Datalink Systems Inc
Wireless Data Solutions

i50 Manual (5.10)

(Last updated: Monday, 2 March 2015)

Contents

1.0 Safety Precautions

This product may contain one or more radio frequency (RF) transmitters. For safety reasons, the following operating conditions and restrictions must be observed at all times.

1.1 RF Exposure

WARNING
A separation distance of 20 cm (8″) or more must be maintained between any i50 antenna and all persons

1.2 Antenna Gain

The maximum permitted GPRS antenna gain is limited to 2 dBi

The maximum permitted Iridium antenna gain is limited to 3 dBi

1.3 GPRS Human Exposure Compliance Statement

Enfora certifies that the Enfora Enabler IIIG 850/900/1800/1900 MHz GSM Radio Module (FCC ID: MIVGSM0308) used in this product complies with the RF hazard requirements applicable to broadband PCS equipment operating under the authority of 47 CFR Part 24 Subpart E and Part 22 of the FCC Rules and Regulations. This certification is contingent upon installation, operation and use of the i50B in accordance with all instructions provided to the end user. When installed and operated in a manner consistent with the instructions provided, the Enfora Enabler IIIG module meets the maximum permissible exposure (MPE) limits for general population / uncontrolled exposure as defined in Section 1.1310 of the FCC Rules and Regulations.

1.4 Iridium Human Exposure Compliance Statement

The Iridium 9601 modem is certified under the authority of 47 CFR Part 25 as FCC ID: Q639601. It also complies with Part 15 of the FCC Regulations. Operation is subject to the condition that this device does not cause harmful interference. Any changes or modifications, including the use of a non-standard antenna, not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

1.5 Servicing

The internal i50 modems must only be serviced by qualified technicians.

2.0 i50 Overview

The i50 is Datalink's intelligent asset tracking unit. It is designed for automatic vehicle location (AVL) and two-way data transfer over multiple wireless communications networks via the Datalink DataGate server software. It includes an internal GPS receiver and optional internal modems for a complete solution in one box. Two main i50 versions are produced: the i50B for general commercial use; and the i50C, which includes support for AES-256 encryption.

Standard features:

- Flash memory based microprocessor with upgradeable firmware
- 50-channel GPS receiver (supports GPS and GALILEO* signals)
- Three external RS-232 serial ports (only two available when using internal Wi-Fi)
- Sleep mode with adjustable timeout and periodic wakeup timer
- Wide input voltage range with load-dump protection
- Battery voltage monitoring
- Four digital inputs plus Ignition input
- Four digital outputs
- Two analog inputs
- Switched power output for driving external devices
- Internal flash memory for permanent storage of unit settings
- Internal data buffer with backup battery to eliminate data loss
- Internal 3D accelerometer to monitor driving style and detect movement while in sleep mode
- Panic alert mode
- SCADA ready
- Remote programmable
- Real-time clock (RTC) to timestamp events as they occur

Optional features:

- Internal satellite and cellular modems with dual-mode capability
- Internal Wi-Fi modem
- External J1708 engine interface

The i50's three external serial ports allow it to interface with external devices, including:

- Cellular modem (GPRS/CDMA)
- Satellite modem (Iridium/Inmarsat D+/Globalstar/MSat)
- Sentry 2-way pager system
- RF modem (point-to-point and trunked)
- Magnetic card reader
- Laptop
- Third-party devices
- J-1708 engine interface

Other devices and networks can be made available with custom development.

* Available through GPS firmware update when Galileo system becomes operational.

3.0 Specifications

Size:	168 mm x 128 mm x 39 mm (L x W x H) (excluding connectors)
Supply Voltage:	7 to 30 VDC continuous operation*
	Vehicle load-dump protection (internal resettable fuse)†
	Reverse polarity protection to -60 VDC
Power Usage:	Normal operation (no modems or GPS): 540 mW‡
	GPS: 340 mW (660 mW during acquisition) excluding antenna
	Cellular: 300 mW (2.6 W during TX)#
	Satellite: 410 mW (2.2 W during TX)#
	Wi-Fi: 1.6 W
	Sleep mode: 60 mW‡
Microprocessor:	30 MHz, 128 KB battery-backed RAM
Internal Battery:	CR2032 lithium cell (user replaceable)
	Three-year shelf life (no external power applied)
	Ten-year life while external power is applied
Temperature Range:	-20°C to 50°C (operating)
	-30°C to 60°C (storage)
	-40°C to 85°C (storage with internal battery removed)
External Serial Ports:	RS-232 ESD protected
	COM1: full handshaking (port unavailable when using internal Wi-Fi)
	COM2: full handshaking
	COM3: three-wire (TX/RX/GND)
Switched Power Output:	1.3 A continuous (internal resettable fuse)
	Vehicle load-dump protection†
	Short circuit protection (9 A max)
	Output voltage = Supply voltage – 0.6 V (at 1 A)
Digital Inputs:	Maximum continuous voltage range: -2 to 32 V
	Digital low level: < 1.3 V
	Digital high level: > 6.5 V
	10 kΩ pull-up resistance (excluding IGN input)
Digital Outputs:	Low-side switches (no pull-ups)
	Load voltage up to 60 V
	170 mA continuous per output (internal resettable fuse)
	Short circuit protection (1.9 A max)
Analog Inputs:	Maximum continuous voltage range: +/- 50 V
	Measurement range: 0 to 36 V (12-bit resolution)
	100 Kohm input resistance, 100 pA leakage current
GPS:	U-blox LEA-5H 50-channel receiver
	Signal tracking down to –160 dBm
	Active antenna connector (3.3 V output. 30 mA max)
Accelerometer:	+/- 2 g in X, Y and Z directions
Temperature Sensor:	Internal temperature sensor (-40°C to 125°C)

* 7 - 21 VDC on units with serial numbers from 15020000 to 15029999.
† Internal fuses are slow acting. Some over-voltage conditions may cause permanent damage.
‡ Power usage will increase when external I/O, VOUT, or serial lines are connected.
# Average TX power shown. Instantaneous peak cellular or satellite modem power usage can reach 20 W.

4.0 Connections

Figure 1 and Figure 2 show the front and back panels of the i50. Each external feature is described below.

Figure 1 – Front Panel

Figure 2 – Back Panel

Pwr & I/O:	Main power and input/output (I/O) connector (see section 4.1)
Program:	RJ-45 connector for updating unit firmware (see section 4.3)
NET LED:	Network status indicator (see section 4.4 for LED information)
GPS LED:	GPS status indicator
Wi-Fi:	SMA connector for Wi-Fi antenna (optional)
Iridium:	SMA connector for Iridium antenna (optional)
GPRS:	SMA connector for GPRS antenna (optional)
COM1:	Female RS-232 port (full handshaking)
COM2:	Male RS-232 port (full handshaking)
COM3:	Male RS-232 port (three-wire)
GPS:	SMA connector for GPS antenna. This connector provides a 3.3 VDC output for an active antenna. The i50 will turn off this voltage if it detects a shorted antenna cable, and periodically retry applying power until the fault is corrected.

4.1 Power and I/O Connector

Table 1 shows the pin assignment of the 14-pin power and input/output connector, shown looking into the connector on the front panel.

PWR	IGN	IN1	IN2	IN3	IN4	ADC1
GND	VOUT	OUT1	OUT2	OUT3	OUT4	ADC2

Table 1 – Power & I/O Connector

PWR: Positive supply. **Note: continuous voltage on this pin MUST NOT exceed the rated maximum**.
IGN: Vehicle Ignition (active high)
IN1: Digital Input 1
IN2: Digital Input 2
IN3: Digital Input 3
IN4: Digital Input 4
ADC1: Analog Input 1
GND: Negative supply (ground)
VOUT: Switched power supply output. See section 4.2 for more information.
OUT1: Digital Output 1
OUT2: Digital Output 2
OUT3: Digital Output 3
OUT4: Digital Output 4. This output pin is not available for user control in firmware versions below 4.11. It is hard coded to an active-low state in firmware versions 4.11 to 4.70. Versions 4.71 and later have full support for output 4.
ADC2: Analog Input 1

See section 3.0 for detailed specifications on these pins.

4.2 VOUT Power Source

The VOUT line provides a switched power output, allowing the i50 to turn an external device on or off. By default, VOUT is active (power turned on) when the i50 is awake, and disabled during sleep mode. Note: in this default state, VOUT is not activated during a periodic wakeup event, when the unit is only awake for a short time (see section 6.2). VOUT can also be configured to behave like one of the digital output lines.

VOUT is supplied from the input power source. Output voltage will follow the supply voltage, with a drop for an inline protection diode and switch. At low currents this drop will be approximately 0.2 V, increasing to 0.8 V at 1.3 A.

This output is available on the power and Program connectors, as well as COM3 (factory option). I50 version 3 hardware provides a VOUT signal on all external COM ports.

Note: the maximum continuous VOUT current is 1.3 A, which is shared between all VOUT lines.

4.3 Program Connector

The i50 Program connector is used to update the unit's firmware and adjust settings. It may also be used to access the i50 COM1 port (see section 4.5.4). Firmware can be updated by connecting a PC to the Program port and running the firmware update utility.

Table 2 shows the pin assignment of the Program connector, including the connections required to attach a female DB-9 connector. Pin 1 is located on the right side looking into the connector on the front panel. All pins (except VOUT and GND) use RS-232 voltage levels.

RJ-45 Pin	Pin Name	Direction (relative to i50)	DB-9 Pin (female)
1	VOUT	Output	-
2	MODE	Input	7 (RTS)
3	RX	Input	3 (TX)
4	STATUS	Output	6 (DSR)
5	TX	Output	2 (RX)
6	RESET	Input	4 (DTR)
7	Not used	-	-
8	GND	-	5 (GND)

Table 2 – Program Connector

VOUT: Switched power output. See section 4.2 for more information
MODE: Used to enter firmware programming mode. Turn off (low) for normal use
RX: Data input
STATUS: Indicates CPU mode
TX: Data output
RESET: Used to reset CPU. Must be turned off (low) for normal operation
GND: Ground

Note: this pin layout has been chosen so that a Datalink Mobile Data Terminal (MDT) can be plugged in using a standard RJ-45 to RJ-45 LAN cable. The MDT provides an LCD screen and keypad for applications where an advanced user interface is required.

4.4 LED Status Indicators

The i50 has two light-emitting diodes (LEDs) attached to the Program connector on the front panel. These lights flash to indicate what mode the unit is in. The following states can be shown:

Power Up:	NET and GPS LEDs turn green briefly when power is applied
No Settings:	NET and GPS LEDs switch between red and green every second
Programming:	NET and GPS LEDs switch between red and green rapidly
Error:	NET and GPS LEDs alternate red rapidly (see section 6.7)
Sleeping:	NET LED flashes orange (red plus green) every two seconds GPS LED off

When the unit is in normal operating mode, the LEDs are used to show network and GPS status, as follows:

NET LED:

Red flashes: no network signal
Green flashes: network and server OK
Red and green flashes: network OK, but can't access server

One flash per second: no data in buffer
Two flashes per second: data waiting to be sent
Three flashes per second: alarm active (ACK received)
Four flashes per second: alarm active (waiting for ACK)

GPS LED:

Red flashes: no GPS signal - check antenna position
Green flashes: GPS signal OK

One flash per second: GPS antenna OK
Four flashes per second: GPS antenna short circuit

4.5 COM Connectors

The i50 has three external DB-9 serial connections: COM1, COM2 and COM3. These all use RS-232 voltage levels, with ESD protection.

4.5.1 Automatic Shutdown (i50 hardware versions < 3)

The COM2 and COM3 ports will not automatically wake up until a valid external RS-232 signal is present. Once awake, the ports will shut down immediately when all RS-232 signals have been removed. Note: because COM3 shares some lines with the internal Iridium modem, it will always stay awake while the Iridium modem is enabled (requires internal Iridium modem to be installed).

Important note for Garmin users: newer NUVI devices also keep their serial ports turned off until valid signals are detected. Because of this, they will not work correctly with the i50's COM2 port. The COM3 port will only work with these devices if an internal Iridium modem is present and enabled. The same applies to any external devices that power down their ports when no signal is detected, such as many RS-485 converters.

I50 version 3 hardware automatically enables the COM2 and COM3 ports while it is awake, and disables them when sleeping.

4.5.2 COM1

COM1 has a female connector, through which the i50 acts as a DCE (data communication equipment). This is intended for connection to a PC or other terminal, but can be used for any purpose. See Table 3 for pin descriptions.

DB-9 Pin (female)	Pin Name	Direction (relative to i50)
1	DCD	Output
2	RX	Output
3	TX	Input
4	DTR	Input
5	GND	-
6	DSR	Output (always high) / VOUT*
7	RTS	Input
8	CTS	Output
9	RI	Output

Table 3 – COM1 Connector

Note: the COM1 DSR pin is always active (high) when COM1 is enabled (hardware version < 3).

COM1 is turned on and off by the i50, based on the Port A route setting. The port is enabled when Port A is routed to COM1, and disabled when Port A is routed to the program connector or internal Wi-Fi.

* In i50 hardware version 3, the COM1 DSR line is connected internally to the VOUT signal.

4.5.3 COM2/COM3

COM2 and COM3 use male connectors, through which the i50 acts as DTE (data terminal equipment). These ports are intended to connect to external modems, but may also be used for other purposes.

COM2 provides most handshaking and control pins, allowing full control of external devices and hardware flow control to prevent data loss. Table 4 shows the COM2 pin descriptions.

DB-9 Pin (male)	Pin Name	Direction (relative to i50)
1	DCD	Input
2	RX	Input
3	TX	Output
4	DTR	Output / VOUT*
5	GND	-
6	DSR	Input (ignored)
7	RTS	Output
8	CTS	Input
9	RI	Input

Table 4 – COM2 Connector

Note: the COM2 DSR pin is ignored by the CPU.

COM3 uses a three-wire interface, so is unable to support hardware handshaking. Table 5 shows the COM3 pin descriptions.

DB-9 Pin (male)	Pin Name	Direction (relative to i50)
1	Not used	-
2	RX	Input
3	TX	Output
4	DTR	Output (always high) / VOUT*
5	GND	-
6	Not used	-
7	RTS	Output (always high)
8	Not used	-
9	VOUT	Factory Option

Table 5 – COM3 Connector

Note: the COM3 DTR and RTS pins are always active (high) when COM3 is awake. This allows attached devices to communicate if they are expecting these signals to be present.

COM3 pin 9 can be modified at the factory to provide a VOUT source. See section 4.2 for more information.

* In i50 hardware version 3, the COM2 and COM3 DTR lines are connected internally to the VOUT signal.

4.5.4 Using Program connector to access COM1

The Program RJ-45 connector can be configured to access the COM1 signals, in which case the COM1 DB-9 connector is disabled. This allows easy connection of an external terminal, especially one requiring a switched power source (which is provided on the Program connector).

Note: external devices connected to the Program connector MUST NOT activate the RESET line (DTR on), or else the i50 CPU will reset and stop working until the line is deactivated.

4.6 Antenna Connectors

The front panel provides Wi-Fi, Iridium and GPRS antenna connectors (SMA). Each connector will only be present if the matching modem is installed internally. Note: antennas should always be attached before applying power to the i50 to prevent damage to internal modems and also to allow the GPS receiver to perform automatic noise profiling.

The back panel includes the GPS antenna connector (SMA). This connector provides a 3.3 VDC output for an active antenna. The i50 will turn off this voltage if it detects a shorted antenna cable, and periodically retry applying power until the fault is corrected.

5.0 Installation

The i50 is designed to be installed inside a vehicle or other asset. It operates over a wide temperature range (-20°C to 50°C), but should not be placed in an engine compartment or anywhere temperatures can exceed the operating values. An external case is recommended if operating the unit in wet or dusty environments. See section 3.0 for detailed specifications.

5.1 Device Orientation

The i50 may be installed in any orientation. However, if the optional internal accelerometer is being used to detect high g-forces, the mounting angles must first be set. See section 9.0 for details on configuring the accelerometer.

5.2 Power Supply

Connect the i50 ground line to vehicle ground (or negative battery terminal). Then connect the power line to a continuous voltage source (or positive battery terminal). Make sure to select a voltage source that remains active while the vehicle starter motor is engaged. It is recommended to use an external 5 amp fuse on the power line.

Connect the VOUT line to any device you want to power up while the i50 is awake. This is commonly used to power an external data terminal such as the Datalink Mobile Data Terminal (MDT).

5.3 I/O Connections

The i50 will operate successfully with only power and ground I/O connections. In this configuration, it can be set to use battery voltage to detect engine running, and use its accelerometer to detect motion to wake up from sleep.

However, it is recommended to connect the IGN input to a vehicle ignition source (high voltage only when ignition is turned on). The i50 can then be configured to wake up and go to sleep as IGN is turned on or off.

If accurate engine hour calculations are required, the default method of using battery voltage to detect engine running may not be reliable enough. In this case, one i50 input can be configured as an “Engine On” input, and connected to a vehicle circuit that is active only while engine is on (oil pressure, fuel pump, etc).

See section 13.0 for more information about Input configuration.

You can also use the i50 digital outputs to control external circuits. These outputs can be controlled remotely, and maintain their state while the i50 is sleeping.

5.4 COM Connections

Use the three serial ports (COM1, COM2, and COM3) to connect external RS-232 devices to the i50. These ports are commonly used to connect modems or external data sources.

5.5 Antennas

Before turning the i50 on for the first time, ensure all antennas have been attached. Note: antennas are not normally supplied with the unit. Operating without antennas may cause high voltages on the modem power amplifiers, possibly damaging the modem circuits.

See section 1.2 for important information about antenna selection.

Note: to allow automatic noise profiling, the GPS antenna should be attached BEFORE turning the unit on.

5.6 Initial Set Up

Important: install and run the i50 Programmer software to program the unit settings (see section 7.0).

Use the Programmer to configure:

- How the I/O lines and serial ports have been connected
- Reporting intervals
- Which events will be generated by the i50
- Network and hardware parameters
- Accelerometer angles (also see section 9.0)

6.0 Operation

6.1 LEDs

The i50's LEDs will turn on briefly when power is applied, then start flashing. See section 4.4 for details on what the flashes mean. If no LED activity is seen, check that power is being applied to the correct pins, and that voltage and polarity are correct.

6.2 Power Modes

The i50 has three power modes: asleep (sleep mode), awake, and periodic wakeup.

During sleep mode, the i50 turns off its GPS receiver, internal modems and COM ports, and the microprocessor enters a low power mode. The VOUT power source is also turned off to shut down any externally connected devices. This allows the i50 to remain connected to a vehicle power supply over an extended period without draining the battery. While asleep, the i50 continues to monitor its digital input pins and records any changes in its data buffer for later transmission. Note: there is no way to contact the i50 remotely while it is asleep, as all modems are powered down.

In awake mode the i50 turns on all its internal devices, activates the VOUT power source, and begins normal operation.

Periodic wakeup mode occurs when the unit wakes briefly to send its position then goes back to sleep. All internal devices are turned on, but the VOUT power source is not activated in this mode.

6.2.1 Power Up

Upon power up, the microprocessor determines its power mode using these parameters:

1) If an input alarm is active (see section 13.4), select awake mode.
2) If the "Sleep Timeout" setting is set to zero, select awake mode.
3) If any input is configured as "Priority" and is active, select awake mode.
4) If the "Wake on motion" bit is set and motion is detected, select awake mode.
5) If the "Sleep Pin" digital input is inactive, select awake mode.
6) If the "Wake at boot" bit is set, select periodic wakeup mode. The i50 will wake up, attempt to send its position, then enter sleep mode.
7) Otherwise enter sleep mode immediately. Note: a power up report will be buffered and sent at a later time.

6.2.2 Entering Sleep Mode

During awake mode, the microprocessor uses these parameters to determine when to sleep:

1) If an input alarm is active, stay awake.
2) If the "Sleep Timeout" setting is set to zero, stay awake.
3) If any input is configured as "Priority" and is active, stay awake.
4) If the "Wake on motion" bit is set and motion is detected, stay awake.
5) If the "Sleep Pin" digital input is active, start a timer. If the timer reaches the "Sleep Timeout" period, enter sleep mode.

6) Otherwise reset the timer and stay awake.

When entering sleep mode, the i50 will queue a sleep event, then wait until it is sent. The “Max Send Wait Time” setting limits the maximum time the unit will wait in case there is no network coverage.

6.2.3 Returning to Awake Mode

While sleeping, the microprocessor uses these parameters to determine when it should wake up:

1) If an alarm input is toggled, enter awake mode.
2) If any input is configured as “Priority” and is active, enter awake mode.
3) If the “Wake on motion” bit is set and motion is detected, enter awake mode.
4) If the “Sleep Pin” digital input is inactive, enter awake mode.
5) If the “Periodic Wakeup” timer expires, enter periodic wakeup mode.
6) Otherwise stay asleep.

6.2.4 Periodic Wakeup

An optional timer can be configured using the “Periodic Wakeup” setting, which forces the unit to send its position periodically during periods of sleep. During this wakeup period the unit will attempt to obtain a GPS location and then send this to the server, before going straight back to sleep. The “Max GPS/Send Wait Time” settings limit the maximum time the unit is awake, in case there is no GPS or network coverage.

6.3 Motion

Asset motion is detected using the following techniques (in order of precedence):

1) If an accelerometer is installed, and the Use Accelerometer to Detect Motion option is enabled, the i50 detects motion based on vibration measurements from the sensor. When instantaneous vibrations exceed the programmable motion threshold, the i50 is moving. When the one-second average vibrations are lower than the threshold, the i50 is stationary.
2) If any serial port is configured for OBD-II data, a non-zero OBD vehicle speed indicates i50 is moving. A zero OBD speed reading, or no OBD data, implies i50 is stationary.
3) If GPS signal is valid, a GPS speed greater than the GPS Start Speed indicates motion. GPS speed less than or equal to the GPS Stop Speed implies i50 is stationary.

The motion reading is used in the calculation of drive time, idle time, fuel used, idle fuel, start/stop events, and tow alerts. It is also used to switch the city/highway reporting mode when the thresholds are set to zero.

6.4 Engine Running State

The i50 attempts to detect the vehicle engine running state to calculate engine running hours, drive time, and idle time. The engine state is detected as follows (in order of precedence):

1) If OBD-II data is available, engine is running if RPM exceeds 300.
2) If any input is configured as Engine-On, engine is assumed to be on if the input is active.
3) If the Engine On Battery Voltage setting is non-zero, engine is assumed to be on when the battery voltage exceeds this level.
4) Otherwise, IGN input is used. IGN high indicates engine is running.

6.5 Network

The i50 monitors all connected modems for network signal, and chooses the lowest cost option available when sending data. For example, an i50 can be configured with both satellite and cellular modems. While in cell coverage, all data will be sent through the cellular modem, but if coverage is lost the i50 will automatically switch to the satellite modem. When cell coverage is regained the unit will switch back immediately to the lower cost modem.

When no network is available, or the i50 has been configured to buffer reports, the outgoing packets will be stored in memory for transmission at a later time. Up to 200 events or 2000 GPS positions can be buffered at once. An internal backup battery keeps all buffered reports retained in memory if the i50 is turned off.

6.6 Packet Size

Data packets will vary in size depending on the i50 settings and available data. Size will also depend on which network is being used. The following list shows approximate payload length:

Standard GPS Report:	16 bytes
Advanced GPS Report:	21 bytes (basic information)
	41 bytes (all options)
Basic Events:	Add 1 byte
Status/Start/Stop Events:	Add 51 bytes (without OBD-II)
	Add 84 bytes (with OBD-II)

On top of these payloads, cellular and RF networks require a 3 byte Asset ID. Cellular packets will also be embedded in UDP/IP datagrams, adding 28 bytes.

Lastly, the server will send ACK packets over cellular and RF networks to acknowledge receipt of the data. These ACKs will add 4 bytes (32 including UDP cellular datagram).

Note: when the i50 has buffered multiple positions in memory, the overall packet size will be smaller. For example, 19 standard GPS reports will fit into a single 250 byte packet. Buffering can be enabled on a per-network basis using the i50 settings.

6.7 Error Handling

In the event of a firmware error, a watchdog timer inside the i50 will automatically restart the device after a one second delay. Once restarted, the i50 will send a data packet containing the error details to the server to identify the problem.

During the restart delay the LEDs on the front panel will alternate red quickly to indicate the error condition. If further errors occur, the delay before restarting is increased exponentially. This prevents excessive data usage in case of a recurring problem.

Any errors should be forwarded to Datalink technical support at support@datalinksystemsinc.com.

7.0 Configuration

Initial device settings can be configured using the i50B Programmer utility (Windows only). This is available on the Datalink web page at http://www.datalinksystemsinc.com/download.html.

Download and install the programmer, then run it using the shortcut on the Start menu in the All Programs/DataNet folder. Figure 3 shows the Programmer window.

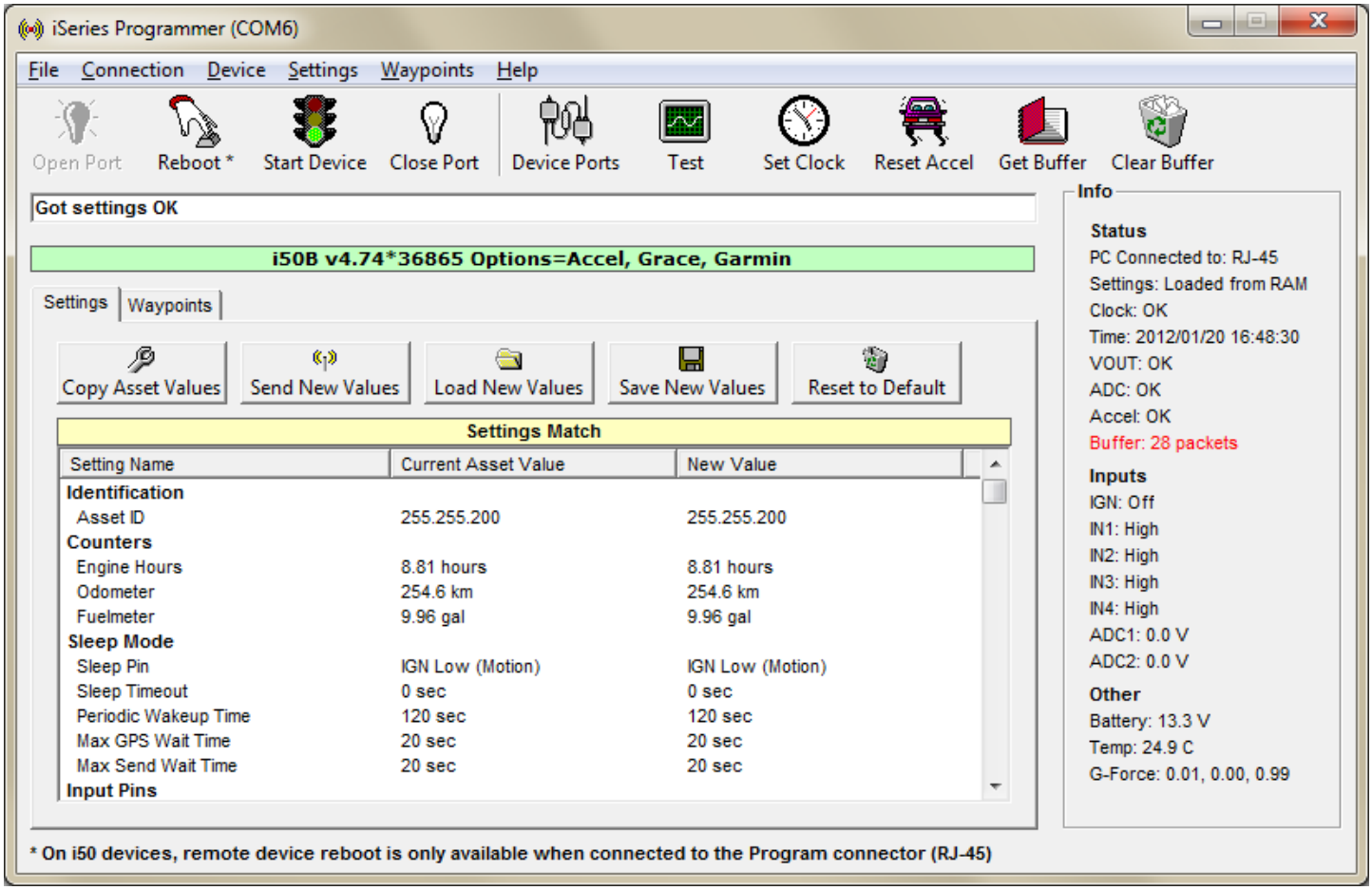


Figure 3 – i50B Programmer

7.1 Connecting a PC to the i50

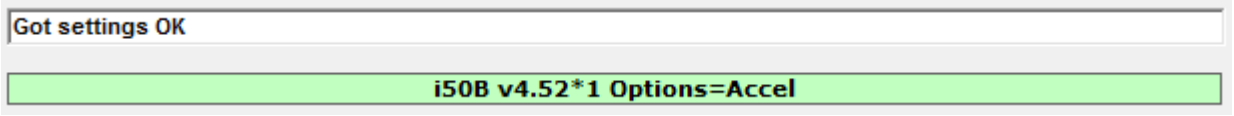
The i50 is normally programmed through the Program connector on the front panel. See section 4.3 for information on making a cable to connect from a PC serial port to the RJ-45 connector. Using this connector allows the programmer to reboot the device without removing power. This can be useful if the device is installed in a hidden location where it is difficult to access the power connector. In this case a programming cable could be left installed in the vehicle, allowing quick programming changes in the future.

Firmware versions 3.95 or newer also allow programming through the COM ports on the back panel. The i50 will automatically scan each port during boot up to detect programming signals.

7.2 Programming

When the i50 Programmer starts for the first time, it will ask which PC COM port should be used to connect to the i50. This can be changed at any time using the Connection/Select Port menu. Once the port is selected, the programmer will attempt to open the connection and send programming commands to the i50. If the port is open at the time the programmer application is closed, it will automatically be opened the next time the programmer starts. The *Open Port* and *Close Port* buttons can also be used to open and close the port manually.

Connect the i50 to the PC COM port, and reboot the i50 to enter programming mode. A reboot can be forced by removing power briefly, or by using the *Reboot* button on the programmer toolbar. Note: the reboot button only works when the PC is connected to the device's RJ-45 Program connector. If successful, the programmer will show a "Got settings OK" message, along with the detected firmware version and any optional features.



Optional features can be included in custom firmware, depending on customer requirements and available firmware space. The current options include:

Accel:	3D accelerometer support
AES-256:	Encryption available on the i50C only
PDT:	Support for PDT-100 satellite terminal
GS:	Globalstar 1620 support
Dial-up:	Allows a third-party to connect to an i50 serial port using PPP
RF:	RF modem support
OBD-II:	External OBD-II engine monitoring
Driver:	Driver ID features (when using Garmin terminals)
Wi-Fi:	Internal Wi-Fi module
No Waypts:	Waypoints turned off
Grace:	Support for Grace pagers
Kenwood:	Enables interface to NXDN/Fleetsync radio systems
Garmin:	External Garmin terminal for messaging and route planning
Signs:	Transparent data port modified to talk to portable road signs
NTCIP:	Transparent data port modified for NTCIP signs
Amsig/NTCIP:	Transparent data port can send to portable or NTCIP signs.

The programmer automatically reads the asset's settings, which are shown under the "Current Asset Value" column. If no local data exists, the programmer automatically creates a local copy that can be modified by a user, shown under the "New Value" column. Figure 4 shows the settings window where two values have been modified by a user. Any settings that do not match the asset values are shown in red, and a red bar is displayed to warn of the mismatch. This provides a quick method of tracking changes before they have been sent to the asset. At any time the current asset values can be copied into the local values using the *Copy Asset Values* button, erasing any changes the user has made.

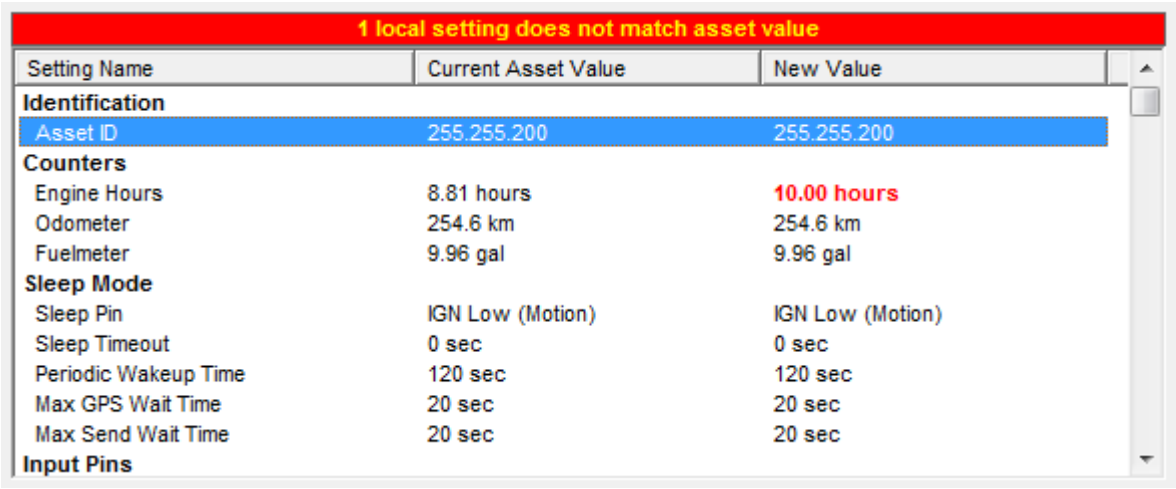


Figure 4 – Editing Settings

Settings can also be read from and written to the PC disk drive for future use using the *Load/Save New Values* buttons. Note that these buttons work with the local settings copy, and do not read/write to the asset.

Click on the *Send New Values* button to write the modified values to the device. A confirmation window will be shown to indicate which settings will be changed (Figure 5). Click OK to write the values to the i50. The programmer will then read back the values to make sure they match OK.

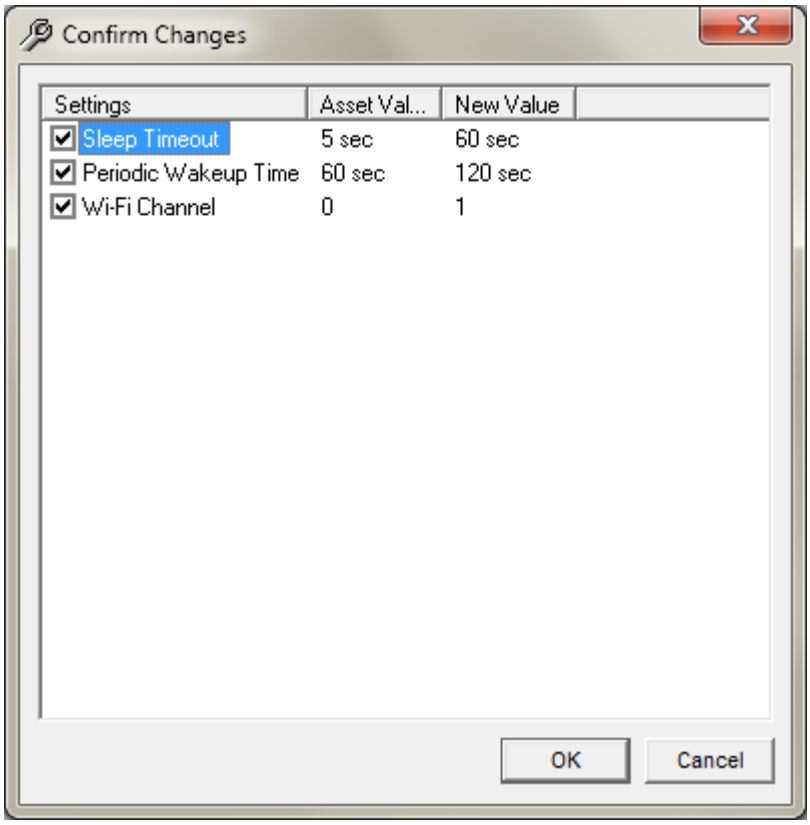


Figure 5 – Confirm Setting Changes

i50 settings are stored in non-volatile memory, so they will be retained if the power supply is removed (even if the internal backup battery is flat).

When finished programming, use the *Start Device* button to have the i50 exit programming mode and begin normal operation. The programmer will automatically close the PC COM port at this stage to prevent sending data to the i50.

Note: once the initial settings have been made and the device is communicating with the DataGate server, ALL settings can be adjusted remotely from the DataGate interface (see section 15.0 for details). The DataHost client software can also be used for remote configuration, although this is limited to adjusting reporting and other common features.

7.2.1 Programmer Toolbar

Open Port:	Open PC COM port. Use the Connection/Select Port menu to select the desired port.
Reboot:	Attempt to reboot the i50. This will only work if the PC is connected to the i50 Program connector (RJ-45).
Start Device:	Instruct the i50 to exit programming mode and begin normal operation. The programmer will close the COM port at this stage to prevent sending data to the i50.
Close Port:	Close PC COM port.
Device Ports:	Open the Ports window. See section 7.4.
Test :	Open the Test window. See section 7.5.
Set Clock:	Set the i50 Real Time Clock (RTC) to match the PC's clock. Note that the programmer determines the time in UTC format so that it is written correctly no matter what time zone the PC is in.
Reset Accel:	Cause the i50 to automatically calibrate its accelerometer. A short list of instructions is shown to assist in the calibration.
Get Buffer:	Retrieves any packets in i50 memory and saves to disk.
Clear Buffer:	Clears all position and event packets from the i50 buffer. Note that the i50 will send a special event to indicate that its buffer has been cleared.

7.2.2 Settings

Double-click on a setting to modify its value. See section 15.0 for default values. The following settings are supported (some may not be available or supported, depending on i50 firmware version):

Identification

Asset ID:	ID (0.0.0 to 255.255.255), used to identify unit on server.

Counters

Engine Hours:	Accumulated engine hours counter.
Odometer:	Accumulated odometer reading.
Fuelmeter:	Accumulated fuel used.

Sleep Mode

Sleep Pin:	Selects which pin (and polarity) will be monitored to put unit into sleep mode. On power up, normal behaviour is to go straight into sleep mode if the sleep pin is active. However, there is also a “Wake at boot” option to force the unit to wake up when power is applied. The “Wake on motion” option causes the unit to wake up when motion is detected.
Sleep Timeout:	Delay after sleep pin activated (and motion stops, if the “Wake on motion” option is set under the “Sleep Pin” setting) before unit enters sleep mode. Set to zero to disable sleep mode.
Periodic Wakeup:	While sleeping, the unit can wake periodically to send its location. Set to zero to disable periodic wakeups.
Max GPS Wait Time:	Max time to wait for valid GPS signal during a periodic wakeup.
Max Send Wait Time:	Max time to wait for modem to go online and send data when entering sleep mode.

Input Pins

Report IGN:	Select whether to send events when IGN line changes state.
Debounce IGN:	Time required to trigger an IGN change.
Report Input 1-4:	Select whether to send events when input lines change state.
Debounce Input 1-4:	Time required to trigger an input change.
Input 1-4:	Select input type. See section 13.0 for more information.
Input 1-4 Polarity:	Select polarity of input signals.
ADC1-2 High Voltage:	Trigger event when ADC voltage exceeds this level.
ADC1-2 Low Voltage:	Trigger event when ADC voltage drops under this level.
Debounce ADC1-2:	Time required to trigger an ADC change.

Output Pins

Output 1-4:	Select output type. See section 13.0 for more information. Note: the fourth i50 output is not available with firmware versions before 4.71.
Output 1-4 Polarity:	Polarity for output signals. For General Outputs, the polarity defines the current output state (high or low).
VOUT Function:	Controls behaviour of VOUT pin.
VOUT Polarity:	VOUT polarity when using VOUT as an output signal.

Alarm

Alarm State:	Value used internally to track alarm status.
Alarm ID:	Counter used to identify alarms.

Report Intervals

City Threshold:	Unit uses City reporting settings when speed drops below this value. If set to zero, city settings are used whenever the i50 is stationary. See note on highway threshold setting.
Highway Threshold:	Unit switches to Highway reporting settings when speed reaches this value. If set to zero, highway settings are used whenever the i50 is moving. See section 6.3 for information on how the i50 detects motion. Note: when unit speed is between

	the city and highway thresholds, the current city/highway mode is maintained. If both thresholds are active, the city threshold will be selected. When the city/highway mode changes, firmware versions >= 4.96 will select the shortest time and distance settings until the next report is triggered.
City Time Reports:	Used to enable periodic position reports in City mode. Options are provided to disable these reports when IGN is off or device is stationary.
City Max Time:	Interval for City periodic reports.
Highway Time Reports:	Enable periodic position reports in Highway mode.
Highway Max Time:	Interval for Highway periodic reports.
City Distance Reports:	Enable position reports based on distance travelled in City mode.
City Distance:	Distance between reports in City mode.
City Min Time:	Minimum time between reports in City mode.
Highway Distance Reports:	Enable position reports based on distance travelled in Highway mode.
Highway Distance:	Distance between reports in Highway mode.
Highway Min Time:	Minimum time between reports in Highway mode.
Dual-Mode Min Time/Dist:	Minimum time/distance between sending reports when operating on satellite network and unit is configured to use both satellite and terrestrial modems. Note: reports will still be generated and stored based on the City/Highway settings, but only sent if the dual-mode settings have been reached. Set to zero to disable.

Events

System Events:	For firmware versions >= 4.77, this setting controls whether power up/down and error events are generated by the i50.
Overspeed Reports:	Select whether unit sends alerts when overspeed condition detected.
Overspeed:	Speed limit for overspeed condition.
Overspeed Time:	Allowed time for overspeed condition, after which alert is sent.
Stop Reports:	Send report when unit stops. See section 6.3 for information on how the i50 detects motion. Firmware versions >= 4.96 allow choice between sending a stop event or standard position.
GPS Stop Speed:	GPS speed under which unit is considered stopped (if not using accelerometer or OBD signal to detect motion).
Stop Time:	Period unit must remain stopped to trigger a Stop event. A stop is triggered immediately if the IGN signal turns off.
Start Reports:	Send report when unit starts moving. See section 6.3 for information on how the i50 detects motion. Firmware versions >= 4.96 allow choice between sending a stop event or standard position.
GPS Start Speed:	GPS speed over which unit is considered moving (if not using accelerometer or OBD signal to detect motion).
Start Time:	Period unit must remain moving to trigger a Start event or tow alert.

Use Accel to detect motion:	If enabled, the unit will use g-force readings to detect when the unit is moving, rather than using the OBD port (if enabled) or GPS Stop/Start Speed settings. See section 6.3 for details. **Note: firmware versions 4.79 to 4.89 have a bug where enabling this setting causes invalid speed readings. It is highly recommended to disable this option when using these firmware versions.**
Status Reports:	Controls the interval for sending status reports, which contain odometer and engine hour counters as well as other accumulated values. Set to zero to disable.
Waypoint Reports:	Enable Waypoint alerts.
Heading Change:	If set greater than zero, position reports are generated when unit heading changes by this value.
Heading Time:	Heading must change for more than this period to trigger report.
Max Idle Time:	Send report if unit stops moving for this period while engine is running.
Send Tow Alerts:	Send event when vehicle motion is detected for at least “Start Time” duration and IGN is off.
Engine On Battery Voltage:	Assume engine is running when input voltage exceeds this limit.
Low Battery Voltage:	Alert will be triggered when battery voltage drops below this level for 20 seconds. Alert will not retrigger until voltage has risen 1 V above limit for 10 minutes. Set to zero to disable.
Invalid GPS Warning:	Sends an alert when the GPS signal has remained invalid for a certain time. Since version 4.88, the timer for this event only increments when the vehicle is moving. This prevents warnings where a vehicle is parked in a covered area.

Data Format

Send Full Heading:	Option to send full heading (accurate to one degree) instead of eight-point compass reading. Note: this option adds one byte to each position packet.
Advanced GPS:	Modify the data included in each position report. This allows you to customize what data is sent to the server, and minimize packet size by sending only what is required.
Encrypt Packets:	Turn encryption on. This option is only available for i50C firmware, and requires a DataGate-256 server.
AES-256 Key:	Encryption key. This must be a 64-character hex string, containing digits 0-9 or letters A-F.

Data Buffering

Buffer Period:	If buffering is enabled, packets will be stored for this period, and then sent together. This option will increase efficiency for time-based networks (Globalstar) and IP networks (cellular).
Buffer Type:	Type of data to buffer. 0=GPS only. 1=GPS, Start/Stop, Idling, Status. 2=GPS, Start/Stop, Idling, Status, Waypoints, Overspeed, Input Change. Firmware versions < 4.71 used this setting (named Globalstar Buffer) for Globalstar networks only.

Cell Buffer:	Enable position buffering when using a cellular modem. See note on RF Buffer setting.
Iridium Buffer:	Enable position buffering when using Iridium. See note on RF Buffer setting.
RF Buffer:	Enable position buffering when using an RF modem. Note: since firmware version 4.96, the network buffer settings provide a “Polling” mode. When selected, the i50 will only send data when checking for network coverage, or when data is received from the server.

Self-Geofence

Peg Lat/Lon:	Latitude and longitude values used for self-geofence.

COM Ports

Port A Route:	Controls whether Port A is routed to the Prog connector, COM1 connector or Wi-Fi module during normal operation.
Port A-F:	Defines what devices are connected to each of the i50’s serial ports. Port A route is controlled by the setting above. Port B connects to COM2. Port C connects to internal GPRS modem. Port D connects to internal Iridium modem. Port F connects to the COM3 connector. See section 8.0 for a list of available options.
COM1/2 Flow Control:	Turn flow control on or off for the COM1 and COM2 connectors. Firmware version 4.16 and earlier also controlled the Wi-Fi flow control using the COM1 setting. Later versions force Wi-Fi flow control on.

GPS

GPS COM Speed:	GPS module COM speed.
Update clock using GPS:	Automatically set real-time clock base on GPS signals.
GPS satellites:	Require a certain number of GPS satellites to mark a position as valid. Note: this should normally be set to zero, as the GPS module calculates position validity based on received signal strength and satellite positions.
Internal GPS:	Enable use of internal GPS module. If disabled, an external GPS module can be connected via a serial connection.

Cellular

Cell COM Speed:	Cellular modem COM speed.
Cell Modem Type:	Type of cellular modem.
Cell Server Domain Name:	Optional domain name for server. When enabled, the i50 will perform DNS lookups to determine server IP address.
Cell Server IP:	DataGate server address when sending data over cellular network. Also used to allow data through the Wi-Fi firewall.
Backup Cell Server IP:	Backup address, used when remotely switching servers.
Cell Port:	UDP port for sending data over cellular network.
Cell Echo:	Enable PPP echo requests. This is normally disabled.

GPRS Signal:	Signal strength required before attempting to connect to the GPRS network. This may help reduce the number of connection attempts in weak coverage areas.
Cell Keep-Alive:	Some networks may require sending a small packet periodically to maintain the assigned IP address.
Cell Username:	Username for cellular PPP connection, if required.
Cell Pass:	Password for cellular PPP connection, if required.
GPRS APN:	Access Point Name for establishing GPRS connection.

Iridium/Sat

Iridium COM Speed:	Iridium modem COM speed.
Iridium Portable:	If enabled, the i50 will add its ID to each packet it sends over Iridium. This increases packet size, but allows modems to be swapped between units.
PDT COM Speed:	PDT satellite modem COM speed.

RF

RF COM Speed:	RF modem COM speed.
RF Serial Config:	Serial settings for RF port.
Ack Time:	Time to wait after receiving data before replying over an RF modem. This provides time for half-duplex modems to switch from transmit to receive mode.
Kenwood:	Kenwood radio settings. Enabling the Software ACKs option will ensure data is received by the server, but will increase radio traffic. With this disabled, the i50 will rely on radio ACKs only. When WAN mode is enabled, the i50 will automatically switch the radio channel/zone based on waypoint locations. Selecting the Transparent option causes the i50 to send raw data packets, which requires the Kenwood radios to be configured for transparent data.
Kenwood Base TX Fleet/Type:	Kenwood base radio fleet ID (Fleetsync) or ID type (NXDN). Together with the Kenwood TX Base ID setting, this is used as the destination when sending data over a Kenwood radio.
Kenwood Base TX ID:	See above.
Kenwood Base RX Fleet:	Kenwood base radio fleet ID (Fleetsync only). Not used for NXDN networks. See below.
Kenwood Base RX ID:	Kenwood base radio ID (combined with Kenwood RX Fleet ID for Fleetsync). The i50 will only accept data from this radio ID.

Globalstar

Globalstar COM Speed:	Globalstar modem COM speed.
Globalstar Server IP:	DataGate server address when sending data over Globalstar. Also used to allow data through the Wi-Fi firewall.
Backup Globalstar Server IP:	Backup address, used when remotely switching servers.
Globalstar Timeout:	This timer limits how long a Globalstar connection will stay active if no data is sent or received.
Globalstar RX Port:	UDP RX port for Globalstar.
Globalstar TX Port:	UDP TX port for Globalstar.

Wi-Fi/Dial-up

Wi-Fi Ch:	Wi-Fi channel in range 1 to 11.
Wi-Fi WEP Key:	Selects encryption key for Wi-Fi interface. Enter 10 hex digits for a 64-bit key, 26 hex digits for a 128-bit key, or leave blank for no encryption.
Wi-Fi SSID:	SSID of ad-hoc network created by the Wi-Fi modem.
Wi-Fi/Dial-up Firewall:	If enabled, limits Wi-Fi and dial-up connections to sending to the DataGate cell/globalstar server IP addresses, as programmed into the “Cell Server IP” and “Globalstar Server IP” settings.
Router IP Address:	IP address used by i50 during a Wi-Fi or dial-up session.
Transparent UDP Port:	UDP port to send and receive transparent data when a dial-up or Wi-Fi connection is established. Set to zero to disable.
Email UDP Port:	UDP port to send and receive email data when a dial-up or Wi-Fi connection is established. Set to zero to disable.
GPS UDP Port:	UDP port to send GPS data to when a dial-up or Wi-Fi connection is established. Set to zero to disable.
Dial-up COM Speed:	Dial-up COM speed. This speed is also used when a port is configured for Messages.

OBD-II

OBD-II Report Diag Codes:	Send alert when engine diagnostic code detected.
OBD-II Report RPM:	Send alert when engine RPM limit exceeded.
OBD-II Report Coolant:	Send alert when engine coolant temperature limit exceeded.
OBD-II COM Speed:	COM speed for OND-II interface.
OBD-II Max Engine RPM:	Maximum RPM limit when monitoring engine.
OBD-II Max Coolant Temp:	Engine coolant temperature limit.
Engine Displacement:	Engine size (cc). See engine efficiency below.
Engine Efficiency:	Engine efficiency. Used along with displacement to calculate fuel used for engines without MAF sensors.

Garmin

Garmin Options:	Enable or disable the sending of estimated-time-of-arrival (ETA) messages and/or Stop Status updates.

Signs

AMSIG/NTCIP Msg Slot:	Message slot to use when sending messages to NTCIP signs. Set to zero to enable the AMSIG protocol.
NTCIP Sign ID:	Sign ID.
NTCIP Community:	SNMP community name for signs interface.
Sign Trans:	When transparent sign data is enabled, transparent data sent to the i50 will be forwarded to the sign, and sign responses will be sent to the server as transparent data. Enabling NTCIP UDP data causes the i50 to send sign data without the standard serial encoding, allowing connection to a sign using a serial to Ethernet adapter.

Transparent Data

Transparent COM Speed:	Transparent COM speed.
Transparent Serial Config:	COM settings for transparent interface.
Transparent Config:	Select whether the i50 will buffer multiple transparent packets. If this is disabled, new transparent data will overwrite any existing unsent data. Also has an option to attach the current time and GPS position to each transparent packet generated. For SIGNS firmware, this setting also contains the sign on and off times.

Pager

Pager System ID:	Only Grace pager signals with a matching System ID will be processed. Set to zero to process all pager signals.
Pager Timeout:	Period of time to wait before alerting a user that a pager signal has been lost. This time should be set greater than the pager polling interval.

Accelerometer

Max Acceleration:	Send alert when vehicle accelerates faster than this limit. Set to zero to disable.
Max Braking:	Send alert when vehicle brakes harder than this limit. Set to zero to disable.
Max Cornering:	Send alert when vehicle corners harder than this limit. Set to zero to disable.
Max Tilt Angle:	Send alert if unit is tilted over this angle. Note that the unit must be stationary to detect a tilt angle. Set to zero to disable.
Accelerometer X/Y Angle:	Amount i50 has been rotated from a level position. The X angle indicates a rotation from front to back of device. The Y angle describes rotation from side to side. Set to zero to calibrate automatically.
Accelerometer Z Angle:	Indicates how far the front of the device (Program connector end) has been rotated away from the front of the vehicle in a level plane. Set to zero to calibrate automatically. Select “Uncalibrated” to disable calibration (no acceleration alerts will be sent).
Motion Threshold:	Set the g-force required to trigger motion detection. This is used to detect several events, including calibration, tilt angle, start/stop motion (if “Use Accelerometer to detect motion” enabled), and sleep mode (if “Wake on motion” enabled).

Extra Settings

Unknown Settings:	Future firmware versions may have settings that are not supported by this programmer. These settings will be shown here, and their values will be maintained when reading and writing.

7.2.3 Waypoints

The i50 can store up to 200 circular waypoints in non-volatile memory. There are two kinds of waypoints: standard and RF zone.

Standard waypoints are used to generate alerts whenever the unit enters or leaves these areas. Each standard waypoint can also be configured so that position reports are disabled while the unit is at that location.

RF zone waypoints are used when the i50 has WAN mode enabled under Kenwood radio settings. In WAN mode, the unit will automatically select the radio zone and channel based on the closest RF zone.

The i50 Programmer has a Waypoints tab where the data can be retrieved from and sent to the device, or loaded from /saved to disk.

ID:	Waypoint ID (1-8191) that will be displayed in the alert message.
Lat/long:	Position at centre of waypoint.
Inner Radius:	Device must enter this area to trigger an enter event.
Outer Radius:	Device must leave this area to trigger an exit event. Setting this value larger than the inner radius will reduce the number of false events received when a unit spends time near the edge of a waypoint.
Zone:	Radio zone to be selected when i50 is inside the RF zone.
Channel:	Radio channel for this zone.
Range:	The i50 will only use this zone if it is within the range specified. If it is outside all zones it will stop sending data.

Note: when position reports are disabled due to a waypoint setting, the i50 will also disable its periodic wakeup reports. It will continue to wake up periodically to confirm whether it is still inside the waypoint, but will not transmit.

7.3 Device Info

Device information is displayed in the Info frame. Any errors or important values will be shown in red.

7.3.1 Status

PC Connected To: i50 port being used for programming.
Settings: Status of settings inside i50.
Clock: Clock status. Use the Set button to adjust the i50 clock to match the PC.
Time: Value of real-time clock (RTC) inside i50. If the clock does not maintain its setting after power is removed from the unit for more than 10 seconds, the internal backup battery may need replacing.
VOUT: Status of VOUT driver.
ADC: Status of internal analog to digital converter (ADC).
Accel: Status of internal 3D accelerometer.
Buffer: Shows how many events or positions are currently stored in memory. This buffer can be cleared using the *Clear Buffer* command, or read and saved to disk using the *Get Buffer* command. When packets are present this value will be shown in red, to remind the user that there may be useful data in memory.

7.3.2 Inputs

IGN: IGN input (Off/On)
IN1: IN1 (Low/High)
IN2: IN2 (Low/High)
IN3: IN3 (Low/High)
IN4: IN4 (Low/High)
ADC1: Voltage on ADC1 pin
ADC2: Voltage on ADC2 pin

7.3.3 Other

Battery: Voltage on PWR pin
Temp: Internal temperature
G-Force: Current g-force readings in X, Y, and Z planes. The X plane relates to cornering forces; the Y plane to acceleration and braking forces; and Z to up/down forces.

7.4 Device Ports Window

For testing or configuration purposes it may be necessary to communicate with modems or devices that are connected to the i50 serial ports. The Ports screen provides access to all six serial ports, which are: COM1, PROG, Wi-Fi, COM2, GPRS, Iridium, GPS and COM3. Open this window using the *Device Ports* button on the programmer toolbar.

Figure 6 shows the ports window.

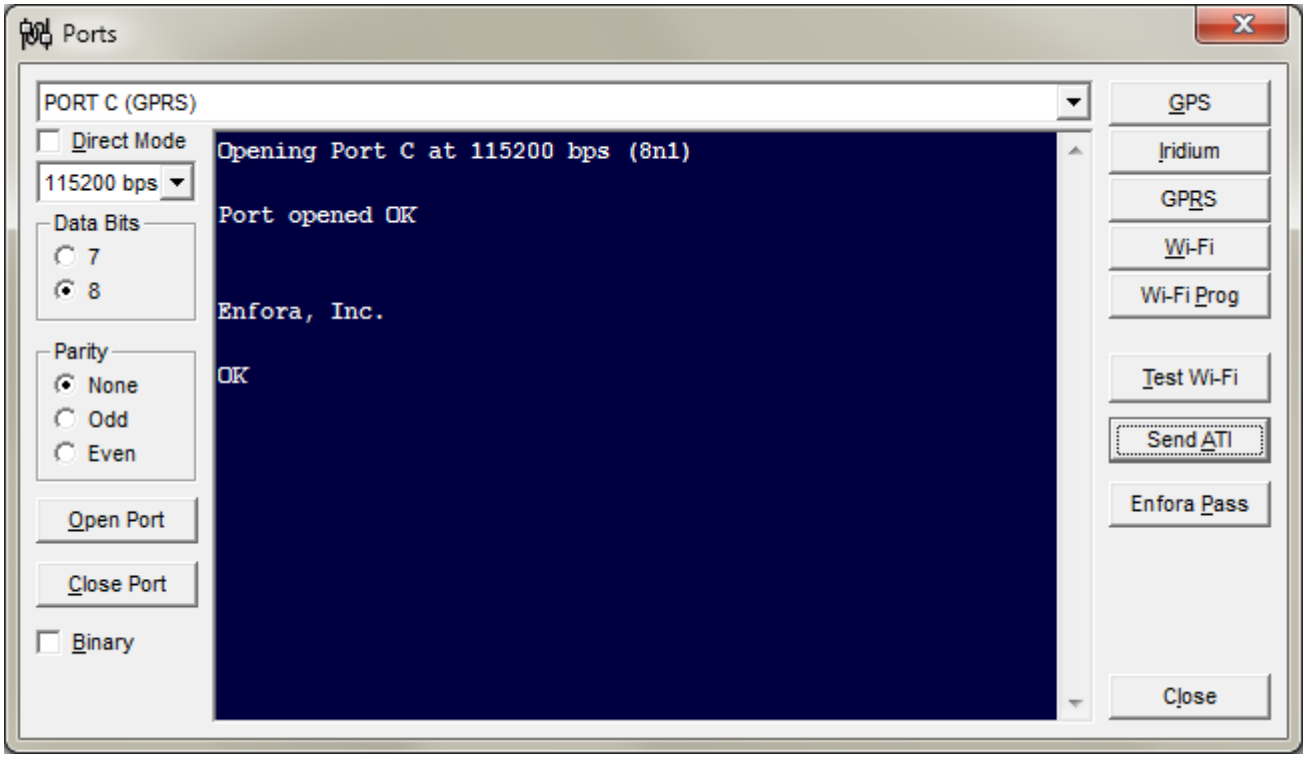


Figure 6 – Ports Window

To open a port, simply select it, along with the desired COM speed and settings, and then use the *Open Port* button. The screen acts as a simple terminal showing data received, and allowing data to be sent by typing. The *Close Port* button closes the port, and the Binary option is used to display all incoming data in hexadecimal notation, allowing the display of non-printable data.

Caution: sending commands to modules can alter configuration values and cause connection problems.

All ports can be accessed, with the exception of the port that is being used to program the unit. For example, if the programming cable is connected to the COM3 connector, you will not be able to open COM3.

Note: the COM1, PROG and Wi-Fi connectors are shared by one internal serial port. If you wish to access any of these connectors you will need to program the unit using either the COM2 or COM3 port.

Note: to connect a PC to the COM2 or COM3 ports you will need a null-modem adapter with RX/TX pins crossed over.
Shortcut buttons are provided on the right side of the window, allowing quick access to modules using the default port and COM speed for each module.

The *Test Wi-Fi* command sends a request to the current port for the Wi-Fi version number.
Use the *Send ATI* command to quickly send an ATI request to the current port.
The *Enfora Pass* command provides a quick way to program a password into an Enfora modem. See section 8.11 for an important note about Enfora passwords.

7.4.1 Direct Mode

The Direct Mode checkbox causes the i50 to map the current programming port directly to the selected port. Once connected, the i50B Programmer utility will close the PC COM port, allowing another program to connect to the port to access the i50. Since the i50 is no longer processing the serial data itself, it will not respond to the programmer until rebooted.

Direct mode is useful if you need to communicate with an i50 port using a third-party program. Specific examples of this are when upgrading the firmware of the internal modems, or using the U-Blox GPS programming software to fine-tune the GPS receiver.

7.4.2 Wi-Fi Firmware Update

A special command button labelled *Wi-Fi Prog* is provided for updating the firmware of the internal Wi-Fi module. This option applies power to the Wi-Fi module when programming signals are detected. The i50B Wi-Fi Update file on the Datalink downloads web page contains firmware and detailed instructions.

7.5 Test Window

The Test window is accessed using the *Test* button on the main screen. It shows the status of various i50 inputs, and allows control over outputs. Figure 7 shows the Test window.

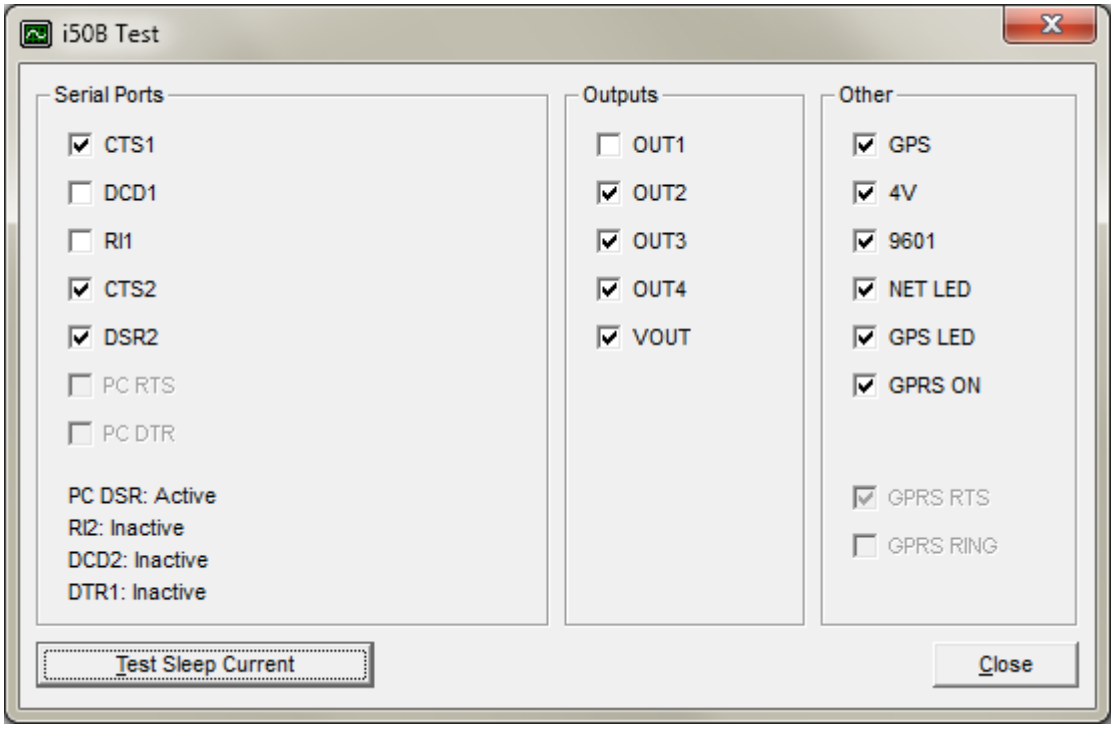


Figure 7 – Test Window

The Serial Ports frame contains checkboxes that activate the i50 and PC serial control outputs. If the programmer is connected to i50 COM1 or COM2, labels will be shown to indicate the status of serial inputs. These states should change when the corresponding outputs are toggled, assuming a full-handshaking cable is being used.

The Outputs frame allows the i50 digital outputs and VOUT line to be turned on and off for testing purposes. Note: any changes made to output pins will be discarded when the unit restarts.

Checkboxes are also provided for controlling internal circuits. These control the GPS receiver, 4V power supply (GPRS and Wi-Fi modems), 9601 Iridium modem, LEDs, and GPRS specific circuits.

Finally, the *Test Sleep Current* button turns off all outputs and puts the microprocessor into sleep mode, allowing measurement of sleep mode current draw. Note: the unit must be rebooted manually to exit this test.

8.0 Port Assignment

The i50 supports a wide variety of internal and external devices. This section lists each device, providing descriptions and operating instructions. Only one of each device can be selected at a time (except the NMEA Output option, which can be configured on multiple ports). Note that in order to reduce firmware size, the i50 is normally provided with the following external devices disabled: PDT-100, Sentry, Globalstar, RF, OBD-II, and Garmin Driver logging. Datalink Systems can provide firmware with these devices enabled on request.

8.1 PDT-100

An EMS PDT-100 satellite modem can be used to provide network coverage across most of North America. The modem communicates with a geo-stationary satellite, and includes a built-in GPS receiver. If the i50 is configured to use a PDT-100, it will not require its own internal GPS receiver.

8.2 Sentry

The Sentry is a limited range two-way paging device. It provides a link between the unit and user at a distance of up to 1000 feet (range depends on surroundings). Its primary use is in man-down and lone-worker applications. The Sentry pager has three buttons for triggering emergency and general alerts. Because it is a two-way system, messages can also be sent to the user.

8.3 RF

This option allows the connection of a variety of external modems. The unit will send raw serial data, relying on the modem to encode and transmit over the air. Optional firmware is available for interfacing directly with Kenwood Fleetsync/NXDN radios. i50 options include selecting Fleetsync or NXDN mode, long or short data messages, protocol version and base ID.

8.4 Palm Pilot

Not currently supported. Use the Transparent port option to interface with third-party devices.

8.5 Dial-Up

If the i50 is using an IP modem, it makes sense to be able to connect another mobile computing device (such as a laptop) to the modem. This allows the laptop to access the Internet for email, file transfer, etc. The dial-up port acts as a modem emulator. Any external device can send AT commands to the modem to establish a PPP connection to the Internet. Meanwhile, the i50 maintains control of the actual modem, ensuring vehicle location and event reporting features remain active. This link also allows the i50 GPS and status to be retrieved by the connecting device. See section 10.0 for more information on setting up the dial-up link.

8.6 Transparent

One i50 port may be configured as a “transparent” link. Any serial device can connect to this port and send data over the network. The network server then forwards that data to a specific IP address and/or to DataHost clients. Likewise, data can be sent from the destination IP address (using a Telnet

connection), or from a DataHost client, to the network server. The data is then forwarded to the i50, which will send the data out the transparent COM port to the attached serial device.

Data sent by the serial device is buffered by the i50 to prevent loss. Transmission occurs after a gap of 200 ms between characters, or if the data buffer (1500 bytes) is more than 2/3 full. The i50 settings control whether multiple transparent packets will be buffered at one time. If disabled, the i50 will delete any existing transparent data when new data is received. Another setting enables attaching a GPS position to each transparent data packet. This GPS position will be processed and removed by the server, so it will not interfere with the raw data.

A special version of firmware is available for interfacing the i50 with traffic signs. This firmware uses the transparent port to send data to the signs.

Caution: the i50 will send all data that it receives on the transparent port, which may increase network data costs considerably.

8.7 Ext. GPS

If an external GPS receiver is available, the i50 can be configured to use it as a location source. The i50 requires a standard NMEA serial string, and supports both RMC and GGA messages.

8.8 OBD-II

An external OBD-II box is available to interface the i50 with the vehicle engine. This allows the unit to monitor various engine parameters and send alerts when values exceed a predefined range. Current firmware is designed to talk to adapters that use the ELM-327 chipset.

8.9 Alarm Interface

This is a custom option to allow the i50 to control an external alarm box.

8.10 Grace Pager

The i50 can communicate with a Grace Industries pager receiver or transceiver to receive signals from Grace pagers and optionally send commands to the pagers. Two pager types are supported: the T-Pass series, which is a one-way intrinsically safe pager; and the Super-Cell series, which is a two-way pager with LCD screen.

When a panic button push or no-motion alarm is received from a pager, the i50 will immediately enter alarm mode. See section 13.4 for more information on alarm mode.

When a Garmin display is connected, the i50 will automatically send messages to the Garmin when pager signals are lost or found, and when alarms are received. Call-back alerts and pager test signals can also be sent to Super-Cell pagers using the Garmin messaging interface. See section 11.0 for more information.

8.11 Cellular (GPRS/CDMA)

The unit supports several GPRS modems, as well as Cypress and Airlink CDMA modems. An internal Enfora GPRS modem is available as an option.

Important note: Some Enfora GPRS modems allow control of their settings from external IP addresses when using their default settings. Make sure you use the AT$APIPWD command to set a password to prevent unauthorized access. The i50B Programmer provides a button to quickly set the Enfora password (see section 7.4).

8.12 Globalstar

The Globalstar network uses a large group of low orbit satellites to provide coverage around many parts of the world. Billing is time-based, so the unit limits online time to the minimum required. It is recommended to enable buffering on this network to reduce the number of connections to the server.

8.13 Iridium

The Iridium network uses a large group of low orbit satellites that talk to each other to create a worldwide data network. Latency is higher than terrestrial networks, with round-trip times of approximately 20 seconds with a good signal. An internal Iridium modem is available as an i50 option.

8.14 Wi-Fi

The i50 has the option of an internal Wi-Fi module. This module allows third-party devices to connect to the i50 via an ad-hoc (computer to computer) Wi-Fi connection. The i50 acts as a DHCP server to provide a private IP address to the connecting device, and then allows the device to send data to the Internet if an IP modem (Cellular or Globalstar) is available. Various Wi-Fi settings are available to control channel and encryption settings. It is highly recommended to assign each i50 a unique SSID and encryption key so that they will not interfere with each other when in close proximity.

See section 10.0 for more information on the Wi-Fi link.

Section 7.4.2 describes how to use the i50 Programmer to update the Wi-Fi module's firmware. This may be necessary to make use of new features as they are developed.

8.15 Garmin

The i50 supports the Garmin Fleet Management Interface (FMI). This allows the i50 to use the Garmin device as a messaging terminal, send and edit stops, and monitor ETA and driver status. See section 11.0 for more information.

8.16 NMEA Output

One or more i50 ports can be programmed to output GPS NMEA data strings. This data is an exact copy of data received from the internal GPS module, sent using 9600,8N1 port settings.

8.17 Messages

A simple messaging interface is available for sending and receiving text messages and emails using the i50's network connection(s). The port is opened using the COM speed set for the Dial-up port, with 8 data bits, no parity and 1 stop bit. See section 11.0 for details on the messaging protocol.

9.0 Accelerometer

An optional internal accelerometer is available on the i50. This enables the i50 to detect motion and monitor driving style. Events can be sent when high acceleration/braking/cornering forces occur or a high angle of tilt is detected. The events will contain the peak acceleration detected, and the period of time the threshold was exceeded. See section 7.2.2 for more information on setting these thresholds.

Using the accelerometer to detect motion allows two special features, which can be enabled in the i50 settings:

- "Wake on motion" (set under the Sleep Pin settings). The i50 will wake up when the i50 moves, and stay awake until motion stops. This allows theft detection, which would normally go unnoticed if the unit was asleep.
- "Use Accelerometer to detect motion". When enabled, the i50 will base its start/stop state on the accelerometer output, rather than using GPS signal. This will create more reliable start/stop reports, as it will work in areas with poor or non-existent GPS signals.

The "Motion Threshold" setting controls the sensitivity of the sensor when detecting motion.

9.1 Calibration

By default the i50 accelerometer is not calibrated. In this state the i50 will use the accelerometer to detect motion, but will not send events based on high g-forces or tilt angles. To return to the not calibrated state, set the "Accelerometer Z Angle" value to "uncalibrated" using the i50 Programmer.

The accelerometer must be calibrated before using it to detect high g-forces or tilt angles. To begin, ensure that the i50 is installed securely in the vehicle. The angle of installation is not important, but any change of angle or movement of the box during operation will cause inaccurate readings.

Calibration can be done manually if the installation angles are known, or automatically otherwise.

9.1.1.1 Manual Calibration

The i50 orientation can be programmed by setting the “Accelerometer X/Y/Z Angles” using the i50 Programmer. The value zero is reserved for calibration, so use a small value (such as 0.1) instead of zero when setting values manually. The X/Y/Z angles are measured in degrees relative to the starting position shown in Figure 8.

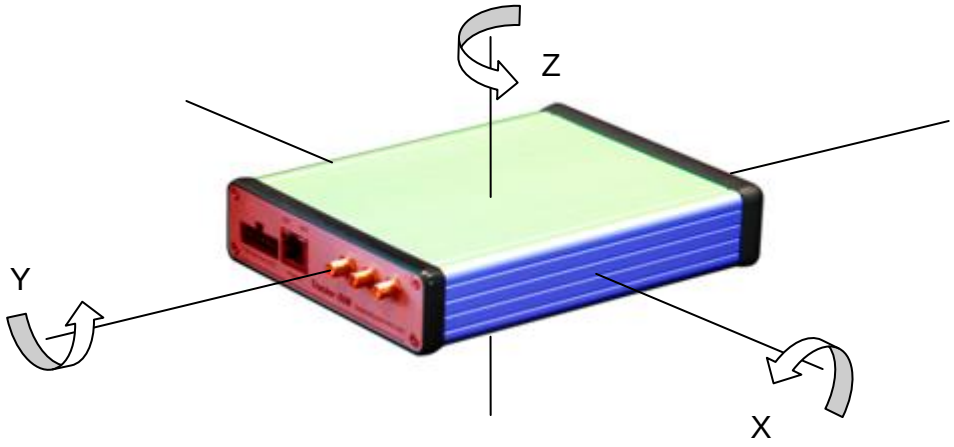


Figure 8 – Accelerometer Angles

With all values near zero the i50 orientation has the power connector (on red side in illustration) facing forward, and top (green side) facing up. The X value increases from zero as the red side angles down, Y values increase from zero as the blue side angles up, and Z values increase from zero as the blue side rotates backwards.

If the angle of installation is known then manual adjustment will work well, but automatic calibration should give more accurate results.

9.1.1.2 Automatic Calibration

Automatic calibration is begun by using the *Reset Accel* button on the i50 Programmer toolbar or by sending a remote configuration command (setting 156=0) from the DataGate server (see section 15.0). These commands set the Accelerometer Z Angle to zero, which triggers calibration mode.

- Park the vehicle on a level surface
- Reset angles using one of the commands described above
- Wait at least 10 sec
- Accelerate slowly to approximately 20 mph
- Brake rapidly and stop for at least 5 seconds to set angles
- An “Angles Set” event will be sent to the server when calibration is complete

10.0 Dial-Up/Wi-Fi Interface

A PC or other hardware can establish an IP connection to the i50 in two ways: using a serial dial-up link (PPP); or via a Wi-Fi connection. This allows the hardware to communicate directly with the i50, or forward data to an IP modem (cellular or Globalstar) for Internet access.

10.1 Dial-Up Configuration

Use the i50 Programmer to assign the Dial-up feature to the desired i50 port. It is recommended to use COM1 for dial-up connections, as it provides all RS-232 control lines. However, three-wire operation is possible if the appropriate control lines are hard wired and flow control is disabled.

Also set the Dial Speed option so that you can match the COM speed when configuring the PC modem settings. The default is 19200 bps.

10.1.1 Adding i50 modem to Windows

1) Open the Phone and Modem Options window from the Windows Control Panel.
2) Click on the Modems tab, and then “Add…” to install a new modem.
3) Select the “Don’t detect my modem” option, and next to continue.
4) Choose “Standard 19200 bps Modem” under the Standard Modem Types group.
5) Select the PC COM port where the i50 will be connected. Note that if you are going to use a USB to serial converter, it must be plugged in at this point.
6) The new modem should now show in the Phone and Modem list.

10.1.2 Adding a Windows dial-up connection

1) Open the Network Connections (or Network and Sharing Center) window from the Windows Control Panel.
2) Select “Create a new connection” or “Set up a new connection” to add a dial-up connection.
3) Under “Connection Type”, select “Connect to Internet”.
4) Select “Set up my connection manually”.
5) Choose “Connect using a dial-up modem”.
6) Select the modem created above, making sure to uncheck any other modems.
7) Type “i50” in the ISP or Connection Name box.
8) The Phone number can be any numeric value, such as 1234.
9) Leave the User Name and Password fields blank.
10) In XP, close the Wizard. The new connection should show in the Dial-Up section of the Network Connections window. In later versions of Windows, you will need to complete the connection.
11) Right-click on the i50 connection icon, and select Properties.
12) Under the Options tab, uncheck the “Prompt for name and password” and “Prompt for phone number” options.
13) Under the Networking tab, select PPP as the server type.
14) Click Advanced, and ensure the “Use default gateway” option is enabled, assuming you want to use this connection by default to access the Internet.

10.2 Wi-Fi Configuration

Wi-Fi connections are made using an ad-hoc (computer to computer) link, using the SSID and encryption key assigned in the i50 settings. The i50 includes a DHCP server, which assigns an IP address to the connecting computer.

Note: as this is an ad-hoc connection, no indication will be given if the wrong encryption key is entered. If no IP address is assigned when connecting, first check that the encryption keys are configured correctly.

10.3 Connection Details

The i50 monitors the dial-up/Wi-Fi connection, looking for data to be sent to the Internet. Any data packets addressed to the local subnet or multicast addresses are ignored (except transparent/email data – see sections 10.3.2 and 10.3.3). If the Wi-Fi/Dial-up firewall setting is enabled, only data packets addressed to the Cellular or Globalstar server IP addresses will be allowed through.

If a cellular or Globalstar network connection is available, the data is then forwarded over the Internet. Otherwise an ICMP response is returned to indicate there is no route to that address.

Data received from the wireless network is parsed to check whether it is addressed to the i50 itself. If not, it is forwarded to the attached computer over the dial-up/Wi-Fi link.

Network address translation is used to isolate the computer from the wireless network, allowing the unit to switch networks transparently if more than one wireless modem is available.

When using Globalstar service, the unit will only establish a satellite connection when data is received from the computer, and will shut down the connection if no more data is received after the Globalstar Timeout period. This allows a computer to keep its dial-up/Wi-Fi connection active at all times. Note: the computer should be configured to reduce network traffic (preferably using a firewall), as satellite airtime will be used each time a packet is sent.

10.3.1 GPS over UDP

While a dial-up or Wi-Fi connection is established, the i50 will broadcast all internal GPS data to the PC using UDP packets, allowing the PC to make use of the GPS information independently. The UDP port used can be adjusted in the i50 settings. If this feature is unwanted, the UDP port can be set to zero to disable the GPS UDP packets.

10.3.2 Transparent data over UDP

Any UDP packet sent to the i50's IP address (defined by the "Router IP" option) and transparent UDP port will be sent to the DataGate server as transparent data. Likewise, any transparent data received from the DataGate server will be broadcast as UDP data over the dial-up/Wi-Fi connection. Setting the UDP port to zero will disable this feature.

10.3.3 Status/Messaging over UDP

This feature operates like the transparent option described above, except it adds a basic interface to handle message addressing and status monitoring. Any UDP packets sent to the i50's IP address and email UDP port will be parsed as message data. Likewise, any messages received from the DataGate server will be broadcast to the UDP port. Setting the UDP port to zero will disable this feature.

See section 11.0 for details on the status and messaging protocol.

11.0 Status/Messaging Protocol

The i50 uses a basic protocol to allow text messages and emails to be sent and received over its network connection(s), and to query/set internal status.

This protocol can be accessed over the dial-up/Wi-Fi connection using the email UDP port, or through a COM port configured for “Messages”. When using the COM port, the port speed is set to the same value as the dial-up port speed.

Data is formatted as a series of ANSI fields separated by <CTRL-Z> characters (0x1A), with each packet ending with an <ETX> character (0x03). An exception to this format is the file transfer command/response packets, which include binary data and use a length value to determine packet size (see section 11.3 for details).

When using UDP, each command or response is contained in a separate UDP datagram.

The first field in each packet identifies the command or response type. Subsequent fields are referred to as parameters. Unused parameters can be empty.

11.1 Commands sent to i50

The following commands can be sent to the i50:

Command	Description	Parameters	Responses
“N”	Query status		“n”
“G”	Query GPS		“g”
“I”	Query I/O lines		“i”
“T”	Send message	<MsgID><UserID><Subject><Address><Message>	“t”, “x”, “s”, “e”, “?”
‘C’	Clear message	<MsgID><UserID>	“x”,”?”
“F”	File transfer	<FileData>	“f”, “?”
“A”	Set alert state	<AlertState>	“n”

Response	Description	Parameters
“n”	Status	<Net><AlertState><AlertResp><RX><TX><Packets>
“g”	GPS data	<Valid><FixTime><Fix><Lat><Lon><Heading><Speed><Alt><Sats><HDOP><Short><SpdValid><Motion>
“i”	I/O data	<IGN><In1><In2><In3><In4><In5><In6><Out1><Out2><Out3><Out4><VOUT><Temp><ADC1><ADC2><Battery>
“t”	Queued	<MsgID><UserID>
“x”	Rejected/Cleared	<MsgID><UserID>
“s”	Sent	<MsgID><UserID>
“e”	ID exists	<MsgID><UserID>
“f”	File transfer response	<FileData>
“?”	Error	<Error>

Where the parameters are:

<MsgID>	Message ID (0-16777215)
<UserID>	User ID if addressed to a single DataHost/WebGate user. Not currently implemented, and must be left blank or set to zero
<Subject>	Email subject if message is an email
<Address>	Email address if message is an email
<Message>	Message body
<FileData>	See section 11.3
<Error>	“0”=Unknown command, “1”=No ID, “2”=Invalid ID, “3”=Unknown ID, “4”=Wrong network for file transfer, “5”=File data too long
<Net>	“0”=None, “1”=MSAT, “3”=Radio, “11”=Cellular, “12”=Globalstar, “14”=Iridium
<AlertState>	“0”=Off, “3”=Cancelled, “5”=Active but silenced, “6”=Active
<AlertResp>	“0” or “1”=Not acknowledged, “5”=ACK received
<RX>	“0”=Receiver Idle, “1”=Receiving data
<TX>	“0”=Transmitter Idle, “1”=Transmitting data
<Packets>	Number of packets waiting to be sent
<Valid>	“0”=No GPS data available, “1”=GPS Valid
<FixTime>	Time of last GPS fix (sec since 12:00 am Dec 31, 1989 UTC)
<Fix>	“0”=No GPS signal, “1”=GPS OK
<Lat>	Latitude (degrees * 100000)
<Lon>	Longitude (degrees * 100000)
<Heading>	Heading (degrees)
<Speed>	Speed (knots)
<Alt>	Altitude (metres)
<Sats>	Number of satellites visible
<HDOP>	Horizontal accuracy
<Short>	“0”=GPS antenna OK, “1”=GPS antenna short circuit
<SpdValid>	“0”=Speed information invalid, “1”=Speed reading valid
<Motion>	“0”=Device stationary, “1”=Device moving, “255”=Unknown
<IGN>	“0”=IGN off, “1”=IGN on
<In1>	“0”=Input 1 low, “1”=Input 1 high
<In2>	“0”=Input 2 low, “1”=Input 1 high
<In3>	“0”=Input 3 low, “1”=Input 1 high
<In4>	“0”=Input 4 low, “1”=Input 1 high
<In5>	“0”=ADC 1 low, “1”=ADC 1 high
<In6>	“0”=ADC 1 low, “1”=ADC 2 high
<Out1>	“0”=Output 1 low, “1”=Output 1 high
<Out2>	“0”=Output 2 low, “1”=Output 2 high
<Out3>	“0”=Output 3 low, “1”=Output 3 high
<Out4>	“0”=Output 4 low, “1”=Output 4 high
<VOUT>	“0”=VOUT off, “1”=VOUT on
<Temp>	Internal temperature (degrees C * 100)
<ADC1>	ADC 1 voltage (volts * 100)
<ADC2>	ADC 2 voltage (volts * 100)
<Battery>	Battery voltage (volts * 100)

Use the “Query status” command to check which network the i50 is using. This command should be sent periodically to confirm the i50 is still turned on and connected. Initially, this command can be sent to the broadcast IP address (255.255.255.255) when connecting via dial-up or Wi-Fi. When the i50 replies, its IP address will be contained in the from address of the response. Further packets can then be sent directly to the i50’s IP address.

The “Send message” command is used to send text messages over the network. When an <Address> parameter is supplied, the message will be forwarded to that email address. Otherwise, the message will be sent to DataHost/WebGate users. Responses are returned to indicate the status of the message. “Queued” means the message has been accepted for transmission. “Rejected” indicates the message has been rejected, or cannot be sent to the destination. The “Sent” response is returned when the message has been delivered to its destination.

A unique combination of <MsgID> and <UserID> should be used for each message sent. If a message is already queued with the same ID, the i50 will respond with an “ID exists” response.

11.2 Commands received from i50

When the i50 receives a message, it will output an unsolicited command as follows:

Command	Description	Parameters	Responses
“R”	Message received	<MsgID><UserID><Subject><Address><Message>	“x”, “r”, “o”

Response	Description	Parameters
“x”	Message rejected	<MsgID><UserID>
“r”	Accepted	<MsgID><UserID>
“o”	Read	<MsgID><UserID>

Where the parameters are:

<MsgID> Message ID (0-16777215)
<UserID> User ID if message is from a DataHost/WebGate user
<Subject> Email subject if message is an email
User name if message is from a DataHost/WebGate user
<Address> Email address if message is an email
<Message> Message body

When such a command is received, an appropriate response must be returned to the i50. If no response is received, the i50 will retry the message for up to an hour.

Each new message should contain a unique ID, although this is not guaranteed. When a duplicate ID is received, it may be useful to compare the data fields to confirm whether the message is a retry or not. When a retry is detected a response must still be returned, in case the previous response was lost.

11.3 File Transfer

File transfer packets contain a single <FileData> parameter, which contains several binary values. These packets do not end with <ETX> characters, but instead contain a length field to indicate how long the packet is. When sending these packets, the full data packet must be sent before any further commands can be issued.

The <FileData> parameter contains the following binary fields; where all integer values are stored least significant byte first:

Length (2 bytes)	Length of following fields
Command (1 byte)	1=Start File, 2=Send Data, 3=ACK, 4=Error
Reserved (1 byte)	Ignore this value
Data	Variable length field

The Data field contains different fields depending on the Command value.

Command	Data
1	Length (3 bytes) LSB. Total length of file. Name (null terminated string). Name of file.
2	Offset (3 bytes) LSB. Offset of this data block within file. Starts at 1. Length (2 bytes) LSB. Length of this data block. 1024 maximum. RawData. Raw file data.
3	ACK Offset (3 bytes) LSB. Position of highest received byte. Optional (included if server has missed some part of the file): NAK Offset (3 bytes) LSB. Start of missing data. NAK Length (3 bytes) LSB. Length of missing data.

The following example is shown in hexadecimal notation, where each 2-character hexadecimal value represents a byte sent or received.

The first line starts a file transfer, where the total length of the file is 3000 bytes, and the file name is “Test.txt”. The response is an ACK with offset set to zero. The file is then sent one block at a time. Multiple blocks can be sent without waiting for an ACK, which will improve performance at the risk of having to retry more blocks if signal is weak. If the server fails to receive one of several blocks, it will include NAK fields in the ACK response. These fields indicate what data needs to be resent.

TX: 46 1A 0E 00 01 00 B8 0B 00 54 65 73 74 2E 74 78 74 00
RX: 66 1A 05 00 03 01 00 00 00
TX: 46 1A 07 04 02 00 01 00 00 00 04 .....
TX: 46 1A 07 04 02 00 01 04 00 00 04 .....
RX: 66 1A 05 00 03 01 01 04 00
...

The final ACK from the server will contain an offset equal to the total length of the file, and will contain no NAK fields. Once this is received, the file has been sent successfully.

11.4 Status/Messaging Examples

1) Check status. i50 response shows it has an active cellular connection, it is currently transmitting data, and has 5 packets waiting in its buffer.

TX: N<ETX>
RX: n<CTRL-Z>11<CTRL-Z>0<CTRL-Z>0<CTRL-Z>1<CTRL-Z>5<ETX>

2) Email received from user@example.com:

RX: R<CTRL-Z>1<CTRL-Z><CTRL-Z>Subject<CTRL-Z>user@example.com<CTRL-Z>Text<ETX>
TX: r<CTRL-Z>1<CTRL-Z><ETX>

2) DataHost message sent:

TX: T<CTRL-Z>2<CTRL-Z><CTRL-Z><CTRL-Z><CTRL-Z>Hello<ETX>
RX: t<CTRL-Z>2<CTRL-Z><ETX>
RX: s<CTRL-Z>2<CTRL-Z><ETX>

12.0 Garmin Interface

The i50 can talk to any Garmin terminal supporting the Garmin Fleet Management Interface (FMI) version 2. Specifically, it must support Garmin protocols A602, A603 and A604. A special data cable (available from Garmin suppliers) is required to connect the Garmin terminal to the i50.

If any i50 port is configured to use a Grace pager system, the i50 will send special messages to the Garmin whenever a pager signal is detected or lost, or an alarm message is received. Also, when the i50 boots up it will send a message stating the current list of pagers in range. When a pager test signal is received, the i50 creates a Garmin message to display the test, allowing a user to respond directly to the pager, or else wait for an ACK from the server. If the pager receiver stops responding for any reason, a Garmin message will be sent to warn the user that the pager system is down.

Two-way text messaging is supported using the standard Garmin messaging screens. These messages can be sent to and from DataHost clients.

The Garmin Quick Message list is automatically populated with one or more messages when the Garmin is connected. This list provides a way to request the current i50 status (network, GPS, and pager states). If a Grace system is enabled, another quick message is provided to call-back all Super-Cell pagers in range. This feature alerts each pager and displays a call-back message on screen.

DataHost clients have the option of sending stop locations to the Garmin terminal. Drivers can then select these stops from a list, causing the Garmin to calculate a route and guide the driver to the desired location. The status of stops as well as the estimated-time-of-arrival (ETA) for the current route can be sent to the server as they change (if enabled in the i50 options). Note that the ETA is transmitted whenever it changes by more than 10%, at a maximum rate of once per minute. The ETA is transmitted as either the actual time of arrival (e.g. 10:15 pm) or time remaining (e.g. 25 min), depending on which is more constant. This prevents unnecessary data transmissions if a vehicle stops and starts while en route.

An optional firmware feature is support for Garmin driver logging. This firmware monitors the Garmin driver name and driver status fields, sending them back to DataHost clients. The Garmin driver status list is automatically populated with a range of commonly used status strings when the unit is connected to the i50.

13.0 I/O Configuration

13.1 Digital Inputs

Digital Inputs can be configured in the following ways:

- General Input. Used to monitor external circuits.
- Priority Input. When active, i50 will not enter sleep mode.
- Alert Input. Used to trigger panic alerts. See section 13.4.
- Engine-On. Indicates when engine is running (used to count engine hours and detect idling). See section 6.4 for details.
- Geofence. This input causes the i50 to generate a self-geofence, and then send an alert if it moves more than 500 metres from this location.

Each input has a polarity setting, which indicates the active state (high or low voltage). Note that the four digital input lines have internal pull-up resistors, and will default to a high voltage state if disconnected. Input changes (programmable in the i50 settings) can be sent to the server when the input is configured for any use except alert input.

13.2 Analog Inputs

The i50's analog inputs are monitored while the i50 is awake. If the ADC1/2 High/Low settings are non-zero, then alerts are sent when the input voltages exceed the high threshold, or fall below the low threshold. Regardless of these high/low settings, the ADC values can be sent back to the server using the advanced GPS format.

13.3 Digital Outputs

Digital Outputs can be configured as follows:

- General Output. Output state can be set in the i50 settings, and/or controlled remotely from a DataHost client.
- Alert Output. Designed to connect to an external buzzer or siren. This pin changes to indicate the current alarm state.
- Overspeed. Activates when overspeed condition is detected.
- Network Status. Turns on when connection to server is available.
- GPS Status. Activates when GPS signal is valid.
- RX/TX. Turns on briefly when receiving or transmitting data.
- Satellite mode. Activates when using a satellite modem.
- Awake state. Output is active while unit is awake, and turns off when unit is sleeping or in periodic wakeup mode. This is the default setting for the VOUT pin.

The output polarity settings control the active switch state. Note that the four digital outputs are actively pulled to ground when set to a low voltage, but left floating in the high voltage state.

13.4 Alarm Mode

When an input is configured as an “Alert Input”, it can be used to test the system, and trigger alarms. It should be connected to a switch or push button (configured as active low with the other side of the switch connected to ground). To monitor the i50 alarm mode, one digital output should be configured as an "Alert Output". This output is designed to drive a buzzer or siren (configured as active low with the other side of the buzzer connected to the positive supply). Note: the i50 will not enter sleep mode while an alarm is active.

13.4.1 Alarm Input

Pressing the alarm button performs these functions:

1 push:	Network test. Alert output will beep 3 times if no network, otherwise the i50 will wait for a server ACK then beep once. If there is no response from the server after 3 minutes, the test will be cancelled and the alarm output will beep 3 times.
2 pushes:	Silence alert output when in alarm mode (unit stays in alarm mode).
3 pushes:	Panic alarm. Triggers a high priority alarm and turns on alert output. Note: this state is also triggered when a Grace pager alert is received. The alarm must be cancelled before another alarm can be sent. Even if a server ACK is received, alarms will be resent every 5 min until a DataHost responds.
4 pushes:	Cancel alarm (only works after alarm has been silenced).
Hold for 5 sec:	Diagnostic test. Checks GPS, network, and pager receiver. The Alert output will beep to indicate the result (see below).

Note: any changes on the alarm input will force the i50 to wake up immediately if it is currently in sleep mode.

13.4.2 Alarm Output

The Alert output beeps as follows:

1 beep:	ACK. Occurs when a network or diagnostic test is started or a user cancels alarm.
2 beeps:	Server ACK. Indicates server ACK has been received for a network test.
3 beeps:	No Network. Indicates no network available during alarm or diagnostic test.
4 beeps:	Cancel ACK. Occurs when server ACKs a cancel alarm event.
5 beeps:	Pager receiver not found during a diagnostic test.
6 beeps:	No GPS signal available during diagnostic test.
On continuously:	Alarm triggered but no ACK received (this can be a pager or panic button alarm).
2 sec pulses every 3 sec:	Alarm ACK received from DataHost user. Alarm output will turn back on in this mode when ACK is received and output has previously been silenced (to indicate state change).

14.0 Firmware Updates

The i50 firmware can be updated by connecting a programming cable to the RJ-45 Prog connector on the front panel, and using the Rabbit Field Utility (RFU) program. Programming cables may be purchased from Datalink Systems, or made up using the pin outs defined in section 4.3. The RFU program is available at http://www.datalinksystemsinc.com/download.html. Figure 9 shows the program's main screen.

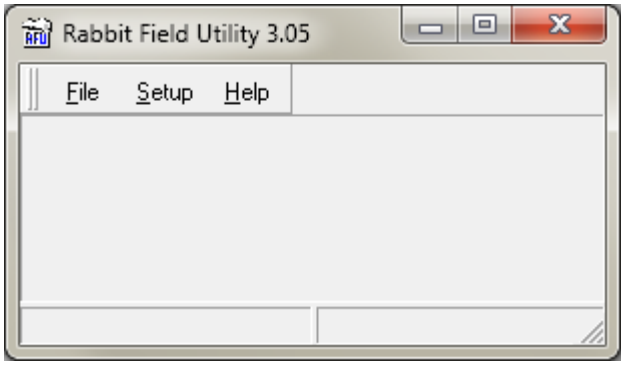


Figure 9 – Rabbit Field Utility

Use the Setup menu to access the File locations screen, as shown in Figure 10. Ensure the locations point to the files supplied with the RFU program.

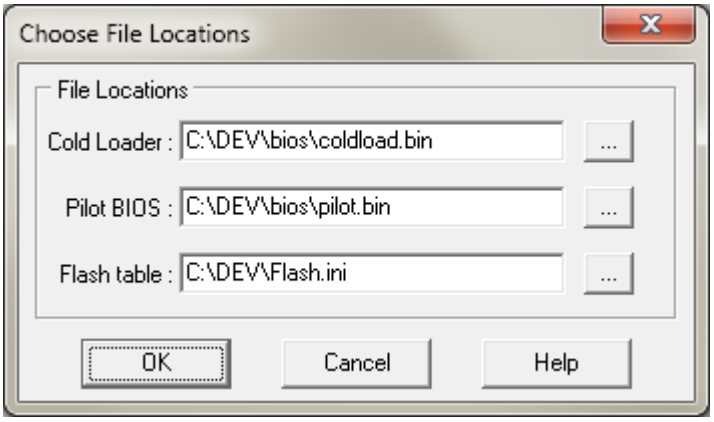


Figure 10 – RFU file locations

Use the Setup menu to access the communications options. Select the options as shown in Figure 11, replacing the Serial Port setting with the correct port. Uncheck the Enable Processor Verification option if you have problems connecting, and check the Use USB to Serial Converter option if appropriate. If problems persist, try setting the Stop Bits to 1.

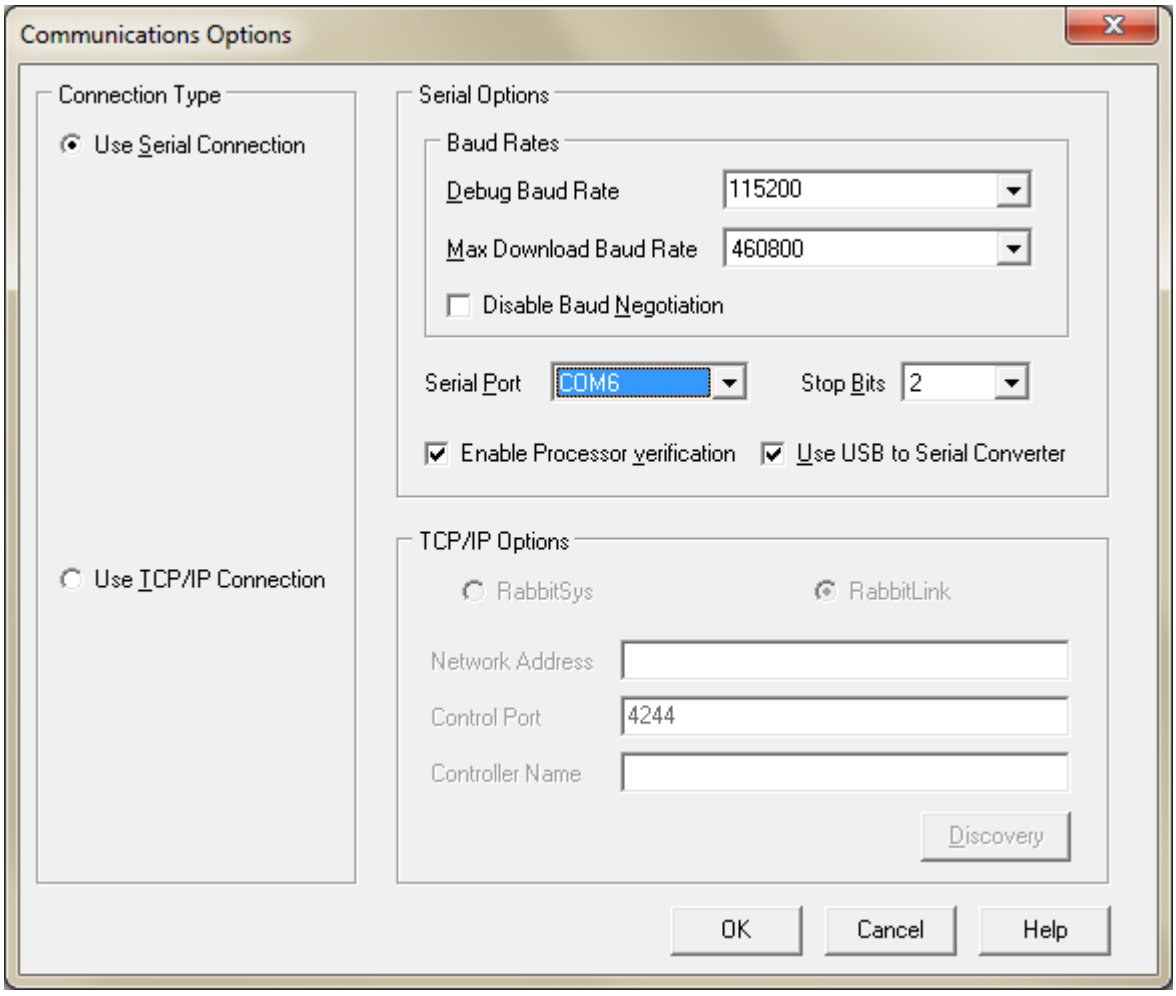


Figure 11 – RFU Communications Options

Use the File/Load flash image menu to select and send the firmware data. Contact Datalink to obtain firmware update files.

Note: the programmer may not work reliably when using a USB to serial converter connected through a USB hub. If you have problems, try connecting the converter directly to the PC.

15.0 Programming Settings from DataGate

The DataGate server can send and receive individual i50 settings using the *Remote Config* button on the Asset Properties window (Modems tab). Each setting is referenced by ID, with integer and string values in separate lists. Many of these settings are crucial to the correct operation of the device, so take care when making changes. These changes can also be made by an administrator via the WebGate interface.

15.1 Integer Values

ID	Name	Description	Default
0	I_UPDATE	Update clock using GPS (1=Yes 0=No)	1
1	I_ALARMSTATE	Alarm state. Bits 7-5 are response state. Bits 4-1 are alarm state. Bit 0 indicates geofence on	0
2	I_IP1	Cellular IP address (also uses I_IP2-I_IP4). Range=0-255	-
3	I_IP2	“	-
4	I_IP3	"	-
5	I_IP4	"	-
6	I_PORTA	PORTA (Program/COM1/WiFi) Port Setting. See note at bottom for values	0
7	I_PORTB	PORTB (COM2) Port Setting. See note at bottom for values	0
8	I_PORTC	PORTC (GPRS) Port Setting. See note at bottom for values	0
9	I_PORTD	PORTD (Iridium) Port Setting. See note at bottom for values	0
10	I_PORTF	PORTF (COM3) Port Setting. See note at bottom for values	0
11	I_SATSPEED	PDT COM Speed. See note at bottom for values	7
12	I_EVENTS	System Events (Firmware >= 4.77). Bit 2=Errors. Bit 1=Power Down. Bit 0=Power Up	7
13	I_ID1	Unit ID (also uses I_ID2 and I_ID3). Range=0-255	255
14	I_ID2	"	255
15	I_ID3	"	255
16	I_INPUT1	Input 1 Setting. See note at bottom for values	0
17	I_INPUT2	Input 2 Setting. See note at bottom for values	0
18	I_INPUT3	Input 3 Setting. See note at bottom for values	0
19	I_INPUT4	Input 4 Setting. See note at bottom for values	0
20	I_USEINPUT1	Send events when Input 1 changes. Bit 0=Low. Bit 1=High	0
21	I_USEINPUT2	Send events when Input 2 changes. Bit 0=Low. Bit 1=High	0
22	I_USEINPUT3	Send events when Input 3 changes. Bit 0=Low. Bit 1=High	0
23	I_USEINPUT4	Send events when Input 4 changes. Bit 0=Low. Bit 1=High	0
24	I_INPOLARITY1	Input 1 polarity (0=Active Low 1=Active High)	0
25	I_INPOLARITY2	Input 2 polarity (0=Active Low 1=Active High)	0
26	I_INPOLARITT3	Input 3 polarity (0=Active Low 1=Active High)	0
27	I_INPOLARITY4	Input 4 polarity (0=Active Low 1=Active High)	0
28	I_USEIGN	Send events when IGN changes. Bit 0=Low. Bit 1=High	0
29	I_OUTPUT1	Output 1 Setting. See note at bottom for values	32
30	I_OUTPUT2	Output 2 Setting. See note at bottom for values	32
31	I_OUTPUT3	Output 3 Setting. See note at bottom for values	32
32	I_OUTPOLARITY1	Output 1 polarity (0=Low 1=High)	1
33	I_OUTPOLARITY2	Output 2 polarity (0=Low 1=High)	1
34	I_OUTPOLARITY3	Output 3 polarity (0=Low 1=High)	1

ID	Name	Description	Default
35	I_RFSPEED	RF COM Speed. See note at bottom for values	4
36	I_TRANSSPEED	Transparent COM Speed. See note at bottom for values	4
37	I_WAYPT	Enable Waypoint reports (1=Yes 0=No)	0
38	I_USEDISTLO	Use city distance reports (1=Yes 0=No)	0
39	I_USEDISTHI	Use highway distance reports (1=Yes 0=No)	0
40	I_USETIMELO	Use city time reports. Bit 0=Enable. Bit 1=Don't send while IGN off. Bit 2=Don't send while stationary	0
41	I_USETIMEHI	Use highway time reports (1=Yes 0=No)	0
42	I_USEOVERSPD	Send overspeed alerts (1=Yes 0=No)	0
43	I_USESTOPS	Send Stop alerts (2=Position Only 1=Send Event 0=No)	0
44	I_USESTARTS	Send Start alerts (2=Position Only 1=Send Event 0=No)	0
45	I_USEACCEL	Use accelerometer to detect motion, instead of OBD or GPS speed (1=Yes 0=No)	1
46	I_USEINTGPS	Use internal GPS (1=Yes 0=No)	1
47	I_GSSPEED	Globalstar COM Speed. See note at bottom for values	11
48	I_GPSSPEED	GPS COM Speed. See note at bottom for values	7
49	I_JSPEED	OBD-II COM Speed. See note at bottom for values	7
50	I_TRANSBITS	Transparent COM settings. Bits 0-1=(Data bits-5). Bit 2=Extra Stop bits. Bit 3=Parity. Bit 4=Even	3
51	I_JREPDIAG	OBD-II diag codes events 0=Off 1=Display 2=Send 3=Display and Send	0
52	I_JREPREV	OBD-II high rev events. See I_JREPDIAG for values	0
53	I_JREPBRK	Not used	0
54	I_JREPACC	Not used	0
55	I_JREPCOOL	OBD-II high coolant temp events. See I_JREPDIAG for values	0
56	I_JREPTRANS	Not used	0
57	I_JREPOIL	Not used	0
58	I_JREPFUEL	Not used	0
59	I_IPMODEMTYPE	0=External GPRS 1=Cypress CDMA 2=AirLink CDMA 3=Internal GPRS 4=Enfora GPRS 5=BlueTree CDMA	3
60	I_JREPOILPRESS	Not used	0
61	I_MINSATS	Number of GPS sats required for valid signal. Range=0-12	0
62	I_DIALSPEED	Dial-up and messaging/status port COM Speed. See note at bottom for values	9
63	I_GPRSECHO	Enable PPP echo requests (1=Yes 0=No) Normally disabled	0
64	I_PREVIP1	Cellular backup IP address (also uses I_PREVIP2-I_PREVIP4)	0
65	I_PREVIP2	"	0
66	I_PREVIP3	"	0
67	I_PREVIP4	"	0
68	I_GSIP1	Globalstar IP address (also uses I_GSIP2-I_GSIP4). Range=0-255	-
69	I_GSIP2	"	-
70	I_GSIP3	"	-
71	I_GSIP4	"	-
72	I_PREVGSIP1	Globalstar backup IP address (also uses I_PREVGSIP2-I_PREVGSIP4)	0
73	I_PREVGSIP2	"	0
74	I_PREVGSIP3	"	0
75	I_PREVGSIP4	"	0
76	I_IRIDIUMSPEED	Iridium COM Speed. See note at bottom for values	9
77	I_BUFFERGPRS	Enable position buffering on GPRS network (2=Polling 1=Yes 0=No)	0

ID	Name	Description	Default
78	I_BUFFERRF	Enable position buffering on RF network (2=Polling 1=Yes 0=No)	0
79	I_BUFFERIRIDIUM	Enable position buffering on Iridium network (2=Polling 1=Yes 0=No)	0
80	I_CSQ	Cellular signal strength required to connect. Bits 0-4=Signal (0=-113dBm, 31=-51dBm). Bit 7=Send Timing Advance instead of RSSI in Advanced GPS Packet	0
81	I_MINTIMELO	City min report time. Range=1-64800 sec	5
82	I_MAXTIMELO	City max report time. Range=1-64800 sec	600
83	I_DISTLO	City report distance. Range=100-65500 metres	1000
84	I_DEBOUNCE1	Input 1 debounce. Range=20-30000 ms	100
85	I_DEBOUNCE2	Input 2 debounce. Range=20-30000 ms	100
86	I_DEBOUNCE3	Input 3 debounce. Range=20-30000 ms	100
87	I_DEBOUNCE4	Input 4 debounce. Range=20-30000 ms	100
88	I_DEBOUNCEIGN	IGN debounce. Range=20-30000 ms	250
89	I_MINTIMEHI	Highway min report time. Range=1-64800 sec	5
90	I_MAXTIMEHI	Highway max report time. Range=1-64800 sec	600
91	I_DISTHI	Highway report distance. Range=100-65500 metres	10000
92	I_THRESLO	City threshold. Range=0-2560 km/h*10	400
93	I_THRESHI	Highway threshold. Range=I_THRESLO-2560 km/h*10	700
94	I_OVERSPEED	Max speed allowed. Range=160-2560 km/h*10	1300
95	I_OVERTIME	Allowed overspeed time. Range=0-64800 sec. 0=No warning. 64800=Unlimited	10
96	I_STOPTIME	Time required to trigger stop event. Range=0-64800 sec	300
97	I_STOPSPEED	GPS stopped speed. Range=0-2560 km/h*10	100
98	I_GOSPEED	GPS start speed. Range=I_STOPSPEED-2560 km/h*10	300
99	I_SHUTDOWN	Number of seconds to wait after sleep pin activates before going to sleep. Set to zero to disable sleep mode	0
100	I_ACKTIME	Delay before responding on RF. Range=0-3000 ms in steps of 20 ms.	100
101	I_PEGLATHI	Position used for internal geofence	0
102	I_PEGLATLO	"	0
103	I_PEGLONHI	"	0
104	I_PEGLONLO	"	0
105	I_ALARMPASS	Not used	-
106	I_GPRSSPEED	GPRS COM Speed. See note at bottom for values	14
107	I_GSTIMEOUT	Max Globalstar idle online time. Range=4-60 sec	5
108	I_GSPORTRX	Globalstar UDP RX port	3616
109	I_GSPORTTX	Globalstar UDP TX port	3615
110	I_BUFFER	Buffer period for GPS reports. Range=0-64800 sec. 0=No Buffer	3600
111	I_GPRSPORTTX	GPRS UDP Port	4004
112	I_JREV	OBD-II Max rev. Range=0-9999 rpm	6000
113	I_JBRK	Not used	13
114	I_JACC	Not used	8
115	I_JCOOL	OBD-II Max coolant temp. Range=0-999 deg F	220
116	I_JTRANS	Not used	240
117	I_JOIL	Not used	240
118	I_JFUEL	Not used	10
119	I_STARTTIME	Time required to trigger start event. Range=0-64800 sec	10
120	I_GPRSCHECK	GPRS Keep Alive. Range=60-64800 sec. 64800=Never	0
121	I_BUFFEREVENTS	Globalstar buffer setting. 0=Positions only. 1=Pos+Start/Stop. 2=Pos+All Events	0

ID	Name	Description	Default
122	I_JOILPRESS	J1708 Min oil pressure. Range=0-99 PSI	5
123	I_HEADCHANGE	Heading change reports. Range=0-90 degrees. 0=Off	0
124	I_HEADTIME	Time required to trigger heading change event. Range=0-64800 sec	10
125	I_IDLELIMIT	Max idle time allowed. Range=0-64800 sec. 0=No Limit	0
126	I_ENGINE1	Engine Hours (seconds)	0
127	I_ENGINE2	"	0
128	I_ODO1	Odometer (1/10 km)	0
129	I_ODO2	"	0
130	I_PERIODICWAKEUP	Time between wakeup events while sleeping (sec)	0
131	I_MAXGPSWAIT	Max time to wait for GPS signal during periodic wakeup (sec)	120
132	I_MAXSENDWAIT	Max time to wait for network during periodic wakeup (sec)	120
133	I_IRIDIUMTIME	Satellite time reporting limit in dual-mode. Range=0-64800 sec	0
134	I_IRIDIUMDIST	Satellite distance reporting limit in dual-mode. Range=0-65500 metres	0
135	I_GPSUDPPORT	UDP port for sending GPS data during a dial-up or Wi-Fi connection. Set to zero to disable.	2000
136	I_DYNIRIDIUM	Send Unit ID over Iridium to allow modems to be swapped between units (1=Yes 0=No)	0
137	I_STATUS	Status report interval (Bits 7-6: Units 00=Days 01=Hours 10=Min. Bits 5-0: Interval). Firmware versions < 4.26 only support 0 and 1 (off and daily)	1
138	I_ALARMID	Current Alarm ID used by MDS	0
139	I_FULLHEADING	Send full heading (0-360 degrees) instead of 8-point compass heading. Adds one byte to each position packet (1=Yes 0=No)	0
140	I_COM1FLOW	Turn flow control on for COM1 port (1=Yes 0=No)	0
141	I_COM2FLOW	Turn flow control on for COM2 port (1=Yes 0=No)	0
142	I_COM1ROUTE	COM1 route (0=COM1 1=RJ45 2=WiFi)	0
143	I_SLEEPPIN	Pin used to trigger sleep mode. Bit 7=polarity. Bit 6=report at start-up. Bit 5=Motion wakeup. Bits 2-0=Input # (0=IGN, 1=Input 1, 2=Input 2, 3=Input 3, 4=Input 4)	0
144	I_ROUTERIP1	Router IP address used by WiFi DHCP server	192
145	I_ROUTERIP2	"	168
146	I_ROUTERIP3	"	0
147	I_ROUTERIP4	"	1
148	I_WIFICHANNEL	WiFi Channel Number (1-11)	6
149	I_FIREWALL	Limit WiFi traffic to IP addresses assigned in the I_IPx and I_GSIPx settings (1=Yes 0=No)	1
150	I_ENCRYPT	Turn on AES-256 Encryption (1=Yes 0=No)	0
151	I_PAGERSYSTEMID	System ID for Grace pager system. Other IDs will be ignored. Set to zero to process all IDs	0
152	I_PAGERTIMEOUT	Timeout (sec) before showing pager signal lost message	45
153	I_GARMIN	Bit 1=Send stop status. Bit 0=Send ETA updates	3
154	I_TRANSCONFIG	Bits 7-5=Sign On Time. Bits 4-2=Sign Off Time. Bit 1=Don't buffer multiple packets (existing transparent packets will be overwritten when new data is received). Bit 0=Add position and date/time to transparent data packets	1
155	I_TOWALERT	Send alert if asset moves while engine is off (1=Yes 0=No)	1
156	I_ACCELZ	Accelerometer rotation around Z axis (radians*10000). Set to zero to recalibrate. Set to 65535 to leave uncalibrated (no acceleration alerts will be sent)	65535
157	I_MAXACCEL	Max allowed accelerating g-force (1/100 g). Set to zero to disable	50
158	I_MAXBRAKE	Max allowed braking g-force (1/100 g). Set to zero to disable	80

ID	Name	Description	Default
159	I_MAXCORNER	Max allowed cornering g-force (1/100 g). Set to zero to disable	60
160	I_USEBATT	Voltage (1/10 V) above which engine is running. Set to zero to disable. When disabled, unit will use Engine On input or IGN to assume engine running. This setting is used to count engine hours and calculate drive and idle times.	130
161	I_ACCELX	Accelerometer rotation around X axis (radians*10000). Set to zero to recalibrate	0
162	I_ACCELY	Accelerometer rotation around Y axis (radians*10000). Set to zero to recalibrate	0
163	I_MAXTILT	Max allowed tilt when stationary (degrees). Set to zero to disable	45
164	I_MOTIONSENSE	Set g-force required to trigger motion detection (approx 1/1000 g). Range 1-255	60
165	I_TRANSUDPPORT	UDP port for sending and receiving transparent data during a dial-up or Wi-Fi connection. Set to zero to disable	4001
166	I_EMAILUDPPORT	UDP port for sending and receiving message/email data during a dial-up or Wi-Fi connection. Set to zero to disable	4000
167	I_FUEL1	Engine Hours (1/100 gallons)	0
168	I_FUEL2	"	0
169	I_ADVANCED	Advanced GPS report. Bit 2=Digital I/O States. Bit 3=Cell Info. Bit 4=ADC2. Bit 5=ADC1. Bit 6=Battery Voltage. Bit 7=Temperature. Bit 8=Speed. Bit 9=Altitude. Bit 10=Heading. Bit 11=GPS HDOP	0
170	I_SIGNTRANS	Bit 1=Send NTCIP data in UDP format. Bit 0=Enable transparent access to sign terminal	0
171	I_SIGNMSG	NTCIP Sign Message Number. Set to zero to use AMSIG protocol	0
172	I_SIGNID	NTCIP Sign ID	1
173	I_KENWOOD	Kenwood settings. Bit 7=Long data. Bit 6=NXDN. Bit 5=Software ACKs. Bit 4=WAN mode. Bit 3=Transparent. Bit 0=KW Prot Ver 1	193
174	I_RFBITS	RF COM settings. Bits 0-1=(Data bits-5). Bit 2=Extra Stop bits. Bit 3=Parity. Bit 4=Even	3
175	I_UNIT	Kenwood unit number used as destination when sending data (0000, 1000-4999 for Fleetsync, or 00000-65519 for NXDN)	0
176	I_FLEET	Kenwood fleet/ID type for sending data (0, 100-349 for Fleetsync, or 0=GID, 1=UID, 2=Broadcast for NXDN)	0
177	I_ENGINEVE	Engine volumetric efficiency (%)	80
178	I_ENGINEDISP	Engine displacement (cc)	3000
179	I_LOWBATT	Low battery warning (1/10 V). Set to zero to disable	0
180	I_OUTPUT4	Output 4 Setting. See note at bottom for values	32
181	I_OUTPOLARITY4	Output 4 polarity (0=Low 1=High)	0
182	I_VOUT	VOUT function. See I/O note at bottom for values	40
183	I_VOUTPOLARITY	VOUT polarity (0=Low 1=High)	1
184	I_ADC1HIGH	Trigger event if ADC1 exceeds this voltage (1/10 V). Set to zero to disable	0
185	I_ADC1LOW	Trigger event if ADC1 drops under this voltage (1/10 V). Set to zero to disable	0
186	I_ADC2HIGH	Trigger event if ADC2 exceeds this voltage (1/10 V). Set to zero to disable	0
187	I_ADC2LOW	Trigger event if ADC2 drops under this voltage (1/10 V). Set to zero to disable	0
188	I_DEBOUNCEADC1	Debounce time (ms) for ADC1 changes	100
189	I_DEBOUNCEADC2	Debounce time (ms) for ADC2 changes	100
190	I_NOGPS	Send alert if GPS signal is unavailable for this period (sec). Ver 4.88 and later only increment this counter while vehicle is moving.	0
191	I_RXUNIT	Kenwood unit number used to listen for data from base radio (1000-4999 for Fleetsync, or 00001-65519 for NXDN). Set to zero to use I_UNIT	0
192	I_RXFLEET	Kenwood fleet ID used to listen for data from base radio (Fleetsync only). Set to zero to use I_FLEET	0

Table 6 – Integer Settings

COM Speed Values: 1=110, 2=300, 3=600, 4=1200, 5=2400, 6=4800, 7=9600, 8=14400, 9=19200, 10=28800, 11=38400, 12=56000, 13=57600, 14=115200

I/O Settings: 0=General Input, 1=Priority Input (forces i50 awake when active), 11=Alert Input, 12=Engine On Input, 13=Geofence Input, 32=General Output, 33=Alert Output, 34=Overspeed Output, 35=Network OK Output, 36=GPS OK Output, 37=TX Output, 38=RX Output, 39=Satellite Output, 40=Awake

COM Port Settings: 0=None, 1=PDT, 2=Sentry, 3=RF, 4=Palm, 5=Dial-up, 6=Transparent, 7=Ext GPS, 8=J1708, 9=Alarm, 10=Grace, 11=Cellular (GPRS/CDMA), 12=Globalstar, 13=Accel, 14=Iridium, 15=Wi-Fi, 16=Garmin, 17=NMEA Out, 18=Messages/Status

15.2 String Values

ID	Name	Description
0	STR_GPRSUSER	GPRS Username
1	STR_GPRSPASS	GPRS Password
2	STR_GPRSAPN	GPRS APN
3	STR_WEPKEY	WEP key for Wi-Fi connection. First two characters define encryption type (00=No Security, 01=64-bit, 02=128-bit). The key starts at third character. 64-bit keys use 10 hex characters. 128-bit keys use 26 hex characters. For example, 64-bit key “A1B2C3D4E5” = 0x01A1B2C3D4E5
4	STR_AESKEY	AES-256 key for encryption. 64 hex characters.
5	STR_SSID	Wi-Fi SSID
6	STR_SNMPCOMMUNITY	Community Name for NTCIP Signs
7	STR_VERSION	Firmware Version String (version 4.62 or later)
8	STR_DOMAIN	GPRS Server Domain Name (version 4.71 or later)

Table 7 – String Settings

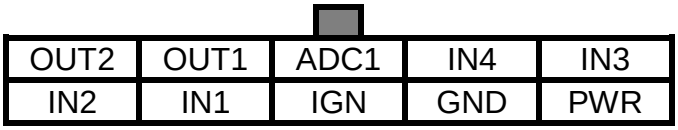
16.0 Contact Information

For further support, email: support@datalinksystemsinc.com

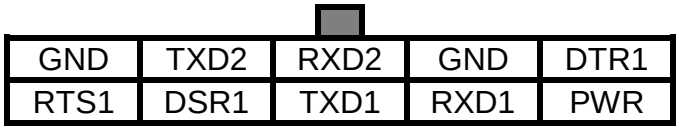
17.0 i50 Variants

17.1 i52 Marine

This board uses two Molex connectors to provide all power and I/O signals. The following diagram shows the pin assignments, looking into the connectors on the PCB.



Power and I/O



Serial Ports

Power and I/O	
Pin Name	**Description**
OUT2	Digital Output 2
OUT1	Digital Output 2
ADC1	Analog Input 1
IN4	Digital Input 4
IN3	Digital Input 3
IN2	Digital Input 2
IN1	Digital Input 1
IGN	Vehicle Ignition (active high)
GND	Negative supply (ground)
PWR	Positive supply

Serial Ports			
Pin Name	**Description**	**COM 1 DB9 (female)**	**COM2 DB9 (female)**
GND	Negative supply (ground) (x2)	5	5
TXD2	COM2 TXD Input		3
RXD2	COM2 RXD Output		2
DTR1	COM1 DTR Input	4 *	
RTS1	COM1 RTS Input	7 *	
DSR1	COM1 DSR Output	6	
TXD1	COM1 TXD Input	3	
RXD1	COM1 RXD Output	2	
PWR	Positive supply		

Note: All serial pins are defined with the i52 acting as a DCE. Use female DB9 connectors with pins connected as shown above to connect a PC to the i52.

* COM1 DTR and RTS inputs should only be used for programming. For general COM1 usage, only DB9 pins 2, 3 and 5 are required.

17.2 i30 Compact

The i30 has one onboard Picoflex header, which handles all power, I/O and serial lines. Pin 1 of the header is next to the PCB's main inductor (L1).

Picoflex Header						SATMATE	
Pin	**Pin Name**	**Direction (relative to i30)**	**PROG DB9 (female)**	**COM1 DB9 (female)**	**COM2 DB9 (male)**	**External Pin**	**Colour (i30 cable)**
1	GND	-	5	5	5	F	Purple/White
2	PWR	Input	-	-	-	D	Orange/White
3	OUT1	Output	-	-	-	E	Pink/White
4	OUT2	Output	-	-	-	C	Purple
5	OUT3	Output	-	-	-	R	White
6	IGN	Input	-	-	-	B	Pink
7	IN1	Input	-	-	-	S	Red
8	IN2	Input	-	-	-	P [#]	Black
9	ADC1	Input	-	-	-	P [#]	Black
10	DTRP	Input	4 *	-	-	G	Red/White
11	RTSP	Input	7 *	-	-	V	Blue
12	DSR1	Output	6	6	-	A	Orange
13	RX1	Output	2	2	-	T	Grey
14	TX1	Input	3	3	-	N	Clear
15	CTS1	Output	-	8	-	U	Brown
16	DCD1	Output	-	1	-	M	Light Brown
17	DTR1	Input	-	4	-	J	Brown/White
18	RTS1	Input	-	7	-	L	Black/White
19	RX2	Input	-	-	2	H	Grey/White
20	TX2	Output	-	-	3	K	Blue/White

Note: The PROG and COM1 serial pins are defined with the i30 acting as a DCE (for connection to a PC). The COM2 serial pins are defined with the i30 acting as a DTE (for connection to an external modem).

[#] Hardware selectable between IN2 and ADC1.
* The DTRP and RTSP inputs should only be used for programming.

18.0 Troubleshooting

18.1 GPRS Modem

Follow the procedure below to detect problems with the internal GPRS modem:

1) Use the iSeries Programmer to connect to the i50 and enter programming mode. Click on the Device Ports toolbar button, then select GPRS to open the GPRS modem serial port.
2) Type **ATE1<ENTER>**. If the modem is powered up, you should receive an OK response.
3) Type the following commands, in order, using **<ENTER>** to execute each one:

AT+CPIN?	Queries SIM state. Check for a +CPIN: READY response.
AT+CFUN=0	De-registers the modem, if online.
AT+CGDCONT=1,"IP","APN"	Sets modem APN (Access Point Name). Replace **APN** with the APN defined by the network operator.
AT$AREG=2	Enables auto-registration.
AT&W	Saves modem settings.
AT$RESET	Resets modem.
AT+CREG?	Checks GSM registration. If working OK, response should be +CREG: 0,1 (home network) or +CREG: 0,5 (roaming).
AT%CGREG?	Checks GPRS registration. Should return %CGREG: 0,1 (home) or %CGREG: 0,5 (roaming).
AT$NETIP?	Checks GPRS activation. If modem is online, response will show the modem's IP address. If response shows all zeroes, a GPRS connection problem exists.
AT$CGEER	Show error messages. A "service not subscribed" error indicates an invalid APN or SIM not activated.
AT&F	Reset modem to factory defaults.
AT&W	Save settings.

