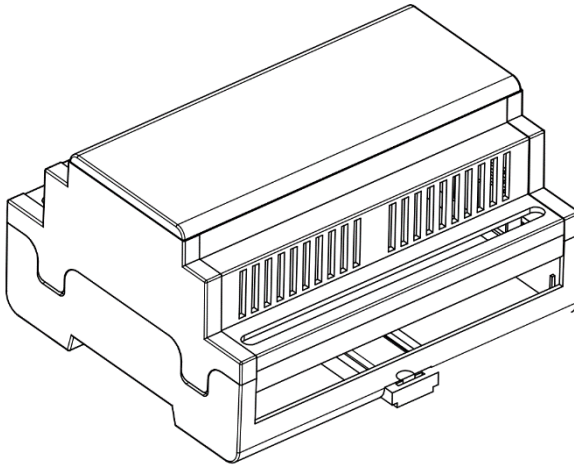


# Andino X1

Raspberry Pi extension with integrated signal preprocessing

**Best.Nr. 500 1606**

This manual is part of the product. It contains important information on commissioning and operation! Keep this in mind, even if you pass it on to a third party! Please keep this manual for future reference!



# Table of Contents

- Safety Instructions .....3
- Additional Information .....3
- Product description .....4
- Intended Use .....4
- Overview and schematic structure .....5
- Connectors.....6
  - Jumper .....6
  - Connections .....7
  - Expansion Interface .....8
- Opening the housing cover .....9
- Insert the Raspberry Pi .....9
- Programming the microcontroller .....10
- HowTo Setup Raspberry Pi to communicate with the Ardino .....11
- Firmware.....12
- Troubleshooting .....13
- Technical specifications .....13
- Tested according to standards .....14
- Delivery.....15
- Symbols .....15
- Disposal .....15

## Safety Instructions

The current VDE regulations must be observed for all devices which require an electrical voltage for their operation. Particularly relevant for this product are the VDE guidelines VDE 0100, VDE 0550/0551, VDE 0700, VDE 0711 and VDE 0860. Please also observe the following safety instructions:



- Do not use the Andino X1 if it is damaged.
- Components do not belong in children's hands!
- When handling products that come into contact with electrical voltage, the valid VDE regulations must be observed.
- In commercial facilities, the accident prevention regulations of the Association of Professional Cooperatives for electrical installations and operating equipment must be observed.
- Components, subassemblies or devices may only be commissioned if they have previously been installed in a housing in a safe manner. During installation, they must be disconnected from the power supply.
- The product must not be dropped or subjected to strong mechanical pressure as it may be damaged by the effects.
- The unit must be protected from moisture, splashing water and heat.
- Do not operate the unit in an environment where flammable gases, vapors or dust are present.
- Devices operated with a supply voltage greater than 24 V- may only be connected by a qualified person.
- In schools, training facilities, hobby and self-help workshops, the operation of assemblies is to be supervised by trained personnel.
- If the device has to be repaired, only original spare parts may be used! The use of deviating spare parts can lead to serious damage to property and personal injury! The unit may only be repaired by an electrician!
- This device is not intended to be used by persons (including children) with limited physical, sensory or mental abilities, or lack of experience and / or lack of knowledge, unless directed or supervised by a person responsible for their safety from her instructions on how to use the device.

## Additional Information

Further information, application examples, frequently asked questions (FAQ) can be found on the product page:

**<https://www.andino.systems>**

**<https://github.com/andino-systems/Andino-X1>**

<https://github.com/andino-systems/Andino-X1/tree/master/doc/>

<https://github.com/andino-systems/Andino-X1/tree/master/doc/BaseBoard>

## Product description

The Andino X1 is a microcontroller board for the Raspberry Pi in a DIN-rail housing for installation in a control cabinet.

It is used to adapt digital inputs and outputs for a voltage of 24 V. The X1 has its own microcontroller for precise signal preprocessing and adaptation of signal generators and actuators.

It also contains a Raspberry Pi (2/3). The inputs and outputs as well as the power supply of the Pi are optimally protected.

Communication between the microcontroller and the Pi takes place via the UART interface.

The Andino X1 offers the following advantages:

- The sensitive GPIO of the Raspberry Pi are protected.
- Fast signals can be precisely detected by the microcontroller.
- Actuators and sensors can be electrically connected to the Raspberry Pi.
- It provides an industrial power supply for the Raspberry Pi.
- Customized adapters from the Raspberry Pi GPIO or the micro controller IO can be connected electrically to terminals.
- Provides mounting on a DIN rail for installation in manifolds.

## Intended Use

Andino X1 is designed for installation in switch cabinets. The integrated voltage regulator is designed for an input voltage of max. 24 V. The protection class of the housing is IP20. The device must be protected against splashing water, moisture and dust.

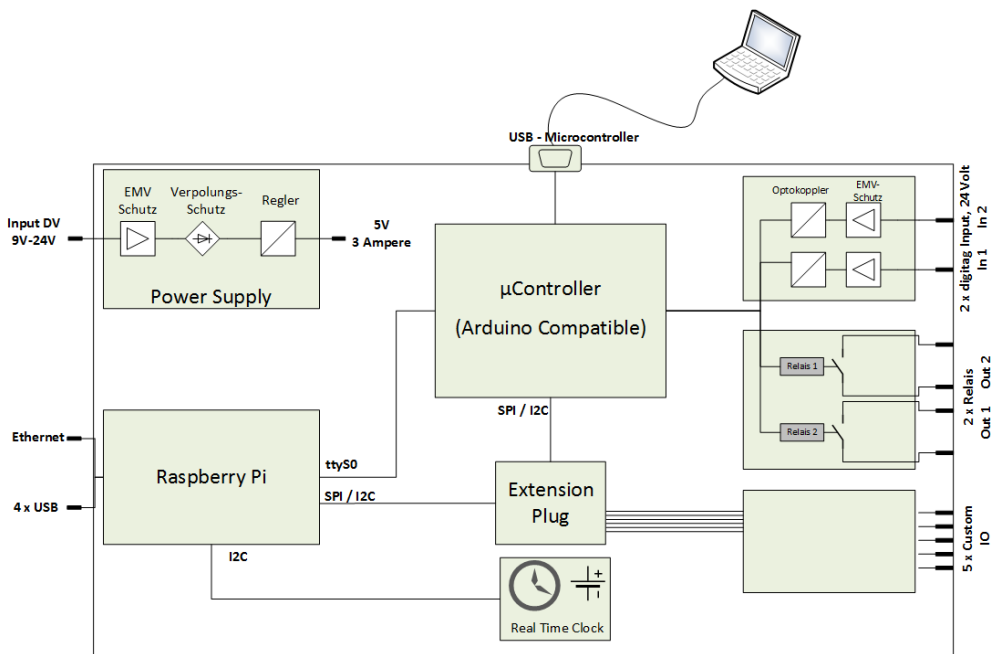


With a 24 volt operating voltage, the current consumption at +5 volts must not exceed 2.5 Ampere.

Any use other than specified is not permitted! Modifications can lead to damage to this product. Short circuit, fire, electric shock, etc. The manufacturer is not responsible for all personal injury and material damage resulting from non-intended use.

Please note that operating and / or connection errors are outside our sphere of influence. Understandably, we cannot accept any liability for damages resulting from this.

## Overview and schematic structure



Power supply	Voltage regulator with EMC protection circuit and polarity reversal protection. Power secondary +5 Volt max. 2.5 Amps!
Digital inputs	Galvanically isolated inputs for 24 volts. Isolated up to 5 kV.
Digital outputs	Relay outputs for 120VAC and 2 Ampere.
Microcontroller	ATMEGA 168 PA with 8 MHz with Arduino compatible bootloader.
RTC	real-time clock, temperature-compensated and battery-buffered.
Extension plug	slot for customer-specific extensions on five screw terminals.
Raspberry Pi	Intake of a Raspberry Pi 2 or 3 Model B.

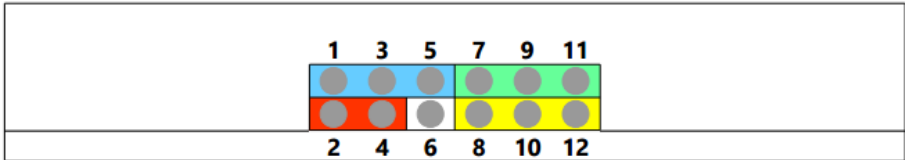
The Arduino compatible microcontroller is connected to the Raspberry Pi via the UART interface. The interface / dev / ttyAMA0 is used on the Raspberry Pi.

Via this interface the Raspberry can communicate with the controllers and program it.

If no Raspberry Pi is inserted, the microcontroller can be addressed via USB (Virtual Com Port) from the outside. This allows the microcontroller to be programmed from a Windows PC with Arduino IDE installed. To do this, set the jumper black to "USB".

## Connectors

### Jumper



2-4	Use USB Power.
1-3-5	DTR Config
7-9-11	RxD Config
8-10-12	TxD Config



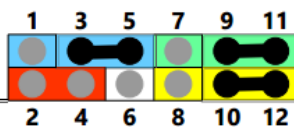
Use USB Power only to Power up the X1 in stand alone mode.  
Do use for the Raspberry Pi.  
If Jumper is set, disconnect the 24 Volt Power supply.

With the plug-in connector 2-4 the circuit can be powered by the +5 Volt from the USB connector. This is mainly used to program the controller and test the firmware.

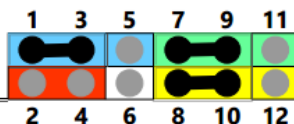


Please note that this bridge is not plugged in when the Raspberry Pi is used or the circuit is supplied with +24 volts!

### USB Configuration



### Raspberry Pi Configuration



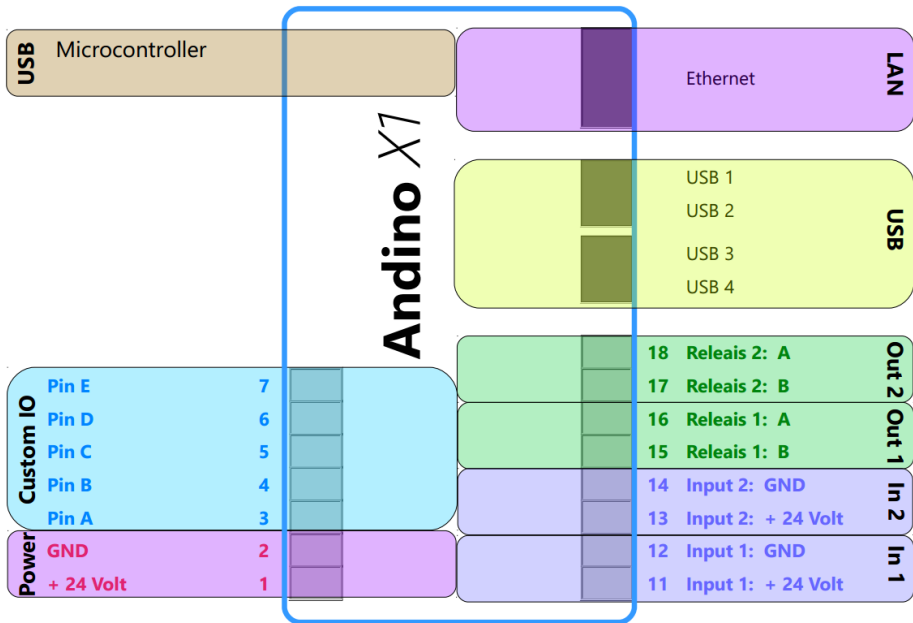


Image 1 Connections

LAN	Network connection. Only available when a Raspberry Pi is inserted.
USB	Four USB ports. Only available when a Raspberry Pi is inserted.
Output 1, Output 2	Relay contacts.
Input 1, Input 2	Optocoupler. Set for 9V to 24V, 2mA - 5mA.
Power supply.	9V to 24V.
Custom IO	Contacts for extension. Connected to an internal Pin Header.
USB	Microcontroller interface to internal microcontroller. (Control and programming interface).

# Expansion Interface

The expansion interface is a pin header inside the Andino X1.  
This allows further adaptation of GPIO of the Raspberry Pi or IO lines of the microcontroller to screw terminals.

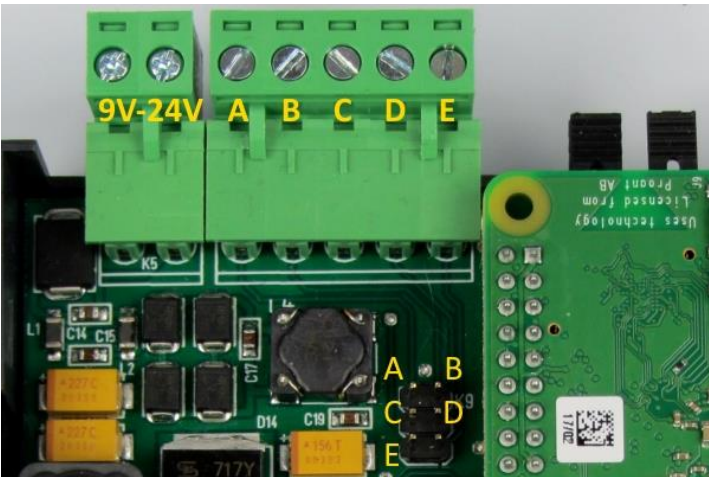
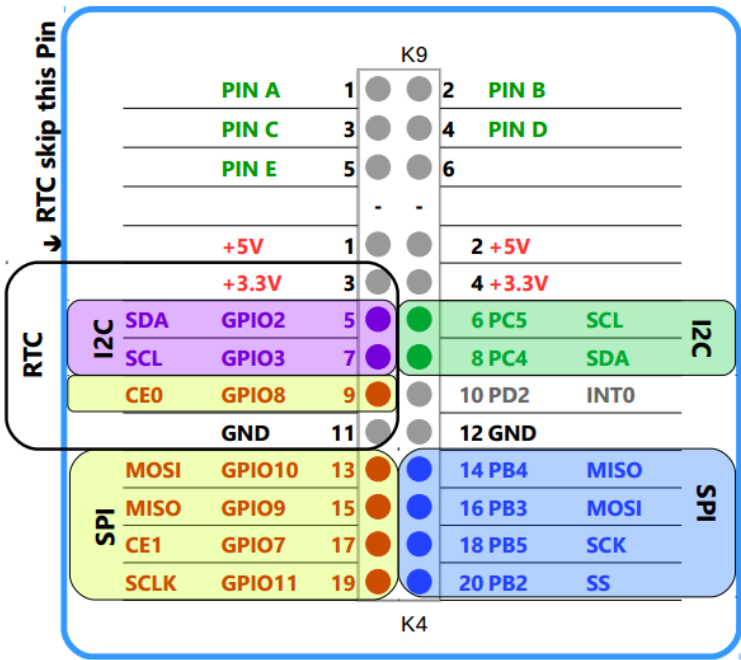


Image 2: Expansion Interface



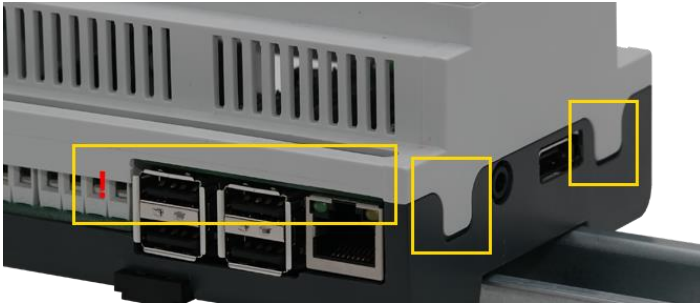


## Opening the housing cover

The housing cover is held by four clamps. To ensure a good hold of the lid, the clips are relatively tight. Pull the brackets one after the other on one side and slightly lift the lid.

Repeat the process on the other side. Do not use force.

When mounting the cover, please note the cutouts. The lid can not be twisted.



## Insert the Raspberry Pi

The Raspberry Pi is placed on the head, lying on the pin header. Raspberry Pi 2 or 3 Model B can be used. The power supply of the Raspberry Pi is taken over by the internal voltage transformer.



We recommend the use of heat sinks for the CPU and the USB hub chip of the Pi!



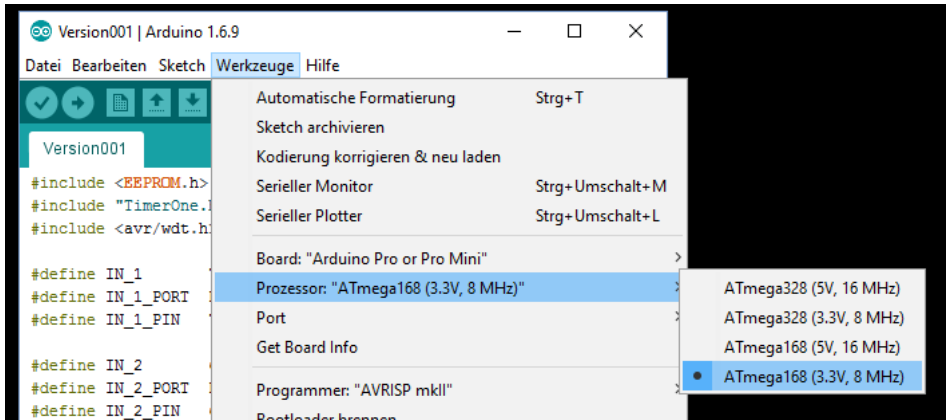
## Programming the microcontroller

The Arduino development environment can be used to program the microcontroller. Install this first.

Under Tools select the controller type

"Arduino Pro or Mini" and for processor then ATmega 168 3.3V 8Mhz.

Set the jumpers on the Andino X1 to "USB Configuration". Now the board can be programmed with the Arduino IDE.



From the Raspberry Pi, the controller can be programmed with the tool AVRdude and / or Ino. Please read the corresponding blog entries at <https://andino.systems>.

The pins for the optocouplers and relays are as follows:

INPUT_1	6
INPUT_2	7
OUTPUT_1	14
OUTPUT_2	5

# HowTo Setup Raspberry Pi to communicate with the Arduino

Description based on

## Raspbian Stretch Lite

Minimal image based on Debian Stretch

Version: November 2018

Release date: 2018-11-13

Kernel version: 4.14

- 1.) Enable UART as /dev/ttyAMA0 and /dev/serial0

**sudo nano /boot/config.txt**

..add this at the end of the file..

```
# RASPI 3 UART
enable_uart=1
# Allow the normal UART pins to work
dtoverlay=pi3-disable-bt-overlay
dtoverlay=pi3-miniuart-bt
```

- 2.) Disable Console on serial0

**sudo nano /boot/cmdline.txt**

Remove "console=..."

```
dwc_otg.lpm_enable=0 console=serial0,115200 console=tty1 root=/dev/mmcblk0p2 rootfstype=ext4 .....
```

- 3.) Reboot and test

**sudo apt-get install minicom**

**sudo minicom -s**

```
+-----+
| A - Serial Device : /dev/ttyAMA0 |
| B - Lockfile Location : /var/lock |
| C - Callin Program : |
| D - Callout Program : |
| E - Bps/Par/Bits : 38400 8N1 |
| F - Hardware Flow Control : No |
| G - Software Flow Control : No |
| |
| Change which setting? |
+-----+
| Screen and keyboard |
| Save setup as dfl |
| Save setup as.. |
| Exit |
| Exit from Minicom |
+-----+
```

set Hardware Flow to No, set Device to /dev/ttyAMA0, set BPS to 38400

## Firmware

We ship the Andino X1 with the Counting Sample Firmware. It works with **38400 Baud**.

**!! For the latest Version please see here:**

<https://github.com/andino-systems/Andino-X1/tree/master/src/firmware/counting>

### Commands to the Controller

<i>Command</i>	<i>Arguments</i>	<i>Action</i>	<i>Example</i>
RESET	none	Restart the Controller	RESET
INFO	none	Prints the current settings	INFO
POLL	Cycle in ms	Sets the sampling cycle of the digital inputs [in ms]	POLL 1000
EDGE	HL(0) LH(1)	Count on edge HL or LH	EDGE
SEND	Cycle in ms	The counter will send all nnn milliseconds	SEND 5000
DEBO	Number of polls	Sets the debounce count. The signal has to be stable for nn polls	DEBO 100
REL1	state (0 or 1)	Relay 1 is switched on or off	REL1 1
REL2	state (0 or 1)	Relay 2 is switched on or off	REL2 1
RPU1	pulse in sec	Pulse the Relay 1 for nns seconds	RPU1 2
RPU2	pulse in sec	Pulse the Relay 2 for nns seconds	RPU2 2

### Messages from the Controller

<i>Message</i>	<i>Arguments</i>	<i>Action</i>	<i>Example</i>
CNTR	messageID counter1 counter2	Send the counter every [SEND] millis	CNTR 9998 12 32
STAT	messageID pin1 pin2	Send the state of the pins every [SEND] millis	CNTR 9998 12 32

Message-ID increments on every Message to check any lost.

Troubleshooting		
Problem	Causes	Solution

For further information, frequently asked questions (FAQ), please refer to the product page:

<https://andino.systems>  
<https://github.com/andino-systems/Andino-X1>

Technical specifications

Operating voltage:	+ 24V DC
Current consumption:	max. 1200 mA
Temperature range (operation):	+5 ... 50 ° C, max. 80% rel. Humidity (non-condensing)
Dimensions	(HxWxD): 58 mm x 107 mm x 95 mm
Weight:	140g without Raspberry Pi approx 180g with Raspberry Pi
Optocoupler:	24V DC, 5 mA, 5 kV Insulating
Relay:	120 VAC, 2 A

## Tested according to standards

### *Radiated field strength / conducted emissions*

**DIN EN 55022:** 2011 according to **VDE 0875 part 22** of 12.2011

*Störaussendung: Klasse B (Wohnbereich) (strengere Grenzwerte)*

*Störfestigkeit: Klasse A (Industriebereich) herangezogen. (höhere Einstrahlung)*

### *Immunity ESD*

**DIN EN 61000-4-2:** 2009 according to **VDE 0847 part 4-2** of 12.2009

### *Immunity radiated electromagnetic fields*

**DIN EN 61000-4-3:** 2006+A1:2008+ A2: 2010 according to **VDE 0847 part 4-3** of 04.2011

### *Immunity Burst*

**DIN EN 61000-4-4:** 2012 according to **VDE 0847 part 4-4** of 04.2013

### *Immunity Surge*

**DIN EN 61000-4-5:** 1995 +A1: 2014 according to **VDE 0847 part 4-5** of 03.2015

### *Immunity high frequent uncoupled emission*

**DIN EN 61000-4-6:** 2014 according to **VDE 0847 part 4-6** of 08.2014

### *Immunity magnetic fields*

**DIN EN 61000-4-8:** 2010 according to **VDE 0847 part 4-8** of 11.2010

## Delivery

Andino X1Anleitung

## Symbols



The symbol with the exclamation point in the triangle indicates important instructions in this manual, which must be observed. Furthermore, if there is danger to your health, e.g. by electric shock.

## Disposal



Electrical and electronic equipment, which is covered by the "ElektroG" Act, is marked with the following marking and may no longer be disposed of via the residual waste, but can be used free of charge at municipal collection points, e.g. Recycling facilities.



As an end user, you are obliged to return used batteries and accumulators by law. Batteries / accumulators containing pollutants are marked with the following marking. Disposal in the household garbage is prohibited.

Used batteries / rechargeable batteries can be used free of charge at municipal collection points. Recycling centers or wherever batteries / accumulators are sold!

WEEE Reg Nr: **DE 21223449**