



B&R PP500/APC51x Debian User's Manual

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I Version information

Version	Date	Comment	Author
1.00	10-Jul-12	First edition	NIF, HOH

Table 1: Version information

II Organization of safety notices

Safety notices in this document are organized as follows:

Safety notice	Description
Danger!	Disregarding safety regulations and notices can be life-threatening.
Warning!	Disregarding safety regulations and notices can result in severe injury or substantial damage to equipment.
Caution!	Disregarding safety guidelines and notices can result in injury or damage to equipment.
Information:	Important information for preventing errors.

Table 2: Organization of safety notices

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1 Introduction

B&R supports Linux in the form of the Debian GNU/Linux 6.0 Distribution ("Squeeze") on the following devices:

- B&R Power Panel 500 (PP500)
- B&R Automation PC 510 (APC510)
- B&R Automation PC 511 (APC511)

Debian can be ordered together with a device and preinstalled on a storage medium with all B&R-specific modifications ("B&R Debian"), or it can be installed separately with the help of the B&R Installation Guide and packages.

Reasons for using Debian:

- High stability.¹
- Wide selection of packages.
- Appropriate packages including real-time kernels are already available for Debian (see Page 22).

For more information on Debian, see www.debian.org.

2 General information

A Linux or GNU/Linux system is an open, Unix-like multiuser operating system based on the Linux kernel and GNU software. Widespread use and commercial applications were made possible starting in 1992 with the licensing of the Linux kernel under the GPL.

Development of this modular operating system continues to be advanced by software developers working on various projects all around the world. These developers work in companies, non-profit organizations and as hobbyists. In practice, Linux distributions containing a collection of software applications are generally used. The distributions are built on top of the Linux kernel, however many distributors and experienced users adapt the operating system kernel to their needs.

Linux is used extensively and in a wide range of applications on desktop PCs, mobile phones, routers, netbooks, multimedia devices and supercomputers. The prevalence of Linux in each of these areas varies greatly: For example, Linux has established a strong foothold in the server and mobile device markets, with only marginal use on desktop PCs. Regional economic and geographic factors also play an important role. Currently, the strongest trend toward increased use of Linux is seen in the South American emerging markets.

[Source: translated from de.wikipedia.org/wiki/Linux]

¹ However, this high stability comes at the cost of longer release cycles and conservative implementation of new functions.

3 Model numbers


Model number	Short description	Image
5SWLIN.0136-MUL	Debian 6.0 32-bit, Multilanguage; for PP500; order CompactFlash separately (min. 4 GB).	
5SWLIN.0137-MUL	Debian 6.0 32-bit, Multilanguage; for APC510; order CompactFlash separately (min. 4 GB).	
5SWLIN.0138-MUL	Debian 6.0 32-bit, Multilanguage; for APC511; order CompactFlash separately (min. 4 GB).	

Table 3: B&R Debian model numbers

4 System requirements

The following requirements must be met in order to run Debian on a B&R device:

Model number	Target system	Minimum size of CF/HDD	Minimum amount of RAM	Memory required on CF/HDD	RAM required
5SWLIN.0136-MUL	PP500	4 GB ²	512 MB	Approx. 2.7 GB	Approx. 130 MB
5SWLIN.0136-MUL	APC510				
5SWLIN.0136-MUL	APC511				

Table 4: B&R Debian system requirements

Additional requirements in order to use certain functions:

- Internet access (may incur charges)
- A compatible optical drive is required in order to burn a DVD/CD.
- An audio output device is needed in order to play music and sound.

Product information and graphics may vary depending on the system configuration. Some functions may require more powerful or additional hardware.

Information:

With Linux, the RAM and hard drive requirements depend on many components that may be installed. Linux provides a large number of possible graphical working environments and GUIs. Especially the larger and more fully-featured ones, such as KDE and Gnome, require more resources to ensure smooth operation.

² The recommended hard drive size is 5 GB according to www.debian.org/releases/stable/i386/ch03s04.html.de.

5 Installation

5.1 Preinstalled B&R Debian

Upon request, Debian 6.0 can be factory preinstalled at B&R on a suitable CompactFlash card (min. 4 GB).

5.2 Standard Debian installation

Debian can also be downloaded from the Debian website (www.debian.org) and installed separately. The Debian website provides more detailed instructions.

Special considerations for installation on B&R devices are explained in a separate document, which can be downloaded from the B&R website (www.br-automation.com), see Page 25.

Installation packages are available for the necessary B&R modifications; these are also available from the B&R website (see Page 26).

5.3 Installation of additional components

Other Debian software packages can also be installed at any time – also in B&R Debian. A list of available packages can be found on the Debian website under www.debian.org/distrib/packages.

5.4 Copy (clone) installed version of Debian

You can clone an existing version of Debian using the **B&R Embedded OS Installer** under Windows, or using a program such as Linux **Clonezilla**.

The **B&R Embedded OS Installer** can be downloaded from the B&R website (www.br-automation.com). In order to clone Debian, you must have access to the storage medium where Debian is installed from your Windows PC (e.g. with a CompactFlash reader). Since the B&R Embedded OS Installer doesn't support Linux file systems, the image can only be handled as a 1:1 copy.

Clonezilla can be downloaded from <http://clonezilla.org/> and run from a bootable CD/DVD, USB flash drive, USB hard drive ("Clonezilla Live" version). Detailed step-by-step instructions can be found under <http://clonezilla.org/clonezilla-live-doc.php>. For information on disk-to-disk cloning see http://clonezilla.org/show-live-doc-content.php?topic=clonezilla-live/doc/03_Disk_to_disk_clone.

6 Start / Login

The first time you start B&R Debian it doesn't perform any further installation, it is immediately ready for operation and displays the login screen:

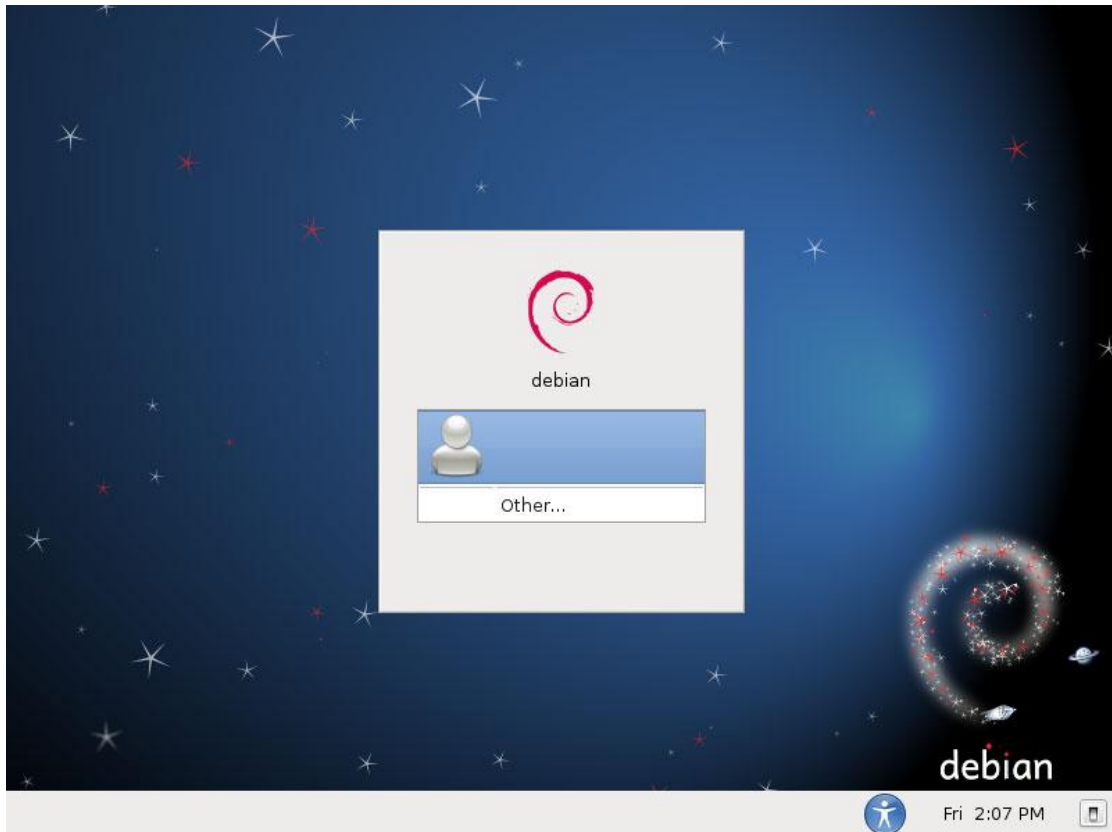


Figure 1: Debian login screen

Note: The following B&R Debian user account is set up by default: Username = „user“, Passwort = „user“.

7 Debian features

Debian provides software in the form of predefined groups of packages. The B&R Debian system uses the groups of packages listed below. In most cases, this standard selection provides a sufficient foundation.

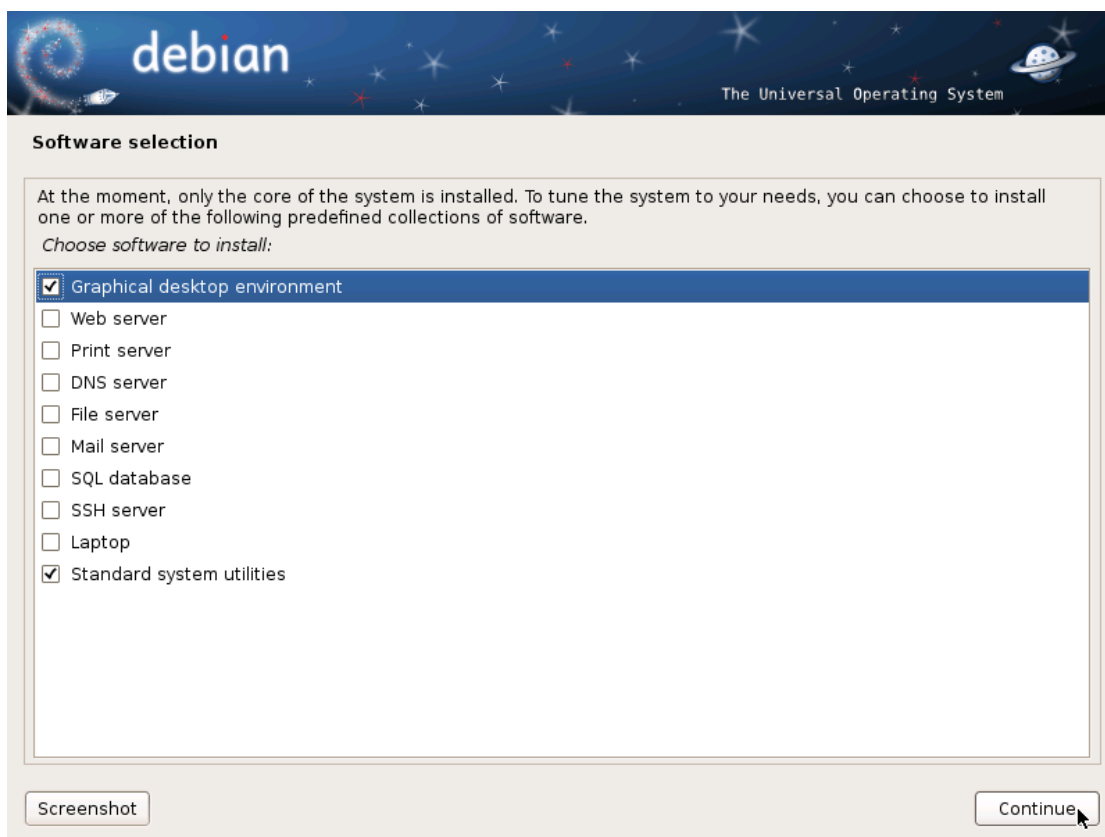


Figure 2: Groups of software packages in B&R Debian

Further packages can be added to the installed image at any time.

Tip: To display a list of installed packages, enter `dpkg -l` in the console window (keep in mind that B&R Debian already contains more than 1000 packages as standard).

The **Gnome** desktop is used by default.

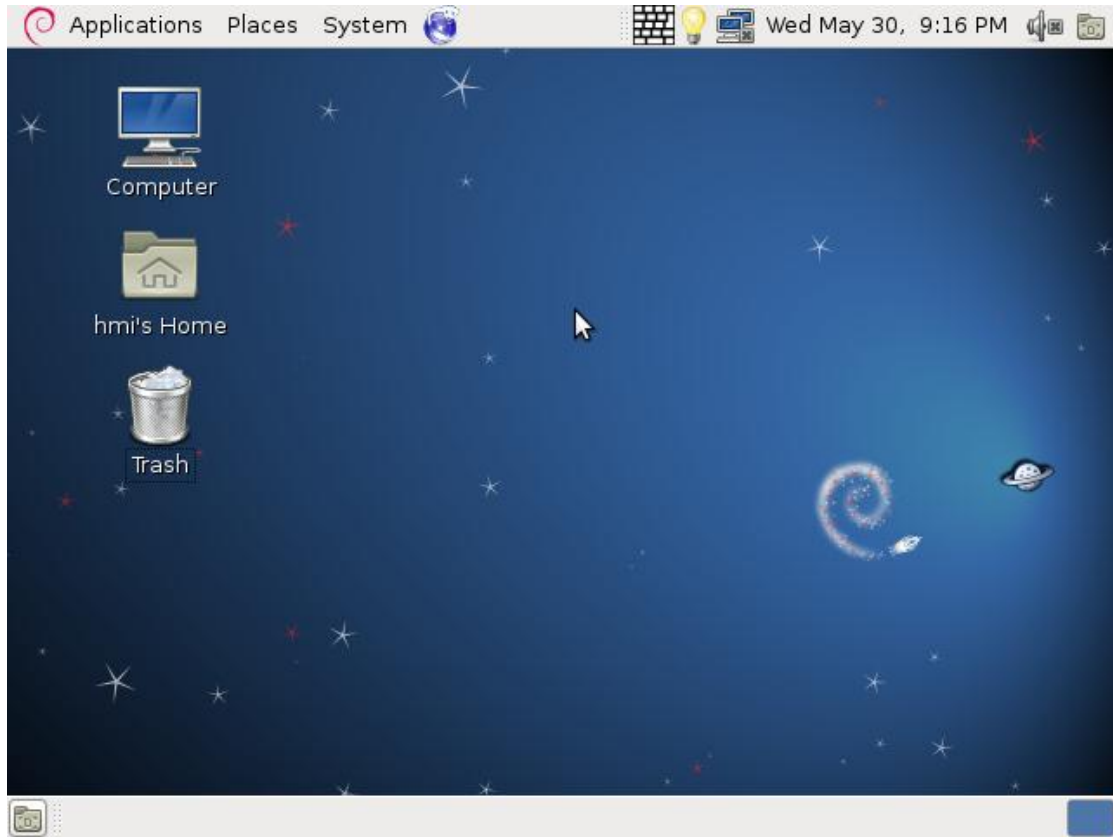


Figure 3: Debian desktop (Gnome)

8 B&R-specific adaptations

B&R made a number of adaptations in order to support Debian on PP500, APC510 and APC511 devices.

All of these adaptations are included in the B&R Debian installation and are also available in the form of separate installation packages to be downloaded from the B&R website (www.br-automation.com) (see Page 26).

8.1 Graphics driver (Intel EMGD)

B&R Debian uses the **Intel Embedded Media and Graphics Driver** (Intel EMGD) Version 1.5.2.

A number of adaptations were made in order to support B&R devices: On PP500 devices, the resolution of the integrated display is detected and configured. B&R Automation Panels or displays connected to the monitor/panel port are configured automatically based on their EDID.

Note: The EMGD can only use the native resolution of the PP500's integrated display or any connected Automation Panels, which means it is not possible to set any other resolution in Debian.

PP500 system units with the following sizes are supported:

Diagonal	Resolution
5.7"	VGA, 640 x 480 pixels
7"	WVGA, 800 x 480 pixels
10.4"	VGA, 640 x 480 pixels
12.1"	SVGA, 800 x 600 pixels
15"	XGA, 1024 x 768 pixels

Table 5: Supported PP500 sizes

Information:

For system units with other resolutions, such as custom devices, it may be necessary to make further adaptations to install graphic devices or in the graphics driver settings.

The EMGD settings can be viewed and modified using the **Intel EMGDGUI**. This can be opened from **Applications > System Tools**.

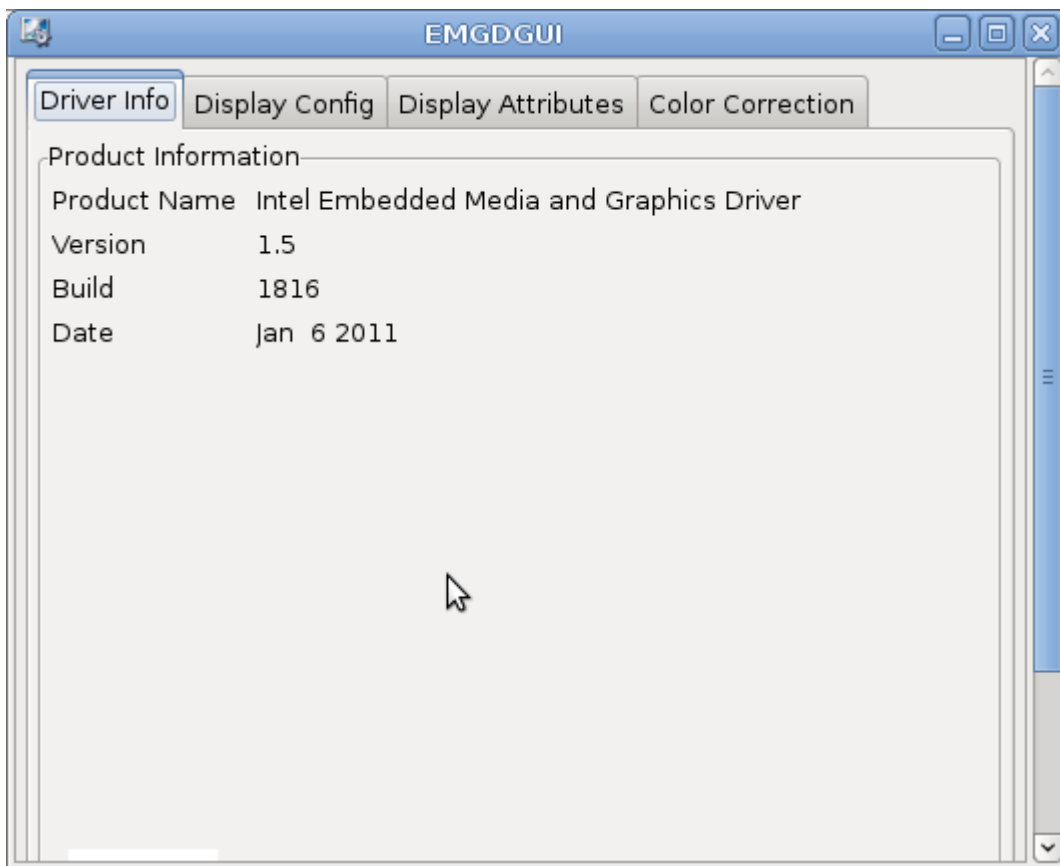


Figure 4: EMGDGUI

However, this program doesn't provide any way to rotate the screen. In B&R Debian you can rotate the screen using B&R's Touch-Screen program (see Page 13).

8.2 B&R Touch-Screen program

The B&R Debian system uses the **evdev driver** included in Debian to communicate with the touch screen on a PP500 device or a connected Automation Panel. The evdev driver is used by mice, keyboards and all other input devices.

The **B&R Touch-Screen** program is used to set up (calibrate and configure) the touch screen. This can be opened from **Applications > System Tools**.

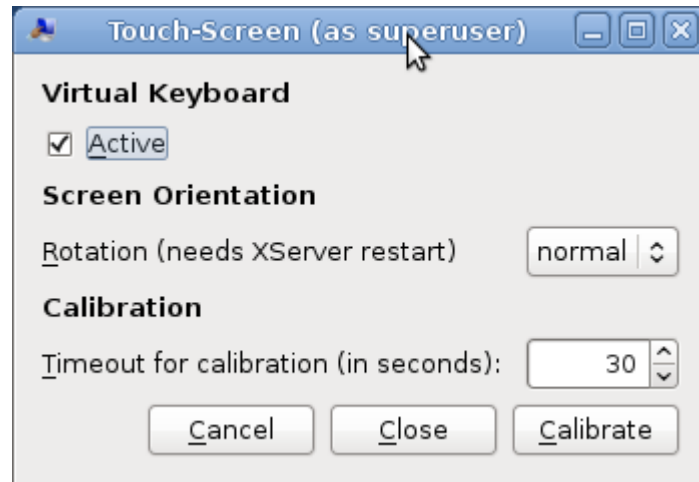


Figure 5: B&R Touch-Screen program

With this program you can configure the following touch screen functions and features:

- The virtual keyboard (and having it auto-start at login)
(see also Page 18)
- Screen orientation³
- (Software) calibration of the touch screen

Note regarding calibration:

B&R touch screen devices are equipped with a touch controller that supports hardware calibration. This means that the devices come already pre-calibrated. This feature is especially advantageous in the case of replacements, because it is not necessary to recalibrate when exchanging identical devices (same model/type). In order to achieve the best possible results, and to adapt the touch screen to the needs of the user, you can perform an additional software calibration.

³ The screen orientation setting can only be used if the graphics driver supports it – with the Intel EMGD this is the case. However, the driver only supports static rotation, which means the XServer needs to be restarted. The B&R Touch-Screen program does this automatically when it is closed.

This calibration can also be performed using the B&R Touch-Screen program. To do so, simply touch each of the targets as they appear on the screen. The system will then permanently remember the calibration.

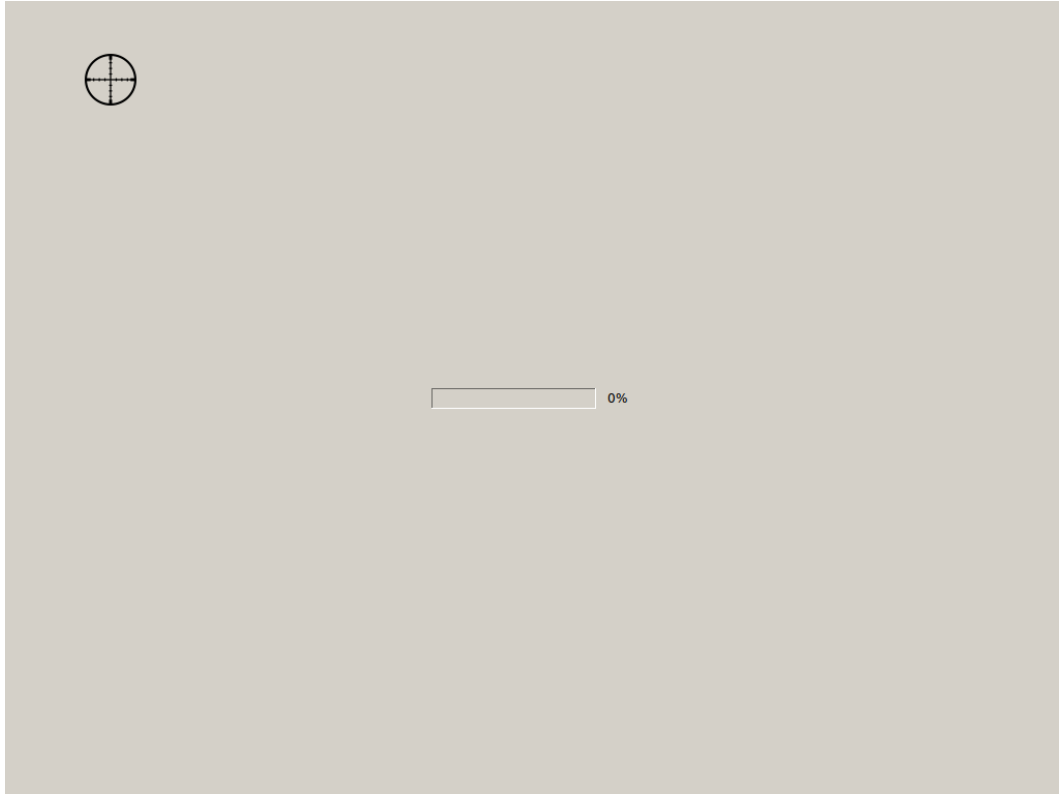


Figure 6: B&R touch screen calibration

Note: You need to minimize the virtual keyboard (see Page 18) before configuring the touch screen, since the keyboard is always shown in the foreground and would otherwise cover the calibration screen. If you don't you need to wait until the timeout for the calibration expires or cancel the calibration with the ESC button.

Information:

The calibration performed in the Touch-Screen program is applied to all connected touch screens, so if you calibrate the display integrated in a PP500, the calibration will also be applied to any connected Automation Panels.

This may alter the existing calibration of the connected Automation Panels.

8.3 B&R Touch Click Tool

By default, touching the touch screen triggers a left-click. Some situations call for a right-click (e.g. to show a shortcut menu), so B&R offers the **Touch Click Tool**, which allows you to switch to a right-click.

The B&R Touch Click Tool can be opened from the start menu: **Applications > Accessories**.

Tip: You can also set the tool as an auto-start application.

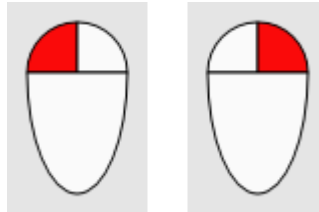


Figure 7: B&R Touch Click Tool

The image above shows the two modes. The red button shows which is active for touch screen operations. Clicking on the icon switches between the modes.

To close the Touch Click tool, press its icon for at least 5 seconds.

8.4 B&R MTCX driver

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

The MTCX is a standalone processor that provides additional functions that are not found on a "normal" PC but are available on a B&R Industrial PC. The MTCX communicates with the B&R Industrial PC via I/O addresses.

8.5 B&R ADI library

ADI (Automation Device Interface) provides access to certain functions of B&R devices, such as display brightness settings and temperature readings.

Linux C/C++ programs can access these functions using the **ADI library**, which is included in the B&R Debian installation. A separate Linux **ADI Development Kit** is available for download from the B&R website (www.br-automation.com).

8.6 B&R HMI Diagnostics Tool

Device-specific functions can be analyzed using the **B&R HMI Diagnostics** tool and logged in a file.

The B&R HMI Diagnostics tool can be opened from the start menu: **Applications > System Tools**. The report file that is generated is shown automatically in the browser.

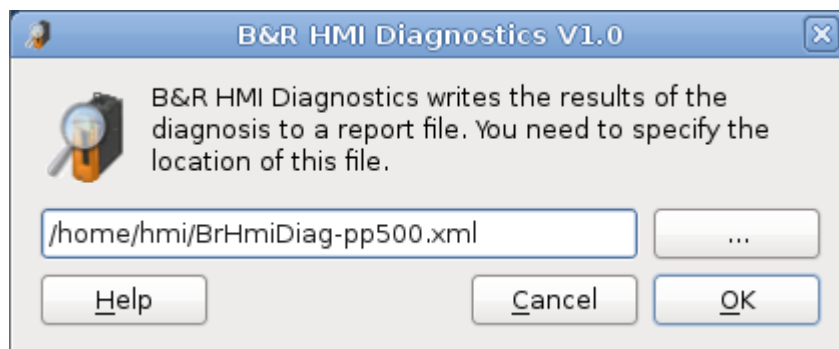



Figure 8: B&R HMI Diagnostics Tool

8.7 B&R display brightness

The brightness of the PP500 display and any connected Automation Panels can be easily configured with the **B&R Display Brightness** program using the icon in the tray  :

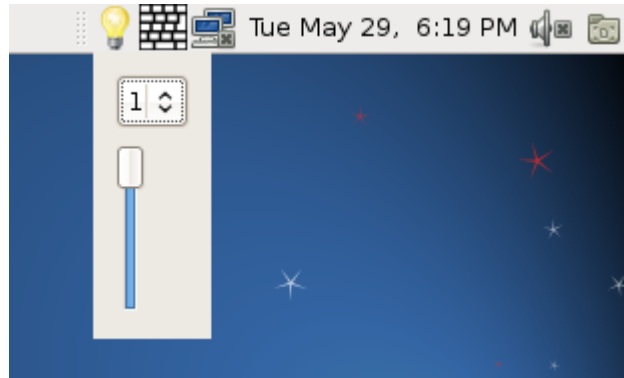


Figure 9: B&R Display Brightness in the tray

The numbers of the detected displays are shown in a selection list (note: the integrated display is number 0).

8.8 Virtual keyboard

For operation without a keyboard, it is possible to display a virtual keyboard⁴ on the screen.

By default, the virtual keyboard is opened automatically at login. This feature can be disabled using the B&R Touch-Screen program (see Page 13). It is also possible to open the virtual keyboard manually: **Application > Universal Access > Florence Virtual Keyboard**.



Figure 10: Virtual keyboard (Florence)

Clicking on the down arrow  or the tray icon  minimizes the virtual keyboard, and it can be restored at any time using the tray icon. Note: On the Gnome desktop, the tray is at the top of the screen by default:



Figure 11: Virtual keyboard in tray

The keyboard's properties (e.g. appearance of keys) can be configured by right-clicking on the tray icon.

Information:

When Debian is displaying the lock screen (e.g. after locking manually with *System > Lock Screen*), it is not possible to display a virtual keyboard. In this case you need the appropriate key assignments in order to enter the user password in the lock screen.

⁴ The keyboard used is the **Florence Virtual Keyboard**. This was not developed by B&R; it is a backport solution. See <http://florence.sourceforge.net/english.html>

9 Supported interfaces

Debian supports the following interfaces on PP500, APC510 and APC511 devices.

Interface	Short description	Comment
System units		
COM	RS232	under Debian /dev/ttyS0
COM (internal for touch screen)		under Debian /dev/ttyS1
USB1	USB 2.0	
USB2	USB 2.0	
USB3 (PP500, front)	USB 2.0	
ETH	10/100/1000 Mbit/s	under Debian eth0
Interface boards		
ETH	10/100/1000 Mbit/s	under Debian eth1
MIC, Line IN, Line OUT	HDA sound	See information below
I/O boards		
SDL (Smart Display Link / DVI)		
COM	RS232/422/485	under Debian /dev/ttyS3
COM (internal for SDL touch screen)		under Debian /dev/ttyS2
USB3	USB 2.0	Only when the system unit has no USB3
USB4	USB 2.0	
USB (via SDL)	USB 1.1	
MIC, Line IN, Line OUT	HDA sound	See information below

Table 6: Supported interfaces

Information:

Debian supports MIC, Line IN and Line OUT either on the interface board or on the I/O board. "Dual" sound support on both boards is not possible.

10 Guidelines for use

10.1 Language switching

B&R Debian (and the Gnome desktop) are set to English by default. To change the language, enter the following command in the console window ⁵:

```
dpkg-reconfigure locales
```

Note: You'll need root rights to do this.

In the dialog box that opens, select the desired language(s) and click **OK**.

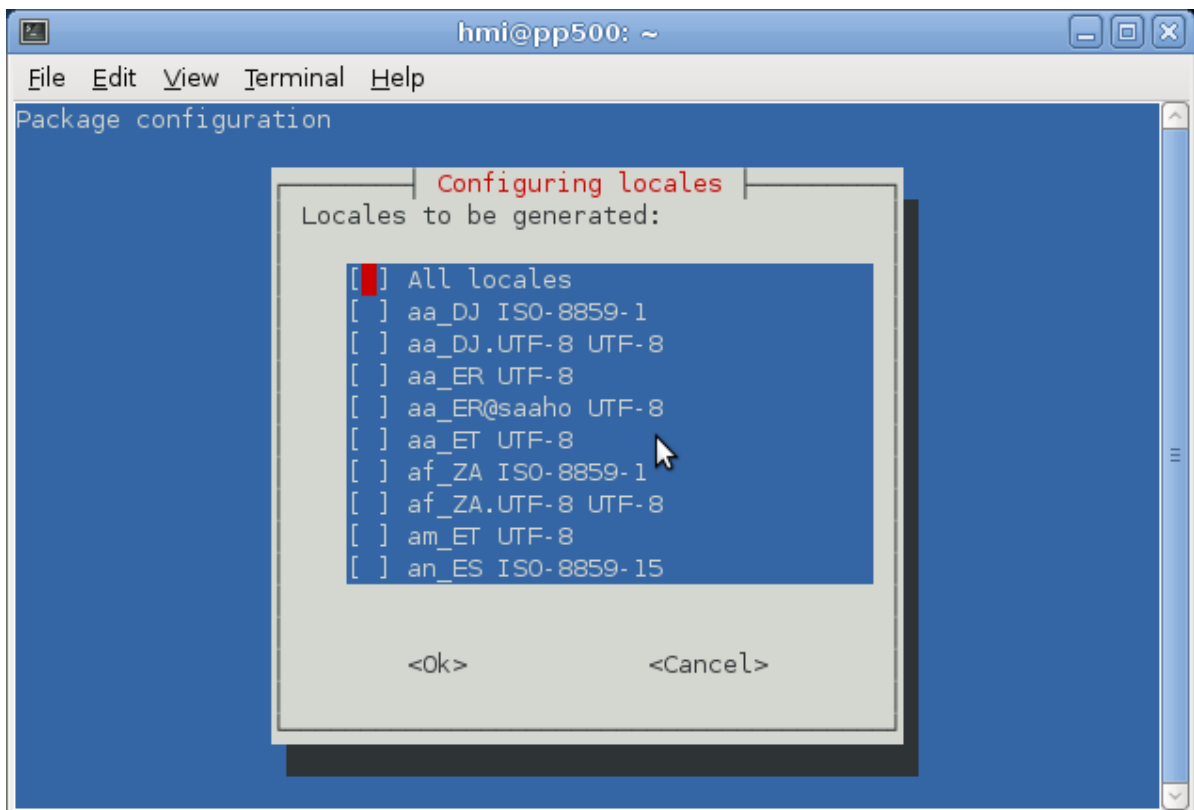


Figure 12: Configuring languages

In the next dialog box you can select the default language for the system. When you finish the configuration, the selected locales are generated automatically.

Then you need to log out from the system (with **System > Log Out**). The next time you log in, you can select the language in the bottom left corner of the screen.

Note: If a component doesn't support the selected language, English is used automatically (this applies to all B&R programs).

⁵ Open the console window from **Applications > Accessories > Terminal**.

10.2 Touch function when monitor is off

The system continues to evaluate touch actions when the monitor is in power saving mode. Touching the screen "wakes up" the monitor but may also perform an operation in a previously hidden dialog box.

Information:

This may result in unintended actions!

10.3 Accessing Linux files under Windows

If you need to access Linux files under Windows, e.g. to evaluate log files, you can use the **DiskInternals Linux Reader**. This Windows freeware program can be downloaded from <http://www.diskinternals.com/linux-reader/> – however only read access is supported.

10.4 Real-time support

There are various approaches to providing real-time support for Linux systems. One of them is the implementation of real-time add-ons directly on the Linux kernel. This development is driven by the Open Source Automation Development Lab (OSADL).

Information regarding supported kernel versions and download links for kernel versions that include run-time patches can be found on the OSADL website:

<https://www.osadl.org/Realtime-Linux.projects-realtime-linux.0.html>

The image provided by B&R does not contain a real-time version of the Linux kernel. However, it is possible to replace the kernel version in the installed image.

The packages required to do so can be installed from the repo (software repository) from Pengutronix: http://www.pengutronix.de/software/linux-rt/debian_de.html

There are a number of real-time packages provided here. The "latest stable" version should preferably be used.

The latest stable version is listed on the following page:

<http://www.osadl.org/Latest-Stable.latest-stable-realtime-linux.0.html>

Currently (as of May 2012) Linux kernel 2.6.33.7.2-rt30 has been defined as stable.

Additional information:

A guide to manual installation can be found under the following link:

<https://www.osadl.org/?id=87>

(osadl.org > HOWTOS > Realtime-Preempt Kernel)

Information:

The EMGD graphics driver used by B&R has dependencies on the kernel and X.Server version, and may no longer be able to be used. In this case a driver such as the Vesa driver from the X.Org project must be used.

Information:

Linux systems with a real-time preempt patch may display a weaker performance, for example with graphics-intensive applications.

B&R has not performed any tests with a real-time system.

11 Limitations

11.1 Suspend to RAM (Standby)

Currently not supported by Debian.

11.2 Suspend to Disk (Hibernate)

Suspend to Disk is only supported when there is a separate swap partition with at least the same size as the RAM.

Note: The standard B&R Debian does not support Suspend to Disk. One reason for this is to minimize the size of the required CompactFlash card.

12 Known problems

12.1 Dialog boxes cut off on VGA and WVGA displays

Debian works with VGA and WVGA displays, but some system dialog boxes are partially cut off, such as those for the keyboard and mouse preferences.

Information:

As a result, it may not be possible to operate or close some dialog boxes using the touch screen.

Tip: It may help to set the panel toolbars to auto-hide in order to make more room, or to rotate the screen using the B&R Touch-Screen program (see Page 18).

12.2 Touch screen functionality in Xinerama mode

In "Xinerama" mode (= extended desktop) touch operations are applied only on the monitor where the mouse is currently located. This means that touching the screen on a secondary monitor is detected as a touch on the primary monitor if that is where the mouse is currently located, and vice versa.

Information:

This may result in unintended actions!

12.3 No display after switching users

If you attempt to **switch users** (e.g. via **System > Log out** or on the Debian lock screen), the current GUI terminal switches to a black screen.

You must then press Ctrl+Alt+F7 (or F8 or F9), in order to return to the first or current GUI terminal and the login screen.

Note: If your device doesn't have the necessary key assignments you need to connect a USB keyboard.

12.4 Debian doesn't boot after changing the time in BIOS or when the CMOS battery is empty

If you reset the time in BIOS or the CMOS battery dies and the CMOS time is lost, the Debian system will no longer boot due to an error when checking the root file system:

```
"/dev/sda1: Superblock last mount time (...) is in the future
"/dev/sda1: UNEXPECTED INCONSISTENCY: RUN fsck MANUALLY"
fsck died with exit status 4
```

You must then:

a) Replace the CMOS battery and set the time in BIOS to a sometime after the last time Debian was started.

or

b) Enter the root password, run fsck manually and then restart Debian.

Note: If your device doesn't have the necessary key assignments you need to connect a USB keyboard.

13 Downloads

The B&R website provides the following downloads for Debian:

13.1 Documentation

The following documentation is available in addition to this manual:

- **B&R PP500/APC51x Debian Installation Guide**
Explains how to perform a standard Debian installation on a PP500, APC510 or APC511.

13.2 Tools

- **B&R Linux ADI Development Kit**
Contains B&R header files and assistance for accessing ADI functions from Linux C/C++ programs.

13.3 Installation packages

These installation packages are available for download:

- **B&R PP500/APC51x Debian EMGD**
Contains the Intel EMGD, including adaptations for Debian on a PP500, APC510 or APC511 device.
- **B&R PP500/APC51x Debian Touch Screen**
Contains the B&R Touch-Screen program for configuring and calibrating the touch screen on PP500, APC510 and APC511 devices.
- **B&R Debian Touch Click**
Contains the B&R Touch Click tool for performing right-clicks on the touch screen.
- **B&R Debian MTCX Driver**
Contains the B&R MTCX driver for communication with the MTCX on a B&R device.
- **B&R Debian ADI Library**
Contains the B&R ADI library.
(Note: currently only contains functions for PP500, APC510 and APC511)
- **B&R Debian HMI Diagnostics**
Contains the B&R HMI Diagnostics program.
(Note: currently only provides diagnostics for PP500, APC510 and APC511)
- **B&R Debian Display Brightness**
Contains the B&R Display Brightness control.

Information:

All B&R installation packages are released for Debian 6.0 (due to dependencies with kernel ⁶, X.Server ⁷ or QT ⁸ version).

⁶ B&R Debian contains Kernel Version 2.6.32-5.

⁷ The X Window System (commonly known as: X Version 11, X11, X) is a network protocol and computer software system that enables windows on bitmap displays on most Unix-like operating systems and Open-VMS. X11 has been implemented on all common operating systems.

See also: http://en.wikipedia.org/wiki/X_Window_System

⁸ Qt (pronounced like "cute") is a C++ class library for cross-platform programming of graphical user interfaces.

See also: [http://en.wikipedia.org/wiki/Qt_\(framework\)](http://en.wikipedia.org/wiki/Qt_(framework))

14 Support

Support for using Debian can be found on the Debian website under <http://www.debian.org/support>.

For support regarding the B&R-specific adaptations, please contact B&R.

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