



PreCise MRM, Inc

PreCise IX-201 | IX-301 | IX-302

Installation Guide

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# Introduction

The PreCise product line is a rugged, reliable asset management device that combines a GPS receiver, 802.11b/g (“WiFi”) short-range transceiver, and a GSM/GPRS cellular radio for an easy-to-use and effective method to capture and transfer trip data for assets as they arrive back at a terminal or service location. The system provides out-of-the-box, Internet-based reporting along with an advanced data-export interface to integrate with existing asset management solutions. You can access the information about your equipment on Preco’s secure website (<http://www.preciseinfox.com>) via the Internet.

## Features

- Gathers information about where a vehicle has been and when it was there
  - Position (latitude/longitude)
  - Speed
  - Heading
  - Time
- Automatically logs engine hours (ignition on time)
- Monitors six discrete inputs and tracks when and where they change
- Interfaces to select electronic controllers to provide data transfer capabilities
- Wirelessly downloads data using the most cost-effective means
  - 802.11b/g access point when in range
  - GSM/GPRS network at other times
- Rugged design
- 12V/24V operation



# Warnings & Cautions



- Read and follow all safety rules and instructions before installing or operating this equipment.
- Never operate a vehicle within a closed area. Always assure proper ventilation before starting engine.
- Always use eye protection. Use goggles that are ANSI approved against impacts and shattering.
- Before wiring, disconnect the negative cable from the battery terminal. Failure to do so may result in electric shock or injury due to electrical shorts. Batteries can generate explosive gases. Keep sparks, flames and smoking materials away from batteries. Always wear eye protection around batteries.
- Do not damage pipe or wiring when drilling holes. When drilling holes in the chassis for installation, take precautions so as not to contact, damage or obstruct pipes, fuel lines, tanks or electrical wiring. Failure to take such precautions may result in fire.
- Do not use bolts or nuts in the brake or steering systems to make ground connections. Bolts or nuts used for the brake or steering systems (or any other safety-related system), or tanks should NEVER be used for installations or ground connections. Using such parts could disable control of the vehicle and cause fire etc.
- Arrange the wiring so it is not crimped or pinched by a sharp edge. Route the cables and wiring away from moving parts (like the seat rails) or sharp or pointed edges. This will prevent crimping and damage to the wiring. If wiring passes through a hole in metal, use a rubber grommet to prevent the wires insulation from being cut by the metal edge of the hole.
- When making connections to the vehicle's electrical system, be aware of the factory installed components (e.g. on-board computer). Do not tap into these leads to provide power for this unit. When connecting the unit to the fuse box, make sure the fuse for the intended circuit has the appropriate amperage. Failure to do so may result in damage to the unit and/or the vehicle.
- Be sure to connect the color coded leads according to the diagram. Incorrect connections may cause the unit to malfunction or damage to the vehicle's electrical system.
- To avoid property damage, personal injury, or death, park the vehicle on a flat level surface, set the parking brake, turn the engine off, and chock the wheels before beginning installation.
- Do not mount the module in a location that could interfere with proper operation of the vehicle, such as behind the gas or brake pedals.
- Avoid any circuits associated with the airbag system. Inadvertent airbag deployment may cause personal injury or death.
- While the system is in operation, a separation distance of at least 20 centimeters (approximately 8 inches) must be maintained between the antennas and the body of all persons in order to meet FCC RF exposure guidelines.

# INSTALLATION INSTRUCTIONS

## Before you start

Prior to installing an IX module, take time to familiarize yourself with the installation instructions, theory of operation, and system components. Check the contents of the shipping package and verify the following items are included:

## Included Items

item #	Supply
1	PreCise IX module
2	power harness
3	installation manual
4	magnet-mount combination antenna - 802.11b/g & GPS (IX-201 & IX-302 modules only)
5	magnet-mount combination antenna – GPRS & GPS (IX-301 & IX-302 modules only)

## Recommended Supplies (dependent on installation)

item #	item	qty/vehicle
1	18-22 awg 4 conductor wire	50ft (varies)
2	18 awg stranded wire	30ft (varies)
3	12Vdc SPDT relays (for inputs)	4
4	breakout cable (part #: 2260007)	1
5	buttsplice	10
6	spade connectors	20
7	cable ties	25
8	3A to 5A in-line fuse holder	1 – 2
9	5A fuse	2
10	wire loom	25ft (varies)
11	silicone	0.1 tube
12	1/4" x 1.25" bolts	4
13	1/4" washer	4
14	1/4" lock nuts	8
15	electrical tape	
16	roof-mount ant	1
17	1/4" self-tapping screws	4
18	3/8" grommet	1
19	5/16" ring lug terminals (18awg)	5
20	duplex faston terminals	4
21	#10 ring lug terminals (18awg)	3

## Recommended Tools (dependent on installation)

item #	tool
1	electrical drill
2	terminal crimping tool
3	Strippers
4	drill bit sets
5	Screwdrivers
6	socket sets
7	Needle-nose pliers
8	pliers
9	big channel-locks
10	1/4" drill bit
11	1/2" drill bit - mounting holes
12	spring-loaded center punch
13	tape measure
14	wrench set
15	7/16" open end wrench
16	Volt-Ohm meter

# Mounting Locations

## Antennas

Selecting a good mounting location for the antennas is important for proper system operation. You should consider a few points prior to selecting a location:

- Do not mount the antennas within 20cm (~8") of each other or within 20cm (~8") of the vehicle operator.
- The combination antenna should have a clear view of the sky. In order for the GPS receiver to calculate position, it needs to "see" several satellites. These satellites are constantly moving overhead in different orbits, so the wider the field of view, the better.
- Consider where the IX module will be mounted to ensure the antenna cables will reach. Keep in mind that depending on how the cables are routed, the actual distance between the antenna and the IX module may have to be much closer than the overall length of the cables. (NOTE: Do not cut the antenna cables to shorten them. Carefully coil the extra cabling and tie wrap in a safe, out of the way area to prevent damage.)
  - One possibility is to utilize the marker lights as an exit point for the antenna wires and reseal with silicone.
  - For service trucks, the most common mounting location for the permanent mount antenna is the top of the utility box (adjacent to the exterior work light) which is located directly behind the passenger seat.
- Make sure the magnet-mount antenna (when needed) will stick to the mounting surface. The magnet will work with steel, but it won't stick to a surface like aluminum or fiberglass. If mounting on aluminum or fiberglass a small amount of silicone can be used to adhere to the magnetic base to these surfaces.

## IX module

Before you mount the IX module, be sure to write down the module's Mac ID, ICC ID, the activation codes, and the identifier for the equipment on which you are installing it. This information is necessary to identify which data belongs to a particular piece of equipment if you are installing multiple IX modules. The Mac ID is a 12-digit identifier (i.e. 00026F32A9E9) printed on a label attached to the IX module. The ICC ID is a 19 or 20-digit identifier. The equipment identifier can be a combination of letters and/or numbers that you use to uniquely identify your equipment. Examples include the Vehicle Identification Number (VIN), the license plate number, or the driver's name (i.e., "Joe's Truck").

While the IX module is designed to operate from  $-30^{\circ}\text{C}$  to  $+60^{\circ}\text{C}$  ( $-22^{\circ}\text{F}$  to  $+140^{\circ}\text{F}$ ) and is water-resistant, it should be mounted where it's not directly exposed to the weather. This will help ensure reliable operation in adverse conditions. Mounting the module in the engine compartment is not recommended due to the high temperatures. Good locations might be under or behind a seat, or in a utility box near the chassis, crane, and compressor meters.

The IX modules have integral mounting flanges that you can use to fasten it to a flat surface. You can use the module itself as a template to mark the hole locations, or you can use the dimensions shown in figure 1. Be sure to allow enough room to make the necessary connections to the antenna cables as well as the power harness. You should consider a few points prior to selecting a location:

- Consider the wire routing for the antenna and power.
- Consider protection of connections from weather and items stored nearby.
- Consider if the unit needs to be tamper proof

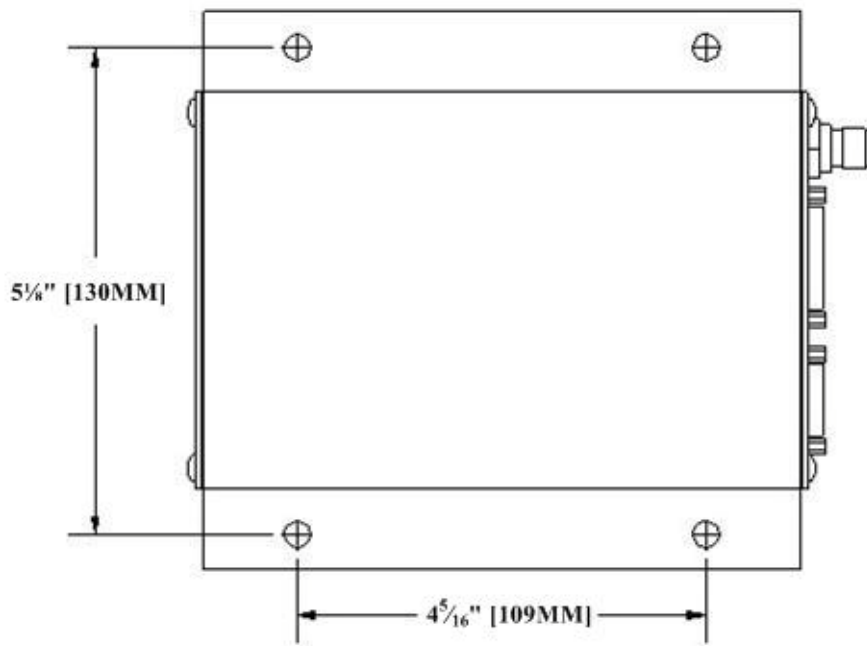


Figure 1: Mounting Hole Dimensions



# Electrical Connections

The IX modules are designed to operate from a continuous voltage source and a switched voltage source (ignition signal). To track and report total operating hours, as well as allow the unit to manage its own shut-down sequence, you will need to connect the green ignition wire on the power harness to a line on the vehicle that supplies between 7 and 32 volts during operation only. This could be a line from the alternator to indicate the engine is running, an input from a key-switch, or a similar connection. If the green ignition wire is connected to the alternator for the switched power source, you will need to confirm that the voltage remains at a minimum of 7 volts even when the battery is fully charged in order to avoid the following: false ignition off signals, increased data usage due to more frequent ignition off reports, and skewed ignition times. When determining where you should make your connections, you should use a volt-ohm meter or digital multimeter to verify proper voltage levels and determine whether the voltage is constant or switched, as required by the connection. (NOTE: If the vehicle is equipped with a master disconnect switch for the battery this does not qualify as a “switched” power source. An example of a proper switched power source would be something that only comes on when the ignition has been turned on, such as a chassis meter)

The threaded antenna connectors on the IX modules should only be connected finger tight. Do not use a wrench or pliers to make these connections or damage may occur. **Figure 2** below shows all of the connections necessary for basic operation. **NOTE:** This diagram shows both the GPS combo WiFi and GSM/GPRS antennas installed. Your installation may only require the use of one of the antennas, WiFi or GSM/GPRS, each of which has a built in antenna.

The ends of the wires of the supplied power harness are stripped but un-terminated. Depending on how you will connect the IX module to your equipment, you may choose to leave the wires as they are and use screw terminals, solder them to existing wires, or use crimp terminals. If you choose to use crimp terminals, be sure to use the proper crimping tool and terminals that are designed for 18 AWG wire.

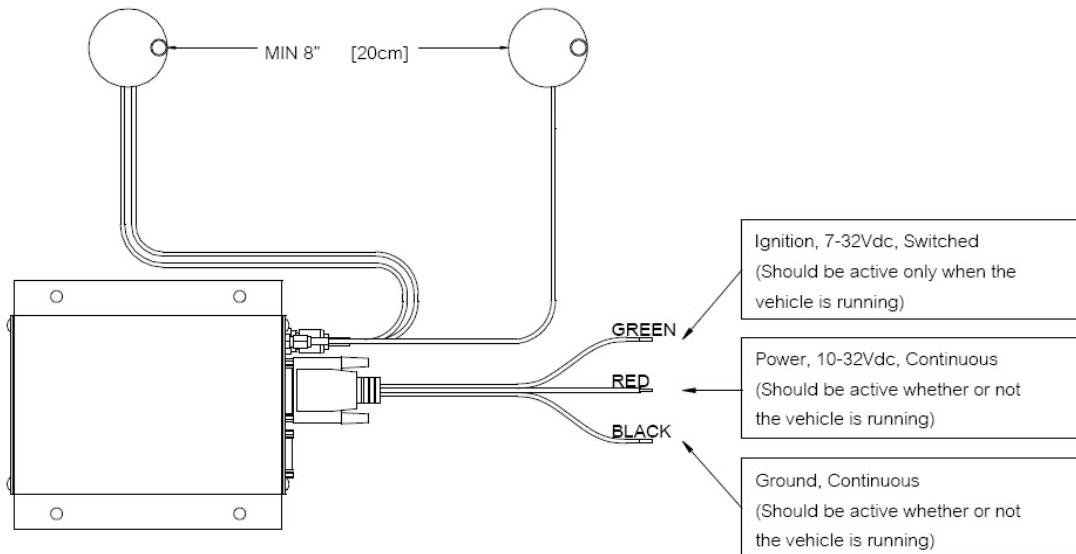


Figure 2: Connection Diagram

# Service Truck Installation

## Under body and engine compartment

- Install a 4 conductor electrical cable from the subpanel area, through the grommet at the rear of the cabinet. Route the cable along the frame into the engine compartment, securing with tie wraps. This cable will be for battery power, PTO sense, and availability switch.
- Connect one wire to a constant hot (battery) connection through a 3 - 5 amp fuse.

## Cab

- Install a cable from the inside of the cab through the grommet into the engine compartment.
- Mount the availability switch (part #: Carling V1D1B60B-AKB00-000 or equivalent) in the cab where it is accessible to the driver. Connect pin 7 to battery power, Pin 2 to ground, and Pin 3 to one wire in the cable exiting the cab. This will connect to input 6 on the IX module. The light in the switch should turn on when the switch is activated to give feedback to the driver.
- Connect one wire from the cable exiting the cab to the PTO.
  - If the switch is electric, one side should turn off and on, (check with a meter.)
  - If the switch is pneumatic, one side of the indicator lamp should switch when the PTO is engaged.
- Connect the wires from the PTO and availability switch to the cable under the chassis.

## Welder

- Drill a ¼ inch hole in the front of the welder panel and install a 1/4 x 1/8 grommet. Remove the cover from the welder. Locate the plug connecting to the hour meter. Using a meter, locate the pin that reads voltage when the welder is in the “run idle” and the “run” mode. Splice into this wire and extend a wire out of the front of the welder through the grommet. This sense wire will extend to the PreCise unit in the rear of the truck and connect to the wire labeled Input 4 on the breakout cable that is plugged into the IX module.

## Antenna

- Drill a ½ inch hole in the top of the utility cabinet adjacent to the external work light which is located directly behind the passenger seat. Install the antenna through the hole, sealing with silicone.
- Connect the long antenna leads to the antenna.
- Route the antenna leads and welder sense wire through 3/8 woven loom and install along the top of the cabinets, following the existing wiring harness to the rear cabinet where the PreCise unit is installed. DO NOT STRAIN THE ANTENNA WIRES! Tie wrap to the existing harness to hold in place.

## Rear Cabinet

- Mount the PreCise unit in the rear cabinet using ¼ inch bolts and locking nuts.
- Connect the power harness of the PreCise unit with the red wire connecting to the constant power wire coming from the engine compartment.
- Connect the black wire to ground (may use chassis as ground if a good electrical connection is assured, i.e. no paint, grease, or dirt).
- Using a meter locate a switched power wire that is activated only when the key is turned on. Connect the green wire to that source.
  - A good source for this electrical signal is the chassis meter that is normally located in the back right utility cabinet.
- Insert the power harness into the upper 15 pin connector and hand tighten the mounting screws.
- Connect the antenna leads to the IX module. The GPS lead will attach to the center gold SMA connector. The GPRS lead to the top gold SMA connector. For a GSM/GPRS cellular only (no WiFi), there is no connection to the large silver antenna connector. (Refer to [Appendix D](#))
- Connect the 12 wire “breakout cable harness” to the lower 15 pin connector on the IX module and hand tighten the mounting screws.
- Mount three to four 12 volt relays (depending on the number of components, i.e. welder/crane/PTO/compressor) in the cabinet in an area where they will be protected from damage. Pins 86 and 30 of all three relays are tied to ground. (Refer to [Appendix F](#))
- Locate the hour meters for the crane and compressor. Using a meter, locate the connection that is active when these devices are in use. Splice into these lines and run wires to pin 85 of a relay and connect relay pin 30 to the appropriate input on the breakout cable connecting to the PreCise unit. (Refer to [Appendix E](#))
  - Input cables are:
    - Input 1 – PTO\*\*
    - Input 2 – Compressor\*
    - Input 3 – Crane\*
    - Input 4 – Welder\*
    - Input 5 – not used
    - Input 6 – availability switch
      - \* Requires inverter Relay
      - \*\* May require inverter relay
- Secure all wiring with tie wraps or loom as needed to protect from damage
- Reinstall any panels removed as part of installation
- Record the following information off of the IX module:
  - Serial number
  - ICC ID number
  - Mac ID number
  - Vehicle VIN/Make/Model/Year
  - All meter readings
    - Odometer/Chassis/Crane/Welder/Compressor
    - NOTE: The meter readings may need to be updated again if any of these meters accumulate additional time/distance before being entered into the asset on the PreCise website.

# Post-Install Checklist

Upon successful completion of the IX module installation, the following tasks should be performed:

- Ensure the vehicle is in a location where it has a clear view of the sky for obtaining a GPS lock on at least 4 satellites and registering on a cellular tower for wireless communications.
- Start the vehicle and visually inspect the LED status lights on the IX module (refer to [Appendix A](#))
  - NOTE:** The IX module may take up to 10 minutes to acquire a GPS lock on the first startup. Subsequent startups will acquire a GPS lock quickly.
- Confirm the asset is reporting either by watching for the #3 LED to change from blinking to a solid state, or by checking the asset's status on the PreCise website
  - NOTE:** This step assumes that the asset has already been configured in the PreCise website. For information regarding the initial setup and configuration of devices and assets in the PreCise website please refer to the online tutorials.
- Confirm the meter readings have been configured and are correct in the PreCise website
- Confirm the settings on the GSM/Cellular tab are configured and correct in the PreCise website
- Confirm the location of the asset on the map in the PreCise website
- Confirm that the availability switch is working by running a Raw Data Report on the PreCise website or by connecting a laptop directly to the IX module (refer to [Appendix B](#) and [Appendix C](#))
- Confirm that the PTO switch is working by running a Raw Data Report on the PreCise website or by connecting a laptop directly to the IX module (refer to [Appendix B](#) and [Appendix C](#))
- Confirm that the electrical signal from the crane, welder, and compressor are reporting the status correctly. This is best accomplished by connecting a laptop directly to the PreCise unit (refer to [Appendix B](#) and [Appendix C](#))

# Appendix A - LED Status Definitions

## LED #1 – GPS & Time/Date Status

- OFF: Unit does not have time and date. It has not acquired a satellite signal since continuous power was disconnected.
- SHORT BLINK: Unit has started and is using time/date from the real time clock. No satellite time signal has been acquired since power up (ignition ON).
- LONG BLINK: GPS has acquired time/date information from a satellite since ignition ON, but no position fix.
- SOLID ON: A position fix has been acquired. If positions are no longer acquired LED returns to long blink.

## LED #2 – WiFi Status

- OFF: The unit is not within range of an appropriate access point. (No WiFi connection)
- SHORT BLINK: The unit is within range of an appropriate access point, but no data transfers are occurring.
- LONG BLINK: A data transfer is occurring.
- SOLID ON: A file has been transferred. (This status indication remains for one minute and then reverts to the status existing at the end of the minute)

## LED #3 – GSM Cell Phone Status

- OFF: Not registered on any cell tower.
- SHORT BLINK: Registered on a cell tower.
- LONG BLINK: Data transfer is occurring.
- SOLID ON: A file has been transferred. (This status indication remains for one minute and then reverts to the status existing at the end of the minute)

## LED #4 & LED #5 – System Status

- BLINKING TOGETHER: System is normal (No error status indications).
- BLINKING SEPARATELY: This condition allows the transfer of up to eight simultaneous numerical status codes. To read these codes, count the number of blinks on LED #4 (LED #5 will remain OFF when #4 is blinking). Then count the number of blinks of #5 (LED #4 will remain OFF when #5 is blinking). The count for #4 is the tens digit and the count for #5 is the ones digit for an error code. Up to eight codes may be displayed in sequence, and then the sequence will restart. Thus it doesn't matter which code is read first. All codes have been read when any code observed is seen a second time.

## POWER

- This LED indicates that the system is "awake" which corresponds to the ignition ON, continuing activity after ignition OFF, a real time clock initiated wake up, or other system activity. It does not illuminate when continuous power exists if the system is "asleep".

# Appendix B - Connecting a Laptop Directly to an IX Module

At times it will be necessary to connect a laptop directly to an IX module in order to verify proper switch and electrical signals for the digital inputs. The following steps should be taken to configure a laptop to perform these tasks.

## Tools:

- Laptop running a Windows based operating system, preferably Windows 2000 or Windows XP.
- Straight through serial cable and a serial to USB converter if your laptop does not have a built in serial port.
- Microsoft HyperTerminal – built into Windows 2000 and Windows XP.

## Setup:

- On the laptop go to Start/Programs/Accessories/Communications and click on HyperTerminal to launch the application.
- If this is the first time it has been run you will need to setup a new HyperTerminal connection specific to the IX module.
  - On the “New Connection” window provide a name such as, IXDirect and click OK.
  - On the “Connect To” screen change the “Connect Using” option to COM1 and Click OK.
  - On the “COM1 Properties” screen configure as per **Figure 3: COM1 Properties** and Click OK.

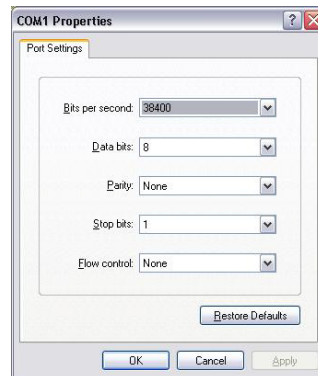


Figure 3: COM1 Properties – HyperTerminal

- At the main IXDirect HyperTerminal window go to File/Properties and then click on the Settings tab. Click on the “ASCII Setup” button and place a check mark for “Append line feeds to incoming line ends” as in **Figure 4: ASCII Setup** and click OK.

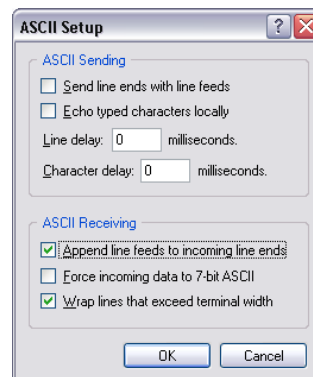


Figure 4: ASCII Setup

- The HyperTerminal IXDirect connection should now be complete and ready for use.

- Connect a straight through DB-9 cable from the RS-232 port on the IX module to a serial port on your laptop. If your laptop does not have a serial port, a USB Serial Adapter is recommended.
  - NOTE: A cross-over serial cable will not work properly.
- Once the DB-9 cable is attached, you will need to click on the “connect” icon, as in Figure 5: Connect Icon – HyperTerminal.

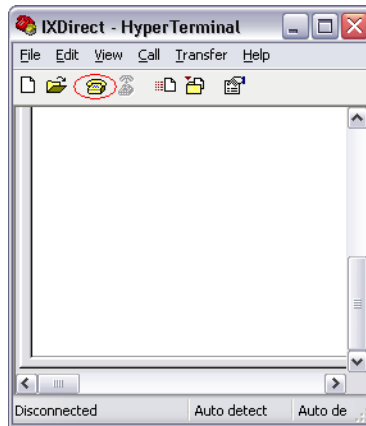


Figure 5: Connect Icon – HyperTerminal

- In order to start the flow of data on the HyperTerminal window you will need to start the vehicle to power up the IX module.
- Refer to Figure 6: IX Module Output – HyperTerminal for an example of the data output.

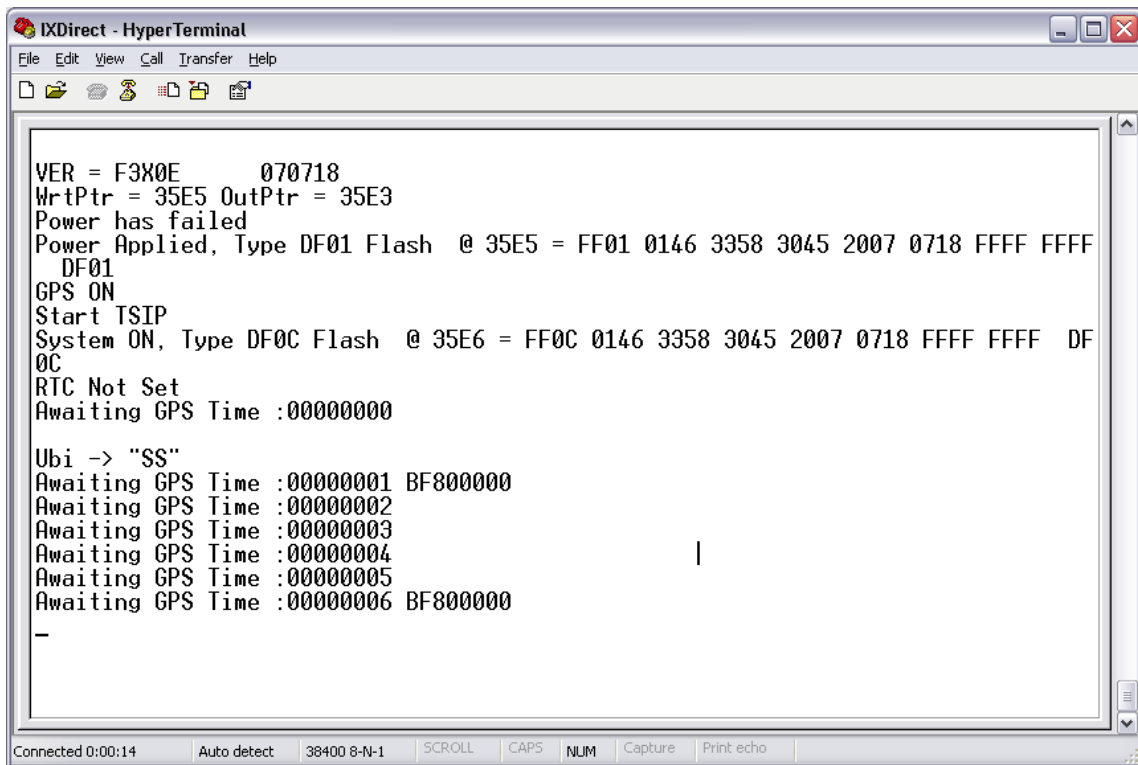


Figure 6: IX Module Output – HyperTerminal

- Refer to [Appendix C](#) for a list of commands that can be used in the HyperTerminal session.

# Appendix C – IX Module Commands for HyperTerminal Sessions

Command	Definition
ESC key	The ESC key enters the IX module into the diagnostics mode where commands can be entered
APP	Returns the IX module to the normal running application mode from the diagnostics mode
BAT	Measures input power voltage and displays it to the terminal
DIR	Print monitor directory to the terminal
EDF	Erases stored data and Infineon processor system configurations – contact Support for password
FPR	Program Flash – reads 1 line at a time, prompts for the next with ""
GOF	GPS Power Off
GON	GPS Power On
GRC	GPS output to CRT (TSIP displayed in hex; use Q1A for NMEA messages)
Q1A	Pass ASCII data between Quadart Chan A (GPS) and diagnostic port
GSF	GSM cell radio off
GSN	GSM cell radio on
IPF	Infineon processor power off (self-power control)
IPN	Infineon processor power on (self-power control)
NME	Switch to NMEA message type
O1F	Digital output 1 off
O1N	Digital output 1 on
O2F	Digital output 2 off
O2N	Digital output 2 on
QWD	Watch dog timer test (executes after a 5 second delay)
SID	Utility routine to prompt for a new Wi-Fi SSID (hit enter after the last character, repeat command if needed to correct errors)
STR	Displays the satellite numbers and signal strength for all tracked (at least 4 must be tracked for a GPS lock)
US1	Manual setup of parameters #1 (use "=" before any line to be changed, i.e. Max Speed = 00FF =00fe)
US2	Manual setup of parameters #2 (use "=" before any line to be changed, i.e. Move Check Period when ign OFF (5 min) = 0000 =0100)
US3	Manual setup of parameters #2 (use "=" before any line to be changed, i.e. Switches = N =Y)
VIU	Displays the revision of upper Infineon code
VIL	Displays the revision of lower Infineon code
VPI	Displays the revision code of the PIC code
VUB	Displays the revision of the Ubicomm code
WDF	Watch dog timer off
WDN	Watch dog timer on
WI?	Query command to determine whether WiFi is on or off (q0 = off and q1 = on)
WIF	Disables the WiFi communications
WIN	Enables the WiFi communications
WKY	Prompts for the key word for encryption used during WiFi communications (input key must be > 7 char and < 64   use Enter after last character)
WPF	Disables the WPA encryption
WNP	Enables the WPA encryption
INP	Displays decoded ignition and digital inputs to the terminal window
	<pre> I-----      [Ignition (switched power) is ON (above +6 volts); all digital outputs are OFF] I1-----     [Digital input 1 switched ON (Input line is grounded)] I-----      [Digital input 1 switched OFF (Open circuit or raised above about 3 volts)] I-2-----    [Digital input 2 switched ON (Input line is grounded)] </pre> <p>...continued from previous page</p>



```
I----- [Digital input 2 switched OFF (Open circuit or raised above about 3 volts)]
I--3--- [Digital input 3 switched ON (Input line is grounded)]
I----- [Digital input 3 switched OFF (Open circuit or raised above about 3 volts)]
I---4-- [Digital input 4 switched ON (Input line is grounded)]
I----- [Digital input 4 switched OFF (Open circuit or raised above about 3 volts)]
I---5- [Digital input 5 switched ON (Input line is grounded)]
I----- [Digital input 5 switched OFF (Open circuit or raised above about 3 volts)]
I---6- [Digital input 6 switched ON (Input line is grounded)]
I----- [Digital input 6 switched OFF (Open circuit or raised above about 3 volts)]
I---4-- [Digital input 4 switched ON (Input line is grounded)]
I--34-- [Digital input 3 switched ON (Input line is grounded)]
I---4-- [Digital input 3 switched OFF (Open circuit or raised above about 3 volts)]
I----- [Digital input 4 switched OFF (Open circuit or raised above about 3 volts)]
----- [Ignition input 1 switched OFF (Open circuit or lowered below about 3 volts)]
I----- [Ignition (switched power) is ON (above +6 volts)]
----- [Ignition input 1 switched OFF (Open circuit or lowered below about 3 volts)]
I----- [Ignition (switched power) is ON (above +6 volts)]
----- [Escape was hit here to go to utilities]
```

SP= FBF4

# Appendix D - Electrical Installation of the IX 201/301/302

## Antenna Connections:

**IX-201** - Two antenna cables must be connected to the IX-201. The GPS cable is connected to the small gold (SMA) connector in the right side of the front panel about half way up. The WiFi antenna cable with the larger connector must be connected to the larger silver connector in the right side of the front panel near the bottom.

**IX-301** - Two antenna cables must be connected to the IX-301. The GPS cable is connected to the small gold (SMA) connector in the right side of the front panel about half way up. The GSM/GPRS phone antenna cable with the second small (SMA) connector must be connected to the small gold connector in the right side of the front panel near the top.

**IX-302** - In order to allow either of the possible communication methods, the IX-302 must have three antenna cables connected. The GPS/GPRS cable is connected to the small gold (SMA) connector in the right side of the front panel about half way up. The WiFi antenna cable with the larger connector must be connected to the larger silver connector in the right side of the front panel near the bottom. The GSM/GPRS phone antenna cable with the second small (SMA) connector must be connected to the small gold connector in the right side of the front panel near the top. **NOTE:** The antennas supplied with the IX-302 are dual purpose antennas, and therefore they have two cables each. One is a GPS/WiFi antenna, and the other is a GPS/GSM/GPRS antenna. For the fully functioning IX-302 this will result in one of two available GPS antenna cables unused. It does not matter which of the two is utilized by the unit.

## POWER Connections:

**All IX-201/301/302 Versions** - There are three wires which must be connected for a minimally configured IX module can function. The supplied cables are color coded to aid in proper installation.

The **BLACK** wire is the ground and should be connected to the negative battery voltage. This is normally, but not always, the chassis of the equipment. If the equipment has a master disconnect switch on the negative side this ground connection should be between the battery and that switch.

The **RED** wire is the continuous power wire. It should be connected to the positive side of the battery power. It must not be switched by the ignition, a master disconnect switch, nor any other switched apparatus. This power is used to run the real-time clock which enables the unit to wake at scheduled intervals. It also maintains the GPS data to allow quicker position determination when the equipment starts.

The **GREEN** wire is the switched power ("ignition") signal. It provides information that the equipment has started operation (or is running). It should be connected to a signal which is grounded (or open circuit) when the equipment is "OFF". And it should be at the battery voltage (greater than 8 volts) when the equipment is running. **NOTE:** It is very unlikely that any existing signal will be open circuit in normal operation nor while stopped. **NOTE:** If equipment has a negative side (ground) disconnect switch, a relay must be installed. The relay's activation coil must be installed between the switched power (ignition) signal which is greater than 8 volts while running and the negative side of the equipment past the disconnect switch. The relay's normally open contacts should be connected to the battery's positive terminal and to the GREEN wire (the ignition input of the IX module).

## DIGITAL INPUTS:

All IX-201/301/302 Versions - There are six available digital inputs on the IX module when incorporating the breakout cable. They are all electrically identical. Functionally they are the same except that in some versions the sixth input may be optionally configured to trigger a wireless communication when it is switched. The IX module reports the input as "ON" if the input is switched to below approximately two volts. It reports "OFF" when it is open circuit or is switched above about four volts. An open circuit will not normally be found in equipment's electrical system.

## NEGATIVE GROUND EQUIPMENT

**Circuit Type #1:** Positive battery power is applied at all times and ground is applied for ON.

Connect the digital input wire directly to the switched side of the circuit.

**Circuit Type #2:** Switched positive power is applied (as when the ignition is ON) and ground is applied to turn the circuit ON.

A relay's activation coil should be connected between the circuit's positive and negative inputs. The relay's normally open contacts should be connected to ground and to the digital input (refer to [Appendix E](#))

**Circuit Type #3:** Ground is connected at all times, and positive voltage is used for ON.

If the digital input is connected to the positive side of the circuit (the switched side), the input will report ON when the circuit is not activated. It will report OFF when the circuit is activated. In some cases this may be acceptable. If it is not acceptable, a relay must be used to reverse the report to match the activity of the circuit. In this case, the relay's activation coil should be connected to the ground at the circuit being reported and to the switched positive side of the circuit. The relay's normally open contacts should be connected to the ground (same as the IX module's negative power) and to the digital input.

## POSITIVE GROUND EQUIPMENT

**Circuit Type #4:** Negative battery voltage is applied at all times, and positive ground is applied for ON.

If the digital input is connected to the switched side of the circuit, the reports will show ON when the circuit is OFF and OFF when the circuit is ON.

In some cases this may be acceptable. If it is not acceptable, a relay must be used to reverse the report to match the activity of the circuit. In this case, the relay's activation coil should be connected to the ground at the circuit being reported and to the switched positive side of the circuit. The relay's normally open contacts should be connected to the negative battery voltage (same as the IX module's negative power) and to the digital input.

**Circuit Type #5:** Switched negative voltage is applied (as when the ignition is ON) and positive ground is applied for ON.

If the digital input is connected directly to the switched side of the circuit to be reported, two things are reported incorrectly. First, when the circuit is ON and the switched power (ignition) is ON, then the digital input will show OFF. With the switched power (ignition) OFF, the input will show OFF regardless of the actual switch position. Therefore a relay should be used in this application. The relay's activation coil should be connected to the positive voltage side and the negative voltage side of the reported circuit. The relay's normally open contacts should be connected to the batteries negative voltage (unswitched) and to the digital input.

**Circuit Type #6:** Positive ground is applied at all times and negative voltage is applied for ON.

Connect the digital input wire directly to the switched side of the circuit.

# Appendix E - Ignition Relay Installation

If the equipment has a negative side (ground) disconnect switch, a relay must be installed. The relay's activation coil must be installed between the switched power (ignition) signal which is greater than 8 volts while running and the negative side of the equipment past the disconnect switch. The relay's normally open contacts should be connected to the battery's positive terminal and to the GREEN wire (the ignition input of the IX module).

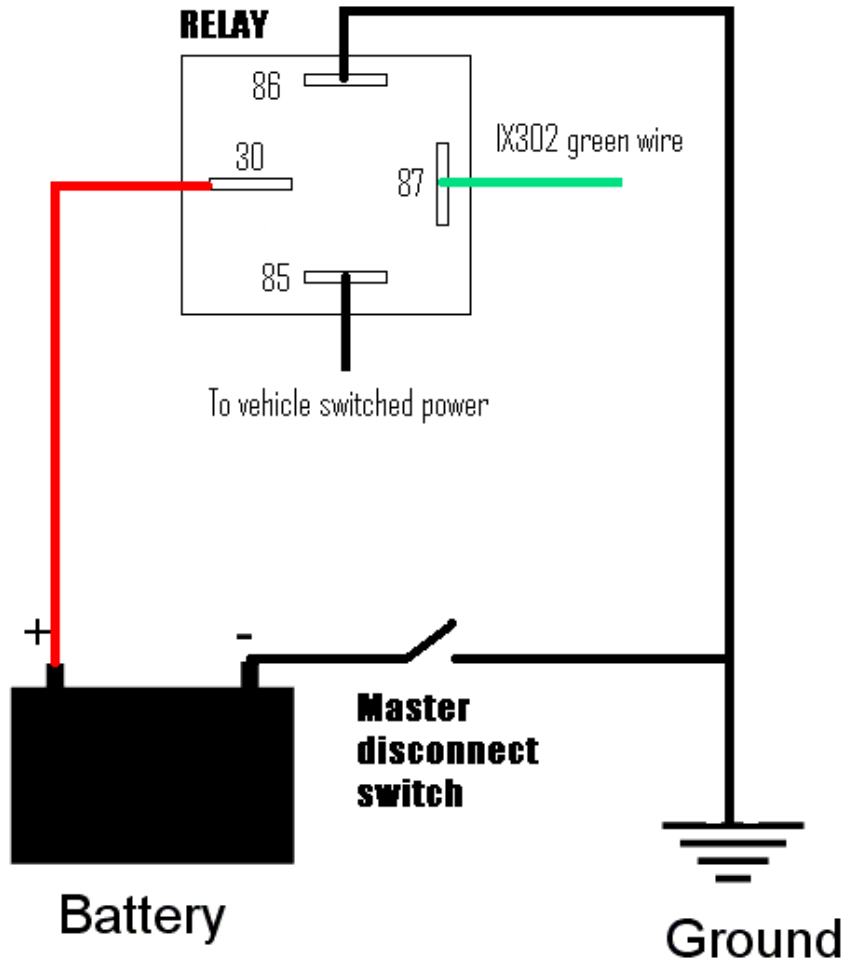


Figure 7 – Ignition Relay Install Diagram

# Appendix F – Input Relay Installation Diagram

## Input Sense Inverter

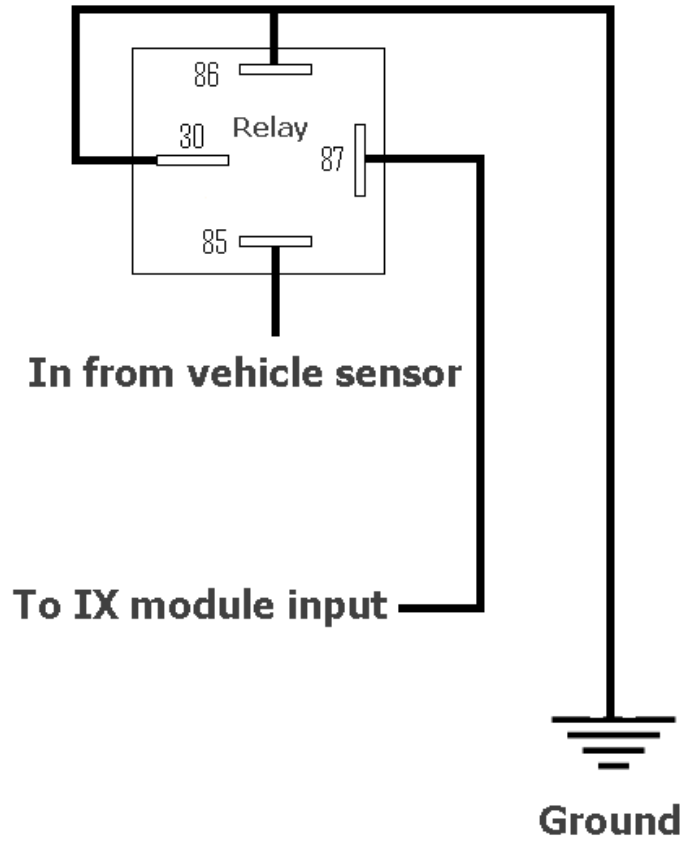


Figure 8 – Input Relay Install Diagram

# IX- 201/301/302 Specifications

## GPS

Parameter		Rating	Units
Satellite tracking		12	channels
Update rate		1	Hz
Acquisition time	Reacquisition	<2	s (90%)
	Hot start	<10	s (50%)
		<13	s (90%)
	Warm start	<38	s (50%)
		<42	s (90%)
Cold start	<50	s (50%)	
	<84	s (90%)	
Accuracy	Horizontal	<5	m (50%)
		<8	m (90%)
	Velocity	0.06	m/s
	Time	50	ns

## 802.11 Radio [IX-302 / IX-201 only]

Parameter		Rating	Units
Radio type		IEEE 802.11b (DSSS)	
Frequency coverage		2.400-2.484	GHz
Channel spacing		5	MHz
Number of channels		11	
Modulation (Auto Fall-Back)	11, 5.5 Mbps	CCK	
	2 Mbps	DQPSK	
	1 Mbps	DBPSK	
Range (open environment)	11 Mbps	80	m (typ)
	5.5 Mbps	120	m (typ)
	2 Mbps	200	m (typ)
	1 Mbps	300	m (typ)
Receiver Sensitivity (FER=0.08)	11 Mbps	-80	dBm (min)
	5.5 Mbps	-83	dBm (min)
	2 Mbps	-84	dBm (min)
	1 Mbps	-87	dBm (min)
Transmitter	Power output	17	dBm (max)
Regulatory Certifications		FCC Part 15 ETSI 300/328/CE	FCC ID: JCK-GN-WIAG02

GSM Radio [IX-302 / IX-301 only]

Parameter		Rating	Units
Frequency bands	EGSM850 transmit	824-849	MHz
	EGSM850 receive	869-894	MHz
	EGSM900 transmit	880-915	MHz
	EGSM900 receive	925-960	MHz
	GSM1800 transmit	1710-1785	MHz
	GSM1800 receive	1805-1880	MHz
	GSM1900 transmit	1850-1910	MHz
	GSM1900 receive	1930-1990	MHz
Output power	EGSM850	+33 ±2	dBm (max)
	EGSM900	+33 ±2	dBm (max)
	GSM1800	+30 ±2	dBm (max)
	GSM1900	+30 ±2	dBm (max)
Receiver Sensitivity BER Class II <2.4%	EGSM850	-102	dBm (min)
	EGSM900	-102	dBm (min)
	GSM1800	-102	dBm (min)
	GSM1900	-102	dBm (min)
Data transfer	GPRS	Multislot Class 12	
		Full PBCCH support	
		Mobile Station Class B	
		Coding Scheme 1-4	
SIM interface	SIM cards supported	3V and 1.8V	
Regulatory Certifications		R&TTE, FCC, UL, IC, GCF, PTCRB	FCC ID: QIPTC63

## Power

Parameter		Rating	Units
Supply voltage	Operating	9.8 to 32.0	V
	Continuous	65.0	V (max)
Over-voltage protection threshold (Note 1)		32	V (min)
		36	V (max)
Input current			
Vin=24V dc	Sleep	9	mA (typ)
	Operating	250	mA (typ)
Vin=12V dc	Sleep	7	mA (typ)
	Operating	500	mA (typ)

1. Above this threshold, device will not operate until voltage is within normal operating range

## Input/Output

Parameter		Rating	Units
High Level Input (Note 1)		4.0	V (min)
		36.0	V (max)
Low Level Input (Note 1)		0.8	V (max)
		-24.0	V (min)
High Level Output (Note 2)		Vbat + 0.5	V (max)
Low Level Output	Id = 0.5A	0.7	V (max)
Output Short-Circuit Protection Threshold		300	mA (min)
		600	mA (max)
Output Diode	rms	1.0	A (max)
Current	peak (8ms half-sine)	30	A (max)

1. Input is high when left open or driven above high level input threshold. Input is low when driven below low level input threshold.

2. Outputs have a diode tied to supply voltage to enable connection to unclamped inductive loads.

## Physical

Parameter		Rating	Units
Dimensions		2.3 x 5.9 x 7.4	in
		57 x 150 x 188	mm
Weight		2.2	lbs
		1.0	kg



## Environmental

Parameter	Rating
Operating Temperature:	-30°C to +60°C
Storage Temperature:	-40°C to +85°C
Humidity:	5% to 95% RH non-condensing at +40°C
Vibration:	SAE J1455 for chassis-mounted devices (4g, 20Hz-2kHz).
Shock:	±25g
Electrical Protection:	SAE 1455 (12V & 24V) <ul style="list-style-type: none"> <li>● load dump</li> <li>● inductive switching</li> <li>● mutual</li> </ul> ±8kV ESD, human body model Reverse polarity Over-voltage shutdown Short-circuit

# Pin-Outs

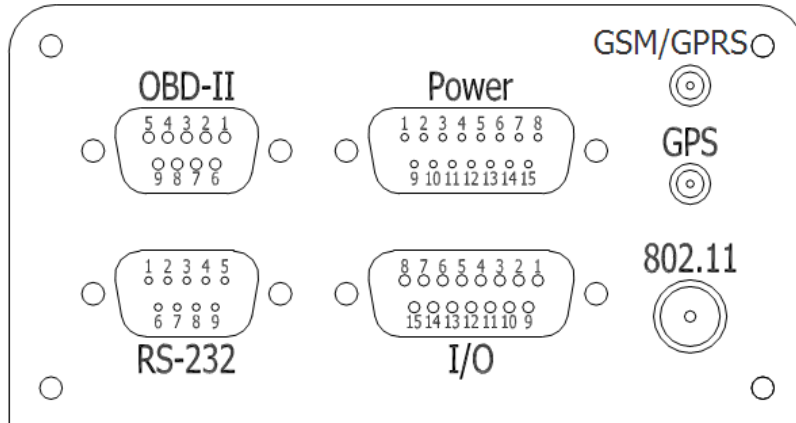


Figure 9: IX-302 Connectors

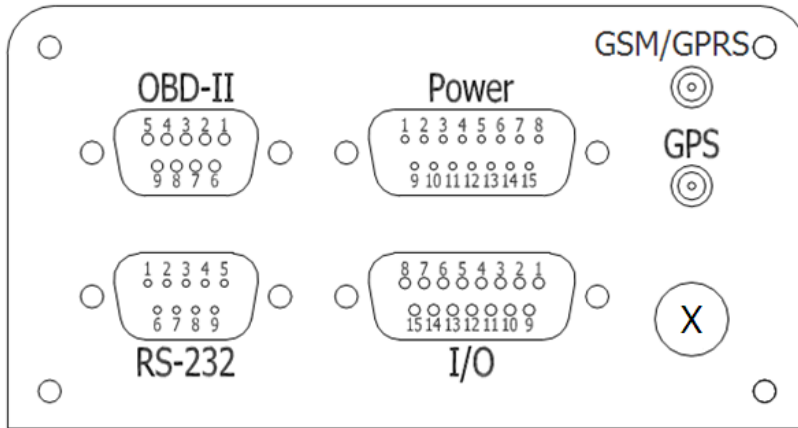


Figure 10: IX-301 Connectors

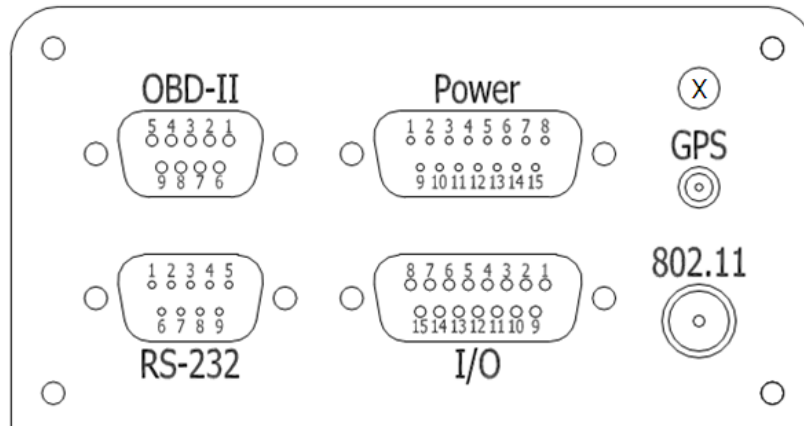


Figure 11: IX-201 Connectors

## Power Connector

Pin Number	Pin Label	Description
1	RESERVED	Reserved for future use; do not connect
2	RESERVED	Reserved for future use; do not connect
3	RESERVED	Reserved for future use; do not connect
4	+12V	Un-switched power input (12/24Vdc compatible)
5	+12V	Un-switched power input (12/24Vdc compatible)
6	IGN	Switched power input (active above 7V)
7	RESERVED	Reserved for future use; do not connect
8	BOOT	Active high boot; connect for service mode only
9	RESERVED	Reserved for future use; do not connect
10	GND	Ground
11	GND	Ground
12	GND	Ground
13	GND	Ground
14	CAN2_H	CAN2_H*
15	CAN2_L	CAN2_L*

### RS-232 Connector

Pin Number	Pin Label	Description
1	RESERVED	Reserved for future use; do not connect
2	RS232_TX1	SERVICE RS232 Transmit line
3	RS232_RX1	SERVICE RS232 Receive line
4	RESERVED	Reserved for future use; do not connect
5	GND	Ground
6	RESERVED	Reserved for future use; do not connect
7	RESERVED	Reserved for future use; do not connect
8	RESERVED	Reserved for future use; do not connect
9	RESERVED	Reserved for future use; do not connect

### OBD-II Connector

Pin Number	Pin Label	Description
1	GND	Ground
2	GND	Ground
3	CAN1_H	CAN1_H*
4	K_LINE	K_LINE*
5	CAN1_L	CAN1_L*
6	J1850-	J1850*
7	J1850+	J1850*
8	L_LINE	L_LINE*
9	BAT	BAT

## I/O Connector

Pin Number	Pin Label	Description
1	IN5	Input #5
2	IN6	Input #6
3	IN1	Input #1
4	IN2	Input #2
5	IN3	Input #3
6	IN4	Input #4
7	OUT1	Open-drain output #1
8	OUT2	Open-drain output #2
9	RS232_TX2	RS232 Transmit line
10	RS232_RX2	RS232 Receive line
11	GND	Ground
12	GND	Ground
13	J1708_A	J1708_A
14	J1708_B	J1708_B
15	GND	Ground

\*currently not supported in firmware

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This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

