ACAS-X

FOR MEGASQUIRT 3

BY DRAGDYNAMICS.COM

INSTALLATION AND CONFIGURATION

DISCLAIMERS, Trademarks

Drag Dynamics is not affiliated with "Megasquirt" in any way – we just like using their products and developing complementary parts that work with Megasquirt products.

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Parts Included

1 – ACAS-X Sensor Module
1 – 4' Wire Harness, DTP Connector assembled – Flying Leads

Operation:

For use with Megasquirt3-based systems only. See "Requirements" section for minimum supported firmware versions.

Chassis Angle

The ACAS-X channel 1 output shows Chassis Angle – also known as Pitch. This is the absolute angle of the chassis, unaffected by acceleration or roll (up to 30* roll angle). It uses "fusion data" to give the most accurate position

Pitch Velocity

Pitch Velocity is the Chassis Angle RATE OF CHANGE – If your car is optimized for tracks where a wheelie is a potential problem, Pitch Velocity lets you see the problem long before the chassis angle is too high to do anything about it – potentially saving both a pass, and thousands of dollars of damages from hard landings. This is output on Channel 2.

Linear Acceleration

Channel 3 transmits Linear Acceleration. This is the typical "X-Axis" raw data, from the onboard G-Meter. It will be affected by the vehicle's pitch angle during a pass, but it's what most are used to seeing, therefore we included it in the ACAS-X.

Corrected Linear Acceleration

Channel 4 reports a Corrected Linear Acceleration value. This channel is similar to X-Axis on a typical G-Meter, minus the effects of chassis tilt, gravity, and vibration that causes normal X-Axis accelerometer data to become inaccurate or unusable. This helps with pass-to-pass repeatability regardless of chassis angle, surface preparation, etc. This is very useful to measure true acceleration values in cars that require large chassis angles for best performance.

General Information and Use:

Power Consumption: The ACAS-X uses 5 volt power and sensor ground directly from your Megasquirt3 ECU, just like any other 5v sensors. This unit consumes no more than .003 amps (30 milliamps) during use.

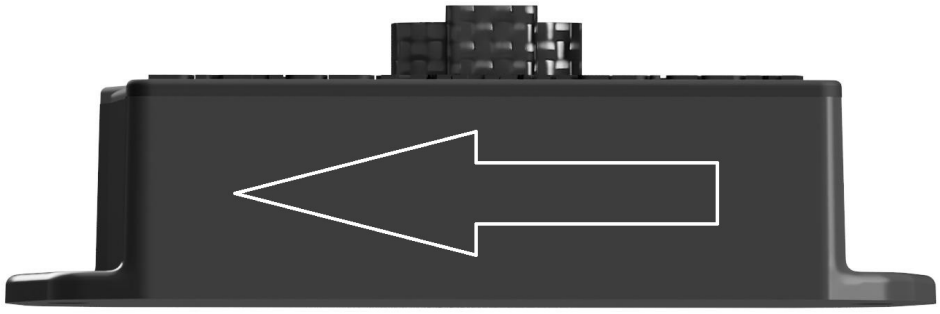
Performance: The ACAS-X samples chassis orientation and movement at 400khz, and generates CAN data packets at 100 samples per second. This results in a time of 0.008 seconds between sensor measurement and delivery to your ECU.

Requirements: The ACAS-X requires your Megasquirt3 ECU be running firmware Version MS3 pre-1.6 alpha 3. Other earlier firmwares likely work as well, but this system was tested on the latest MS3 Firmware. Contact support for any questions or help making sure yours works correctly.

Wiring and Installation

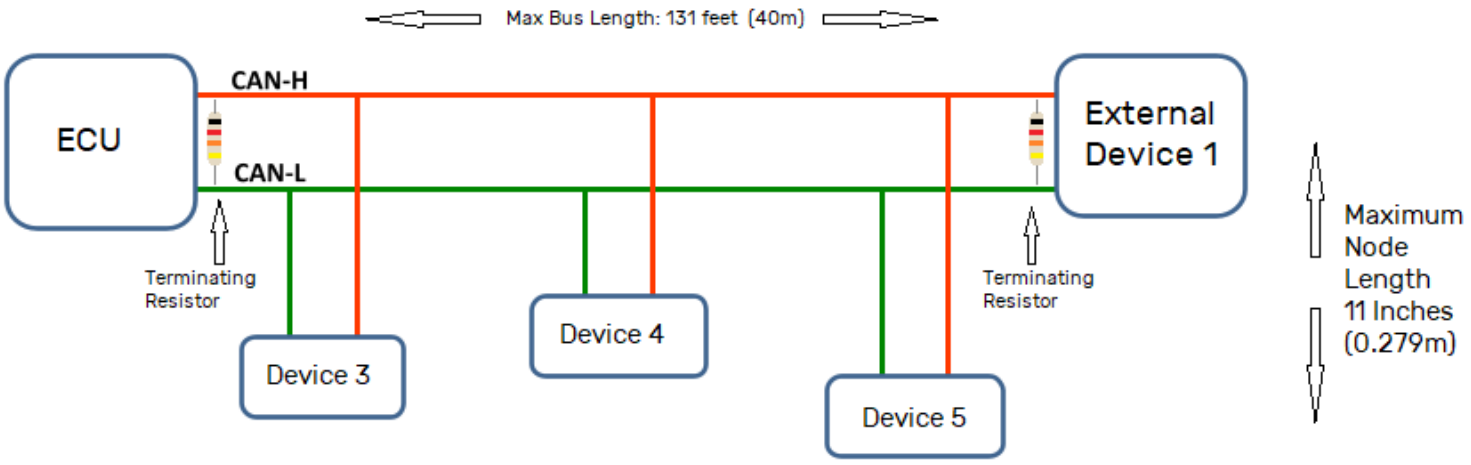
Mounting: Mount the ACAS-X module on a horizontal surface in your vehicle chassis with the text/top facing up. The arrow on the top of the module must point in the forward direction the car travels during racing. The Lid must be facing UP (the sensor cannot be installed upside-down). The sensor can be mounted just about anywhere relatively flat and level.

The ACAS-X needs to be “zero’d” each time its used. There are 2 options for zeroing the system: (1) Each time power is applied (ECU power up, this happens by default), and (2) whenever the system detects a trigger from the Megasquirt3 CAN Bus that is easily configured in TunerStudio. The closer you have it mounted level in your chassis, the better. The mount can be rigid – unlike other inertia measurement systems, this one will filter high frequency noise from chassis vibrations. The unit can be mounted anywhere temperatures won’t exceed 170* F continuous. The unit operates reliably in temperatures as low as 45* F continuous, and uses internal temperature compensation.



CAN Bus Layout

CAN bus performance is **dramatically** affected by noise problems unless laid out per the following diagram. It's very easy to have a non-compliant layout in your car, be sure to keep your node lengths shorter than 11" and have a **terminating resistor** in or at the devices at each end of the chain. Your ECU is usually terminated internally, and some devices (such as Holley Dashes) are also terminated. The way to confirm correct termination is by measuring the resistance (Ohms) between CAN HI and CAN LO, it should read 120 ohms with power OFF when properly terminated.



Wiring:

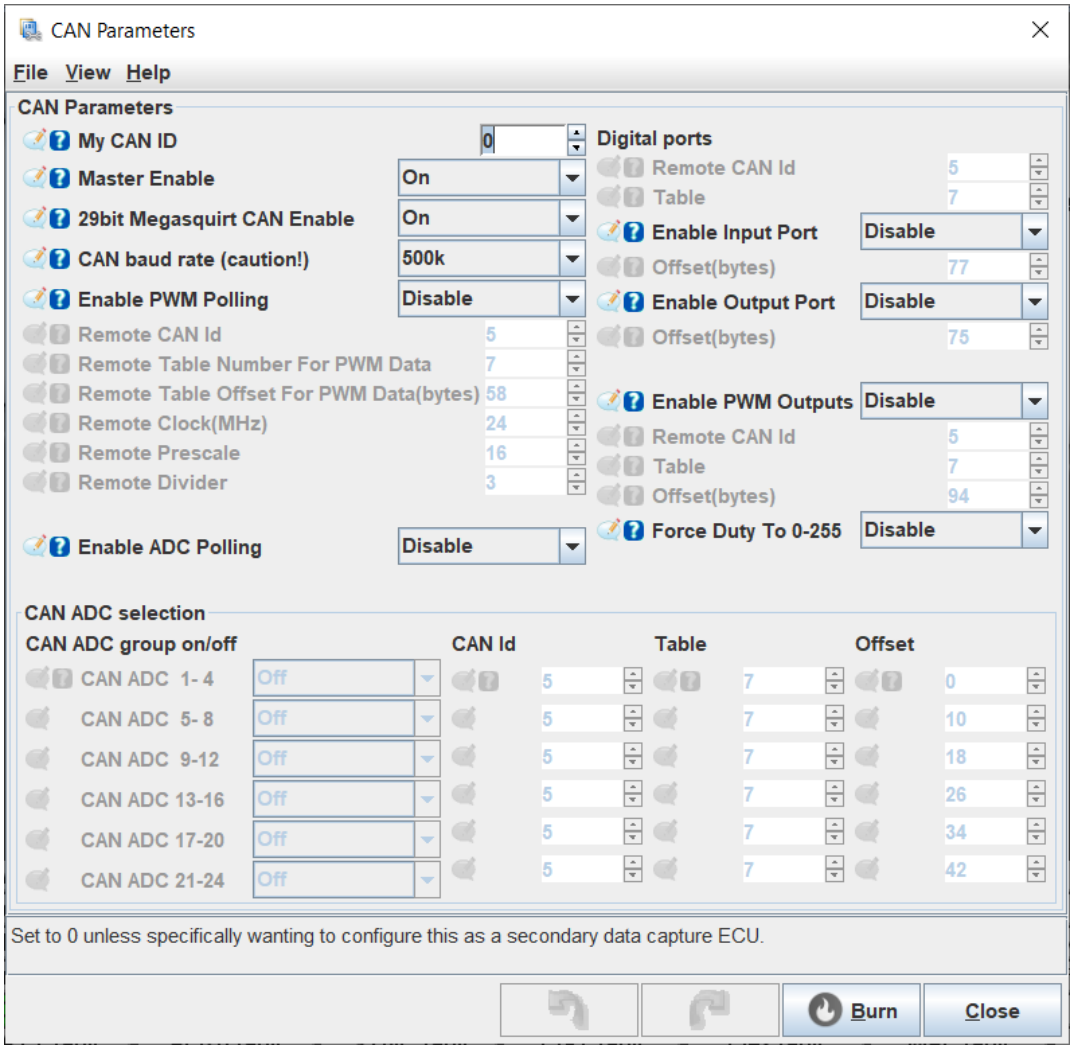
Pin:	Color:	Function:
1	Yellow	+5v Power from VREF +5v circuit. DO NOT CONNECT TO IGNITION POWER, 12v, 16v, etc.
2	Black	Ground – attach to Sensor Ground circuit. DO NOT CONNECT TO CHASSIS OR BATTERY GROUND
3	Orange	CAN Bus Low. Connect to MS3 CAN Low
4	Orange/Blk	CAN Bus High. Connect to MS3 CAN High

MS3 Software Configuration:

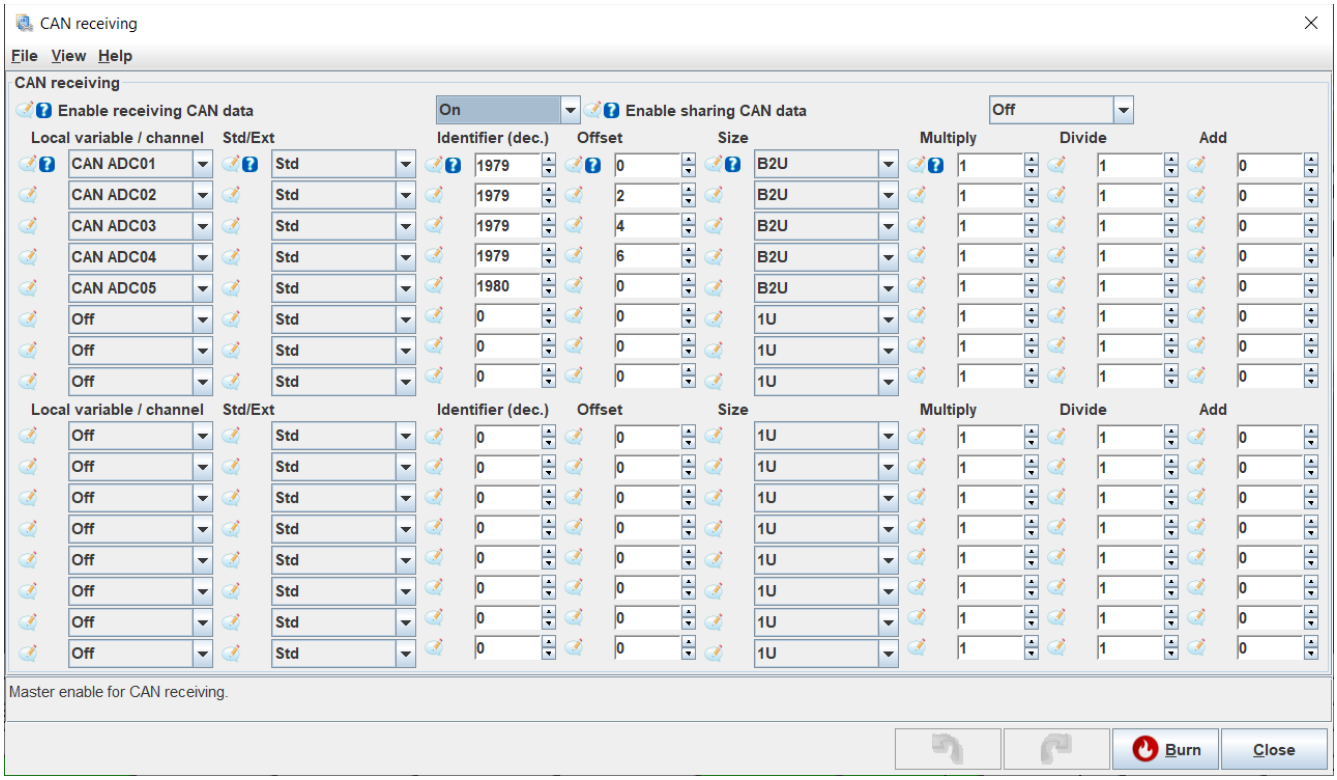
MS3 CAN Configuration

Open a tune file you wish to configure for the ACAS-X, or download the current tune from your car's ECU. Under the CAN-bus/Test Modes menu, choose CAN Parameters and set the following:

Master Enable = On 29bit Megasquirt CAN enable = On CAN Baud Rate = 500k

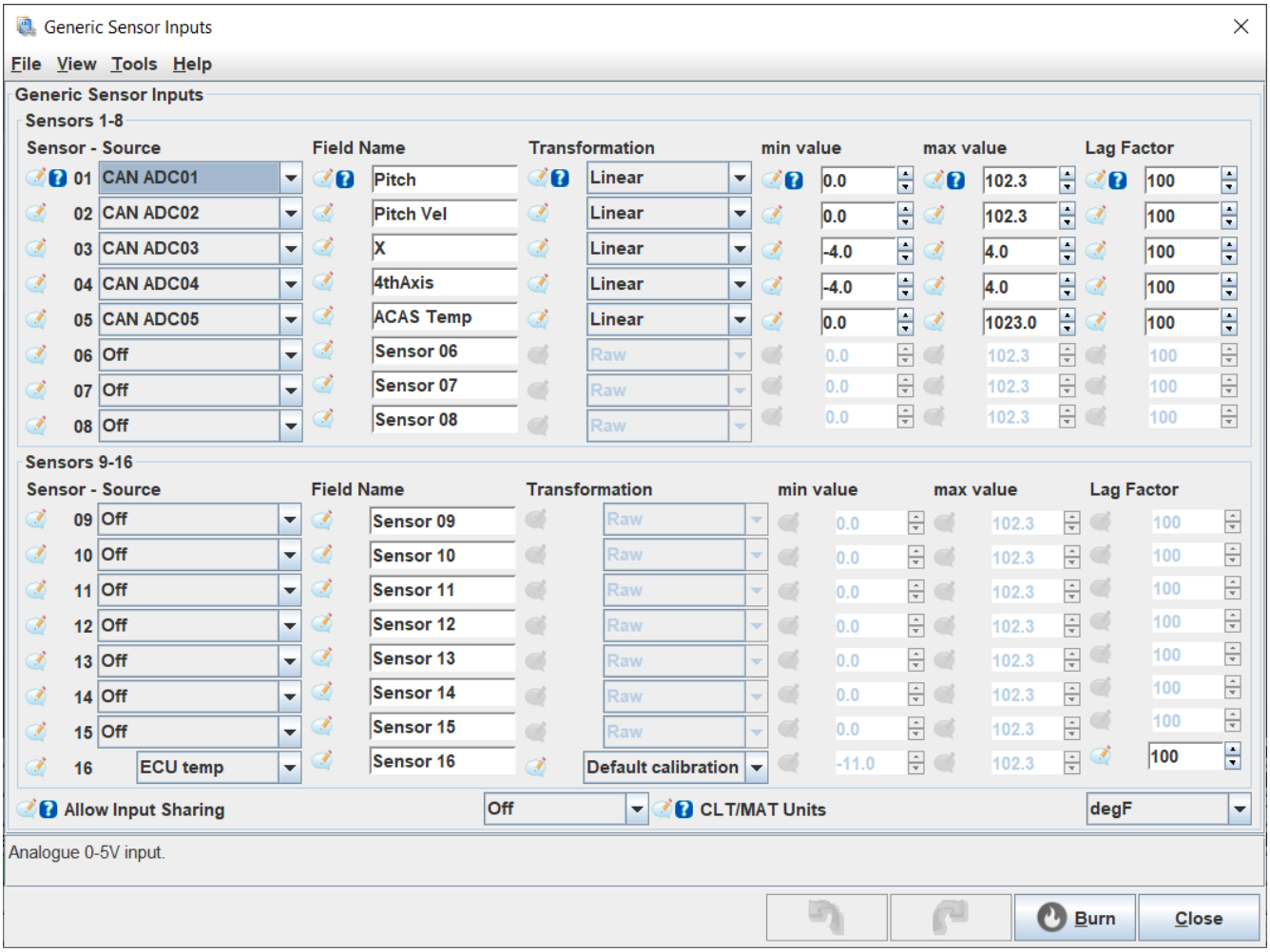


Next, under CAN-Bus/Test Modes menu, select “CAN Receiving” menu and configure as seen in the figure below. CAN ADC01 is the Pitch channel; CAN ADC02 is Pitch Velocity; CAN ADC03 is X-Accel and CAN ADC04 is Corrected X-Accel; CAN ADC05 is the IMU Temperature. Note that you may have devices that already use CANADC01



Configuring Inputs

Next, we'll configure the actual channel inputs so that you can see, and use, each ACAS-X channel. Goto the Advanced Engine menu, and select "Generic Sensor Inputs." Configure each input as directed in the following image:



Now, you have 5 new channels available everywhere you might want to display, datalog, or use them!

We recommend Spark Table Blending for spark retard when reducing power, but there are many ways in Megasquirt-3 that you can use these different data inputs! Let us know how you uses yours, or contact us if you need guidance on power management.

Zeroing the Sensor, and the Zero Modes

Your ACAS-Xsensor automatically zeros itself when powered up. However, you may want it to zero just before launching the car (using a trans brake input, or clutch switch, for example).

By default, the ACAS-X automatically every time the Megasquirt-3 ECU powers up. Optionally, it can be zero'd whenever the ACAS-X detects an event triggered by the MS3 ECU over CAN Bus.

AutoZero

ACAS-X will automatically zero the chassis angle every time power is applied (ignition on) to the MS3 ECU. This works great for cars with changing ride heights, BUT it can be a problem if the car is started in staging lanes that are on an incline.

Triggered Zero

This method will read a "trigger" via CAN Bus from the MS3, whenever the user has activated the Launch option (usually, using a trans brake button to trigger both Trans Brake and 2-step rev limiter). How this works is by configuring your MS3 to broadcast the state of the Launch input (regardless of which physical pin you've assigned for Launch Input). You can validate this by seeing the blue light flash one time, whenever a CAN Zero message is received.

Setup of this method is as follows:

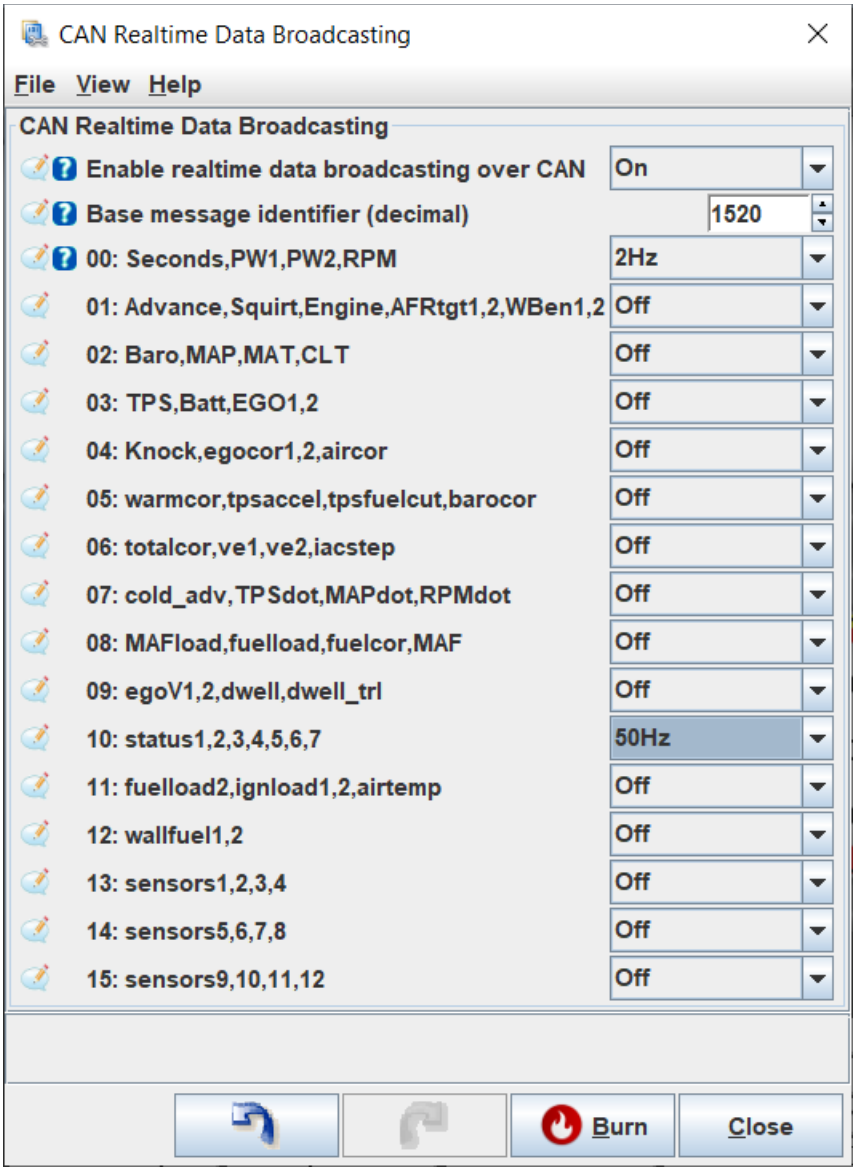
Open the CAN-bus/Test Modes menu and select "CAN Realtime Data Broadcasting"

Set "Enable realtime data broadcasting over CAN" to ON.

Set 00: Seconds, PW1, PW2, RPM to 2Hz. (This is what activates the "C" Light on your ACAS sensor, and tells it that there is a valid CAN communication from the MS3)

Set "10: status1, 2, 3, 4, 5, 6, 7" to 50Hz. This transmits the packet containing the Launch button status, over CAN Bus for your ACAS to receive.

Check the following diagram to make sure you have it correct:



Configuration of your MS3 ECU is now complete! To test the Auto Zero, observe the BLUE (labelled "C") LED light on your ACAS sensor. It should go out momentarily every time a CANbus Auto Zero is triggered.

CAN Bus Tuning and Performance

Its a good idea to make sure your CAN bus networks are performing their best, so here are some things to consider:

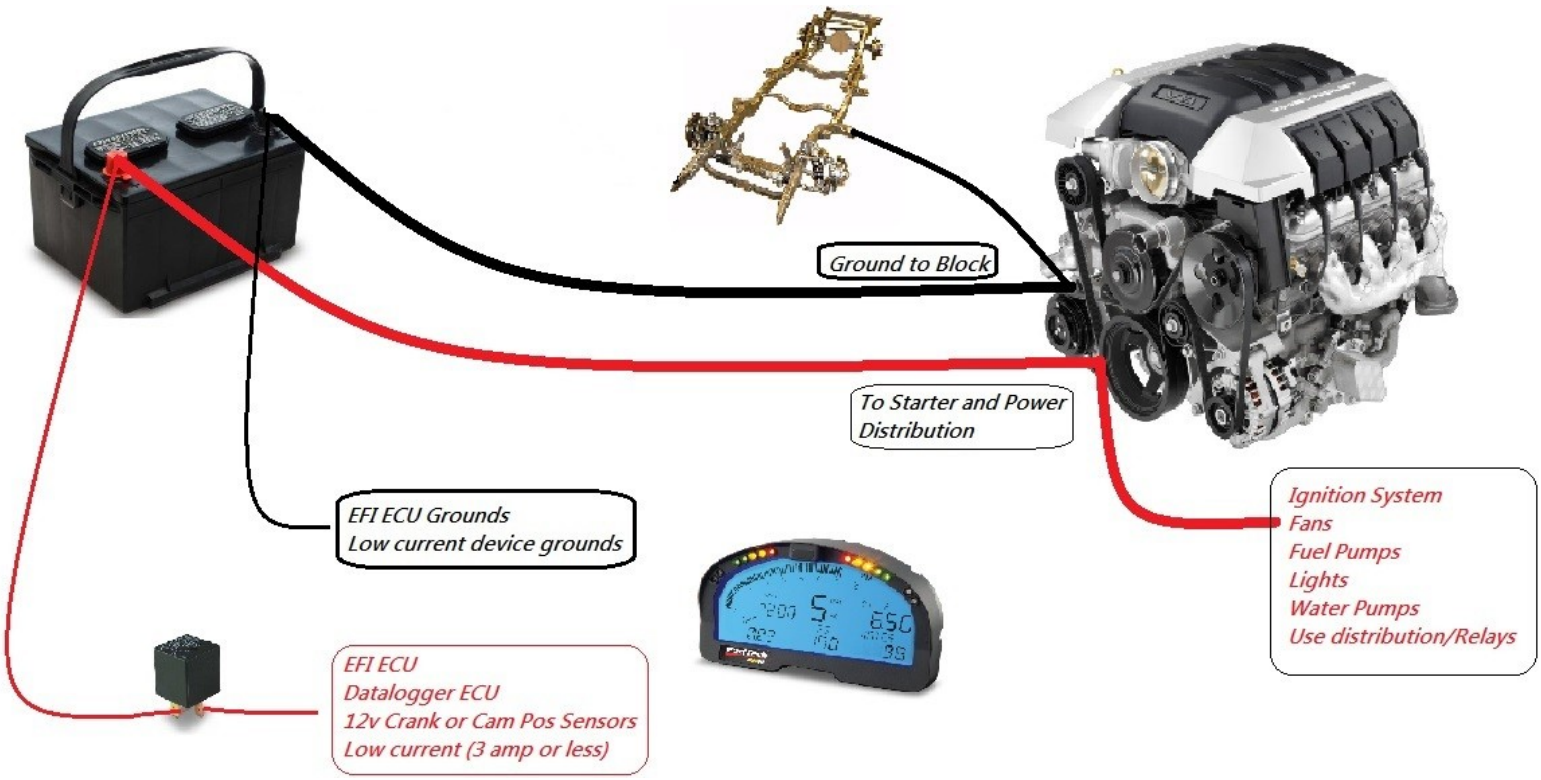
CAN Bus Termination: measure the **resistance** (the Ohms option on your meter) of the CAN bus wires while all sensors are installed and wired, but NOT powered on. The ideal resistance for a CAN network, is 60 ohms. Measure this by probing both CAN bus wires and observing the resistance. If the bus measures 120 ohms or higher, it's time to install another terminating resistor. Most ECU or CAN device manufacturers/retailers sell them, or you can easily install a 120-ohm, ¼ watt resistor across the two CAN wires.

Make sure your node lengths are within specification (maximum 11" for CAN speeds 500kb/s-1000kb/s). It's a good idea to use twisted pair, or manually twist your CAN pair to reduce electrical noise that can interrupt/slow CAN traffic. We've even see Ferrite Cores that snap over your power and CAN wires that reduce or eliminate noise.

CAN Bus Tuning and Performance (ctd)

Chassis Power and Grounds

If this is a race / offroad or engine swap vehicle, try to arrange your power and grounds such that high current and low current devices have their own paths to battery (both positive and ground), as drawn in the image below. This separates devices that leave noise signatures on their power and grounds, from devices that are sensitive to that noise.



Dragdynamics.com Product Warranty

Limited 3-Year Warranty

Congratulations on your purchase of an ACAS-X! We stand behind the quality of our products and are pleased to offer you a limited warranty against manufacturer defects and problems. Please read the following terms carefully.

Warranty Coverage: Drag Dynamics, LLC ("the Company") warrants that your ACAS-X (the "Product") is free from defects in materials and workmanship for a period of three (3) years from the date of purchase, provided that the Product is used under normal conditions and for its intended purpose.

Scope of Warranty: This warranty covers any defects or malfunctions arising from the manufacturing process or materials used in the Product. The Company will, at its discretion, repair or replace the defective Product or parts, or provide a refund, within the warranty period.

Original Purchaser Coverage: This warranty is applicable only to the original purchaser of the Product and is non-transferable. To be eligible for warranty service, the original proof of purchase must be presented.

Exclusions: This warranty does not cover damage resulting from:

- Accidents, misuse, or abuse
- Unauthorized modifications or repairs
- Acts of nature, such as lightning, floods, earthquakes, etc.
- Normal wear and tear

Obtaining Warranty Service: If you believe your Product is defective and covered by this warranty, please email *support@dragdynamics.com* for instructions on how to proceed with the warranty claim. The Company reserves the right to require proof of purchase and may ask for the defective Product to be returned for inspection.

Limitation of Liability: To the extent permitted by law, the Company's liability under this warranty is limited to the repair, replacement, or refund of the Product, and shall not exceed the purchase price paid for the Product.

No Other Warranties: This warranty is the sole and exclusive warranty for the Product, and no other warranties, express or implied, are made, including any warranty of merchantability or fitness for a particular purpose.

Effective Date: This warranty is effective as of the date of purchase and is valid for three (3) years.

Thank you for choosing Drag Dynamics, LLC. We appreciate your trust in our products.