PHYTEC

Connected Embedded Systems
for industry and smart home.

Low Power
Solutions for IoT

Zephyr™

www.phytec.de

reel board

PHYTEC
Designed and manufactured in Mainz
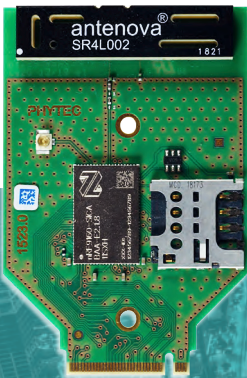
Smarter. Faster. Easier.

Low Power Solutions

Embedded applications become more and more prevalent and diverse. Former mechanical components and handheld tools now often require electronic components to enable monitoring or automation of workflows. In monitoring applications, the spectrum ranging from sensor nodes to gateways must become smaller and more efficient. This, in turn, often allows for faster develop and deploy cycles. PHYTEC develops these systems under the name "Low Power Solutions". These systems are usually based on ARM Cortex M-Class SoCs and can be equipped with a wide variety of features, such as:

- **Sensors and actuators**
- **Bluetooth Low Energy**
- **USB**
- **CAN-Bus**
- **Ethernet**
- **Displays**
- **Cellular Connectivity**
  (LPWAN such as LTE CAT NB1, LTE CAT M1)

To support all these components and features efficiently within resource-constrained systems, there must be a generic operating system. For this constrained systems, we are committed and actively involved in the development of Zephyr OS.

ZEPHYR OS

Zephyr OS has been hosted under the Linux Foundation since 2016. Zephyr integrates device drivers, protocol stacks, file systems, and firmware updates into one project. This integration of components simplifies the development of a full applications. The incredible development pace of Zephyr OS caught our attention very early on and we are happy to be an early adopter and contributor to this project.

KEY FEATURES FOR CONNECTED LOW POWER SYSTEMS

- **Device Drivers**
- **Network Stacks**
- **Over the Air (OTA) updates**

ZEPHYR

"The Zephyr(TM) project strives to deliver the best-in-class RTOS for connected resource-constrained devices, built to be secure and safe."


reel board

reel board is an evaluation board based on the Nordic Semiconductor nRF52840 SoC. The board was developed by PHYTEC Messtechnik GmbH in cooperation with Zephyr Project for the Hackathon – "Get Connected". The board has a built-in debug adapter based on the DAPLink interface firmware.

It is equipped with the Electrophoretic (electronic ink) Display (EPD), environmental (temperature, humidity, light, accelerometer) sensors, and Bluetooth connectivity making it easy to experiment and evaluate the Zephyr OS in these kinds of use cases:

- **battery powered sensor node**
- **low-power, low-cost human-machine interface (HMI)** for remote control and environmental sensor monitoring
- **temperature and humidity monitor on your table**
- **product, name or price tag**
- **interactive badge for meetings and conferences**

The board provides support for the Nordic Semiconductor nRF52840 ARM® Cortex®-M4F SoC with an integrated 2.4 GHz transceiver supporting Bluetooth® Low Energy and IEEE® 802.15.4.
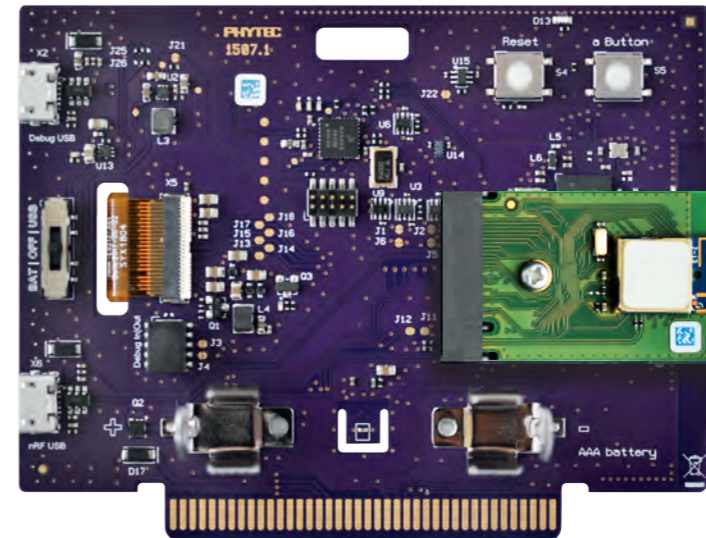
Take a look to our web shop, where you can order our products easily.

Part Number: PN-02521-B-001

sample price
49 €
plus VAT

reel board

"I'm equipped with an Epaper Display, environmental sensors, and Bluetooth connectivity. Explore the world of low-power solutions with me and Zephyr OS."

# Choose your SoC Platforms
via NOTM.2 Modules

NOTM.2 modules allow you to use the reel board with a different SoC. There are 5 different NOTM.2 modules, each with its own individually-capable SoC using different RF solutions.

Furthermore, the effort to develop a new NOTM.2 module is very low, which makes the platform more flexible and future-proof.

NOTM.2 | ST 32WB55

- Bluetooth 5.0
- ARM Cortex-M4
- 1 MB Flash
- 256 KB RAM
- USB
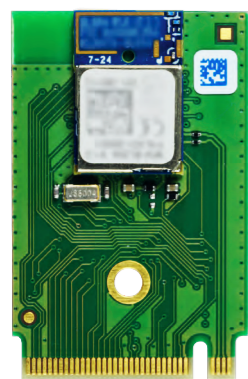
NOTM.2 | Nordic nRF52840

- Bluetooth 5.2
- ARM Cortex M4
- 1 MB Flash
- 256 KB RAM
- ARM Cortex-M4
- 1 MB Flash
- 256 KB RAM
- USB, NFC

NOTM.2 | NXP KW41Z

- Bluetooth 4.2
- ARM Cortex-M0+
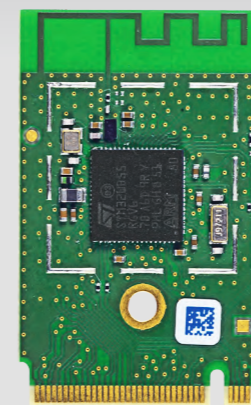- 512 MB Flash
- 128 KB RAM
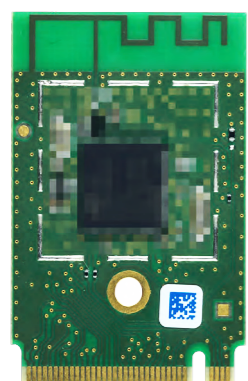
NOTM.2 | Nordic nRF5340

- Bluetooth 5.2
- Application processor ARM Cortex-M33
- Dedicated network processor ARM Cortex-M33
- 1 MB Flash
- 512 KB RAM
- USB, NFC

NOTM.2 | Nordic nRF9160
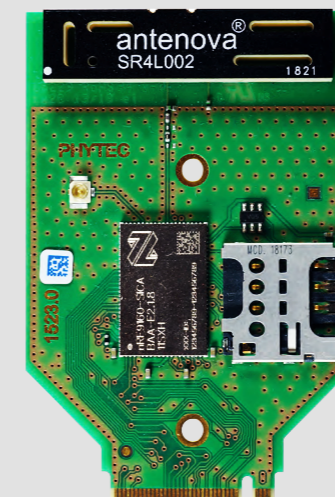
- LTE-M / NB-IoT radio
- ARM Cortex-M33
- 1 MB Flash
- 256 KB RAM

Expanding the reel board

Link boards serves as a feature expansion for the reel board. For example, link boards can be used for connecting displays, sensors, or interfaces like Ethernet and CAN to the reel board. The development of a new link board for adding a hardware device to the reel board is very easy, similar to the NOTM.2 CPU modules. There are several expansion boards for using the reel board as an individual development platform.

link board BASE
The link board BASE is a passive expansion board and allows other link boards or third party shields in Arduino UNO R3 format to be connected to the reel board. In addition, it includes a NOTM.2 connector and a more powerful DCDC converter then reel board. The link board BASE can be used in combination with other link boards or third party shields in two ways:

As an adapter
The reel board is plugged into the link board BASE. Both peripherals on reel board and shields can be used as long as there is no conflict between I2C devices. Care should be taken to provide enough power to the complete circuit.

Stand-alone
The NOTM.2 adapter is removed from the reel board and connected to NOTM.2 connector on the link board BASE. The wiring to the shield connector is identical to the configuration above and no software modification for the shield is necessary. A stand-alone configuration is more suitable for applications where peripherals on the reel board are not used or in conflict, power provided by the reel board is not enough, or for prototypes in the field.
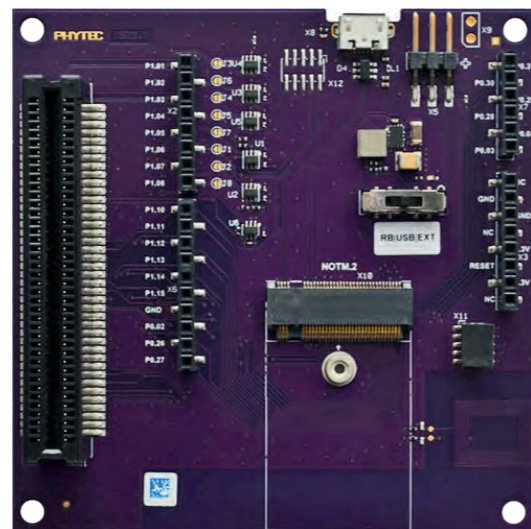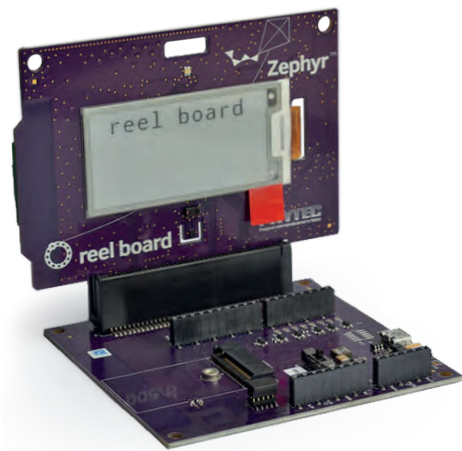
link board BASE

Components on the link board BASE:

• reel board Connector

• Micro USB Connector

• NOTM.2 Connector

• SWD Connector

• Shield Connector
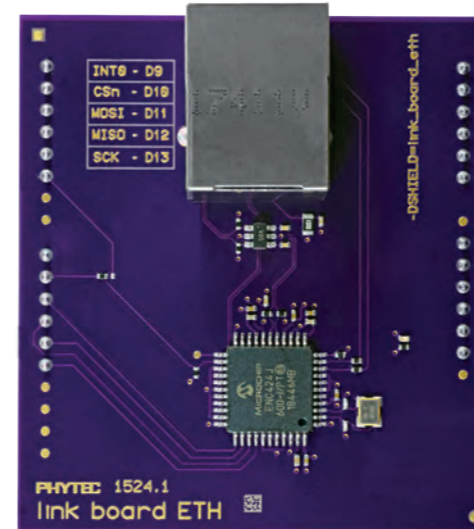
Part Number: PN-02521-B-001

sample price
20 €
plus VAT

link board ETH

The link board ETH is an Ethernet extension board compatible with the Arduino UNO R3 connector.

• Ethernet extension for reel board

• ENC424J600 ethernet controller

• 10/100Base-T PHY

• Automatic polarity detection and correction
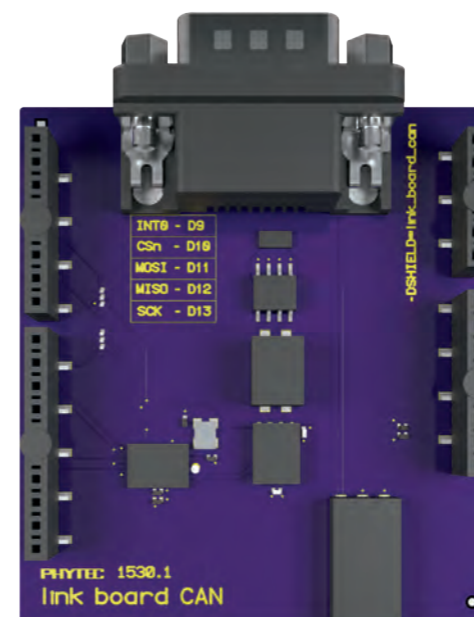
Part Number: PEB-E-002

sample price
15 €
plus VAT

link board CAN

The link board ETH is a CAN extension board compatible with the Arduino UNO R3 connector.

• CAN extension for reel board

• MCP2517FD CAN FD Controller

• CAN 2.0B and CAN FD

Part Number: PEB-E-007

sample price
15 €
plus VAT

phyWAVE®-KW41Z

ARM® Cortex™-M0+

*im Maßstab 1:1
15 x 19 mm*

Small but powerful: the phyWAVE-KW41Z is based on the NXP Kinetis®-W series featuring a ARM Cortex-M0+ CPU. The module has dimensions of 15 x 19 mm and is designed for applications that require small dimensions. Nevertheless, phy-WAVE offers an integrated power management and supports input voltages between 0.9-4.2 V. Due to deep sleep it is also energy efficient and well-suited for energy harvesting and battery operated applications. The module offers a populated chip antenna or U.FL connector.

   phyWAVE-KW41Z supports Bluetooth Low Energy networks and 802.15.4 based networks such as Thread simultaneously. This multi-mode functionality allows direct communication with mobile devices via BLE and integration into Thread Mesh networks at the same time.

- Power-Management on Modul:
  Wide input voltage range from 0.9 V to 4.2 V
- Chip antenna or U.FL connector equipped
- Extremely energy-saving due to Deep Sleep (32 kHz Quarz)
- Supports BLE networks and 802.15.4-based networks simultaneously
- CE compliant, FCC (shield mounted)
- Variants with NXP SOCs (on demand: KW21Z, KW31Z)

phyWAVE-KW41Z

Processor	NXP Kinetis KW41Z, ARM Cortex-M0+ Core, 48 MHz
Architecture	ARM® Cortex™-M0+
Memory	up to 512 kB Flash, up to 128 kB SRAM
Radio Receiver	2,4 GHz IEEE 802.15.4 Bluetooth Low Energy 4.2 (simultaneously)
RX/TX current	6.8/6.1 mA at 0 dBm
Antenna	PCB Antenna or configurable
Interfaces	UART, 2x I²C, 2x SPI, Analog, RTC
Crypto	Cryptography Acceleration Unit (CAU), AES encryption
ADC	16-Bit ADC, up to 800 kS/s, 6 channels
RF Output Power	Programmable output power -30 to +3.5 dBm
Sensitivity	6LoWPAN -100 dBm, BLE -95 dBm
Certification	CE compliant, FCC
Power Supply	Wide input voltage range from 0.9 V to 4.2 V
Dimensions	15 x 19 mm
Part Number	PWA-A-007
Price excl. VAT	€ 8,90

Start Your Project Now!

Hardware Design Service

Embedded hardware shows its advantages in series production, especially when it is perfectly adapted to the target system. The most efficient way to do this is a project-specific system. Describe your task to us in a project workshop or send us your specification. We will sketch your individual solution and work out the specifications with you. Thanks to existing designs from the reel board and link boards, as well as the experience of our engineers in hardware and software, the development of individual hardware is more cost-effective than you might think. Furthermore, PHYTEC project managers will support you from specification to series production. We offer many additional services with our hardware such as compliance test and certifications, power management optimization, and 3D integration services to fit the PCB in small mechanical enclosures. Your specific solution will be manufactured in our Mainz location. This enables short response times and the flexible fulfillment of individual wishes, including assembly and roll-out service.

ADVANTAGES

- Taking your individual power budget into consideration from the beginning of the project
- Space and cost-efficient solutions, tailored to your product
- Hardware from a single source no need to manage and assemble many parts from different sources
- Rapid Prototyping for PCB and mechanics for fast feedback loops

Software Consulting

Ensure you have maximum control of your project by using open source solutions like Zephyr OS and Yocto Linux. We know from our experience that vendor independent solutions offer you more freedom and flexibility in your project. For every customer specific development, we will provide a BSP for the Zephyr OS. This BSP demonstrates basic functionality for your hardware for radio, sensors, and displays. This basic BSP is the basis for an end-of-line test for our production.

ADVANTAGES

- BSP based on Zephyr OS
- Examples for individual testing of all hardware components
- Expert support for Zephyr OS
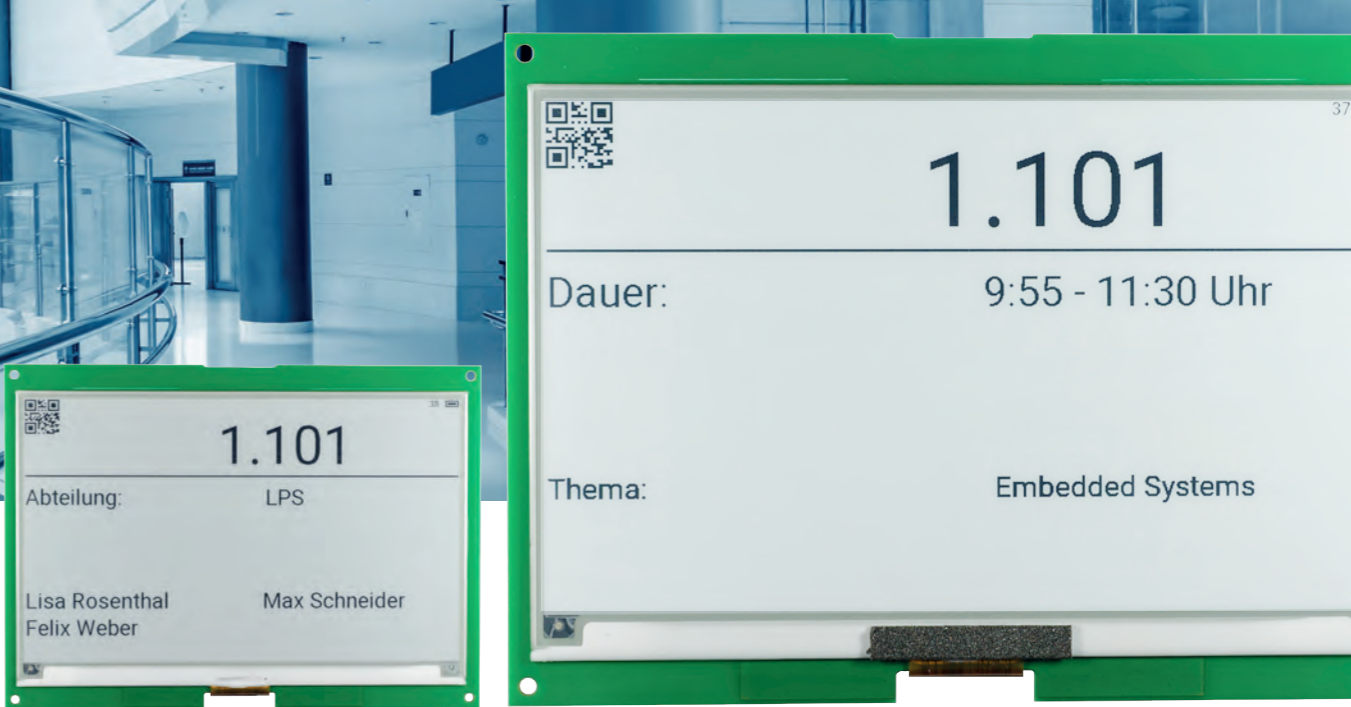
Projects and Target Application Examples for LPS

PHYTEC products have been deployed in thousands of systems across a wide range of industries and applications. We have a broad hardware and software expertise for our Linux driven devices.

Connected products with a low power requirement are at the other end of the spectrum. Developing such products requires further development skill sets. With PHYTECs proven experience in low power projects, we could develop many applications in the field and show that we are capable to efficiently support our customers.

We ensure our customers an efficient and maintainable low power IoT solution.

KEY AREAS OF EXPERTISE

- Battery driven devices
- Passive and active display applications
- Smart beacons and sensor nodes
- Connected handheld devices and hand tools
- BLE, USB and CAN
- Gateways (Linux and Zephyr OS)
- Energy harvesting

OUR APPROACH

- Having a set of generic technologies and customize products with reduced development effort
- Taking low power and security requirements into account before deciding about an architecture

SUPPORTING OUR CUSTOMERS IN EVERY STEP

- Hardware Development
- Software Development and Consulting
- Certification
- Series Production and delivery management
- Delivery Management
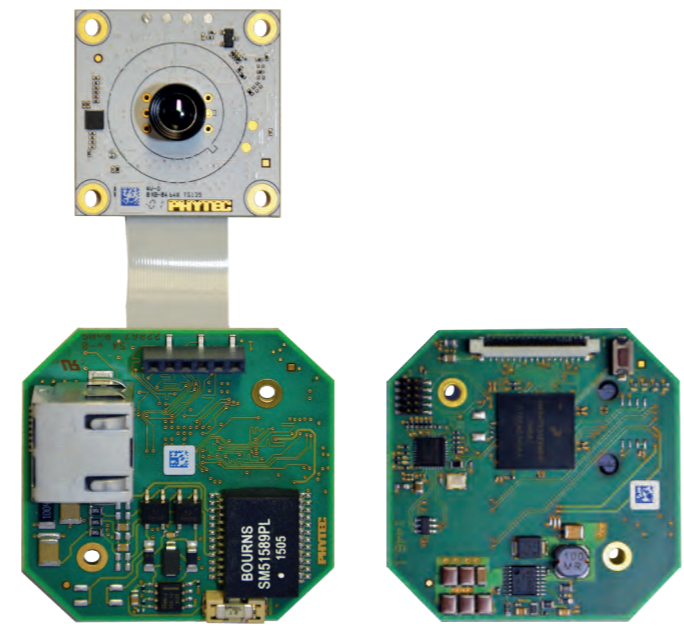
7.5" Passive **Display**

This project features a 7,5 inch passive display for showcasing the possibilities of a low power HMI. It is battery operated using a single AAA Alkaline battery. Zephyr OS with LittlevGL, an open-source embedded GUI library, makes it easy to create a various graphical elements.

- Battery Powered (1x AAA Alkaline)
- Build with NOTM.2 nRF52840
- Bluetooth LE
- Zephyr OS
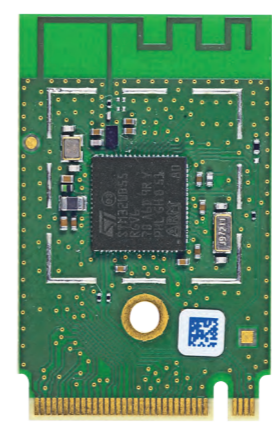
reel board **Adapters** (STM32WB55RG)

The reel board NOTM.2 adapter with the STM32WB55 was developed, manufactured, and validated within 4 weeks. It was validated, including the sensors and a passive display, on the reel board. A fast turnaround time was achieved by reusing a PCB antenna which was previously qualified in other PHYTEC projects.

The Zephyr OS is critical to such aggressive timelines. It has a device tree support similar to the device tree in the Linux Kernel. The device tree and existing driver implementations of many sensors allows for very fast development of new projects.
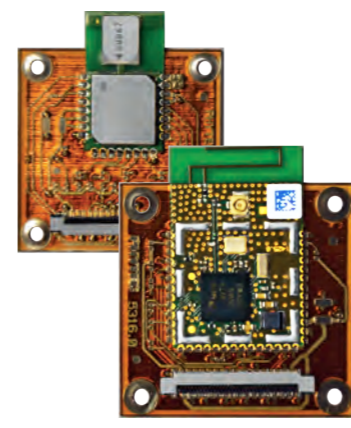
phy**GATE**®-K64 | Termopile Camera

The phyGATE-K64 is a gateway module based on the NXP K64 SoC with integrated ARM Cortex-M4, 1 MB Flash, and a Power-over-Ethernet interface (PoE). The phyGATE-K64's 50 x 50 mm form factor enables its integration in industry standard 60 mm flush mount recessed boxes.

This application concept enables the precise tracking of a person's (or group of people) presence in rooms or outdoor. It recognizes people in rooms without being a privacy concern. The limited resolution of 32 x 32 pixel does not allow faces to be detected.
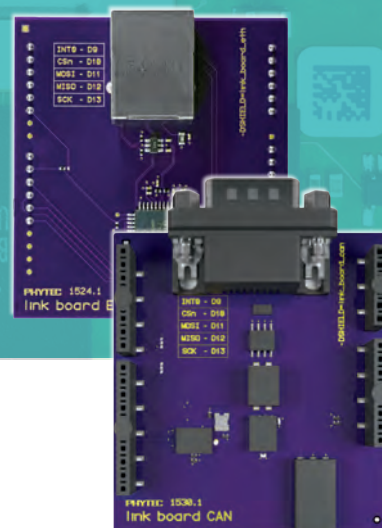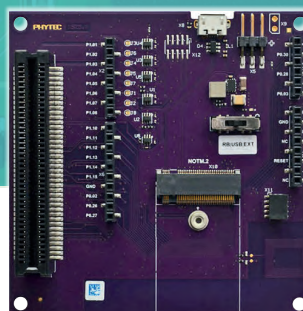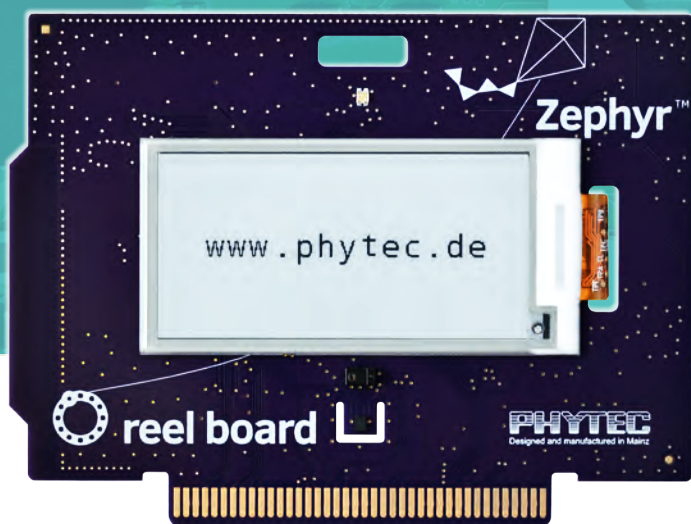
Your direct entry with low power solutions:

Order your reel board rapid prototyping system now in our Online Shop

reel board EVALUATIONBOARD
Part Number: PN-02521-B-001

sample price
49 €
plus VAT

link board BASE
Part Number: PEB-E-001

sample price
20 €
plus VAT

link board ETH
Part Number: PEB-E-002

sample price
15 €
plus VAT

link board CAN
Part Number: PEB-E-007

sample price
15 €
plus VAT

Current dates at:
www.phytec.eu/events

LPS – CONSULTING AND SERVICE

We will help you to define a solid specification for your project based on our project experiences. We offer many services around hardware development, software consulting and manufacturing.

LPS – PROJECT WORKSHOP

Our hardware and software developers give you a general overview of low power design with Zephyr OS. You will get to know possible solutions tailored to your project.

How can we help you?
Let's talk about your project and explore the possibilities of modern Low Power Design.

Get in Contact:

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contact@phytec.de**