B&R Linux 9

User's manual

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Publishing information

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1 Introduction

Information:

B&R makes every effort to keep documents as current as possible. The latest versions are available for download on the B&R website (www.br-automation.com).

1.1 Manual history

Version	Date	Comment
2.08	September 2021	Updated the following chapter: • "Downloads" on page 39
2.07	August 2021	Updated the following chapter: • "B&R Hypervisor mode" on page 24
2.06	July 2021	Updated the following chapter: • "Troubleshooting" on page 38
2.05	April 2021	Updated the following chapters: • "Autostart Manager" on page 16 • "B&R UPS Manager" on page 27 Updated the following chapters: • "32-bit support" on page 31 • "System log (journal/syslog)" on page 31 • "File system settings" on page 32
2.04	March 2021	Updated the following chapters: • "MTCX/ADI functions" on page 24 (B&R Hypervisor mode) • "HMI Report" on page 24 • "Downloads" on page 39
2.03	November 2020	• Editorial revisions.
2.02	September 2020	• Updated chapter B&R Linux installer. • Editorial revisions.
2.01	October 2019	Updated the following chapters: • HMI Report • CAN
2.00	September 2019	Applied data to SMC (including editorial revision). Added browser update and font support. Added use of MTCX in B&R Hypervisor operation.
1.06	August 2019	Adapted to the editorial guide.
1.05	August 2019	Updated model numbers for xPC2200 legacy versions. Updated note in Automation Help for fsprotect. Updated "Configuration as mapp View client". Updated "Disable screensaver".
	July 2019	B&R Linux 9.1.1.0 updates: Updated "Installation of operating system updates". Removed sentence about "First Config" with Panel PCs and resistive touch screen. Updated information about ADI, ADI Development Kit and "B&R ADI samples". Updated "B&R First Config". Replaced B&R Service Tool with "B&R Config Utils". Added instructions for su/sudo: "Executing privileged processes in the terminal", "Editing system files in the terminal".
1.04	September 2018	Updated model numbers. Updated note about fsprotect in hypervisor operation. Integrated appendix in application notes. Removed HMI Diagnostics. Corrections and text adjustments.
1.03	July 2018	Corrections
1.02	May 2018	Revised description for B&R Touch Screen. Updated B&R Hypervisor in chapter "ADI". Update for B&R UPS Manager.
1.01	March 2018	Updates and corrections for B&R Linux 9 and Debian references.
1.00	March 2018	First edition

1.2 Information about this document

This document is not intended for end customers! The safety guidelines required for end customers must be incorporated into the operating instructions for end customers in the respective national language by the machine manufacturer or system provider.

1.2.1 Organization of notices

Safety guidelines

Contain **only** information that warns of dangerous functions or situations.

Signal word	Description
Danger!	Failure to observe these safety guidelines and notices will result in death, severe injury or substantial damage to property.
Warning!	Failure to observe these safety guidelines and notices can result in death, severe injury or substantial damage to property.
Caution!	Failure to observe these safety guidelines and notices can result in minor injury or damage to property.
Important!	Failure to observe these safety guidelines and notices can result in damage to property.

General notices

Contain **useful** information for users and instructions for avoiding malfunctions.

Signal word	Description
Information:	Useful information, application tips and instructions for avoiding malfunctions.

1.2.2 Software specifications

Within this document, the following conventions must be observed:

- Commands that should/must be executed by normal unprivileged users are identified by prefix `$`.
- Commands that must be executed by the privileged `root` user are identified by prefix `#`.
- Command without a prefix not specifically noted otherwise in the text should be executed by a normal user.

For more details about handling, see chapters "Executing privileged processes in the terminal" on page 35 and "Editing system files in the terminal" on page 21. The *principle of least privilege (POLP)* should also always be applied.

2 System overview

2.1 Function overview

B&R supports Linux in the form of modified images based on Debian GNU / Linux 9 ("Stretch").

With B&R Linux, B&R offers a variant of Debian optimized for B&R industrial PCs that already includes all B&R-specific modifications and offers the broadest possible basis for various applications.

Reasons for Debian:

- High stability
- Large package selection
- Wide distribution of Debian and various derivatives (e.g. Ubuntu, Linux Mint)

For additional information, see the Debian website (https://www.debian.org/).

2.2 Compatibility

B&R supports B&R Linux 9 on the following devices:

- Automation PC 910 (APC910)
- Automation PC 2100 (APC2100)
- Automation PC 2200 (APC2200)
- Automation PC 3100 (APC3100)
- Panel PC 900 (PPC900)(only QM77/HM76)
- Panel PC 2100 (PPC2100)
- Panel PC 2200 (PPC2200)
- Panel PC 3100 (PPC3100)

2.3 Model numbers

Model number	Short description
5SWLIN.0740-MUL	B&R Linux 9 64b APC910 QM77/HM76
5SWLIN.0741-MUL	B&R Linux 9 64b PPC900 QM77/HM76
5SWLIN.0742-MUL	B&R Linux 9 64b APC2100 BYT
5SWLIN.0743-MUL	B&R Linux 9 64b PPC2100 BYT
5SWLIN.0744-MUL	B&R Linux 9 64b APC2200 APL
5SWLIN.0745-MUL	B&R Linux 9 64b PPC2200 APL
5SWLIN.0749-MUL	B&R Linux 9 64b APC910 QM170/HM170/CM236
5SWLIN.0753-MUL	B&R Linux 9 64b APC3100 KBU
5SWLIN.0754-MUL	B&R Linux 9 64b PPC3100 KBU
5SWLIN.0755-MUL	B&R Linux 9 64b APC3100 KBU legacy
5SWLIN.0756-MUL	B&R Linux 9 64b PPC3100 KBU legacy
5SWLIN.0758-MUL	B&R Linux 9 64b APC2200 APL legacy
5SWLIN.0759-MUL	B&R Linux 9 64b PPC2200 APL legacy

2.4 Features

B&R Linux 9 contains a selection of predefined software package groups. Additional packages can be installed later with an existing Internet connection.

```
# apt update
# apt search [KEYWORD]...
# apt install [PACKAGE_NAME]...
```

A list of installed packages can be displayed in a terminal using command `dpkg --list` (more than 1000 packages are installed by default).

LXDE is used as the default desktop, and **Chromium** is included as the web browser.

B&R has modified and provided certain features using their own packages for the use of Debian on B&R Automation and Panel PCs. Most of these packages are already included in B&R Linux and/or available for download on the B&R website (www.br-automation.com) (see chapter "Downloads" on page 39).

2.5 System requirements

The following requirements must be met in order to execute B&R Linux 9 on a supported B&R device:

- 4 GB mass storage device
- 1 GB RAM

Installing additional applications, saving data and general use of the system can result in changes to these values and the system load. The exact resource consumption and requirements therefore depend on the configuration and use of the system and cannot be guaranteed by B&R.

Additional requirements must be met in order to use certain functions. For example:

- Internet access (fees may apply).
- DVD/CD creation requires a compatible optical drive.
- An audio output device is required for music and sound playback.

3 Installation

3.1 Preinstalled B&R Linux

The Debian 9-based B&R Linux 9 can be obtained from B&R as part of a PC configuration on a suitable storage medium (min. of 4 GB).

3.2 Standard Debian installation

Debian installation images can be downloaded from *Getting Debian* (https://www.debian.org/distrib/) and installed by the user. For corresponding instructions, see the *documentation* (https://www.debian.org/doc/).

In a Debian standard installation, the customizations made specifically for B&R Linux are missing.

3.3 Installing additional components

Additional Debian software packages can be installed at any time. A list of available packages is available on the Debian website. It is also advisable to keep the software packages up to date and update installed packages accordingly (see chapter Installing local packages).

3.4 Adjusting the partition

Information:

If a user with high privileges (`root` privileges) is working on the system, it is easily possible to perform destructive operations on the system. This is especially true when manipulating data storage media directly. Executing these types of commands requires great care.

This procedure must not be used in combination with Intel RAID software. Partition adjustment tools do not recognize the metadata partitions on each data storage medium and may overwrite them. This will corrupt the RAID configuration and can result in data loss.

A B&R Linux 9 installation uses approximately 2.5 GB of disk space on a drive. Additional free disk space is required for normal use of the operating system. Using 4 GB storage media (CFast card) is therefore possible. The exact dimensioning of the data storage medium depends on the specific application, however.

GParted can be used to adjust the partitions and file systems. The program is controlled via an easy-to-use GUI. Some operations can only be performed when the affected file system is not in use (e.g. shrinking *ext4* file systems). *GParted Live*, which can be booted from a USB flash drive, for example, can be used for this purpose.

It is recommended to make these adjustments offline when the data storage medium is not in use (file system(s) are not mounted). Using *ext4* also makes it possible to extend the file system during use but not to shrink it.

In principle, two steps are necessary:

- Adjust the partition with tools like *fdisk* (https://manpages.debian.org/buster/fdisk/fdisk.8.html) or *GNU parted* (https://manpages.debian.org/buster/parted/parted.8.html).
- Adjust the file system, with *resize2fs* for *ext2/3/4* (https://manpages.debian.org/buster/e2fsprogs/resize2fs.8.en.html) and *e2fsck* (https://manpages.debian.org/buster/e2fsprogs/e2fsck.8.html).

If other abstractions such as *Device Mapper* (LVM, LUKS/dm-crypt, MD/RAID) are used, additional steps are necessary; these will not be explained here. An example would be extending the main partition (second and last partition) of a B&R Linux UEFI installation on data storage medium */dev/sdc* while the system is not booted. This extends the partition to the end of the data storage medium.

```
# echo ',+' | sfdisk /dev/sdc -N 2
# e2fsck -f -p /dev/sdc2
# resize2fs /dev/sdc2
```

3.5 Cloning an installed image

The user can clone an installed B&R Linux 9 or Debian using tools such as Clonezilla (https://clonezilla.org/) or alternative software solutions.

Information:

If a data storage medium is copied 1:1, TRIM should be executed for flash memory based data storage media to make unallocated memory blocks available again. For additional information, see section "TRIM support " on page 33.

3.6 B&R Linux installer

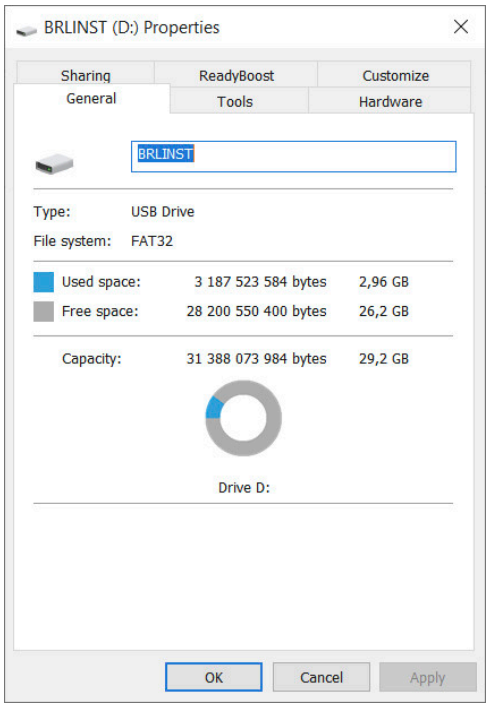
The B&R Linux installer makes it possible to easily install B&R Linux images (*.img*) on supported devices. This makes it possible to return to the original factory state, for example.

1. Create a USB flash drive with the FAT32 file system and name "BRLINST".
2. Extract the contents of **brl-installer.zip** to the empty USB flash drive.
3. Copy the desired B&R Linux image (complete folder containing the .img.gz file and other files) to folder IMAGES on the USB flash drive.
4. Start it on the target PC using the boot menu (**[F11]**, **[F5]**, **[ESC]**, etc.) from the UEFI entry of the USB flash drive.
5. Follow the installer dialog box.

Compatible OS images can be requested via B&R Support.

3.6.1 Preparing the installer data storage medium

The installer can be applied to USB flash drives or other conventional data storage media. To do this, it is necessary to format the data storage medium as a FAT32 file system and give it the label "BRLINST". This is possible in Microsoft Windows using Disk Management or File Explorer.



Information:

In Microsoft Windows, it is not possible to format a partition larger than 32 GB as FAT32. In addition, it is only possible to interact with multiple partitions on removable storage devices using Microsoft Windows 10 version 1703 or later.

The data storage medium must contain an MBR or GPT partition table. The partition for the FAT32 file system should be of type W95 FAT32 (LBA) (0Ch) or Microsoft basic data (EBD0A0A2-B9E5-4433-87C0-68B6B72699C7). Both requirements are met when formatting in Microsoft Windows.

Ideally, the file system should still be completely empty. The files from brl-installer.zip must be transferred to the root of the file system. One or more images that should be available for installation can then be placed on the file system in folder IMAGES.

On a Linux system, a data storage medium such as `/dev/sdb` could be overwritten and formatted as follows:

```
#> sfdisk --wipe always --wipe-partitions always /dev/sdb <<EOF
label: gpt
type=EBD0A0A2-B9E5-4433-87C0-68B6B72699C7
EOF
#> mkfs.fat -n BRLINST /dev/sdb1
#> mount /dev/sdb1 /mnt
$> unzip brl-installer.zip -d /mnt
#> umount /mnt
```

Hierarchical representation of a correctly sized B&R Linux installer file system with three B&R Linux images in folder *IMAGES*:

```
BRLINST
├── EFI
│   └── BOOT
│       └── BOOTX64.EFI
├── IMAGES
│   ├── brl-10_1.0.0-alpha.1_2020-05-13_uefi_desktop
│   │   ├── B2SUMS
│   │   ├── dpkg-list.txt
│   │   ├── image-size.txt
│   │   ├── partition-md5sums.txt
│   │   ├── raw.img.gz
│   │   ├── SHA256SUMS
│   │   └── SHA512SUMS
│   └── V1.1.0 (R) PPC2200
│       ├── bios-raw
│       │   ├── dpkg.list
│       │   └── stretch.img.gz
│       └── uefi-raw
│           ├── dpkg.list
│           └── stretch.img.gz
├── Liesmich.txt
├── LiveOS
│   └── squashfs.img
├── NEWS.md
├── options.txt
├── Readme.txt
└── startup.nsh
```

Information:

The case (upper- and lowercase letters) shown is mandatory and not permitted to be changed.

BRLINST is only the name (label) of the file system and not a separate folder in the file system. In Microsoft Windows, the correct path to the installer's bootloader would be *D:\EFI\BOOT\BOOTX64.EFI* for the D: drive.

Certain settings can be made for the installer in file **options.txt**. These are already described in the file. It is possible to run through the entire installation automatically. The installer is interactive by default and data storage media are not overwritten or changed until selected by the user.

Notice!

A fully automated configured installer should be handled very carefully. Starting it on an incorrect system will most likely result in data loss. The B&R Linux installer can also be booted on many non-B&R PCs.

3.6.2 Structure of folder IMAGES

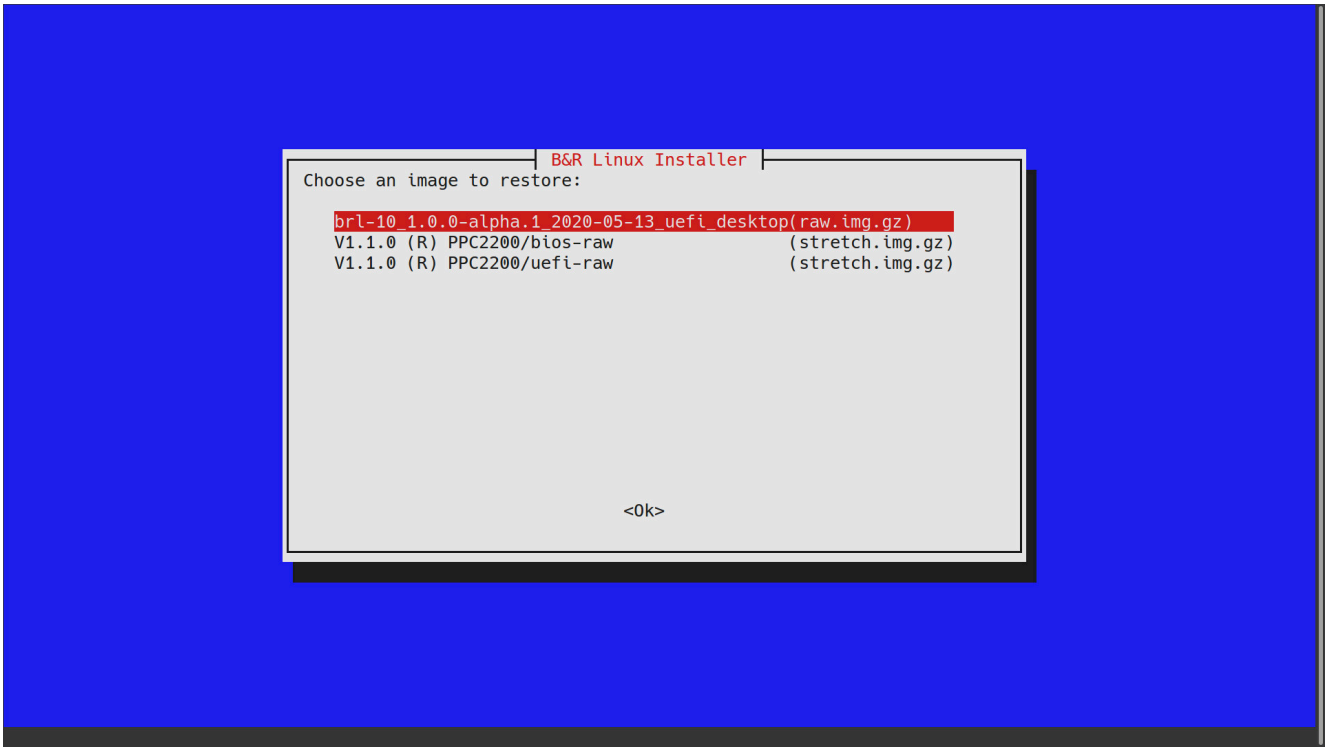
In general, the images available from B&R can be used directly with the B&R Linux installer.

- Only file *.img.gz* is required for the recovery. However, the entire folder should be considered as part of the image and copied to folder *IMAGES*.
- The installer only supports B&R Linux images. Other files that also use the .img file extension are not supported. The content of the files is a raw image of a data storage medium with a partition table, file systems, etc. The installer makes some assumptions about the contents of the image file. For example, a valid partition table must be available (MBR or GPT) and the last partition must be occupied by an *ext2/3/4* file system, which is then adapted to the data storage medium. In addition, the partition can only be extended, not shrunk.
- The data storage medium image is already compressed with gzip (*.img.gz*) in the image download. The installer supports the recovery of the compressed file. It is also possible to decompress the file and save it as *.img*. *Zstandard* compressed images (*.img.zst*) are also supported.
- The images must be located in subfolders of *IMAGES*.
- If a *SHA256SUMS*, *SHA512SUMS* or *B2SUMS* file exists in the respective image folder, it will be used to validate the checksums of the files before recovery. If a full match cannot be determined with any of the checksum files, the installer aborts. If there is no **SUMS* file available, the check is simply skipped.
- If file *partition-md5sums.txt* exists in the image folder, it is used to validate that the data storage medium image was written correctly. If this file does not exist, this step is skipped. The file must contain MD5 checksums of the partitions present in the image.

3.6.3 Installation procedure

As long as no other operating system has been installed, the PC will automatically boot from the removable storage device with the installer using the default settings of the firmware (BIOS). If this is not the case, it is possible to boot either from the UEFI shell or the installer boot menu. The default UEFI boot entry of the specific data storage medium must be selected in the boot menu. Script *startup.nsh* script must be executed in the UEFI shell. This will start automatically if it is not aborted within a short timeout. Using the UEFI shell for booting is only necessary for the APC2100 and PPC2100; the boot procedure via the boot menu should be preferred for other PC series.

If no other settings are made in *options.txt*, the installation process occurs interactively. Control is possible via the keyboard (arrow keys, return, tab, space bar, etc.):



1. First, one of the images placed in folder *IMAGES* can be selected.
2. This is followed by the selection of the target data storage medium on which the operating system will be installed.
3. Optionally, space can also be left free for installing the B&R Hypervisor.
4. The installation process is performed and the selected data storage medium is permanently overwritten.
5. After the installation is completed, the installer allows the following options by keyboard input:
    - Reboot (**r**, **R** or any)
    - Power off (**p** or **P**)
    - Opening a shell (**s** or **S**)

    In the shell, the system can be shut down with command *reboot* or *poweroff* or with keyboard shortcut **[Ctrl] + [Alt] + [Del]**.

    After the system has shut down, the installer data storage medium should be removed.

The newly installed image will boot at the next startup of the system. If this is not the case, check that the installer has run successfully and that the firmware settings and boot sequence are configured correctly.

4 Initial startup

When switched on for the first time, B&R Linux 9 performs one-time automatic detection and configuration.

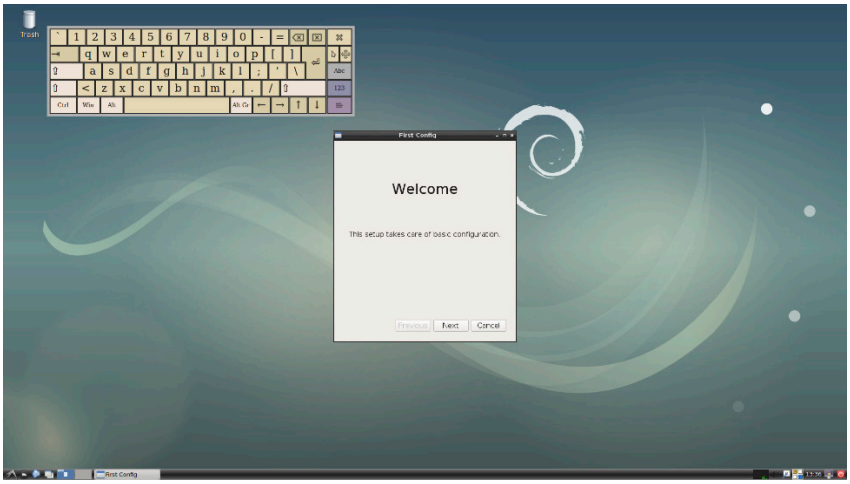
The automatic first boot configuration is now integrated into the new "First Config" program in B&R Linux 9. This makes it possible to customize the settings in various ways during commissioning.

> **Information:**
>
> **The first boot mechanism is not permitted to be interrupted. If the process is interrupted, the image may no longer be bootable.**
>
> **The following applies to APC2100 and PPC2100 devices: After the first complete boot procedure, it is important to ensure that no USB devices are connected since the restart may not work properly otherwise.**

After restarting, B&R Linux 9 is ready for operation and the login screen is displayed:

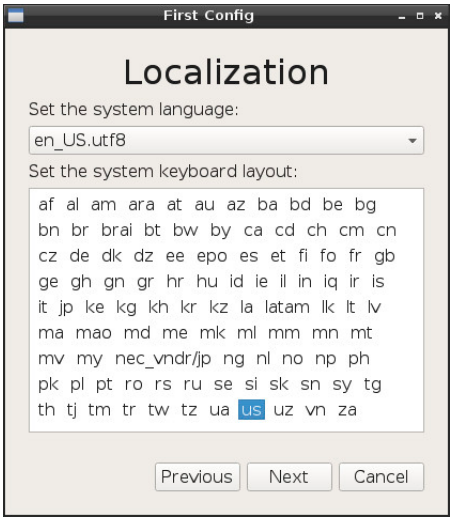
4.1 B&R First Config

When B&R Linux 9 is started for the first time, it automatically logs in and starts B&R program **First Config**. A one-time automatic detection and configuration is carried out. A USB driver configuration is performed on all Automation PC 2100 and Panel PC 2100 devices.

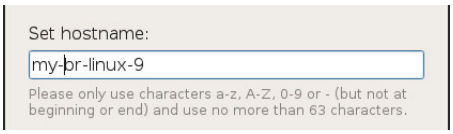


1. The system language and keyboard layout can be selected.

   The settings are only active after the configuration has been completed.



2. Assign a hostname. This should be unique in the LAN network.

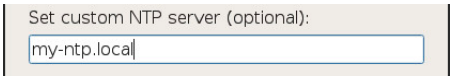


3. Optionally, the firewall can be enabled/disabled (B&R Linux 9 1.1.0 or later).

   The firewall is disabled until **First Config** has been completed and is enabled afterwards by default. More detailed settings, such as opening ports, can be performed in the normal desktop environment afterwards.

4. Set the time and time zone. Optional: Define your own NTP server (B&R Linux 9 1.1.0 or later).

   The Debian NTP server pool is used by default. If these servers cannot be reached due to the local network configuration, it is possible to use a local NTP server (e.g. local domain controller). The NTP client in B&R Linux is `systemd-timesyncd` by default, and the entry is made in "/etc/systemd/timesyncd.conf".



5. Create a user.

   It is optional to add the created user to group "sudo". This user is then made an administrator and can perform privileged tasks with his password (sudo, polkit). At the same time, the root user is locked for easier password management. This configuration has the advantage that a password must always be entered deliberately for administrative, possibly destructive, operations. In addition, these operations are noted in the system log.

   If the root account is not locked, a password must be specified. This means that only this user is defined as the administrator; the newly created user cannot use his or her password to authorize privileged commands. This configuration is similar to the one in B&R Linux 8. The root user has all system rights and should only be used for administrative purposes. A normal user must therefore be created.

   For additional information about su and sudo, see chapters "Executing privileged processes in the terminal" on page 35 and "Editing system files in the terminal" on page 21.

6. After the configuration has been completed, the settings become active and the system restarts.
7. The new user can log in after the restart.

> ## Information:
>
> **At this point, it is necessary for Automation PC 2100 and Panel PC 2100 devices to disconnect all USB devices in order to shut down successfully after applying the settings.**

5 Configuration

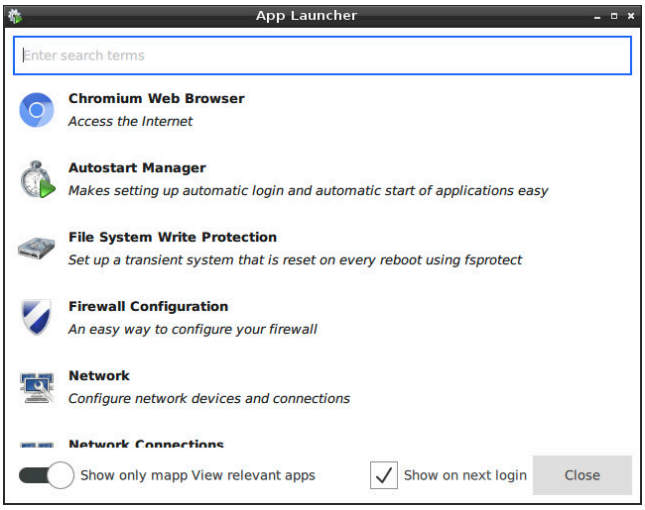
5.1 B&R Config Utils

B&R Linux 9 1.1.0 replaces the **B&R Service Tool** with package **B&R Config Utils**. This package offers all configuration options of the Service Tool but is structured differently. The Service Tool is divided into two separate tools: **Autostart Manager** and **File System Write Protection**. App Launcher is also available; this starts automatically after completion of **First Config** and the first login.

5.1.1 App Launcher

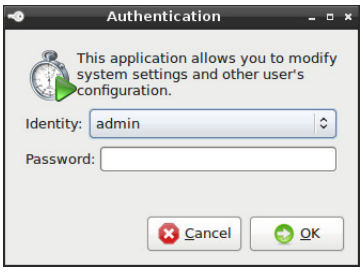
App Launcher makes it easier to find and execute installed programs. It displays a preselection of applications to configure a mapp View client by default.

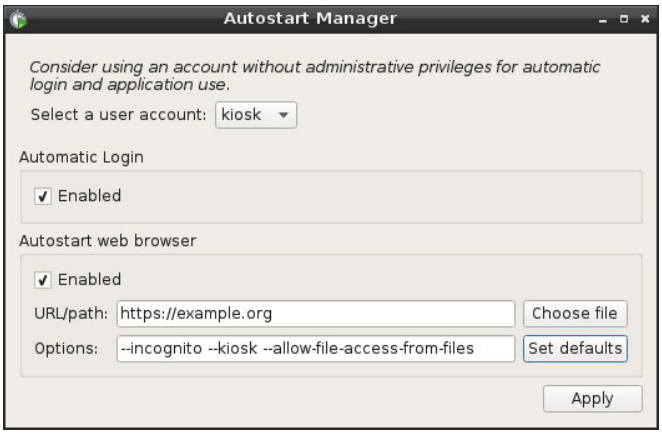
App Launcher also has a search function that searches for suggestions as you type.



5.1.2 Autostart Manager

With this application, automatic login of a user without a password request can be configured. In addition, automatic web browser startup can be set for the user account when using *mapp View*.





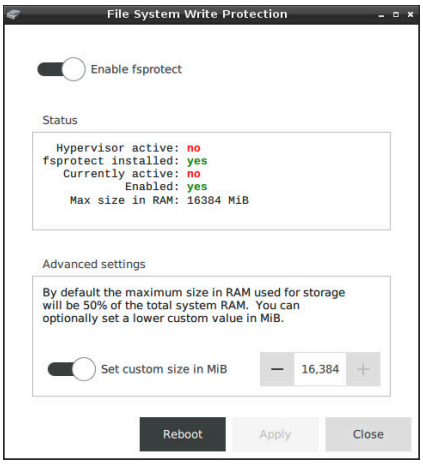
To start the application, authentication as administrator is required.

In the web browser configuration, it is also possible to specify a URL of a website or a file path that the browser should open. In addition, parameters can be entered with which the browser should start. "Set defaults" writes the options recommended for *mapp View* into the text field.

> **Information:**
>
> **Even if started in kiosk mode, Chromium can be closed via the usual keyboard shortcuts: [Ctrl] + [W], [Ctrl] + [Q] or [Alt] + [F4].**
>
> **This makes it possible to return to the normal desktop. All possibilities of the system can be used, and data can be accessed.**

5.1.3 File System Write Protection

Can be used to make settings for operating with **fsprotect**. The actual file system is added to the physical drive without write access, and all write operations are intercepted by a virtual drive in RAM. After each restart, the system restores the state that was set before enabling **fsprotect**.



1. Since no permanent changes can be made when the write filter is active, all other settings should be made first (the write filter can be disabled at any time).
2. Enable **Enable fsprotect**.
3. Optional: Set the user-defined RAM size.
4. Apply changes via **Apply**.

   This requires administrative rights.
5. Button **Reboot** is now highlighted.

   Changes are only active after a restart.

Information:

These settings make it possible to write to the data storage medium. Write protection can be avoided with administrative rights. Protection is only in effect during normal use.

Write procedures are limited to the size of the RAM file system. It is therefore recommended to allocate enough disk space.

Enabling fsprotect in hypervisor operation requires further steps or adjustments. These are described in Automation Help.

5.2 B&R Touch Screen

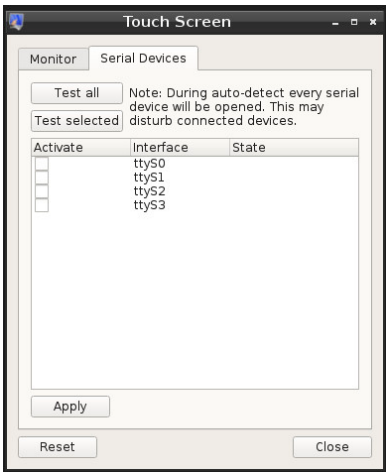
In B&R Linux 9, driver **evdev**, which is already contained in Debian, is used for communication with the touch screen of a Panel PC display or connected Automation Panels. **evdev** is the actual driver for mice, keyboards and all other input devices.

Program **B&R Touch Screen** is available for setting up (calibrating and configuring) resistive and capacitive touch screens. This can be started via **Preferences**.

A specific procedure must be observed when setting up touch screens with this program. If an already saved configuration has changed, the configuration must be deleted and created again by clicking on "Reset".

5.2.1 Registering single-touch devices

> **Information:**
>
> **This step must only be performed if resistive touch screens are used. If capacitive touch screens are used, this step should be omitted.**



If at least one resistive touch screen is used, it must be registered first. Resistive touch screens communicate with the PC via a serial interface. It is required to switch to the second tab for this.

1. Open program **B&R Touch Screen**.
2. Change to tab "Serial devices".

   Serial interfaces can be tested and enabled for touch operation.
3. Select an entry from the list to test whether a touch screen is connected to an interface.
4. Click on **Test selected**. The selected interface is tested.

   As an alternative, all interfaces can be tested with **Test all**.
5. The test may take some time. If a touch screen is found on an interface, this is indicated via a check mark.
6. Select a suitable interface and enable it by clicking on **Apply**.
7. Although it is possible at this point to make entries via the touch screen, it is still not calibrated or assigned to the screen.

> **Information:**
>
> **This test involves communication via the serial interfaces. The test may affect other devices that are connected to the interfaces.**

5.2.2 Assigning a touch screen

All touch input devices must be assigned to the screen. This applies to all touch screens.

1. Open program **B&R Touch Screen**.
2. Change to tab "Monitor".
3. Assign a touch screen to the respective panel or monitor in section "Assign".
4. Confirm with **Assign**.
5. A gray window opens.
6. The touch screen is assigned by confirming.

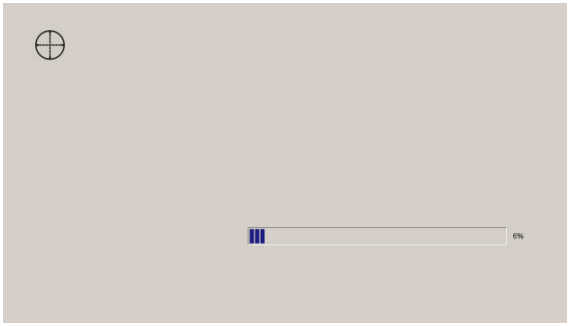
> **Information:**
>
> **It is difficult to assign multiple screens if they are in clone mode since the assignment window is displayed on both screens.**

In multi-screen operation, i.e. when using two monitors on different graphics lines, the display for assigning the touch screen is only available on one monitor. The touch screen is assigned to the respective panel or monitor simply by touching the panel (and triggering the touch screen).

5.2.3 Calibration

It is recommended to perform calibration.

1. Open program **B&R Touch Screen**.
2. Change to tab "Monitor".
3. Click on **Calibrate** in section "Calibration".
4. A gray window opens in full screen.
5. Touch the four calibration points one after another as precisely as possible.



5.2.4 Setting rotation and alignment

Screen rotation and the monitor relationship in multi-screen configurations can be defined in the last step.

1. Open program **B&R Touch Screen**.
2. Change to tab "Monitor".
3. The arrangement of the panels can be set up for multi-screen operation in section "Configuration".

   Two panels are supported. These can be arranged on top of or next to each other. Alternatively, clone mode is also possible.
4. Screen rotation can be set in section "Appearance". This setting applies to all screens.

5.3 mapp View client

Various settings must be made for the configuration as a mapp View client. These are primarily made using the standard dialog boxes available in B&R Linux 9 and the B&R-specific applications. All settings can be opened via **App Launcher**(see chapter "B&R Config Utils" on page 16):

- Configuration of the **network** (with standard dialog boxes).

  It only makes sense to make the network settings in hypervisor operation after installing the hypervisor driver and the hypervisor system or its configuration. The network interfaces are then assigned to the respective OS (Linux or AR) and the virtual network interface becomes visible.
- It is recommended to create a **user** for starting the web browser (with standard dialog boxes).

  Multiple users should be configured for different purposes. For example, a user for kiosk mode should be created separately from a user with administrative rights. An administrator is necessary since some system settings require corresponding rights.
- Configure an **automatic login and start the browser** in kiosk mode (see chapter "B&R Config Utils" on page 16).
- Optional: Enable **MTCX access synchronization** in hypervisor operation (see "MTCX/ADI functions" on page 24).
- Optional: Configure the touch screen (see chapter "Calibration" on page 19).

  For single-touch devices (analog resistive) or multi-screen operation, the touch devices must be assigned to the monitor.
- Optional: Configure the **write protection for the file system** (see chapter "B&R Config Utils" on page 16).
- Optional: Configure the **firewall** (with standard dialog boxes).
- Optional: Configure the **screensaver** (using standard dialog boxes, see chapter "Disabling the screensaver" on page 22).

  The screensaver is disabled by default for B&R Linux 9 1.1.0 or later.
- Optional: Update the browser if required (see chapter "Browser update" on page 35).
- Optional: Install fonts if required (see chapter "Font support" on page 35).

5.4 Editing system files in the terminal

Information:

GNU nano is used for the editor in these instructions. GNU nano is defined as the default editor for B&R Linux via the *Debian alternatives system* and therefore also opened with sudoedit. GNU nano is generally recommended for inexperienced users.

GNU nano makes it possible to navigate with the arrow keys and write without using any additional keyboard shortcuts. [Ctrl] + [X] saves the written text. Other combinations are also described directly in the editor.

Modifying system files requires administrative rights. These rights are not always easy to manage in normal GUI programs and require corresponding knowledge of the system. It is recommended to perform these activities in a terminal.

These examples are used to describe the options available for editing a system file interactively (see "Executing privileged processes in the terminal" on page 35).

The following applies if the user was configured as a member of the sudo group in First Config:

► These three commands are effectively synonymous and open the selected file with read/write permissions in GNU nano.

```
$ sudoedit /etc/br/adi.conf
$ sudo editor /etc/br/adi.conf
$ sudo nano /etc/br/adi.conf
```

If a root user has been configured with a password:

► Enter the following command chain:

```
$ su -
# nano /etc/br/adi.conf
# exit
```

► Alternatively, the following command can also be entered:

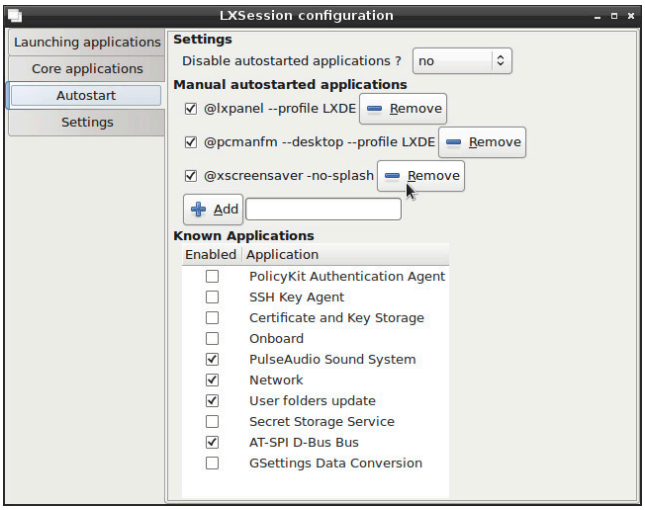
```
$ su -lc 'nano /etc/br/adi.conf'
```

5.5 Disabling the screensaver

XScreenSaver is set as the default screensaver in B&R Linux. This runs as a separate process in the background and has several interfaces that can change its behavior. It can be started automatically via different mechanisms during login.

As long as the process is running, a timeout must be defined; after this timeout, it is enabled. To prevent the screensaver from ever being started, the background process must also be prevented from being started.

To completely disable the screensaver, the process must be stopped. Every restart causes the process to restart too, however. In B&R Linux, this is done via LXSession for each user.



1. Open the Start menu.
2. Open GUI tool **Default applications for LXSession** in folder **Preferences**.
3. Select tab "Autostart".
4. Remove entry "xscreensaver".
5. Automatic startup is avoided.
6. An already running process can be stopped via configuration tool XScreenSaver.

Information:

This behavior has been modified in B&R Linux 9 1.1.0, i.e. the screensaver is disabled for each user.

5.5.1 Display power management

To additionally prevent the display from being switched off (screen blanking), it is necessary to execute the following command for the respective user:

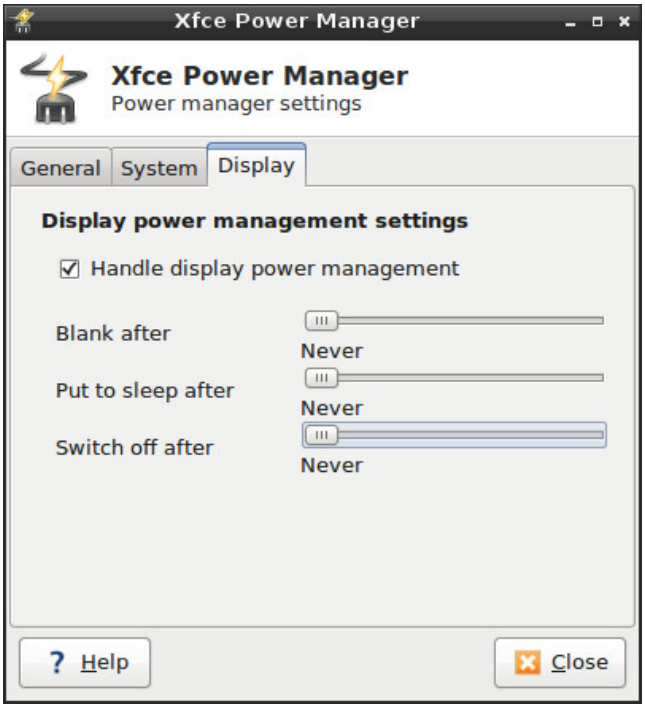
```
$> cat >> ~/.xsessionrc <<EOF
xset s off
xset -dpms
EOF
```

This setting only becomes active after a new login. The commands can also be called directly to change this setting for the current session.

Alternatively, a program can be installed to configure display power management:

```
#> apt update
#> apt install xfce4-power-manager
```

Display power management can be customized in the newly installed GUI as shown in the screenshot. This setting also only applies to the current user.



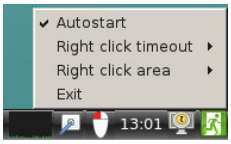
6 Operation

6.1 Touch screens

B&R Touch Click (right-click)

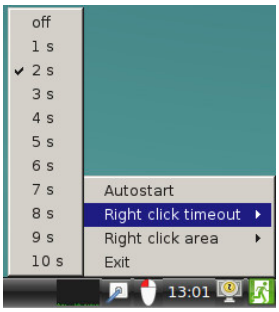
B&R Touch Click can be used to perform right-clicks on resistive and capacitive touch screens. The program is available in the Start menu under **Accessories**.

1. Click on the mouse icon in the tray to configure the right-click behavior.
2. Click on "Autostart" to enable or disable the program.

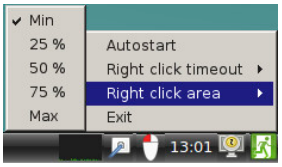


This setting is user-specific.

3. Use menu **Right-click timeout** to set the interval for the right-click.



4. In order not to trigger an unwanted right-click when moving windows, the right-click is suppressed when moving over longer distances. This behavior must be configured in menu **Right-click area**.



> **Information:**
>
> **The size of the active area heavily depends on the touch screen used (resolution and geometry) and the user behavior.**
>
> **If right-clicking is enabled, the clicking behavior only changes after the timeout has expired. After the timeout has expired, no further events are sent except a single right-click.**

Clicking behavior

B&R touch devices (single- and multi-touch) have the same clicking behavior as a standard computer mouse.

Touch screen functionality when the monitor is off

Touch operations are also evaluated by the system when the monitor is in sleep mode. This will "wake up" the monitor. It is important to note that this may also affect a previously invisible dialog box. This can cause unintentional operation!

Touch screen functionality with extended desktop

In the extended desktop, the touch screens must first be assigned to the panels using the B&R Touch Screen program (see chapter "B&R Config Utils" on page 16).

6.2 MTCX/ADI functions

B&R MTCX driver

The **B&R MTCX driver** communicates with the B&R Maintenance Controller Extended (MTCX) and provides the functions of MTCX for ADI.

The MTCX is a standalone processor that provides a B&R industrial PC with additional functions that are not available on a "normal" PC.

B&R ADI library

The Automation Device Interface (ADI) makes it possible to access specific functions of B&R devices, e.g. setting the display brightness or reading temperatures.

The *B&R ADI library* is preinstalled with B&R Linux because it is required by certain B&R tools.

B&R ADI Development Kit

The *B&R ADI Development Kit* for Linux is available for download from the B&R website (www.br-automation.com) to develop applications that use the library (see chapter Downloads). It is not preinstalled and not required at runtime.

B&R ADI samples

The compiled sample programs are already preinstalled in B&R Linux and can be executed with script *adi-samples*:

```
$> adi-samples --help
$> adi-samples Versions
```

The source code is included in the **ADI Development Kit**.

B&R ADI samples are not preinstalled by default and can be downloaded from B&R.

B&R Hypervisor mode

> **Information:**
>
> **Hypervisor mode changes the timing for accessing the ADI interface and therefore the timing of the customer application. Updating the firmware in hypervisor mode is therefore not possible for performance and security reasons.**

To use the MTCX interface in both Linux and Automation Runtime, hypervisor mode of the ADI library must be enabled. ADI library version 2.7.3 or later is required for this.

Hypervisor mode ensures that B&R Linux and Automation Runtime Embedded do not access the MTCX interface at the same time. If the MTCX is blocked by Automation Runtime Embedded, the ADI will wait a defined amount of time until the interface is freed up. The waiting times currently cannot be adjusted in Linux.

- Value *Busy wait time* specifies the length of time the ADI waits for the interface to be enabled by Automation Runtime Embedded (default value: 500 ms).
- Value *Sync wait time* specifies the length of time ADI waits for the interface to be enabled by another instance of ADI (default value: 500 ms).

If the interface is blocked by another ADI instance and by the MTCX, then these two waiting times are added together (default value: 1 s).

To generally enable synchronized access to the MTCX in a virtual environment, a special setting must be made. The following must be entered in configuration file */etc/br/adi.conf*:

```
[Hypervisor]
enabled=true
```

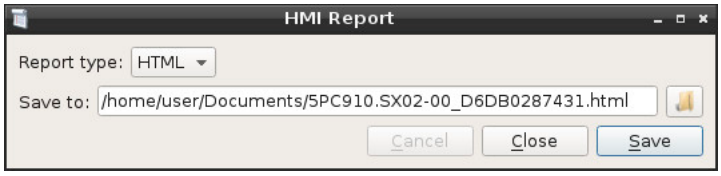
For the changes to take effect, the system or all applications that use the ADI must then be restarted.

6.3 HMI Report

This creates a report of device-specific information. This report can then be used for support purposes or system documentation. The tool can be called by a terminal. The GUI, a wrapper for the command line interface of HMI Report, can be launched from the Start menu.

Splitting the tool into two packages

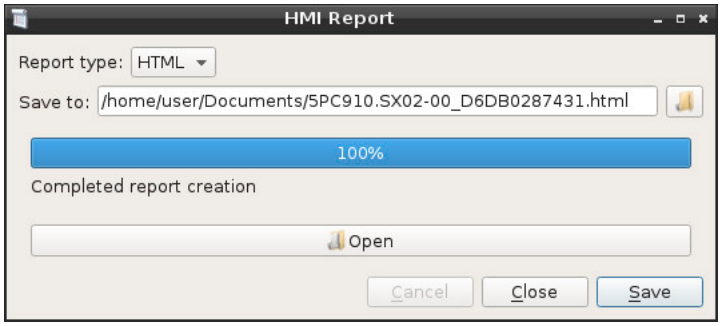
- `hmi-report-gui`
- `hmi-report`
  This can be installed without the GUI component and its dependencies.



Supported output formats

- HTML
  Report in HTML format for display in a browser.
- Text
  Report in simple text format for display in a text editor, which is especially useful for direct comparisons of multiple reports.
- XML
  Report in XML format with corresponding XSL file for display in a browser.
- Diagnostics package
  Archive file with a report in text format and a variety of other log files and information files for diagnostic purposes.

After the report has been created, it can be opened directly from the GUI in the respective application.



Information:

XML reports can no longer be displayed in modern browsers by default due to security policies. This is because local files are not permitted to load other local files (XML loads the style sheet file).

Chromium/Chrome must be started with option `--allow-file-access-from-files`.
Firefox has setting `security.fileuri.strict_origin_policy` in `about:config`, which is applied permanently.

If a report cannot be successfully created due to problems during creation, it is recommended to create a text report in the terminal and query detailed process information.

```
$ hmi-report --verbose 3 --format text --output report.txt
```

Due to its simple format, the report in text format is more robust in relation to possible errors or early process termination.

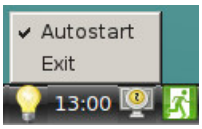
6.4 Changing the display brightness

The brightness of the Panel PC display and Automation Panels connected via SDL can be set via tool **B&R Display Brightness**.

1. Open the Start menu.
2. Start the program in folder **Accessories**.
3. Click on the lamp icon in the tray.

   The number of detected displays is shown in the menu together with their IDs.
4. Use the slider to set the display brightness.

The program can be closed or the autostart can be enabled by right-clicking on the lamp icon. This setting is user-specific.



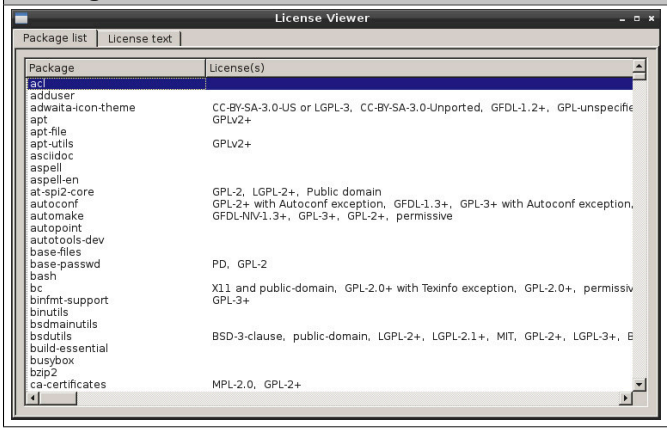
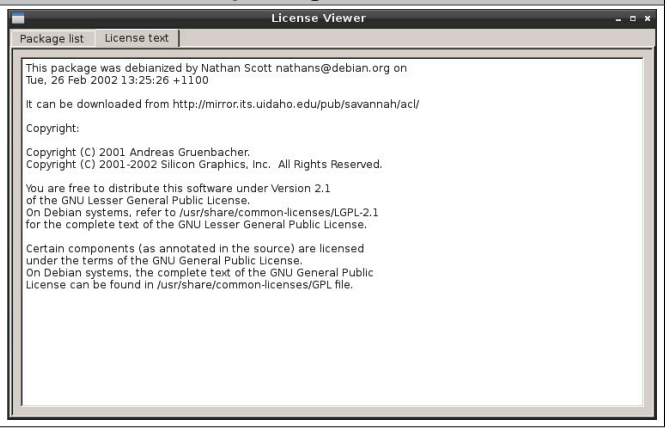
6.5 B&R License Viewer

The **B&R License Viewer** is used to view the licenses of the currently used packages.

1. Start the program via **System Tools**.
2. Call the list of the currently installed packages under tab "Package list".
3. Select a package (in blue).
4. The licenses of the package can be viewed under tab **License text**.

Information:

Loading licenses, especially applications with many license notes (e.g. Chromium, Firefox, etc.) may take some time.

Package list view	License view of a package
	

6.6 B&R UPS Manager

Two packages are available for managing B&R UPS units: *ups-daemon* and *ups-control*.

1. Package *ups-daemon* provides the system service. This package can be installed without *ups-control*, and the service can be operated without a GUI.
2. In addition, package *ups-control* provides a user interface that can be used to configure the service, read information and display notifications in the notification area.

6.6.1 Graphical user interface

The UPS Manager user interface is started minimized in the system tray. 4 different icons can be displayed there:

Figure 1: Mains operation

Figure 2: Battery operation

Figure 3: UPS not connected

Figure 4: UPS warning

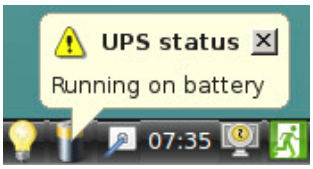
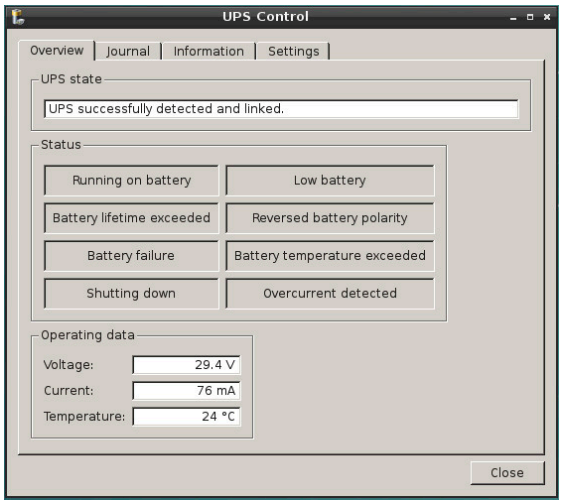


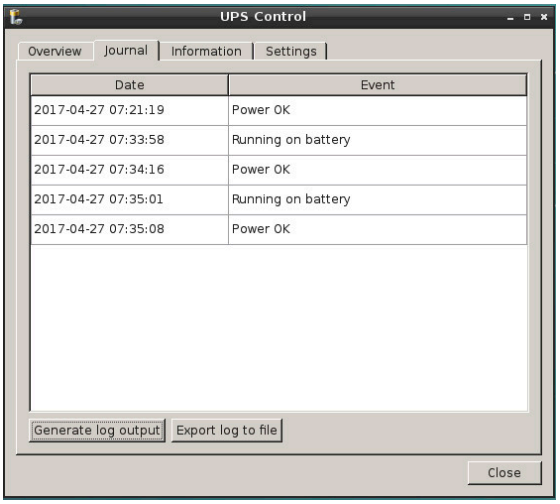
Figure 5: UPS Manager notification

The UPS Manager interface has four tabs:

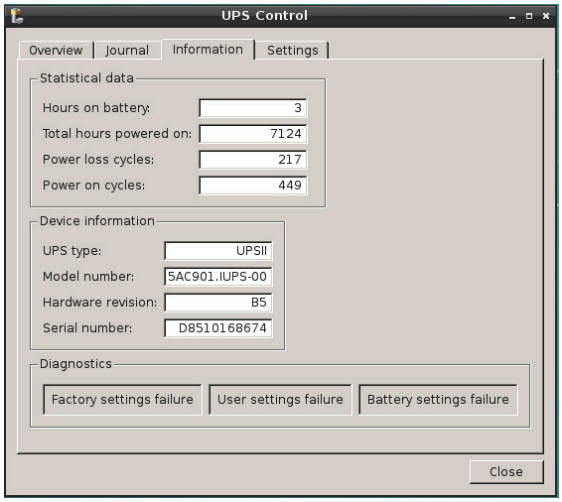
a) The overview allows the most important values about the current state of the UPS to be viewed immediately.



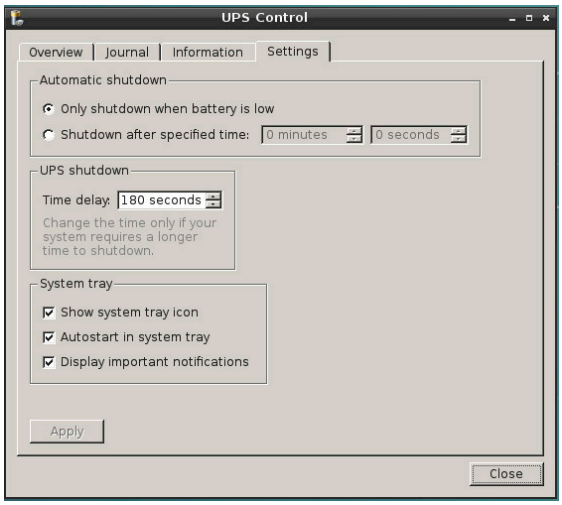
b) The history of UPS operation can be read in tab "Journal". This log is not saved permanently by default (for more information, see System log (journal/syslog)).



c) Tab "Information" provides more details and statistics about the UPS hardware used.



d) The service and interface can be configured in tab "Settings".



6.6.2 UPS management without a visual interface

If *ups-daemon* is used without the graphical interface, the default settings are used automatically. To change settings, file */etc/br/ups.conf* can be edited. The default values of this file are listed below:

```
[brupsd]
max_battery_time=-1
shutdown_time=180
```

- max_battery_time:
  The maximum amount of time (in seconds) that the system will run on battery operation. The default value of -1 indicates that the system will shut down when the UPS battery level is low.
- shutdown_time:
  The maximum amount of time (in seconds) that the system will have time to shut down after the UPS service initiates a shutdown while running on battery operation.

With the following command, the service can also be notified of the changed configuration without restarting:

```
#> systemctl reload brupsd
```

The UPS service can be managed like any other system service. As usual with Debian, it is enabled starting with installation. If no UPS module is detected in the system, the service is ended. Commands to query the UPS service status, start the UPS service, permanently enable it and read the journal entries are as follows:

```
$> systemctl status brupsd
#> systemctl start brupsd
#> systemctl enable brupsd
#> journalctl --unit=brupsd.service
```

The service program also has a command to read the current values without a GUI:

```
#> brupsd --report
```

6.7 Virtual keyboard

For keyboard-free operation of the device, a virtual keyboard can be used on the screen. The virtual keyboard can also be used for login.

The onboard virtual keyboard is used as the virtual keyboard. This is provided by Debian, not B&R. For additional information, see https://launchpad.net/onboard.

6.8 Language conversion

B&R Linux allows the language to be configured by the B&R "First Config" program (see "B&R First Config" on page). The following mechanism can be used to change the language settings later or to use a language other than German or English:

```
#> dpkg-reconfigure locales
```

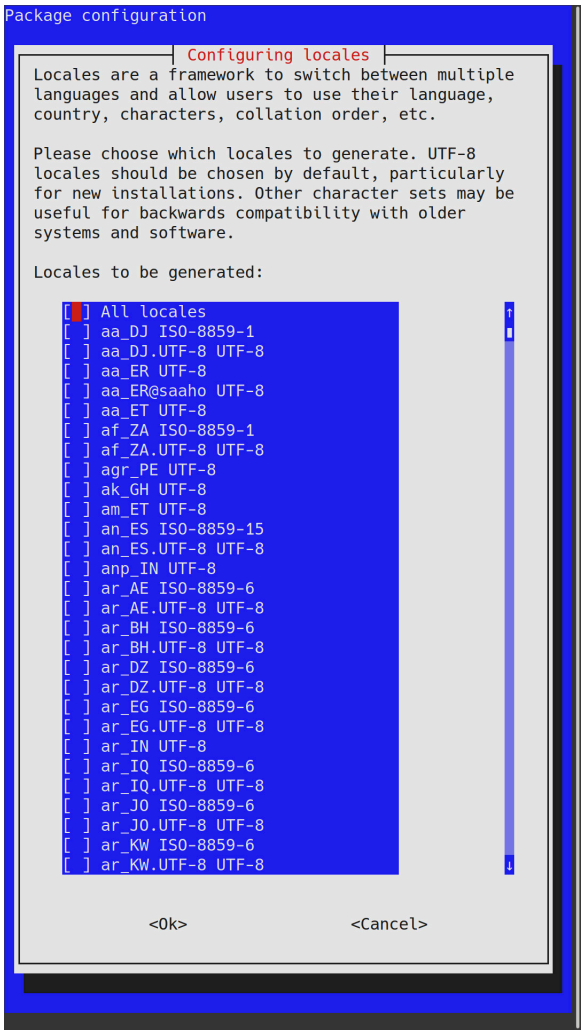
In the **DPKG** configuration interface, it is possible to navigate through the dialog boxes with the keyboard (arrow keys, tab, return, space bar) and configure the available language packs (*locales*).

Only the selected locales are generated, which saves memory space. Only these locales can then be used in operation. An explanation of this procedure is located in the output descriptions and respective "Installed size" fields by calling these two commands:

```
$> apt show locales
$> apt show locales-all
```

Translations of individual programs are usually part of the respective packages. With isolated packages, the entire translations require a relatively large amount of memory and are therefore swapped out into separate packages, e.g. *firefox-esr-l10n-** and *chromium-l10n*.

If a translated text is not available for the localization used in an internationalized application, the original texts from the source code are used; these are usually in English.



6.9 32-bit support

B&R Linux only uses 64-bit (*x86_64/amd64*) compiled software. The Linux kernel used also supports 32-bit (*x86/i386*) programs. A few steps are necessary for installing this type of software on the operating system.

For additional information about this topic, see the Debian wiki (https://wiki.debian.org/Multiarch) and a how-to (https://wiki.debian.org/Multiarch/HOWTO), for example.

6.10 System log (journal/syslog)

B&R Linux does not have a *syslog* implementation (e.g. *rsyslog*) preinstalled, only *systemd-journald*.

journald is configured so that logs are only stored in the random-access memory (*/run/log/journal*). To keep logs across system reboots, the journal settings must be changed. Saving log files takes up space and requires write cycles on the drive, however.

The easiest way to do this is to create folder */var/log/journal*. This will cyclically synchronize the logs stored in */run* to the mass storage in */var*. Detailed settings can be made in configuration file */etc/systemd/journald.conf*. In both cases, root privileges are required.

For additional information about journal configuration, see journald.conf (https://manpages.debian.org/buster/systemd/journald.conf.5.html), for example.

6.11 File system settings

B&R Linux uses *ext4* as the file system. The default settings are used except for the following three items.

- After a file system error, the file system is mounted as read-only (*-e remount-ro*).
- The file system is checked once a month during mounting (*fsck*). This may cause the system to take longer during startup at this point in time.
- Mount option *data=journal* (or *journal_data*) is set; this option has a negative effect on file system performance, especially on direct I/O. During internal tests, however, better voltage loss behavior was determined and no file corruption occurred.
  Depending on the use case, it may be preferred to revise this setting to return to the default value *journal_data_ordered* (*data=ordered*):

```
#> tune2fs -o ^journal_data /dev/sd...
#> reboot
```

These settings can be viewed and manipulated using tune2fs(8) (https://manpages.debian.org/buster/e2fsprogs/tune2fs.8.html).

For more information, see man page mke2fs(8) (https://manpages.debian.org/buster/e2fsprogs/mke2fs.8.html) and the Kernel Wiki (https://ext4.wiki.kernel.org/index.php/Main_Page).

6.12 Multiple monitors

Only displays with the same resolution are supported for multi-screen operation.

6.13 Display resolutions

The graphics driver in B&R Linux 9 can only operate the panel of a B&R Panel PC and connected Automation Panels with their native resolution. No other resolution can be set in the operating system.

6.14 Accessing Linux file systems in Windows

Microsoft Windows is not able to read or handle the *ext4* file system used with B&R Linux. However, there are various driver implementations for Microsoft Windows and other operating systems available from third-party vendors commercially and at no cost that make it possible to access various Linux file systems.

6.15 TRIM support

Cyclic TRIM support is preconfigured for B&R Linux. Service *systemd* is executed weekly for this. This service has no defined execution time and can thus change during use.

The service configuration can be read as follows:

```
/etc/systemd/system/fstrim.service
/etc/systemd/system/fstrim.timer
```

If this service is unwanted, it can be disabled with the following command:

```
systemctl disable fstrim.timer
```

Information:

Executing fstrim (https://manpages.debian.org/buster/util-linux/fstrim.8.html) can have a short-term effect on performance.

6.16 Real-time support

Various approaches exist for real-time support together with Linux. Real-time extensions can be added directly to the Linux kernel, for example. This procedure is preferred by the Open Source Automation Development Lab (OSADL).

For information and downloads of kernel versions with included real-time patches, see the OSADL website (https://www.osadl.org/Realtime-Linux.projects-realtime-linux.0.html) or the Real-Time Linux Wiki (https://rt.wiki.kernel.org/index.php/Main_Page).

There are no real-time extensions added to the Linux kernel in B&R Linux 9. The kernel version can be replaced in the installed image, however. Since multiple versions are available, it is recommended to use the version with additional text "Latest stable".

Information:

Linux systems with an included "real-time preempt patch" may perform worse, for example in intensive graphics applications.

B&R has not performed any tests using real-time extensions.

6.17 Installing local packages

Packages provided by Debian should always be installed via a package manager from a Debian package archive. Tools such as *apt*, *aptitude* or graphical front ends such as *Synaptic Package Manager* can be used to download and install packages directly.

B&R packages are downloaded as .deb files and must be installed locally on the system. *apt* should be used for this. APT will also recognize local files if they are uniquely specified. The package name must start either with ./ or / for this:

```
# apt install /absolute/path/to/package.deb
# apt install ./relative/path/to/package.deb
```

If multiple packages should be installed and there are dependencies between these packages, it is recommended to install them all together in one run. *apt* ensures that the correct sequence is followed:

```
# apt install /path/to/packages/*.deb
```

6.18 Installing operating system updates

Information:

If the file system write filter is active, it must be disabled before the update. Otherwise, it is not possible to install updates because they will be lost after restarting the system.

Operating system updates can be downloaded via the Debian package directories. This requires an Internet connection to access the servers of the Debian package directories. Administrator rights are required for installation.

The first command is used to update the local package index. The second one is used to download and install the updated packages.

```
apt update
apt upgrade
```

The update process is interactive by default, and the individual updates are listed before installation so that they can be checked. If a non-interactive update is desired, option "--yes" can be added to the **apt** calls. An additional automatic update service is available for Debian 9 or later, which is not enabled by default in B&R Linux. For more information, see the official APT documentation. This refers to more detailed documentation of the individual commands.

Command for the man page documentation of .apt:

```
man apt
```

Updates of B&R packages must be downloaded from the B&R Downloads section and can be installed as local files. See Downloads and "Installing local packages" on page 34.

6.19 Hibernation support

Hibernate (suspend to disk) is only supported if sufficient swap memory is available, i.e. if there is space for the entire RAM. It is also necessary to define the swap partition with kernel parameter *resume*=. If a swap file should be used instead of a partition, *resume_offset*= must also be set. In B&R Linux, *hibernation* is not supported by default in order to keep the required CFast card size as small as possible and to reduce write cycles to the mass storage device.

For additional information about swap, see the Debian Wiki (https://wiki.debian.org/Swap) or kernel documentation (https://www.kernel.org/doc/html/latest/power/swsusp.html).

6.20 Browser update

B&R Linux 9 uses Chromium as the default web browser. Unlike Google Chrome, it does not perform automatic updates. If a newer version should be used, it can be updated separately as long as a more recent version is available in the Debian archive of the respective distribution version:

- **Online**: Execute the following commands for this:

```
# apt update
# apt install chromium
```

- **Offline:** The Debian packages can be downloaded from the web interface of the Debian package database, even from another computer. It is necessary to download updated dependencies as well. The downloaded packages can be installed as follows as long as they are all located in the current folder:

```
# apt install ./*.deb
```

The status of chromium in the Debian archive can be queried via the Debian Tracker.

6.21 Font support

Information:

Standard fonts Arial, Arial Unicode, Times New Roman, Courier New, which are available for configuration in mapp View, are not included in B&R Linux 9 for licensing reasons.

If these are used in a mapp View HMI application, a fallback to Helvetica or a Sans Serif font occurs. If Times New Roman or Courier New was used, the display may differ from the one configured.

The license conditions of the respective font must be observed.

B&R Linux 9 features the following fonts:

- DejaVu Sans | SansMono | Serif
  For more information about these fonts, see https://packages.debian.org/stretch/fonts-dejavu.
- Liberation Mono | Sans | Serif
  These replace Arial, Times New Roman and Courier New. For more information about these fonts, see https://packages.debian.org/stretch/fonts-liberation.
- Adding more fonts:
  Copy fonts (OTF or TTF files) to folder */usr/local/share/fonts*. For more information, see https://wiki.debian.org/Fonts.
- Web fonts
  The required fonts can also be loaded by the server in a mapp View HMI application. For more information, see Automation Help.

6.22 Executing privileged processes in the terminal

Depending on the setting in **First Config**, either su or sudo can be used to execute privileged processes.

- **su:** Queries the root user password. Starts a new shell as *root* after successful authentication. Commands can be executed as *root* until this shell is stopped (e.g. with **exit**). The *root* password must be set and the *root* user must not be locked for this. To clean up the environment variables, it is recommended to start *su* with option **-**, *-l* or *--login*.
- **sudo:** Queries the user password, provided the user is listed in the *sudo* group, and executes the next command. The password is then stored in the current terminal for 15 minutes and is no longer requested when *sudo* is called again. The behavior of *su* can also be imitated by *sudo --login*.

For more detailed information, see the man pages for *su* and *sudo*. See also Editing system files in the terminal.

6.23 CAN

For its industrial PCs, B&R offers CAN modules with two different controllers:

- **CC770**

This is also supported by Linux in the mainline kernel. B&R offers a Debian package that integrates the module via Dynamic Kernel Module Support (DKMS). The driver source code from the respective kernel used in Debian is used.

- **SJA1000**
  The SJA1000 driver is already included as a module in the Debian standard kernel configuration.

To determine which controller is used for specific hardware, see the corresponding hardware user's manual. Both modules are connected via the ISA bus, which requires the use of kernel modules `sja1000_isa` and `cc770_isa`.

Information about the kernel modules can be queried using the following commands:

```
# modinfo cc770_isa
# modinfo sja1000_isa
```

Both drivers require specific parameters when loading:

- port: I/O number
- indirect: Indirect access via address and data port
- irq: IRQ number

Parameter *msgobj15_eff=1* can also be used with the CC770 controller. In some situations this can solve problems with the 29-bit addressing (EFF). Alternatively, parameter *i82527_compat* can be set to *1* to achieve strict compatibility with the Intel **i82527 CAN** controller.

The respective module can be loaded with one of these commands:

- **CC770:**

```
#> modprobe cc770_isa port=0x384 indirect=1 irq=10
#> modprobe cc770_isa port=0x384 indirect=1 irq=10 msgobj15_eff=1
#> modprobe cc770_isa port=0x384 indirect=1 irq=10 i82527_compat=1
```

- **SJA1000:**

```
#> modprobe sja1000_isa port=0x384 indirect=1 irq=10
```

The following commands can be executed to automate this procedure and make the configuration permanent. This automatically loads the modules with the corresponding parameters when booting.

- **CC770:**

```
#> echo 'options cc770_isa port=0x384 indirect=1 irq=10' > /etc/modprobe.d/cc770.conf
#> echo 'cc770_isa' > /etc/modules-load.d/cc770.conf
```

- **SJA1000:**

```
#> echo 'options sja1000_isa port=0x384 indirect=1 irq=10' > /etc/modprobe.d/sja1000.conf
#> echo 'sja1000_isa' > /etc/modules-load.d/sja1000.conf
```

It should be possible to read this or a similar output after successfully loading the module using "`dmesg`":

```
...
[ 47.776948] CAN device driver interface
[ 47.778385] sja1000 CAN netdevice driver
[ 47.779589] sja1000_isa sja1000_isa.0: sja1000_isa device registered
(reg_base=0x00000000c021a4d2, irq=10)
[ 47.779610] Legacy sja1000_isa driver for max. 8 devices registered
...
```

As soon as the driver is loaded, the CAN interface can be configured like a network interface. This command can be used to determine the name and existence of the interface:

```
$ ip link
```

All network interfaces are listed. The CAN interfaces are enumerated, i.e. the first interface should be called *can0* and can be enabled as follows:

```
# ip link set can0 up type can bitrate [BITRATE_IN_BIT/S]
```

For example:

```
# ip link set can0 up type can bitrate 250000
```

The "can-utils" package can be used to test the CAN interface, for example. This can be downloaded and installed from the Debian package archive:

```
# apt update
# apt install can-utils
```

`candump` can be used to read from the interface, `cansend` to transmit and `cangen` to send generated messages. For detailed information, see the corresponding man pages.

The CAN modules use the Linux **SocketCAN** driver implementation. For more details about usage, see the official documentation (https://www.kernel.org/doc/html/latest/networking/can.html).

Information:

The CC770 and SJA1000 CAN drivers are not compatible with suspend/hibernate (S3/S4 power states). After such a state, the module may need to be reloaded (`rmmod`/`modprobe`).

7 Troubleshooting

Truncated dialog boxes on VGA and WVGA displays

B&R Linux 9 works with VGA and WVGA displays, but some system dialog boxes are not fully displayed. Some dialog boxes can thus no longer be operated and closed via touch screen or mouse!

As a workaround, the panel bars can be set to **Automatic hiding** to enlarge the display area or rotate the display in the B&R "Touch Screen" program (see chapter B&R Config Utils).

Debian not booting on older APC2100 or PPC2100 devices

Debian does not boot on B&R devices with CPU stepping prior to D0. The boot procedure only be performed on D0 CPU stepping (or later).

USB devices not working on APC2100 or PPC2100 devices

The USB BIOS settings must be set to **Smart auto** or **Enabled** under XHCI.

DisplayPort on APC910 with Skylake chipset

On APCs with Skylake chipsets (QM170/HM170/CM236), image output on the DisplayPort interface is not reliable with every configuration.

MTCX package upgrade

The *mtcx* system group is also deleted when uninstalling MTCX packages (version 2.2.5 or lower). This is also the case with a package upgrade. The group is first deleted and then created again by the new package. This removes all members of the group, and they must be added again manually.

8 Downloads

The following downloads are available for B&R Linux 9 on the B&R website (www.br-automation.com).[1)]

Documentation

- **Debian 9 installation package**
  Describes how to perform a standard Debian 9 installation on B&R PCs.

Packages

Information:

The B&R packages are only released for B&R Linux 9. If a different Debian 9 installation is used, the functionality of the respective package cannot be guaranteed.

- **ADI library**
  Includes library, development kit and samples as three separate packages.
  - *libbradi2*: ADI shared library and files required at runtime.
  - *libbradi-dev*: Contains C headers, API documentation in HTML format, source code of ADI samples and other files for developing applications with ADI. This package is not preinstalled.
  - *libbradi-tools*: Compiled ADI sample programs.
- **CAN driver CC770**
  Includes driver-based *Dynamic Kernel Module Support* (DKMS) for CAN controller CC770. In Debian, this is not included in the Linux kernel or as a module by default. This package is not preinstalled.
- **Config Utils**
  Contains a package with tools App Launcher, Autostart Manager and File System Write Protection. This installation package replaces the service tool and is only included in B&R Linux 9.1.1.0 and later.
- **Display Brightness**
  Tool for adjusting the display brightness of B&R panels.
- **First Config**
  Tool for starting B&R Linux images. This package should not be installed on systems that have already been configured and should not be updated.
- **HMI Report**
  Contains packages *hmi-report* and *hmi-report-gui*, which are used to create reports about the hardware and operating system for diagnostic purposes. These packages are not preinstalled.
- **License Viewer**
  GUI tool for viewing the license texts of all installed Debian packages.
- **MTCX driver**
  DKMS kernel driver that enables communication between the ADI library and the MTCX on B&R PCs.
- **Service Tool**
  Tool was replaced by Config Utils and is therefore no longer installed on B&R Linux 9 1.1.0 and later.
- **Touch Click**
  Tool that simplifies the operation of touch screens in LXDE.
- **Touch screen**
  GUI tool for configuring screens and touch screens.
- **UPS Control**
  GUI for managing B&R UPS units.
- **UPS Daemon**
  System service that controls and monitors B&R UPS units.

[1)] Some downloads require a login.

Other downloads

- **B&R Linux installer**
  Live OS for installing B&R Linux images.