A Home for the Raspberry Pi

Housing for the miniature computer for industrial and building automation applications

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The Raspberry Pi is well known to the hobby community as a fun and useful piece of technology. However, the microcomputer requires a functional and safe enclosure with integrated connection technology (Figure 1, lead figure) in order to be used effectively in professional applications.

Single-board computers for industrial and building automation solutions

The Raspberry Pi has exceeded many of its creators’ expectations. Many amateur developers use the miniature computer to automate processes within their own homes, for example. At the same time, a growing number of companies and institutions are discovering the advantages of using the Raspberry Pi in their commercial building automation and industrial applications. Creative ideas have emerged in areas ranging from development environments and prototype construction to low-cost mini-controllers and data loggers. For example, Raspberry Pi’s Wi-Fi and Bluetooth connectivity allow easy implementation, such as creating an ERP system for tracking packages or monitoring production on a plant floor.

Demands for shorter turnaround times and lower costs toward development and series production, not to mention the (Industrial) Internet of Things, are helping to foster the success of the Raspberry Pi and other single-board...
computers. Electronics developers have relied on ready-made electronics modules for some time, buying more complex modules that feature micro-controllers, RAM, and flash memory in order to combine them with their own I/O boards. This approach is advantageous because module components that are complex and often too expensive to buy in smaller quantities are now readily available to any developer.

The Raspberry Pi is the most common single-board computer among hobbyists. With its easy-to-use interface and connectivity, the Raspberry Pi is appealing to any type of programmer. It can also be upgraded with expansion boards — either developed in-house or purchased from outside vendors.

Device solutions for professional applications

The Raspberry Pi requires high-quality, functional enclosures and connection technology in order to be used in professional applications. The devices need to be assembled and used in control cabinets in a safe way and in accordance with the applicable standards — especially if they are part of commercial building and industrial automation solutions.

Many commonly available housing solutions can only accommodate the Raspberry Pi board. They are mostly used as stand-alone housings that cannot be attached to DIN rails or panel mounted. However, they do not enable simple mounting within a cabinet. These housings, typically aimed at hobbyists, are offered in many colors and designs and constructed with plastic, metal, or even wood. The connections, also known as general purpose input/output (GPIOs), are accessed via ribbon cables. Most hobbyists either prefer or do not mind these details regarding a housing or enclosure. Unfortunately, these details do not align with the needs of a professional application using the Raspberry Pi.

Housings designed for mounting the Raspberry Pi on a rail offer a standardized and reliable method of assembling the module in a control cabinet. Furthermore, the housings allow a user to integrate expansion boards and connect to the GPIOs using reliable and innovative plug-in connectors. These Raspberry Pi–specific housings eliminate wasted space on the DIN rail by orienting the connections vertically and having bus connection technology to allow modules to connect straight into the Raspberry Pi housing. This allows multiple Raspberry Pi modules to be connected without external wiring. Ideally, a Raspberry Pi housing should be compatible with the Raspberry Pi A+, B+, B2, and B3 series (Figure 2) and should offer all of these features. An adapter is required to connect a USB cable to the A+ model.

Connection technology for professional applications and expansion boards for more circuits

If the Raspberry Pi is being used in a production environment — for example, when connecting sensors to the GPIOs — it is essential to have simple and reliable wiring. Furthermore, wiring should be completed quickly, and connecting GPIOs to expansion boards should not require additional time-consuming steps, especially during assembly.

The push-in connection allows you to wire the connectors without using tools. The expansion boards, which can also be snapped into the housing without tools, leave ample room for you to add your additional circuitry. The expansion boards connect to the Raspberry Pi and to the bus system when the device is assembled, since the corresponding PSTD terminals, which are soldered onto the expansion boards, plug directly into the GPIOs of the Raspberry Pi and the bus slot (Figure 3).

The micro-SD card is an important component of the Raspberry Pi, since it serves as the computer’s hard drive. It would be quite problematic if someone — an unauthorized user, for example — were to remove this storage medium.
conveniently. Bus connectors significantly reduce the amount of time it takes to implement and start up a modular system, as the bus carries power to the modules and can also enable them to communicate with one another.

Similarly, it is beneficial to use bus connectors, such as an H-Bus, when developing devices with the Raspberry Pi. They allow the Raspberry Pi to serve as a CPU and the additional modules as I/O modules, for example. The H-Bus can then take care of communication with the GPIOs and I/O modules. You can assemble the modules on the mounting rails simply by plugging them in (Figure 4).

**Application example: Building automation**

**Home-Pi from Elfin**

Home-Pi SHC-01 from Elfin GmbH is a gateway used in applications that allow you to control the heating or lighting in a building with a smartphone or computer via the Internet. The Raspberry Pi B2 is the key component of the device and is connected to the expansion boards via the GPIOs. The device is housed in Phoenix Contact’s RPI-BC professional-grade product.

A power module with an output voltage of 12–24 V DC is integrated into the device, powering the Home-Pi as well as the REM-08 relay expansion module, which can be connected via the H-Bus. The Home-Pi also features open software and hardware, allowing many providers in the building automation industry to add extra features to the system. Furthermore, the Home-Pi system is compatible with the eQ-3 AG “Homematic” home automation system.

**Rail mount bus connectors for easy wiring**

Bus connectors are widely used for device development and are especially popular when developing modular device systems. Most systems have a power supply unit (PSU), a central processing unit (CPU), and many I/O units, allowing for various system configurations to be put together conveniently. Bus connectors significantly reduce the amount of time it takes to implement and start up a modular system, as the bus carries power to the modules and can also enable them to communicate with one another.

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Summary

Single-board computers are not a recent invention. They have been in use since the 1970s for development and production systems. However, today's microcomputers feature two innovations. First, they are significantly more powerful, more reliable, and less expensive, thanks in part to the growing market for smartphones and tablets. Second, there is strong demand from today's industrial and building automation solutions for low-cost control and monitoring products.

However, the single-board computer, its operating system, and software cannot fully function as a complete and usable stand-alone device. High-quality, functional electromechanical components, such as rail mount housings and interfaces, are necessary to use single-board computers in an industrial or semi-industrial environment in control cabinets. At the same time, amateur developers would also be pleased to have professional solutions that meet their needs. Manufacturers of electromechanical products have taken these requirements to heart. Phoenix Contact's RPI-BC housing and the corresponding connection technologies for Raspberry Pi boards are the next big step toward new, forward-looking markets.

Additional information:
www.phoenixcontact.com/housing
www.elfin.de