



ADDAC System
Instruments for Sonic Expression
Est.2009

INTRODUCING
ADDAC320
SERVO CONTROL
USER'S GUIDE . REV01
April.2025



ADDAC
System

From Portugal with Love!

Welcome to: ADDAC320 SERVO CONTROL USER'S GUIDE

Revision.01 April.2025

Tech Specs:
4HP
4.5cm deep
Up to 300mA +12V
0mA -12V

WELCOME

At ADDAC we always admired the geniality of Neil Young's Whizzer, way ahead of it's time, a great example how great ingenuity and engineering can come together to make something great.

Inspired by it's motor controlled method we created a 4HP solution to control any knob that doesn't have a CV input, while also possible to use for other gear as well (within certain distance constraints).

We use a Servo motor which is a specific type of motor that can be digitally controlled to go to a precise angle. This motor is controlled by a microcontroller that also receives an incoming CV voltage from 0 to +5v and lineary converts this voltage range to the 270 degree Servo motor range.

Using a spring wire and metal couplers the motor shaft is then attached to the target knob to be controlled which will turn as the Servo turns.

Two other knobs [MAXIMUM ANGLE] & [MINIMUM ANGLE] further allow to control the "sweet spot" of the target knob, setting a smaller Servo range.

Raising the [MIN ANGLE] knob above the [MAX ANGLE] knob inverts the Servo range.

SERVO MOTOR
270 degree micro servo motor with metal gears

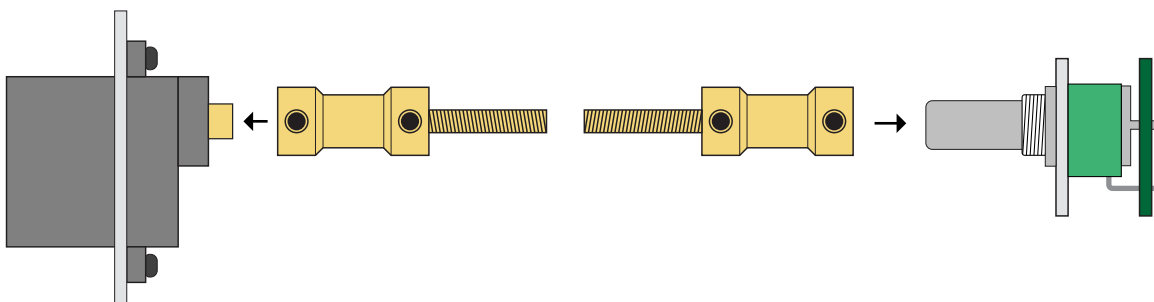
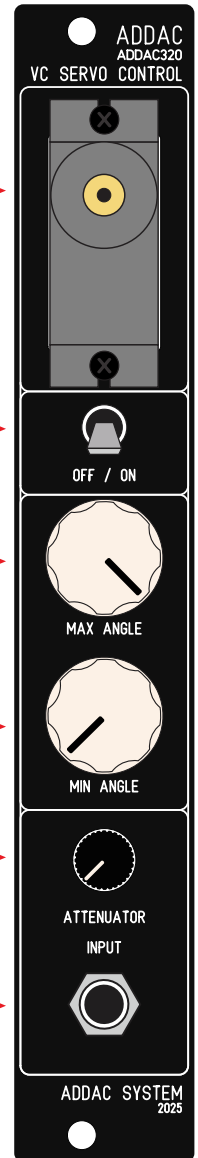
OFF / ON
Turns the servo operation OFF/ON

MAXIMUM ANGLE
Sets the minimum angle of the Servo Range

MINIMUM ANGLE
Sets the maximum angle of the Servo Range

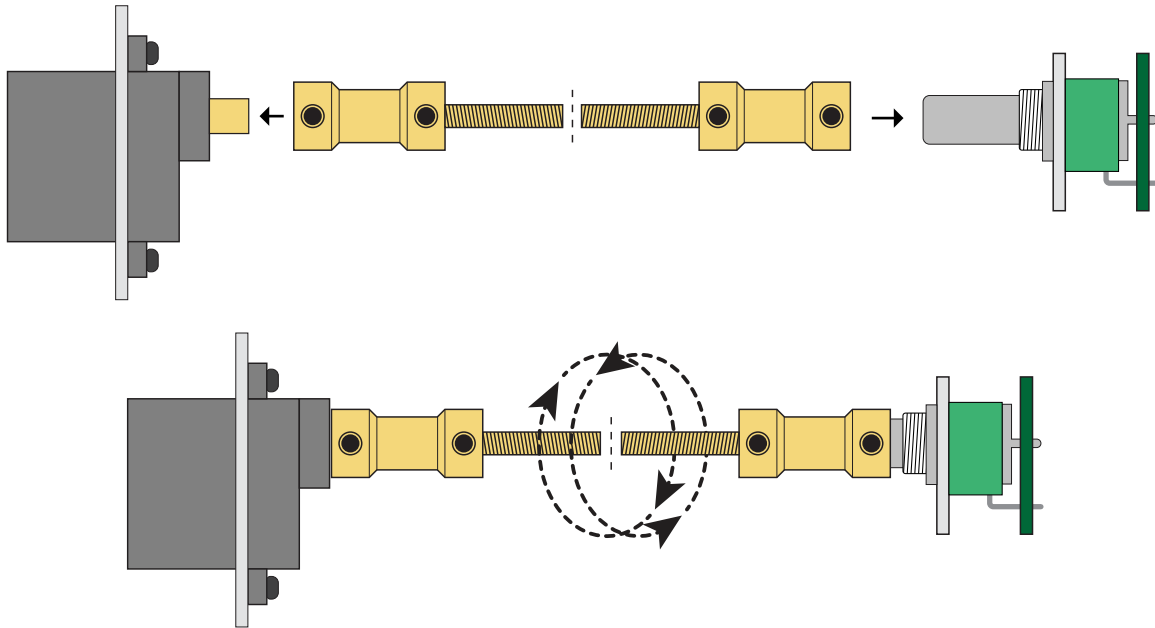
ATTENUATOR
When no CV is plugged in works as a manual Servo control.
If a CV input is used then it attenuates the incoming CV.

CV INPUT
CV input 0 to +10



OPERATION PRINCIPLE

1. The operation principle is simple, the servo motor and target pot shaft are coupled together using a special fiber/metal wire that twists around itself when the servo turns, sort of like a spring, forcing the target knob to turn in tandem.

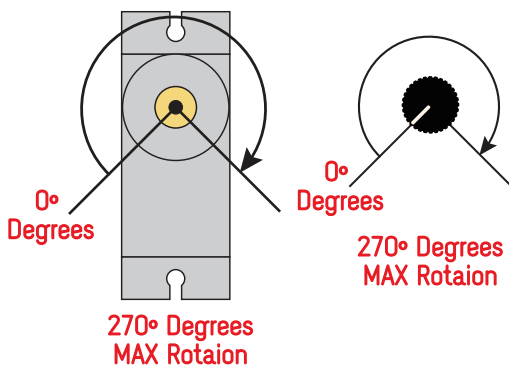


Knobs rotate about 270 degrees so we're using servos that also turn 270 degrees so that they don't go over the pot maximum rotation angle.

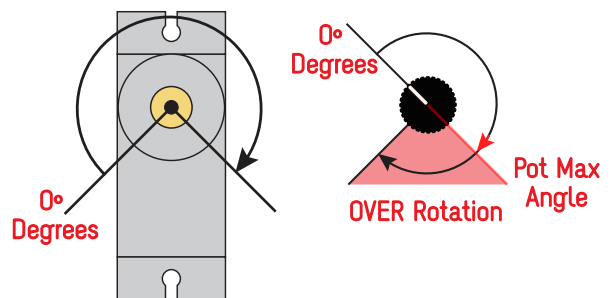
In order for this 270 degree range to work properly the servo and target pot need to be calibrated so that both left most position is matching. For this we need to make sure both the servo and target pot are fully CCW prior to attaching the connection wire.

If badly coupled the servo will try to over rotate the pot beyond its maximum or minimum angle creating a lot of stress on the servo which is blind to this issue and will try its best by applying the max torque possible trying to force the pot to go over its mechanical range which eventually will lead to damaging the servo or the pot.

CORRECT COUPLING

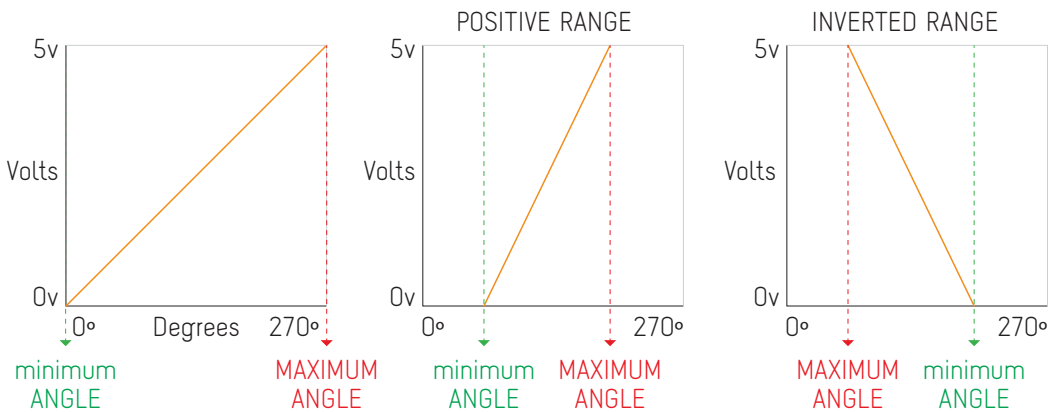


PROBLEMATIC COUPLING



VOLTAGE TO ANGLE PLOTS

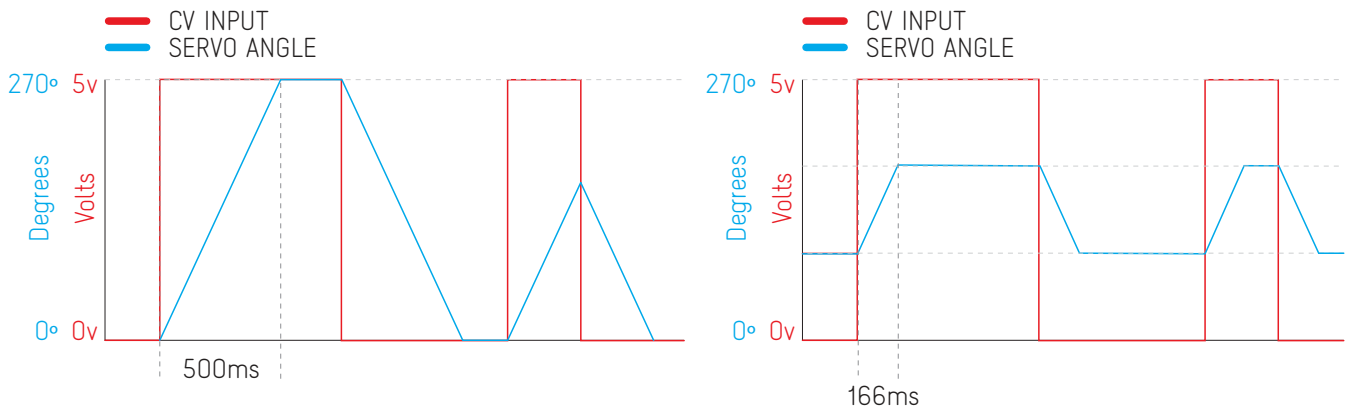
Here we illustrate the voltage to angle relation at full and constrained ranges using the [MIN ANGLE] and [MAX ANGLE] controls



RESPONSE TIME & PRECISION

The Servo response time is digitally limited to low frequencies, for reference it can track an lfo up to 0.5Hz or 500ms, this will prevent abrupt changes extending the motor life and avoid extreme strain on the motor gears. If the incoming CV frequency is above 1Hz then the Servo angle will lag behind. This slow response time will be most noticeable when using a Gate signal, once the gate is detected the Servo will take approx. 500 milliseconds to reach from 0 to 270 degrees. As the Servo rate of change is fixed, if the Servo is set to a narrower range then it will take 1/3 of the time (166ms) to reach from 0 to 90 degrees ($270 / 3 = 90$ degrees).

The servos precision will vary depending on the strain put on the connection wire, it is a good practice to place the ADDAC320 next to the module to be controlled, deciding the location based on where the connection wire can be less strained. If the wire has too much strain it will also affect the target knob rotation angle which will then be smaller than the servo angle.



COMPATIBILITY

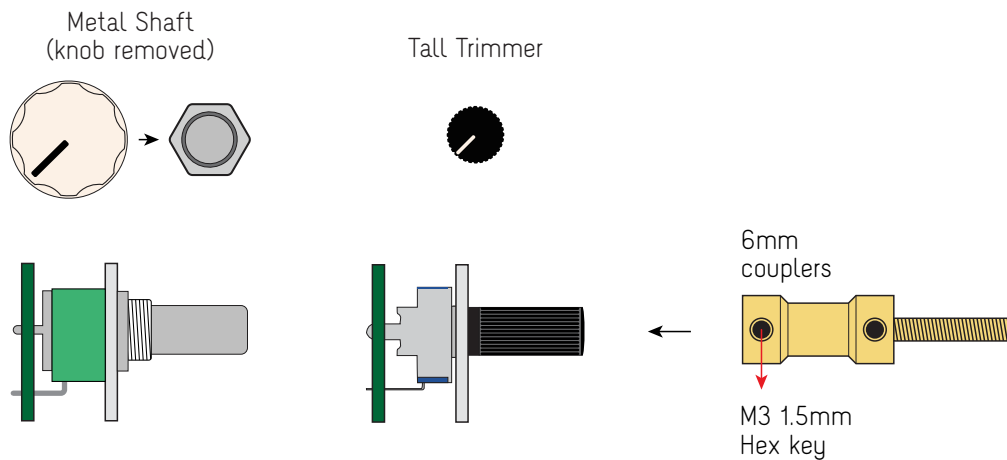
Compatible with most common potentiometers used in Eurorack:

6mm shaft's potentiometers and tall trimmer potentiometers

For pots using knobs they will need to be removed in order to attach the connection wire coupler.

Do not use this system with rotary switches, they will cause too much stress on the small motor!

For pots with 6.35mm shafts we can provide adequate couplers upon request.



CONNECTION WIRES

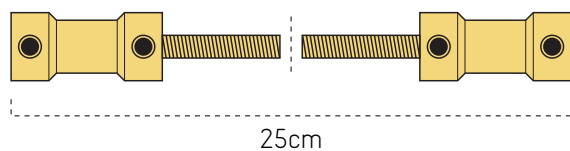
We provide a 25cm connection wire this is optimised for the mechanical system to keep the target knob range close to the Servo 270 degrees range, longer wires will start to shorten the target knob range.

Longer wires are available upon request, up to 50cm there's barely any change in range, longer lengths won't be as effective and lose most of the range:

25 cm effective range = aprox. 270 degrees

50 cm effective range = aprox. 260 degrees

100 cm effective range = aprox. 90 degrees



CONTROLLING NON-EURORACK HARDWARE

Although restricted by the connection wire lengths in theory this system can also be used with any external hardware that has a pot and can be placed close to the ADDAC320 module, anything from guitar pedals, drum machines or even rack gear like effect units, EQs or even compressors, this would be especially easy for those users with frames already mounted on 19" Racks.

SERVOS DURABILITY & REPLACEMENT

We use good quality servos with metal gears for extra resistance to use, still being a mechanical element it is prone to eventually wear out and stop working. The Servo durability will vary greatly depending on frequency of use, style of use and good coupler installation.

A bad coupler installation will be the worse case scenario for the servo as eventually the pot will stop rotating at one of the edges but the motor will want to keep turning causing a lot of stress on the internal gears while also increasing its current. This strain will also affect the motor shaft being controlled, if this issue is not resolved eventually either the servo or the pot will break.

For an extended motor life always be careful upon installing the connection wire and make sure to test the full range properly before using the CV input..

The life expectation will also be longer when using the module with very low frequencies, faster LFOs or gate signals will make it run faster causing more gear wear.

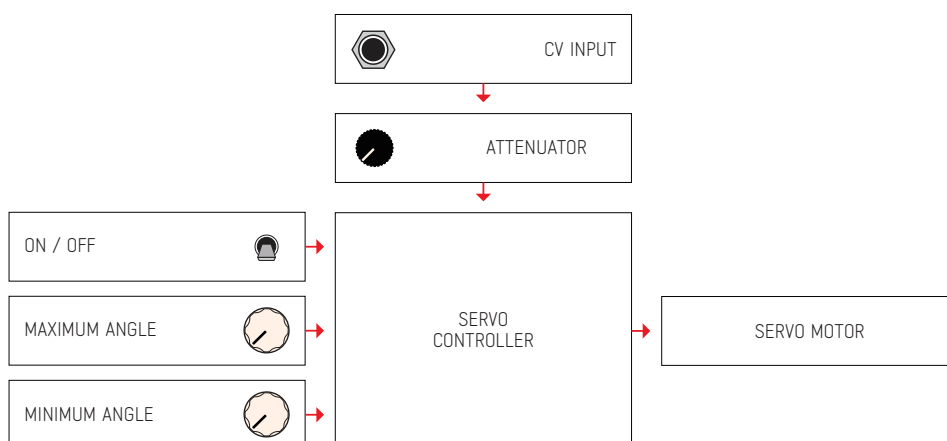
Servos are easily replaceable by removing the 2 screws on the frontpanel and detaching the pinheader connector, users just need to be carefull when plugging the servo back to the pcb, Black servo wire must be connected to the pin marked BLK on the pcb.

We provide Servo replacements upon request.

CURRENT CONSUMPTION

It's hard to pinpoint a precise current consumption for this module as it mostly depends on the servo activity, speed and torque will greatly affect its consumption. While idle the module take about 30mA from the +12v, at slow speeds there will be peaks of about 100mA. At higher speeds or using Gate signals the peak current consumption can be about 250mA, if put under stress it can go up to 300mA.

SIGNAL FLOW DIAGRAM

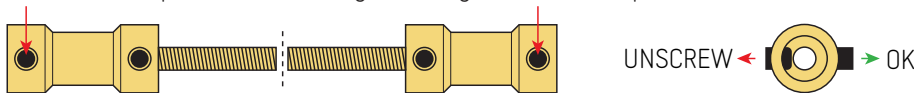


INSTALLATION

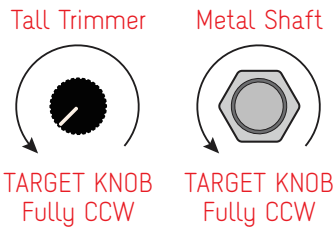
1. Place the ADDAC320 module close to the target knob to control, choose the position based on how the connecting wire will have less strain to do its work. do not try to "stretch" it to make for that extra bit. Allow the connecting wire to make a nice arch between both modules.

Also important to mention that both modules should, at all times, be attached with screws to the user's frame.

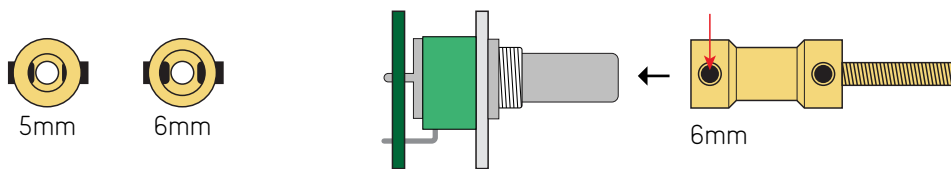
2. Using the Hex key provided unscrew the small screws at the coupler extremities, making sure they don't protrude inside the coupler shaft allowing to easily slide into the pot shaft.



3. Prepare the target knob by turning it fully CCW and removing the knob if that's the case.

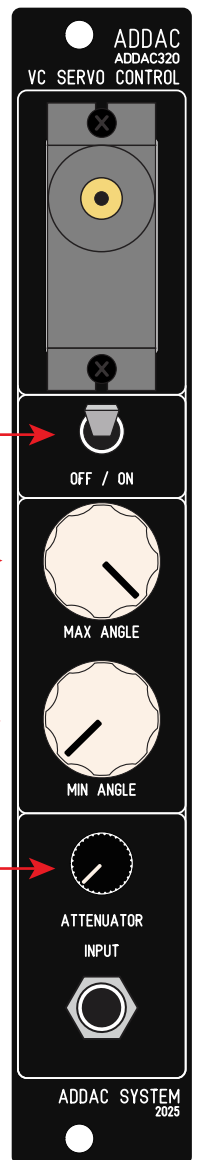
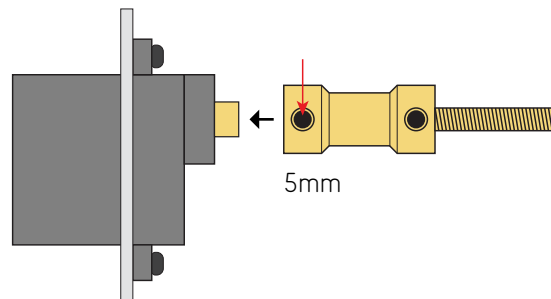


4. Notice the couplers have 2 different inner diameters, 5 and 6mm, make sure the target pot is fully CCW and attach the 6mm coupler to the target pot. Set the coupler orientation according to the space available allowing the hex key to tighten the small screws.



5. Disconnect any CV input and set the controls as indicated here. These settings should put the servo fully CCW or at the minimum angle possible.

6. Make sure the motor is fully CCW bend the connection wire coming from the target knob and attach the smaller 5mm coupler to the motor shaft tighten both screws. Once you attach it to the target pot do not move the modules in the rack, always remove the connection wire prior to moving either modules connected as moving them will most probably alter the rotation calibration.



7. Using the [ATTENUATOR] control slowly rotate the knob to test and ensure the mechanical system is being used effectively, without excessive strain on the connection wire.

! WARNING !

If the couplers positions are not well installed it can lead hard stops that will strain the motor gears as well as on the motor shaft being controlled. Always be careful when installing the couplers following the "everything fully CCW" rule and always remove the connecting wire if changing the module's location on your frame.

For feedback, comments or problems please contact us at:
addac@addacsystem.com