Andino LoRa

Project description

Version 2018-09-20

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2. Requirements

The System based on the Concept of the Andino X2.

Major requirements are:

- Six Opto coupled input's (H11L3 with Schmitt Trigger)
- Power to control the inputs has to be provided by the Andino LoRa (dry input)
- One TTL 3.3 V Input as Power Fail Signal (direct wired to the Raspberry)
- Three relayed output 250V / 5 Ampere max.
- A LoRa WAN Module or a mobile network modem 3G or 4G
- RTC via I2C (DS1307 or similar mounted as Plug)
- 24 Volt Input
- OLED Display in the Lid of the Housing
- Degson Signal Skew Terminals
- One RS232
- One RS485
- CAN Bus (Non-Isolated, optional Isolated)
- Internal temperature Sensor

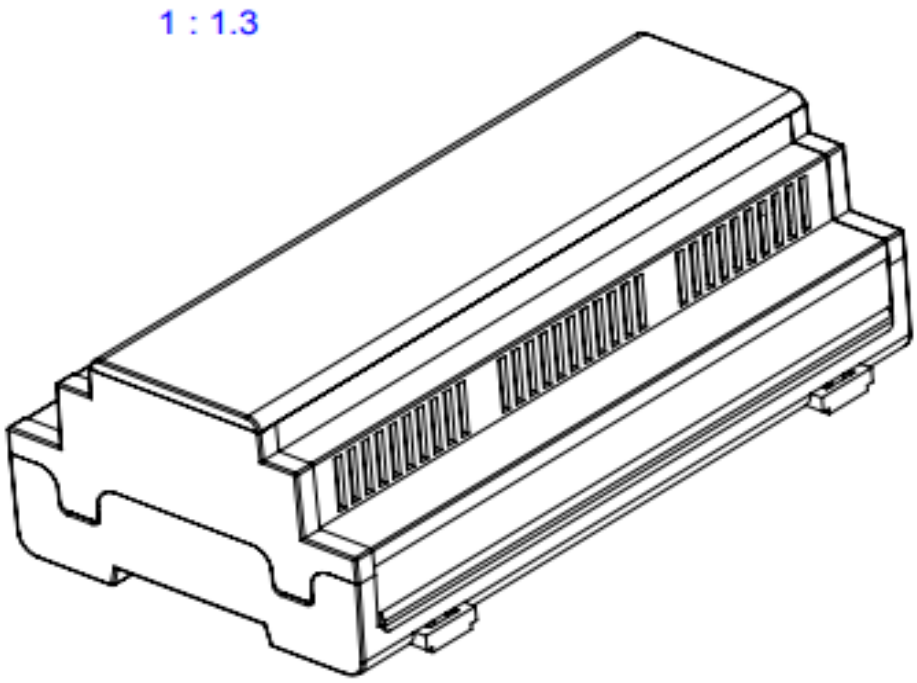
2.1 Environment

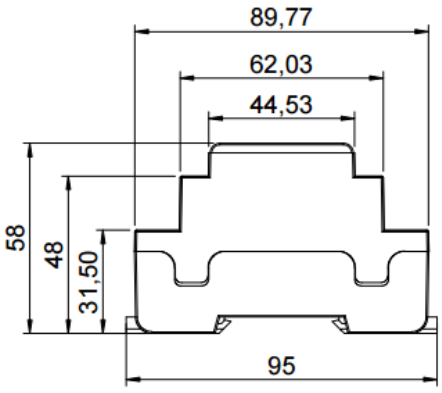
The System should be able to operate inside of buildings in a temperature range from +5°C to +50°C. All Components must be designed for this purpose.

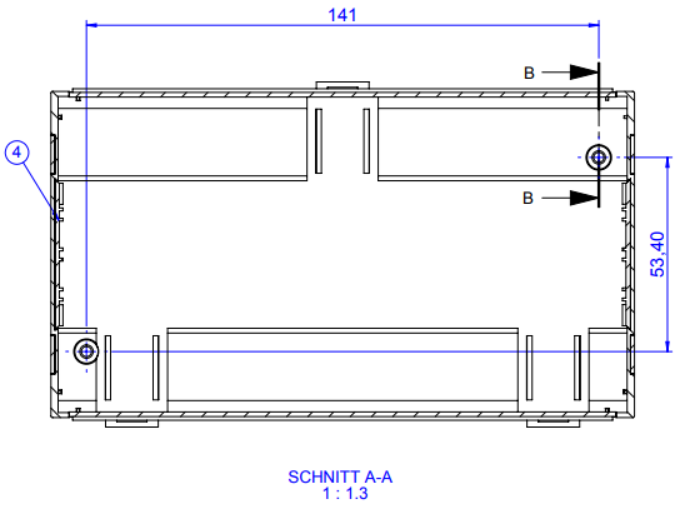
3. Mechanic

3.1 Housing

The Case is an Apra Norm DB Rail 9 Modules will be used. Material: Polycarbonate UL94V-0.
Color Top Cover: lichtgrau RAL 7035
Bottom: anthrazitgrau RAL 7016







3.2 Skew Terminals

As Skew Terminals we suggest to use the Degson Signal series (5mm). This Terminal uses an external Skew Block with a Push In and Snap In connector.

The Skew Terminals has to be labeled and numbered.

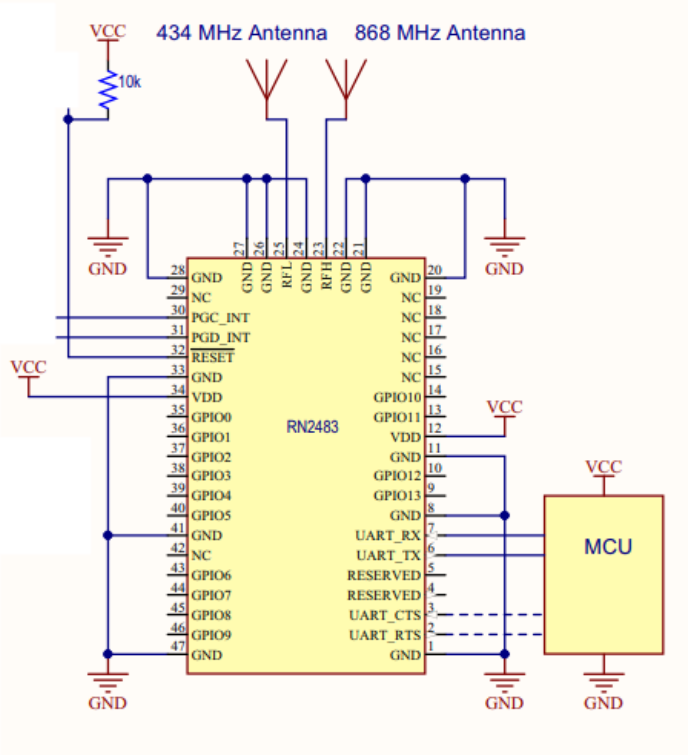
3.3 OLED

- 0,96“ OLED display
- Resolution 128x64 pixel
- Power supply 3.3V DC
- I2C communication only 4 wire needed (plus optional interrupt line)
- PCB is Mounted in the Lid of the Housing
- 3 Buttons
- MCP23008 I2C expander

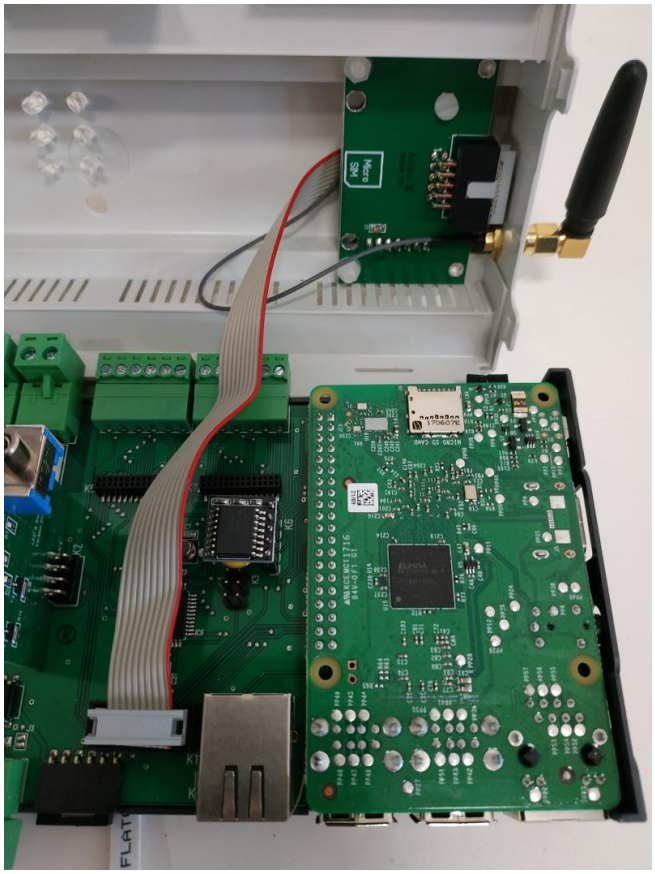
3.4 Lora WAN Module

As Lora Interface the RN2483 Chip from Microchip will be used. The Interface to the Raspberry Pi is the build In UART of the Pi.

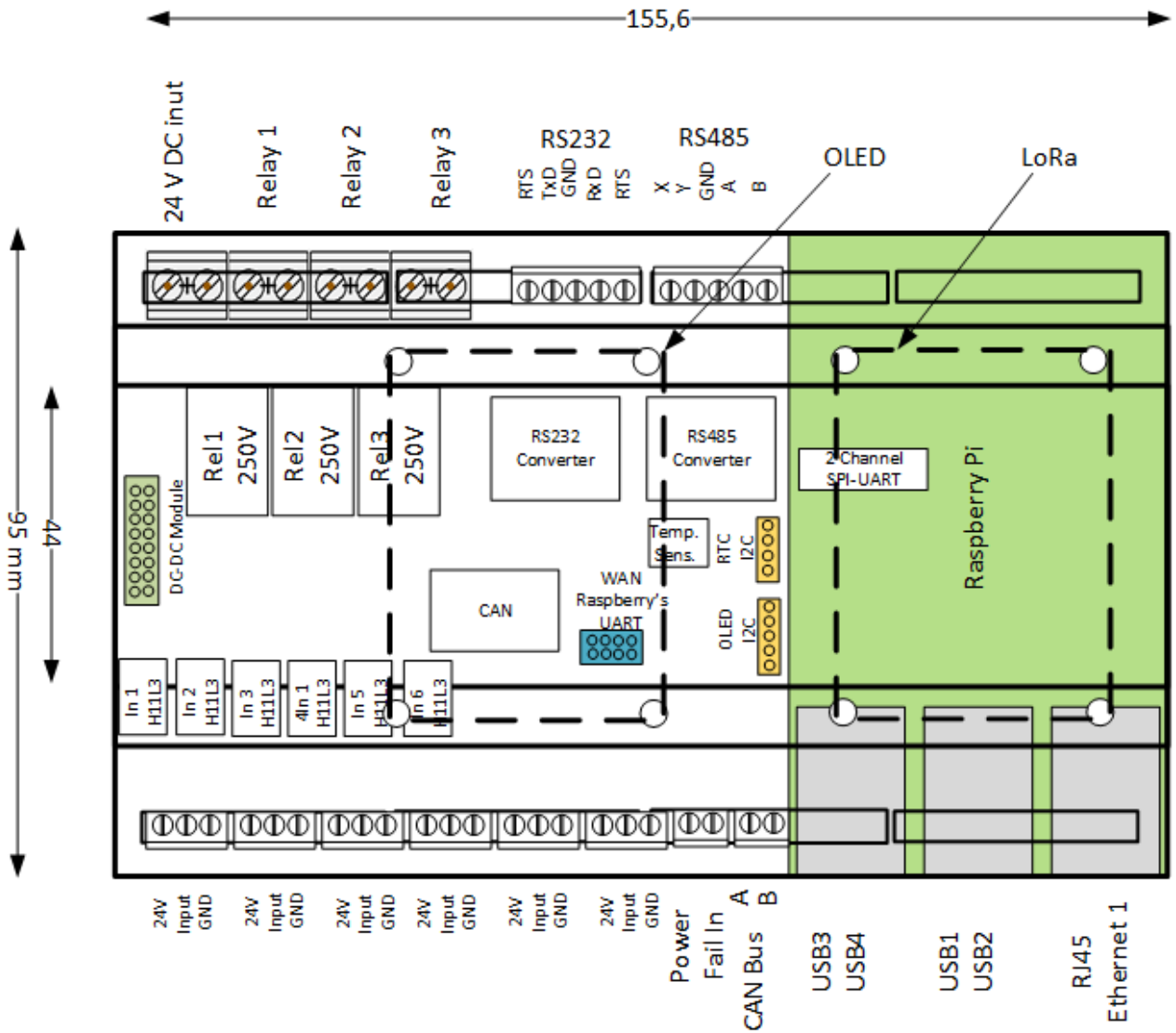
- On-board LoRaWAN™ Class A protocol stack
- ASCII command interface over UART
- Compact form factor 17.8 x 26.7 x 3 mm
- Castellated SMT pads for easy and reliable PCB mounting
- Device Firmware Upgrade (DFU) over UART
- 14 GPIO for control, status, and ADC

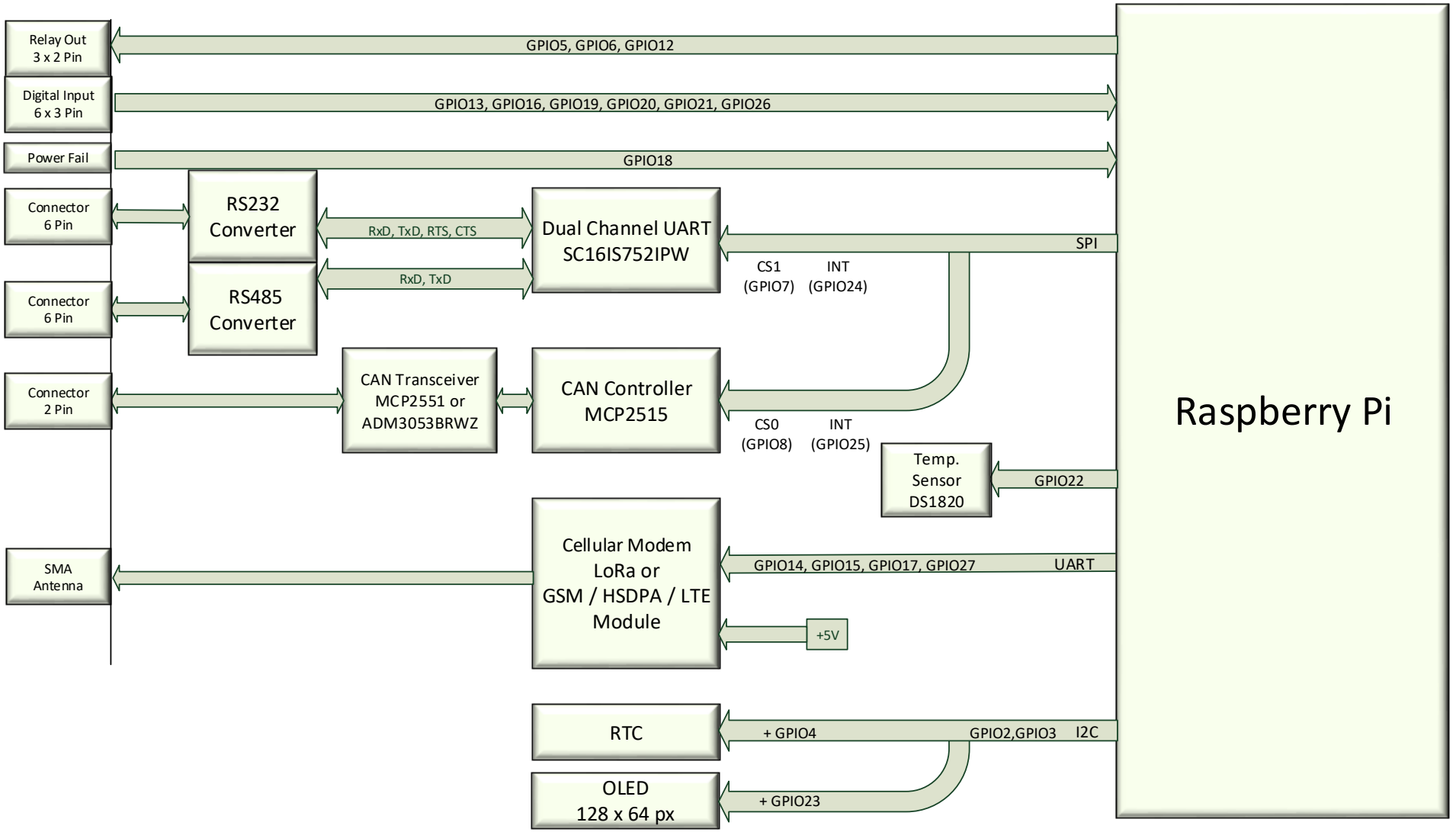


The Module will be placed on a Daughter Board in the Lid of the Housing like the GSM Modem of the Andino LoRa.



4. Rough draft




Relay Out
3 x 2 Pin
GPIO5, GPIO6, GPIO12
Digital Input
6 x 3 Pin
GPIO13, GPIO16, GPIO19, GPIO20, GPIO21, GPIO26
Power Fail
GPIO18
Connector
6 Pin
RS232
Converter
RxD, TxD, RTS, CTS
Dual Channel UART
SC16IS752IPW
SPI
CS1
(GPIO7)
INT
(GPIO24)
Connector
6 Pin
RS485
Converter
RxD, TxD
Connector
2 Pin
CAN Transceiver
MCP2551 or
ADM3053BRWZ
CAN Controller
MCP2515
CS0
(GPIO8)
INT
(GPIO25)
Temp.
Sensor
DS1820
GPIO22
Raspberry Pi
SMA
Antenna
Cellular Modem
LoRa or
GSM / HSDPA / LTE
Module
GPIO14, GPIO15, GPIO17, GPIO27
UART
+5V
RTC
+ GPIO4
GPIO2,GPIO3
I2C
OLED
128 x 64 px
+ GPIO23

4.1 Base Board

The Base Board has the Size of 85 mm x 207 mm.
It includes the following Components:

Connector for Raspberry Pi	Model B 3 B+
Connector for Power Supply	24 Volt, 1 Ampere
Connector for DC – DC Converter	9V to 28V Input to 5 Volt Output (or bypassed / bridged if 5Volt input is required)
3 Relays	250V, 5 Ampere
6 digital Inputs	H11L optocoupler with Schmitt Trigger (SMD)
RS232 Port	One Port of the dual Channel UART is converted RS232 Signals RxD, TxD, RTS, CTS
RS485 Port	The second Channel of the UART will be converted to RS485, RS422 Signals.
SPI UART with two channels CS1 from Raspberry	Channel 1: RS232 Channel 2: RS485
6 SMD LED SK6812	Multicolor serial SMD LED controlled by the ATMega. Lichtleiter (Light guides) brings are mounted in Lid.
Connector for RTC	RTC is connected via I2C with Raspberry Pi
Connector for Cellular Modem	Pin Header connected to the internal UART of the Raspberry Pi
CAN Bus Interface	Microchip MCP2515 Chipset with Non-Isolated or Isolated interface (optional)

4.2 Modules

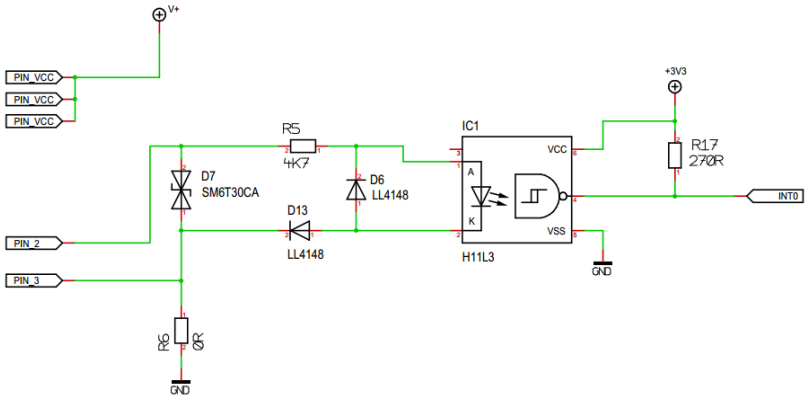
To save space within the Case and build the System in a Modular manner, the Andino LoRa is constructed with Modules. This Modules can be mounted or not as required.

The Modules are

Module	Standard Module	Alternative 1
DC/DC Converter	9V to 28V to 5 Volt	bridged so that the DC Input has to be 5 Volt
Internal UART Adapter for LoRa or Cellular Modem	Adapter to 3rd Party 2G or 3G Module	Left empty if not needed
RTC (I2C)	Uses an standard DS3231 Module	
OLED (I2C)	OLED Display 128x64 with 3 Button	

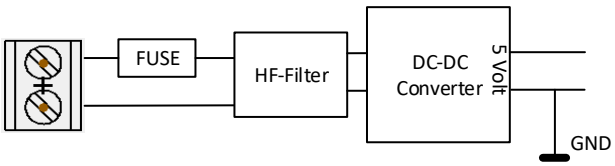
4.3 Digital Input Configuration

The digital Inputs will provide the power Source to drive the Inputs. The Client side can then use e.g. a Relay to drive the Input.



4.4 Power Supply

The input Power is 24 Volt with 1 Ampere. A Polyfuse protect the Device.



4.5 DC DC Converter Module

To provide a stable and reliable 5 Volt Power for the Raspberry Pi and the Cellular Module a 5 Ampere switching Regulator will be used. The same regulator as the Andino X1 is used for the LM2678S-5.0. A HF Filter will be placed on the base-board.

- Efficiency Up to 92%
- Simple and Easy to Design Using Off-the-Shelf External Components
- 5-V Fixed Output
- ±2% Maximum Output Tolerance Over Full Line and Load Conditions
- Wide Input Voltage Range: 8 V to 40 V
- 260-kHz Fixed Frequency Internal Oscillator
- −40 to 125°C Op

4.6 RTC

As RTC a DS3231 Module will be used. The Dallas 3231 is a high precise RTC with a temperature compensated internal clock. The Module is connected via I2C to the Raspberry Pi.

4.7 CAN Bus

To extend the System a CAN Bus is provided to connect external IO.
The CAN Controller MCP2515 is connected to the Raspberry Pi via SPI.

- Features (from the Datasheet)
- Implements CAN V2.0B at 1 Mb/s:
- 0 to 8-byte length in the data field
- Standard and extended data and remote
- frames
- Receive Buffers, Masks and Filters:
- Two receive buffers with prioritized message
- storage
- Six 29-bit filters
- Two 29-bit masks
- Data Byte Filtering on the First Two Data Bytes
- (applies to standard data frames)
- Three Transmit Buffers with Prioritization and
- Abort Features
- High-Speed SPI Interface (10 MHz):
- SPI modes 0,0 and 1,1
- One-Shot mode Ensures Message Transmission
- is Attempted Only One Time
- Clock Out Pin with Programmable Prescaler:
- Can be used as a clock source for other
- device(s)
- Start-of-Frame (SOF) Signal is Available for
- Monitoring the SOF Signal:
- Can be used for time slot-based protocols
- and/or bus diagnostics to detect early bus
- degradation
- Interrupt Output Pin with Selectable Enables
- Buffer Full Output Pins Configurable as:
- Interrupt output for each receive buffer
- General purpose output
- Request-to-Send (RTS) Input Pins Individually
- Configurable as:
- Control pins to request transmission for each
- transmit buffer
- General purpose inputs
- Low-Power CMOS Technology:
- Operates from 2.7V-5.5V
- 5 mA active current (typical)
- 1 µA standby current (typical) (Sleep mode)
- Temperature Ranges Supported:
- Industrial (I): -40°C to +85°C

- Extended (E): -40°C to +125°C

4.8 RS232 Interface

The RS232 Interface converts the UART TTL Signals to the screw terminals.

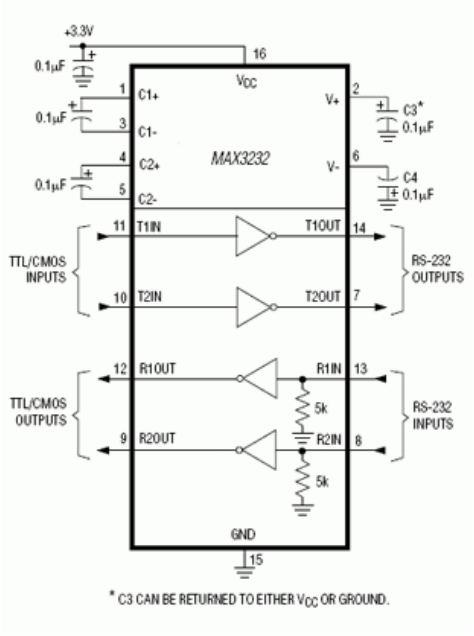


ABBILDUNG 1 MAX3232 OR SIMULAR

The RS232 Module provides the Signals RTS, CTS and RxD, TxD.

4.9 RS485 / RS422 Interface

RS485 can be used as Half Duplex (RS485) or Full Duplex (RS422). This Module also has an “Auto Transmitter On” function with can be switched on by Jumper.

The functionality is the same as the RS485 Shield for the Andino X1.

Switch	RS422	RS485 Auto	RS485 RTS	
S3 – 1	ON	ON	ON	A-B 120R
S3 – 2	-	-	-	NC
S3 – 3	ON	ON	ON	B 120R GND
S3 – 4	ON	ON	ON	A 120R +5V
S2 – 1	ON	OFF	OFF	Y to PIN D
S2 – 2	ON	OFF	OFF	Z to PIN C
S2 – 3	OFF	ON	ON	Z to B
S2 – 4	OFF	ON	ON	Y to A
S1 – 1	ON	OFF	OFF	/RE to GND
S1 – 2	OFF	ON	ON	/RE to DE
S1 – 3	OFF	ON	OFF	555 to DE
S1 – 4	ON	OFF	ON	RTS to DE

5. EMC and CE

The Andino LoRa with all Modules will be checked by an independent and Accredited EMC laboratory. The following standards will be checked:

Radiated field strength / conducted emissions
DIN EN 55022: 2011 according to **VDE 0875 part 22** of 12.2011
Emitted interference: class B (residential area) (tighter limits)
Immunity: class A (industrial area). (Higher irradiance))

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