Low Profile Drive

Size 1 - Size 2 - Size 3

Elife-Drive SR Series

Elife International

Application Reference Manual

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Overview

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SR Elife-Drive is the 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.
Elife-Drive 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 12 V to 96 V Brushless, Brushed and AC ServoMotors.
- The different types of feedback are supported: ***Resolver***, *SinCos*, *Hall Sensors*, *Incremental Encoder*, *Fa-Coder*, *SSI*, *Sensorless*.
- Advanced algorithms for predictive speed and torque control.
- CANopen® modes of operation:[1]: Profile Velocity Mode, Torque Profile Mode, Profile Position Mode, Homing Mode and Cyclic Sync Position Mode
- Electromagnetic Holding Brake Output with DPR System (Dynamic Power Reduction)
- SR Size 1 and Size 2 - Dedicated Safe Torque Off (STO) input
- SR Size 3 - Dedicated Safe Torque Off SIL 3 (STO SIL 3) 2xinputs
- Telemetry of the Internal functions
- European Conformity CE, and designed and tested in accordance with the **EMC** emission (EN 61000-6-4) and immunity (EN 61000-6-2) standards. Elife-Drive is compliant with EN 60950-1 safety requirements.

[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
- ☑ On-the-fly Mode and Gain Set Switching
- ☑ Emergency Deceleration Ramp (Emergency) Input
- ☑ Safe Torque Off (STO) Input

Programmable Input/Output:

- **Six** Digital *Inputs* Single Ended
- **One** 12-bit Analog *Input* 0 ÷ 10 V
- **Four** Digital *Outputs* Singled Ended
- **One** High Powered Brake *Output*
- **One** Programmable 5 or 10V - 100mA Throttle *Output*

SIZE 1 120x85x38 mm PHASE CURRENT *	NOMINAL BATTERY VOLTAGE - MAX MOTOR POWER 12V - 400W 10V ÷ 22V	24V - 800W 16V ÷ 34V	48V - 1.6kW 28V ÷ 70V
up to 35 Arms	SR12-35-040-x	SR24-35-080-x	SR48-35-1.6-x
up to 70 Arms	SR12-70-040-x	SR24-70-080-x	SR48-70-1.6-x

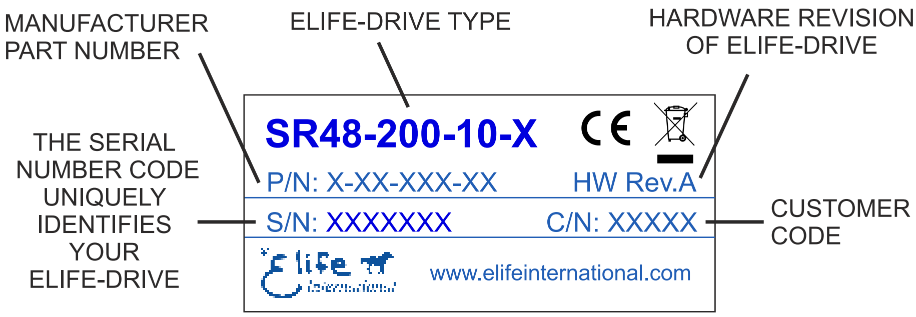
SIZE 2 195x95x32 mm PHASE CURRENT *	NOMINAL BATTERY VOLTAGE - MAX MOTOR POWER 12V - 2.5kW 10V ÷ 22V	24V - 5kW 16V ÷ 34V	48V - 10kW 28V ÷ 75V	72V - 15kW 46V ÷ 100V
up to 100 Arms	SR12-100-2.5-x	SR24-100-5-x	SR48-100-10-x	SR72-100-15-x
up to 200 Arms	SR12-200-2.5-x	SR24-200-5-x	SR48-200-10-x	SR72-200-15-x

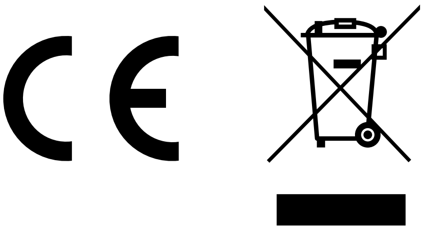
SIZE 3 220x120x32 mm PHASE CURRENT *	NOMINAL BATTERY VOLTAGE - MAX MOTOR POWER 12V - 7kW 10V ÷ 22V	24V - 14kW 16V ÷ 34V	48V - 28kW 28V ÷ 75V	72V - 43kW 46V ÷ 100V	96V - 56kW 65V to 150V
up to 400 Arms	SR12-400-7-x	SR24-400-14-x	SR48-400-28-x	SR72-400-43-x	SR96-400-56-x
up to 600 Arms	SR12-600-7-x	SR24-600-14-x	SR48-600-28-x	SR72-600-43-x	SR96-600-56-x

* The value of the maximum continuous (60 min) RMS phase current is ensured with an appropriate heat sink.

Product Identification Label

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





Compliance with the EU regulatory requirement for electrical and electronic equipment. When your Elife-Drive 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).

2 Installation and Wiring

2.1 Mounting Elife-Drive on-board

The Elife-Drive 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 Elife-Drive on-board you should **ensure an effective heat dissipation** between the Elife-Drive and the vehicle surface.
Elife-Drive has a LED light on the front of the device that visually explains what the driver is doing (see Section 3.1), if you want it to be visible you should take this into consideration before choosing the location where your Elife-Drive will be mounted.

Warning
In order to ensure the proper functioning of the Elife-Drive you must keep the controller clean and dry and ensure an effective heat exchange between the Elife-Drive and the vehicle surface.

The installation must be performed with an adequate heat exchange between the Elife-Drive and the surface on which it will be placed. In Figure 2.1 is shown a suggested installation method in order to ensure an effective heat dissipation between the Elife-Drive and the surface on which it will be placed.

Tips and Advice
A thermal grease should be used on the rear side of the Elife-Drive heatsink to improve the heat exchange between Elife-Drive and the surface on which it will be placed.

If the installation method shown in Figure 2.1 is not sufficient to ensure an effective heat dissipation from the Elife-Drive, you should install a Fan Cooler or a Liquid Cooler on your Elife-Drive.

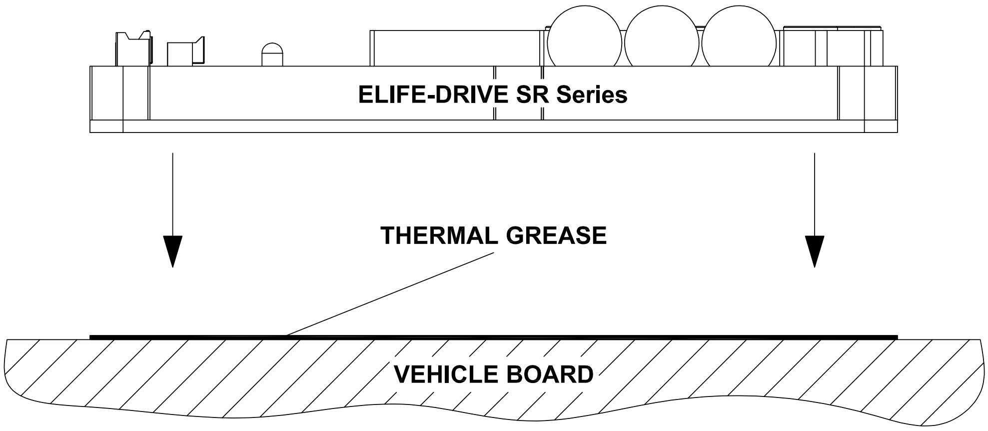


Figure 2.1: A recommended installation method in order to ensure an effective heat dissipation between the Elife-Drive and the surface on which it will be placed. A thermal grease should be used between the Elife-Drive and the surface on which it will be placed.

2.2 Connections

Elife-Drive on the front has different types of connectors:

High Power Connections

The three-phase alternating-current generated by Elife-Drive is supplied through the **U**,**V**,**W** terminals.
The **B+** and **B-** are the positive and negative terminals to connect to your battery.
You must connect an external fuse between the **B+** terminal and the positive battery terminal. (see Section 2.2.1)

Low Power Connections

4 pins female connector for STO SIL 3 Inputs
6 pins female connector for Output Signals
8 pins female connector for Digital Communications CANopen® and RS232
14 pins female connector for Digital, Analog Input and Command Signals
30 pins female connector for Universal Feedback Interface

Details of the 30 pins female connector

- Resolver Differential Input
- SinCos Differential Input (also works in Single Ended mode)
- Multifunction Differential Input
  . Digital SinCos
  . Digital Endat
  . Generic SSI Encoders
  . Generic SPI Encoders
  . The communication protocols installed are constantly updated as needed
- Multifunction Single Ended Input
  . Hall Sensor
  . Incremental Encoder
  . Fa-Coder
- Motor Thermal Sensor Input
- Power Supply Output

4 pins STO connector (only available on SR Size 3)

- STO SIL 3 certifiable 2x Inputs

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 (**B+**,**B-**).

In order to connect correctly Elife-Drive, you should use the following instructions:

1. Connect the **battery negative** cable to the **B-** terminal.

2. An external fuse (See Table 2.1) must be fitted from the **battery positive** to terminal **B+** to avoid damage to the controller.

   Note
   Elife-Drive models haven't any fuse already installed.

Table 2.1: Fuse size in accordance with the Elife-Drive SR Series

Elife-Drive Type	Fuse Rating
SR Size 1	63 A
SR Size 2	250 A
SR Size 3	700 A

* All models of SR Series require an external fuse.

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

   Note
   The **tightening torque** must be:
   for **SR Size 1** = 2.5 Nm for all five Power Connections
   for **SR Size 2** = 4.5 Nm for all five Power Connections
   for **SR Size 3** = 6.5 Nm for all five Power Connections

Table 2.2: A summary table of high-power connections

Terminal	Connect to
B+	Battery positive terminal
B -	Battery negative terminal
U,V,W	U, V, and W motor phases

Warning
When connecting the high power cables, make sure that the feedback cable passes as far as possible from the power cables, possibly with a different path, this to avoid electromagnetic interference.

2.2.2 Low Power Connections

The low power logic control connections are provided by 4 female connectors.

- The feedback interface connector
- The Input/General Purpose connector
- The Output connector
- The Communications interface connector

The pin's description is given in Table below:

30PINS FEEDBACK CONNECTOR (Multifeedback)			
PIN	**NAME**	**DESCRIPTION**	**OPERATING RANGE**
1	R_SIN+	SIN+ - Resolver Input	Resolver standard
2	R_SIN-	SIN- - Resolver Input	Resolver standard
3	R_COS+	COS+ - Resolver Input	Resolver standard
4	R_COS-	COS- - Resolver Input	Resolver standard
5	R_EXC+	EXC+ - Resolver Output	Resolver standard
6	R_EXC-	EXC- - Resolver Output	Resolver standard
7	S_SIN-	SIN- - Analog SinCos Input	From 0 to 5V
8	S_SIN+	SIN+ - Analog SinCos Input	From 0 to 5V
9	S_COS-	COS- - Analog SinCos Input	From 0 to 5V
10	S_COS+	COS+ - Analog SinCos Input	From 0 to 5V
11	DATA+	DATA+ - SSI/SPI Input	RS422 Standard
12	DATA-	DATA- - SSI/SPI Input	RS422 Standard
13	CLK+	CLK+ - SSI/SPI Output	RS422 Standard
14	CLK-	CLK- - SSI/SPI Output	RS422 Standard
15	CSn-SSI	Chip Select Output - SSI	Active low, Imax = 10 mA
16	CSn-SPI	Chip Select Output - SPI	Active low, Imax = 10 mA
17	MOSI+	MOSI+ - SPI Output	RS422 Standard
18	MOSI-	MOSI- - SPI Output	RS422 Standard
19	THERM-A	Thermal sensor - Terminal A	-
20	THERM-B	Thermal sensor - Terminal B	-
21	DGND	Digital Common Ground	-
22	GND_ISO	Insulated Resolver Ground, to be used for HW rev.C and later	-
23	DGND	Digital Common Ground	-
24	5VOUT	+5V Supply Output	Imax = 50mA
25	H1	H1 - Hall Sensor Input	From 0 to 5V
26	A	A - Incremental Encoder Input	From 0 to 5V
27	H2	H2 - Hall Sensor Input	From 0 to 5V
28	B	B - Incremental Encoder Input	From 0 to 5V
29	H3	H3 - Hall Sensor Input	From 0 to 5V
30	Z	Z - Incremental Encoder Input	From 0 to 5V

P/N 5016463000 - FEMALE, WIRING VIEW

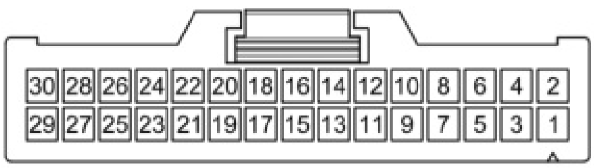
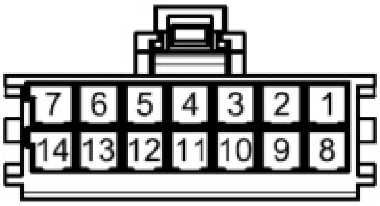


Figure 2.2: **Feedback Sensor Connections**

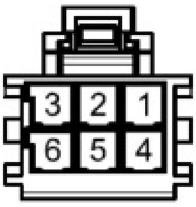
14PINS I/O CONNECTOR			
PIN	**NAME**	**DESCRIPTION**	**OPERATING RANGE**
1	IN1	Digital Input 1	Vmax = 54V, High > 11V
2	IN2	Digital Input 2	Vmax = 54V, High > 11V
3	IN3	Digital Input 3	Vmax = 54V, High > 11V
4	IN4	Digital Input 4	Vmax = 54V, High > 11V
5	IN5	Digital Input 5	Vmax = 54V, High > 11V
6	IN6	Digital Input 6	Vmax = 54V, High > 11V
7	OUT STO	Supply Output - STO	Imax= 50mA
8	SRV PWR	Service Power	From 10 to Vbatt,max
9	NC	Not Connected	-
10	DGND	Digital Common Ground	-
11	AGND	Analog Ground Reference	-
12	VDD POT	Supply Output - Potentiometer	Vout = 5V/10V, Imax = 50mA
13	AIN	Analog Input	From 0 to 5V (or 10V)
14	IN STO	STO Input	-

P/N 1053081214 - FEMALE, WIRING VIEW



6PINS OUT CONNECTOR			
PIN	**NAME**	**DESCRIPTION**	**OPERATING RANGE**
1	OUT1	Digital Output 1	Active Low, Imax = 250mA
2	OUT2	Digital Output 2	Active Low, Imax = 250mA
3	OUT3	Digital Output 3	Active Low, Imax = 250mA
4	OUT4	Digital Output 4	Active Low, Imax = 250mA
5	BRAKE OUT	Digital Output for Motor Brake	Active Low, Imax = 2 A
6	COM+	Positive Common - Digital Outputs	Vmax = 54V

P/N 1053081206 - FEMALE, WIRING VIEW



8PINS SERVICE CONNECTOR			
PIN	**NAME**	**DESCRIPTION**	**OPERATING RANGE**
1	GND CAN	CAN Ground Reference	-
2	CAN-	CAN-	Standard CAN
3	CAN+	CAN+	Standard CAN
4	DGND	Digital Common Ground	-
5	GND RS232	RS232 Ground Reference	-
6	TX RS232	TX RS232	Standard RS232
7	RX RS232	RX RS232	Standard RS232
8	SERVICE	-	GND only to upload firmware

P/N 1053081208 - FEMALE, WIRING VIEW

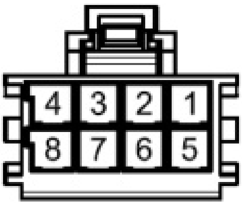
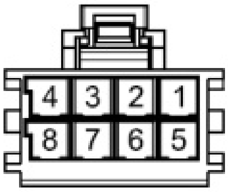


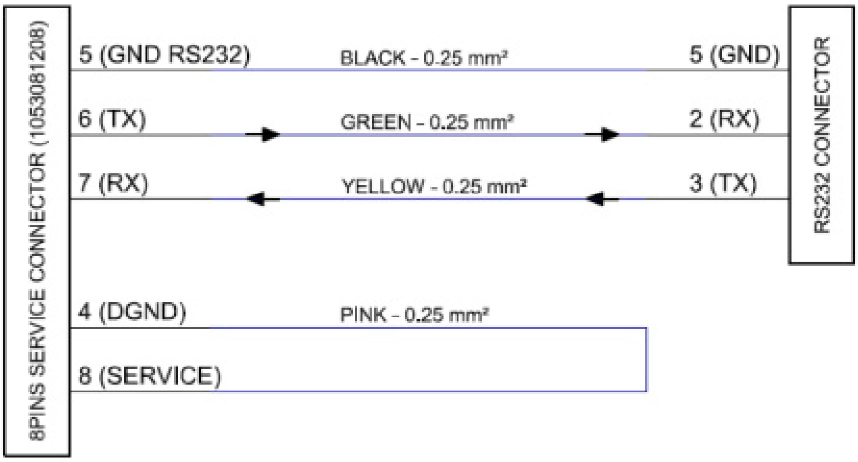
Figure 2.3: **Signal Command Connections**

The programming connections is provided by an 8 pins male connector and a DB9 female connector. The cable description is given in Table below:

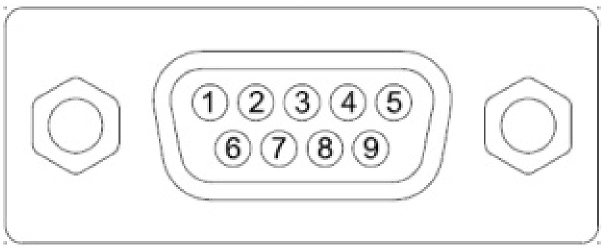
8PINS SERVICE CONNECTOR - FIRMWARE UPDATING			
PIN	NAME	DESCRIPTION	OPERATING RANGE
1	-	-	-
2	-	-	-
3	-	-	-
4	DGND	Digital Common Ground	-
5	GND RS232	RS232 Ground Reference	-
6	TX RS232	TX RS232	Standard RS232
7	RX RS232	RX RS232	Standard RS232
8	SERVICE	-	GND only to upload firmware

P/N 1053081208 – FEMALE, WIRING VIEW





RS232 CONNECTOR (DB9) – FEMALE, WIRING VIEW



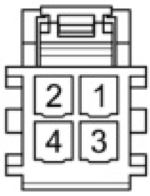
IMPORTANT:
Firmware updating is **ONLY** possible when **STO INPUT** is **LOW**.
Make sure to keep **STO SWITCH OPEN** before and during the firmware updating.

Figure 2.4: **Program Connections**

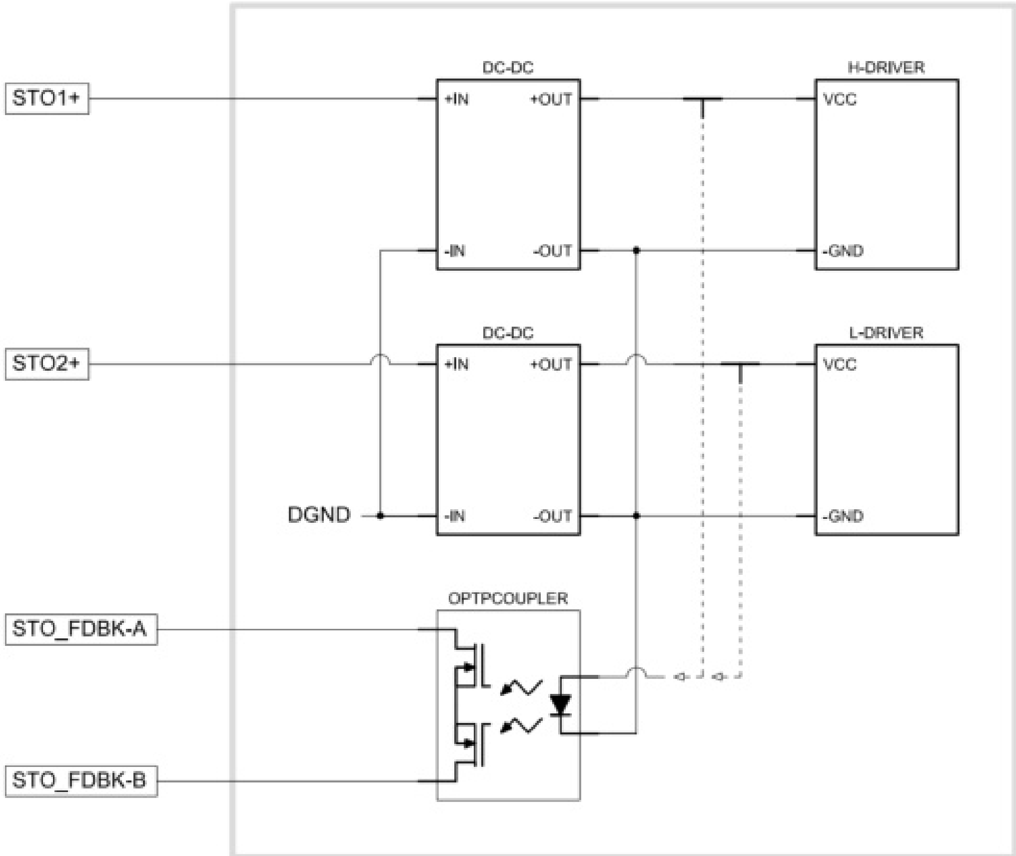
The STO SIL 3 Certifiable connections are provided by 4 female connectors.

4PINS STO CONNECTOR			
PIN	**NAME**	**DESCRIPTION**	**OPERATING RANGE**
1	STO1+	Positive STO1 Input	From 9 to 36V
2	STO2+	Positive STO2 Input	From 9 to 36V
3	STO_FDBK-A	Internally connected to STO_FDBK-B when STO1+ and STO2+ are both high	From -36 to +36V differential voltage to STO_FDBK-B Imax = 80mA
4	STO_FDBK-B	Internally connected to STO_FDBK-A when STO1+ and STO2+ are both high	From -36 to +36V differential voltage to STO_FDBK-A Imax = 80mA

P/N 1053081204 - FEMALE, WIRING VIEW



Internal Schematic



IMPORTANT: STO-OUT and STO-IN (pin 7 and 14 on 14PINS I/O CONNECTOR) **MUST** be **NOT CONNECTED** when STO1+ and STO2+ (pin 1 and 2 on 4PINS STO CONNECTOR) are used.

Figure 2.5: **STO SIL 3 connections**

2.3 Standard Wiring Diagrams

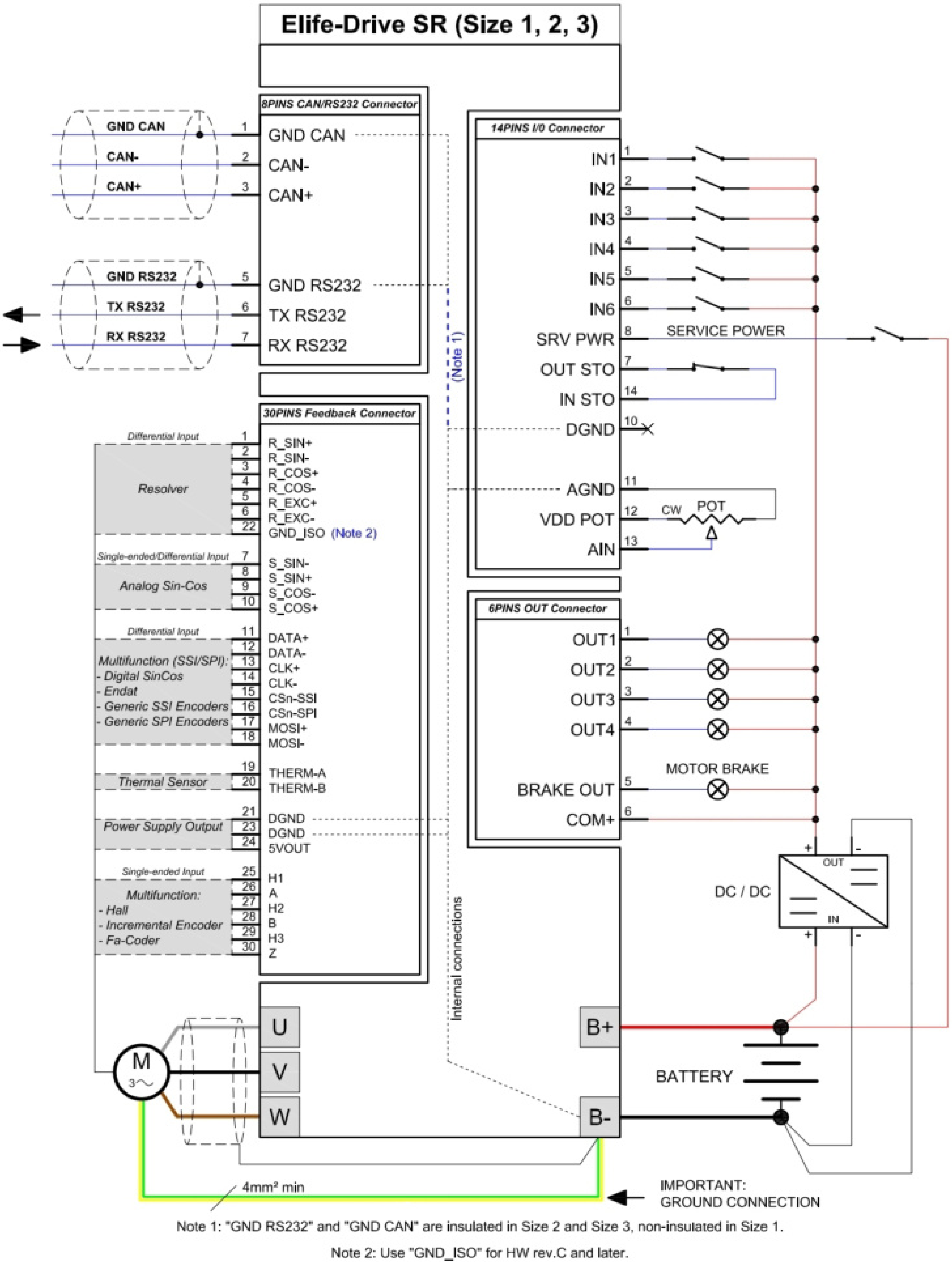


Figure 2.6: Standard wiring diagram to connect the **Elife-Drive SR Series** to your system - Multifeedback

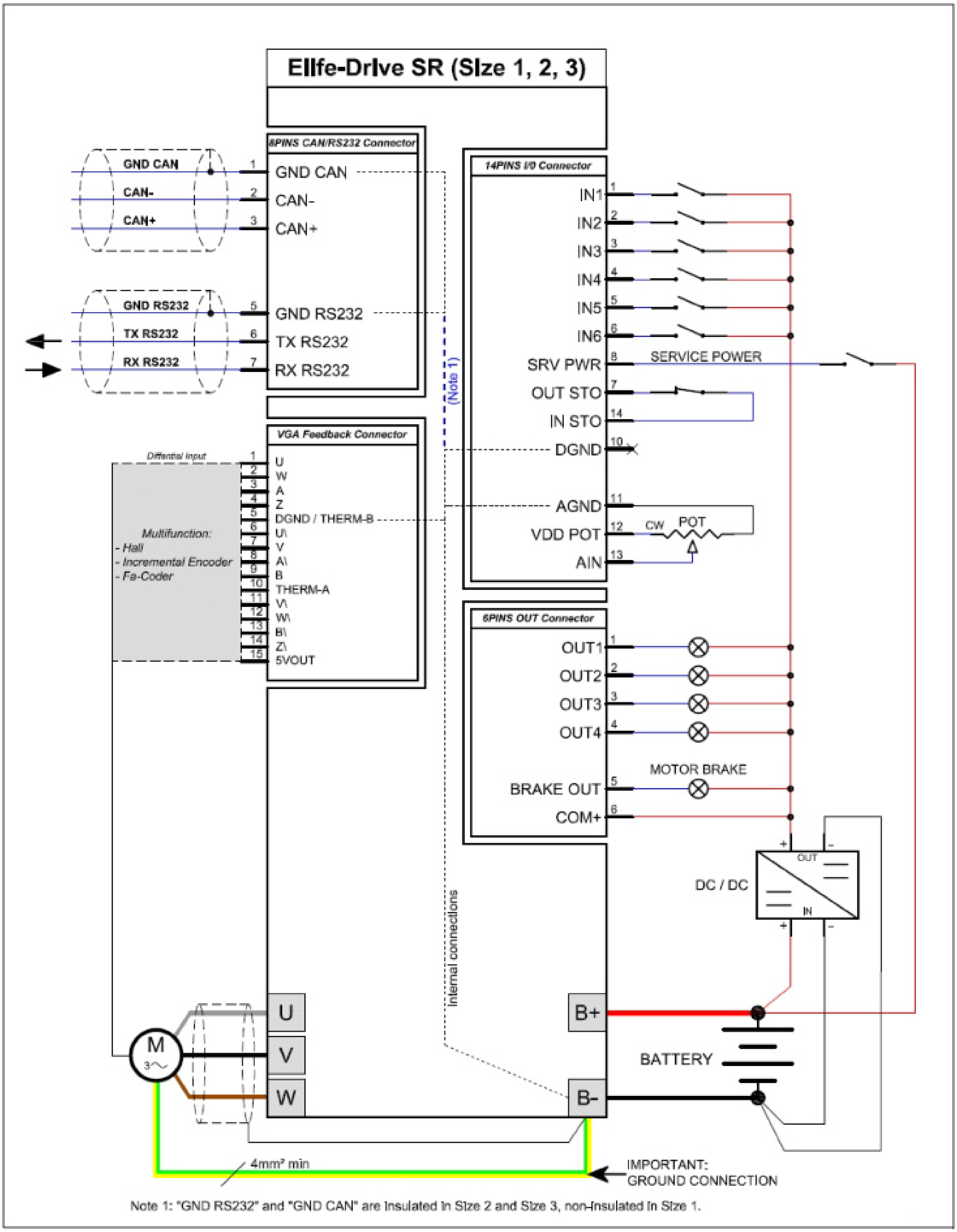


Figure 2.7: Standard wiring diagram to connect the **Elife-Drive SR Series** to your system - Differential Fa-Coder Feedback

Alternative wiring diagram for connecting the ground wire from the negative terminal of the converter to the metal frame of the motor.

This solution is used when it's not allowed to connect the potential of the battery to the metal frame of the vehicle, thus allowing the passage of by-pass of the disturbance frequencies caused by the high switched current flowing through the wire through the capacities in series with the wire internal phases of the motor.

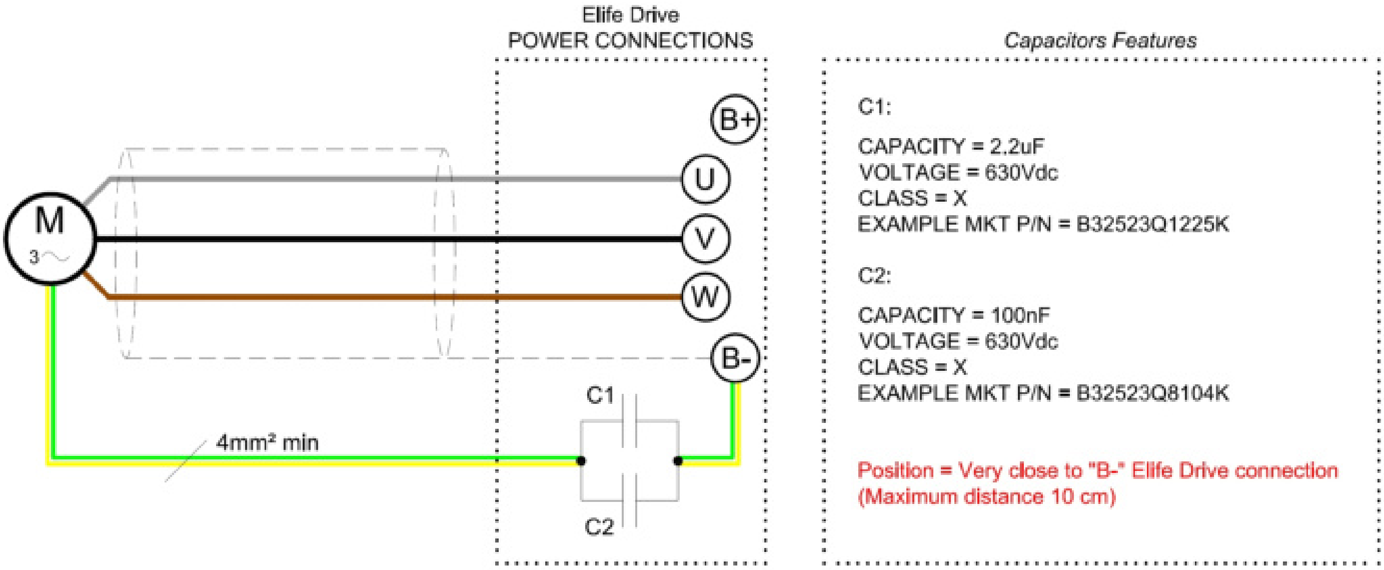


Figure 2.8: Alternative wiring diagram to connect the Ground Wire from the **Elife-Drive** to the Motor

2.3.1 Standalone Mode

The *Standalone* mode is divided into two specific functions, traction motor control and steering motor control.

The logic of this mode is to be able to drive the motor independently via the main inputs dedicated to the two specific functions.

Other optional inputs can be used to extend the functionality of these operating modes (See Table 2.3).

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

Note
If you've installed a 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 the speed mode (FAST/SLOW input).
(only for **Standalone Traction** Mode)

Tips and Advice
You can setup accurately the levels of your throttle in the **Configuration Standalone Tab**

The Standalone Traction Mode has a **Cruise Control**. The controller - when the Cruise Control is activated by a Rising Edge Signal on IN1 - reads the actual velocity and keeps this velocity stable also when the throttle is released. The Cruise Control is disabled by the following actions:

- A Rising Edge Signal on IN1
- If the Emergency Input is unsupplied.
- For any Alarm Occours.

Table 2.3: Elife-Drive I/O definitions for **Standalone Traction** Mode

I/O Type	Name	Description	
IN1	CRUISE	Rising Edge Signal = Enable/Disable Active or Disable the Cruise Control if a Rising Edge Signal is detected	Optional
IN2	FAST/SLOW	High =Fast mode, Low = Slow mode. This input is processed *only before* bridge activation	Optional[b]
IN3	FORWARD	High = Forward, Low = Stop (only if BACKWARD is low)	Optional[a]
IN4	BACKWARD	High = Backward, Low = Stop. This input is only processed if FORWARD input is low.	Optional[a]
IN5	EMERGENCY	Emergency input should always be supplied, otherwise Elife-Drive stops motor rotation and unlocks motor brake.	**Mandatory**
IN6	SLS	Safe Limited Speed High = maximum configured speed Low = limited speed	Optional
OUT1	BUZZER	It becomes active when the motor runs backwards It deactivates when the motor is running forwwards or stopped	
OUT2	STATUS	It gets steady high when motor is running and blinking when motor is stopped. It's low when there is an alarm.	
OUT3	ALARM	Alarm output, it changes its current state whenever an alarm is present.	
OUT4	SPEEDOMETER	rotation speed expressed in impulses/revolution	
- - -	BRAKE OUT	It becomes active when the motor is stopped	Optional

[a] **Mandatory** only for 0-5V throttle.
[b] **Mandatory** if you want to switch between Fast and Slow mode.

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 the **Analog adjustment in Configuration Standalone** parameters)

Table 2.4: Elife-Drive I/O definitions for **Standalone Steering** Mode

I/O Type	Name	Description	
IN1	OVERTRAVEL CW	High = Active Overtravel for CW rotation, Low = Inactive Overtravel	Optional[a]
IN2	OVERTRAVEL CCW	High = Active Overtravel for CCW rotation, Low = Inactive Overtravel	Optional[a]
IN3	DIR	High = Clockwise, Low = Counterclockwise	Optional[b]
IN4	RUN / STOP	High = Run, Low = Stop	**Mandatory**
IN5	EMERGENCY	Emergency input should always be supplied, otherwise Elife-Drive stops motor rotation and unlocks motor brake.	**Mandatory**
IN6	SLS	Safe Limited Speed High = maximum configured speed Low = limited speed	Optional
OUT1	- - -	- - -	
OUT2	- - -	- - -	
OUT3	ALARM	Alarm output, it changes its current state whenever an alarm is present.	
OUT4	SPEEDOMETER	rotation speed expressed in impulses/revolution	
- - -	BRAKE OUT	It becomes active when the motor is stopped	Optional

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

The table above shows the connections optimized for the Standalone Steering Mode

2.3.2 CANopen® Mode

In **CANopen®** 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 Elife-Drive CANopen® Manual.
A description of the inputs and outputs connections for this operating mode is shown in Table 2.5

In this operating mode is needed to set the correct CANopen® parameters via Telemetry Panel Configuration CANopen® section

Table 2.5: Elife-Drive I/O definitions for **CANopen®** Mode

I/O Type	Name	Description	
IN1	BWD	It could be used as negative limit switch	Optional[a]
IN2	FWD	It could be used as positive limit switch	Optional[a]
IN3	HOME SENSOR	It could be used as home switch	Optional[a]
IN4	- - -	- - -	
IN5	EMERGENCY	Emergency input should always be supplied, otherwise Elife-Drive stops motor rotation and unlocks motor brake.	**Mandatory**
IN6	SLS	Safe Limited Speed High = maximum configured speed Low = limited speed	Optional
OUT1	- - -	- - -	
OUT2	- - -	- - -	
OUT3	ALARM	Alarm output, it changes its current state whenever an alarm is present.	
OUT4	SPEEDOMETER	rotation speed expressed in impulses/revolution	
- - -	BRAKE OUT	It becomes active when the motor is stopped	Optional

[a] It is processed only if CAN modes of operational is Homing Mode.

Please pay particular attention when wiring CANopen® connection: at both ends there must be a 120Ω resistor[1] and the bus length must be the following:

Bit rate	Bus length
1 Mbit/s	up to 40 m
500 Kbit/s	up to 100 m
250 Kbit/s	up to 250 m

[1] the termination resistor is already set up inside the drive and can be activated in the appropriate configuration section

2.3.3 RS232 Mode

The RS232 Mode allows you to drive your motor via Telemetry Panel (See Chapter 3) or send the control commands[2] to the Elife-Drive 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 Table 2.6 for a description of inputs and outputs.

Table 2.6: Elife-Drive I/O definitions for **RS232** Mode

I/O Type	Name	Description	
IN1	- - -	- - -	
IN2	- - -	- - -	
IN3	- - -	- - -	
IN4	- - -	- - -	
IN5	EMERGENCY	Emergency input should always be supplied, otherwise Elife-Drive stops motor rotation and unlocks motor brake.	**Mandatory**
IN6	SLS	Safe Limited Speed High = maximum configured speed Low = limited speed	Optional
OUT1	- - -	- - -	
OUT2	- - -	- - -	
OUT3	ALARM	Alarm output, it changes its current state whenever an alarm is present.	
OUT4	SPEEDOMETER	rotation speed expressed in impulses/revolution	
- - -	BRAKE OUT	It becomes active when the motor is stopped	Optional

[2]For further information, see **Elife-Drive - RS232 Communication Protocol** document

2.3.4 EV Car Mode

Table 2.7: Elife-Drive SR I/O definitions for **Ev Car** Mode

I/O Type	Name	Description	
IN1	CRUISE	Rising Edge Signal = Enable/Disable Active or Disable the Cruise Control if a Rising Edge Signal is detected	Optional
IN2	SPORT / ECONOMY	High = Sport mode, Low = Economy mode. This input is processed *only before* bridge activation	Optional[a]
IN3	FORWARD	High = Forward, Low = Stop (only if BACKWARD is low)	**Mandatory**
IN4	BACKWARD	High = Backward, Low = Stop. This input is only processed if FORWARD input is low.	**Mandatory**
IN5	EMERGENCY	Emergency input should always be supplied, otherwise Elife-Drive stops motor rotation and unlocks motor brake.	**Mandatory**
IN6	HANDBRAKE	High = Unlocked, Low = Locked. This input is processed *only before* bridge activation	Optional
OUT1	BUZZER	It becomes active and deactivated alternately when the motor runs backward It is deactivated when the motor is running forwwards or stopped	
OUT2	STATUS	It gets steady high when motor is running and blinking when motor is stopped. It's low when there is an alarm.	
OUT3	ALARM	Alarm output, it changes its current state whenever an alarm is present.	
OUT4	BRAKE LIGHT	It is the output to connect to brake light, it gets high when velocity decreases of at least set value.	
- - -	BRAKE OUT	It becomes active when the motor is stopped	Optional

[a] **Mandatory** if you want to switch between SPORT and ECONOMY mode

The *EV* mode is specially designed to control motors mounted in Electric Vehicles (EV). This operating mode employs sophisticated proprietary algorithms to offer you a driving experience as much as possible similar to traditional gasoline engine vehicles.
For the correct functioning of this operating mode, you must install only 0–10V or 0-5V throttle and choose the correct value of *Analog Input* in according to the throttle characteristics.

Note
In this operating mode 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), the rotation direction (BACKWARD or FORWARD) and the speed mode (SPORT/ECONOMY input).

The **SPORT** and **ECONOMY** modes are designed to meet two different purposes:

ECONOMY mode This operating mode is specially designed in order to extend the battery life. The *acceleration ramp* is smoother than Sport Mode and the max power available is limited.

SPORT mode The SPORT mode is designed to get the maximum performance as possible.

It's scheduled both the configuration of the maximum motor velocity and the maximum velocity at ECONOMY mode.

2.3.5 EV Bike Mode

Note

This operating mode is reserved and unavailable

Monitoring Elife Drive

3

After wiring up correctly Elife-Drive and adjusting the programmable parameters , 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.

3.1 LED Diagnostics

Elife-Drive 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 Elife-Drive works correctly, motor is stopped

Blinking GREEN Elife-Drive works correctly, motor is running

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

Steady BLUE Elife-Drive is in the FW programming function, motor is stopped

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.

3.2 Telemetry - Monitoring and Setting of Data

The telemetry panel allows you to set and view different types of telemetry data for each selected operating mode (Standalone, CANopen®, RS232, Bike EV, Car EV).

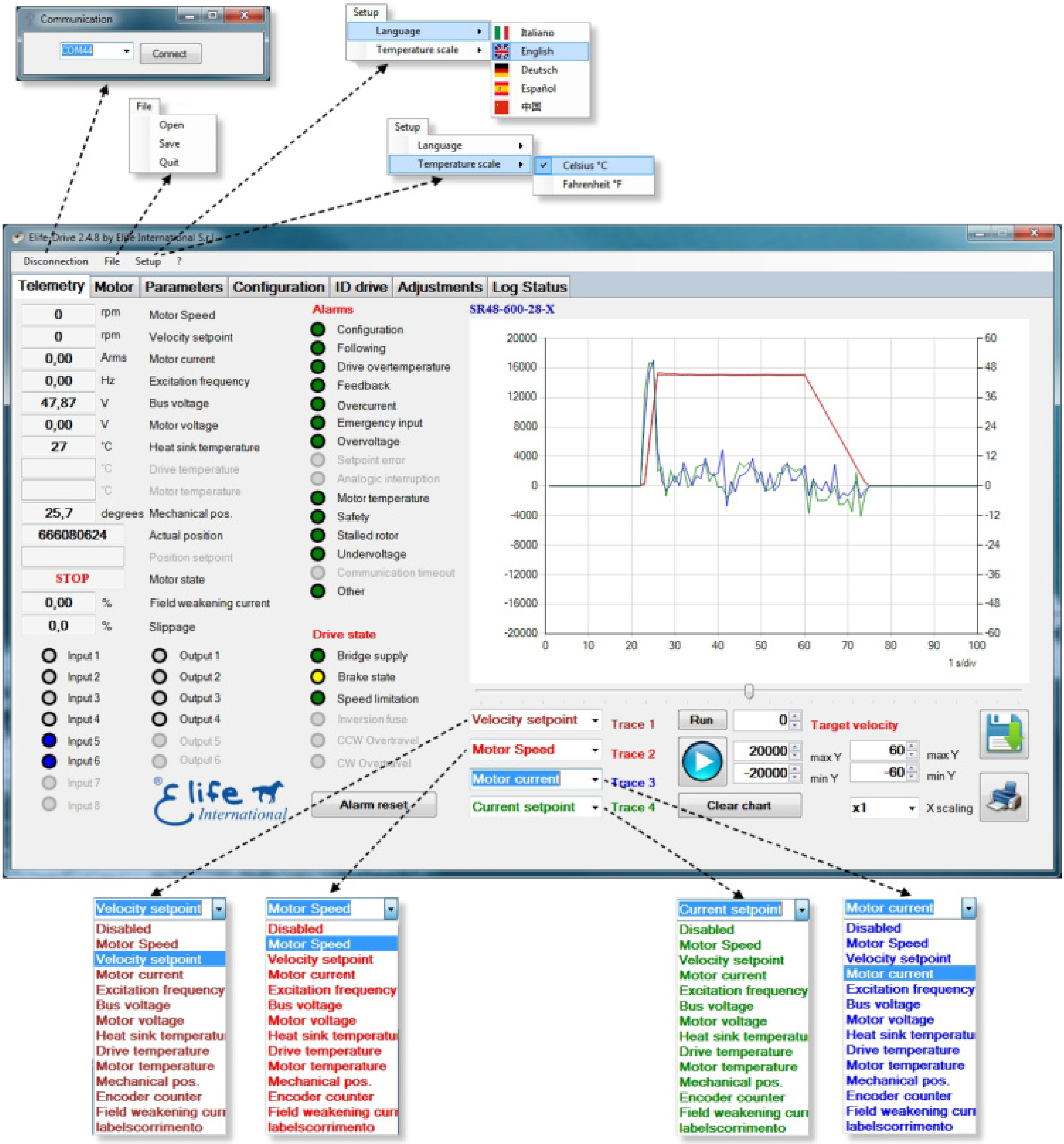
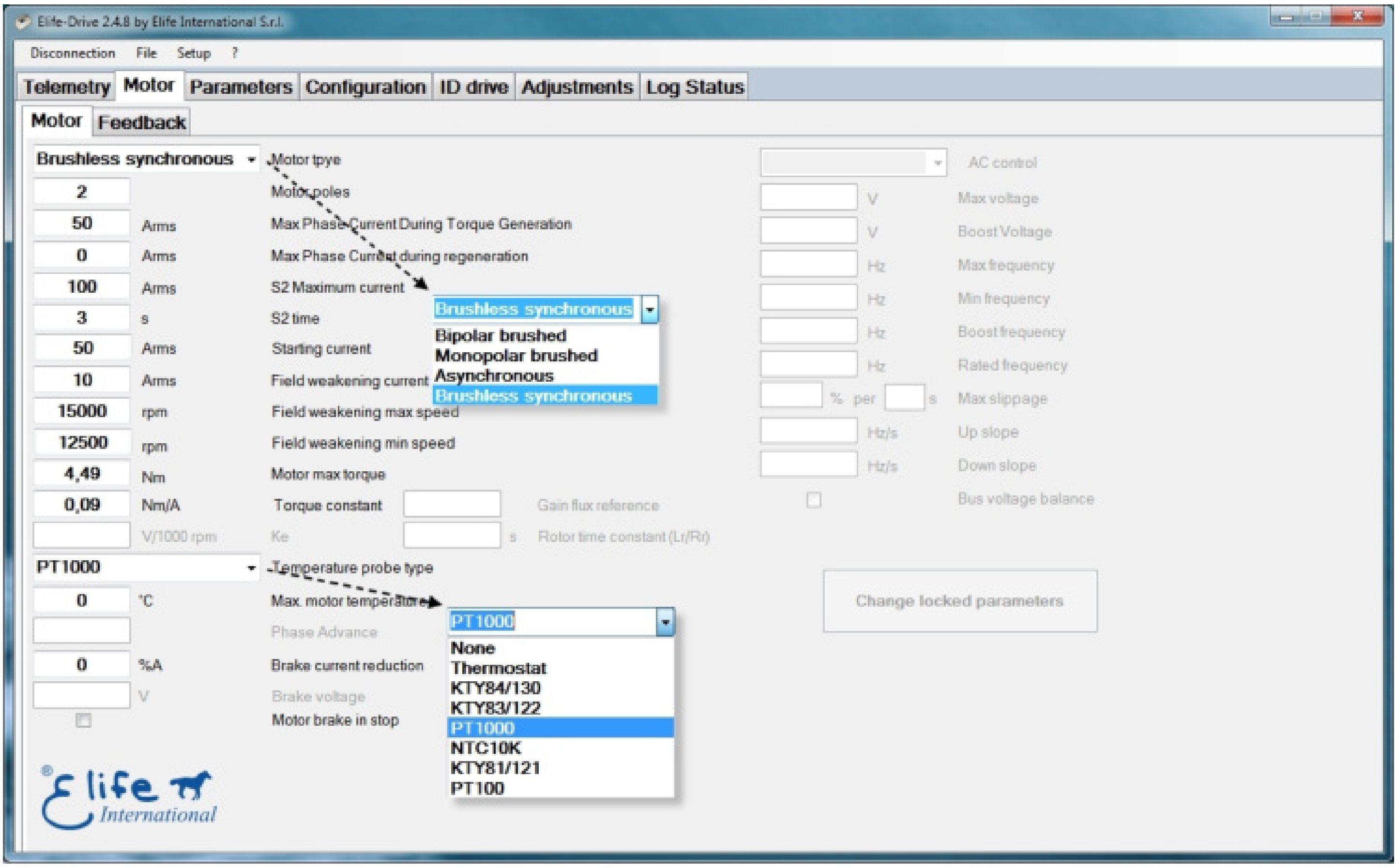


Figure 3.1: Telemetry Panel displays a wide range of telemetry data and enables you to plot or log these data over time.

3.2.1 Motor Setting

Telemetry Motor Setting



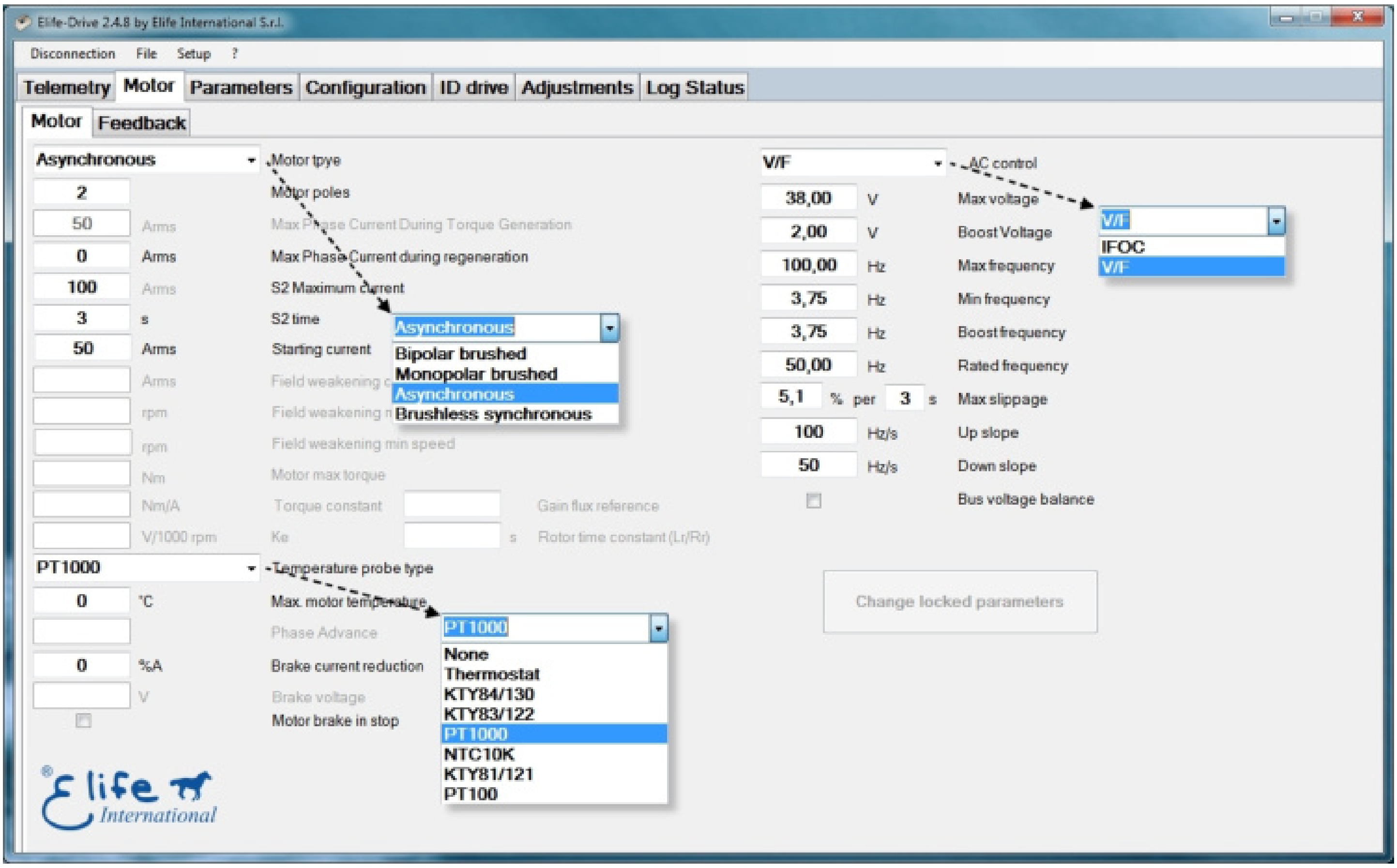


Figure 3.2: Telemetry Panel displays the Motor Parameters

3.2.2 Feedback Setting

Telemetry Motor Feedback Setting

All of our drives have the ability to interface with different types of Feedback sensors, in some models you can have multiple feedback interfaces at the same time, while other models only have one possible interface and must be explicitly requested when ordering.

Hall Sensors are devices that exploit the Hall effect, which is the change in an electrical voltage in the presence of a magnetic field. Hall sensors are used to detect the position of the rotor of an electric motor, particularly a brushless motor, which has permanent magnets on the rotor. Hall sensors are placed on the stator, at the electrical phases, and generate digital signals that change state when the rotor passes in front of them. These signals are used to switch the electrical phases and keep the motor in synchronism.

SinCos is a type of incremental encoder, that is, a device that generates electrical signals proportional to the angular displacement of the rotor of an electric motor. Unlike conventional incremental encoders, which generate digital signals in the shape of a square wave, SinCos encoders generate analog signals in the shape of a sine and cosine wave, offset from each other by 90 degrees. These signals can be processed by an electronic circuit to achieve higher resolution and greater noise immunity.

Incremental Encoder is a device that generates electrical signals proportional to the angular displacement of the rotor of an electric motor. An incremental encoder consists of an optical or magnetic disk, which has alternating lines or poles, and an optical or magnetic sensor, which detects the passage of the lines or poles. The incremental encoder generates two digital signals in the shape of a square wave, offset from each other by 90 degrees, called channel A and channel B. The number of pulses per revolution determines the resolution of the encoder. In addition, the incremental encoder can have a third signal, called the Z or index channel, which generates one pulse per revolution and serves as the zero reference.

Fa-Coder is a type of incremental encoder, patented by Tamagawa Seiki, that is based on the principle of frequency modulation. A Fa-Coder consists of an optical disk, which has concentric lines with a variable frequency, and an optical sensor, which detects the passage of the lines. The Fa-Coder generates two analog signals in the form of a sine and cosine wave, 90 degrees out of phase with each other, with a frequency proportional to the angular speed of the rotor. These signals can be converted to digital signals in the form of a square wave, with a resolution equal to the number of lines on the disk.

Resolver is a device that generates electrical signals proportional to the absolute angular position of the rotor of an electric motor. A resolver consists of a rotor, which has a coil energized by an alternating voltage, and a stator, which has two orthogonal coils that sense the voltage induced by the rotor. The resolver generates two analog signals in the form of a sine and cosine wave, 90 degrees out of phase with each other, with an amplitude proportional to the position of the rotor. These signals can be converted into a serial digital signal with a resolution equal to the number of bits of the converter.

Absolute encoder SSI/BiSS is a device that generates electrical signals that uniquely identify the angular position of the rotor of an electric motor. An absolute encoder consists of an optical or magnetic disk, which has lines or poles coded in binary, and an optical or magnetic sensor, which detects the code of the lines or poles. The absolute encoder generates a serial digital signal, which transmits the position code in binary format. The number of bits in the code determines the resolution of the encoder. There are several serial communication protocols for absolute encoders, including SSI (Synchronous Serial Interface) and BiSS (Bidirectional Serial Synchronous Interface).

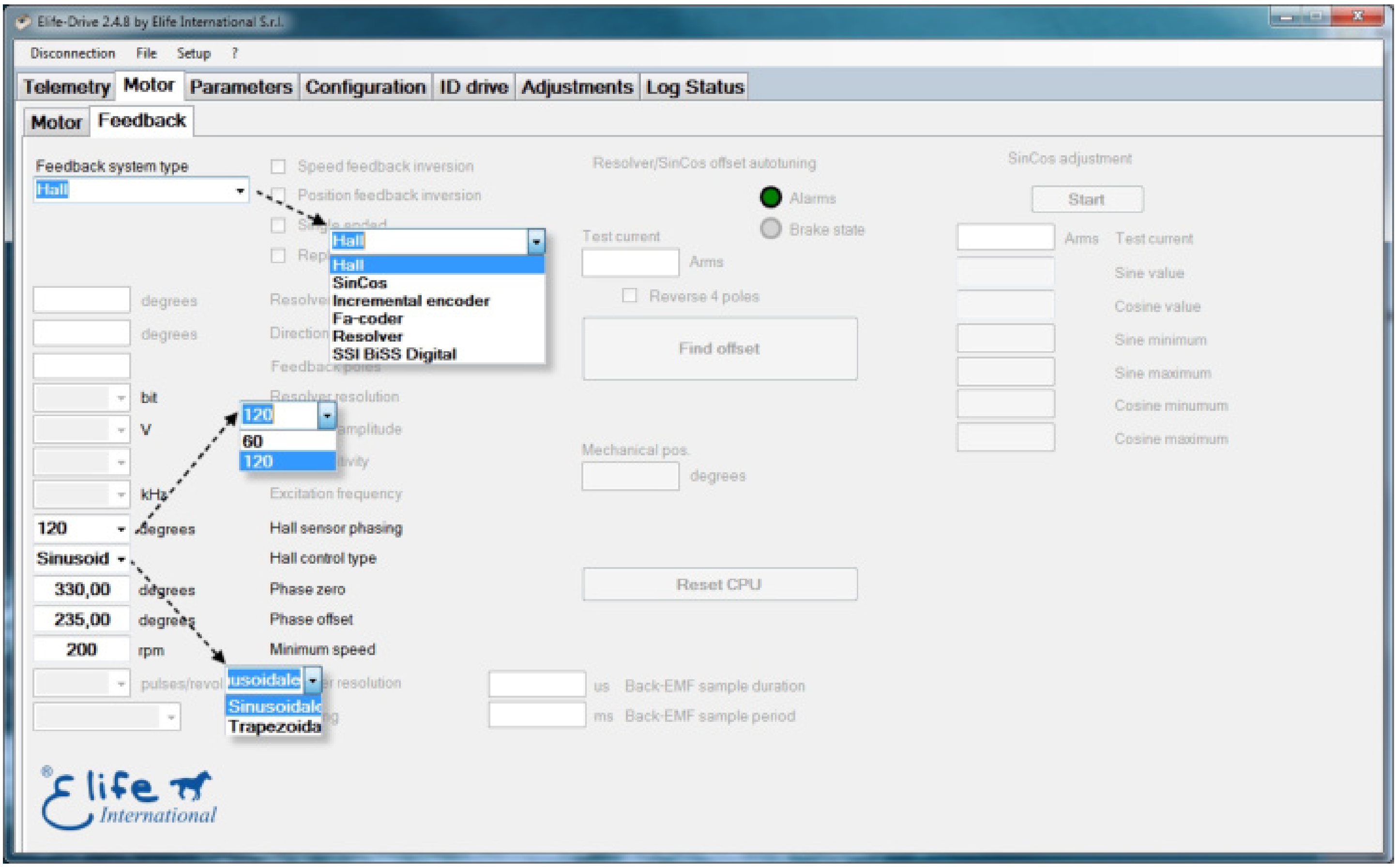


Figure 3.3: Telemetry Panel displays the Motor Feedback Hall Parameters

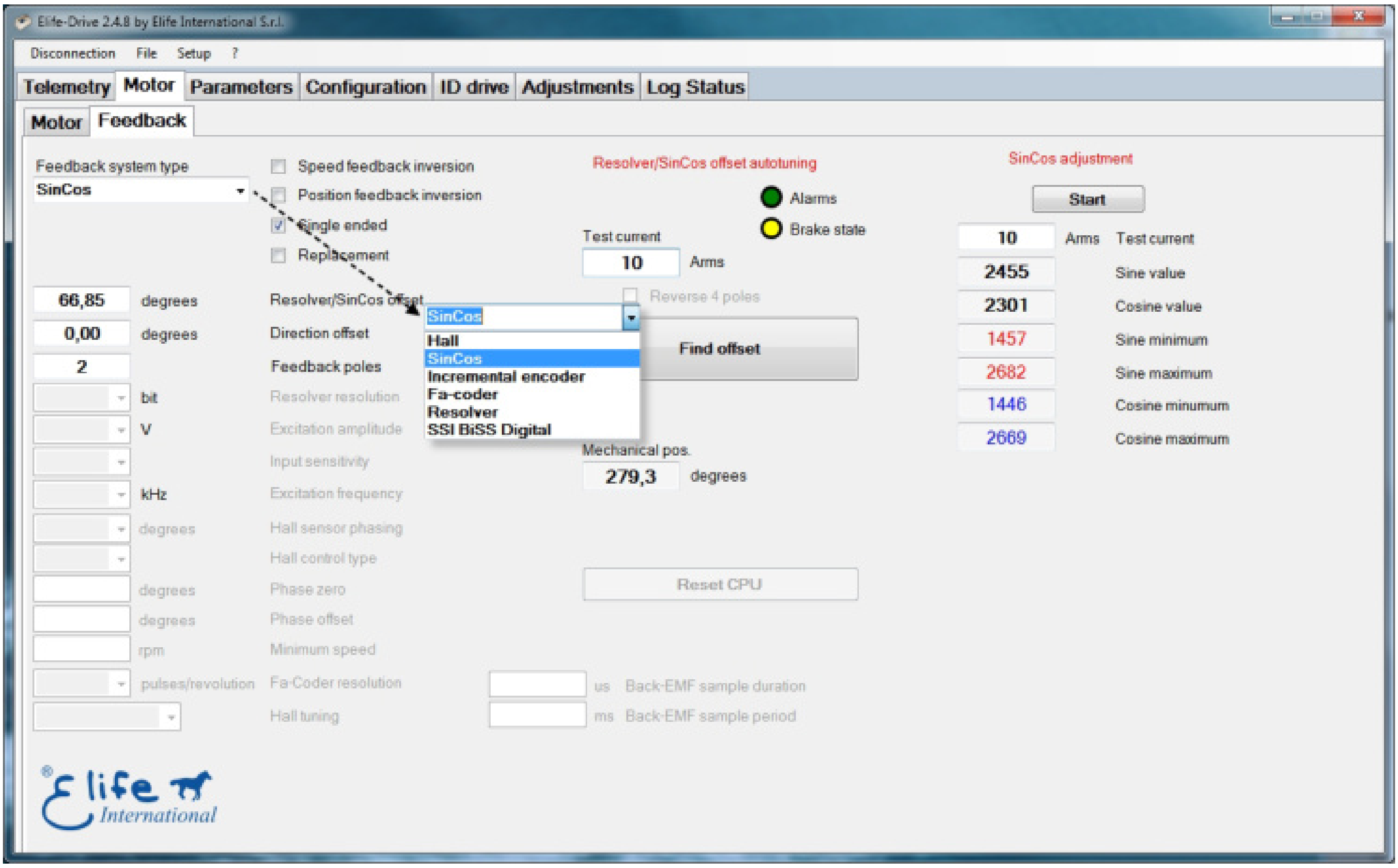


Figure 3.4: Telemetry Panel displays the Motor Feedback SinCos Parameters

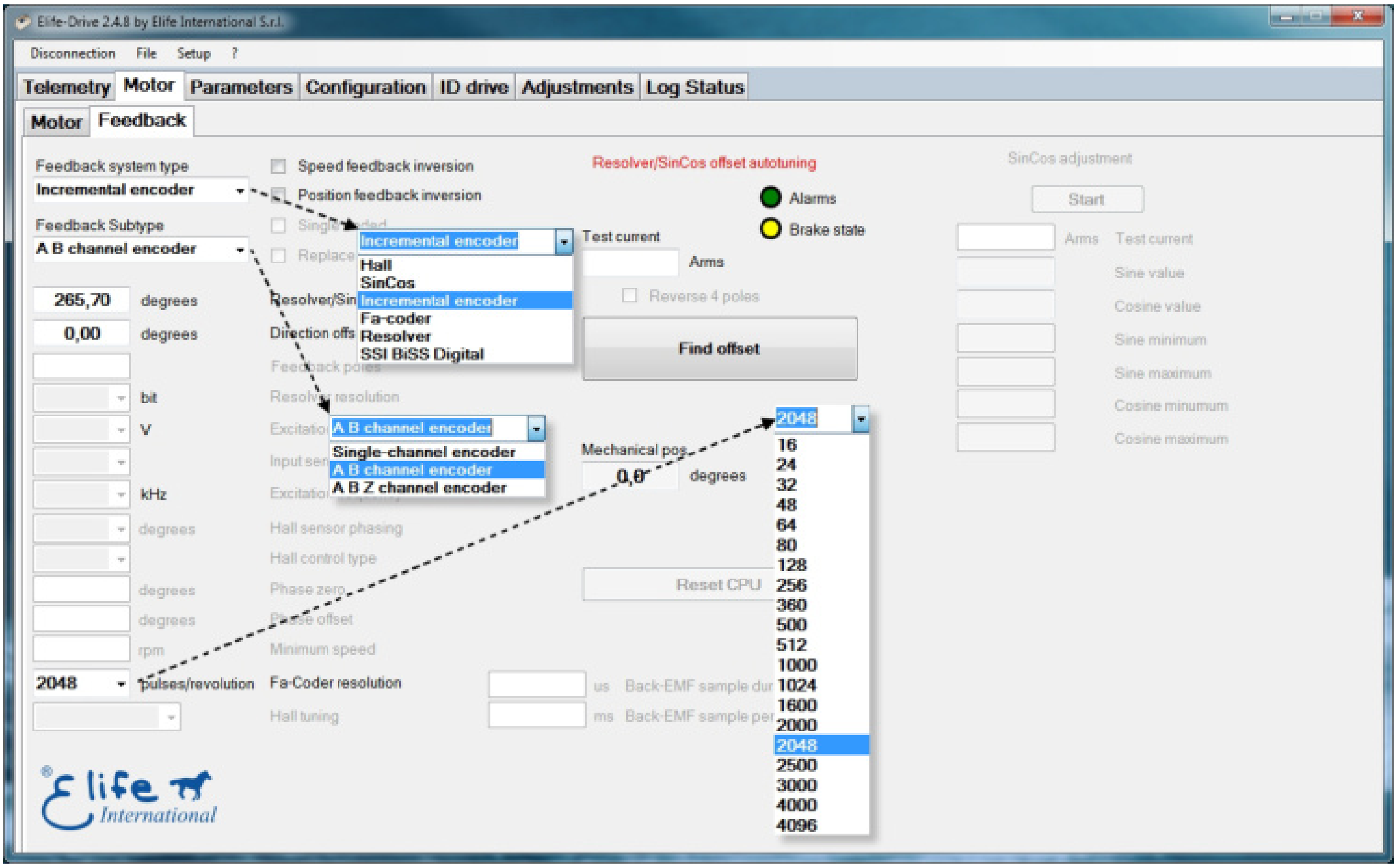


Figure 3.5: Telemetry Panel displays the Motor Feedback Incremental Encoder Parameters

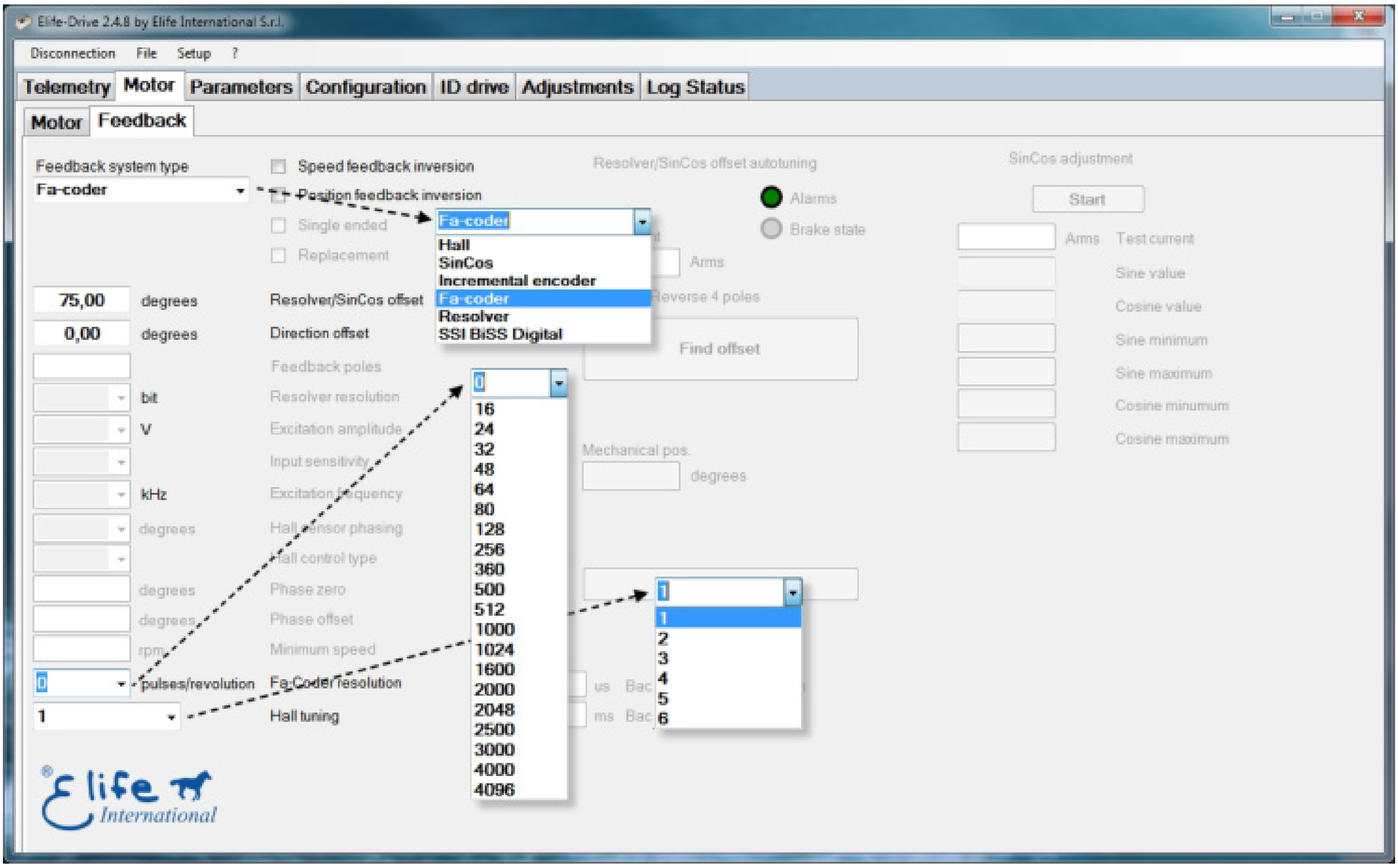


Figure 3.6: Telemetry Panel displays the Motor Feedback FaCoder Parameters

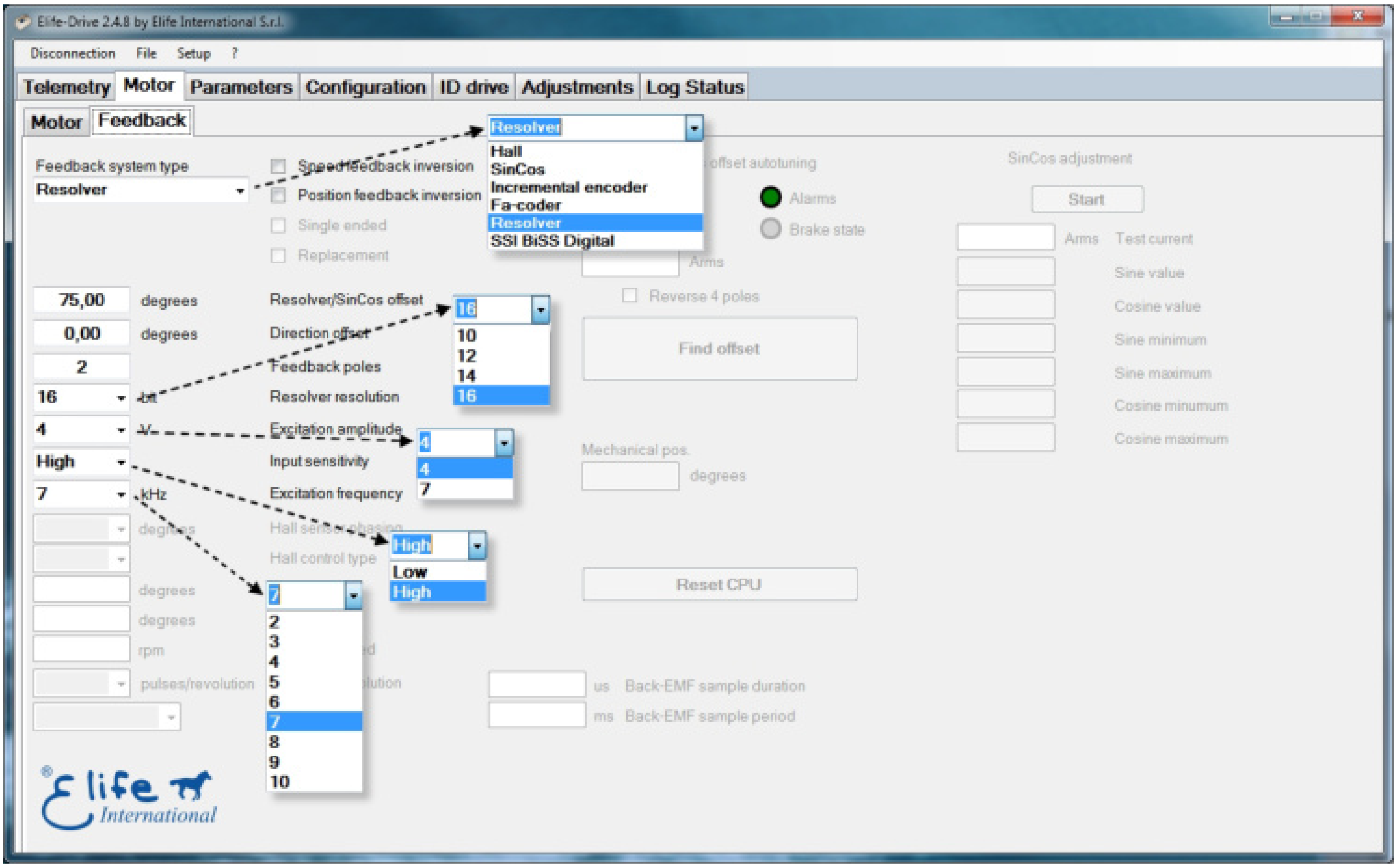


Figure 3.7: Telemetry Panel displays the Motor Feedback Resolver Parameters

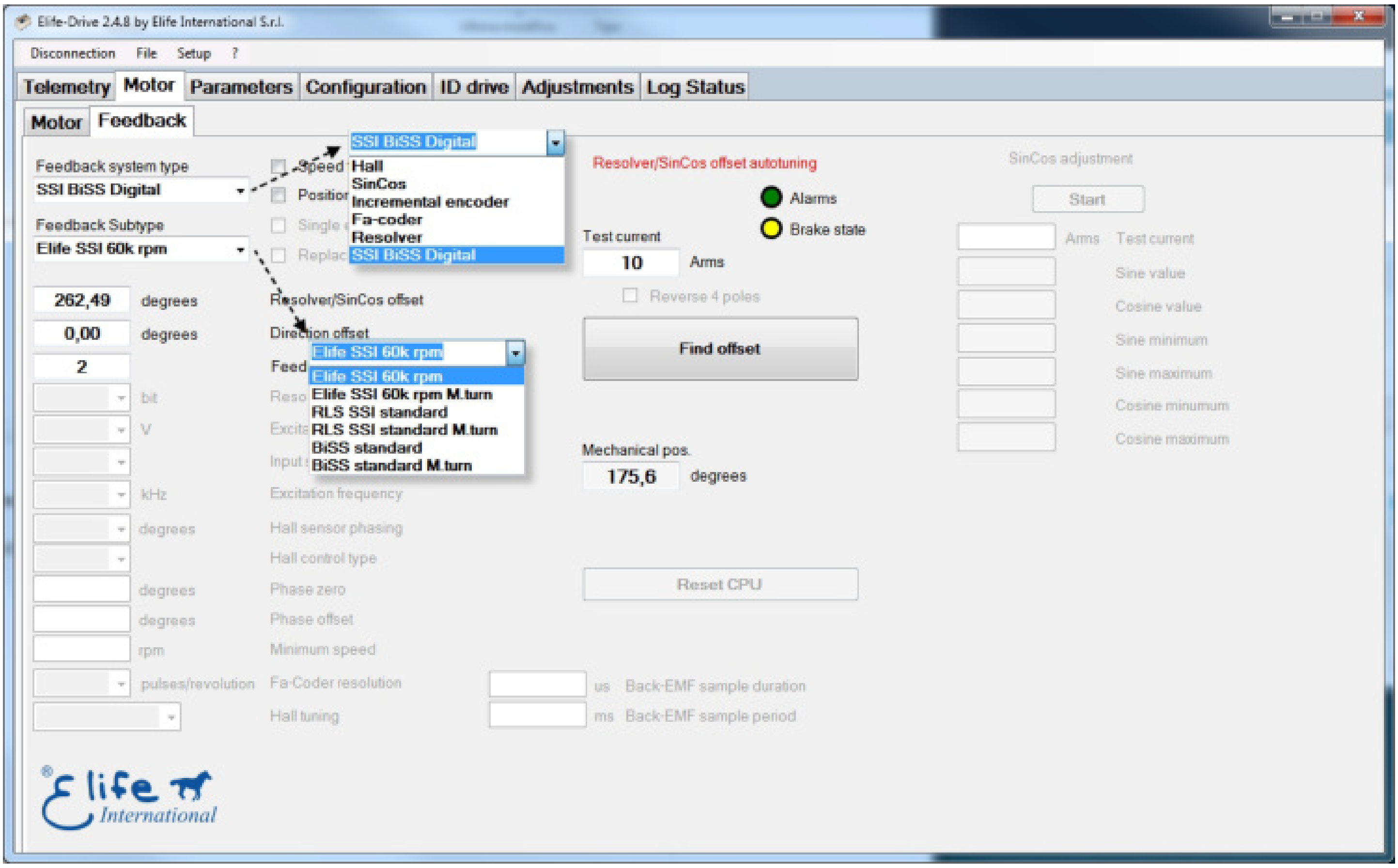


Figure 3.8: Telemetry Panel displays the Motor Fedback Absolute Encoder SSI Parameters

3.2.3 System Parameters

Telemetry System Parameters

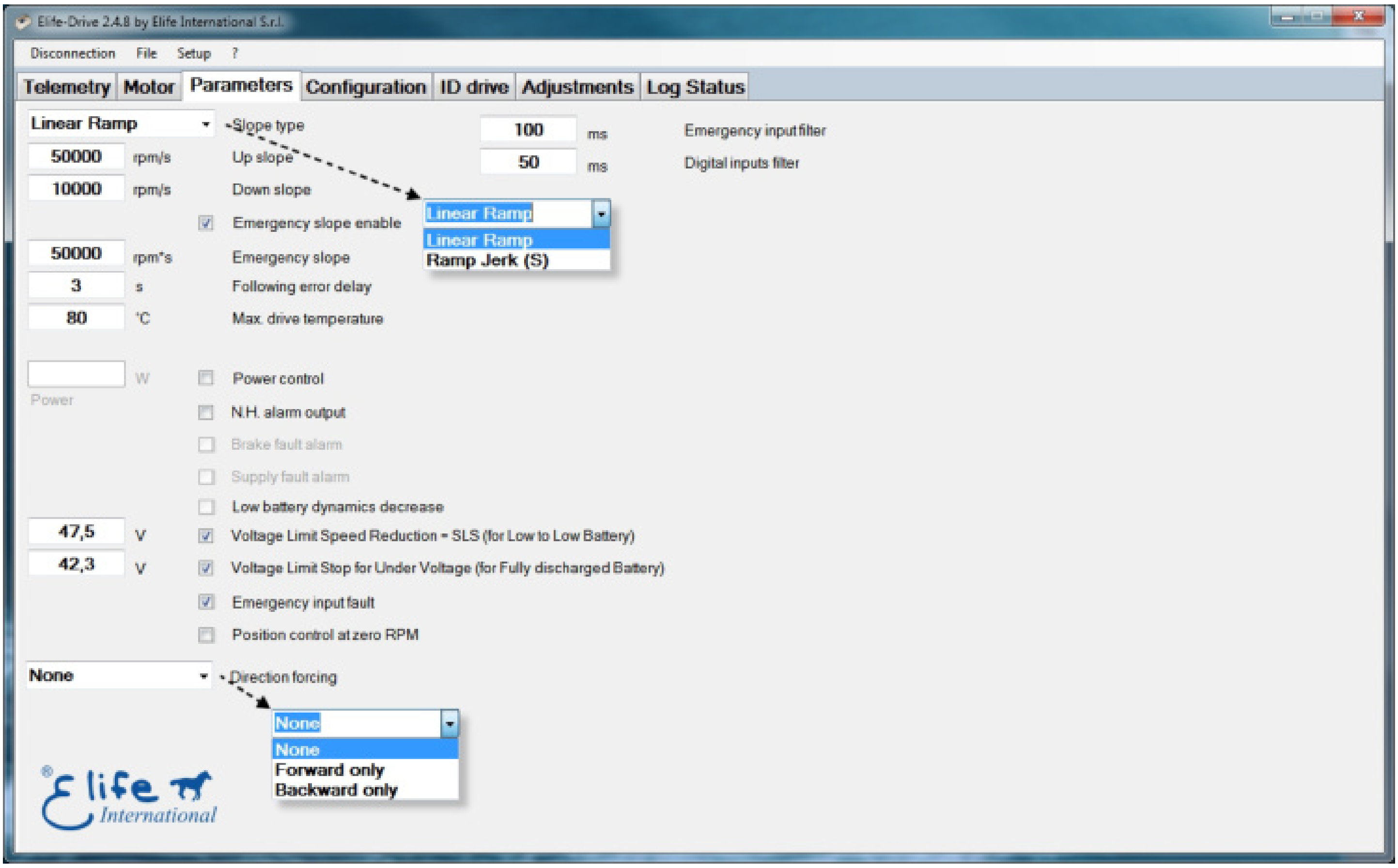


Figure 3.9: Telemetry Panel displays the System Parameters

3.2.4 Configuration - Connection

Telemetry Connection Configuration

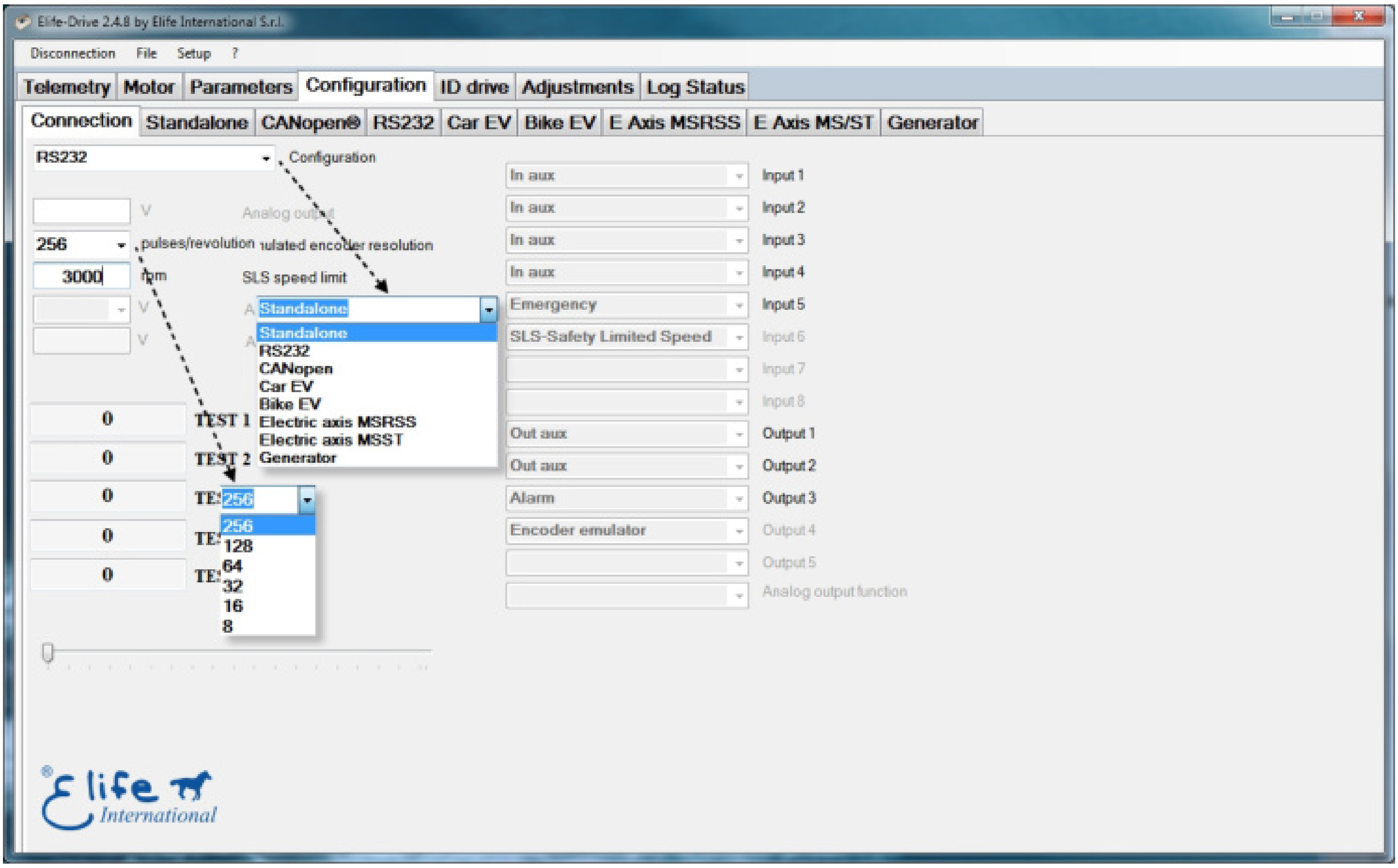


Figure 3.10: Telemetry Panel Connection Configuration

3.2.5 Configuration - Standalone

Telemetry Standalone Configuration

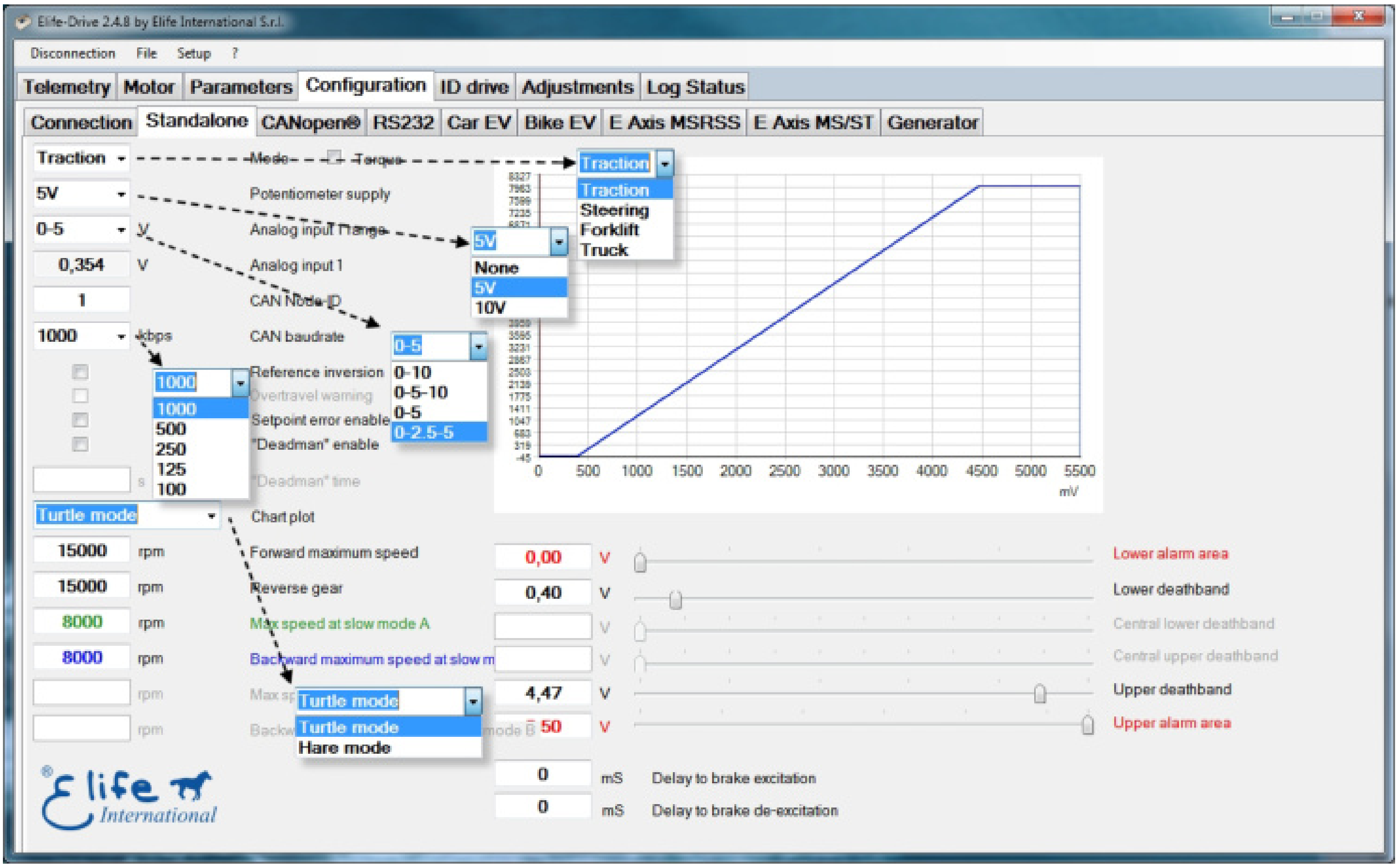


Figure 3.11: Telemetry Panel displays the Standalone Configuration

3.2.6 Configuration - CANopen®

Telemetry CANopen® Configuration

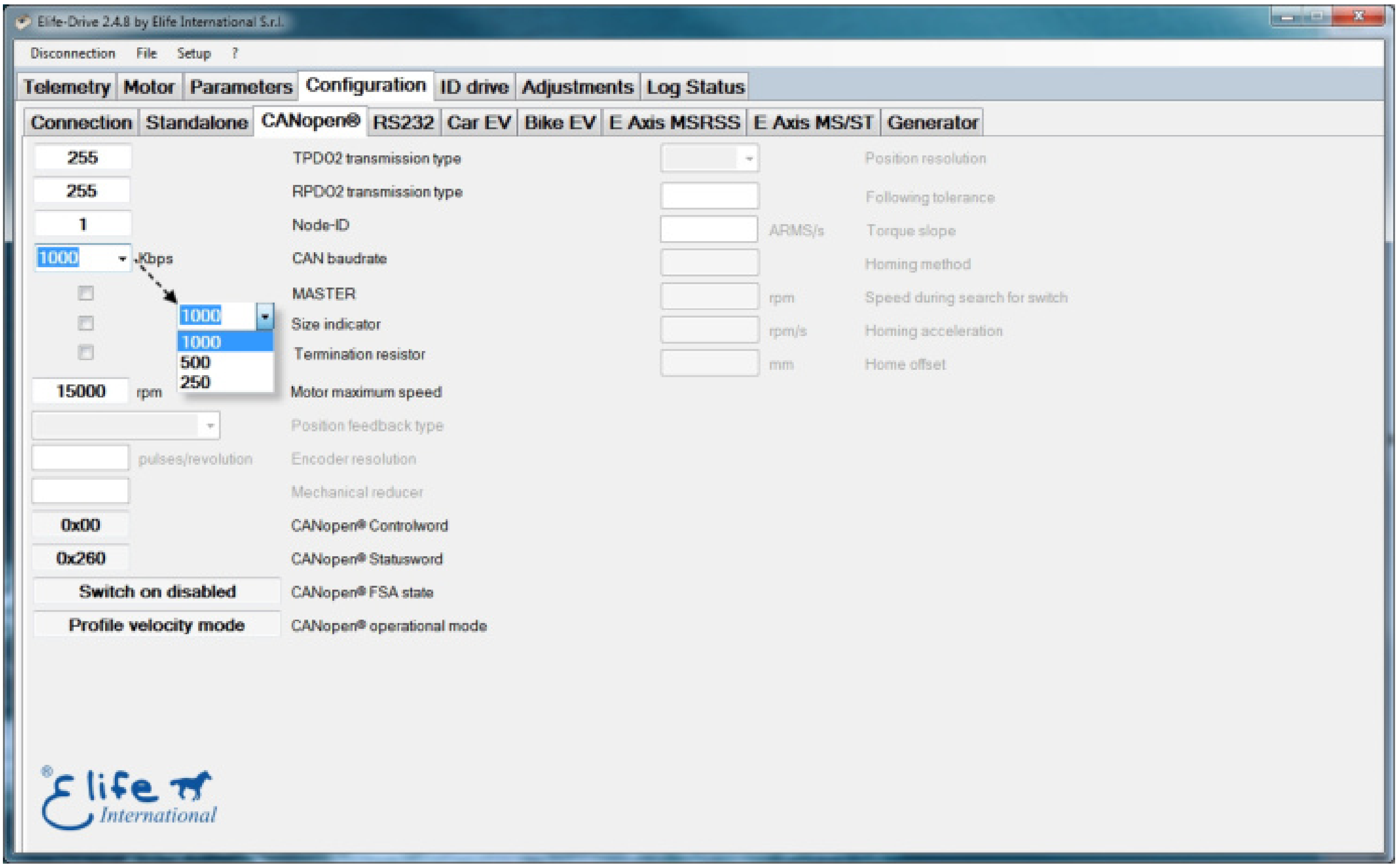


Figure 3.12: Telemetry Panel displays the CANopen® Configuration

3.2.7 Configuration - RS232

Telemetry RS232 Configuration

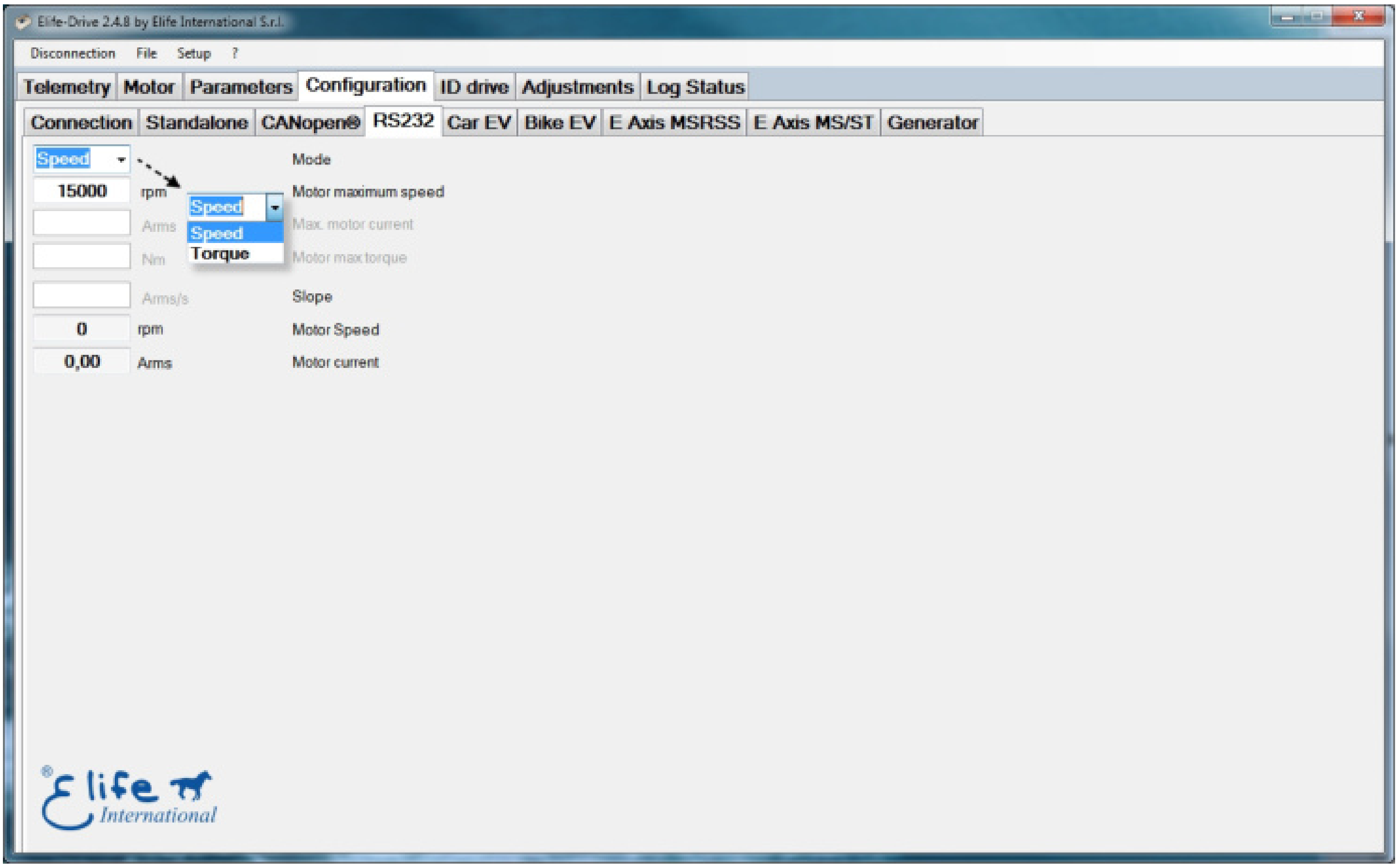


Figure 3.13: Telemetry Panel displays the RS232 Configuration

3.2.8 Configuration - EV CAR

Telemetry EV Car Configuration

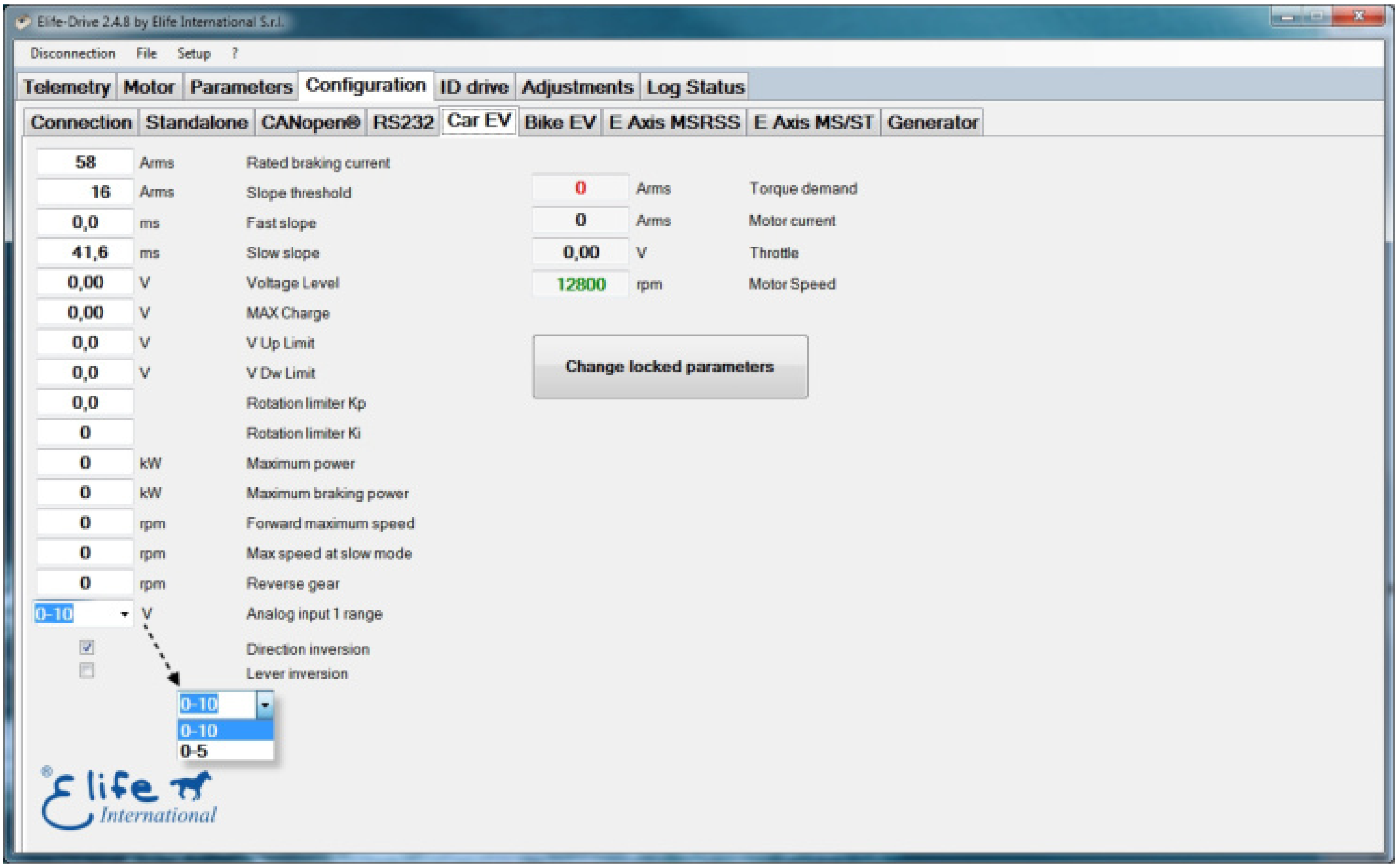


Figure 3.14: Telemetry Panel EV Car Configuration

3.2.9 Configuration - EV BIKE

Telemetry EV Bike Configuration

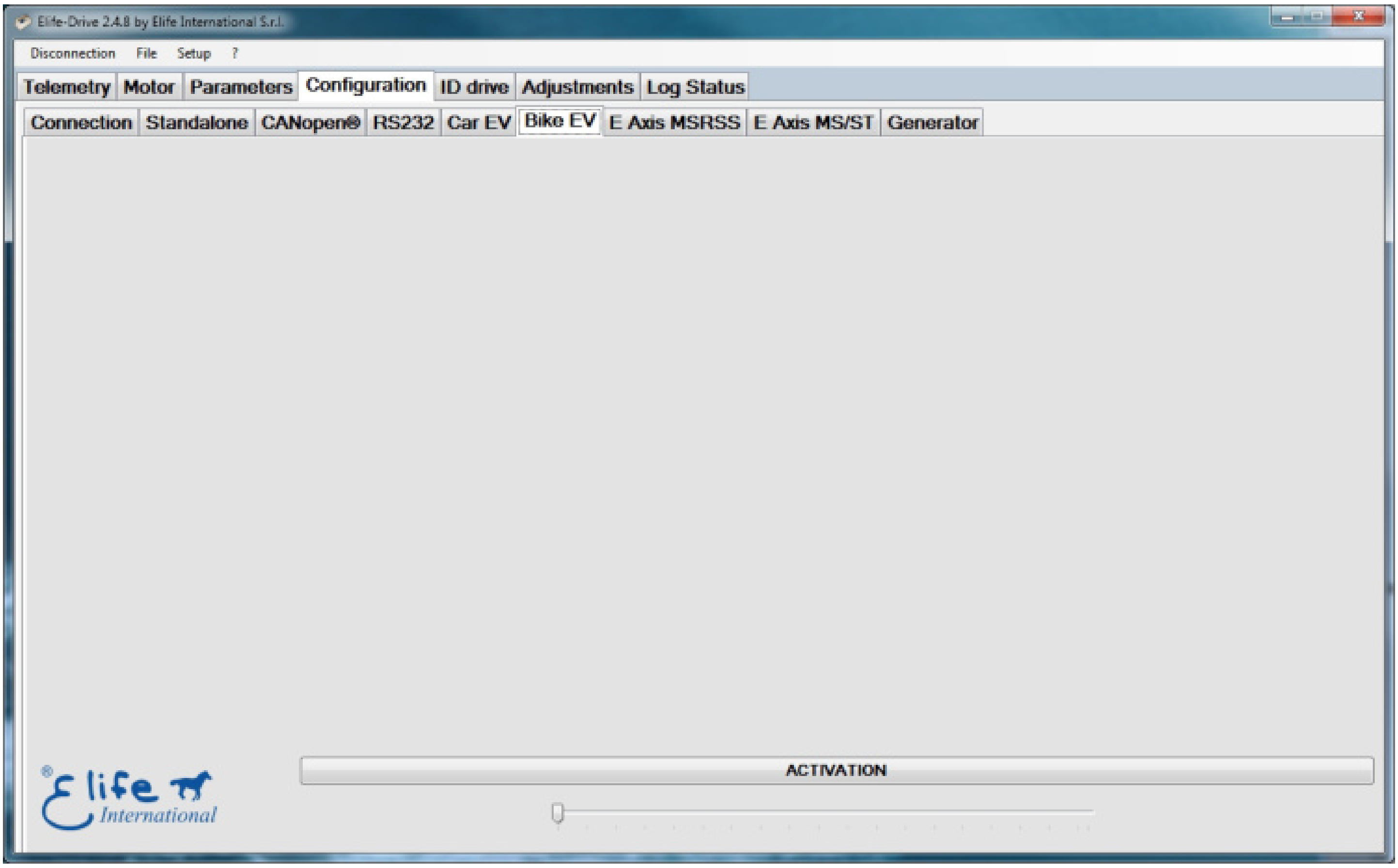


Figure 3.15: Telemetry Panel EV Bike Configuration

3.2.10 Configuration - E Axis MSRSS

Telemetry E Axis MSRSS Configuration

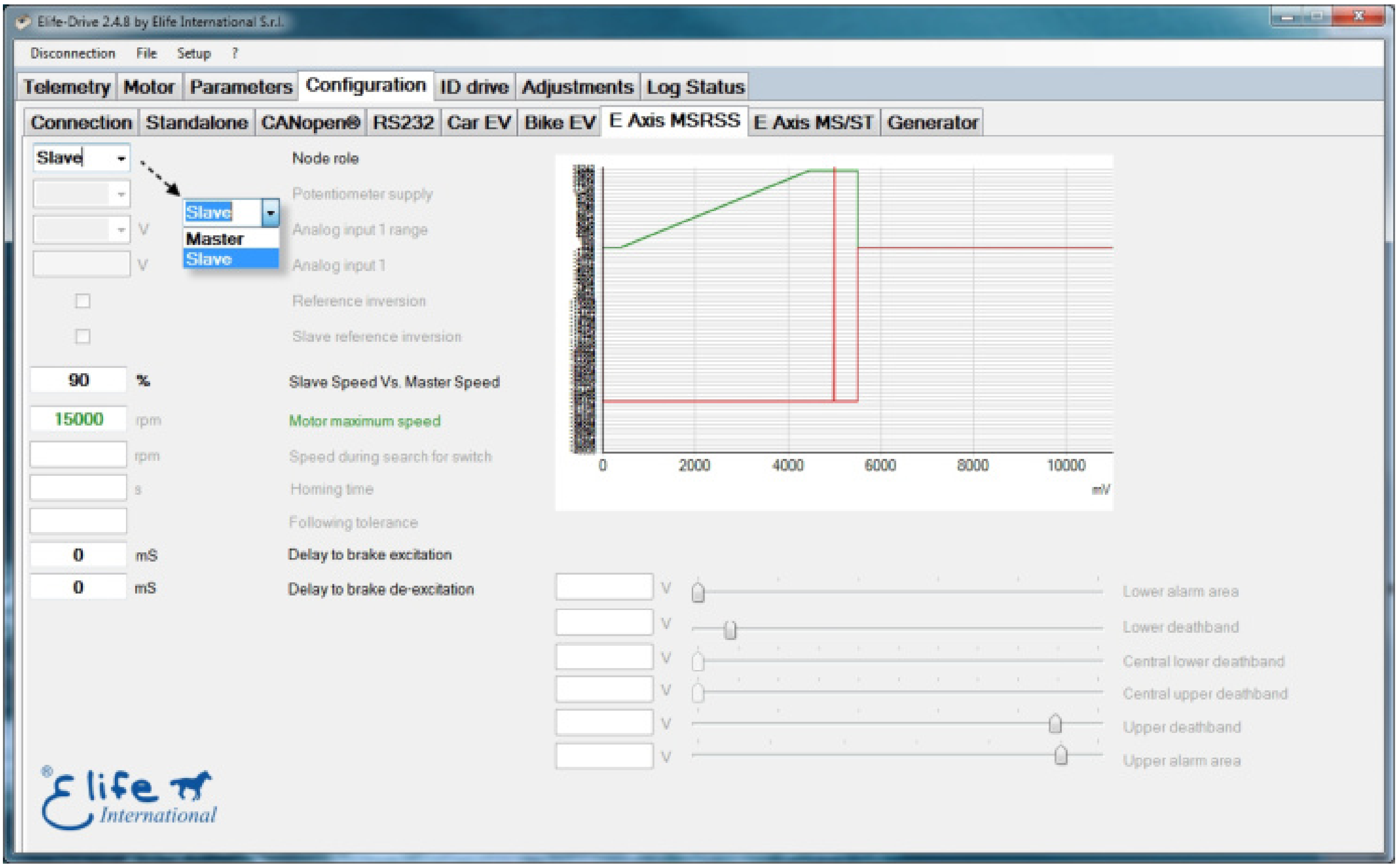


Figure 3.16: Telemetry Panel E Axis MSRSS Configuration

3.2.11 Configuration - E Axis MS/ST

Telemetry E Axis MS/ST Configuration

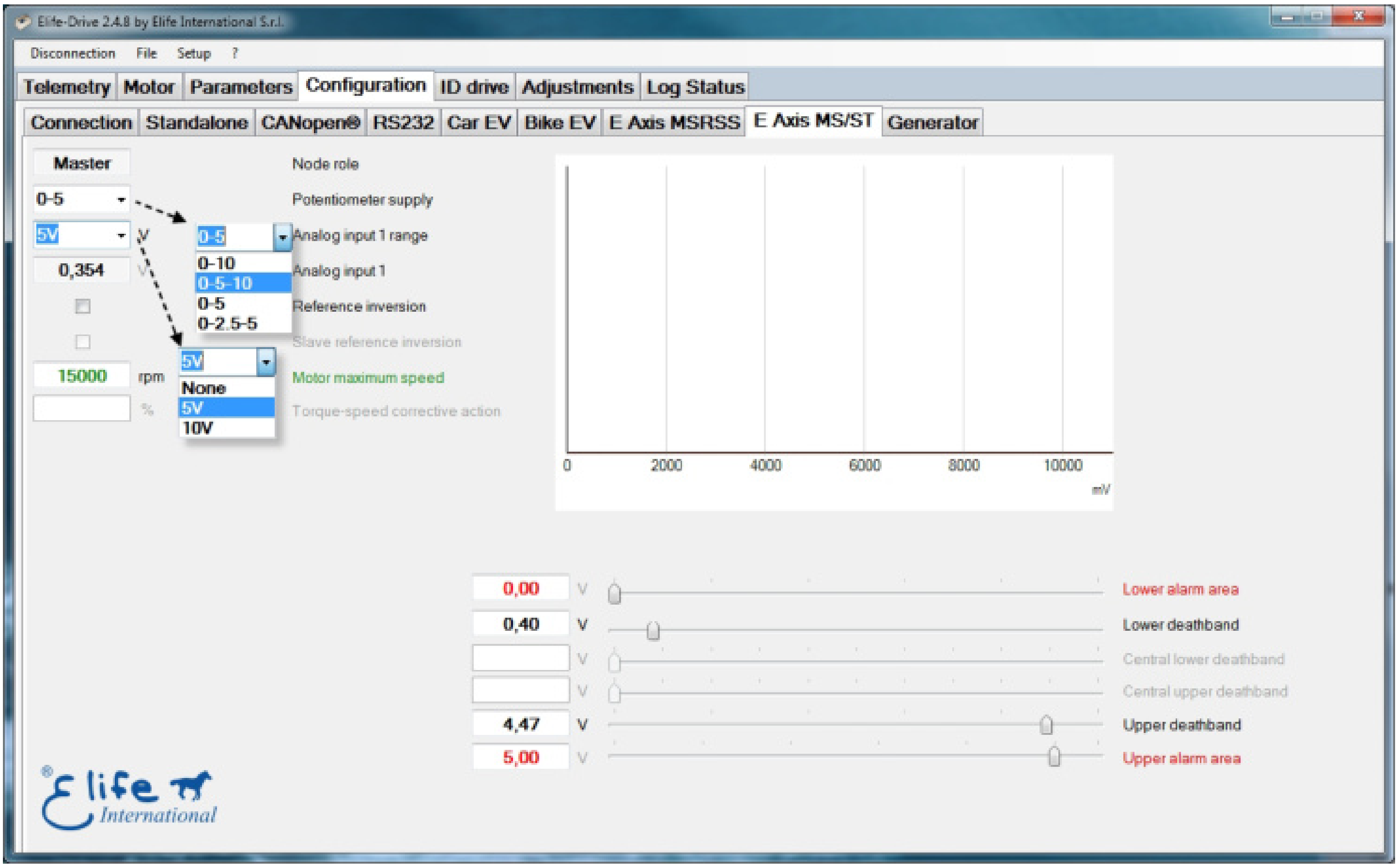


Figure 3.17: Telemetry Panel E Axis MS/ST Configuration

3.2.12 Configuration - Generator

Telemetry Generator

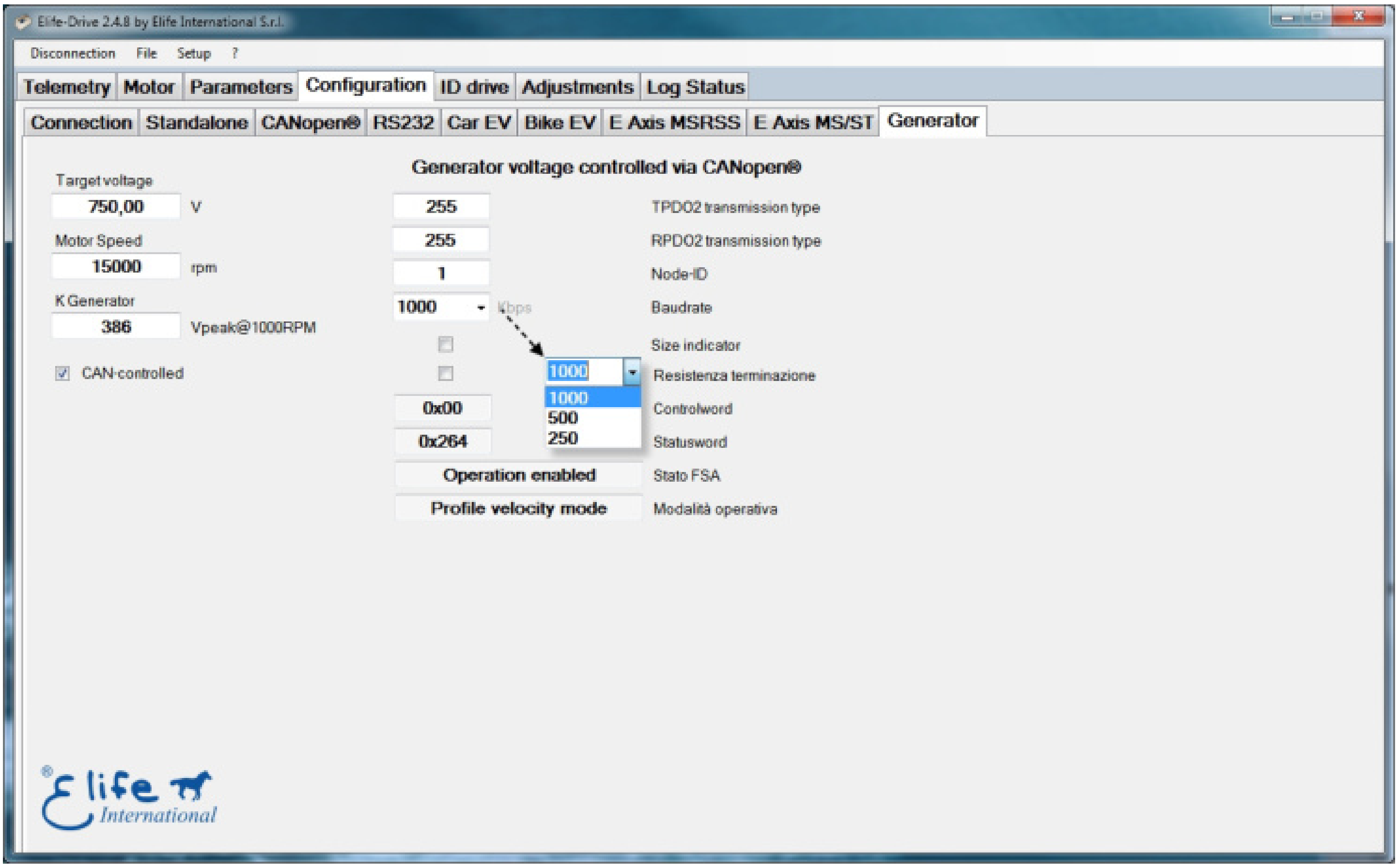


Figure 3.18: Telemetry Panel Generator Configuration

3.2.13 ID Drive

Telemetry ID Drive

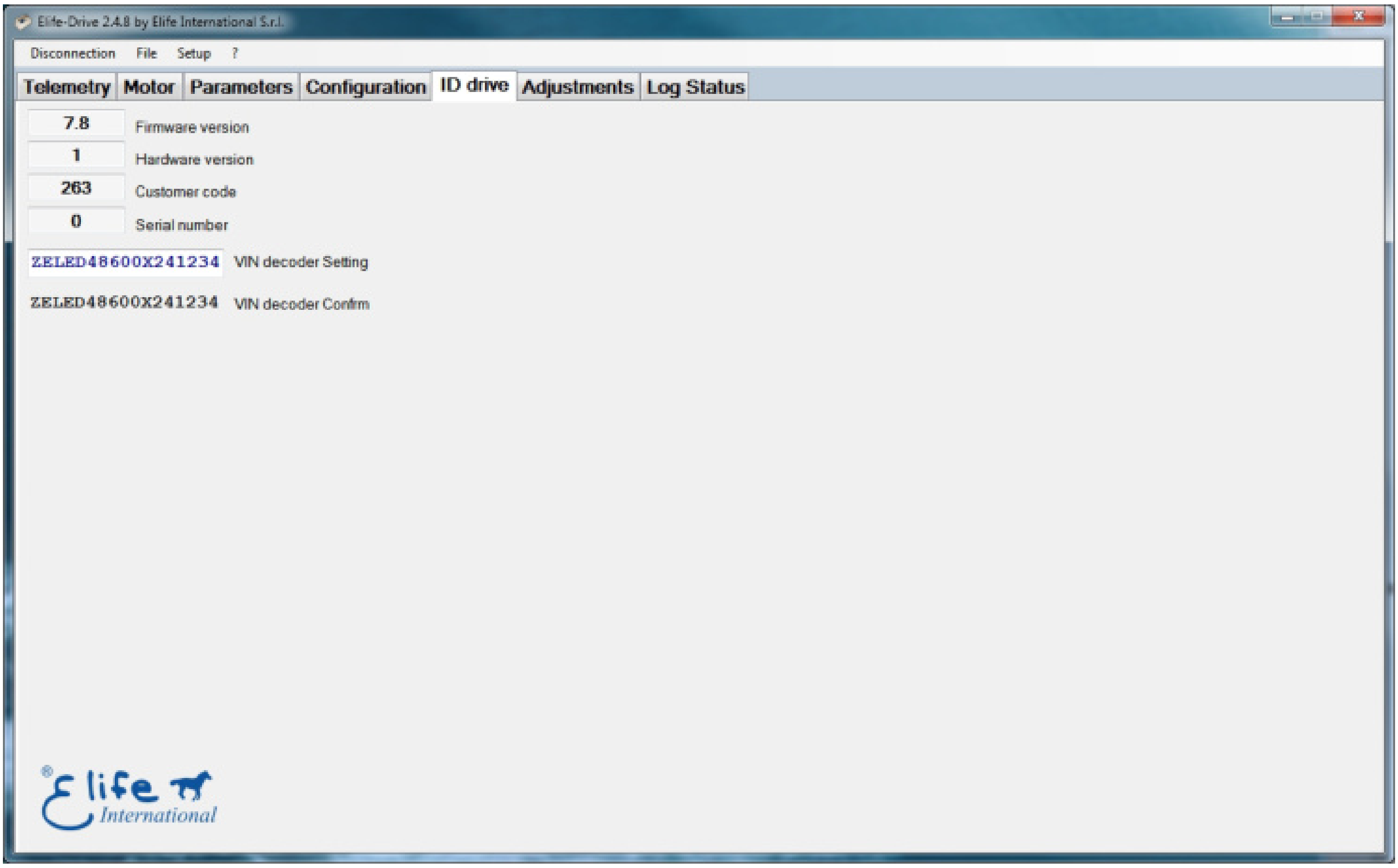


Figure 3.19: Telemetry Panel displays the ID Drive

3.2.14 Adjustments

Telemetry Adjustments

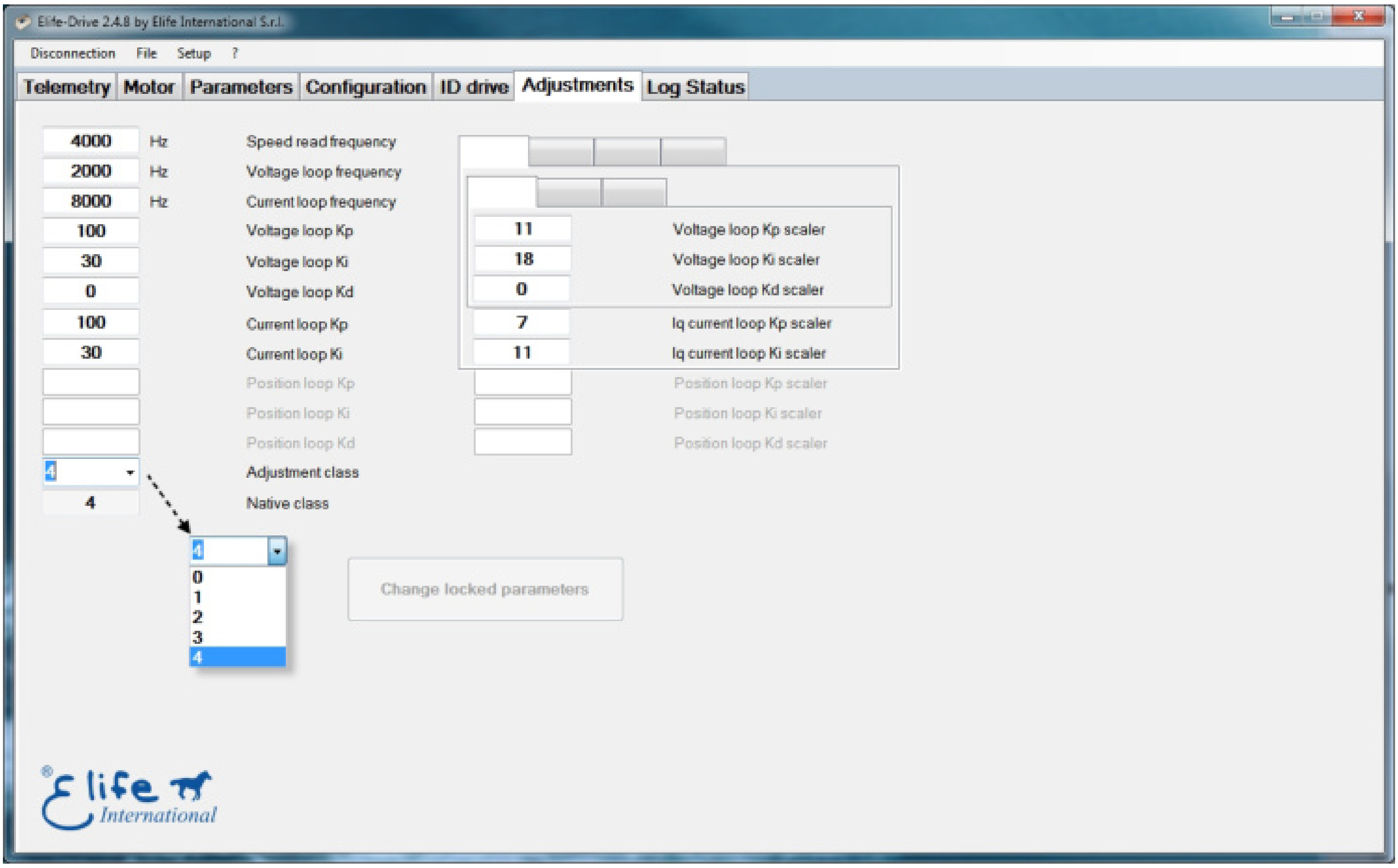


Figure 3.20: Telemetry Panel Adjustments

3.2.15 Log Status

Telemetry Log Status

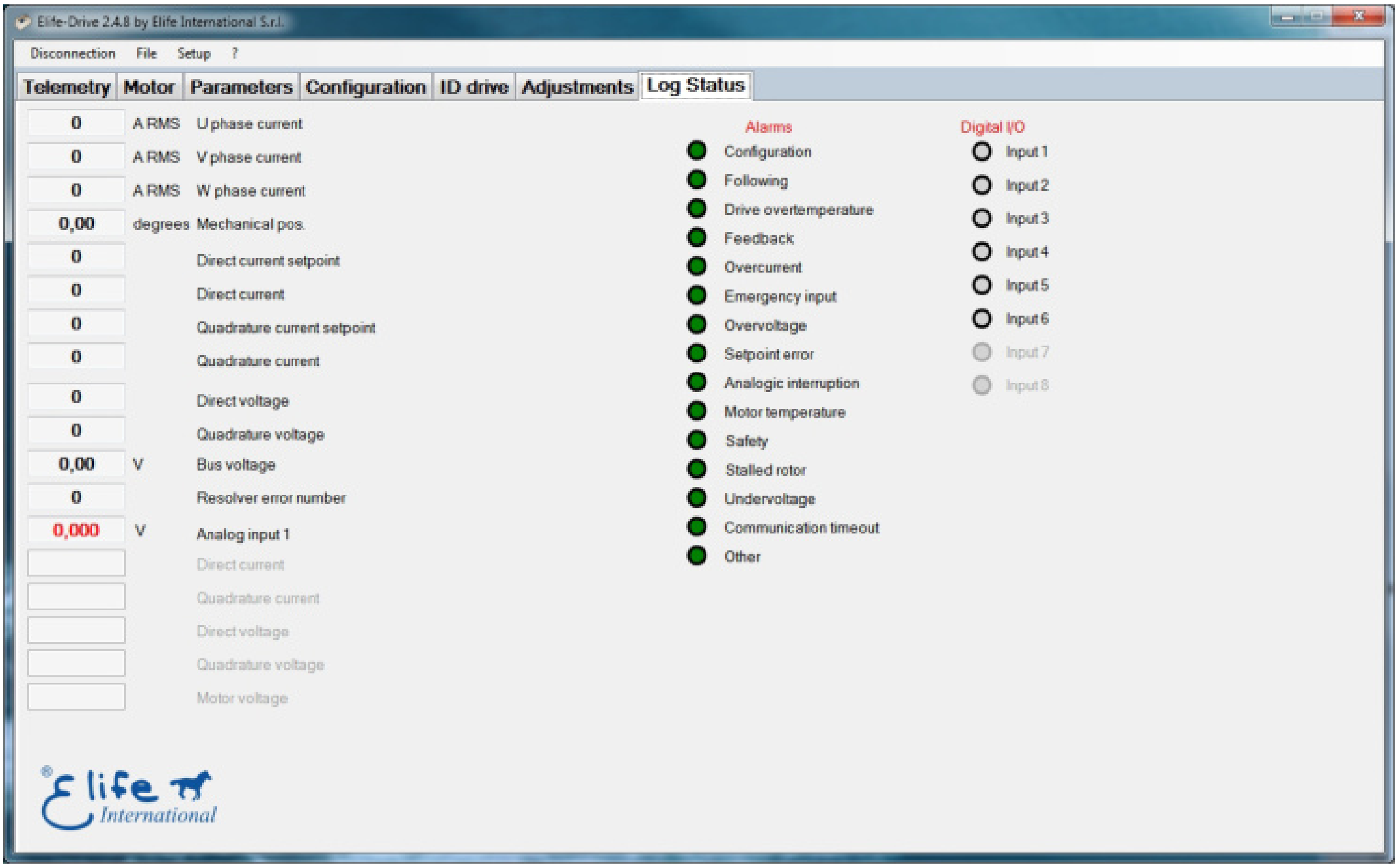


Figure 3.21: Telemetry Panel displays the Log Status