

# Uninterruptible Power Systems

## DX400E/DX600E/DX800E

### Service Manual

Date	Version.	Remark
2009/08/16	1.0	

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# 1 SPECIFICATIONS

Model	DX400E	DX600E	DX800E
Capacity (VA)	400VA	600VA	800VA
Capacity (Watts)	240W	360W	480W
Input			
Input Voltage Range	192-263Vac Transfer Point:      Recovery Point: VL=192±10Vac      VL+2V~+12V VH=263±10Vac      VH-2V~VH-12V		
Frequency Range	47Hz To 63Hz		
Nominal RMS Current (VA/120)	1.74 A	2.61A	3.48A
Max. RMS Current	5A	5A	8A
Output			
On Battery Output Voltage	Simulated Sine Wave at 230±7%		
On Battery Output Frequency	50/60 Hz +/-1%		
Surge Protection			
Lightning / Surge Protection	405Joules(L-N)		
Battery			
Sealed Maintenance Free Lead Acid Battery	12Vdc / 4.5Ah	12Vdc / 4Ah	12Vdc / 8.5Ah
Protection	DC fuse 40A/32V x1	DC fuse 30A/32V x2	DC fuse 40A/32V x2
Battery Low	11Vdc+/-0.3Vdc		
Battery Shutdown	10Vdc+/-0.3Vdc		
User Replaceable	Yes		
Charger			
Charge Voltage	13.3Vdc-13.8Vdc		
Charge Current	1.0Amax		
Typical Recharge Time	8 Hours(Recovery to 90% capacity)		
Charging Over Volt	15Vdc±0.3Vdc		
Transfer Time			
Typical	≤10ms		
Overload Protection			
Overload Protection-Output Short(Line mode)	Circuit breaker: 5A	Circuit breaker: 5A	Circuit breaker: 8A
Overload Protection-Output	- Load ≥ 120%: Buzzer long beep, shutdown in 3 secs.		

Short(Batt mode)	- 120% ≥ Load ≥ 110%: Buzzer long beep, shutdown in 60 secs. - Load ≤ 90%: Stop warning & stop over load shut down procedure.		
<b>Indicators</b>			
Orange LED	Illuminate when main switch is on and the UPS is working.		
LCD: Battery Capacity	Show 5 level		
LCD: Load Capacity	Show 5 level		
LCD: Estimated run time	Show run time in minutes		
LCD: Input voltage	Show input voltage in 1 volt resolution		
LCD: Output voltage	Show output voltage in 1 volt resolution		
LCD: AVR	Show AVR status		
LCD: normal/battery	Show normal/battery status		
LCD: overloaded	Show overloaded status		
LCD sleep	LCD mask will be turn off after 1 minute if the “display” switch was not pressed in 1 minute. The back light led will be turn off after 2 minutes if the “display” switch was not pressed in 2 minutes.		
LCD wake up	LCD will be waked up after 2 seconds if the “display” switch is pressed.		
<b>Audible Alarms</b>			
Battery Discharge	2 beeps in 30 seconds		
Battery Low	Sounding every 1 second		
Overload	Continuously sounding		
<b>Physical</b>			
Total # of UPS Receptacles	French/Schuko *3		
Maximum Dimensions	235x90x190mm		
Weight (Kg)	2.7Kg	3.4Kg	3.9Kg
<b>Environmental</b>			
Operating Temperature	+32°F to 95°F ( 0°C to 35°C )		
Operating Relative Humidity	0 to 95% NON-CONDENSING		
Noise Level	Less than 40dB		
<b>Communication</b>			
PowerPanel Business Edition (for USB Port)	Windows 98/ME/2000/NT/XP		
PowerPanel Business Edition (for Serial Port 1) PowerPanel® Software (for Serial Port 2)	Windows 98/ME/2000/NT/XP		
<b>Management</b>			
Self-Test	Manual Self-Test		

Auto-Charger	Yes
Auto-Restart	Yes
USB Interface	USB1.1

## 2 COMPONENTS LOCATION



### 1. Power Switch

Press the power switch to turn the UPS ON or OFF.

### 2. LCD Function Selected Switch

The switch can be used to select the LCD display contents Including input/output voltage and estimated run time, etc.



### 1. AC Inlet

Connect to utility power through the input power cord

### 2. Input Circuit Breaker

The circuit breaker provides optimal overload protection.

### 3. AC outlet

The UPS provides 6 outlets for connected equipment to insure temporary uninterrupted operation

during a power failure and against surges and spikes.

#### 4. Serial Port to PC

This port allows connection and communicates from the DB-9 serial on the computer to the UPS unit.

#### 5. USB Port to PC

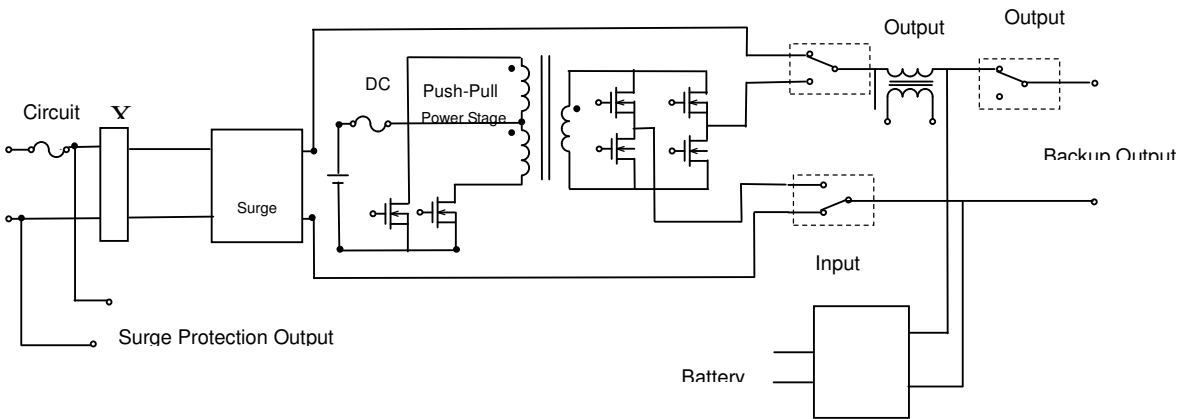
This port allows connection and communication from the USB port on the computer to the UPS unit.

#### 6. Communication Protection Ports RJ11/RJ45

Communication protection ports will protect any standard modem, fax, telephone line, or network cable.

### 3 PRINCIPLES OF OPERATION

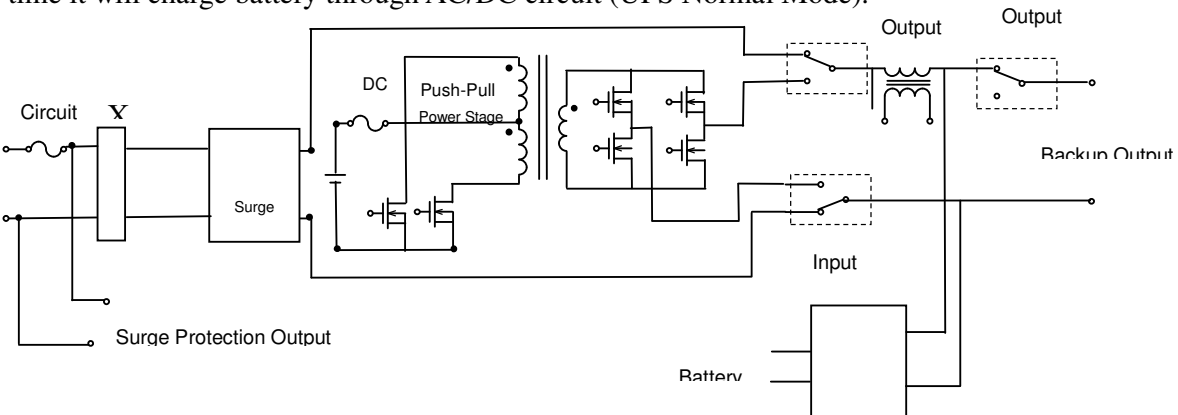
#### 3.1 System Block Diagram



System Block Diagram

#### 3.2 Normal Mode

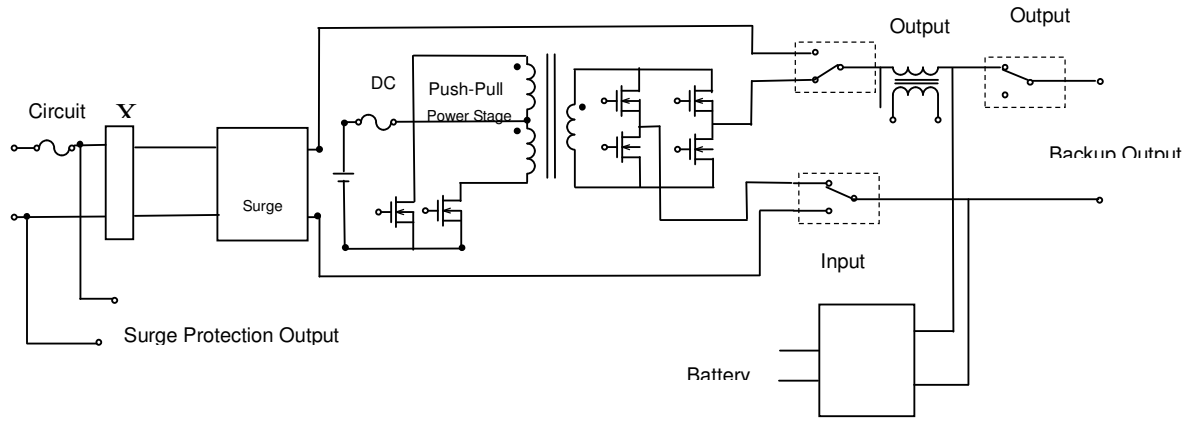
When AC utility power is normal, it will go through the UPS to provide power (Bypass), at the same time it will charge battery through AC/DC circuit (UPS Normal Mode).



UPS Normal Mode

### 3.3 Battery Mode

When AC utility power is abnormal, battery will provide power via DC/AC circuit to output socket.



UPS Battery Mode

## 4 REPAIR

### 4.1 Test Equipment

- Digital Multi-Meter (DMM) with true RMS measurement
- DC power supply 30V 6A
- Digital Storage Oscilloscope (DSO)
- AC power supply
- Power Meter
- Load: 100~200W/230V milky light bulb
- PC

### 4.2 Repair Procedure

#### 4.2.1 Equipment Preparation

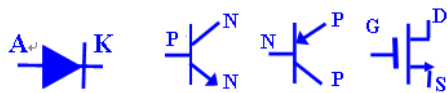
- Adjust the DC power supply to 12V
- Adjust the AC power supply to 230Vac
- Prepare 100W/480W light bulb load
- Install UPS communication software and prepare USB cable
- Check the waveform of UPS output
- Observe the output voltage, frequency, and power with Power Meter.

#### 4.2.2 Check Components

- Please check if there is any object that may cause a short circuit on the surface of circuit board or electronic components. (Please remove it if any.)
- Please check if there is any tin stick on the surface of circuit board or electronic components. (Please remove it if any.)
- Measure the components with Digital Multi-Meter.

1. Set DMM to  function and measure Transistor and Diode voltage, as described below.

- Read the figure of voltage difference between A-K (“Anode” and “Cathode”) of the diode (including Zener diode). The reading should be within the range of 0.4-0.65V.
- Read the figure of voltage difference between B-E (“Base” and “Emitter”) or B-C (“Base” and “Collector”) of the BJT. The reading should be within the range of 0.45-0.65V.
- Read the figure of voltage difference between S-G (“Source” and “Drain”) and the S-D (“Source” and “Gate”) of the MOSFET. The reading should be within the range of 1.3-2.5V / 0.45-0.65V.



- If the measured reading is over normal value, the component might be broken.

Part Reference	Approval Sheet	Measured Reading
D11,D12,D13,D14,D15,D16,D17,D18,D29	<a href="#">BAS32L(Diode)</a>	0.4V~0.65V
Z1	<a href="#">30V/0.5W(Zener Diode)</a>	0.4V~0.65V
Z2	<a href="#">12V/0.5W(Zener Diode)</a>	0.4V~0.65V
D23	<a href="#">BAV70LT1(Diode)</a>	0.4V~0.65V
D21,D22,D23	<a href="#">1N5404(Diode)</a>	0.4V~0.6V
D10	<a href="#">HER108(Diode)</a>	0.4V~0.6V
D3,D4,D9,D10,D26,D28	<a href="#">1N4007(Diode)</a>	0.4V~0.6V
D5,D6,D7,D8	<a href="#">MUR460(Diode)</a>	0.4V~0.6V
Q11,Q12,Q13,Q14,Q15,Q16,Q17,Q18,Q19,Q21,Q22,Q25,Q26,Q27	<a href="#">PN2222A(BJT NPN)</a>	0.5V~0.75V
Q20,Q24	<a href="#">MPSA42(BJT NPN)</a>	0.5V~0.75V
Q23	<a href="#">PN2907(BJT PNP)</a>	0.5V~0.75V
Q3,Q4,Q5,Q8	<a href="#">CEP83A3 (N MOS)</a>	0.4V~0.6V
Q6,Q7,Q9,Q10	<a href="#">IRF840( N MOS)</a>	0.4V~0.6V

2. Set DMM to “Ω” function and measure the resistor and fuse and see if they are normal.



### 4.2.3 Check Functions

- Connect the transformer, wires, and power cord to the main board. Use DC power supply (set 24V) to replace the battery. Follow the steps below to measure.

Step	Test Point	Test Steps	Solutions
1	Charger Test	<ol style="list-style-type: none"> <li>1. Input AC 230V when power is off.</li> <li>2. Observe if battery side (DC charger header) become 13.3-13.8V from DC 12V.</li> <li>3. Remove AC 230V.</li> </ol>	<ul style="list-style-type: none"> <li>• <b>If there is no output, check charger circuit.</b> <ol style="list-style-type: none"> <li>1. Check if there is input. The fuse or copper foil might be broken if there is no input. (Change or touch up the broken parts.)</li> <li>2. Check if there is broken semi-conductor. (Change the broken parts.)</li> <li>3. Check if there is broken resistor. (Change the broken parts.)</li> </ol> </li> </ul>
2	Boot Test System Power Test Battery Mode Test	<ol style="list-style-type: none"> <li>1. Supply DC 12V with DC power supply.</li> <li>2. Observe if the output voltage, frequency, and waveform are correct.</li> <li>3. Observe if the LCD header is correct.</li> <li>4. Press the LCD function switch to see if the function selection is normal.</li> <li>5. Check if the voltage 24V, 15V, -15V, 5V are correct with DMM.</li> </ol>	<ul style="list-style-type: none"> <li>• <b>If fail to boot (no power condition), please check the system power circuit.</b> <ol style="list-style-type: none"> <li>1. Check if DC fuse or copper foil are broken. (Change or touch up the broken parts.)</li> <li>2. Check if the tin of switch board is broken. (Touch up the broken parts.)</li> <li>3. Measure if BJT is damaged. (Change the broken parts.)</li> <li>4. Measure if 7805 output to ground is short. (If short, please check if there is tin stick of 5V to ground. If there is no tin stick, CPU might be broken. Change the broken parts.)</li> </ol> </li> <li>• <b>If fail to boot (there is a little power and then shut down), please check system power circuit.</b> <ol style="list-style-type: none"> <li>1. Check if there is ON signal sent out. (If no, the CPU ON foot might have problem or the CPU is broken. Please make sure the CPU is with program.)</li> <li>2. If ON signal is sent out, please check if the path (R45、D16、R18) from ON to BJT is broken. (Change the broken parts.)</li> </ol> </li> <li>• <b>If fail to boot (there is power but inverter does not work), please check is input battery voltage is too low. (Battery voltage must be higher than 12V.)</b></li> <li>• <b>If fail to boot (buzzer long beep without</b></li> </ul>

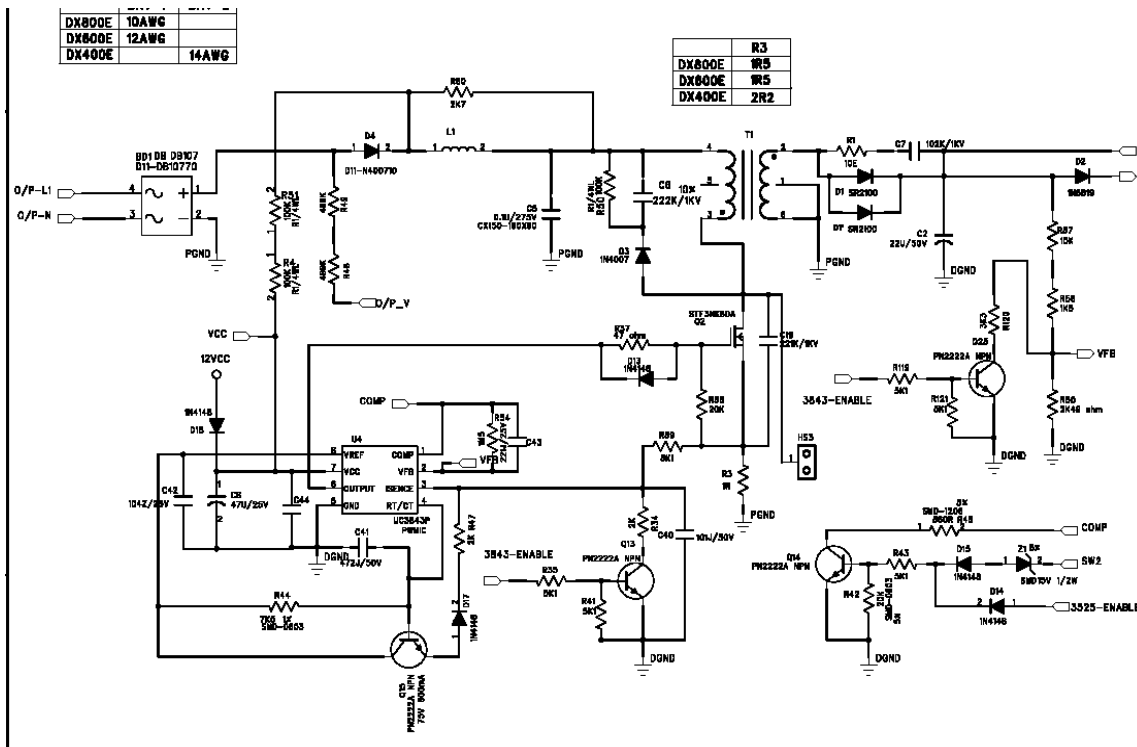
			<p><b>output), please check inverter circuit.</b></p> <ol style="list-style-type: none"> <li>1. Please check if output is short. (Remove the short part.)</li> <li>2. Please check if inverter circuit MOSFET D-S side is short and if copper foil is broken. (Change or touch up the broken parts.)</li> <li>3. Please check if resistors of inverter circuit are normal. (Change the damaged parts.)</li> </ol> <p><b>• If UPS can boot but the output waveform is not normal, please check interver circuit.</b></p> <ol style="list-style-type: none"> <li>1. Check if Q3,Q4,Q5,Q8 are installed backwards. (Correct the installation.)</li> <li>2. Check if Q3,Q4,Q5,Q8 driver circuit Q22Q21Q18Q17 are broken. (Change the broken parts.)</li> <li>3. Check if the value of resistor is wrong or damaged. (Change the broken parts.)</li> </ol> <p><b>• If LCD cannot display normally, please check Panel circuit.</b></p> <ol style="list-style-type: none"> <li>1. Please check if there is broken tin or wires fall off on LCD board. (Touch up the broken parts.)</li> <li>2. Check if the Panel circuit is normal. (Change the broken parts.)</li> <li>3. Check if RB, BL, WB, DAT signals are sent out. (If not, the CPU feet of RB, BL, WB, DAT might have problem or the CPU is damaged. Please make sure the CPU is with program.)</li> </ol> <p><b>• If LCD cannot switch normally, please check panel circuit.</b></p> <ol style="list-style-type: none"> <li>1. Please check if there is broken tin or wires fall off on LCD board. (Touch up the broken parts.)</li> <li>2. Please check if there is broken tin or wires fall off on Switch board. Please check if the switch is normal. (Touch up the broken parts.)</li> <li>3. Please check if Panel BDT+ circuit is normal. (Change the broken parts.)</li> <li>4. Check if BDT+signal is sent into CPU. (If yes but no reaction, the CPU BDT+ foot might have problem or the CPU is damaged. Please make sure the CPU is with program.)</li> </ol>
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3	Line Mode Test	<ol style="list-style-type: none"> <li>1. Followed by step 2, turn on the UPS in battery mode and then add AC 230V (using AC power supply).</li> <li>2. Observe if it switches to Line Mode.</li> <li>3. Adjust the utility power to AC 192V to see if it switches to battery mode.</li> <li>4. Adjust the utility power back to AC 263V to see if it switches to battery mode.</li> <li>5. Adjust the utility power back to AC 230V.</li> </ol>	<p>• <b>If fail to switch to Line Mode, please check input detection circuit and main circuit Relay and Relay control.</b></p> <ol style="list-style-type: none"> <li>1. Please make sure AC input is rated frequency. (If not, adjust the AC power supply.)</li> <li>2. Please check input detection circuit and if the resistor or copper foil is broken. (Change or touch up the broken parts.)</li> <li>3. Observe if the SYNC and LINEV waveforms are normal with DSO. (If not, check if the detection circuit elements are broken.)</li> <li>4. Check if SYNC (50Hz square wave) and LINEV (50Hz full-wave rectifier) signals are sent into CPU. (If not, the CPU SYNC or LINEV feet might have problem or the CPU is damaged. Please make sure the CPU is with program.)</li> <li>5. Check if Relay (K1, K2) and control circuit are normal. (Change or touch up the broken parts.)</li> </ol> <p>• <b>If the above is all normal but over voltage and low voltage cannot switch to battery mode, please check if the program version is correct. (If not, please burn correct program.)</b></p>
4	Load/Overload Test  USB Communication Test  Dry Contact Test	<ol style="list-style-type: none"> <li>1. Followed by step 3, add 100W load.</li> <li>2. Check if the LCD display is correct.</li> <li>3. Check if the USB software (PPPE) display (firmware version) is correct.</li> <li>4. Power Panel Personel Edition ° Disconnect utility power to switch to battery mode and check the USB software display using PPPE.</li> <li>5. Restore utility power and add rated load and check if display and software are correct and goes to overload constant tone.</li> <li>6. Remove load and run self test with software.</li> </ol>	<p><b>If USB fails to communicate, check the USB related CPU circuit.</b></p> <ol style="list-style-type: none"> <li>1. Check if USB to CPU components and circuit are normal. (Pay attention to stick tin or broken tin. Change the broken parts.)</li> <li>2. Make sure the CPU program version is correct. (If not, burn the correct program.)</li> </ol> <p><b>If dry contact fails to communicate, check the dry contact related CPU circuit.</b></p> <ol style="list-style-type: none"> <li>3. Check if dry contact to CPU components and circuit are normal. (Pay attention to stick tin or broken tin. Change the broken parts.)</li> <li>4. Make sure the CPU program version is correct. (If not, burn the correct program.)</li> </ol> <p>• <b>If it fails to display correct percentage (wattage) or no overload warning, check if the program version is correct. (If not, burn the correct program.)</b></p>

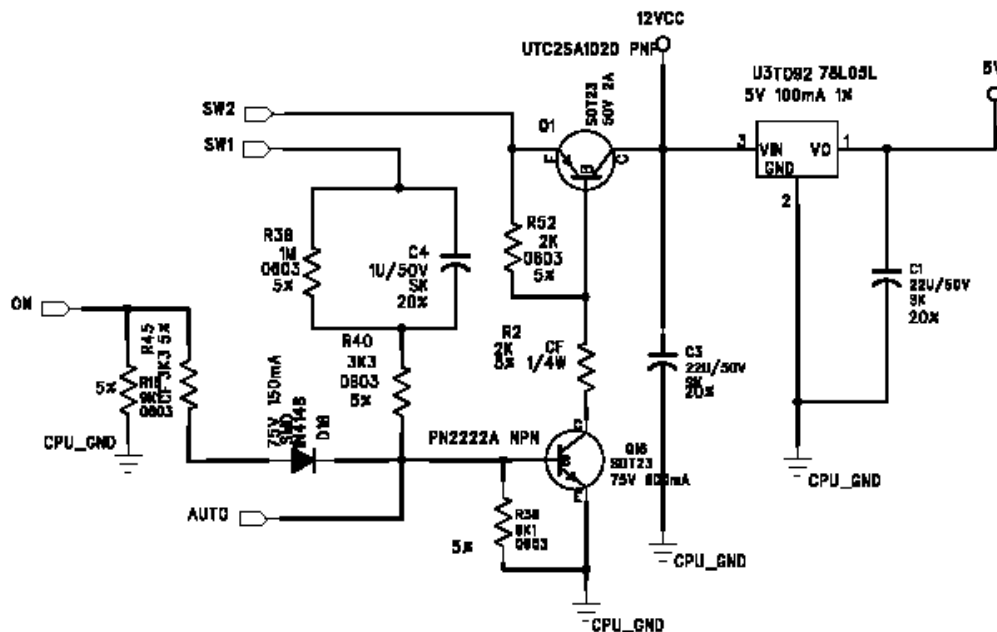
			<p>• If the program is correct but percentage (wattage) display is wrong or no overload warning, check if main circuit current detection components are normal.</p> <ol style="list-style-type: none"> <li>1. Check if CT is correct and surrounding components are normal. (Change the broken parts.)</li> <li>2. Check if LOAD signal is sent into CPU. (If yes but no action. The CPU LOAD feet might have problem or the CPU is damaged.)</li> </ol> <p>• If cannot run self test, please check if the program version is correct. (If not, burn the correct version.)</p>
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## 5 SCHEMATIC

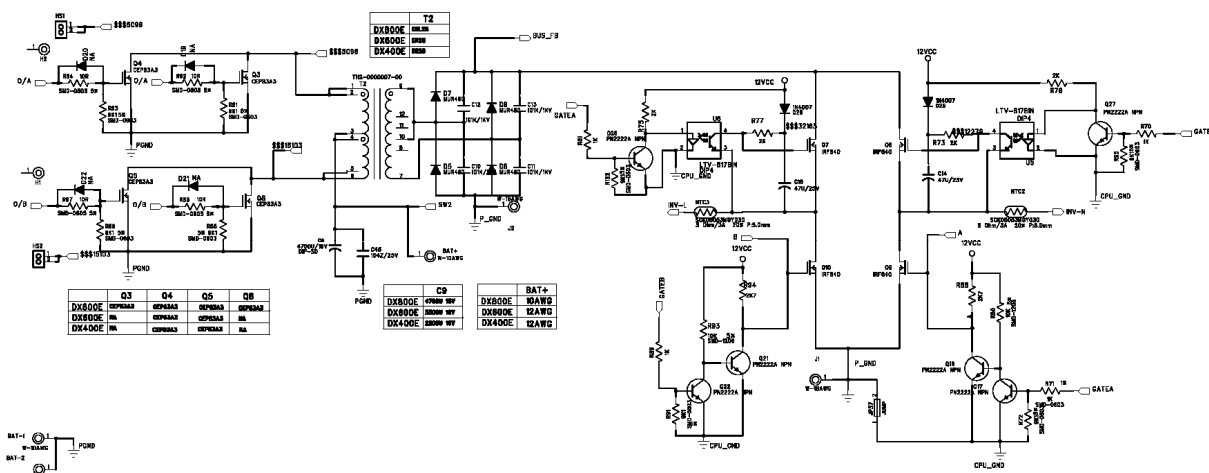
## 5.1 Charger & Output Detection



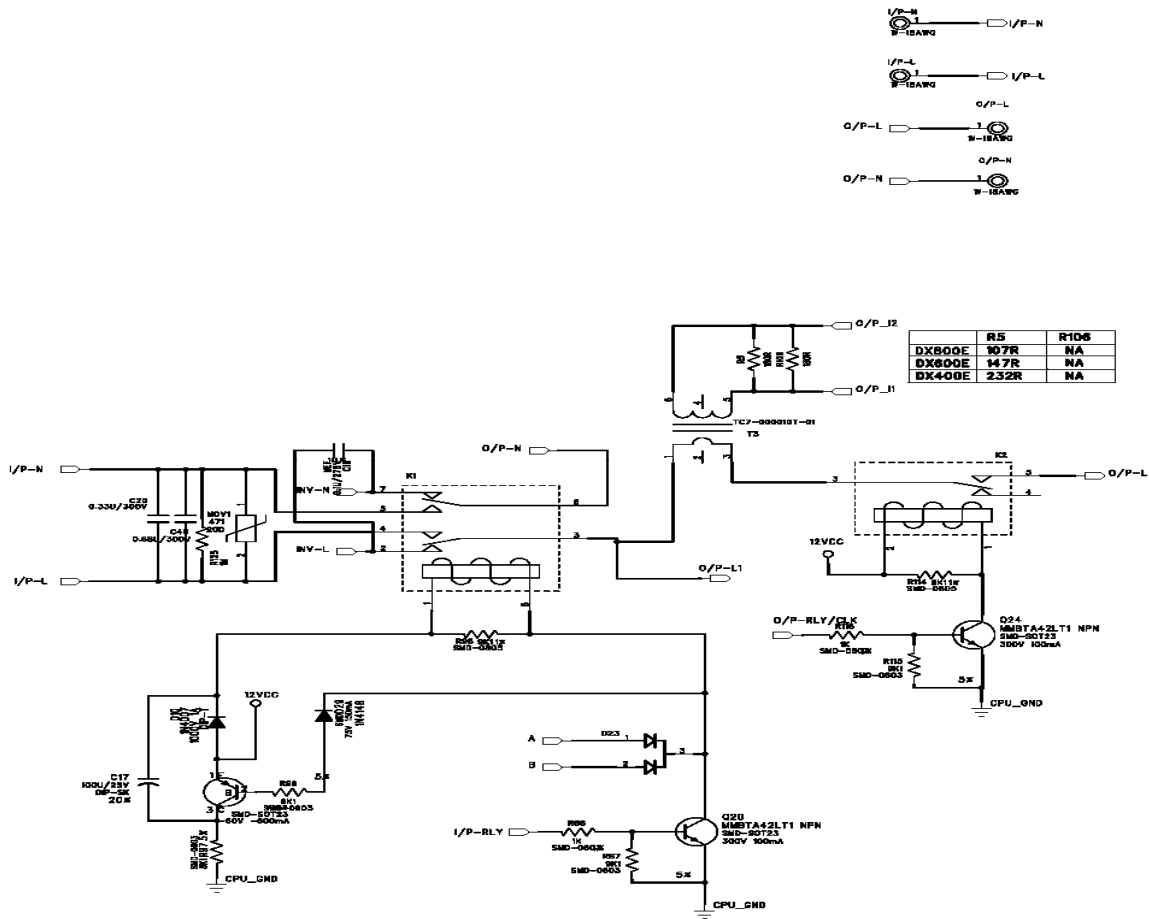
## 5.2 System Power



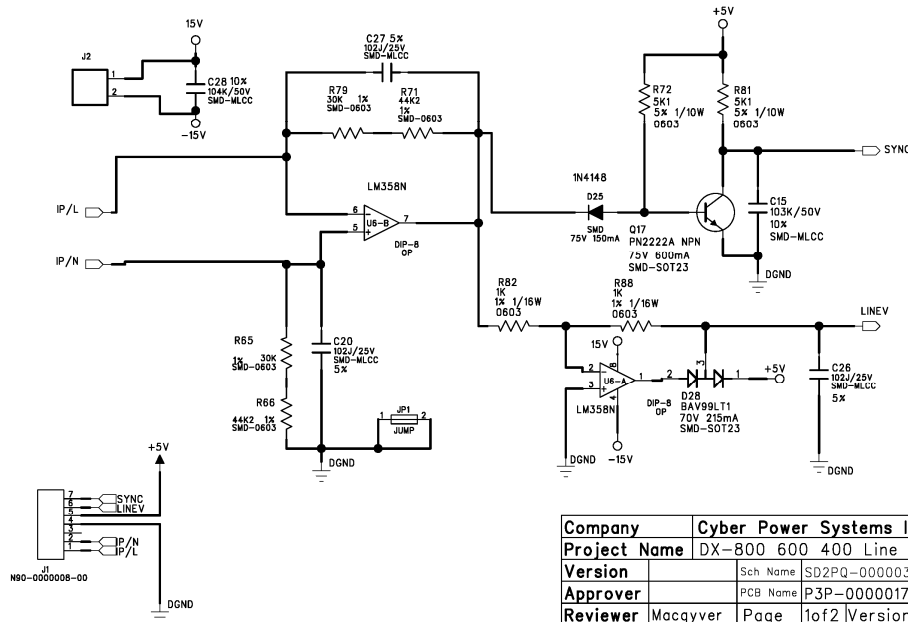
### 5.3 Inverter Circuit



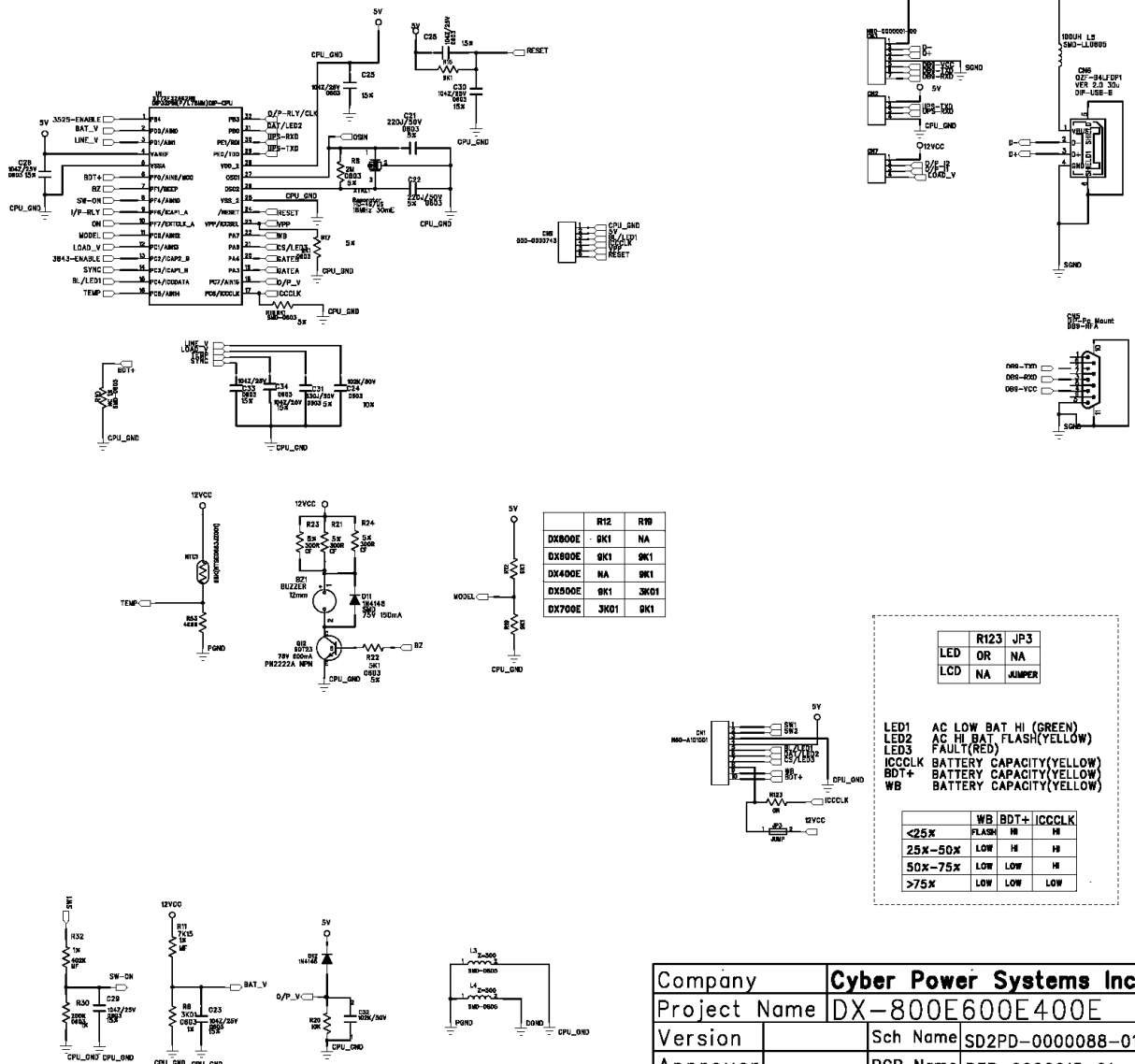
### 5.4 Main Circuit



## 5.6 Input Detection



## 5.7 CPU & Communication



Company	Cyber Power Systems Inc.		
Project Name	DX-800E600E400E		
Version		Sch Name	SD2PD-0000088-01
Approver		PCB Name	P3P-0000015-01
Reviewer	Macgyver	Page	2 of 3
Designer	Macgyver	Version	1.1
		Date	2009/08/15