

Zerynth ZeroBox 11

User Manual

IND-ZB-11

For more details, visit: www.zerynth.com

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Contents of the present documentation refers to products and technologies described within. All technical data contained in this document may be modified without prior notice. The content of this documentation is subject to periodic revision.

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Document versioning

Version	Author	Date	Notes
20240906	Zerynth S.p.a	06-Sep-2024	First revision

Overview

Easily monitor your assets and acquire data from industrial machines with the power to perform on the edge signal processing and AI operations with onboard NPU hardware acceleration.

The **ZeroBox 11** is an Industrial data acquisition device that features Wi-Fi connectivity, Bluetooth, dual Ethernet LAN, and optional Cellular 4G with GPS capabilities. There are many onboard features like: a DIN-rail mountable case, industrial grade sensor channels, support for Wi-Fi, Relays, support for CAN protocols, RS485, RS232 interfaces.

The ZeroBox 11 can be integrated with any of the Zerynth expansion boards. They can act in concert or individually as a prototype during the development stage, and as a core for industrial applications.

The ZeroBox 11 is a linux based system which permits to run the whole range of off-the-shelf applications.

General Characteristics

- RK3568 Processor
 - 64-bit quad-Core Cortex-A55, 4 x 2.0GHz
 - 2GB RAM
 - Clock frequency up to 2.0Ghz.
 - Embedded 16 GB eMMC Flash memory
 - Integrates the ATECC608B crypto element to allow ultra-secure communication.
 - WiFi 2.4G/5G, up to 433Mbps (Client and AP mode supported) and Bluetooth® 4.2 with Low-Energy Support
- 2 Channel 1000M LAN
- 4 Analog channels that can measure (dependent on the dip switch configuration):
 - 4-20mA sensors (single ended or differential)
 - 0-10V sensors (single ended or differential)
 - current transformers (non-invasive)
 - resistive sensors (NTC, RTD, contact, proximity, etc.)
- 8 Digital inputs
 - Max voltage (open circuit) = 36VDC
- 2 solid state photorelay channels
 - Max voltage (open circuit) = 36VDC
 - Max current (closed circuit) = 150mA
- RS232 and RS485 Interface.
- Supports CAN Protocol.
- Supports USB-C for PC communication.
- USB-C Slot for updating Firmware
- 1 x USB 2.0 Host, 1 x USB 3.0 Host, 1x
- MicroSD card, supports up to 128GB SDHC
- Optional GSM/GPRS on mini-PCIe, Tested Quectel EC20/EC25
- SMA Antenna for WiFi/Bluetooth and the optional 4G or GPS
- High accuracy RTC with farad capacitor, can work 1 week after power off
- 1 Channel HDMI-D

- Powered by Zerynth Linux OS – efficient and easy to use, Python enabled OS for IoT applications
- DIN-rail mountable (9 slots)

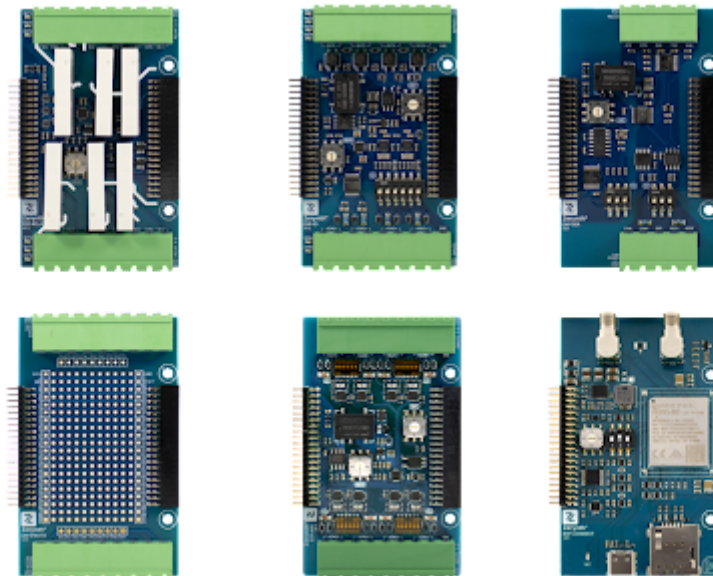
Modular Expansion System

Zerynth Development boards offer a game-changing way of connecting and adding functionalities to your application in a simple and easy way.

The development board offers a modular expansion system that adds expansion boards through the connectors on the board (zBUS).

Expansion boards vary in features and functionality. Currently, Zerynth offers :

- **EXP-AIN:** Expansion board with 8 Industrial analog input channels
- **EXP-CONNECT:** GSM-NB-IoT and GPS enabled expansion module.
- **EXP-IO:** Industrial input/output board with 4 solid-state relays, 2 analog channels (4-20mA/0-10V/NTC/current clamp) channels, 2 opto-isolated digital inputs
- **EXP-RELAY:** Expansion board with 6 Electromechanical power relays.
- **EXP-SER:** Serial Communication board with : CAN, RS232 and RS485 interfaces.
- **EXP-PROTO:** Prototyping board for connecting and testing different types of sensors and devices.



Screw Description

Connector P1 - Power Screw Terminal		
Screw Number	Symbol	Description

1	VIN	External Power Supply 9-36V
2	GND	Ground pin for Power supply

Connector P2 - Photorelay/Communication Screw Terminal		
Screw Number	Symbol	Description
1	COM1	Relay #1 Common terminal
2	OUT1	Relay #1 Normally open terminal
3	COM2	Relay #2 Common terminal
4	OUT2	Relay #2 Normally open terminal
5	CANH	CAN High
6	CANL	CAN Low
7	GND	Ground Pin
8	B/TX	RS485 B / RS232 Transmit
9	A/RX	RS485 A / RS232 Receive

Connector P3 - Digital Input Screw Terminal		
Screw Number	Symbol	Description
1	IN1	Digital Input 1+
2	IN2	Digital Input 2+
3	IN3	Digital Input 3+
4	IN4	Digital Input 4+
5	COM_GND	Common Ground
6	IN5	Digital Input 5+
7	IN6	Digital Input 6+
8	IN7	Digital Input 7+
9	IN8	Digital Input 8+

The negative terminal of all digital channels are the GND pins.

GND of digital channels are connected to other GNDs on the board.

Connector P4 - Analog Input Screw Terminal		
Screw Number	Symbol	Description
1	AGND	Isolated Ground reference for analog bias
2	AIN1-	Analog Input 1-
3	AIN1+	Analog Input 1+
4	AIN2-	Analog Input 2-
5	AIN2+	Analog Input 2+
6	AIN3-	Analog Input 3-
7	AIN3+	Analog Input 3+
8	AIN4-	Analog Input 4-
9	AIN4+	Analog Input 4+

The **AGND** pin must be connected to the relevant AINx- pin, together with the negative line of input signal to read resistive channels.

Technical Specifications

Power Supply	
Voltage	9 to 36 Vdc
Current @ 15V	300 mA max
Power Consumption	4.5 W max
Power Consumption + 4G cellular⁽¹⁾	8.2 W max
Power Consumption + 4G cellular + GNSS⁽¹⁾	8.4 W max

Note 1: Using Quectel EG25-G miniPCle modem

Inputs / Outputs	
ADC Inputs Resolution	11 bits + sign.
4-20mA Channels - x4 (according to dip-switch positions)	Min supported input current 4 mA Max supported input current 20 mA
0-10V Channels - x4 (according to dip-switch positions)	Min supported input voltage 0 V Max supported input voltage 10 V
Resistive Channels x4 (according to dip-switch positions)	Min supported Resistor value 0 Ohm Max supported Resistor value 70 KOhm

SolidState Relays	Max voltage (open circuit) = 36VDC Max current (closed circuit) = 150mA
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Note: For each analog channel the user can choose **only one configuration**.

Environmental Conditions	
Recommended operating temperature	0 to +60 °C
Humidity	Max 90% (not condensing)
Storage Temperature	-30 to +70 °C
Degree Protection	< IP40

IMPORTANT : operating the device at high temperature for a short period of time is allowed however we strongly recommend operating the device at the **recommended operating temperature**.

Connectors	
Programming	USB-C Connector
SIM Card	Micro SIM Slot
Micro SD	Micro SD Slot
Power Supply, Analogs, Digitals, RS485, RS232, CAN, Relays,	Screw Connectors 3mm pitch

Categories	Items	Specifications
Certification	RF Certification	FCC/CE-RED
	Green Certification	RoHS/REACH
Test	Reliability	HTOL/HTSL/uHAST/TCT/ESD
Wi-Fi	Protocols	802.11ac/abgn up to 433 Mbps
		A-MPDU and A-MSDU aggregation and 0.4 µs guard interval support
	Frequency Range	2.4-5.8 GHz
Bluetooth	Protocols	Bluetooth 2.4.2 BDR/EDR LE
	Radio	NZIF receiver with -85 dBm sensitivity

		AFH
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Dip-Switches

S1 Switch: Enables term resistors for CAN Bus.

PIN	OFF	ON
1	-	CANH and CANL are connected through 120ohm resistor
2	-	RS485A and RS485B are connected through 120ohm resistor
3	-	Connects RS485B terminal with B/TX terminal
4	-	Connects RS485A terminal with A/RX terminal
5	-	Connects RS232TX terminal with B/TX terminal
6	-	Connects RS232RX terminal with A/RX terminal

- To expose RS485 on the outer screws:

Switch pin	State
S1.3	ON
S1.4	ON
S1.5	OFF
S1.6	OFF

- To expose RS232 on the outer screws:

Switch pin	State
S1.3	OFF
S1.4	OFF
S1.5	ON
S1.6	ON

- **S1.PIN3 and S1.PIN5 can never be on at the same time**
- **S1.PIN4 and S1.PIN6 can never be on at the same time**

S2 Switch: each Analog channel can be configured with 3 DIP switches that enable specific features.

PIN	OFF	ON
1	Gain ADC AIN1 = 1	Gain ADC AIN1 = 5

2	AIN1 read as voltage	AIN1 read as current
3	-	AIN1 read as resistive sensor
4	Gain ADC AIN2 = 1	Gain ADC AIN2 = 5
5	AIN2 read as voltage	AIN2 read as current
6	-	AIN2 read as resistive sensor

S3 Switch: each Analog channel can be configured with 3 DIP switches that enable specific features.

PIN	OFF	ON
1	Gain ADC AIN3 = 1	Gain ADC AIN3 = 5
2	AIN3 read as voltage	AIN3 read as current
3	-	AIN3 read as resistive sensor
4	Gain ADC AIN4 = 1	Gain ADC AIN4 = 5
5	AIN4 read as voltage	AIN4 read as current
6	-	AIN4 read as resistive sensor

For Voltage measurement - 0 10V standard industrial voltage sensor:

Switch pin	State
Sx.1	OFF
Sx.2	OFF
Sx.3	OFF

For Current measurement - 4-20 mA standard industrial sensor:

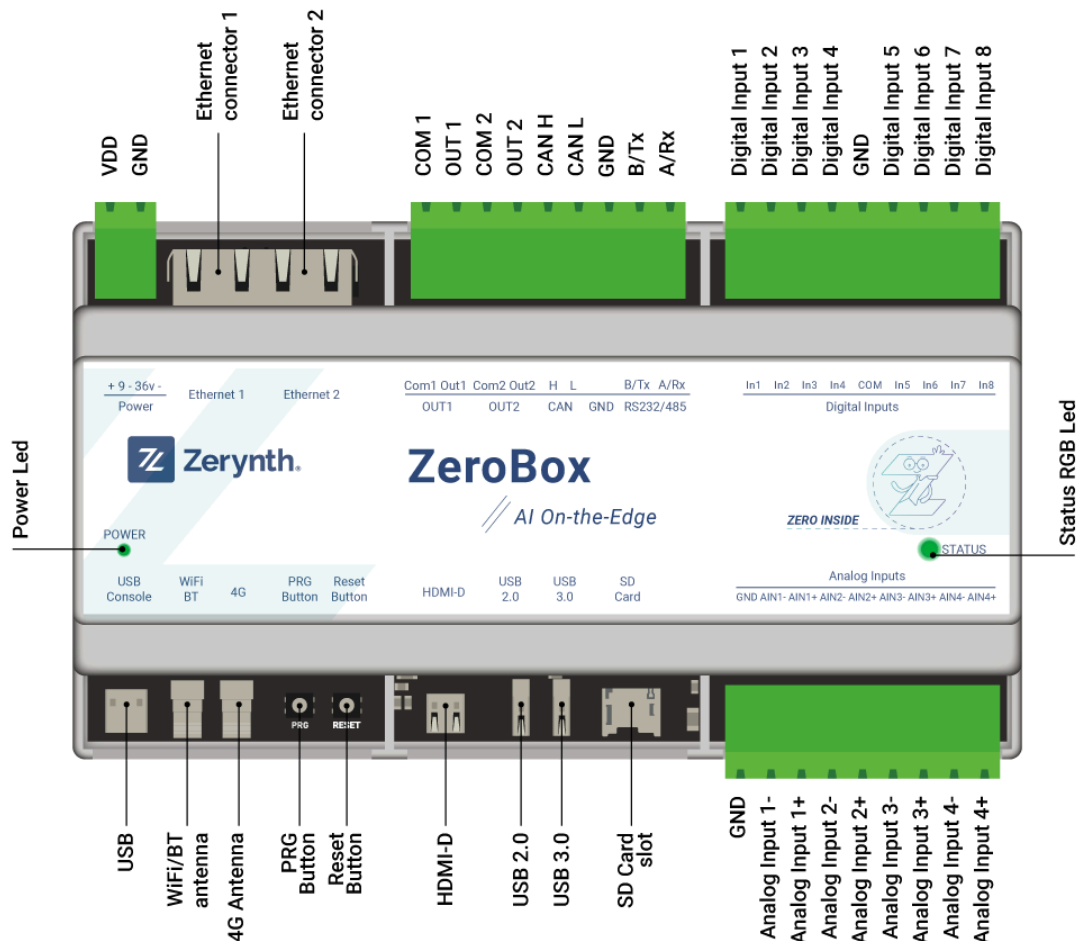
Switch pin	State
Sx.1	ON
Sx.2	ON
Sx.3	OFF

For Resistive passive industrial sensor:

Switch pin	State
Sx.1	ON
Sx.2	OFF
Sx.3	ON

NOTE: A Current Clamp (transformer) can be connected using the 4-20mA configuration of the DIP switches exploiting the full input range of $\pm 20\text{mA}$. That is $\pm 2\text{V}$ across the on-board 100 Ohm resistor which cannot handle power dissipation required by $\pm 10\text{V}$.

Board-Map



LEDs

- Power-on LED.
- 3 RGB LEDs Configurable through application code.

Push-Buttons

- RST BTN for resetting the MCU
- PRG Button to update ZeroBox OS

NOTE: Texas Instruments ADS7128 Port Expander has address 0x16 on I2C2

NOTE: Crypto Element Microchip ATECC608B driven in I2C at the address 0x35 with our libraries with 7 bit address or 0xC0 with the 8bit one on I2C3

Software

The ZeroBox 11 comes with a linux based system which permits to run the whole range of off-the-shelf applications. Among these is the **zagent**, which allows the device to safely connect to the Zerynth Cloud, use the peripheral of the device easily and publish acquired data to your account.

Zerynth Configurator

The Zerynth Configurator is the main way to program and configure the ZeroBox 11. It allows the user to configure all the various apps supported by the ZeroBox 11 directly from the cloud. No coding is required, all the apps can be configured with a wizard or using a graphic interface.

Declaration of Conformity



Doc N. 002/2024

Dichiarazione di Conformità UE EU Declaration of Conformity

Fabbricante /Manufacturer Zerynth S.p.A.	Prodotto /Products Name: Zerobox - Version: 11.x
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Norme Applicate / Applied Standards

EN 55032:2015 + /A1:2020 +/A11:2020
ETSI EN 301489-17 V3.2.4
ETSI EN 300328 V2.2.2
ETSI EN 301489-1 V2.2.3
CEI EN IEC 61000-6-2:2019
CEI EN IEC 62368-1:2020
EN 55035:2017 + /A11:2020

Il fabbricante dichiara che il prodotto specificato è conforme alle normative sopra riportate e soddisfa i requisiti essenziali richiesti dalle Direttive: 2014/53/UE (RED), 2014/35/EU (LVD), 2014/30/EU (EMC), 2011/65/UE (RoHS).

La presente dichiarazione di conformità è rilasciata sotto l'esclusiva responsabilità del fabbricante.

The manufacturer declares that the product complies with the Standards specified above and meets the essential requirements of the Directives: 2014/53/UE (RED), 2014/35/EU (LVD), 2014/30/EU (EMC), 2011/65/UE (RoHS).

This declaration of conformity is issued under the sole responsibility of the manufacturer.

Pisa, Italy, 01/06/2024



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IMPORTANT: KEEP THIS INFORMATION FOR FUTURE REFERENCE. FOR FULL SET UP AND INSTALLATION INSTRUCTIONS PLEASE VISIT docs.zerynth.com

Warnings

- All external power supplies used with Zerynth boards must comply with the relevant regulations and standards applicable in the country of use and must provide a voltage between 9 and 36 VDC.
- The manufacturer cannot guarantee compliance with the RED directive if the end user uses custom circuits other than those supplied by Zerynth (used in conformity tests).
- All boards that require CE marking have been tested and meet the essential requirements set by the Directives: 2014/53/EU (RED), 2014/35/EU (LVD), 2014/30/EU (EMC), 2011/65/UE (RoHS). The declaration of conformity (DoC) can be downloaded from the website <https://zerynth.com/certifications/>
- All Zerynth boards have undergone compliance testing for conducted and radiated emissions meeting the requirements of the following standards: FCC Part 15 B and IC ICES-003.
- Any device or component connected to one of the connectors of the ZeroBox 11 must comply with the electrical characteristics defined in the specifications described in the complete manual to ensure that the performance and safety requirements are met.
- Each cable used to connect other devices or components to the Zerynth boards must be less than 300 cm long and must offer adequate insulation and operation so that the appropriate performance and safety requirements are met.

Instructions for safe use

- Do not expose this product to water or moisture and do not place it on a conductive surface while it is operating.
- Do not expose this product to excessive heat sources which could cause it to operate outside the permitted temperature range defined in the specifications (0, +60 ° C).
- Be careful when handling the product to avoid mechanical or electrical damage to the printed circuit board and connectors.
- If a board looks damaged, do not use it.
- Do not touch the printed circuit board when it is powered on and never operate on live electrical parts.
- The printed circuit board must not come into contact with conductive objects when it is powered on.
- Discharge static electricity from your body and touch only the edges of the board to minimise the risk of damage from electrostatic discharge.



EN - Waste Electrical and Electronic Equipment (WEEE) Symbol

The use of the WEEE symbol indicates that this product/board may not be treated as household waste. By ensuring this product/board is disposed of correctly, you will help protect the environment. For more detailed information about recycling of this

product/board, please contact your local authority, your household waste disposal service provider or the shop where you purchased it.