

3-Axis Accelerometer

Model ACC-2000



Installation and User's Manual

Version 1.0

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1 Introduction

1.1 Included Components

The accelerometer module is shipped with the following items.

- Accelerometer Module
- Installation Manual
- Wiring Harness

If any of the above items are missing, please contact Powertrain Control Solutions.

1.2 System Overview

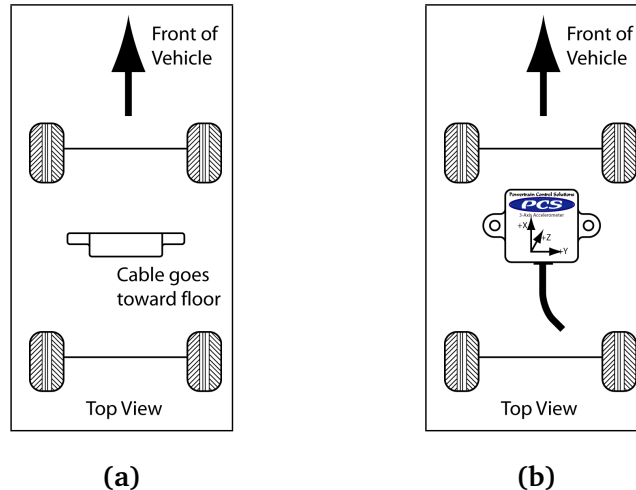
The accelerometer module measures and transmits G-force data from all three axis. The module transmits the data using the PCS Controller Area Network (CAN) protocol at 500 kbps. Once transmitted, the data is available for viewing and logging with the D200 Dash Logger.

2 Installation

2.1 Mounting

The accelerometer module should be mounted as close to the vehicle's centerline as possible. The module should be secured to the vehicle using the two bolt holes in the case. It can be mounted vertically or horizontally as shown in Figure 1. Be sure the accelerometer is mounted level when the vehicle is on flat and level ground.

Figure 1: Vertical (a) and Horizontal (b) Mounting.



When mounting the accelerometer, the most important rule to follow is to have one axis perfectly aligned with the vehicle's direction of motion, and another axis perpendicular to this. If the accelerometer is not mounted perfectly square in the vehicle, it will transmit inaccurate vehicle measurements. Once the accelerometer is mounted, make note of the label on the accelerometer and identify which axis is measuring forward or reverse forces and which is measuring lateral forces. The axis names, such as X, Y or Z, are fixed. These names are used when monitoring the data or reviewing a data log.

To check for proper installation, monitor the accelerometer when the vehicle is stationary on flat level ground. The forward and lateral axis should measure 0g's while the third axis measures 1g. When driving, during a straight line acceleration, the change in g's should only be noticed in the forward axis. If the lateral g's also increase when driving in a straight line then the module is not mounted square to the vehicle. Check the mounting and perform another test.

Each axis' positive or negative sign can be switched from the D200. For more information on how to switch the axis refer to Section 3.1.3.

2.2 Wiring

The accelerometer module pin out and wire color description is listed in Table 1.

2.2.1 Power and Ground

The accelerometer module requires a switched 6 to 24 volts DC connected to Pin 1 for operation. The power should turn on and off with the ignition switch. The module draws 0.05 Amps of current and should be fused

Table 1: Pinout and Wire Color.

Pin	Function	Wire Color
1	Power	Red
2	Ground	Black
3	CAN High	White w/ red stripe
4	CAN Low	White w/ black stripe
5	Not Used	No Wire
6	Not Used	No Wire
7	Not Used	No Wire
8	Not Used	No Wire

accordingly. A clean ground should be connected to Pin 2.

2.2.2 Communication

The accelerometer module transmits data to the D200 using the Controller Area Network (CAN). CAN is a two wire connection that can be used to connect a series of devices together.

PCS CAN devices use a connector system to provide an easy means for connecting new devices to CAN without cutting or splicing wires. The four components to the PCS CAN connector system are listed below.

- Device Connector
- Tee Connector
- Extension Cable
- Terminating Resistor Plug

The Device Connector is on the harness of the device, such as the D200 or the accelerometer. This connector has an orange key in the connector and can only plug into one of the three ports on the Tee Connector.

The Tee Connector has three ports on it. One is keyed for a device (the orange key), while the other two ports are used for the Extension Cable or the Resistor Termination Plug (both with black keys).

The Extension cable is twelve inches in length and has a black keyed connection on each end.

The Terminating Resistor Plug is a necessity. It looks like a connector with no wires coming out of it. It is keyed black and can be inserted in two of the three ports of the Tee Connector. A CAN network should have one terminating resistor plug on each end of the bus for a total of two resistors.

NOTE: CAN communication will NOT WORK if Terminating Resistor Plugs are not used.

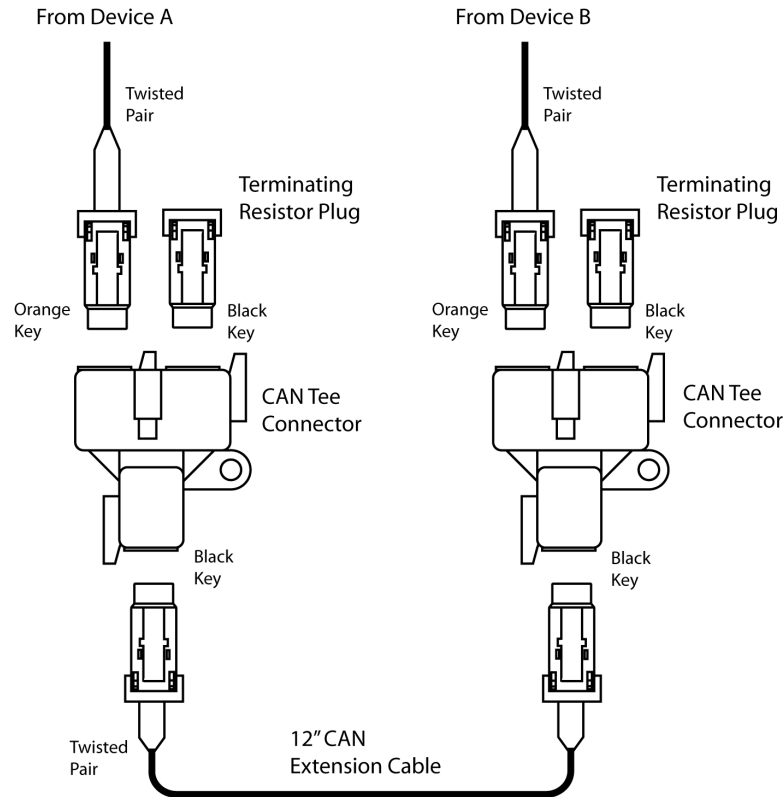
NOTE: Orange or black keys may be in connectors with black or gray housings. The key color can be seen by looking at the end of the connector that is inserted into the Tee.

2.2.3 Building a New CAN Network

If this is a new CAN network, then the purchase of the CAN Master Connection Kit (Part #CON-5500) is required. This kit includes two Tee Connectors, two Terminating Resistor Plugs, and one Extension Cable. These are all of the components necessary to connect a D200 to an Accelerometer. This kit will only have to be

purchased once. As new items are added to the CAN network, only the CAN Add-on Connection Kit is required. The connections are shown in Figure 2.

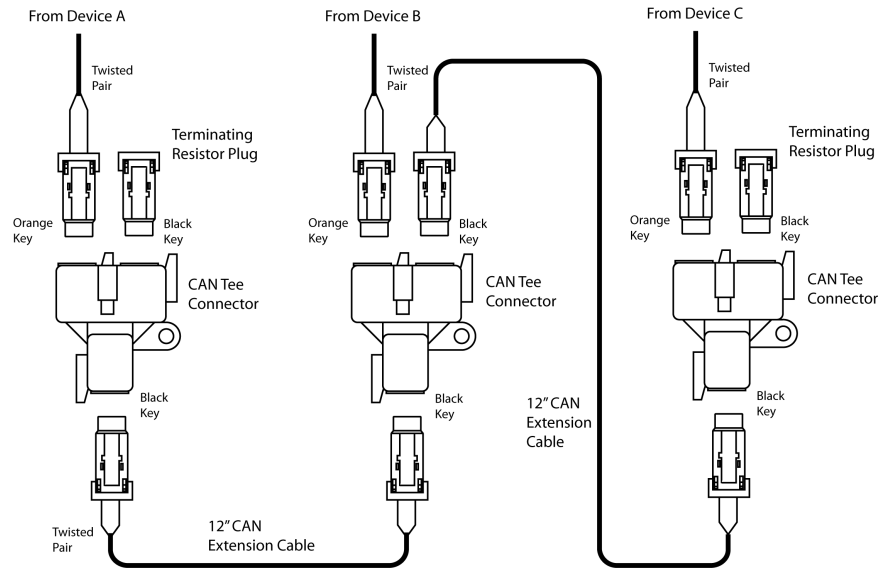
Figure 2: Two Device CAN Network.



2.2.4 Adding the Accelerometer to an Existing CAN Network

If this is not the first CAN device connected to the D200, and the CAN Master Connection Kit is already installed, then only the CAN Add-on Connection Kit (Part #CON-5501) is required. This kit includes a Tee Connector and one Extension Cable. The connections are shown in Figure 3. Simply remove one of the Terminating Resistor Plugs, and insert the Extension Cable. Connect the other end of the Extension Cable to the new Tee Connector. Insert the Termination Resistor Plug into the other black keyed port on the new Tee and insert the Accelerometer's orange keyed device connector into the remaining port on the Tee.

Figure 3: Three Device CAN Network.



3 D200 Monitoring and Logging

3.1 Setup

The accelerometer must be enabled on the D200. From the D200's Main Menu, press Communications then CAN-A and select PCS ACC. Throughout the D200, the accelerometer is referred to as the ACC.

The accelerometer has three programmable options; Range, Sensitivity, and Invert Axis. The options are viewed and changed from the Properties button on the CAN-A selection screen. The accelerometer must be selected to view the properties. Also, the accelerometer options are only viewable when the accelerometer is online. If the accelerometer is offline, the message "Accelerometer communication not detected" will be displayed. When the accelerometer is online, a menu similar to Figure 4 will be displayed.

All option changes are stored in the accelerometer and take affect immediately. Once the options have been stored in the accelerometer, they will remain set even when the accelerometer is disconnected from power.

Figure 4: Accelerometer Properties Menu

ACC Properties

Range: 1.5g 2.0g 4.0g 6.0g

Sensitivity: Low Med High

Invert Axis: X Y Z

Firmware: **1.02.01**

3.1.1 Range

The range can be set to one of four settings; 1.5g, 2.0g, 4.0g, and 6.0g. The range is the maximum G (positive and negative) the accelerometer will measure. The benefit to selecting the appropriate range, is that the accelerometer will provide a finer resolution on the lower ranges. Normal street driving should use the 1.5g setting. This will provide a $\pm 1.5g$ measurement on all three axis, while providing the highest resolution. Select the range by touching the appropriate circle on the screen. If you are unsure about what range to use, select the 4 or 6g range and monitor or log the vehicle under normal conditions. Adjust the range accordingly once the vehicles range has been observed.

3.1.2 Sensitivity

There are three levels of sensitivity; low, medium, and high. The sensitivity adjusts how sensitive the accelerometer is to noise and vibration. Most automotive applications should use the low sensitivity setting. The medium and high settings are typically used for research and development projects involving high frequency vibration analysis. When reviewing a data log, if the data appears to be very noisy and changing extremely quickly, reduce the sensitivity to a lower setting.

3.1.3 Invert Axis

The invert axis setting is used to switch the positive and negative values of a particular axis. This is used when the accelerometer has already been mounted and the user would like to change how an axis is viewed and logged. For example, if a user mounts the accelerometer and then realizes he would like positive X-axis to increase instead of decrease while accelerating, he can simply select the invert axis option for the X-axis. This allows the accelerometer to compensate for vehicle mounting limitations and eliminates the need to unbolt the accelerometer to change the way an axis is interpreted.

3.2 Monitoring

To select the accelerometer data to monitor, return to the Main Menu and select **Monitor Settings** then **Set Display Data** then **PCS ACC**. This menu shows the selection for the X, Y, and Z axis. Select all three. Throughout the D200, the X, Y, and Z axis are referred to as **XAXIS**, **YAXIS**, and **ZAXIS** respectively.

The D200 has three monitor screens to monitor the accelerometer data; **Tach Slider and Digital Gauges**, **Analog Gauges and List**, and **Full Screen Accelerometer**. To change the view, select the **More** from any Monitor screen and select **Select View**.

3.2.1 Tach Slider and Digital Gauges

The accelerometer data can be viewed on any of the six digital displays on the bottom half of the screen. To change the assignment of a digital display touch it and select the desired data item.

3.2.2 Analog Gauges and List

The accelerometer data can be viewed on the list. There is not an analog gauge for G-force so it will not be an option for any of the gauges. The accelerometer data will be present in the list as long as the data has been selected as described in Section 3.2.

3.2.3 Full Screen Accelerometer

The full screen accelerometer view displays a cursor to indicate the current acceleration in two-dimensions. The horizontal and vertical axis are assigned to a particular force by selecting the **Setup** button in the lower left-hand corner. The button displays the **ACC Screen Setup** menu. To assign a direction of acceleration, select the appropriate circle for each axis and then select **Back**. The assignments are stored in the D200 and will not be lost when it is disconnected from power. The axis labels on the full screen view indicate which direction is assigned to the axis.

All three directions of acceleration are displayed at the bottom of the screen. A marker will indicate the maximum absolute value for the horizontal and vertical axis. To clear the marker clear the D200 peak values by selecting **More** then **Clear Peak**.

There are a total of three zoom levels for viewing the data. The zoom levels only change the viewing area on that screen and do not actually change the range of the accelerometer module. The three zoom levels are detailed in Table 2.

On power-on, the D200 defaults to the widest zoom range. Zoom levels can be rotated through by touching the cursor area of the screen.

Table 2: Zoom Levels.

Level	Vertical Axis (g's)	Horizontal Axis (g's)
1	±4	±6
2	±2	±3
3	±1	±1.5

3.3 Logging

To enable the data logging on the D200, the accelerometer communication on the CAN bus must be enabled as described in Section 3.1.

From the Main Menu, select **Data Log Settings** then **Sources** then **Comm Inputs**. Select the logging rate associated with the PCS ACC. Logging rates are selectable up to 100 times per second. The X next to the number means *times per second*. A setting of 0x means the accelerometer will not be logged.