How to use Arduino to Go Beyond Prototyping in Industrial Automation

MOUSER ELECTRONICS

September 30th, 2025

Agenda | Goals

01	**Arduino in Enterprise Embedded Prototyping**
02	**Proto Kit VE & ME - Overview**
03	**Arduino in Industrial Automation Prototyping**
04	**Opta Family - Overview**
05	**Q / A**

Arduino in
Enterprise Embedded Prototyping

Almost everybody uses Arduino for Prototyping*

Industries	Companies
High Tech	aws, TATA, Google, Microsoft, amazon, Apple, Meta, Texas Instruments, BOSCH, RENESAS, TOSHIBA, arm, Qualcomm, NXP
Automotive	Ford, Mercedes-Benz, gm general motors, BMW, Buick, AUDI, TESLA, RENAULT, Ferrari, BENTLEY
Industrial	Milwaukee, General Electric, GARMIN, CORNING, EATON, ThermoFisher SCIENTIFIC, Steelcase, BOEING, Coca-Cola, COMAU, DENSO, Honeywell
Public Sector	LOCKHEED MARTIN, U.S. Department of Defense, US Army Corps of Engineers, NASA, NavtechGPS
Others	Shell, JABIL, Southwest, VANGUARD ROBOTICS, amcor, stryker, SPACEX, xerox, Lilly, Baxter

* that we are aware of

CASE STUDY

BMW Rapid Prototyping using Arduino as a Platform

BMW integrated the **Arduino products and ecosystem as their Prototyping Platform,** allowing real-time data acquisition and analysis.

Manufacturing
Automotive

Munich, Germany

Challenge

BMW's Innovative R&D team needed to quickly turn bold hypotheses into working prototypes with rapid iteration cycles.

Accelerate innovation cycles and create working prototypes for complex ideas with unique specifications

Rapid Prototyping for Scale using a flexible, cost-effective, and efficient platform; while accelerating Innovation Cycles.

Accelerate innovation by avoiding **Vendor lock-in** as Arduino open-source nature allows for seamless integration with other systems

Modularity is key: Arduino boards and Shields allow to bridge the gap between sensors, actuators, and central processing units in their prototypes.

More Use Cases; Success Stories in Corridor Today and at www.arduino.cc/pro

Many Problems in Enterprise Prototyping (Lead with Pain)

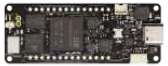
Problems				
Need to accelerate innovation cycles *(get to finish line quicker)*	**Cannot outsource the project due to IP Concerns**	**Talent Shortage on getting things done internally**	**Inflexible design - be married to Silicon vendor from Day 1**	**Need for greater complexity bringing in Cloud and AI**
Accelerate Innovation, Prototyping Cycles with "first article" 10x faster	**Arduino provides your own Cloud workspace with the Proto Kit Arduino Cloud voucher to work on.**	**Engineers already familiar with Arduino Toolchain**	**Keep design flexible - not married to the Silicon vendor from Day 1.**	**We have introduced NPIs to solve this.** - HW: **Proto Kit** - SW: **Gen AI CoPilot** for Arduino IDE - Cloud: **Arduino Cloud templates**
Arduino Solutions				

Arduino Product & Solutions Portfolio

SOMs & SENSORS + ENCLOSURES

Portenta C33

Portenta H7



Portenta X8

Nano Matter

NICLA SENSE ME

NICLA VOICE

NICLA VISION

NICLA SENSE ENV

MODULINOS

CARRIERS & ACCESSORIES

Mid Carrier

Hat Carrier

Proto Shield

Vision Shield

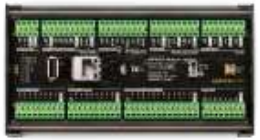
GNSS Shield

Pro 4G Module

INDUSTRIAL AUTOMATION

OPTA + Expansions

Portenta Machine Control



Portenta Proto Kits

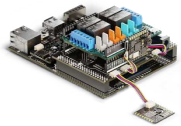
+ Portenta Mid Carrier
+ Proto Shield
+ Portenta H7
+ Pro 4G GNSS Module Global

Portenta Proto Kit ME

+ Nicla Sense ME

Portenta Proto Kit VE

+ Nicla Sense Env
+ Nicla Vision



Software — Arduino IDE — PLC IDE

Cloud — ARDUINO CLOUD — aws — Azure

Portenta Proto Kit ME & VE

Enterprise Embedded Prototyping

Portenta Proto Kits

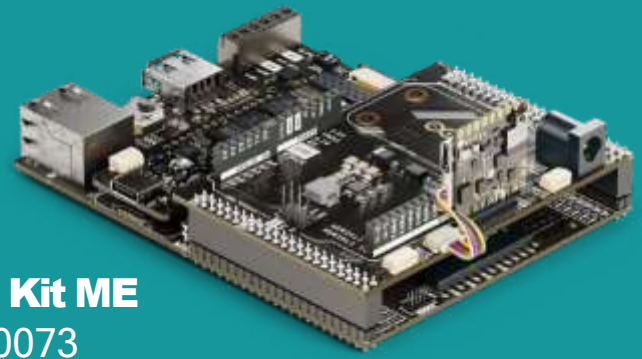
Benefits

Packaged “icebreaker” to start Customer conversation!
Helps you leverage Arduino Brand to open doors!

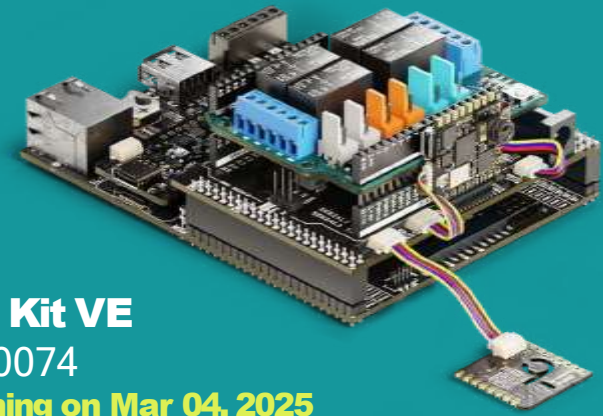
Opportunity opener

Prototype accelerator

Foot in the door

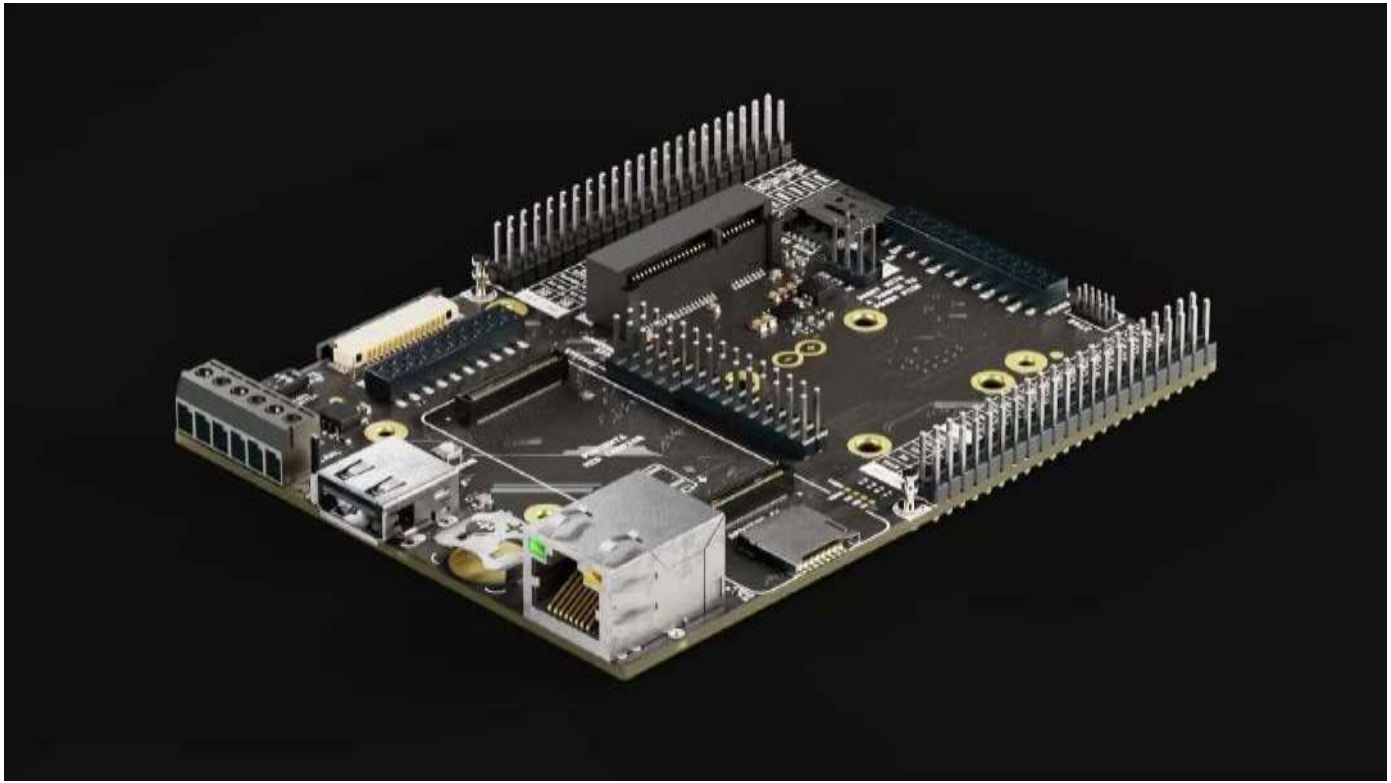


Proto Kit ME
AKX00073



Proto Kit VE
AKX00074
Launching on Mar 04, 2025

Video Animation of Portenta Proto Kit



Portenta Proto Kit Overview

PORTENTA PROTO KIT (Common to all SKUs)

Portenta H7

4G GNSS Module Global

Modulino

Portenta Mid Carrier

NEW **Proto Shield**

MOTION and ENVIRONMENT SKU - AKX00073

Nicla Sense ME

VISION and ENVIRONMENT SKU - AKX00074

Nicla Vision

Nicla Sense Env

Software — **Arduino IDE**

Cloud — ARDUINO CLOUD

Product Differentiation of Proto Kit VE

1. Dual-Core Processing Power

a. STM32H747XI Dual-Core MCU (Cortex-M7 + Cortex-M4)

b. Hybrid Flexibility

1. Vision & Audio-Ready Hardware

a. MIPI Camera Interface & 2MP Global Shutter Camera

b. Digital Microphone and I2S Audio support

2. Industrial-Grade Robustness

a. -40°C to +85°C operating range and EMC protection

b. Secure Element (ECC608)

3. High-Speed Connectivity

a. Wi-Fi/BLE 5.1 + Gigabit Ethernet (10/100/1000 Mbps) + 4G Connectivity

b. USB-C (Host/Device) and CAN bus support

5. Modular Expandability

a. Proto Carrier Board with mikroBUS™ sockets, Grove connectors,

b. 80mm FPC connector for custom PCB extensions.

6. Native Arduino Cloud & Ecosystem integration

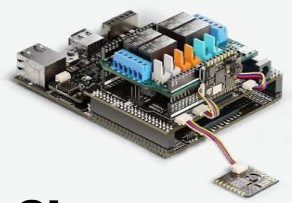
a. Arduino Cloud integration for OTA updates, Low-code Cloud Templates, and Remote monitoring

b. Pre-certified FCC/CE modules

c. Python Open-Source Libraries , TensorFlow Lite, and OpenMV.

7. All-in-One Prototyping

a. Combines carrier board, Portenta module, camera, and accessories in a single kit

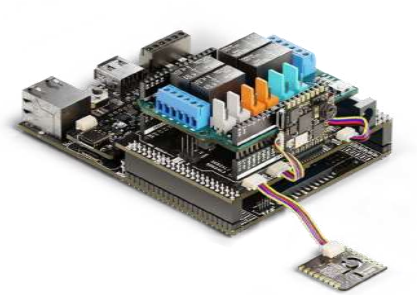


Why Choose Portenta Proto Kit VE/ME Over Others?

No Compromises:
Unites speed, ruggedness, and scalability in one platform.

Faster Time-to-Market:
Pre-integrated vision/audio hardware and Arduino's developer-friendly tools.

Arduino Advantage to SIs



Quickly get building your Prototypes with Proto Kit

Best in class Documentation and learning resources (ACE-220)

Arduino Cloud Templates at scale for deployment and native Arduino Cloud integration

Get started in no time with a dedicated course!

Enterprise Prototyping with Arduino (**ACE-220**) course!

Arduino in
Industrial Automation

Empowering Data Collection in Industrial Automation for Legacy Equipment Monitoring in Existing/Brownfield Factories

GREENFIELD

BROWNFIELD

SHOP-FLOOR (OT)

Portenta H7

Nicla Vision

Nicla Sense ME

Nicla Voice

Portenta X8

Portenta Machine Control

% of total equipment that is disconnected from cloud

70% Heavy Manufacturing, Utilities, and Process Industries

40% Electronics & Automotive Manufacturing

GATEWAY

Opta PLC

- PROGRAMMABLE INPUTS FOR SAFETY MECHANISM
- BLENDED DEVELOPMENT ENVIRONMENT [PLC & C++]
- MULTIPLE COMMUNICATION PROTOCOLS
- REAL-TIME DATA ACQUISITION, STORAGE & ANALYTICS

CLOUD

aws

ARDUINO® CLOUD

Opportunity for Prototyping in Industrial Automation

OEM Retrofitting - Taking you to the NEW from the OLD

Retrofitting Existing Machines

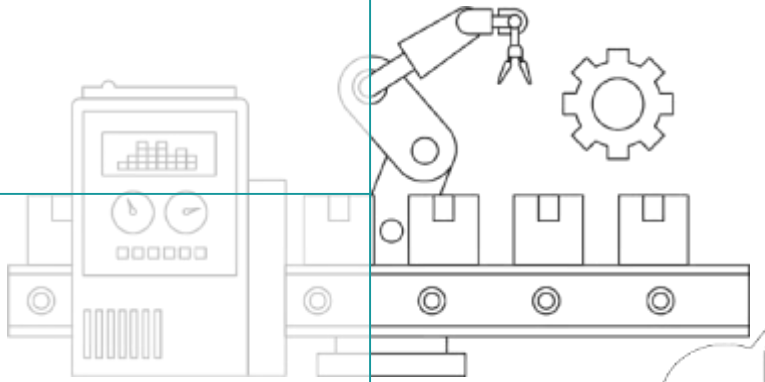
- Industrial Compressor
- Packaging
- Conveyor Belts

Water & Tank Level Management

- Car Washes
- Chemical Plants
- Municipalities
- Waste Water

Fluid Injection (Liquids & Gases)

- Fluid Injection r.g. Industrial Printers
- Bottling Systems



RETROFIT ANY OEM ASSET

OPTA PLC

+

EXPANSIONS

Interoperable with your existing…

Industrial Protocol	Cloud	SCADA and MES	HMI	Existing Control & Automation System
Modbus, MQTT, OPC UA	aws, Azure, HUAWEI, Google Cloud	Ignition, EMERSON, Honeywell, AVEVA	WEINTEK, EXOR, AUTOMATIONDIRECT	Rockwell Automation, Schneider Electric, SIEMENS

NOT Competitive to Mainstream Vendors

Diagnostics & Behavioral **"Add on"** to your current Automation & Control Systems - **ERP, MES, SCADA, OEE, HMI**

Arduino Flexibility with Industrial Reliability

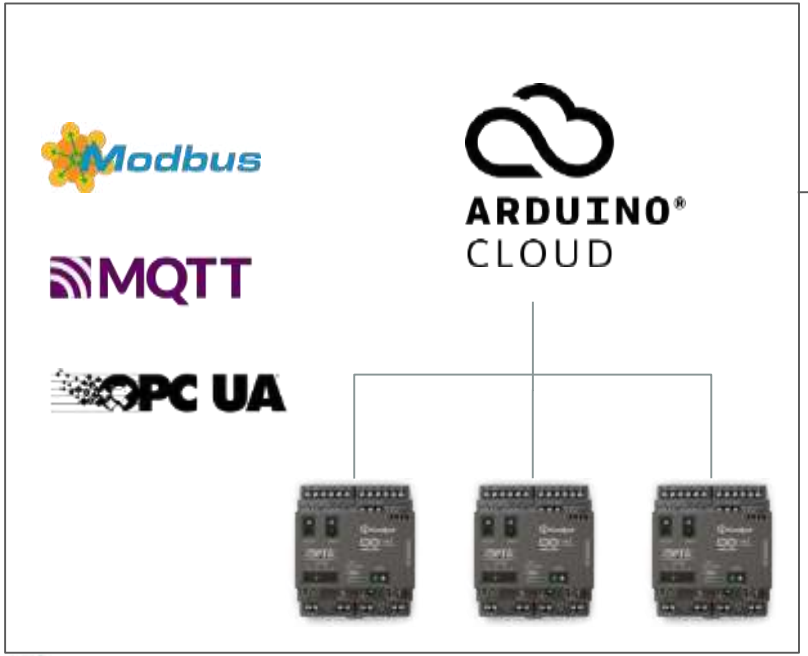
- **Last Mile Connectivity** as a microPLC, Smart I/O Capabilities
- Use **IEC 61131** and/or **Arduino/C++** programming approaches in Industrial
- **Industrial Certifications,** Reliability, Support; built jointly with **Finder**

High Value at the "Right" Price

- **Affordable HW and value-driven** with the software licensing costs included
- Up to **80% less** n deployment costs; and up to **3X Faster** deployments
- **Secure Cloud** connected and **certified**

Integrations out-of-the Box

Start with **out of the box** integrations



Node-RED

IFTTT

IDbox

alexa

aws

zapier

Azure

Arduino PRO: Industrial Turnkey Products Portfolio At A Glance

INDUSTRIAL AUTOMATION

OPTA + Expansions

- LITE
- WiFi
- RS485

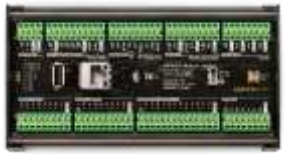
DIGITAL

ANALOG

NEW
Opta Condition Monitoring

Launching in Q4 ‘2025

Portenta
Machine Control



CONNECTIVITY

WisGate Edge Lite
LoRa Indoor Gateway

WisGate Edge Pro
LoRa Outdoor Gateway

Software — Arduino IDE — PLC IDE

Cloud — ARDUINO CLOUD — aws

Opta Family
Industrial Automation

Engineered for the industry

Arduino Opta is a secure, easy-to-use **micro PLC with Industrial IoT features.** Developed with Finder, a leader in industrial automation, it helps professionals scale automation projects using the open Arduino ecosystem. Its computing power supports **real-time control, monitoring** , and **predictive maintenance.**

Opta is quick to deploy with many **software libraries available** , and its **secure element** enables **over-the-air firmware updates** and **remote control** through Arduino Cloud or third-party platforms.

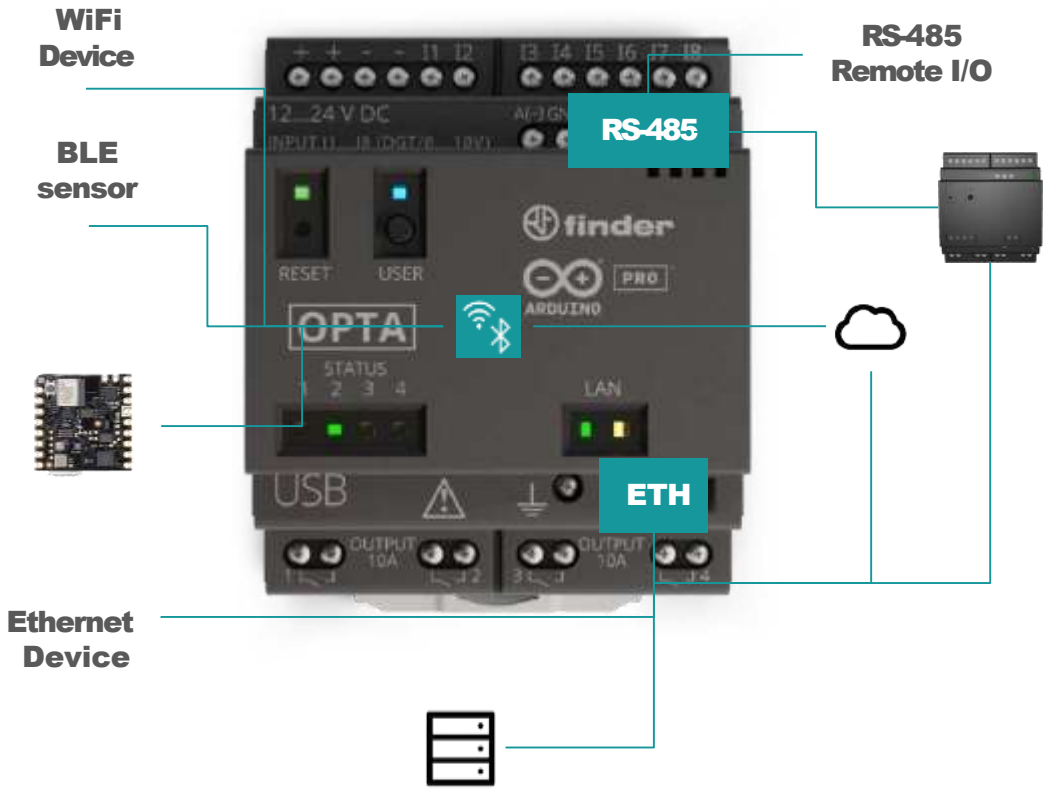
Available in **three variants** :

- **Opta Lite:** Ethernet and USB-C
- **Opta RS485:** Ethernet, USB-C, and RS485
- **Opta WiFi:** Ethernet, USB-C, RS485, and Wi-Fi/Bluetooth® Low Energy

The AUX port allows expansion to meet diverse industrial needs.

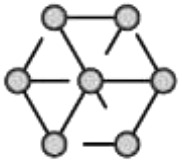
Born connected

- **Ethernet port on all models:**
  - TCP IP communication
  - Modbus TCP
- **RS485 Option:**
  - Modbus RTU Half Duplex
  - Other custom protocols
- Wi-Fi/Bluetooth® Low Energy Option
- Cloud, Arduino or 3rd party Cloud



Data security as a cornerstone

Designed to guarantee data security from the hardware to the cloud and from machine to machine



ARDUINO® CLOUD

Local

- Anti Tampering
- Device Identity
- Encrypted communication
- Secure Bootloader

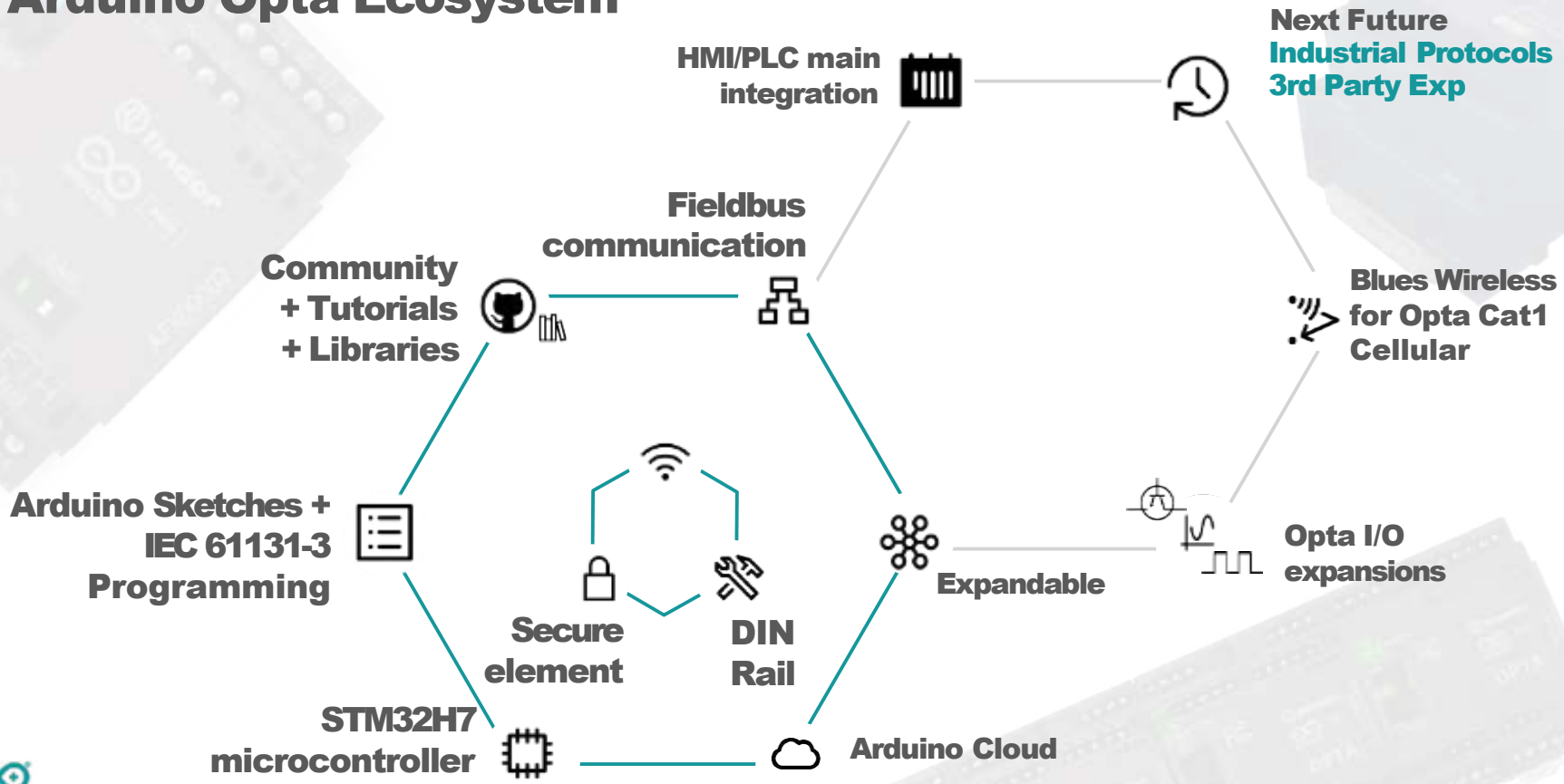
Communication

- Data encryption
- X.509 secure standard compliance

Arduino IoT Cloud

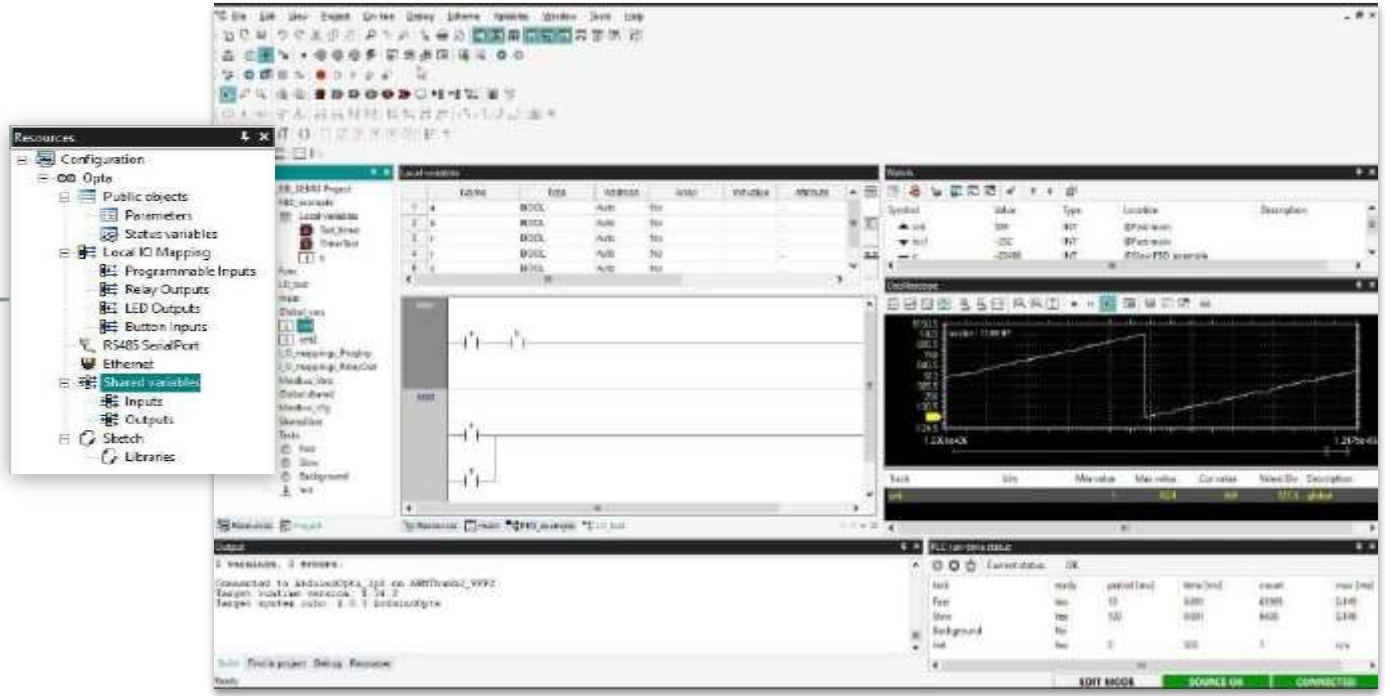
- 2 Factor Authentication
- Secure Firmware Update

Arduino Opta Ecosystem



Arduino PLC IDE + Arduino Sketch: The Secret Sauce

Shared Variables

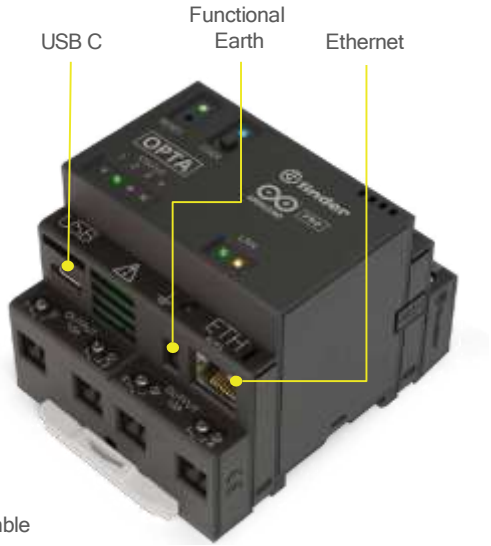


Opta - Comparison of 3 Variants

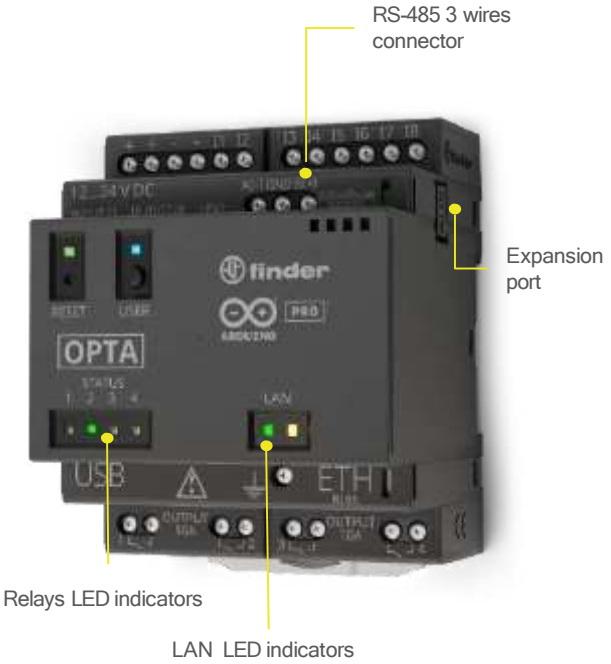
Product Name	Opta WiFi	Opta RS485	Opta Lite
SKUs	AFX00002	AFX00001	AFX00003
Connectivity	• Ethernet • USB-C • RS485 • Wi-Fi • Bluetooth® Low Energy	• Ethernet • USB-C • RS485	• Ethernet • USB-C
Barcode	7630049203457	7630049203167	7630049203549
MSRP	€161 or $193.20	€134 or $160.80	€122 or $146.40

Technical Specs - Opta

Top View



Side Down view



Perspective View

Arduino Pro Opta Expansions

D1608E

16 programmable Voltage inputs,
8 Electromechanical relays 250 VAC 6A

D1608S

16 programmable Voltage inputs,
8 Solid State relays 24 VDC 3A

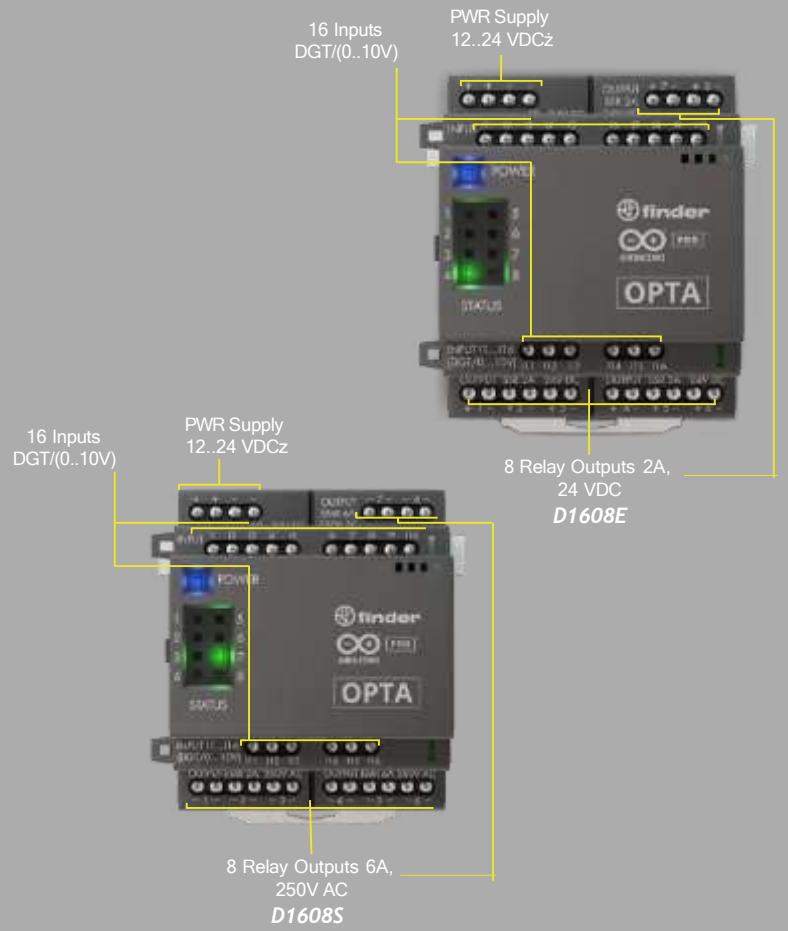
A0602

8 Analog channels:
Input/Output - Voltage/Current/RTD
4 PWM Output

Opta Digital Expansions

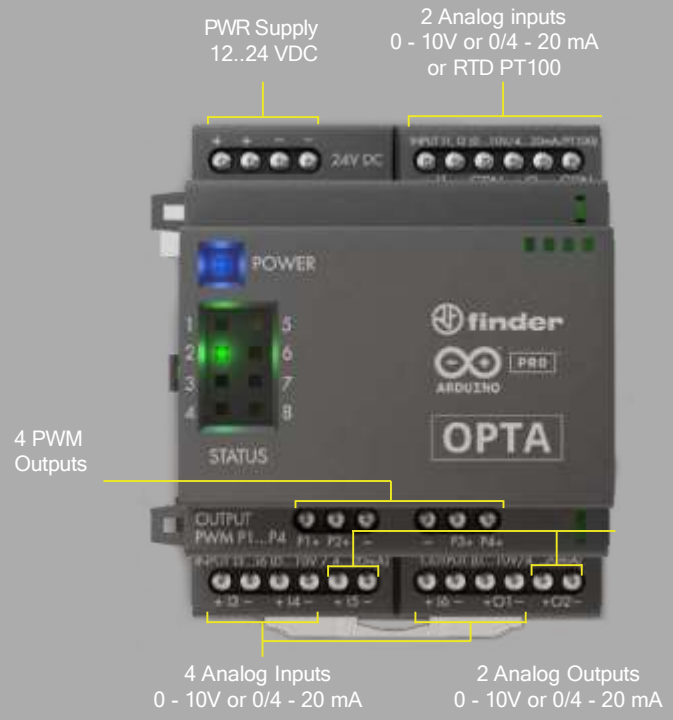
Link to Official Document

- **Flexible Inputs and Outputs:** Each module supports 16 inputs (0-24 VDC digital or 0-10 V analog) and offers a choice between 8 EMR (250 VAC, 6A) or 8 SSR (24 VDC, 2A) outputs.
- **Modular Expandability:** Add up to 5 snap-on modules to mix and multiply I/O configurations seamlessly alongside the Opta Base module.
- **Programming Versatility:** Compatible with Arduino IDE and supports IEC 61131-3 PLC languages (LD, SFC, FBD, ST, IL) for easy programming and integration.
- **Remote Monitoring:** Use Arduino Cloud dashboards for real-time monitoring and secure communication across connected devices.
- **Industrial Reliability:** Certified for industrial use, ensuring reliability and durability in harsh environments.
- **Easy Installation:** Designed for DIN rail mounting, providing quick access and efficient use of space.
- **Wide Temperature Range:** Operates reliably from -20 °C to +50 °C, suitable for varied industrial environments.



Opta Analog Expansion

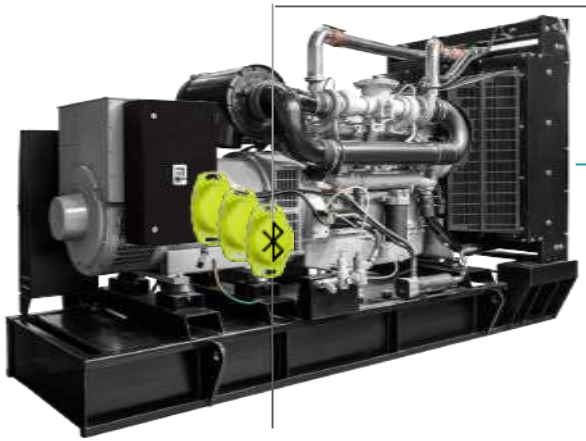
- **Analog Inputs:** 6 inputs programmable for 0-10 V, 0/4-20 mA, or temperature measurement (-25 °C to +400 °C with 3-wire RTD PT100 sensors).
- **Analog Outputs:** 2 configurable outputs delivering 0-10 V or 0/4-20 mA.
- **Digital PWM Outputs:** 4 outputs for flexible digital control.
- **Modular Expandability:** Up to 5 snap-on modules allow seamless expansion and mixing of I/O configurations with Opta Base module.
- **Programming Versatility:** Use Arduino IDE for extensive libraries, tutorials, and easy integration. Also supports PLC IDE for IEC 61131-3 languages with low-code programming and pre-mapped resources.
- **Remote Monitoring and Updates:** Real-time monitoring, firmware OTA updates via Arduino Cloud dashboards, and secure communication across connected devices.
- **Industrial Reliability:** Certified for industrial use with reliable performance and easy DIN rail installation for efficient setup in industrial environments.



Top View

Condition monitoring +business logic add-on

Industrial compressor



TEMP. HUMIDITY VIBRATION

OPTA + ANALOG EXT
Monitoring and Operation

ACTUATION

SPEED CONTROL

HEATING

COOLING

Arduino PRO Cloud
Dashboards
+ Alerts

EFFICIENCY METRICS

ANOMALIES DETECTION

REMOTE ACTUATION

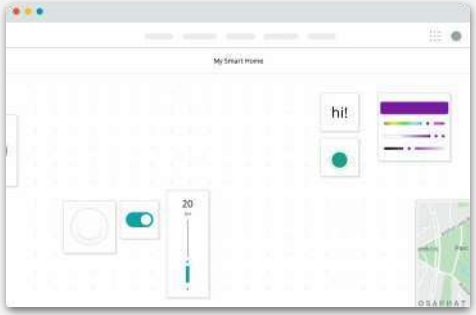
ARDUINO® CLOUD

All-in-one platform to develop, deploy and monitor devices

Cloud Editor

Zero-touch online IDE to develop for Arduino and ESP boards

- Over-the-Air (OTA) FW update
- USB connection



IoT

Device management and monitoring made easy

- CloudCLI
- API
- Clients
- Node-RED

IFTTT alexa zapier

1

Develop from anywhere

- No code
  Ready-to-use Templates
- Low-code
  Automatically generated sketches, AI Assistant
- Full Arduino IDE experience
  Both online and offline

2

Program and Deploy

- Cable
  Traditional USB programming
- Fleet management
  Over-The-Air updates, low-touch device provisioning
- Mass-scale & automation
  Command line → Cloud CLI

3

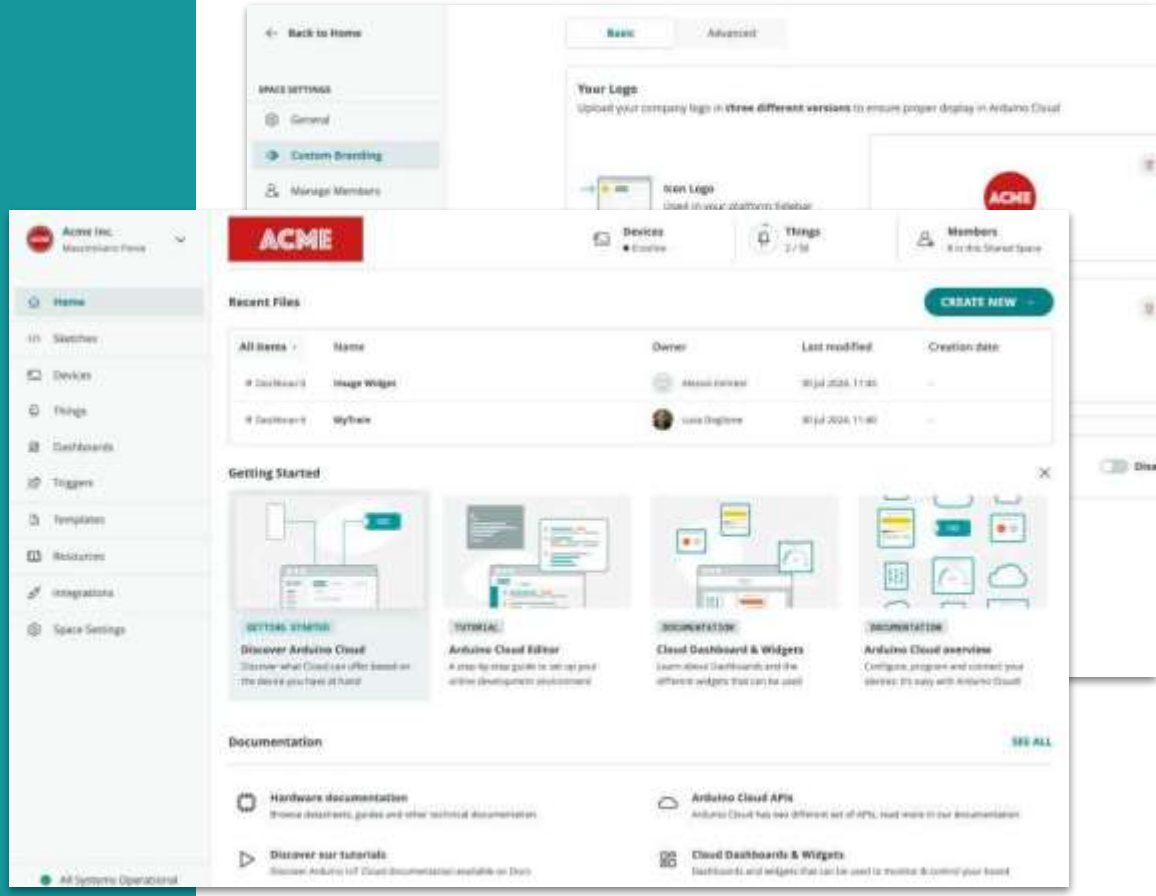
Monitor and Control

- Custom dashboards
  User-friendly dashboard creation
- Insightful widgets
  Real-time and historical data
- Mobile app
  From anywhere at any time

Arduino Cloud Custom Branding

White labeled workspace for enterprise users.

Arduino Cloud experience, tailored to reflect companies brand identity.



ARDUINO® CLOUD

aws

AWS Cloud-to-Cloud Integration

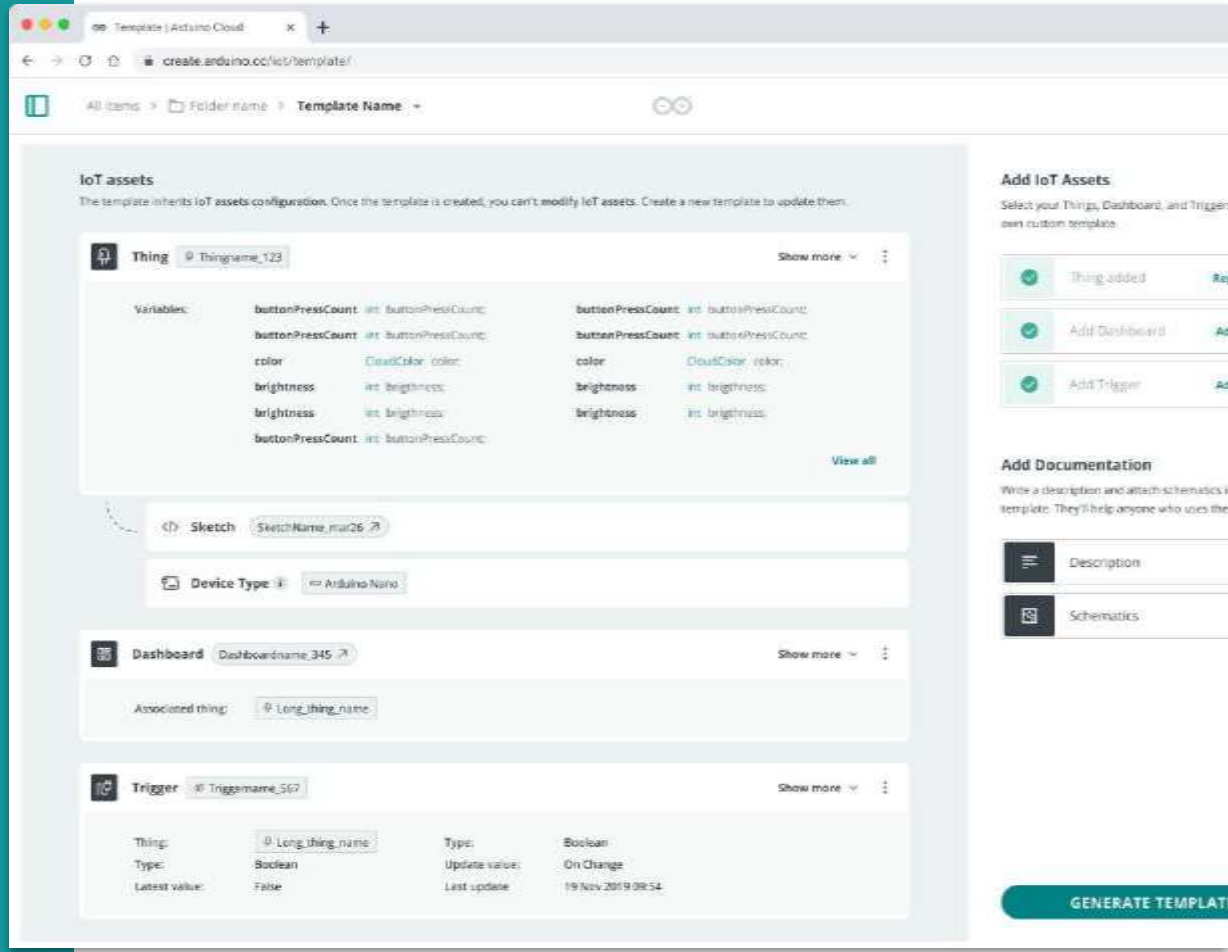
Enhancing data streaming capabilities by incorporating a stronger integration with AWS (data push to S3).

Arduino Cloud
Fleet Management

Custom Templates

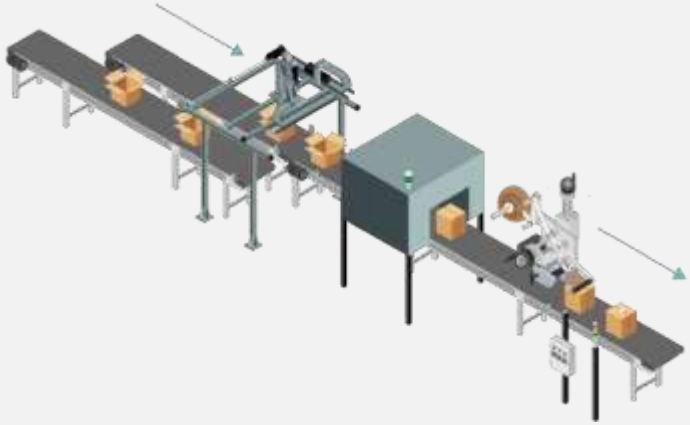
Optimized resource management system (with Folders)

Bulk Actions (coming soon…)



Packaging & Labeling Use Case

Discrete Manufacturing | Hybrid Manufacturing | OEM Retrofit



Opta PLC

Opta Digital Expansions

PLC

ARDUINO CLOUD

How The System Works & Unique Competitive Advantage ?

- Real-time oversight of Packaging and Labeling processes
- Opta's seamless integration with Existing systems
- Cloud connectivity for Remote Access
- Simple IEC-61131 compliant PLC IDE & Cloud Programming interfaces
- Scalable and Modular design with Expansion modules

Impact and Benefits:

- **Enhanced Production Efficiency (OEE)** for automating packaging tasks
- **Improved accuracy and consistency** in precise labeling and packaging
- **Cost savings** due to labor costs and minimizing material waste
- **Remote Troubleshooting and Maintenance** due to Cloud connectivity
- Opta's flexible programming allows **Adaptable and Dynamic workflows**

Target Personas:

Process engineer

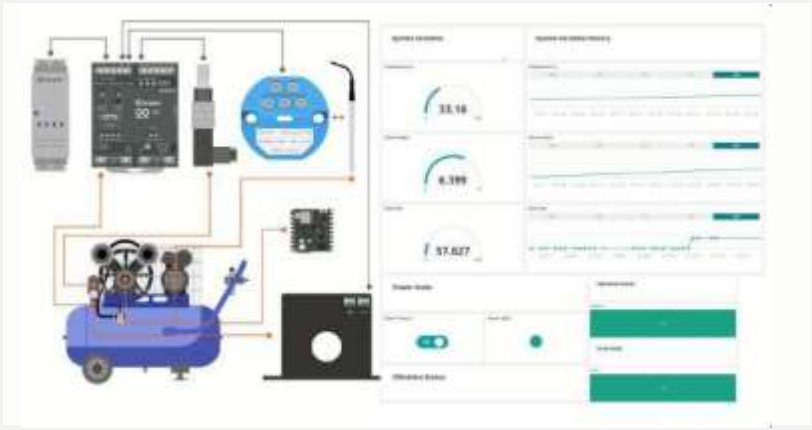
Field technician

Quality Assurance Manager

View full Use Case

Air Compressor Remote Condition Monitoring Use Case

Process Manufacturing | Hybrid Manufacturing | OEM Retrofit



Opta PLC

Nicla Sense ME

Arduino IDE

ARDUINO® CLOUD

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Target Personas:

Automation & Process engineers

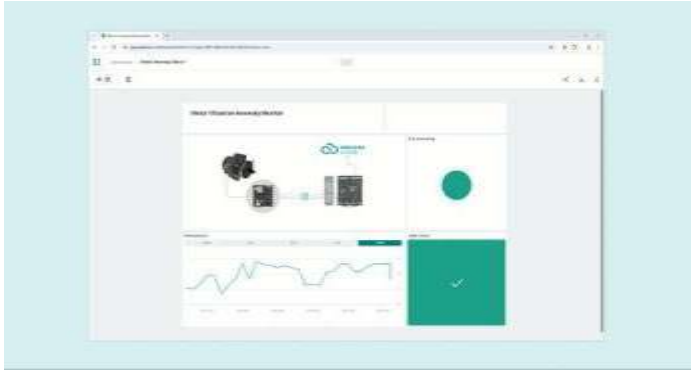
Maintenance technician

Business Leaders

View full Use Case

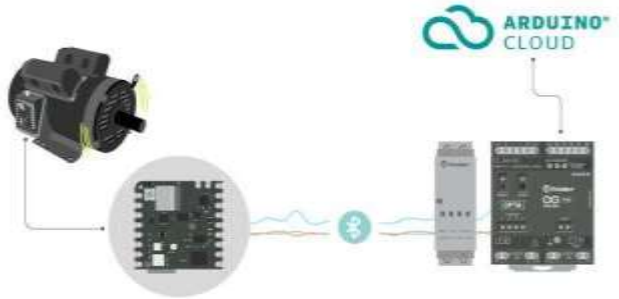
Predictive maintenance

EDGE IMPULSE



Real-time monitoring of motor behavior, made more accessible by connected technologies, enables proactive maintenance and improved operational performance.

- **Early detection** of potential motor issues
- Ensures a seamless, data-driven maintenance workflow
- The solution is scalable and adaptable to a wide range of industrial applications
- **Enhances system** reliability and efficiency
- Aligns seamlessly with the principles of **Industry 4.0** by enabling smart, connected, and data-driven industrial environments



Getting Started with Arduino Opta

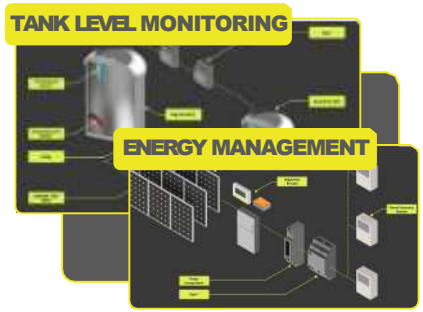
1 Start with Training

Opta Essentials ACE-100

HMI learning ACE-120

2 Industrial-focused Use Cases

docs.arduino.cc/hardware/opta/#tutorials



... and many more

3 Sign Up for Arduino Newsletter

Keep to update on all News & Events

https://www.arduino.cc/pro/

Opta Essentials - ACE-100

This foundational course is designed to introduce Programmable Logic Controller (PLC) programming for industrial automation using the Arduino Opta.

Course Outline:

- Create and configure basic PLC projects using Arduino Opta
- Write and test PLC code
- Work confidently with Arduino Opta hardware and software including Arduino IDE and Arduino PLC IDE
- Implement PLC programs using both Ladder Diagrams and Arduino Sketches
- Leverage Arduino Cloud for IoT and Industry 4.0 applications using the Opta.

SCAN QR CODE TO ENROLL

NEW COURSE ALERT:
ACE-120

Weintek HMI with Opta (ACE-120) Course

Course Outline:

- Understand the role and importance of HMIs in industrial automation
- Install and navigate EasyBuilder Pro software
- Create and configure HMI projects
- Establish communication between Weintek HMI and Arduino Opta
- Design functional HMI displays
- Link HMI elements to Opta parameters
- Test and validate HMI-Opta integration

SCAN QR CODE TO ENROLL

Support

DOCUMENTATION

Getting started, Datasheets libraries and user manuals
docs.arduino.cc

COMMUNITY

Visit forum.arduino.cc to leverage the knowledge of our community of 30M+ users

TRAINING

Do you need some training?
We are here for you:
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SUPPORT

You can always count on our technical support, just reach us out: arduino.cc/en/contact-us

HELP CENTER

Read FAQ and troubleshooting articles from our Support team
support.arduino.cc/hc

TUTORIALS AND EXAMPLES

Learn how to quickly get started with our products on
docs.arduino.cc/

That’s a wrap
Thank you!
Questions?