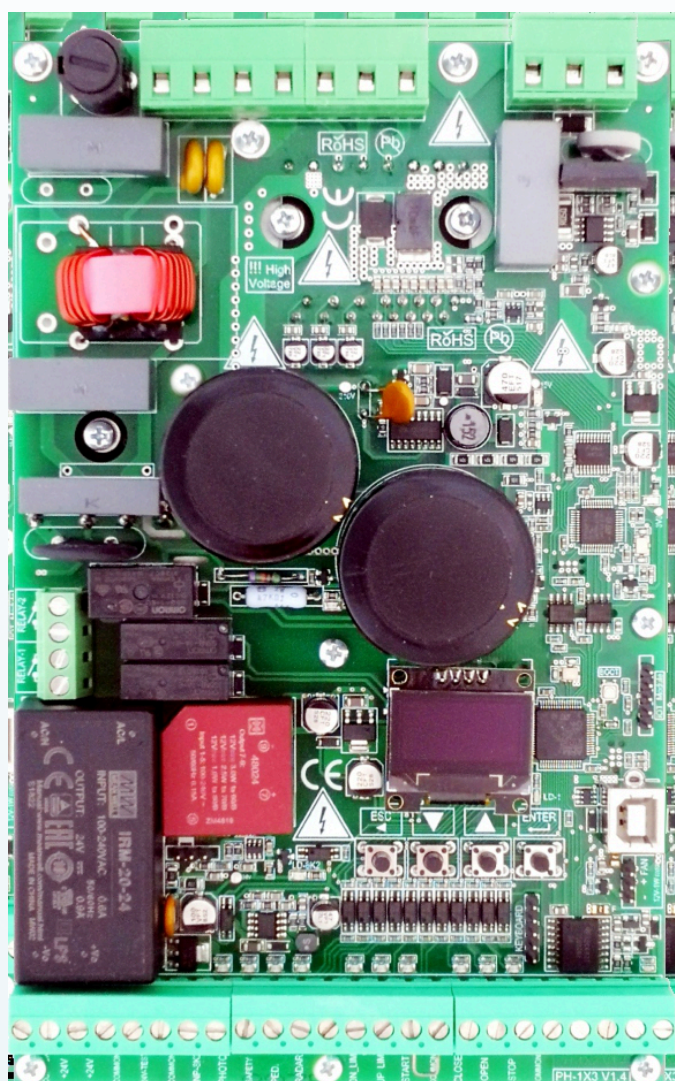


RoHS 2002/95/EC VARIABLE-SPEED DRIVE

PH1x3

Motor Control Inverter

Installation, programming & user-interface manual for the three-phase, single-phase-supplied gate & door drive.



Status display, 4-button interface and 24-way control terminals.

CONTENTS

What's inside

A single reference combining the wiring & installation guidance with the on-screen programming and user-interface menus.

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HOW TO USE THIS MANUAL

Sections 1–3 cover safety and compliance — read them before powering the drive. Sections 4–11 explain the display and every menu option. Sections 12–19 show the field wiring, terminal by terminal.

01 SAFETY & COMPLIANCE

Important safety information

Read this section, and every Warning and Danger notice in this manual, before installing or operating the drive.



DANGER — ELECTRIC SHOCK

Risk of electric shock that, if not avoided, could result in equipment damage and possible injury or death.



DANGER — MECHANICAL / PROPERTY

A potentially hazardous situation other than electrical that, if not avoided, could result in damage to property.

- ◆ This variable-speed drive is intended for professional incorporation into complete equipment or systems as part of a fixed installation. If installed incorrectly it may present a safety hazard. It uses high voltages and currents, stores a high level of electrical energy, and controls mechanical plant that may cause injury.
- ◆ System design, installation, commissioning and maintenance must be carried out only by personnel with the necessary training and experience, who have read this safety information and follow all instructions regarding transport, storage, installation and use, including the specified environmental limits.
- ◆ Do not perform any flash test or voltage-withstand test on the drive. Any electrical measurements should be made with the device disconnected.
- ◆ Electric-shock hazard. Disconnect and **ISOLATE** the drive before any work. High voltages are present at the terminals and inside the drive for up to 10 minutes after disconnection. Always confirm with a suitable multimeter that no voltage is present on any power terminal before starting.
- ◆ Where the supply is through a plug-and-socket connector, do not disconnect until 10 minutes have elapsed after switching off the supply.
- ◆ Ensure correct earthing and cable selection per local codes. Leakage current may exceed 3.5 mA; the earth cable must carry the maximum supply fault current. Fit suitably rated fuses or an MCB in the mains supply.
- ◆ Do not work on the drive control cables while power is applied to the drive or to the external control circuits.
- ◆ Within the EU, machinery using this product must comply with Directive 2006/42/EC. The machine manufacturer must provide a main switch and ensure the electrical equipment complies with EN 60204-1.
- ◆ The integrity of the control inputs (stop/start, direction, max speed) is not sufficient for safety-critical use without independent protection. Applications where malfunction could cause injury must be risk-assessed and given further protection.
- ◆ The driven motor can start at power-up if the enable input signal is present.
- ◆ The STOP function does not remove lethal voltages. ISOLATE the drive and wait 10 minutes before any work on the drive, motor or motor cable.
- ◆ The drive can run the motor above or below mains speed. Confirm with the motor and machine manufacturers that operation over the intended speed range is acceptable before start-up.
- ◆ Do not activate automatic fault-reset where this could create a dangerous situation. This device is for indoor use only.
- ◆ When mounting, provide sufficient cooling. Do not drill with the drive in place — dust and swarf may cause damage. Prevent entry of conductive or flammable bodies; keep flammable material away. Relative humidity must be below 95% (non-condensing).
- ◆ Ensure supply voltage, frequency and single-phase input match the device rating. Never connect mains to output terminals U, V, W. Do not install switchgear between drive and motor.
- ◆ Keep control cabling at least 100 mm from power cabling and cross at 90°. Tighten all terminals to the correct torque. Do not attempt any repair — contact your sales partner.

Foreword, environment & safety precautions

Foreword

This manual provides the information you need to familiarise yourself with and correctly operate your unit. Read it carefully on purchase and consult it whenever you have doubts about use, and before any maintenance.

Environmental protection

Within the EU, Directive 2002/96/EC requires that units bearing the crossed-out bin symbol be disposed of separately from household waste. The owner is responsible for disposal through the appropriate collection facilities. Correct disposal and recycling help prevent negative effects on the environment and human health.



Safety precautions

Installations of gates and automatic doors must be carried out by qualified personnel according to the applicable norms. Before installing, check the strength and mechanics of the gate or door and verify that the mechanical stops can halt the cycle immediately — even with faulty limit switches or during a manual cycle.

For safety, install a STOP switch that immediately stops the gate when activated. The switch must have a **N.C.** contact that opens when actuated.

Symbols & warnings



DANGEROUS

A warning which, if not respected, can lead to material damage.



DEVICE UNDER VOLTAGE

Installation must be carried out only by professional installers.



READ THE MANUAL

Read this manual before installation and keep it for future use.

Noise considerations for CE

The inverter generates high-frequency noise; account for it when designing the control panel. Recommended measures:

- ◆ Separately bundle the wires to the main-circuit power terminals and to the motor terminals.
- ◆ Keep main-circuit and control-circuit wiring apart — not in the same conduit, not parallel, not bundled.
- ◆ Provide shielding and twisted wire for control-circuit wiring.
- ◆ Separate the input (power) and output (motor) wires of the main circuit.
- ◆ Ground the inverter ground terminals.
- ◆ Fit a surge suppressor on any contactor or relay coil used near the inverter.
- ◆ Install noise filters and use shielded wires.

Electromagnetic compatibility



DESIGNED FOR EMC

All versions for single-phase 230 V supplies intended for use in the EU must be connected through a suitable external EMC filter, selected to reduce conducted emissions back into the supply via the power cables for compliance with the harmonised European standards.

It is the installer's responsibility to ensure the equipment or system into which the product is incorporated complies with the EMC legislation of the country of use. Within the EU it must comply with EMC Directive 2004/108/EC; with a suitable external filter, the categories defined by EN 61800-3:2004 can be achieved.

NOTE

EMC compliance depends on the installation environment, motor switching frequency, motor and cable lengths, external EMC filters and installation methods.

Compliance with the EMC directives is achieved with the factory-default parameter settings.



RESPONSIBILITY & INSTALLATION

The manufacturer cannot assume responsibility for compliance (or non-compliance) with any national or local code regarding installation of this drive or associated equipment. A hazard of personal injury and/or equipment damage exists if safety measures are ignored during installation.



STORED ENERGY — WAIT 10 MINUTES

This device contains high-voltage capacitors that take time to discharge after the supply is removed. Before working on the drive, isolate the supply from the line inputs and wait ten (10) minutes for the capacitors to discharge to safe levels. Failure to observe this could result in severe injury or loss of life.



QUALIFIED PERSONNEL ONLY

Only qualified personnel familiar with the construction and operation of this equipment, and the hazards involved, should install, adjust, operate or service it. Read and understand this manual and other applicable manuals in full before proceeding.

04 USER INTERFACE

Status display & the 4-button interface

At power-on the display shows the firmware version for a few seconds, then switches to the status screen and arms the power relay.

Motor speed Hz

Output frequency to the motor.

Motor direction

Arrow shows opening (▲) or closing (▼).

Motor current A

Live motor current draw.

50Hz

40%

1.1A – 289V

33C

Door opening %

Position as a percentage of full travel.

Capacitor voltage V

DC-bus voltage at the capacitors.

Module temperature °C

Power-module temperature.

ESC DOWN UP ENTER

Status screen — shown after boot. Example reading: 50 Hz, 40% open, 1.1 A, 289 V, 33 °C.

The four buttons

- ESC** ◀ Step back / cancel an edit.
- ▼ DOWN** Previous item / decrease value.
- ▲ UP** Next item / increase value.
- ENTER** ↵ Open list / edit / store.

Firmware & screensaver

During boot, and for a few seconds, the firmware version is displayed.

The display enters a screensaver after **2 minutes** of menu inactivity; press any button to wake it.

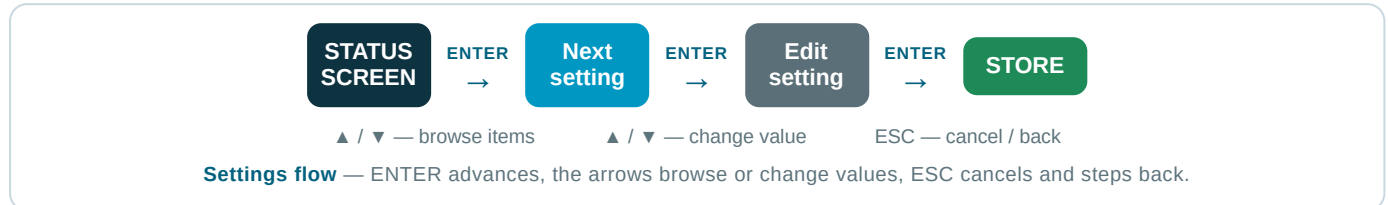
05 USER INTERFACE

Navigating settings & factory reset

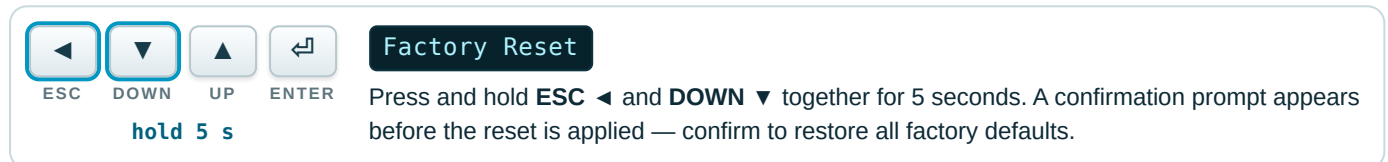
From the status screen, ENTER opens the settings list; the same button edits and stores each value.

Viewing & editing a setting

Press ENTER on the status screen to open the list. Use ▲ / ▼ to find an item, ENTER to edit, then ENTER to store — or ESC to cancel.



Factory reset



TWO PROTECTED MENUS

Beyond the standard list, the **Installer** settings (section 10) and the **Advanced** settings (section 11) hold the commissioning and behaviour parameters. The Advanced menu is opened by holding **ESC** ◀ + **UP** ▲ for 5 seconds. Each menu can be protected with its own password.

06 COMMISSIONING

Quick setup — Kostal encoder

Recommended positioning method. Set the mode, check motor direction, then teach the calibration and the four positions.

4.1 Positioning Mode **set: Kostal**
Open **Positioning Mode** with ▲ / ▼ and set it to **Kostal Encoder**.

4.2 Manual Move **Manual Move**
Jog the motor with the buttons and confirm the direction is correct.

- If the motor does not move or draws too much current, check the mechanical brake.
- If it runs in the opposite direction, switch off power and swap two motor phases.

4.3 Positioning Calibrate **Positioning Calibrate**
Drive the gate until it touches the slow-close limit switch; when the message appears, press **ENTER** ↵.

4.4 Positioning Set Low **Positioning Set Low**
Move the gate to the fully-closed position and press **ENTER** ↵.

4.5 Positioning Set High **Positioning Set High**
Move the gate to the fully-open position and press **ENTER** ↵.

4.6 Positioning Set Pedestrian **Positioning Set Pedestrian**
Move the gate to the pedestrian position and press **ENTER** ↵.

4.7 Operate & verify
Operate with the OPEN and CLOSE (or START) inputs.
If the motor does not move, check the N.C. STOP input.
If it opens but will not close, check the N.C. PHOTO input.

07 COMMISSIONING

Limit switches at the slow-speed positions

Use when slow-speed limit switches set the deceleration points. Teach calibration and positions as below.

5.0 Positioning Mode **set: Slow Limit**
Open **Positioning Mode** with ▲ / ▼ and set it to **Slow Limits**.

5.1 Manual Move **Manual Move**
Jog the motor and confirm the direction. Move the gate to the middle of its normal travel.

- If the motor does not move or draws too much current, check the mechanical brake.
- If it runs in the opposite direction, switch off power and swap two motor phases.

5.2 Positioning Calibrate **Positioning Calibrate**
Drive the gate until it touches the slow-close limit switch; when the message appears, press **ENTER** ↵.

5.3 Positioning Set Low **Positioning Set Low**
Move the gate to the closed position and press **ENTER** ↵.

5.4 Positioning Set High **Positioning Set High**
Move the gate to the open position and press **ENTER** ↵.

5.5 Positioning Set Pedestrian **Positioning Set Pedestrian**
Move the gate to the pedestrian position and press **ENTER** ↵.

5.6 Operate & verify
Operate with the OPEN and CLOSE (or START) inputs.
If the motor does not move, check the N.C. STOP input.
If it opens but will not close, check the N.C. PHOTO input.

08 COMMISSIONING

Limit switches at the final positions

Use when mechanical end limit switches define the travel. A short calibration move teaches the system.

- 6.0 Positioning Mode** **set: Final Limit**
Open **Positioning Mode** with ▲ / ▼ and set it to **Final Limits**.

- 6.1 Manual Move** **Manual Move**
Jog the motor and confirm the direction is correct.
- If the motor does not move or draws too much current, check the mechanical brake.
 - If it runs in the opposite direction, switch off power and swap two motor phases.

- 6.2 Positioning Calibrate** **Positioning Calibrate**
Move the gate a few centimetres towards open; a new message appears to confirm calibration.
- If the motor does not move or draws too much current, check the mechanical brake.
 - If it runs in the opposite direction, switch off power and swap two motor phases.

- 6.3 Set pedestrian, operate & verify** **Positioning Set Pedestrian**
Move the gate to the pedestrian position and press **ENTER** ↵.
Operate with the OPEN and CLOSE (or START) inputs.
If the motor does not move, check the N.C. STOP input.
If it opens but will not close, check the N.C. PHOTO input.



MECHANICAL LIMITS

With mechanical end limit switches, if both the OPEN and CLOSE switches are seen active at once the drive raises a **Positions Limits** error. Check the switch wiring and that the gate cannot overrun its stops.

09 DIAGNOSTICS

Error messages

When the drive detects a fault it shows the message below and stops the motor. Clear the cause, then power-cycle if required.

Message	Cause	What to do
AC Failure	Power-supply failure on the AC input while the motor was opening.	Ensure AC voltage is present at the power input.
Position Cable	Encoder or limit-switch cable problem; it may run too close to power/motor cables.	Re-route the cable; for encoders use a shielded, twisted cable.
Control Error	Communication error between the motor controller and the user interface.	Cycle power; if it persists, return the unit to your supplier.
Motor Stall	(Encoder mode) the motor stopped or ran in the opposite direction.	Check the brake releases the motor and that it is not overloaded.
Overheat	The unit overheated — only Manual Movements are allowed until it cools.	Improve ventilation; let it cool, or review the Overheat limit.
Critical Temp	Severe overheat above 100°C — no motor operation until it cools.	Check the thermal paste / radiator; normal protection did not hold.
Safety Time	The motor ran too long without changing direction.	Check limit switches; review the Safety Time setting.
Positions Limits	Abnormal positioning. Mechanical: both limit switches active. Encoder: gate moved too far beyond the set limits.	Check limit switches and that the encoder cable is shielded & separated.
Positions Cal.	Motor operation was attempted without a positioning setup.	Run the positioning calibration (sections 6–8).
General Error	Unknown error.	Cycle power; if it persists, return the unit to your supplier.



RECOVERING FROM A FAULT

Most faults clear once the cause is removed. Thermal faults need the unit to cool before motor operation resumes. If **Control Error** or **General Error** persist after a power cycle, return the unit to your supplier.

10 PROGRAMMING

Installer settings

Commissioning parameters: speeds, slow-down ranges, the positioning method and its calibration, plus the installer password.

8.1 Language

Sets the on-screen menu language.

English Italian **default English**

8.2 Open Speed

Motor speed while opening.

10–120 Hz **default 50 Hz**

8.3 Slow Open Speed

Speed during the final part of opening, before stopping.

10–120 Hz **default 20 Hz**

8.4 Slow Open Range

Share of travel run slowly while approaching the open position.

0–30 % **default 15 %**

8.5 Close Speed

Motor speed while closing.

10–120 Hz **default 40 Hz**

8.6 Slow Close Speed

Speed during the final part of closing, before stopping.

10–120 Hz **default 20 Hz**

8.7 Slow Close Range

Share of travel run slowly while approaching the close position.

0–30 % **default 15 %**

8.8 Manual Move

Jog the motor ignoring all inputs and protections. Use ▲ / ▼.

action

8.9 Positioning Mode

Choose how travel is measured.

Kostal Slow limits Position limits **default Kostal**

8.10 Positioning Calibrate

Calibrate the chosen method; hold ▲/▼ until the success message, then ENTER.

action

8.11 Positioning Set Low

Store the closed position (▲/▼, then ENTER).

action

8.12 Positioning Set High

Store the open position (▲/▼, then ENTER).

action

8.13 Positioning Set Pedestrian

Store the pedestrian position (▲/▼, then ENTER).

action

8.14 Installer Password

Protects this menu. Set 0000 to disable.

0000–9999 **default 0**

11 PROGRAMMING

Advanced settings

Open by holding ESC ◀ + UP ▲ for 5 s. Ramps, auto-close timing, lamp behaviour and photocell handling
 (1 of 2).

9.1 Acceleration

Ramp-up rate.

10–240 Hz/s default 80 Hz/s

9.2 Deceleration

Ramp-down rate.

10–240 Hz/s default 80 Hz/s

9.3 Auto Close

Delay before auto-closing after opening. Only after START / RADAR / OPEN with auto-close; cancelled by STOP.

Disabled, 0–60 s default 5 s

9.4 Auto Close Pedestrian

Auto-close delay after a pedestrian opening.

Disabled, 0–60 s default 5 s

9.5 Auto Close Photocell

Auto-close delay after the photocell is triggered while open.

Disabled, 1–60 s default 2 s

9.6 Safety Time

Maximum continuous-movement time before stopping.

Disabled, 1–60 s default 10 s

9.7 Motor Boost

Torque boost below 50/60 Hz — helps lift a heavy door from standstill.

0–30 % default 15 %

9.8 Reversing

Speed used to reverse to open while closing. Ignored if ≥ Open Speed.

10–120 Hz default 50 Hz

9.9 Lamp Preflash Open

Lamp-on time before opening from a stop.

1–60 s default Disabled

9.10 Lamp Preflash Close

Lamp-on time before closing from a stop.

Disabled, 1–60 s default Disabled

9.11 Lamp Mode

Output lamp behaviour.

On Semaphore

9.12 Photocell Mode

Photocell operating mode.

With test Without test Disable

11 PROGRAMMING

Advanced settings

Input modes, UPS behaviour, manual speed and the advanced password (2 of 2).

9.13 Photocell Exclusion

Position beyond which the photocell is ignored.

Disabled, 1–75 %

9.14 Start Mode

Behaviour of the START input.

Only open Step-by-step

9.15 Stop Mode

Behaviour of the STOP input.

Enable Disable

9.16 Open Mode

Behaviour of the OPEN input.

Full open Push to open Slow open

9.17 Close Mode

Behaviour of the CLOSE input.

Full close Push to close Slow close

9.18 Safety Input Mode

Behaviour of the SAFETY input.

Allow OPEN Total STOP

9.19 UPS Act ON

Action when AC power is lost.

No action Open

9.20 UPS Act OFF

Action when AC power returns.

No action Close

9.21 UPS Mode Speed

Motor speed while UPS mode is active.

5–50 Hz

9.22 Manual Mode Speed

Motor speed in manual-movement mode.

10–50 Hz

9.23 Slow Close From Top

Start slowly when closing from the top.

Enable Disable

9.24 Advanced Password

Protects this menu. Set 0000 to disable.

0000–9999


CHANGE WITH CARE

Advanced parameters affect how the drive responds to commands and safety devices. Verify each change with a full open/close cycle before leaving the installation. A Factory Reset restores every value in this menu.

12 FIELD WIRING

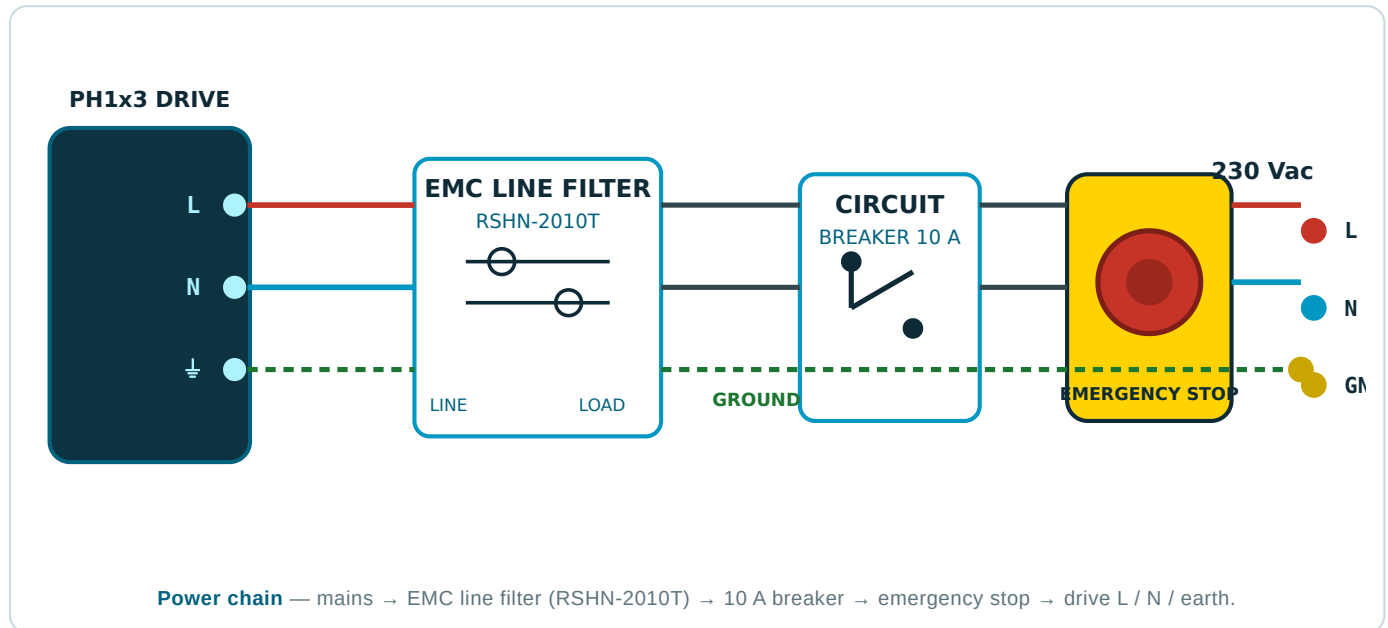
Power connection

Single-phase 230 Vac supply through an external EMC filter and a circuit breaker, with an emergency-stop in line.



REQUIRED AT THE SUPPLY

Install a **10 A circuit breaker** and an appropriate **EMC network filter** for CE compliance. Check the mains: **230 Vac, -5% / +10%**.



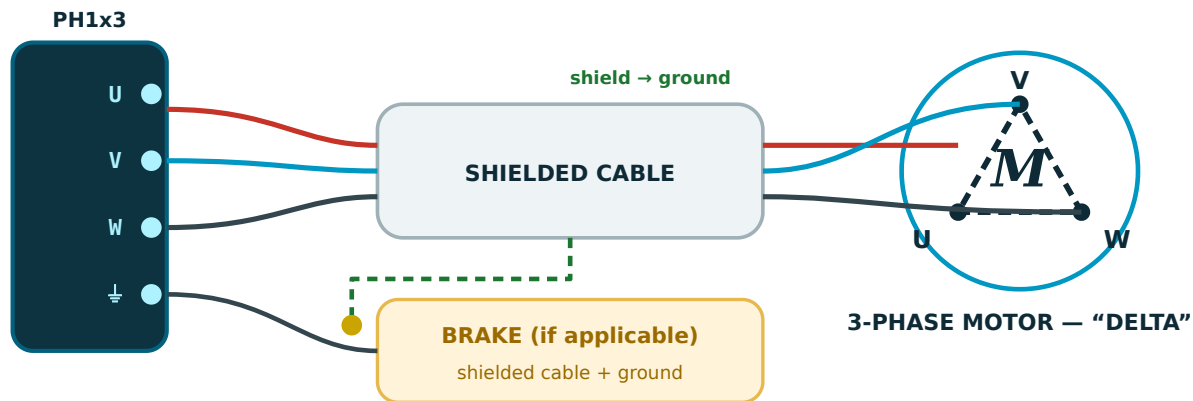
CONNECT ACCESSORIES DE-ENERGISED

The safety devices, motor, brake and all accessories must be installed while the control unit is **not powered**. Isolate the supply and wait 10 minutes before wiring.

13 FIELD WIRING

Motor, brake & lamp connection

Three-phase motor in delta, with shielded cable; optional brake; warning lamp via the N.O. relay contact.



Motor & brake — U / V / W to the motor in "delta". Use a shielded cable with the screen earthed; fit an output filter for CE. Wire the brake (if used) with a shielded cable.



Lamp — the warning lamp is switched by **Relay 2 (N.O. contact)**; feed it from a fused supply.

Notes

- ◆ Never connect the mains supply to output terminals **U, V, W**.
- ◆ Do not fit any switchgear between the drive and the motor.
- ◆ Use shielded motor cable and an output filter to meet CE noise limits; earth the shield at the drive.
- ◆ The brake output and lamp circuit each need their own protection.

14 FIELD WIRING

Terminal layout & control inputs

The 24-way control connector. Colours group the terminals: power/common, +24 V outputs, inputs and encoder.

■ Power / Common
 ■ +24 V output
 ■ Input
 ■ Encoder

1	COMMON
2	OUT +24 VDC / 500 mA
3	OUT +24 VDC / 500 mA
4	COMMON
5	+24 VDC / Photo-Test
6	COMMON
7	INPUT 8K2
8	PHOTO-CELL N.C.
9	SAFETY - COSTA N.C.
10	PEDESTRIAN N.O.
11	MAGNETIC LOOP N.O.
12	COMMON
13	LIMIT - CLOSE N.C.
14	LIMIT - OPEN N.C.
15	START N.O.
16	COMMON
17	CLOSE N.O.
18	OPEN N.O.
19	STOP N.C.
20	COMMON
21	COMMON
22	A_ENC
23	B_ENC
24	+12V OUT to ENCODER

Terminal groups

- 1–6, 12, 16, 20 COMMON (0 V) reference for the inputs.
- 2, 3 +24 Vdc / 500 mA accessory supply.
- 5 +24 Vdc switched output for photocell self-test.
- 7 8K2 resistive safety-edge input.
- 8, 9 Photocell & COSTA safety edge (N.C.).
- 10, 11 Pedestrian & magnetic-loop (N.O.).
- 13, 14 Close / Open limit switches (N.C.).
- 15, 17, 18, 19 Start, Close, Open (N.O.) & Stop (N.C.).
- 21–24 Encoder: COMMON, A, B, +12 V.



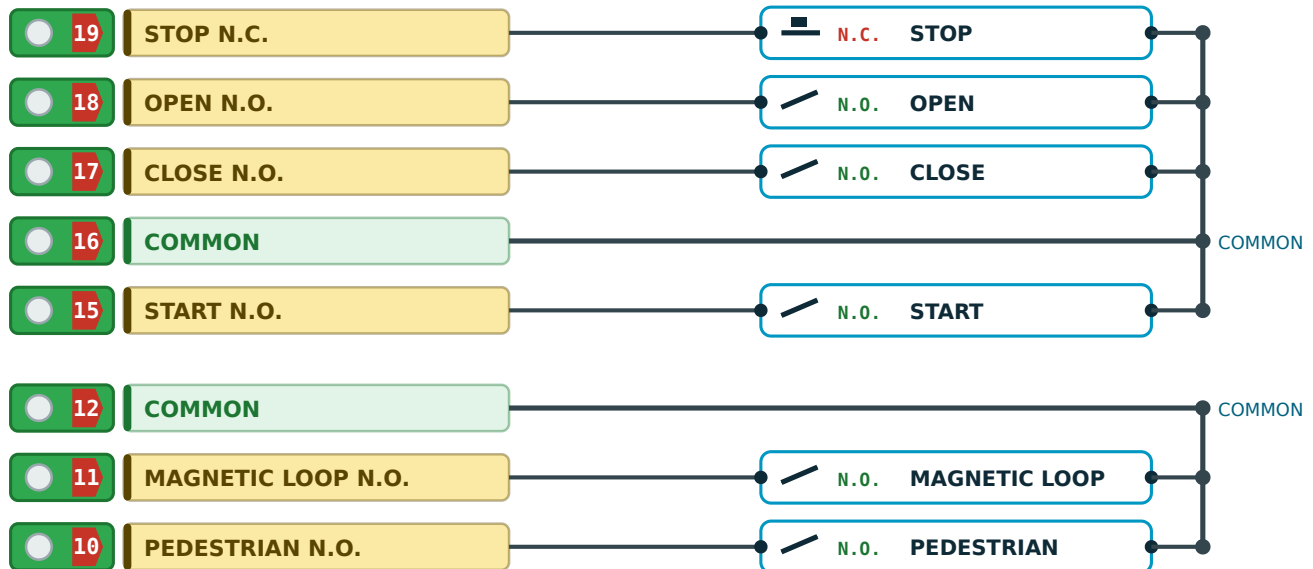
COMMON & +24 V

N.O./N.C. command and safety contacts connect between their terminal and a **COMMON**. Accessories draw +24 Vdc from terminals 2/3 (max 500 mA total).

15 FIELD WIRING

Command inputs wiring

Push-buttons and detectors. STOP is normally-closed (N.C.); OPEN, CLOSE, START, magnetic-loop and pedestrian are normally-open (N.O.).



Command inputs — each contact connects between its terminal and a COMMON. STOP (19) is N.C.; OPEN (18), CLOSE (17), START (15), MAGNETIC LOOP (11) and PEDESTRIAN (10) are N.O.

Contacts

- ◆ **STOP – N.C. (19):** opening this contact stops the gate immediately.
- ◆ **OPEN / CLOSE – N.O. (18 / 17):** direct open and close commands.
- ◆ **START – N.O. (15):** step-by-step or open-only, per **Start Mode**.

Detectors

- ◆ **MAGNETIC LOOP – N.O. (11):** vehicle-loop input.
- ◆ **PEDESTRIAN – N.O. (10):** opens to the pedestrian position.
- ◆ Return every contact to a **COMMON** (12 or 16).

16 FIELD WIRING

Limit switch & safety-device wiring

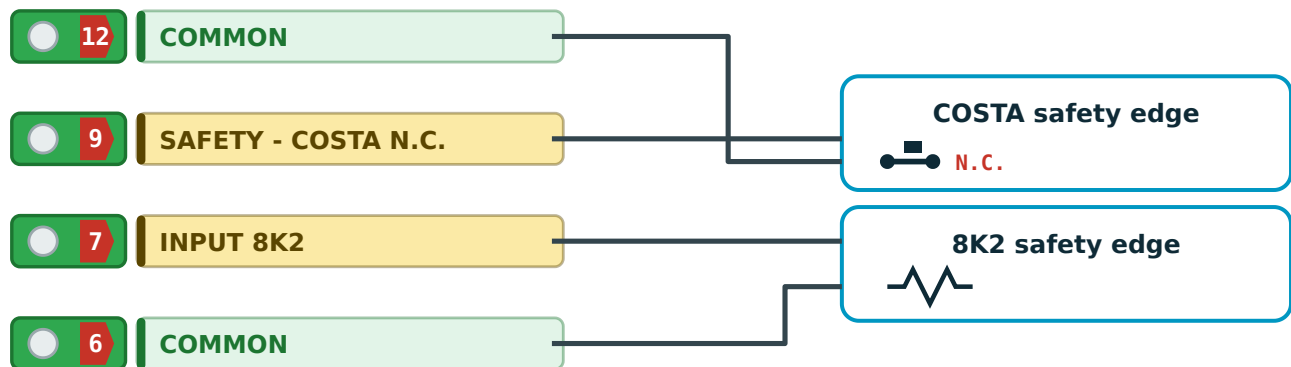
End limit switches and the two safety-edge options. All limit and safety contacts are normally-closed (N.C.) or resistive.

Limit switches



Limit switches — LIMIT-OPEN (14) and LIMIT-CLOSE (13) are N.C. contacts returned to COMMON (12).

Safety devices



Safety edges — a COSTA edge wires as N.C. to SAFETY-COSTA (9)/COMMON (12); an 8K2 resistive edge wires to INPUT 8K2 (7)/COMMON (6).



KEEP THE SAFETY CHAIN HEALTHY

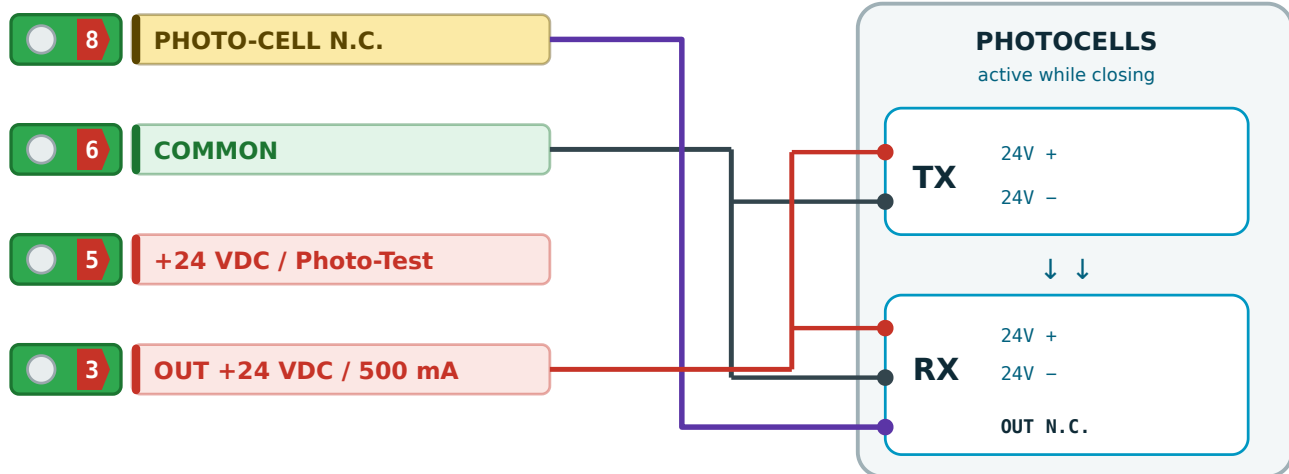
A break in any N.C. safety or limit contact stops the gate. If both limit switches read active together the drive raises a **Positions Limits** error.

17 FIELD WIRING

Photocell connection — with / without test

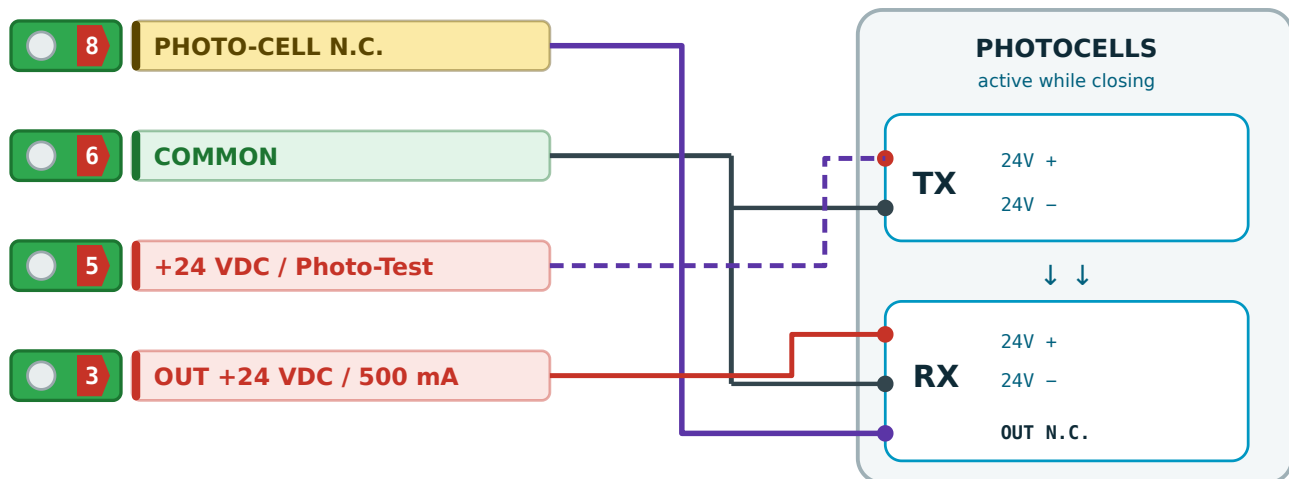
Photocells acting while closing. Choose continuous power (no test) or switched power so the drive can verify the beam before each move.

Without test



No test — TX and RX are powered continuously from +24 V (3) and COMMON (6); the RX N.C. output goes to PHOTO-CELL (8).

With test

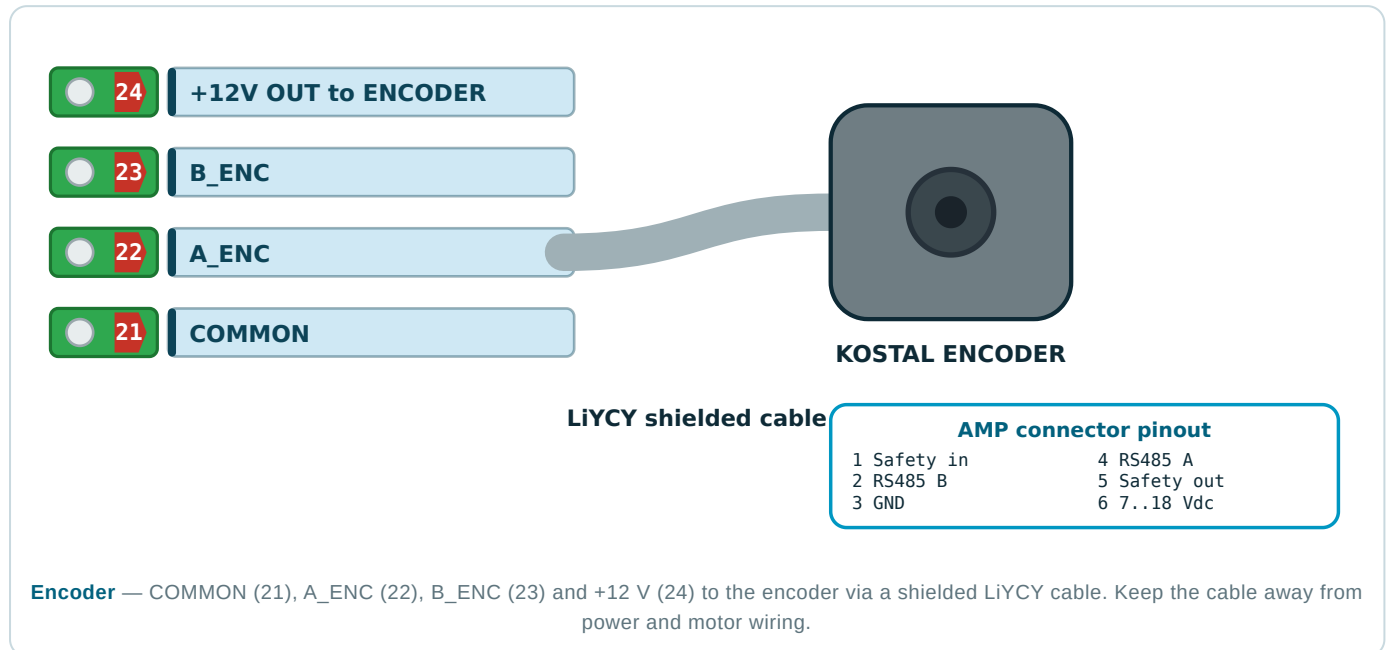


With test — TX is powered from the switched +24 V / Photo-Test (5) so the drive can pulse-test the beam; RX output still goes to PHOTO-CELL (8). Enable via **Photocell Mode**.

18 FIELD WIRING

Encoder connection

Kostal encoder over a shielded LiYCY cable to the encoder terminals, with the AMP connector pinout for reference.



Cabling

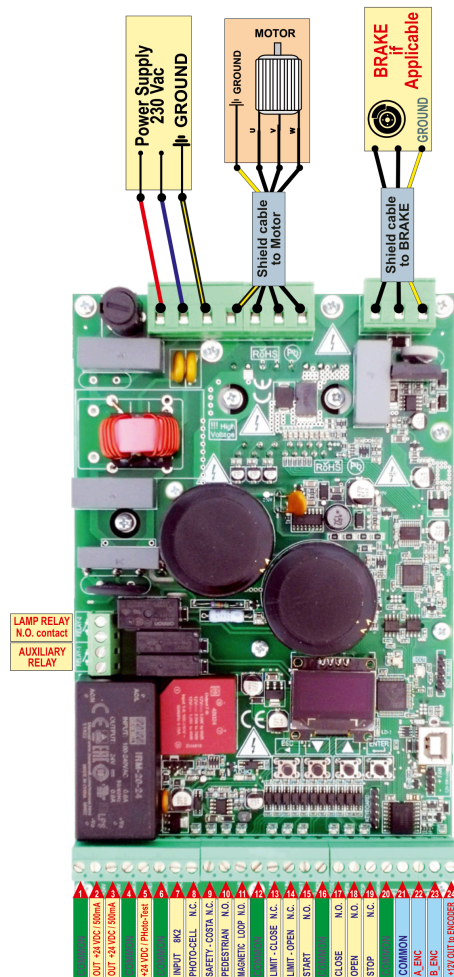
- ◆ Use a shielded, twisted **LiYCY** cable; earth the screen at the drive only.
- ◆ Do not run the encoder cable in the same channel as the motor or mains.
- ◆ If the gate moves too far past the taught limits, the drive reports **Positions Limits**.

AMP connector

- 1 Safety-chain input
- 4 RS485 A
- 2 RS485 B
- 5 Safety-chain output
- 3 GND
- 6 7–18 Vdc

Complete wiring overview

How the mains, motor, brake, lamp and every input group connect around the drive.



Complete wiring — mains, motor (U/V/W), brake and lamp on the power side; commands, limits, safety, photocell and encoder terminals on the control side.

Power side

- ◆ 230 Vac via the EMC filter, a 10 A breaker and the emergency stop.
- ◆ Motor U/V/W in delta on a shielded cable with output filter.
- ◆ Optional brake on a shielded cable; earth all screens at the drive.

Control side

- ◆ Commands & detectors on terminals 10–19, returned to COMMON.
- ◆ Limit switches & safety edges (COSTA / 8K2) in the N.C. chain.
- ◆ Photocells on terminal 8 (test from 5); encoder on 21–24.

Outputs

- ◆ Warning lamp on **Relay 2 (N.O.)**; an auxiliary relay is also provided.



BEFORE POWER-UP

Re-check earthing, that mains is not on U/V/W, and that all safety contacts are wired N.C. Wire every accessory with the unit de-energised and wait 10 minutes after isolation before touching the terminals.