

## THE HEART OF THE REVOLUTION

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## MODULAR DESIGN

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## New RevPi S/SE series launched

We are happy to present you the newest members of our Revolution Pi family: The S and SE series, based on the brand-new Raspberry Pi Compute Module 4S. The series are an intermediate step between the 3+ series and the RevPi 4 series.

Last couple of months, Revolution Pi was not spared from the global chip shortage. This was mainly due to the supply of Compute Modules, which could not be delivered sufficiently. The Raspberry Pi organization has therefore offered us a special alternative to the CM3+: The Compute Module 4S. This is a Compute Module in the form factor of the CM3+, on which

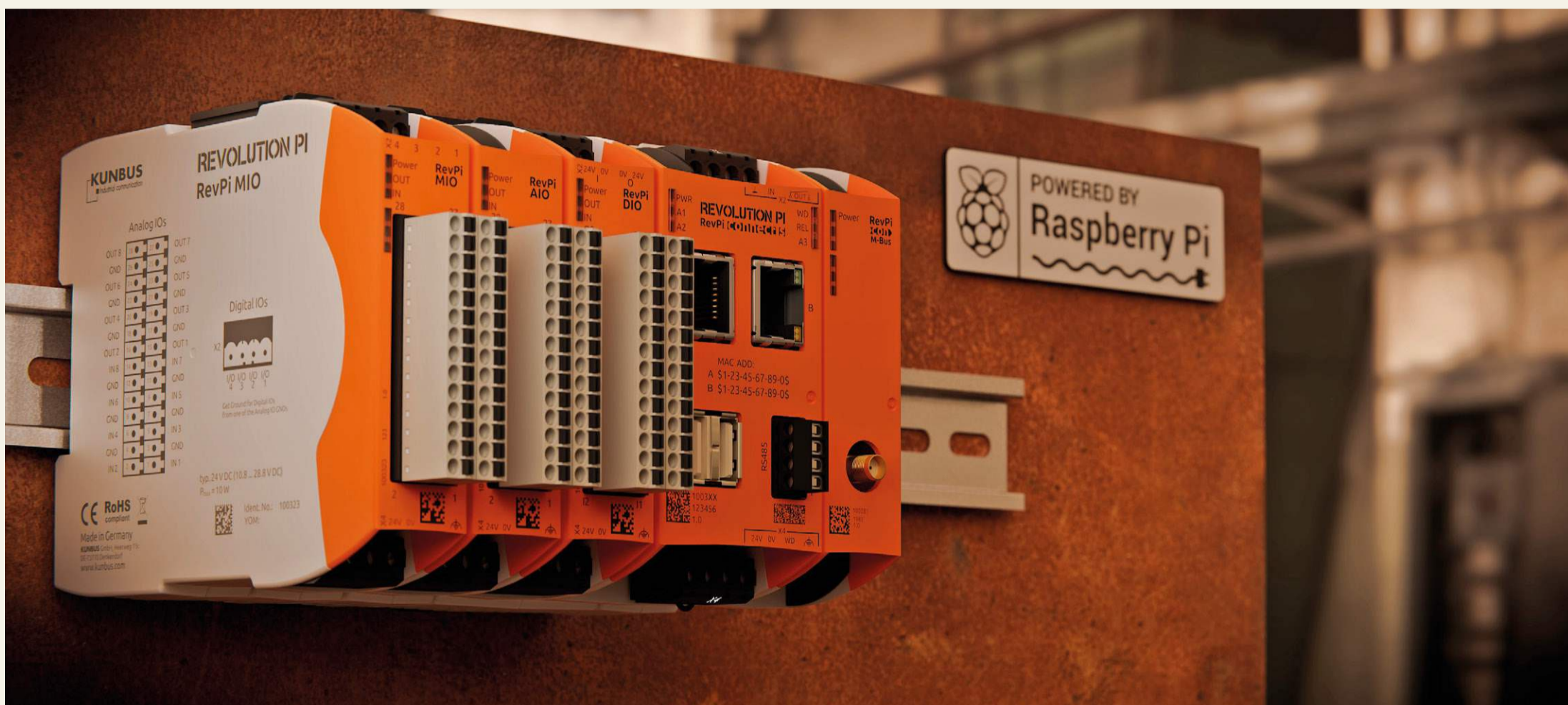
the more powerful Arm Cortex-A72 processor of the CM4 is installed. This gives the RevPis of the S/SE series a nice little extra boost in comparison to the RevPis based on the Compute Module 3+ (specs on page 3).

### Difference between the S and SE series

The difference between the S & SE series is quickly explained: The S series is compatible with all expansion modules including our fieldbus gateways. The SE series can only be extended by IO modules and in case of the RevPi Connect by Con modules. Fieldbus gateways are not supported in the SE series.

The reason, why we chose to develop two different series is also the global chip shortage. The required IC, which is responsible for the connection of the gateways via PiBridge, is currently not available for us in adequate quantities.

As we see from the sales figures, many RevPi users operate their devices without gateways: Therefore, we have decided to launch the SE series in order to make sure that we can build enough devices for every customer's requirements.



## DON'T JUST CLAIM IT - MAKE IT !

In launching Revolution Pi, we have brought an open, modular and inexpensive industrial PC based on the established Raspberry Pi to the market. Equipped with Raspberry Pi Compute Module, the base modules can, depending on requirements, be expanded seamlessly using appropriate I/O modules and fieldbus gateways.

Based on the Raspberry Pi Compute Module, we have developed an industrial PC composed of open hardware and software meeting the EN61131-2 standard. Thanks to the modular structure, Revolution Pi can, depending on customer requirements, be supplemented by digital or analog I/O modules respectively as well as appropriate fieldbus gateways to connect it to an industrial network.

Installed in a DIN rail housing, the base modules of the Revolution Pi already have USB, Ethernet and HDMI connections. The base modules and expansion modules are supplied with 24 volts which is the norm in the industry.

In addition to revealing the circuit diagrams, we are rigorously pursuing the Open Source concept within the software. A customized version of the established Raspberry Pi OS (formerly Raspbian) is preinstalled. Using Raspberry Pi OS ensures that basically any software or application running on Raspberry Pi will also run on Revolution Pi. Full root access allows obstacle-free programming and implementation of customised programs. By cooperating with various software manufacturers, we provide inexpensive and powerful control and SCADA software for users preferring

off-the-peg software solutions. As a result, Revolution Pi can be developed into an industrially viable small control system.

One of our aim is to provide a tool with Revolution Pi enabling companies to offer new sales opportunities, such as for example Cloud Services. Revolution Pi enables the development of business models and services that open up new markets. Value added chains of companies using Revolution Pi can be shifted significantly.

An online forum networks Revolution Pi developers and users from all over the world. Problems, solutions and suggestions for improvements can therefore be exchanged quickly, openly and easily.

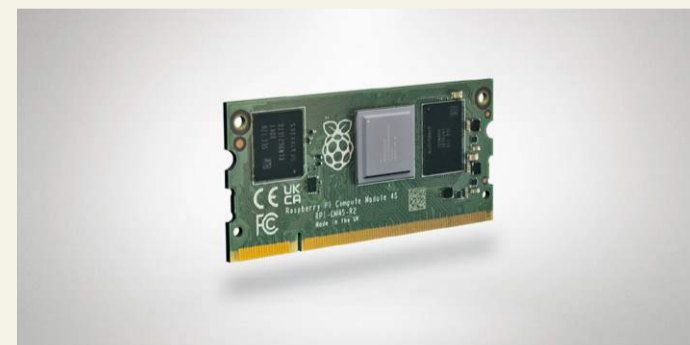
## Revolution Pi - more than just a device

Revolution Pi is more to us than just a device. We believe it is time to break down the fossilized structures within the industry with the Open Source concept. We will reveal our source code and all the circuit diagrams belonging to Revolution Pi devices. Our customers should not be limited

to our ideas and solutions. This allows you to give free rein to your own ideas. If the ideas are then exchanged just as freely with other users on the Revolution Pi platform, a strong community will develop. We will provide the tools for such networking with Facebook, video channels, forums

and blogs. Together we are strong and can invent brilliant contributions for the challenges of the 4th industrial revolution.

## Why Raspberry Pi ?

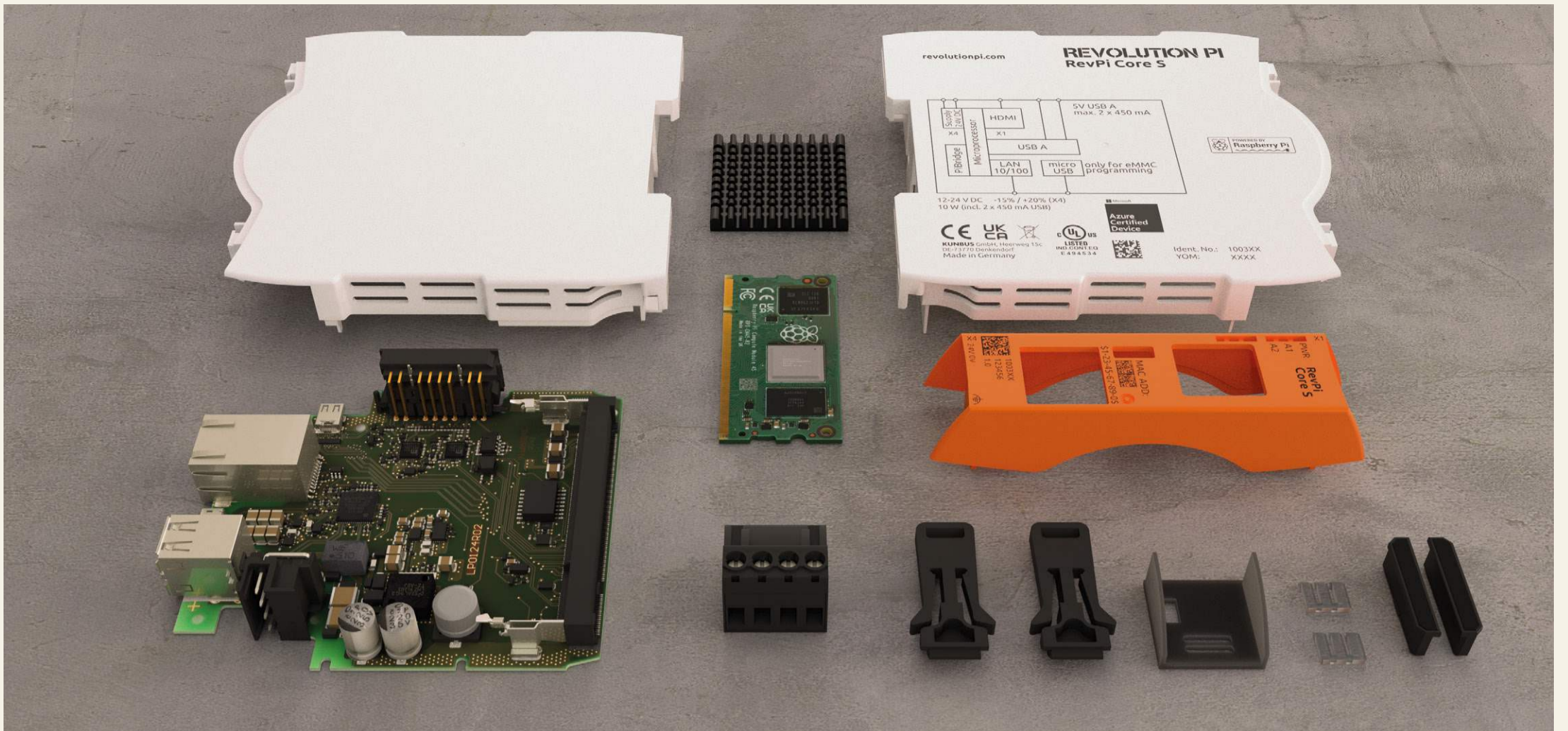


Raspberry Pi Compute Module 4S.

Raspberry Pi has had an impressive career ever since its launch early 2012. By the beginning of 2022, the small and inexpensive single-board computer was sold more than 45 million times.

Raspberry Pi comes in a variety of versions. We at KUNBUS have decided in favour of the lesser known variant going by the name of Compute Module. Why? Quite simply because by using Compute Module, Raspberry Pi is limited to the most essential. We therefore had sufficient leeway to design its connections etc. in an industrially viable way.

With the presentation of the new Compute Module 4 last year, the start signal was given for the development of the new RevPi 4. Please check and bookmark our Revolution Pi website or follow us on LinkedIn for the latest updates and additions. Then you can be sure not to miss anything.



No secrets - The circuit diagrams of the base modules are disclosed.

## The base modules - the foundation of the revolution

**RevPi Connect and RevPi Core are the central processing units of our modular system. By using the Raspberry Pi Compute module, the devices are largely compatible with a Raspberry Pi models.**

A very important element of our Revolution Pi base modules are their power supply units. To ensure that heat losses are kept to a minimum, we have used the most advanced and highly efficient DC-DC converters (overall efficiency > 80%), which generate the necessary operating voltages from the standard 24 V in industrial switching cabinets.

However, the base modules not only run within the standardised voltage range from 20.4 V to 28.8 V, but at just 10.7 V supply voltage as well\*. Thus, car batteries or solar power systems can also be used as a voltage source. At

24 V supply, the devices can withstand a voltage drop of 10 ms without disruptions (at full load of the USB sockets) and even 25 ms without load at the USB sockets. The power supply voltage and a functional earthing are connected from below using a very robust connector.

A complex suppressor circuit guarantees unimpaired function even in the case of massive disruptions on the power supply line, provided that the functional earthing is connected. Lightning strikes or adjacent welding units were simulated in a certified test laboratory and could not affect the devices.

At the front are two USB-A sockets for connecting USB 2.0 client devices. Both sockets supply the full 500 mA current on the 5 V connections. As a result, USB hard disks or surf sticks can also be easily connected without an external, active hub. The micro-USB socket in the middle is used to connect a USB host system (normally a PC)

and switches the system to the passive memory card mode. In this way, a PC can access an installed eMMC flash memory and store software there, for example.

A LAN can be connected at the RJ45 Ethernet socket. Alternatively, the connection to a LAN can be established via a WLAN-USB dongle. USB and Ethernet connections have a suppressor circuit. Irradiations or ESDs cannot harm the Revolution Pi system.

The Broadcom processor of the Compute Module provides high-resolution graphic functions. For this reason, the Revolution Pi base modules are fitted with a micro-HDMI socket at the top that can be used to connect a monitor with sound output. Thus, a fully equipped PC is available together with a mouse and keyboard.

The PiBridge is the data highway interconnecting the individual modules of Revolution Pi.

Two adjacent modules on the top of the housing are each interconnected via a system connector.

Revolution Pi includes Raspberry Pi OS as an operating system by default (a Debian variant) with a real-time patch of the kernel. Further information on software, drivers etc. can be found on page 5.

## RevPi Connect - for all who need more interfaces

The RevPi Connect pays tribute to those users who want to use the Revolution Pi System as an IIoT gateway. Therefore, the base module was supplied with even more interfaces such as RS485 and a second Ethernet socket. Just like the RevPi Core modules, the RevPi Connect modules are also equipped with the Raspberry Pi Compute Module.

Two Ethernet interfaces enable the device to be simultaneously integrated within the automation network and the IT network to transmit machinery data from, for example, the shop floor to

the Cloud or a superordinate IT system. A hardware watchdog allows the RevPi Connect to be used anywhere, even in areas that are difficult to access. The hardware watchdog monitors the status of the RevPi Connect, a relay output serves to ensure that connected devices or expansion modules can be monitored or reset respectively. The RevPi Connect additionally has a 24 V input to receive shutdown signals of an UPS.

Instead of having two PiBridge connectors at the top as with the RevPi Core, the RevPi Connect has one PiBridge and

one ConBridge connector each. While the PiBridge is responsible for connecting the various IO expansion modules and fieldbus gateways, a CAN bus and M-Bus expansion module can be connected via the ConBridge. In the future, further expansion modules for different radio standards will follow which can exclusively be connected via the ConBridge.

The RevPi Connect also has a 4-pole RS-485 interface on the front, for example to connect Modbus sensors.



At 45 mm, the RevPi Connect is twice as wide as the RevPi Core.

\* 2 x 500 mA USB output current are only available with output voltages >11 V. The bridging time of voltage drops lasting at least 10 ms required by En 61131-2 is only guaranteed for supply with 20.4 to 28.8 V. This time reduces significantly for 12 V supply, especially when accessing power from the USB sockets.

## Base modules - facts & figures

### Specifications

	RevPi Connect S/SE	RevPi Connect+	RevPi Core S/SE	RevPi Core 3+
Processor	Broadcom BCM2711, quad-core ARM Cortex-A72	Broadcom BCM2837B0, quad-core ARM Cortex-A53	Broadcom BCM2711, quad-core ARM Cortex-A72	Broadcom BCM2837B0, quad-core ARM Cortex-A53
Clock rate	1.5 GHz	1.2 GHz	1.5 GHz	1.2 GHz
RAM	1 GB LPDDR4	1 GB LPDDR2	1 GB LPDDR4	1 GB LPDDR2
eMMC flash memory	8 GB / 16 GB / 32 GB	8 GB / 16 GB / 32 GB	8 GB / 16 GB / 32 GB	8 GB / 16 GB / 32 GB
HDMI version	HDMI 2.0a (4K)	HDMI 1.3a (FHD)	HDMI 2.0a (4K)	HDMI 1.3a (FHD)
Power supply	12 - 24 V DC	12 - 24 V DC	12 - 24 V DC	12 - 24 V DC
Size (L x W x H)	111 x 45 x 96 mm	111 x 45 x 96 mm	111 x 22.5 x 96 mm	111 x 22.5 x 96 mm
Operating temperature	-25 °C...+55 °C	-25 °C...+55 °C	-25 °C...+55 °C	-25 °C...+55 °C
Storage temperature	-40 °C...+85 °C	-40 °C...+85 °C	-40 °C...+85 °C	-40 °C...+85 °C
Humidity	93 %, non-condensing	93 %, non-condensing	93 %, non-condensing	93 %, non-condensing
Protection class	IP20	IP20	IP20	IP20
ESD protection	4 kV/8 kV	4 kV/8 kV	4 kV/8 kV	4 kV/8 kV
EMI tests (acc. to EN61131-2 & IEC 61000-6-2)	Passed	Passed	Passed	Passed
Surge/Burst tests (acc. to EN61131-2 & IEC 61000-6-2)	Passed	Passed	Passed	Passed
CE, RoHS	Yes	Yes	Yes	Yes
UL	Yes, UL-File-No. E494534	Yes, UL-File-No. E494534	Yes, UL-File-No. E494534	Yes, UL-File-No. E494534
Microsoft Azure certified	Yes	Yes	Yes	Yes
Operating system	Customized Raspberry Pi OS	Customized Raspberry Pi OS	Customized Raspberry Pi OS	Customized Raspberry Pi OS
Item no.	100362 (Connect S / 8 GB) 100363 (Connect S / 16 GB) 100364 (Connect S / 32 GB) 100368 (Connect SE / 8 GB) 100369 (Connect SE / 16 GB) 100370 (Connect SE / 32 GB)	100302 (8 GB) 100303 (16 GB) 100304 (32 GB)	100359 (Core S / 8 GB) 100360 (Core S / 16 GB) 100361 (Core S / 32 GB) 100365 (Core SE / 8 GB) 100366 (Core SE / 16 GB) 100367 (Core SE / 32 GB)	100299 (8 GB) 100300 (16 GB) 100301 (32 GB)

### Interfaces (quantity)

	RevPi Connect S/SE/+	RevPi Core S/SE/3+
RJ45 Ethernet ports (10/100 Mbit/s)	2 (each with its own MAC address)	1
USB 2.0 socket	2	2
Micro HDMI socket	1	1
Micro USB 2.0 socket (for firmware uploads only)	1	1
RS485 screw terminal (4 pole)	1	-
PiBridge (for RevPi expansion modules)	1	2
ConBridge (for RevPi Con expansion modules)	1	-
24 V input for shutdown signal of an UPS	1	-
Freely programmable relay switching contact	1	-

### Available expansion modules

Name	Function	Item no.	RevPi Connect S/+	RevPi Core S/3+	RevPi Connect SE	RevPi Core SE
RevPi DIO	Digital IO module	100197	X	X	X	X
RevPi DI	Digital Input module	100195	X	X	X	X
RevPi DO	Digital Output module	100196	X	X	X	X
RevPi AIO	Analog IO module	100250	X	X	X	X
RevPi MIO	Analog & digital IO module	100323	X	X	X	X
RevPi Gate PROFINET IRT	Gateway PROFINET IRT Device/Slave	100074	X	X		
RevPi Gate PROFIBUS	Gateway PROFIBUS Slave	100069	X	X		
RevPi Gate EtherNet/IP	Gateway EtherNet/IP Adapter/Slave	100066	X	X		
RevPi Gate EtherCAT	Gateway EtherCAT Slave	100073	X	X		
RevPi Con M-Bus	Wireless M-Bus module (868 MHz)	100281	X		X	
RevPi Con M-Bus VHP	Wireless M-Bus module (169 MHz)	100282	X		X	
RevPi Con CAN	CAN bus module	100286	X		X	



Digital I/O module RevPi DIO with 14 inputs and outputs.

## Digital I/O modules

To transform Revolution Pi into an industrial control unit, various digital I/O modules, amongst other things, can be connected to the base modules.

The I/O modules come in three versions. All have the same 28-pin I/O connector at the front (connector with two rows of 14 pins each – two suitable 14-pin socket connectors with spring clamp contacts for the connection of up to 1.5 mm<sup>2</sup> stranded hook-up wires are supplied). Apart from the standard version with 14 digital inputs and 14 digital outputs, there are also two special versions that exclusively have either 16 digital inputs or 16 digital outputs. In all three variants, the inputs or outputs are galvanically isolated from the logic component with the PiBridge (600 VRMS isolation voltage). In the standard version, the inputs are also galvanically isolated from the outputs. All three versions are protected against disturbances according to EN61131-2 and can be operated between -40 and +50 °C ambient temperature and up to 80 % relative humidity. The standard version of the module is also fitted with PWM outputs (pulse width modulation) and counter inputs.

The inputs work at 24 V supply with switching thresholds, as required by the EN61131-2 standard for type 1 and type 3. The input current is limited to a maximum of 2.4 mA per input. At 12 V power supply, this standard no longer takes effect. If the power supply voltage should discontinue and fall below 9 V, an alarm is sent automatically to the base module to indicate that the transmitted input values no longer match the reliable threshold values as laid down in the standard according to 24 V switching logic. An adjustable low-pass filter can be used for debouncing input signals. It can always only be switched on simultaneously for all inputs. The filter only passes on input changes if an input assumes a stable state for at least 25 µs, 750 µs or 3 ms. The filter can also be switched off completely. Inputs are protected against static discharges, burst and surge impulses in accordance with EN61131-2 requirements.

Each of the outputs can be configured separately as a high-side-switch with up to 500 mA current carrying capacity or as push-pull-output with at least 100 mA current load capacity. All outputs are short-circuit proof independent of the operating mode. A watchdog circuit ensures that the outputs are set to 0 (safe state), once the STM processor no longer

transmits any data from the PiBridge to the outputs. The outputs are set to 0 also in the event of undervoltage at the power supply connection for the outputs or in the case of overtemperature. These last two error states as well as the triggering of the short circuit fuse per channel are transmitted to RevPi Connect/Core via the PiBridge.

In addition, the outputs can be configured so that an open load detection (line break) is also switched on and a corresponding alarm is transmitted to the RevPi Connect/Core for high-side output type. Just like the inputs, the outputs are also protected against static discharges, burst and surge impulses in accordance with EN61131-2 requirements.



Available for major industrial network protocols such as PROFINET, the RevPi Gates help to integrate Revolution Pi into an industrial network.

## Fieldbus connection

It is not easy at all to integrate a device into an industrial network. Special protocols are often used for data transmission, such as PROFINET or PROFIBUS. When using our gateways – called RevPi Gate – integrating Revolution Pi into an industrial network is however no problem.

Like all Revolution Pi expansion modules, the gateways are also connected to the base module via the overhead PiBridge connector. Thus, up to two gateway modules (maximum of 2 for RevPi Core and 1 for RevPi Connect) can be used per system. These, like all modules, are supplied with 24 volts that is the norm within the industry.

We have currently set the cycle time between the base module and a gateway to 5 ms by means of drivers. Though the gateway modules could reach cycle times of less than 2 ms, it would burden the system load of the base module disproportionately. For the lower the cycle times are set in the driver, the greater the system load is of the device that has to be expended for this process.

We currently offer gateways for the network protocols shown below (also see page 3). All module variants have been tested and certified by the respective user organisations.

Please note, that the gateways are NOT compatible with the RevPi Connect SE and RevPi Core SE series.



EtherNet/IP™

EtherCAT®



## Analog I/O modules

The two expansion modules RevPi AIO and RevPi MIO allow the RevPi system to be expanded with analog inputs and outputs as well as temperature channels. Just like the digital I/O modules, these analog modules also have a 28-pin I/O connector on the front and are connected to the base modules via the PiBridge. Both are well equipped for tough everyday industrial use and are protected against static discharges, burst and surge pulses in accordance with the EN61131-2 standard.

The RevPi AIO offers 4 analog inputs, 2 analog outputs and 2 analog temperature channels.

The two RTD inputs enable temperatures to be measured with high precision from -165 °C to +600 °C in steps of 0.5 °C using common RTDs sensors like Pt100/Pt1000 probes. The probes can be connected directly to the module with two, three or four cables.

The RevPi MIO supplements our basic modules with 8 analog inputs, 8 analog outputs and as a goodie with 4 digital channels that can be individually configured via software either as inputs or outputs and are connected via the 4-pin connector on top.



RevPi Core 3, RevPi AIO and RevPi MIO on DIN rail.

## Open source also with the software

Revolution Pi is for starters an open platform upon which everything, from the operating system to applications, can be installed that also run on a Raspberry Pi.

We have decided to preinstall Raspberry Pi OS (a Debian variant) with a Real-Time patch of the kernel. In our view, it is the best compromise to

remain as close as possible to the original development environment of a Raspberry Pi and still maintain a high level of control over the priorities of the tasks that the scheduler manages. The scheduler, which controls the execution of the tasks by the operating system, can be configured extensively with this modified kernel to ensure that the delays normally caused by net-

work access and other I/O access operations are avoided. Appropriate drivers for the expansion modules are obviously already preinstalled.

On this basis, you can purchase the Soft PLC from logi.cals among other things from our online shop. These components enable you to have a complete and operational PLC.

But maybe you would also like to write your own software under Linux with Python? Then you can just use our driver and the optimised operating system version to access all process data. For this purpose, we, in a memory area, keep a process image with all the current process values which can easily be written in or read from.

## Simple configuration with PiCtory

**Every Revolution Pi system is supplied with the PiCtory configuration software. It enables you to define the positioning of hardware modules and the symbolic names of the input and output signals. Furthermore, PiCtory can also be used to configure connected hardware modules or installed drivers.**

Revolution Pi is a high grade, modular and expandable system. For example, you can write your own drivers to integrate your special hardware seamlessly into the system. The central process image in the memory is the link between all components. The components, no matter whether they are hardware modules or software applications, always exchange their data with this process image. However to do so, drivers as well as software applications must know exactly where (at which address in the memory) the individual process values can be found.

PiCtory is a browser application. The server is preinstalled by us on the base modules.

Alternatively, you can also use a PC program (Windows) which installs a small web server.

You can arrange the system you require by drag & drop. Predefined rules help you to position the modules correctly. Unfeasible combinations are detected automatically and prevented. Apart from the expansion modules we provide, you can also add your own modules to the configuration tool.

PiCtory also supports you when defining, for example, all I/O signals. You can assign symbolic names and define which adapter supplies and retrieves the data. An adapter can be a hardware module on the PiBridge but it can also be a "virtual device" – driver software for example – for which the memory location is reserved in the process image and for which process values can be defined with symbolic names. The finished configuration file is stored as a JSON file.



PiCtory helps you to set up your Revolution Pi system.

## SOFTWARE SPECIAL

Revolution Pi is a very flexible solution because we offer a great variety of software ready for use on the Revolution Pi hardware family. If you need an IoT tool or a PLC software - just choose the software which fits your needs. Here is a list of application programs which are already available for you (additional licensing costs may apply):

### CODESYS



The manufacturer-independent IEC 61131-3 automation software for planning control systems turns the Revolution Pi into a small industrial controller. Thanks to the built-in soft master functionality for various industrial protocols, the Revolution Pi system can be integrated into an industrial network without the use of gateway modules.

### TeamViewer



By means of software agent that is activated at the start, TeamViewer users can now also reach and remotely control their Revolution Pi devices via the internet. It is made possible by means of a very secure and user-friendly TeamViewer technology to access the RevPi webserver via a browser window. Available therefore are all the functions that can be processed via the server and the ones offering a browser.

### Node-RED



With the open-source software Node-RED, the user has a browser-based programming tool at his hand to map (IoT) application cases quickly and without much effort. In addition to control tasks, Node-RED can also be used to create browser-based HMIs.

### logi.CAD 3



logi.CAD 3 is the engineering software for creating control applications meeting IEC 61131-3 for Revolution Pi. Special adaptations of the logi.RTS runtime system for Revolution Pi turn the device into a Soft-PLC for industrial applications.

### RevPi Connect+ feat. CODESYS

Additionally, the RevPi Connect+ is available with a preinstalled CODESYS Runtime license and offers a real alternative to complex and cost-intensive PLCs. Programmed with CODESYS according to IEC 61131-3, the controller has a 16 GB eMMC memory and is equipped with two RJ45 Ethernet sockets, two USB ports, a 4-pin RS485 interface, a micro-HDMI and a micro-USB socket. Integration into the CODESYS development environment is quick and easy by importing the device description files.

Thanks to its modular design, it is possible to equip the RevPi Connect+ with suitable expansion modules such as IOs, fieldbus gateways and radio modules. These can be coupled to the base unit without tools via plug-and-play using a top-mounted connector, just as easily integrated into CODESYS and controlled and configured via the integrated development environment (IDE).



RevPi Connect+ feat. CODESYS

### Modbus TCP & Modbus RTU

Fully available via the PiCtory functions, Modbus Master and Slave can exchange data cyclically with the process image and therefore with all other SW components. The destination and intervals for communication with the Modbus protocol are freely configurable. It means that, alongside RevPi Gate, there's an additional low-cost method of connecting a multitude of sensors, actuators and controllers to Revolution Pi devices.

## The new ones: RevPi Compact & RevPi Flat

With the RevPi Compact and the RevPi Flat, we are presenting two new devices that – if you compare them with our well-known modules – will catch your eye at first glance with their changed design, their flat construction. This has happened for a good reason: Both modules can thus be easily and space-savingly installed in sub-distribution cabinets, which are usually found in building automation. In addition, they are not modular, but have extensive interfaces directly on board.

The RevPi Compact is our slim and cost-effective alternative to the RevPi Connect with its expansion modules and is usually completely sufficient for common automation solutions. Based on the Raspberry Pi Compute Module 3+, it impresses with real industrial suitability, open-source capability and its high performance and functionality. The most important interfaces are already integrated.

The RevPi Flat is a versatile, freely programmable hardware platform developed for the energy industry. The device is also based on the Raspberry Pi Compute Module 3+ as well as Linux and is also WLAN-capable as a novelty in the RevPi family. The RevPi Flat can be used to implement a wide range of projects, for example for process optimisation, for more efficiency in data handling and for the implementation of new marketing strategies and concepts in the energy industry.

Detailed information on both modules, their technical data including interfaces, performance features, etc. can be found on the product pages of our website:

[revolutionpi.com/revpi-compact/](http://revolutionpi.com/revpi-compact/)  
[revolutionpi.com/revpi-flat/](http://revolutionpi.com/revpi-flat/)



RevPi Compact and RevPi Flat



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