

---

## **Automotive ATX/ITX DC-DC 90W Power Supply**

### **Introduction**

Thank you, for purchasing an OPUS Solutions, Inc DCX3.xx09 a smart Automotive DC-DC Power Supply.

OPUS Solutions DCX3.xx09 DC-DC smart power supply (Patent Pending) is designed specifically for ATX, uATX, Flex ATX and ITX compatible motherboards to be used in an automotive environment. This Product brings a new dimension to your PC's mobility. Just get in your vehicle and start the engine; your PC is ready to go. When you switch off the ignition the PC can go into shut down, standby or hibernate modes automatically, no switch to fiddle or fuss.

The DCX3.xx09 DC-DC Power supply has a micro-controller that controls and monitors various functions of the power supply operation. It monitors automobile battery voltage to protect against deep discharge. The Ignition lead is monitored to start the PC when the ignition is turned on and to implement a safe shutdown procedure. It controls and monitors motherboard signals to provide smooth power-up and power down sequences. In addition, it also responds to shut down, stand-by and hibernate modes. The power supply can be programmed to shut down the PC after a delay of 20 minutes. The power supply outputs are monitored to assure proper PC operation. Wake-up on interrupt is implemented to access the vehicle computer over wireless LAN. Optional Remote function can be implemented to wake-up slave devices such as LCD monitors, Head units, Amplifiers, external DVD/ROMs, etc. A green LED indicator in the power supply continually reports the power system status and health. It is also used for troubleshooting.

There are features that are built-in for trouble free and safe PC operation. The input power is protected against transients, Load dumps and double battery during jumpstarts. PC does not reboot during engine start or cranking.

It also uses state-of-the-art technologies and the most advanced techniques to maximize efficiency, performance and reliability. Simply put, there are no other PC power supply like it.

### **List of products supported by this guide**

---

<b>DCX3.1209</b>	ATX/ITX DC-DC Power supply 12V input, 90W output
<b>DCX3.2409</b>	ATX/ITX DC-DC Power supply 24V input, 90W output

### **Contact Information:**

---

For Technical support e-mail or call

Email: [tsupport@opussolutions.com](mailto:tsupport@opussolutions.com)

Tel: 949-388-7623

Fax: 949-388-7628

### **Package Contents**

---

If any of the items are missing from the package, please contact customer support at OPUS Solutions, Inc.

- 1 – DCX3.xx09 DC-DC Power supply Module
- 1 - 20 pin ATX power cable with 2 HDD power and 1 FDD power connectors.
- 1 - 2 pin power switch cable.
- 1 - 3 pin DC input main power and IGN pigtail cable.

---

## General Information

---

### Power input

Powered by 12Volt or 24 Volt battery systems. The Computer on and off sequence is determined by the state of ignition/switch input. The DCX3.xx09 power supply is compatible with ATX/SFX power specification.

### Normal operating condition

When the computer is properly assembled, cabled, configured and power applied to the DC-DC power supply it should function as described below.

### Idle state (ignition off):

In an idle (ignition off) condition, the Status Green LED light in the power supply will blink for 100ms ON and OFF for approximately 2.5 sec. The PC is powered down. Only standby power is supplied to the motherboard. The power consumption should be at very minimum. (The idle state power consumption varies depending on the motherboard manufacturer, bios setup, amount of memory modules installed and other hardware installed).

### PC ON State:

When the ignition switch is turned on the Status LED light will be ON constantly within 9 seconds. This indicates that proper handshakes and controls were accomplished between DC-DC power supply and the motherboard, and they are operating normally. The operating system should be booting, coming out of standby or hibernate mode. The PC is ready for your use.

### Back to Idle state:

When the ignition switch is turned off, The DC-DC power supply will delay going into shut down, stand-by or hibernate modes. The delay time is set by a jumper located on the narrow side the DC-DC power supply (Refer to the heading 'Setting the turn off delay'). Once the delay time has elapsed, the DC-DC power supply hand shakes and controls with the motherboard to go into one of three states namely shut down, standby or hibernate mode if supported by the motherboard.

If the ignition is turned on again, while shut down delay is in progress, the DC-DC power supply will turn off the delay function and the PC will continue operate normally. If the PC is manually put into stand-by mode, tapping the keyboard or pointing device will start the PC as long as Ignition is on and the mother board BIOS is setup for the this function. If the PC is manually put into power down mode, to restart the PC the ignition must be turned off for at least 5 sec and turned on again.

### Abnormal condition:

If the green LED light flashes at a faster rate, this indicates a problem condition. Count the number of flashes and refer to trouble shooting section to determine the nature of the fault.

### Battery management

The normal full load operating voltage range of the power supply hardware is between 7.5V to 18VDC. However, if the battery voltage dips below the set low battery voltage level for more than 10 sec. Continually the microcontroller in the DCX3.xx09 smart power supply will go into shut down sequence. This prevents the battery from deep discharge, which may cause permanent damage or shorten life of the battery, and it is saved for its main intended purpose, to start the vehicle.

### Stand-by power control

The Stand-by power to motherboard operation is controlled by a pair of pins on JU1 on the DC-DC power supply.

Jumper not installed: The stand by power is turned off immediately after shut down sequence. In this setup, the computer system can only go into power down or hibernate mode but CANNOT go into stand-by mode. The power drain on the battery will be the minimum, less than 0.25W.

Jumper installed: The stand-by power is maintained after shut down sequence. If the battery voltage dips below the low battery voltage limit during idle state of the computer system, the stand-by power will be turned off to protect the battery. It is also turned off if an error condition is detected during shut down sequence. In this set up the computer system can go into power down or stand-by modes. The power drain on the battery is determined by the motherboard make and model, I/O devices that are enabled for stand-by, amount of memory, etc. The power drain on the battery can be between 1 to 8Watts.

### Power-up on interrupt

The computer system can be powered up by an interrupt source without ignition or On/Off input being enabled. In this mode the computer system will go into shut down sequence 20 minutes after interrupt wake up or power up. This **mode of** operation is useful if you need to wakeup the computer system for software updates, up or down loading files from **the vehicle** computer system over wireless network without physically turning on the ignition or ON/OFF input to the vehicle computer system.

**Remote/ Trigger output (optional)**

The remote/trigger output can supply raw switched battery to turn-on slave device. This out can be used to turn on such devices as LCD monitors, Head units, Amplifiers, external DVD-ROMs, etc. It is intended to control remote inputs of above mentioned slave devices and NOT intended to power directly by the remote output of the DC-DC. If a slave device does not have remote input then a relay or such devices must be used to switch power to the Slave devices, and the relay can be controlled directly by the remote output of the DC-DC. A clamping diode must be used across the relay to suppress back EMF.

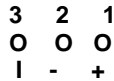
**General wiring guidelines**

Connect the computer power input cable directly to the battery terminal through a 10A or 15A fuse.  
 Use half loop to prevent cable/connector stress.  
 Use a dedicated #12 AWG or thicker cable to connect the unit to the battery.  
 Use an #18 AWG wire for ignition or on/off  
 Note: Do not share power cable with other equipment/s.

Make sure the voltage at Input power connector of the DC-DC (across pin 1 and pin 2) is less than 0.5V drop than the voltage at the battery, with the computer operating at full load. If the voltage drop is greater then 0.5V then use thicker cable for the battery and Ground connections.

**Input Power connector**

Connector pin description



**View of connector used on the power supply.**

Mating Plug: AMP; P/N: 350766-1  
 Crimps: Amp P/N: AMP; 640310-3 qty 2 and 350919-3 qty 1

Pin#	Label	Function
1	Batt (+)	+12V Battery power feed - Red
2	GND (-)	Battery return (GND) - Blk
3	IGN/SW	Ignition or power switch input - Yel

**Shut Down Delay Time and Stand-by Power mode Jumpers**

A four-pin jumper block (JU1) is located on top left corner of the DC-DC power supply.

Jumper configuration



## System requirements

Motherboards must be ATX 2.01 compliant. The motherboards must be able to support ACPI function under power management in BIOS setup. If the motherboard does not support ACPI function, then the computer can go only into power down mode and not into shutdown, stand-by or hibernate modes.

## Installation Steps

- Step 1. Configure your ATX/ ITX motherboard BIOS
- Step 2. Configure your operating system
- Step 3. Test the PC for proper operation.
- Step 4. Install OPUS DC-DC power supply and the wiring
- Step 5. Test the PC with OPUS DC-DC for proper operation, if all passes then, enjoy it.

## Configuring VIA EPIA-M Series ITX motherboard BIOS

1. Power-up the computer and press the 'Del' key to go into the 'BIOS SETUP UTILITY'
2. Go to the 'Power Management Setup'. Use arrow keys to navigate and enter.
3. ACPI Function - Enabled
4. ACPI Suspend Type - S3 or S1&S3
5. Power Off by Power Button - Instant-off
6. Run VGA BIOS if S3 resume - Auto
7. AC loss auto restart - OFF
8. Go to 'Peripheral Activity'
9. PS2KB wakeup select - Hotkey
10. PS2KB wakeup from suspend - Cntrl+F1 or whatever is your preference
11. Type 'Esc' to go back to 'Power Management Setup'
12. Type 'Esc' to go back to top level of BIOS setup menu.
13. Select 'Save and Exit setup'; Type Enter, Y, Enter.

VIA EPIA-M ITX motherboard configuration is complete.

## Configuring your ATX, micro ATX or Flex ATX motherboard BIOS

Here is an example of how to configure a typical motherboard. For this example we used Intel D815EEA2 motherboard. Your motherboard may vary where certain options are located. This example provides general knowledge how to configure the motherboard.

1. Power-up the computer and press the 'Del' key to go into the 'BIOS SETUP UTILITY'
  2. Go to the 'Power' tab. Use arrow keys to navigate.
  3. Go to 'APM' option. (Advanced Power Management)
  4. Select 'Enabled' for Power Management, Choose time for Inactivity Timer, Select 'Enabled' for Hard Drive.
  5. Type 'Esc' key to go back into the 'Power' tab.
  6. Go to 'ACPI' option (Advanced Configuration and Power Interface).
  7. Select 'S3 State' for ACPI Suspend State, Select 'Enabled' for Video Repost and select 'Stay off' for Wake on LAN from S5.
  8. Type 'Esc' key to go back into the 'Power' tab.
  9. Select 'Stay Off' for After Power Failure.
  10. Go to 'Exit' tab and select Exit Saving Changes.
- ATX motherboard configuration is complete.

Note: If an application or motherboard does not support standby mode then select 'S1 state' in step 6 above.

---

## Configuring your operating system - Windows 2000 Pro or Win XP Pro

---

NOTE: ACPI is not a plug and play function. If ACPI is not enabled at the time Windows is installed, you should install as shown below.

Click *Start >> Settings >> Control Panel*, then double click *Add/Remove Hardware* Icon. Let windows automatically detect. Windows should automatically detect ACPI component (if it was enabled as described in configuring your ATX mother board section) and install the proper drivers. You may need the original Windows CD

Re-boot the computer to detect the newly installed ACPI component.

Now follow the steps outlined below to configure Shutdown or Stand-by mode of operation.

1. Go to Display Properties: Click *Start >> Settings >> Control Panel*>> – double click *Display* for accessing Display Properties window.
2. Click the *Screen Saver* tab >> Click *Power* button to access 'Power Option Properties' Window.
3. Click '*Hibernate*' tab; Check box [x] Enable Hibernate support, Click *Apply*.
4. Click '*Advanced*' tab.
5. Click down arrow to open choices 'Under Power buttons' (When I press the power button on my computer),
6. Select one of three choices Standby, Hibernate or Power-off options.
7. Select Portable/Laptop under Power schemes.
8. Click the *Advanced* tab. In Power buttons box, under the statement 'When I press the power button on my computer:' select Standby or Shutdown. See note below
9. Click *Apply*>> OK to apply and close the Power Option Properties window.
10. Click 'OK' on the Display properties window.  
Windows 2000 Pro configuration is complete.
11. Shut down the computer. Click *Start >> Shut Down >> Shut Down* under Shut Down Windows.

Note: Some applications do not support standby mode. In that case select Power-off or hibernate in step 6 above.

---

## Configuring your operating system - Windows 98 SE

---

NOTE: ACPI is not a plug and play function. If ACPI is not enabled at the time Windows is installed, you should install as shown below.

Click *Start >> Settings >> Control Panel*, then double click *Add/Remove Hardware* Icon. Let windows automatically detect. Windows should automatically detect ACPI component (if it was enabled as described in configuring your ATX mother board section) and install the proper drivers. You may need the original Windows CD

Re-boot the computer to detect the newly installed ACPI component.

Now follow the steps outlined below to configure Shutdown or Stand-by mode of operation.

1. Go to Display Properties: Click *Start >> Settings >> Control Panel*>> – double click *Display* for accessing Display Properties window.
2. Click the *Screen Saver* tab >> *Settings* on the Display Properties window to access Power Management Properties window.
3. Select Portable/Laptop under Power schemes.
4. Click the *Advanced* tab. In Power buttons box, under the statement 'When I press the power button on my computer:' select Standby or Shutdown. See note below
5. Click *Apply*>> OK to apply and close the power management Properties window.
6. Click 'OK' on the Display properties window.  
Windows 98 SE configuration is complete.
7. Shut down the computer. Click *Start >> Shut Down >> Shut Down* under Shut Down Windows.

Note: Some applications do not support standby mode. In that case select Shutdown in step 4 above. Try it.

---

## Testing the PC for proper operation before installing the DC-DC power supply

---

1. Power-up the computer by pushing the soft Power ON/OFF switch on the front panel of the computer. The computer should power up normally.

2. Open any application and test for normal operation, then close the application.
3. Push the soft Power On/OFF switch for less than 1 second. The computer should go into Standby or shut down mode, as it was set in step 6 of configuring your operating system (Windows 2000 Pro).
4. Wait about 10 seconds and push the soft Power ON/OFF switch again. The computer should power up normally.
5. Open an application for Standby mode testing. Use the application as you would normally.
6. Push the soft Power On/OFF switch for less than 1 second. The computer should go into Standby or shut down mode, as it was set in step 6 of configuring your operating system (Windows 2000 Pro). See note below
7. Repeat steps 4 to 6 for all applications that are used in your computer.

Note: All applications software must be checked for proper Standby mode operation.

If any application has problem going into Standby mode then the operating system must be configured for Shutdown

## Installing the DC-DC Power supply

!! Caution! Observe proper Static protection to prevent damage to your computer or the DC-DC power supply. Use wrist strap to prevent static damage. The OPUS DC-DC power supply has Static sensitive MOS devices.

### Refer to application example drawing.

1. Power down and open the computer case.
2. Remove the AC- DC power supply if was installed.
3. Set shut down delay timer jumpers in the OPUS DC-DC power supply for minimum time (Default factory setting)
4. Install the OPUS DC-DC Power Supply in your computer.
5. Connect the bottom end of 20-pin ATX power cable Y cable to OPUS DC-DC power supply J7 –ATX/ITX Power Connector. Connect the 20-pin connector end to a Power connector on the ATX/ITX motherboard.
6. Connect the 4-pin drive power cable end to the appropriate Drives.
7. Connect the 2-pin cable (polarized side) to J5- (Power-switch) of DC-DC power supply. Connect the other end to the motherboard 2 pin ITX power switch/soft power switch pins on the F\_Panel header.  
Important: proper polarity is required to function accurately. The green wire side of the 2-pin connector must be connected to the +ve side and white wire side must be connected to the – ve side of pins.  
VIA, EPIA-M ITX motherboard: F-Panel header Pin 6 is +ve (green wire side) and pin 8 is –ve (white wire side). Refer to motherboard user guide.  
Intel D815EEA2 motherboard: Front panel header Pin 6 is +ve (green wire side) and pin 8 is –ve (white wire side). Refer to motherboard user guide.
8. Wire the 3 pins DC input power connector.  
Pin 1: Battery Positive. Use RED color # 12 AWG automotive grade wire.  
Pin 2: Ground or Battery Negative. Use Black color # 12 AWG automotive grade wire.  
Pin 3: Ignition or Switched Battery. Use Yellow #18 AWG automotive grade wire
9. Insert the 3 pin input power cable connector to OPUS DC-DC power supply input power connector.
10. Double-check all wiring for proper connection, power feed and battery polarity to the power supply.
11. If the power feed to the power supply/ PC is connected properly, Status Green LED in the OPUS DC-DC power supply should blink at a rate of approximately .1 sec. ON and 2.5 sec OFF. This is the idle /standby state of power supply.

## Testing the PC with DC-DC Power supply installed for proper operation

1. Power-up the computer by Turning the Ignition switch on (starting the vehicle) or toggling the switch. The Green Status LED should light up constantly and the computer should power up normally.
2. Open any application and test for normal operation, then close the application.
3. Turn off the computer by turning the ignition switch off. Within 5 Sec. the PC should start to go into Standby or shut down mode and the Green status light should go back to the idle/standby blink rate.
4. Wait about 10 seconds and Turn on the Ignition switch again. The computer should power up normally.
5. Open an application for Standby mode testing. Use the application as you would normally.
6. Turn off the computer by turning the ignition switch off. The computer should go into Standby or shut down mode, as it was set in step 4 of configuring your operating system (Windows 98 SE). See note below.
7. Repeat steps 4 to 6 for all applications that are used in your computer.

Note: All applications software must be checked for proper Standby mode operation.

If any application has problem going into Standby mode then the operating system must be configured for Shutdown

## Application Wiring Example

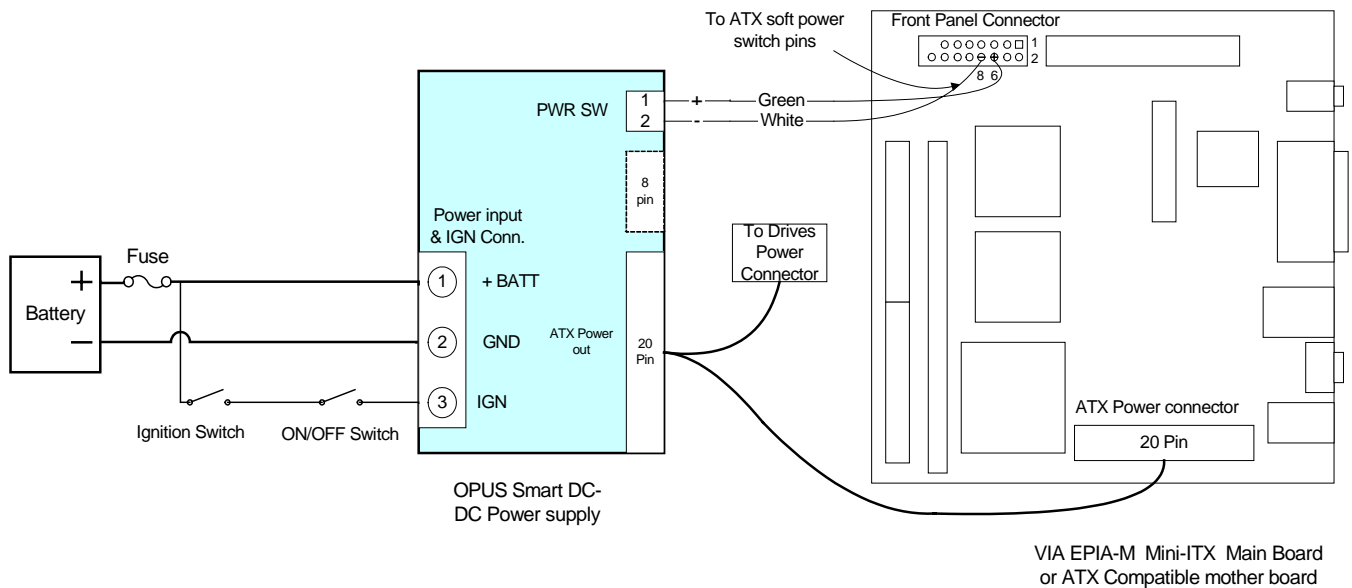


Fig. 1 OPUS DC-DC Power Supply to VIA EPIA-M Mini ITX Mother board Application Drawing

**Remote/ Trigger Option Wiring**

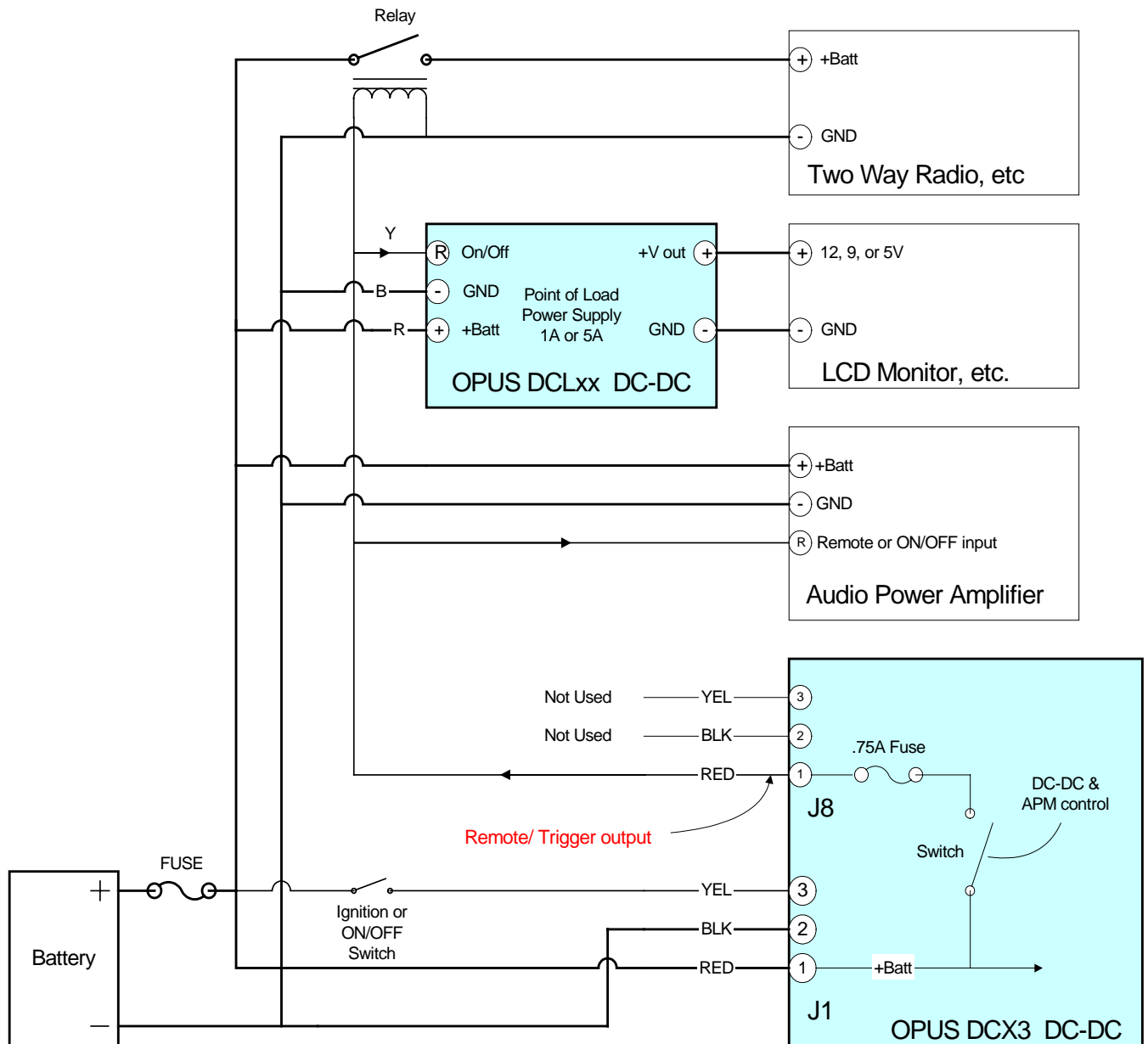


Fig 2. Remote/Trigger output and / or DCLxx DC-DC Application Schematic Drawing

**Remote/ Trigger option - Application Notes**

It is an output that can source .75A of raw switched battery voltage. (J8 pin 1, Red wire)  
The switch is controlled by the power supply and the power management of the PC system.

**J8 Connector Detail**

- Pin 1, (Red wire) - Remote /Trigger output
- Pin 2, (Blk wire) - Ground
- Pin 3, (Yel Wire) - Reserved for future use



Note: The black and Yellow wires are not required for remote / trigger use.

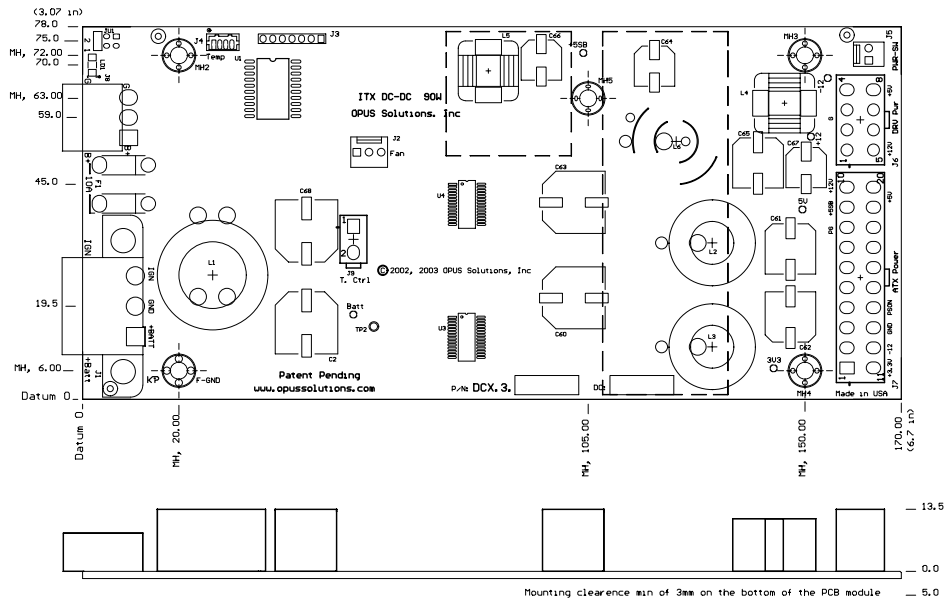
It is intended for turning ON/OFF of the computer slave/peripheral devices.

The slave/peripheral devices are such as LCD monitors, Amplifiers, 2 way radio, Cameras, Remote DVD or CR ROMs, etc.

The output of the remote / trigger (Red wire) can be connected directly to the Audio Power amplifier's Remote or Trigger input. In this application, the computer is turned ON first, then 40 Sec later the amplifier will be turned on to prevent pop noise in the audio system.

If slave/peripheral devices does not have trigger /Remote input, then, the Remote/Trigger output from DCX3 DC-DC power supply can be used to power a relay, which in turn can switch the power to slave devices.

### DCX3 DC-DC PCB Dimensions



Printed Circuit Board Assembly Dimensions

Part #: DCX, xx09

ITX-DC/DC 90W

OPUS Solutions, Inc.  
pcb-3-b-dwg.pcb

## Trouble shooting guide

---

### *Computer does not turn on?*

Check to make sure that battery is connected to DC-DC Power supply connector.

Check to make sure that Ignition input to DC-DC power supply is connected to pin 3 of the power input connector. Make sure the 2-pin power switch pins are properly attached.

### *Computer does not turn off when the ignition is turned off!*

Check the Green LED state

## Interpreting the Green Status LED light flashing

---

0.1 sec ON and 3.5 Sec OFF Approx.:	DC-DC power supply is in Idle or stand-by state.
On constantly	The PC is powered and the PC should be operating.
Number of flashes	Reason for flashing
1 Flash	Battery voltage is below normal operating range. The normal range is 10.6 VDC to 18 VDC. During engine cranking the low battery voltage detection is ignored so the battery voltage can dip below 10.6V.
2 Flashes	The computer power up sequence failed Reasons: <ol style="list-style-type: none"> <li>1. Check the wiring of the two wire power-switch cable from power supply connector J9 to power switch pins on the ATX motherboard. If connected properly check the polarity of the power switch pins. May be reversed.</li> <li>2. Check ATX mother board bios settings.</li> <li>3. Locked up motherboard or software crash of bug.</li> <li>4. Faulty DC-DC power supply.</li> </ol>
3 Flashes	Power supply output voltages are out of normal voltage range. Reasons: <ol style="list-style-type: none"> <li>1. Power supply output is over loaded or shorted.</li> <li>2. Faulty DC-DC power supply.</li> </ol>
4 Flashes	Power down, stand-by or hibernate sequence failed. Reasons: <ol style="list-style-type: none"> <li>1. Check the wiring of the two wire power-switch cable from power supply connector J9 to power switch pins on the ATX motherboard. If connected properly check the polarity of the power switch pins. May be reversed.</li> <li>2. Check ATX mother board bios settings.</li> <li>3. Check if ACPI function is enabled in the power management BIOS setup.</li> <li>4. Make sure ACPI drivers are installed in the operating system.</li> <li>5. Check if application is compatible with ACPI mode of operation.</li> <li>6. Locked up motherboard or software crash of bug.</li> <li>7. Faulty DC-DC power supply</li> </ol>

## Technical Specifications

---

Input:	12V	24V	
Normal input voltage range:	7.5V to 18V DC	15V to 32V DC	
Low battery shutdown voltage:	10V or 10.9V $\pm$ 0.25V	20.2V or 22.2V $\pm$ 0.25V	
Battery good Detection Voltage:	11V or 11.9V $\pm$ 0.25V	22.2V or 24.2 $\pm$ 0.25V	
Low battery de-bounce time:	10 Sec.		
Input current drain:			
Power down/ Standby mode:	< 0.015 A (power supply only)		
Ignition/ Power switch current drain:	<10 mA		
Ignition on/off de-bounce time:	5 Sec		
Turn off delay setting:	10 Sec. (Factory default) or 20 minutes.		
Output:	90W	Ripple	Regulation
+3.3V:	6 A max, 8 A pk,	50mV p-p max	2%
+5 V:	6 A max, 8 A pk	50mV p-p max	2%
+12 V:	2.5A max, 3 A pk	50mV p-p max	2%
-12 V:	0.2 A max, .4 A pk,	150mV p-p max	10%
5 V standby:	1.5 A max, 2 A pk	50mV p-p max	2%
Power supply efficiency	> 88% at optimum loads		
MTBF:	150,000 hrs		
Operating Temperature Range:	-20°C to 65°C		
Input Fuse:	10A mini Blade replaceable (Automotive mini blade fuse)		
Input Power Mating connector:	Plug: AMP P/N: 350766-1 Crimps: Amp P/N: 640310-3 and 350919-3		
Output Power Connectors:	20 pin ATX Mother power connector, cable length 240 mm long 2 HDD and 1 FDD power connectors 2 pin ATX power Switch connector, cable length 420mm		
Printed circuit Board Module Dimensions:	78mm (W) x 170mm(D) x 17mm (H) 3.1"(W) x 6.7"(D) x 0.7" (H).		
External Dimensions:	80mm(W) x 170mm (D) x 19mm (H) 3.2" (W) x 6.72" (D) x 0.75" (H)		
Warranty:	3 Years, Limited warranty		
Specifications Subject to change without notice			

---