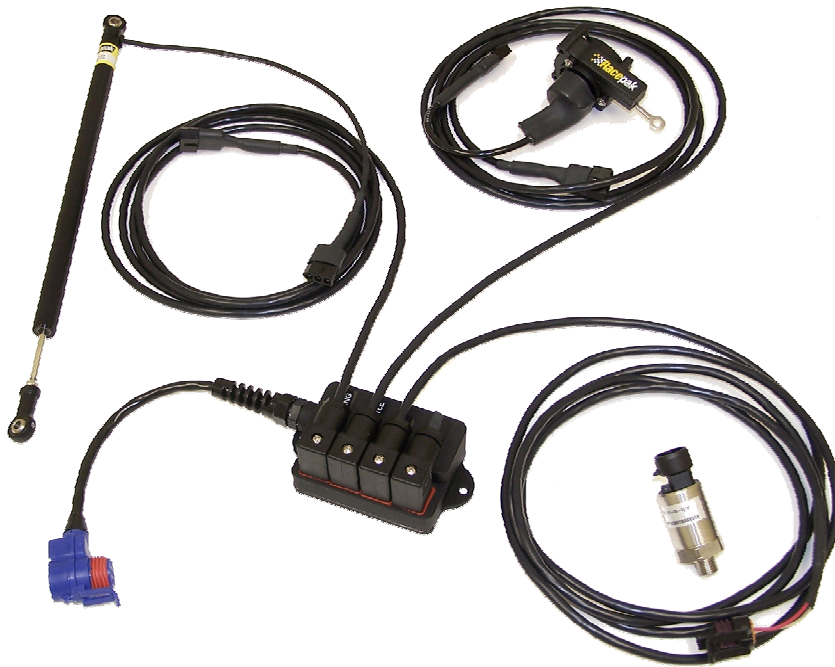




Installation and Calibration Instructions



Steering, Throttle and Brake Kit
Part Number: 620-KT-STB

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Table of Contents

STEERING, THROTTLE & BRAKE KIT COMPONENTS.....	3
PREPARING THE G2X AUX PORT FOR VNET SENSOR USAGE.....	4
MOUNTING OF COMPONENTS	7
QUAD BOX MODULE	7
STEERING SENSOR	8
INSTALLATION OF FOUR PIN HIRSCHMAN CONNECTOR TO STEERING SENSOR CABLE	9
THROTTLE SENSOR	11
BRAKE PRESSURE SENSOR	12
CONNECTION OF STEERING, THROTTLE AND BRAKE KIT TO G2X	13
UPDATING THE G2X AND G2X_CONFIG FILE	14
EDIT AND READ COMMAND	14
ADDING NEW SENSOR CHANNELS TO THE REAL TIME LIST	15
CALIBRATION OF STEERING AND THROTTLE SENSORS.....	16
THROTTLE SENSOR CALIBRATION	17
STEERING SENSOR CALIBRATION	18
PERFORMING REAL TIME FUNCTIONS TO VERIFY CALIBRATION DATA.....	19
VIEWING NEW SENSOR DATA ON G2X DISPLAY DASH	20

Steering, Throttle & Brake Kit Components

The above kit includes the following items:

1. (1 each) Quad Box Module
2. (3 each) Hirschman four pin 90 degree connectors
3. (3 each) 12 sensor to Quad Box cables
4. (1 each) 8 linear travel sensor (steering sensor)
5. (1 each) 10 string potentiometer sensor (throttle sensor)
6. (1 each) 0-1500 psi sensor (brake pressure)

The addition of a Steering / Throttle / Brake kit to a G2X data system enables the user to monitor:

1. Tire or Wheel Angle - Dependant upon the calibration method utilized
2. Throttle Position: Typically calibrated as Closed Throttle = 0% and Wide Open Throttle = 100%
3. Brake Pressure: Factory calibrated 0-1500 PSI

Each 12 sensor cable is equipped with a Racepak factory installed sensor connector on one end, while the opposite end contains no connector. The Steering and Throttle sensor cable both utilize a three pin flat connector, while the brake sensor cable utilizes a three pin, triangular connector

The non-terminated sensor cable end allows the user to cut each cable to the desired length and install a four pin Hirschman connector on each cable. This four pin Hirschman connector is then plugged to the appropriate port on the Quad Box Module.

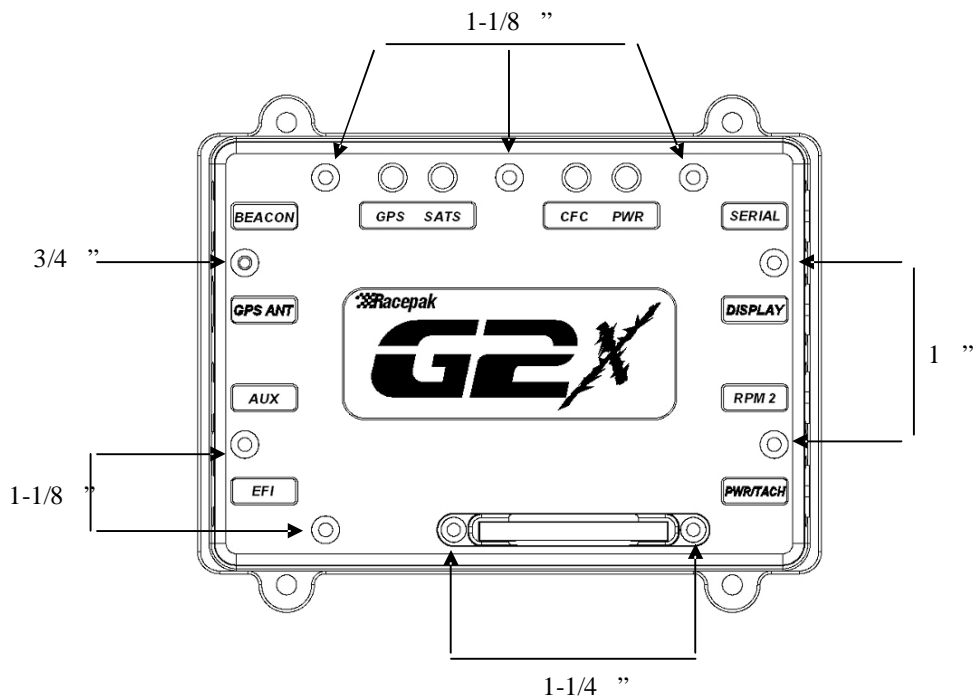
The steering, throttle and brake pressure sensors arrive from the factory with default calibration values. In order to provide accurate graphical data, it will be necessary to calibrate both the throttle and steering sensor specific to customer installation. The brake pressure sensor requires no additional calibration.

The following instructions provide the necessary information for the installation of the steering, throttle and brake pressure sensors. In addition, the mounting of the Quad box, routing and termination of sensor cables, along with the required calibration and DatalinkII software updates is also covered in this manual.

Preparing the G2X AUX Port for Vnet Sensor Usage

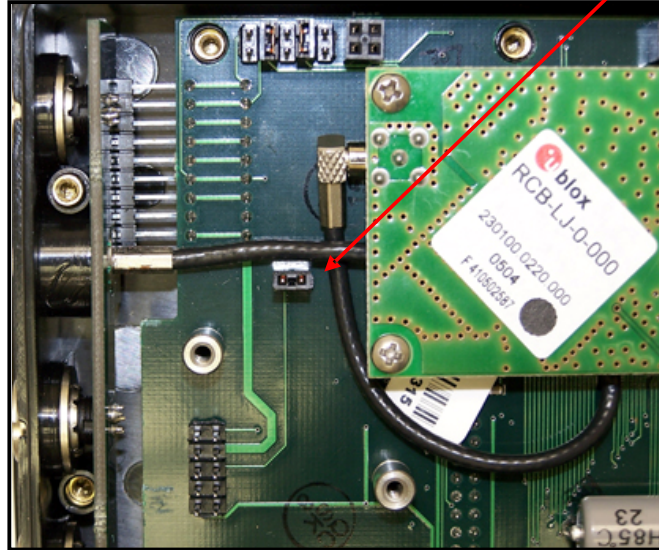
All external Vnet sensors added to the G2X transmit their data through the AUX to Vnet cable. This cable connects to the AUX port of the G2X. Before utilizing the AUX port, it is necessary to remove the internal bus termination jumper inside the G2X. To perform this procedure:

1. Turn the power off and remove the compact flash card.
2. Remove all 10 screws on top of the G2X. Make sure to note the location of each screw as there are 4 different lengths. The diagram below provides location and screw length.

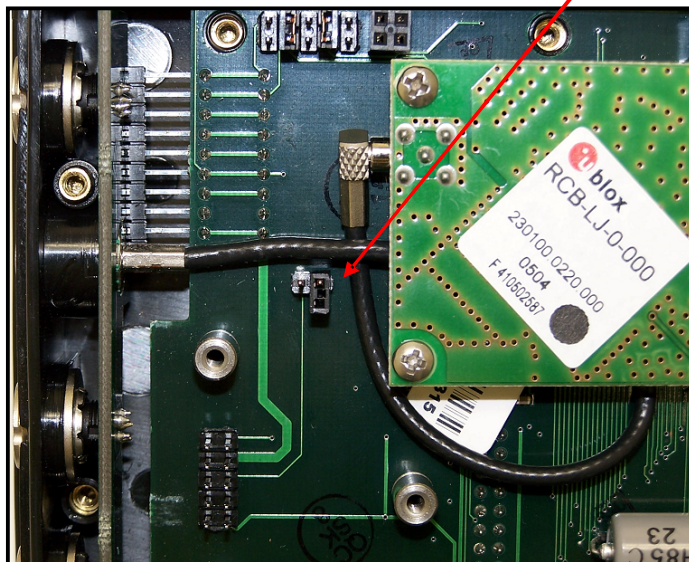


3. Carefully remove the top cover. There may be some slight resistance due to the status LED connectors.

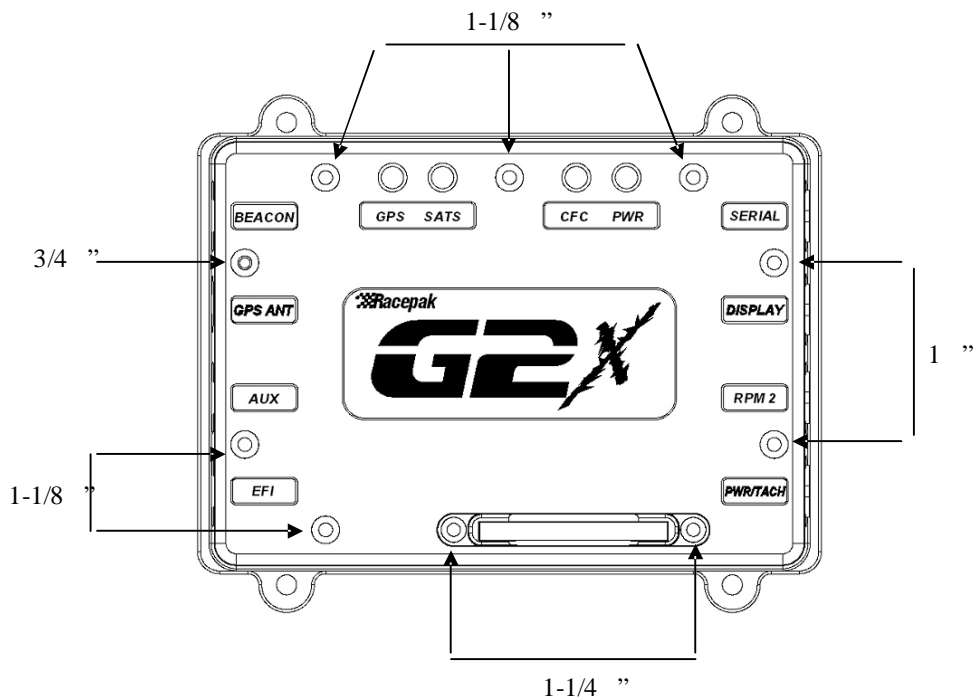
4. Located next to the internal GPS antenna cable you will find a 2 pin jumper.



5. Remove the jumper from the two pins and place it back on one of the pins for storage, in case of future need.



6. Carefully replace the top cover making sure to properly align the male pins on the status LEDs with the mating female connector on the G2X.
7. Reinstall the 10 screws, again making sure to use the proper length screw in each location. Do not over tighten the screws, as they only need to be snug.



TIP: When adding VNet modules to the AUX port it is very important that you remove the internal bus termination jumper and then install the Vnet termination cap on the last VNet module installed on the AUX port. Failure to properly perform these steps may result in erratic operation of all modules connected to the G2X AUX port.

Mounting of Components

Quad Box Module

The mounting location of the STB Quad Box Module is dependant upon the type of vehicle, along with customer preference. The module is designed to connect to the G2X by means of a single Vnet Tee cable, while each sensor is connected to the module by means of an individual sensor cable. The individual sensor cables can be shortened and terminated by the user, utilizing the enclosed four pin 90 degree connectors.

If the mounting location was determined at the time the STB Kit was ordered (to allow simultaneous ordering of appropriate length Vnet cables) the module can be mounted utilizing the two, # 10 mounting holes located on the rear of the module housing. If no mounting location was determined before ordering, determine the desired location and mount the module.

The module should be mounted in a way that avoids:

1. Excessive heat and vibration
2. Excessive electrical interference

Avoid mounting the module near exhaust or ignition components. Heat can render the module inoperative, while electrical interference will affect data.

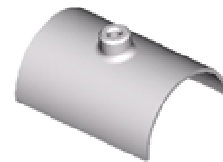
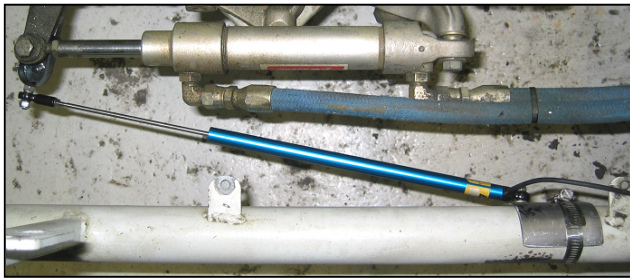
Mounting Tips:

1. The mounting position determines the exiting route for each sensor cable. Try to pre-plan the route that each sensor cable will take, before mounting the module. This will allow for proper orientation of the module, to best accommodate the connection of the sensor cables to the module.
2. Insure the mounting position is within distance of each sensor, according to the length of each sensor cable. It could be frustrating to mount the module beyond the reach of any of the three sensor cables.

Steering Sensor

Locate the 8" linear travel steering sensor. The 8" length refers to the total travel of the sensor, from fully compressed to fully extended. While there are various styles of sensors utilized for obtaining steering data, Racepak has found the most durable and reliable method of obtaining this information is through a linear style shaft sensor. The sensor is designed to monitor movement of the steering system by mounting one end of the sensor to a stationary location, while the opposite end of the sensor is mounted to a portion of the steering system that provides linear movement through out the entire steering travel. Each end of the sensor is equipped with a #10 monoball, to facilitate mounting.

The types of mounting methods are as varied as the number of steering systems in use. However, the following photo illustrates an example mounting method, which provides a stationary mount on one end of the sensor, while the opposite end is attached to the power steering arm.



Again, this illustration is provided to simply demonstrate the basic idea of how steering motion is monitored, utilizing a linear steering sensor. Following installation of the steering sensor, connect the supplied steering sensor cable to the sensor, route to the module and terminate according to the instructions that accompany the STB Kit.

Mounting Tips:

1. The sensor can not monitor movement of a rotating steering column.
2. The sensor should not be attached to any portion of the suspension that moves in an up and down motion (spindles, control arms, etc). Not only will this provide inaccurate data, it will typically pull the sensor out of the mounting system.
3. Allow for adequate travel of the sensor. Mount the sensor in a method that allows equal amounts of travel when turning left or right. This is typically accomplished by insuring the front wheels are pointed forward, while the steering sensor is mounted with four inches of extended shaft in view.
4. Mount the sensor in a method that avoids any binding of the monoball mounts, found on each end of the sensor. Movement should rotate parallel with the monoball, not perpendicular to the monoball.
5. Insure the sensor can not interfere with any steering components.

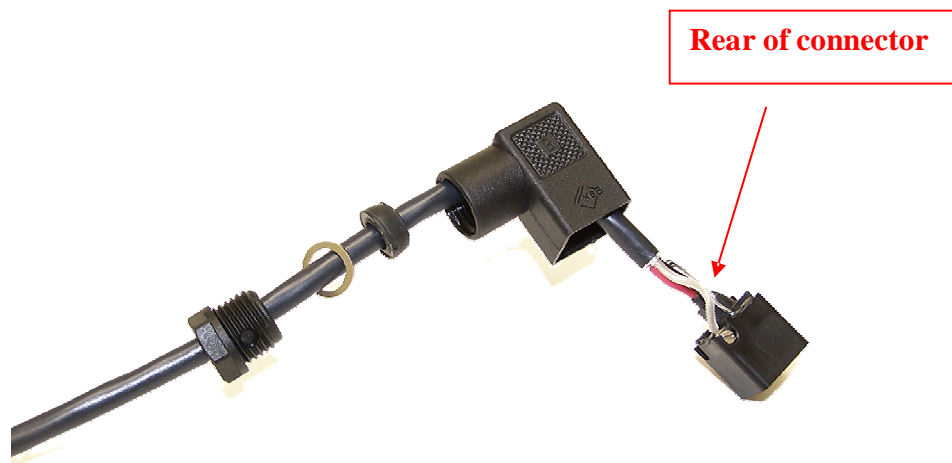
Warning: Racepak is not liable for any problems associated with the installation of a steering sensor into the steering system.

Installation of Four Pin Hirschman Connector to Steering Sensor Cable

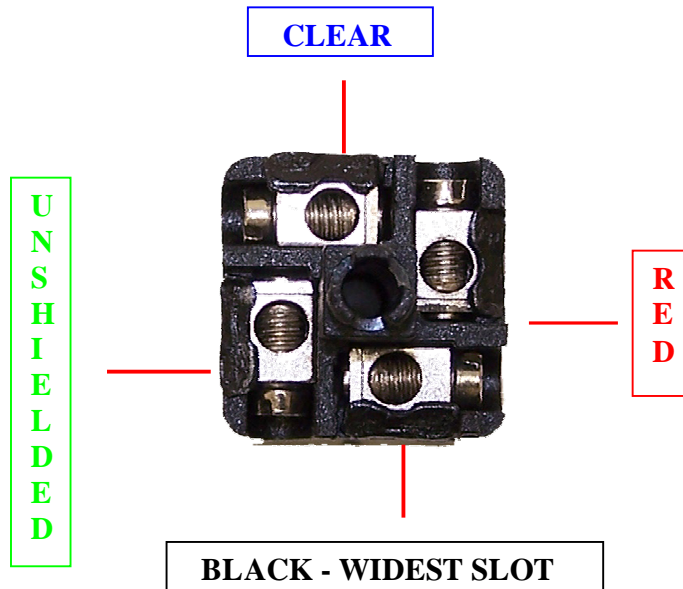
Following installation of the steering sensor, the steering sensor cable may now be connected to the sensor. Simply connect the three pin Molex connector found on one end of the Quad Mode steering sensor cable, to the three pin Molex connector found on the cable connected to the steering sensor. Route the cable back to the Quad Module.

At this time, determine if it will be necessary to short the steering sensor Quad Module cable. If the cable will be shortened, remember to allow extra length, in case the cable is re-routed or installed in another vehicle. Locate the four pin Hirschman connector at the time. To install the connector:

1. Strip away approximately 1" of the cable shielding. Insure the four wires are not cut or nicked during this process.
2. Strip approximately 3/16" of shielding from the red, black and clear wires.
3. Place the strain relief components over the cable as show below.
4. Insert the cable through the 90 degree connector housing as shown below.



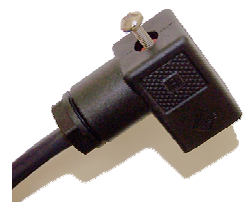
5. The following provides pinout instructions for connection of the red, black clear and unshielded cables. Please note this is viewed exactly as shown, from the rear of the connector. The ground (widest connector opening) is at the **bottom**. Loosen each small screw and insert the each wire as shown below. Tighten each screw following insertion of each stripped wire.



6. Following connection of the wires, gently push the cable and connector back into the 90 degree housing, until a click is felt and the connector is seated flush with the edge of the 90 degree housing. It may be necessary to gently pull the cable, while pushing the connector. Insure the connector remains oriented as shown above.

7. Insure no wires are in the opening through which the attachment screw is routed.

8. Gently slide the rubber gasket, steel washer and threaded strain relief up to the housing. Turn the threaded strain relief into the 90 degree housing, until tight. Insert the attachment screw through the top of the connector housing, insuring the small rubber gasket remains on the attachment screw.



9. Place the square rubber gasket over the four steering connector pins, located on the Quad Module. Push the 90 degree connector over the four pins. Insure the connector is seated on the rubber gasket, and tighten the mounted screw.



10. Installation is complete. This same procedure may be followed for the installation of the 90 degree Hirschman connector onto the throttle and brake sensor Quad Module cable, with the exception that the final connection is made to their respective throttle and brake Quad Module connector.

Throttle Sensor

The throttle position sensor utilized by Racepak is a style of sensor known as a string potentiometer. This sensor provides data in a method similar to the steering sensor. In the case of the steering sensor, movement is detected by the extension and retraction of a solid shaft. In the case of the throttle sensor, movement is detected by the extension and retraction of a small cable. String potentiometers are well suited for obtaining throttle data, as the flexible nature of the cable prevents interference with the throttle actuation.



Again, there are as many mounting methods as there are fuel systems in use. This drawing illustrates one example of a mounting method utilized when the sensor is mounted to the motor. The throttle position sensor is designed to mount utilizing the three # 10 holes in the main body of the sensor. The cable is designed to be attached to any portion of the fuel / throttle system that can provide a reasonably linear opening and closing motion.



Mounting Tips:

1. Insure the mounting ring at the end of the cable is allowed to rotate freely. If the ring is not allowed to rotate, the cable will break.
2. Attempt to mount the sensor in an under hood location, in a position that takes advantage of the throttle linkage. This will also assist in routing the sensor cables to the module, as many door car type vehicles will mount the steering, throttle and brake sensor, under hood. In the event of an open cockpit or rear engine vehicle, it is possible the steering, throttle and brake pressure sensors may be mounted in a forward position, near the nose of the vehicle.
3. Attempt to mount the throttle position sensor on the engine. Often times, throttle sensors are mounted independent of the engine, on a crossbar, bulkhead, etc. What can result from this type of mounting is erroneous data. Flex between the chassis and the engine will appear as throttle movement in graphed data, but in reality is movement between the sensor mount and the engine.
4. Much the same as the steering sensor, insure adequate cable travel through the entire range of throttle motion.

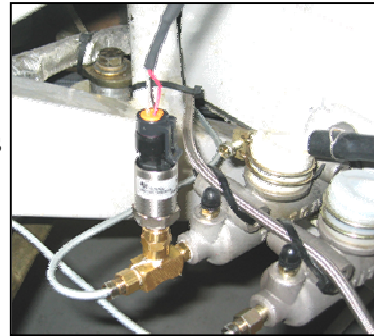
Warning 1: Do not allow the cable to snap back, into the housing. This will damage the sensor, typically requiring the purchase of a new sensor.

Warning 2: Racepak is not liable for any problems associated with the mounting of a string potentiometer throttle sensor into the throttle system.. Insure no binding or locking of the linkage occurs, upon installation of the string potentiometer.

Following installation of the throttle sensor, install the 90 degree Hirschman connector to the Quad Module throttle sensor cable, according to the previous instructions found on pages 9 and 10 of this manual.

Brake Pressure Sensor

The brake pressure sensor is equipped with a 1/8th pipe thread fitting, and may be installed in either the front or rear brake line. One installation method involves the installation of a T fitting in either master cylinder. This method provides a means to install the brake pressure sensor for testing and upon completion of testing, the sensor can be removed and the T fitting plugged until the next test session (for vehicles that must remove the sensor before race competition).



Regardless of the manner of installation, insure there are no leaks in the brake system, following installation.

Following installation of the brake pressure sensor, connect the supplied brake pressure sensor cable to the sensor, route to the module and terminate according to the instructions that accompanies the STB Kit.

Mounting tips:

1. Insure the sensor and associated wiring do not come in contact with excessive heat, such as from headers.
2. Insure the brake pressure sensor is mounted in a manner that does not allow for leaks in the brake system.

Warning: Racepak is not liable for any problems associated with the installation of a brake pressure sensor into the braking system.

Following installation of the brake sensor, install the 90 degree Hirschman connector to the Quad Module brake sensor cable, according to the previous instructions found on pages 9 and 10 of this manual.

Connection of Steering, Throttle and Brake Kit to G2X

The next step is to connect the Steering, Throttle and Brake Quad Module to the G2X by means of the AUX to Vnet Cable, P/N: 680-CA-AUX-084.

1. Connect the G2X AUX to Vnet cable to G2X AUX port.
2. Connect the blue end of the G2X to AUX Vnet cable to the male end of the Quad Module Tee connector.
3. Finally, connect the Vnet termination cap, P/N: 280-CA-VM-TCAPM to the female end of the Quad Module Tee connector.



If additional Vnet sensors are added, their respective Vnet modules may connect directly to the Quad Module Tee connector, by removing the Vnet termination cap, attaching the additional modules and replacing the Vnet termination cap on the last module in line.

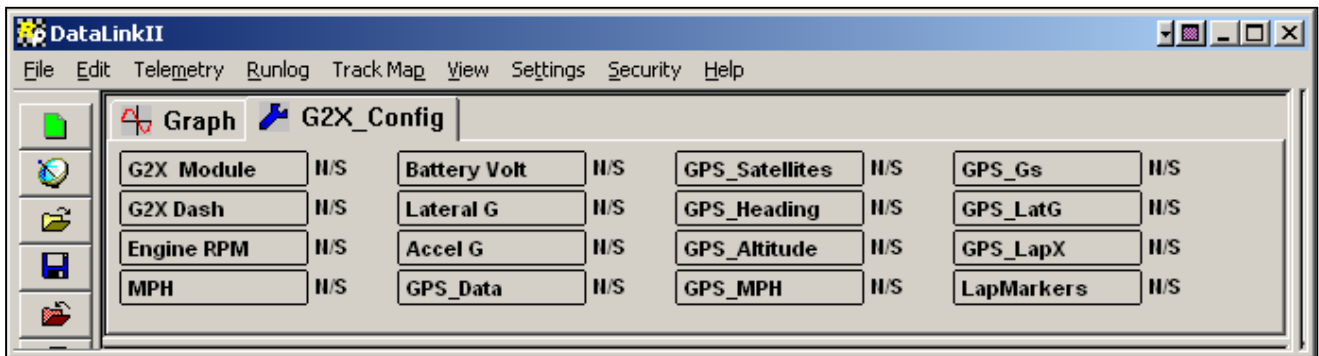
If the additional Vnet modules are out of reach of the Quad Module Tee connector, those Vnet modules may be connected to the Quad Module Tee connector by means of Vnet extension cables, with the terminator cap installed on the last Vnet module in line.

Updating the G2X and G2X_Config File

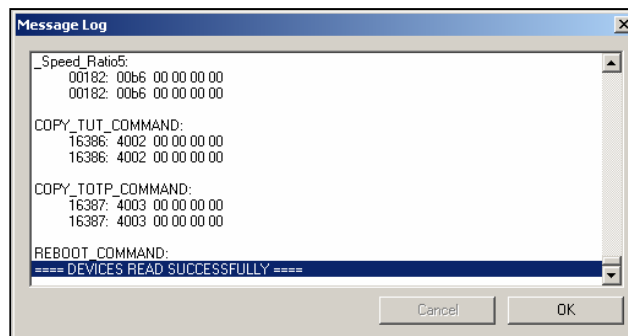
Edit and Read Command

Following installation of the Module and sensors to your G2X system, it is necessary to update the G2X_Config configuration file. This action allows the G2X logger to not only recognize the new sensors but enables the user to calibrate, record and view data from the new sensors. Following final connection of all wiring and VNet cables:

1. Connect the Communication serial cable from your PC to the G2X data logger.
2. Turn on power to your G2X data logger and open the DataLink II program. Your screen should appear as shown below.



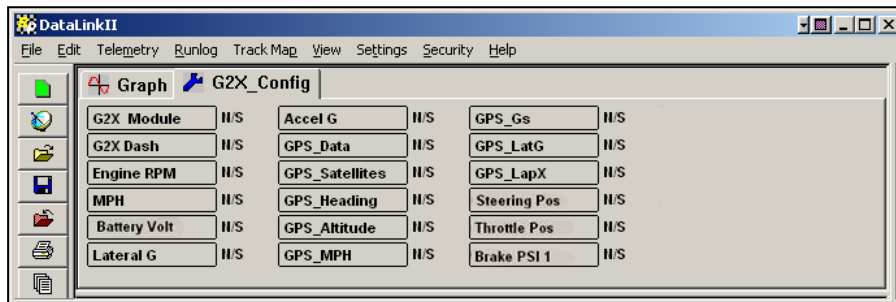
3. Insure that all files, other than the G2X_Config file are closed, at this time.
4. Select the Read VNet Config menu option located in the Edit main menu selection.
5. When selected, a Message Log dialog box will be displayed and the read configuration process will begin. As the information is read, a log of the status will be displayed on the Message Log dialog box.
6. When completed the following Message Log dialog box will be appear as shown below.



7. The message Devices Read Successfully should appear at the bottom of the dialog box indicating the read was successful.

8. Click OK to continue.

Following this action, a new channel button will be inserted in the configuration file, for each new sensor added to your G2X system. The G2X_Config configuration file will appear as shown below.

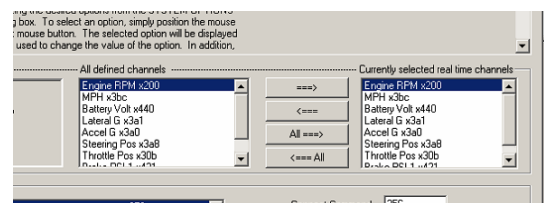


You should next verify that a new channel button has been added for each new device added to the system. If any devices are missing, check the mechanical installation to insure all devices were properly connected and repeat the above Edit and Read process.

Adding New Sensor Channels to the Real Time List

Each channel may be viewed in real time, by connecting the user's PC to the G2X, via the Serial Communication cable. However, each time new sensors are added, it will be necessary to add the new sensor channel to the list of channels available for real time viewing: To perform this procedure:

1. Insure the G2X_Config file is open. Place the mouse cursor over the G2X Module channel button and right click.
2. In the center of the currently open dialog window is a list of All Defined Channels. To the right of this list is a Currently Selected Real Time Channel list.
3. Select the desired channels to be viewed in real time from the All Defined Channels and place each channel (one at a time) in the Currently Selected Real Time Channel list by use of the > arrow, located between the two input areas. Channels may be removed from the Real Time list by using the < arrow. Complete this procedure for all desired channels.
4. Select the Send button, located in the bottom, right corner of the open dialog Window and select OK when the process is complete. Select the Save icon in the toolbar or select the Save menu item located in the File main menu selection to save the modified configuration file to disk. You are now ready to proceed to the calibration information, found in the following section.



Calibration of Steering and Throttle Sensors

Calibration can be defined as the process of programming a sensor to provide usable data that may be graphed for analysis. To understand the necessity of sensor calibration, it is helpful to understand the operation of a typical sensor. For example, a 1500 PSI brake pressure sensor receives voltage power from the G2X data logger. In return, the sensor sends to the G2X data logger a voltage reading that changes according to the brake pressure detected by the brake pressure sensor. This voltage reading must then be converted to data that can be viewed and graphed in the DatalinkII software.

The brake pressure sensor is designed to return a voltage reading to the G2X data logger, between 0-5 volts. Of course this voltage reading varies according to the pressure detected by the sensor. Each sensor is designed to operate in a specific range. In the case of our brake pressure sensor, this range is between 0 and 1500 PSI. Therefore, the calibration values pre-programmed for our brake pressure sensor will be defined as 0 PSI = .4 Volts, while 1500 PSI = 4.5 Volts.

The Datalink II software thus can convert any returning voltage between .4 and 4.5 into data that can then be displayed as graphed brake pressure data.

Typically, sensors monitoring temperature, pressure, vacuum, voltage or RPM requires no additional calibration. Racepak factory personnel have pre-configured this information for the user. However, when utilizing movement sensors such as steering or throttle, it becomes necessary to calibrate the movement of the sensor to the travel of the item monitored.

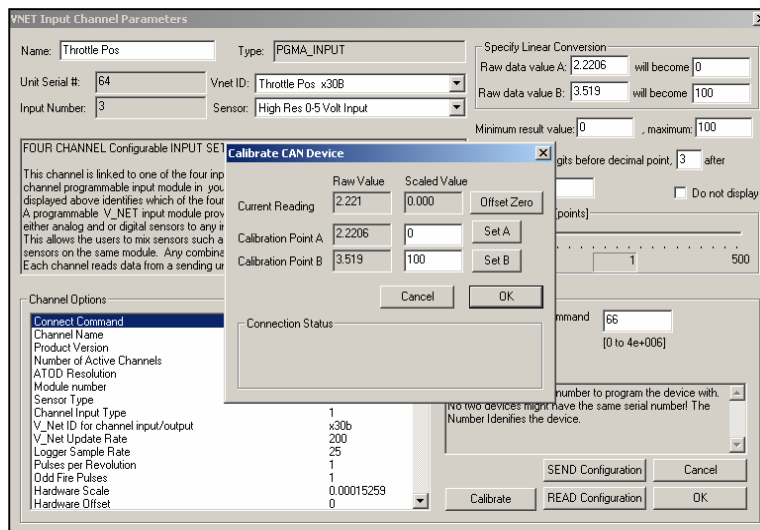
From the factory, steering and throttle sensors are programmed to only display and graph the entire range of the sensor. In the case of the steering sensor, this is 0-8 .”In the case of the throttle sensor, this is 0-10 .”This data would not be very useful, if the user was trying to determine the number of degrees the wheel was turned, or the percentage the throttle was open.

In the case of steering, we recommend calibrating the angle (in degrees) of the front wheel to the movement of the sensor. In the case of throttle, we recommend calibrating the percentage of throttle movement (0-100%) to the movement of the sensor. As the sensors arrive from they factory, they only know a voltage change has occurred. It does not know what to call this movement for specific graphing purposes. It is the responsibility of the user to properly calibrate the movement sensor, in order to obtain usable data.

Throttle Sensor Calibration

Prior to calibration, insure there is no interference by opening and closing the throttle multiple times (without the engine running). At this time, insure the DatalinkII software is open and the G2X_Config file is in view and the G2X is powered up. To calibrate the newly installed sensors, it will be necessary to perform the following steps:

1. Right click over the Throttle Pos channel button. This will open the VNET Input Channel Parameters dialog box.
2. Locate the Calibrate button, at the bottom right corner of the dialog box. Left click this button.
3. The system will connect to the Throttle Pos sensor and open a CAN Calibrate Device dialog window, as shown below.



To assign calibration values, we will use the Set A and Set B buttons. Set A will be our first calibration point and is entered with the throttle in a closed position. (0 % throttle).

4. Insure the throttle is in a closed position and the Scaled Value is at 0. If so, click the Set A button. The system will reassign the current output voltage reading to the Set A box.
5. To set the 100 % position it will be necessary for a second person to open the throttle to wide open position. Insert 100 into the Set B Scaled Value input box. With the throttle wide open, select the Set B button. When the system places the current voltage reading in the Set B box, the throttle can be closed.
6. Select the OK button.
7. Change the Minimum Result Value to -5 and the Maximum to 110. These numbers are found in the upper right corner of the VNET Input Channel Parameters dialog window.
8. Select the SEND Configuration button, located in the lower right corner of the VNET Input Channel Parameters box, then select OK when completed.
9. Power the data logger off and back on. Throttle calibration is now complete.

Steering Sensor Calibration

Before calibration of the steering sensor, turn the steering full left and full right to insure no interference or binding of the sensor, has occurred. The goal when performing steering calibration is to define a 0 degree point (straight ahead) and a 15 degree (or your preferred values) turn to the left. If your team has front toe plates, place the vehicle on them, at this time. If you do not have access to front toe plates, create a method that will allow you to determine a left turn calibration point that can be repeated each time the system is installed. The information received from the data logger is only as good as the calibration data within the data logger.

An alternative to calibration at the front wheel is calibration of the steering wheel angle to the sensor position. Again, it does not matter what method you prefer, but insure either method utilized can be repeated on a consistent basis, to insure accurate comparison of data.

With the steering pointed straight ahead (using strings, steering box marks, etc) to determine this point, repeat the same procedures utilized for the throttle sensor calibration.

1. Insure the G2X_Config file is open in the DatalinkII software.
2. Right click the Steering Pos button.
3. Left click the Calibrate button, in the lower right corner of the VNET Input Channel Parameters dialog window.
4. With the steering pointed straight ahead and Scaled Value at 0, left click the Set A box.
5. Turn the steering 15 degrees (or your desired amount) to the left. With the assistance of a second person, request they hold the steering wheel at the 15 degree point or lock the steering with some type of reliable method.
6. Enter 15 in the Scaled Value box beside of the Set B button.
7. Left click the Set B button. Insure the current voltage values are reassigned to the Calibration Point B location.
8. Change the Minimum Result Value to -20 and the Maximum to 20. These numbers are found in the upper right corner of the VNET Input Channel Parameters dialog window.
9. Left click OK and then left click the Send button, located at the bottom right of the VNET Input Channel Parameters dialog window and OK when complete.
10. Power the data logger off and back on
11. Steering calibration is now complete.

Performing Real Time Functions to Verify Calibration Data

Following the previous calibration procedures, it is advisable to check the steering and throttle calibrations, to insure the correct numbers were entered during the procedures. Our experience has shown that in the rush to complete calibration and head to the track, incorrect numbers are occasionally entered.

A quick way to check each calibrated sensor is to repeat the first three steps in the calibration process, as shown below. Insure the G2X is still powered up and the Communication Cable is still connected to the users PC.

1. Right click over the Throttle Pos channel button. This will open the VNET Input Channel Parameters dialog box.
2. Locate the Calibrate button, at the bottom right corner of the dialog box. Left click this button.
3. The system will connect to the Throttle Pos sensor and open a CAN Calibrate Device dialog window, as shown below.

	Raw Value	Scaled Value	
Current Reading	2.221	0.000	Offset Zero
Calibration Point A	2.2206	0	Set A
Calibration Point B	3.519	100	Set B

Cancel OK

Connection Status

Note the Current Reading area, in the above Calibrate CAN Device window. This data represents live data, as it is being received from the throttle pos sensor. The Raw Value represents the real time voltage that is received from the throttle pos sensor. Next, note the Scaled Value window. This number represents the current position of the throttle. While continuing to view this data, slowly open the throttle to a wide open position. The scaled value should climb until it reaches 100 (if the throttle was scaled for 0-100). Slowly release the throttle and observe the Scaled Value numbers fall, relative to the throttle position. When the throttle is returned to closed position, the Scaled Value should be approximately 0. Typically, the values will not precisely reach 0 and 100.

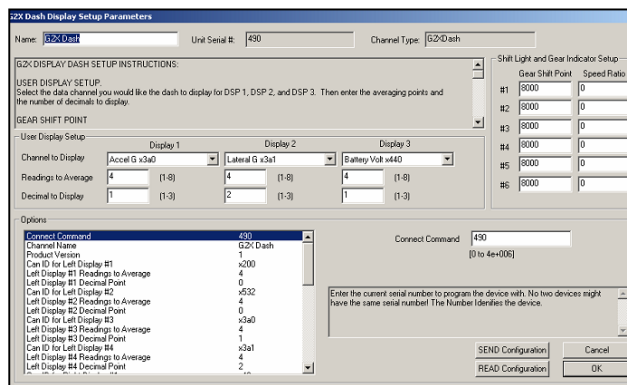
Repeat the above procedure for the Steering Pos sensor. If it is determined the Scaled Value data does not appear correct according to the sensor position, repeat the entire calibration process, to insure correct numbers were entered.

At this time, calibration procedures are complete. The following section provides data concerning the viewing of external sensor data on the G2X Display Dash.

Viewing New Sensor Data on G2X Display Dash

The G2X Display Dash provides the ability to display the data from any three external sensors connected to the G2X. In order to do so, it is necessary to perform the following Display Dash programming changes. Insure the G2X is still powered up, the user s PC is connected to the G2X via the serial communication cable and the Datalink II software is open with the G2X_Config file in view.

1. Place the mouse cursor over the G2X Dash Channel Button and Right click.
2. This action will open the G2X Dash Display Setup Parameters dialog window.



3. Notice the Display 1, Display 2 and Display 3 input areas. To change the input channel for any of the three display areas, simply place the mouse cursor over the pull-down arrow located beside of the Channel To Display input area and left click.
4. This action will open a list of all available channels for display.
5. Select the desired channel for the desired display area.
6. Following selection of desired channels, select the SEND Configuration button, located in the lower, right corner of the G2X Dash Display Setup Parameters dialog window.
7. Upon completion of the Send and OK function, power the data logger off and back on.

Remove the serial communication cable from the G2X, following completion of the above procedure.

To view the newly selected channels on the G2X Display Dash, use the left or right button to toggle through and activate the red LED beside of Display 1, Display 2 or Display 3. When the LED is lit, that channel will be displayed on the left or right side, according to the location of the Display Channel LED.