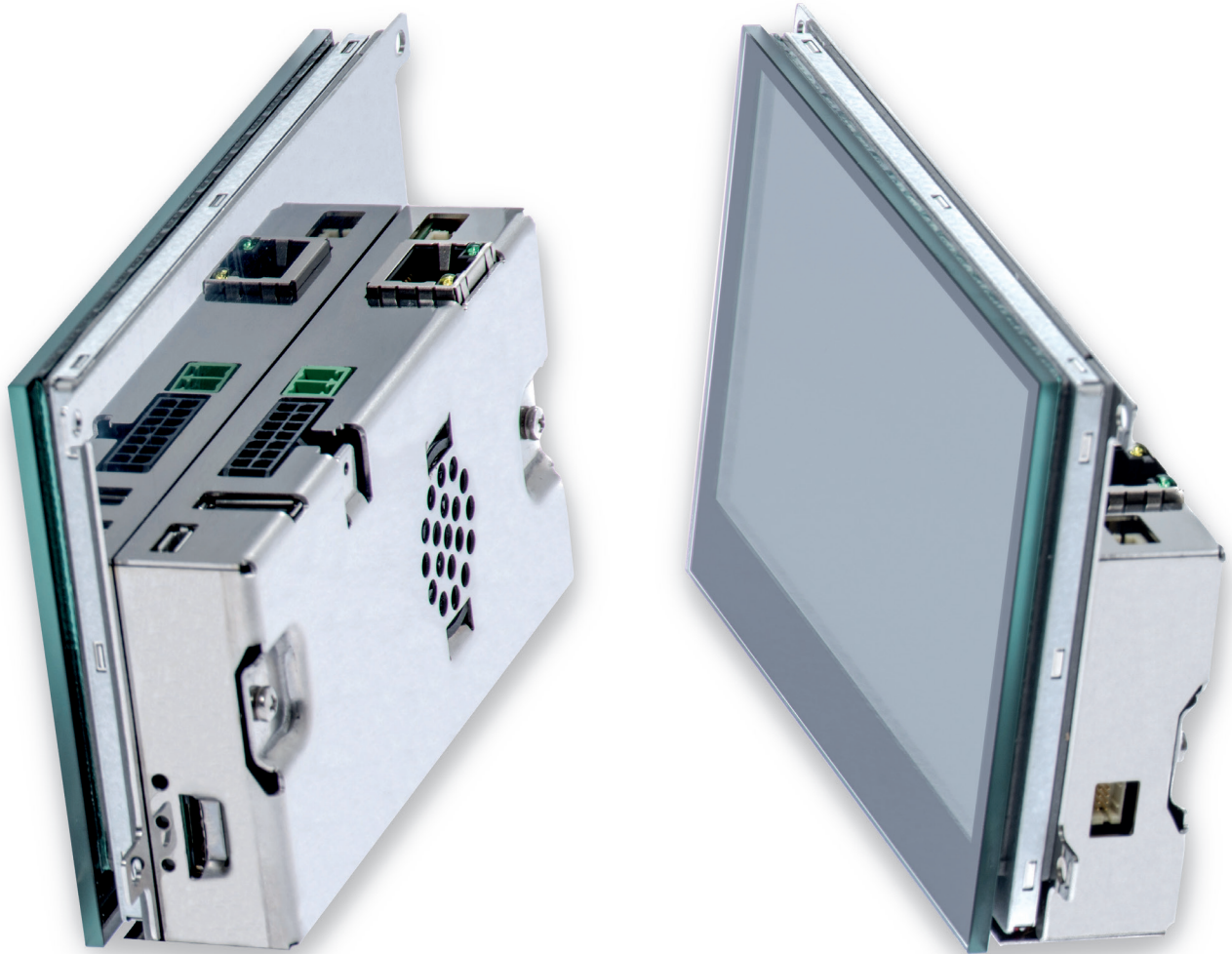


SOLUTIONS THAT COMPLETE!

GARZ  **FRICKE**

SANTINO LT 5.0 OF PCT

ARM Cortex A9 Rear Mount



Product Manual

Document Revision History

The information in this document is subject to change without prior notice in order to improve reliability, design and function and does not represent a commitment on the part of the manufacturer.

Revision	Date	Author	Description
V 1.0	09.02.2017	CG	Initial Release V1.0

Online support on www.garz-fricke.com

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* alternative assembly upon request

1. Introduction

Thank you very much for purchasing a Garz & Fricke product. Our products are dedicated to professional use and therefore we suppose extended technical knowledge and practice in working with such products.



The information in this manual is subject to technical changes, particularly as a result of continuous product upgrades. Thus this manual only reflects the technical status of the products at the time of printing. Before design-in the device into your or your customer's product, please verify that this document and the therein described specification is the latest revision and matches to the PCB version. We highly recommend contacting our technical sales team prior to any activity of that kind.

The attached documentation does not entail any guarantee on the part of Garz & Fricke GmbH with respect to technical processes described in the manual or any product characteristics set out in the manual. We do not accept any liability for any printing errors or other inaccuracies in the manual unless it can be proven that we are aware of such errors or inaccuracies or that we are unaware of these as a result of gross negligence and Garz & Fricke has failed to eliminate these errors or inaccuracies for this reason. Garz & Fricke GmbH expressly informs that this manual only contains a general description of technical processes and instructions which may not be applicable in every individual case. In cases of doubt, please contact our technical sales team.

In no event, Garz & Fricke is liable for any direct, indirect, special, incidental or consequential damages arising out of use or resulting from non-compliance of therein conditions and precautions, even if advised of the possibility of such damages.



Before using a device covered by this document, please carefully read

- **Annex „E-1 Warranty Hints“**
- **Annex „E-2 Field of Application“**



Embedded systems are complex and sensitive electronic products. Please act carefully and ensure that only qualified personnel will handle and use the device at the stage of development. In the event of damage to the device caused by failure to observe the hints in this manual and on the device (especially the safety instructions), Garz & Fricke shall not be required to honour the warranty even during the warranty period and shall be exempted from the statutory accident liability obligation. Attempting to repair or modify the product also voids all warranty claims.

2. Safety Hints

Please read this section carefully and observe the instructions for your own safety and correct use of the device. Observe the warnings and instructions on the device and in the manual. Garz & Fricke embedded systems have been built and tested by us and left the company in a perfectly safe condition. In order to maintain this condition and ensure safe operation, the user must observe the instructions and warnings contained in this manual.



I. General Handling

- Don't drop or strike the unit: The PCB, display and/or other parts might be damaged.
- Keep away from water and other liquids, the unit is not protected against.
- Operate the unit under electrical and environmental conditions according to the technical specification.
- The electrical installations in the room must correspond to the requirements of the local (country-specific) regulations.
- Take care that there are no cables, particularly power cables, in areas where persons can trip over them.
- Do not place the device in direct sunlight, near heat sources or in a damp place.
- All plugs on the connection cables must be screwed or locked to the housing.
- Repairs may only be carried out by qualified specialist personnel authorized by Garz & Fricke GmbH or their local distributors.
- Maintenance or repair on the open device may only be carried out by qualified personnel authorized by Garz & Fricke GmbH which is aware of with the associated dangers.



II. Electricity

- The embedded systems may only be opened in accordance with the description in this user's manual for
 - replacing of the (rechargeable, where applicable) lithium battery and/or
 - configuration of interfaces, where applicable
- These procedures have to be carried-out only by qualified specialist personnel.
- When accessing internal components the device must be switched off and disconnected from the power source.
- When purchased core or basic versions without protecting back cover, don't touch the PCB directly with your fingers. Especially these products need to be handled very carefully.
- Don't operate or handle the unit without typical ESD protection measures, such as ground earthing.
- Operate the unit according to the technical specification only.



III. Damage or Permanent Malfunction

- It must be assumed that a safe operation is no longer possible, in case
 - the device has visible damage or
 - the display is dark or shows strange pattern for longer period
 - the device doesn't react after a reset
- In these cases the device must be shut down and secured against further use



IV. LCD and touch handling

- If equipped with, the soft surface of a resistive touch screen is not suitable for use with stencils and/or other devices for touch operation. There are special plastics pens available in commercial shops. A projective capacitive touch screen might be protected by a heat strengthened glass or acrylic or polycarbonate cover lens. These are dedicated for use with finger tips. There are very special pens available which might work with a PCT touch.
- Protect the LCD/touch/cover lens against scratches and sharp edges. The warranty does not cover pixel failures resulting from non-compliant handling.
- Clean the LCD/touch/cover lens with a soft cotton cloth with alcohol. Don't use organic solvents, acid or alkali solutions.
- Water drops, finger fat or any similar fouling should be removed immediately from the LCD, cover lens and metal frame to avoid any staining.

3. Product Introduction

This document is applicable for hardware revisions 1.0 or later of the SANTINO LT series.

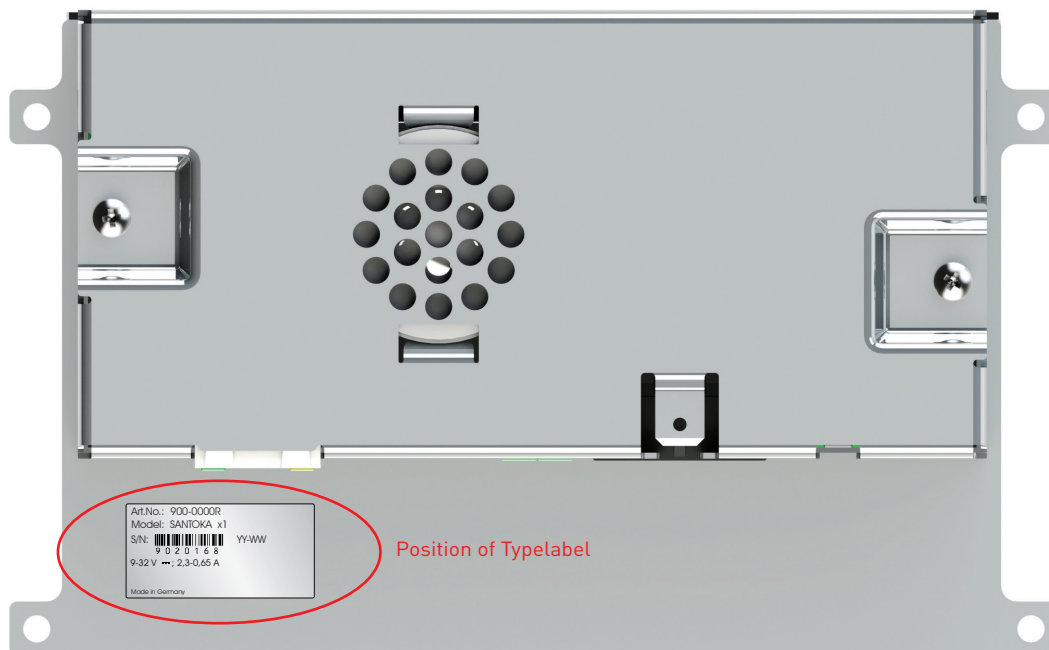
Please find the hardware version grid in „**Annex B: Hardware Revision Information**“:

SANTINO LT is an Embedded System to be used as human machine interface (HMI) in various applications.

Please refer to **Annex „E-2 Field of Application“** for further information. The system is equipped with a large number of industrial interfaces. A wide variety of options is available as well.

3.1 Type Plate and Device Information

For service and later identification of the device, the type plate contains important information.



Art.No.: 900-0000R	Garz & Fricke article number
Model: SANTINO LT x1	Product name and configuration
S/N:  YY-WW	Production date (week/year)
9 0 2 0 1 6 8	Serial number
9-32 V  ; 2,3-0,65 A	Power ratings
Made in Germany	

3.2 Product names and variants

Product name definition:

SANTINO LT <CPU> <5.0> <OF> <PCT> <IPS> <additional description> <Vx.y.z>

Explanation:

SANTINO LT	Product family name (invariable)
<CPU> x1, x2L	(number of cores inside the i.MX6 processor)
<5.0>	Display size in inch
<OF>, <SG>, <BX>	mechanical design of enclosure
<PCT>, <RES>	projected capacitive touch; if blank: 4-wire resistive
<IPS>	Display technology "in-plane switching", (option)
<additional description>	contains variants which are important to sales product description, i.e.
● without or with WLAN/Bluetooth module ("W/B") ● untreated glass surface or including antiglare treatment ("AG") ● front frame made from die-cast zinc or aluminium ("Alu") ● different memory capacities for RAM and/or eMMC ● customer-specific reduced assembly ● etc.	
<Vx.y.z>	revision of PCB layout
<x>	describes major changes in form fit and functions
<y>	describes variants that are different in PCB layout and could affect the list of critical components (UL LoCC).
<z>	describes minor changes to PCB layout due to production optimization like solder resist mask or drilling diameters. Also minor changes in assembly of PCB and/or device which do NOT affect the list of critical components (UL LoCC) due to unlisted components or declared "interchangeable".

3.3 Related Documents and Online Support

This document contains operating system specific information. The following additional documentations are available:

OPERATING SYSTEMS

Linux Yocto Jethro	 http://mx31.de/j	Contains information about Linux BSP with development environment Linux Embedded System Yocto (Codename: Jethro, Version 3.0) includes first information about the bootloader Flash-N-Go
--------------------	--	--

UPDATE / BOOT / SYSTEM

Flash-N-Go	 http://mx31.de/k	Contains information about the usage of the G&F Flash-N-Go solution which consists of three submodules: ● Flash-N-Go Boot (A tiny boot loader) ● Flash-N-Go System (A maintenance os) ● Flash-N-Go Update (A GUI based update solution for all os)
------------	--	---

4. Technical Data

CPU	x1	x2L
CPU Type	i.MX6Solo	i.MX6DualLite
Core Class	ARM Cortex - A9	
Core Clock	1 GHz	
Features	NEON for SIMD media acceleration and VFP operations; Multi-format HD 1080p video decoder and HD 720p video encoder hardware engine; L1 cache, 32 KB for instruction, 32 KB for data; 512 KB L2 cache	
HW Accelerators	OpenGL ES 2.0, OpenVG 1.1	
RTC	Accuracy: +/- 30 ppm at 25°C	
Memory		
eMMC Flash	4 GB MLC eMMC	
RAM Standard	512 MB 32 bit DDR3L	1 GB 32 bit DDR3L
MicroSD Card Slot	4 bit MMC/SDIO/SD/SDHC	
Operating Systems		
Supported OS	Linux Yocto Jethro	
Communication Interfaces		
Network	1x 10/100 Mbit/s Ethernet (RJ-45)	
RS-485	1 x RS-485 (Half duplex)	
RS-232	1x RS-232 (RX/TX/CTS/RTS) MDB ² / 1x MDB (Master / Slave optional) ³ instead of external RS-232	
Synchronous Serial Interfaces	I²C, Matrix keypad up to 4 x 4	
USB 2.0	1x 480 Mbit/s Host (Type A) 1x 480 Mbit/s OTG (Type Micro-AB) ¹	
CAN Fieldbus	1x CAN (ISO/DIS 11898)	
Audio		
Speaker output	1x speaker (connector), 1.5 W RMS (8Ω)	
Audio Internal	1x speaker 1 WRMS (8Ω) parallel to external output	
Display and Touch		
Size	5 inch/ 125.95 mm	
Resolution	800 x 480 pixel	
Brightness	Typ. 1120 cd/ m²	
Backlight Lifetime	min. 50 000 h	
Viewing Angle	60°, 70°, 75°, 75° (UDRL)	
Color	24 bit (16.7 Mio. colors)	
Touch	projected capacitive multi touch	

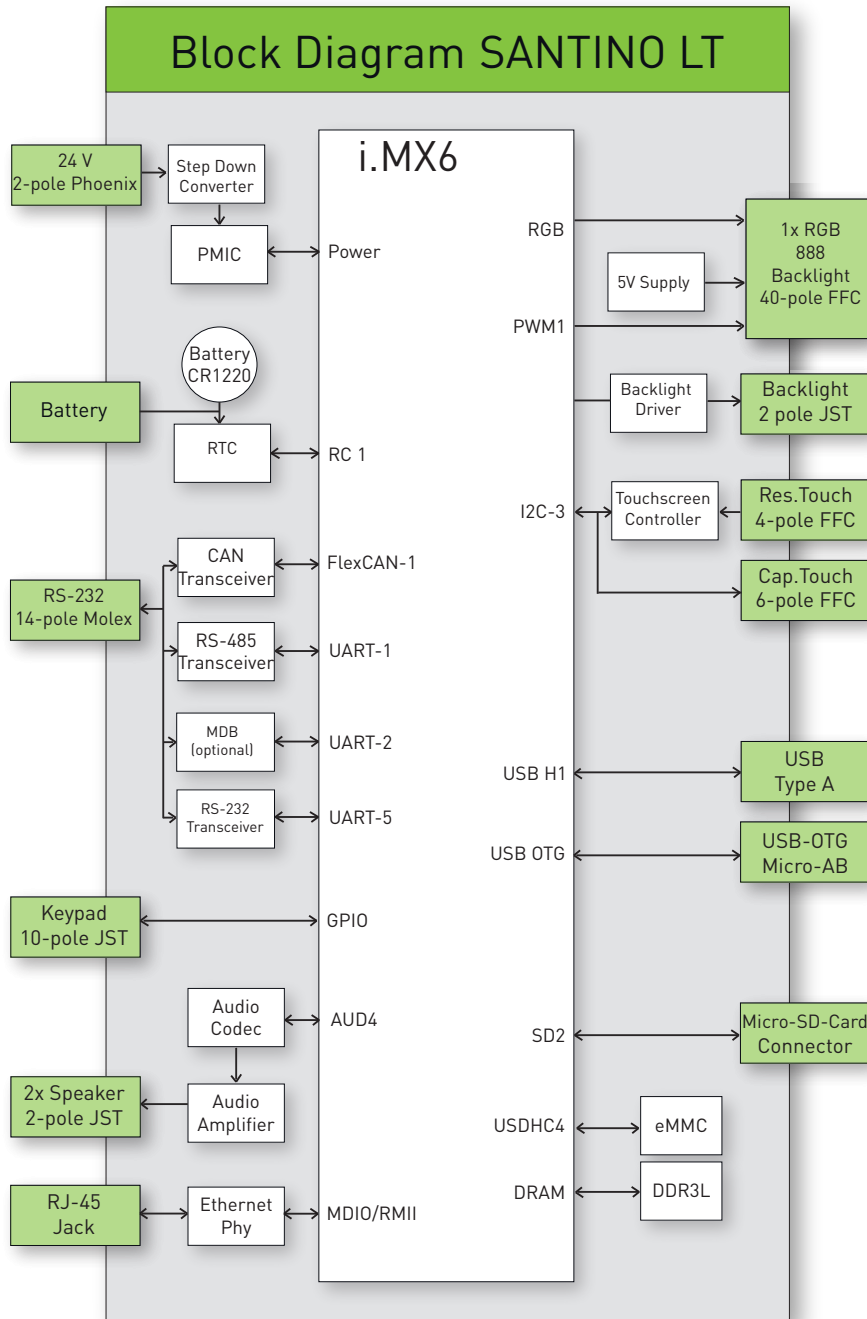
¹ Mechanically the Micro-USB interface has not been designed for frequent contact operations. Please use an adapter cable with a strain relief.

² Option

³ The selection of a variant eliminates the other.

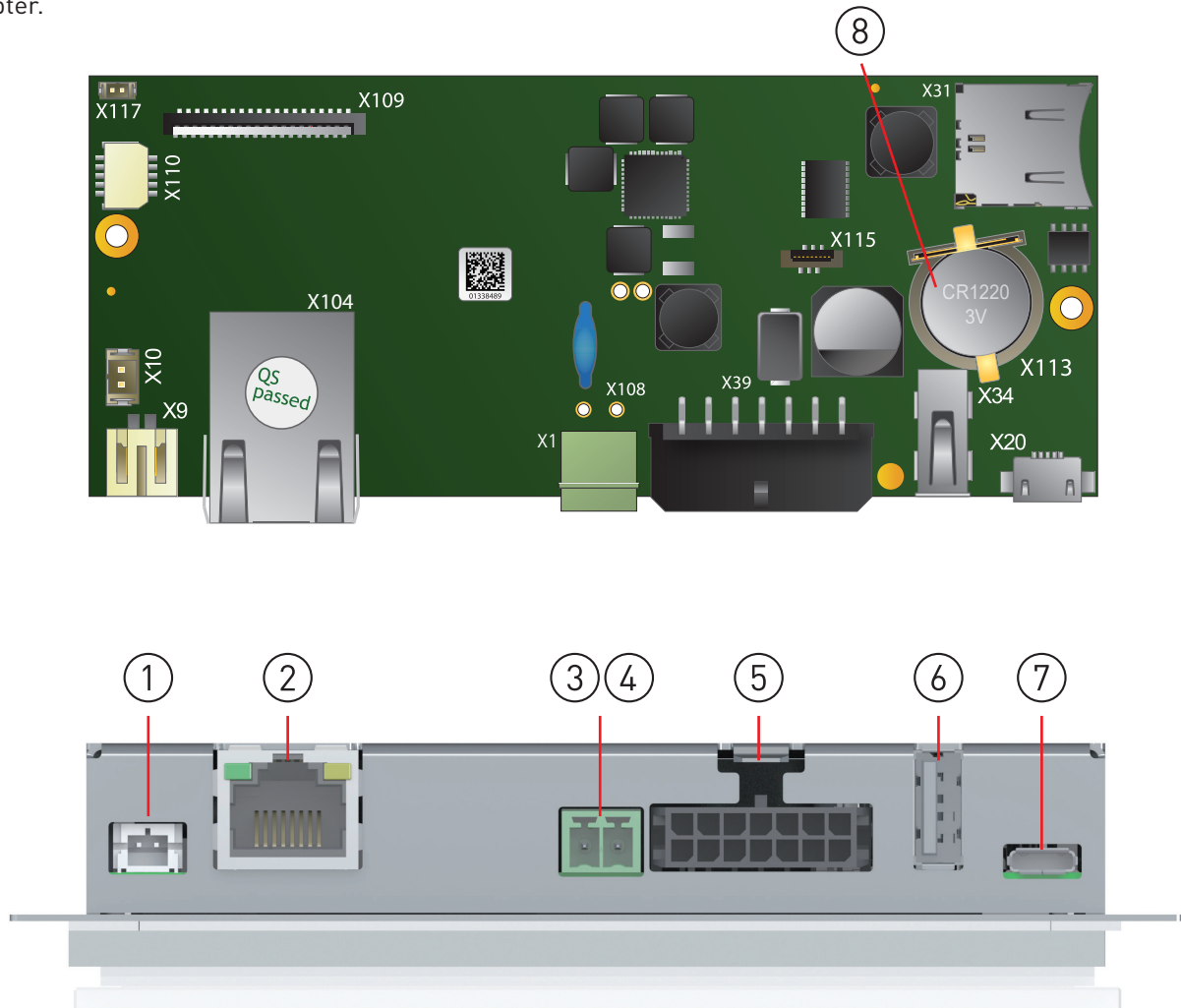
Housing	x1	x2L
Front	2.8 mm toughened glass; RAL 9005	
Frame	None	
Rear	1.4016 stainless steel	
Ingress Protection	Front IP 20/Rear IP20	
Device Dimensions		
W x H x D	134.4 x 83.0 x 30.7 mm	
Weight	321 g	
Power Supply		
Supply Voltage	Nom. 9 to 32 V DC	
Consumption	Typ. 7.1 W; max. 20.4 W	
Internal Backup Battery (RTC)	Type: 3 V Li-Ion Type CR1220: Lifetime (RTC only): Approximately 8 years, depending on application	
Typical Environmental Conditions		
Storage Temp.	-20 to +70 °C	
Operating Temp.	0 to +60 °C	
Humidity	5 to 90 % RH	
Max. Operating Altitude ty	3.000 m	
Max. Storage/Transit Altitude	10.000 m	
Noise Level [db(A)] @ 1m	<<40 (fanless design)	
Lifetime		
MTBF	≥ 400.000 h (without backlight)	

4.1 Block Diagram SBC



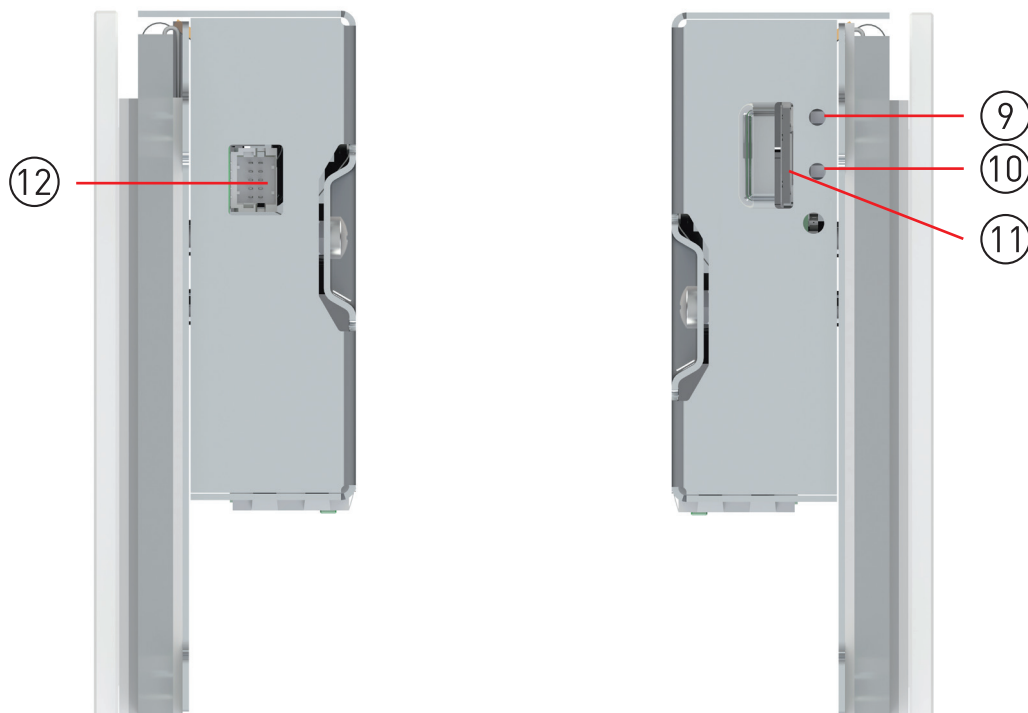
4.2 Connectors

As this manual describes an open frame version, only the external interfaces will be mentioned in the following chapter.



[Exemplary Illustration. It shows the fully equipped SANTINO LT Dualcore light 5.0" OF.]

Pos.	Description
1	Speaker (X9)
2	Ethernet (X104)
3	Power (X1)
4	eBus (X108) Option
5	CAN/RS-485 Interface (X39)
6	USB Host (X34)
7	USB OTG (X20)
8	Battery (X113)



(Exemplary Illustration both sides)

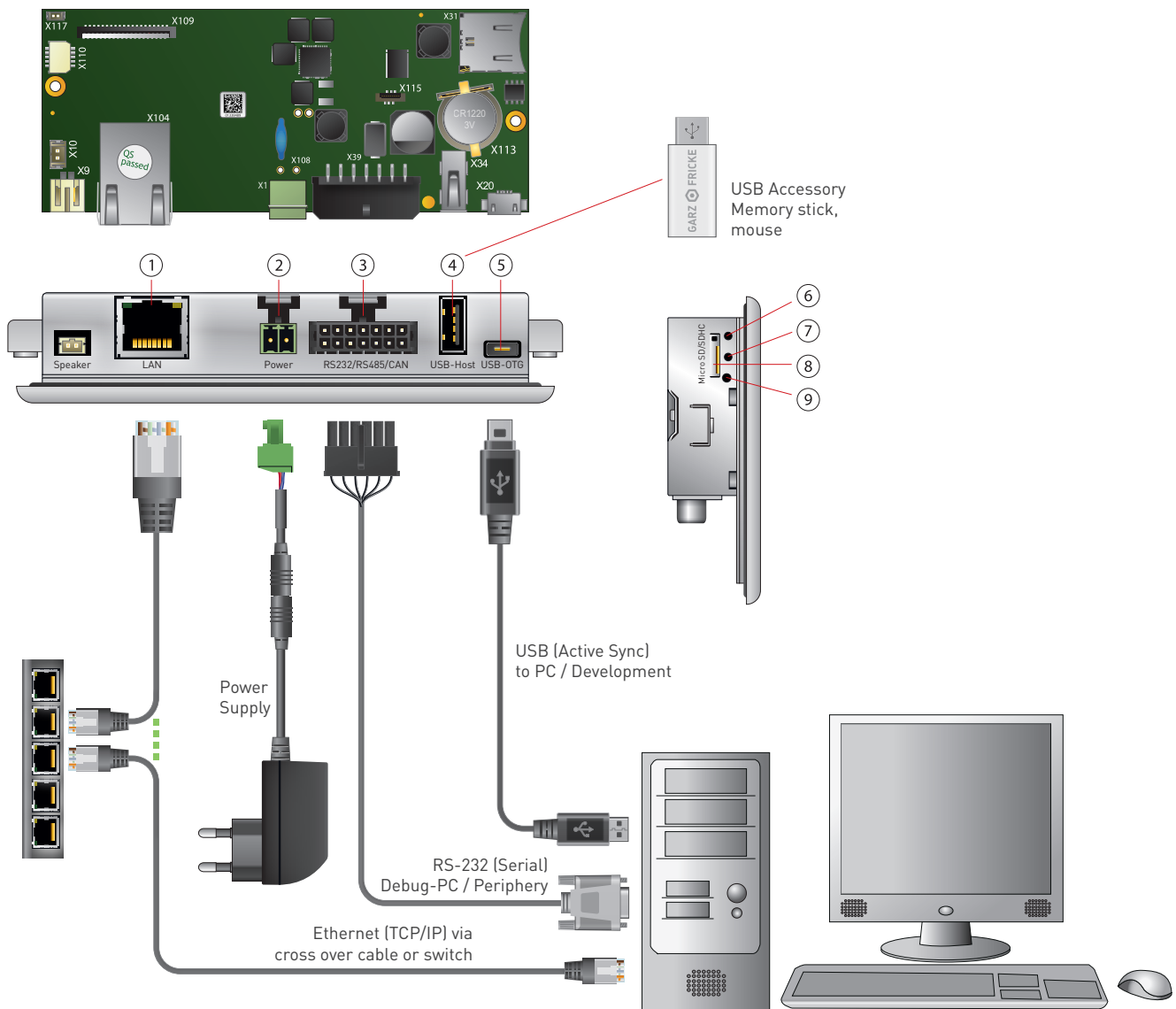
Pos.	Description
9	Reset Switch (SW1)
10	Bootselect Switch (SW2) ¹
11	Micro SD Card (X31)
12	Keypad / I ² C (X110)

¹ For the function of this switch please refer in the future to the Flash N Go User Manual.

5. Installation and Start Up

The content of this document is limited to explain the device connectors and how to access SANTINO LT via FTP over your local area network (LAN) within a few seconds. For advanced hardware specifications and software support, please refer to chapter „3.3 Related Documents and Online Support“

5.1 Connection Scheme



Pos.	Description
1	Ethernet
2	DC in
3	RS-232
4	USB-Device
5	USB-Host (OTG)

Pos.	Description
6	Reset sw
7	Bootselect sw
8	SD card slot
9	Power LED



<http://mx31.de/1a>

6. Internal and External Interfaces

6.1 Speaker (X9)

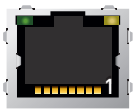


Pin	Name	Description	Level
1	Speaker +	Parallel to X10	1.5W RMS 8 Ohm
2	Speaker -		

Header: JST S2B-PH-SM3-TB

Plug: ST PHR-2 with crimp contacts SPH-002GW-P0.5L-ND

6.2 Ethernet (X104)



Pin	Name	Description	Information
1	Tx+		Rx/Tx might be swapped (Auto-MDIX) +/- might be swapped (Autom. polarity correction)
2	TX-		
3	RX+		
4	SPARE 1		
5			
6	RX-		
7	SPARE 2		
8			

Header: RJ45

Green LED (link) is default off and turns on when link is detected.

Yellow LED (act) flashes during sending/receiving packets.

6.3 Power (X1)

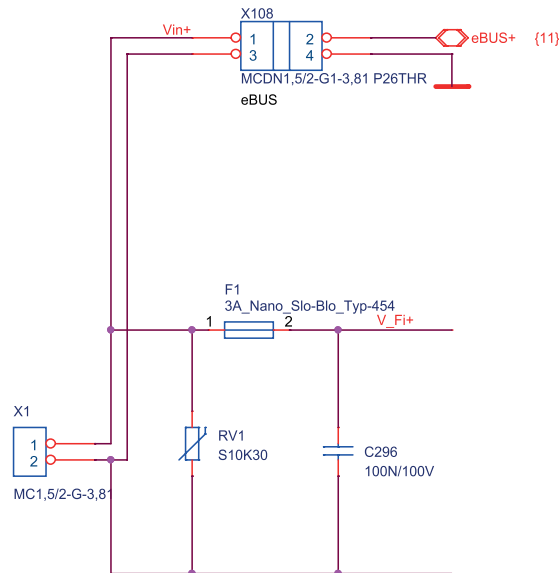


Pin	Name	Description	Level
1	Vin+	Input voltage	Nom. 9 to 32 V DC
2	Vin-	Input voltage	0 V

Header: Phoenix Contact MC1,5/2-G-3,81 2p
 Plug: MCC 1/ 2-STZ-3,81 2p, crimp contact MCC-MT 0,5-1,0
 Shielding with 6,3 mm male spade terminal connector
 GND/Vcc_In is not galvanic isolated from System-GND



Caution:
 Power supplies connected to this device must be compliant to the requirements of "limited power sources" (LPS) to prevent the end-user from danger in case of a fault.



6.4 eBus (X108)*

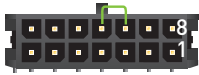
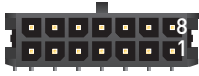
instead of X1

Pin	Name	Description	Level
1	Vin +	Input Voltage	Nom. 9 to 32 V DC
2	eBus +	eBus	15 to 24 V High 9 to 12 V Low
3	Vin -	Input Voltage	0 V
4	GND	Ground	0 V

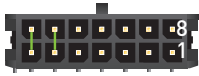
Header: Phoenix Contact MCDN1,5/2-G1-3,81
 Plug: Phoenix Contact FMC 1,5/2-ST-3,81

* alternative assembly upon request

6.5 RS-232/RS-485/CAN (X39)



CAN1 Termination



RS485 Termination

Pin	Name	Description	Level
1	GND	Ground	
2	RS-232_TXD1	Port #1: Transmit data (Output)	V. 28
3	RS-232_RXD1	Port #1: Receive data (Input)	V. 28 +24 V
4	RS-232_RTS1	Port #1: Request-to-send (Output)	V. 28 +24 V
5	RS-232_CTS1	Port #1: Clear-to-send (Input)	V. 28
6	RS485_A_T+	RS485 Termination high side, bridge with T+	
7	RS485_B_T-	RS485 Termination low side, bridge with T-	
8	GND	Ground	
9	CAN_H	CAN bus high	
10	CAN_L	CAN bus low	
11	CAN_TERM	To enable CAN-Termination, bridge with CAN_L	
12	GND	Ground	
	RS485_T+	Half Duplex A	
	RS485_T-	Half Duplex B	

Header: Molex 43045-1400 Micro-Fit 14p

Plug: Molex 43025-1400 Micro-Fit 14p, crimp contact Molex 43030-0007

Shielding with 6.3 mm male spade terminal connector CAN/RS-485 is not galvanic isolated from System-GND/Housing

6.6 USB Host (X34)



Pin	Name	Description	Level
1	USB_H1_VBUS	Power supply	+5 V DC max 500mA
2	USB_H1_DN	Data minus (D-)	
3	USB_H1_DP	Data plus (D+)	
4	GND	Ground	

Header: USB Type A

6.7 USB OTG (X20)



Pin	Name	Description	Level
1	USB__OTG_VBUS	Power supply	+5 V DC max 500mA
2	USB_OTG_DN	Data minus (D-)	
3	USB_OTG_DP	Data plus (D+)	
4	USB-OTG_ID	Device ID	
5	GND	Ground	

Header: Micro-USB Type AB

6.8 Micro SD-Card Holder (X31)



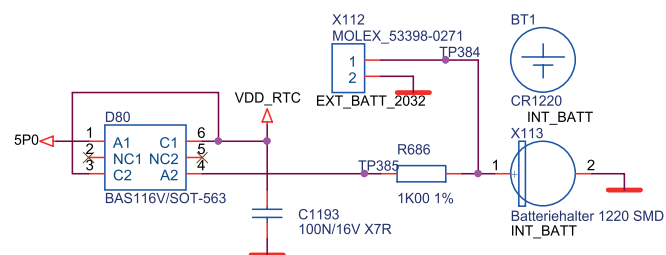
Pin	Name	Description	Level
1	DAT3		
2	CMD	Pullup	3.3 V
3	GND		
4	VDD		3.3 V
5	CLK		
6	GND		
7	DAT0		
8	DAT1		
9	DAT2		

6.9 Battery Connector (X113)



Pin	Name	Description	Level
1	VCC	Supply	3 V
2	GND	Ground	

Header: Keystone 1056
Battery: CR1220



6.10 Keypad / I²C (X110)

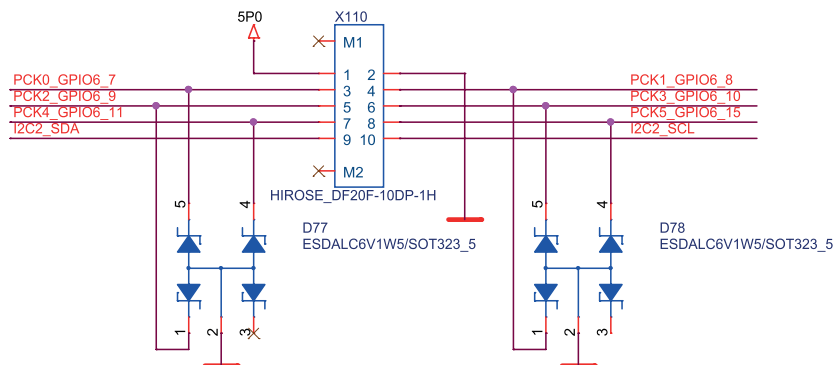
Keypad/SPI/I²C, multiplexed



Pin	Name	Description Default Mode	Level
1	Power Supply		5.0 V
2	GND	Ground	
3	PCK0_GPIO6_7	Keypad row 0	3.3 V
4	PCK1_GPIO6_8	Keypad column 0	
5	PCK2_GPIO6_9	Keypad row 1	
6	PCK3_GPIO6_10	Keypad column 1	
7	PCK4_GPIO6_11	Keypad row 2	
8	PCK5_GPIO6_15	Keypad column 2	
9	I2C1_SDA	I ² C data	
10	I2C1_SCL	I ² C clock	

Header: JST DF20F-10DP, side entry, RM = 1.00

Plug: JST DF20-10DS-1C, crimp contact: DF20 F2830 SCF A



Digital output Specification (3.3 V):

V_{OH}: min OVDD-0.15; V_{OL} max: 0.15V

Drive Strength (Software defined)	I _{OL} (mA)	I _{OH} (mA)
Low	5.1	-5.1
Medium	10.2	-10.2
High	15.3	-15.3

7. Battery

7.1 Battery Specifications

The internal baseboard is equipped with a Primary Lithium battery (type CR1220), which has a typical lifetime of 8 years.

Type	Garz & Fricke Article Number
Battery type CR1220	010-0059R

Manufacturer	Model
Varta	CR1220
Alpha 3 Manufacturing Ltd.	Y0BCR1220
Keystone	1220
Maxell	CR1220

One of these brands must be installed.



Danger of explosion when replaced with wrong type of battery.
Replace the battery only with a Lithium battery that has the same or equivalent type recommended by Garz & Fricke GmbH.



Do not dispose of used CMOS batteries in domestic waste.
Dispose of the battery according to the local regulations dealing with the disposal of these special materials (e. g. to the collecting points for disposal of batteries).

7.2 Replacement of the Internal Battery

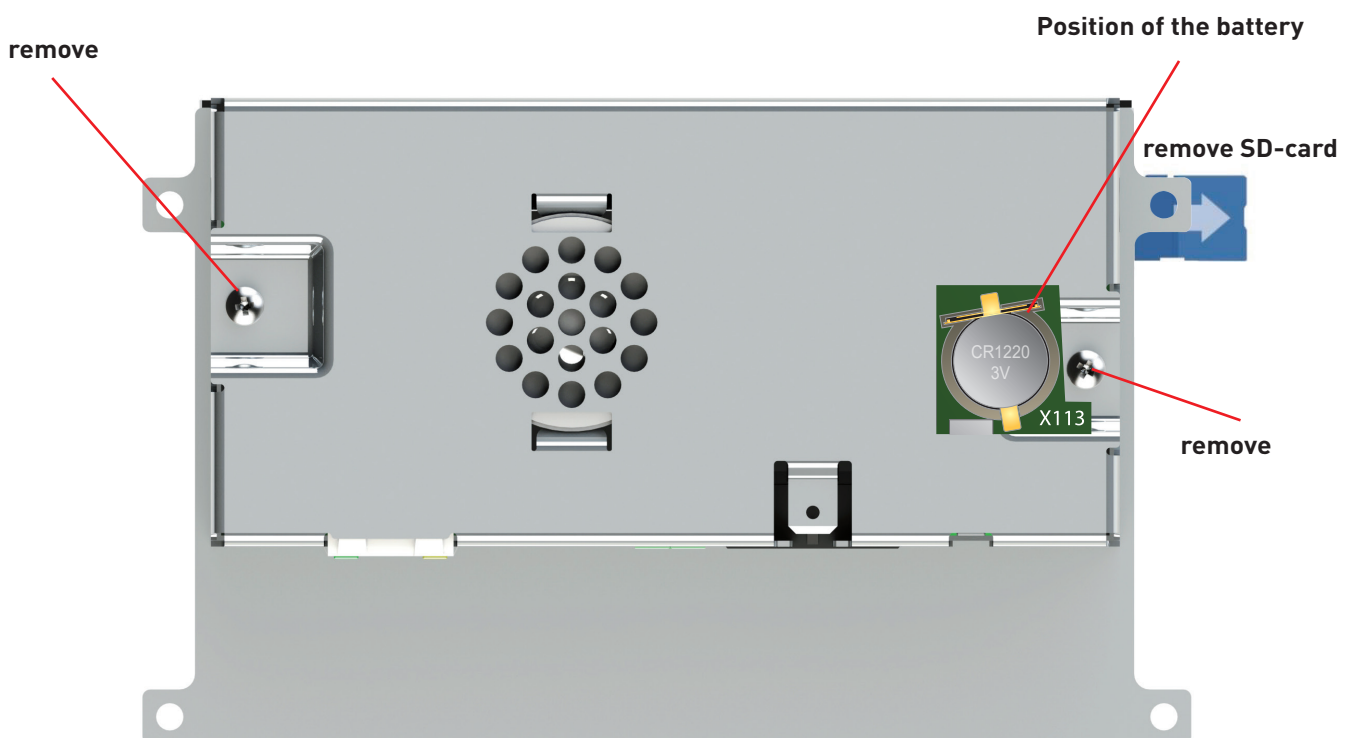
The internal battery is placed as per figure below.

For replacement, the SD-card and the back cover have to be removed.

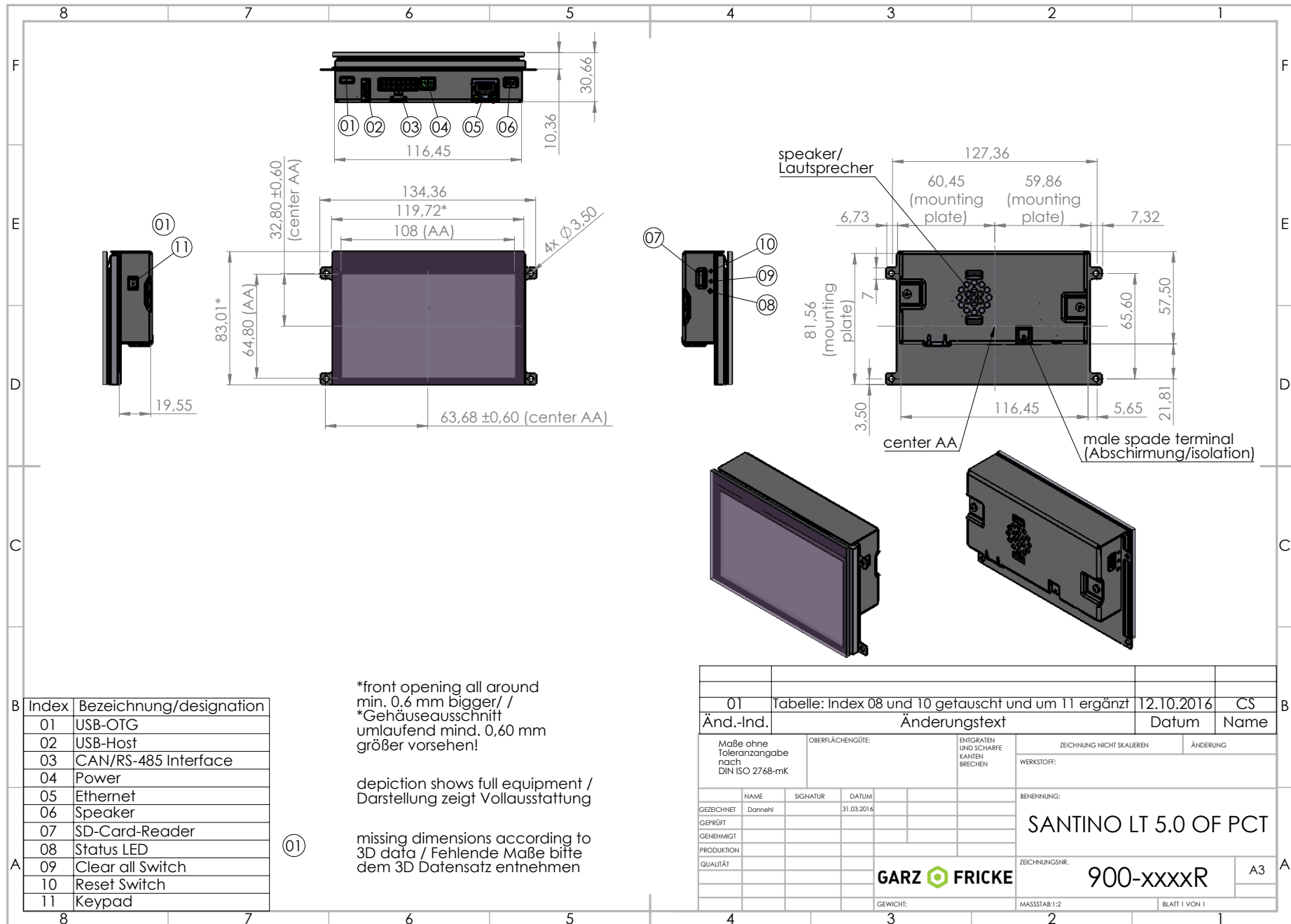
The device shall be opened by authorized and skilled personnel only.



Danger of electric hazard! First before opening, please make sure that the unit is completely disconnected from any power supply, direct or indirect. In order to remove the back cover all other connectors must be removed as well. Please make sure that the SD-card has been removed as it blocks the cover. Furthermore take care about the socket and connectors. Especially the micro USB connector might be damaged easily.



Annex A: Technical Drawing



Annex B: Hardware Revision Information

This document is applicable for all products listed below. Please note that customized variants might possibly not support all features listed herein. Additional features are documented in specific attachments.

Platform	Article Number	Marking on PCB
SANTINO LT x1 5.0 OF PCT V1.1	900-3359R	0599 SANTINO LT V1.1
SANTINO LT x2L 5.0 OF PCT V1.1	900-3513R	0599 SANTINO LT V1.1

Hardware Revision	Changes	Marking on PCB
V1.0	initial release	0599 SANTINO LT V1.0
V1.1	Minor bug changes	0599 SANTINO LT V1.1

Annex C: Assembly Options

C-1 Wi-Fi / Bluetooth

Some appliances require a wireless network connection. To be more flexible with regard to future Wi-Fi standards and regulations, we decided not to assemble this functionality directly onto the single-board-computer. We recommend an external USB or miniPCle solution. Drivers for both versions will be included in the related operating systems. Please contact the support for information about supported modules.



Annex D: Guidelines and Standards

D-1 RoHS Declaration

Devices comply with the requirements of Directive 2011/65/EU of the European Parliament and of the Council of 8th June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

D-2 Supplier Declaration – Directive EG 1907/2006 REACH

Garz & Fricke is manufacturer of electronic products, thus - in the sense of REACH - we are so called „downstream users“. The products we supply to you are solely non-chemical products (goods). Moreover and under normal and reasonably foreseeable circumstances of application, the goods supplied to you shall not release any substance. For that, Garz & Fricke is neither obligatory for registration nor for the creation of material safety data sheet (MSDS).

From state of knowledge today our products contain no substances of very high concern from the current SVHC candidate list of the European Chemicals Agency in percentage >0,1.

We will immediately inform you in correspondence to REACH-Article 33 if any substance of content >0,1 percentage in our goods will be classified alarming by the ECHA. Based on the current status, however, we do not expect such an incidence.

D-3 UL Certification

Customers of Garz & Fricke are attending on different markets. These markets are subjected to different UL certifications. Therefore Garz & Fricke have no UL certification for their products.

To obtain UL certifications the product is designed to respect the following constraints:

- All electronic printed circuit boards are conform to UL standard
- Battery schematics meets the requirements of UL standard (please refer to chapter „6.9 Battery Connector [X113]“)
- All wirings are designed with UL components
- The selected components on the markets are UL (List of UL relevant components is available at Garz & Fricke (on request))

Garz & Fricke do not guarantee to obtain UL certifications.

D-4 Garz & Fricke Conformity Statement

Garz & Fricke GmbH develops and distributes reliable, ARM-based embedded solutions. We offer various solutions from computer-on-modules (COM) to single-board computers (SBC) and fully-assembled human machine interface (HMI) with pre-installed operating system, display and housing.

These solutions are offered exclusively as OEM products. They do not include any application software that is intended for the end user. Therefore, we do not make any EU declarations of conformity in the name of Garz & Fricke GmbH and do not provide the products with the CE mark.

Our customers provide the products with application software and build them into an end-user device as part of an industrial production process. They identify themselves as a manufacturer by affixing a license plate with their company or brand name.

We are happy to assist our customers when they compile the necessary technical documentation for the EU Declaration of Conformity of the complete device. We provide e.g. Supplier declarations or RoHS certifications, issue EMC testing results and carry out safety / radio / SAR tests, etc.

Annex E: Common Documentation

E-1 Warranty Hints



Garz & Fricke embedded systems are subject to manufacturer's warranty as long as the products are handled with adequate care and caution and in accordance to this manual.

The period of guarantee starts from the date of shipment

The products are warranted against defects in material, quality and functionality within the warranty period.

During this period, the repair of the products is free of charge.

Garz & Fricke will decide for repair or replacement at their own discretion.

If the product has been returned with or without prior notice and no failure or malfunction can be detected or the failure or malfunction is caused by inappropriate handling or the device has been returned after expiry of warranty period, Garz & Fricke reserve the right to charge the user for repair or replacement.



The warranty does not cover defects caused by improper or inadequate installation, maintenance or handling by the user, unauthorized modification or misuse, operation outside the specification or non-compliance of this manual. In case of doubt, please contact the technical sales team prior to intended activity.

The warranty does also not cover any defects or damages of other equipment connected to the Garz & Fricke product, faulty or not.

For warranty or repair service, please contact the technical sales team.

Support@garz-fricke.com
RMA@garz-fricke.com

E-2 Field of Application

The products covered by this document are designed and manufactured for the following applications (I). If you intend to use these products in applications as quoted in (II) we highly recommend a personal contact with our consultants and/or technical sales team.

(I) Recommended application areas for Garz & Fricke embedded systems

Even for these applications, we recommend to get in contact with our technical sales team. We offer a wide range of support, even at an early stage of evaluation and/or design-in phase.

- Vending machines and gastronomy devices
- Industrial controllers and HMI systems
- Home automation and facility management
- Audiovisual equipment
- Instrumentation and measuring equipment

(II) Restricted application areas, prior consultation is mandatory to identify and meet the individual regulatory requirements

- Gas leak detectors
- Rescue and security equipment
- Safety devices
- Control and safety devices for airplanes, trains, automobiles and other transportation equipment
- Traffic control systems
- Control equipment for nuclear power industry
- Medical equipment related to life support etc.
- Gasoline stations and oil refineries

Annex F: Technical Support

Before contacting the Garz & Fricke support team, please try to help yourself by the means of this manual or any other documentation provided by Garz & Fricke or the related websites.

If this does not help at all, please feel free to contact us.

Our technicians and engineers will be glad to support you. Please note that beyond the support hours included the Starter Kit, various support packages are available. To keep the pure product cost at a reasonable level, we have to charge support and consulting services per effort.

Shipping Address:

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Support Contact:

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Annex G: General Information

Trademarks and service marks

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In some cases descriptions for copyrighted products are not explicitly indicated as such. The absence of the trademark (™) and copyright (©) symbols does not imply that a product is not protected. Additionally, registered patents and trademarks are similarly not expressly indicated.

Drawings

All drawings, which are shown in this manual are schematic drawings.

For exact technical drawings please refer to our sales team or product manager

All other product or service names are the property of their respective owners.

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