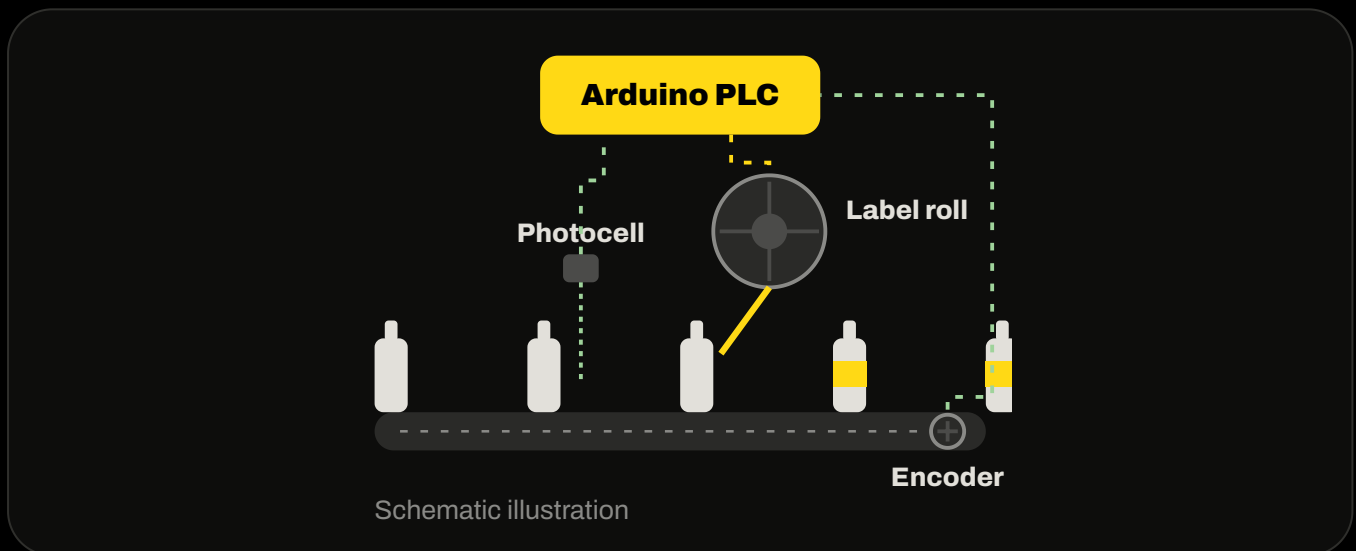


BOTTLE LABELLING · ARDUINO PLC

Label bottles in motion, while the line speed changes.

An encoder, a photocell and two stepper motors on one Arduino based PLC.

[Read the interactive case study online ›](#)


2

stepper motors: label roll and conveyor

2

interrupt inputs read the conveyor encoder

6

digital outputs: pulse, direction and enable for two drivers

1

photocell detects the position of each bottle

THE CHALLENGE

Put a label on a moving bottle. At any speed, with any gap.

The customer listed five requirements: apply labels accurately to bottles in motion, allow a variable conveyor speed, allow an inconsistent distance between bottles, pull the label web through the dispenser, and label smoothly and consistently at all speeds. A fixed time delay is not enough when the speed changes. The label has to follow the real movement of the belt.

01

Bottles in motion

The label goes on while the bottle moves. It has to land in the same place on every bottle.

02

Speed changes at any time

The conveyor can slow down, speed up or stop at any moment. The labelling has to follow it.

03

Irregular gaps

Nobody regulates the spacing between the bottles. The system has to find each bottle on its own.



A heavy label roll

The label web comes from a large roll and goes through the dispensing head. The motor needs enough torque and speed to overcome the friction of the head and the inertia of the roll.

HOW IT WORKS

Two loops: measure the line, then meet each bottle.

Loop 1 · Line speed

The encoder is the reference. Not a timer.

A rotary encoder is mounted on the conveyor. Its two signals go to two interrupt inputs of the PLC, I0.5 and I0.6. Each pulse is a small piece of belt travel. The PLC refers all the speeds and distances of the label roll to this count. When the conveyor slows down, speeds up or stops, the reference changes with it. With interrupts, the PLC does not have to ask the encoder for data all the time.

- Rotary encoder on the conveyor, on interrupt inputs I0.5 and I0.6
- Encoder supplied with 24 V and GND, as in the original diagram
- All speeds and distances of the label roll refer to the encoder

Loop 2 · Label cycle

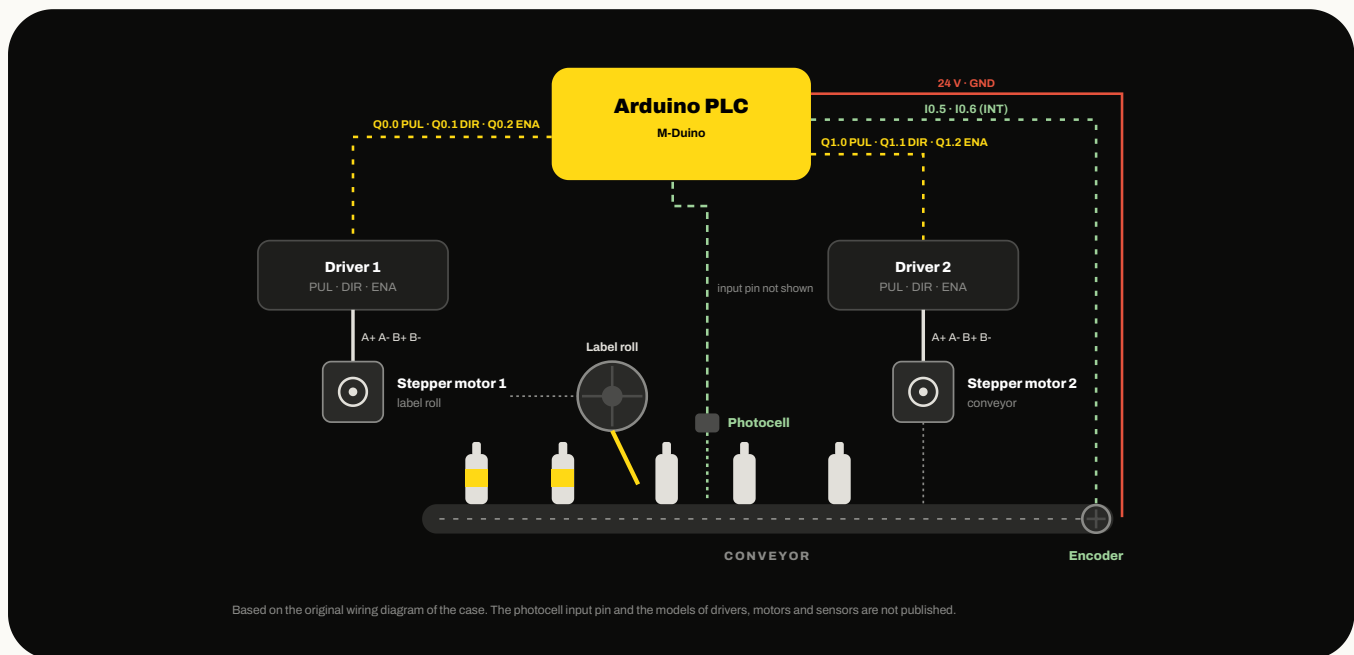
The photocell finds the bottle. The label meets it at line speed.

A photocell detects the position of each bottle before the labelling head. The gaps are not regular, so each bottle starts its own label cycle. The PLC commands the label motor to accelerate to line speed at the moment the first edge of the label touches the bottle. The motor keeps line speed until the full label is on the bottle. Then it slows to a stop and waits for the next bottle.

- Start photocell: position of each bottle at the time of labelling
- Stepper motor 1 pulls the label web from the large roll through the dispenser
- Accelerate, hold line speed, slow down, stop, wait

How does one Arduino PLC synchronise a label roll with a conveyor?

The rotary encoder goes to two interrupt inputs. Three digital outputs drive each stepper driver: pulse, direction and enable. Driver 1 moves the label roll, driver 2 moves the conveyor. The start photocell gives the position of each bottle. This diagram follows the original wiring diagram of the case.



— Sensor signals: encoder and photocell — Digital outputs: PUL, DIR, ENA — Motor phases A+ A- B+ B-
— 24 V supply

Signals

Signal	Between	Type	Purpose
Encoder signals	Rotary encoder → I0.5 and I0.6	Digital inputs with interrupt	Line speed and belt travel, without constant polling
Encoder supply	24 V and GND → rotary encoder	Power	Supplies the encoder, as in the original diagram
Bottle position	Start photocell → PLC	Digital input (pin not shown in the diagram)	Position of each bottle at the time of labelling
Label motor: pulse, direction, enable	Q0.0, Q0.1, Q0.2 → driver 1	Digital outputs	Steps, direction and enable of stepper motor 1 (label roll)
Conveyor motor: pulse, direction, enable	Q1.0, Q1.1, Q1.2 → driver 2	Digital outputs	Steps, direction and enable of stepper motor 2 (conveyor)
Driver returns	PUL-, DIR-, ENA- of both drivers → GND	Common reference	Closes the input circuits of the drivers
Motor phases	Driver → stepper motor	A+, A-, B+, B-	Two phases per motor

One Arduino based PLC on the DIN rail.



M-DUINO ETHERNET PLC ARDUINO 42

An industrial PLC built around an original Arduino Mega 2560. It has the pins of the original diagram: interrupt inputs I0.5 and I0.6, and digital outputs Q0.0 to Q0.2 and Q1.0 to Q1.2. You program it in C++ with the Arduino IDE.

Inputs	26: 12 analog/digital (0-10 V), 14 digital optoisolated (5 to 24 Vdc), 4 with interrupt
Outputs	16: 6 analog/digital/PWM (0-10 V), 10 digital optoisolated (5 to 24 Vdc)
Network and serial	Ethernet 10/100 (RJ45), RS-485, RS-232, I2C, SPI
Built in	Real-time clock, microSD slot
Power supply	12 to 24 Vdc
Mounting	DIN rail TS35, IP20

The case does not publish the exact PLC model. The image and the link show the M-Duino 42+ (reference IS.MDuino.42+), a current model with all the pins of the diagram. The case does not publish the models of the drivers, the motors, the encoder or the photocell. Before you wire a stepper driver, check that its inputs accept the output voltage of the PLC.

[See the M-Duino 42+ ›](#)

Interrupts for the encoder

The encoder uses two interrupt inputs. The PLC does not ask the encoder for data all the time: the pulses come to it.

Three outputs per motor

Each stepper driver takes three digital outputs: pulse, direction and enable. The same PLC drives the label roll and the conveyor.

Speed and distance, not time

The label roll follows the encoder, and each bottle starts from the photocell. The cycle adapts when the speed or the gap changes.

SIMILAR PROJECT?

Tell us your line and your labels. An engineer will answer.

Tell us what you label, how the products arrive, how the line speed changes and which motors and drivers you use. We will tell you how to connect the encoder, the sensor and the drives, and which controller fits.

READ IT ONLINE

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