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# **emPC-A/iMX6**

embedded PC

(Hardware Manual)

Version 1.3

refers to product revision no.

1.1

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## About this Manual

This is the hardware manual for the emPC-A/iMX6 embedded PC.

Throughout the manual, the term emPC-A/iMX6 is used to identify the all systems. When required, the letters S/D/Q are appended for Solo, Dual or Quad.

## Conventions

If numbers are specified in this manual, they will be either decimal or hexadecimal. We use C-notation to identify hexadecimal numbers (the 0x prefix).

If we refer to low active signal names, they will suffixed by a “#” character.

Some parts of the document contain notices you have to observe to ensure your personal safety, or to prevent damage to property. These are visually marked with the following alert symbols:



### DANGER

Indicates that death or severe personal injury *will* result if proper precautions are not taken.



### WARNING

Indicates that death or severe personal injury *may* result if proper precautions are not taken.



### CAUTION

Indicates that *minor* personal injury can result if proper precautions are not taken.



### NOTICE

Indicates that damage to equipment can result if proper precautions are not taken.



Indicates information that we think you should have read to save your time by avoiding common problems. Important suggestions that should be followed will also be marked with this sign.

## Acronyms and Abbreviations

EMC	Electromagnetic capability.
ESD	Electrostatic discharge.
GND	System ground potential. Inside the product this is connected to the metal housing, which might be connected to protective earth by the installation. There exist some isolated reference grounds for communication interfaces or IO. These reference signals are referred to as GND-x, where x indicates function.
SELV	Safety extra low voltage.



# 1 Introduction

## 1.1 Features

### 1.1.1 Standard Products

- Freescale i.MX6 application processor
- Single-, Dual- or Quad-Core CPU based on ARM Cortex-A9 800 MHz, with ARMv7™, Neon, VFPv3 and Trustzone support
- Fanless cooling concept
- 32 kB instruction and data L1 caches and 256 kB to 1 MB of L2 cache
- System memory 2 GB DDR3 (1GB with Solo)
- 128 kB of MRAM which does not require battery backup
- Internal CFast Socket for SATA SSD (not available for Single-Core CPU type)
- Internal SDcard socket
- Superior 3D graphics performance with up to quad shaders performing 200 Mt/s and OpenGL support
- Separate 2D and/or Vertex acceleration engines for an optimal user interface experience
- DVI-D graphic interface on front panel (Single Link)
- internal LVDS display interface
- Single channel LVDS on internal connector
- 2 x 10/100/1000 Mbit/s Ethernet
- 2 x USB 2.0 interface (480Mbit/s)
- Battery backed up RTC
- System Power supply 9..34 VDC
- Reset Push Button and Power LED
- 2 male 9pin D-SUB connectors, utilized by serial ports or CAN
- Power supply monitor

### 1.1.2 Hardware Customization

Due to its flexible system architecture, the emPC-A/iMX6 can be customized if the standard products do not provide optimum features or price. Customization is possible even at moderate quantities. Ask sales department for details.

Following you find a (non-complete) list of possible customization:

- Internal eMMC with up to 16 GByte. Soldered to PCB for improved mechanical reliability.
- Without MRAM for price reduction.
- Serial ports can be modified for RS485 physical layer (optionally isolated)
- More CAN ports are possible by using expansion cards (in a larger housing)
- More serial ports are possible
- Digital/Analog-IO expansion card
- Customer specific expansion cards
- Other mounting options (e.g. flange mount)

### 1.1.3 Software

Supported by

- Linux

Contact Janz Tec for more information about the available software packages.

The emPC-A/iMX6 is equipped with the u-boot bootloader software.



## 1.2 Functional Overview

The emPC-A/iMX6 is built upon a couple of standard building blocks, as shown in figure 1.

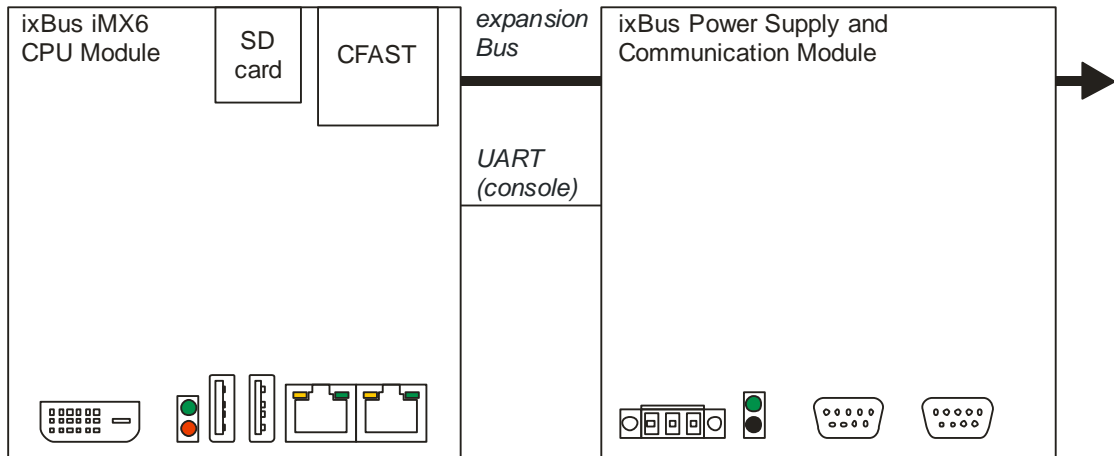


figure 1: block diagram (2 PCB variant shown)

The system consists of the following building blocks:

- Janz Tec ix-Bus i.MX6 CPU module
- Janz Tec ix-Bus power supply and communication module
- Optionally additional IO modules

Refer to Janz Tec ixBus System Reference Manual for details on the Janz Tec specific building blocks.

## 2 Safety Instructions

Refer to page iii for explanation of the warning notice system.

The product described in this documentation may be operated only by personnel qualified for the specific task in accordance with the relevant documentation for the specific task, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products.

### 2.1 Installation and Maintenance

**DANGER: Electrical Shock**

Danger to life.  
This product operates with 9.34 V DC SELV power supply. Do not connect this product to an improper power supply.

**DANGER: Electrical Shock**

Danger to life.  
The IO interfaces (connectors) of the product are only suited to be connected to SELV circuits. Use interfaces (connectors) for their intended use only.

**CAUTION: Explosive Risk**

The installed computer board is equipped with a Lithium battery.  
Danger of explosion if battery is incorrectly replaced. Replace only with battery of the same or equivalent type.

**WARNING: Burns Hazard**

The product generates considerable amount of heat. The housing transports this heat to the environment and therefore gets hot. **Caution when touching the housing, burns hazard!**

### 2.2 Ambient and Environmental Conditions

**CAUTION: Damage**

Do not operate the product beyond the specified ambient conditions

**DANGER: Explosive Risk**

Do not operate the product in potentially explosive atmosphere.

**NOTICE: EMI**

This product is a class A device. This product may cause radio interference. In this case the user must take adequate measures.

### 3 Intended use

The emPC-A/iMX6 is designed for computing purposes in industrial environments. It is destined to be used indoor only.

### 4 Installation

**WARNING: Burns Hazard**

The product generates considerable amount of heat. The housing transports this heat to the environment and therefore gets hot. **Caution when touching the housing, burns hazard!**

The product can be operated with DC power supply from 9 to 34 V.

#### 4.1 Mounting

The emPC-A/iMX6 is intended for DIN rail mount. Refer to figure 2 for the recommended mounting orientation.

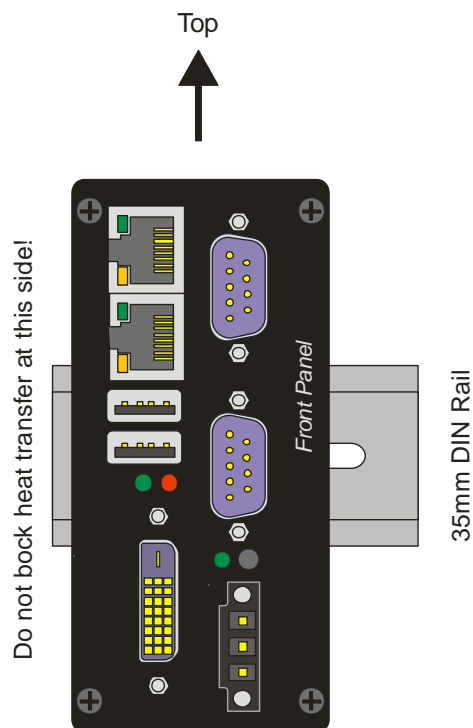


figure 2: emPC-A/iMX6 mounting options

## 4.2 Connectors and Operators

The emPC-A/iMX6 is equipped with differing interfaces. The following interfaces are common for all systems: DVI-D, 2 x USB 2.0, 2 x 10/100/1000 Mbit/s Ethernet. Depending on which alternative was ordered additional interfaces are available. The following table shows the standard systems.

Product	Interface	Linux	Address
emPC-A/iMX6/0	Serial-0 (Console)	/dev/ttymx0	
	Serial-1 (Console)	/dev/ttymx1	
emPC-A/iMX6/1	Serial (Console)	/dev/ttymx0	
	CAN	/dev/pcan_0	MOD_BASE
emPC-A/iMX6/2	CAN0	/dev/pcan_0	MOD_BASE
	CAN1	/dev/pcan_1	MOD_BASE + 0x200
emPC-A/iMX6/4	CAN0	/dev/pcan_0	MOD0_BASE
	CAN1	/dev/pcan_1	MOD0_BASE + 0x200
	CAN2	/dev/pcan_2	MOD1_BASE
	CAN3	/dev/pcan_3	MOD1_BASE + 0x200

Table 1: Interfaces connected to D-SUB

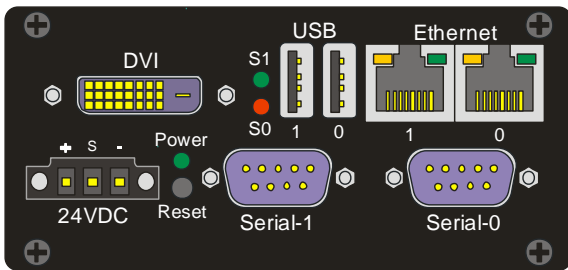


Figure 3: emPC-A/iMX6/0 interfaces

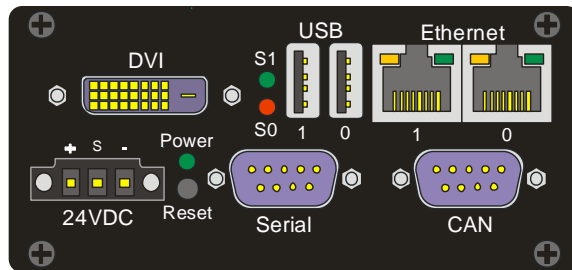


Figure 4: emPC-A/iMX6/1 interfaces

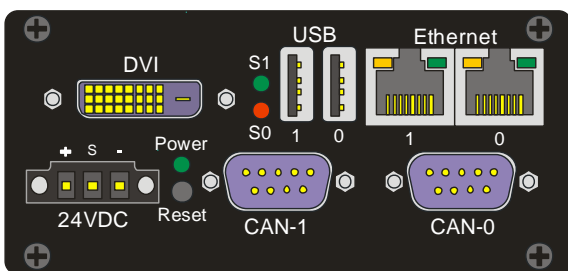


Figure 5: emPC-A/iMX6/2 interfaces

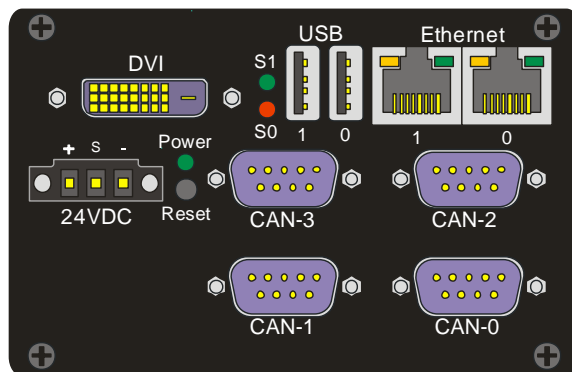
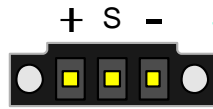


Figure 6: emPC-A/iMX6/4 interfaces

#### 4.2.1 POWER IN

The system power supply is connected with a 3 pin screw terminal with 5.08 mm pitch.



Pin	Description
1 (+)	+9 ..34 VDC
2 (S)	Control input (0 .. 34 V)
3 (-)	GND

Figure 7: Power connector

Table 2: Power connector pin assignment

A suitable mating connector is Phoenix Contact 1900895. Equivalent Models exists from other vendors.

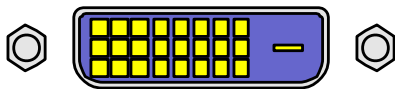


#### **DANGER**

The product may only be operated with power supplies which can be considered SELV circuits.

#### 4.2.2 Graphics connector (DVI)

Combined digital and analog graphics connectors. The digital interface provides single link only.

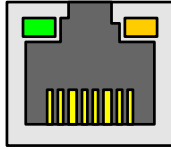


1	TMDS 2-	13	N/C
2	TMDS 2+	14	+5V
3	SHIELD	15	GND
4	N/C	16	Hotplug detect
5	N/C	17	TMDS 0-
6	DDC clock	18	TMDS 0+
7	DDC data	19	SHIELD
8	N/C	20	N/C
9	TMDS 1-	21	N/C
10	TMDS 1+	22	SHIELD
11	SHIELD	23	TMDS C+
12	N/C	24	TMDS C-

table 3: DVI-D connector

#### 4.2.3 Ethernet Interfaces (Ethernet1 and Ethernet2)

Ethernet interfaces of the motherboard. The Ethernet physics is 10/100/1000BaseT, available through the shielded modular jack at the connector panel. Twisted pair cable can be used to connect to this port.

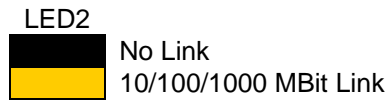


1	MDIO+	5	MDI2+
2	MDIO-	6	MDI2-
3	MDI1+	7	MDI3+
4	MDI1-	8	MDI3-

1

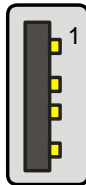
table 4: Ethernet connector

The two LEDs indicate Ethernet status as follows:



#### 4.2.4 USB type A receptacle (USB0-USB1)

Two USB interfaces are available at the connector panel.

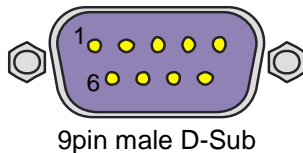


1	+5V, I <sub>MAX</sub> = 500 mA
2	USB-
3	USB+
4	GND

table 5: USB connector

### 4.1 RS232 (Console)

The RS232 (Console) serial interface is provided by the i.MX6 CPU. The connector is a standard 9 pin D-SUB plug, but the interface is connected with four wires only, table 6 shows the pin out.

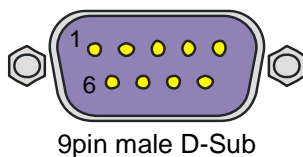


1	n.c.	6	n.c.
2	RxD	7	RTS
3	TxD	8	CTS
4	n.c.	9	n.c.
5	GND		

table 6: RS232 (Console) connector

### 4.2 RS232

Additional serial interfaces might be implemented by a XR16V2750 dual UART chip. This type of serial port has proprietary implementation over the internal expansion bus. Hence it needs special software driver. For a description of UART registers refer to the EXAR manual. The UART clock input is 14,7456MHz to allow error free generation of standard baud rates. This RS232 variant provides all 8 interface signals as shown in table 7.



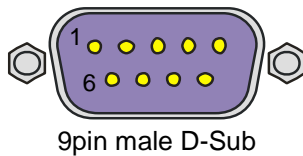
1	DCD	6	DSR
2	RxD	7	RTS
3	TxD	8	CTS
4	DTR	9	RI
5	GND		

table 7: RS232 connector

### 4.3 RS485

In the RS485 variant, there are only the differential signals D+ and D- provided. The transceiver is enabled to send data, when RTS# of the corresponding UART is low. Data received on the RS485 will always be seen on the UART's RxD input. This is regardless of the RTS# state. It is however possible to modify the hardware, so that transmitted data is not received (RTS# low disables receiver).

When the receiver is enabled and no data is send (MARK=1), then  $D+ > D-$ .

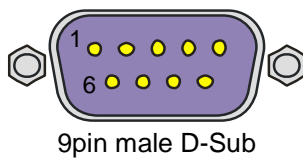


1	n.c.	6	GND
2	B / D+	7	A / D-
3	GND	8	n.c.
4	n.c.	9	n.c.
5	n.c.		

table 8: RS232 connector

### 4.4 CAN

The CAN interface is implemented with a SJA1000 controller chip. The connector is a standard 9 pin D-SUB plug with a pin out shown in table 9. The CAN interface is isolated and has a software switchable 120 Ohm termination.



1	n.c.	6	GND
2	CANL	7	CANH
3	GND	8	n.c.
4	n.c.	9	VEXT <sup>1</sup>
5	n.c.		

table 9: CAN connector

<sup>1</sup> This signal is optionally available to provide power to supply an external transceiver module

## 5 Maintenance



### NOTICE

Always follow common ESD practice when you service the product!

To open the housing, you can remove the back panel or the front panel. Different maintenance tasks require one of them to be removed, others require full disassembly.

Task	Back Panel		Remarks
Replace CFast	remove		
Replace SD-card	remove		
Replace Battery			Complete disassemble

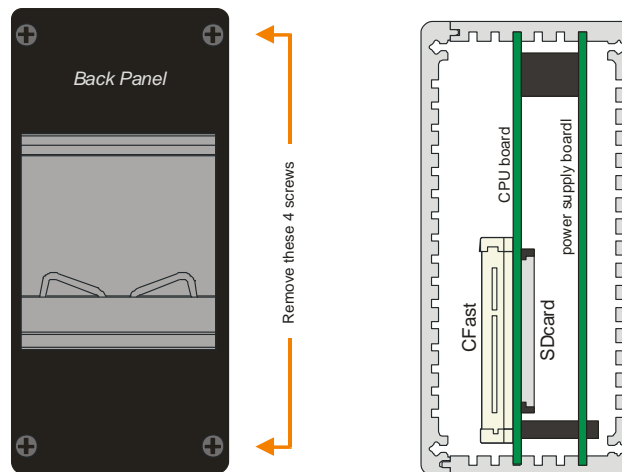


figure 8: emPC-A/iMX6 back panel removal

### 5.1 CFast Card Replacement



### NOTICE

Power must be turned off before removing or inserting the CFast card

Refer to figure 8 to identify the location of the CFast card.

### 5.2 SDcard Replacement



### NOTICE

Power must be turned off before removing or inserting the SDcard

Refer to figure 8 to identify the location of the SDcard.



## 5.3 Battery Replacement



### CAUTION

The installed computer board is equipped with a Lithium battery. Danger of explosion if battery is incorrectly replaced. Replace only with battery of the same or equivalent type (3-volt lithium coin cell battery).

- Do not attempt to recharge the battery.
- Do not disassemble, crush, puncture, short external contacts, or dispose of in fire or water.

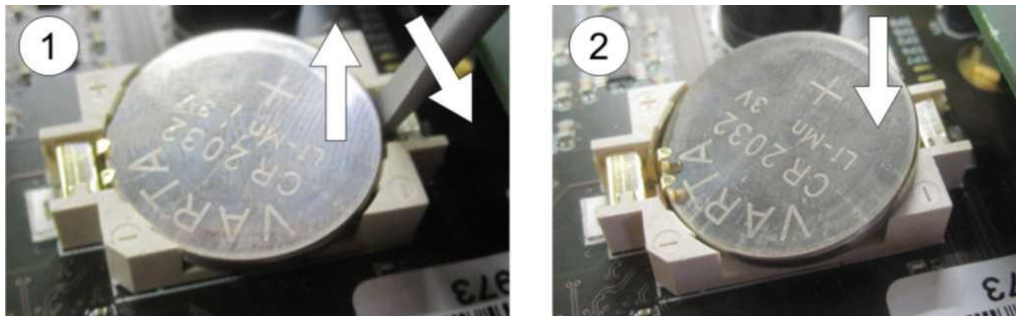


### NOTICE: Battery approval

The battery must be a compatible battery type: CR2032 (3 Volt lithium coin cell battery). The replacement battery must have a NRTL approval.

The battery is used for backing up the system time when the power supply is removed.

1. Turn off the computer properly through the operating system, then turn off any external devices.
2. Disconnect the power supply from the power inlet and disconnect any external devices.
3. Disassemble the housing and locate the battery on the power supply board
4. Remove the battery from the holder (See figure 9)
5. Insert the new battery (See figure 9)
6. Reinstall the wall mount bracket



1. Removal: Insert screwdriver at right side and bend so that the battery pops outs. Use only gentle force, otherwise the battery holder might be damaged.  
The use a plastic tool is preferred to avoid shorting the battery
2. Insertion: Align new battery to the left side of the holder and gently press down on the right side of the battery until the battery snaps into the holder.

figure 9: Removing and replacing coin cell battery

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Package	License
u-boot	BSD-2-Clause BSD-3-Clause eCos-2.0 GPL-2.0 IBM-pibs LGPL-2.0 LGPL-2.1

The u-boot software is stored in the SPI flash of the emPC-A/iMX6 and is required to boot software that is stored on the CFast, SD card or the internal eMMC.

As the u-boot can be replaced by the skilled end user, we have no control of which version of u-boot is installed on which device. You can check the u-boot version by checking the u-boot startup messages. Please indicate this version when you request the source code.

This license Agreement does NOT cover any software that is installed on the CFast, SD card or the internal eMMC.

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Version 2, June 1991

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Because of this blurred distinction, using the ordinary General Public License for libraries did not effectively promote software sharing, because most developers did not use the libraries. We concluded that weaker conditions might promote sharing better.

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For an executable, the required form of the "work that uses the Library" must include any data and utility programs needed for reproducing the executable from it. However, as a special exception, the source code distributed need not include anything that is normally distributed (in either source or binary form) with the major components (compiler, kernel, and so on) of the operating system on which the executable runs, unless that component itself accompanies the executable.

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Ty Coon, President of Vice

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## 7 Appendices

### 7.1 Technical Data

#### Processing Core

CPU	<b>emPC-A/iMX6S:</b> i.MX6 Solo ARM Cortex A9, 1 x 800 MHz, 512 KB L2 Cache
	<b>emPC-A/iMX6D:</b> i.MX6 Dual ARM Cortex A9, 2 x 800 MHz, 1 MB L2 Cache
	<b>emPC-A/iMX6Q:</b> i.MX6 Quad ARM Cortex A9, 4 x 800 MHz, 1 MB L2 Cache

#### Memory

Main Memory	1 GB DDR3 1066 for Solo 2 GB DDR3 1066 for Dual and Quad
Nonvolatile RAM	128 kB MRAM

#### Storage

CFast	1 x internal socket with SATA 3 GB/s (not available for Solo)
SDcard	1 x internal socket

#### Video

Controller	i.MX6 defined
Memory	Shared with main memory
Interface	1 x DVI-D single link connector on front panel, up to 1280x1024 1 x Single channel LVDS on internal connector, up to 1024x768

#### External Interfaces (connector panel)

Video	1 x DVI-D
Ethernet	1 x 10/100/1000 Mbit/s Ethernet (Ethernet 0: i.MX6 EMAC) 1 x 10/100/1000 Mbit/s Ethernet (Ethernet 1: Intel i210)
USB	2 x USB2.0
CAN (Option)	SJA1000 controller <ul style="list-style-type: none"> <li>• ISO/DIS 11898-2 (isolated from logic),</li> <li>• software switchable 120 Ohm termination resistor</li> </ul>
Serial Port (Option)	i.MX6 UART <ul style="list-style-type: none"> <li>• RS232 (4 wire)</li> <li>• RS485, optionally isolated from logic</li> </ul> Xicor 16V2750 (Port expansion) <ul style="list-style-type: none"> <li>• RS232 (full featured)</li> <li>• RS485, optionally isolated from logic</li> </ul>

#### Expansion

iX-Bus	Internal 8/16 bit interface for IO and low speed peripherals
--------	--

#### Indicators and Switches

Reset	Pushbutton
Status	LED for power supply status (green)
User LEDs	2 programmable LEDs (S0 – red and S1 - green)

**System**

Housing	Aluminium, passivated, outside painted
Battery	CR 2032, for real time clock
Watchdog	Yes, implemented in i.MX6

**Power Requirements**

Power Supply	DC power, 9 .. 34 V (lower limit with adjustable UVL)
Inv.-pol. protection	Yes
Fuse	Internal melting fuse in DC in, GND is unfused
potential separation	No, GND (Pin 3 in Table 2) is connected to case
Inrush Current (max)	TBD
Power Dissipation	Without external load or expansion cards <b>emPC-A/iMX6S:</b> 6W (est.) <b>emPC-A/iMX6D:</b> 8W (est.) <b>emPC-A/iMX6Q:</b> 9W (max)

**External Load Capabilities**

+5V (USB)	Max. 0.5 A per USB port
-----------	-------------------------

**Environmental Specifications**

Ambient Temperature operating	<b>emPC-A/iMX6S:</b> TBD <b>emPC-A/iMX6D:</b> TBD <b>emPC-A/iMX6Q:</b> 0 .. +60 °C at sea level, derating of 1 °C per 300 m above sea level to a maximum of 2000 m.
Temperature storage	-40..+75 °C <sup>2)</sup>
Humidity	5%..95% r.H., non condensing
Protection Class	IP20
Altitude	max.2000m

**Physical Dimensions**

Size (WxHxD)	Including connectors and rail mounting bracket <b>2 DSUB:</b> 52 x 105 x 117 mm <b>4 DSUB:</b> 72 x 105 x 117 mm
Weight	<b>2 DSUB:</b> 600 g <b>4 DSUB:</b> TBD



## 7.2 References

These references direct you to manuals and specifications that you might need to know when you attempt to program the product. Most of the documents can be downloaded from the Internet. Look for the WWW servers of the component/chip manufacturers.

- [1] **SJA1000 Product specification**, Philips Semiconductor, Jan 04, 2000
- [2] **ixBus System Reference Manual**, Janz Tec AG

### WWW-References

Janz Tec AG  
Freescale

[www.janztec.com](http://www.janztec.com)  
[www.freescale.com](http://www.freescale.com)

## 7.3 Dimensions

Refer to figure 10 for the housing dimensions.

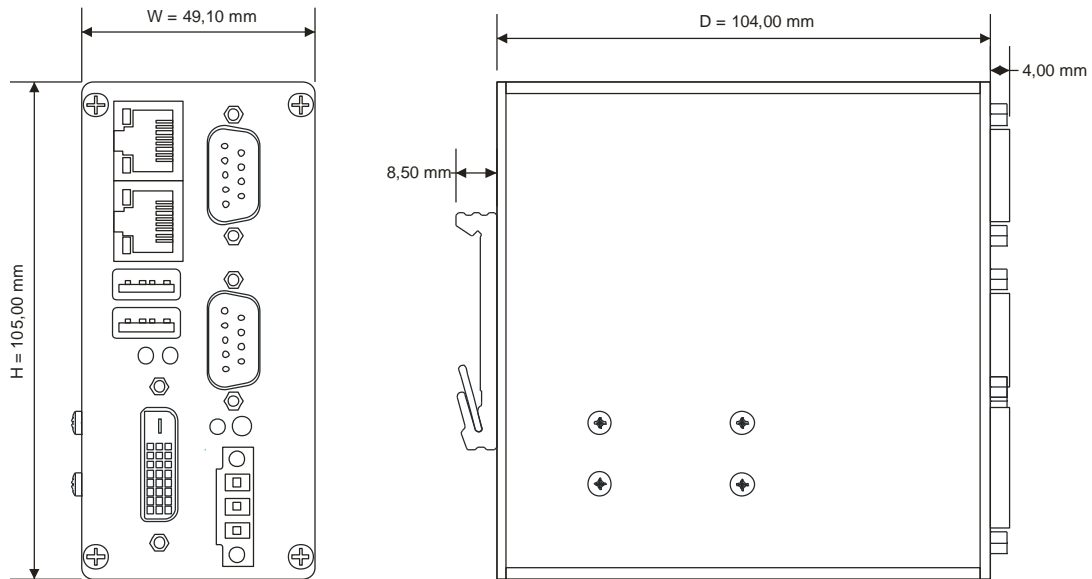


figure 10: housing dimensions (2 DSUB system shown)

emPC-A/iMX6 Systems with different IO options just differ in dimension W

Slot Variant	W
2 DSUB	49.1 mm
4 DSUB	69.5 mm

## 7.4 Product History

Version	Release Date	Name	Changes
V1.0			<ul style="list-style-type: none"><li>• Prototype system for customers</li></ul>
V1.1	2014-12-21	As	<ul style="list-style-type: none"><li>• Improved cooling solution</li></ul>
			<ul style="list-style-type: none"><li>•</li></ul>
			<ul style="list-style-type: none"><li>•</li></ul>

## 7.5 Manual History

Version	Release Date	Name	Changes
V1.0	2014-01-16	As	<ul style="list-style-type: none"><li>• Initial release</li></ul>
V1.1	2014-01-20	As	<ul style="list-style-type: none"><li>• Technical Data: Removed system controller and changed DVI-I do DVI-D</li><li>• Removed “operating with hazardous voltages”.</li><li>• Typographic changes</li></ul>
V1.2	2015-05-22	ime	<ul style="list-style-type: none"><li>• Added Intended use</li></ul>
V1.3	2015-10-05	As	<ul style="list-style-type: none"><li>• Added chapter Open Source Licensing</li></ul>