GR-SYNC

GIMSON ROBOTICS

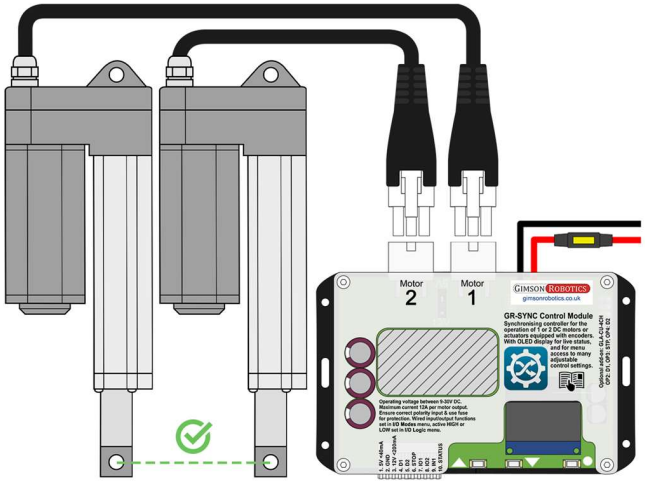
Updated for February 2024

User Instructions

gimsonrobotics.co.uk/GR-SYNC

The **GR-SYNC** is a general purpose highly configurable DC motor and actuator control module, designed to operate one or two connected motors with encoders, tracking their positions and applying automatic accelerations, current limiting and synchronisation (when in dual channel mode). In these instructions we will describe the controller features and how to configure them for your application.

For frequently asked questions visit **gimsonrobotics.co.uk/gr-sync-faq** or scan the QR code



Contents

A Device Specifications

Input Supply: **9V - 28V DC** (ensure that supply is able to handle load current)

Outputs: **Two DC motor outputs, up to 12A each**, with adjustable overcurrent (0.5 - 12A) and over-duty settings. **Combined** load should be kept <20A 3min, <16A 10min and <10A 30min. Acceleration and deceleration ramping is adjustable between 100 - 4000ms. The **PWM frequency on motor outputs is 20kHz**.

Braking: Default regenerative braking ON, this can be disabled (freewheel braking) in menus.

Command Signals: GND **0V - 1V** = **LOW**, **3V - 12V** = **HIGH**. Active HIGH is input default, though can be configured active LOW.

Compatibility: **Brushed DC motors/actuators with quadrature encoders operating at 5V or 12V**, with a signal of **up-to 2000Hz per channel** in complete pulses/second. Works with all *Gimson Robotics* actuators w/encoders.

Regulated Outputs: **5V up-to 40mA**, **12V up-to 200mA**. Be aware that if adding loads to BOTH of these outputs, the maximum loads should be halved (to a maximum 20mA at 5V and 100mA at 12V). **Do not** overload these outputs.

Display: **128 x 64px OLED**, White text on Black display.

Operating Temp: **-10°C ~ 45°C** with over-temperature detection.

Dimensions: **120 x 75 x 29mm** including enclosure, excluding connectors and leads.

Weight: **180g** including enclosure, input screw terminal, and I/O connector (10P connector with leads).

Assessed to: EMC **BS EN IEC 61000-6-3:2021** and **BS EN IEC 61000-6-1:2019**
RoHS **RoHS Directive 2015/863 (RoHS 3)**

B

1 Motor 1 & Motor 2 Outputs

6-pin 4.2mm pitch 3x2 connectors allow for the operation of either one or two connected actuators. On each, 2 pins connect to each motor, and four pins connect to the encoder.

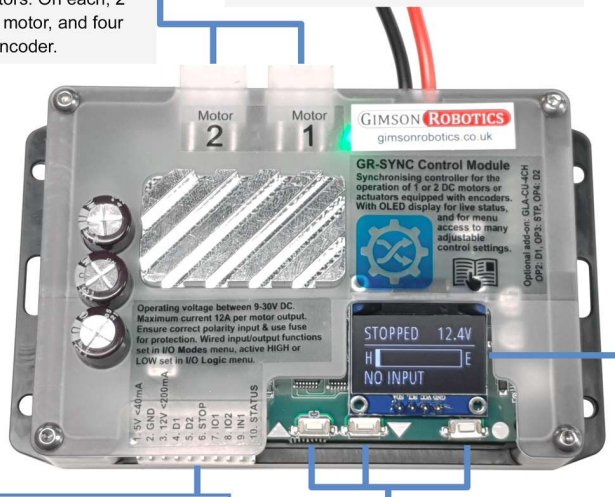
2 12V - 24V DC Fused Input

The controller features red & black 16AWG silicone-insulated leads (250mm length) for input power. The red lead has an in-line 'micro' blade fuse (20A default).

3 Enclosure

Each controller is supplied mounted in an ABS (black, base) and polycarbonate (lid) enclosure. This enclosure provides convenient mounting via flanged side rails, though it does not provide protection against water or debris. In many applications it is appropriate to add an external enclosure for further protection.

Mounting holes and slots along the side rails of the enclosure base are intended for M4 screws.
The four corner hole centres are 112 x 50mm apart.
Be aware that for high-vibration environments anti-vibration mounts may be necessary.



4 I/O Connector

A 10-way connector here (2.54mm pitch) provides access to the wired inputs **D1**, **D2**, **STOP**, **IO1**, **IO2** and **IN1**, as well as to the **5V** (max 40mA) and **12V** (max 200mA) rails of the device. A 10P ready-wired connector is included with every controller.

5 Control Buttons

- ▲ Up
- ▼ Down
- ● Select / Deselect

Used to navigate through menus and change device settings.

6 OLED Display

Built-in display for live output status information, controller calibration, and access to settings menus. The default display page shows the live position of the connected actuator(s) between Home (H) and the End Limit (E).
The display will go blank after an adjustable timeout period, default 180s, and turn back on automatically upon a movement or button press.

C Design Considerations & Safety

The GR-SYNC is a complex and highly configurable general-purpose motor control module whose characteristics can be modified significantly by changing its control settings and by connecting different power supplies, input controls and loads. It is designed with features to enhance safety, including overtemperature detection (and automatic turn-off), overcurrent detection (and adjustable response to overcurrent), stop and limit switch control overrides, as well as a fuse on the input supply.
It is very important that the connected hardware and controller settings are configured, and tested thoroughly, to suit each application individually. Where this device forms part of a consumer product, it is the product manufacturer or installer who must ensure that the system as a whole meets the relevant regulatory requirements for their product.

⚠ It is critical that all warnings on this document are adhered to, *Gimson Robotics Ltd* declines liability for damages caused by not following these instructions.

⚠ As this is a general purpose electronic device (and not a product with a defined end application) it is the user's responsibility to ensure that their usage of it, and any connected power sources and loads, meets all applicable regulatory requirements.

⚠ The device is not designed or suitable for use in safety-critical applications. It should not be used in any system directly affecting the control or operation of passenger vehicles (land, water or air).

⚠ If using the device with the RF module accessory (GR-RX-868A, combined reference GR-MOT1-RX), you must read and follow the seperate instructions provided for that device too, and of any connected remote controls. As explained on its instructions, extra precautions should be taken if the remote receiver module is incorporated.

⚠ Components such as the heat sink may become hot during loaded operation, be aware that external physical protections may be appropriate for your application.

D Contact Details

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United Kingdom

A SW version 1.23

Home Display

Input Voltage and Control State

```
STOPPED      12.0V
H              E
NO INPUT
```

IF LOCK IS ENABLED (IN DISPLAY SETTINGS) CODE NEEDS TO BE ENTERED HERE TO ENTER MENUS

Main Menu

```
Main Menu      1 / 7
1. >CTRL SETTINGS
2.  I/O MODES
3.  I/O LOGIC
4.  DISP SETTINGS
5.  RUN PROGRAM
6.  ADVANCE MENU
    BACK
```

1. Control Settings

```
Ctrl Settings   1 / 18
>MAX SPD:        100%
 HOM SPD:         60%
 CUR AWY:        5.0A
 CUR RTN:        5.0A
 ACCEL:         500ms
 DECEL:         500ms
 END LIM:        1500
 OFFSET:           20
 END SL:          300
 HOM SL:          300
 SLO SPD:         60%
 CUR SEN:        80ms
 MIN VLT:         10V
 MAX VLT:         30V
 ENC T/O:         500
 SYNC MOD:          5
 HOME DIR:         D2
 BACK
```

	*DEFAULT VALUES	MIN / MAX VALUES
Max Speed	[100]	+/-1 (20 - 100)%
Home Speed	[60]	+/-1 (10 - 90)%
Away Current Limit	[5.0]	+/-0.1 (0.5 - 12)Amps
Return Current Limit	[5.0]	+/-0.1 (0.5 - 12)Amps
Acceleration	[500]	+/-100 (100 - 4000)ms
Deceleration	[500]	+/-100 (100 - 4000)ms
End Limit	[1500]	+/-1 (50 - 999999)
Home Offset	[20]	+/-1 (0 - 32000)
End Slow Distance	[300]	+/-1 (0 - 32000)
Home Slow Distance	[300]	+/-1 (0 - 32000)
Slow Speed	[60]	+/-1 (10 - 90)%
Overcurrent Sensitivity	[80]	+/-20 (20 - 400)ms
Minimum Voltage	[10]	+/-0.2 (9 - 24)Volts
Maximum Voltage	[30]	+/-0.2 (12 - 30)Volts
Encoder Timeout	[500]	+/-20 (40 - 2000)ms
Sync Modifier	[5]	+/-1 (1 - 10)
Home direction	[D2]	(D1 / D2)

2. I/O Modes

```
I/O Modes      1 / 9
>WIR MODE:       MO
 REM MODE:       MO
 STOP MODE:       1
 CURR REV:      OFF
 IO1 MODE:        1
 IO2 MODE:        1
 IN1 MODE:      HOM
 1/2CH:         2CH
 BACK
```

*DEFAULT VALUES

Wired Mode	[MO]	MO = MOMENTARY (KEEP PRESSED) LA = LATCHING (SINGLE PRESS)
Remote Mode	[MO]	MO = MOMENTARY (KEEP PRESSED) LA = LATCHING (SINGLE PRESS)
Stop Mode	[1]	1 = NORMALLY-OPEN 2 = NORMALLY-CLOSED
Overcurrent Reverse	[OFF]	OFF 2s , 4s, 6s, 8s OR 10s AUTO-REVERSE TIME
IO1 Mode	[1]	1 = AWAY LIMIT NORMALLY-OPEN 2 = AWAY LIMIT NORMALLY-CLOSED 3 = HOMING TRIGGER 4 = END INDICATOR (OUTPUT)
IO2 Mode	[1]	1 = RETURN LIMIT NORMALLY OPEN 2 = RETURN LIMIT NORMALLY CLOSED 3 = HOMING TRIGGER 4 = HOME+OFFSET INDICATOR (OUTPUT)
IN1 Mode	[HOM]	HOM = HOMING TRIGGER SPD = SPEED ADJUST POTENTIOMETER
2CH/1CH	[2CH]	M1 = SINGLE CHANNEL OUTPUT M1 ONLY M2 = SINGLE CHANNEL OUTPUT M2 ONLY 2CH = DUAL-CHANNEL SYNC MODE

3. I/O Logic

```
I/O Logic      1 / 6
> DIR ACTIV:     HI
  STP ACTIV:     HI
  IO1 ACTIV:     HI
  IO2 ACTIV:     HI
  IN1 ACTIV:     HI
  BACK
```

*DEFAULT VALUES

D1/D2 Logic	[HI]	HI = ACTIVE HIGH LO = ACTIVE LOW
Stop Logic	[HI]	HI = ACTIVE HIGH LO = ACTIVE LOW
IO1 Logic	[HI]	HI = ACTIVE HIGH LO = ACTIVE LOW
IO2 Logic	[HI]	HI = ACTIVE HIGH LO = ACTIVE LOW
Input 1 Logic	[HI]	HI = ACTIVE HIGH LO = ACTIVE LOW

4. Display Settings

```
Disp Settings   1/ 5
>HOME DISP:       1
 AUTO OFF:     180s
 LOCK:          OFF
 LOCK VAL:        0
 BACK
```

*DEFAULT VALUES

Home Display	[1]	+/-1 (1 - 4)
Auto Off	[180]	+/-1 (0–180s)
Menu Lock	[OFF]	(OFF / ON)
Lock Value	[0]	+/-1 (0 - 999)

5. Run Programs

```
Run Program   1/3
<HOMING>
HOLD ● TO RUN

Run Program   2/3
<RESET VALUES>
HOLD ● TO RUN

Run Program   3/3
BACK to main?
PRESS ● TO ESC
```

6. Advanced Menu

```
ADVANCED       1 / 6
>DUTY 3min:      20A
 DUTY 10min:     12A
 DUTY 30min:      8A
 REGEN:           ON
 VOL TIME:      1500
 BACK
```

*DEFAULT VALUES

Duty Cycle 3min	[20A]	+/-1 (4 – 20)Amps
Duty Cycle 10min	[12A]	+/-1 (3 – 16)Amps
Duty Cycle 30min	[8A]	+/-1 (2 – 12)Amps
Regen Braking	[ON]	(ON / OFF)
Low Volt Timeout	[1500ms]	+/-100 (100 – 5000)ms

Key

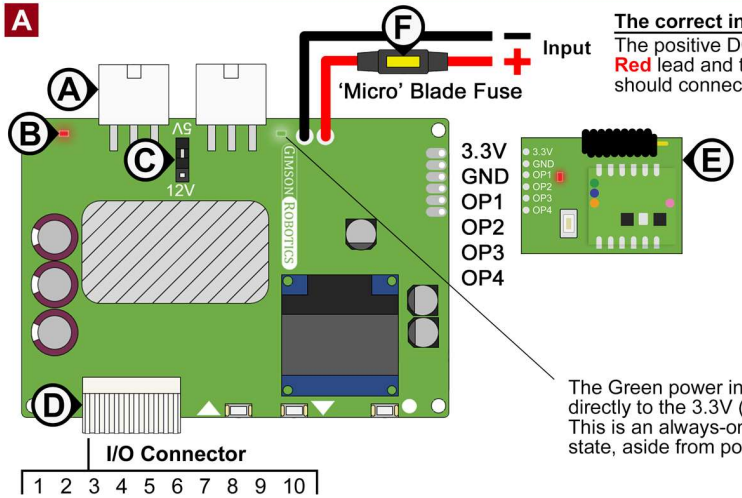
- △ Up Press
- ▽ Down Press
- ○ Select Press
- ◉ Select Hold
- Button(s) refers to all
- lock screen if active

AFTER 30 SECONDS OF INACTIVITY THE DISPLAY WILL AUTOMATICALLY RETURN TO HOME

> THE SELECTED MENU ITEM.

◉ HOLD SELECT TO RETURN TO HOME DISPLAY FROM MENU, UNLESS ◉ HOLD IS LINKED TO A PROGRAM START. PRESSING OR HOLDING ▽ OR △ WILL ALLOW YOU TO SCROLL THROUGH ITEMS AND INCREASE OR DECREASE SELECTED VALUES.

A



The correct input polarity must be ensured.
The positive DC supply should connect to the **Red** lead and the negative supply (or Ground) should connect to the **Black** lead.

Be aware that for the GR-SYNC, if used with the optional RF receiver module, the control logic follows that:
OP2 = Remote D1
OP3 = Remote STOP
OP4 = Remote D2
and OP1 is not used by the controller.

The Green power indicator LED here is connected directly to the 3.3V (processor logic) regulated output. This is an always-on LED (not affected by controller state, aside from power loss).

Ⓐ Dual independent Motor 1 & Motor 2 outputs
6pin 3x2 4.2mm pitch connector (5557 compatible)

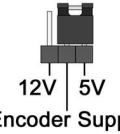
A. Encoder channel A
B. Motor A output
C. Motor B output
D. Encoder +ve supply
E. Encoder -ve (supply GND)
F. Encoder channel B

i. The controller provides a PWM-modulated current between the A and B terminals connected to each motor, inverting polarity between them to change the direction of travel.

ii. When encoder channels A and B are connected to a quadrature encoder in a driven motor these inputs allow the controller to track the motor position.

Ⓑ RED controller status LED Flashes or pulsates to indicate status. See key to the right (section **B**).

Ⓒ Encoder output select jumper, 5V or 12V (default 5V)



Using the selection jumper here you can change the encoder supply from 5V to 12V, useful for some applications where a 5V supply is insufficient. This jumper is accessed below the enclosure lid, between the motor connectors.

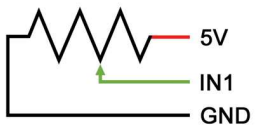
Ⓓ 10pin (KF2510, 2.54mm pitch) connection port

1. **5V** Regulated 5V output, maximum 40mA available here, or maximum 20mA if 12V rail is also connected to.
2. **GND** Output controller Ground connection.
3. **12V** Regulated 12V output, maximum 200mA available here, or maximum 100mA if 5V rail is also connected to.
4. **D1** D1 direction control input. +12V tolerant, may be set active HIGH or active LOW.
5. **D2** D2 direction control input. +12V tolerant, may be set active HIGH or active LOW.
6. **STOP** STOP control input. +12V tolerant, may be set active HIGH or active LOW.
7. **IO1** Multifunction input and output, see I/O Modes menu on page 2 for options. +12V tolerant.
8. **IO2** Multifunction input and output, see I/O Modes menu on page 2 for options. +12V tolerant.
9. **IN1** Multifunction input including for speed (potentiometer) adjustment, see I/O Modes menu on page 2.
10. **STATUS** 3.3V output for the connection of an external LED, with on-board 470Ohm current limiting resistor.

Ⓔ Optional 868Hz RF Receiver See note **D** to the right.

Ⓕ Input Fuse A 'micro' blade fuse is located in series with the positive input lead (16AWG, red silicone insulated). This provides a secondary failsafe to the overcurrent detections of the controller. By default a 20A Littelfuse 'Low Profile MINI' fuse is installed here. DO NOT use the controller with fuses rated for above 20A.

IN1 wiring, when used for speed control



B

The status LED built-in to the controller is **Red** in colour, and is located next to the Motor 2 output connector. It either flashes, or pulses/fades, to indicate the state of the controller, as illustrated below. These sequences are the same as those transmitted to the STATUS pin, for connecting external LEDs.

LED Status Indications

1 Blink, repeating: Current limit (Overcurrent) Event
Current on M1 or M2 has exceeded the set **CUR AWY ☰** or **CUR RTN ☰** for longer than the **CUR SEN ☰** time (ms)

2 Blinks, repeating: Encoder Error
This indicates that either the encoder signal for one or other channel (M1 or M2) has not changed for **>ENC T/O ☰** or that signals are travelling in opposite directions, or that the encoder counts are going negative.

3 Blinks, repeating: Low Voltage Error
The detected voltage has dropped below **MIN VOLT ☰** for longer than the **VOL TIME ☰** setting.

4 Blinks, repeating: High Voltage Error
The detected voltage has risen above the **MAX VLT ☰** setting

LED Pulsing States

1 Second Pulsing: Homing
A steady 1 second pulse frequency means that homing is underway, see page 5 for details

500ms Pulsing: End Limit Calibration
A faster pulsing action indicates that End Limit Calibration is underway, see page 5 for details

LED Continuously **ON**: Output Stopped

This can occur due to Overtemperature, Homing incomplete, Limit Switch or an active Stop input. Check the display to see what the trigger is

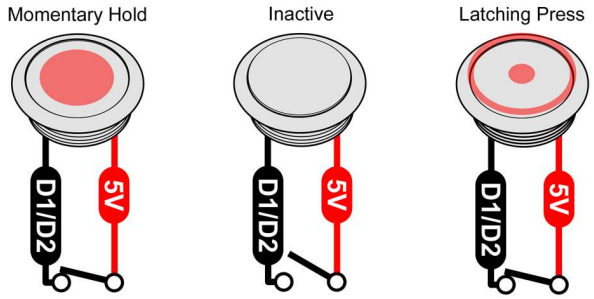
LED **OFF**

No errors or calibration states are active

For all error states, view the OLED display, if possible, for more information on the cause.

C Control Modes

By default, inputs to the GR-SYNC are '**Momentary (MO)**', meaning that they need to be maintained for the output to keep moving (a button input needs to stay pressed). It is possible to instead change the control response to '**Latching (LA)**', meaning that a single input starts an action and a second trigger of the same input (for example a button being pressed a second time) ends the action. This mode selection, between **MO** or **LA**, is applied seperately to wired inputs at D1 and D2 (**WIR MODE ☰** setting) and to remote inputs (**REM MODE ☰** setting) if an optional remote receiver is connected (see section **C**, alongside).
For applications with latched operation set, additional care should be taken to ensure that the system remains safe when the output is latched on, in one direction or the other.

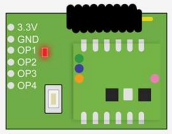


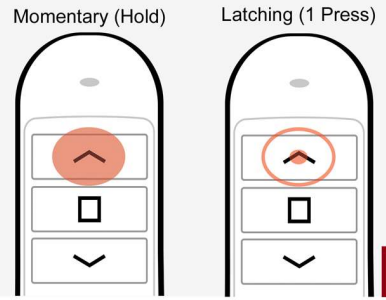
Momentary = Keep Pressed, Latching = Single Press
Above button example applies when inputs are set active HIGH

D GR-RX-868A

The controller has an input terminal row for the optional connection of a **GR-RX-868A** 868MHz receiver module, so that the controller may be commanded via remote control(s). When a receiver is connected here, remote inputs are independent of wired inputs, and wired inputs are set to override remote commands.

You must also read the GR-RX-868A instructions if your controller incorporates this module.





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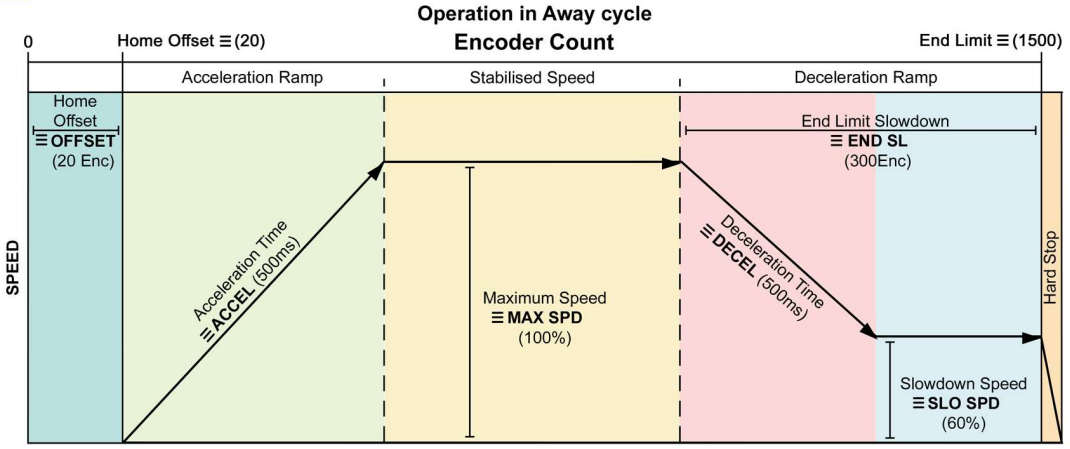
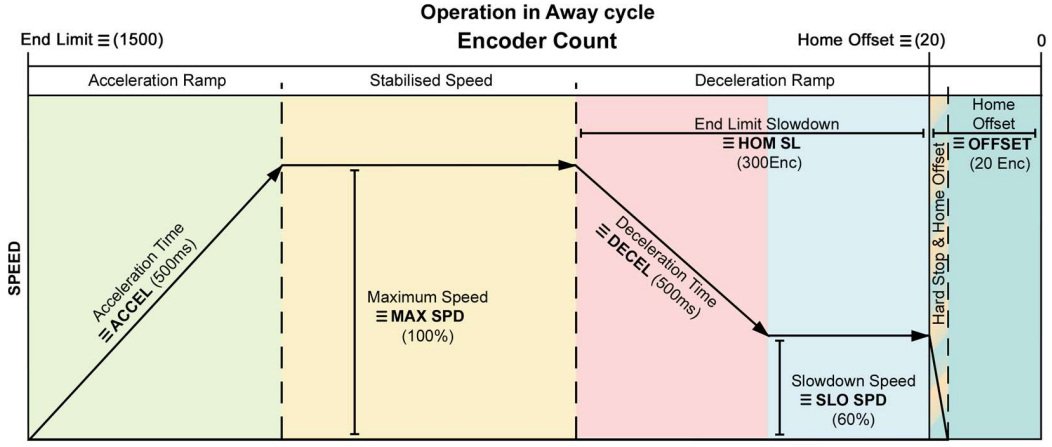
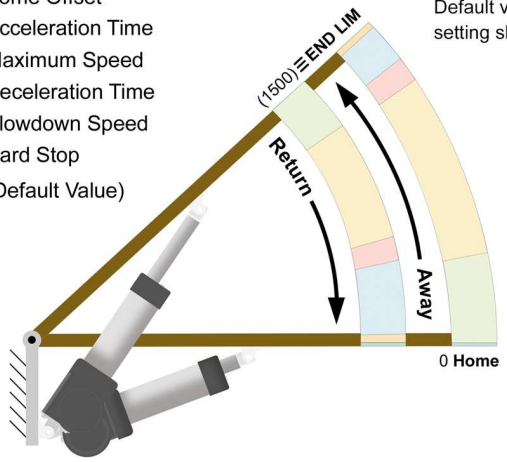


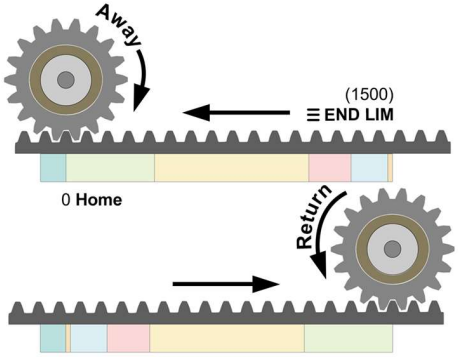


Key

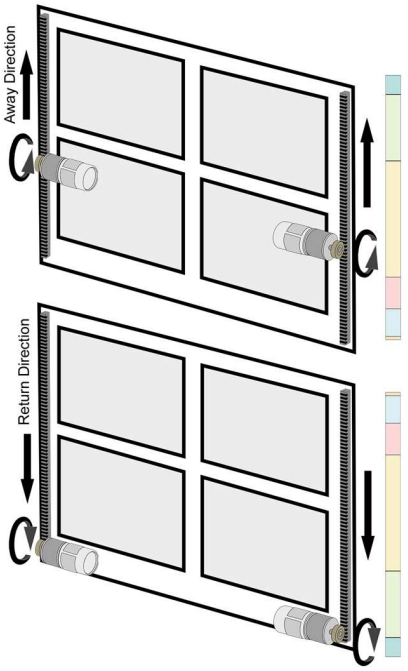
- Home Offset
- Acceleration Time
- Maximum Speed
- Deceleration Time
- Slowdown Speed
- Hard Stop
- ☰ (Default Value)

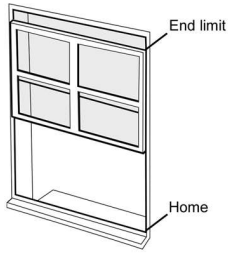
These diagrams illustrate how a complete operation cycle can occur, from **Home** to the **End Limit** in the **Away** cycle, and then back from the **End Limit** to **Home** in the **Return** cycle. Default values are shown in (brackets), with the menu name for each setting shown in **bold**.





B Home Orientations





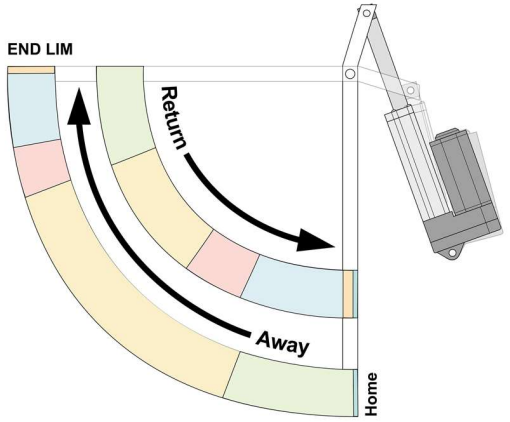
The controller is designed to be configurable for use in many different applications, for example it could be used to operate sliding doors or windows (via rack & pinion, or belt drive), or perhaps hinged opening hatches and signs (via directly connected actuators).

In different applications the **Home** and **End Limit** orientations may vary. Ideally the **Home** point will offer a mechanical or electrical reference point which is unchanging, for example the closed point of a window (which can be found via current limit detection), or the limit switches inside a pair of linear actuators. Since the controller 'homes' each motor independently (though simultaneously, until the first is homed), if the motors were misaligned against the home position, the controller will attempt to maintain this misalignment for the rest of the travel cycle, since **Home** is the reference used to synchronise motion from. As such it is important to make sure that the motors or actuators, and the assembly, are square at this point.

The homing direction is set via **HOME DIR** ☰ in the Control Settings menu, either to **D1** or to **D2**. Each of these labelled inputs corresponds to a fixed output current polarity. An active **D1** output means that the connector pin labelled '**Motor A**' on the diagram on page 3 is positive (+ve) and '**Motor B**' is **negative** (-ve), whereas output **D2** active means '**Motor A**' is **negative** (-ve) and '**Motor B**' is positive (+ve).

C Limit Switches

The multipurpose terminals **IO1** and **IO2** can be used as limit switch inputs, to stop travel in one direction or the other **before** the configured **END LIM** ☰ or **OFFSET** ☰ positions are reached, as illustrated below. The input **IO1** can be set as an **Away** limit, meaning that if this input is triggered while travelling towards the End Limit, the output will be stopped abruptly (not waiting for the **DECEL** ☰ time, applying motor braking), but a subsequent control input in the opposite direction (to Home) will still work. Meanwhile **IO2** can be set as a **Return** limit, stopping travel back towards Home. The *polarity* direction that these limits operate in will depend upon the **HOME DIR** ☰ setting. **STOP** inputs are similar to Limit Switch inputs in that they enact a sudden stop, with no deceleration period, however they differ in that they prevent subsequent travel in **both** directions (while active).



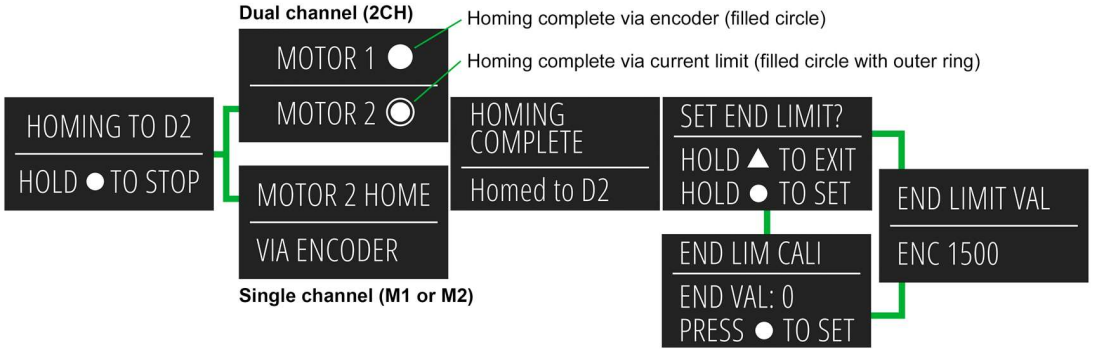
A Homing

Slow 1000ms status pulse

Homing is a process whereby the controller records the 'zero' or **Home** position, for one or two connected actuators. When using two actuators together, this routine ensures that they begin from a level position relative to one-another, before the controller actively tries to synchronise them away from this point. After first assembling your system, with actuator(s) installed and loaded up, you ought to trigger a homing cycle to ensure that the reference position that the controller is using to measure travel away from, is up-to-date. There are some possible error states, including encoder detection errors, from which a fresh homing cycle is the only escape back to normal operation, this would be indicated on the display if so.

To begin homing, you can either
a) Hold down the UP and DOWN menu buttons (△ ▽) simultaneously for at least 2 seconds, or
b) Trigger the direction button inputs (D1 and D2) simultaneously for at least 10 seconds, or
c) Trigger one of the other external homing inputs, for example by default IN1 is set to trigger homing, and IO1 and IO2 can be optionally set to trigger homing

When homing is underway, the status (Red LED on the controller, and out to STATUS output pin) will begin pulsing with a 1 second frequency, and the display will say '**HOMING TO D1**' or '**HOMING TO D2**' depending upon which direction homing has been locked to. If you need to change the homing direction lock, hold the Select button (◯) to escape to the menus, and go to CTRL SETTINGS > HOME DIR (menu item 17), to change this setting.
Apply the stated input, either D1 or D2, and the actuators will travel in that direction for as long as the input is still triggered, UNTIL the controller detects either; a) The encoder count for an actuator has stopped changing or b) An actuator has tripped its current limit (current has gone above the **CUR RTN** setting for at least **CUR SEN**, the sensitivity time); whereupon the display will either confirm completion (for single channel output mode) or display which Motor has already homed with a circle icon and which is yet to home (for 2CH output mode). In the default 2CH output mode, a filled circle display means that the motor has been homed via the encoder, a filled circle with an outer ring means it has been homed via current limit, and an un-filled circle means that homing is not yet complete. For each motor that completes homing, the STATUS will flash once. Once homing is complete, either hold UP (△), or trigger D1 and D2 simultaneously for >2s, to exit to normal operation, or hold Select (◯) to begin End Limit Calibration.



B End Limit Calibration

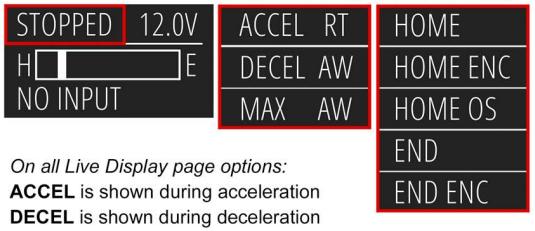
Fast 500ms status pulse

At the end of *Homing*, as shown above, you can either exit to normal operation (the display will briefly show the **END LIM** value stored before returning to the Live Display) OR you can pass through (by holding the Select button) to *End Limit Calibration*. This mode allows you to manually operate the connected actuators, travelling Away from the Home or 'zero' position, to your desired end stop position (you should initially trigger the opposite input, either D1 or D2, to your homing direction lock **HOM DIR**, to begin travel). The **END VAL** shown on the display will update in real time as the actuator(s) travel, to show how far, as an encoder count, the actuator(s) have come from the Home point. If you have two actuators connected, the controller will actively synchronise them during this process. After you have travelled beyond the **HOM SL** (Home Slow offset distance), you can use both D1 and D2 to control movement both away from and returning back towards the Home position.

There are 2 possible escape routes from this mode. Either:
a) Press the Select (◯) menu button, when your desired end limit position is reached, or
b) Encoder timeout (an actuator has not moved, despite the output being active, for > **ENC T/O** milliseconds).

When exiting, the display will show the saved **END LIM** value, which you can also edit in the **CTRL SETTINGS** menu.

C Live Display Information



Encoder count of one or other actuator is 0, or below

Encoder error within (1% x **END LIM**), of **OFFSET** during Return travel

Encoder count of one or other actuator is **OFFSET**, or below

Encoder count of one or other actuator is **END LIM**, or above

Encoder error within (1% x **END LIM**), of **END LIM** during Away travel

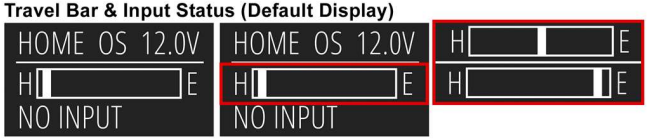
On all Live Display page options:
ACCEL is shown during acceleration
DECEL is shown during deceleration
MAX is shown if the output is at maximum speed, **MAX SPD**☰
AW or **RT** corresponds to the direction of travel, either **AW: Away** from Home or **RT: Return** back towards Home.
The top-left status will say **STOPPED** if the output is OFF but the system has not reached an end position, either it's Home or End.

Ⓢ appearing at the top-right of the display indicates that a stop input is currently active

Ⓛ indicates that a limit switch input (to IO1 or IO2) is currently active

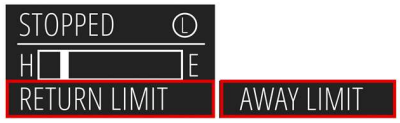
D Live Display Options

Travel Bar & Input Status (Default Display)



In **Display Mode 1**, a horizontal bar shows the output travel position, between **HOME** and **END LIM**. If a Home Offset is set (setting **OFFSET**) then the output will stop this distance from Home and HOME OS will appear to the top left.

Display Mode 1 also shows the input signal state on the bottom line, showing if a particular input (e.g. D1 or D2, or STOP) is active and causing a controller response, which is useful for debugging input hardware issues.

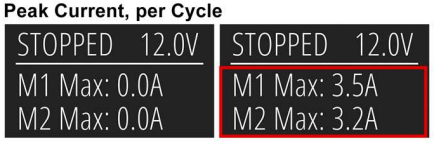


Other possible messages, to appear at the bottom of this display, are RETURN LIMIT or AWAY LIMIT, indicating that either the limit switch input in the Return direction (connected to IO1) or the limit in the Away direction (connected to IO2) are currently active and blocking travel.

Live Current

In **Display Mode 2**, the live detected current is displayed for each motor output. Currents are measured every 10ms and then averaged over the last 5 values (running average) to obtain these figures.

Peak Current, per Cycle



In **Display Mode 3**, the maximum detected current, per movement cycle (since the output was last off) is displayed for each motor. This display is very useful for determining appropriate current limit settings for your system.

Live Encoder Travel Positions

In **Display Mode 4**, the live encoder positions, as detected by the controller (relative to Home = 0), are shown for each motor. This display can help illustrate the performance of the synchronising function, and inform on whether changes to the **SYNC MOD** setting are appropriate.

A

These descriptions provide more detail to the settings shown on the **Menu Navigation** page (2).

Ctrl settings 1/18
>MAX SPD: 100%
HOM SPD: 60%

1. Maximum Speed
The maximum PWM duty (percentage) provided to connected motor(s) during normal operation.

2. Home Speed
A lower PWM duty (percentage) provided to connected actuators during **Homing** and **End Limit Calibration** processes, for slower movement. Maximum value 90%, minimum 10%.

Ctrl settings 3/18
>CUR AWY: 5.0A
CUR RTN: 5.0A

3. Current Limit, Away
The current limit threshold (in Amps) applied when travelling **AWAY** from the Home direction.

4. Current Limit, Return
The current limit threshold (in Amps) applied when in the **RETURN** direction, back towards Home.

Ctrl settings 5/18
>ACCEL: 500ms
DECEL: 500ms

5. Acceleration Time
Ramping time (in milliseconds), for linear ramp from 0% to **MAX SPD**% in normal operation.

6. Deceleration Time
Deceleration ramp time (in milliseconds), applied unless a 'Hard stop' has been triggered.

Ctrl settings 7/18
>END LIM: 1500
OFFSET: 20

7. End Limit
Encoder count at which the controller will automatically trigger a 'Hard stop', during an **AWAY** movement (see transition graphs, page 1, section B).

8. Homing Offset
Offset distance, from Home (0) at which the controller will trigger a 'Hard stop' during the **RETURN** movement, after having first travelled past this point after **Homing** (which sets the '0' position).

Ctrl settings 9/18
>END SL: 300
HOM SL: 300

9. End Slow Down
The distance from the **END LIM**, at which controller decelerates down to **SLO SPD** during **AWAY**.

10. Home Slow Down
The distance from **OFFSET** position, at which the controller decelerates to **SLO SPD** during **RETURN**.

Ctrl settings11/18
>SLO SPD: 60%
CUR SEN: 80ms

11. Slow Speed
The lower PWM duty (percentage) supplied to the output during **END SLO** and **HOM SLO** phases.

12. Current Sensitivity (Overcurrent debounce)
The minimum time, in milliseconds, for the detected current on one motor output to go beyond **CUR AWY** or **CUR RTN** thresholds (depending on travel direction), to trigger an overcurrent event.

Ctrl settings13/18
>MIN VLT: 10.0V
MAX VLT: 30.0V

13. Minimum Voltage Threshold
Voltage level, which if fallen below for **>VOL TIME** (in Advanced menu, default 1500ms) will trigger a low voltage error.

14. Maximum Voltage Threshold
Maximum supply voltage allowed before automatically stopping output and triggering an error (no delay).

Ctrl settings15/18
>ENC T/O: 500
SYNC MOD: 5

15. Encoder Timeout (Encoder Error Sensitivity)
If the output is active (not Stopped), time in milliseconds for there to be no change in encoder count, before an encoder error is triggered.

16. Synchronising Modifier
Variable to adjust the strength of synchronising routine. 5 = default, which works well for most actuator systems. Increasing this value increases synchronising strength (but may cause twitching, and so should only be used for lower encoder frequencies), decreasing this value decreases strength (only use for higher encoder frequencies).

Ctrl settings17/18
>HOM DIR: D2
BACK

17. Home Direction Lock
Sets the output direction in which Homing is set, either in direction D1 or D2 (D2 is the default). See page 4 section D, for details.

18. Back to Main Menu

I/O Modes

1. WIR MODE: Input control mode for D1 and D2 wired inputs. MO = Momentary (keep pressed), LA = Latching (single press). When in Latching mode, a single direction trigger starts movement and a second trigger of the same direction, or of the opposite direction, causes a deceleration (over DECEL time) to a stop.
2. REM MODE: Input control mode for the optional remote module, if connected (GR-RX-868A). MO = Momentary (keep pressed), LA = Latching (single press), and latching operates in the same way as described above.
3. STOP MODE: 1 = Normally-Open (closing contact), 2 = Normally-Closed (opening contact). Where possible, especially if incorporating a sensor input here, normally-closed is the preferred operating mode as it should then trigger a STOP command if there is a wiring fault causing a disconnect ('normally-closed' logic expects a current to keep flowing, a disconnect triggers the input).
4. CURR REV: Overcurrent Reverse. Optional mode to trigger a reverse movement away from an overcurrent event. 0 = OFF (default), 1-5 = time in seconds for the output to run in the opposite direction to the direction in which the overcurrent event occured (if current on one output has exceeded **CUR AWY** or **CUR RTN**, depending on travel direction, for **>CUR SEN**).
5 - 7. Refer to page 2.
8. 2CH/1CH: Select which outputs are active, allows switch between single channel modes **M1** or **M2**, or dual channel synchronised mode **2CH**.

I/O Logic

All of menu items 1 - 5 in the I/O logic menu configure whether an input (to the input terminal affected by each setting) is to be considered Active when it is connected to a **HIGH (3-12V)** OR when connected to a **LOW (0-1V, GND)** signal. The default for all of these items is Active HIGH (HI) and there is a pull-down resistor set (internal pull-down to ground), if toggled to Active LOW (LO) a pull-up resistor is set (processor internal pull-up to 3.3V). **DIR ACTIV** affects the **D1** and **D2** wired inputs, **STP ACTIV** the **STOP** input, **IO1 ACTIV** the **IO1** input, **IO2 ACTIV** the **IO2** input, and **IN1 ACTIV** sets the **IN1** input mode.

Display Settings

1. HOM DISP: Home Display Mode. 1 = Travel Bar, 2 = Live Current, 3 = Max Current (per cycle), 4 = Encoder Counts. Refer to page 5, C and D, for examples of these.
2. AUTO OFF: Time in seconds (0-180s) without an active input before OLED display turns off. 0 = Always On.
3. LOCK: Toggle whether a code needs to be entered to access the setting menus. ON = Enabled, OFF = Disabled (default).
4. LOCK VAL: The lock code value which needs to be entered to access menus, when **LOCK** is ON.

Advanced

1. DUTY 3min: Maximum average current allowed before an automatic stop, across M1 and M2 combined, over 3 minutes.
2. DUTY 10min: Maximum average current allowed before an automatic stop, across M1 and M2 combined, over 10 minutes.
3. DUTY 30min: Maximum average current allowed before an automatic stop, across M1 and M2 combined, over 30 minutes.
4. REGEN: Regenerative motor braking, ON = Enabled (default) or OFF = Disabled. Be careful if turning this OFF, as this leaves the output to 'freewheel' to a stop.
5. VOL TIME: Time allowed, in milliseconds, for the input supply voltage to drop below **MIN VLT** before an error is triggered.

B Error Codes

ERR 1: CURR LIM
M1 IN AWAY
DIR EXCEEDED

ERR 2: ENCODER
M1 AT MAX SPD
HOLD ● TO HOME

When an error occurs, the display will change to indicate (at the top left) what error number it is, and any further details relevant to the error. See error details below.

Error 1: Current limit exceeded. This message will include travel direction (Away or Return) and which motor (M1 or M2) triggered the error.
Error 2: Encoder error. This error occurs if, during a movement cycle, one of the encoder signals has not changed (no movement is detected). The motor which triggers the error (M1 or M2) and the phase of travel will be described. The output must be re-homed (see page 5, A) after an encoder error.
Error 3: Opposite encoder signals. According to the encoder signals the motors are travelling in opposite directions. Swap encoder leads to one of the motors and then re-home.
Error 4: Low voltage. The detected input supply has dropped below **MIN VLT** for longer than **VOL TIME**. Check supply.
Error 5: High voltage. The detected input supply has exceeded **MAX VLT**. Check supply.
Error 6: Negative encoder count. The motor(s) have gone too far 'backwards' past Home, and so must be re-homed.
Error 7: Overtemperature. The temperature (of either the processor, or the H-Bridge sensor) has exceeded the limit, allow to cool.
Error 8: Overduty. Duty cycle limit (accessed through the ADVANCED menu) has been exceeded. This error will indicate the duty period setting (3min, 10min or 30min) that has been exceeded.
Error 9: Power failure. Error occurs if power drops out whilst motors are moving. The controller must therefore be re-homed to ensure that position tracking remains accurate.