CarNetix

CarNetix CNX-P1900 DC-DC Power Supply
(applies to Version 1.0.8+ hardware)

Installation and Operation Manual

Version 1.0

May 1, 2005

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1.0 CNX-P1900 Introduction

NOTE: This manual and feature set apply to Rev 1.0.8 and above of the printed circuit board (PCB). The PCB revision number is printed on the top of the PCB in white lettering. Please make sure you are using the correct manual for the correct product revision.

1.1 Introduction

The CNX-P1900 is a 140 watt intelligent DC-DC power regulator designed to provide safe, reliable power to today's newest CarPCs......including the Mac mini and Pentium P4-based systems!
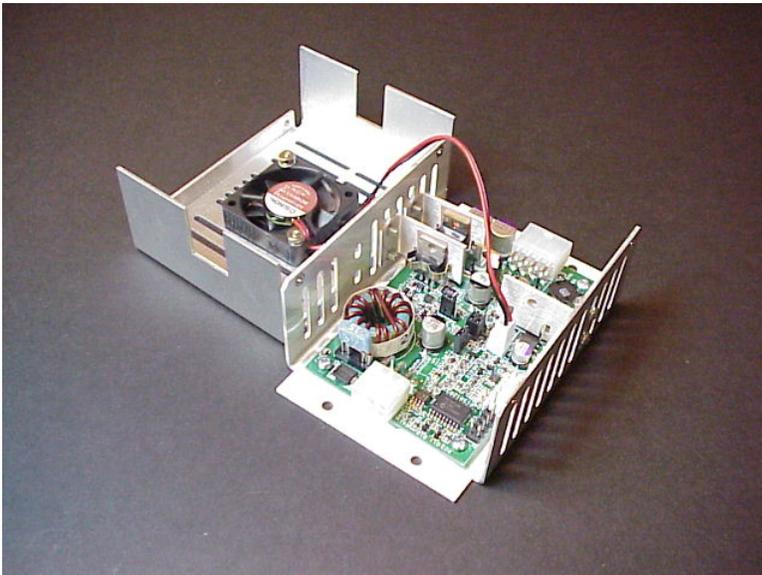
Figure 1 CarNetix CNX-P1900

The P1900 provides two outputs. The primary output is jumper selectable for 18V, 19V, or 20V operation and can provide up to 6.32 amps (125 Watts @ 20V). The secondary output is jumper selectable to provide either +12V to power your LCD screen (or 13.5V or experimental purposes), or +5V to power USB devices (such as the Audigy 2NX sound USB sound card or USB powered hubs) with up to 3 amps (15 Watts). The P1900 can accept battery input as low as 7 volts under full load (140 watts) during cranking while providing a well-regulated output so that your Mac/CarPC does not crash.

The P1900 includes all of the sophisticated features of its predecessors (P1260 and P1280/90) such as Startup/Shutdown controller, Pulse Start (remotely start the P1900 with door locks, car alarm, or wireless device), and DelayON (prevents speaker "thump" during booting). The P1900 fully and safely supports "Standby" mode and will automatically shut itself down (by detecting excess current drain) if the CarPC fails to properly go into Standby mode.

The P1900 is also designed to power larger systems that demand higher power, such as P4-based motherboards (ie Insight P4 ITX) with full sized hard drives. The P1900 is fully compatible with the Travla C137 (90 watt and 120 models), the C138 (90 watt and 120 watt models) as well as the newer C158 (90 watt and 120 watt models) cases. In fact, a very cost effective P4 CarPC system can be built using the Travla C137, C138, or C158-120 and the Insight P4 ITX motherboard. No need to spend $100 more for other DC-DC PSUs that may not even handle the +12V rail power!

In addition, the P1900 can be used with the Mac mini, Sumicom, Xenarc, and Cappuccino models that require an external 18v, 19v, or 20v power source (ie on-board power supply). It is also a very cost effective solution for custom applications when used in conjunction with a DC-DC PSU such as the Casetronic C4-CT-DC150L DC-DC Converter, or the P4-CT-DC150: X72W - 143W DC-DC Converter (see http://206.14.132.88/products/PowerSupply/DCCONVERTER/C4/DC-C4.html or http://206.14.132.88/products/PowerSupply/DCCONVERTER/P4/DC-P4.html for more information).

P1900 Features

- 140 Watt Dual Output Regulator
- Jumper selectable main output of +18/+19/+20V
- Jumper selectable secondary output of +12V/+13.5V or +5V
- Survives Engine Cranking under full load over entire temperature range
- Includes sophisticated Startup/Shutdown Controller
- Includes sturdy aluminum chassis with variable speed fan suitable for car environment
- Field upgradeable flash microprocessor
- Low battery monitor prevents drained battery, even during Standby/Sleep
- "Anti Thump" delayed remote control for audio amplifiers
- Remote "Pulse Start" from wireless device or car alarm/remote start system
- Over current protection on both outputs with graceful forced shutdown of main output
- Powers both your CarPC/Mac AND your screen or USB devices
- Compatible with Mac mini including startup/shutdown and sleep mode
- Compatible with Pentium P4-based systems such as Travla C158-120, Sumicom S630, or Xenarc SC8
- Full, safe support for Windows Standby mode including auto shutdown if PC fails to shutdown
- Over voltage surge suppression on battery input for protection of harsh automotive environment
- User replaceable fuse on battery input to protect your car from internal short circuits
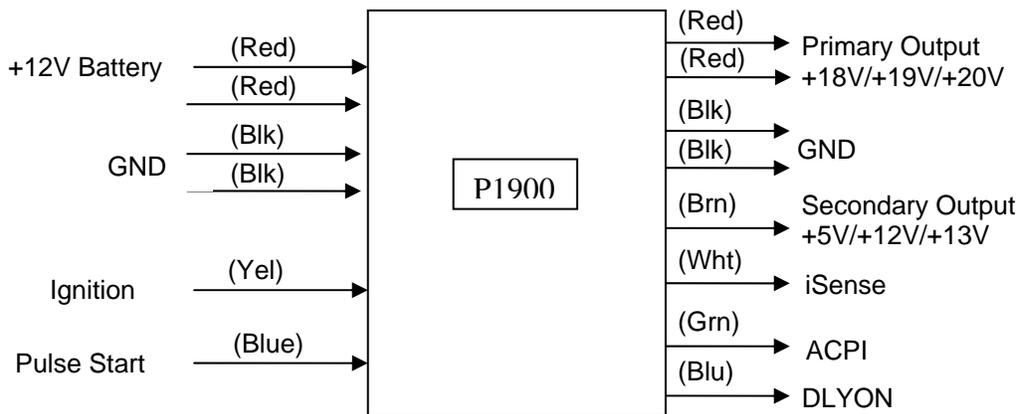

Figure 2 P1900 Block Diagram

1.2 Primary Power Output

The P1900 Primary Output can provide +18V, +19V, or +20V (note: these voltages have actually been designed to be about .5V higher to overcome wiring losses in a typical installation) via jumper selections on the PCB. The total current available on the primary output is 6.32 amps (120 watts at +20 Volts). The primary output is typically used to power your CarPC PSU in a case which contains a 90 Watt or 120 Watt DC-DC PSU, the Mac mini, or a Sumicom/Xenarc/Cappuccino PC.

1.3 Secondary Power Output

The P1900 also provides a Secondary Output of either +5V, +12V or +13V via jumper selections. The total current available on the Secondary Output is 3 amps (15 watts at +5 Volts). If you exceed the current or power limit of the secondary output it will automatically shut down.

Using the Secondary Output for +5V devices

The +5V selection is typically used to power USB devices such as external USB sound cards (ie Audigy 2NX) or powered USB hubs. The +5V output can provide up to 3 Amps. When jumpered for +5V operation, the secondary output does not de-rate the total power available on the primary output (see +12V Secondary Output below).

Using the Secondary Output for +12V/+13V devices

When the secondary output is jumpered for either +12V or +13V operation it derives its input from the primary (+19V) output. Since the total power available from the primary output is 120 Watts, when using the +12V/+13V secondary option, the primary output must be de-rated by current consumed by the secondary output.

The secondary output can be jumpered to provide +12V at up to 2Amps for powering your LCD screen or other low powered +12V devices.

The secondary output can also be jumpered for +13V operation for those who want to experiment with attempting to make their LCD screens brighter by applying a higher supply voltage. Be very cautious when attempting this since it may damage your screen. If you use this higher voltage it is recommended that you add additional ventilation (ie fan) to your screen.

> *THIS +13V SECONDARY OUTPUT IS FOR EXPERIMENTATION ONLY. USE AT YOUR OWN RISK. CARNETIX IS NOT RESPONSIBLE FOR DAMAGE TO SCREENS OR OTHER DEVICES THAT ARE OPERATED OUTSIDE OF THE LIMITS SPECIFIED BY THE MANUFACTURER OF THE DEVICE.*

1.4 Startup/Shutdown Controller (SSC) Overview

The P1900 contains a sophisticated, PIC microprocessor-based Startup/Shutdown Controller (SSC). Its main job is to automatically start and stop your PC/Mac when you turn ON or OFF your ignition switch. However, it is also designed to help prevent HDD (hard disk drive) problems by inadvertently removing power while your PC/Mac is accessing the drive. The timing of the bootup and shutdown signals are carefully designed to help prevent unwanted booting or shutdown if the user turns ON or OFF the ignition while the PC/Mac is already in the process of booting or shutting

down. Once the PC/Mac begins its bootup or shutdown process, the SSC enters a "bootup lockout" state that prevents the user from attempting to reverse this process until it has completed.

In addition, the SSC provides control and monitoring to allow the PC/Mac to safely enter "Hibernation" (PC only) or "Standby/Sleep Mode" (PC and Mac). These modes are selected jumpers on the P1900 and are described in more detail in Section 3.

The SSC also contains a battery monitor which will shut the P1900 down in the event the battery voltage drops below approximately 10.6 volts. This will help prevent deep discharge and damage to your battery.

The SSC has a "Pulse Start" input that allows you to start the P1900 by using an externally applied "pulse" from a device such as your car alarm, remote starter, or wireless device.

The various operating states of the SSC are described in more detail in Section 7 of this manual.

2.0 Applications

The following sections discuss application specific information about the P1990 installation, setting, and operation for various computer systems.

2.1 Mac mini Application

The P1900 is well suited to power the Mac mini in an automotive application. The Mac mini requires an input of +18.5VDC at a maximum power consumption of 85 watts, well within the range of the P1900. The Primary Output of the P1900 will be used to power the Mac, while the secondary can be used to power either your LCD screen or a USB hub for your USB peripheral devices. The P1900 Startup/Shutdown Controller (SSC) can be used to automatically start/stop the Mac mini when you start and stop your car's engine.

The following sections point out important considerations to keep in mind when connecting the P1900 to the Mac mini.

2.1.1 DC Power Connection

Since the DC power connector on the Mac mini is not commercially available you must use the DC power connector that comes with the Mac mini AC adapter to connect to the P1900. This requires cutting the DC output cable on the AC adapter and splicing it to the power output cable of the P1900. The details of this process appear on our website (http://www.carnetix.com/p1900/P1900PowerConectionforMacmini/index.html). There is currently no other way to connect the P1900 to the Mac mini.

2.1.2 Sleep Mode

When you turn off the Mac mini it can either be put into "sleep" mode or powered completely down. Using Sleep Mode offers several advantages, but also presents some challenges and tradeoffs. The advantage to using Sleep Mode is that the Mac will shutdown and resume very quickly (~5 seconds) when controlled by the P1900 SSC (Startup/Shutdown Controller). This is very advantageous in an automotive application.

However, using Sleep Mode also means that the P1900 must continue to provide power to the Mac during its Sleep Mode when your car's engine is turned off. This places a drain on your car's battery (~200mA) so you will want to monitor the health of your battery to prevent damage over an extended period of time. The effect this current drain will have is directly dependent upon the "health" (age and condition) of your battery. Your mileage will vary.

Since the P1900 SSC currently simulates a momentary button press (~500mSec), Sleep Mode is the only configuration currently supported (not Shut Down). However, the P1900 firmware is field upgradeable by the user with an inexpensive (~$10) PIC programmer. Information will be posted in the future that will allow you to upgrade your firmware to support the Power Down mode (6 second button press). See the U-Flash portion of our website for details on the PIC programmer hardware and free software.

To enable the Mac mini Sleep Mode setting, go to:

SystemPreferences -> **EnergySaver** -> **Options** -> **WakeOptions** and check the box labeled "*Allow power button to sleep the computer*".

The enable the P1900 for Sleep Mode you must change the jumper position of JP1 Pins 5-6 from the factory default (Hibernate) to the Standby(Sleep) position (see Section 3.1 for jumper locations).

You MAY choose NOT to use the P1900 SSC to control your Mac mini. There is nothing wrong with this. Simply push your power button as you normally do to control the Mac, and let your P1900 start and stop under the control of your ignition switch.

2.1.2 Mac USB Devices/Connections

While in Sleep Mode the Mac mini will wake up when any activity occurs on any connected USB devices. This includes powering or de-powering a self-powered USB hub. This means that if you use the P1900 to power a USB hub that connects USB devices to your Mac mini, you will need to properly jumper the P1900 to turn power OFF to the USB hub BEFORE the Mac mini enters Sleep Mode. Otherwise, the act of de-powering the USB hub after the Mac mini been put in Sleep Mode will wake the Mac mini causing confusion with the P1900 SSC.

THEREFORE, if you are using the P1900 to power your USB hub, make sure you set the P1900 jumper JP4 to DLYON position (see "Setting the Jumpers" section). See installation section for jumper locations.

2.1.3 "Restart Automatically After Power Failure" Setting

If you are using the P1900 SSC to start/stop your Mac mini, you should DISABLE the *"Restart Automatically After a Power Loss"* feature in the Mac mini. Otherwise the Mac min may boot inadvertently, causing the P1900 SSC to be out of sync with the Mac.

To disable the Mac mini auto restart function, go to:

SystemPreferences -> EnerySaver -> Options -> OtherOptions and UNCHECK the box called "*Restart automatically after a power failure*".

If you are NOT using the P1900 SSC to start/stop your Mac mini, you can leave this box checked so that the Mac mini automatically turns ON when you P1900 comes on (ie with you ignition switch). Again ,you will have to manually turn the Mac mini off if not using the P1900 SSC.

2.1.4 Power Button Cable Kit

CarNetix has developed an optional Power Button Cable Kit which is used to provide access to the Mac mini power button without modifying the existing Mac mini cabling. It also allows you to leave your existing power button connected to your motherboard so that it can function normally. The Power Button Cable Kit includes an "extension" cable that allows you to easily disconnect the Mac

mini from the P1900 if you want to temporarily remove the Mac mini from your car (ie take it inside for software upgrades, etc).

The center connection of the Y-cable should be inserted into the Mac mini motherboard where the existing power button is normally connected. Gently remove the existing Mac mini power button connector from the motherboard and plug it into either side of the 2-output end of the Y-cable. Then plug the center of the Y-cable into the motherboard where the original power button connector had been removed. Now plug the "power button extension" cable into the remaining connector on the 2-output end of the Y-cable. This extension cable will be connected to the "ACPI" (GRN/BLK) wires on the output (J2 Pins 6&8) of the P1900. Once connected, the P1900 will be able to automatically start and stop the Mac mini when your ignition is turned on or off.
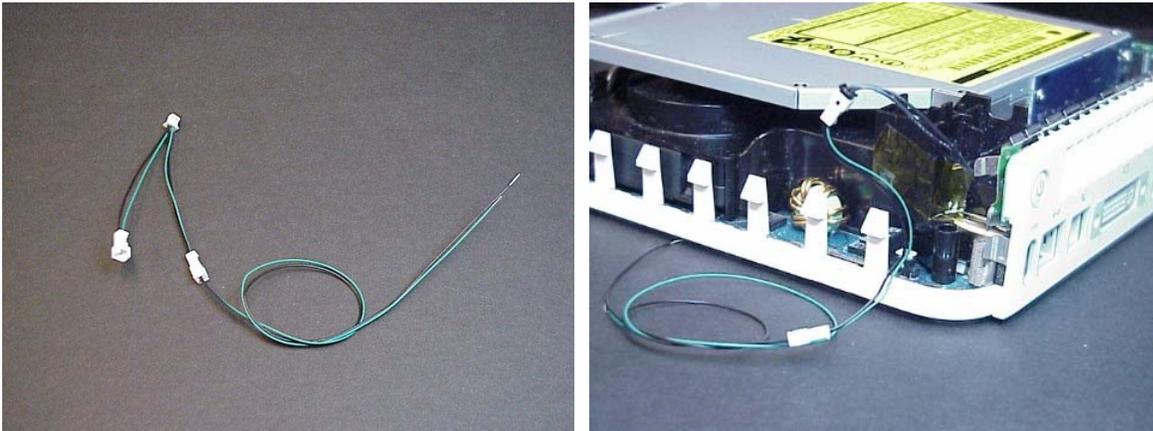

Figure 3 Mac mini Power Button Cable Kit

2.1.5 Mac mini Connection Diagram

In the typical application diagram below the P1900 is providing +18.5V to the Mac mini from its Primary Output, while providing +5V to a powered USB hub from its Secondary Output. The Power Button of the Mac mini is connected to the P1900 using the Power Button Cable Kit described above. The DelayOn signal may be used to provide a 3 second delayed "enable" signal to your audio amplifier to help prevent "thump" when your Mac gets powered by the P1900.

2.1.5.1 Power Input Connections

The P1900 comes with TWO RED POWER INPUT leads. Tie ONE of the input Power leads to your car battery. Make sure to install a 15A fuse in this line somewhere near your battery. This will help protect against shorts in the power cable. The second RED input power lead is not used. Put a piece of electrical tape over the end of it to prevent it from shorting out.

The P1900 comes with Two BLACK GROUND INPUT leads. Tie ONE of the input Ground leads to a common grounding point on your car's chassis. It is a good idea to ground this lead at the same

location where you ground other devices used in the CarMac setup. The second input ground lead is not used.

2.1.5.2 Ignition Input Connection

If you will be using the Startup/Shutdown Controller (SSC) on the P1900 to start/stop your Mac mini you will need to locate an "ignition" wire somewhere in your car. This wire is typically yellow and will produce +12V when your key is ON, and 0V when the key is OFF.

Once you have located a suitable Ignition wire, connect it to the Yellow Ignition input to the P1900. You may want to install a "Valet" switch in series with this line so that you can prevent the Mac mini from turning ON at certain times (ie when you let someone borrow you car, or when you let a parking attendant park your car). This is a simple single pole single throw switch and carries very little current.

2.1.5.3 Power Output Connections

The P1900 comes with TWO RED POWER OUTPUT leads. Tie ONE of these output Power leads to the RED wire on the DC power cable from your Mac mini AC adapter. The second output power lead is not used. Put a piece of electrical tape over it to keep it from shorting out.

The P1900 comes with two BLACK Ground OUTPUT leads. Tie one of these leads to your Mac mini DC power cable. The second Ground lead can be shared with your secondary output and your power button cable.

The Mac must sense the presence of the appropriate power supply thru the iSense wire on the P1900 output. Connect the WHITE iSense wire from the P1900 to the small GREY wire on the Mac mini DC power cable.

2.1.5.4 Power Button Output Connection

The P1900 emulates the Mac mini power button and produces a "button press" (~500msec) on its "power button output (ACPI)" leads (GRN/BLK). Tie these GRN/BLK wires to the GRN/BLK wires on the Power Button Extension Cable described above in the Power Button Cable Kit section. The black wire is the second output ground wire and is shared with your secondary output connection.

2.1.5.5 Using DelayON to Control Your Audio Amplifier

If your car's audio amplifier has a "remote enable" input, you can use the P1900 DLYON (Delay ON) output to provide a 3-second delayed enable signal to the amps. This will help prevent a loud "thump" in your speakers when power is applied to the Mac.
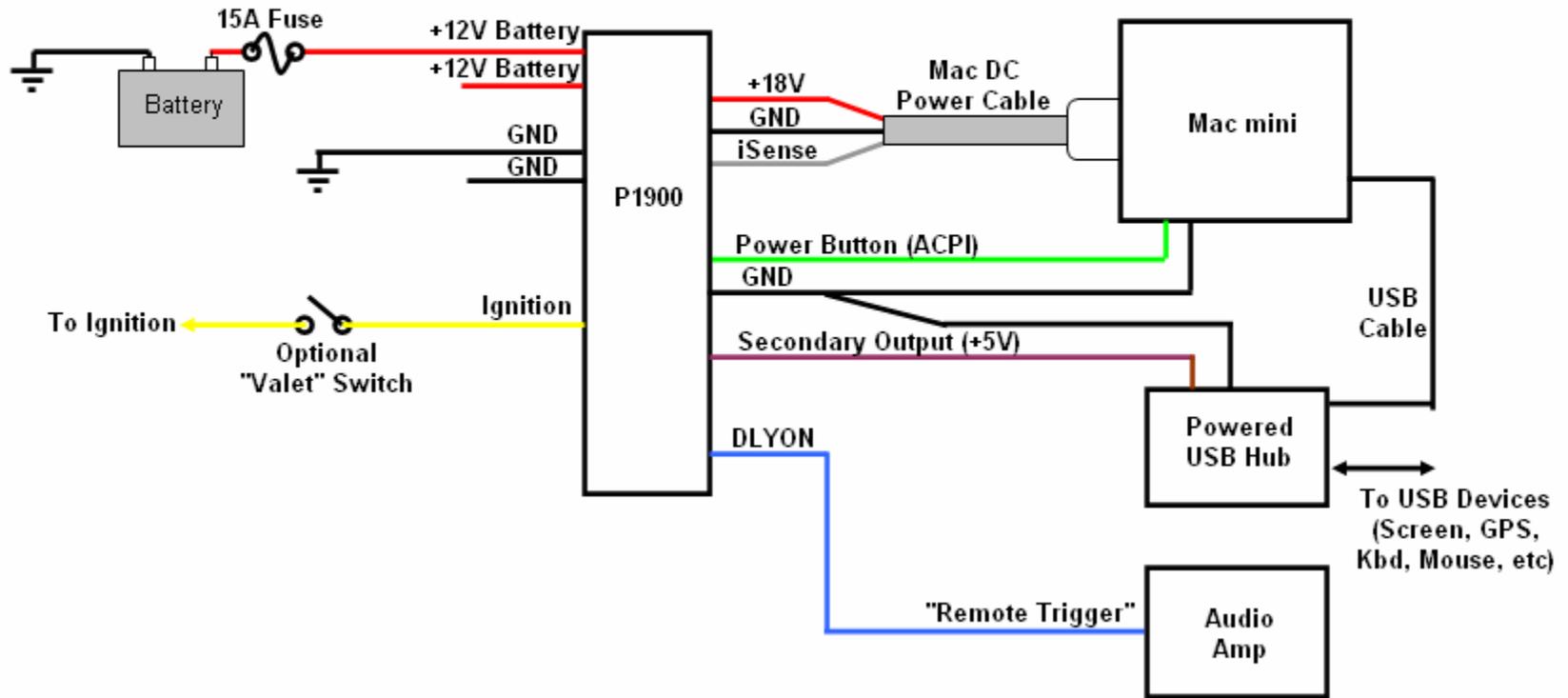
Typical Mac mini Application

Figure 4 Mac mini Application

2.2 Travla (Casetronic) Applications

The P1900 can be used to provide power to a Travla C137, C138, and C158 case if it contains either the 90 Watt or 120 Watt DC-DC ATX PSU. These PSUs are shown below:
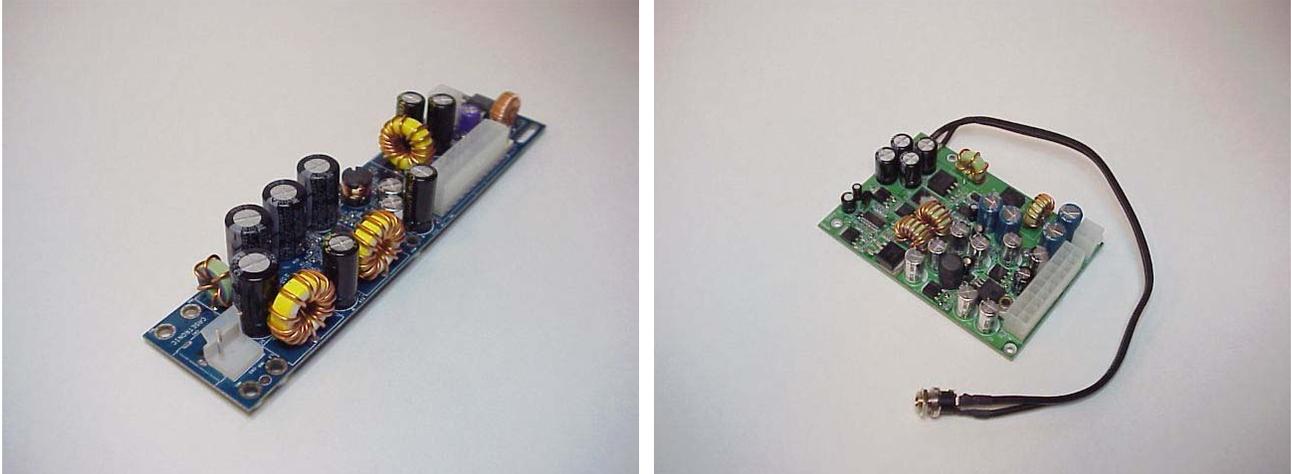
Figure 5 Travla 90W and 120W DC-DC PSU

These cases typically have a round DC input connector (5.5mm x 2.5mm) which will mate with the CarNetix black power cable contained in the optional Travla C137/8 Power Cable Kit shown below. Also show is the ACPI cable used to attach to the ACPI (power button) header on the motherboard.

Figure 6 Optional C137/8 Power Cable Kit

If the motherboard contains a P4 processor it is recommended that you utilize BOTH RED battery input leads and BOTH BLACK ground leads to allow a low-resistance path for the higher currents. The same is true of the +19V RED output leads and BLACK output ground leads. Also, cut the length of the black power cable provided in the Power Cable Kit to 6 inches or less to minimize wiring losses.

Typical Travla (Casetronic) Application
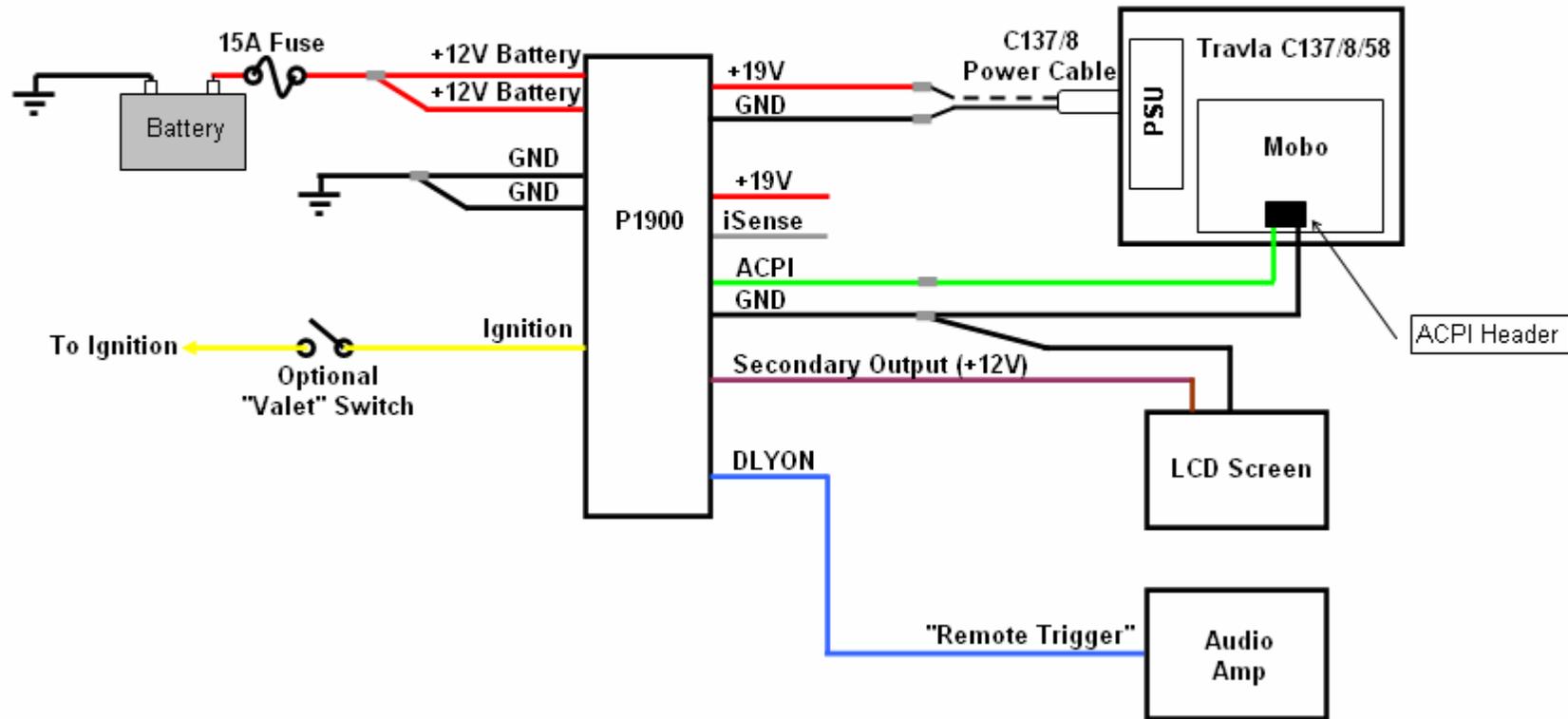

Figure 7 Typical Travla (Casetronic) Application
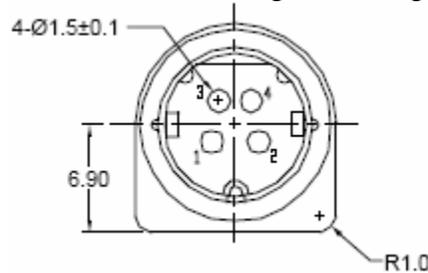
2.3 Sumicom/Xenarc P4 Application

The P1900 is compatible with Sumicom S620 and the Xenarc SC8 P4-systems. However, since the Sumicom system boards use a proprietary ACPI electrical interface, a special outboard relay must be added if the P1900 SSC will be used to turn ON/OFF the PC. An inexpensive, low current +12V SPST (single pole, single throw) relay can be used as show in the application diagram below. The coil side of the relay is connected between the +12V secondary output (us a +5V relay if you are using a Secondary Output voltage of +5V) and the ACPI output from the P1900. The P1900 provides a "short circuit to ground" on the ACPI out put that will allow current to flow through the relay coil. The output contacts of the relay are connected to two wires that you soldered in parallel with the Sumicom power button. The relay thus creates a short circuit across the power button when the P1900 issues the ACPI pulse.

Also, since the Sumicom mainboard contains a proprietary power input connector, the Optional Sumicom/Xenarc Power Cable will be required.

Figure 8 Optional Sumicom/Xenarc Power Cable

This cable has the following Pin configuration:

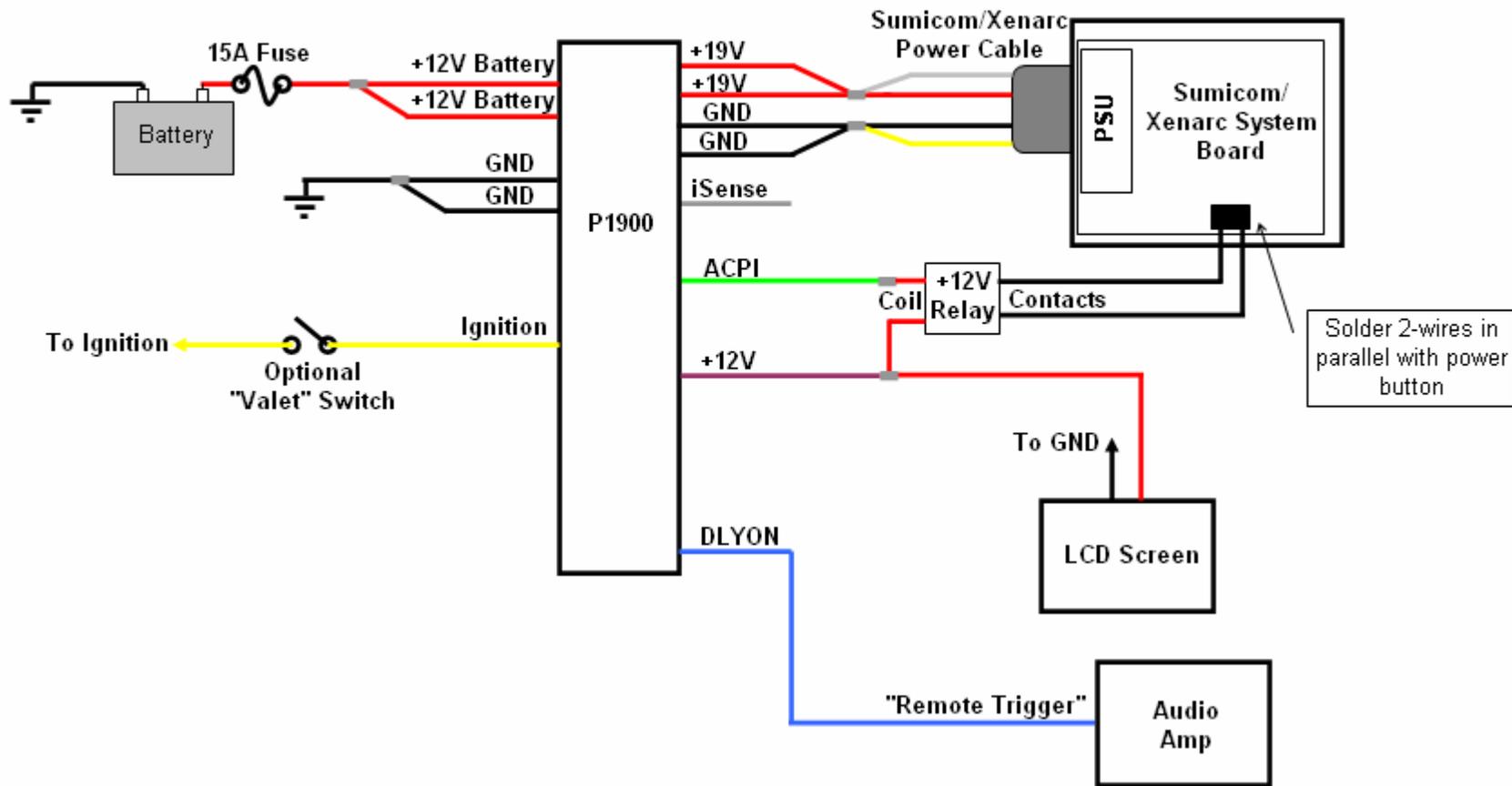| Pin	Wire Color	Function
1	RED	+19V
2	WHITE	+19V
3	BLACK	GND
4	YELLOW	GND

Figure 9 Typical Sumicom/Xenarc Application

3.0 Installing the P1900

3.1 Before You Begin

Before you begin the installation, make sure you take the time to read through these instructions. The CNX-P1900 is a sophisticated, microprocessor-based device. If the proper installation steps are not followed, various types of problems could occur ranging from nuisance resets of your CarPC, to "Car-B-Que" (ie flames). Please read these instructions carefully and contact us either in our Support Forum (www.carnetix.com/forum) or via email (support@carnetix.com) if you have any questions or problems.

It is assumed that you have a basic to advanced understanding of electronics. It would be helpful, and is highly recommended (especially if you plan to get much further involved in CarPCs) that you purchase, as a minimum, a simple VOM (volt-ohm meter) or DMM (Digital Multi-Meter). These devices are inexpensive (starting around $20) and will save you and me a great deal of time. They can be purchase over the web or at your local retail electronics store (Radio Shack, Home Depot, some hardware stores, some auto parts stores).

Whether you plan to use the on-board Startup/Shutdown Controller (SSC) or not, please read the section describing its operation first, before attempting to install the CNX-P1900. The SSC will affect the power turn-on and turn-off operation whether you use its features or not.

Installation of the P1900 consists of :
- Setting the Jumpers
- Connecting the Wires.

3.2 Setting the Jumpers

It is very important to set the jumpers before applying power to the P1900. The location and function of the jumpers is presented below. More detail on the specific operation of each jumper selectable function appears later paragraphs.

Jumper	Functions
JP1	Pulse Start Input
	Shutdown Delay Time
	Hibernate/Standby(Sleep)
	DelayOn Option
JP2	+5V/+12V/+13V Select
JP3	+5V Always On
JP4	Secondary Output Control
JP5	Secondary Output Source
JP6	+18V/+19V/+20V Select
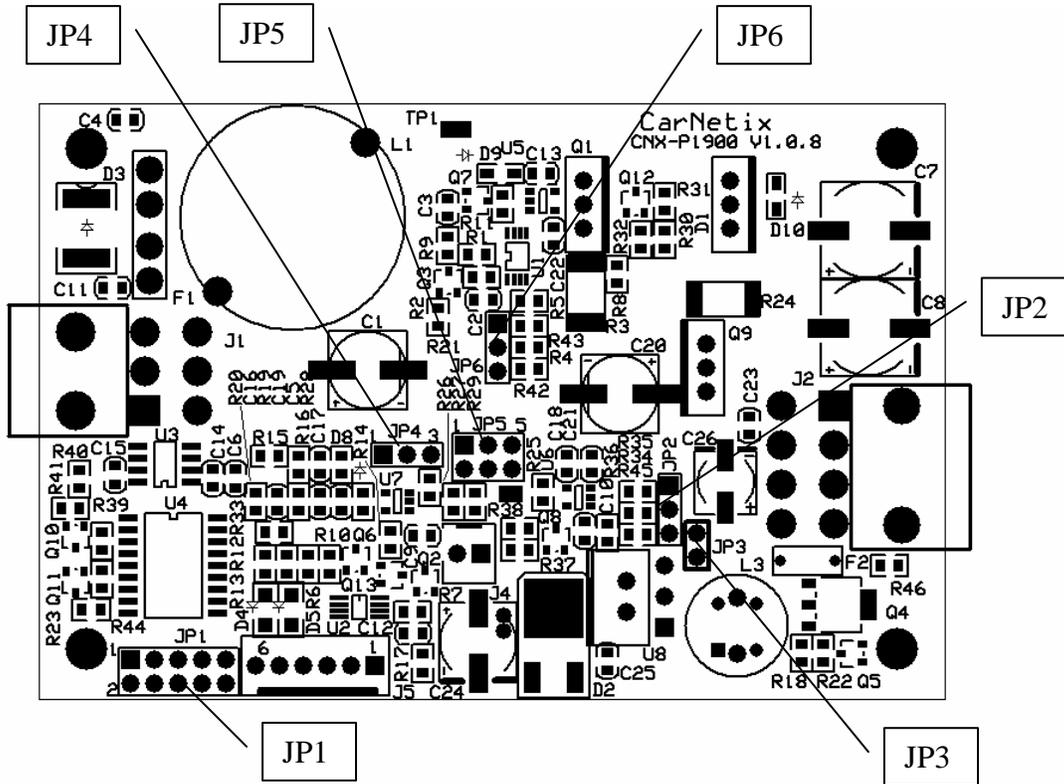
3.2.1 Setting JP1 Jumpers

Below is a table with the jumper selectable options that appear on JP1. To move a jumper from its factory default position (open), use a pair of tweezers or needle nose pliers. Be careful to place the jumper in the correct position or erratic behavior could result. Double-check your settings before replacing the lid.

	Pins				
	1-2	**3-4**	**5-6**	**7-8**	**9-10**
Function	Pulse Start Input	Shutdown Delay Time	Hibernate/ Standby (Sleep)	Not Used	DelayOn Option
Open (default)	Connect to external contact closure	6 Seconds	Hibernate	Not Used	DLYON follows IGN
Jumpered	Connect to external contact closure	1 minute	Standby(Sleep)	Not Used	DLYON follows PSU

Table 1 JP1 Settings

3.1.1.1 Shutdown Delay – this is the delay between the time you turn off your ignition and when the SSC begins the Shutdown Sequence. It is jumper selectable for either 6 seconds (default) or 1 minute.

3.1.1.2 Hibernate/Standby(Sleep) – this jumper allows you to select either the Hibernate or Standby(Sleep) mode for the P1900 after the ignition is turned off.

If Hibernate is selected the P1900 cuts all output power after the Shutdown Delay and Shutdown Sequence have expired. This mode is used when you have set your PC to enter hibernation via your BIOS settings. Hibernate mode does not exist in the Mac OS.

If Standby(Sleep) is selected the P1900 will continue to provide output power on the Primary and Secondary outputs after the Shutdown Delay and Shutdown Sequences have expired. This state is used when your PC/Mac is set to go into Standby (PC) or Sleep (Mac) when its ACPI ("power button") is pressed. This state is designed to provide a low level of power to the PC/Mac to maintain the system state in RAM. If the power demanded by the PC/Mac during this time exceeds approximately 1 amp the P1900 will automatically shut down. Also, while in standby, the P1900 continues to monitor the battery voltage. If the battery voltage drops below approximately 10.6 volts, the P1900 will automatically shut itself down.

3.1.1.3 Delay-On Option – this jumper allows you to set your DLYON control line to either follow your Ignition or follow the ON/OFF state of the Primary Output. If set to follow the state of the Primary Output the DLYON signal will come on 3 seconds after the Primary Output (and Ignition) comes on. It will turn off either 6 seconds after the Ignition goes off, or 1 minute after the Ignition goes off, depending upon the state of the Shutdown Delay jumper (JP1 Pins 3-4).

3.2.2 Setting JP2 (Secondary Output Voltage)

JP2 allows you to select the output voltage that appears on the Secondary Power Output (J2 Pin 1). The selections are:

    +12V   +5V   +13V
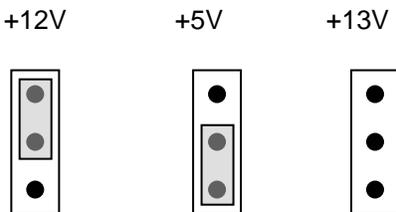
3.2.3 Setting JP3 (+5V Always On)

In some cases it may be desirable to leave certain low powered USB devices always powered (ie. GPS receiver for faster lockup time). JP3 can be used to force the secondary regulator to remain powered even after the primary output power is turned off. THIS SCENARIO IS ONLY

AVAILABLE WHEN USING THE SECONDARY OUTPUT AT +5V since the +12v/+13v setting derives its input from the primary power output.

Always   Follow JP4
On   Setting
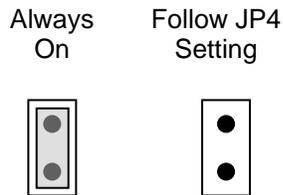
3.2.4 Setting JP4 (Secondary Output Control)

The JP4 jumper gives you the flexibility to use the Secondary Output in different ways depending upon your CarPC system configuration. The Secondary Output can be turned ON or OFF based on two different control signals: 1) DLYON or, 2) the signal that controls the Primary Output (PRI OUT).

- **DLYON**
Jumpering DLYON will turn your Secondary Output ON or OFF with the DLYON signal. This means that your Secondary Output will come on 3 seconds after your Primary Output comes ON, and will go OFF either 1) when your ignition is turned OFF (JP1 Pins 9-10 open) or 2) when your primary output goes off (JP1 Pins 9-10 shorted).

If you use the Secondary Output to power your screen (+12V) and want your screen to turn on and off with your CarPC's main power, then select DLYON to control your Secondary Output.

- **PRI OUT**
Jumpering PRI OUT will make the Secondary Output follow the control used to turn ON and OFF the Primary Output. Thus, when the Primary Output is ON, the Secondary Output will also be ON. If the Primary Output is OFF, the Secondary Output will be OFF.

This setting is affected by the jumper setting of the Shutdown Delay AND Hibernate/Standby jumpers on JP1 as described in the next sections.

Shutdown Delay Effects on JP4
If you have set the Shutdown Delay jumper to the default position (6 seconds), both the Primary and Secondary Outputs will be turned OFF 6 seconds after the Ignition is turned OFF. If you have set the Shutdown Delay jumper for 1 minute, both the Primary and Secondary Outputs will remain ON for 1 minute after the Ignition is turned off. This setting is useful for keeping certain USB devices powered during the Shutdown Delay time. For example, if you use the Secondary Output to power your USB sound card and you want to keep your sound card powered during the Shutdown Delay time, then set the jumper JP4 for PRI OUT.

Hibernate/Standby Effects on JP4

If you have the Hibernate/Standby(Sleep) jumper (JP1 Pins 5-6) set to Standby(Sleep), the primary output is never turned off (see Standby section). If you also have JP4 jumpered to follow the Primary Output, the Secondary Output will also NOT be turned off when the unit goes into Standby mode. (ie Ignition is turned off). Hence any devices connected to the Secondary Output will remain powered in Standby. You should be very careful not to drain your battery when using Standby. It is highly advised that, if you are using Standby, that you jumper your Secondary Output to follow DLYON, and jumper DLYON to follow the Ignition (JP1 Pins 9-10).
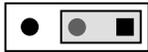
Follows PRI OUT
Follows DLYON

3.2.5 Setting JP5 (Secondary Power Input Select)

*** WARNING ***
*IT IS EXTREMELY IMPORTANT TO MOVE BOTH JUMPERS TOGETHER WHEN
SETTING JP5. IF YOU MOVE ONE JUMPER AND NOT THE OTHER, YOU WILL DAMAGE
YOUR PRIMARY OUTPUT REGULATOR!!!*

JP5 controls which power input is applied to the Secondary Output regulator. Below is a simple diagram which illustrates the concept.
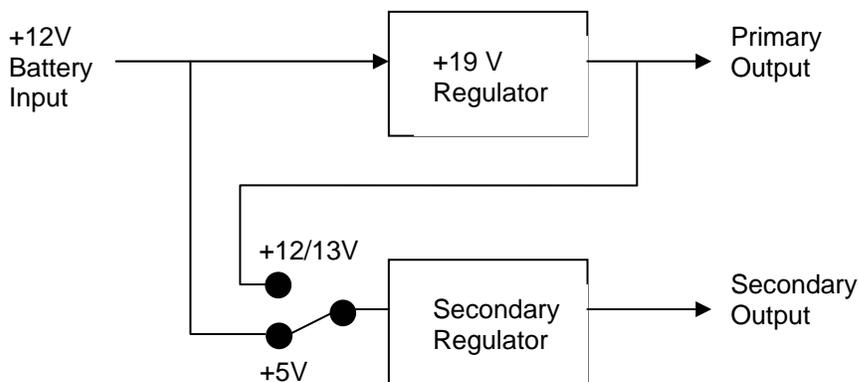
The following rules apply to this jumper setting:

1) If you have set JP2 (Secondary Output Voltage) to +5V, you MUST set JP5 to the "+5V Setting" which routes the +12V battery input to the Secondary Output regulator.
2) If you have set JP2 (Secondary Output Voltage) to +12V or +13V, you MUST set JP5 to the "+12V/+13V Setting". This will route the output of the Primary Output (+19V) to the input of the Secondary Output regulator.

Again, it is very important that you move BOTH jumpers on JP5 together or you will damage your Primary Output regulator!

+5V Setting

+12V/+13V Setting
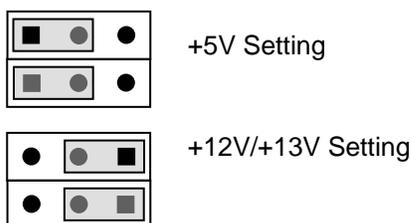
3.2.6 Setting JP6 (Primary Output Voltage Selection)

JP6 allows you to select the output voltage that appears on the Primary Output (J2 Pin 4). The selections are +18V, +19V, or +20V as shown below. Note: the actual voltage is set approximately .5 Volts higher to compensate for any wiring losses you may have in your installation.
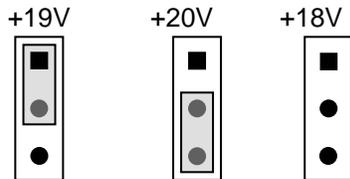
3.3 Connect Input Power (J1)

Connect the input power connector (J1) per the Typical Application drawing above. The J1 Pin assignments are detailed below. For an explanation of the Pulse Start input see Section 6.

The connector comes with "pigtails", or short lengths of wire that allow you to splice longer runs of larger gauge wire from your battery and ground connections.
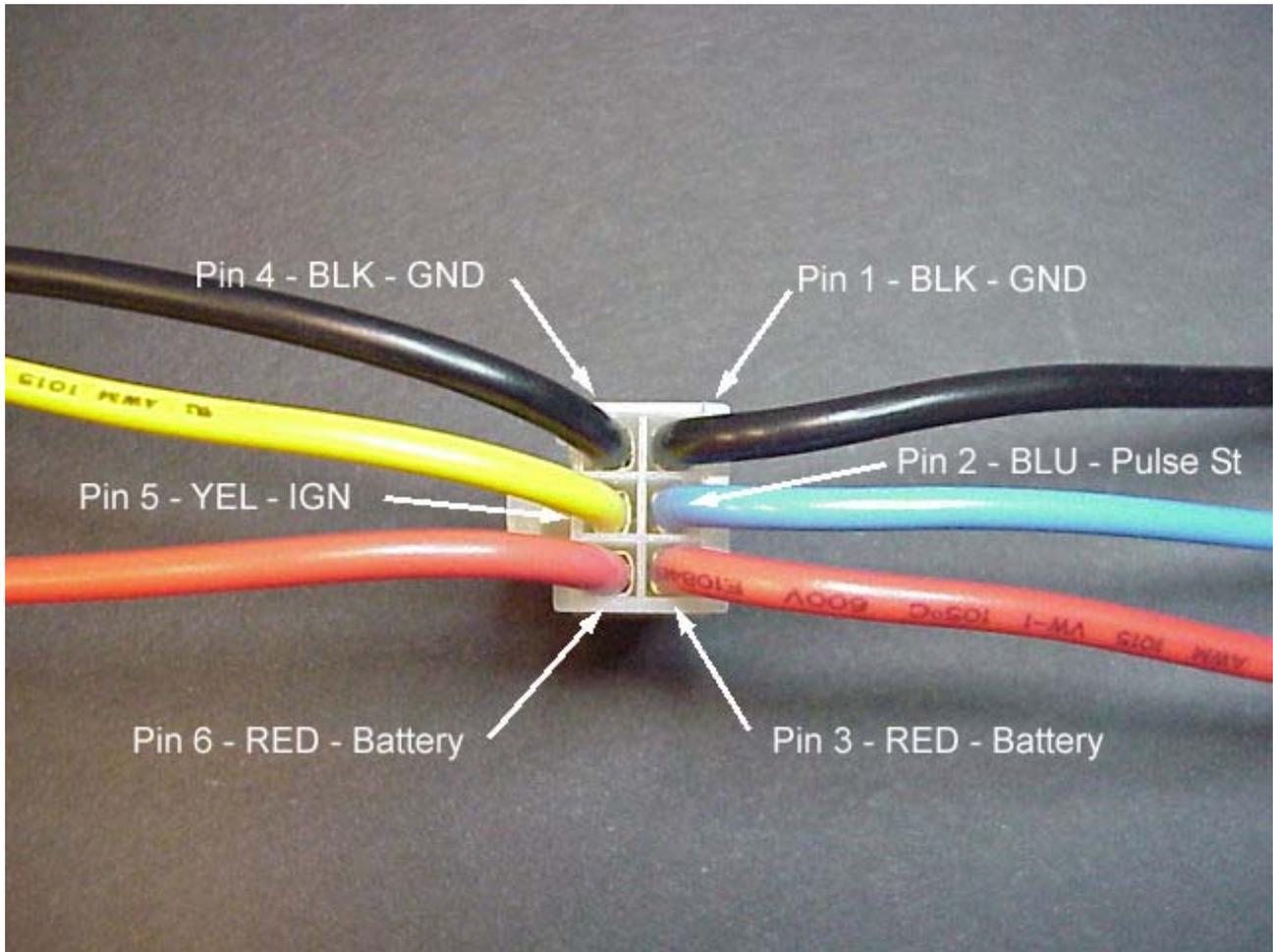
Pin	Wire Color	Function
1	Black	Ground
2	Blue	Pulse Start Input (See Section 6)
3	Red	+12V Battery Input
4	Black	Ground
5	Yellow	Ignition/ACC input
6	Red	+12V Battery Input

Table 2 – P1900 J1 Pin Assignments

3.4 Connect Output Power (J2)

Connect the Output Power Connector (J2) per the Typical Application drawing above.

The connector comes with "pigtails", or short lengths of wire that allow you to splice longer runs of larger gauge wire from your battery and ground connections..
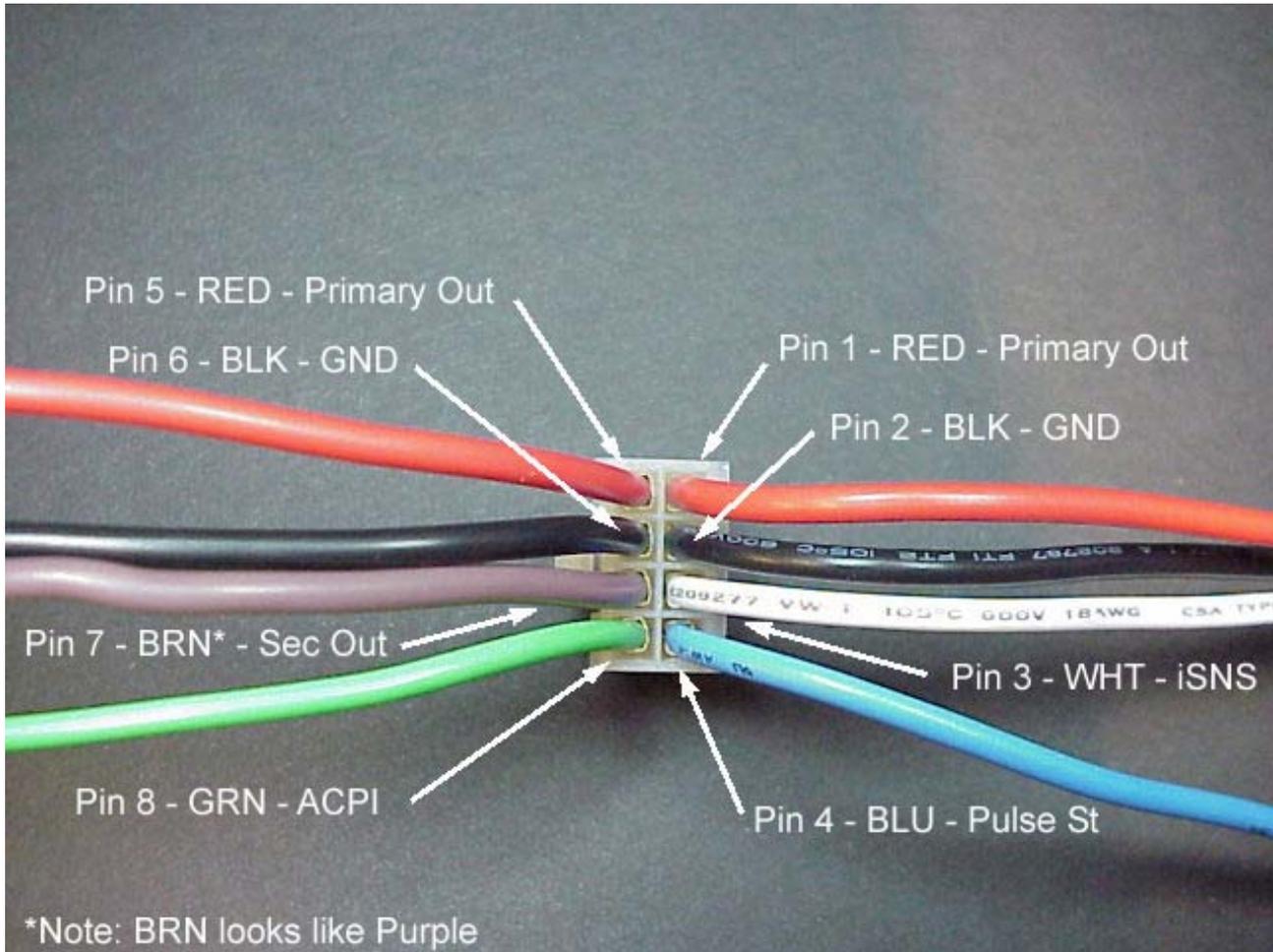
Pin	Wire Color	Function
1	Red	+19V Primary Output
2	Black	Ground
3	White	iSense Out
4	Blue	DLYON Out
5	Red	+19V Primary Output
6	Black	Ground
7	Brown* (may look purple)	Secondary Power Output (+5V or +12V)
8	Green	ACPI/PWRON

Table 3 – P1900 J2 Pin Assignments

4.0 Using the Pulse Start Feature

The CNX-P1900 includes a new feature that allows you to remotely start and stop the PSU. This feature is called "Pulse Start". This feature would normally be used in conjunction with a wireless device such as a car alarm with auxiliary inputs/outputs or a WiFi device with Wake-On-LAN (WOL) features.

4.1 Pulse Start Connections

The Pulse Start input can either be an externally applied voltage (ie +5v or +12V) pulse, or a momentary relay contact closure. The externally applied voltage pulse is connected to Pin 1 of J1 using the Blue wire. The momentary relay contact closure is connected to Pins 1&2 of JP1 (see Section 2.2 for location). You can use either or both of these connections to start/stop the PSU.

4.2 Pulse Start Operation

4.2.1 What is a pulse?

Voltage Pulse on Pin 1 of J1

When connecting to Pin 1 of J2, the "pulse" must be a voltage that transitions from 0V to +V, *and then transitions back to 0V*. The SSC will wait (hang) if the voltage stays high without going back to 0V after the initial transition from 0V to +V.

The value of the +V can be any voltage from approximately +2V to +20V. Typical voltages are +5V or +12V. The value of 0V must be below +.2V or open circuit (ie you could drive this input with a relay that momentarily connects to a +12V source and then provides an open circuit).

The current required to drive this input is very low (milliamps).

Contact Closure Pulse on Pins 1&2 of JP1

When connecting to Pins 1&2 of JP1, the "pulse" must be a low resistance metallic contact closure (ie relay) that transitions from OPEN to CLOSED, *and then back to OPEN*. The SSC will wait (hang) if the contact closure remains CLOSED after the initial transition from OPEN to CLOSED.

The current passing through this relay is very small (milliamps) so a low power relay can be used.

Pulse Width

The pulse width can be any value from a minimum of approximately 100mSec to several seconds. As mentioned above, if the pulse is very long the SSC will wait for the transition back to the normal state before continuing.

4.2.2 Starting the PSU with a pulse

When the PSU is in Idle State (both LEDs off) and an externally applied pulse is applied to the Pulse Start input, the PSU will power up normally, as it would if the Ignition line had gone high. During the Bootup Lockout State any input pulse is ignored.

4.2.3 Stopping the PSU with a pulse

After the normal power up sequence, and while in Runs State, the SSC monitors the Pulse Start input for a shutdown pulse. If a single shutdown pulse is sensed, the PSU goes into the Shutdown Delay State. However, if control has been passed to the Ignition line (see Ignition Override below) the Pulse Start input is ignored.

4.2.4 Prolonging the Shutdown Delay State

If, while in the Shutdown Delay State, a single pulse is detected, the Shutdown Delay is restarted at its original value in order to prolong the Shutdown Delay. This is useful for occasionally downloading large files that would take longer than the normal Shutdown Delay time.

Once the Shutdown Delay has timed out, the PSU enters the Shutdown Lockout State. At this point the SSC ignores any pulse input until the PSU enters the Idle State.

4.2.5 Shutting down the PSU with double pulses

If two pulses are detected within a 5 second window during the Shutdown Delay State the PSU will skip any remaining Shutdown Delay Time and immediately enter the Shutdown Lockout Sequence. This feature is useful for shutting down the CarPC when your file transfer process is completed.

4.2.6 Ignition Override

If, after the PSU has been started by a pulse, the Ignition is turned on, control is passed to the Ignition line. Once the Ignition line has gained control of the SSC it will be able to shutdown the PSU as if it had initially started it. This feature is useful when you wish to remotely start the CarPC with your wireless device, but then get into your car and drive.

5.0 CNX-P1260 Startup/Shutdown Controller

The CNX-P1900 includes an intelligent, microprocessor-based startup/shutdown controller. The CNX-P1900 Startup/Shutdown Controller (SSC) provides safe, reliable control over your CarPC/Mac bootup and shutdown (full shutdown, Standby (Sleep), or hibernation) processes. The chief concerns of the SSC are protecting your hard drive from corruption, protecting your car battery from being discharged, and protecting the PSU from overheating.

5.1 Hibernate/Standby Operation

The CNX-P1900 supports both Hibernate and Standby (Sleep) operation of your CarPC/Mac. This option is jumper selectable with Pins 5 & 6 on JP1.

When supporting Hibernation the P1900 completely shuts down all power to the CarPC after the Shutdown Lockout State. However, if Standby (Sleep) mode is selected, the P1900 continues to provide primary and secondary output power after the Shutdown Lockout State is completed, but turns off its fans to conserve power. This has several very important ramifications.

1) In Standby your CarPC/Mac continues to receive power from the P1900 so that it can retain the processor state in RAM. If for some reason the CarPC/Mac did not properly shut down when it received the ACPI shutdown pulse from the P1900, it will continue to draw current from the P1900. If this current exceeds approximately 1 amp the P1900 will automatically shut itself down.

2) Any USB devices connected to your CarPC/Mac via the USB connector will continue to draw current in the Standby state. THIS COULD POTENTIALLY DRAIN YOUR BATTERY IF THE CURRENT DEMAND OF YOUR USB DEVICES IS VERY HIGH. Exercise caution when using USB devices in the Standby mode, or connect your USB devices to the secondary output of the P1900 and jumper the Secondary Output to "follow DLYON".

5.2 SSC Operation States

5.2.1 Idle State

While idle, the SSC monitors your car battery while waiting for the ignition switch to be turned on. If the battery is below approximately 10.5 volts, the SSC will not allow the CarPC/Mac to boot. If the battery is above 10.5 volts, the SSC will allow the CarPC/Mac to boot normally.

5.2.2 RunDelay State

When you turn on your ignition, the SSC briefly (approx. 2 seconds) enters the RunDelay state. During this time the SSC checks to make sure the battery is stable, the ignition stays on, and then turns on its PSU output to the CarPC/Mac.

5.2.3 Bootup Lockout State

After the CarPC/Mac is powered, the ACPI (PWRON) strobe is sent to the motherboard. At this point the SSC enters a "Lockout" state. In this state the SSC will not allow the PSU to be turned off

until after a Lockout Time period. This state is designed to prevent damage or corruption of a user's hard drive during bootup or shutdown by premature loss of power. The Lockout Time is set to 60 seconds.

5.2.4 Run State

After the Lockout period ends, the SSC enters the Run state. During this time your CarPC/Mac is running normally and the SSC continues to monitor your car battery, the PSU fan, and the output current. If the battery dips below approximately 10.5volts for more than 10 seconds, or if the fan fails, or if the user is drawing more than the specified maximum output current, the SSC enters a "ForcedShutdown" state (described below). Under normal conditions, you exit the Run State either by turning off the ignition switch or with a remotely applied pulse. After normally exiting the Run State, the SSC enters the Shutdown Delay State.

5.2.5 Shutdown Delay State

After you turn off your ignition, or apply a remote pulse, the SSC enters a Shutdown Delay state. This state allows you to keep your CarPC/Mac running for a jumper selectable time after the ignition is turned off. The selectable time periods are 6 seconds (default) and 1 minute. During this Shutdown Delay State, turning the ignition switch back on will cause the SSC to re-enter the Run State and cancel the shutdown sequence. Also, a remotely applied pulse can either prolong the Shutdown Delay State, or send the PSU immediately into Shutdown Sequence State (see Section 6 Remote Start Pulse).

When this Shutdown Delay time has elapsed, the SSC enters the Shutdown Sequence state (see below).

The SSC timing is designed to accommodate the use of the ACC wire instead of the IGN wire to control the SSC. Note that during engine cranking, the ACC wire drops from +12V to zero volts. The SSC has a minimum 6 second delay to accommodate this temporary interruption in input voltage if the CarPC/Mac was already running when you start (or re-start) your engine. This delay will also give you time to briefly turn off the ignition switch to stop your engine (ie at a gas station) and immediately turn the ignition switch back on to keep the CarPC/Mac running indefinitely.

5.2.6 Shutdown Sequence State

At the beginning of this state the SSC issues an ACPI (PWRON) strobe to the motherboard. After the ACPI strobe is sent the SSC enters a Shutdown Lockout time period, in which the SSC prevents the PSU from being turned on again. This is to prevent the SSC from issuing multiple ACPI strobes to the CarPC/Mac motherboard while it is shutting down. The Shutdown Lockout time is the same length as the Bootup Lockout time (approx 60 seconds). After the Shutdown Sequence State, the SSC re-enters the Idle State and waits for the ignition switch to be turned on.

5.2.7 Forced Shutdown State

If the SSC detects either 1) a low battery (<10.5volts for >10seconds), 2) a fan fault, or 3) an Over Current condition, the SSC enters a Forced Shutdown state. During this state the SSC immediately begins a Shutdown Sequence without first entering the Shutdown Delay State. The Shutdown Sequence cannot be exited by turning on (or leaving on) the ignition. After a Forced Shutdown State is completed, the ignition switch must be turned off to unlock the state and re-start the CarPC/Mac.

5.3 Fault Indicator LEDS

The CNX-P1900 has 2 LEDs that give an indication of the status and states of the SSC. The pattern and blink-rates of these LED have different meanings depending upon what state the SSC is in. Below is a link to the LED codes.

CNX-P1900 Operation States

Normal Operation					
	PSU Output	*LED1*	*LED2*	*State*	*Description*
	OFF	OFF	OFF	Idle State	PSU is idle and waiting for ignition/accessory switch to be turned on. It is monitoring battery voltage during this time.
	ON	Fast Blink	OFF	Run Delay State	PSU is on and waiting for output voltages to stabilize before turning on CarPC
	ON	ON	ON	Bootup Lockout	PSU is on and has sent ACPI pulse to motherboard. No changes can occur until after boot period. This time period is set to 60 seconds.
	ON	ON	OFF	Run State	PSU is on and motherboard is running. No faults have been detected.
	ON	BLINK10%*	OFF	Shutdown Delay	PSU is waiting before going into shutdown cycle. This delay period is jumper selectable for 6 sec (default) or 1min. After this delay PSU goes into shutdown Lockout state.
	ON	BLINK50%*	OFF	Shutdown Lockout	PSU is in the process of shutting down and has sent ACPI pulse to motherboard. No changes can occur until after shutdown lockout period (same as Boot Lockout period 60sec). After Shutdown Lockout state, PSU shuts down power and goes into Idle State, waiting for IGN/ACC to be turned on.

Fault Conditions					
	PSU Power	*LED1*	*LED2*		
	OFF	OFF	ON	Low Battery/IGN OFF	Low battery voltage detected (<10.6V). PSU will not start unless battery voltage is greater than 10.6V.
	OFF	BLINK10%*	ON	Low Battery/IGN ON	Low battery voltage detected (<10.6V) and IGN/ACC switch is on, or remote pulse has attempted to start PSU. PSU will not start unless battery voltage is greater than 10.6V.
	ON	BLINK10%*	ON	Major Fault Pending	Low battery, Fan Fault, or over current condition is detected. PSU will wait 10 seconds for condition to clear. If condition persists for more than 10 seconds, PSU goes into Forced Shutdown state.
	ON	BLINK50%*	BLINK50%	Forced Shutdown	A major fault has occurred (persistent low battery, fan fault, over current fault) and the PSU is in Forced Shutdown state. There is no Shutdown Delay before shutdown begins. Shutdown time is set to approximately 60 seconds. Once Forced Shutdown begins, clearing the fault condition will not abort the Forced Shutdown cycle. After Forced Shutdown, PSU waits for IGN/ACC switch to be turned off, then on, before it will attempt to restart.
	OFF	BLINK10%*	ON	Abnormal Shutdown	A major fault has occurred (persistent low battery, fan fault, over temperature fault) and the PSU was forced to shutdown. IGN/ACC switch must be turned off, then back on, before PSU will attempt to restart. You should check the status of the battery, fan, and ventilation if this fault occurs.

* BLINK10% means that the LED is on 10% of the time and off 90% of the time (ie, short blink).
* BLINK50% means that the LED is on 50% of the time and off 50% of the time.

Table 4 Status/Fault Indicator LED