RoHS Directive

# 11 Contact

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# 12 Document History

| Document Version | Date | Changelog |
|---|---|---|
| 1 | February 2020 | First Publication in new Design |
| 2 | March 2020 | Backpanel and frontpanel images were updated |
| 3 | May 2021 | Introduction of new housing |
| 4 | October 2022 | New slew rate limiter added, new chapter “Safety shutdown” and “Interlock” added |
| 5 | August 2025 | New design |