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Software Manual Linux

(English)

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Contents

1	Introduction.....	3
2	Safety instructions.....	3
3	User management.....	4
4	System configuration.....	5
5	SSH.....	6
5.1	SSH server.....	6
5.2	SSH terminal.....	6
5.2.2	Authentication by private key file.....	7
5.3	SSH access and file transfer.....	11
5.3.1	PuTTY.....	11
5.3.2	WinSCP.....	13
6	Hard drive partitioning.....	14
7	Ethernet interfaces.....	15
8	Image update.....	16
8.1	Update by USB stick.....	16
8.2	Update by the update service.....	18
9	Write protection filter.....	19
10	Watchdog.....	20
11	Docker.....	21
12	Codesys.....	22
12.1	CODESYS Development Environment.....	22
12.2	CODESYS Runtime System.....	22
12.3	Licence dongle.....	22
13	Attachment: Open source licensing.....	23

1 Introduction

This manual contains the general software documentation for Janz Tec systems.

Not every system contains all of the features described in this manual.

A **Debian** image is used in the Janz Tec systems by default.

You can find the image number of your Janz Tec device under **/root/imageversion.txt**.


If you want more information or if you need help, you can use our online service desk or you can contact our support team.

You can find the software license terms at:

<https://www.janztec.com/en/software-license-terms/>

You can reach us under:  support@janztec.com

 +49 5251 1550 200

 <https://support.janztec.com>

2 Safety instructions



Do not connect this device to the internet as long as no proper security precautions have been taken against undesired incoming network connections. (VPN/firewall)

3 User management

Janz Tec images have two preset users (root und dev) and one service user:

- „root“
Debian standard root user; no password assigned.
Automatic log-in in local consoles tty1, tty3 - 6 (USB + DVI+D/display).
SSH log-in allowed (only key-based authentication, refer to chapter 5).
Remote log-in with password-based authentication not allowed.
- „dev“
Additional user for image-specific tasks which do not require root access;
no password assigned.
No SSH access permitted.
Has sudo rights (can run programs as root via sudo command).
- „service“
This user is not active by default.
The service user can be activated temporarily via jconfig or by USB stick and it can log-in via SSH.
Refer to chapter 5 „SSH terminal – Authentication by service user“ for further information.

If desired, additional users can be set up for customer-specific images.

4 System configuration

The configuration tool "jconfig" is installed on Janz Tec systems with Debian images.

To access the configuration tool, log-in via SSH or connect a USB keyboard and a display to the system and press "CTRL + ALT + F3" to open the console.

Run „jconfig“ to start the tool. (root@emPC-xxxxxxx:(read only):~# jconfig)

```

Janz Tec System Configuration Tool

1 Graphics          Graphics Settings (resolution)
2 Ports            Port Settings (CAN)
3 Security         Security Settings (SSH keys)
4 Write Protection Disk write protection Settings (enable, disable)
5 Internationalisation Language Settings (locale, keyboard)
6 Watchdog         Watchdog Settings
7 Time             Time Settings (NTP, timezone)
8 Console          Boot Console Settings (serial)
9 Touch            Calibrate Touchscreen
10 Hostname        Set network name of this system
11 Service         Service User

<Select>             <Finish>

```

The following options are available:

- Graphics
Selection of a DVI-D resolution (only emPC-A/iMX6 systems)
- Ports
Set a standard baud rate for CAN bus
- Security
Import a public SSH key for the root user via USB (refer to chapter 5.2.2)
- Write Protection
Activate/deactivate write protection (refer to chapter 9)
- Internationalisation
Select keyboard layout and system language
- Watchdog
Activate/deactivate the CPU watchdog (refer to chapter 10)
Activate/deactivate further watchdog monitor scripts
- Time
Activate/deactivate the NTP client
Setting the time zone
- Console
Boot console settings
- Touch
Calibration of the touch screen (only emVIEW systems)
- Hostname
Set the network name of the system
- Service
Activate the temporary service user for SSH access (refer to chapter 5.2.1)

5 SSH

5.1 SSH server

An SSH daemon is installed on Janz Tec systems by default which enables encrypted SFTP access to data and directories of the system. Use an SFTP compatible program such as WinSCP for this. The SSH daemon supports the following cipher suites:

KexAlgorithms: curve25519-sha256@libssh.org, diffie-hellman-group18-sha512, diffie-hellman-group14-sha256, diffie-hellman-group16-sha512

Ciphers: chacha20-poly1305@openssh.com, aes256-gcm@openssh.com, aes128-gcm@openssh.com, aes256-ctr, aes192-ctr, aes128-ctr

MACs: hmac-sha2-512-etm@openssh.com, hmac-sha2-256-etm@openssh.com, umac-128-etm@openssh.com

Empty passwords are not allowed. (PermitEmptyPasswords no)

5.2 SSH terminal

The following software is recommended for operating an SSH terminal:

PuTTY (<https://de.wikipedia.org/wiki/PuTTY>)

WinSCP (<https://de.wikipedia.org/wiki/WinSCP>)

(Refer to chapter 5.3 "SSH access and file transfer")

Authentication of an SSH terminal to the SSH server can be done in two ways: Temporarily via the service user or permanently by means of private key files.

Because systems with key pair authentication are much more difficult to compromise than systems with password authentication, Janz Tec Linux default images do not allow SSH access of Linux users enabled on the system using password-based authentication in the default configuration (/etc/ssh/sshd_config).

5.2.1 Authentication by service user

If you have physical access to the system, the temporary service user can be activated. This user can use SSH and has **sudo** rights. This can be useful when you want to allow access for a 3rd party, e.g. in remote service scenarios.

The service user can be activated either via console and "**jconfig**" or via **USB stick**.

The service user is used for maintenance purposes or for installing key-based authentication. Use key-based authentication for production applications!

Login process with **jconfig**:

- Connect a USB keyboard and display to the system and press "CTRL + ALT + F3" to open the console
- Run "**jconfig**" (root@emPC-xxxxxxx:(read only):~# jconfig)
- Go to "Menu / Service / Activate temporary service account for remote SSH access"

The username and password for the service user are displayed.

```
User account for service user enabled! (Console and SSH remote access)


Username: service
Password: 789331-226426-852331

Close this dialog to disable service account!

<Ok>
```

The password is randomly generated each time the dialog box is opened. The service account is valid as long as the dialog box is open and expires when the dialog box is closed (<ok>) or automatically after 24 hours.

Login process by **USB stick**:

 *This function is only available as long as no password has been assigned to the root user.*

To activate the service user without connecting a display, proceed as follows:

Create a file "serviceuser.txt" on a USB stick and plug the USB stick into your device for a few seconds.

The service user is now unlocked for **24 hours** with a randomly generated password. The corresponding username and password can be found in the file "serviceuser.txt".

You can plug the USB stick into several devices in succession. The "serviceuser.txt" then contains all IP addresses and the access data of the enabled service users of the plugged-in devices.

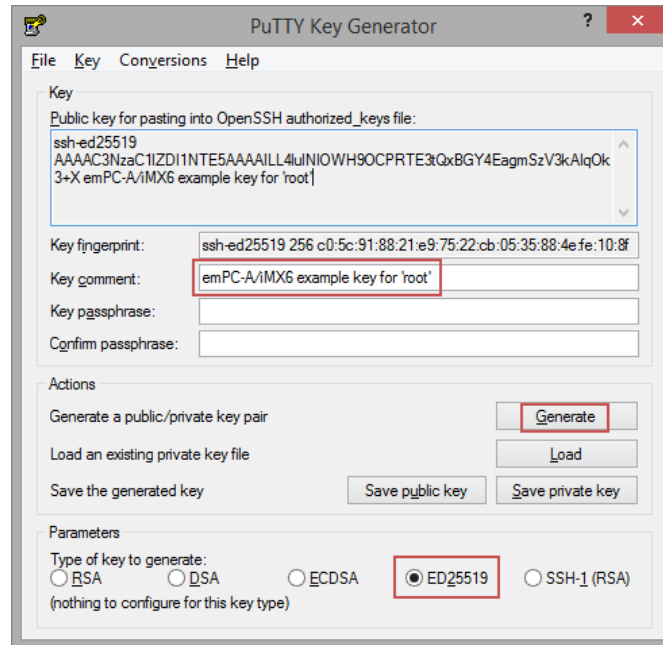
5.2.2 Authentication by private key file

Key file authentication is a very secure way to connect to your device via SSH. The following sections describe how to generate the necessary key files and install the public key on an emPC.

Desktop PC:

Under Windows, the PuTTY Key Generator (puttygen.exe) can be used to generate a key pair:

- Run PuttyGen:



- Select the key type **ED25519**.
- To generate a new key pair, select **Generate**.
- Moving the mouse over the empty area in the upper part of the window generates the random data necessary for key generation.
- After the generation is completed, you can save the **public key** by clicking the button **Save public key**.
- Choose a file name that identifies this key as a public key, e.g. **examplekey.pub**.
- **Save private key** saves the **private key** in PuTTY format.
- Choose a file name that identifies this key as a secret private key, e.g. **secret_examplekey.ppk**.

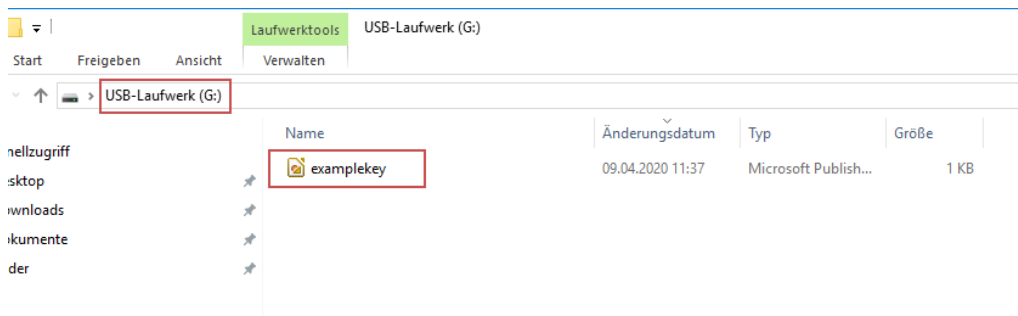


Keep this private key secret, as anyone with access to this key can establish an SSH connection to the emPC. If multiple users are to have access to a device, consider creating multiple key pairs (one for each individual user).



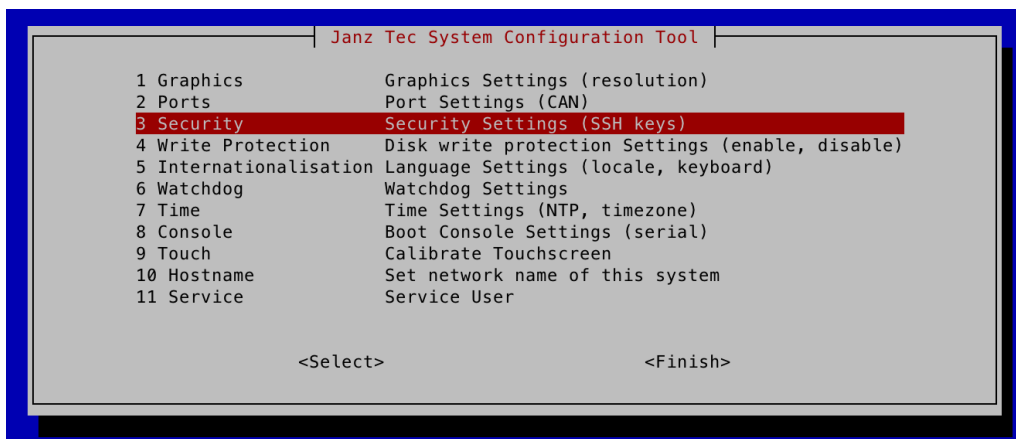
If the private key is also to be used by programs other than PuTTY (e.g. OpenSSH compatible programs), it can also be exported in the OpenSSH file format - **Menu / Conversions / Export OpenSSH key**.

- Make a note of the "key fingerprint" for later matching.
- Copy the public key to a USB stick:

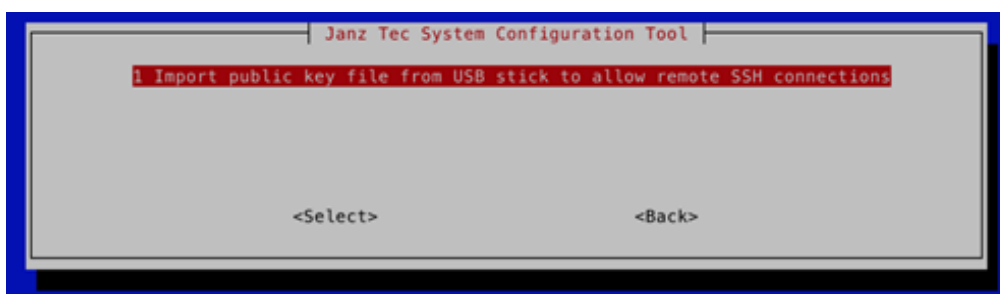


emPC/emVIEW:

- Connect the USB stick to your Janz Tec system (emPC/emVIEW).
- Connect a USB keyboard and display to the system and press "CTRL + ALT + F3" to open the console.
- Run "jconfig". (root@emPC-xxxxxxx:(read only):~# *jconfig*)
- Go to "Menu / Security / Import SSH keys".



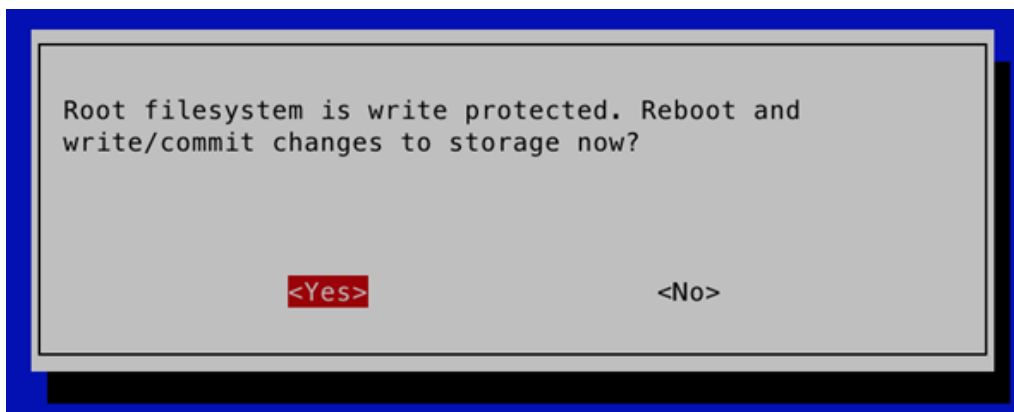
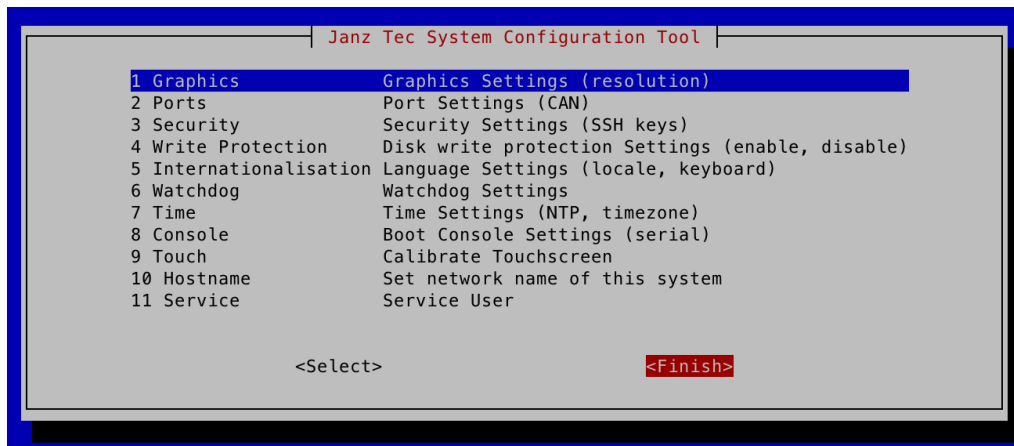
Import the public key from the USB stick for the root user.



Before confirming the dialog box, match the displayed "fingerprint" with the previously noted "key fingerprint"! This prevents man-in-the-middle attacks from taking place.



Perform a "Reboot and write/commit" to permanently save the changes to the file system.



For authentication, Janz Tec can provide a custom image that contains your public keys. To do this, you must provide Janz Tec with your public keys prior to image creation. If you wish to do so, please contact your Janz Tec sales representative. The associated private keys will remain with you so that only you can establish SSH connections to your devices. (Recommended procedure)

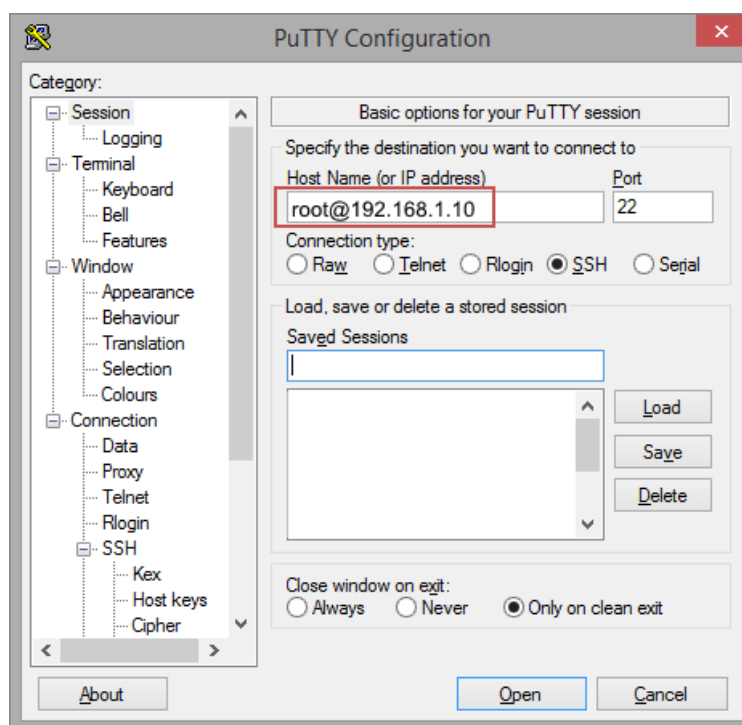
5.3 SSH access and file transfer

For direct interaction with the server and communication via command line, we recommend using PuTTY. For data exchange between SSH terminal and SSH server, we recommend using WinSCP.

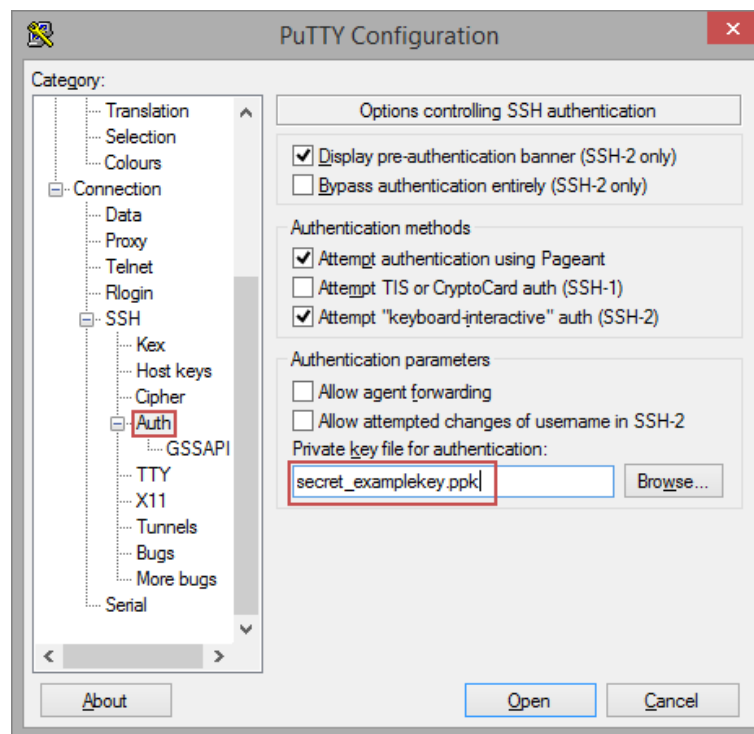
5.3.1 PuTTY

To establish a connection via PuTTY, use the previously created private key (private.key.ppk) - refer to chapter 5.2 "SSH terminal".

- Start PuTTY.
- Enter the line "root@" followed by the IP address of the emPC in the "Host Name" field. The port must remain set to 22 (SSH protocol).



- In the SSH authentication settings, the private key file is stored in PuTTY format (.ppk).



- A name for this configuration can be entered in the "Saved Session" field. With **Save**, this is saved for future use and can be reloaded at any time via **Load**.
- **Open** starts the connection and opens the console window for the root user.

Linux SSH commando:

From a Linux based PC / notebook, an SSH connection to the emPC can be established using the Linux SSH command by means of the exported private key or the service user in OpenSSH format.

```
root@aspb-pc-jos:/home# ssh -i private.key.openssh root@192.168.0.224
Linux emPC-0090e9005cc2 4.14.34-rt27-aimx6 #1 SMP PREEMPT RT Tue Sep 10 11:57:03 UTC 2019 armv7l
```

Example of SSH connection with private key

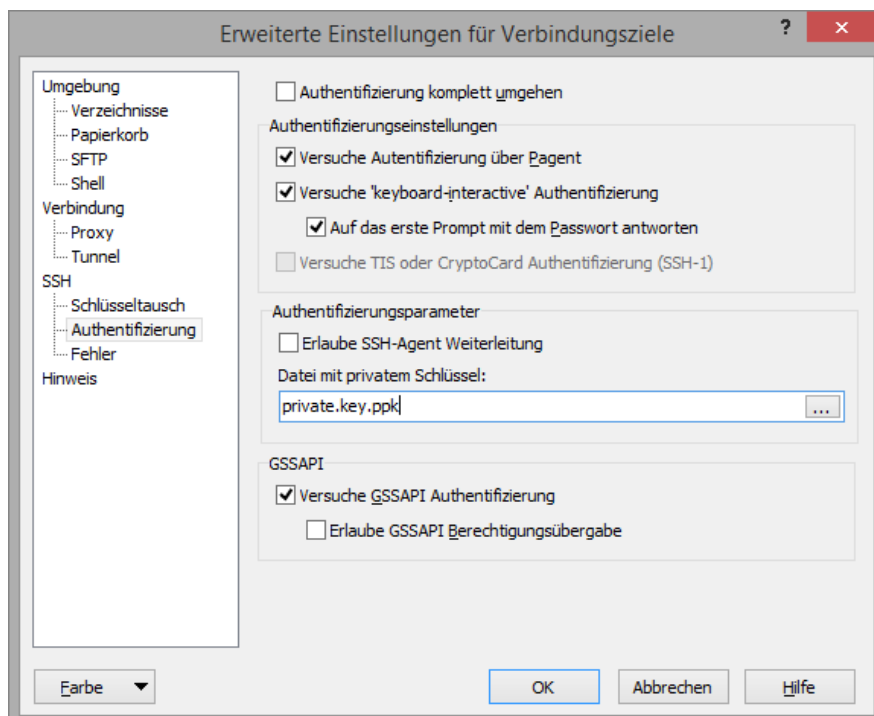
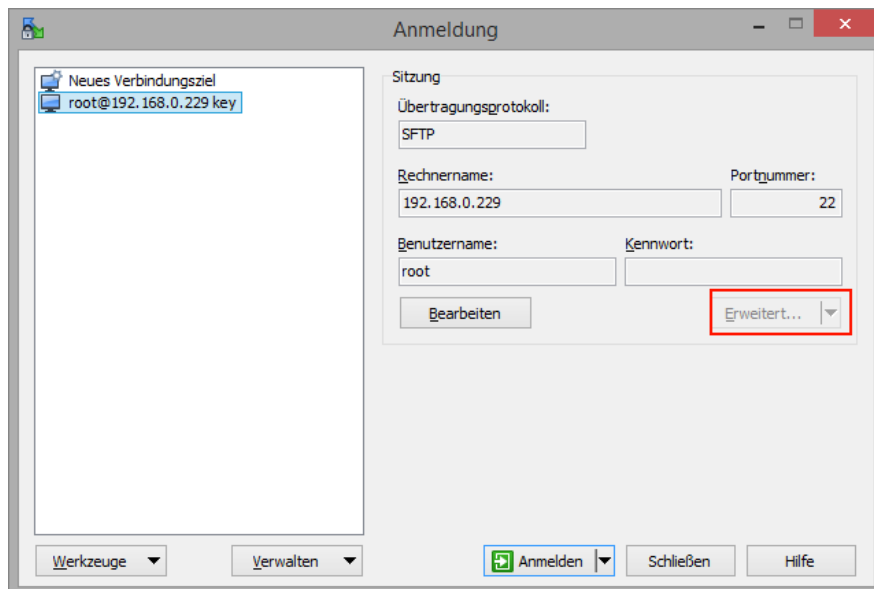
```
root@aspb-pc-jos:~# ssh service@192.168.0.185
The authenticity of host '192.168.0.185 (192.168.0.185)' can't be established.
ED25519 key fingerprint is f8:be:68:41:71:c3:00:cd:22:3e:b1:0b:9d:d9:5b:48.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.0.185' (ED25519) to the list of known hosts.
service@192.168.0.185's password:
Warning: your password will expire in 1 day
Linux emPC-0090e9004ce0 4.14.34-rt27-aimx6 #1 SMP PREEMPT RT Wed Mar 4 09:46:05 UTC 2020 armv7l
```

Example of SSH connection using service user

5.3.2 WinSCP

WinSCP is used to transfer files to and from your server. WinSCP is a file transfer application that uses Secure FTP.

For authentication, use the same private key that you generated with PuTTY (refer to chapter 5.2 SSH terminal).



6 Hard drive partitioning



To improve system stability, a file system check is performed at each boot (the check can take up to 2 minutes).

The system contains 3 partitions by default:

- `/dev/sda1`: Boot partition
 - With X86 processors: Mounted at `/boot/`
 - With iMX6 processors: Not mounted
 - Contains the bootloader configuration
 - Contains the Linux kernel
- `/dev/sda2`: Linux system partition
 - Read-only
 - Contains the Debian root filesystem
- `/dev/sda3`: Data partition
 - Writable
 - Mounted at `/data/`
 - Contains the Docker directory for Docker images

7 Ethernet interfaces

Janz Tec systems have 2 Ethernet ports by default with the following configuration:

- **Ethernet 0:** Uses a **static IP address**

Recommended for real-time Ethernet protocols.

When the system is first started, a fixed IP address from the area of 169.254.x.y is assigned. The numbers x and y correspond decimally to the last two bytes of the Ethernet 0 MAC address.


- **Ethernet 1:** Automatic assignment of the IP address via **DHCP**

Recommended for e.g. connecting a PC with the CODESYS development environment.


To view the current network configuration, use the command: "**sudo nano /etc/network/interfaces**".


```
#auto eth0
allow-hotplug eth0
#iface eth0 inet dhcp
iface eth0 inet static
    address 192.168.100.1
    netmask 255.255.255.0

#auto eth1
allow-hotplug eth1
iface eth1 inet dhcp
```


-  On request, the Ethernet ports can be configured to customer specification.

8 Image update

 If you are updating your system to a new image for the first time, we recommend that you create a backup of the memory card before the update.

 By default, the operating system is reset to factory settings after the update. Settings made in the past (network IP address, SSH keys, users, passwords, ...) may not be adopted during this process.

8.1 Update by USB stick

 The possibility of installing an update via USB stick currently only exists on **emPC-A/iMX6** systems.

 Only a limited selection of USB sticks is compatible with the USB boot function.

Compatible USB sticks are for example:

- Verbatim: PinStripe USB2.0 Drive 16GB Go
- Intenso: Basic Line 2.0 High Speed 16GB

Before booting from the USB stick and installing updates, the USB stick and the emPC-A/iMX6 must be set up accordingly. See "Setting up the USB stick/emPC-A" at the end of this chapter.

Connect the USB stick to the USB1 port (next to the red/green LEDs).

After the emPC-A/iMX6 boots from the USB stick, the image backup and installation program starts.


```
-----| Janzilla |-----
Make your choice

      backup  Backup Image
      install Install Image
      update  Update Image
      console Recovery Console


      <Ok>                                <Cancel>
```


The following actions can be performed afterwards:

- backup: Backup Image
Compresses the contents of the CFast card and saves it to an image directory on the USB stick.
- install: Install Image
Lists all image directories on the USB stick. Selecting an image installs it to the CFast card and replaces all data.

 All data on the CFast card will be deleted during installation.

- update: Update Image
Lists all image directories on the USB stick. After selecting an image, the update script formats the boot and system partitions and restores all files from the .tgz files. The data on the data partition is preserved.

 All data of the boot and system partition on the CFast card will be deleted during the update.

Setting up the USB stick/emPC-A

To set up the USB stick and the emPC-A/iMX6, proceed as follows:

USB stick:

- Format the file system of the USB stick to FAT32.
Extract the "update-imx6-usbstick_v<latest-version>.tgz" to the root directory of the USB stick

emPC-A/iMX6:

To enable the USB boot function on an emPC-A/iMX6, it is necessary for the system to boot a Linux image with an image number greater than or equal to IMG-LX100 at least once. During the first boot, the boot loader configuration is automatically changed to this boot order: 1. USB boot, 2. CFast card, 3. internal eMMC, 4. SD card. To change the boot order at the first boot, you can use a bootable CFast card.

To do so, proceed as follows:

- Format the CFast card with FAT32 using a USB-to-CFast card reader.
- Extract the "Partition 1.tgz" from any image \geq IMG_LX100 to the root directory of the CFast card
- Boot the system once with this CFast card.
- Ensure that the system is powered on for at least 1 minute and that there is no power off during the boot order reconfiguration.

If you need assistance with this, please contact our support team (refer to chapter 1).

8.2 Update via the Janz Tec update service


Janz Tec offers a customer-specific update service with which Janz Tec devices can be updated securely, quickly and easily over the internet with the help of an update client. Physical access to the devices is not necessary.


For further information and individual advice, please contact your Janz Tec sales representative.

9 Write protection filter

The Linux system partition /dev/sda2 is read-only by default.

The data directory is located on the writable partition /dev/sd3.

 When write protection is enabled, the login prompt displays "read only".

 Power failures can cause file system corruption and subsequent reboot problems in running systems. For use in production environments, enable write protection or use a UPS (uninterruptible power supply).

Use the configuration tool or alternatively use the following commands to enable/disable write protection. The system is restarted in each case:

Activate:

```
root@emPC-xxxxxxx:# reboot-ro
```

Deactivate:

```
root@emPC-xxxxxxx:# reboot-rw
```

Use the "reboot-commit" command to write changes to read-only partitions. The system is restarted in each case:

Commit:

```
root@emPC-xxxxxxx:# reboot-commit
```

Commit & deactivate write protection:

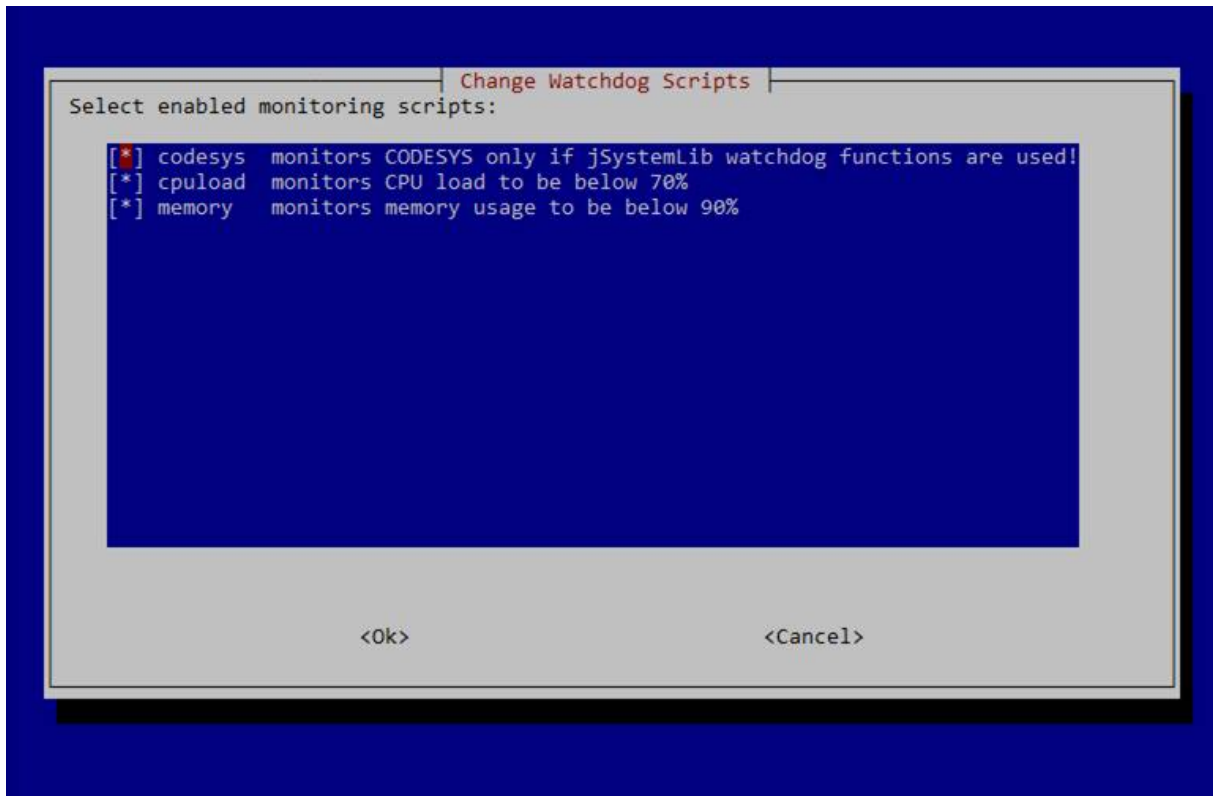
```
root@emPC-xxxxxxx:# reboot-commit-rw
```

10 Watchdog

Janz Tec systems have various watchdogs by default, which automatically initiate a restart of the system in the event of a malfunction or if certain limit values are exceeded.

Run "**jconfig**" to enable/disable the watchdogs.

The following watchdogs are available for selection:



The watchdog monitor script can be found at: **„/opt/janztec/watchdog/monitor.d”**

11 Docker

Docker is pre-installed by default and stores images on the data partition in the /data/var/lib/docker directory.

To display the installed Docker version, use:

```
root@emPC-xxxxxxx:/home/dev# docker version
```

Docker containers must be configured appropriately for armhf.

Example:

```
root@empc-aimx6:/home/dev# docker run armhf/hello-world
Unable to find image 'armhf/hello-world:latest' locally
latest: Pulling from armhf/hello-world
a0691bf12e4e: Pull complete
Digest: sha256:9701edc932223a66e49dd6c894a11db8c2cf4eccd1414f1ec105a623bf16b426
Status: Downloaded newer image for armhf/hello-world:latest
```

```
Hello from Docker on armhf!
This message shows that your installation appears to be working correctly.
```

12 Codesys


By default, the CODESYS project directory is located on the data partition with read and write access.

12.1 CODESYS Development Environment

The CODESYS development environment is available at <http://www.codesys.com>.

 We recommend using CODESYS v3.5 with the latest Service Pack (SP).

A login for the "Administrator" user is required for the initial connection. The initial password is displayed in the target visualization and is also available in the `/data/opt/codesys/initialpassword.txt` file.

 After successful login, the password must be changed to a secure password of your choice.
For more information on user management in CODESYS, visit <https://help.codesys.com>.

You can remove the password protection for the administrator. To do this, select "Reset original" on the device (right-click in the device structure) and enter the user name "Administrator" and the password entered in the previous step.

Important: A "reboot-commit" is required!

For information on CODESYS security, visit <https://www.codesys.com/security.html>.

12.2 CODESYS Runtime System

CAN/CAN open optimization (to reduce CAN jitter)

- Create an additional task with the name "CANTask", priority 0 and 1 ms cycle time.
- For each CAN device tree entry, open the CANOpen_Manager, tab: "CANopen I/O Mapping" and change the value from "Buscyclic-Task" to "CANTask".

12.3 License dongle

If the CODESYS runtime license is installed on a USB CODESYS license key (CODESYS key), make sure that the license dongle is always connected to one of the USB ports (recommended port 0).

 Janz Tec strongly recommends the use of a license dongle!

13 Attachment: Open source licensing

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Open Source Compliance Division

Janz Tec AG

Im Dörener Feld 8
D-33100 Paderborn

Email: opensource@janztec.com

This offer is valid to anyone in receipt of this information.

13.3 Software packages

The software contained in this product makes use of the following open source software packages.

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.

13.4 Verbatim License Texts

All license texts can be found electronically on <http://spdx.org/licenses>.

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Version 2, June 1991

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Version 2.1, February 1999

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