

## 1 Introduction

This document describes the assembly, installation, maintenance and usage of the YourDyno water brake valve.



*Figure 1 The YourDyno Water brake valve*

## 2 Valve mechanical assembly

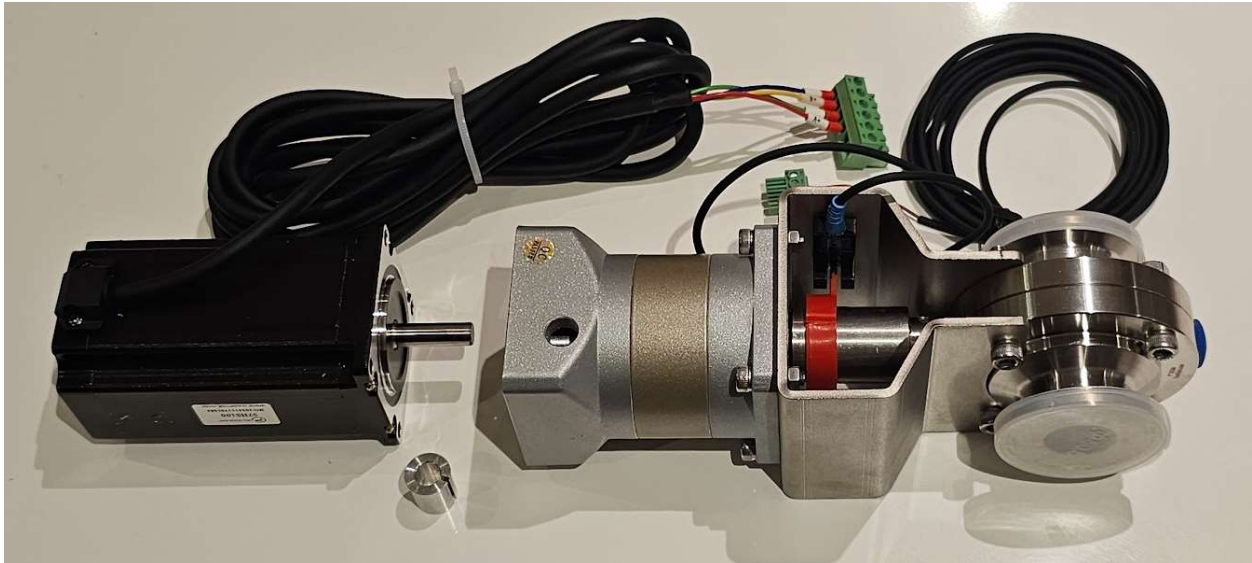


Figure 2 The assembly comes with gearbox, position sensor and valve assembled into one unit. The stepper motor must be fitted to the gearbox

### 2.1 Setting up the zero-position sensor

Before assembling the valve, it is useful to set the zero-position sensor. Go to Options->RPM/Frequency channels and set Freq1 like this:

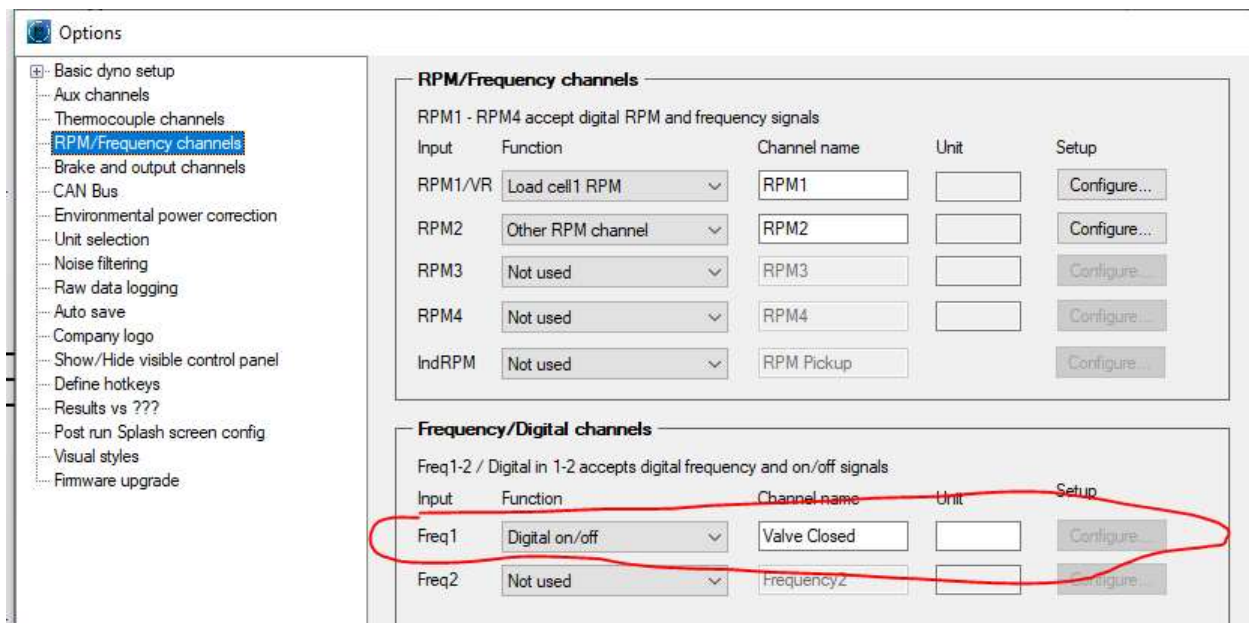


Figure 3 Setup the zero-position sensor. RPM3/4 and Freq2 can also be used

Connect the zero-position sensor to the YourDyno box using the selected RPM/Freq input channel. Click Run->New run. Turn on the Valve Closed channel gauge.

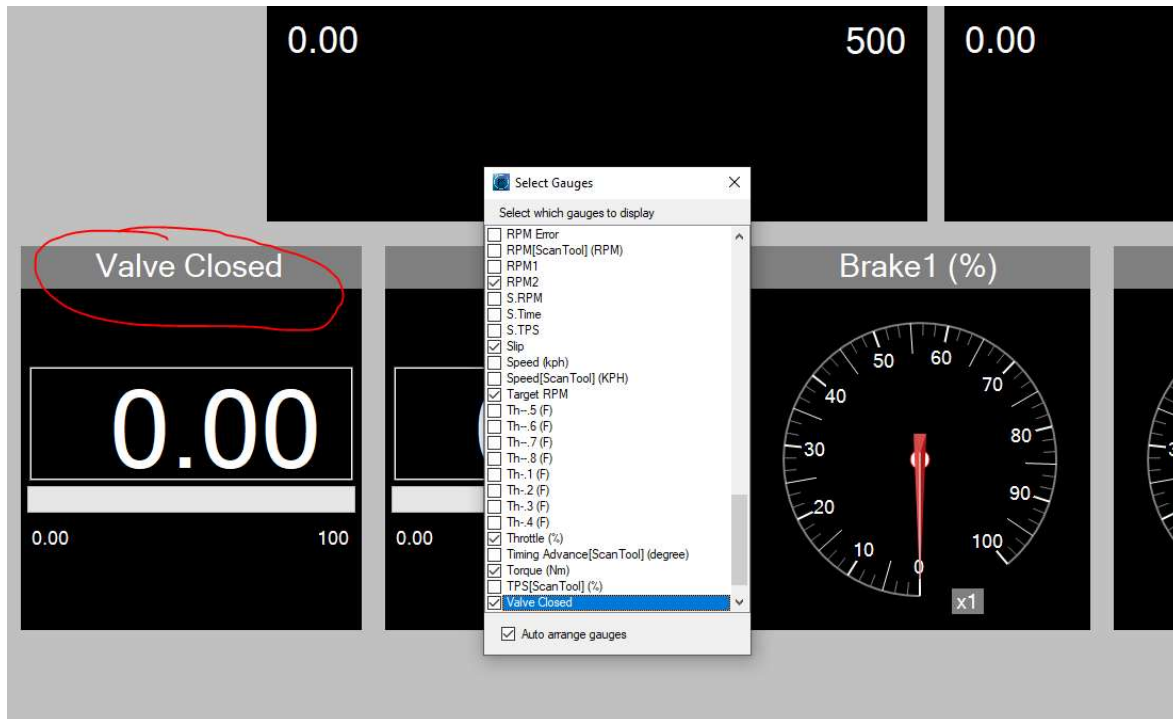


Figure 4 Turn on the "Valve Closed" gauge

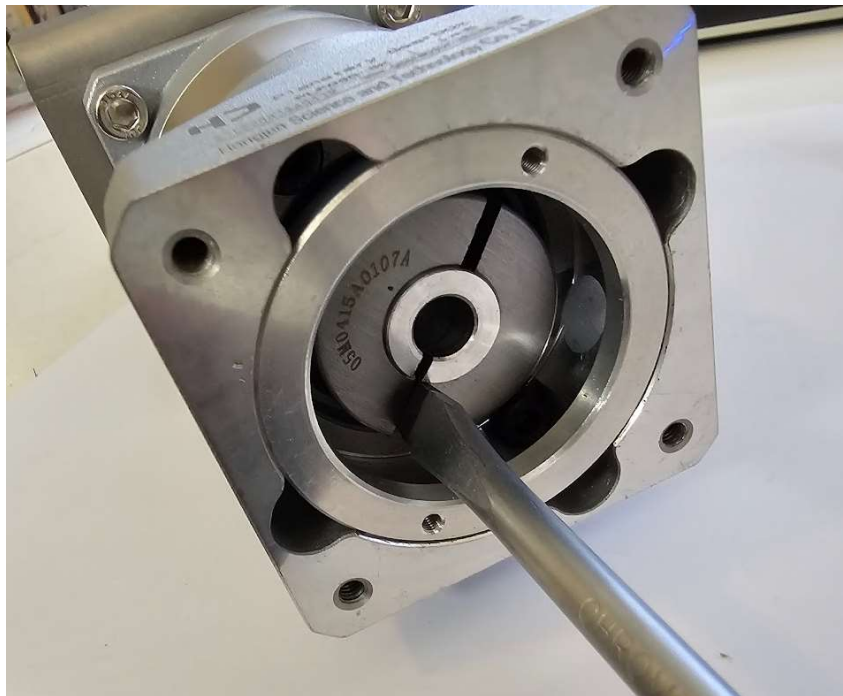


Figure 5 Turn the gearbox input using a flat screwdriver

The valve can be opened and closed with a flat screwdriver. Adjust the red pointer such that the Valve closed channel turns from 0 to 1 exactly where the valve goes fully closed. Don't go to the full 90 degrees of the flow, just close it enough to stop the water flow.

Important: The valve will close in the clockwise direction and open in the counterclockwise direction. Make sure to take the direction into account when adjusting the pointer, so the "Valve closed" channel goes to 0 when you barely open the valve (by counter clockwise rotation of the gearbox input shaft).

## 2.2 Fitting the stepper motor to the gearbox



*Figure 6 Clean the stepper motor shaft and gearbox shaft coupler with acetone or similar, to limit the chance of slippage between the motor and gearbox. Turn the gearbox shaft coupler such that an allen key fits the bolts. Fit the shaft adapter*

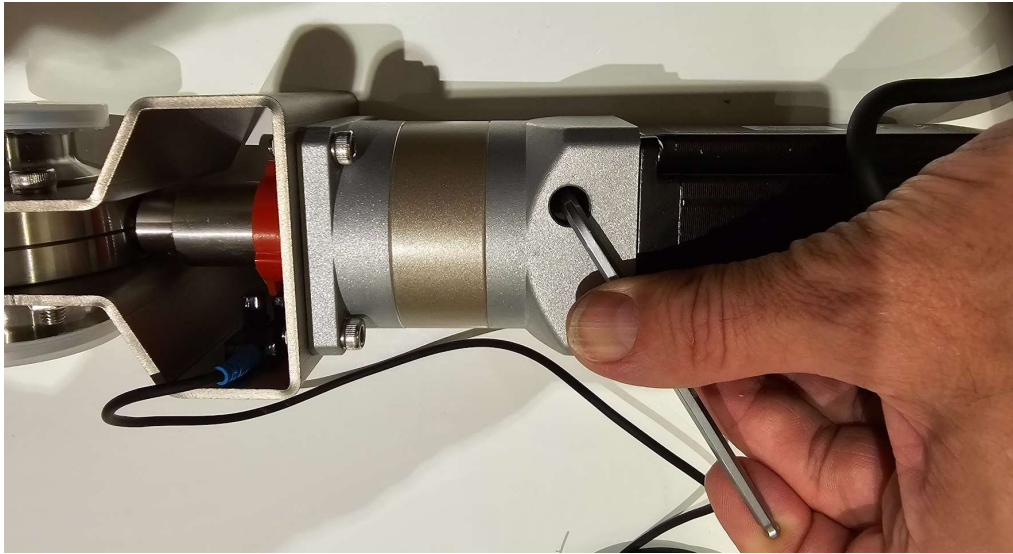


Figure 7 First secure the stepper to the gearbox with 4 x m4 bolts. Then tighten the shaft coupler bolts, a bit at the time, symmetrically on each side. Torque spec is 8.7Nm (6.4 lb ft). Fit the caps to the screw holes to keep water/dirt out

### 3 Electrical connections

#### 3.1 Stepper motor/controller connections

All connections are pre-made and wires between the motor and controller are marked. The dip switch settings are also pre-set. Should you need to re-set them, here is the correct setting.



Figure 8 Correct stepper dip switch settings for the controller with feedback



Figure 9 Correct dip switch settings for controller without feedback (Zero position instead)

### 3.2 Stepper controller/ YourDyno instrument connections

A 4-wire cable is needed between the YourDyno instrument unit and the YourDyno stepper controller. The cable is included in the valve kit, but if a new cable is needed, connections are like this:

YourDyno instrument unit	YourDyno Stepper controller
Out1 Out	PUL+
Out1 0V	PUL-
Out2 Out	DIR+
Out2 0V	DIR-

### 3.3 Power connections

- 1) Install a suitable power cord to the N, L and Ground connections of the power supply
- 2) Some power supplies have a switch between 110V and 220-240VAC. Make sure the switch is in the correct position if fitted
- 3) Connect the red/black power cable to the Power supply (24VDC). Red is + and Black is -. This cable connects to the Stepper Controller power port.

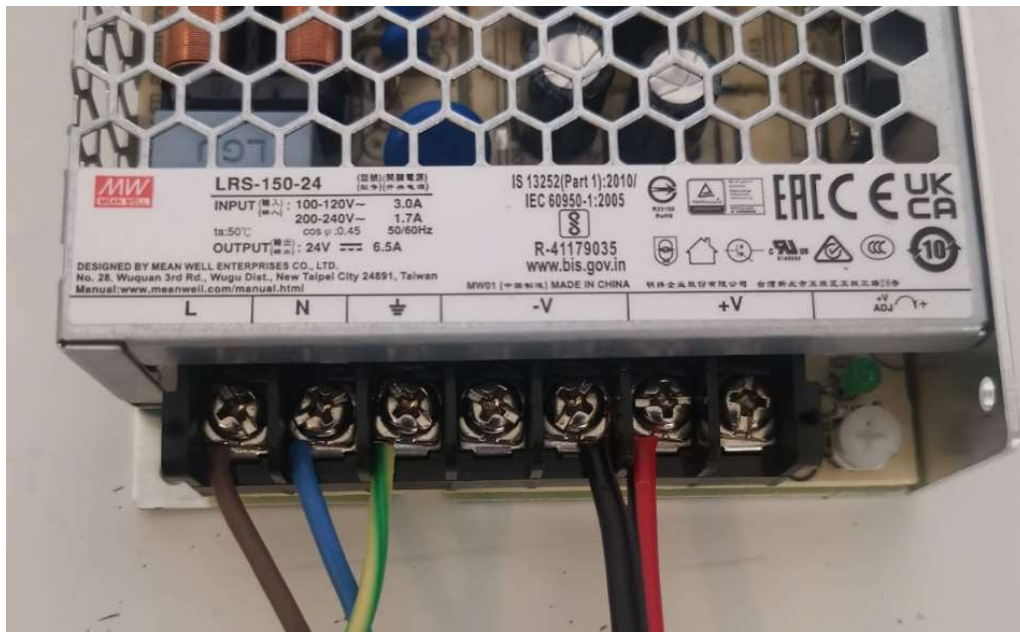


Figure 10 Power connections to the power supply (European colors). Do NOT mix up V+ and V-

## 4 Mechanical installation

- 1) The valve package includes pipe thread couplers (standard) or hose couplers (optional) on each side of the valve. Connect them to the piping/hoses
- 2) Fit the valve to the pipe or hose couplers using a gasket and a clamp
- 3) The valve can be installed using only the pipe clamps if the pipes are strong enough. Mounting holes can be drilled in the bracket between the valve and the gear box if needed. The 6mm/8mm screws on the valve itself can also be used to support the valve assembly further
- 4) The stepper motor can get warm, install it away from other parts
- 5) The stepper tolerates occasional water sprays, but not heavy jets. Install the valve in a way that minimizes the motor's exposure to water
- 4) Install the stepper controller and power supply in a place free from water spray and excessive vibration. The controller can get a warm, so put it in a place with ventilation or enough air volume

## 5 Software settings

The following settings are needed to configure the water brake valve.

Go to Options->Brake controller setup.

Scroll to the bottom where the Stepper motor options are. Set it like this:

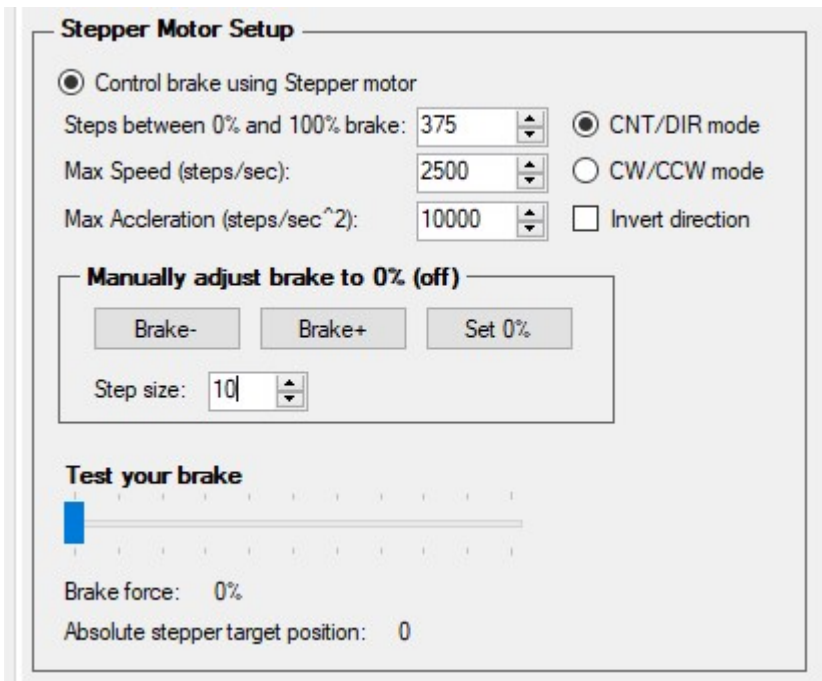
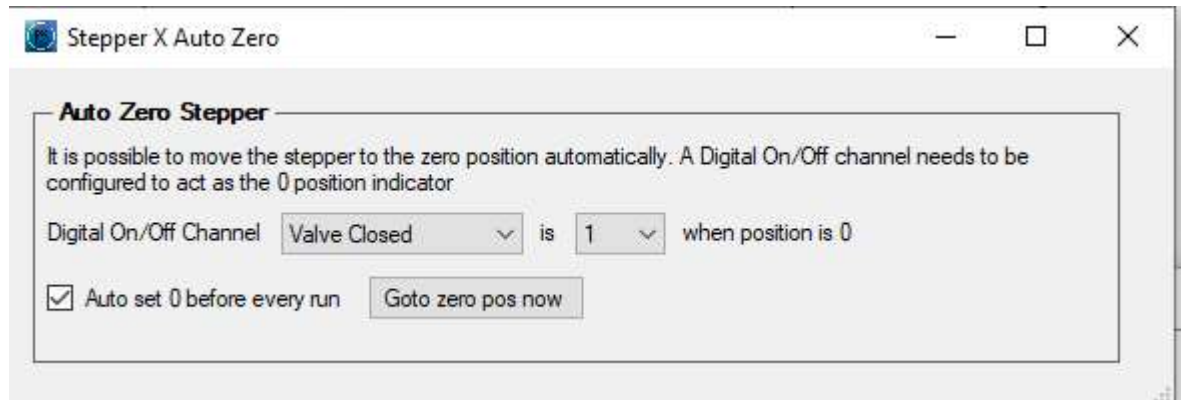


Figure 11 Brake settings in the software

## 6 Initial testing

- 1) It is recommended to test the valve operation on the bench before mounting it to the pipe clamps
- 2) Use the "Options->Brake controller setup->Test your brake" functionality to test that everything works after it is connected electrically
  - a. Set Step size to 10 (or less)
  - b. Click the Brake+. The valve should move a small amount and move the other direction when clicking Brake-
  - c. Click the Auto close button and select the "Valve Closed" channel as the Digital On/Off channel



- d. Click the Goto zero pos now button and verify that the valve actually closed
- e. Alternatively, the zero position can be set manually:
  - i. Click Brake- until the valve is closed. Make sure not to "over close" the valve. Just close it enough to stop the water flow.
  - ii. Click the "Set 0%" to store the 0% brake position
- f. Drag the slider quickly back and forth and see that the valve moves fast and freely, and returns to the 0 position

## 7 Engine testing

Here are a few recommended settings for water brakes.

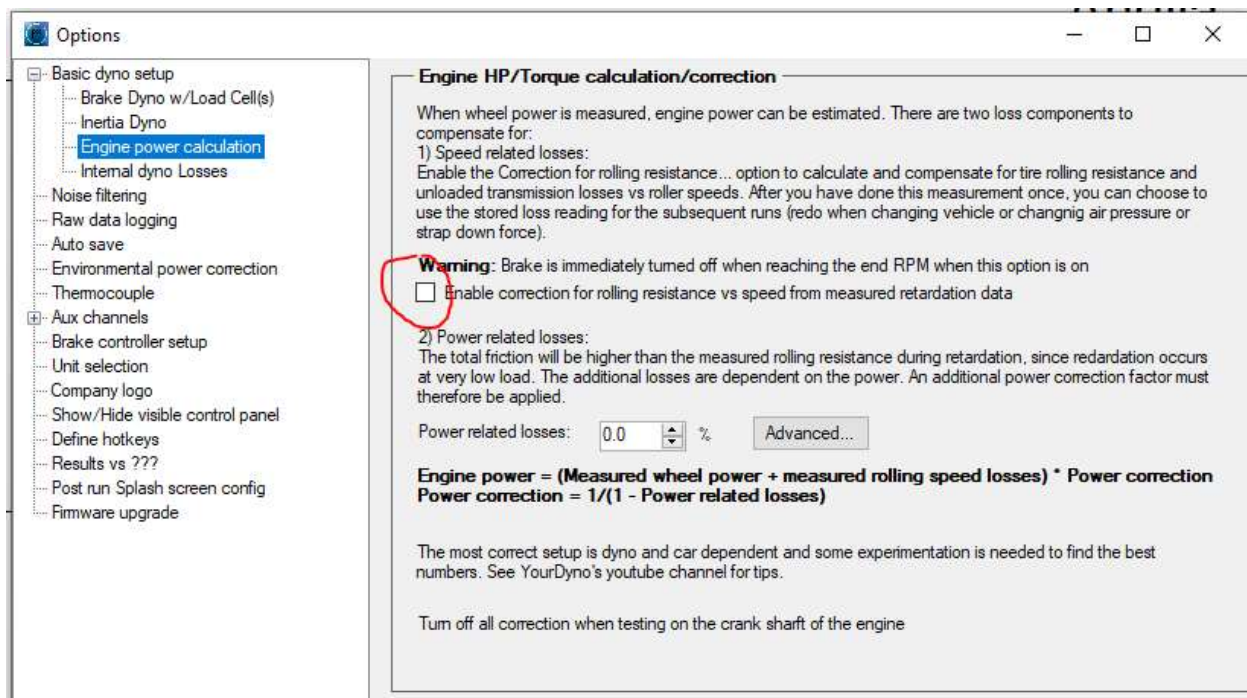


Figure 12 Ensure rolling resistance correction is off (or the brake will turn off at max RPM)

## 7.1 Run window->Control loop setup

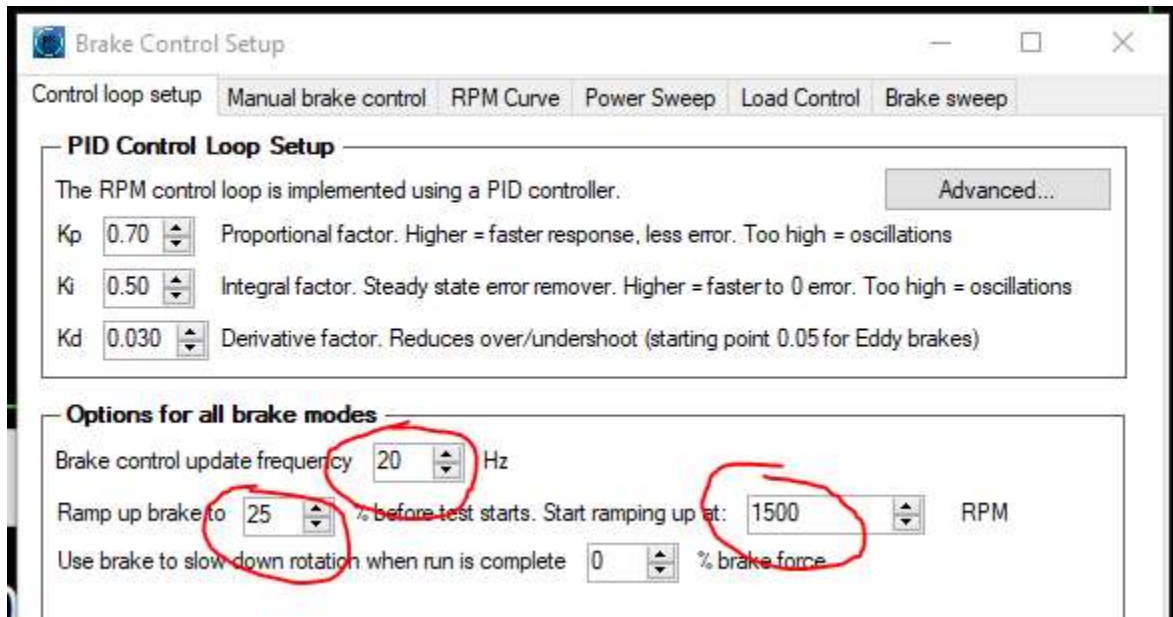


Figure 13 Control loop setup

- 1) Ensure "Ramp up brake" is on. This will gradually increase the brake as RPM nears the start RPM, ensuring a quick and smooth lock-in of the start RPM. Some water brakes need high start %, but most need something around 20%. Experiment there to make a smooth start
- 2) Make sure the "Start ramping up at:" RPM is sufficiently below the start RPM of the sweep. For example start ramping up at say 1500 RPM if your sweep starts at 3000 RPM. This way, the brake will have time to respond to the ramp up before you reach the start RPM
- 3) Set "Brake control update frequency" to 20 Hz.

## 7.2 Defining an RPM sweep

There are several brake modes that can be used to control an RPM sweep. For water brakes, Load control is recommended.



Figure 14 Load Control is the best brake mode for water brakes. Here is a starting point for the settings

## 7.3 Understanding Load control

Load Control is different from regular PID control. PID tries to make the RPM follow a straight line from start RPM to end RPM. This makes it prone to oscillations. Load Control is different, as it allows for a more natural sweep. Where the engine is strong, the RPM will increase a bit faster than the set sweep rate and vice versa. Following a straight RPM line is not important, it is much more important to get a nice smooth sweep, which Load Control more naturally creates.

### 7.3.1 The parameters

By far the most important parameter is Gain. Gain sets how much the brake responds to RPM changes. Too high = oscillations and too low = slow/sluggish regulation. Typical numbers are 10-20, but it may be higher or lower depending on your setup.

If you prefer, you can have a somewhat higher gain at the starting condition to make it lock faster. You can also play with the Regulator speed to make it lock to the start RPM faster (too fast = oscillations).

Derivative factor adds brake when the engine accelerates. Low numbers like 0.01-0.03 are normal.

Advanced options make it possible to have different gains at different RPMs. Similarly, you can set different sweep rates at different RPMs. This is typically not needed but can

be used in special situations (very abrupt torque band for example) or if you prefer a more ideal response over the full RPM range. Water brakes are typically more responsive at high RPM, so an ideal Gain is often lower at higher RPMs.

In the below example the Gain is 20 until 5000 RPM, then reduced gradually from 5000 to 7500 to 15 (over 7500 it is 15) and Sweep is 500 RPM/s until 5000 RPM then gradually decreased to 300 RPM/s until 7500 RPM

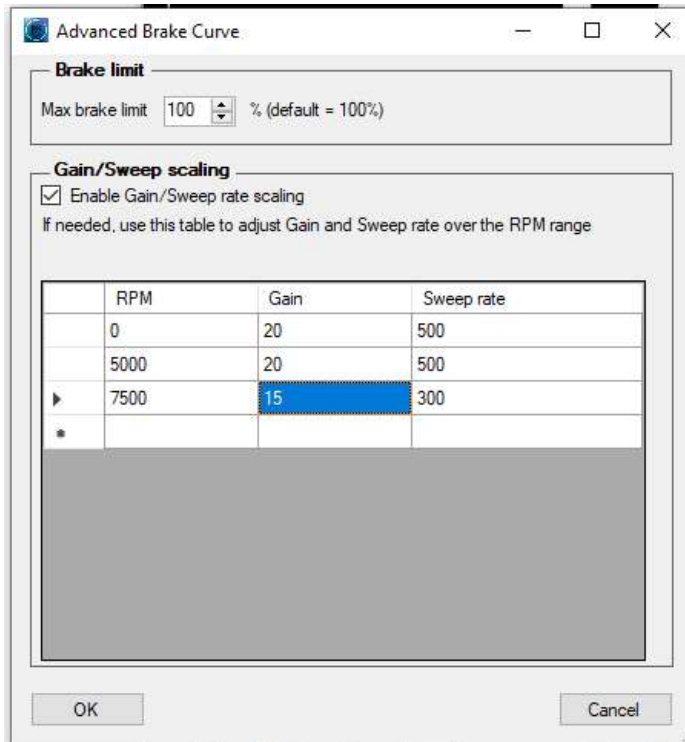


Figure 15 Advanced Load control parameters example

## 8 Valve maintenance

No regular maintenance is necessary. The valve can be opened and greased by removing the 4 x M6/M8 valve bolts. Replacement Teflon bearings and valve seals can be bought separately from YourDyno if needed.

## 9 Startup and shutdown

It is recommended to disconnect the power supply from the mains when the system is not in use, as the stepper and the stepper controller get hot.



Figure 16 Complete valve kit (zero position sensor is also included)