UNIDRIVE H Series

Elife
International

Application
Reference Manual

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Technical Manual Version: 1.0 **#Pre2**

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Overview

UNIDRIVE is the new family of drivers designed to drive the various types of low-voltage servomotors, specifically for use in battery powered devices.
The compact form was made possible thanks to the high efficiency of the design, manufactured with state-of-art electronic components.
UNIDRIVE is highly configurable, a wide range of programmable parameters allow you to customize your system for your needs.

The main **key features** include:

- Designed to drive from 24 V to 96 V Brushless, Brushed and AC ServoMotors.

- The different types of feedback are supported: ***Absolute Resolver***, *SinCos Encoder, Hall Sensors, Sensorless, Incremental Encoder, Tachometer*.

- Advanced algorithms for predictive speed and tourque control.

- CANopen® communication protocol[1]: CiA® DS301 and CiA® DSP402 (Interface Profile Velocity and Interpolated Position Mode and Torque Profile Mode)

- Electromagnetic Holding Brake Output with DPR System (Dynamic Power Reduction)

- Telemetry of the Internal functions

- Integrated Fuse Holder (only up 80 V)

- European Conformity C€, and designed and tested in accordance with the *Electromagnetic compatibility* (EMC) emission [EN 61000-6-4] and immunity [EN 61000-6-2] standards.

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[1] Elife International is a Member of **CiA® - CAN in Automation**

Specification:

- ☑ Four Quadrant Regenerative Operation

- ☑ Space Vector Modulation Technology

- ☑ Sinusoidal and Trapezoidal Commutation Methods

- ☑ Programmable Gain Setting

- ☑ Fully Configurable Velocity and Position Limits

- ☑ PIDF and PID + FF Velocity Loop

- ☑ On-the-fly Mode and Gain Set Switching

- ☑ Emergency Deceleration Ramp and Emergency Input

Programmable Input/Output:

- ➡ **Two** High Powered Digital *Outputs*
- ➡ **Five** Digital *Inputs* Single Ended
- ➡ **One** 12-bit Analog *Input* $0 \div 10\,V$
- ➡ **Four** Digital *Outputs* Singled Ended

Table 1.1: The common features of all models of **UNIDRIVE H Series**

	VALUE
PWM Operating Frequency:	6103 Hz
Digital Input Pin Voltage:	up to 36 V
Electrical Insulation at Heat Sink:	500 V (minimum)
Digital Output Pin Current:	up to 250 mA
Brake and Power Relay Pin Current:	up to 2 A
Digital Input Pin Current:	1.0 mA @24 V
Digital Output Pin Voltage:	From 6 to 30 V
Analog Input Voltage:	From 0 to 10 V
Package Environmental Rating:	IP 30
Weight	1.1 kg
Dimensions H x W x D:	144x100x56 mm (*Electrical Box Version*) 110x90x40 mm (*OEM Version*)

A broad range of models enable us to satisfy every requirements and to suggest the best solution for your system.

An overview of the **UNIDRIVE H** Series Models is shown in Table 1.2. For other models, have a look at UNIDRIVE S Series for *lower power* models or at UNIDRIVE M Series for *higher power* models.

Table 1.2: An overview of the **UNIDRIVE H** Series Models

DRIVER	CONTINUOUS RMS PHASE CURRENT *	MAXIMUM OUTPUT POWER	NOMINAL VOLTAGE SUPPLY (*Operating Range*)
H2448-2-X	up to 100 A	2 KW	48 V (18 Vmin - 80 Vmax)
H2424-3-X	up to 150 A	3 KW	24 V (18 Vmin - 32 Vmax)
H2436-3-X	up to 150 A	3 KW	36 V (18 Vmin - 55 Vmax)
H2448-3-X	up to 150 A	3 KW	48 V (18 Vmin - 80 Vmax)
H4896-6-X	up to 150 A	6 KW	96 V (43 Vmin - 150 Vmax)

* The value of the maximum **continuous** RMS Phase current is ensured with an appropriate heat sink

(a) **Electrical Box Version**
Size: 144x100x56 mm

(b) **OEM Version**
Size: 110x90x40 mm

Figure 1.1: UNIDRIVE series H enables you to drive from 24 V to 96 V Brushless, Brushed and AC ServoMotors. It's available in two configurations: (a) *Electrical Box* with container and in (b) *OEM Version* for integrating into motor housing.

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Product Identification Label

Most of information about your UNIDRIVE - such as *serial number*, model, customer information, *etc* - can be found on a label located on the front of the UNIDRIVE (see figure below). Some of these information might be requested when you contact the technical assistance.

UNIDRIVE TYPE

UNIDRIVE **H2448-3-0**

P/N: 1-01-0002-00   HW. rev. B

S/N: 00001579   Customer Code: 00000143

℮ life International   Portoferraio - ITALY
www.elifeinternational.com

THE SERIAL NUMBER CODE UNIQUELY IDENTIFIES YOUR UNIDRIVE

HARDWARE REVISION OF UNIDRIVE

THE CUSTOMER CODE IDENTIFIES YOU AS A ELIFE CUSTOMER
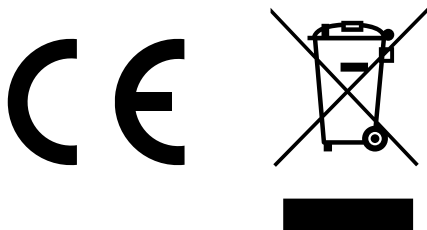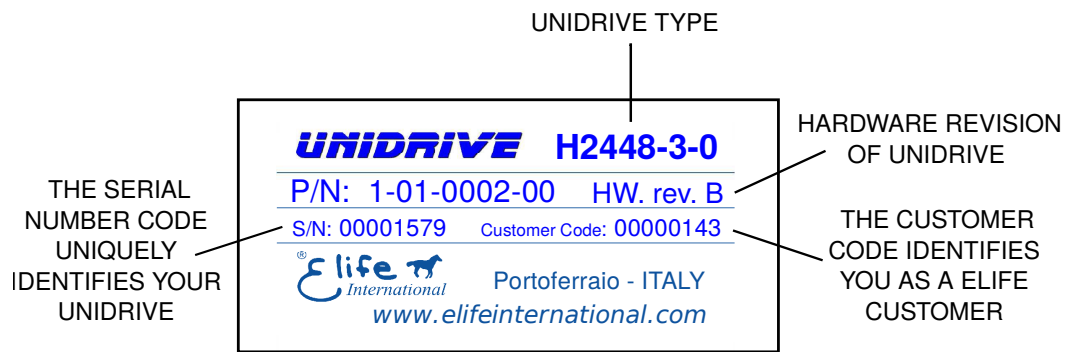
Compliance with the EU regulatory requirement for electrical and electronic equipment. When your UNIDRIVE is no more usable, can't be treated as generic garbage, but must be disposed of at a collection point for recycling of electrical and electronic equipment, in compliance with the **WEEE** regulation (Waste of Electrical and Electronic Equipment).

Installation and Wiring

<div style="text-align: right">2</div>

2.1 Mounting UNIDRIVE on-board

The UNIDRIVE can be mounted in any orientation, but you must choose a location in order to keep the controller **clean** and **dry**, aways from sunlight, water and ice. When you mount the UNIDRIVE on-board you should **ensure an effective heat dissipation** between the UNIDRIVE and the vehicle surface.

> 💡 **Tips and Advice**
> A thermal grease can be used on the rear side of the UNIDRIVE heatsink to improve the heat exchange between UNIDRIVE and the vehicle surface.

UNIDRIVE has a LED light on the front of the device that visually explains what the driver is doing (see Section 4.1), if you want it to be visible you should take this into consideration before choosing the location where your UNIDRIVE will be mounted.

> ⚠️ **Warning**
> In order to ensure the proper functioning of the UNIDRIVE you must keep the controller clean and dry and ensure an effective heat exchange between the UNIDRIVE and the vehicle surface.

2.2 Connections

UNIDRIVE on the front, see Figure 2.1, has different types of connectors:

High Power Connections The three-phase alternating-current generated by UNIDRIVE is supplied through the **U**,**V**,**W** terminals. The **F+**,**B-** are the positive[1] and negative terminals to connect to your battery.

Low Power Connections A 24-pin male connector (**J1 - COMMAND**) for low power logic control.

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[1]For **H4896-6-X** Type you must connect an external fuse to the **B+** terminal, see Section 2.2.1.

Feedback Connections A 9-pin female low power connector (**J2 - FEEDBACK**) to connect your feedback board.
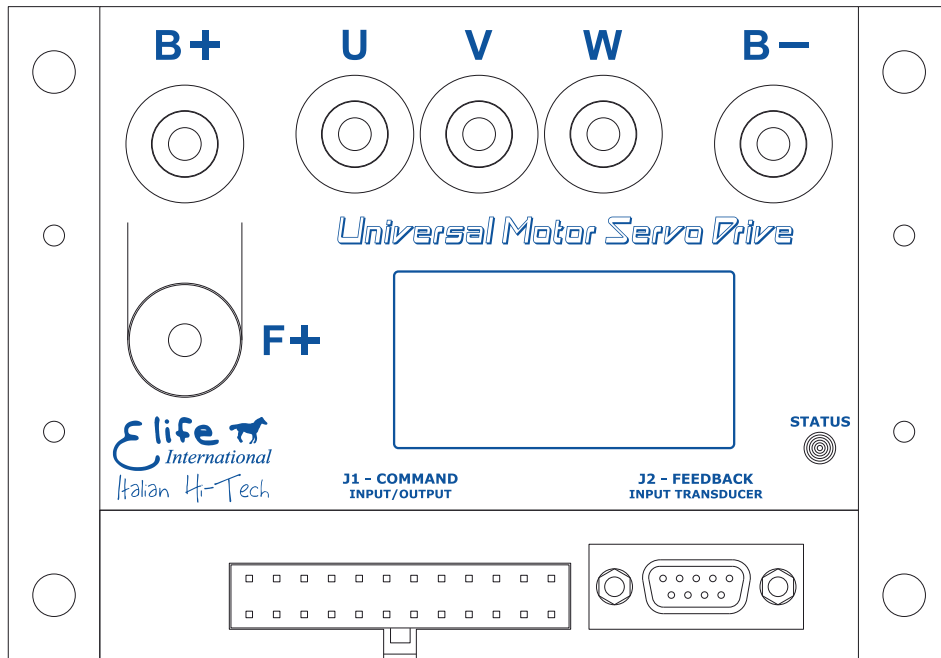
Figure 2.1: UNIDRIVE has different types of connectors that can be categorized in: High Power Connections (**U**,**V**,**W**,**F+**,**B-**,**B+**), Low Power Connections (**J1 - COMMAND**) and Feedback Connector (**J2 - FEEDBACK**).

2.2.1 High Power Connections

High power connections are provided by: 3-phase supply terminals (**U**,**V**,**W**) and two terminals for battery connections (**F+** or **B+**,**B-**).

In order to connect correctly UNIDRIVE, you should use the following instructions:

1. Except the **H4896-6-X** Type, you must mount an appropriately sized fuse (See Table 2.2) between **F+** and **B+** terminal to avoid damage to the controller.

   ✎ **Note**
   All UNIDRIVE models, except the **H4896-6-X Type**, have a fuse already installed.

2. Connect the **battery positive** cable to the **F+** terminal and the **battery negative** cable to the **B-** terminal.

   ❯ For **H4896-6-X** Type you must connect an external fuse to the **B+** terminal (see Table 2.2 and the Wiring Diagrams).

Table 2.1: A summary table of high-power connections, except the H4896-6-X Type.

TERMINAL	CONNECT TO
F+	Battery positive terminal to the fuse link
B+	Fuse terminal
B-	Battery negative terminal
U,V,W	U, V, and W motor phases

3. Connect the U, V, and W motor phases to the 3-phase supply terminals (**U**,**V**,**W**).

📝 **Note**

The **tightening torque** for high-power connections must be $5.5\,\text{N·m}$.

⚠️ **Warning**

Make sure when you connect the high-power cables that the feedback cable passes as far as possible from the power cables and they are not located close to each other, in order to avoid electromagnetic interference.

Table 2.2: Fuse size in accordance with the UNIDRIVE Type.

UNIDRIVE TYPE	FUSE RATING
H2448-2	100 A
H2424-3	100 A
H2436-3	70 A
H2448-3	50 A
H4896-6	**70 A**
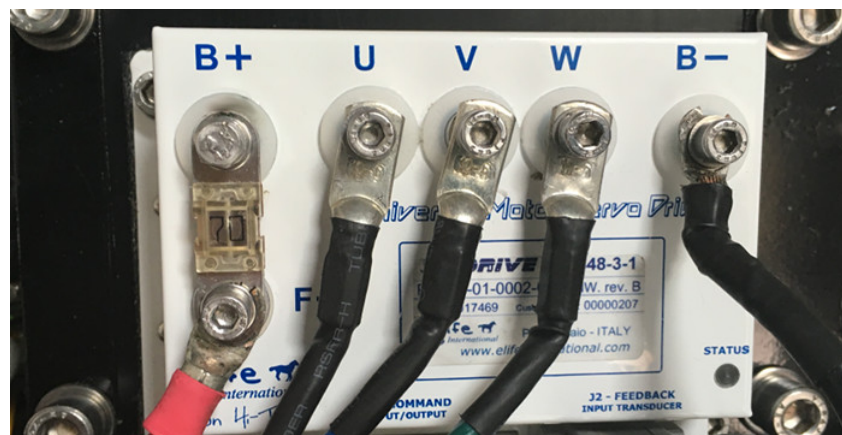
Figure 2.2: UNIDRIVE H Series - High-power connections.

2.2.2 Low Power Connections

The low power logic control connections are provided by a 24-pin male connector (**J1 - COMMAND**). The pins' description is given in Table 2.3.

J1 - COMMAND
INPUT/OUTPUT
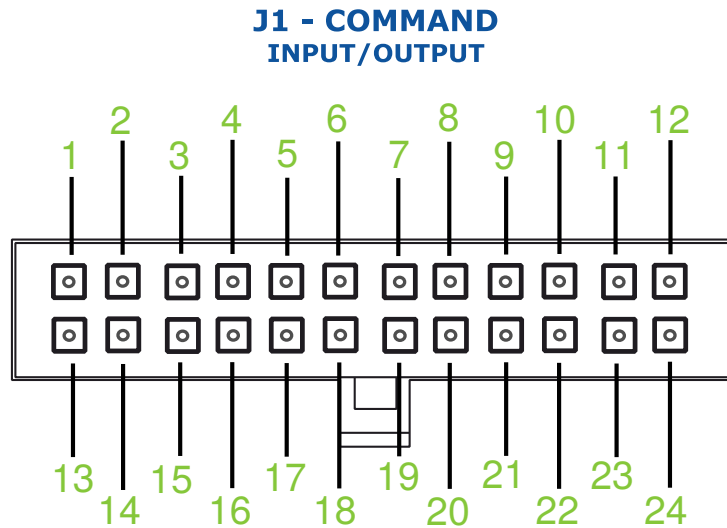
Table 2.3: The pins' description for the **J1 - COMMAND** connector.

PIN	I/O TYPE	DESCRIPTION	OPERATING RANGE
1	IN1	Digital input 1	$V_{MAX} = 36\,V$, High $> 11\,V$
2	IN3	Digital input 3	$V_{MAX} = 36\,V$, High $> 11\,V$
3	IN5	Digital input 5	$V_{MAX} = 36\,V$, High $> 11\,V$
4	+24V INPUT	Power supply for output pins, it should be protected with 4A delayed fuse, type T	From 6 to 30 V
5	BRAKE	Brake supply with programmable dynamic power reduction	Output Voltage in according to the Input voltage on PIN 4 $I_{MAX}=2\,A$
6	LINE CONTACTOR OUT	Driver main contactor output	Output Voltage in according to the Input voltage on PIN 4 $I_{MAX}=2\,A$
7	OUT1	Digital output 1	Output Voltage in according to the Input voltage on PIN 4 $I_{MAX}=250\,mA$
8	PWR POT	Speed potentiometer supply output	$V_{OUT}= 10\,V$ $I_{OUT}=100\,mA$

Continued on next page . . .

PIN	I/O TYPE	DESCRIPTION	OPERATING RANGE
9	ANALOG GND	Analog Common / Potentiometer Low Input	/
10	CAN-	CAN_L bus line (dominant low)	Standard CAN
11	TX RS232	TX output, it is used to communicate with RS232 in order to realize Telemetry panel	Standard RS232
12	SERIAL GND	RS232 Common, it is used to communicate with RS232 in order to realize Telemetry panel	/
13	KEY (+BATT)	Internal logic circuits power supply, it should be protected with 1A delayed fuse, type T	From 18 to 80 V (Only for **H4896-6-X Type**: From 43 to 160 V)
14	IN2	Digital input 2	$V_{MAX} = 36\,V$, High $> 11\,V$
15	IN4	Digital input 3	$V_{MAX} = 36\,V$, High $> 11\,V$
16	SERVICE	Do not use	/
17	OUT2	Digital Output 2	Output Voltage in according to the Input voltage on PIN 4 $I_{MAX}=250\,mA$
18	OUT3	Drive fault alarm output, it changes its current state whenever an alarm is present. See Section 3.4.1, Pag. 33	Output Voltage in according to the Input voltage on PIN 4 $I_{MAX}=250\,mA$
19	OUT4	Encoder emulator, single phase	Output Voltage in according to the Input voltage on PIN 4 $I_{MAX}=250\,mA$
20	-BATT	Common ground, it should be connected to the negative terminal of battery	/
21	AIN / WIPER POT	Analog input / Wiper input for throttle	From 0 to +10 V From 0 to +5 V
22	CAN+	CAN_H bus line (dominant high)	Standard CAN
23	GND CAN	CAN bus common	/

Pin	I/O Type	Description	Operating Range
24	RX RS232	RX Input, it is used to communicate with RS232 in order to realize Telemetry panel	Standard RS232

Concluded

Note

The digital inputs have over-voltage protection up to battery voltage.

2.3 Standard Wiring Diagrams and Wiring Instructions

This section contains standard wiring diagrams to be used to connect your **UNIDRIVE H Series** on your system. The following wiring diagrams cover only the standard operating mode in which the UNIDRIVE works to drive a Brushless Servomotor. It's also possible to connect two or more UNIDRIVE together for specific application (*e.g*: steering wheel control) and drive different types of servomotor. These advanced installations will not be dealt with in the present manual.

> ⚠ **Warning**
> The following wiring diagrams and operating instructions should be read carefully and completed before wiring your UNIDRIVE up on your system. The wiring diagram must be chosen in according to the operating mode (PLC, Standalone, CAN, RS323) that suits your needs.

> 🧽 **Note**
> For **H4896-6-X Type** you should mount an external fuse, see Section 2.2.1.

2.3.1 Standalone Mode

The *Standalone* mode is designed to drive your motor with only two inputs: a *throttle* and a *emergency input*.
Other optional inputs can be used to extend the functionality of this operating mode (See Table 2.4).
For the correct functioning of this operating mode, special attention must be paid to choose the correct value of *Analog Input* (See Section 3.4.4) in according to the throttle characteristics.

> 🧽 **Note**
> If you've installed a 0-10V or 0-5V throttle the rotation direction of the motor should be given through the FORWARD and the BACKWARD input.

When **throttle is put to neutral position** - before bridge activation - you can indicate if the brake should be locked or unlocked (HANDBRAKE input) and the speed mode (FAST/SLOW input).

Table 2.4: UNIDRIVE I/O definitions for **Standalone** Mode.

PIN	I/O TYPE	NAME	DESCRIPTION	
1	IN1	HANDBRAKE	High = Unlocked, Low = Locked. This input is processed *only before* bridge activation	Optional
14	IN2	FAST/SLOW	High = Slow mode, Low = Fast mode. This input is processed *only before* bridge activation	Optional[a]
2	IN3	FORWARD	High = Forward, Low = Stop (only if BACKWARD is low)	Optional[b]
15	IN4	BACKWARD	High = Backward, Low = Stop. This input is only processed if FORWARD input is low.	Optional[b]
3	IN5	EMERGENCY	Emergency input should always be supplied, otherwise UNIDRIVE stops motor rotation and unlocks motor brake.	**Mandatory**
7	OUT1	REVERSE	It is the output to connect to buzzer, it gets high when the rotation direction is backward.	
17	OUT2	STATUS	It gets steady high when motor is running and blinking when motor is stopped. It's low when there is an alarm.	
18	OUT3	ALARM	Alarm output, it changes its current state whenever an alarm is present. See Section 3.4.1, Pag. 33	

[a] **Mandatory** if you want to switch between Fast and Slow mode, see Section 3.4.2.
[b] **Mandatory** only for 0–10V or 0-5V throttle.

The **Fast** and **Slow** modes are designed to meet two different purposes:

Slow mode It's programmable so that the vehicle indoor moves slowly with accurate operation.

Fast mode It allows a faster velocity for outdoor long distance path.

It's scheduled both the configuration of the maximum motor velocity and the maximum velocity at Slow mode (See Section 3.4.2).

The **wiring diagram** for standalone mode is shown in Figure 2.3 for any UNIDRIVE H Series Type, except the **H4896-6-x** Type (Figure 2.4).

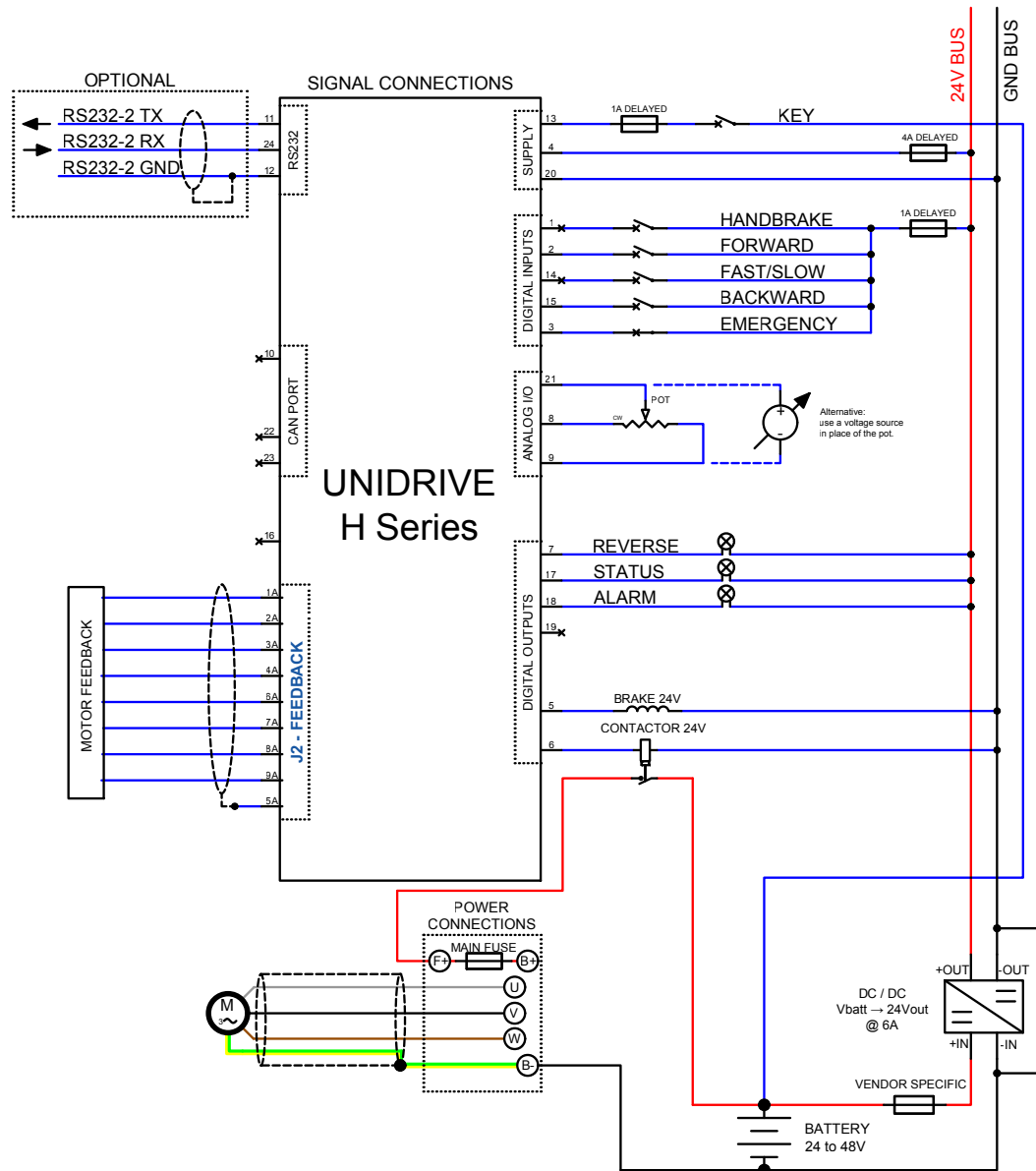# Standalone Mode - Wiring Diagram

Figure 2.3: The wiring diagram to connect your **UNIDRIVE H Series** - except the H4896-6-x Type - to your system in **Standalone Mode**.

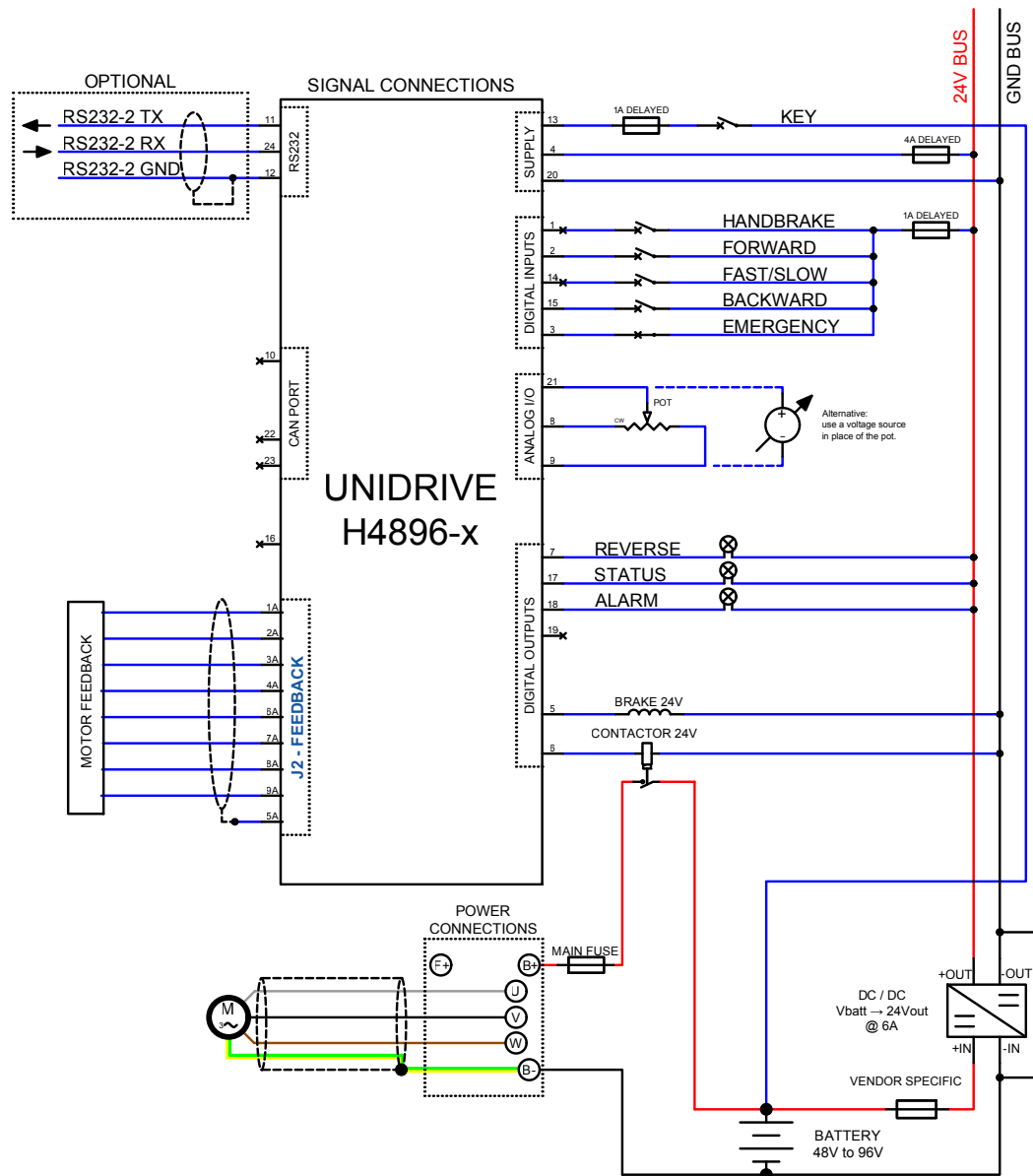# Standalone Mode - Wiring Diagram [H4896-6-x Type]

Figure 2.4: The wiring diagram to connect your UNIDRIVE **H4896-6-x** to your system in **Standalone Mode**

2.3.2 PLC Mode

The *PLC mode* is a flexible, self-contained operating mode for automatic vehicles (AGV).

The details of inputs and output of this operating mode are shown in Table 2.5.

Table 2.5: UNIDRIVE I/O definitions for **PLC** Mode

PIN	I/O TYPE	NAME	DESCRIPTION	
1	IN1	CCW OVERTRAVEL	High = Active Overtravel for CCW rotation, Low = Inactive Overtravel	Optional[a]
14	IN2	CW OVERTRAVEL	High = Active Overtravel for CW rotation, Low = Inactive Overtravel	Optional[a]
2	IN3	DIR	High = Clockwise, Low = Counterclockwise	Optional[b]
15	IN4	RUN / STOP	High = Run, Low = Stop	**Mandatory**
3	IN5	EMERGENCY	Emergency input should always be supplied, otherwise UNIDRIVE stops motor rotation and unlocks motor brake.	**Mandatory**
18	OUT3	ALARM	Alarm output, it changes its current state whenever an alarm is present. See Section 3.4.1, Pag. 33	

[a]   It is processed only if *overtravels* are enabled by Telemetry panel, see Section 3.4.6.
[b]   **Mandatory** only for 0–10V or 0-5V throttle.

For the correct functioning of this operating mode, special attention must be paid to choose the correct value of *Analog Input* (See Section 3.4.4) in according to the throttle characteristics.

📝 Note

If you've installed a 0-10V or 0-5V throttle the rotation direction of the motor should be given through DIR input.

When the RUN / STOP input gets high the brake is unlocked and the motor starts to spin-up. If *overtravels* are enabled by Telemetry panel (see Section 3.4.6) UNIDRIVE will stop the motor when one of two over-travel inputs (CCW OVERTRAVEL and CW OVERTRAVEL) will get high.
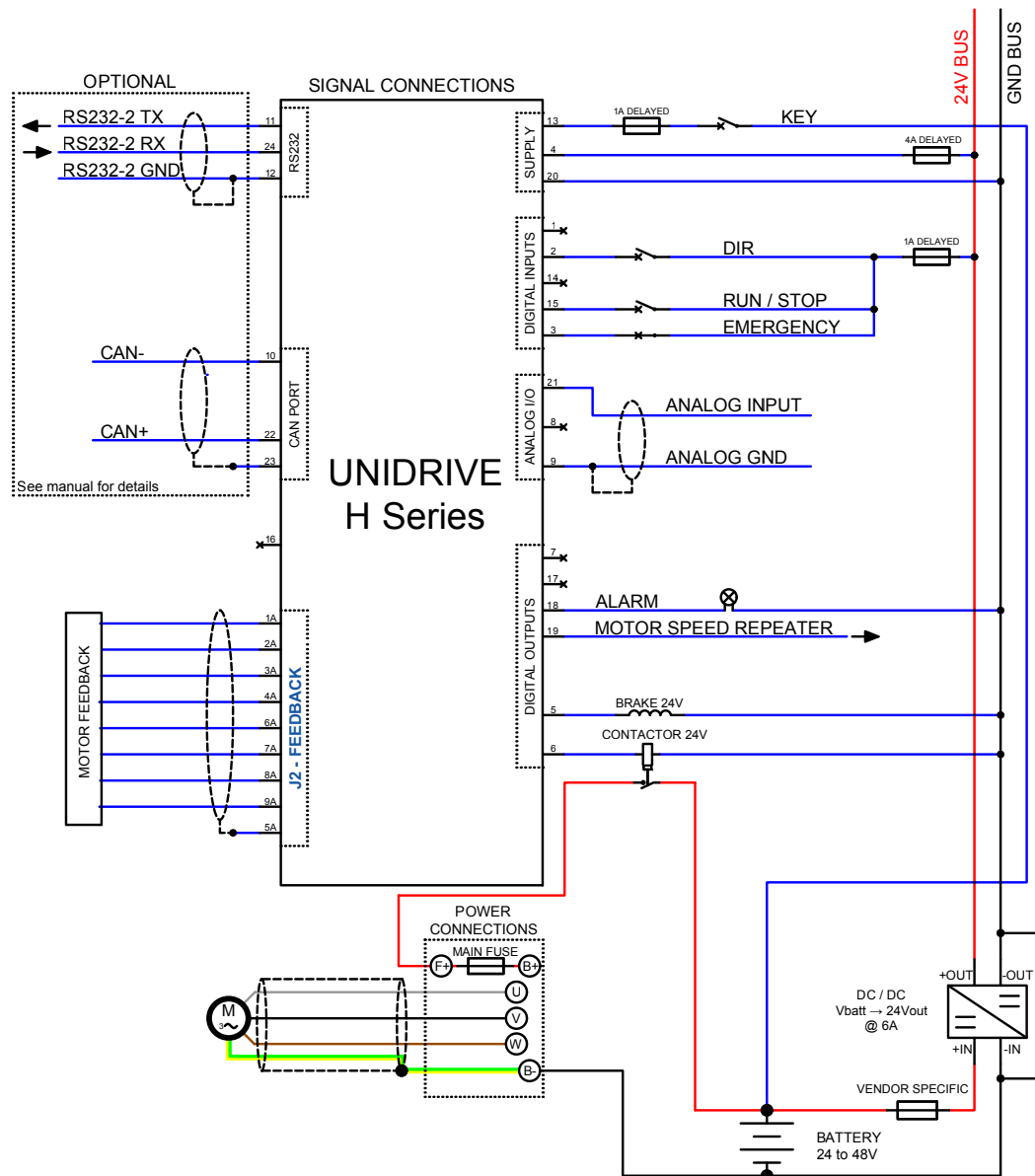
PLC Mode - Wiring Diagram

Figure 2.5: The wiring diagram to connect your **UNIDRIVE H Series** - except the H4896-6-x Type - to your system in **PLC Mode**.

PLC Mode - Wiring Diagram [H4896-6-x Type]
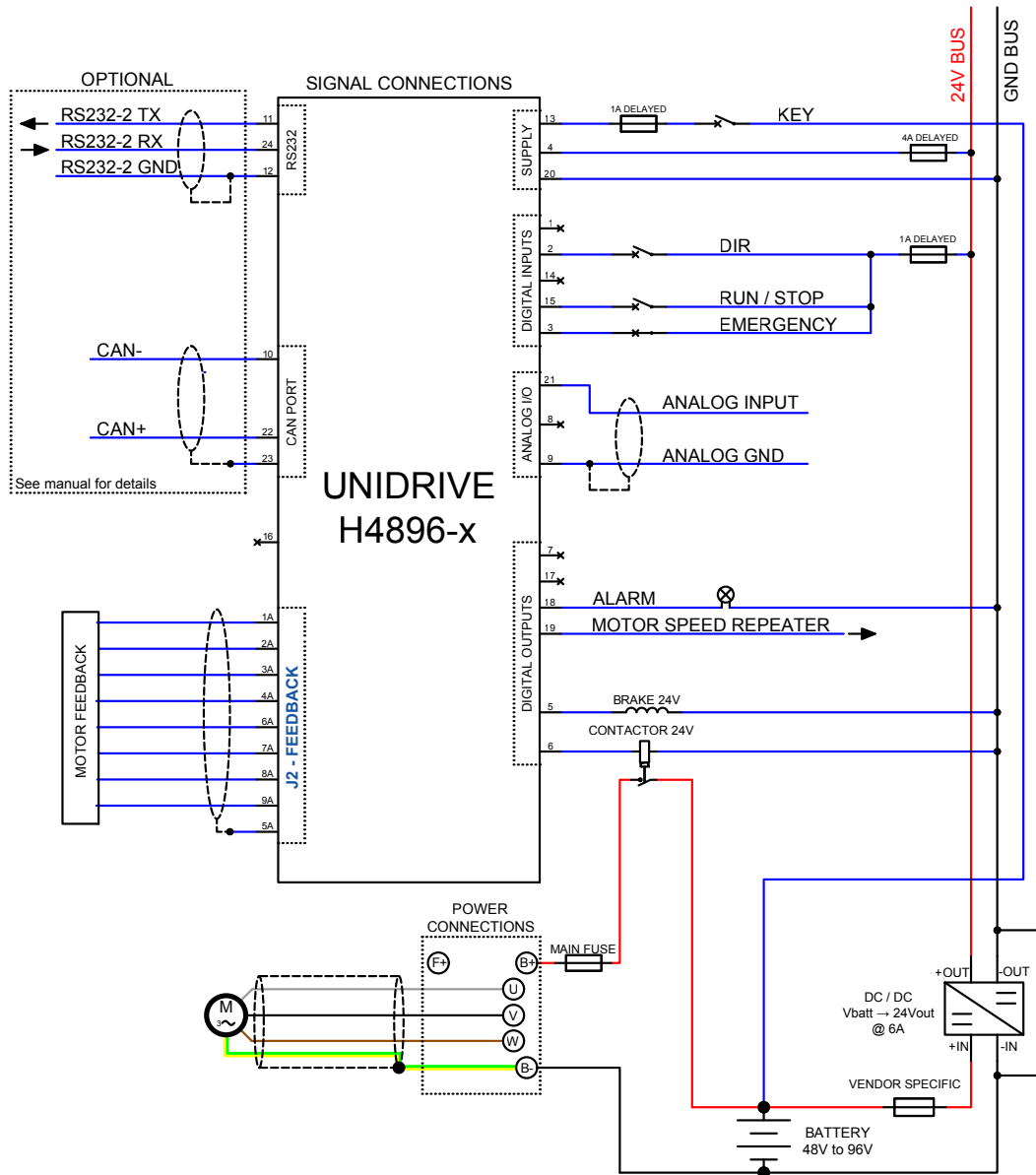
Figure 2.6: The wiring diagram to connect your UNIDRIVE **H4896-6-x** to your system in **PLC Mode**.

In this configuration it is also possible to read the most important information through **CAN** bus. In this case the **IN4** and **IN5** input could be used as shown in Table 2.6.

CAN bus address selector switch at the node set to 0.

PIN	I/O TYPE	NAME	DESCRIPTION
15	IN4	CAN ADR0	It could be used as CAN address selector 0
3	IN5	CAN ADR1	It could be used as CAN address selector 1

In case that the CAN address is set to **0** through Telemetry panel, after switch-on it is possible to appoint the node-ID depending on two digital inputs: CAN ADR0 and CAN ADR1, in the following way:

CAN NODE	INPUT CONFIGURATION	
1	CAN ADR1 $\rightarrow$ GND	CAN ADR0 $\rightarrow$ GND
2	CAN ADR1 $\rightarrow$ GND	CAN ADR0 $\rightarrow$ +24V
3	CAN ADR1 $\rightarrow$ +24V	CAN ADR0 $\rightarrow$ GND
4	CAN ADR1 $\rightarrow$ +24V	CAN ADR0 $\rightarrow$ +24V

2.3.3 CAN Network Mode

In **CAN Network** mode you can control your motor through CANopen® bus protocol. For further information about CANopen® protocol, please refer to CiA® DSP402 protocol (version 3.0.1.15) and UNDRIVE CANopen® Manual.

A description of the inputs and outputs connections for this operating mode is shown in Table 2.7

Table 2.7: UNIDRIVE I/O definitions for **Can Network** Mode

Pin	I/O Type	Name	Description	
1	IN1	BWD	It could be used as negative limit switch	Optional
14	IN2	FWD	It could be used as positive limit switch	Optional
2	IN3	HOME SENSOR	It could be used as home switch	Optional
15	IN4	CAN ADR0	It can be used as CAN address selector 0	Optional
3	IN5	CAN ADR1	It could be used as CAN address selector 1	Optional
18	OUT3	ALARM	Alarm output, it changes its current state whenever an alarm is present. See Section 3.4.1, Pag. 33	

In this operating mode is needed to set the correct CANopen® parameters via Telemetry Panel (See Section 3.4.4).

In case that the CAN address is set to **0** through Telemetry panel, after switch-on it is possible to appoint the node-ID depending on two digital inputs: CAN ADR0 and CAN ADR1, in the following way:

CAN Node	Input Configuration	
1	CAN ADR1 ⇀ GND	CAN ADR0 ⇀ GND
2	CAN ADR1 ⇀ GND	CAN ADR0 ⇀ +24V
3	CAN ADR1 ⇀ +24V	CAN ADR0 ⇀ GND
4	CAN ADR1 ⇀ +24V	CAN ADR0 ⇀ +24V

CAN Network Mode - Wiring Diagram

Figure 2.7: The wiring diagram to connect your **UNIDRIVE H Series** - except the H4896-6-x Type - to your system in **CAN Network**.
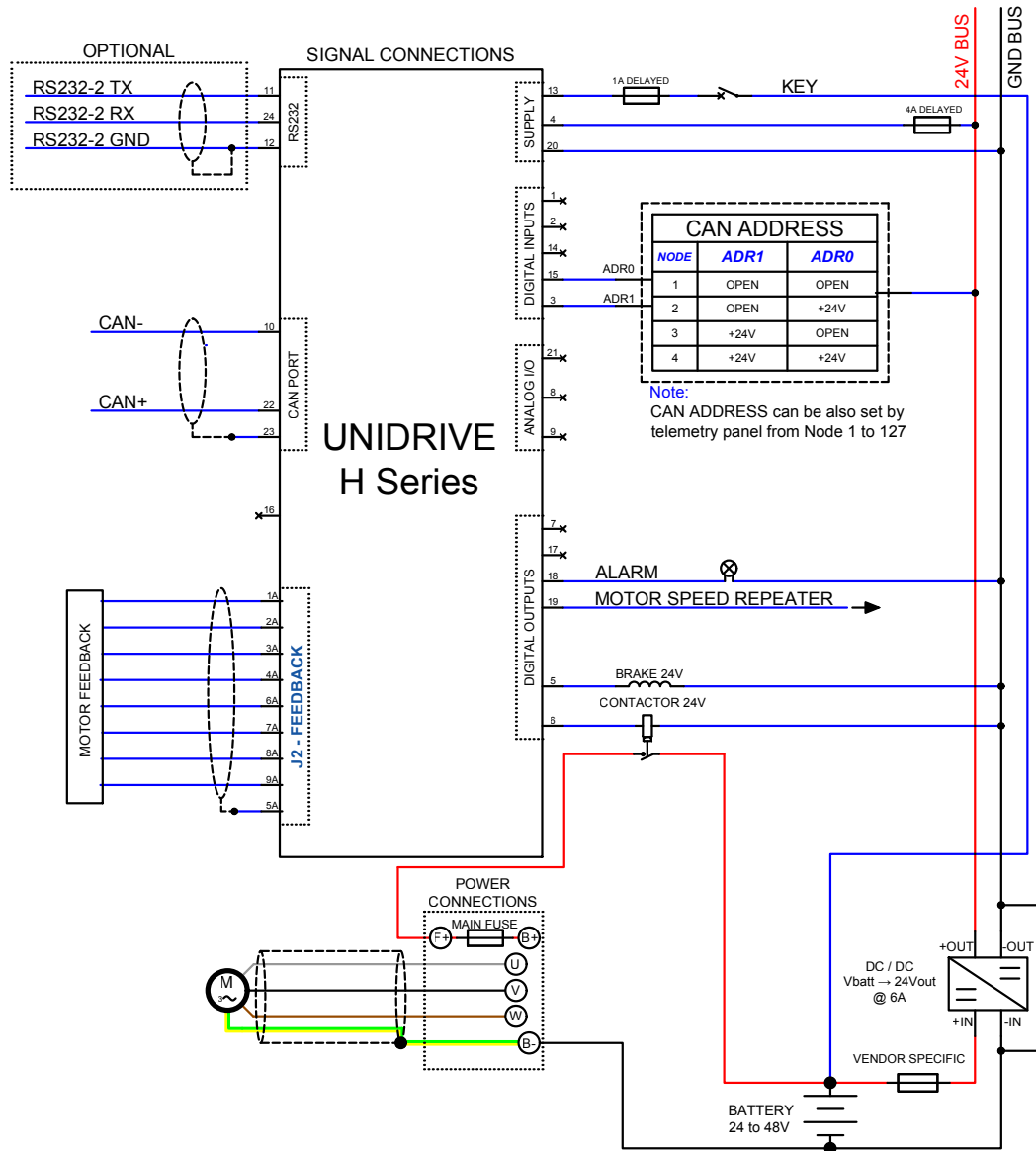
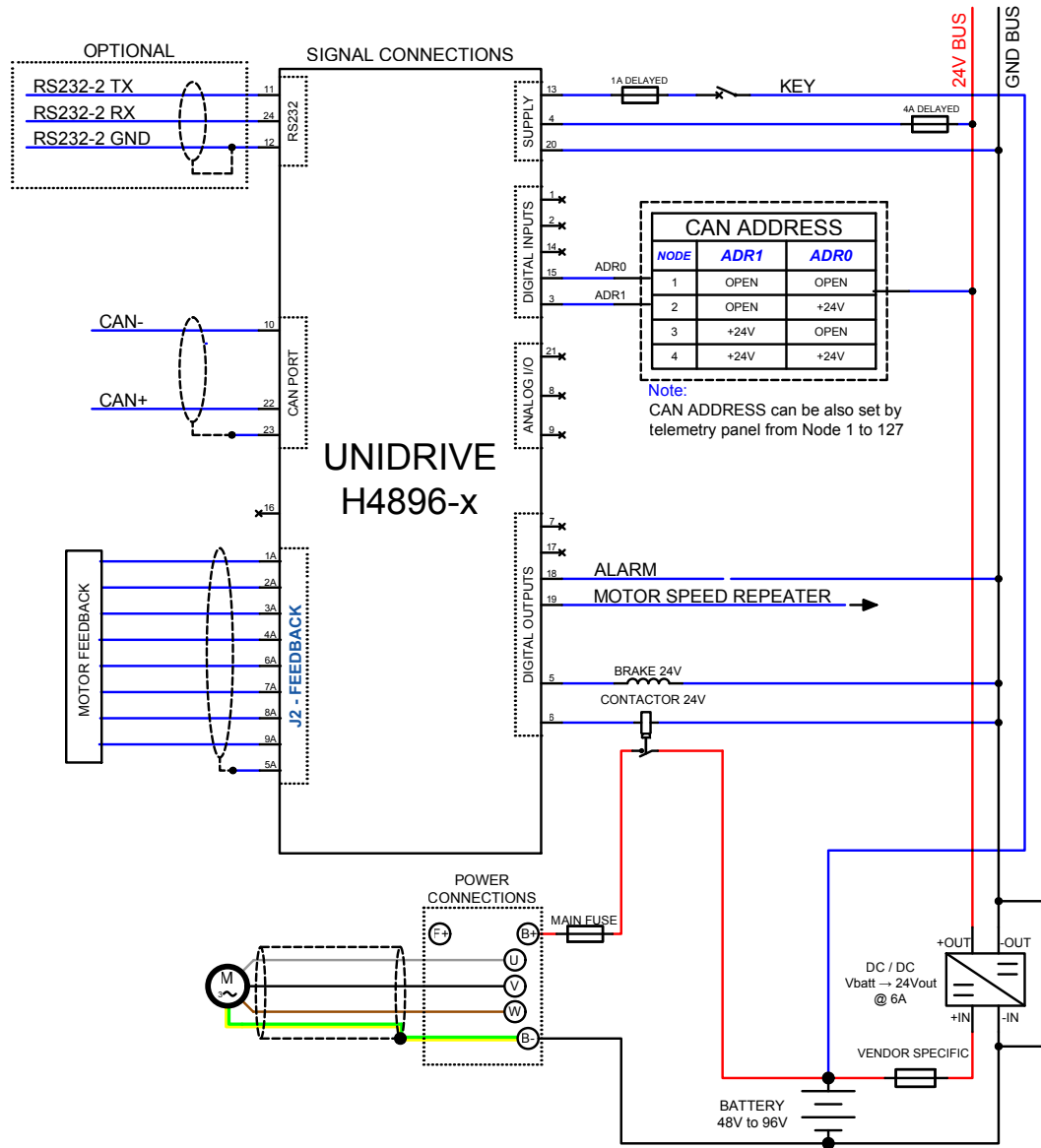# CAN Network Mode - Wiring Diagram [H4896-6-x Type]

Figure 2.8: The wiring diagram to connect your UNIDRIVE **H4896-6-x** to your system in **CAN Network Mode**.

Please pay particular attention when wiring CANopen® connection: at both ends there must be a 120Ω resistor and the bus length must be the following:

Bit rate	Bus length
1 Mbit/s	25 m
500 Kbit/s	100 m
250 Kbit/s	250 m
125 Kbit/s	100 m
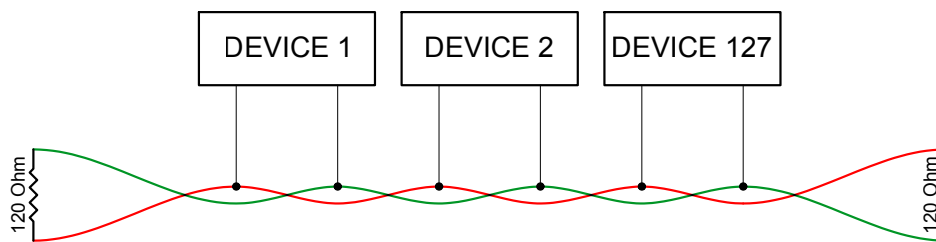
2.3.4 RS232 Mode

The RS232 Mode allows you to drive your motor via Telemetry Panel (See Chapter 4) or send the control commands[2] to the UNIDRIVE through the RS232 protocol. This operating mode can be useful for testing your motor, without worrying about other devices (e.g: potentiometer) or other controllers (e.g: PLC) (See Section 4.2.4). See Figure 2.9 for wiring diagrams for this operating mode and Table 2.8 for a description of inputs and outputs.

Table 2.8: UNIDRIVE I/O definitions for **RS232** Mode.

Pin	I/O Type	Name	Description	
3	IN5	EMERGENCY	Emergency input should always be supplied, otherwise UNIDRIVE stops motor rotation and unlocks motor brake.	**Mandatory**
18	OUT3	ALARM	Alarm output, it changes its current state whenever an alarm is present. See Section 3.4.1, Pag. 33	

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[2]For further information, see **UNIDRIVE - RS232 Communication Protocol** document
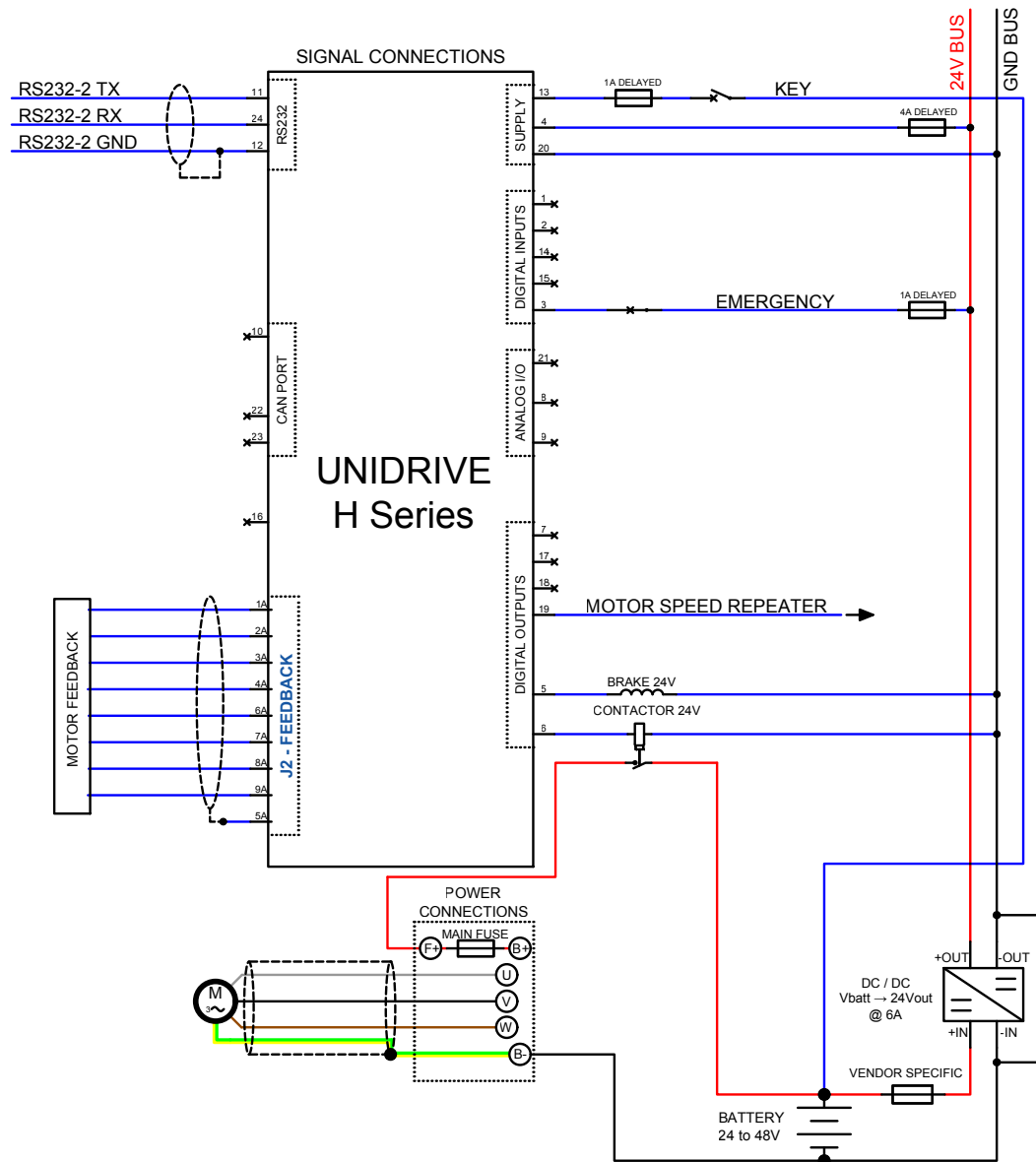
RS232 Mode - Wiring Diagram

Figure 2.9: The wiring diagram to connect your **UNIDRIVE H Series** - except the H4896-6-x Type - to your system in **RS232 Mode**

RS232 Mode - Wiring Diagram [H4896-6-x Type]
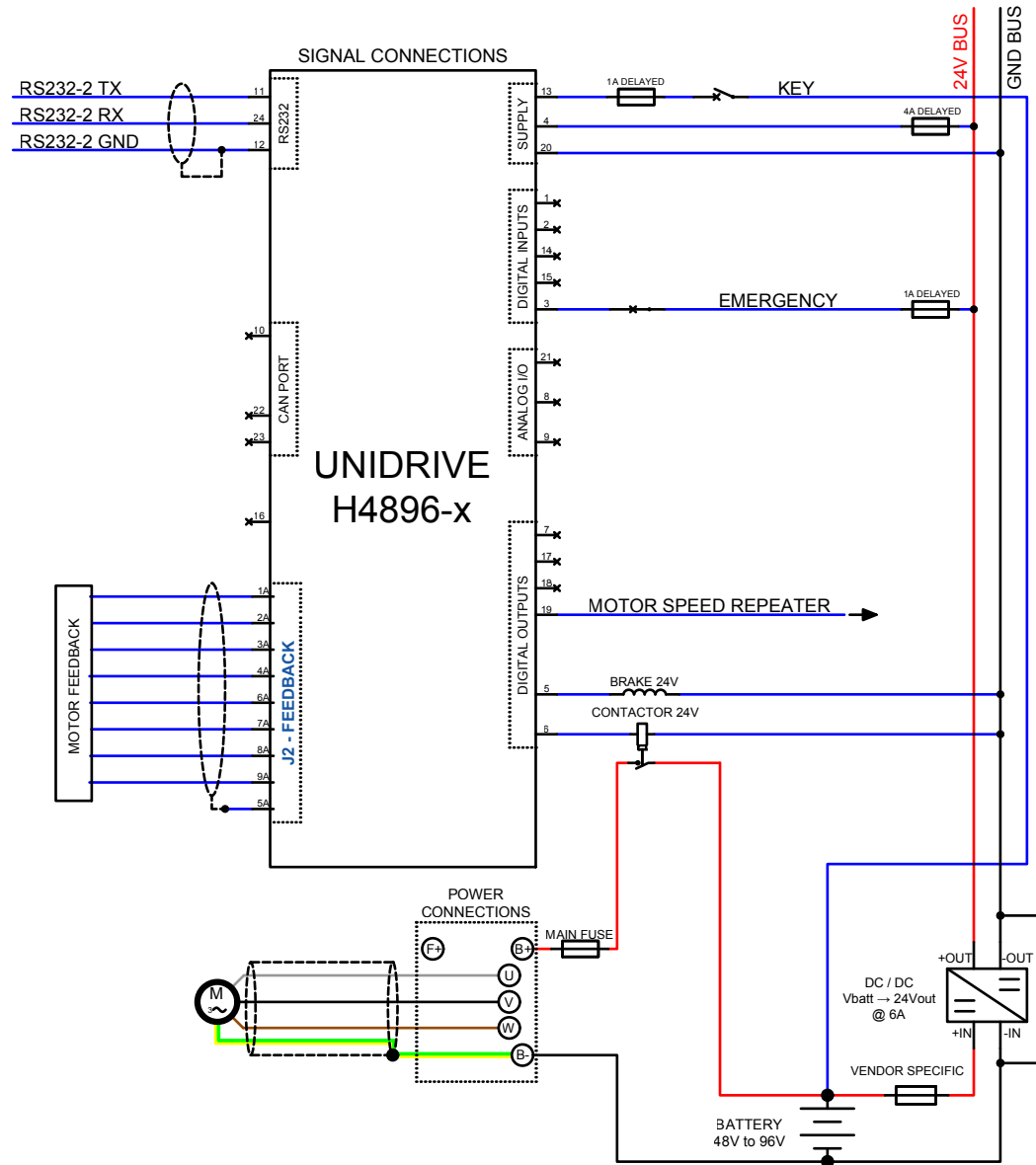
Figure 2.10: The wiring diagram to connect your UNIDRIVE **H4896-6-x** to your system in **RS232 Mode**

2.4 Feedback Connector

A female 9-pin connector (**J2 - FEEDBACK**) is provided to connect the feedback board to the UNIDRIVE (See Figure 2.11).

J2 – FEEDBACK
INPUT TRANSDUCER
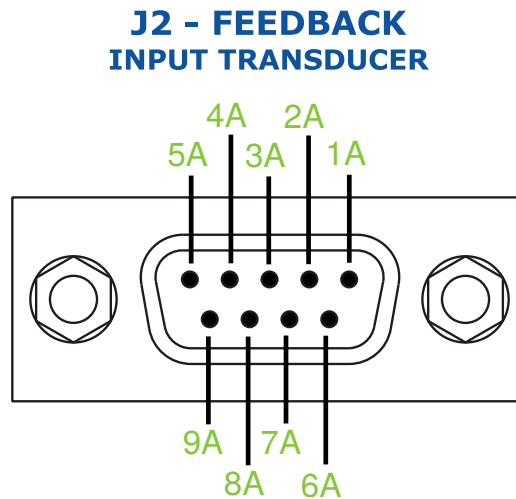
Figure 2.11: Pin Assignments of the **J2 - FEEDBACK** connector.

> 📝 **Note**
> The pinout descriptions of **J2 - FEEDBACK** connector depends on the type of feedback board mounted on your motor.

It's essential for the proper functioning of the feedback system that the feedback cable was constructed specifically for the feedback type mounted on your motor. We **highly recommend** choosing a **good quality cable** in accordance with the type of signals transmitted.

> ⚠️ **Warning**
> Make sure when you connect the high-powered connections that the feedback cable passes as far as possible from the power cables, and them are not located close to each other, in order to avoid electromagnetic interference.

2.4.1 Resolver

Table 2.9: Pinout Description of the **J2 - FEEDBACK** connector (See Figure 2.11) to connect a **Resolver** to your UNIDRIVE.

PIN	I/O TYPE	DESCRIPTION	OPERATING RANGE	
1A	DRIVING SIGNAL -	The negative Driving signal	From -5 to +5 V	**Mandatory**
2A	THERMAL	Temperature sensor	/	Optional[a]
3A	SIN-	Negative Sine	From -4 to +4 V	**Mandatory**
4A	COS-	Negative Cosine	From -4 to +4 V	**Mandatory**
5A	INNER SHIELD	Connect to the cable shield	/	**Mandatory**
6A	DRIVING SIGNAL +	The positive Driving signal	From -5 to +5 V	**Mandatory**
7A	SIN+	Positive Sine	From -4 to +4 V	**Mandatory**
8A	THERMAL	Temperature sensor	/	Optional[a]
9A	COS+	Positive Cosine	From -4 to +4 V	**Mandatory**

[a] **Mandatory** only if you've selected Thermistor, KTY83/122 or KTY84/130 as *Temperature probe type* (See Pag. 40)

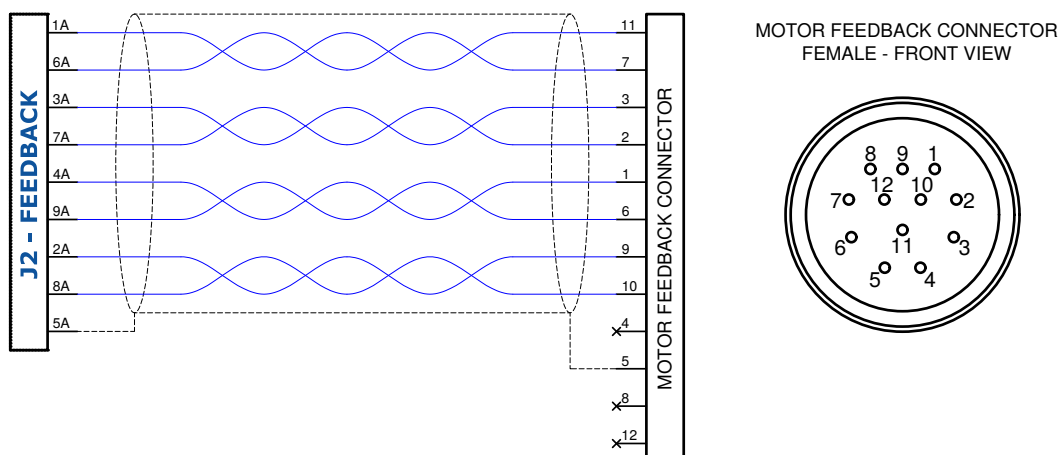**For example**, if your motor has a **M12** *feedback motor connector* :

Figure 2.12: Wiring Diagram to connect your **Resolver** board to UNIDRIVE if your motor has a **M12** *feedback motor connector*.

2.4.2 SinCos Encoder

Table 2.10: Pinout Description of the **J2 - FEEDBACK** connector (See Figure 2.11) to connect a **SinCos Encoder** to your UNIDRIVE.

Pin	I/O Type	Description	Operating Range	
1A	+5 V	SinCos Supply	V = +5 V	**Mandatory**
2A	SIN	Sine Signal	From -5 to +5 V	**Mandatory**
3A	COS	Cosine Signal	From -5 to +5 V	**Mandatory**
4A	THERMAL	Temperature sensor	/	Optional[a]
6A	GND	Common Ground	/	**Mandatory**
7A	INNER SHIELD	Connect to the cable shield	/	**Mandatory**
9A	THERMAL 2	Temperature sensor	/	Optional[a]

[a] **Mandatory** only if you've selected Thermistor, KTY83/122 or KTY84/130 as *Temperature probe type* (See Pag. 40)

2.4.3 Hall Sensor

Table 2.11: Pinout Description of the **J2 - FEEDBACK** connector (See Figure 2.11) to connect a **Hall Sensor** to your UNIDRIVE.

Pin	I/O Type	Description	Operating Range	
1A	+8V	Hall sensors supply	/	**Mandatory**
2A	THERMAL	Temperature sensor	/	Optional[a]
3A	H3	Hall Sensor 3	From +5 to +24 V	**Mandatory**
4A	H2	Hall Sensor 2	From +5 to +24 V	**Mandatory**
5A	H1	Hall Sensor 1	From +5 to +24 V	**Mandatory**
6A	GND	Hall Sensor Ground	/	**Mandatory**
7A	GND	Hall Sensor Ground	/	**Mandatory**
8A	THERMAL	Temperature sensor	/	Optional[a]
9A	GND	Hall Sensor Ground	/	**Mandatory**

[a] **Mandatory** only if you've selected Thermistor, KTY83/122 or KTY84/130 as *Temperature probe type* (See Pag. 40)

Configuration

<div style="text-align: right">3</div>

This chapter covers what you need to know to configure your UNIDRIVER H Series via *Telemetry Panel*.

> ⚠ **Warning**
> This part of the manual assumes that UNIDRIVE was wired up correctly by following methods described in Chapter 2.

Telemetry Panel allows the adjustment of a wide range of parameters through the USB port in order to customize the vehicle's performance characteristics. To install Telemetry Panel you would simply double-click on *Setup.exe* file and following the instructions in the setup assistant.

After the installation, you can select your preferred language[1] and temperature scale - Celsius or Fahrenheit - from the list that appears under *Setup* menu.

> ✎ **Note**
> This Reference Manual is written for Telemetry Panel version **2.4.6.8** or later, and is not suitable for earlier software and firmware versions.

3.1 Software Overview

Software is organized in tabs according to the main functions:

Telemetry In this tab real-time telemetry data are displayed in easy-to-read format. You can also look at variables over time, both in graphical form and as data files.

Programmable Parameters In Programmable Parameters tab you can configure main parameters of UNIDRIVE, import and export them in CFG format.

Advanced Advance Tab includes some more programmable parameters to control your driver.

---

[1]In order to display Chinese Unicode characters, user needs a Unicode Window or Unicode-compatible controls. User may also need to ensure that his Regional Settings are set up to support far eastern text/fonts.

Autotuning The gain parameters for closed-loop current control and offset value of Resolver/SinCos can be estimated in Autotuning tab.

Car EV Mode Only activated for UNIDRIVE M Series. It will not be dealt with in the present manual.

Steering Mode Steering Mode is an advanced operating mode of UNIDRIVE. For more information, see the *Steering Mode* manual.

3.2 Connect UNIDRIVE to your PC

In order to connect your UNIDRIVE to Telemetry Panel, you should connect it to PC and wait for *USB* port recognition. After USB port recognition, you can launch Telemetry Panel and click on *Connection* menu (Figure 3.1).
Connect button permits to start communication toward the select USB port.

> ✎ **Note**
> Telemetry panel automatically creates a list of available USB port. It's then necessary to choose the suitable port where UNIDRIVE is connected.

After connection, Telemetry Panel loads parameters from UNIDRIVE allowing you to change them.
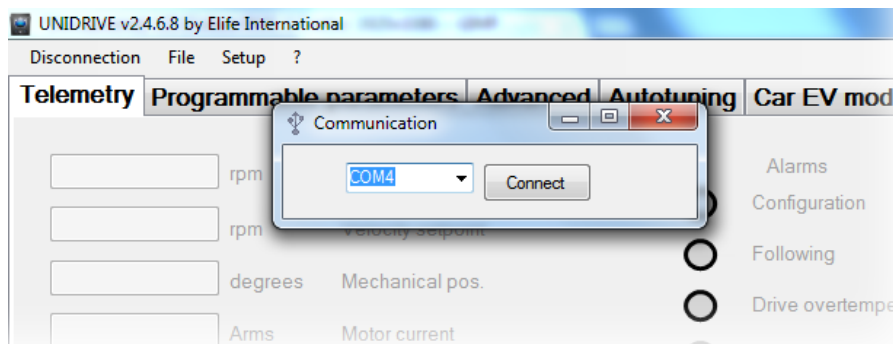

Figure 3.1: Connect your UNIDRIVE to Telemetry Panel by USB port

3.3 Import and Export Parameter Values

After connecting your UNIDRIVE to PC you can easily *import* or *export* (*save*) parameter values from and to *.cfg* file by *Telemetry Panel*.
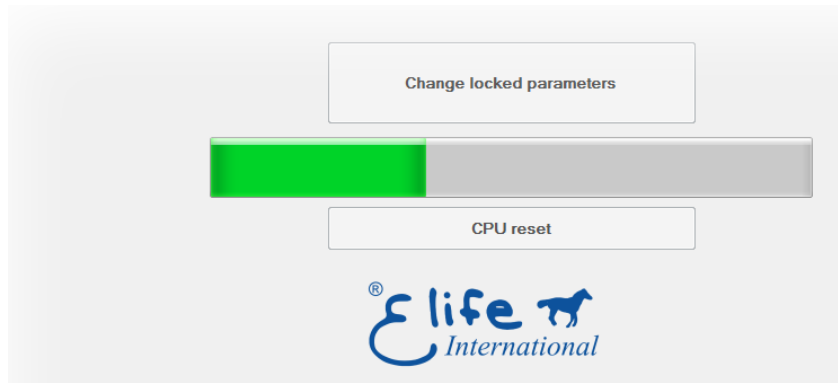
Figure 3.2: When the progress bar is running, Telemetry Panel downloads data from .cfg file to UNIDRIVE.

- In oder to **import** parameters from file and download them on to UNIDRIVE:

    1. Move to *Programmable Parameters* tab.

    2. Select the *File* Menu and click on *Open* option.

    3. Select the desired *.cfg* file and wait for the progress bar to get completely green (Figure 3.2).

- Parameter values can also be **exported** to a *.cfg* file:

    1. Move to *Programmable Parameters* tab.

    2. Select the *File* menu and click on *Save*.

    3. Enter a descriptive name in the file name box and click Save.

3.4 Change Programmable Parameters

Programmable Parameters enables you to customize vehicle's performance characteristics to best fit your needs.

> **Note**
>
> Telemetry Panel automatically recognizes your UNIDRIVE type and the feedback input (Resolver,Hall Sensor,SinCos Encoder,*etc*) that you've installed on your system. The **Parameters** that have their textboxes **empty and disabled** are not interesting for your model connected or for the operating mode selected.
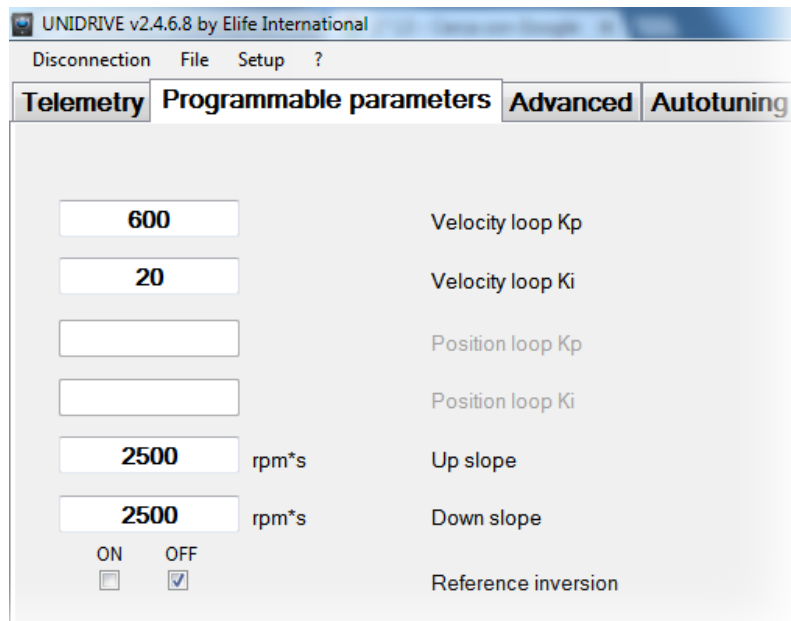
Figure 3.3: Programmable Parameters tab allows you to read and change the main programmable parameters and set the operating mode.

In *Programmable Parameters tab* (Figure 3.3) you can read and change the main programmable parameters and set the operating mode of UNIDRIVE (*Standalone,PLC,etc*). After connecting your UNIDRIVE to PC and **stopping the motor**, the values can be changed in Programmable Parameters tab.

> ⚠ **Warning**
> We recommend saving preset programmable parameters to *.cfg* file before changing them, so that you can restore the preset parameters if necessary. See Section 3.3

3.4.1 Operating Mode and Controller Parameters

Velocity Loop Kp Proportional gain for closed-loop speed control, it must be less than 4096. This parameter is also programmable by CANopen® protocol.

Velocity Loop Ki Integral gain for closed-loop speed control, it must be less than 1024. This parameter is also programmable by CANopen® protocol.

Position loop Kp Proportional gain for closed-loop position control, it must be less than 16384. This parameter is also programmable by CANopen® protocol.

Position loop Ki Integral gain for closed-loop position control, it must be less than 128. This parameter is also programmable by CANopen® protocol.

Note

The gain parameters for closed-loop position control will only processed if configuration is CANopen® and mode of operation is Interpolated Position Mode.

Speed closed loop This text box is only valid for DC motor.

Feedback inversion This text box is only valid for DC motor.

Encoder inversion This text box is only valid for DC motor.

NH Alarm Output If checked OFF, alarm output is normally low (NL), else it is normally high (NH).

Configuration This option set the operating mode of UNIDRIVE. The allowed values for this parameter are *Standalone,CAN Network,PLC* and *RS232* (in Speed or Torque Mode).

Warning

UNIDRIVE must be wired up correctly according to the operating mode selected. See Chapter 2.

Max drive temperature At this drive temperature drive must rise "*Drive over-temperature*" alarm.

Unit	Min Value	Max Value
$°C$	80	110
($°F$)	(176)	(230)

Following error delay When the detected speed is less than 80% or more than 120% of the target speed over the set time, UNIDRIVE stops the motor with *following error* alarm. This parameter is also programmable by CANopen® protocol.

Unit	Min Value	Max Value
s	0	15

3.4.2 Motor and Acceleration Parameters

Up slope Lower values indicate a longer acceleration time and a more gradual departure, while bigger values indicate a faster acceleration. The implemented ramp is linear. This parameter is also programmable by CANopen® protocol.

UNIT	MIN VALUE	MAX VALUE	STEP
rpm/s	500	$35 \cdot 10^5$	500

Down slope Lower values indicate a longer deceleration time and a more gradual arrest, while bigger values indicate a faster deceleration. The implemented ramp is linear. This parameter is also programmable by CANopen® protocol.

UNIT	MIN VALUE	MAX VALUE	STEP
rpm/s	500	$35 \cdot 10^5$	500

Reference inversion It allows you to invert the stated direction.

Max motor speed It indicates the maximum allowed speed for the motor in either direction. It is used to protect the motor and must be taken from the motor datasheet. This parameter is also programmable by CANopen® protocol.

UNIT	MIN VALUE	MAX VALUE
rpm	0	7000

Max speed at slow mode It indicates the maximum allowed speed for the motor in either direction when *Slow* mode is selected.

UNIT	MIN VALUE	MAX VALUE
rpm	0	7000

Backward maximum speed Only valid for UNIDRIVE M Series.

3.4.3 Throttle Parameters

Analogic input This parameter describes the analog operational mode used to process the speed potentiometer. It is processed only for PLC and Standalone.

Value	Description
0 - 10	Direction inversion is realized through direction digital input (DIR/FORWARD).
0-5 - 10	When the potentiometer value is between 5 and $10\,V$ speed reference is positive. When it is less than $5\,V$ speed reference is negative.
0 - 5	Direction inversion is realized through direction digital input (DIR/FORWARD)
0-2.5 - 5	When the potentiometer value is between 2.5 and $5\,V$ speed reference is positive. When it is less than $2.5\,V$ speed reference is negative

Deadband It is the percentage of deadband for potentiometer. Increasing deadband enlarges the stop range.

Unit	Min Value	Max Value
%	0	50

Tips and Advice

This parameter is particularly useful for potentiometers that can't regularly go back to a clear idle point. Deadband must be wide enough to guarantee the transfer of driver to idle when accelerator mechanism is released.

3.4.4 CANopen® Parameters

Size Indicator if checked ON, the size of the data to be transmitted is specified in the last four bytes of the communication.

CANopen® address It's the CANopen® node-ID for the device that is the network-wide unique identifier for each device. When this parameter value is changed, device will be automatically reset.

Unit	Min Value	Max Value
$integer$	0	127

CANopen® baudrate The baudrate for the CANopen® communication between PLC and the device. When this parameter value is changed, device will be automatically reset.

Unit	Allowed Values
$Kbps$	1000 - 500 - 250

3.4.5 Locked Parameters

In Programmable Parameters tab there are a few programmable parameters which their text-boxes are disabled but filled with a value (Figure 3.4). You can unlock them and change their value.

> **⚠ Warning**
> These parameters are critical for the correct function of UNIDRIVE. You should change these parameters carefully and only if necessary.

In order to change these parameters:

1. Click on **Change Locked Parameters** button.

2. Insert the password: **8192**

After unlocking, you will be able to change:

Current Loop Kp Proportional gain for closed-loop current control; it must be less than 1024. This parameter is also programmable by CANopen® protocol.

Current loop Ki Integral gain for closed-loop current control; it must be less than 512. This parameter is also programmable by CANopen® protocol.

 Tips and Advice
 The Kp and Ki values can be calculated by using Telemetry Panel. See Section 3.5.1

Motor poles It indicates the number of motor poles and must be taken from motor datasheet.

Unit	Allowed Values
even integer	4 - 6 - 8 - 10 - 44

Phase Advance Phase advance techniques provide field-weakening operation to improve efficiency and torque performance for brushless machines. This

Figure 3.4: In Parameters Programmable tab there are some parameters locked. You can unlocked them after clicking on *Change Locked Parameters* button.

parameter indicates the phase advance angle with respect to back-EMF of phase current.

Unit	Min Value	Max Value	Step
$a.u.$	0	32	1

💡 **Tips and Advice**

Motors whose inductance value is high might require a high value of phase advance angle.

Maxiumum phase current It shows the maximum permissible current in the motor. This parameter is also programmable by CANopen® protocol.

Unit	Min Value	Max Value
$Amperes\ RMS$	0	Max[2]

Brake current reduction It is the reduction of current and voltage applied to motor. It's useful to reduce thermal dissipation due to service brake activation. It

---

[2] The maximum peak output current depends on the UNIDRIVE model installed.

intervenes only after one minute from brake activation. Its value must be less than 50%.

Resolver/SinCos offset This parameter is only valid for Motor with Resolver or SinCos Encoder. Offset to sum to resolver/encoder position.

Unit	Min Value	Max Value
degree	0	359.99

> 💡 **Tips and Advice**
>
> Resolver/SinCos offset value can be calculated by using Telemetry Panel. See Section 3.5.2

Phase zero This parameter is only valid for Hall sensor drive. It must be chosen applying forward direction.

Unit	Min Value	Max Value
degree	0	359.99

Phase offset(backward) This parameter is only valid for Hall sensor drive. It must be chosen after precisely setting of phase zero, applying backward direction.

Unit	Min Value	Max Value
degree	0	359.99

> 💡 **Tips and Advice**
>
> For phase zero and phase offset value we suggest to start with a small value (e.g. 0.05) and increase by 5 until motor consumption and sinewave are at their best.

Hall sensor phashing This parameter is only valid for Hall sensor drive. It indicates the relative position of Hall sensors.

Unit	Allowed Values
degree	60 - 120

S2 Maximum current This text box is only valid for DC motor.

S2 time This text box is only valid for DC motor.

Back-EMF sample duration This text box is only valid for DC motor.

Back-EMF sample period This text box is only valid for DC motor.

Ke This text box is only valid for DC motor.

3.4.6   Advanced Parameters

Adavanced tab allows you to read and change some more programmable parameters (Figure 3.5).

Some information about UNIDRIVE - such as **firmware version**, serial number, customer code, *etc* - and **CANopen® parameters are displayed** in this tab.

❯ It's possible to **read** the following *telemetry data*:

Direct current It shows the actual value of direct current, that is one output for Park transform (stator current component proportional to the flux). Motor is working fine if it is about 0. It is given in arbitrary unit.

Quadrature current It shows the actual value of quadrature current, that is one output for Park transform (stator current component proportional to the rotor torque). It is given in arbitrary unit.

Direct voltage It shows the actual value of direct voltage, that is one output for PI closed-loop. It is given in arbitrary unit.

Quadrature voltage It shows the actual value of quadrature voltage, that is one output for PI closed-loop. It is given in arbitrary unit.
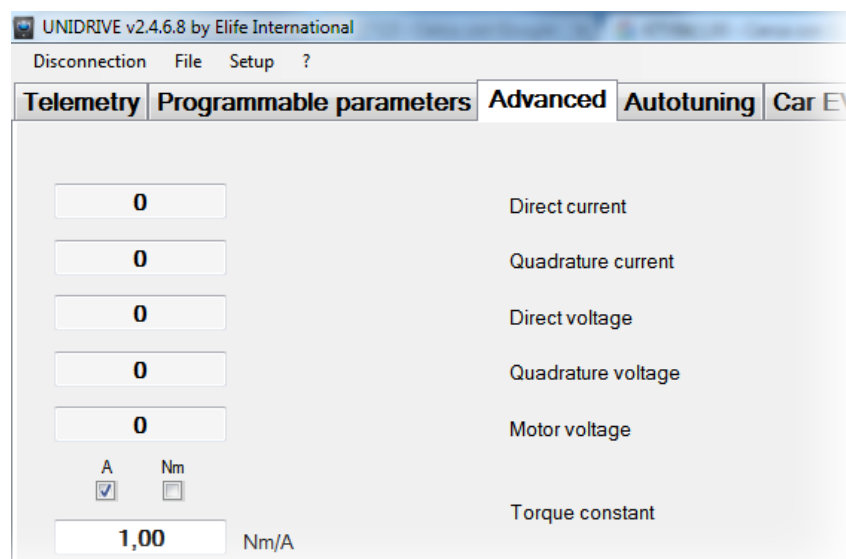

Figure 3.5: In Advanced tab is possible to read and change some more programmable parameters.

Motor voltage It shows the actual value of motor voltage. It is given in arbitrary unit.

❯ In Advanced tab you can also **modify** the following programmable parameters:

Torque constant This variable permits to convert motor torque current from $Amperes$ to $N{\cdot}m$. This parameter is also programmable by CANopen® protocol.

Unit	Min Value	Max Value
$N{\cdot}m/A$	0.00	10.00

Analog output This parameter is only available for UNIDRIVE M Series.

Analog output function This parameter is only available for UNIDRIVE M Series.

Brake fault alarm When turned OFF, UNIDRIVE won't stop the motor nor inform about a brake failure.

Supply fault alarm When turned OFF, UNIDRIVE won't stop the motor nor inform about a power supply relay failure.

Lower battery dinamic decrease if it turned ON, when the battery is being consumed UNIDRIVE decrease automatically the speed in order to extend the battery life.

Overtravel warning When turned ON, UNIDRIVE will stop the motor when one of two over-travel inputs will get high. Only for PLC Mode

Emergency input fault If emergency input fault is ON, when emergency input gets low motor will stop with alarm; otherwise motor will only stop with ramp.

Alarm output N.L. logic This textbox is disabled for UNIDRIVE H Series in standard operating mode.

Emergency Slope This parameter configures alarm deceleration, lower values indicate a longer deceleration time and a more gradual arrest, while bigger values indicate a faster deceleration. The implemented ramp is linear. This parameter is also programmable by CANopen® protocol.

Unit	Min Value	Max Value	Step
rpm/s	500	$35 \cdot 10^5$	500

Temperature probe type From this combobox, user can select the correct PTC type from Thermostat, KTY83/122, KTY84/130 or none.

> **Note**
>
> If KTY83/122 or KTY84/130 is chosen, it will also be possible to read motor temperature from *Telemetry tab*.

Maximum motor temperature At this temperature drive must rise *Motor overtemperature* alarm.

UNIT	MIN VALUE	MAX VALUE
$°C$	0	255
$(°F)$	(32)	(491)

Encoder resolution This parameter is only available for DC motors.

Mechanical reducer This parameter is only available for DC motors.

Encoder resolution This parameter is only available for DC motors.

Potentiometer Supply This parameter is only available for UNIDRIVE M Series.

TPD02 transmission type It sets the type of transmission for TPDO2. It's only processed if configuration is CANopen® and can be programmable by CANopen® protocol also.

UNIT	MIN VALUE	MAX VALUE
integer	1	255

RPD02 transmission type It sets the type of transmission for RPDO2. It's only processed if configuration is CANopen® and can be programmable by CANopen® protocol also.

UNIT	MIN VALUE	MAX VALUE
integer	1	255

In Advanced tab there is also **Reset Alarm** button which allows you to reset all current alarms.

3.5 Auto-tuning UNIDRIVE Parameters

Telemetry Panel includes two functions which help you to estimate approximate value of the following parameters:

- The gain parameters for closed-loop current control.

- The Offset Resolver/SinCos to sum to resolver/encoder position.

> ⚠ **Warning**
> Please note that the suggested parameters are only a point of departure. They must be adjusted according to system and you should run the motor only after checking them.

3.5.1 Gain Parameters for closed-loop Current Control

In order to calculate the value of Kp and Ki for closed-loop current control you need two basic motor information: **Winding resistance** and **Winding inductance**.
You should normally find these parameters on *data-sheet* of your *motor,* otherwise you must ask the motor manufacturer to provide these data.

To calculate Kp and Ki values by Telemetry Panel:

1. Move to Autotuning tab (Figure 3.6).

2. Insert the **Winding resistance** and **Winding Inductance** value.

3. Click on *Calculate* button.

Telemetry Panel shows you the value of Kp and Ki and gets you some information (Cut Frequency, Motor RL Constant, PWM attenuation) which can be useful to tune Kp and Ki parameters.

> 📝 **Note**
> Telemetry Panel will automatically send the suggested current loop Kp and Ki values to UNIDRIVE.

Figure 3.6: In Autotuning tab allows you to estimate gain parameters for closed-loop current control.

3.5.2 Offset Resolver/SinCos

Finding the correct value of *Offset Resolver/SinCos* is critical to the proper functioning of the system. Telemetry Panel helps you determine the correct value of *Offset Resolver/SinCos* to sum to resolver/SinCos position:

1. Move to *Programmable Parameters* tab.

2. Choose **RS232 Speed** as *Configuration*.

3. Move to *Autotuning* tab and check if **Feedback state** is green, else see Appendix A.

   > **Note**
   > **For SinCos Encoder:** Before finding the correct offset value, you must run the SinCos adjustment function (Figure 3.7b). Click on **Start** button and wait for about 30 seconds.

4. Set the *Test Current* in $Amperes\ RMS$ (Figure 3.7a). This value depends on motor dimension and characteristics.

5. Click on *Find Offset* button and wait for the progress bar to get completely green.

6. Check that motor runs through *Velocity Target* trackbar.

   > **Note**
   > Telemetry Panel will automatically send the new value of Offset Resolver/SinCos calculated to UNIDRIVE.

In *Resolver Autotuning* panel you can see two LED indicators:

Resolver state This alarm indicates that resolver cable isn't connected or that resolver is broken. If led is red, it won't be possible to accomplish resolver autotuning.

Brake state This led reflects the brake setting: when brake is locked led is green, when unlocked led is yellow. When led is red, it indicates a brake failure.
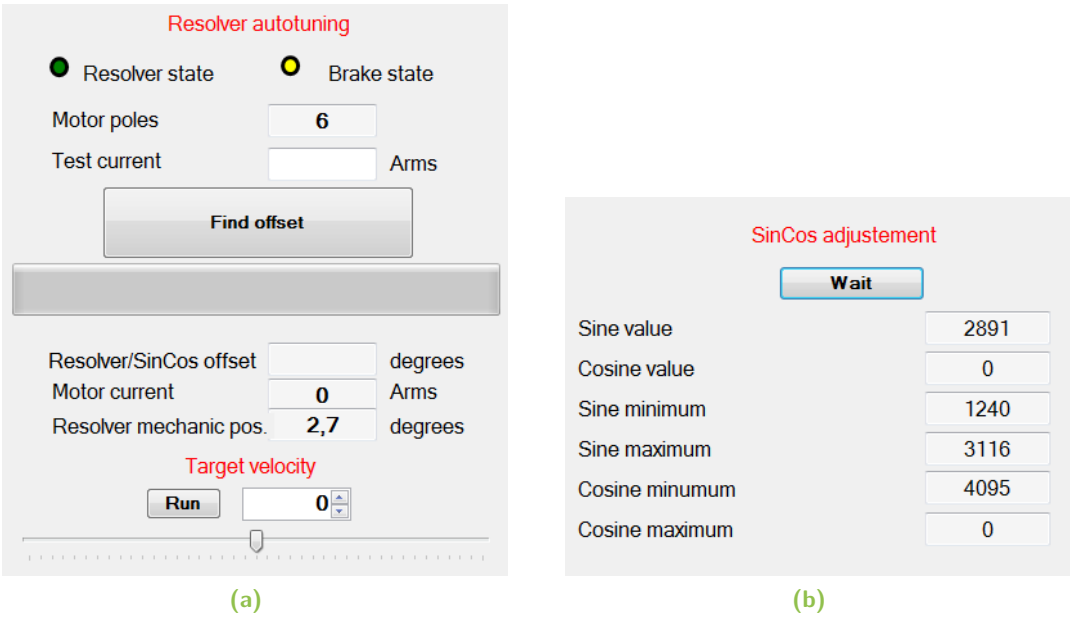

(a)   (b)

Figure 3.7: Telemetry Panel helps you to find the correct value of offset Resolver/SinCos value **(a)**. In case you've mounted a SinCos Encoder on your motor, you must before running the SinCos adjustment function **(b)**

Monitoring UNIDRIVE

<div align="right">

4

</div>

After wiring up correctly UNIDRIVE (See Chapter 2) and adjusting the programmable parameters (See Chapter 3), you are finally ready to test your system.

> ⚠️ **Warning**
> Before starting the test, you had better lift your vehicle up. The driving wheels must be off the ground and free to rotate. All testing and adjustment must be done in safe condition.

4.1 LED Diagnostics

UNIDRIVE has an LED light on the front of the device that visually explains what the driver is doing. Below is the explanation of the different LED's status:

Blinking ORANGE UNIDRIVE works correctly, motor is stopped

Blinking GREEN UNIDRIVE works correctly, motor is running

Steady RED UNIDRIVE detects one or more alarms. In this case, UNIDRIVE stops motor rotation (disabling power relay and three-phase bridge) and unlocks motor brake.

If **CANopen**® mode is set, and the CANopen® FSA State is *Switch on disabled*, led will be **steady ORANGE** until it will receive shutdown command from PLC, independently from alarms or motor state.

4.2 Reading Telemetry Data from Telemetry Panel

UNIDRIVE collects several types of telemetry data which allows you to understand better how your driver works.
Telemetry Panel[1] shows telemetry data values for each operating mode selected (Standalone,PLC,CAN Network,RS232).

---

[1]In Chapter 3 is explained the details how install and connect your UNIDRIVE to PC.

In Telemetry Panel you can read the following telemetry-data:

Motor velocity It is the detected speed, expressed in rotations per minute (rpm).

Velocity setpoint It displays the actual velocity target. This value is gotten from:

- The **Potentiometer** for *PLC* and *Standalone* configuration.

- The **CAN master** if you set *CAN Network* or PLC in CANopen® configuration as *Configuration*.

- The **Target Velocity Trackbar** for *RS232* configuration.

Mechanic. pos. It shows the resolver/encoder mechanical position in mechanical degrees. This is displayed only for Brushless motor with Resolver/SinCos.

Motor current or Torque This shows the actual motor current ($Ampere\ RMS$) or the Torque ($N{\cdot}m$) value.

Heat sink temperature Temperature of UNIDRIVE heat-sink.

Drive Temperature Temperature of UNIDRIVE.

Motor Temperature This information is available only if *Temperature probe type* parameter in *Advanced tab* is **KTY83/122** or **KTY84/130**.

Bus voltage It shows the real-time bus voltage.

Figure 4.1: Telemetry Panel displays a wide range of telemetry data and enables you to plot or log these data over time.

Analog input 2 It's only displayed for UNIDRIVE M Series.

Output Power It shows the relative electrical output power.

Actual position It shows the actual of position control closed-loop. This parameter is processed only for *CAN Network* configuration when the operational mode is *Interpolated position mode*.

Position setpoint It is the position target of position control closed-loop. This parameter is processed only for *CAN Network* configuration when the operational mode is *Interpolated position mode*.

Motor state This text box indicates if motor is stopped or if it is running, and in which direction.

VALUE	DESCRIPTION
CCW rotation	Cunterclockwise rotation, backward direction
CW rotation	Clockwise rotation, forward direction

4.2.1 Alarm Indicators

The Alarm Indicators on *Telemetry* tab enable you to determine what kind of errors are present. When UNIDRIVE detects one or more alarms stops motor rotation (disabling power relay and three-phase bridge) and unlocks motor brake.
A **green led** means that the corresponding alarm isn't signaled, while a **red led** means that the alarm is active.

The Alarm indicators are as follows:

Configuration This error appears when:

- No *configuration* (Standalone, CAN Network, PLC, RS232) is selected.

- Set *pole number* is different from allowed values.

- The internal memory of UNIDRIVE has never been programmed.

Following This kind of alarm happens when the detected speed is less than 80% or more than 120% over the set time period (See Section 3.4.6).

Drive overtemperature This alarm happens when the drive temperature is higher than *max drive temperature degrees* (See Section 3.4.6).

Communication timeout This alarm happens when configuration is **Steering** and driver measure a communication timeout.

Feedback This alarm indicates that the feedback cable isn't properly connected or that the feedback is broken.

Overcurrent It happens whenever one of the modules of three current phases is higher than a threshold.

Emergency input It indicates that the emergency input is not supplied, if LED is yellow it means that drive just set target velocity to 0. it is processed only for *PLC, Standalone* and for *RS232 configuration*.

Overvoltage This error is showed when bus voltage is higher than $80\,V$ for $24 \div 48$ models and $122\,V$ for $48 \div 96$ models.

Setpoint error It indicates that speed potentiometer isn't initially put to 0. It's processed only for Standalone configuration.

Analogic interruption It indicates that analog input for velocity reference isn't connected. It's processed only for PLC and Standalone configuration.

Motor overtemperature This alarm appears when:

- Motor temperature exceeds *Maximum motor temperature* value if set PTC type is *KTY83/122* or *KTY84/130*.

- Motor temperature sensor isn't connected if *Thermostat* is selected as PTC type.

Safety It is only displayed for UNIDRIVE M Series.

Stalled Rotor It's alarm appears when the motor is blocked and at the same time the phase current is high about for approximately for a second.

Other This alarm is showed when bus voltage is lower than 12 V.

For information on troubleshooting possible issues, see Appendix A.

4.2.2 Reset all Current Alarms

In *Advanced Tab* is present a **Reset Alarms** button that allows you to reset all running alarms.

> **Tips and Advice**
>
> It's also possible to reset all running alarms with a *rising edge* signal (transition from low to high) at the **PIN 15** (RUN / STOP) in **Standalone** and **PLC** configuration and with a *fault reset command* if you employ **CAN telemetry protocol**.

4.2.3 Digital I/O and Drive State Indicators

The I/O indicators enables you to read in real-time the status of input and output signal. If a led indicator is **green** means that the corresponding input/output is active: it's **supplied** if it's an **input** pin or it **sends** a signal if it's an **output** pin. The meaning of different input/ouput pins in according to the operating mode selected - *PLC,Standalone,CAN Network,RS322* - is given in Table 4.1.

Table 4.1: Description of Digital I/O indicators in Telemetry Panel.

	STANDALONE	PLC	CAN NETWORK	RS232
Input 1	HANDBRAKE	CCW OVERTRAVEL	Positive limit switch	/
Input 2	FAST / SLOW	CW OVERTRAVEL	Negative limit switch	/
Input 3	FORWARD[a]	Direction[a]	Home switch	/
Input 4	BACKWARD[a]	RUN CAN address 0	CAN address 0	/
Input 5	EMERGENCY	EMERGENCY CAN address 1	CAN address 1	EMERGENCY
Output 1	Reverse	/	/	/
Output 2	Drive status	/	/	/
Output 3	Drive alarm			
Output 4	Encoder emulator			

[a] Only if "*Analog input*" is 0-10V or 0-5V.

The **Drive State Indicators** get you some information about the following UNIDRIVE state:

Power Relay This led reflects the supply relay:

Status	Meaning
Green	The relay is enabled
Yellow	The relay is disabled
Red	Power supply relay failure

💡 **Tips and Advice**

If you get this alarm only when you give RUN command, this behavior is probably due to a Resolver problem (See Appendix A and read the **Feedback Alarm** troubleshooting).

Brake State This led reflects the brake setting:

Status	Meaning
Green	The brake is locked
Yellow	The brake is unlocked
Red	The brake failure

Speed Limitation This is indicator is yellow when quadrature current is saturating and so drive is limiting velocity.

Inversion fuse This is indicator is red when **F+** and **B-** connections have been inverted at least once.

Period overcurrent It's displayed only for DC motors.

CW overtravel This indicator is yellow when drive is stopped because driver CW OVERTRAVEL input is high.

CCW overtavel This indicator is yellow when drive is stopped because driver CCW OVERTRAVEL input is high.

📝 **Note**

Some of these controls can be disabled in *Advanced tab*. See Section 3.4.6.

4.2.4 The Target Velocity/Torque Track Bar

The *Target velocity/Target torque* track bar is enabled on Telemetry Tab when **RS232** velocity/tourque mode is chosen as *Configuration* in Programmable Parameters Tab (Figure 4.2).

This track bar allows you to manually set the target velocity - or torque - value of your Motor from 0 to the *Max value* that you have set as the *Max motor Speed* (See Section 3.4.2). The sign of value determine the direction of rotation:

VALUE	DIRECTION OF ROTATION
Positive	CW
Negative	CCW

This function can be useful for testing your motor, without worrying about other devices (e.g: potentiometer) or other controllers (e.g: PLC).
You can also put the exact value of desired target velocity/tourque on the textbox at the left end of the track bar.

Figure 4.2: Target Velocity track bar is enabled by the *RS232* mode when this operating mode has been chosen as *Configuration* in Programmable Parameters tab.

4.3 Plot and Log Telemetry Data in Real-Time

In telemetry Panel you can also plot telemetry data over time and create a log file to view later in a spreadsheet program.
Telemetry Panel allows you to set the following plot parameters:

Y-axis Scale *Y Max* and *Y Min* set the maximum and minimum value the y-axis of the plot.

Time Scaling You can choose how much time to display in X-axis in **X Scaling**:

VALUE	DESCRIPTION
x1	1s/div
x2	2s/div
x3	3s/div
...	

After adjusting the X/Y ranges you can plot and log telemetry data following below instructions.

Table 4.2: Plotting and logging telemetry data with Telemetry Panel.

BUTTON	FUNCTION	BUTTON	FUNCTION
	Play Button Start to plot telemetry data		Pause Button Stop plotting telemetry data
	Save Button Start to log telemetry data		Stop Button Stop collecting telemetry data

1. Select one or more (max four) telemetry data that you'll want to observe from *TRACE 1*, *TRACE 2*,*TRACE 3* or *TRACE 4* list (Figure 4.3).

2. Click on *Play button*.

3. If you want to log these data click on *Save button* and enter a descriptive name in the file name box and click Save.

4. Click on *Stop button* when you want to stop collecting data.

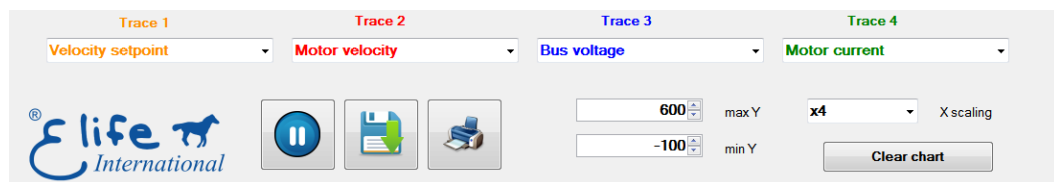5. To stop plotting telemetry data and freeze the plot you must click on *Pause button*.

Figure 4.3: Telemetry Panel allows you to plot and log one or more telemetry data.

Maintenance

UNIDRIVE no needs any maintenance interventions. It's only necessary to keep the contacts and the controller clean and dry. The fuse is the only user-serviceable part in the UNIDRIVE (See Table 2.2, Pag. 7).

> ⚠️ **Warning**
> Never attempt to disassemble, repair, or modify the UNIDRIVE yourself, penalty the voiding of the warranty rules.

If you perform a maintenance operation on your system owing to a problem, it could be useful to read the **error messages** that have been sent by UNDRIVE. You can read these messages in one of the following ways:

Diagnostic Display Elife Diagnostic Display allows you to get some information about battery - autonomy and voltage - and UNIDRIVE fault codes.

Telemetry Panel Telemetry Panel enables you to control your UNIDRIVE and read a wide range of telemetry data (See Chapter 4).

CAN Network The error messages that have been sent by UNIDRIVE can be read through the CANopen® protocol[1].

RS232 You can read the error messages through the RS232 protocol[2].

For more information on the meaning of error messages and troubleshooting procedures, see Section 4.2.1 and Appendix A.

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[1]For further information, see **UNIDRIVE - CANopen®** manual
[2]For further information, see **UNIDRIVE - RS232 Communication Protocol** document

Troubleshooting: Alarm Messages

A

This section covers only the common and likely causes of alarm messages and actions that should be taken by the operator.

UNIDRIVE alarms can be interpreted using the **Telemetry Panel** (See Chapter 5), **Elife Diagnostic Display** or can be read through the **CanOpen**® Protocol also.

> **Note**
>
> In Advanced Tab in Telemetry Panel software is present a **Reset Alarms** button that allows you to reset all running alarms.

After the resolution of the problem, UNIDRIVE might need to be restarted.

Configuration Alarm

DESCRIPTION This error appears when:

- No *configuration* (Standalone, CAN Network, PLC, RS232) is selected.

- Set *pole number* is different from allowed values.

- The internal memory of UNIDRIVE has never been programmed.

UNIDRIVE BEHAVIOUR After switch on, drive won't enable power relay and three-phase bridge.

POSSIBLE TROUBLESHOOTING ISSUE

1. Check if a configuration is selected in the **Configuration** list (See Section 3.4.1).

2. If the other programmable parameters are null, it also needs to download parameters from motor configuration file (See Section 3.3).

3. Check if the **pole number** value is correct (See Section 3.4.5).

Following Alarm

DESCRIPTION This kind of alarm happens when the detected speed is less than 80% or more than 120% over the set time period (See Section 3.4.6).

UNIDRIVE BEHAVIOUR UNIDRIVE stops motor rotation with emergency slope (disabling power relay and three-phase bridge) and unlocks motor brake.

POSSIBLE TROUBLESHOOTING ISSUE There are two possible reasons for this alarm: the phase current isn't sufficient to accomplish operation or your motor is unable to attain the desired speed.

- Check the integrity of the fuse.

- Check if the motor is braked.

- Check the maximum phase current (See Section 3.4.5) is correct for your motor.

- Check if the gain parameters for closed-loop velocity control fit your needs.

- Increasing the *Following error delay* value (See Section 3.4.6).

- Decrease the *Max motor speed* if your motor is unable to achieve it (See Section 3.4.2).

Drive overtemperature Alarm

DESCRIPTION This alarm happens when the drive temperature is higher than the set *maximum drive temperature* degrees (See Section 3.4.6).

UNIDRIVE BEHAVIOUR UNIDRIVE stops motor rotation with emergency slope (disabling power relay and three-phase bridge) and unlocks motor brake.

POSSIBLE TROUBLESHOOTING ISSUE Restore drive temperature conditions, then reset alarms. If the error appears frequently, you must improve heat exchange between the UNIDRIVE and the vehicle surface (See Section 2.1).

Communication timeout Alarm

DESCRIPTION This alarm happens when configuration is **Steering** and master measure a communication timeout.

UNIDRIVE BEHAVIOUR UNIDRIVE stops motor rotation with emergency slope (disabling power relay and three-phase bridge) and unlocks motor brake.

POSSIBLE TROUBLESHOOTING ISSUE Check configuration and wiring between the UNIDRIVE and master (See **UNIDRIVE - Steering Mode Manual**).

Feedback Alarm

DESCRIPTION The Feedback cable isn't properly connected or otherwise if this error appears when your motor is running, the possible causes are:

- Lack of earth interconnection between motor housing and driver negative terminal (**-**).

- Probable leakage between motor housing and phases.

- The Feedback cable passed near power cables.

- **For Resolver and SinCos:** Radial misalignment between Resolver/SinCos stator and rotor (this results in driver input signal undervoltage).

- **For Hall Sensor:** The Hall sensors are not precisely linked.

UNIDRIVE BEHAVIOUR UNIDRIVE stops motor rotation with emergency slope (disabling power relay and three-phase bridge) and unlocks motor brake.

POSSIBLE TROUBLESHOOTING ISSUE **Firstly**, check the feedback cable connection:

1. Check the feedback cable connection on driver/feedback side.

2. Check the electrical integrity of the cable, pay specific attention to the cable's shield.

3. Ensure that the feedback cable was constructed specifically for the feedback type mounted on your motor. It's essential that the feedback cable is of the high quality.

> If these checks failed, you must:

1. Check the correct connection between motor housing appropriate terminal and driver negative terminal (**-**).

2. Check electrical isolation between every phase and motor housing.

3. Pass feedback cable as far as possible from power cables.

4. Check the correct Resolver/SinCos installation within motor.

Overcurrent Alarm

DESCRIPTION It happens whenever one of the modules of three current phases is higher than a threshold.

UNIDRIVE BEHAVIOUR UNIDRIVE stops motor rotation with emergency slope (disabling power relay and three-phase bridge) and unlocks motor brake.

POSSIBLE TROUBLESHOOTING ISSUE The possible actions that should be taken:

- Check the proper functioning of the feedback system.

- Check if the gain parameters for closed-loop current control are not too high for your application (See Section 3.4.5).

If this error appears when your motor is in **generator mode**, the voltage generated by your motor is higher than the battery voltage: Change your battery system or decrease the Max motor speed value (See Section 3.4.2).

Emergency input Alarm

DESCRIPTION It indicates that the emergency input is not supplied. It's processed only for *PLC*, *Standalone* and for *RS232 configuration*.

UNIDRIVE BEHAVIOUR UNIDRIVE stops motor rotation with emergency slope (disabling power relay and three-phase bridge) and unlocks motor brake.

POSSIBLE TROUBLESHOOTING ISSUE Check the *Emergency Input* (**PIN 3**), then reset alarms.

Overvoltage Alarm

DESCRIPTION This error is showed when bus voltage is higher than $80\,V$ for $24 \div 48$ models and $122\,V$ for $48 \div 96$ models.

UNIDRIVE BEHAVIOUR UNIDRIVE stops motor rotation with emergency slope (disabling power relay and three-phase bridge) and unlocks motor brake.

POSSIBLE TROUBLESHOOTING ISSUE There are two possible explanation for this alarm:

- Battery voltage, or battery charging voltage, is too high for the UNIDRIVE Type installed.

- The voltage generated by your motor, when is in **generator mode**, is higher than the battery voltage: Change your battery system or decrease the Max motor speed value (See Section 3.4.2).

Setpoint Alarm

DESCRIPTION It indicates that the speed potentiometer isn't initially put to 0 or the speed potentiometer is grater than 25% of the end-of-stroke during the start phase of the motor. It's processed only for *Standalone* configuration.

UNIDRIVE BEHAVIOUR After switch on, drive won't let motor run.

POSSIBLE TROUBLESHOOTING ISSUE Put the speed potentiometer to idle state, then reset alarms.

Analogic interruption Alarm

DESCRIPTION It indicates that analog input for velocity reference isn't connected. It is processed only for PLC and Standalone configurations.

UNIDRIVE BEHAVIOUR When motor is rotating, if analog input cable will disconnect or break during run operation, UNIDRIVE stops motor rotation with emergency slope (disabling power relay and three-phase bridge) and unlocks motor brake.

POSSIBLE TROUBLESHOOTING ISSUE Check the *wiring* between PIN 21 (AIN / WIPER POT) and UNIDRIVE.

Motor overtemperature Alarm

DESCRIPTION This alarm appears when:

- Motor temperature exceeds *Maximum motor temperature* value if set *Temperature probe type* is *KTY83/122* or *KTY84/130*.

- Motor temperature sensor isn't connected if *Thermostat* is selected as *Temperature probe type*.

UNIDRIVE BEHAVIOUR UNIDRIVE stops motor rotation with emergency slope (disabling power relay and three-phase bridge) and unlocks motor brake.

POSSIBLE TROUBLESHOOTING ISSUE If motor hasn't any PTC, set **none** as *Temperature probe type* option (See Section 3.4.6. Otherwise, restore motor temperature conditions, then reset alarms.

Stalled rotor Alarm

DESCRIPTION This alarm appears when the motor is blocked and at the same time the phase current is high about for approximately for a second. For instance, the vehicle's wheels are blocked by an obstacle.

UNIDRIVE BEHAVIOUR Drive won't enable power relay and three-phase bridge.

POSSIBLE TROUBLESHOOTING ISSUE Find the cause of the block and then remove it.

Other

DESCRIPTION This alarm is showed when bus voltage is lower than 12 V.

UNIDRIVE BEHAVIOUR After switch on, drive won't enable power relay and three-phase bridge.

POSSIBLE TROUBLESHOOTING ISSUE The possible actions that should be taken:

- Check the integrity of the fuse.

- If this error appears always when you run UNIDRIVE, contact the technical assistance.

B

Index of Programmable Parameters

NAME	OPERATING RANGE			PROGRAMMABLE by CANOPEN®	REFERENCE
	UNIT	MIN	MAX		
Maximum motor temperature	°C (°F)	0 (32)	255 (491)		Pag. 41
Maximum phase current	Amperes RMS	0	Max	●	Pag. 37
Motor poles	integer	4	44		Pag. 36
NH Alarm Output	boolean value				Pag. 33
Overtravel warning	boolean value				Pag. 40
Phase Advance	a.u.	0	32		Pag. 36
Phase offset(backward)	degree	0	359.99		Pag. 38
Phase zero	degree	0	359.99		Pag. 38
Position Loop Ki	a.u.	0	128	●	Pag. 32
Position Loop Kp	a.u.	0	16384	●	Pag. 32
Reference inversion	boolean value				Pag. 35
Resolver/SinCos offset	degree	0	359.99	●	Pag. 38
RPD02 transmission type	integer	1	255	●	Pag. 41
Size Indicator	boolean value				Pag. 35
Supply fault alarm	boolean value				Pag. 40
Temperature probe type	allowed values				Pag. 40
Torque constant	N·m/A	0	10	●	Pag. 40
TPD02 transmission type	integer	1	255	●	Pag. 41
Up slope	rpm/s	500	$35 \cdot 10^5$	●	Pag. 34
Velocity Loop Ki	a.u.	0	1024	●	Pag. 32
Velocity Loop Kp	a.u.	0	4096	●	Pag. 32

Concluded