

# *NetGain Controls, Inc.*

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# *WarP-Drive™*

## *Throttle – Cable Pull*

*- Patent Pending -*

By: NetGain Controls, Inc.

*Powering the future!*



## Installation Guide

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# Introduction

Thank you for purchasing a NetGain Controls WDT-CP Throttle Assembly. This device will allow you to easily and reliably interface a cable-drive throttle pedal or lever to this sensor for input to a compatible piece of electronics. While designed to input to the WarP-Drive speed controllers, with some modifications, it can be used with other pieces of equipment.

This throttle assembly device is built to last a lifetime. It has dual sealed bearings, a high quality waterproof Hall-effect sensor, anodized aluminum base, and stainless steel hardware throughout. Its patent-pending design has been intelligently thought out to provide the most versatile and reliable operation possible.

This installation guide shows you how to connect and mount the throttle assembly. Installation is straight-forward, and simple to perform. Follow the instructions in this guide and your throttle will be interfaced quickly.

# Installation Overview

Estimated time: 15-30 minutes to complete the installation.

1. Determine a suitable mounting point that is within reach of the existing throttle cable, and does not interfere with any other components.
2. Mount the throttle assembly in the chosen location.
3. Determine the throttle cable travel distance from off to full on.
4. Select the closest inner disc matching the distance determined in the previous step.
5. Remove the inner disc that the unit shipped with.
6. Install the selected inner disc, route the throttle cable, and replace the top disc and springs.
7. Secure the throttle cable sheath mounting point.
8. Test the throttle pedal to ensure full travel is accomplished. Adjust as necessary.
9. Test the springs for proper operation and adjust as necessary.

# Package Contents

When you open the package, verify that you received everything.

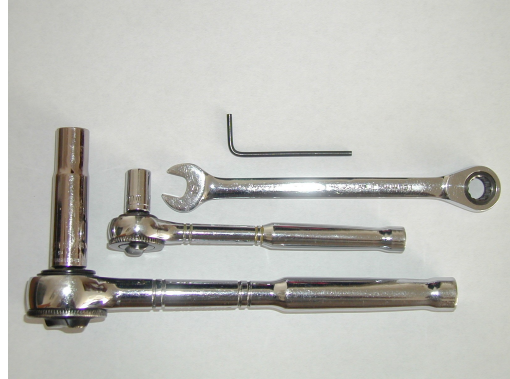
The package includes:

- Throttle assembly with top disc, 1.5” disc, and springs installed.
- Four additional discs, for 1.125”, 1.250”, 1.75”, and 2” travel.
- One low tension spring.
- Electrical cable assembly with connectors for the WDT-CP and a WarP-Drive controller.

## Tools Required

The following tools might be required for the installation:

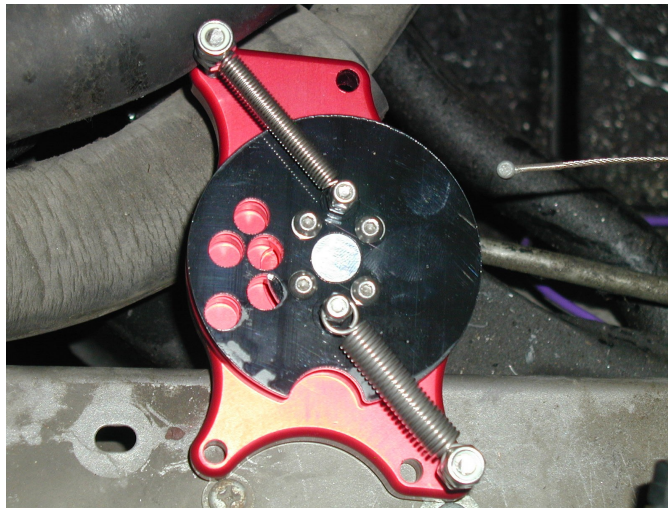
- 2.5 Metric hex wrench
- 7mm socket and ratchet (or 7mm combination wrench)
- 10mm socket and ratchet



*Illustration 1: Possible tools required for installation*

## Mounting

The throttle assembly can be mounted in several ways. The easiest is to find a flat ledge or overhang to where the assembly can bolt flat. Standoffs can also be used to mount the assembly over a flat surface. Use at a minimum two of the available mounting holes. Choose a location that suits the routing of the throttle cable. The throttle cable must be able to reach the throttle assembly without causing excessive bending or interference that would affect its smooth operation.



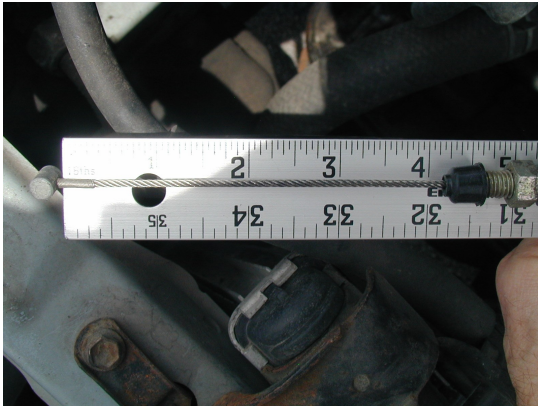
*Illustration 2: Possible mounting position in a vehicle, on the frame rails*

Ensure that the throttle assembly has clearance around all moving parts so that nothing could potentially interfere or bind the throttle assembly. This is **CRITICAL** to the safe operation of the device.

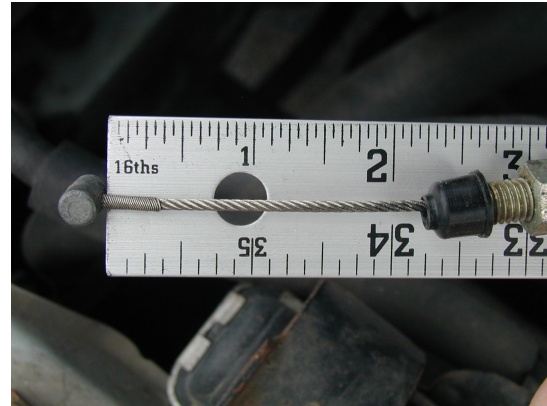
## Determine Throttle Cable Travel

The throttle cable travel must be determined to properly configure the throttle assembly. This process will likely require the assistance of a helper. Other methods than those suggested here might be effectively used.

Position a ruler against the end of the throttle cable, keeping tension on the cable. Take note of where on the ruler the throttle cable end is located. Have the helper fully depress the throttle pedal. Take note of the new position that the throttle cable end is on the ruler. From these two points, determine the throttle cable travel distance.



*Illustration 3: Fully extended throttle cable measurement*



*Illustration 4: Fully depressed throttle cable measurement*

The pictures above show the process of taking the measurements of the throttle cable travel. The first measurement with the cable fully extended shows about 4 1/8". The next picture with the throttle pedal depressed shows about 2 1/4". That leaves a distance of about 1 7/8".

In some cases, the end stop of the throttle was provided by the original throttle body that the cable connected to. In these situations, with the throttle cable disconnected from the original throttle body, a longer travel might be measured than what the vehicle originally utilized. Where possible, it is helpful to verify throttle cable travel measurements with the cable connected to the stock throttle body.

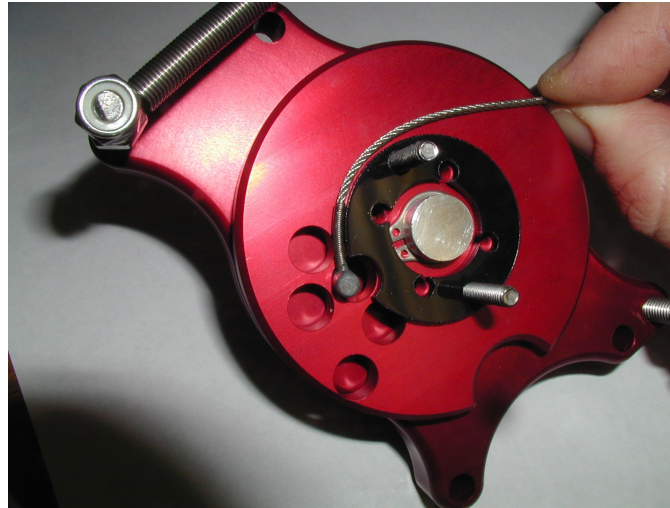
## Install Throttle Cable

Remove the four bolts and lock-washers that retain the top disc. The bolts require a 2.5 metric hex wrench. Also remove all four nuts on the spring-retaining studs. These require a 7mm socket or wrench. Set these nuts, lockwashers, and bolts in a safe place where they will not be lost. Remove the top plastic disc.

Inner discs are available in 1.125", 1.25", 1.5", 1.75", and 2". Choose the disc that measures just less than than the measurement taken in the previous step. For example, if the measurement was 1. 7/8" as measured in the section above, use the 1.75" disc. Using a disc that larger than the measurement taken will potentially result in less than 100% throttle being possible.

If the default shipped inner disc (usually 1.5") is not the correct disc for your application, remove it and then install the correct disc.

Position the throttle cable around the inner disc so that it will pull the throttle in the right direction. Place the throttle cable barrel end into the hole corresponding with the installed inner disc. The throttle cable assembly is designed to be compatible with most conventional throttle cable ends. **If your throttle cable does not have a barrel on the end, or the barrel is too large to fit in the hole, or the barrel is less than 3/16" in diameter, use of the throttle assembly is not recommended.** Use of the throttle under any of these conditions is not supported unless prior approval is obtained in writing by NetGain Controls. Any modifications to the throttle assembly will void the warranty.



*Illustration 5: Throttle cable barrel installation*

In the picture above, notice the direction that the cable exits. The cable exit point should be at least 90 degrees from the cable barrel to achieve linear behavior between the sensor rotation and cable travel.

Replace the top disc, ensuring that the cable barrel end is captive in the cable barrel holes in the top and bottom discs. Install and tighten the 4 bolts with lock washers. Install a M4 lock nut on each spring stud. Turn it down until it is at a height above the top disc of approximately 1/8". Place each of the two springs over the spring studs. Install the M4 lock nut only on the lower tension spring at this time. The nut for the other spring will be installed in a later step. Tighten the nut until it about makes contact with the spring. Move the spring down so it rests on the rounded portion of the bottom nut. Tighten the top nut until it makes contact with the bottom nut. Ensure that the spring is not pinched between the nuts, but rather rests on the rounded portion of the bottom nut. **It must rotate freely on the nut! Also ensure that the locking portion of the top lock nut is completely threaded on the spring stud.**

The next step involves mounting the cable sheathing end (usually a threaded portion of the cable sheath that allows for adjustment). In some cases, it is possible to use the stock bracket that held this part of the cable. In other cases, a custom bracket must be fabricated. Mount the bracket so that it rests in the middle of the adjustment area (if the cable end has provision for adjustment). Mount it so the cable is taut against the throttle assembly cam, but does not cause it to rotate. Depress the throttle pedal and verify that the throttle assembly rotates and that all mounted components remain intact without flexing or movement.

## Test and Adjust

With the throttle cable connected to the throttle assembly and the throttle cable sheathing end secured, the installation is ready for testing and fine tuning. The testing procedure will depend on the particular system that is reading the throttle signal. This manual will discuss the procedure for testing with a WarP-Drive controller that has the Interface Module (IM) connected. **Make sure that all testing is done with the driven system in a state where motor operation is not possible!**

While looking at the IM throttle reading, verify that with the throttle pedal not depressed, the throttle reading is 0%. If the reading is anything other than 0%, use the adjustment of the throttle cable sheathing end to let out some slack in the cable. Do this until the IM reads exactly 0%.

Now, completely depress the throttle pedal. Ensure that the IM reads 100%. If it doesn't reach the 100% reading, the wrong inner disc was chosen. Return to the step of choosing the right inner disc, and repeat the procedure from that point. If full throttle is reached substantially before the throttle is fully depressed, it is likely that too small of an inner disc was chosen. Try the next size larger disc and repeat the procedure from that point.

## Spring Force Adjustment

Both springs are required for safe operation. Either spring must be capable on its own of returning the throttle to zero in case the other spring breaks. The unit is shipped with a higher tension and a lower tension spring. To this point, the top lock nut on the higher tension spring has not been installed. Remove the higher tension spring from the spring stud. With two people, have one person fully depress the throttle and the other person watch the throttle assembly. Have the person depressing the throttle quickly let off the pedal. The person watching the throttle assembly needs to ensure that the single lower tension spring is capable of quickly snapping the throttle to 0%. If the throttle returns slowly, or does not return, it must be determined what is causing the binding! **The lower tension spring must be capable of returning the throttle to zero on its own!** Do not proceed until this has been verified.

Replace the higher tension spring onto the spring stud. Check the feel on the throttle pedal. It should be comfortable to press. If it feels too heavy to press, replace the higher tension spring with the included lower tension spring. Repeat the test to see if this provides comfortable operation.

If the throttle pedal is too easy to press with the lower tension and higher tension spring installed, a second higher tension spring can be obtained from NetGain Controls to replace the lower tension spring. This should not be necessary for most installations.

Once the springs have been tested for proper operation, install the other top M4 lock nut on the spring stud in the same way the other one was installed. **Verify that the lock nuts are positioned low enough for the locking portion of the lock nut to make complete contact with the stud! Also make sure that the springs have clearance between the bolts that secure the top disc!** There must be no binding in the operation of the throttle assembly. Everything **must** operate smoothly! Do not proceed until smooth, comfortable operation has been verified!

# Maintenance Procedures

It is recommended that the throttle unit is regularly checked for proper operation. However, if installed correctly, no adjustment, lubricating, or maintenance is required.

## Physical Specifications

Weight:	1 lb, 3 oz
Dimensions:	3" x 4.5" x 2.75"
Frequency Response:	1000 Hz minimum
Throttle Connector:	METRI-Pack 150.2 series, p/n 12162260
Controller Connector:	Molex MX150L, p/n 19418-0022
Operational Cycles:	35 million

## Electrical Specifications

Input Voltage:	5.0VDC +/- 0.25VDC
Input Current:	10mA maximum per channel
Orange wire:	Channel 1, 0.5V to 4.5V
Blue wire:	Ground for channel 1
White wire:	5V supply for channel 1
Green wire:	Channel 2, 0.25V to 2.25V
Black wire:	Ground for channel 2
Red wire:	5V supply for channel 2
Accuracy:	+/- 2.0% of full scale for room temperature +/- 3.0% of full scale over operating temperature range

## Environmental Specifications

Electromagnetic compatibility:	100V/meter, 14kHz – 1GHz range
Vibration:	10G peak, 20 – 2000 Hz
Shock:	50Gs, half sine pulse, 5ms duration
Operating temperature range:	-40C to 85C
Storage temperature:	-55C to 105C
Protection:	Sensor sealed to IP66/IP67