FOOBARENGINEERING

CAN-GPS-IMU

CAN-GPS-IMU Board User Guide

Dead Reckoning GPS and Inertial Motion interface to CAN.

CAN GPS IMU
www.FooBarEngineering.com

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Introduction

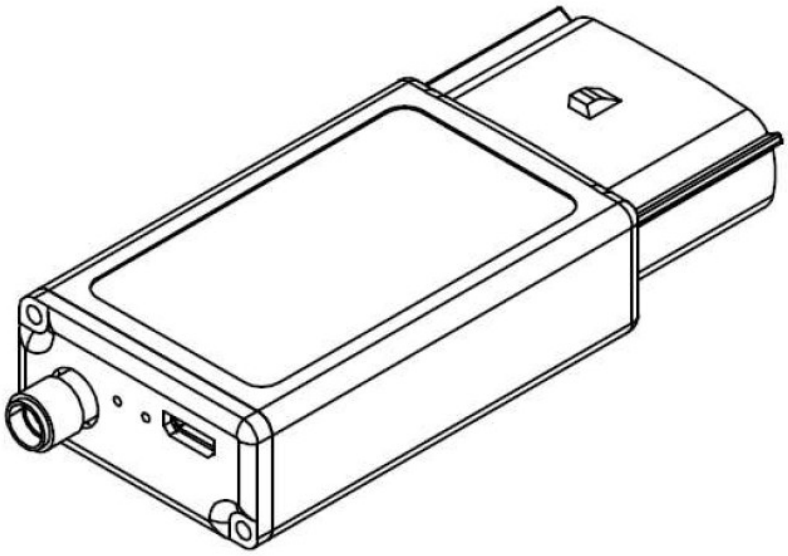
The FooBarEngineering CAN GPS Inertial Motion Unit (CAN-GPS-IMU) is based on the proven WSL range of loggers and designed to interface sensors to the CAN bus.

The CAN-GPS-IMU allow a dead reckoning GPS and IMU to be interfaced into existing loggers and systems using CAN.

The CAN-GPS-IMU can be configured to have a user specified CAN address and device configuration.

Further cost options include in built logging function based on the WSL range of loggers.

Hardware



Specifications

Electrical Data

Supply Voltage	7.9Vdc to 18Vdc
Supply Protection	Reverse and over voltage
Supply Current	300mA @ 12V
Temperature Range Operating	-10°C to +60°C
Temperature Range Storage	-20°C to +70°C

I/O Information

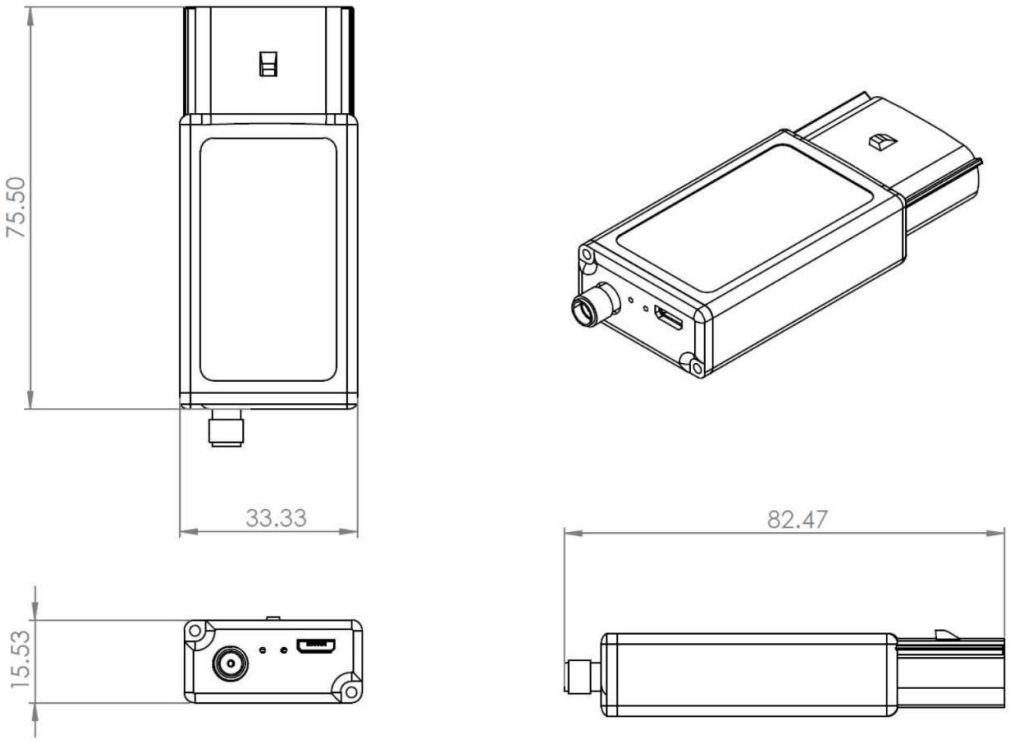
1x CAN	1Mbit, 512k, 256k, 128k software selectable
1x GPS	Connection to active GPS antenna
2x LED	Indicates GPS lock and logging active

Communication Ports

1x USB (Debug use only) RS232 terminal for setup and in use testing/ offloading of data.
CAN 2.0B

Mechanical Data

CAD model available on request.



Weight 60 grams.

Wiring connectors

1. Mating connector Molex 33471-0606 or Molex 33471-6006 Mx150 6 way connector.

J1

1	V Supply
2	CAN H
3	CAN L
4	RS232 Tx
5	RS232 Rx
6	Gnd

GPS device setup

The GPS device within the unit is UBLOX UDR , this is pre-configured within the device.

The GPS uses Untethered Dead Reckoning (UDR) to create a 20Hz position from internal accelerometers and gyroscopes and GNSS fixes. This has the advantage that positions are updated in areas with bad GPS coverage. The unit must be firmly attached to the vehicle for this to work and the UDR feature is active when ‘GPS-fusionMode’ = 4.

For advanced users who wish to configure the GPS for specific applications the UBLOX u-centre configuration software can be connected to the internal device via the USB by issuing the “gps direct “command within the WSL command interface. Once this command is issued the CAN-GPS-IMU com port will be directly connected to the GPS comm port and will allow connection to the UBLOX software. The CAN-GPS-IMU must be power cycled to resume normal operation.

The CAN-GPS-IMU supports the following message types from the UBLOX GPS module.

NMEA-RMC
NMEA-GGA
NMEA-Gll
NMEA-GST
NMEA-GSA
NMEA-GSV
NMEA-VTG
NMEA-ZDA
UBX_HNR_PVT
UBX_ESF_STATUS
UBX_ESF_INS
UBX_NAV_ATT

Note :

Custom configurations can be complex and only the standard configuration is supported.

IMU device setup

The IMU device within the unit is a Bosch IMU this is pre-configured within the device.

The device produces acceleration gyro and magnetic field readings at 100Hz using an internal algorithm roll, pitch and yaw for the unit in degrees is computed at 50Hz.

Note:

The roll pitch and yaw angle data should be evaluated for each application to assess the accuracy as some high accel and hard iron environments introduce errors and provide misleading data.

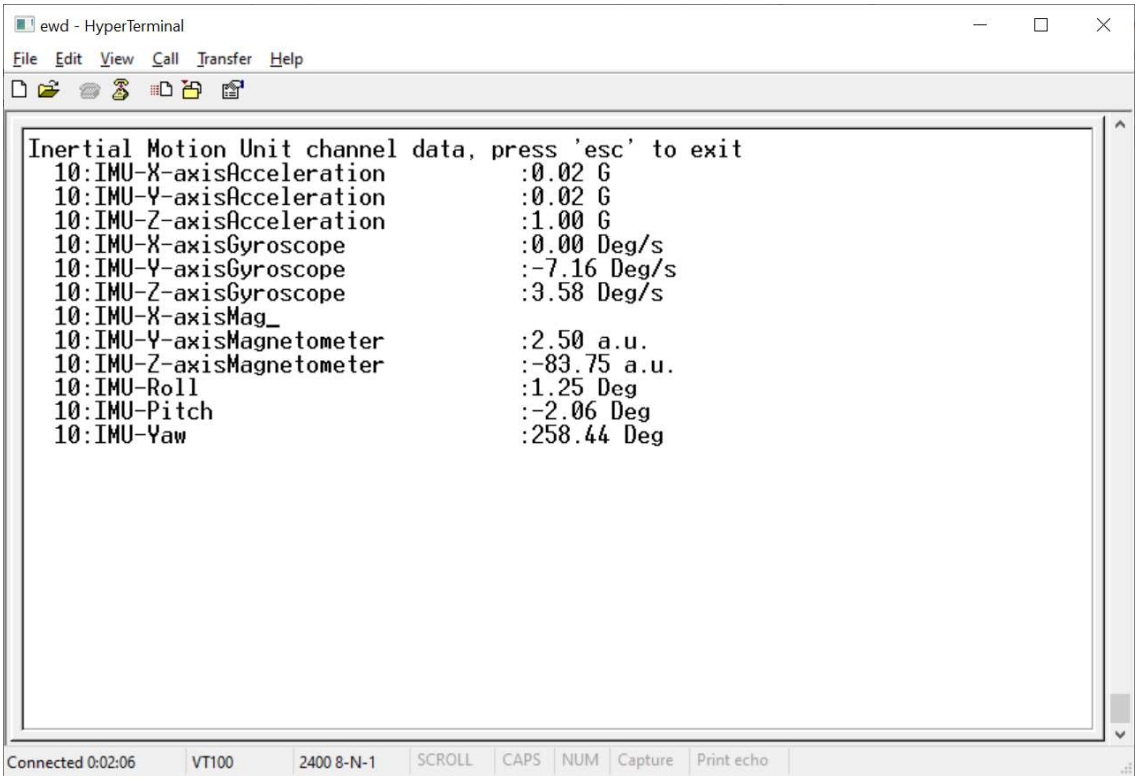
Channels sourced from GPS.

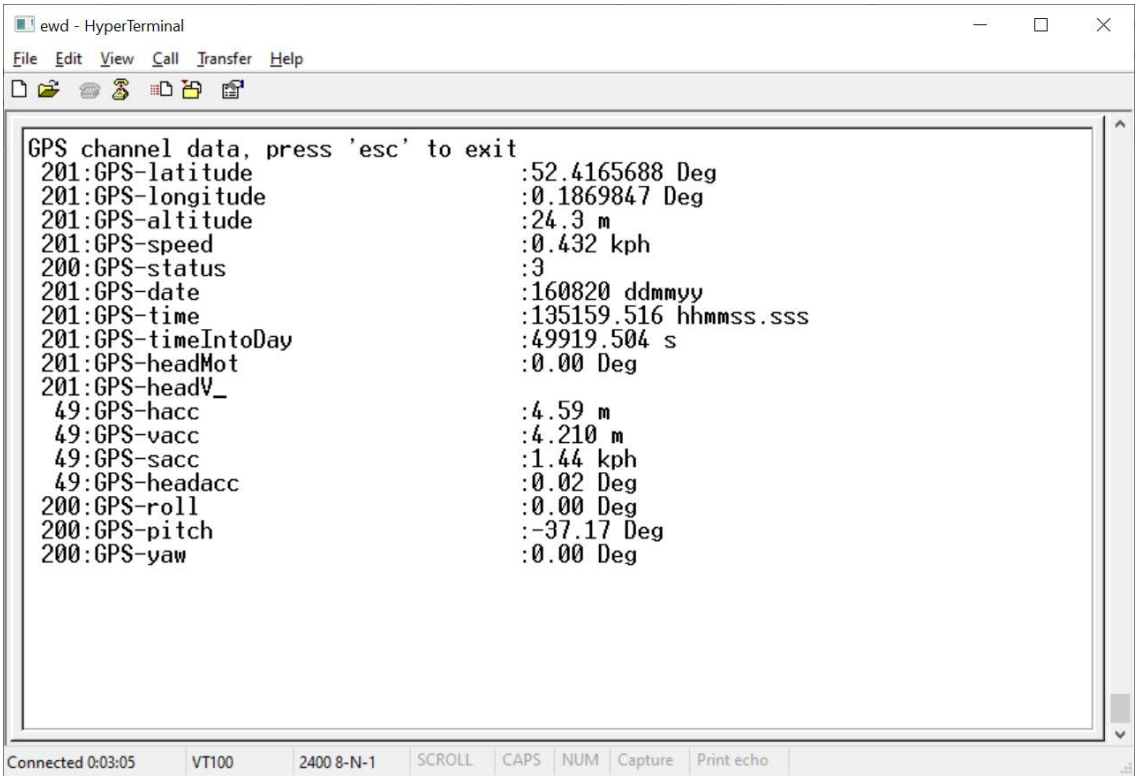
When a device is added to a channel it sources data dependant on the data selected, here is a list of the data sourced from the sensor.

Channel name	Unit	Default Rate
GPS-latitude	Deg	20Hz
GPS-longitude	Deg	20Hz
GPS-altitude	M	20Hz
GPS-speed	kph	20Hz
GPS-status		20Hz
GPS-nsat		20Hz
GPS-pdop		20Hz
GPS-hdop		20Hz
GPS-vdop		20Hz
GPS-cogt	Deg	1Hz
GPS-date	ddmmyy	1Hz
GPS-time	hhmmss.sss	1Hz
GPS-timeIntoDay	S	1Hz
GPS-headMot	Deg	10Hz
GPS-headVeh	Deg	10Hz
GPS-hacc	m	10Hz
GPS-vacc	M	10Hz
GPS-sacc	kph	10Hz
GPS-headacc	Deg	10Hz
GPS-fusionMode		10Hz
GPS-acc-x	G	5Hz
GPS-acc-y	G	5Hz
GPS-acc-z	G	5Hz
GPS-gyro-x	Deg/S	5Hz
GPS-gyro-y	Deg/S	5Hz
GPS-gyro-z	Deg/S	5Hz
GPS-roll	Deg	5Hz
GPS-pitch	Deg	5Hz
GPS-yaw	Deg	5Hz
IMU-X-axisAcceleration	G	50Hz
IMU-Y-axisAcceleration	G	50Hz
IMU-Z-axisAcceleration	G	50Hz
IMU-X-axisGyroscope	Deg/S	50Hz
IMU-Y-axisGyroscope	Deg/S	50Hz
IMU-Z-axisGyroscope	Deg/S	50Hz
IMU-X-axisMagnetometer	a.u	50Hz
IMU-Y-axisMagnetometer	a.u	50Hz
IMU-Z-axisMagnetometer	a.u	50Hz
IMU-Roll	Deg	10Hz
IMU-Pitch	Deg	10Hz
IMU-Yaw	Deg	10Hz

Viewing real time data for a connected GPS.

Data and channel status can be viewed in real time from the sensors within the terminal using the “imu“ and “gps” command .





CAN message transmit of received ant data setup.

The CAN protocol is user configurable via a small csv setup file.

Any channel sourced can be sunk by a CAN message.

Here is an example CAN setup section from a setup.

Setup	CAN	1					
Termination	0						
Speed	1000000						
Name	CanId	offset	size	signed	ratio	zero	period
GPS-latitude	100	0	-32	1	0	0	50
GPS-longitude	100	32	-32	1	0	0	50
GPS-time	101	0	-32	0	0.001	0	50
GPS-speed	101	32	-16	0	0.1	0	50
GPS-altitude	101	48	-16	1	1	0	50
GPS-date	102	0	24	0	1	0	100
GPS-status	102	24	-8	0	1	0	100
GPS-headMot	102	32	-16	1	0.1	0	100
GPS-headacc	102	48	-8	1	0.1	0	100
GPS-nsat	102	56	-8	1	1	0	100
GPS-hacc	104	0	-16	0	0.1	0	50
GPS-vacc	104	16	-16	0	0.1	0	50
GPS-sacc	104	32	-16	0	0.1	0	50
GPS-roll	105	0	-16	1	0.05	0	100
GPS-pitch	105	16	-16	1	0.05	0	100
GPS-yaw	105	32	-16	1	0.05	0	100
IMU-X-axisAcceleration	110	0	16	1	0.01	0	10
IMU-Y-axisAcceleration	110	16	16	1	0.01	0	10
IMU-Z-axisAcceleration	110	32	16	1	0.01	0	10
IMU-X-axisGyroscope	111	0	16	1	0.05	0	10
IMU-Y-axisGyroscope	111	16	16	1	0.05	0	10
IMU-Z-axisGyroscope	111	32	16	1	0.05	0	10
IMU-X-axisMagnetometer	112	0	16	1	0.1	0	10
IMU-Y-axisMagnetometer	112	16	16	1	0.1	0	10
IMU-Z-axisMagnetometer	112	32	16	1	0.1	0	10
IMU-Roll	113	0	16	1	0.05	0	10
IMU-Pitch	113	16	16	1	0.05	0	10
IMU-Yaw	113	32	16	1	0.05	0	10

This Standard setup allows direct connection to the MoTeC range of Loggers and dashes using their standard decode , Cosworth tlf and DBC are also available on request.

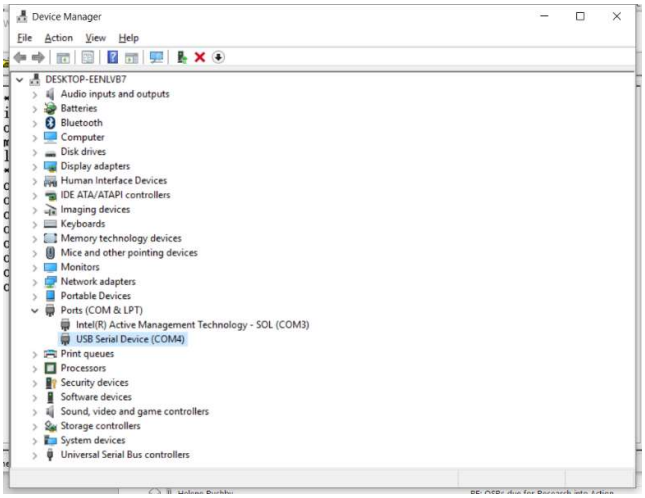
Configuration using USB debug interface

Connection to the WSL is done through Hyperterminal and a USB serial port connection. If you have not connected to a WSL before, you will need to install the correct USB drivers.

Installing USB drivers

The correct USB drivers are contained within the folder lpcopen_examples_windows_usb_drivers_v1.20. The drivers are located in the Hyperterminal folder on the USB flash drive.

Connect the WSL to the computer via a USB cable, switch the WSL on via the switch on the top of the unit. The computer might make the sound that a new USB device has been connected, don't worry if it doesn't we have to hand install the drivers.

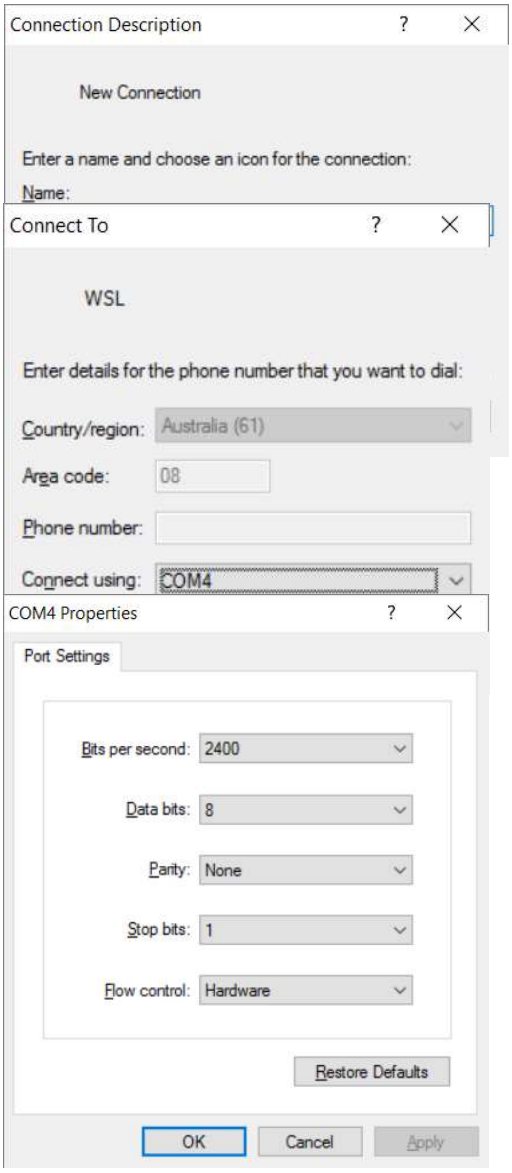


Search for device manager, click on the Ports, find the port that has a question mark. Right click, Update driver. Browse for the driver folder located on the USB flash driver, the x64 folder if your computer is a 64 bit machine.

The computer should then install the correct drivers for the WSL, and give the port a specific number – such as COM4.

Connecting to a WSL

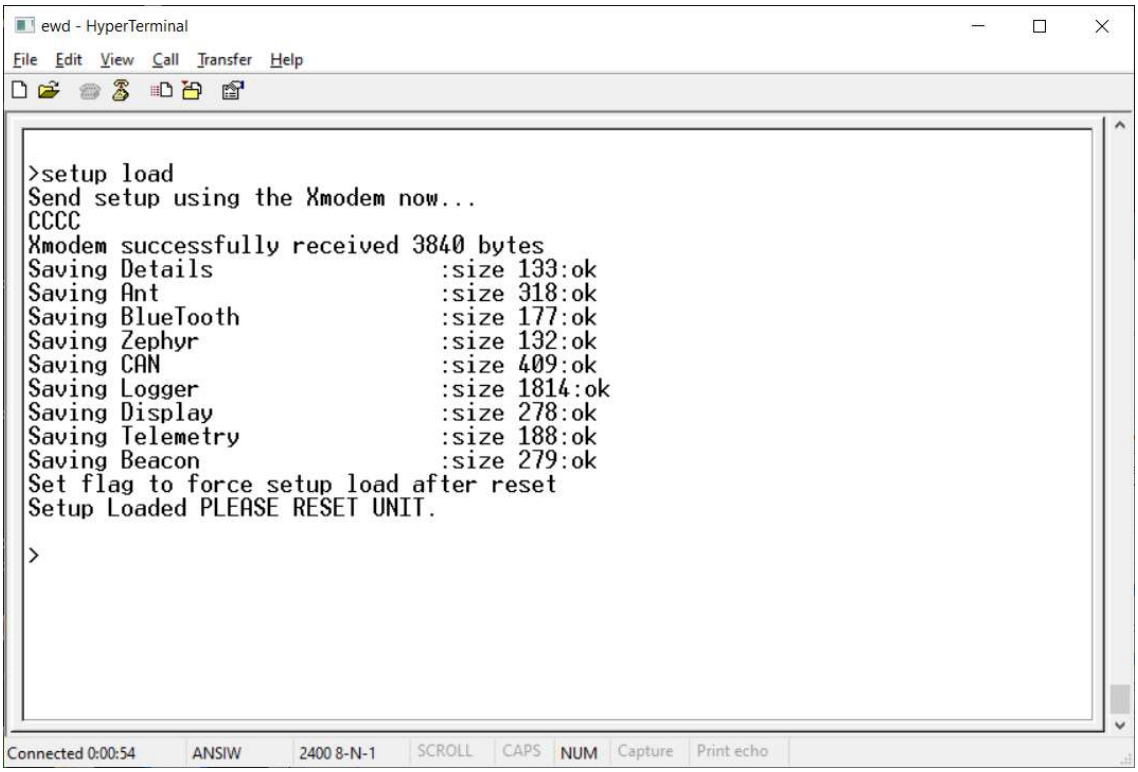
Double click the Hyperterminal Icon a connection name dialogue will come up, call the connection WSL, click okay.



A new dialogue will then appear which is the Connect To. Change the Connect Using: drop down to the COM port that was installed as the USB driver. The quickest way is just to use the down arrow on the keyboard.

Once the correct COM port is selected hit enter.

The COM port properties dialogue will pop up. Don't change anything, just hit enter. This will connect the computer to the WSL.

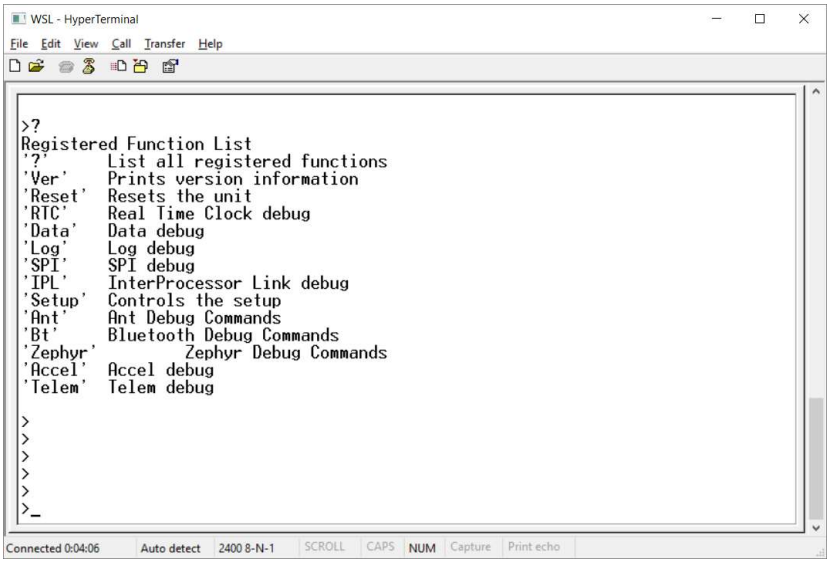


The following dialogue should come up showing that you are communicating to the WSL. At this point you can now program the WSL, watch incoming information, look at the details of the configuration.

List of WSL commands

'?' List all registered functions

You can view all the available commands on the WSL by typing a ?, pressing enter, from the command prompt.



Here is a list of the basic commands:

'Ver' Prints version information.

'Reset'- Resets the unit.

'Ant' view the Ant channels, esc to exit

'Can' view the CAN bus status and data.

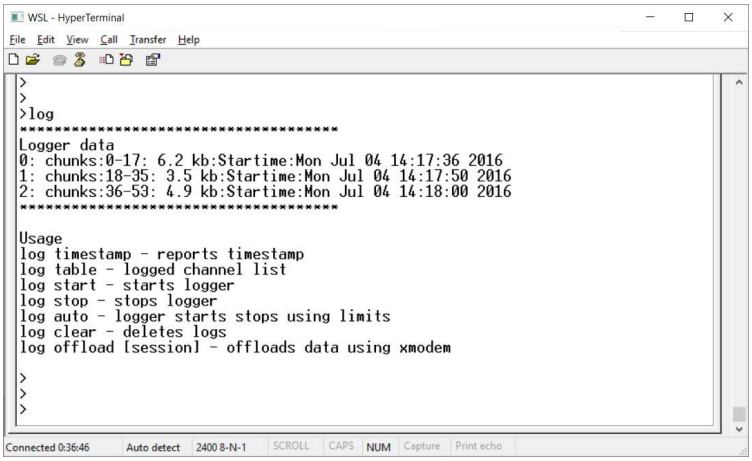
'Log' internal data logger.

'Setup' used to load setup files to the unit.

Internal Data Logger

The Canant is capable of logging data internally (Cost Option) and offloading a tab delimited text file that can be used with many viewers.

The Log command gives access to the all the Log functions such as offloading data files from the box.

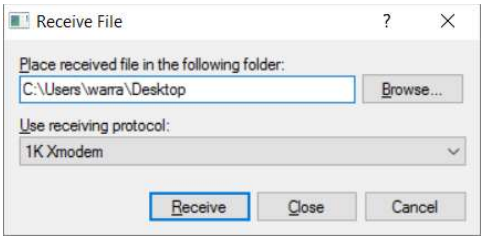


If the WSL has recorded data then the logs are listed under logger data. To offload the data use the command

log offload [session] – the session number being the number of the left hand side under Logger data. An example would be – log offload 1, press enter and you will then follow the procedure to complete a data offload. If you don' designate an effort to offload then the last recorded data set is offloaded.

When you type log offload 1, you will be prompted to Retrieve log data using 1K modem. From the HyperTerminal menu select Transfer, Receive File…

A dialogue will open..select the folder where you want the data to download to and select 1K modem for the receiving protocol, press enter or Receive



A second dialogue will open which is where you set the file name. We have been using a file name definitrion of date_rider_effort.txt.

An example file name would be 20160704_PC_01.TXT

The transfer might time out because you have a limited time to set the information in the two dialogues. If it times out, just repeat the previous two steps, it remembers the first dialogue information so the second time through should be quicker, thus enabling the download.

Once complete a confirmation is printed on the screen.