C1000-Touch™ Thermal Cycler
S1000™ Thermal Cycler
Second Generation

Service Manual

Catalog # 1841100
1842000



BIO-RAD

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About this manual

This document is part of Life Science Group's commitment to provide you, the service professional, with adequate information to effectively support Bio-Rad instruments. Additional copies of this service document may be ordered using part number 10028800.

We welcome and appreciate any suggestions you may have to improve our service documentation. Please address your comments or suggestions to:

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Section 1
Introduction

1.1 General Information

This manual is the reference to be used for troubleshooting, repair, and maintenance of the 1000 series thermal cyclers. It is intended to be used by trained technicians and engineers familiar with safety precautions relative to working with **list of hazards**. The procedures in this manual assume that the reader is familiar with the operation of the 1000 series thermal cyclers. Complete operating instructions are contained in the 1000 series thermal cyclers instruction manual. Information presented in the instruction manual is not repeated in this Service Manual unless there is a compelling reason to do so.

1.2 Service Philosophy

This manual is designed to support mail in products. Regional service centers are the first level of service, where faulty assemblies can be most effectively repaired at a central repair facility. The second level of service is performed at our factory instrument service facility in Richmond, California, where additional service procedures requiring resources not available at regional service centers are performed.

1.3 Safety

The 1000 series thermal cyclers contains the following Hazards:

- Hazardous voltages
- Thermally hot components

The following should be observed when servicing this unit:

- When power is required, the unit should be plugged into an outlet with a properly grounded receptacle. The use of 2-prong plug adapters is not recommended and will void the safety certification of this product.
- The use of extension cords may compromise the safety of the operator and is not recommended.
- Ensure that fuses installed in the unit are of the correct rating.
- Ensure that none of the ventilation openings in the unit are blocked. Excessive heat buildup in the unit may cause failures.

Note: *This Bio-Rad product is designed and certified to meet *EN61010-1 safety standards. Certified products are safe to use when operated in accordance with the instruction manual. This instrument should not be modified or altered in any way. Alteration of this instrument will void the warranty, void the EN61010-1 certification, and create a potential safety hazard. This safety certification does not extend to other equipment or accessories not EN61010-1 certified, even when connected to this product.*

Bio-Rad is not responsible for any injury or damage caused by the use of this instrument for purposes other than for which it is intended or by modifications of the instrument not performed by Bio-Rad or an authorized agent.

1.4 Conventions

The following conventions are used throughout this manual:

- Left and right sides of the unit are as viewed from the front, operator’s position, unless otherwise stated.
- Dimensions are in inches, unless otherwise stated.
- Pressure is in pounds per square inch.

Section 2
System Overview

This section of the manual provides an overview of the second generation of C1000-Touch and S1000 thermal cyclers including safety information and theory of operation.

2.1 Product Description

2.1.1 General Description

Several improvements have been implemented in the second generation C1000-Touch and S1000 Thermal cycler. Some of the improvements include separate internal power supply that provides power to the main board, new USB Hub board with better communication reliability, new LCD screen with LED back light and new C1000-Touch front controller board with micro SD memory card.These improvements and changes are part of maintaining and improving product reliability. The UI remains the same and these changes will not affect the end user. The catalog number Also remain the same for C1000-Touch and S1000 thermal cyclers. To distinguish the C1000-Touch and S1000 second generation from the previous generations in the field, the starting serial number of both thermal cyclers have been changed as follows:

- C1000-Touch-2 thermal cycler starting serial number CT8000
- S1000-2 thermal cycler starting serial number SC10000

The 1000 line of thermal cyclers are the newest generation of Bio-Rad thermal cyclers. The second generation C1000-Touch and S1000 thermal cyclers consist of a base unit and a reaction module that plugs into the base unit. They are used to amplify target DNA into multiple samples. the 1000 line of PCR instrumentation is a flexible and modular platform designed to offer best-in-class performance, and features in an easy-to-use reliable package.

2.1.1.1 The C1000-Touch Thermal Cycler Features:

- Reduced Protocol Run Times: The C1000-Touch offers fast thermodynamics for shorter run times and faster results.
- Reliable results with Precise Thermal Control: Sample block uniformity of +/- 4^{o}C at 90^{o}C after 10 seconds with an accuracy of +/- 0.2^{o}C. Adjustable lid temperature to further control reaction temperature and prevent evaporation.
- Thermal Gradients: Optimize reaction performance using temperature gradients across sample blocks.
- Flexible Vessel Format with Interchangeable Reaction Modules: Simply change reaction modules when you need 48, 96, 96deep well or 384-well blocks with the same thermal cycler base. Uniform and repeatable microplate sealing with adjustable lid force.
- Pre-installed, Customizable Protocols to Use as Templates: Speed protocol writing by customizing pre-loaded protocols.
- Auto-generate customized protocols with the AutoWriter Feature: Which generates optimized protocols based on user input parameters
- Encrypted Logs and Validation Reports: Simple GLP compliance on every run with automatically generate run logs, system logs, and validation reports. Optional administrative control over user access.
- Ready for High-Throughput: Use remote commands to control up to 32 thermal cyclers for automated robotic systems. Use a bar code reader and temperature validation option to verify data flow and quality.

2.2 Technical Description

The 1000 series thermal cyclers consist of a chassis and a reaction module which plugs into the chassis. See Figures 2-1 and 2-2. The reaction modules come in several varieties, including 96 well fast 96 deep well, 384 well, and dual 48 well fast units.The same chassis is used for each type of reaction module. Single or dual operation is sensed automatically at startup. Both the C1000-Touch and the S1000 run a self-test routine on power-up. Basically these routines will check for sensor integrity, run some raw power through the TEs, and other routine 'housekeeping' tests. The C1000-Touch also has a more comprehensive on-board diagnostic test that can be run from the Utilities menu. This test will run through the same types of tests, though more thoroughly. The run-time data from this test are displayed on the C1000-Touch front end, and can be recorded to a USB thumb drive plugged into the machine.

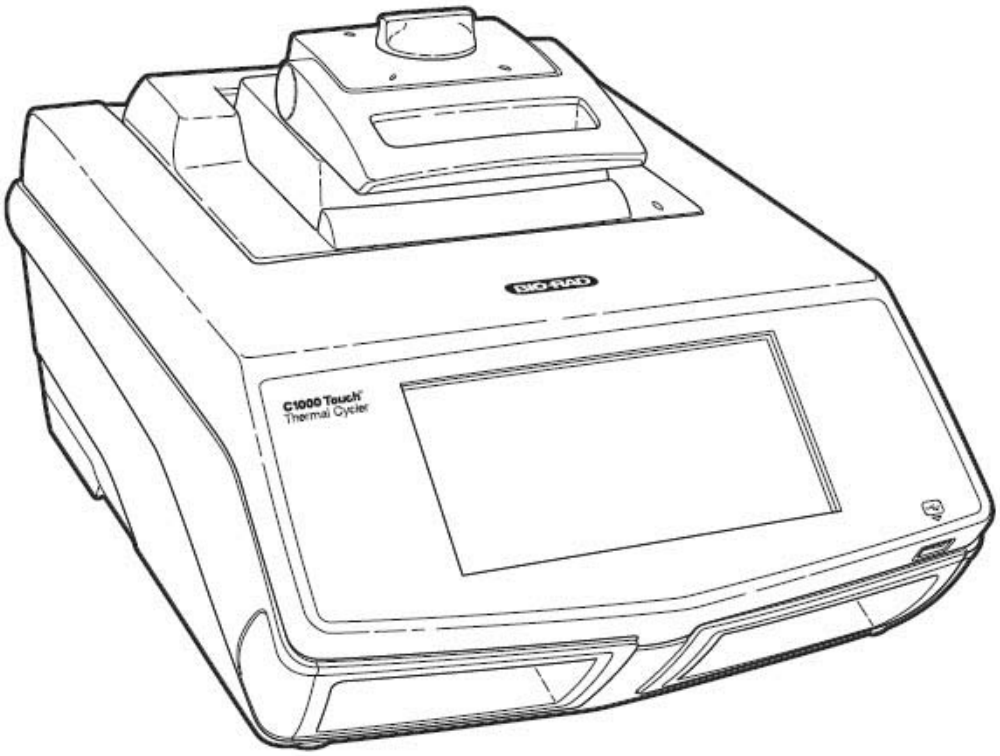


Figure 2-1: C1000-Touch Thermal Cycler

2.2.1 C1000-Touch Thermal Cycler Operating Specification

This thermal cycler is designed to operate safely in a standard research laboratory for research applications.

Table 2-1:C1000-Touch Operating Specification

Requirement	Specification
Thermal Block Uniformity	±0.4◦C well-to-well uniformity at 90◦C within 10 seconds
Thermal Accuracy	±0.2◦C of programmed target temperature
Maximum Temperature	100◦C
Minimum Temperature	0◦C
Max Ramp Rate	5◦C/second
Heated Lid Range	0-110◦C
Dimensions	13” X 18” X 8”
Weight	24 lbs
Line Voltage	100-240 VAC rms (no adjustment needed among voltages within these ranges)
Frequency	50-60 Hz single phase
Input Power	850 W max
Fuses	Two 10 A, 250 V, 5 x 20 mm fast blow
Display	12 x 9 cm, high resolution, full color
Ports	5 USB-A, 1 USB-B

2.2.2 C1000-Touch Gradient Specifications

C1000-Touch thermal cycler can generate a temperature gradient across a 96-well or dual 48- well block.

Table 2-2: C1000-Touch Gradient Specifications

Requirement	Specification
Gradient Direction	Back (lower temperature) to front (upper temper ture) of block
Maximum Gradient	30◦C to 100◦C
Gradient Temperature Differential	1-24◦C
Gradient Uniformity	±0.4◦C well to well uniformity within 10 seconds of step initiation
Gradient Accuracy	±0.2◦C of programmed target temperature
Gradient Calculator Accuracy	±0.4◦C of the actual well temperature

2.2.3 S1000 Thermal Cycler Operating Specification

This thermal cycler is designed to operate safely in a standard research laboratory for research applications.

Table 2-3:S1000 operating specification

Requirement	Specification
Thermal Block Uniformity	±0.4◦C well-to-well uniformity at 90◦C within 10 seconds
Thermal Accuracy	±0.2◦C of programmed target temperature
Maximum Temperature	100◦C
Minimum Temperature	0◦C
Max Ramp Rate	5◦C/second
Heated Lid Range	0-110◦C
Dimensions	13” X 18” X 8”
Weight	23.8 lbs
Line Voltage	100-240 VAC rms (no adjustment needed among voltages within these ranges)
Frequency	50-60 Hz single phase
Input Power	400 W max
Fuses	Two 10A, 250 V, 5 x 20 mm
Display	LCD, semi- graphical
Ports	4 USB-A, 1 USB-B

2.2.4 S1000 Gradient Specifications

S1000 thermal cycler can generate a temperature gradient across a 96-well or dual 48- well block.

Table 2-4: S1000 Gradient Specifications

Requirement	Specification
Gradient Direction	Back (lower temperature) to front (upper temper ture) of block
Maximum Gradient	30◦C to 100◦C
Gradient Temperature Differential	1-24◦C
Gradient Uniformity	±0.4◦C well to well uniformity within 10 seconds of step initiation
Gradient Accuracy	±0.2◦C of programmed target temperature
Gradient Calculator Accuracy	±0.4◦C of the actual well temperature

2.3 C1000-Touch and S1000 Main Board

The C1000-Touch main board has been redesigned and the power supply has been removed from the board. A separate internal power supply provides the power to the main board. This board is not backward compatible to the first generation C1000, S1000 and C1000-Touch thermal cyclers. This main board can only be used in the C1000-Touch second generation and S1000 second generation thermal cyclers.

2.3.1 12.8V Circuit

2.3.1.1 Power

1. 19W for Front End Controller. With charging of batteries operating at the same time, the maximum power required delivered to Front End Controller is estimated at 30W.
2. 19W for local 5V and 3.3V regulation on Main board
3. 7W max for the Fans.
4. 3W max if all USB ports are supplying 100mA to each of the peripheral devices at the same time.
5. The total power needed is estimated at 60W.

2.3.1.2 Voltage

1. The input voltage from power supply module is 40V. A +/- 10% tolerance is used to accommodate for line, load regulations and setting accuracy of the power supply.
2. This voltage is used to power up the Fan. In current production C1000 design, the fan has maximum voltage of 12.8V.
3. This voltage is used to power the Front End Controller and the LCD display, backlight etc. The Front End Controller and LCD display, backlight accepts voltages from 8V to 14V.
4. This voltage is further stepped down to 5V and 3.3V on the LBEC mainboard.
5. The tolerance of this supply is not crucial, but for completeness, a +/-5% is specified.

2.3.1.3 Current

1. With the power estimates from 1.1.2, the total power required of the 12.8V regulator is 60W, giving the output current of 4.93A when the 12.8V droops by 5%.

2.3.1.4 Short circuit protection

1. This is required because this supply is an output of the Mainboard and is one of the connection between the Mainboard and USB hub board. This relies on the integrated DC-DC controller's built-in short circuit protection.

2.3.2 5V Circuit

2.3.2.1 Power

1. 5V is used to power up most of the Mainboard digital electronics, the ADC and the hub board electronics. The power estimated at 1.6W max.
2. 3W max from 5V if all USB ports are supplying 100mA to each of the peripheral devices at the same time.
3. Total power delivered by 5V supply estimated at 5W.

2.3.2.2 Voltage

1. The input voltage is 12.8V +/- 5%.

2. The output voltage is 5V
3. A +/- 5% tolerance provides enough margin as the 5V digital circuit on the Mainboard has a 10% tolerance requirement. The crucial one being the ADC. For ADC, the current design is the same as existing C1000.

2.3.2.3 Current

1. With the power estimates from 1.2.1.1, the total power required of the 5V regulator is 5W, giving the output current of 1.05A when the 5V droops by 5%.

2.3.2.4 Short circuit protection

1. This is required because this supply is an output of the Mainboard and is one of the connection between the Mainboard and USB hub board.
2. This relies on the integrated DC-DC controller's built-in short circuit protection.

2.3.3 3.3V Circuit

2.3.3.1 Power

1. 3.3V is used to power up some of the Mainboard digital electronics that requires 3.3V as supply rail.
2. Estimated power is 2W max.

2.3.3.2 Voltage

1. The input voltage is 12.8V +/- 5%.
2. The output voltage is 3.3V
3. A +/- 5% tolerance provides enough margin for the board 3.3V electronics, which requires a 10% tolerance on the 3.3V rail.

2.3.3.3 Current

1. With the power estimates from 1.3.1.1, the total power required of the 3.3V regulator is 2W, giving the output current of 0.64A when the 3.3V droops by 5%.

2.3.4 Address/Data bus

1. External bus is multiplexed, so the design is based on description provided in Multiplexed External Bus Interface (MEBI) provided in [5].
2. Expanded memory map also utilized. Expanded bus lines XADD14 to XAAD19 connected to additional external SRAM and PLD.
3. Even though PLD is powered from 3.3V, it is 5V tolerant. Therefore it can be connected to the address and data bus lines that are using 5V ACT logic circuits to provide TTL logic input level compatibility, which is in this case used to provide compatibility to 3.3V CMOS logic output levels.
4. Serial communication (in particular TXD1) from Cypress FX1/FX2 USB to Serial Interface which operates on 3.3V, that is connected to RXD1 input of the HC12 also require a level shifter. The opposite line is not critical, since Cypress FX1/FX2 has all inputs that are 5V tolerant.
5. External Static RAM address lines are connected to address registers bits 0 – 13. SRAM is powered from 5V, so it is compatible with the logical levels used on the bus.
6. Separate latch circuits provided for address and data bus, transparent latch circuit and buffer with tri-state for the data bus, and edge triggered D Flip-flops with tri-state register for registered address bus.

7. Additional buffer with tri-state and transceiver with tri-state are provided for the interface with monochrome graphic display and keyboard (S1000 functionality).
8. Read and write cycle is controlled via Altera PLD.
9. Eight data lines (bits) are connected to most significant byte of the microcontroller.
10. ECLK signal of the microcontroller that controls expanded bus timing is used to control address and data bus, by controlling the mentioned latch circuits. This signal is used to latch the output data or the address.
11. Data acquisition is provided using an ADC with parallel interface, connected to the above-mentioned data and address lines.
12. Write, read and High Byte Enable (HBEN, for 8 LSBs or 4 MSBs selection in 12 bit conversion result on an 8 bit data bus) control signals for ADC are generated through PLD. Buffering/Level shifting is necessary, since PLD operates on 3.3V, while ADC is designed to operate from 5V.

2.3.5 Synchronous Serial Bus Interface (SPI)

1. In order to reduce number of lines, the connectivity of external devices that do not require very high speeds through SPI bus greatly simplifies the PCB design. SPI bus is always organized in such way that HC12 microcontroller is Master, while the DAC is wired as a slave device.
2. Data towards the DAC is transferred in 16 bit sets, where 4 bit DAC address (which one of 8 outputs data belongs to), followed by 8 bits of data. Last four bits are ignored.

2.3.6 Asynchronous Serial Communication Interface

HC12 Asynchronous Serial Communication interface (also known as UART) operates as any standard RS-232 device, except that it operates on 5V TTL/CMOS logic levels. In order to provide electrical compatibility, specialized level shifter (transceiver) designed for this purpose is used. This device is operated from single 5V power supply, since it is equipped with internal charge pump and external capacitors to generate necessary voltage required to comply with RS-232 voltage levels.

2.3.7 Satellite Display and Keypad

2.3.7.1 Keypad Theory of Operation

1. Key press detection is done in combination with logic circuits located on the Satellite Display board, which provides support for the keypad. Essentially the microcontroller needs to scan the state on the keypad in order to detect pressed key (or key state change).
2. The keypad should operate the same as the keypad used on MJ Mini.

2.3.7.2 LCD Display

1. Display type that should be supported is a monochrome graphic display 128 x 64 pixels, that would be used as an alphanumeric display.
2. It should use the LCD that has been used on the MJ Mini design [10].

2.3.8 USB

1. Preferred way to communicate with Front End Controller is via USB. Since HC12 microcontroller does not support USB communication, some kind of Interface between USB and serial communication port is required.
2. USB device that is facing Front End Controller should support High Speed USB.
3. Another serial line is needed for the communication between Front End Electronics and the Real Time Lid. Therefore a USB to Dual Serial line should be considered, meaning Cypress FX2 interface (with dual USARTs)

4. The amount of data that needs to be transferred between Front End Controller and the Back End Controller is small. Therefore the speed is not critical for the USB to serial Interface.
5. Access type should be done through virtual COM ports, since this is easily supported by Win CE on the Front End Controller.
6. Since Cypress FX2 is based on 8051 controller, it requires f/w to be loaded from EEPROM after the power up for it to run properly.
7. EEPROM should be sufficiently large to store required f/w. The maximum size that is supported by the Cypress FX2 chip is 16 kByte (128 kbit) EEPROM.
8. FX2 reprogramming can be done either by updating the content of the EEPROM or though USB, if the serial EEPROM is not connected.
9. Reset of the controller is required after the power failure to ensure proper operation of the device. Therefore s supervisor circuit connected to FX2 is required.
10. Since there are different configuration in which BEC board operates (with FEC, without FEC and stand alone), VBUS detection when the PC is connected to the Satellite unit should be provided to HC12 microcontroller.

2.3.9 TE Driver

1. Switches TE current direction
2. Any change of state would generate a dead time the next state required by the control system.
3. It has to disable the current driver before switching
4. Whole polarity control design is done in PIC microcontroller, which includes Watch Dog Timer to monitor the proper operation of the PIC.
5. Firmware required to achieve proper operation can be stored into the microcontroller small FLASH memory, and is executed using built in small SRAM memory

2.3.10 TE Current control

1. Design of the driver is based on DC to DC fixed frequency current mode control schemes with a minimal external parts count. Internally implemented circuits include a trimmed oscillator for precise duty cycle control.
2. Current setting is implemented using the compensation pin of the controller IC, which is used to directly set the current limit analog signal from the PID control via DAC. The current output regulation resolution has to provide about 200 current output levels. This is achieved using PWM outputs from the microcontroller. They are configured to output 70kHz PWM pulse train with 8-bit resolution. These signals are low pass filtered to produce an analog signal (with corresponding number of analog levels) that is fed into the Current mode PWM controller (via emitter follower circuit) as a reference for output current limiting, allowing same number of different current output levels.
3. Dead band is inherent in the design of this PWM controller to reduce the sensitivity to noise. If this becomes a problem, it could be compensated within firmware by artificially adding a fixed offset to PID control output.
4. Asynchronous Buck converter design was selected over synchronous, since it turned out that the minimum current output measured on asynchronous design was lower, which was preferred.
5. In order to achieve lower currents than what the Dead Band limit allowed, PWM output was additionally modulated using already available PIC microcontroller used for polarity swathing. This was abandoned, since measurements proved that the existence of the dead band odes not affecting the stability of the Reaction Block temperature control.

2.3.11 Lid Heater Voltage Control

1. Since the lid heater is purely resistive load, the driver should be based on high frequency switching DC-DC voltage regulator
2. Refer to Linear Technology
3. LT3724 data sheet for details about the operation of this voltage regulator.
4. Additional circuit to allow change of the voltage feedback ratio was provided in order to allow 2 different voltage output levels. Switching was achieved using N-Channel MOS transistor that introduces additional resistance in parallel for feedback voltage divider.
5. Short circuit is not expected in the normal operation and if such condition appears, it is an indication of some serious failure. Therefore fuse was sleeted to provide short circuit protection.
6.

2.3.12 Fan Speed Control

PWM signal generated within HC12 microcontroller is directly fed into logic level N-Channel MOS transistor with low input (C_{gs}) capacitance. This transistor is capable of switching quite fast with very little delay, which produces a corresponding 12V PWM signal that is provided to the fan and averaged by the presence of 22µF capacitor in parallel. Since the fan that is used in the design is DC brushless, the rotational speed is directly proportional to the voltage being supplied to the fan.

2.3.13 RT Lid On/Off Control

Since there is no need for fast switching speed, the design used for this purpose is a simple. Since the switch needs to be provided on the high side, low R_{ds}-on P-Channel MOS transistor was used. In order to drive this transistor from microcontroller, another logic level N-Channel MOS transistor was required to provide voltage compatibility.

Since both mentioned transistors work as inverters, the logic state of the output is in positive logic (output is turned on when the corresponding microcontroller output is high).

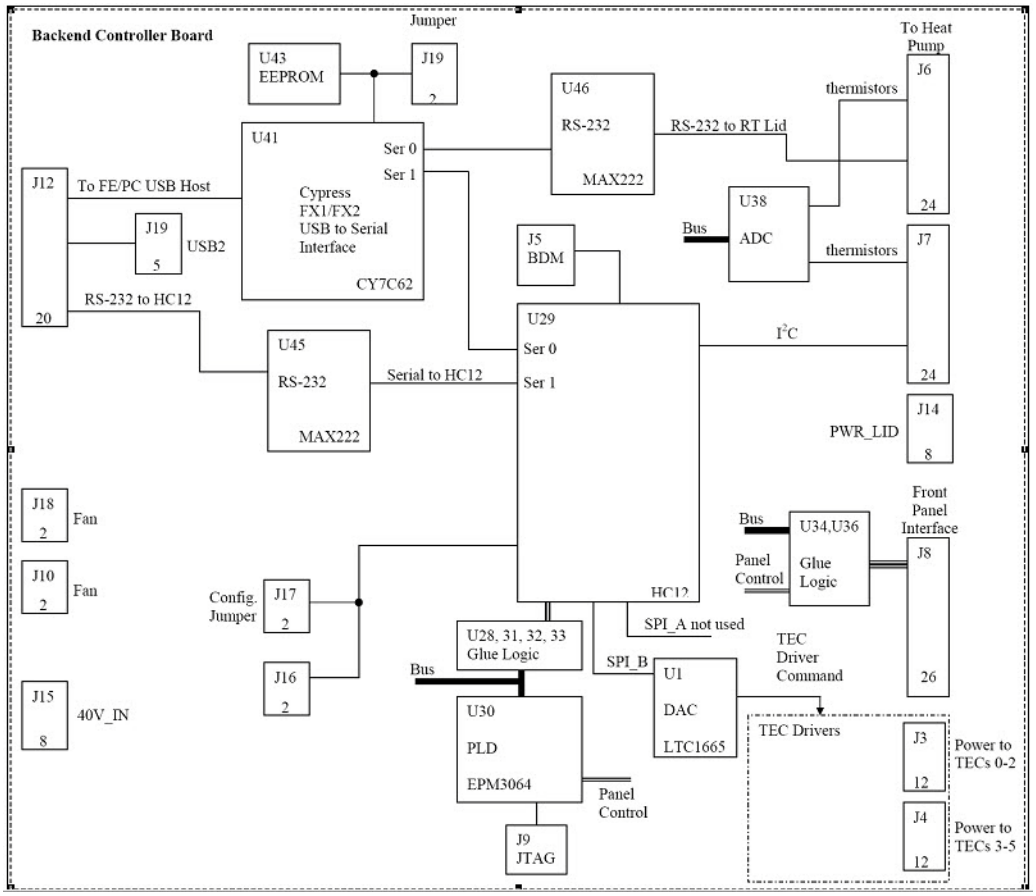


Figure 2-2: C1000/S1000 Main Board Block Diagram

2.3.14 C1000-Touch Controller Board

The C1000-Touch Controller implements high resolution (800x480) 8.5” graphics+touchscreen LCD display, increased Fcore clock speed to 520MHz and utilize other features supported by PXA270 CPU.
The brain behind the C1000-Touchcontroller is the 312Mhz Marvell PXA270, a 32bit ARM7 core with a highly integrated set of peripherals.
The second generation C1000-Touch FE controller board is NOT compatible with the existing/current C1000-Touch base.

2.3.14.1 Power

7V-14V “DC_VIN” power is supplied to FE bd from C1000-Touch Main Bd through J3 which provides power input to DC5V regulator (U10) and to battery charger (U14). Power regulators.

2.3.14.2 Battery charger + battery backup operation

Battery backup switch operation will activate during power failure mode. While DC_VIN power is good (> 6V), Q2 is ON to keep the LT3022 (U15) LDO in shutdown mode to preserve “DC_BATT” charge.

2.3.14.3 CPU and ROM/SRAM Memory

- Marvell Semiconductor’s PXA270 (U26), optimized to run core frequency at 520MHz
- FLASH ROM is Intel/Numonyx JS28F256P30B (U22 & U24), 256Mbit flash memory configured to provide 64MByte total memory. The FLASH memory stores the system firmware which consists of “bootloader, WinCE OS and C1000-Touch application.
- SDRAM is Micron Semi’s MT48LC32M16A2P (U23&U25), 512Mbit/133MHz configured to provide 128MByte total RAM memory.

2.3.14.4 CPLD

Altera EPM240GT100C5N (U19) CPLD contains the system glue logic as well as the board control register (BCR) configured as readable/writable status register I/O controls. The BCR controls the LCD and LCD backlight power, SD Card power enable and control signals, Battery backup SW (Bat_ON) signal and USB Vbus power.

2.3.14.5 MicroSD Memory Storage Card

Utilizing PXA’s SD I/O interface relieves the jitter issue, and benchmark test also showed faster rd/wr time vs CF.

SD Memory Card (J24) is used to store data such as real time results, run reports, error logs and other system files.

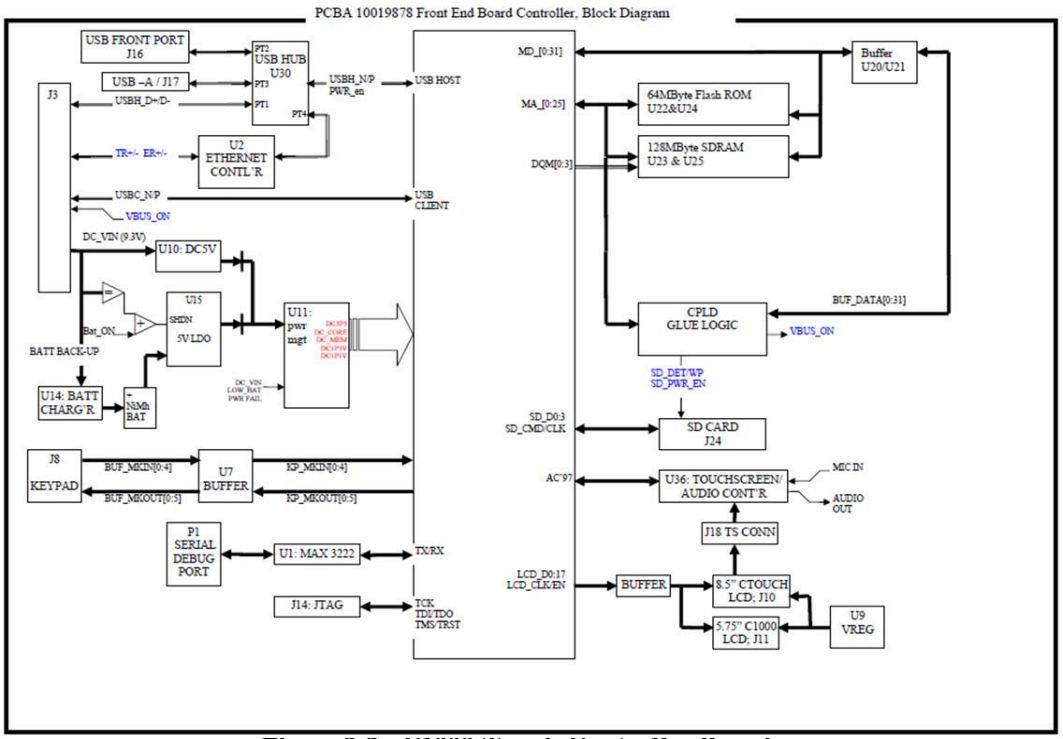


Figure 2-3: C1000-Touch Controller Board

2.3.15 USB I/O CBA

This board has the connectors for interfacing to the outside world and the USB hub. The hub is a 7 port hi-speed device. All communications are routed through this board.

2.4 Power Supply

The internal 40V power supply is used to supply power to C1000-Touch and S1000 system that will be built in different configurations:

- C1000-Touch Second generation
- S1000 second generation

Specifications:

Parameter	Description
AC input Voltage Range	100-240 Vac
Input current	9.5 Amp 110VAC 60Hz 4.8Amp 240VAC 50Hz
Output Power	650W
Output DC Voltage	+40V DC
Output Current	Minium-0.5A Maximum-16.25A
Peak Load output current	18.5A

2.5 1000 Series Reaction Modules

There are four types of 1000 series Reaction Modules: single block 96well ‘Fast’, dual block 48well ‘fast’, single 96 deep well block and a single block 384well standard speed. Each of theses reaction modules are built and tested as a sub-assembly prior to the attachment of a lid. Figure 2.8.and 2.9

The design of the single reaction modules versions employs six (6) 50-couple TEs. The dual 48/48 uses four (4) 40-couple TEs under each block.

All connections to the TEs are made by the Alpha Outer CBAs (two types – one for the 96F and 384, one for the 48/48). The 128pin connector at the front of the assembly makes all of the connections to the base for proper operation.

The 1000 series Reaction Modules employ graphoil thermal interfaces at the heatsink/TE (bottom) interface and block/TE (top) interface. Unlike previous MJ designs, these graphoil interfaces are not active heaters, but rather simple thermal interfaces. Also on the Outer CBAs is the Alpha serial EEProm memory device. This memory is used for Alpha specific parameters, such as control and calibration constants, identifying parameters, and production test values. The ‘Block Active’ LEDs are also located on these CBAs.

Within the sealed area where we locate the TEs there is another PCB (Alpha Inner), which is used to make the connections to the outside of the sealed chamber. By using the outer board, the pins molded into the retainer, and the inner board we realize a hermetically sealed chamber for the TEs. The block sensors are also connected to the outside world in this manner.

The temperature sensor for the heatsink is a thermistor potted into a male-female standoff, which is screwed into a tapped hole on the heatsink and connects to the outer board.



Figure 2-4: Single Alpha



Figure 2-5: Dual 48w Alpha

2.6 Reaction Module Lids

There are two types of manual lids for the 1000 series alphas: single and dual. The single lid is used on the 96well. 96 deep well or 384 alphas, and the dual lid is used on the 48/48F. The C1000-Touch High Lid mechanism looks similar to the old C1000-Touch reaction modules but is 6mm lid height. It is used in the new a Deep Well Reaction Modules which holds 0.5mL tubes, same plastic housing is used in the 96W high lid, 384 high lid, and similar design but narrower housing is used for the dual 48W high lid modules.The C1000-Touch Touch High Lid mechanism is a modification to the old C1000 reaction modules lid design. A pair of handle-activating push bars are added for single motion lid opening and closing. In addition, overload protection clutch has been added to prevent damage of lid components by user error. There is no change in the electronics, lid heater or heat pump where same thermal electric modules are used for PCR heat and cooling.Figure 2.7 and Figure 2.8.



Figure 2-6: Single Lid



Figure 2-7: Dual Lid

2.7 Controlling S1000 cycler with C1000-Touch

2.7.1 Connecting S1000 Thermal Cycler to C1000-Touch via USB A Port

1. Plug a high quality, shielded USB cable into the USB B port on the back of the S1000.
2. Plug the other side of the USB cable into a USB A port on the back of the C1000-Touch. The C1000-Touch will detect the first S1000 thermal cycler.
3. Plug a high quality, shielded USB cable into the USB B port on the back of another S1000 thermal cycler. Plug the other end of the cable into a USB A port on the previous S1000 thermal cycler (the S1000 connected directly to the C1000-Touch).
4. By repeating steps 1-3, you may connect up to three S1000s indirectly to the same C1000-Touch.
5. Open the instrument tree on the C1000-Touch.
6. Select the S1000 by serial number or name. If the S1000 has a name, then the name will display instead of the serial number.

Section 3
Installation

3.1 Introduction

This section of the manual guides you through the installation and setup of the second generation C1000-Touch and S1000 Thermal Cycler. The C1000-Touch and S1000 thermal cycler is simple to install and run. Insert a reaction module, plug in the thermal cycler, and begin a PCR experiment. Use the interchangeable reaction modules to change block formats. The C1000-Touch instrument can run in two modes: Stand-alone or it can be controlled by CFX Manager version 3.0 or higher. S1000 thermal cycler can be used in stand-alone mode and controlled and operated through C1000-Touch thermal cycler. C1000-Touch Interchangeable reaction modules includes: 5-color CFX96™ optical, 4-color CFX384™ optical, gradient-enabled dual 48/48-well fast, gradient-enabled 96-well fast, gradient-enabled 96–deep well, and gradient-enabled 384-well reaction modules. C1000-Touch USB ports support peripherals, such as storage device and mouse. Optional PC control and networking capability for up to 32 systems enable the ultimate in high throughput.

An Installation report should be completed with each installation checkout.The Installation Report shall provide verification that the instrument has passed the requirements in the Installation section. A report checklist is provided in the Appendix section. Starting serial number for second generation thermal cyclers is as follows:

- C1000-Touch-2 thermal cycler starting serial number CT8000
- S1000-2 thermal cycler starting serial number SC10000

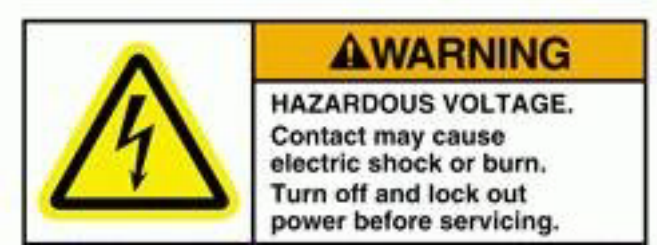
Catalog Items:

Catalog Number	Description
184-1100	C1000-Touch thermal cycler, chassis only
185-1196	C1000-Touch chassis + Fast 96-well Rxn Module
185-1197	C1000-Touch chassis + 96-deep well Rxn Module
185-1148	C1000-Touch chassis + Dual 48/48 Rxn Module
185-1138	C1000-Touch chassis + 384-well Rxn Module
184-2000	S1000 thermal cycler, chassis only
185-2196	S1000 chassis + Fast 96-well Rxn Module
185-2197	S1000 chassis +96-deep well Rxn Module
185-2148	S1000 chassis + Dual 48/48 Rxn Module
185-2138	S1000 chassis + 384-well Rxn Module
184-0196	96-well Fast Rxn Module for 1000 Series
184-0197	96-deep well Rxn Module for 1000 Series
184-0148	Dual 48/48 Rxn Module for 1000 Series
184-0138	384-well Rxn Module for 1000 Series
185-5195	C1000-Touch + CFX96 Optical reaction Module
185-5196	C1000-Touch + CFX384 Optical reaction Module + Reagents
185-5484	C1000-Touch + CFX384 Optical reaction Module + Reagents
185-5485	C1000-Touch + CFX384 Optical reaction Module
184-5000	CFX Manager V.3.0 Software or higher

3.2 Safety

Electrical

High Voltage Circuits: The C1000-Touch and S1000 cyclers contain high voltage circuits. Instrument must have power disconnected before servicing.



Thermal

Thermally Hot Components: The sample block and lid heater of the C1000-Touch and S1000 can reach temperatures of 100°C during operation of the instrument. The heated lid should remain closed at all times during operation to prevent accidental skin burns. Always allow the sample block to return to its idle temperature before opening the lid and removing samples. Take caution to avoid touching the heated lid when lid temperature control is on. When placing or removing samples, open the heated lid all the way up to allow maximum clearance and to avoid the heated lid from falling on hands. Make sure that no object obstructs the lid before opening it. Instrument must be allowed to cool to safe temperature before servicing.



Electro Static Discharge (ESD)

The C1000-Touch and S1000 contain ESD sensitive parts. Observe ESD precautions when handling these parts. Wear grounding wristband and store parts in ESD shielded bags.



3.3 Visual Check

1. Check C1000-Touch for any signs of damage which may have occurred during shipping.
2. The following items are included with the C1000-Touch Thermal Cycler and Reaction Module:
   - C1000-Touch thermal cycler base
   - Power cord
   - C1000-Touch Thermal Cycler Manual
   - 1 USB Flash Drive



Figure 3-1: C1000-Touch Cycler

3.4 Reaction Modules

The C1000-Touch thermal cycler is compatible with any 1000-series reaction module. The reaction modules come in four module sizes: the 96-well fast module, 96-deep well module, dual 48-well fast module, or 384-well module.

3.5 C1000-Touch Installation and Setup

This section provides an overview of the C1000-Touch installation and setup. A C1000-Touch Installation Report should be completed with each installation checkout. The Installation Report shall provide verification that the instrument has passed the requirements in the Installation section. A report checklist is provided in the Appendix section of this manual.The C1000-Touch should be installed on a level, clean, dry surface. Identify an appropriate work area for the installation process prior to unpacking any system components.

1. Insert a reaction module into the C1000-Touch thermal cycler by placing the reaction module in the bay allowing a 1-2cm of space in the front of the module. Figure 3.2.



Figure 3-2: Inserting Reaction Module



Figure 3-3: Locking the Reaction Module

2. Lock the module in place by lifting the locking bar up which will move the reaction block forward and locks it in place. Figure 3.3.
3. Plug in the power cord and turn on the C1000-Touch thermal cycler.
4. The C1000-Touch runs a self test to verify proper functions, and then displays the main window
5. The main window of C1000-Touch displays the type of reaction module, thermal cycler name and serial number, date and time, any attached S1000 cycler and main function menu. Figure 3.4.

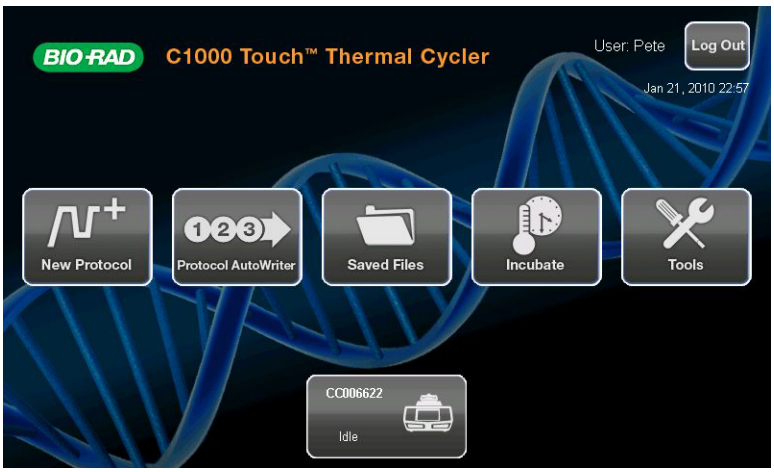


Figure 3-4: C1000-Touch Main window

6. Run the complete C1000-Touch system checkout on section four of this manual.
7. Complete and print the C1000-Touch installation report.

3.6 C1000-Touch USB Data Ports

The back panel includes data ports that transfer data to and from the thermal cycler. Figure 3.5.



Figure 3-5: C1000-Touch Back Panel

- The one USB B ports on the back panel of C1000-Touch is used to connect the cycler to a computer.
- The four USB A ports on the back of C1000-Touch can be used to connect and control up to three S1000 cyclers.
- The USB A port in the front panel below the control panel of the C1000-Touch can be used to connect a USB drive, computer mouse, keyboard, bar code reader or a S1000 cycler.

3.7 Connect and Control a S1000 with C1000-Touch

Up to three S1000s can run under the control of a C1000-Touch. The S1000 can connect to the C1000-Touch through a USB hub or in a “daisy chain” configuration, where the S1000 is connected, in series, to a C1000-Touch.

3.7.1 Connect the S1000 directly to a C1000-Touch

1. Plug a high quality, shielded USB cable into the USB B port on the back of the S1000.
2. Plug the other side of the USB cable into a USB A port on the back of the C1000-Touch. The C1000-Touch will detect the S1000.
3. Open the main menu or instrument tree on the C1000-Touch, or in the 1000 series software if the C1000-Touch is connected to a computer.
4. Select the S1000 by serial number or name. If the S1000 has a name, then the name will be displayed instead of the serial number.

3.8 Renaming the C1000-Touch Thermal Cycler

Each C1000-Touch thermal cycler is initially named using the serial number of the thermal cycler base. Users can rename a thermal cycler for easy identification. To rename a C1000-Touch thermal cycler, follow these steps:

1. From the home screen, touch the **Tools** button to open the tools menu. Touch **About**, then touch the **Name** button. Figure 3.6.
2. Enter a new name using the pop-up alphanumeric keypad.
3. Touch the **OK** button to accept the new cycler name.

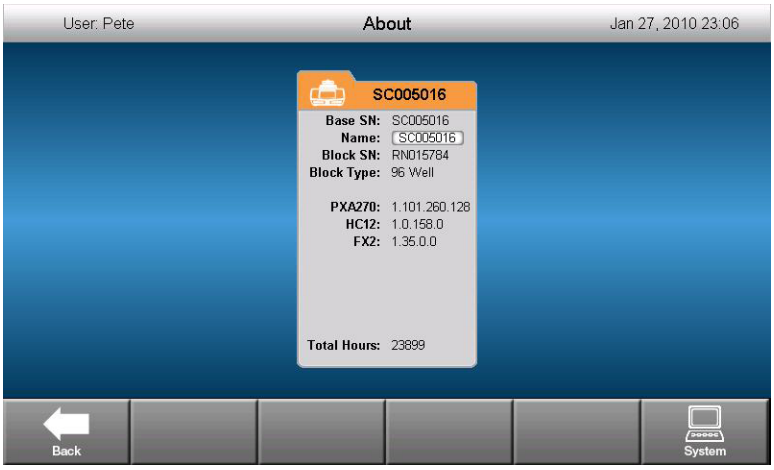


Figure 3-6: Rename The Instrument

3.9 Setting Up E-mail Notification

A run complete confirmation and run report can be e-mailed directly to any computer with Internet access. To configure the outgoing e-mail from the C1000-Touch thermal cycler, use the following instructions:

1. Touch the **Log In** button on the home screen to log in to the thermal cycler as the Administrator.

Note: *The logged in user name appears to the left of the log out button when you return to the home screen.*

2. Touch the **Tools** button on the home screen to launch the tools menu.
3. Touch **E-mail Settings** in the admin menu.

3.9.1 Setting Up the Gmail server

Note: *A Gmail account must be set up with user name and password prior to setting up the instrument Gmail server.*

1. Select the Gmail server from the **Mail Server** drop down list.
2. Enter the Gmail account user name and password.

3. Touch the **Set as Default** check box. Figure.3.7.



Figure 3-7: C1000-Touch E-mail Setup

4. Touch the **Save** button to save the current server settings.
5. Touch the **Test E-mail** button.
6. Touch the **Test E-mail Address** button and enter an e-mail address using the pop-up alphanumeric keypad.
7. Touch the **Attachment Size in MB** button and enter a test attachment size.

Note: *The allowable limit on attachment size is dictated by your institute's server. We recommend testing an attachment size between 0.5 and 5 MB. Entering 0 will send a test e-mail with no attachment.*

8. Touch the **Send E-mail** button. A test e-mail will be sent to the test e-mail address.
9. Touch the **Cancel** button to return to the server settings screen.
10. Touch the **Back** button to return to the tools menu.

3.9.2 Setting up a custom server

1. Touch the **New Server** button. Figure.3.8.

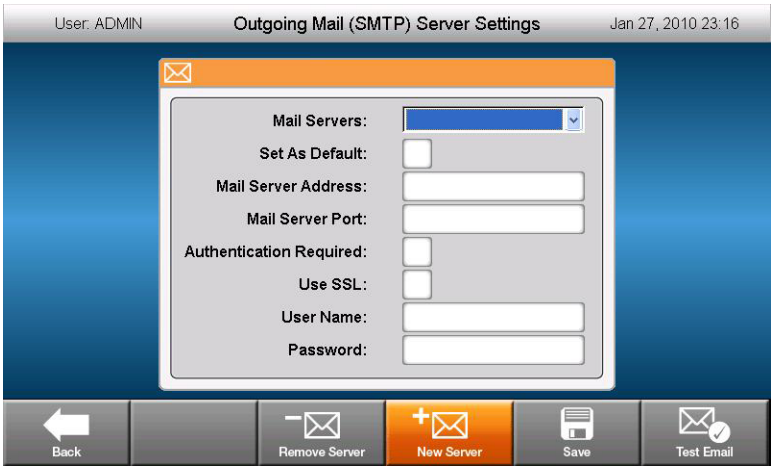


Figure 3-8: New Server Setup

2. Touch the **Mail Server Address** button and enter an address using the pop-up alphanumeric keypad.
3. Touch the **Mail Server Port** button and enter a value using the pop-up numeric keypad.
4. Touch the **Set As Default** checkbox.
5. Enter additional information (Authentication Required, Use SSL, User Name, and Password) only if required by your server.

Note: *TIP: Contact your network administrator for server requirements.*

6. Touch the **Save** button. The new server will appear in the **Mail Servers** drop down list.
7. Repeat steps 5 — 10 in “Setting Up the Gmail server” (page 7).

3.9.3 Removing a server

1. Select the server to be removed in the **Mail Servers** drop down list.
2. Touch the **Remove Server** button.
3. Touch the **Yes** button to confirm removal of selected server.

3.10 Controlling S1000 Cyclers with the C1000-Touch

Up to **three** S1000 thermal cyclers can run under the control of a C1000-Touch thermal cycler. Each S1000 thermal cycler can be connected to the C1000-Touch thermal cycler through the USB A ports of the C1000-Touch thermal cycler. When connected to a C1000-Touch thermal cycler, the S1000 thermal cyclers can be controlled by either the touchscreen on the C1000-Touch thermal cycler, or by a PC connected to the C1000-Touch Thermal Cycler and running CFX Manager 2.1 software (or higher).

3.10.1 Connecting S1000 Cyclers Directly to a C1000-Touch

To connect up to three S1000 thermal cyclers directly to a C1000-Touch Thermal Cycler, follow these instructions:

1. Plug a high quality, shielded USB cable (such as the Bio-Rad USB cable catalog # 184- 8000) into the USB B port on the back of the S1000 thermal cycler.
2. Plug the other side of the USB cable into a USB A port on the back of the C1000-Touch thermal cycler. The C1000-Touch Thermal Cycler instrument detects the attached S1000 thermal cycler and displays the current status on the C1000-Touch thermal cycler home screen.

Note: *If the S1000 thermal cycler instrument has a name, then the name is displayed on the status button instead of the serial number.*

3. Repeat steps 1 and 2 to connect up to three S1000 cyclers directly to the same C1000 Touch thermal cycler.

3.10.2 Operating S1000 Thermal Cyclers Under the Control of the C1000-Touch Thermal Cycler

When an S1000 thermal cycler is under the control of the C1000-Touch Thermal Cycler cycler, it is in semi-lockdown mode. In this mode, the S1000 thermal cycler does not respond when control panel keys are pressed. However, the following keys function on the control panel:

- **SCREEN** — to access the running, graphical, and time remaining screens
- **PAUSE** — to temporarily stop a protocol that is currently running on the S1000 thermal cycler. This function is active when an individual protocol screen is being displayed
- **CANCEL** — to cancel a protocol that is currently running on the S1000 thermal cycler. This function is active when an individual protocol screen is being displayed
- **ENTER** — to begin a run that has been sent remotely from the CFX Manager software
- **ENTER** — to skip a step. This function is active when an individual protocol screen is being displayed

3.11 S1000 Installation and Setup

This section provides an overview of the S1000 installation and setup. A C1000 Installation Report should be completed with each installation checkout. The Installation Report shall provide verification that the instrument has passed the requirements in the Installation section.The S1000 should be installed on a level, clean, dry surface. Identify an appropriate work area for the installation process prior to unpacking any system components.

1. Insert a reaction module into the S1000 thermal cycler by placing the reaction module in the bay allowing a 1-2cm of space in the front of the module. Figure 3.6.



Figure 3-9: Inserting Reaction Module



Figure 3-10: Locking the Reaction Module

2. Lock the module in place by lifting the locking bar up which will move the reaction block forward and locks it in place. Figure 3.7.
3. Plug in the power cord and turn on the S1000 thermal cycler.

4. The S1000 runs a self test to verify proper functions, and then displays the main menu.
5. The main menu of S1000 shows the thermal cycler name, the status of the reaction block “BLOCKS ARE IDLE” and the main menu options. Figure 3.8.

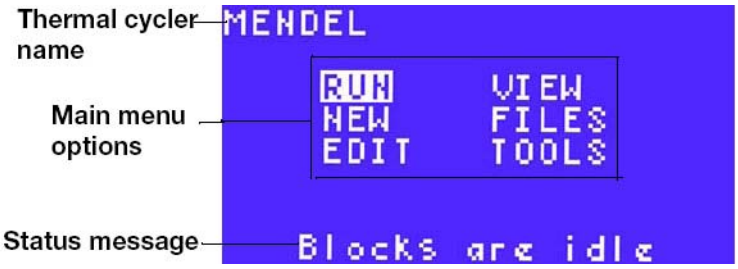


Figure 3-11: S1000 Main window

S1000 Main Menu options	Description
RUN	Select the `RUN` option to choose an existing protocol file to run
NEW	Select the `NEW` option to create a new protocol file
EDIT	Select the `EDIT` option to modify stored protocol files
FILES	Select the `FILES` option to copy, move, rename, delete, or secure protocol files and/or folders
VIEW	Select the `VIEW` option to review an existing protocol file
TOOLS	Select the `TOOLS` option to change thermal cycler settings or to view the last protocol that was run

3.12 Display the S1000 Firmware Version

To view the Firmware version that is currently on the thermal cycler:

1. From the main menu of the S1000, select TOOLS.
2. Select VERSION under the Tools sub menu.
3. The S1000 will display the current firmware version that is on thermal cycler. Additionally, the header version of the alpha is also shown. Figure 3.9.
4. Press the Enter button on the keypad to return to the main menu.

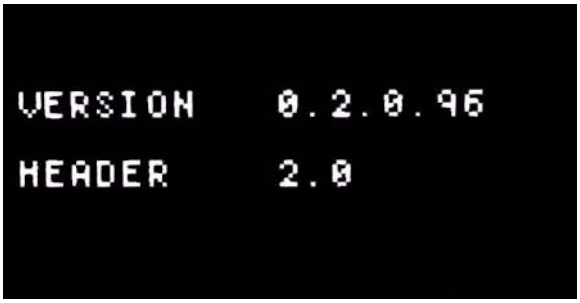


Figure 3-12: Firmware Version

5. Run the complete S1000 system checkout on section four of this manual.
6. Complete and print the S1000 installation report.

Section 4
System Checkout

4.1 About this Section

This section describes the procedures for the complete System Checkout of the Second generation C1000-Touch and S1000 series thermal Cyclers. All testing is to be performed with the instrument in the fully assembled condition.

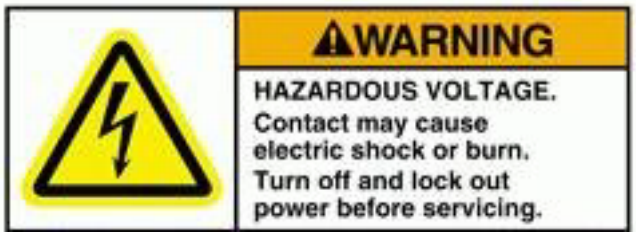
4.2 System Verification

Verification testing is the only method for determining if the 1000 series thermal Cyclers are functioning correctly and if calibrations are within published specifications. Perform the tests below to verify system integrity. All testing is to be performed with the instrument in the fully assembled condition. An Operational Report should be completed with each system checkout. This report checklist shall provide verification that the instrument has passed the tests in the System Checkout section. The Report is provided in the Appendix section.

4.3 Safety

Electrical

High Voltage Circuits: The 1000 series thermal Cyclers contain high voltage circuits. Instrument must have power disconnected before servicing.



Thermal

Thermally Hot Components: The Alpha block and lid heater of the 1000 series thermal Cycler can reach temperatures of 100°C during operation of the instrument. The heated lid should remain closed at all times during operation to prevent accidental skin burns. Always allow the Alpha block to return to its idle temperature before opening the lid and removing samples. Take caution to avoid touching the heated lid when lid temperature control is on. When placing or removing samples, open the heated lid all the way up to allow maximum clearance and to avoid the heated lid from falling on hands. Make sure that no object obstructs the lid before opening it. Instrument must be allowed to cool to safe temperature before servicing.



Electro Static Discharge (ESD)

The 1000 series thermal Cycler contains ESD sensitive parts. Observe ESD precautions when handling these parts. Wear grounding wristband and store parts in ESD shielded bags.



4.4 Tools and Materials

- Thermal Validation Kit
- Laboratory Tape
- Alpha test fixture
- Multimeter

4.5 Testing Alpha with Fixture

This section provides information about testing the 1000 series reaction block using the Alpha test fixture and digital multimeter. This test should be performed with the reaction block out of the thermal cycler base. The reaction block should be at room temperature of approximately 25°C. The measured resistance values will differ from the reference chart if the reaction block is at higher or lower recommended 25°C temperature.

1. For accurate measurements and to avoid false readings, make sure the Alpha reaction block is at **25°C**.
2. Connect the test fixture to the connector of the alpha reaction block. Figure 4.1.
3. Use digital multimeter to measure resistances of all test points.

Note: *Refer to the table below for the proper test points and measured values. Tests should be performed at ambient temperature of approximately* 25°C.

4. To test the standard Alpha units at 25°C, see the resistance tables for the desired resistance values, and the points between which they are measured in. Tables.



Figure 4-1: Alpha test Fixture

Table 1: Alpha test points and measured values

Test Points	Description	96 Fast Alpha 96 Deep Well Alpha 384 Well Alpha	Dual 48/48 Alpha	96Fast Real Time 384 Real Time 96 Deep Well Real Time
TE0 - J14	TE channel 0	<2 Ohms	<2 Ohms	<2 Ohms
TE1- J13	TE channel 1	<2 Ohms	Open	<2 Ohms
TE2 - J12	TE channel 2	<2 Ohms	<2 Ohms	<2 Ohms
TE3 - J11	TE channel 3	<2 Ohms	<2 Ohms	<2 Ohms
TE4 - J10	TE channel 4	<2 Ohms	Open	<2 Ohms
TE5 - J9	TE channel 5	<2 Ohms	<2 Ohms	<2 Ohms
Lid1 - J8	Lid power ch1	11-13 Ohms	11-13 Ohms	
Lid2 - J15	Lid power ch2	11-13 Ohms	11-13 Ohms	
BTS0	Block sensor 0	~10 kOhms	~10 kOhms	~10 kOhms
BTS1	Block sensor 1	~10 kOhms	open	~10 kOhms
BTS2	Block sensor 2	~10 kOhms	~10 kOhms	~10 kOhms
BTS3	Block sensor 3	~10 kOhms	~10 kOhms	~10 kOhms
BTS4	Block sensor 4	~10 kOhms	open	~10 kOhms
BTS5	Block sensor 5	~10 kOhms	~10 kOhms	~10 kOhms
HtSink(L)	Heat Sink sensor-left	~10 kOhms	~10 kOhms	~10 kOhms
HtSink(R)	Heat Sink sensor-Right	open	~10 kOhms	open
Lid (L)	Lid sensor -Left	~10 kOhms	~10 kOhms	~10 kOhms
Lid (R)	Lid sensor -Right	~10 kOhms	~10 kOhms	~10 kOhms
Rt_Enbl	Sierra loop-back	open	open	0 Ohm
40Vsw	not used			
Lid Prsr	not used			
I_Lock	Alpha loop back	0 Ohm	0 Ohm	0 Ohm

Table 1: Desired Resistances for 1000 series Alpha Units at 25°C

4.6 C1000-Touch Start up and Self test

This section describes the boot up and operation of C1000-Touch thermal cyclers.

1. Power on the C1000-Touch cycler.
2. Base fans start in the idle mode and LCD screen boots to white screen displaying system self test in progress. Figure 4.2.

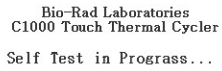


Figure 4-2: C1000-Touch Boot Up Screen

3. After a few seconds the C1000-Touch software boots up and a moving DNA strand is displayed. Figure 4.3.

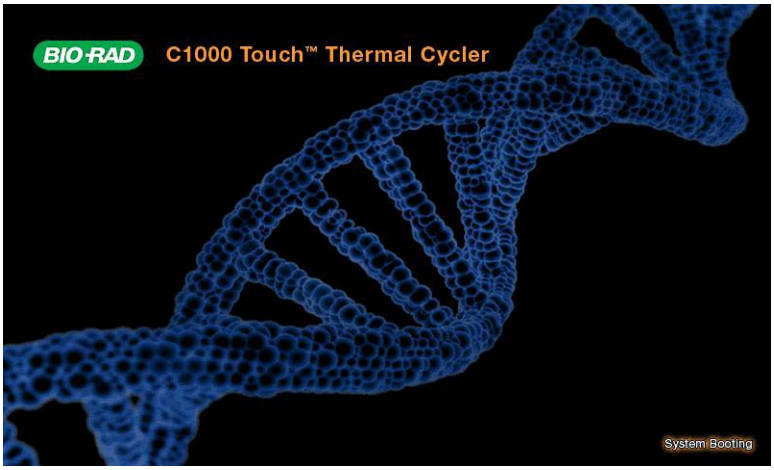


Figure 4-3: C1000-Touch Boot Screen

4. After successful self test C1000-Touch home screen will be displayed. The home screen provides access to all of the C1000-Touch operation and displays all the connected S1000 thermal cyclers and reaction blocks
5. Verify that the C1000-Touch name and status is displayed. Figure 4.4.

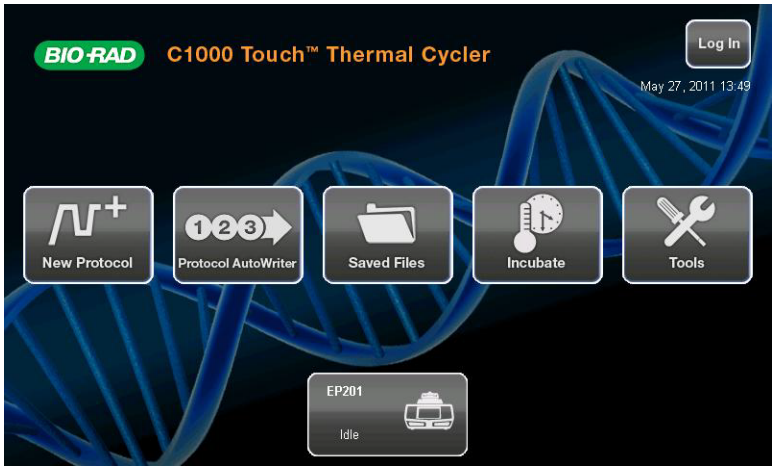
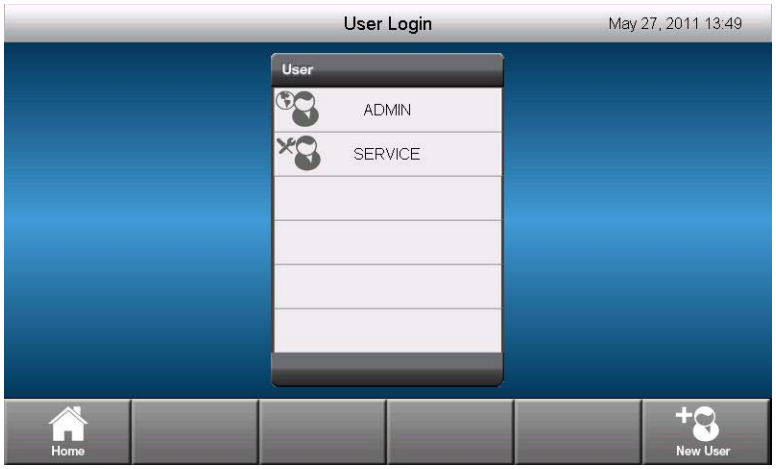


Figure 4-4: C1000-Touch Main Menu

4.7 System Login

C1000-Touch allows three user access levels: User, Administrator and password protected service login. Users have the basic access to operate the system. Administrator login allows user access plus system settings, firmware upgrade, diagnostic test, e-mail setup, User management and system back up and restore. Service login allows access to all of user and administrator functions plus LCD screen pixel test, memory card test, sensor data, manufacturing menu and MAC address setup. Service login is password protected and it is intended for Bio-Rad service and manufacturing. The service password is, Upper case, (BIO94547).



C1000-Touch Service Login

4.8 C1000-Touch Firmware version

This section describes the procedure to check the C1000-Touch Firmware version. Administrator or Service login is not required to check the firmware of the C1000-Touch .

Note: *New feature of CFX Manager version 2.1 or higher allows it to check for any upgrade to the software or C1000-Touch and real time CFX96/CFX384 firmware through internet connected PC. CFX Manager will download the latest version and prompts user to upgrade the software or firmware.*

1. Touch Tools button on the LCD touch screen.
2. On the next screen, touch About button . Figure 4.5.



Figure 4-5: Service About Tools Screen

3. In the following screen, name of C1000-Touch will be displayed along with base serial number and reaction block serial number and all firmware version and any connected S1000 thermal cycler. Verify that PXA270, HC12 and FX2 firmware are up to date for the C1000-Touch. Record all the firmware versions on the system check out report. Figure 4.6

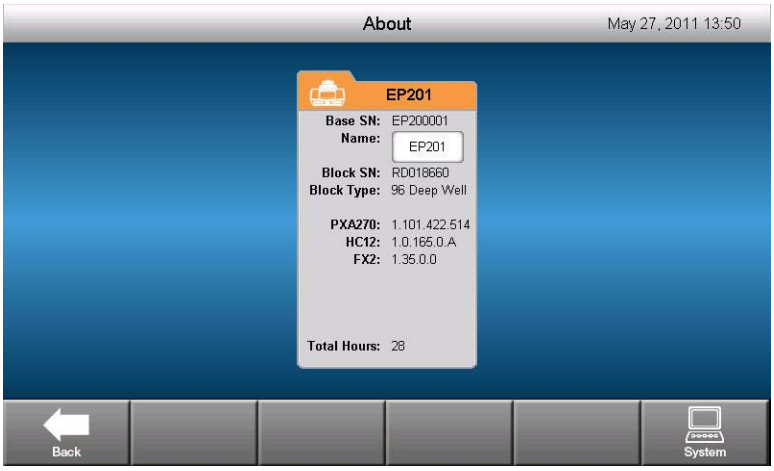


Figure 4-6: Firmware check

4. Touch System button on the lower right hand side of the screen for further system and network information. Figure 4.7.
5. Record MAC address on the system check out report.

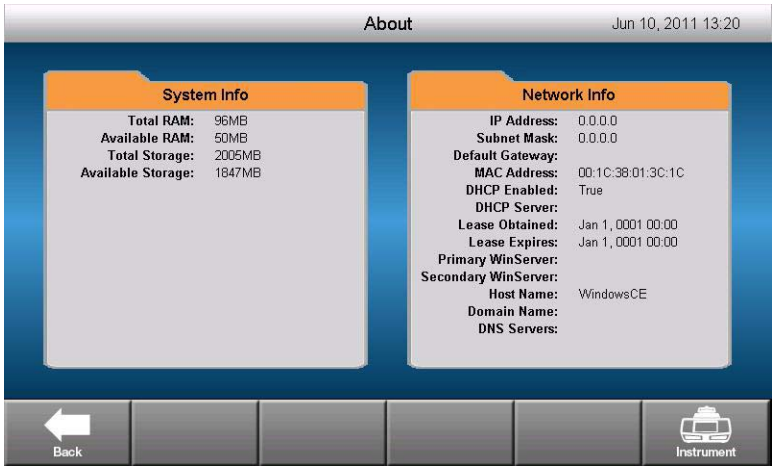


Figure 4-7: MAC Address

4.9 S1000 Firmware Version

This section describes the procedure to check the HC12 Firmware version on S1000.

1. Power on the S1000 cycler.
2. After the S1000 completed its self check, the main menu will be displayed. 4-8

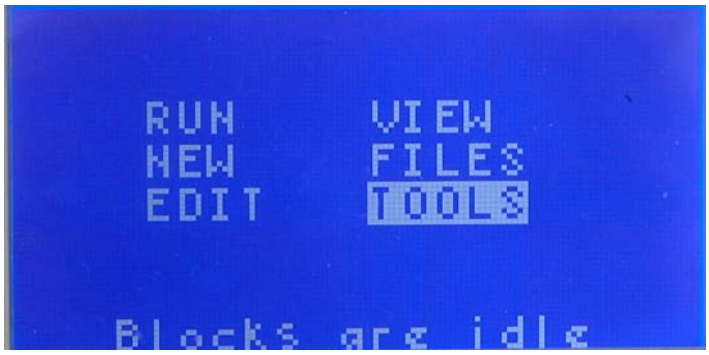


Figure 4-8: S1000 Main Menu

3. Select Tools from the main menu and press enter.
4. Select Version from the Tools sub-menu to display the HC12 Firmware version. 4-9.



Figure 4-9: S1000 Firmware Version

4.10 S1000 Sensor Check

1. Press and hold the (.) button the key board and power on the S1000 to power on in service mode.
2. S1000 will boot to the main menu with an additional Config selection on the menu.
3. Highlight Config by moving the arrow keys on the key board and press Enter button on keyboard to select. 4-10



Figure 4-10: S1000 Main Menu

4. Under the Config menu, select Sensor and press enter. 4-11

5. The sensor screen will show current reading of all the sensors. 4-12



Figure 4-11: Config Menu



Figure 4-12: Sensor Checker

4.11 C1000-Touch system memory test

This section describes the procedure to test internal micro SD memory card and USB flash communication test.

1. From main screen of C1000-Touch, touch the login button on top left corner of screen.
2. On the next screen touch Service, type in the service password, upper case, (BIO94547) . Figure 4.8.

4.11.1 USB Flash Drive Test

1. Plug in a USB flash drive in the front USB-A port or one of the USB-A ports in the back of the C1000-Touch .
2. Select and touch USB Flash Drive Test from the Admin menu. Figure 4.9.

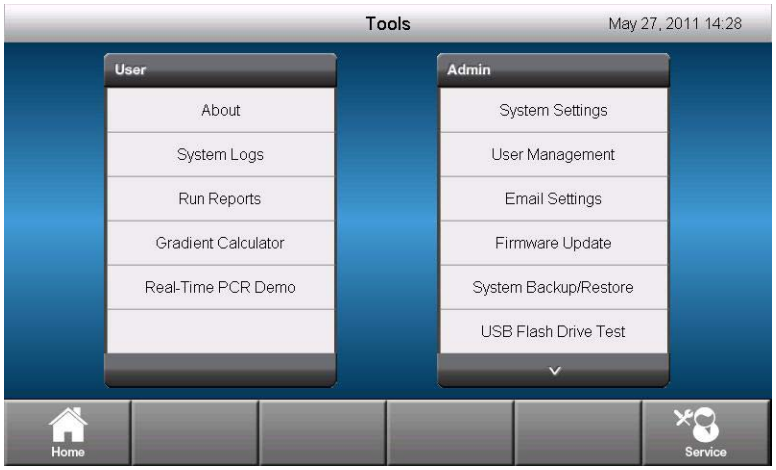


Figure 4-13: C1000-Touch Admin Screen

3. The system will write a series files and export them to the USB Flash drive.

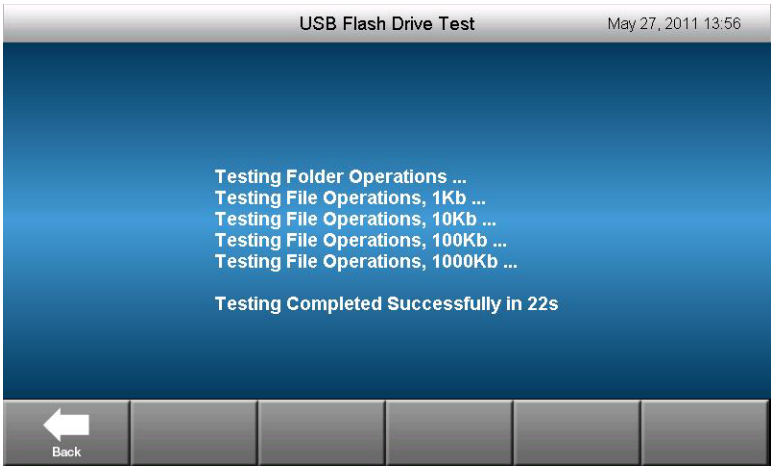


Figure 4-14: S1000 Firmware Version

4.11.2 C1000-Touch Micro SD Memory card test

USB Flash drive needs to be plugged into one of the USB-A ports of C1000-Touch for this test.

1. Login as service if not logged in already. From the main menu select Tools. On Tools screen select Memory card test.
2. The software will create a series of files and writes them to the internal SD memory card. Then the files are copied and written to another location on the SD card. Then files are transferred to the USB Flash drive and verified. Figure 4.10.

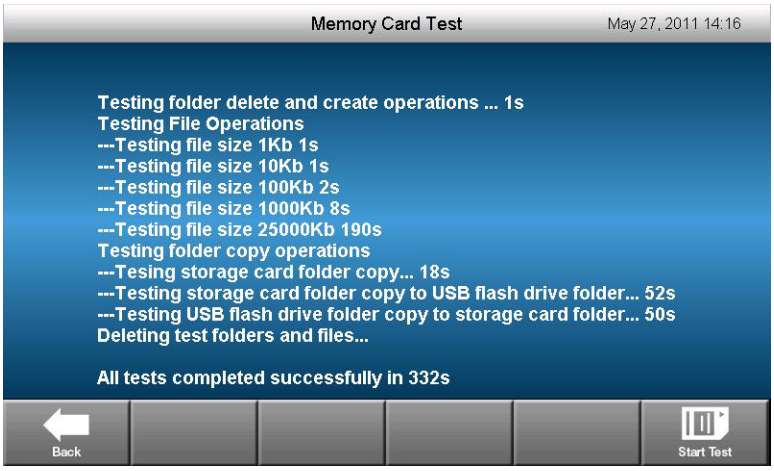


Figure 4-15: C1000-Touch SD Memory Test

3. The test will take from 300 seconds to 450 seconds. This test will time out if it takes longer than 1600 seconds.
4. This test can be canceled at any time by touching the Back button on the bottom left side of the screen.

4.11.3 Sensor Data

1. Login as Service. From the main screen, touch Tools.
2. From the Tools screen, select and touch Sensor Data.
3. This page provides reaction block, heated lid and heat sink temperature information as well as main board voltages present.
4. C1000-Touch and all connected S1000s names are displayed on the left hand column and their corresponding information on the right hand column.
5. Touch the name of the Thermal cycler to display its corresponding temperature and voltage information on the right side column. Figure. 4.10.

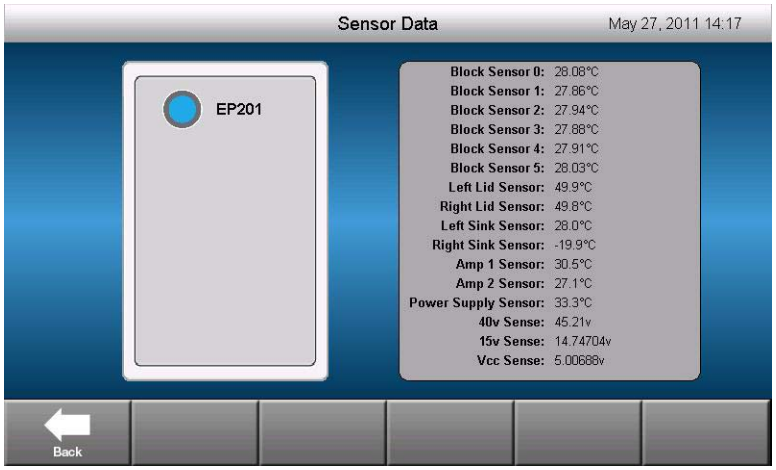


Figure 4-16: Sensor Test Screen

6. Verify that all the block sensors are reporting correct temperature readings. Refer to the Table below and verify that the main board voltages are correct.

Item	Standby Nominal	650 Watt Load Nominal	Tolerance
+40Vout	45V	42V	40 +/- 6V
+15V	15.0V	15.0V	+/- 2V
+5V	5.0V	5.0V	+/- 0.5V

4.11.4 LCD Dead Pixel Test

1. Login as Service. From the main screen, touch Tools.
2. From the Tools screen, select and touch Dead Pixel Test button. Figure.4.11.

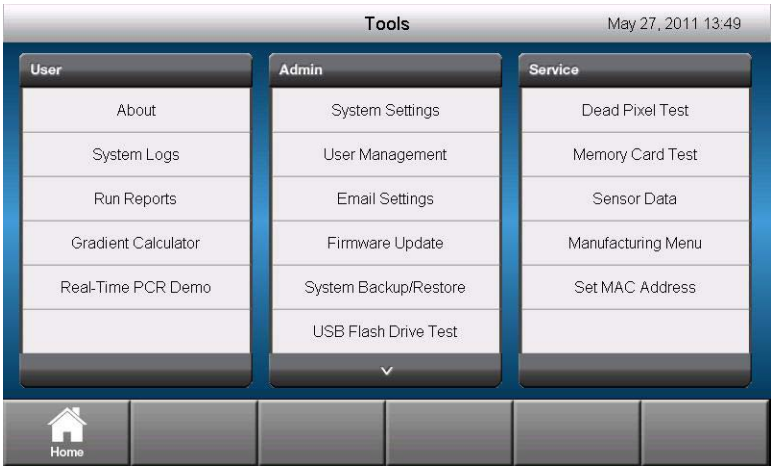


Figure 4-17: Sensor Information Screen

3. The LCD Screen will alternate from solid black, white, red, green and blue solid colors screens. Figure.4.13.

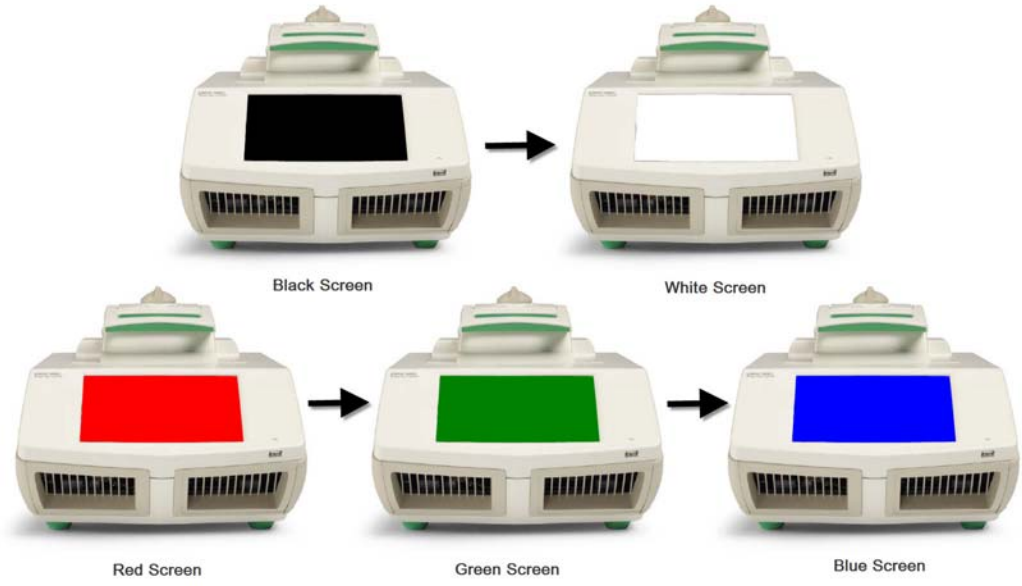


Figure 4-18: C1000-Touch LCD Dead Pixel test

4. There should be five or less dead pixels on the LCD and no more than three dead pixels next to each other.
5. Inspect the LCD screen for any dead pixels in each color before proceeding to the next color.
6. Touch the screen to advance to the next color in the test sequence.

7. Record the results on the system check out report.

4.11.5 C1000-Touch Diagnostic Test

A comprehensive diagnostic test is included in the C1000-Touch software. The diagnostic test can be used in the service mode or Administrator mode to test the functionality of the C1000-Touch and any attached S1000 thermal cycler. The test can be selected and run from the LCD screen of C1000-Touch .

1. Login as Service. From the main screen, touch Tools.
2. From the Tools screen Admin column, select and touch Diagnostic Test.
3. In the diagnostic test screen touch the name of the C1000-Touch or any one of the connected S1000s to select it.
4. Verify that the correct thermal cycler is selected. Button next to the to the thermal cycler name should be marked.
5. Touch Start Test button on the bottom right side of the screen to run the diagnostic test on the selected cycler.

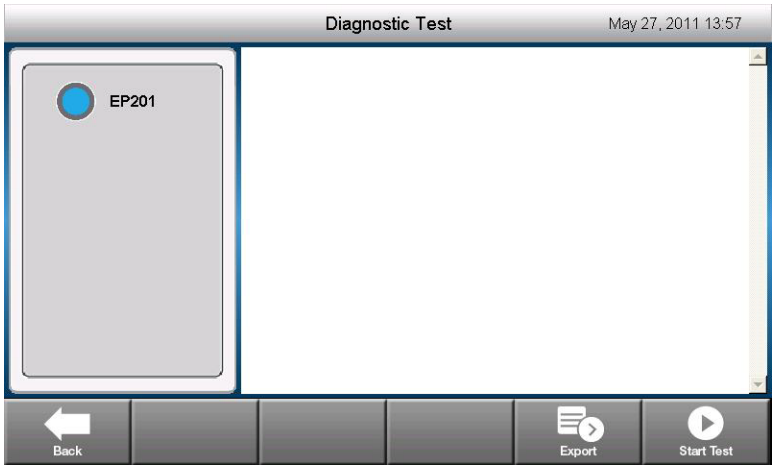


Figure 4-19: C1000-Touch Diagnostic Test

6. Type in the name of operator and press OK button to start the test. Figure 4.15.



Figure 4-20: Diagnostic Test Operator ID

7. The diagnostic test requires operator input for some of the tests like LED, beeper and fan test. Figure 4.16.

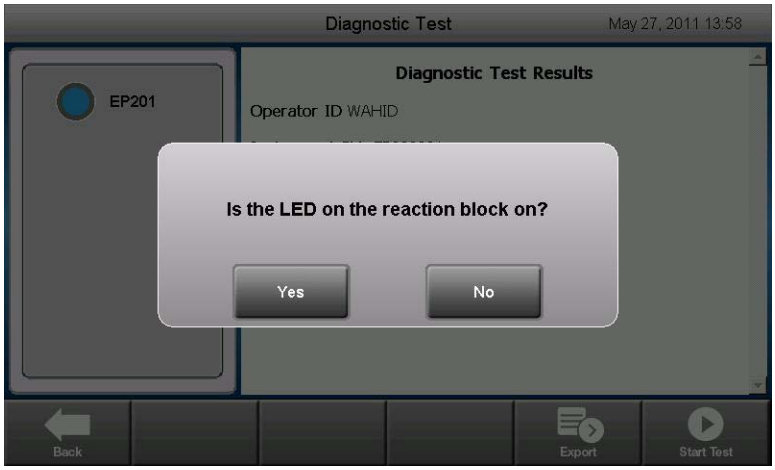


Figure 4-21: S1000 Diagnostic test LED Test

8. Listen and verify that there aren't any scraping or abnormal fan noise during the fan test.

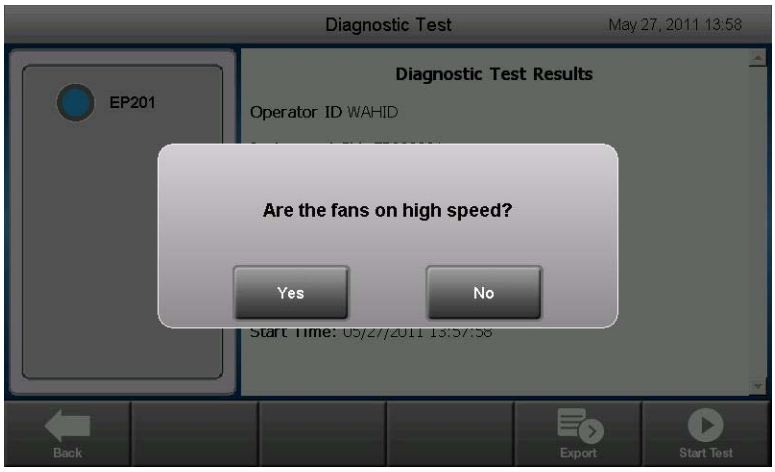


Figure 4-22: S1000 Diagnostic test Fan Test

9. Diagnostic test will take several minutes to complete.
10. After the diagnostic test is completed a field test report is generated that lists each test performed and whether it passed or failed.

11. The diagnostic test result will be displayed on the LCD screen. Figure. 4.18.

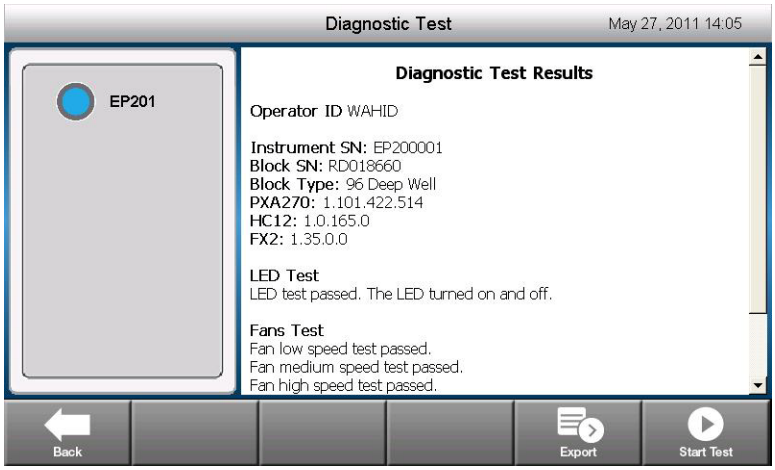


Figure 4-23: S1000 Diagnostic test Results

12. To export the diagnostic test report, plug in a USB flash drive in the font USB port of the C1000-touch. Press export to export the test results to USB flash drive.
13. The diagnostic test result is saved with (.htm) extension. Open the test result with Internet Explorer and print the results.

Note: *The diagnostic test results are not saved in the internal memory of C1000-Touch . The test result will be lost once the user navigates away from diagnostic test screen.*

Table 2: Diagnostic Test Description

Diagnostic Test	Description
Instrument information	Instrument SN, Block SN, Block type, PXA270 firmware version, HC12 firmware version and FX2 Firmware version are checked and logged.
Test 1 ◊ Alpha LED test	Attempts to turn the Alpha Indicator LED on and off. The test asks the user if the LED is on and then off and fails if the user answers no for either case.
Test 2 ◊ Base Fans Test	Turns the fans from idle to low, then medium then high speeds asking the user if the fans turnedon for all the transitions. Fails if the user answered no to any of the questions.
Test 3 ◊ Beeper Test	Turns the beeper on for a short period and asks the user if the beeper sounded. Test fails if the user answered no.
Test 4 ◊ Connected S1000 Keypad Test.	Asks the user to press each key on the front panel of the S1000 thermal cycler that is connected to C1000-Touch in sequence. Fails if any key press isn't detected after 15 seconds.
Test 5 ◊ Self Test	C1000-Touch preforms system self test

Diagnostic Test	Description
Test 6 ◊ Run test protocol.	Runs the following protocol. METHOD Calc; HOTLID 105,30; VOLUME 30; TEMP 100.0,10 TEMP 4.0,10; TEMP 100.0,10 GRAD 46.0,70.0,10 TEMP 55,10; END

Figure 4-24: Diagnostic Test Export Screen

14. An example of diagnostic test report is included in section 11, Appendix B, of this manual.

4.12 Thermal Validation

Note: *The thermal validation test is performed on all new Alpha reaction blocks as part of QC IPP. The following section describes the manufacturing QC IPP Thermal Validation of the C1000-Touch Cyclers. At this time the service Thermal validation fixture is not available. A service advisory will be issued when the service thermal validation fixture becomes available.*

This section describes performing thermal validation of the sample block when attached to chassis unit to operate. This section is generally performed through a Thermal Validation contract or OQ protocol/ field service contract. This procedure is useful for diagnosing and verification of temperature uniformity problems.

In order to meet its thermal specification, the 1000 series thermal cyclers can only be tested and validated using the 1000 series thermal validation test fixture. The 1000 series thermal validation test fixture is designed to work with the C1000-Touch thermal cyclers. The 1000 series thermal validation test fixture and thermal cycler is connected to PC via USB cable and controlled by Bio-Rad 1000 series thermal validation test fixture software. The appropriate parameters and protocols are programed on to the C1000-Touch cycler during testing.

4.13 Bio-Rad Thermal Validation Fixture

The Bio-Rad Thermal Validation fixture consist of thermal validation base and sixteen probes. There are two types of probes for the thermal validation fixture, 96well/dual 48well probes and 384 well probes. For complete instructions to operate the Bio-Rad thermal validation fixture, refer to the Bio-Rad thermal validation service manual part number 10019560. The thermal validation fixtures are assembled in the carrying case with the probes connected to the base and the appropriate cover/probe guide. Following items should be in the case:

4.13.1 96well and dual 48well Bio-Rad Thermal Validation fixture

1x	Storage and transport case
1x	Thermal validation fixture base box
16x 9	6w/dual48w Probes
1x	1000 series reaction block 96w block cover/probe guide
1x	1000 series reaction block 48w block cover/probe guide
1x	MJ Mini reaction block 48w block cover/probe guide
1x	Power Supply

4.13.2 384well Bio-Rad Thermal Validation Fixture

1x	Storage and transport case
1x	Thermal validation fixture base box
16x 3	84w Probes
1x	1000 series reaction block 384w block cover/probe guide
1x Se	rial cable
1x	Power Supply



Figure 4-25: Bio-Rad Thermal Validation fixture

4.14 Tools and Materials

- 96well and 48/48well Thermal Validation Fixture
- 384well Thermal Validation Fixture

4.15 C1000-Touch Thermal validation procedure

Thermal validation fixture is the only thermal tester that is recommended to test and validate thermal accuracy and uniformity of the C1000-Touch thermal cycler and CFX96/CFX384 Real time systems. Follow the instructions below for thermal validation procedure of the 1000 series reaction blocks. If the thermal validation fails, follow the instruction on the next section to recalibrate the BSOs on the 1000 series reaction block.

1. Place the reaction block in to the C1000-Touch thermal cycler base.
2. Connect the thermal cycler to the PC using USB cable. CFX Manager software must be installed on the PC.
3. Power on the thermal cycler base and verify that Windows installs the USB driver for the thermal cycler.
4. Connect the serial cable from the thermal validation fixture to the PC or establish Bluetooth communication with the PC.
5. Use the 96well and 48/48 well thermal validation fixture for testing 96well and dual 48well reaction blocks. Use 384 well thermal validation fixture for testing 384well Alpha blocks.
6. Place the correct probe guide and block cover on the reaction block and insert the probes on the probe guide according to the probe numbers on block cover. Figure4.17.

Caution: *DO NOT ADD MINERAL OIL IN WELLS. MINERAL OIL IS NOT NEEDED.*



Figure 4-26: Place cover on the block

7. Fifteen thermal probes are used for the 96well and 384 well reaction blocks and nine probes are used for dual 48/48 reaction block.

Note: *The 96w/dual 48w probe tip shape are different than the 384w probe tips. Use the correct probes for probe proper seating and contact to reaction block well surface.*

8. Block A must be tested before block B for dual 48/48 reaction blocks.

9. Verify that all the probes are setting correctly in the wells.



Figure 4-27: Thermal probe placement

10. Open the C1000-Touch thermal validation folder and open the (EverettSpreadStation.Exe.Config) file with Note pad by right clicking on the icon and from the menu select open with and choose note pad.

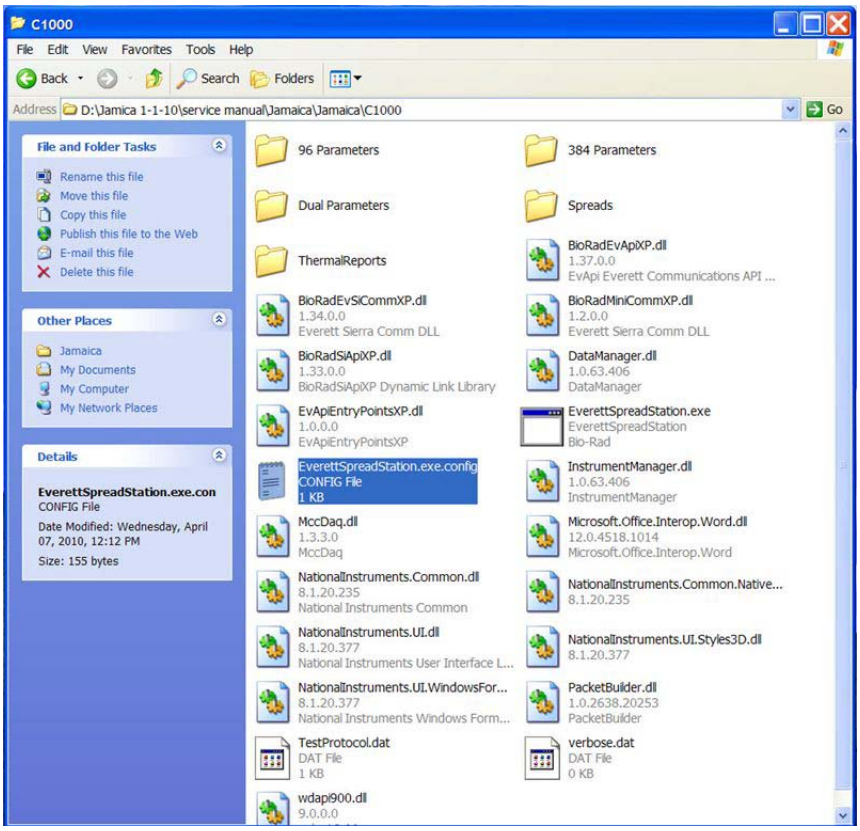


Figure 4-28: C1000-Touch thermal validation software

11. Verify that the Service Mode is set to “True”. If not, change it to True and save the file. Close Notepad. Figure4.20.

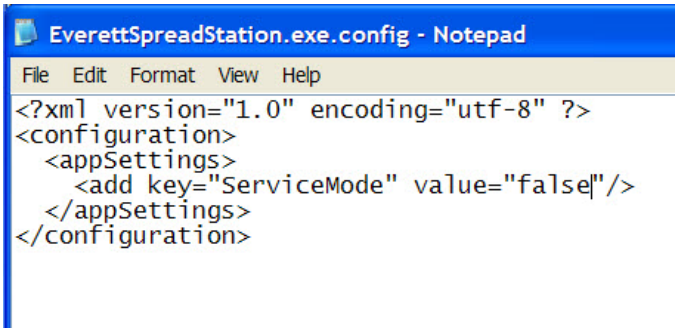


Figure 4-29: Service mode setting

Caution: *Do not change or modify any other words or letters. Doing so will disable the software and will prevent it from operating properly.*

12. Double click on the EverettSpreadStation.exe icon to launch the thermal validation software in the service mode.

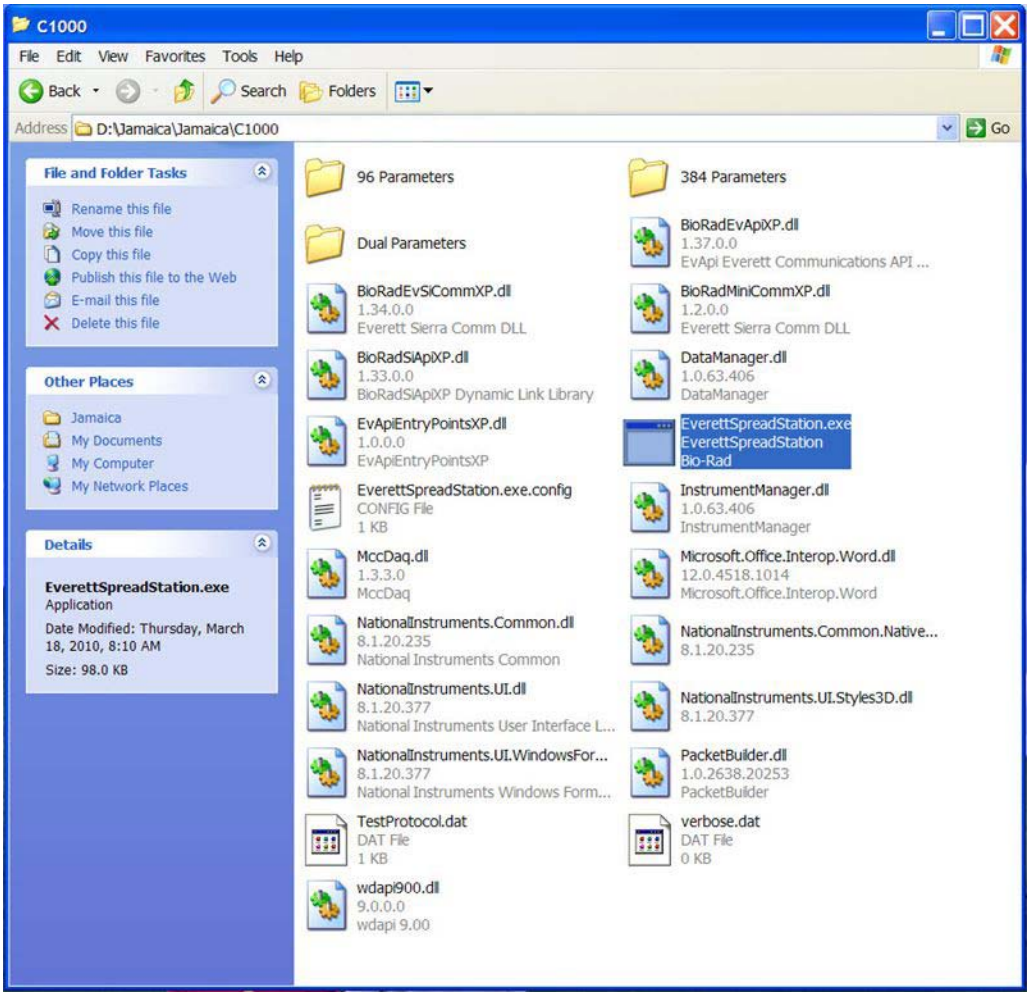


Figure 4-30: C1000-Touch thermal validation software

13. From the software COM port drop down menu on the thermal validation software screen select COM1 to establish communication with the thermal validation fixture, or follow the Bluetooth communication setup in the Appendix A of this manual. Figure 4.22.

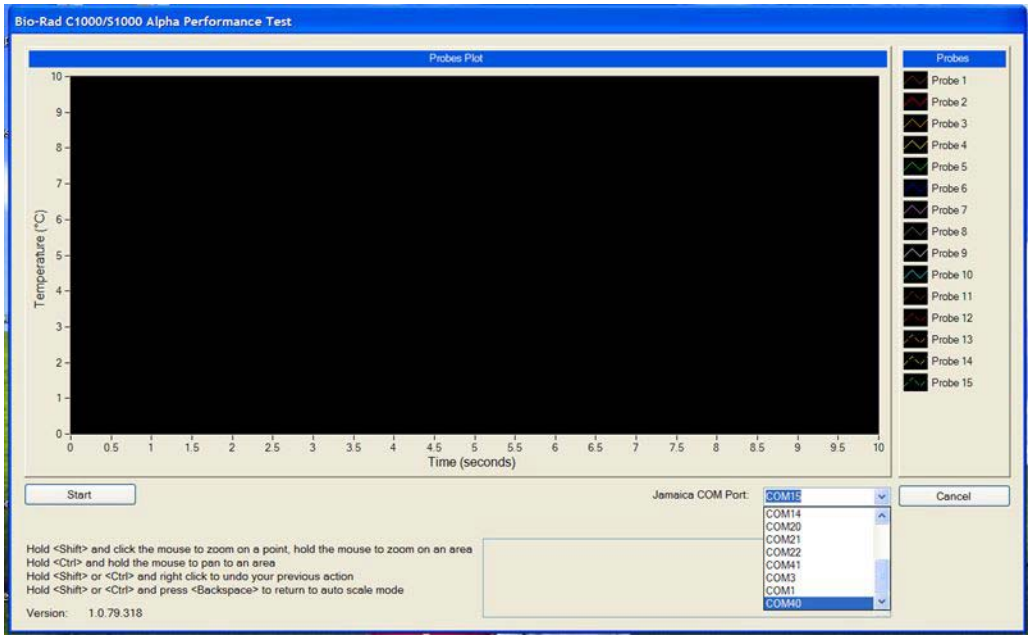


Figure 4-31: Com port setting

14. Click on the Start button to start the thermal validation test. A window will be displayed to input information for the test.

15. Fill out the customer related information in the window and click OK to save and start the test. Figure 4.23.

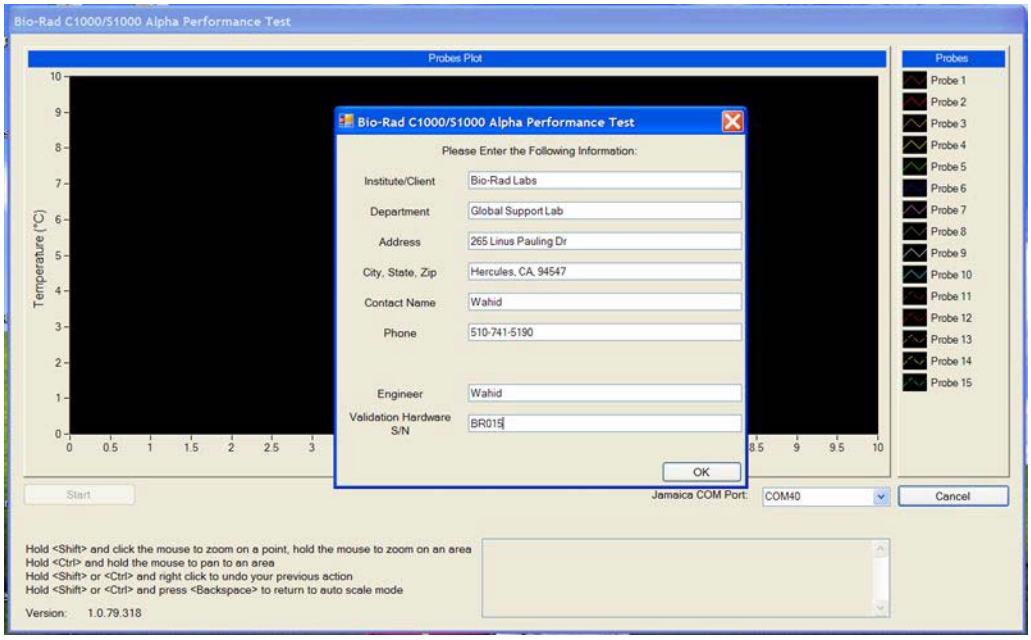


Figure 4-32: Information Screen

16. Software will take a few moments to check communication and verify probe calibration.

17. Software will program the thermal cycler with the thermal validation protocol and will start the test automatically.
18. Check that the probes are fully seated by observing their behavior on the graph during the test. If any of the probe traces lag behind when the block is heating, it is an indication that the probe may not be seated correctly. Gently jiggle the probe and make sure it is seated in the well.
19. The test will take about five to seven minuets. All the probe traces will be displayed as the thermal cycler goes through the thermal validation protocol. Figure 4.24.

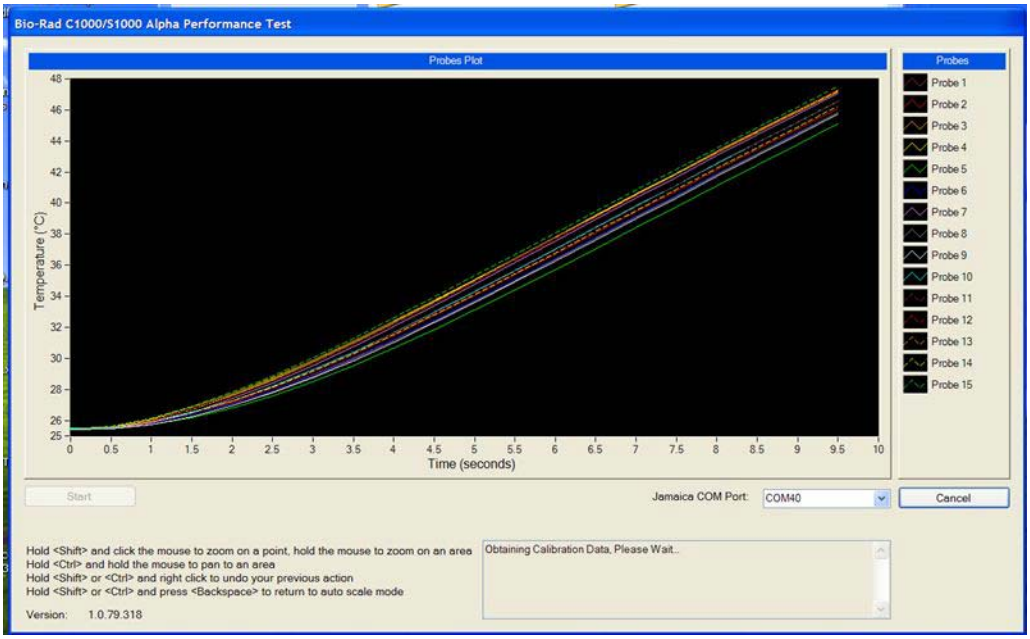


Figure 4-33: thermal Validation software screen

20. As the test completes, a green button with word “Pass” above it will appear if the test passes; or a red button with word “Fail” above it will be displayed if it fails. This will be at the bottom right hand of the software window. Figure 4.25.

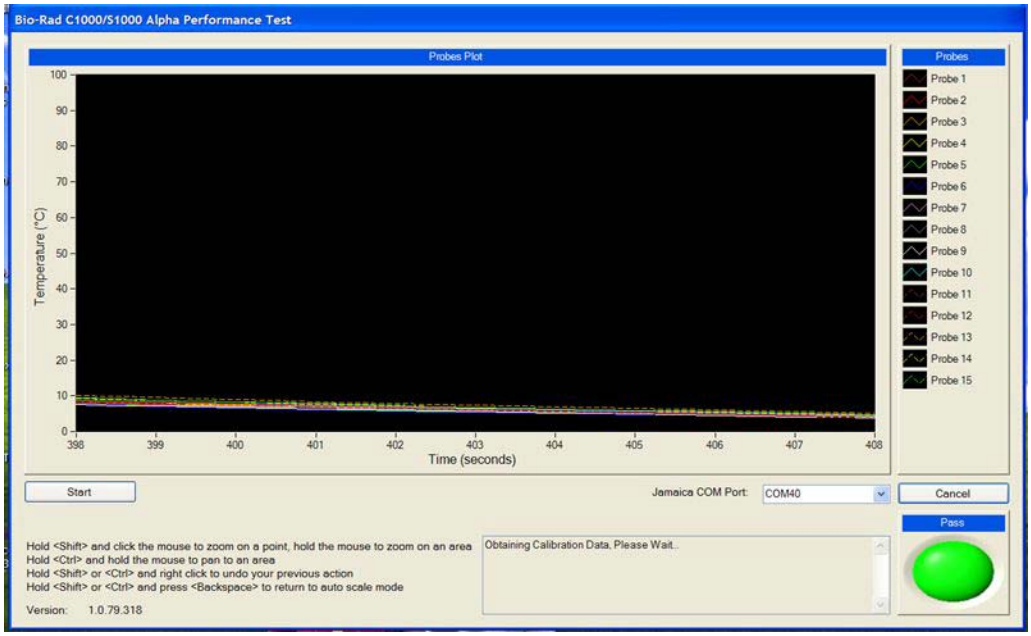


Figure 4-34: Thermal validation Pass screen

21. Upon completion of the test a thermal validation report will be generated in Microsoft Word. The thermal validation report is displayed upon the completion of the test and a copy of it is saved in the C1000/Thermal Report folder with serial number of the thermal cycler, date and time.
22. Print out the thermal validation report and view the PASS or FAIL status on page 2. Page 5 provides the test data results. Provide to the customer or for future service records.
23. If the thermal validation failed, refer to Bio-Rad thermal validation fixture service manual 10019560, or section 7 adjustment and calibration section to recalibrate the reaction block BSOs (Block sensor offsets).

4.16 Heated Lid Test

This section performs the external lid temperature measurement to factory specifications.

Note: *To perform this lid heater test, use a calibrated thermal measurement device such as Fluke Multimeter with temperature function and type K bead probe with kapton or aluminum tape. place the probe in the center of the lid heater. See Figure 4-28.*

1. The lid heater should be tested in the open position.
2. Place the probe tip against the lid heater and secure it in place using Kapton tape or aluminum tape.



Figure 4-35: Lid heater probe placement

3. Run the **Standard3** user protocol to run the lid temperature at **105°C** setting.
4. Wait for temperature stability after 2-3 minutes, the lid temperature on the thermometer should be heating at **105°C ± 3.0°C** for uniformity.

Section 5
Preventative Maintenance

5.1 Introduction

This section provides the preventative maintenance procedure for the C1000-Touch and S1000 Thermal Cycler. Preventative maintenance is recommended at least once a year. The C1000-Touch and S1000 thermal cyclers requires little maintenance to maintain proper operation and precise thermal control. However, with long and constant use, the thermal cycler will require some cleaning and maintenance.

5.2 Tools and Materials

- Small Hand Tools
- Cleaning Materials:
- IPA (Rubbing Alcohol)
- Touchscreen cleaning agent
- Cotton swabs (Q-Tip)
- Soapy water (Liquid dishwashing agent)
- Soft cloth

5.3 Preventative Maintenance

5.3.1 Inspection of 1000 Series Chassis

1. Unplug the thermal cylcer to prevent electrical shock.
2. Remove top cover.
3. Visually inspect for dirt or dust buildup around fans. Remove dust with a soft brush, damp cloth, or vacuum cleaner.Cleaning the vents allows sufficient airflow for precise thermal control during a run.

Warning: *Never use cleaning solutions that are corrosive to aluminium. Never clean the block with strong alkaline solutions (strong soap, ammonia, or high-concentration bleach). Never use corrosive or abrasive cleaning solutions. These cleaning agents can damage the block and prevent precise thermal control. Avoid scratching the surface of the bay. Scratches and damage to this surface interfere with precise thermal control.*

---

4. Reassemble instrument.
5. Clean the reaction module bay. Clean with a damp soft cloth to remove debris and spilled liquids. Cleaning the bay allows precise heating and cooling of the reaction block
6. Clean the outside case of the thermal cycler base. Use a damp cloth or tissue to clean spills off the outside case. If needed, use a mild soap solution and remove the residue completely. Cleaning the outside case prevents corrosion
7. Clean the touchscreen with any commercially available touchscreen cleaning agent. Use a soft cloth to clean the touchscreen.

Warning: *Do not spray or pour cleaning agent directly onto the touchscreen*

5.3.2 Inspection of Reaction Module

1. Open the lid cover.
2. Visually inspect sample block wells for dirt or residue spills. Clean as required with IPA and cotton swabs.
3. Wipe off surrounding areas with soft cloth.
4. Allow the reaction block to thoroughly dry prior to heating the block.

5.3.3 Maintaining Sufficient air flow

The C1000-Touch thermal cycler requires sufficient air flow to heat and cool precisely. If the flow of air is blocked, the thermal cycler cannot ramp to the correct temperature in the specified time.

1. Provide enough space around the C1000-Touch thermal cycler and between adjacent instruments for sufficient air flow.
2. If more than one Cycler is on the bench, arrange instruments so that the warm exhaust air from one instrument does not enter the air intake vents of another.
3. Shield the thermal cycler from heat sources, such as radiators, other heat producing instruments, and bright sunlight.
4. If the air temperature is above 31°C at the front air intake vents of C1000-Touch, adjust the air conditioning to lower the ambient temperature.

5.3.4 Perform System Checkout

1. Perform the System Checkout section of this Service Manual.
2. Fill out the 1000 series Preventive maintenance report.

1000 Series Thermal Cycler

Preventative Maintenance Report

Customer:	Case Number:
Performed by:	Serial #: Date:

Component		Checked	Replaced	Cleaned
C1000-Touch Thermal Cycler	❑			
S1000 Thermal Cycler	❑			
Chassis Inspection				
Reaction Module Inspection				
Heated Lid				
System Checkout				
Display Function				
Power-On Test				
Touchscreen				
Firmware				

Comments:

The 1000 series thermal cycler has been serviced for preventative maintenance and meets all of the PM requirements for the 1000 series Thermal Cycler.

Performed by_____ Date_____
Bio-Rad Service Engineer

Section 6
Removal and Replacement

6.1 Introduction

This section of the manual provides instructions on the proper way to remove and replace parts and assemblies. Alignment procedures that should be performed when an assembly is replaced, are listed in this section in the Replacement / Adjustment Matrix. The procedures indicated should be performed in the order they are listed in the matrix.

Note: *Removal and replacement procedures which are obvious from the appearance of the unit are not included. Unless otherwise specified, following the removal instructions in reverse order will provide the correct procedure for replacing the assembly.*

6.2 Replacement / Adjustment Matrix

The following table shows what adjustment or checkout procedures must be performed after an assembly is replaced. The calibration procedures must be performed even if the original assembly is being reinstalled in the same unit. They must be performed in the order specified.

Replacable Assy.	Adjustment / Calibration	Section
Main Board	Program serial number	Section 7
Main Board	Run System Checkout	Section 4
Main Board	Update HC12 firmware	Section 7
Main Board	Set model type	Section 7
C1000-Touch Controller Board	Update PXA270 Firmware	Section 7
C1000-Touch Controller Board	Run System Checkout	Section 4
Alpha Block	Run System Checkout	Section 4

6.3 Removal and Replacement Procedures

6.3.1 Tools Required

Allen Wrench Set
Nut Driver Set
Screwdrivers Set - Philips and Flat Tip
Spare Tie Wraps - Size Small and Medium

6.4 C1000-Touch Thermal Cycler

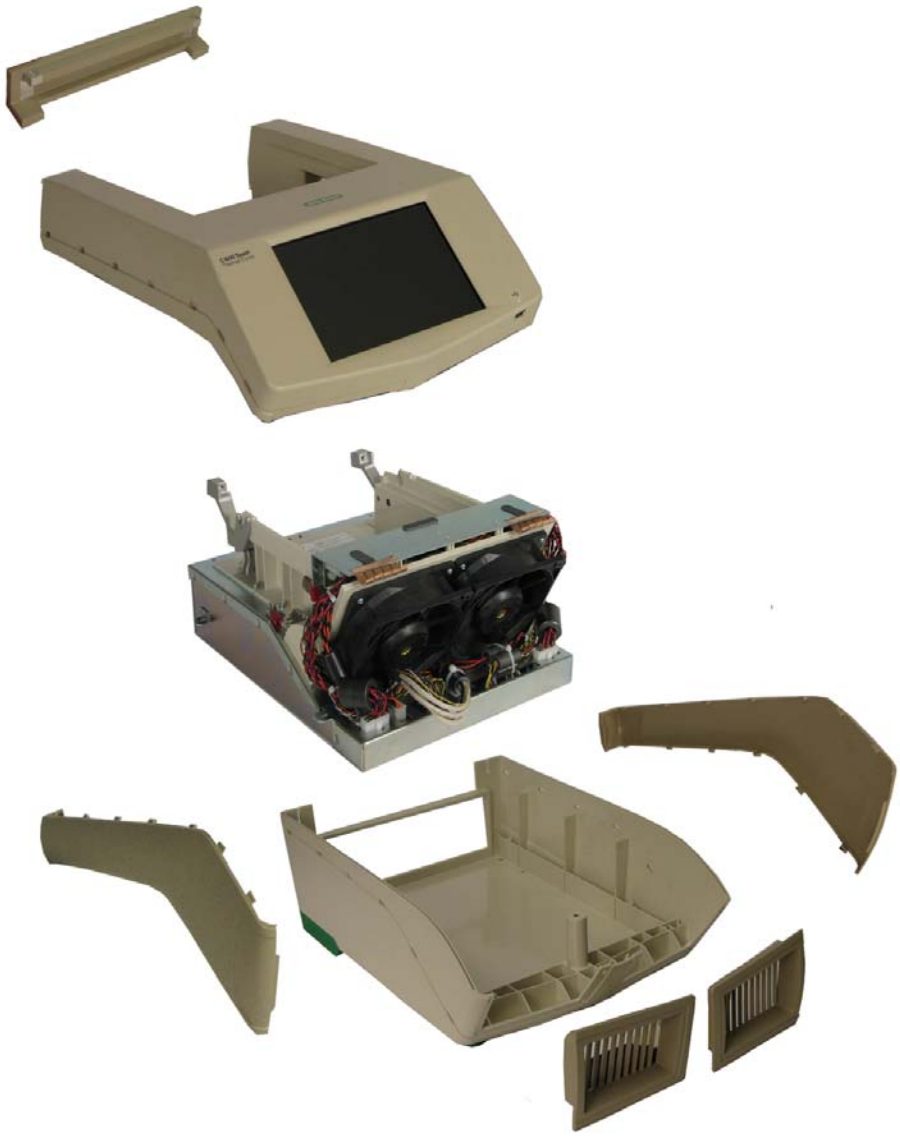


Figure 6-1: C1000-Touch Thermal Cycler

6.5 C1000- Touch and S1000 Case Removal procedure

1. Turn the C1000-Touch/ S1000 on its side and remove the nut (M4) from the bottom of the case. Figure 6.2.

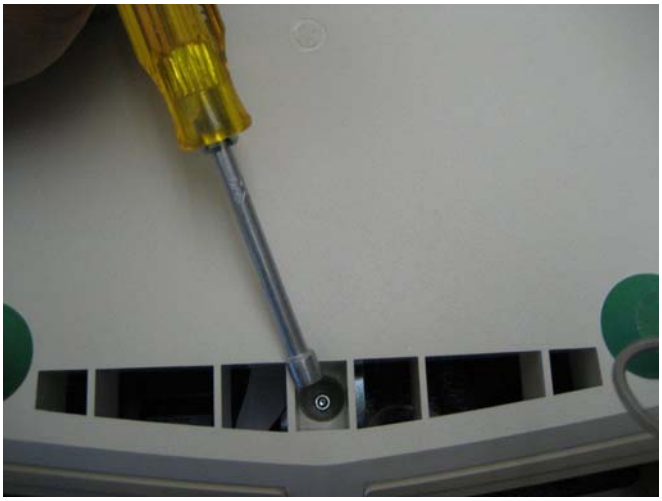


Figure 6-2: Remove nut form bottom case

2. Remove two allen screws from the lever arm assembly. Figure 6.3.



Figure 6-3: Remove Lever Screws

3. Remove five screws from the top of the cover. Two in the front and three in the back. Figure 6.4.

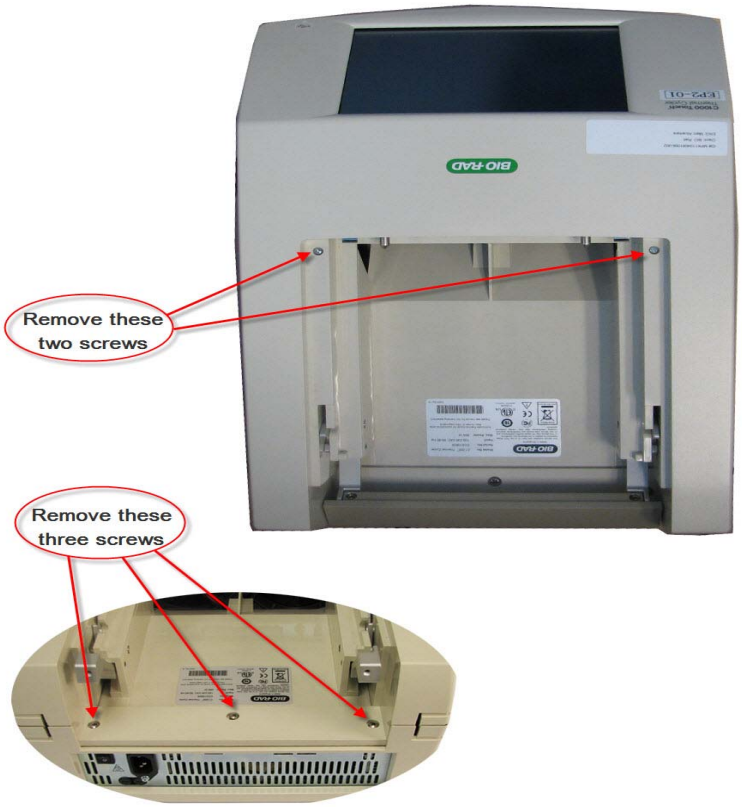


Figure 6-4: Top Case Screws

4. Remove the plastic skirt from each side of the cover. Figure 6.5. and Figure 6.6.

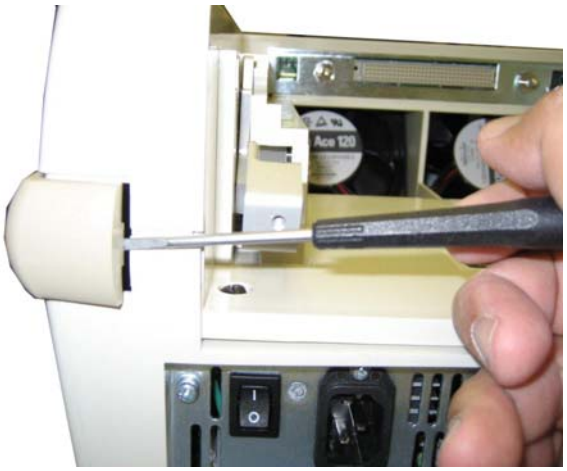


Figure 6-5:



Figure 6-6:

5. Pull the C1000-Touch top cover and unplug the cable from the front end controller board. Figure 6.7.

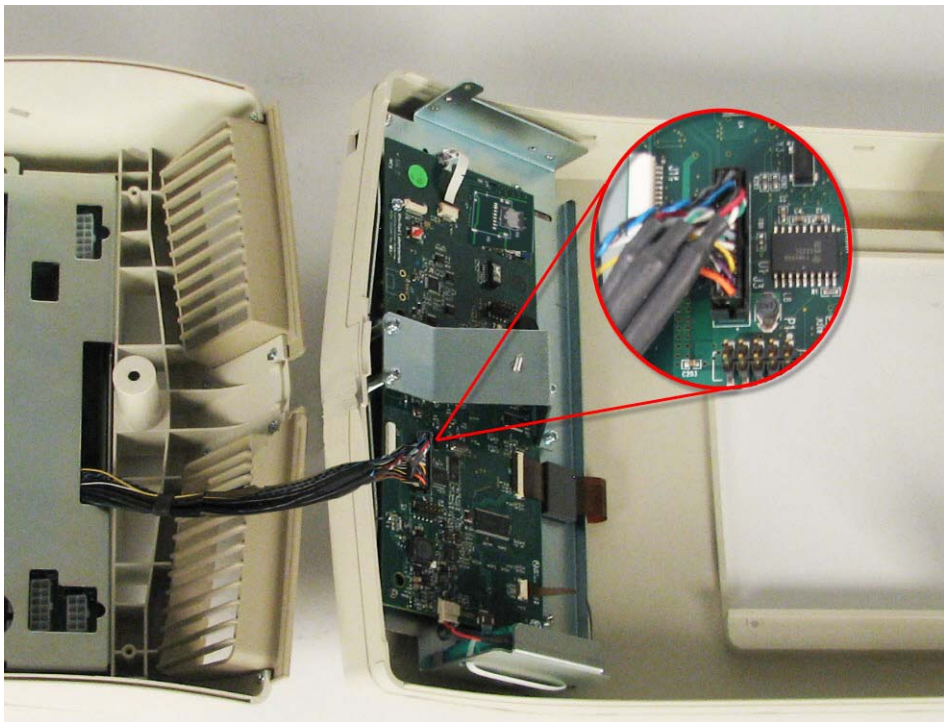


Figure 6-7: Unplug cable from C1000-Touch front end PCB assembly

6. Lift up the S1000 cover and unplug the S1000 front board cable from the main board. Figure 6-8



Figure 6-8: S1000Front cable

7. Remove the springs and the lever arms latches from each side and note the orientation on the unit for re-installation. Figure 6.9. and Figure 6.10.

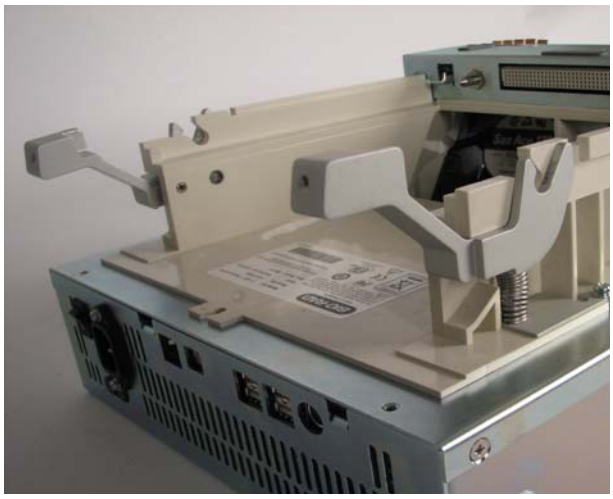


Figure 6-9: Lever position

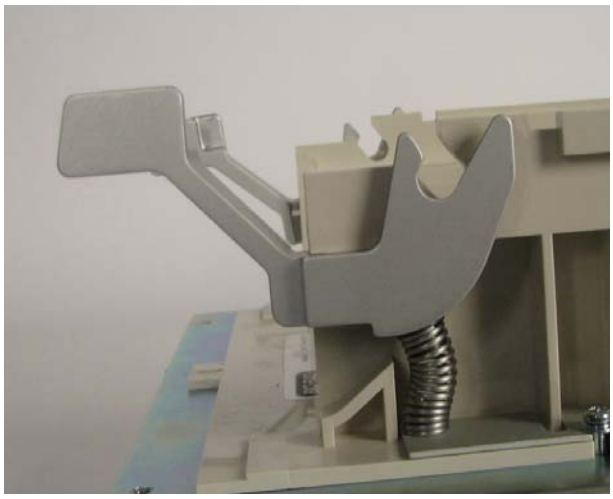


Figure 6-10: Lever and Spring

8. Remove four screws, two on each side, That attaches the inner housing to the base.



Figure 6-11: Inner housing Screws

9. Grab the fan assembly and hold the base cover and pull the chases from the base cover. Figure 6.12.

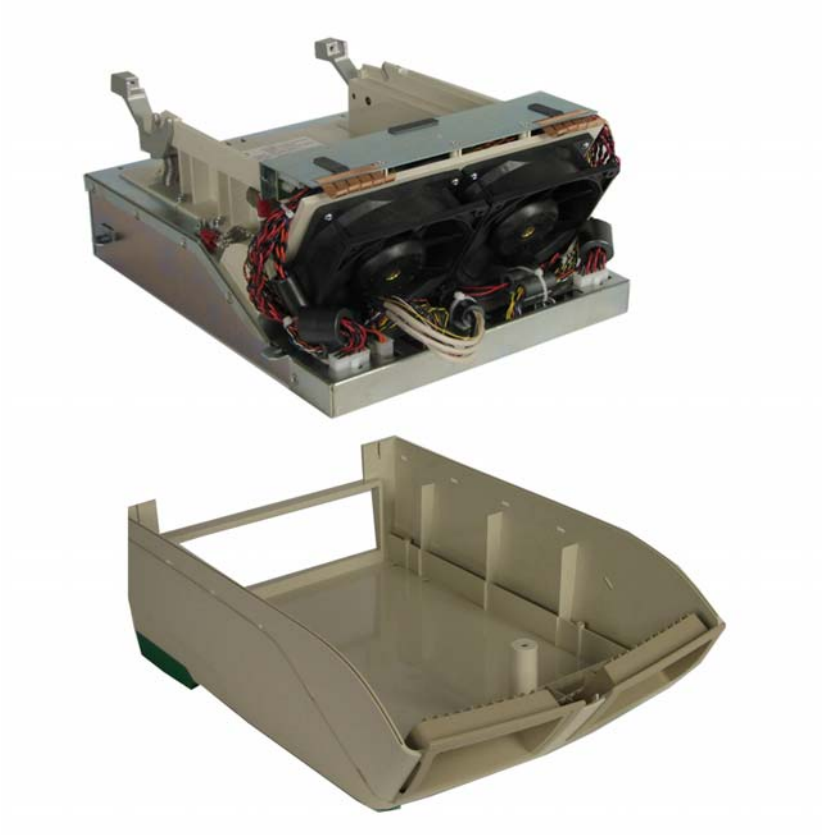


Figure 6-12: Remove inner housing from base

10. Unplug all the alpha interconnect cables from the main board. Figure 6.13.

Note: *When unplugging the cables note the position of all cables.*

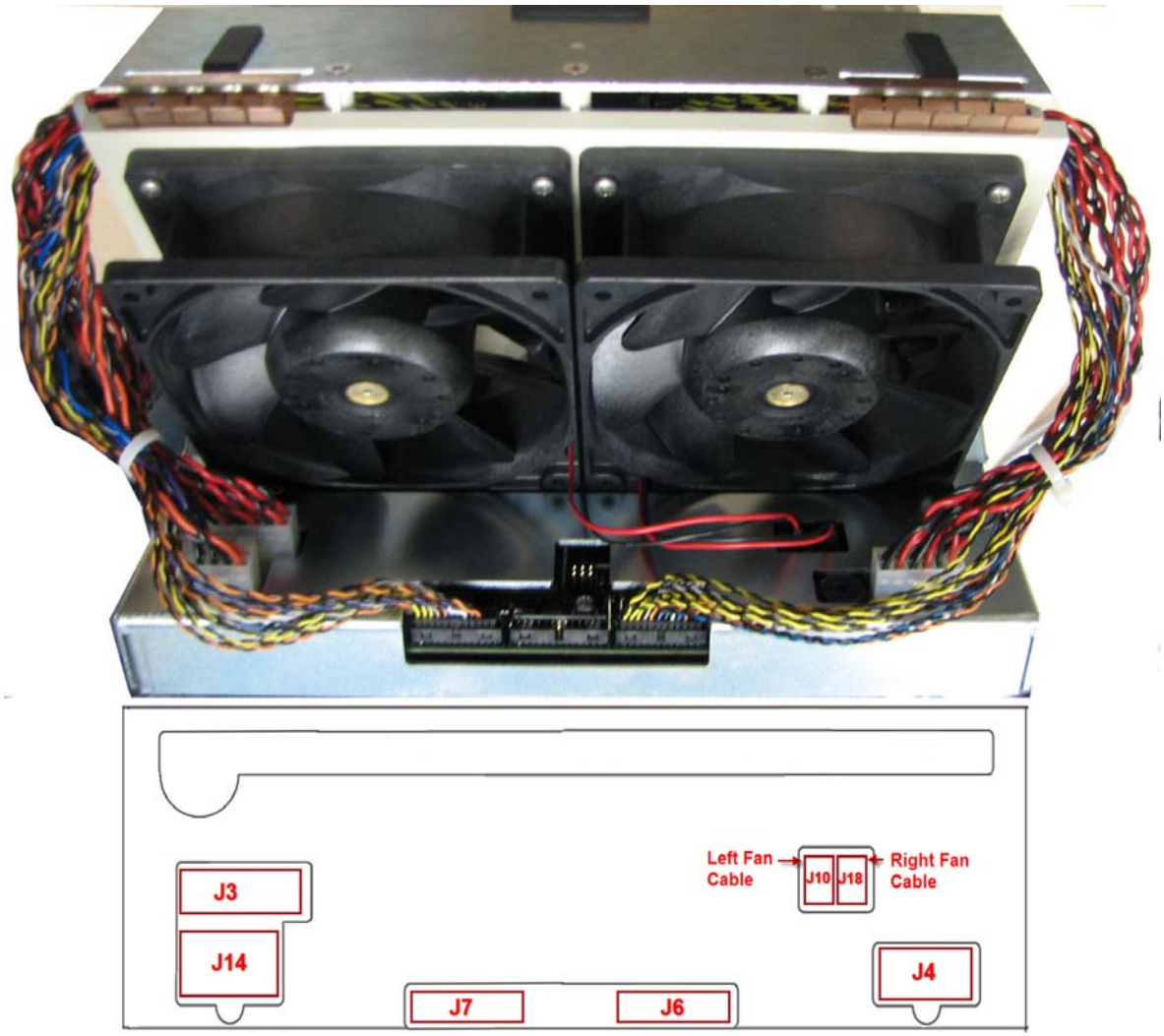


Figure 6-13: Alpha inter-connect cable to main board



Figure 6-14: C1000-Touch inner housing

11. Remove five screws from each side of top inner housing cover. Figure 6.15.

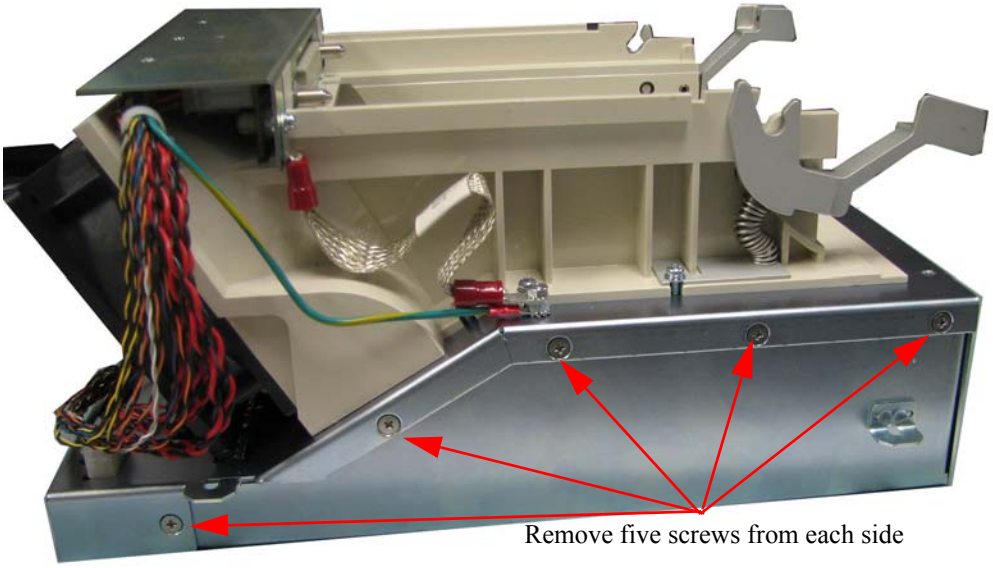


Figure 6-15: C1000-Touch inner housing

12. Left up the top cover from the main board housing. Figure 6.15.

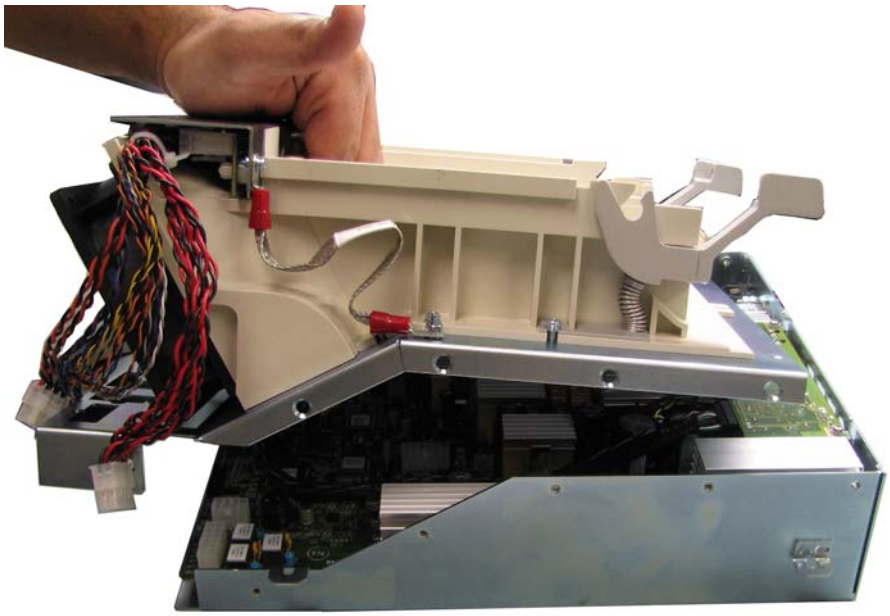


Figure 6-16: Remove Main Board Cover

13. Unplug the front end cable from the USB board and remove cable tie screws.



Figure 6-17: C1000-Touch



Figure 6-18: S1000

14. Unplug the power cable and USB hub board cable from the main board. Figure 6.19.

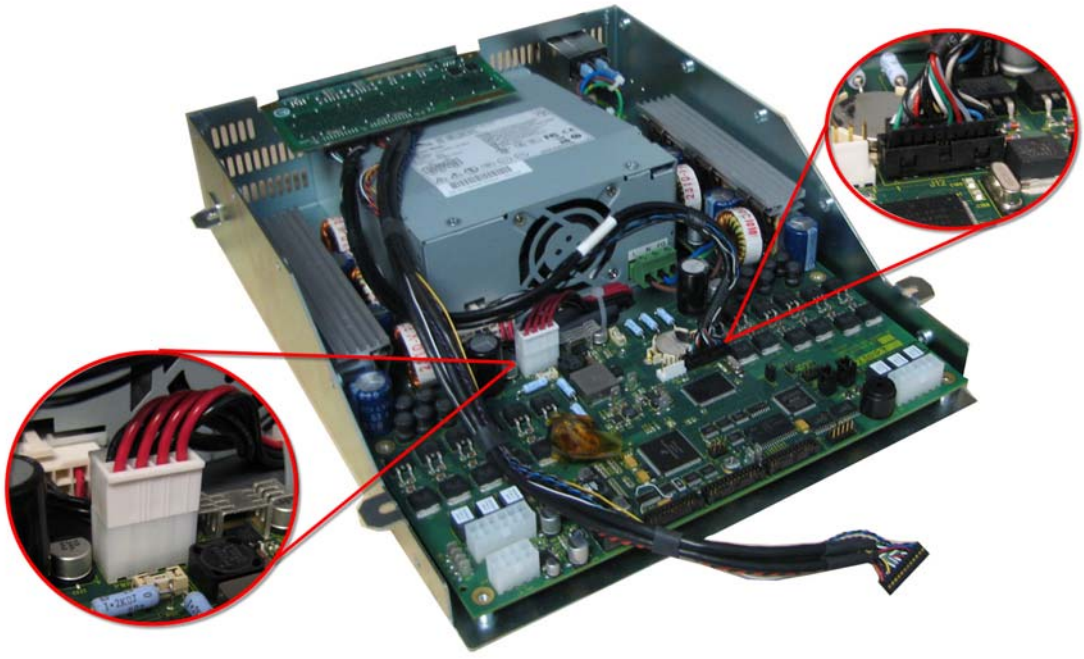


Figure 6-19: USB board cable

15. Remove the two screws that attaches USB hub board to the chassis and remove the USB hub board.



Figure 6-20: USB Hub Board

16. Remove seven screws that attach main board to chassis.
17. Carefully left the board up to release the snap tops and remove main board. Figure 6.21.

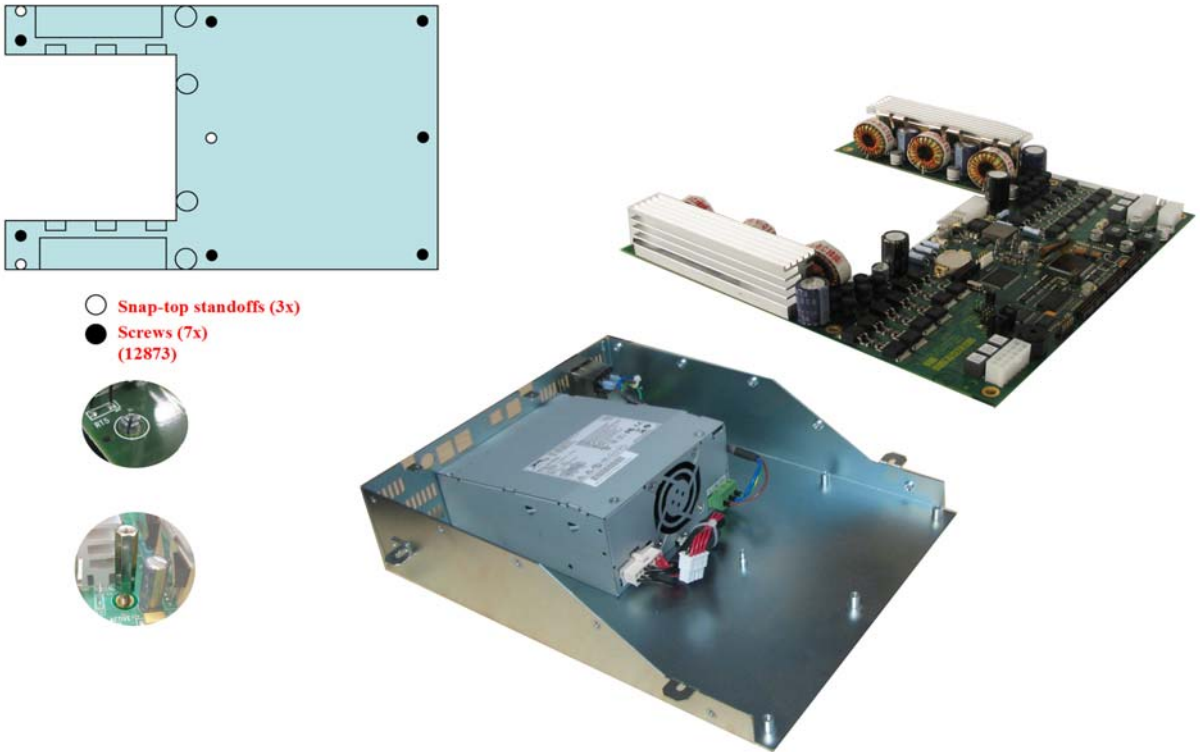


Figure 6-21: Remove main board

18. Remove four screws from the back of the chassis and one M4 nut inside that attaches the power supply to the chassis.
19. Unplug the two cable from power supply and remove power supply. Figure.6.22.

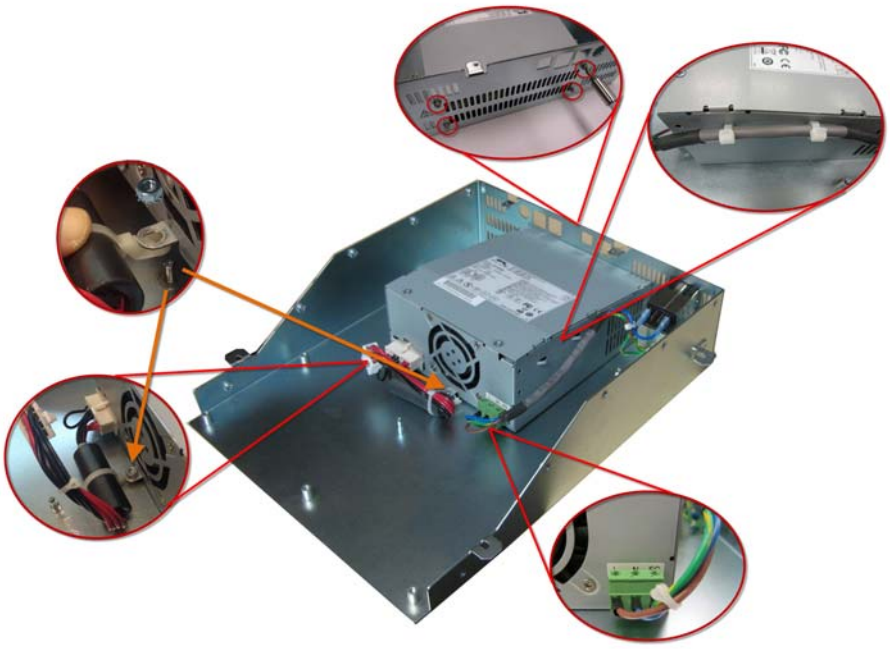


Figure 6-22: Power Supply

20. Unplug the two cables from power entry module.
21. Press the tabs on top and bottom of the power entry module and push the power entry module out of the housing to remove it. Figure 6.23.

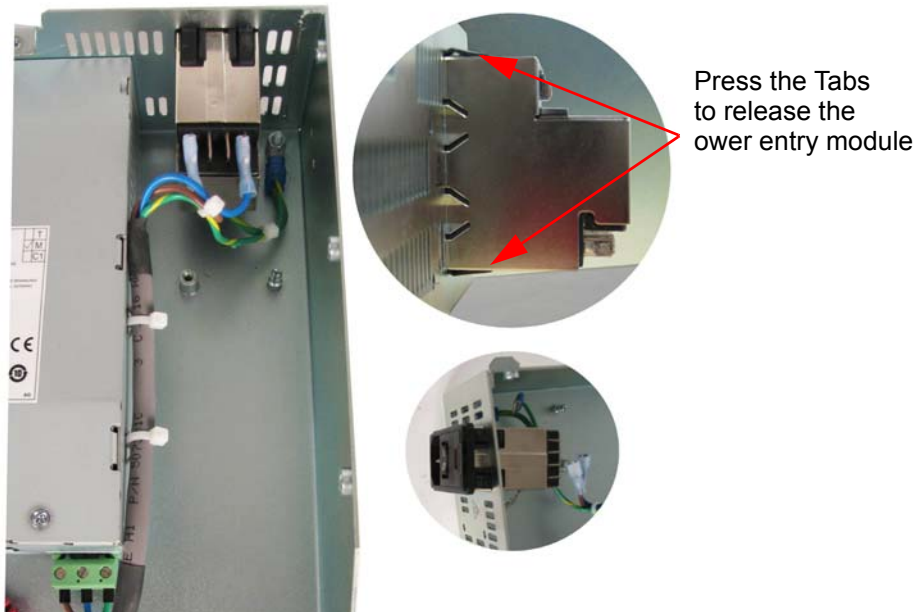


Figure 6-23: Power entry module

6.6 Replacing C1000-Touch Fuses

1. To remove the fuse module of C1000-Touch/S1000 thermal cycler, open the fuse housing using a small flat screw driver.
2. Pull the fuse holder out of the power entry module. Replace both fuses, one on each side of the fuse holder with appropriate fuse. Figure 6.24 and Figure 6.25.



Figure 6-24:



Figure 6-25:

6.7 C1000-Touch controller board assembly

This section describes procedure for removal of the front end controller board assembly. The front end controller board includes Controller board, battery pack, front USB communication board and LCD touch screen.



Figure 6-26: C1000-Touch Controller Board Assembly

1. Unplug all the cables from the front end controller board.Figure 6.27

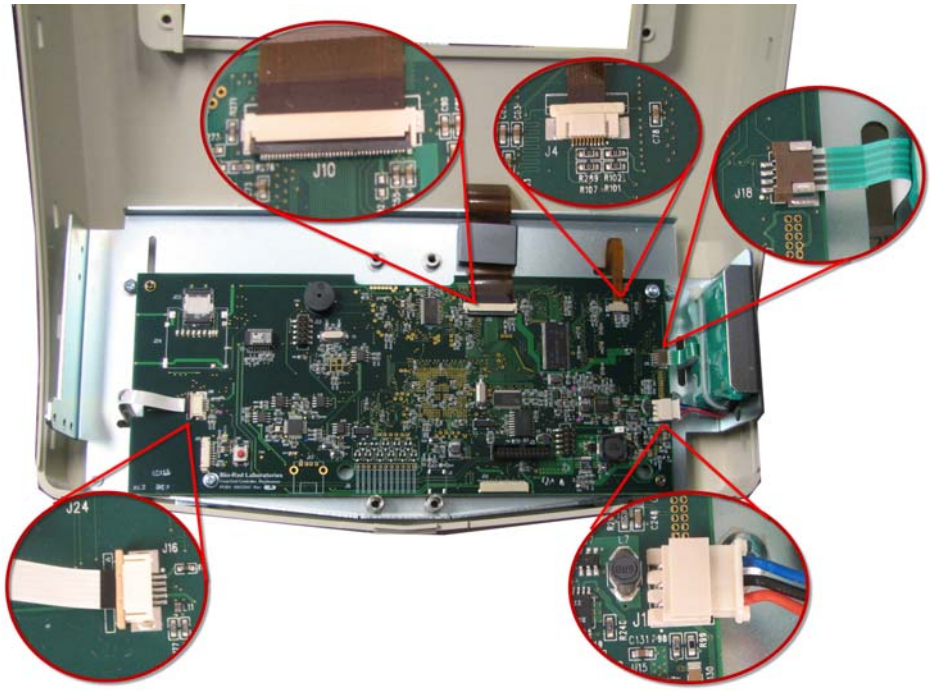


Figure 6-27: Remove Cables From the Controller board

2. Cut the cable tie to remove the Battery pack. Figure 6-28

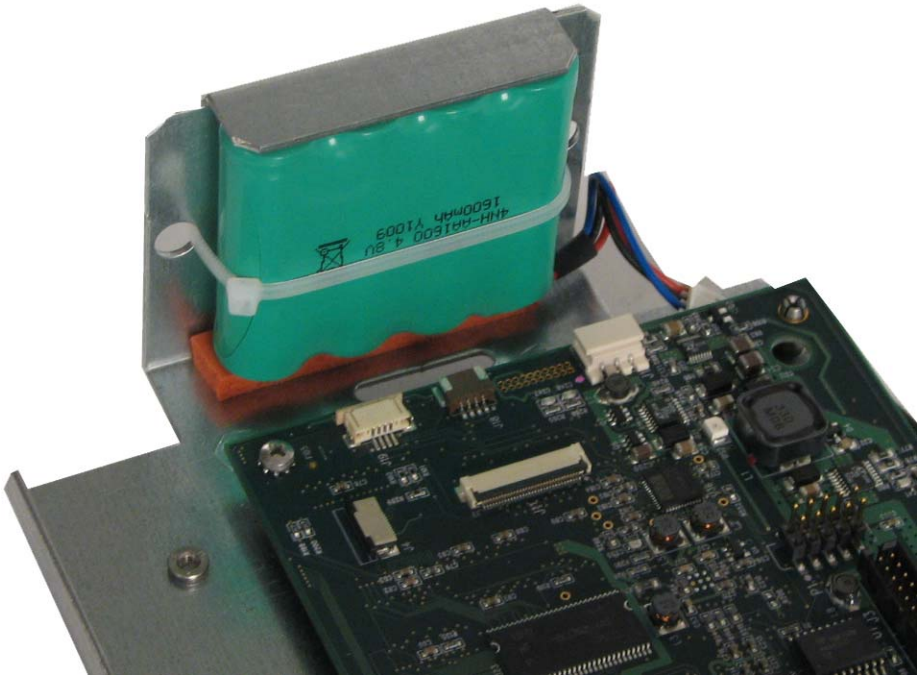


Figure 6-28:

3. Remove four screws from the controller mount bracket and remove the bracket. Figure.6.29.

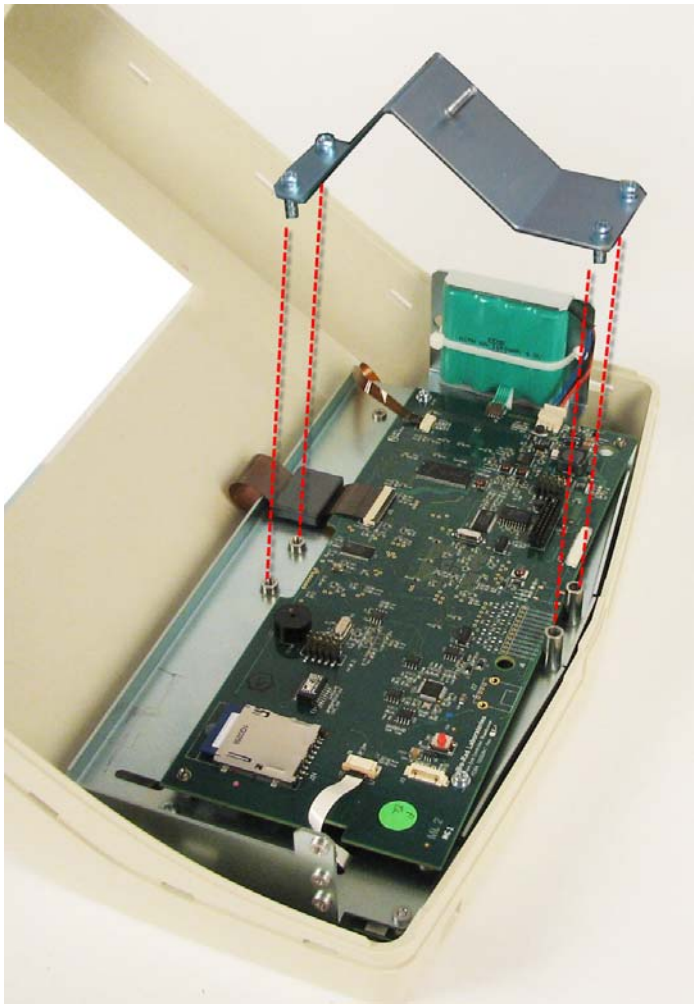


Figure 6-29: Controller Bracket

4. Remove four screws from controller board and remove the controller board. Figure.6.30.

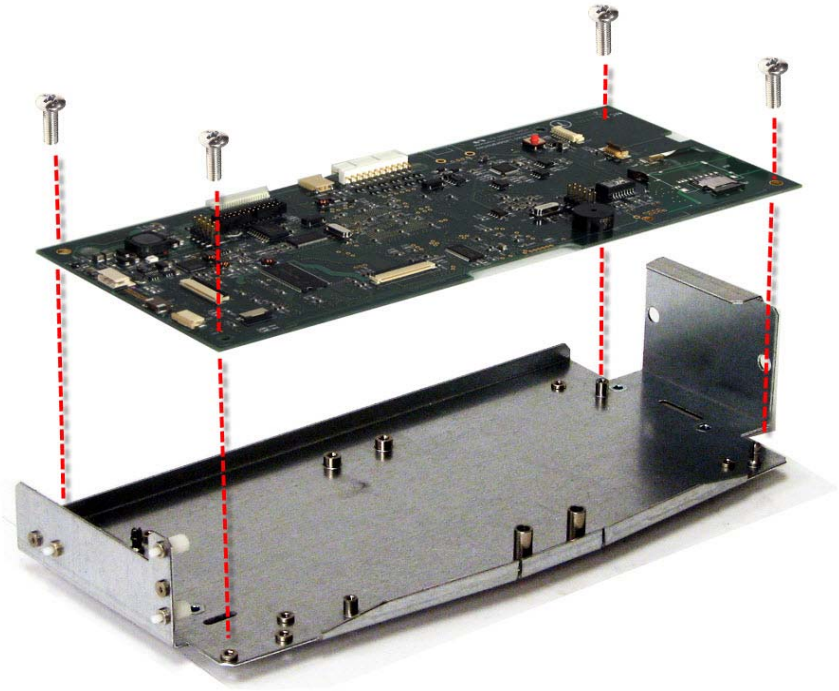


Figure 6-30: Remove Controller Board

6.8 Remove LCD Touch Display

The C1000-Touch LCD screen fits in between the tabs on the top case and it is held in place by the display bracket.

1. Remove four screws from the display bracket and remove the C1000-Touch display bracket. Figure.6.31.

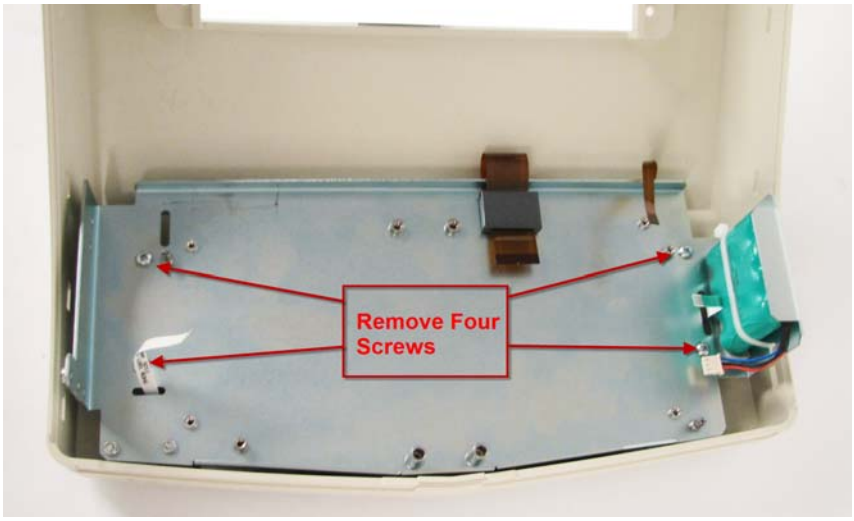


Figure 6-31: Remove C1000-Touch Display Bracket

2. Remove the bracket and carefully left up C1000-Touch LCD to remove it from the top cover. Figure.6.32.



Figure 6-32: LCD Touch Screen

3. When reinstalling the LCD touch screen, verify that the display gasket on the top cover is mounted securely and it is not damaged. Inspect the spacer foam attached on the top of LCD touch screen.

6.9 Front USB board

The C1000-Touch front USB board is used for connecting USB flash drive, Key board, USB mouse or barcode reader.

1. Unplug the flat cable from the USB board.
2. Remove the two screws and plastic spacers that attach the board to the front end bracket. Figure.6.33.
3. Remove the USB board.
4. When reinstalling the board make sure that the USB connector on the board is aligned with the opening in the C1000-Touch top cover.

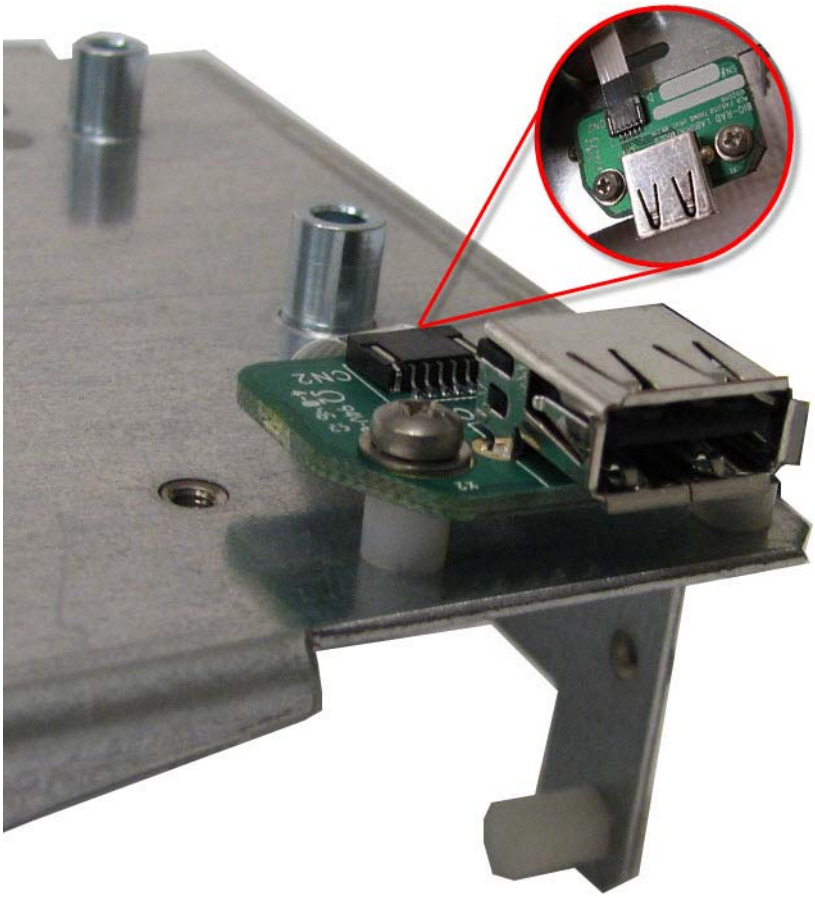


Figure 6-33: LCD Touch Screen Installed

6.9.1 S1000 front board removal

1. Remove four screws from the front board bracket. Figure 6-34.



Figure 6-34: S1000 front board Bracket

2. Unplug the keyboard cable from the S1000 front board and remove the bracket. Figure 6-35

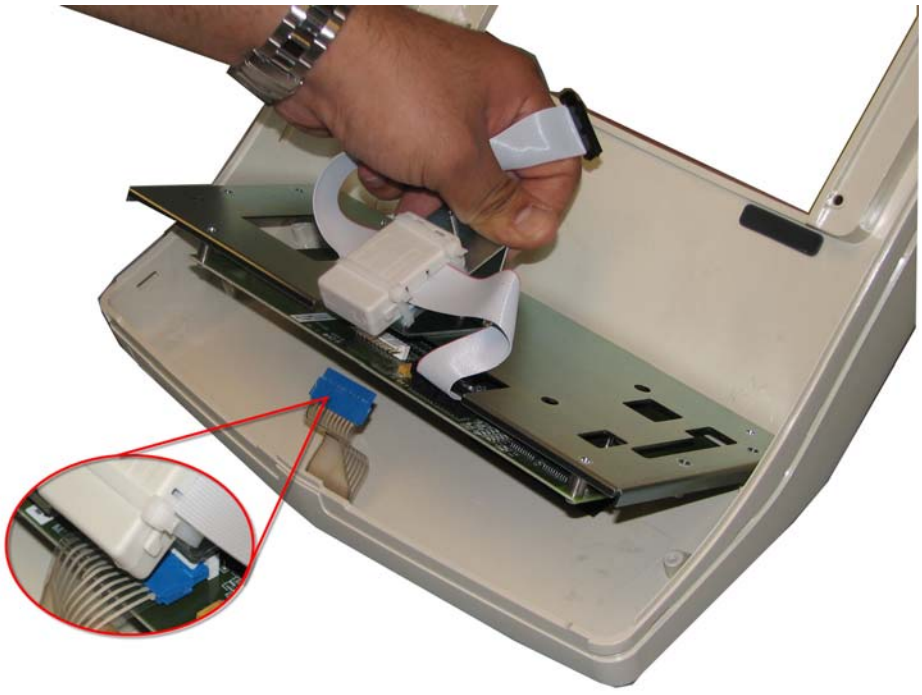


Figure 6-35: S1000 keyboard cable

3. Remove four screws from the S1000 front board and remove the S1000 front board. Figure 6-36

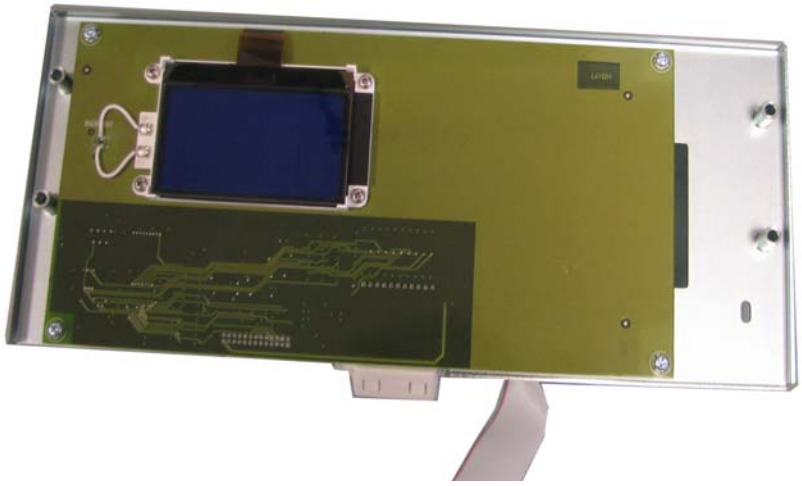


Figure 6-36: Remove C1000-Touch Display Bracket

6.10 Cooling fan installation and adjustment

Installation orientation and adjustment of cooling fans procedure.

1. Remove the four screws that attach each fan to the inner housing.
2. Verify that fan is positioned against the chassis with the airflow pointing toward the chassis frame and the wire at the bottom of the chassis frame, the direction of the airflow is imprinted on the fan. Figure 6-37 and Figure 6-38



Figure 6-37: Fan installation

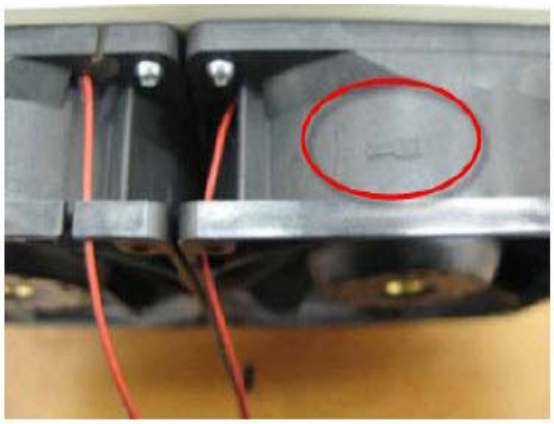


Figure 6-38: Fan installation orientation

3. Insert 0.4 ± 0.1mm feeler gauge (or flexible steel rule with thickness of 0.4 ±0.1mm) between fan and chassis close to screw. Figure 6-39

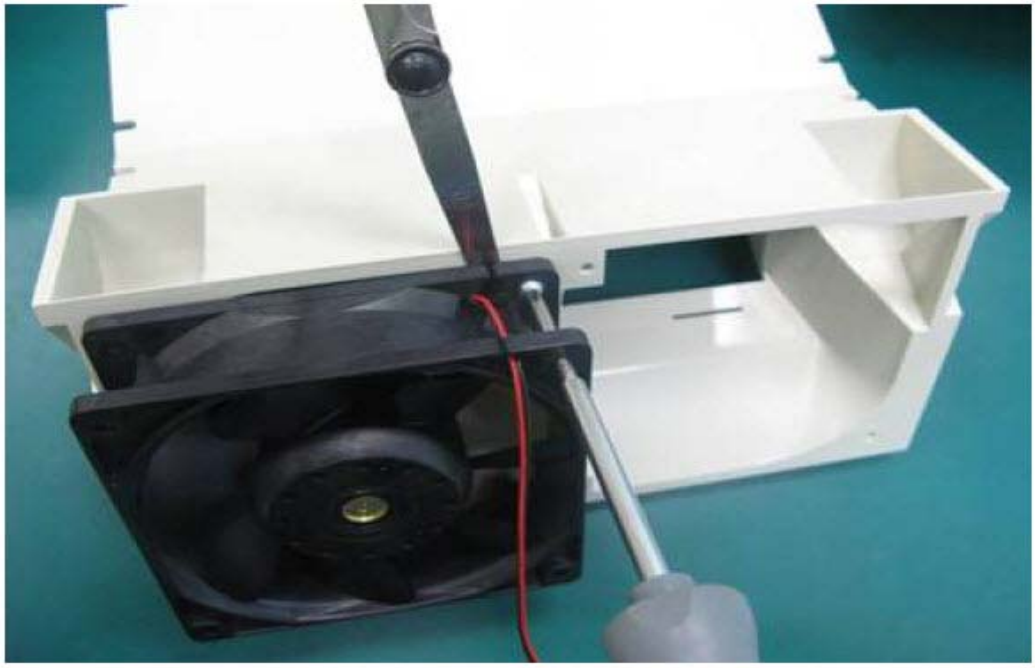


Figure 6-39: Insert feeler gauge between fan and chassis

4. Using screws from 10021965 screw kit, hand tighten fan to the chassis with the feeler gauge in place between the fan and chassis.
5. Remove the feeler gauge and repeat step 4 for the other screws.
6. Verify that both fans are floating and movable. Using the feeler gauge, ensure that the gap between the chassis and both fans is less than 1mm.
7. Reassemble the C1000/S1000 thermal cycler and run the complete system checkout.

6.11 C1000-Touch Alpha Lid Assembly

1. To remove the lid from the reaction block, remove the four screws from the bottom of the reaction block. Figure.6.40.



Figure 6-40: Heated Lid Mounting Screws

2. Left up the lid and unplug the lid heater plug from the reaction block. Figure.6.41 and 6.42.

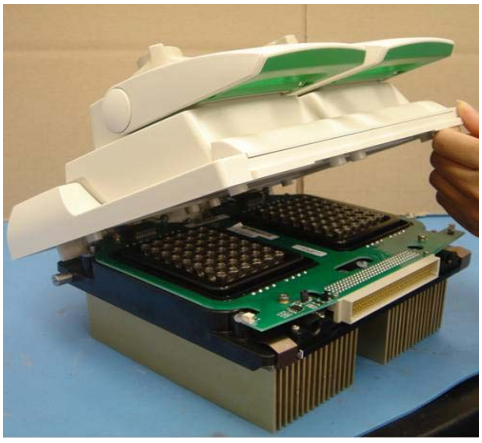


Figure 6-41: Lid Removal

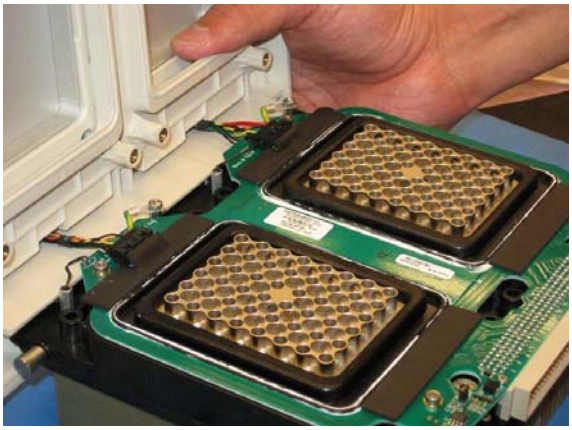


Figure 6-42: Unplug Heated Lid Cables

Section 7
Adjustment and Calibration

7.1 Introduction

This section of the manual provides instructions for adjusting, calibrating, and maintaining the 1000-Touch and S1000 Thermal Cycler. Each procedure also has a short introduction explaining its purpose.

7.2 Safety

Hazardous voltages and hot surfaces are present inside the thermal cycler. Care should be exercised to prevent injury whenever the cover is removed. The procedures in this section should be performed by qualified technicians only.

7.3 Test Equipment

- USB Cable
- USB flash drive
- Bio-Rad thermal validation fixture

7.4 Firmware Upgrade

This section describes the Firmware upgrade procedure for C1000-Touch thermal cyclers. New feature of CFX Manager version 3.0 or higher allows it to check for any upgrade to the software or C1000-Touch and real time CFX96/CFX384 firmware through internet connected PC. CFX Manager will download the latest version and prompts user to upgrade the software or firmware. C1000-touch firmware can be upgraded manually through the USB flash drive if the unit is stand alone and not connected to a PC

C1000-Touch Base Firmware	File Name	Rename File to
HC12	EV0100XYZ00.ABS.S19	UPDATE.S19
PXA270	NK.1.101.Y.Z.BIN	C1000TOUCHUPDATE.BIN
FX2	FX2_SAT_BULK.DLD	

1. Power on the C1000-Touch cycler.
2. Verify that the system completes self test and boots to main menu.
3. Login as Service. From the main screen, touch Tools button to the get to the Tools screen.
4. Touch About button to check the firmware versions installed on the C1000-Touch and any attached S1000 thermal cycler. Proceed to next step if any of the firmware installed needs to be updated.

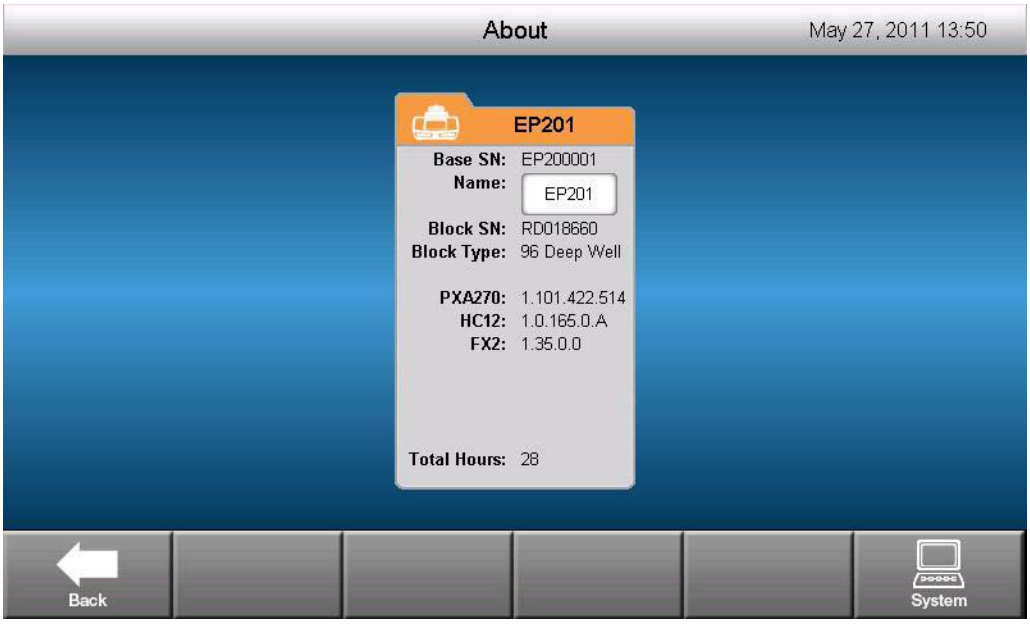


Figure 7-1: C1000-Touch Main Menu

7.4.1 C1000-Touch and S1000 HC12 Firmware Update Procedure

1. Obtain the latest released version of the C1000-Touch/ S1000 main board HC12 firmware file. The image file name will be in the following form (UPDATE.S19).
2. Copy the image file to the root directory of a compatible USB flash drive.
3. Plug-in the USB flash drive containing the firmware file to the front USB port of C1000-Touch.
4. Login as Service if not logged already. From the main screen, touch Tools button to get to the Tools screen.
5. From Admin of Tools screen touch Firmware Update. The system will search the USB flash drive for available firmware files and displays all compatible firmware files with check mark next to them.
6. Select C1000-Touch and any connected S1000 to upgrade the HC12 firmware.

Note: *The main board HC12 firmware is the same for C1000, S1000 and C1000-Touch thermal cyclers*

---

7. Touch Update Firmware button on the bottom right hand side of the screen to start the firmware update.

Warning: *do not turn off the power to the C1000-Touch and do not remove the USB thumb key during the firmware update. Doing so will permanently damage the main board.*

---

8. After the firmware update is completed the instrument will reboot to the main menu.
9. Check to make sure the firmware is updated correctly. Figure 7.4.

7.4.2 C1000-Touch PXA270 Firmware Update Procedure

1. Obtain the latest released version of the C1000-Touch Front end controller PXA270 firmware file. The image file name will be in the following form (NK 1.101.XX.0.bin).
2. Copy the image file to the root directory of a compatible USB flash drive and rename it (nkupdate.bin)
3. Plug-in the USB flash drive containing the firmware file to the front USB port of C1000-Touch.
4. Login as Service if not logged already. From the main screen, touch Tools button to get to the Tools screen.
5. From Admin of Tools screen touch Firmware Update. The system will search the USB flash drive for available firmware files and displays all compatible firmware files with check mark next to them.



Figure 7-2: PXA270 Update Screen

Note: *Original C1000 and C1000-touch controller boards incorporate the same PXA 270 processors chip.The PXA270 firmware file is different for these systems. To avoid incorrect firmware from being installed on the system, firmware file is named differently to allow the updater to distinguish between the C1000 and C100-touch and not install wrong firmware. Incorrect renaming of firmware files my defeat the identification of correct file by updater which could result in damaging the front end controller board.*

6. The PXA270 firmware includes update to Windows CE operating system which makes the firmware file larger than 20MB and firmware installation 10-15 minuets.

Warning: *do not turn off the power to the C1000-Touch and do not remove the USB thumb key during the firmware update. Doing so will permanently damage the main board.*

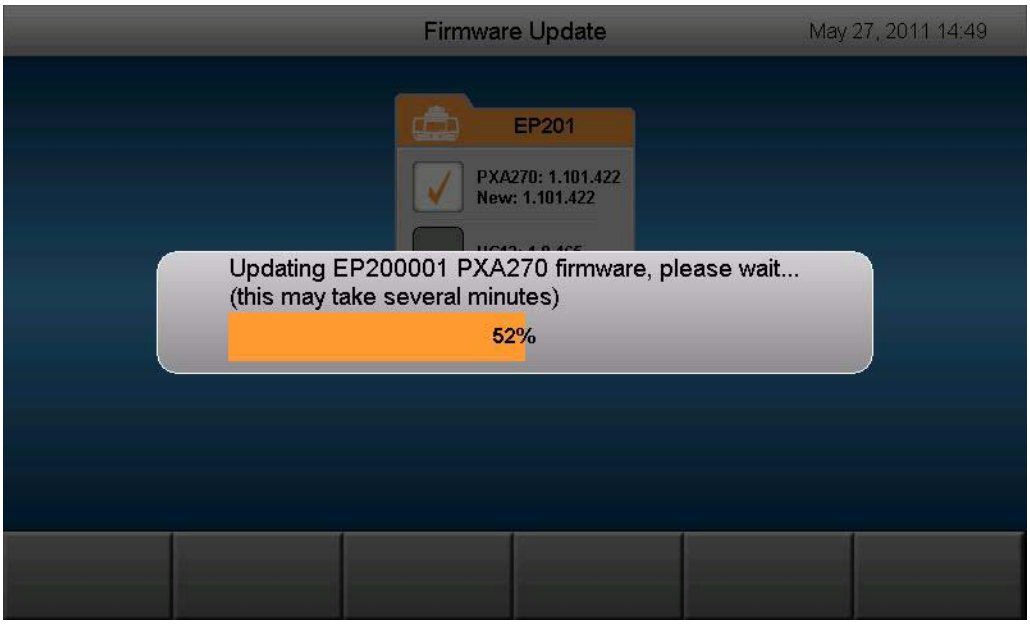


Figure 7-3: PXA270 Update Screen

7. After the firmware update is completed the instrument will reboot to the main menu.
8. Check to make sure the firmware is updated correctly. Figure 7.4.

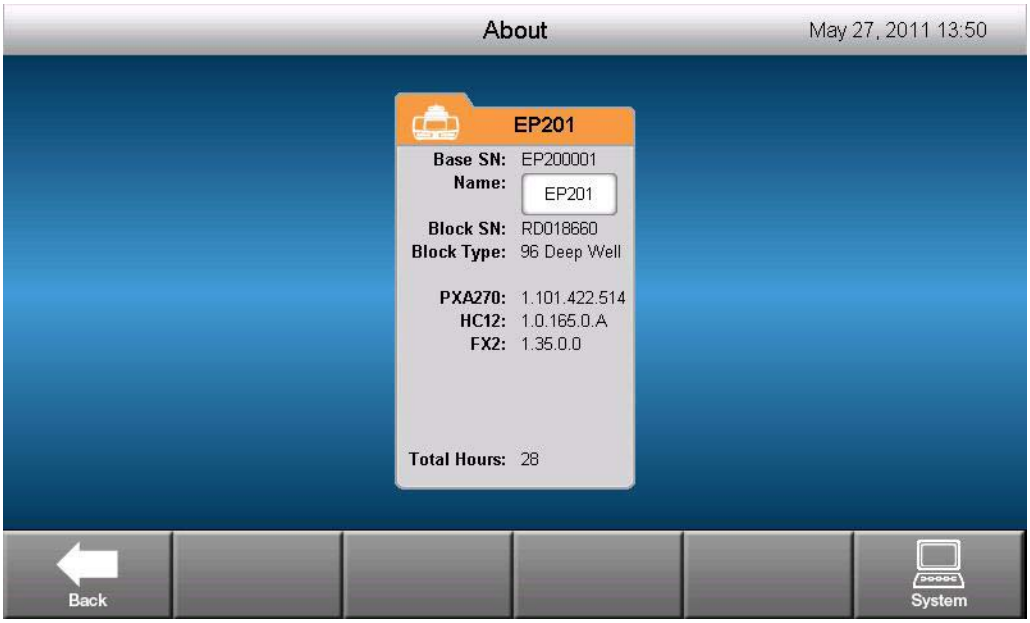


Figure 7-4: Firmware Version

7.5 LCD Touch screen calibration

For best result use a stylus to calibrate the C1000-touch screen.

1. Login as Service. From the main screen, touch Tools button to the get to the Tools screen.
2. Touch the Touch Screen Calibration button on the Admin column of Tools screen.
3. Use a stylus and touch the middle of the crosshaire for all calibration points.

Caution: *If touch screen calibration is not done correctly the touch screen will be misaligned and some command buttons will not respond correctly.*

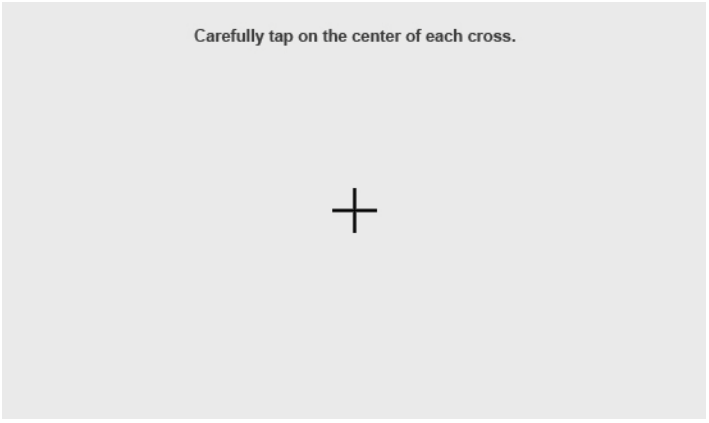


Figure 7-5: Touch Screen Calibration

7.6 Setting the C1000-Touch/S1000 Base serial number

New installation of main board on a C1000-touch or S1000 thermal cycler needs to be set to the correct thermal cycler type before use.

1. Login as Service. From the main screen, touch Tools button to get to the Tools screen.
2. Touch the Manufacturing Menu on the Service column of Tools screen.
3. Select the correct thermal cycler on the left side column.
4. Touch Set C1000 for C1000-Touch thermal cycler or Set S1000 for S1000 thermal cycler.



Figure 7-6: Manufacturing Menu

7.7 Setting MAC address for C1000-Touch Thermal Cycler

MAC address is programmed in manufacturing. Each MAC address corresponds to the individual serial number of C1000-Touch thermal cycler. If the controller board is replaced, the same MAC address should be programed on to the new controller board. Two C1000-Touch thermal cycler with the same MAC address will not be able to connect to the same network.

1. Before replacing the controller board write down the MAC address.

1. Login as Service. From the main screen, touch Tools button to get to the Tools screen.

2. Touch the Set MAC Address button on the Service column of Tools screen.

3. Copy the MAC address. Replace the controller board and reprogram the same number on to the new controller board.

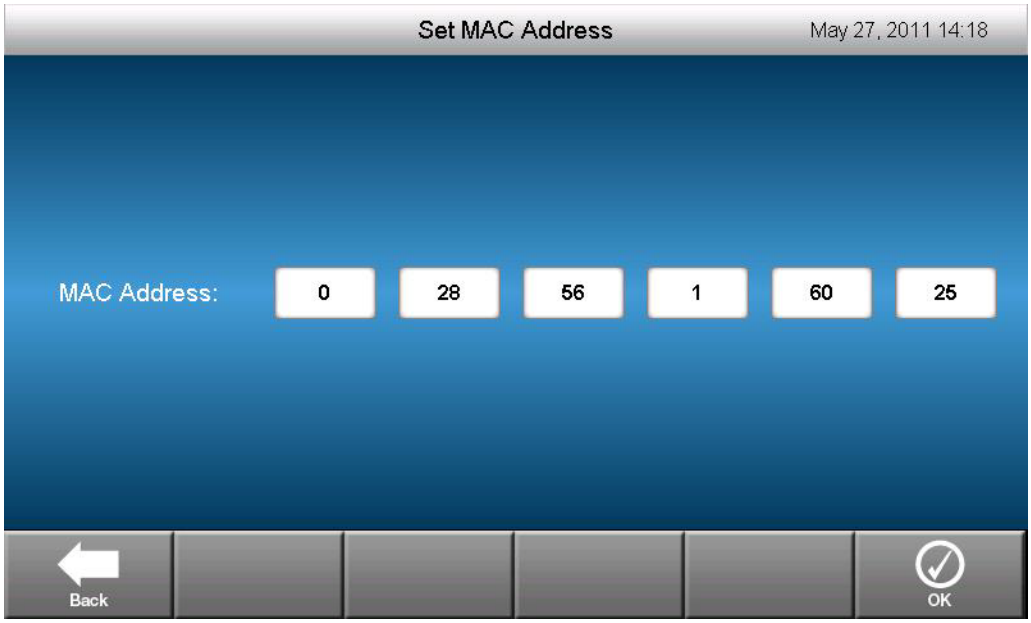


Figure 7-7: File Management Screen

7.8 C1000-Touch exporting complete system logs.

1. Plug in a USB flash drive to the front USB port of C1000-Touch thermal cycler.
1. Login as Service. From the main screen, touch Tools button to get to the Tools screen.
2. Touch the System Logs button on the User column of Tools screen.
3. On the system logs screen touch the system logs to view system log messages or message logs to view message logs.
4. Touch Export button on the bottom right corner of the screen to export all the logs to the USB flash drive. This command will export system logs, message logs and other windows and system logs.

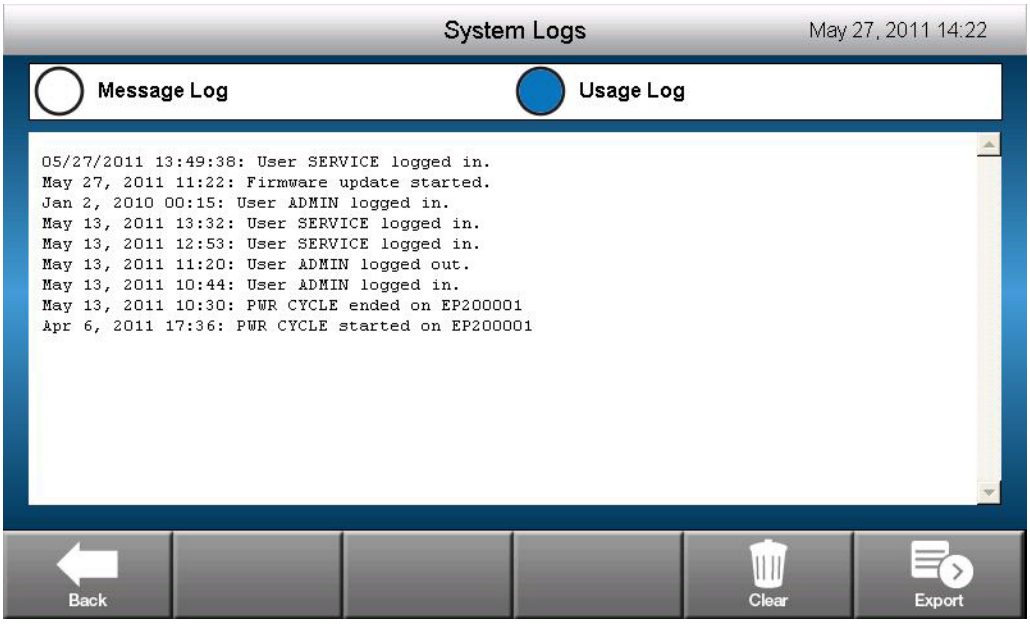


Figure 7-8: Export System files

Section 8
Troubleshooting

8.1 Introduction

The troubleshooting information in this section will help to identify and diagnose operating difficulties and component failures in the C1000-Touch and S1000. This section may be expanded to include additional troubleshooting aids as service center experience identifies recurrent problems and appropriate diagnostic processes.
After reading through this manual, if you find that you need additional assistance in resolving a problem, you may contact our Technical Service Department by phone at 800-424-6723, or by FAX at 510-741-5802.

8.2 Troubleshooting the 1000 Series Cyclers

This section provides troubleshooting information in three parts. The first part lists Error Messages, followed by symptoms and probable causes. The second part is a list of error codes and descriptions. The third part is a troubleshooting guide that uses a Problem, Cause, Solution format for determining the root cause of problems.

8.2.1 Error Messages

Error Messages	Cause	Solution
Running On A/C Power Failed Power Outage During Cycle X Step Y Restarted At Zz.z Press Any Key To Clear This Message	Displayed when a machine running a protocol has been turned off, either intentionally or due to a power outage, and then turned on again.	Check for loose power cable. Check thermal cycler fuse.
Please restart cycler. Block overheated. Please call Bio-Rad for service.	Reaction module has exceeded maximum temperature of 107.5°C or sensor has a malfunction and is not measuring temperature accurately. Protocol terminated.	bad reaction block termister or run away TE. Run the self diagnostics and Perform thermal validation. Replace bad Alpha
Please restart cycler. Heatsink overheated. Please call Bio-Rad for service.	Heatsink temperature has exceeded75°C. Protocol terminated.	Check for sufficient air flow. Check that the fans or operating properly.
All block sensors failed. Please call Bio-Rad for service.	All block sensors have failed. Protocol terminated.	Run self diagnostic. Replace bad Alpha or main board
Power supply overheated. Please call Bio-Rad for service.	Power Supply temperature has exceeded 85°C. Protocol terminated.	Check for sufficient air flow. Check that the fans or operating properly. Replace bad main board.
Heated lid failed. Protocol cancelled. Please call Bio-Rad for service.	Lid sensor has failed during lid preheat. Protocol terminated.	Bad lid sensor or bad lid heater.
Heatsink overheating. Please check air flow. Please call Bio-Rad for service.	Heatsink has exceeded 70°C. System beeps and displays error.	Run Diagnostics test. Replace defective fan assembly or main board.

Error Messages	Cause	Solution
Please check air flow. System overheating. Please call Bio-Rad for service.	Amp temp has exceeded 80°C. System beeps and displays error.	Check for sufficient air flow. Check that the fans or operating properly. Replace bad main board.
Please check air flow. Power supply overheating. Please call Bio-Rad for service.	Power Supply temperature has exceeded 80°C. System beeps and displays error.	Check for sufficient air flow. Check that the fans or operating properly. Replace bad main board.
Slow block cycling. Please call Bio-Rad for service.	Block failed to achieve target in the estimated time.	Replace bad Alpha of mainboard
Slow lid cycling. Please call Bio-Rad for service.	Lid failed to achieve target in the estimated time.	Make sure the heated lid is not touching the reaction module. Replace defective lid heater or main board
Slow gradient. Please call Bio-Rad for service.	Block failed to achieve gradient in the estimated time.	Run diagnostic test. Replace defective block.
Heated lid failed. Please call Bio-Rad for service.	(singles only) If the right and left lid heater channels deviate from each other by more than 5°C the lid is shut off.	Run diagnostic test. Replace defective lid heaters.
Block sensor 0 failed. Please call Bio- Rad for service.	Block sensor 0 has failed* and the protocol was terminated.	Run diagnostic test. Replace reaction block.
Block sensor 1 failed. Please call Bio- Rad for service.	Block sensor 1 has failed* and the protocol was terminated.	Run diagnostic test. Replace reaction block.
Block sensor 2 failed. Please call Bio- Rad for service.	Block sensor 2 has failed* and the protocol was terminated.	Run diagnostic test. Replace reaction block.
Block sensor 3 failed. Please call Bio- Rad for service.	Block sensor 3 has failed* and the protocol was terminated.	Run diagnostic test. Replace reaction block.
Block sensor 4 failed. Please call Bio- Rad for service.	Block sensor 4 has failed* and the protocol was terminated.	Run diagnostic test. Replace reaction block.
Block sensor 5 failed. Please call Bio- Rad for service.	Block sensor 5 has failed* and the protocol was terminated.	Run diagnostic test. Replace reaction block.
Left lid sensor failed. Please call Bio- Rad for service.	Left lid sensor has failed*. If a dual, protocol terminated. If a single and BOTH lid sensors failed, protocol terminated and block sent to 4°C.	Run diagnostic test. Replace lid heater
Right lid sensor failed. Please call Bio- Rad for service.	Right lid sensor has failed*. If a dual, protocol terminated. If a single and BOTH lid sensors failed, protocol terminated and block sent to 4°C.	Run diagnostic test. Replace lid heater
Left heatsink sensor failed. Please call Bio-Rad for service.	Left heatsink sensor has failed*, system using average of amplifier temperatures to continue.	Run diagnostic test. Replace reaction block.
Right heatsink sensor failed. Please call Bio-Rad for service.	Right heatsink sensor has failed* system using average of amplifier temperatures to continue.	Run diagnostic test. Replace reaction block.

Error Messages	Cause	Solution
Lid overheated and was shut off. Please call Bio-Rad for service.	(duals only) Lid has overheated and has been shut off and protocol has been terminated.	Run diagnostic test. Replace lid heater or main board.
Amplified 1 temperature sensor failed. Please call Bio-Rad for service.	Amplifier temperature sensor 1 has failed.	
Power supply sensor failed. Please call Bio-Rad for service.	Power Supply sensor has failed.	Run diagnostic test. Replace main board
Block power failure. Protocol cancelled. Please call Bio-Rad for service.	Power to block is out of range.	Run diagnostic test. Replace main board
Logic power failure. Please call Bio- Rad for service.	Logic power sensor is out of bounds.	Run diagnostic test. Replace main board or front end board.
Base power failure. Protocol cancelled. Please call Bio-Rad for service.	Base power sensor is out of bounds. Protocol cancelled.	Run diagnostic test. Reconnect power cable. Replace main board.
Amplifier 2 sensor failed. Please call Bio-Rad for service.	Amplifier temperature sensor 2 has failed.	
Corrupt protocol memory detected. Protocols may be lost. Please call Bio- Rad for service.	Protocol storage memory has been corrupted.	Too many protocols saved in memory. Erase un-needed protocols in memory.
Unable to read reaction module header. Please restart cycler. Please call Bio-Rad for service.	Unable to read information from reaction module properly.	Replace reaction block. Check for bent or broken pins at reaction block header. Replace block.
Please restart cycler. Incorrect checksum. Please call Bio-Rad for service.	Information read from reaction module appears incorrect.	Restart cycler. Run diagnostic test. Replace front end board.
Please restart cycler. Block power was shut off. Please call Bio-Rad for service.	There was a problem with the block and power was shut off	Check power connection. Run diagnostic test. Replace main board.
One of the block sensors in a single block has failed. The system has cancelled the protocol and sent the block to 4°C to preserve the samples. Please call Bio-Rad for service.	One of the block sensors in a single block has failed. The system has cancelled the protocol at step x, cycle y and sent the block to 4°C to preserve the samples.	Run diagnostic test. Replace defective reaction block.
Touch screen buttons don't respond or the adjacent button responds	LCD Touch screen is not calibrated correctly	Use an Styles to calibrate the LCD touch screen. Carefully touch the middle of the crosshaire for each calibration target.

Section 9
Parts Information

9.1 Introduction

This section contains parts lists and associated information. It provides instructions for ordering and returning defective parts. This section also identifies parts that are field replacable.

9.2 Parts Orders - US Domestic Operations

Parts may be ordered through our Service Parts department. You can help to make processing your order more efficiently by having the following information before you call:

- The part number(s) or catalog number(s) of the parts you want to order
- Shipment information
- Your account or inventory location number

9.3 Parts Orders - International Subsidiaries

The procedures for ordering parts vary from region to region outside the United States. Please contact your Bio-Rad Export Sales Representative through your regular sales and service channels.

9.4 Returning Defective Parts

Defective assemblies returned for repair are an important part of the service logistics and inventory control process. Returned assemblies are refurbished, tested, and returned to service stock. Maintaining the effectiveness and efficiency for this process enables us to deliver the high standard of service that our customer expect, at reasonable cost that allows us to remain competitive.

You are an integral part of our inventory process. When you return parts or assemblies to Bio-Rad to be repaired, please attach a tag to each assembly. The tag should contain the following information:

- Model and serial number of the unit from which the part was removed
- The date of removal
- A description of the problem or symptoms exhibited (*if you could not find the problem, describe what the user reported and specify "CND - Can Not Duplicate")*
- The part number or catalog number of the part being returned
- Your name and other identification information

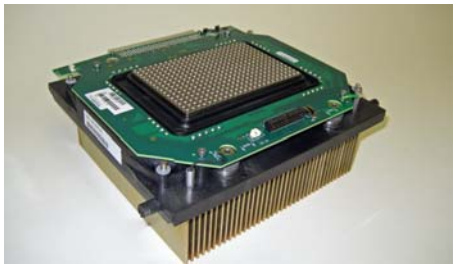
This information will help our service centers to make repairs efficiently. When you receive replacement parts, save the packaging material for returning the defective parts for repair. many of the parts are delicate and expensive; extra attention to packaging will pay off in less damage to parts during shipment.

Note: *Additional procedures and information may be needed for the return of defective parts from international operations. These procedures vary depending on your location.*

9.5 Recommended Spares

The appropriate quantity for each of the **C1000-Touch and S1000 Thermal Cycler** spares will vary depending on the total quantity of instruments in your installed base. A quantity of 1 for each field replaceable part is a good starting point.

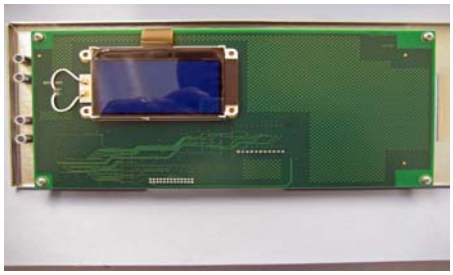
Recommended Spares List

Part Number	Description	Picture
10010798	Dual 48/48 Well Reaction Block	
10010795	384 Well Reaction Block	
10010791	96 well Reaction Block	
10020754	96 Deep well Reaction Block	

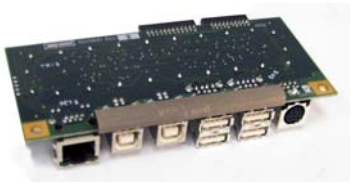
Recommended Spares List

Part Number	Description	Picture
10020753	Dual High Lid Assembly 2nd generation.	
10020752	96W High Lid Assembly 2nd generation.	
10020764	384 High Lid Assembly 2nd generation.	
10010794	Single Lid Heater PCB (Used in 96well and 384 heated Lid)	

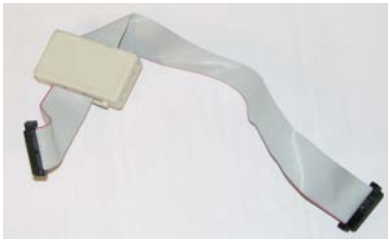
Recommended Spares List

Part Number	Description	Picture
10010801	Dual Lid Heater PCB	
10020343-SVC	C1000-Touch 2nd generation and S1000 2nd generation Main Board, C1000T2	
10022847-SVC	C1000-Touch 2nd generation front-end Controller Board	
10010778	S1000 Display PCB	

Recommended Spares List

Part Number	Description	Picture
10023766-SVC	PCBA,USB HUB C1000-Touch 2nd generation	
10019857-SVC	C1000-Touch 2nd generation Power Supply	
10020117-SVC	C1000-Touch / T100 front USB Board	
10022801-SVC	LCD Touch Screen with LED back light, C1000-Touch 2nd generation	

Recommended Spares List

Part Number	Description	Picture
10020113-SVC	Display Bracket, C1000-Touch 2nd generation	
10010788	C1000 Controller Battery Pack	
10010774	S1000 Front Panel Cable	
10022798-SVC	Alpha interconnect PCB,C1000-Touch 2nd generation	

Recommended Spares List

Part Number	Description	Picture
10022794-SVC	Cable, 40V DC, Power supply to Main board, C1000-Touch 2nd generation and S1000 2nd generation	
10022795-SVC	Power entry module with Cable Harness, AC/PS, C1000-Touch 2nd generation and S1000 2nd generation	
10023769-SVC	C1000-Touch , Cable, USB Hub to Main Board Cable	
10010756	C1000 Fan Assy	
10020765	C1000-Touch , Cable, Flex 5 position, Front USB Board to Controller board cable	

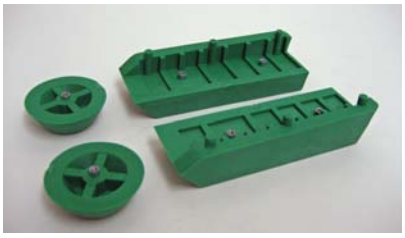
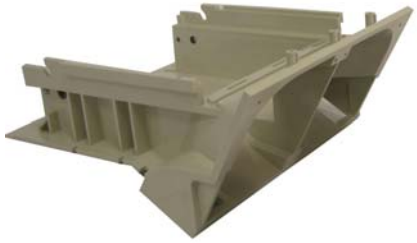
Recommended Spares List

Part Number	Description	Picture
10014633	Fuse, 10A 250V Fast 5X20mm	
10019584	Alpha Shunt Jumper. Quantity 4	
10010769	S1000 Keypad	
10010785	C1000 Braided EMI Cable	
10010767	C1000 Latch .L.R	

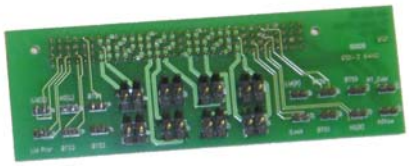
Recommended Spares List

Part Number	Description	Picture
10010789	C1000 Latch Springs	
10010760	C1000 Case Bottom	
10010805	S1000 Case Top	
10020755	C1000-Touch Case Top	

Recommended Spares List

Part Number	Description	Picture
10010762	Case Side Bands .L.R	
10010763	C1000 Front Vents.L.R	
10010764	C1000 Feet	
10010766	C1000 Latch handle	
10010765	C1000 Chassis Frame	

1000 Series Thermal Validation Tools

Part Number	Description	Picture
10013145	1000 Thermal Validation Fixture 96 and 48/48	
10013146	1000 Thermal Validation Fixture 384	
10013148	1000 Alpha Test Fixture	

Section 10
Drawings

10.1 About this Section

This section contains schematics and assembly drawings for the 1000-Touch Thermal Cycler. These drawings are intended to be used as aids for troubleshooting and parts identification.

10.2 Drawings

10.2.1 Schematics

• Single Lid Drawing	AD11565	1 page
• Single Lid Heater Schematic	SC11565	1 page
• Dual Lid Heater Schematic	SC11537	1 page
• Alpha Interconnect Schematic	SC10022798	1 page
• Front USB Schematic	SC10020118	1 page
• USB Hub Board Schematic	SC10023766	2 pages
• Power Supply	AD10019857	1 page
• S1000 Front board Schematic	SC11583	1 page
• C1000-Touch Controller Drawing	AD10022847	2 pages
• C1000-Touch Controller Schematic	SC10022847	16 pages
• C1000-Touch/S1000 Main PCB Drawing	AD10020343	2 pages
• C1000-Touch/S1000 Main PCB Schematic	SC10020343	21 pages

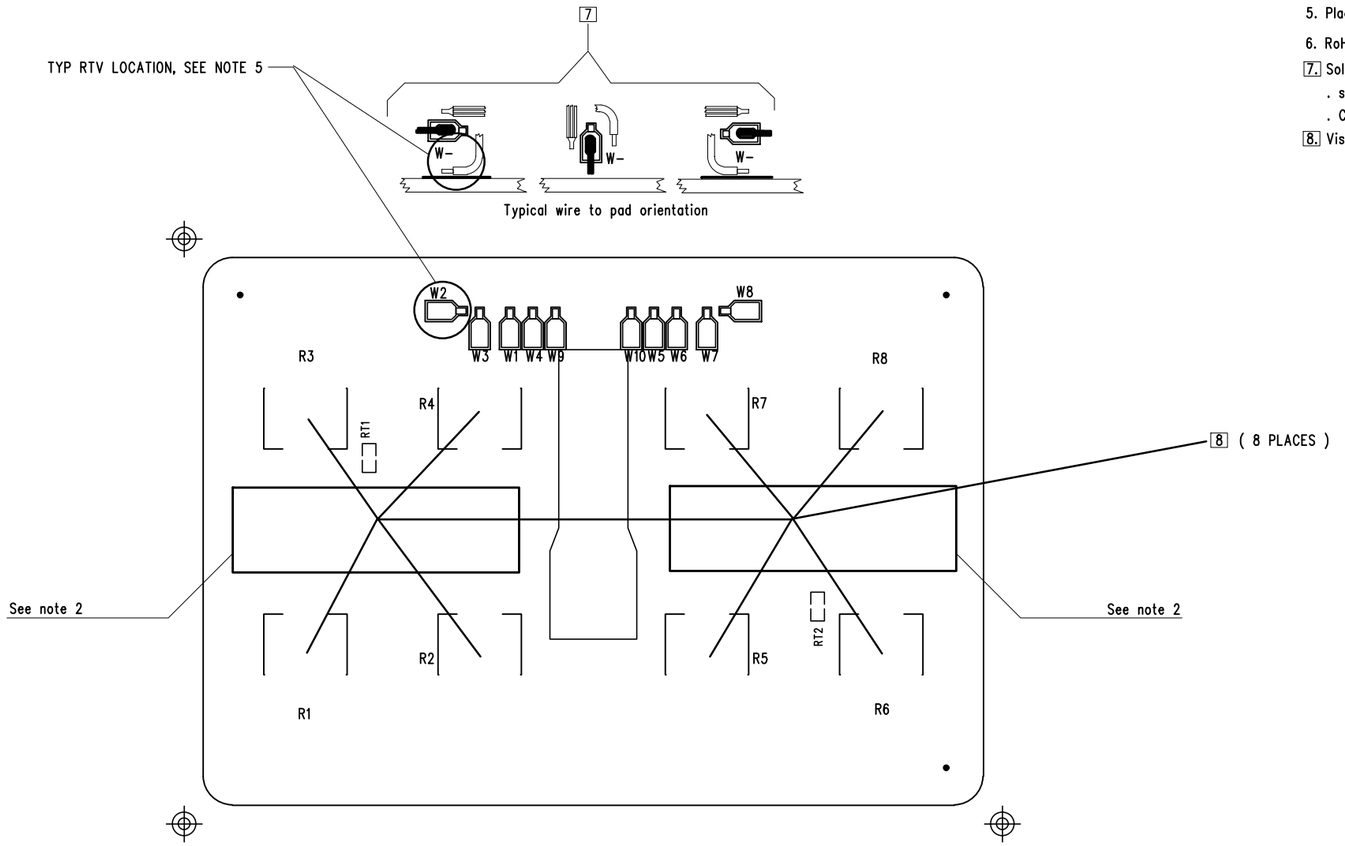
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ASSEMBLY NOTES :

1. Assemble per ANSI/IPC-A-610 "LATEST REV" CLASS 2
2. Label per CBA Labeling Procedure, Reference BIO-RAD PLM DOC ID D049689.
   Locate, on component side of board, within area(s) defined.
3. White haze is not acceptable if a no-clean process is used.
4. All flux and residues shall be cleaned from PCB after soldering.
5. Place a bead of silicone RTV on the board to tack and protect the connections at W1 – W10.
6. RoHS Certificate of Compliance to be provided with each lot of RoHS compliant assemblies.
7. Solder wires of Cable, Lid Heater Single (Item 11571) per the following instructions:
   . solder the wires to the pads orientated as shown.
   . Color of the wire to the connector pin# as shown in the table.
8. Visually inspect soldering quality, contact between component and solder tab for thermal conductivity

7

Pad	Color	Conn. Pin #
W1	White	8
W2	Red	9,10
W3	Black	11,12
W4	Black	7
W5	Green	23
W6	White	24
W7	White	19,20
W8	Green	21,22
W9	Red	5
W10	Black	6
W–	--	none
W–	--	none
--	Green	16,17,18



SEE ASSOCIATED BOM

REV	ECO	DRN/DATE	CHK/DATE	APP/DATE
F	BP026759	JS 12/29/09	YY 12/30/09	FS 01/05/10
E	BP023624	JS 05/14/09	YY 05/15/09	FS 05/22/09

REVISIONS

MODEL

UNLESS OTHERWISE SPECIFIED

TOLERANCES ARE
X. = 0.5
X.X = 0.38
X.XX = 0.13
X.XXX = 0.005
ANGLES = +/- 0.5

SURFACE ROUGHNESS

DIMENSIONS ARE IN MILLIMETERS[INCHES]

PROJECT NO: .

APPROVALS	DATE
DRN P.Jones	10/05/06
CHK R.A.Wakeling	02/14/07
ENG P.Jones	02/14/07
MFG .	.
ISS .	.

PLM DOC NO. D028797

Bio-Rad Laboratories
2000 ALFRED NOBEL DR. HERCULES, CA. 94547

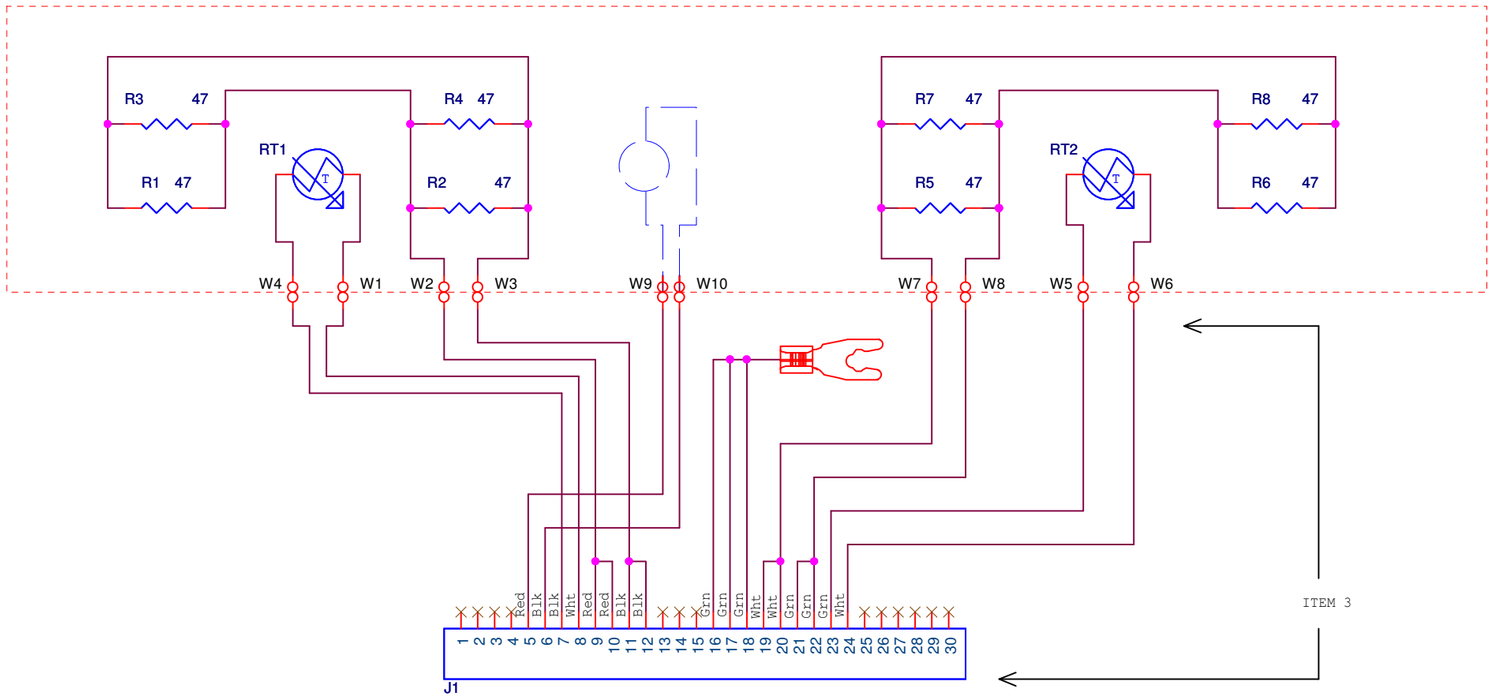
DWG TITLE
PCBA, SINGLE LID, ALUM CLAD

SIZE	DWG NO.	REV
B	11565	F

SCALE: 1.000 SHEET 1 OF 1

FABPCB_11564_H.pcb – Tue Dec 29 14:54:22 2009

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REV	ECO	DRN/DATE	CHK/DATE	APP/DATE
C	BP-023624	JS 05/14/09	YY 05/15/09	FS 05/22/09
B	BP012107	PJ_04/13/07	MC 4/24/07	PJ_04/25/07

REVISIONS

UNLESS OTHERWISE SPECIFIED

TOLERANCES ARE
X. +/- X.
X.X +/- X.X
X.XX +/- X.XX
X.XXX +/- X.XXX
ANGLES +/- 0.5 DEG

SURFACE ROUGHNESS

DIMENSIONS ARE IN MILLIMETERS [INCHES]

PROJECT NO:

APPROVALS	DATE
DRW: P.Jones	01/22/07
CHK: R.A.Wakeling	02/14/07
ENG: P.Jones	02/14/07
MFG: .	.
MKT: .	.

DO NOT SCALE DRAWING

PLM DOC NO. D037009

Bio-Rad Laboratories,
2000 Alfred Nobel Dr. Hercules, Ca. 94547

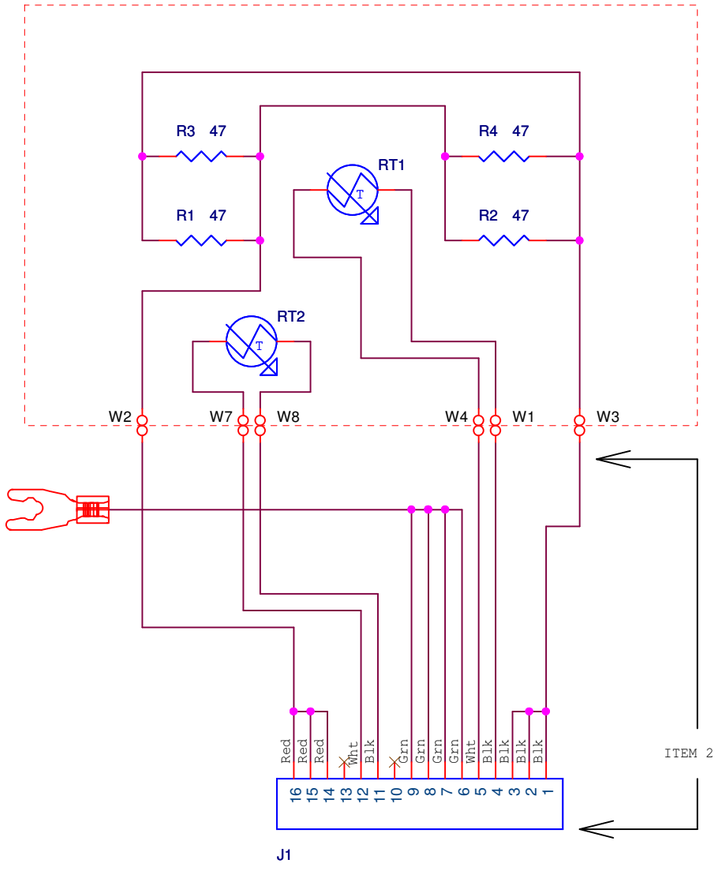
DWG TITLE

SCH, LID HEATER, SINGLE
Aluminum Clad

SIZE	DWG NO	REV
B	D037009	C

SCALE: NONE SHEET: 1 OF 1

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REV	ECO	DRN/DATE	CHK/DATE	APP/DATE
C	BP023624	FS_05/22/09	YY_05/22/09	FS_05/22/09
B	BP014093	PJ_08/27/07	MC_08/27/07	PJ_08/27/07

REVISIONS

UNLESS OTHERWISE SPECIFIED

TOLERANCES ARE
X. +/- X.
X.X +/- X.X
X.XX +/- X.XX
X.XXX +/- X.XXX
ANGLES +/- 0.5 DEG

SURFACE ROUGHNESS

DIMENSIONS ARE IN MILLIMETERS [INCHES]

PROJECT NO:

APPROVALS	DATE
DRW: P.Jones	01/24/07
CHK: R.A.Wakeling	02/14/07
ENG: P.Jones	02/14/07
MFG: .	.
MKT: .	.

DO NOT SCALE DRAWING

PLM DOC NO. D037008

Bio-Rad Laboratories,
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DWG TITLE

SCH,DUAL LID HEATER

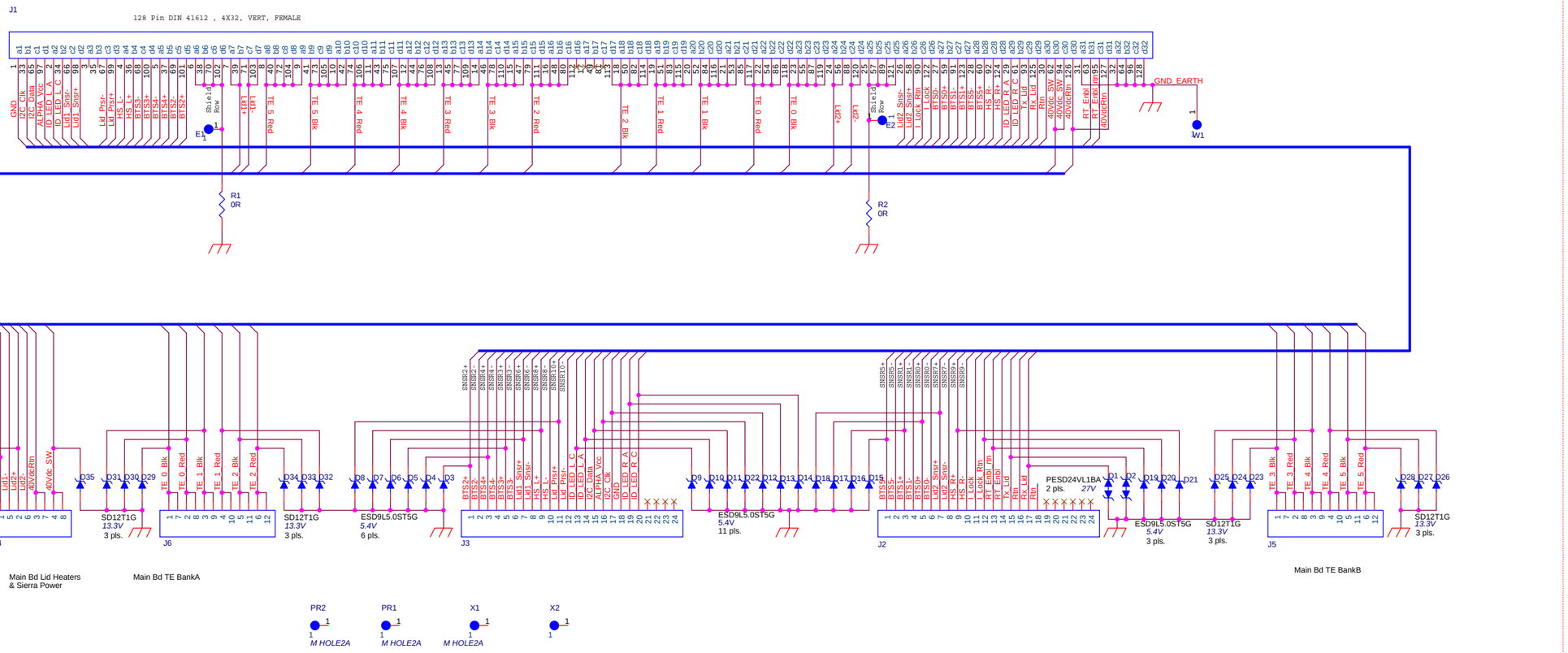
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B	D037008	C

SCALE: NONE

SHEET: 1 OF 1

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REV	BP #	CHANGE DESCRIPTION	CHG'D BY /DATE	CHK'D BY /DATE	APRVD BY /DATE
A	BP-036994	Release to Production	SP 02/27/12	SP 02/27/12	FS 03/02/12



APPROVAL	DATE
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CHK'D: SRP	12/6/11
ENG'R: SRP	8/15/11
MGT: FS	02/27/12

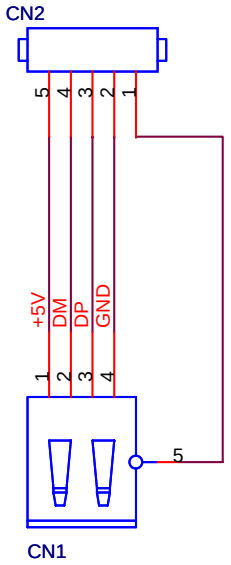
BIO-RAD
Life Science Group
2000 Alfred Nobel Dr.
Hercules, CA 94547

SCH,ALPHA INTERCONNECT
C1000 T

Size	DOC ID NO:	Rev
C	D076256	A

DATA FILE NAME	Scale	Sheet
D076256REV_A.DSN	NONE	1 of 1

REVISIONS					
REV	BP #	DESCRIPTION OF CHANGE	CHANGED BY/DATE	CHECKED BY/DATE	APPROVED BY/DATE
A	031093	INITIAL RELEASE	SM 112910	MT 120310	FS 121010



Note: Make DM,DP parallel and same length, close to each other, do not use vias

DRAWN BY/DATE **MTIMOTI/10-14-10**	DO NOT SCALE DRAWING	*BIO-RAD LABORATORIES* 1329 Meyerside Drive. Mississauga, Ontario. L5T 1C9
CHECKED BY/DATE	UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES.	
ENG'R APPR BY/DATE	TOLERANCE FRACTION +/-.032 .XX +/-.01 .XXX +/-.005 ANGLE +/-0'30'	**SCHEM,PCB,USB THUMB DRI BD,T100**
MGMT APPR / DATE	THE INFORMATION CONTAINED IN THIS DOCUMENT IS PROPRIETARY AND CONFIDENTIAL. THIS DOCUMENT MAY NOT BE COPIED OR REPRODUCED WITHOUT WRITTEN PERMISSION FROM BIO-RAD.	
MATERIAL		
MATERIAL	PLM DOC. NO. **SCHDSN_10020118.DSN**	

SIZE	SCALE	SHEET OF	DRAWING NUMBER	REV
A	N/A	**1 of 1**	**D066923**	A

REV	BP #	CHANGE DESCRIPTION	CHG'D BY /DATE	CHK'D BY /DATE	APR'VD BY /DATE
A	BP-037059	NEW RELEASE	JT 03/07/12	JT 03/07/12	FS 03/12/12

UPSTREAM PORT

FROM PC TO FLAGSHIP

USB-B FE Flagship

FLAGSHIP PRESENT
J3 IN, J4 OUT
FLAGSHIP ABSENT
J3 OUT, J4 IN

FROM PC TO SATELLITE

UPSTREAM PORT

USB-B Sat Satellite

USB-A Flagship

USB-A Satellite

USB-A Flagship

APPROVAL		DATE
DRW:	JT	02/24/12
CHK'D:	JT	02/24/12
ENG'R:	JT	02/24/12
MGT:	FS	02/24/12

DATA FILE NAME: C1000 T PHASE 2 USB HUB D079756 REV A.DSN

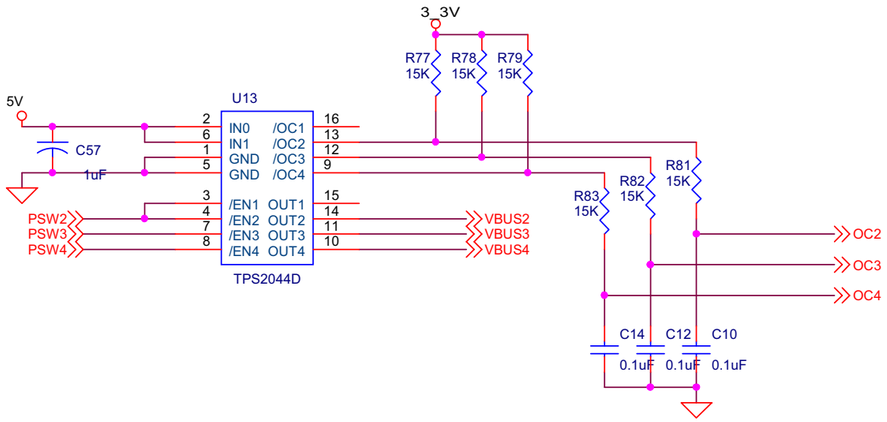
BIO-RAD Life Science Group Hercules, CA 94547 2000 Alfred Nobel Dr.

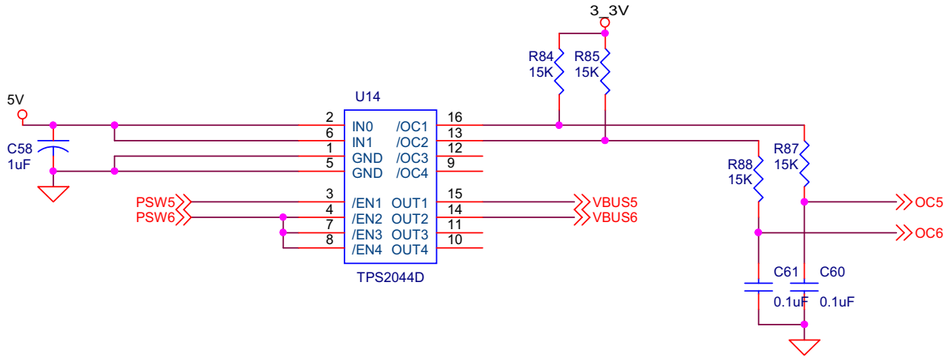
SCHEM,PCB,USB HUB, C1000 T PHASE 2

Size: C | DOC ID NO: D079756

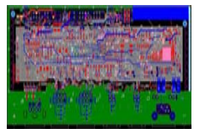
Scale: NONE | Sheet: 1 of 2 | Rev: A

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PCB1



USB Hub PCB

Life Science Group
Hercules, CA 94547
2000 Alfred Nobel Dr.

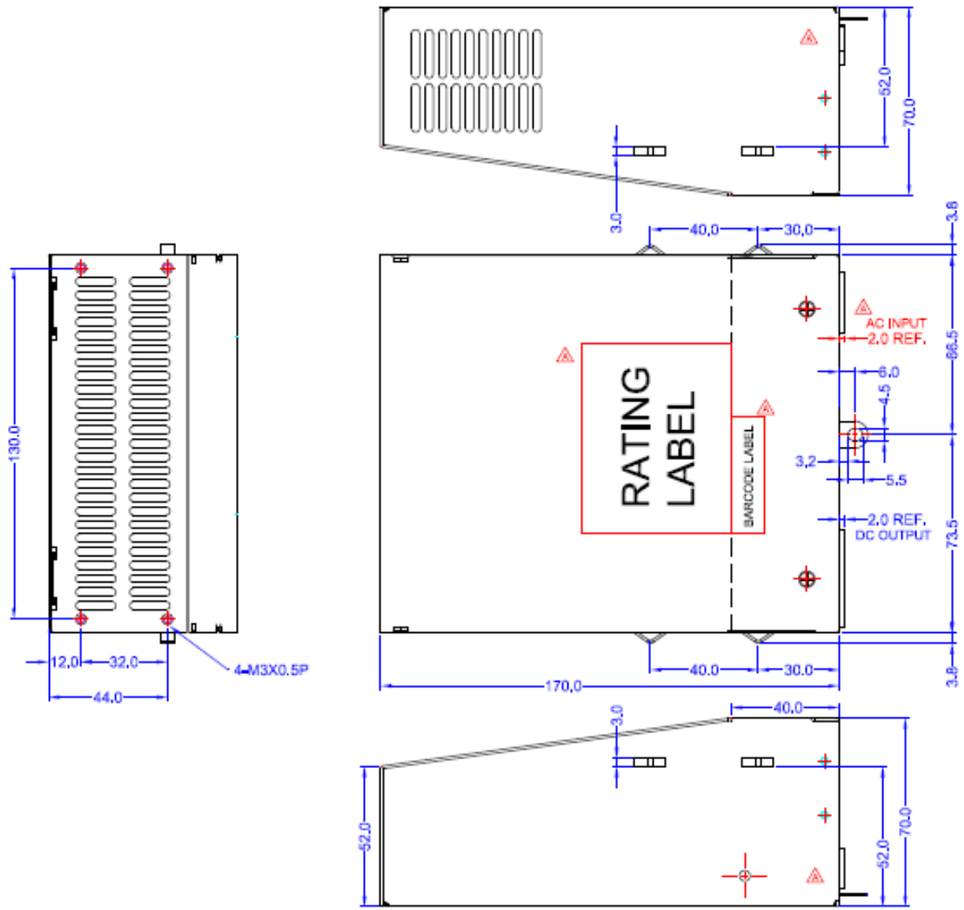
SCHEM,PCB,USB HUB, C1000 T PHASE 2

Size	DOC ID NO:		
B	D079756		
DATA FILE NAME: C1000 T PHASE 2 USB HUB D079756 REV A.DSN	Scale: NONE	Sheet: 2 of 2	Rev: A

REVISIONS

REV	B.P. #	DESCRIPTION OF CHANGE	CHANGED BY/DATE	CHECKED BY/DATE	APPROVED BY/DATE
A	BP-037011	PRODUCTION RELEASE AS REV A = REV 1.	YY 02-29-12	DC 03-02-12	FS 03-05-12

500-0650+B05



FILE:I\nda,hsu\TG10-0650-01\2D\FINAL\500-0650+B05 OUTLINE

REV.	DESCRIPTION	ECN , ECO	DATE
0B	ADD RATING LABEL , BARCODE LABEL , INLET LABEL & AC INPUT DIMENSION, REMOVE RIVET HOLES,		2011,05,25

DRAWN 2011,05,25 | DESIGNED | CHECKED | APPVD

LEAD YEAR ENTERPRISE CO.,LTD.

UNIT mm | SCALE | SHEET 1 OF 1 | Revision 0B | DATE 2010,05,12

TOLERANCE: UNLESS OTHERWISE SPECIFIED

500-0650+B05

TG10-0650-01 OUTLINE

NOTES: (UNLESS OTHERWISE SPECIFIED);

1. MATERIAL: VENDOR'S DRAWING SHOWN ABOVE AND BOM, SPS SPECIFICATION, LABEL AND PACKING LIST ZIPPED, REFERENCE PLM DOC ID D066114-CURRENT REVISION.

[2.] ALL DIMENSIONS AND TOLERANCE PER VENDOR'S DRAWING.

DRAWN BY/DATE YY 02-28-11
CHECKED BY/DATE DC 02-28-11
ENG'R APPR./DATE DC 02-28-11
MGMT APPR./DATE FS 03-10-11
MATERIAL SEE NOTES
FINISH N/A

DO NOT SCALE PRINTS

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES 2

TOLERANCES

FRACTION	.XX	.XXX	ANGLE
+/-.032	+/-.01	+/-.005	+/-0° 30"

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PLM DOC NO.: D066114

BIO-RAD LABORATORIES
2000 ALFRED NOBEL DRIVE • HERCULES, CA 94547

POWER SUPPLY, C1000 TOUCH

SIZE	SCALE	SHEET OF	ERP ITEM NO.	REV
B	1/4	1/1	10019857	A

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FRONT PANEL INTERFACE

LCD

J3 — CON30

CSDisplay_int
RESETn_int
A0_int
/WE_int
E_DISP_int
DSPL0
DSPL1
DSPL2
DSPL3
DSPL4
DSPL5
DSPL6
DSPL7

R2 4.75K
R4 4.75K
R5 4.75K
C2 4.7u
C3 4.7u
C4 4.7u
C5 1u
C6 1u
C7 1u
C8 1u
C9 1u

U1 — 54ACT244
R30 4.75K
R31 4.75K

E_DISP
CSDisplay
RESETn
A0
/WE
/RD

CSKey_latch
CSKey_WR
CSKey_RD

U2 — 54ACT245
DSPL[7..0]
/RD_int
DISPLAY_OE
D[0..7]

J2 — 87831-2620
E_DISPL
/RD
/WE
A0
CSKey_RD
DISPLAY_OE
CSDisplay
CSKey_latch
CSKey_WR
RESETn
D6
D7
D4
D5
D2
D3
D0
D1

C46 220u

R34–R41 10K

D0
D1
D2
D3
D4
D5
D6
D7

C28–C31 47pF
C32–C35 47pF

USER INTERFACE

KEYPAD

J4 — CON11

D1–D20 1N4148

R14 332
R15 332
R16 332
R17 332
R18 332
R19 332
R20 332
R21 332
R22 332
R23 332

R32 0 OHM
R33 0 OHM

C10 .1u
C15 .1u
C11 .1u
C12 .1u
C13 .1u
C14 .1u

R6 10K
R7 10K
R8 10K
R9 10K
R10 10K
R11 10K
R12 10K
R13 10K

C16 4700p
C17 4700p
C18 4700p
C19 4700p
C20 4700p
C21 4700p
C22 4700p

U3 — 74ACT574
U4 — 74ACT574

C24 4700p
C25 4700p
C26 4700p

R42–R44 10K
R46–R51 10K

C36 47pF
C38 47pF
C39 47pF
C40 47pF
C41 47pF
C42 47pF
C43 47pF
C44 47pF
C45 47pF

R45 2.21K

J5 — V_backlight
R29 10 OHM 1W

C27 .1u

SEE ASSOCIATED BOM

REV	ECO	DRN/DATE	CHK/DATE	APP/DATE
A	BP011884	PJ_04/03/07	MC 4/3/07	GC 4/3/07

REVISIONS

UNLESS OTHERWISE SPECIFIED
TOLERANCES ARE
X. +/- X.
X.X +/- X.X
X.XX +/- X.XX
X.XXX +/- X.XXX
ANGLES +/- 0.5 DEG
SURFACE ROUGHNESS
DIMENSIONS ARE IN MILLIMETERS [INCHES]

PROJECT NO:

APPROVALS	DATE
DRW: P.Jones	04/03/07
CHK: M.Carr	4/3/07
ENG: G.Chan	4/3/07
MFG: .	.
MKT: .	.

DO NOT SCALE DRAWING
DATE: Wednesday, April 04, 2007

Bio-Rad Laboratories, Inc. 245 Winter Street
New England Operations Waltham, MA 02451

DWG TITLE
SCH, Satellite Display

SIZE	DWG NO	REV
C	SC11583	A

SCALE: NONE SHEET: 1 OF 1

REVISION					
REV	BP#	DESCRIPTION OF CHANGE	CHG'D BY/DATE	CHCK'D BY/DATE	APPR. BY/DATE
B	BP-038893	ADD ITEMS 10026065, 10022051, 10023778 & 10023779 TO BOM.	YY 07/19/12	RR 07/27/12	RR 07/27/12

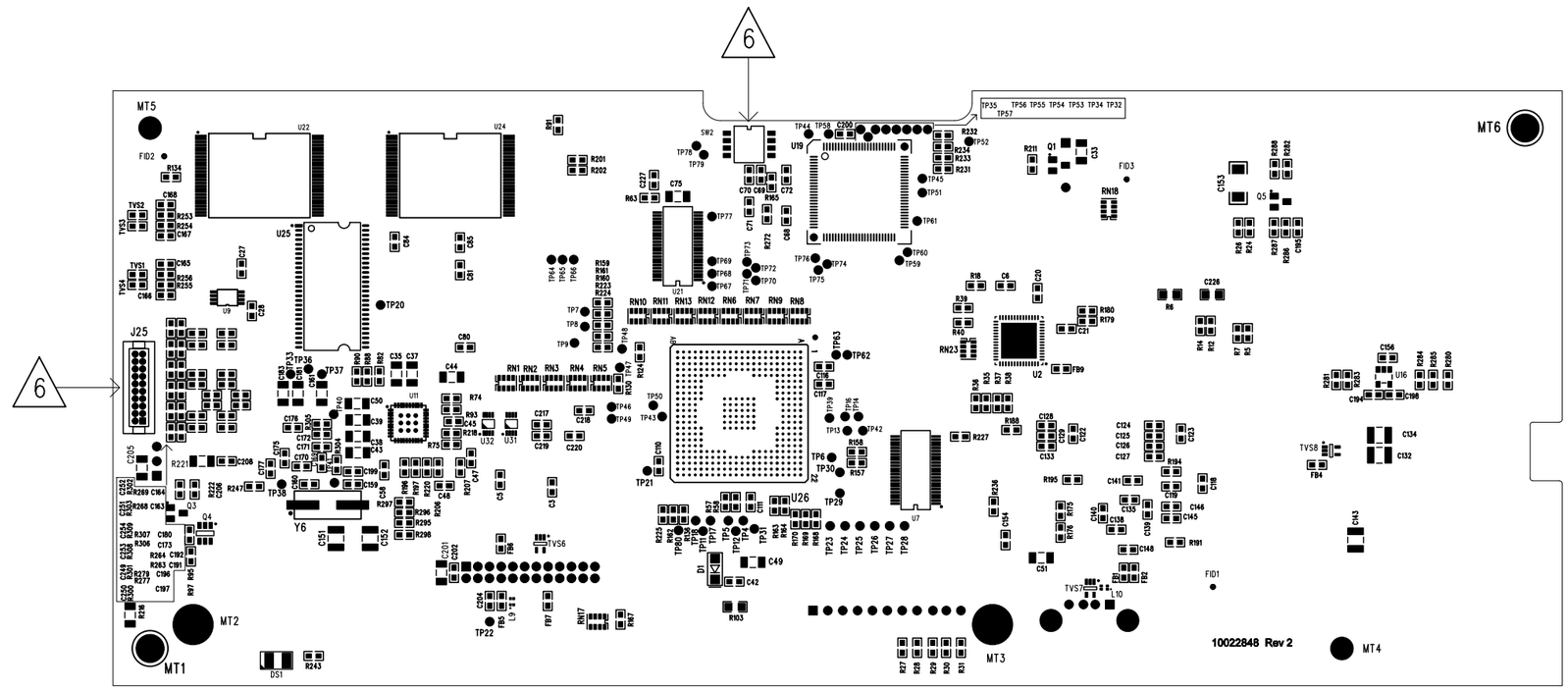
NOTES: UNLESS OTHERWISE SPECIFIED.

1. ESD HANDLING AND ASSEMBLY SHALL MEET OR EXCEED LATEST ANSI/ESD-20-20 SPECIFICATIONS.
2. SOLDER PASTE SHALL MEET AND CONFORM TO LATEST J-STD-005 SPECIFICATIONS.
3. ASSEMBLY CLEANING PRE AND POST SHALL MEET OR EXCEED LATEST IPC-A-610 SPECIFICATIONS.
4. SOLDER MATERIALS (BOTH REFLOW AND WAVE SOLDER) SHALL BE SAC COMPATIBLE LEAD-FREE SOLDER.

△5 STAMP CURRENT REVISION OF BOM ON SECONDARY LAYER WHERE SHOWN

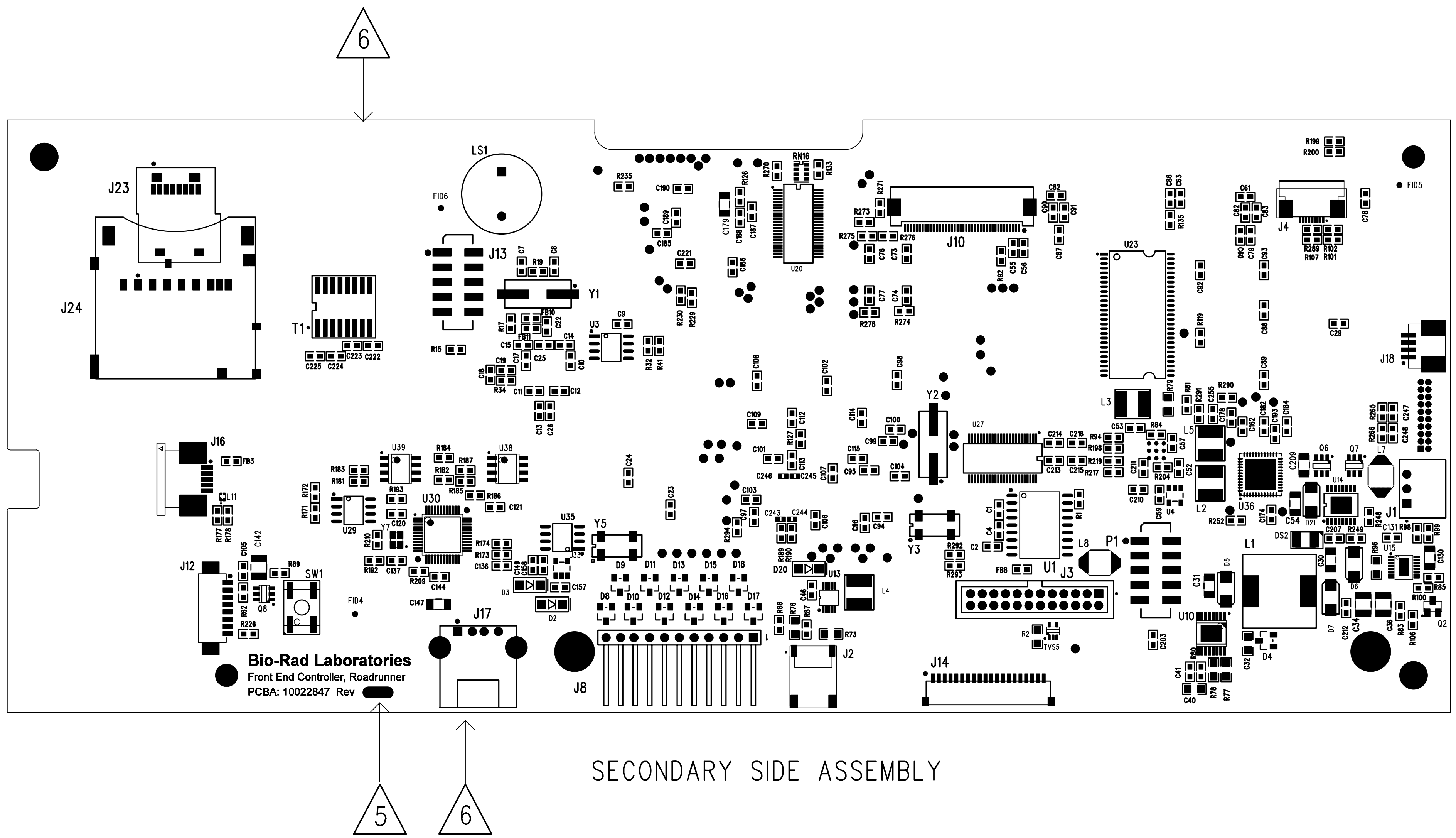
△6 NO LOAD COMPONENTS: J7, J24, J25, SW2 J2, J8, D8-D18
R32, R35, R38, R92, R177, R178, R179, R180, R216, R217, R232, R235, R287, R295, R298

7. LABEL ASSEMBLY PER BIO-RAD LABELING PROCEDURE, REFERENCE, PLM DOC ID D049689-CURRENT REVISION.



PRIMARY SIDE ASSEMBLY

DRWN BY/DATE RR 01/20/12	DO NOT SCALE DRAWING	BIO-RAD LABORATORIES			
CHCK'D BY/DATE RR 01/20/12	DEBURR AND BREAK ALL SHARP EDGES	2000 ALFRED NOBEL DRIVE HERCULES, CA 94547			
ENG'R.APPR./DATE RR 01/20/12	UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN MILLIMETERS	PCB ASSY FE CNTL'R, RR PHASE2			
MGMT APPR/DATE FS 01/20/12	TOLERANCE: INT ± 1, .X ± .25, .XX ± .13, ANGLE ± .5°				
MAT'L N/A	THE INFORMATION CONTAINED IN THIS DOCUMENT IS PROPRIETARY AND CONFIDENTIAL. THIS DOCUMENT MAY NOT BE COPIED OR REPRODUCED WITHOUT WRITTEN PERMISSION OF BIO-RAD.	SIZE B	SCALE N/A	SHEET 1/ 2	DRAWING NO. 10022847 / REV B
FINISH N/A	PLM DOC NO: D076528				

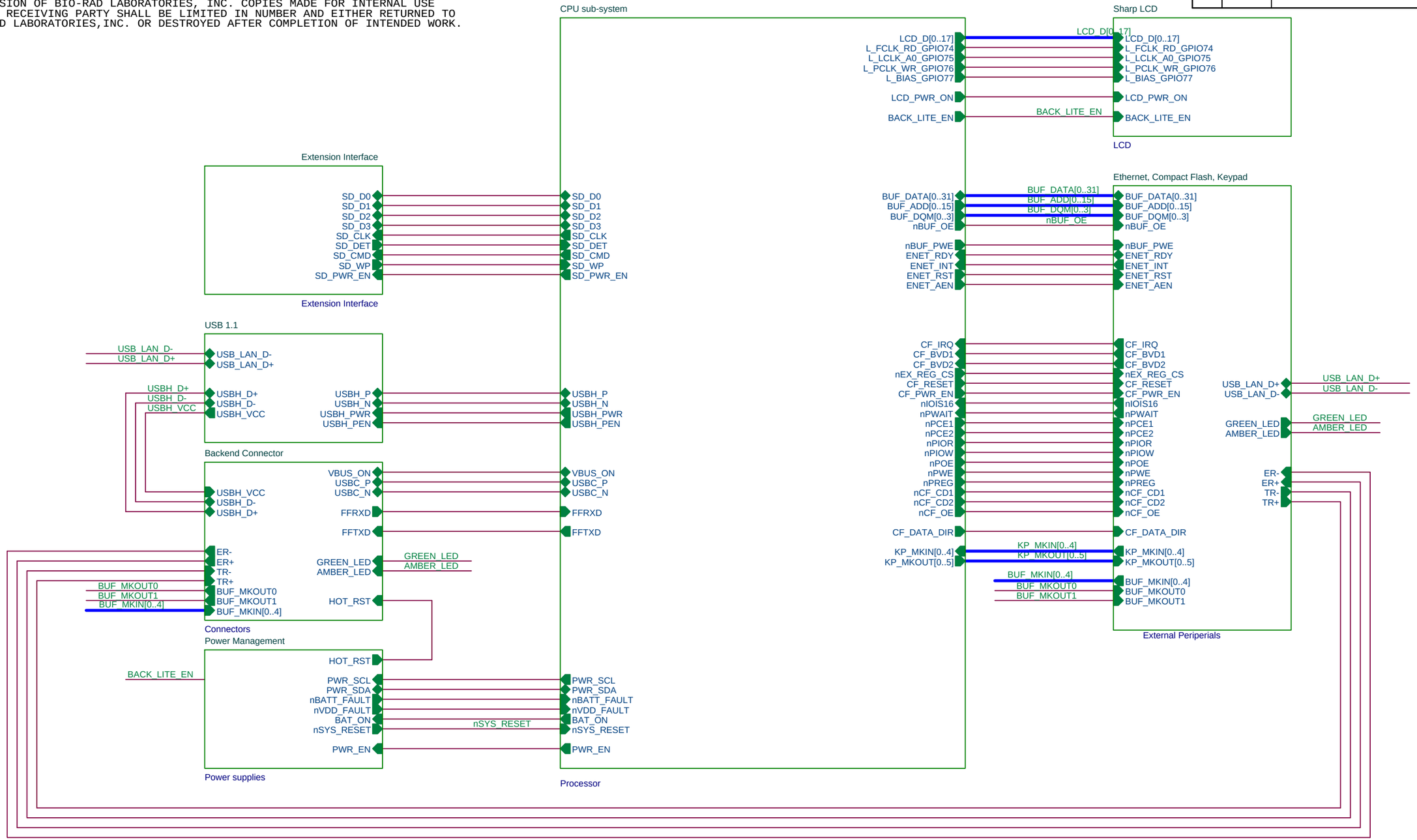


SECONDARY SIDE ASSEMBLY

DO NOT SCALE DRAWING	BIO-RAD LABORATORIES 2000 ALFRED NOBEL DRIVE HERCULES, CA 94547
DEBURR AND BREAK ALL SHARP EDGES	
UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN MILLIMETERS	PCB ASSY FE CNTL'R, RR PHASE2
TOLERANCE INT ± 1 .X ± .25 .XX ± .13 ANGLE ± .5°	
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PLM DOC NO: D076528	

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REV	BP #	CHANGE DESCRIPTION	CHG'D BY /DATE	CHK'D BY /DATE	APRV'D BY /DATE
A	BP-037338	RELEASED TO PRODUCTION	RR 03/19/12	RR 03/22/12	FS 03/26/12



APPROVAL		DATE
DRW:	RR	12/08/09
CHK'D:	RR	03/01/12
ENG'R:	RR	03/01/12
MGT:	FS	03/01/12

DATA FILE NAME
D076531 Rev_x.DSN

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Life Science Group
Hercules, CA 94547
2000 Alfred Nobel Dr.

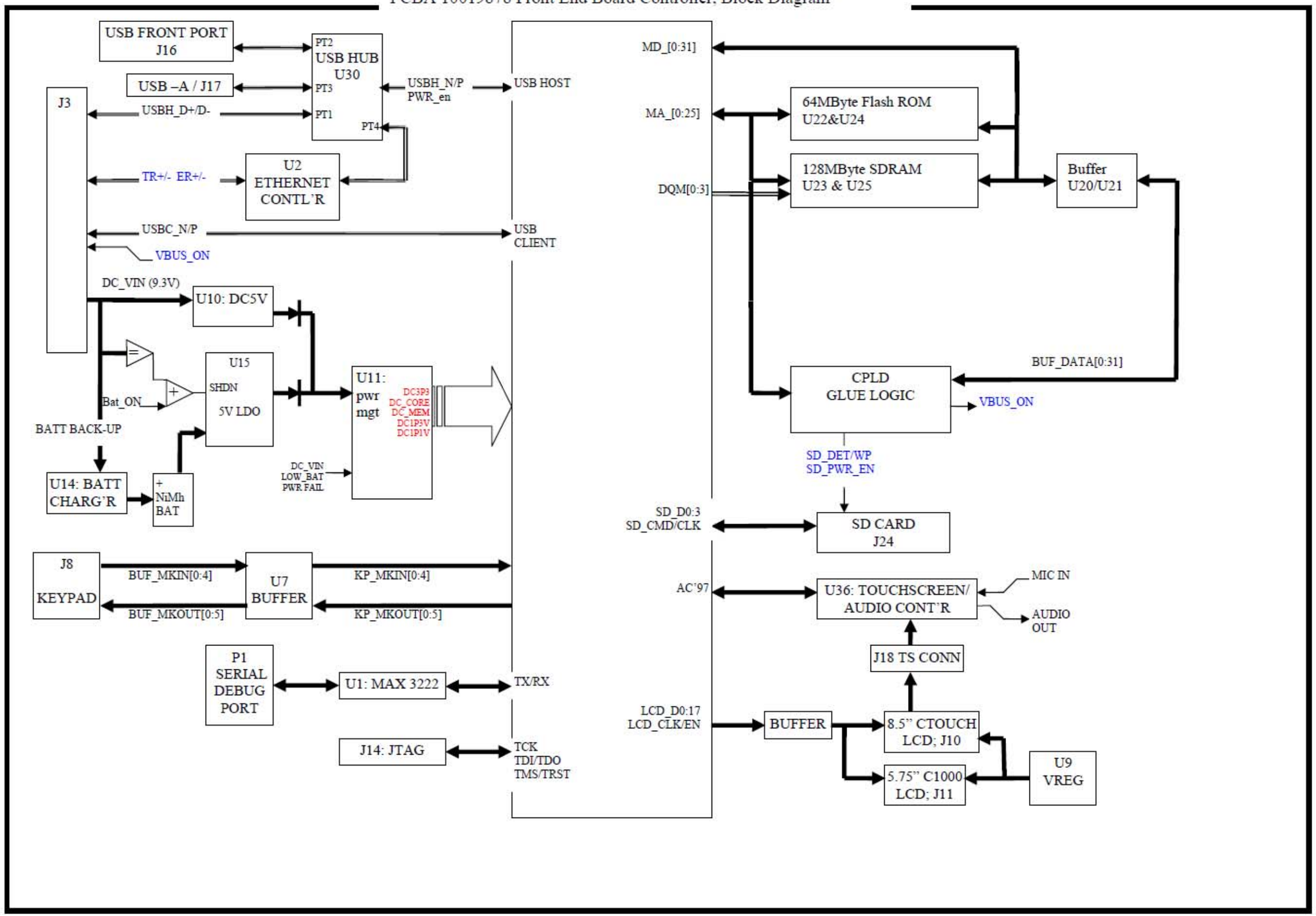
FE CONTRL'R, Phase II

Size	DOC ID NO:	Rev
B	D076531	A

Scale NONE | Sheet 1 of 16

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PCBA 10019878 Front End Board Controller, Block Diagram



BIO-RAD

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Hercules, CA 94547
2000 Alfred Nobel Dr.

FE CONTRL'R, Phase II

Size	DOC ID NO:	
B	D076531	
DATA FILE NAME	Scale	Sheet / Rev
D076531 Rev_x.DSN	NONE	2 of 16 / A

64 MBYTE Flash Memory

0x00000000 to 0x03FFFFFF

Power Supply Decoupling
Flash memory devices require careful power supply de-coupling. Three basic power supply current considerations are 1) standby current levels, 2) active current levels, and 3) transient peaks produced when CE# and OE# are asserted and deasserted. When the device is accessed, many internal conditions change. Circuits within the device enable charge-pumps, and internal logic states change at high speed. All of these internal activities produce transient signals. Transient current magnitudes depend on the device outputs' capacitive and inductive loading. Two-line control and correct de-coupling capacitor selection suppress transient voltage peaks. Because flash memory devices draw their power from VCC, VPP, and VCCQ, each power connection should have a 0.1 µF ceramic capacitor to ground. High-frequency, inherently low-inductance capacitors should be placed as close as possible to package leads.
Additionally, for every eight devices used in the system, a 4.7 µF electrolytic capacitor should be placed between power and ground close to the devices. The bulk capacitor is meant to overcome voltage droop caused by PCB trace inductance.

U22

Intel StrataFlash 16M x 16 TSSOP-56

JS28F640P30
JS28F256P30B85

pg3,7,11 MA_[0..25]

MA_0 MA_1 MA_2 MA_3 MA_4 MA_5 MA_6 MA_7 MA_8 MA_9 MA_10 MA_11 MA_12 MA_13 MA_14 MA_15 MA_16 MA_17 MA_18 MA_19 MA_20 MA_21 MA_22 MA_23 MA_24 MA_25

TP62 TP63

A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15 A16 A17 A18 A19 A20 A21 A22 A23 A24

DQ0 DQ1 DQ2 DQ3 DQ4 DQ5 DQ6 DQ7 DQ8 DQ9 DQ10 DQ11 DQ12 DQ13 DQ14 DQ15

MD_0 MD_1 MD_2 MD_3 MD_4 MD_5 MD_6 MD_7 MD_8 MD_9 MD_10 MD_11 MD_12 MD_13 MD_14 MD_15

MD_[0..31] pg3,4

WAIT RFU

nCE nOE nWE nWP nADV nRST VPP CLK

pg3,11 nFlash_CS
pg3,7,11 nOE
pg3,7,11 nWE
nWP_1
pg3,11 nFLASH_RST
pg3,8 VPEN

VCC_1 VCC_2 VCCQ

VSS_1 VSS_2 VSS_3

DC3P3V
DC1P8V

R134 10K
R199 10K
R200 10K
C61 0.1uF
C78 0.1uF
C60 0.1uF
C79 4.7uF
C82 0.1uF
C83 0.1uF

U24

Intel StrataFlash 16M x 16 TSSOP-56

JS28F640P30
JS28F256P30B85

pg3,7,11 MA_[0..25]

MA_2 MA_3 MA_4 MA_5 MA_6 MA_7 MA_8 MA_9 MA_10 MA_11 MA_12 MA_13 MA_14 MA_15 MA_16 MA_17 MA_18 MA_19 MA_20 MA_21 MA_22 MA_23 MA_24 MA_25

A1 A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12 A13 A14 A15 A16 A17 A18 A19 A20 A21 A22 A23 A24

DQ0 DQ1 DQ2 DQ3 DQ4 DQ5 DQ6 DQ7 DQ8 DQ9 DQ10 DQ11 DQ12 DQ13 DQ14 DQ15

MD_16 MD_17 MD_18 MD_19 MD_20 MD_21 MD_22 MD_23 MD_24 MD_25 MD_26 MD_27 MD_28 MD_29 MD_30 MD_31

MD_[0..31] pg3,4

WAIT RFU

nCE nOE nWE nWP nADV nRST VPP CLK

pg3,11 nFlash_CS
pg3,7,11 nOE
pg3,7,11 nWE
nWP_2
pg3,11 nFLASH_RST
pg3,8 VPEN

VCC_1 VCC_2 VCCQ

VSS_1 VSS_2 VSS_3

DC3P3V
DC1P8V

R135 10K
R201 10K
R202 10K
C62 0.1uF
C86 0.1uF
C87 0.1uF
C63 4.7uF
C90 0.1uF
C91 0.1uF

128 MBYTE SDRAM

0xA0000000 to 0xA7FFFFFF

U23

32M x 16 SDRAM

MT48LC32M16A2P

pg3,7,11 MA_[0..25]

MA_10 MA_11 MA_12 MA_13 MA_14 MA_15 MA_16 MA_17 MA_18 MA_19 MA_20 MA_21 MA_22

A[0] A[1] A[2] A[3] A[4] A[5] A[6] A[7] A[8] A[9] A[10] A[11] A[12]

NC

D[0] D[1] D[2] D[3] D[4] D[5] D[6] D[7] D[8] D[9] D[10] D[11] D[12] D[13] D[14] D[15]

MD_0 MD_1 MD_2 MD_3 MD_4 MD_5 MD_6 MD_7 MD_8 MD_9 MD_10 MD_11 MD_12 MD_13 MD_14 MD_15

MD_[0..31] pg3,4

pg3,7 nSDCS_0
pg3,7,11 nWE
pg3,7 nSDCAS_ADV
pg3,7 nSDRAS

nCS nWE nCAS nRAS

R119 24.3
pg7 SDCKE1
FLASH_SDCKE1
pg3,7 SDCLK1

CLK CKE

pg3,7 MA_23
pg3,7 MA_24

BA[0] BA[1]

pg7 DQM0
pg7 DQM1

LDQM UDMQ

VDD_1 VDD_2 VDD_3

VDDQ_1 VDDQ_2 VDDQ_3 VDDQ_4

VSS_1 VSS_2 VSS_3

VSSQ_1 VSSQ_2 VSSQ_3 VSSQ_4

TSOP-54

DC3P3V

C80 0.1uF
C81 0.1uF
C84 0.1uF
C85 0.1uF

U25

32M x 16 SDRAM

MT48LC32M16A2P

pg3,7,11 MA_[0..25]

MA_10 MA_11 MA_12 MA_13 MA_14 MA_15 MA_16 MA_17 MA_18 MA_19 MA_20 MA_21 MA_22

A[0] A[1] A[2] A[3] A[4] A[5] A[6] A[7] A[8] A[9] A[10] A[11] A[12]

NC

D[0] D[1] D[2] D[3] D[4] D[5] D[6] D[7] D[8] D[9] D[10] D[11] D[12] D[13] D[14] D[15]

MD_16 MD_17 MD_18 MD_19 MD_20 MD_21 MD_22 MD_23 MD_24 MD_25 MD_26 MD_27 MD_28 MD_29 MD_30 MD_31

MD_[0..31] pg3,4

pg3,7 nSDCS_0
pg3,7,11 nWE
pg3,7 nSDCAS_ADV
pg3,7 nSDRAS

nCS nWE nCAS nRAS

TP20 1
FLASH_SDCKE1
pg3,7 SDCLK1

CLK CKE

pg3,7 MA_23
pg3,7 MA_24

BA[0] BA[1]

pg7 DQM2
pg7 DQM3

LDQM UDMQ

VDD_1 VDD_2 VDD_3

VDDQ_1 VDDQ_2 VDDQ_3 VDDQ_4

VSS_1 VSS_2 VSS_3

VSSQ_1 VSSQ_2 VSSQ_3 VSSQ_4

TSOP-54

DC3P3V

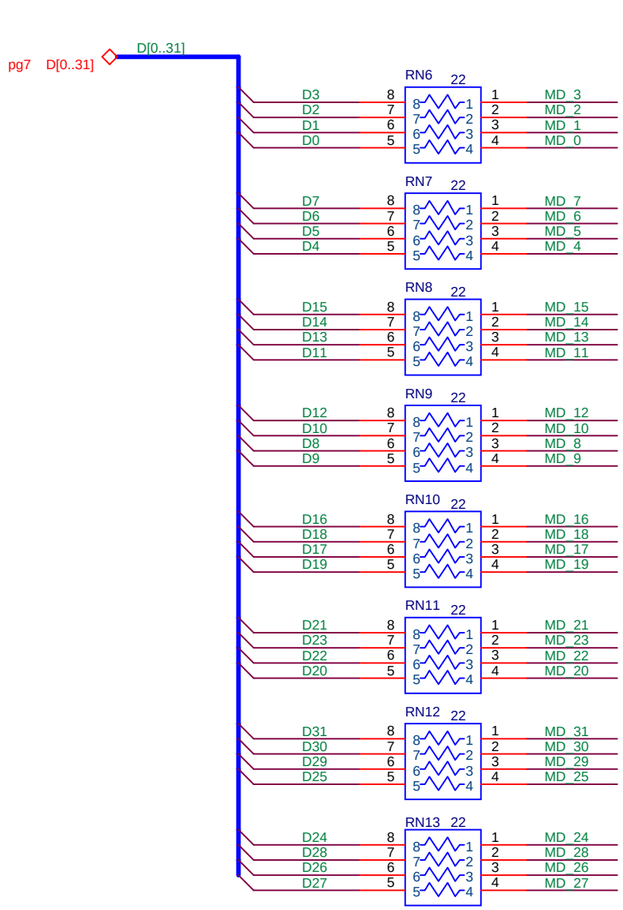
C88 0.1uF
C89 0.1uF
C92 0.1uF
C93 0.1uF

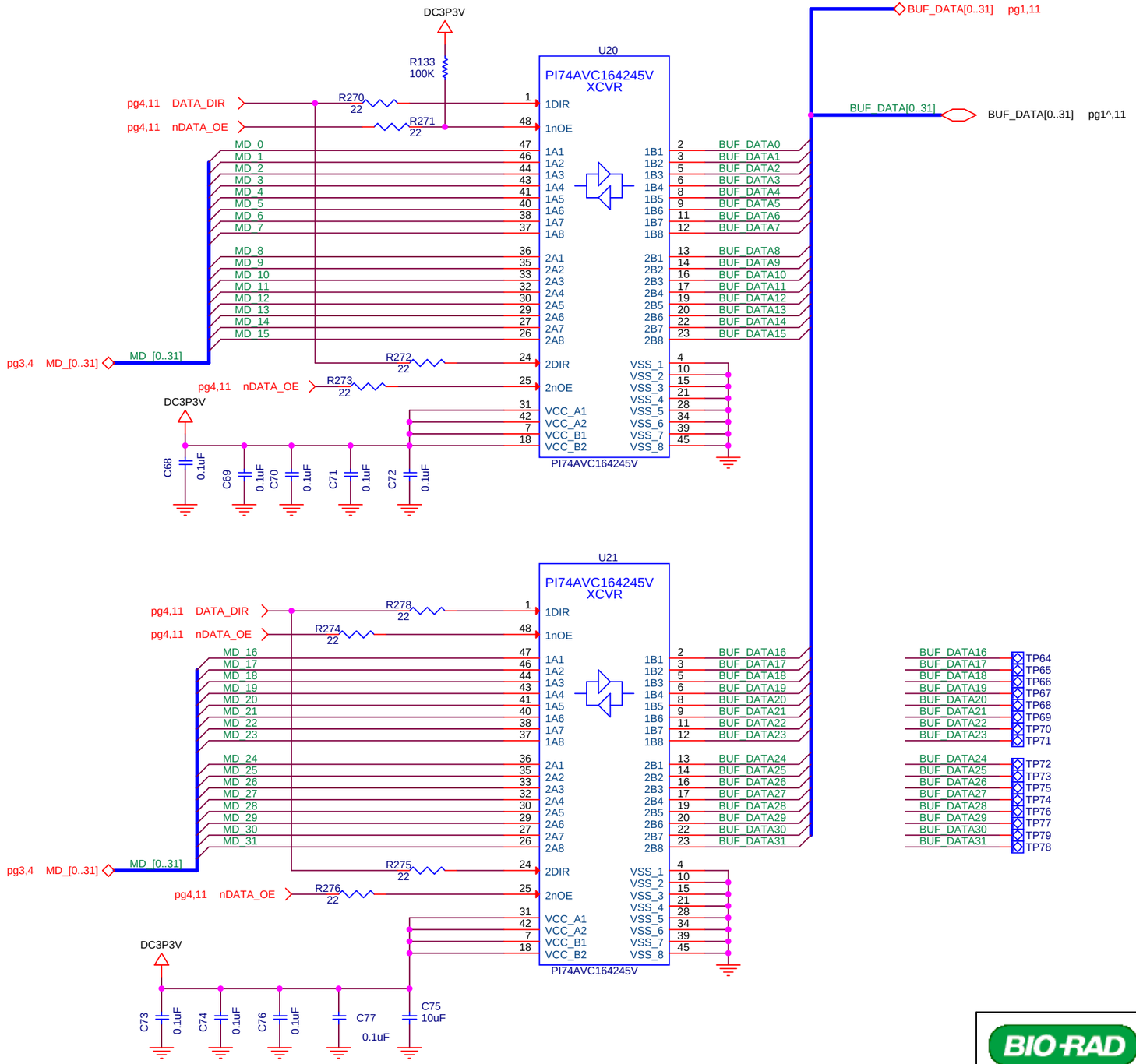
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FE CONTRL'R, Phase II

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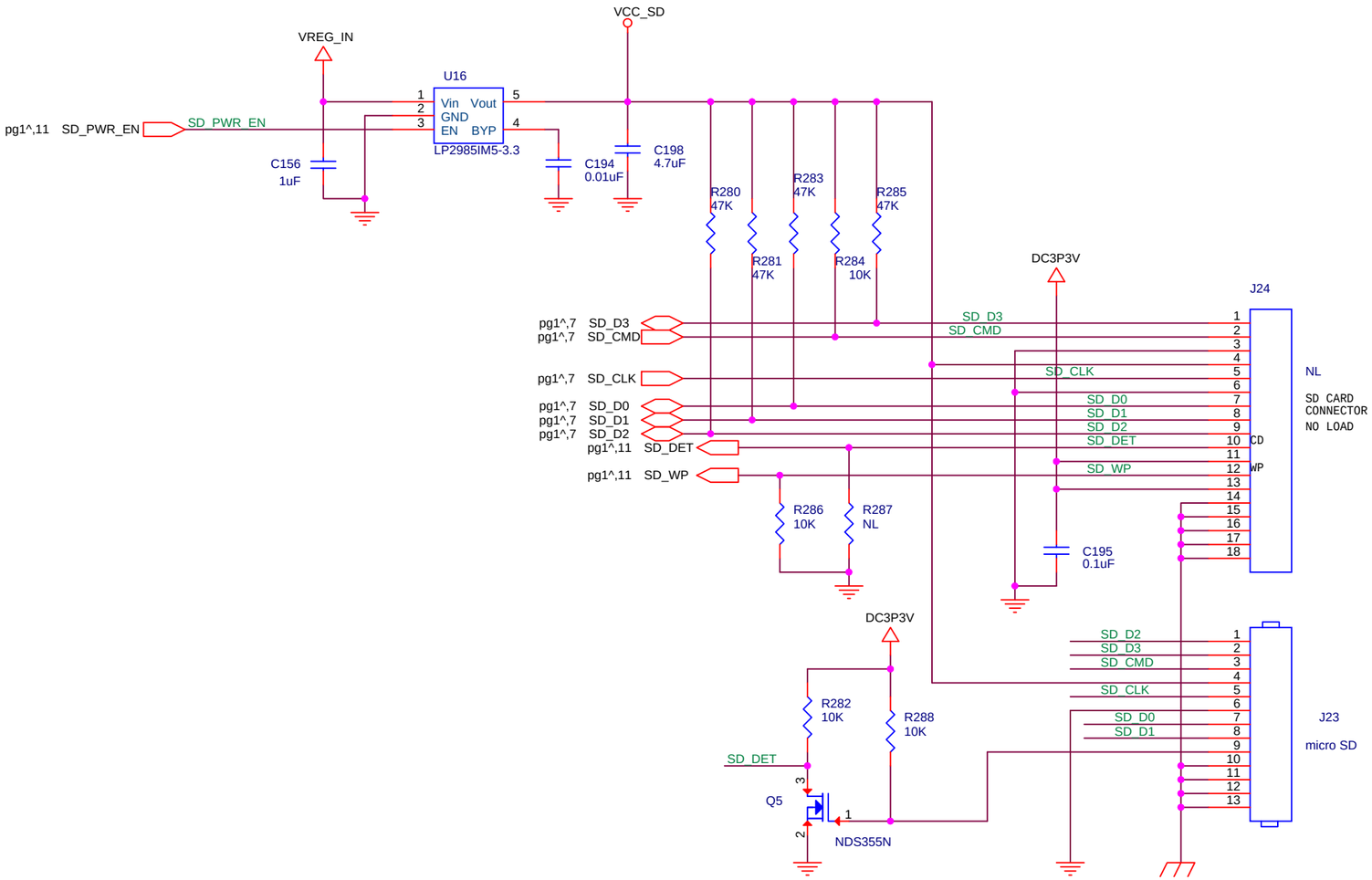
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ADDRESS BUS / CONTROL SIGNALTRANSCEIVERS

DIR=0, B->A
DIR=1, A->B

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UNKNOWN
U26C

pg3,11 MA_[0..25]

MA_25 A3 MA25
MA_24 C4 MA24
MA_23 E4 MA23
MA_22 D4 MA22
MA_21 E3 MA21
MA_20 F4 MA20
MA_19 D3 MA19
MA_18 G4 MA18
MA_17 C2 MA17
MA_16 C1 MA16
MA_15 D2 MA15
MA_14 D1 MA14
MA_13 G3 MA13
MA_12 E2 MA12
MA_11 E1 MA11
MA_10 H4 MA10
MA_9 F1 MA9
MA_8 G2 MA8
MA_7 G1 MA7
MA_6 J3 MA6
MA_5 J4 MA5
MA_4 H1 MA4
MA_3 J1 MA3
MA_2 J2 MA2
MA_1 B5 MA1
MA_0 D5 MA0

MD31 K4 D31
MD30 K2 D30
MD29 L3 D29
MD28 N1 D28
MD27 P1 D27
MD26 N2 D26
MD25 N4 D25
MD24 N3 D24
MD23 R2 D23
MD22 U1 D22
MD21 R3 D21
MD20 V1 D20
MD19 W1 D19
MD18 W2 D18
MD17 Y2 D17
MD16 V4 D16
MD15 K1 D15
MD14 L1 D14
MD13 M1 D13
MD12 M4 D12
MD11 M2 D11
MD10 R1 D10
MD9 T1 D9
MD8 P4 D8
MD7 R4 D7
MD6 U2 D6
MD5 T4 D5
MD4 U3 D4
MD3 Y1 D3
MD2 U4 D2
MD1 W3 D1
MD0 W4 D0

D[0..31] pg4

DC3P3V
R158 10K
R157 10K

pg1^,13 PWR_SCL V22 PWR_SCL/GPIO3
pg1^,13 PWR_SDA T19 PWR_SDA/GPIO4
pg11 EE_SCL EE_SCL C18 SCL/GPIO117
pg11 EE_SDA EE_SDA B20 SDA/GPIO118

pg1^,16USBC_P R169 24.3 D18 USBCP
pg1^,16USBC_N R170 24.3 E19 USBCN
C245 47pF C246 47pF

pg1^,10 USBH_P E22 USBH_P0
pg1^,10 USBH_N D22 USBH_N0
pg1^,10 USBH_PWR C22 USBHPWR0/GPIO88
pg1^,10 USBH_PEN C21 USBHPEN0/GPIO89
C243 47pF C244 47pF

E21 DREQ0/GPIO115
E20 DVAL0/GPIO116
TP4 1 nUSIM_VS1
TP5 1 nUSIM_VS2

pg9 SA_BITCLK D12 AC97_BITCLK_/GPIO28
pg9 SA_SDATA_IN A11 AC97_SDATA_IN_0_/GPIO29
pg9 SA_SDATA_OUT B11 AC97_SDATA_OUT_/GPIO30
pg9 SA_SYNC C11 AC97_SYNC/GPIO31
pg9 SA_nAC97_RESET A10 AC97_RESET*/PIO113

DC3P3V
R162 10K
U20 GPIO0
U21 GPIO1
V19 BOOT_SEL0
R225 10K
32bit BOOT_SEL0 = 0

1 of 3

CS0* D6 nCS0 nCS0 pg11
CS1*/GPIO15 A4 nCS1 1 TP14
CS2*/GPIO78 D8 nCS2 nCS2 pg11
CS3*/PSKTSEL/GPIO79 A5 nCS3 nCS3 pg11
CS4*/GPIO80 D7 nCS4 1 TP13
CS5*/GPIO33 C7 nCS5 1 TP16

DQM0 W8 DQM0 DQM0 pg3
DQM1 AA7 DQM1 DQM1 pg3
DQM2 AB6 DQM2 DQM2 pg3
DQM3 AB7 DQM3 DQM3 pg3

SDCS0* AA5 R223 24.3 nSDCS_0 pg3
SDCS1* Y8 R224 24.3 nSDCS_1 1 TP9
SDCS2*/GPIO20 W5 nSDCS2_MBREQ
SDCS3*/GPIO21 Y6 nSDCS3_MBGNT

SDCKE1 W7 SDCKE1 pg3
SDCLK0 AB3 R159 24.3 1 TP7
SDCLK1 AB5 R160 47.5 SDCLK1 pg3
SDCLK2 AB4 R161 24.3 1 TP8

SDCAS* Y4 nSDCAS_ADV pg3
SDRAS* W6 nSDRAS pg3

RDNWR C8 RD_nWR pg11
RDY/GPIO18 D9 RDY
R127 10K

pg1^,13 nSYS_RESET nSYS_RESET W20 RESET*

pg1^,12 KP_MKOUT[0..5]
KP_MKOUT0 AB15 KP_MKOUT0/GPIO103
KP_MKOUT1 W14 KP_MKOUT1/GPIO104
KP_MKOUT2 Y13 KP_MKOUT2/GPIO105
KP_MKOUT3 W13 KP_MKOUT3/GPIO106
KP_MKOUT4 AB14 KP_MKOUT4/GPIO107
KP_MKOUT5 AA13 KP_MKOUT5/GPIO108

pg1^,12 KP_MKIN[0..4]
KP_MKIN0 AA15 KP_MKIN0/GPIO100
KP_MKIN1 AB16 KP_MKIN1/GPIO101
KP_MKIN2 Y14 KP_MKIN2/GPIO102
KP_MKIN3 Y15 KP_MKIN3/GPIO97
KP_MKIN4 AA16 KP_MKIN4/GPIO98

pg1^,16 FFRXD B19 FFRXD/GPIO34
pg1^,16 FFTXD B17 FFTXD/GPIO39
D17 FFCTS/GPIO35
A19 FFRTS/GPIO41
B13 FFDCD/GPIO36
D13 FFDSR/GPIO37
A13 FFRI/GPIO38
C12 FFDTR/GPIO40

pg9 TS_AUDIO_IRQ R293 0 T22 GPIO9
pg9 PEN_DOWN R292 0 U22 GPIO10
pg9 GEN_IRQ R294 0 A7 GPIO12
TP80 ENET_INT A6 GPIO13
pg11 CF_CARD_DET D15 GPIO17
pg11 GPIO26 GPIO26 A14 GPIO26
pg11 GPIO27 GPIO27 C13 GPIO27

W10 GPIO81
AA8 GPIO82
AB10 GPIO83
TP29 nUSIM_RST H19 GPIO90
TP30 USIM_CLK G19 GPIO91
W16 GPIO96
AB17 GPIO99
TP6 1 USIM_VS0 F19 CIF_DD1/GPIO114
Y16 CIF_DD6/GPIO93
AA17 CIF_DD5/GPIO94
AB18 GPIO95
Y10 CIF_FV/GPIO84
AA12 CIF_MCLK/GPIO53
Y12 CIF_DD4/GPIO52

LAYOUT NOTES:
KEEP TP23-28 IN SAME GROUP; 1 x .10" SP

VREG_IN
TP23 TP24 TP25 TP26 TP27 TP28
BT_RXD D20 BTRXD_/GPIO42
BT_TXD B21 BTTXD/GPIO43
BT_CTS A20 CIF_LV/GPIO44
BT_RTS C17 GPIO45
A9 ICP_RXD/GPIO46
C10 ICP_TXD/GPIO47

J14
HEADER 10x2/SM

DC3P3V
TCK R19 TCK
TDI R22 TDI
TDO R21 TDO
TMS R20 TMS
nTRST T20 TRST*
R167 10K
P22 TESTCLK
nSYS_RESET
U19 BATT_FAULT*
V20 VDD_FAULT*

pg1^,11,13 nVDD_FAULT nVDD_FAULT pg1,11,13
pg1^,11,13 nBATT_FAULT nBATT_FAULT pg1,11,13

DC3P3V
RN17 10K
TDI TMS TDO TCK

nSDCS3_MBGNT R124 10K
nSDCS2_MBREQ R130 10K

2 of 3

UNKNOWN
U26A

DC3P3V
R126 10K

RESET_OUT* W21 nRESET_OUT pg11
PWR_EN W22 PWR_EN pg1^,11,13
SYS_EN V21 SYS_EN pg11
nPCE1 pg1,11
nPCE2 pg1,11
OE* AA4 nOE pg3,11
WE* AA3 nWE pg3,11

PWE*/GPIO49 D10 nPWE TP42
POE*/GPIO48 Y11 nPOE TP43
PCE1*/GPIO85 AA10 TP44 nPCE1 pg1^,11
PCE2*/GPIO54 AB13 TP45 nPCE2 pg1^,11
IOIS16*/GPIO57 AB9 nIOIS16 TP46
PWAIT*/GPIO56 AB8 nPWAIT TP47
PREG*/GPIO55 W9 nPREG TP48
PIOW*/GPIO51 AB12 nPIOW TP49
PIOR*/GPIO50 W12 nPIOR TP50

LCD_D[0..17] pg1^,14

L_DD17/GPIO87 M22 LCD_D17
L_DD16/GPIO86 M20 LCD_D16
L_DD15/GPIO73 L22 LCD_D15
L_DD14/GPIO72 L21 LCD_D14
L_DD13/GPIO71 L20 LCD_D13
L_DD12/GPIO70 K22 LCD_D12
L_DD11/GPIO69 J22 LCD_D11
L_DD10/GPIO68 K21 LCD_D10
L_DD9/GPIO67 K19 LCD_D9
L_DD8/GPIO66 J19 LCD_D8
L_DD7/GPIO65 K20 LCD_D7
L_DD6/GPIO64 H22 LCD_D6
L_DD5/GPIO63 J20 LCD_D5
L_DD4/GPIO62 G22 LCD_D4
L_DD3/GPIO61 F22 LCD_D3
L_DD2/GPIO60 G21 LCD_D2
L_DD1/GPIO59 H20 LCD_D1
L_DD0/GPIO58 G20 LCD_D0

L_FCLK/GPIO74 N22 L_FCLK_RD_GPIO74 pg1^,14
L_LCLK/GPIO75 N20 L_LCLK_A0_GPIO75 pg1^,14
L_PCLK/GPIO76 N21 L_PCLK_WR_GPIO76 pg1^,14
L_BIAS/GPIO77 P21 L_BIAS_GPIO77 pg1^,14
L_CS/GPIO19 P19
L_VSYNC/GPIO14 P20 1 TP17
PWM0/GPIO16 C14 1 TP18

SSPSCLK/GPIO23 A16
SSPSFRM/GPIO24 B14
SSPTXD/GPIO25 A15
SSPSCLK2/GPIO22 A12 CF_IRQ TP39
SSPRXD2/GPIO11 A8

MMDAT3/GPIO111 A17 SD_D3 SD_D3 pg1^,5
MMDAT2/GPIO110 C15 SD_D2 SD_D2 pg1^,5
MMDAT1/GPIO109 D16 SD_D1 SD_D1 pg1^,5
MMDAT0/GPIO92 A18 SD_D0 SD_D0 pg1^,5
MMCMD/GPIO112 B16 SD_CMD SD_CMD pg1^,5
MMCLK/GPIO32 C16 SD_CLK SD_CLK pg1^,5
UIO F20 USIM_IO TP31

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FE CONTRL'R, Phase II

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Power Supply Requirements

VCC_BATT	RTC, Sleep	3.3
VCC_IO		3.3
VCC_LCD		3.3
VCC_MEM	Mem controller	3.3
VCC_BB	Baseband	3.3 (not active)
USIM	USIM	3.3 (not active)
VCC_USB		3.3
VCC_PLL		1.3
VCC_SRAM	Int SRAM	1.1
VCC_CORE	OLD C1000 =	1.15 for 312 Mhz
	ROADRUNNER =	1.45 for 512 Mhz

UNKNOWN

U26B

Y2 13Mhz — AB20 PXTAL_IN, AA20 PXTAL_OUT

TP2 WAS 1Hz MON

Y3 32.768Khz — Y21 TXTAL_IN, Y22 TXTAL_OUT

C94 0.1uF — Y19 PWR_CAP0/GPIO5

AA21 PWR_CAP1/GPIO6

C95 0.1uF — Y18 PWR_CAP2/GPIO7

W17 PWR_CAP3/GPIO8

VSS_OSC Y20; VSS_PLL AA19; VSS_BB AB11; VSS0 AA22; VSS1 AB21; VSS2 AB22; VSS3 W18; VSS_CORE0 E14; VSS_CORE1 E16; VSS_CORE2 J14; VSS_CORE3 L11; VSS_CORE4 N10; VSS_CORE5 P18; VSS_CORE6 V18; VSS_CORE7 V5; VSS_CORE8 V7; VSS_CORE9 V9; VSS_CORE10 E18; VSS_CORE11 E5; VSS_CORE12 E7; VSS_CORE13 E9; VSS_CORE14 G18; VSS_CORE15 G5; VSS_CORE16 J10; VSS_CORE17 J11; VSS_CORE18 J12; VSS_CORE19 J13; VSS_CORE20 J18; VSS_CORE21 J5; VSS_CORE22 J9; VSS_CORE23 K10; VSS_CORE24 K11; VSS_CORE25 K12; VSS_CORE26 K13; VSS_CORE27 K14; VSS_CORE28 K9; VSS_CORE29 L10; VSS_CORE30 L12; VSS_CORE31 L13; VSS_CORE32 L14; VSS_CORE33 L9; VSS_CORE34 M10; VSS_CORE35 M11; VSS_CORE36 M12; VSS_CORE37 M13; VSS_CORE38 M14; VSS_CORE39 M9; VSS_CORE40 N11; VSS_CORE41 N12; VSS_CORE42 N13; VSS_CORE43 N14; VSS_CORE44 N9; VSS_CORE45 P10; VSS_CORE46 P11; VSS_CORE47 P12; VSS_CORE48 P13; VSS_CORE49 P14; VSS_CORE50 P5; VSS_CORE51 P9; VSS_CORE52 T18; VSS_CORE53 T5; VSS_CORE54 V14; VSS_CORE55 V16; VSS_IO0 AA14; VSS_IO1 AA18; VSS_IO2 B12; VSS_IO3 B15; VSS_IO4 B18; VSS_IO5 D21; VSS_IO6 H21; VSS_IO7 M21; VSS_IO8 N19

3 of 3

VCC_USIM F21 VCC_SIM — MBR0530 D20 — DC3P3V

VCC_SIM — C111 0.1uF

VCC_LCD0 J21, VCC_LCD1 M19 — DC3P3V — C106 0.1uF, C107 0.1uF, C108 0.1uF

VCC_BB AA11 — DC3P3V

VCC_USB0 A21, VCC_USB1 A22, VCC_USB2 B22, VCC_USB3 D19 — DC3P3V — C97 0.1uF, C98 0.1uF

VCC_IO1_1 B10, VCC_IO1_2 D14, VCC_IO1_3 W15 — DC3P3V

VCC_PLL AB19 — DC1P3V — C110 0.1uF

VCC_RAM0 B4, VCC_RAM1 B7, VCC_RAM2 B8, VCC_RAM3 C5 — DC1P1V — C116 0.1uF, C117 0.1uF

VCC_CORE0 D11, VCC_CORE1 E15, VCC_CORE2 F5, VCC_CORE3 H18, VCC_CORE4 H5, VCC_CORE5 L19, VCC_CORE6 L4, VCC_CORE7 R18, VCC_CORE8 R5, VCC_CORE9 U18, VCC_CORE18 V8, VCC_CORE10 E17, VCC_CORE11 E6, VCC_CORE12 E8, VCC_CORE13 F18, VCC_CORE14 U5, VCC_CORE15 V15, VCC_CORE16 V17, VCC_CORE17 V6, VCC_CORE19 W11 — DC_CORE — C112 0.1uF, C113 0.1uF, C114 0.1uF, C115 0.1uF

VCC_MEM0 AA2, VCC_MEM1 B2, VCC_MEM2 M3, VCC_MEM3 P3, VCC_MEM4 T3, VCC_MEM5 V3, VCC_MEM6 Y3, VCC_MEM7 Y5, VCC_MEM8 Y7, VCC_MEM9 Y9, VCC_MEM10 C3, VCC_MEM11 C6, VCC_MEM12 C9, VCC_MEM13 F3, VCC_MEM14 H3, VCC_MEM15 K3 — DC3P3V — C101 0.1uF, C102 0.1uF, C103 0.1uF

DC3P3V — C99 0.1uF, C100 0.1uF

DC3P3V — C109 0.1uF

VCC_BATT Y17 — VRTC — C104 0.1uF

VCC_OSC W19 VCC_OSC — C96 0.1uF

VSS_MEM0 A1, VSS_MEM1 A2, VSS_MEM2 B6, VSS_MEM3 B9, VSS_MEM4 F2, VSS_MEM5 H2, VSS_MEM6 L2, VSS_MEM7 P2, VSS_MEM8 T2, VSS_MEM9 V2, VSS_MEM10 AA1, VSS_MEM11 AA6, VSS_MEM12 AA9, VSS_MEM13 AB1, VSS_MEM14 AB2, VSS_MEM15 B1, VSS_MEM16 B3

NC C19, NC C20

CLK_REQ T21 — R136 10K

DC3P3V — RN16 10K (8 7 6 5 / 1 2 3 4) — R165 0 (2 / 1)

SW2 (1 2 3 4 / 8 7 6 5) — NL

DIP_DATA pg11

SW3 pg11

VPEN pg3

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Audio/Touchpanel CODEC
U36
WM9715L

XTAL_IN
Y6
24.576MHZ
C159 22PF
C160 22pF
XTAL_OUT

XTL_IN 2
XTL_OUT 3
SDATA_IN 8 ← pg7 SA_SDATA_IN
BIT_CLK 6 ← R252 47.5 ← pg7 SA_BITCLK
SDATA_OUT 5 ← pg7 SA_SDATA_OUT
SYNC 10 ← pg7 SA_SYNC
RESET 11 ← pg7 SA_nAC97_RESET

MIC_IN-1 → R277 0 → C197 1uF → MIC1 21
MIC_IN-2 → R279 0 → C196 1uF → MIC2 22
C250 220pF, R300 47K, C249 220pF, R301 47K

LINE_IN_L → R263 0 → C191 1uF → LINE_IN_L 23
LINE_IN_R → R264 0 → C192 1uF → LINE_IN_R 24
C247 220pF, R265 47K, C248 220pF, R266 47K

Y1_UP → R253 0 → TSY+ 15
X2_LT → R254 0 → TSX- 16
Y2_DN → R255 0 → TSY- 17
X1_RT → R256 0 → TSX+ 14
C165 1nF, C166 1nF, C167 1nF, C168 1nF

PCBEEP 19
PHONE 20

DC3P3V
C199 4.7uF, C169 0.1uF, C174 4.7uF, C170 0.1uF
DBVDD 1
DCVDD 9
AVDD2 13
AVDD 25
SPKVDD 38
HPVDD 43

DC3P3V
C177 4.7uF, C175 0.1uF, C193 4.7uF, C176 0.1uF, C172 0.1uF, C171 0.1uF
TP33 TP36 TP37 → COMP1/AUX1 29, COMP2/AUX2 30, BMON/AUX3 31
TP38 → WPR/AUX4 12

J18
1.25mm/4P
C1000 8.5"
TS CONNECTOR
1 X1_RT
2 Y1_UP
3 X2_LT
4 Y2_DN
TVS1 TVS2 TVS3 TVS4

DC3P3V
R298 NL
SPDIF_OUT 48 → TP41
ADC_IRQ 47 → R295 NL → TS_AUDIO_IRQ pg7
PENDN 46 → R296 0 → PEN_DOWN pg7
GENIRQ 45 → R297 0 → GEN_IRQ pg7

NC 44
MONOUT 33 → C178 1uF → R290 0 → MONO_OUT
R291 47K, C255 220pF
OUT3 37 → TP40

L_OUT2 35 → C163 1uF → R268 0 → LT-SPKR_OUT
R_OUT2 36 → C164 1uF → R269 0 → RT-SPKR_OUT
R303 47K, C251 220pF, R302 47K, C252 220pF
SPKGND 34 → SPK_GND
HPOUT_L 39
HPOUT_R 41
HPGND 40 → HP_GND
DGND1 4, DGND2 7, AGND 26, AGND1 18, AGND2 42, TH_PAD 49
R304 0, R305 0
C173 1uF → R306 0 → LT-HPHN_OUT
C180 1uF → R307 0 → RT-HPHN_OUT
R308 47K, C253 220pF, R309 47K, C254 220pF

VREF 27, MICBIAS 28
CAP2 32
10uF C161, C162 0.1uF
10uF C181, C182 0.1uF
10uF C183, C184 0.1uF

J25 NL
MIC_IN-1 1 2
MIC_IN-2 3 4
LINE_IN_L 5 6
LINE_IN_R 7 8
MONO_OUT 9 10
LT-HPHN_OUT 11 12 HP_GND
RT-HPHN_OUT 13 14
15 16
LT-SPKR_OUT 17 18 SPK_GND
RT-SPKR_OUT 19 20

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USB HOST

VREG_IN
1uF C118
DC3P3V
U29
USB Power Switch
IN1 OUT1 OUT2
nFAULT NC NC
EN GND
MIC2025-2YM
R171 100K
R172 47K
pg1^,7 USBH_PWR
pg1^,7 USBH_PEN
C119 4.7uF
C120 0.1uF
USBH1_VBUS
R193 51K
R194 75K

R210 0
Y7 30MHz
C145 12pF
C146 12pF
X2 X1

R173 24.3
R174 24.3
USBH_VCC
USBH_VCC pg1^,16
USBH_D- pg1^,16
USBH_D+ pg1^,16
R175 15K
R176 15K

U30
VBUSM
DM1 DP1
DM2 DP2
DM3 DP3
DM4 DP4
BUS_B
VDD33
VDD33
VDD33
VDD33REG
VSSREG
uPD720114-TQFP
VDD25OUT
AVDD
AVDD
AVSS
AVSS(R)
RREF
TEST
SYSRSTB
VDD25
VDD25
VDD25
VSS VSS VSS VSS

R189 24.3
R190 24.3
pg1^,7 USBH_N
pg1^,7 USBH_P
R163 15K
R164 15K
R192 75K
R191 51K
LAYOUT NOTE:
PLACE R189 & R190 CLOSE
TO U26 CPU

C140 0.1uF
C139 0.1uF
C138 0.1uF
C141 4.7uF

FB1 47 ohm
C147 22uF
C148 4.7uF
C144 0.1uF
FB2 47 ohm
R209 2.43K

R195 10K
C121 1uF
C137 0.1uF
C136 0.1uF
C135 0.1uF

L10
CHOKE COM-MODE
VBUS2
TVS7
SP3002-02J
J17
DEFAULT NO LOAD
DEBUG PORT ONLY!
NO LOAD

USB_LAN_D- pg1^,15
USB_LAN_D+ pg1^,15

L11
CHOKE COM-MODE
VBUS3
TVS8
SP3002-02J
FB3 47 ohm
FB4 47 ohm
FE_PT_D-
FE_PT_D+
TO FRONT USB PORT
J16
1.0mm
R178 NL
R177 NL
C134 47uF
C132 47uF

AMBER
GREEN
LED1
LED2
LED3
LED4

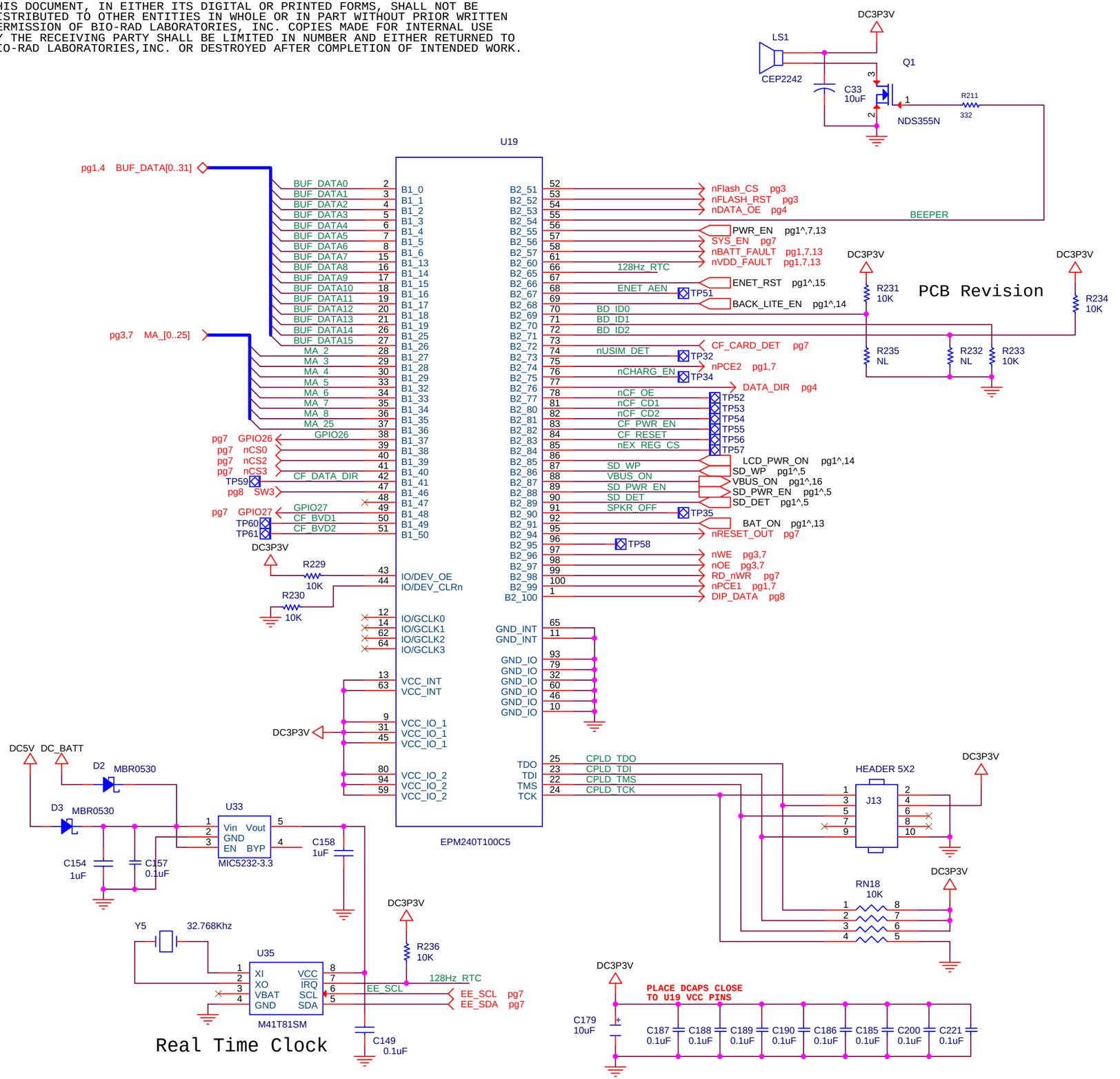
U39
U38
TPS2042BD
PPB1 CSB1 PPB2 CSB2
PPB3 CSB3 PPB4 CSB4
EN2 OC2 EN1 OC1
OUT2 OUT1 IN GND
R181 510K
R182 10K
R183 510K
R184 10K
R185 510K
R186 10K
R187 510K
R188 10K
C123 1uF
C124 4.7uF
C125 0.1uF
C127 4.7uF
C126 0.1uF
C122 1uF
C128 4.7uF
C129 0.1uF
C133 0.1uF
VBUS4

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Hercules, CA 94547
2000 Alfred Nobel Dr.

FE CONTRL'R, Phase II

Size	DOC ID NO:	
B	D076531	
DATA FILE NAME	Scale	Sheet / Rev
D076531 Rev_x.DSN	NONE	10 of 16 / A

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Memory Map		
CS0	Flash	0x0000 0000 to 0x03FF FFFF
CS2	CPLD	0x0800 0000 to 0x0BFF FFFF
CS3	LAN	0x0C00 0000 to 0x0FFF FFFF
	CF SLOT 0	0x2000 0000 to 0x2FFF FFFF
	Registers	0x4000 0000 to 0x43FF FFFF
	LCD REG	0x4400 0000 to 0x47FF FFFF
	MEM REG	0x4800 0000 to 0x4BFF FFFF
		0x4C00 0000 to 0x4FFF FFFF
	INT MEM CTRL	0x5800 0000 to 0x5BFF FFFF
	INT MEMEMORY	0x5C00 0000 to 0x5FFF FFFF
SDC0	SDRAM	0xA000 0000 to 0xA3FF FFFF

STATUS Reg	CPLD Reg 0x0A00 0004	
DIP_DATA	Bit 6	R
CF_BVD1	Bit 7	
CF_BVD2	Bit 8	
CF_DET	Bit 9	

Board Confguration Reg R/W

	CPLD Reg 0x0A00 0000	
CF_PWR_EN	Bit 0	
CF_RESET	Bit 1	
nCF_BUS_ON	Bit 5 (ENABLES CF)	INT
LCD_PWR_ON	Bit 8	
RS232_ON	Bit 9	
	Bit 10	
VBUS_ON	Bit 19	W

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FE CONTRL'R, Phase II

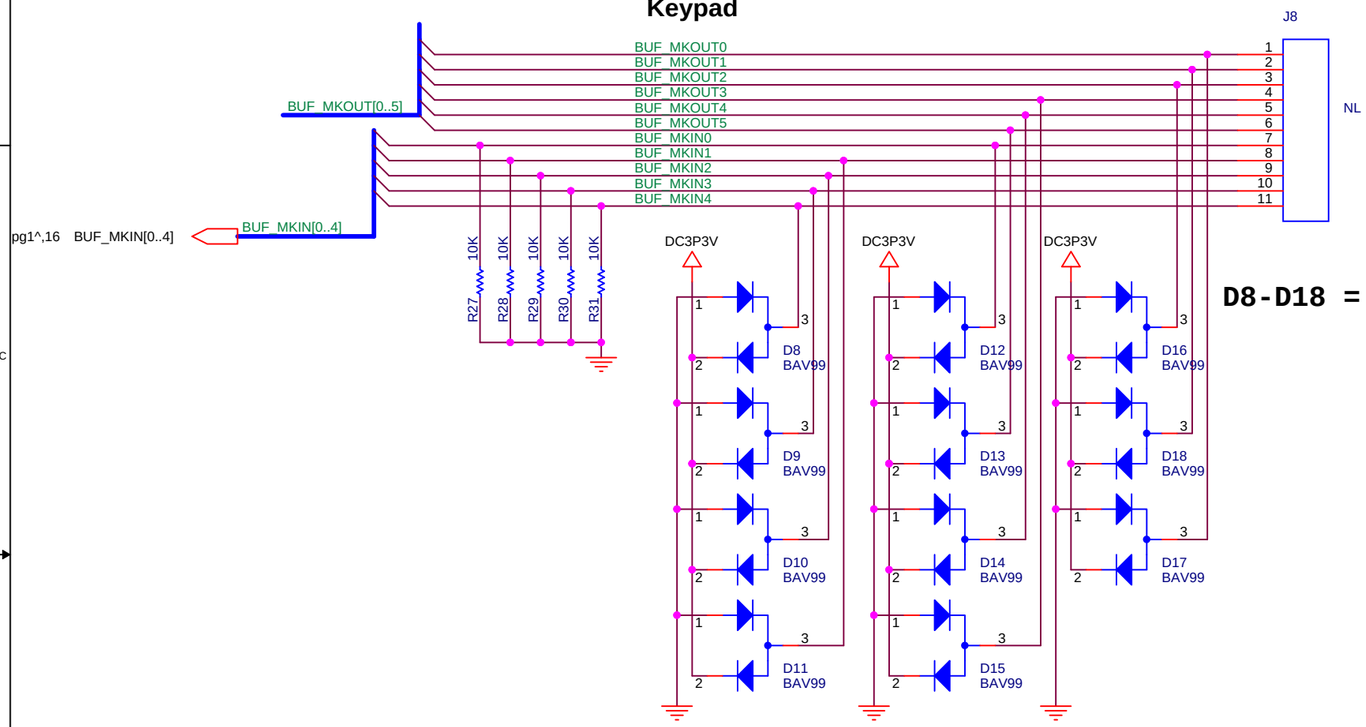
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DATA FILE NAME	Scale	Sheet	Rev
D076531 Rev_x.DSN	NONE	11 of 16	A

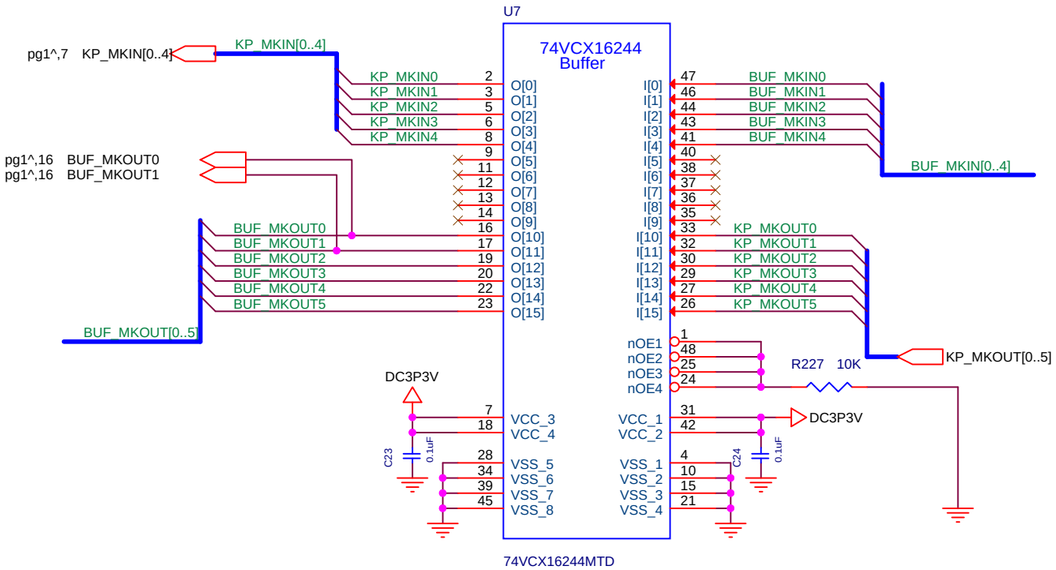
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Keypad

Keypad



D8-D18 = NO LOAD



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FE CONTRL'R, Phase II			
Size: B	DOC ID NO: D076531		
DATA FILE NAME: D076531 Rev_x.DSN	Scale: NONE	Sheet: 12 of 16	Rev: A

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POWER SUPPLY REQUIREMENTS:

INTERNAL SRAM 1.1V

INTERNAL PLL, OSC 1.3V

LAYOUT NOTE:
KEEP IN ISOLATED
"GND" PLANE..!

LAYOUT NOTES:
CREATE THERMAL COPPER
PLANE FOR Q6-7 DAIN PINS

LAYOUT NOTE:
KEEP C58-59
CLOSE TO U4

DC_CORE= .6V x ((R88+R90)/R90)
DC_CORE = 1.09V
Fcore = 312MHz

DC_CORE = 1.45V (R88= 499K,R90 = 348K)
Fcore = 520MHz

TPS65020 LOAD R205, R208

TPS65021 LOAD R206, R207

4 cell NiMh battery charger

Power Management

Life Science Group Hercules, CA 94547 2000 Alfred Nobel Dr.	
FE CONTRL'R, Phase II	
Size: B	DOC ID NO: D076531
DATA FILE NAME: D076531 Rev_x.DSN	Scale: NONE / Sheet: 13 of 16 / Rev: A

ROADRUNNER LCD DISPLAY CONNECTOR

IMSA-9637S-40S-GF

LCD DISPLAY IS CONFIGURED 16BPP RGB 5:6:5 FORMAT

LCD CCFL Backlight I/F

Toshiba LCD Backlight

ADD 250ms DELAY TO "BACK_LITE_EN" PER LCD MFR SPEC

INSTALL 1.6 OHM @ R103 FOR SHARP LED BACKLIGHT LCD

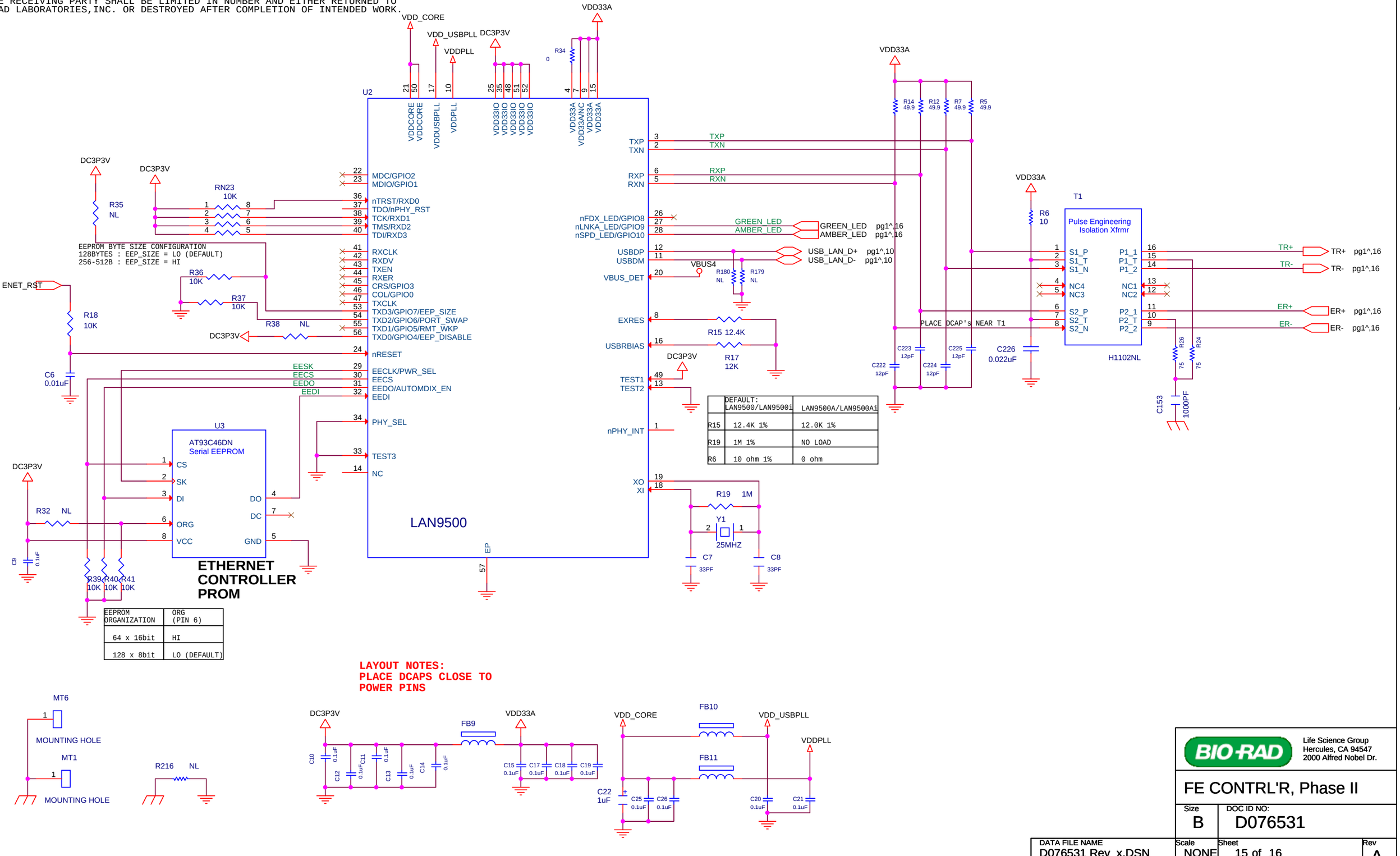
DATA FILE NAME	D076531 Rev_x.DSN
Scale	NONE
Sheet	14 of 16
Rev	A
Size	B
DOC ID NO:	D076531

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USB --> ETHERNET



DEFAULT: LAN9500/LAN9500i		LAN9500A/LAN9500Ai
R15	12.4K 1%	12.0K 1%
R19	1M 1%	NO LOAD
R6	10 ohm 1%	0 ohm

EEPROM ORGANIZATION	ORG (PIN 6)
64 x 16bit	HI
128 x 8bit	LO (DEFAULT)

LAYOUT NOTES:
PLACE DCAPS CLOSE TO POWER PINS

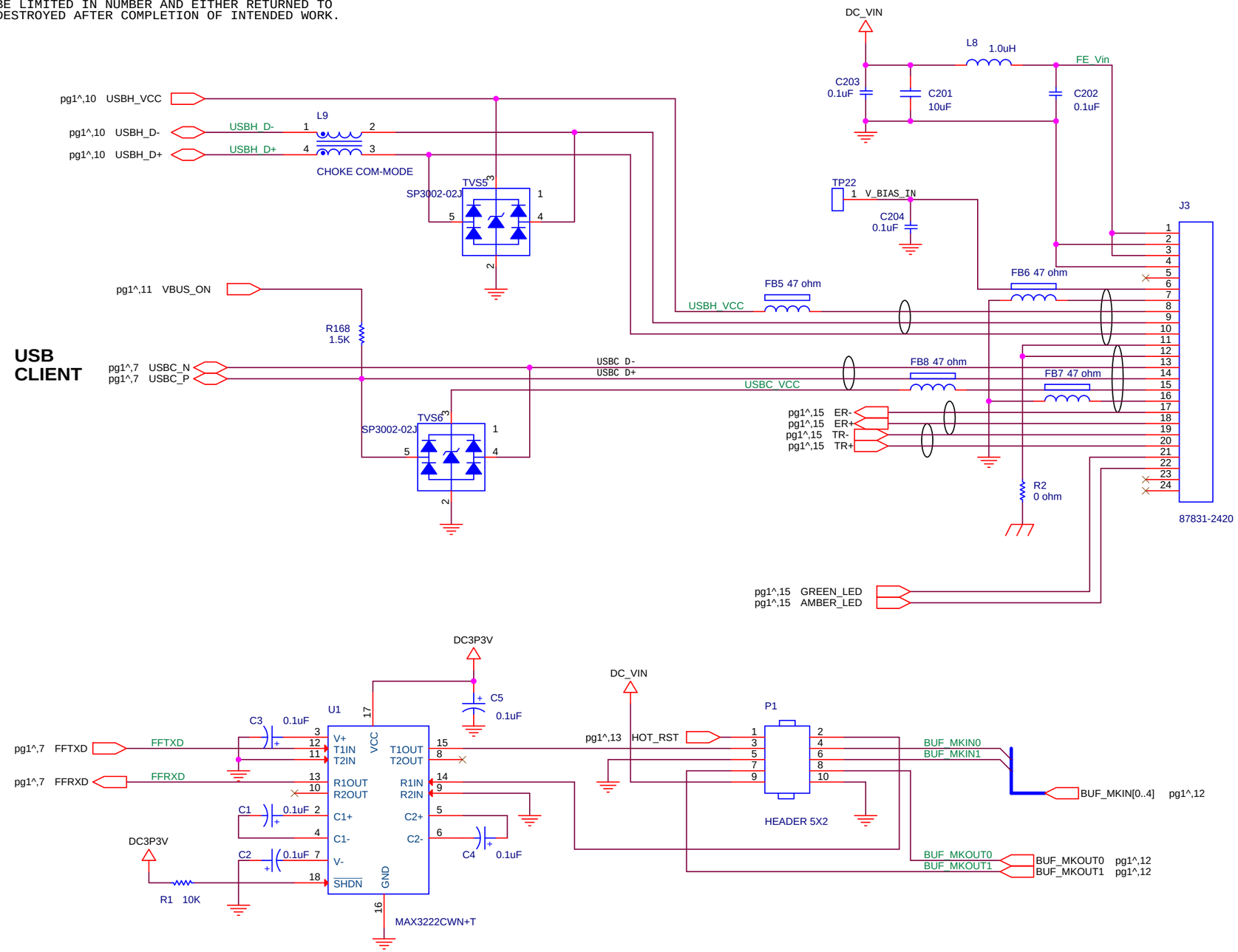
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Hercules, CA 94547
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FE CONTRL'R, Phase II

Size	DOC ID NO:
B	D076531

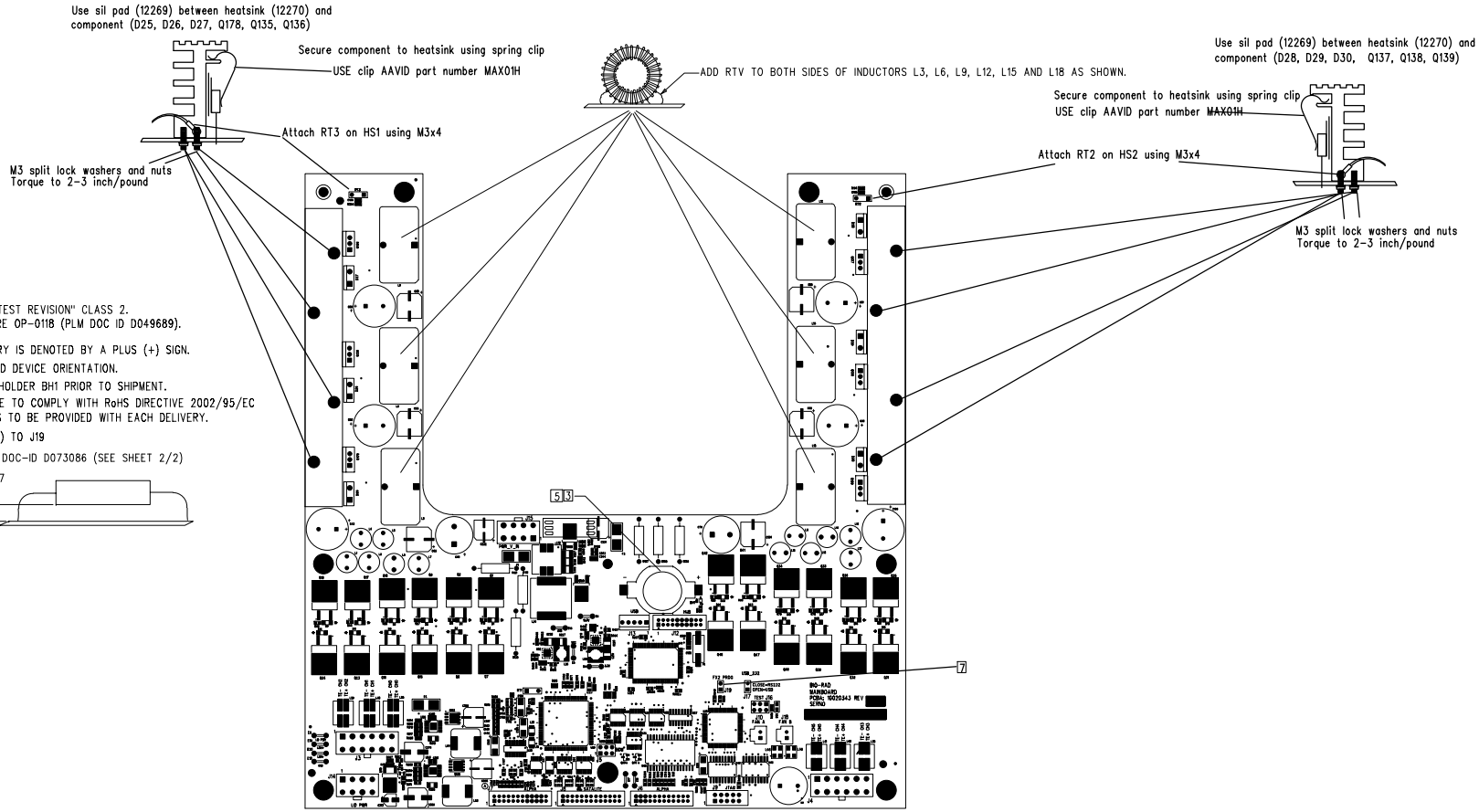
DATA FILE NAME	Scale	Sheet	Rev
D076531 Rev_x.DSN	NONE	15 of 16	A

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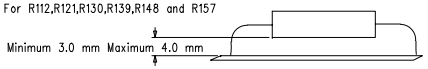


BIO-RAD	Life Science Group Hercules, CA 94547 2000 Alfred Nobel Dr.		
FE CONTRL'R, Phase II			
Size B	DOC ID NO: D076531		
DATA FILE NAME D076531 Rev_x.DSN	Scale NONE	Sheet 16 of 16	Rev A

REVISIONS					
REV	BP #	DESCRIPTION OF CHANGE	CHANGED BY/DATE	CHECKED BY/DATE	APPROVED BY/DATE
C	BP-038893	1. ADD TO BOM STRUCTURE 10022291, FIND NO 0166 QTY 1 2. ADD TO BOM STRUCTURE 10022293, FIND NO 0175 QTY 1 3. ADD NOTE 9	JY 07/19/12	RR 07/23/12	FS 07/25/12



NOTES:
1. ASSEMBLE PER ANSI/IPC-A-610 "LATEST REVISION" CLASS 2.
2. LABEL PER CBA LABELING PROCEDURE OP-0118 (PLM DOC ID D049689). LOCATE AS ALLOWED BY ASSEMBLY
3. ORIENTATION OF CONNECTOR/BATTERY IS DENOTED BY A PLUS (+) SIGN.
4. DOT IDENTIFIES PIN #1 LOCATION AND DEVICE ORIENTATION.
5. INSTALL BATTERY BT1 IN BATTERY HOLDER BH1 PRIOR TO SHIPMENT.
6. ALL MATERIALS AND PROCESSES ARE TO COMPLY WITH RoHS DIRECTIVE 2002/95/EC AND CERTIFICATE OF COMPLIANCE IS TO BE PROVIDED WITH EACH DELIVERY.
7. INSTALL SHUNT (BIORAD PN – 6453) TO J19
8. APPLY LABEL FOR U73 to U78 PER DOC-ID D073086 (SEE SHEET 2/2)
9. For R112,R121,R130,R139,R148 and R157

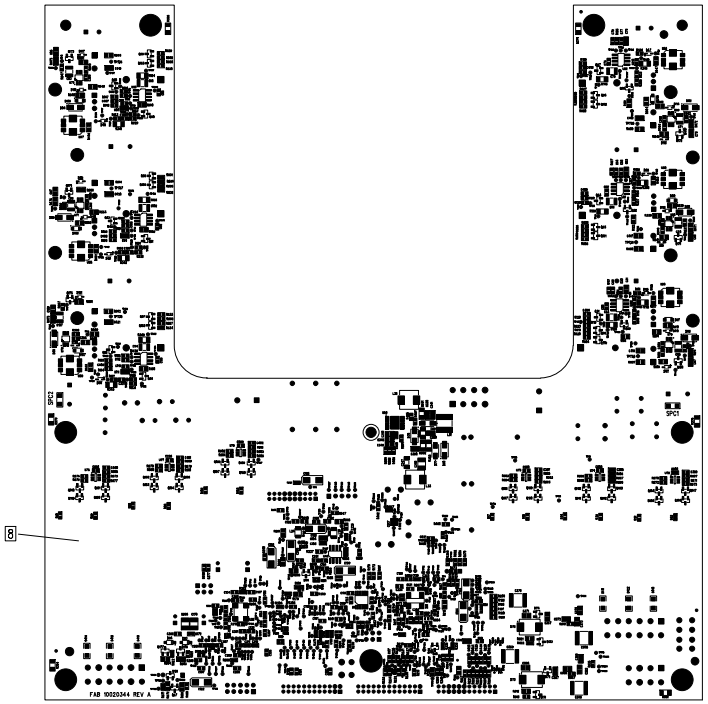


VIEWED FROM TOP SIDE

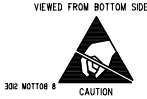
CAUTION
ELECTROSTATIC DISCHARGE SENSITIVE

SILKSCREEN TOP

DRAWN BY/DATE CADPARTS 02/28/12	DO NOT SCALE DRAWING	BIO-RAD LABORATORIES 2000 ALFRED NOBEL DRIVE | HERCULES, CA 94547 | U.S.A.
CHECKED BY/DATE JY 03/28/12	UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES.	
ENG'R. APPR./DATE JY 03/28/12	TOLERANCE FRACTION .XX .XXX ANGLE +/-.032 +/-.01 +/-.005 +/-0+/-30'	PCBA,MAIN BOARD,ROAD RUNNER
MGMT. APPR./DATE FS 03/02/12	THE INFORMATION CONTAINED IN THIS DOCUMENT IS PROPRIETARY AND CONFIDENTIAL. THIS DOCUMENT MAY NOT BE COPIED OR REPRODUCED WITHOUT WRITTEN PERMISSION FROM BIO-RAD.	
MATERIAL		
FINISH	PLM DOC NO: D067327	SIZE C | SCALE NONE | SHEET OF 1/2 | DRAWING NUMBER 10020343 | REV C



VIEWED FROM BOTTOM SIDE



CAUTION

ELECTROSTATIC DISCHARGE SENSITIVE

DO NOT SCALE DRAWING UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES. TOLERANCE FRACTION .XX .XXX ANGLE +/-.032 +/-.01 +/-.005 +/-0+/-30' THE INFORMATION CONTAINED IN THIS DOCUMENT IS PROPRIETARY AND CONFIDENTIAL. THIS DOCUMENT MAY NOT BE COPIED OR REPRODUCED WITHOUT WRITTEN PERMISSION FROM BIO-RAD. PLM DOC NO: D067327	BIO-RAD LABORATORIES 2000 ALFRED NOBEL DRIVE | HERCULES, CA 94547 | U.S.A. PCBA,MAIN BOARD,ROAD RUNNER				
	SIZE	SCALE	SHEET OF	DRAWING NUMBER	REV
	C	NONE	2/2	10020343	C

REV	BP #	CHANGE DESCRIPTION	CHG'D BY /DATE	CHK'D BY /DATE	APRV'D BY /DATE
REV A	BP-037154	Rev A Release	JT 03/12/12	JT 03/14/12	FS 03/23/12

MISC52 MISC53 MISC54



M3X4MM PH-PN-MS-SS M3X4MM PH-PN-MS-SS DNP

Screws for RT2 and RT3

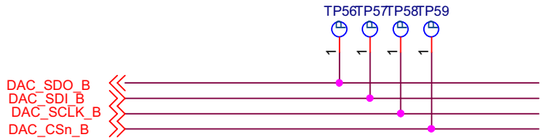
Screw for RT1 is DNP, RT1 is No Load

MYCYCLER BRIDGE COMMAND D/A (U1)

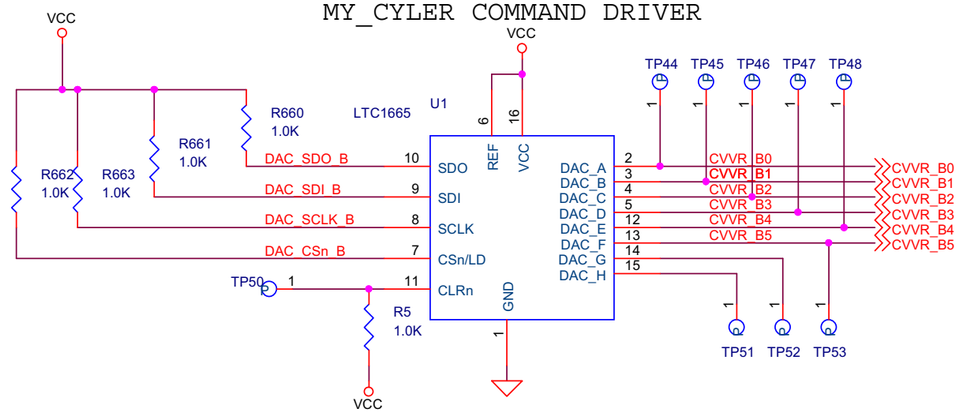
PCB1



Roadrunner Mainboard PCB



MY_CYLER COMMAND DRIVER

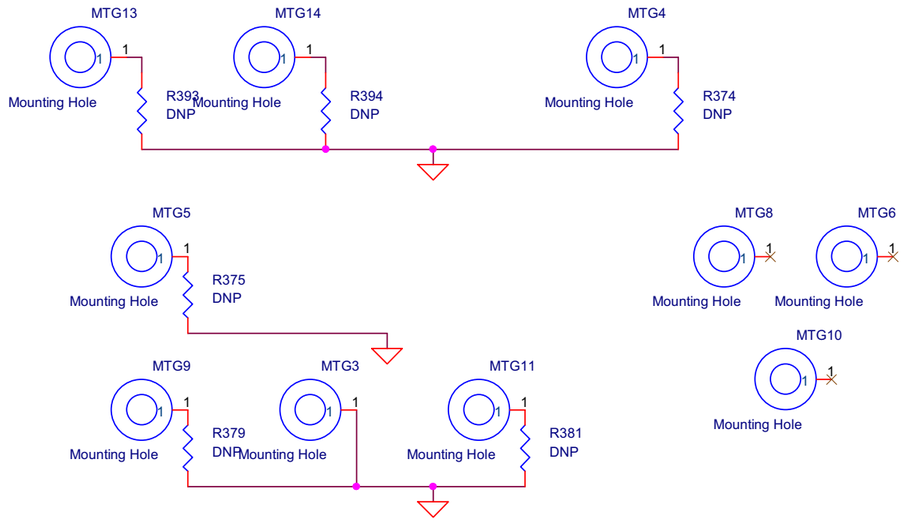


MISC55



929955-06

Install into J19



APPROVAL		DATE
DRW:	JT	2/28/12
CHK'D:	RR	2/28/12
ENG'R:	JT	2/28/12
MGT:	FS	3/2/12

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SCHEM,PCB, MAIN BOARD, ROAD RUNNER

Size	DOC ID NO:	
B	D067329	
DATA FILE NAME: C1000 T Phase 2 Mainboard D067329 Rev A.dsn	Scale: NONE	Sheet: 1 of 21

Rev: A

CHANNEL 0

This indicates 12A current

VCC
R562 1.0K
R563 1.0K
VCC
BR_DR_ENA0
L_HI0
R_LO0
L_LO0
R_HI0
Q166 2N7002LT1G
Q167 2N7002LT1G
Q168 2N7002LT1G
Q169 2N7002LT1G
U73
VDD
GP0/ICSPDAT
GP1/ICSPCLK
GP2/T0CK/FOSC4
VSS
PIC10F200T-E/OT
H/C_CH_0
H/C_CH_0
R605 0R
C397 DNP
R564 0R
R565 0R
VCC
C280 .1uF

TP718
PWR_HB+_CH_0
PWR_V_IN
R10 100.0K
R11 100.0K
L_HI0
Q1 IRFZ44VZSPBF
Q2 IRFZ44VZSPBF
R_HI0
D1 DL5243B-TP
D2 DL5243B-TP
PWR_L_TE+_CH_0
PWR_L_TE-_CH_0

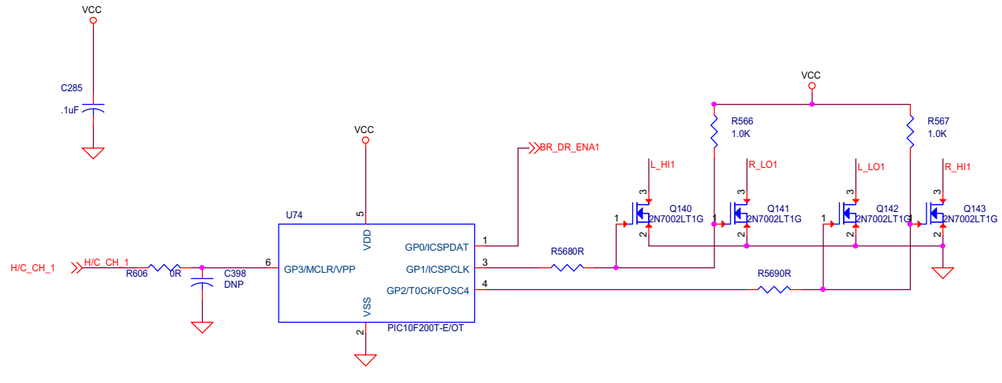
R17 100.0K
R18 100.0K
TP719
L_LO0
Q7 IRFZ44VZSPBF
Q8 IRFZ44VZSPBF
R_LO0
D4 DL5243B-TP
D3 DL5243B-TP
PGND

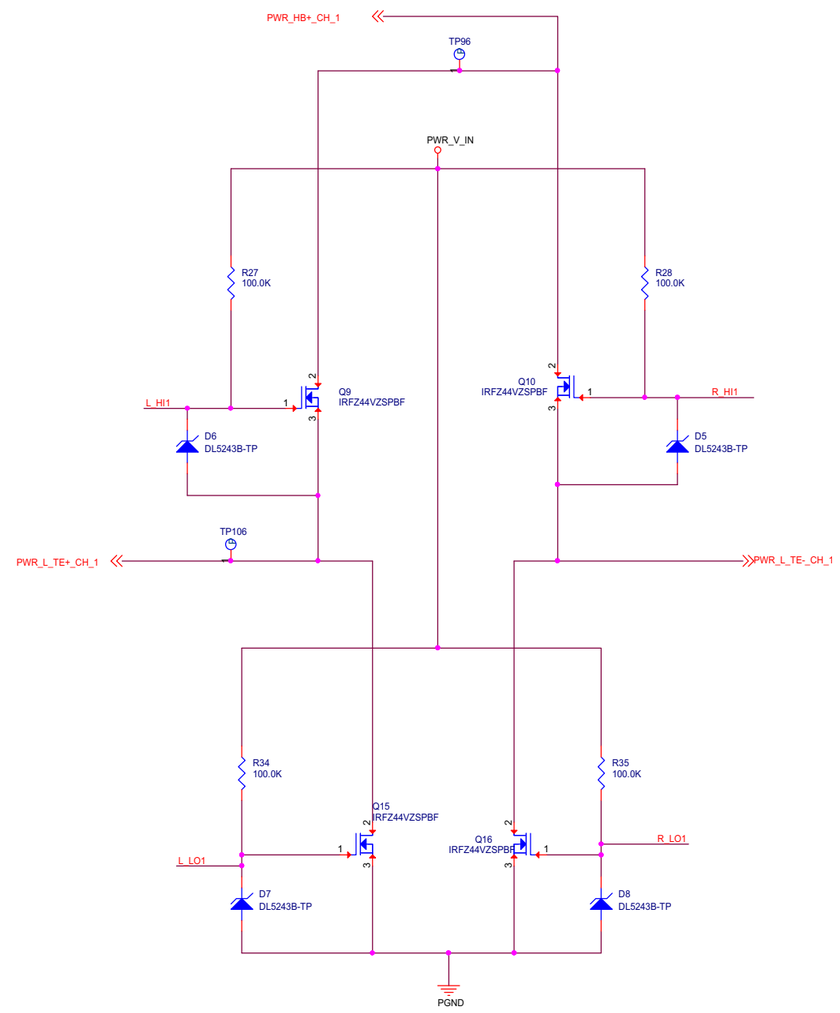
Life Science Group
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SCHEM,PCB, MAIN BOARD, ROAD RUNNER

Size	DOC ID NO:	
C	D067329	
Scale NONE	Sheet 2 of 21	Rev A

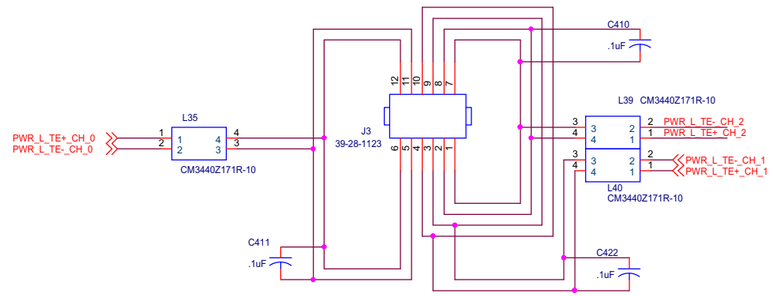
CHANNEL 1

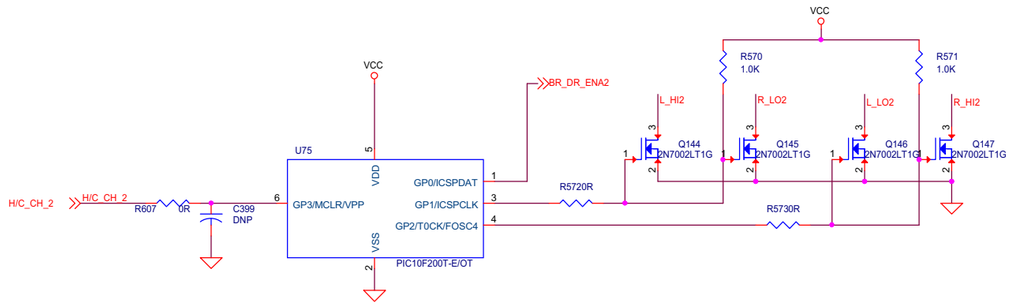


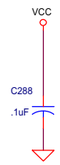


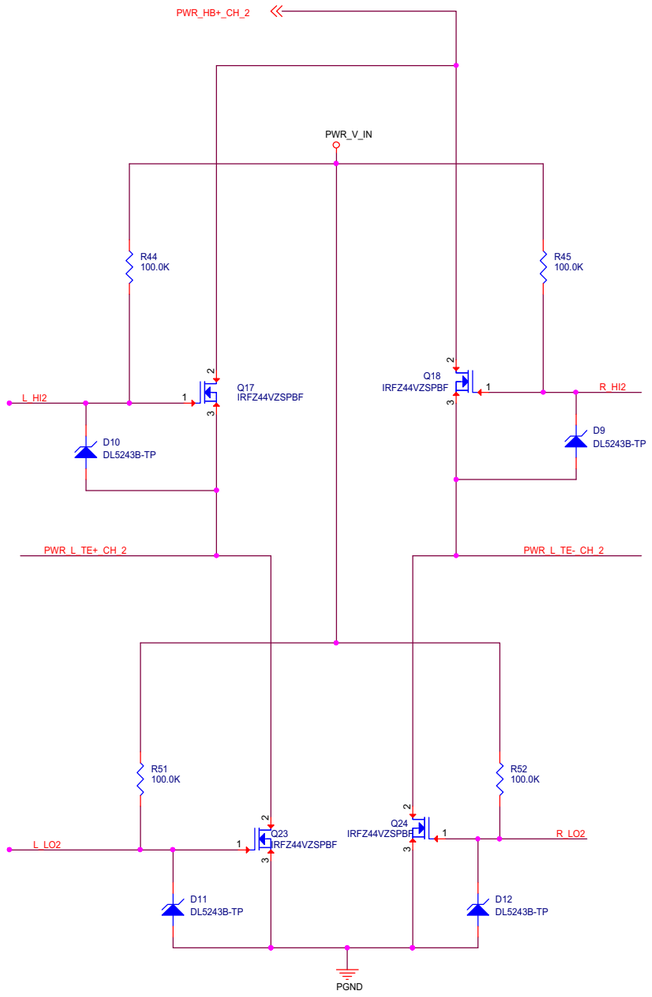
BIO-RAD	Life Science Group Hercules, CA 94547 2000 Alfred Nobel Dr.	
SCHEM,PCB, MAIN BOARD, ROAD RUNNER		
Size C	DOC ID NO: D067329	
Scale NONE	Sheet 3 of 21	Rev A

CHANNEL 2







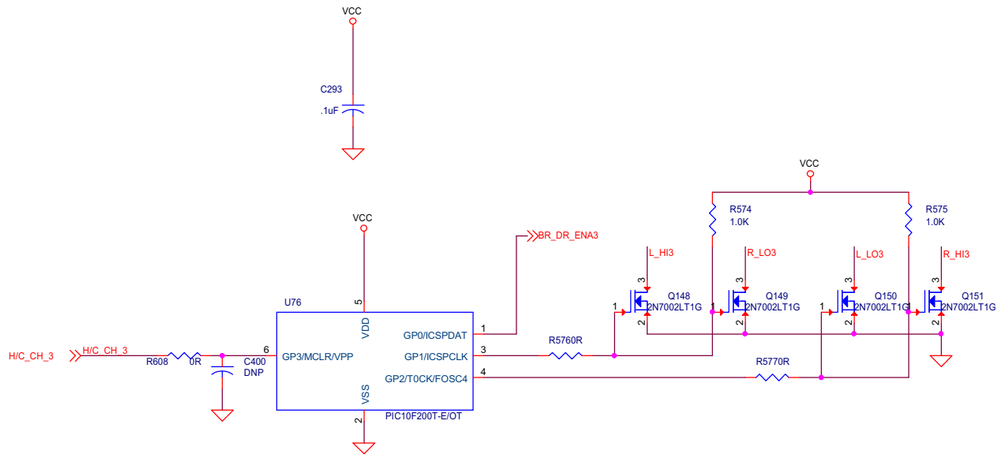


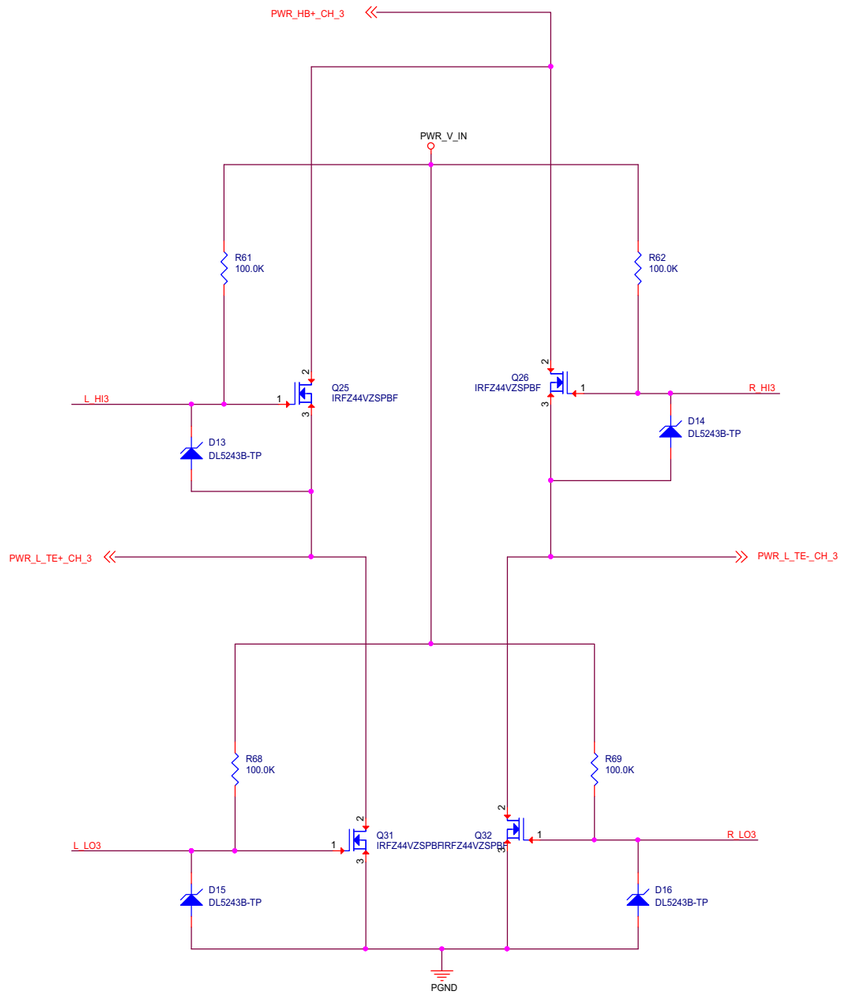
BIO-RAD
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2000 Alfred Nobel Dr.

SCHEM,PCB, MAIN BOARD, ROAD RUNNER

Size	DOC ID NO:	
C	D067329	
Scale	Sheet	Rev
NONE	4 of 21	A

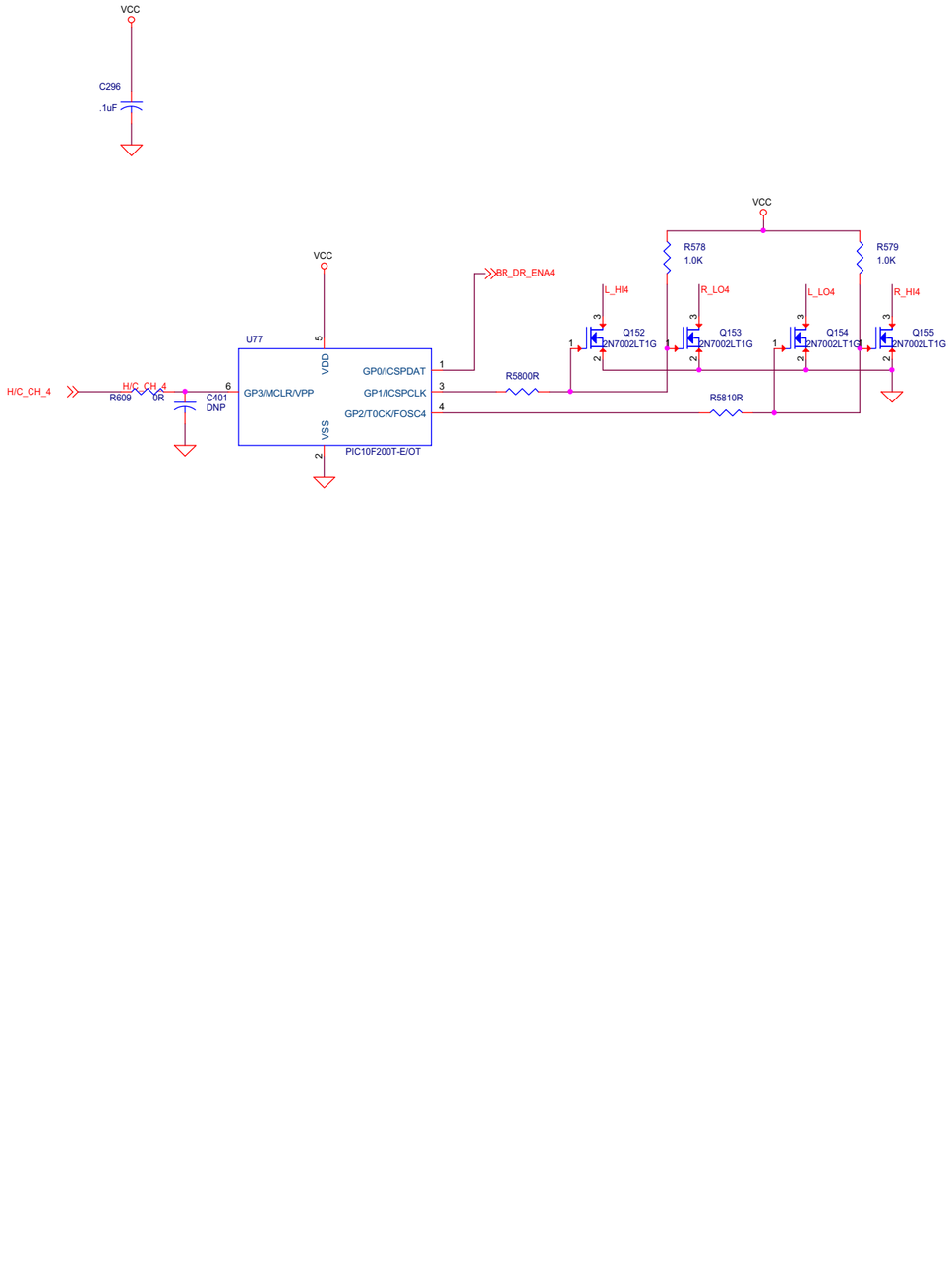
CHANNEL 3

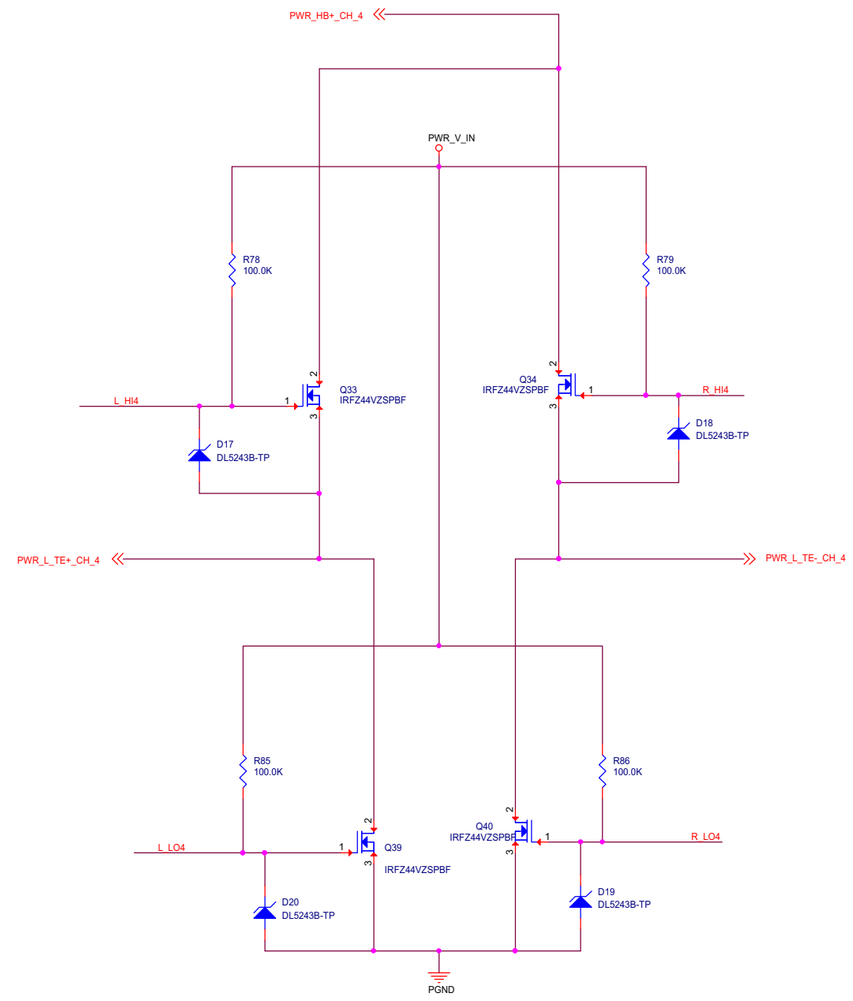




BIO-RAD	Life Science Group Hercules, CA 94547 2000 Alfred Nobel Dr.	
SCHEM,PCB, MAIN BOARD, ROAD RUNNER		
Size C	DOC ID NO: D067329	
Scale NONE	Sheet 5 of 21	Rev A

CHANNEL 4





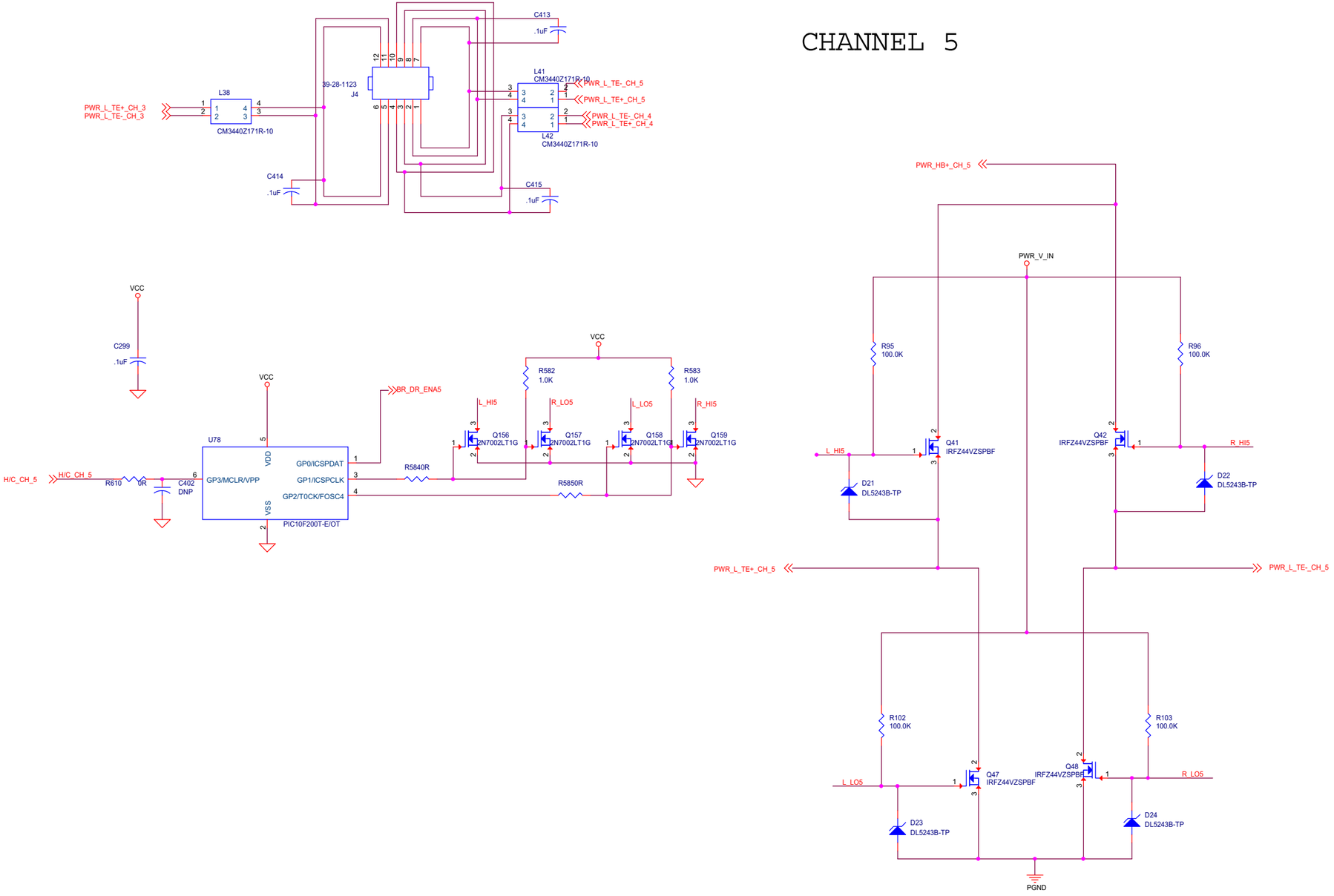
BIO-RAD

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SCHEM,PCB, MAIN BOARD, ROAD RUNNER

Size	DOC ID NO:	
C	D067329	
Scale: NONE	Sheet: 6 of 21	Rev: A

CHANNEL 5



BIO-RAD	Life Science Group Hercules, CA 94547 2000 Alfred Nobel Dr.	
SCHEM,PCB, MAIN BOARD, ROAD RUNNER		
Size C	DOC ID NO: D067329	
Scale NONE	Sheet 7 of 21	Rev A

The main branch of PWR_V_BANK_1 will supply 3x12A current

This indicates 12A current

DRIVER CHANNEL 0

NOTE: Must use version of UC3843 with wider input voltage

MISC44 MISC45 MISC46 MISC47

M3 HX-NU-STYLE1-SS

MISC48 MISC49 MISC50 MISC51

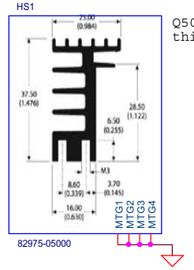
M3 HX-NU-STYLE1-SS

M3-SPLT-LK-WA-SS-D

HS1 Mounting Nuts and Washers

PWR_V_IN
F1
0154010.DR
PWR_V_BANK_1
L1
4.7uH/4.6A
L2
4.7uH/4.6A
DR0_FIL_40V
DR0_HMOS_D
12.8V
TP720
R611
10.0ohm/1%
C46
1000uF/63V
R112
1.21K/2W/5%
C47
1000pF
C48
4.7uF/16V
Q49
MMBTA06
U19
VREF
COMP
VFB
ISEN
RTCT
VCC
OUT
GND
UC3843BD1
R114
12.4K/1%
C50
.1uF
R115
16.2k
C316
.1uF
C51
1000pF
R618
1.0K
C52
.1uF
R117
10.0K
C53
330p
R116
330
TP723
PGND
D95
10MQ100NPBF
C403
.1uF
R612
10.0K
ENA_SW0
U79
VDD
EN
IN
NC
RDT
HB
HO
HS
VSS
LO
LM5106MM
R615
10.0K
R616
DNP
D111
DNP
D110
DNP
D97
BAS70H,115
R613
24.9R
Q178
IRFZ44VZPBF
R614
4.99R
L3
56uH/10.2A
PWR_HB+_CH_0
PWR_FET_DR_CH0
D25
MBR1060
R637
9.1R
TP733
330uF/35V
C45
C416
1000pF
PGND
TP727
D45
SD103CWS-7-F
R118
3.6R
TP728
U20
R617
2.21K 1%
P8
P1 P6
P2 P5
P3 P4
P7
B82801B324A40
DR0_FIL_40V
DR0_HMOS_D
SPC1
Single Point Connection
PGND
C54
DNP
TP730
CVVR_B0
R119
3.16K
TP731
Q51
MMBT3906
C404
0.01U
R120
10.0K
R126
3ohm
TP732
VCC
R619
1.0K
ENVR0
R623
0R
Q92
NDS355AN
VCC
R620
1.0K
BR_DR_ENA0
R624
0R
TP11
Q179
NDS355AN
TP7
ENA_SW0
Q180
DNP

HS1



82975-05000

Q50, D25, Q53, D26, Q56, D27 are mounted to this heatsink. Silpads are used for isolation

MISC1



12269

MISC7 MISC10

MISC8 MISC12

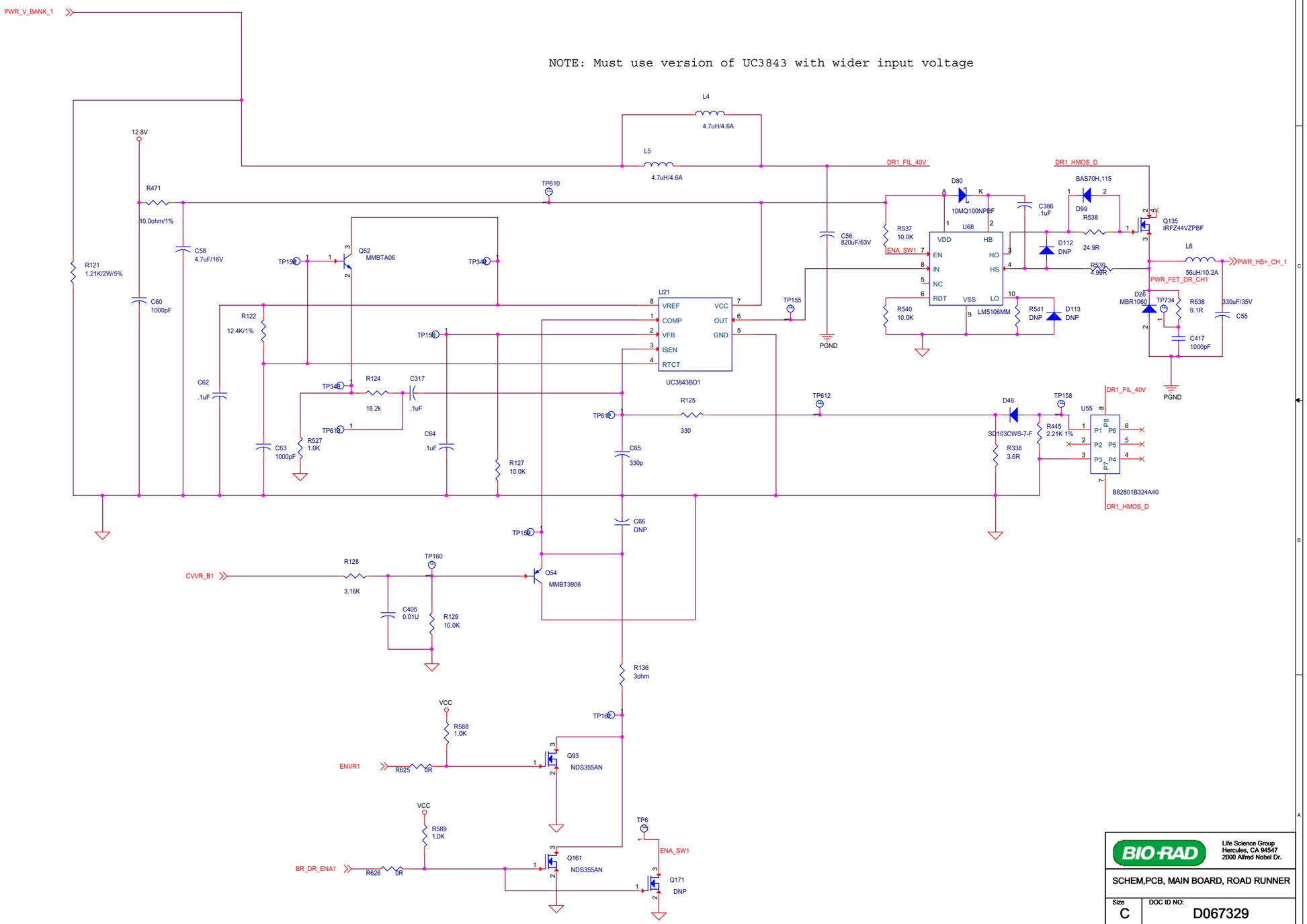
MISC9 MISC11

MAX01HG

BIO-RAD	Life Science Group Hercules, CA 94547 2000 Alfred Nobel Dr.	
SCHEM,PCB, MAIN BOARD, ROAD RUNNER		
Size C	DOC ID NO: D067329	
Scale NONE	Sheet 8 of 21	Rev A

DRIVER CHANNEL 1

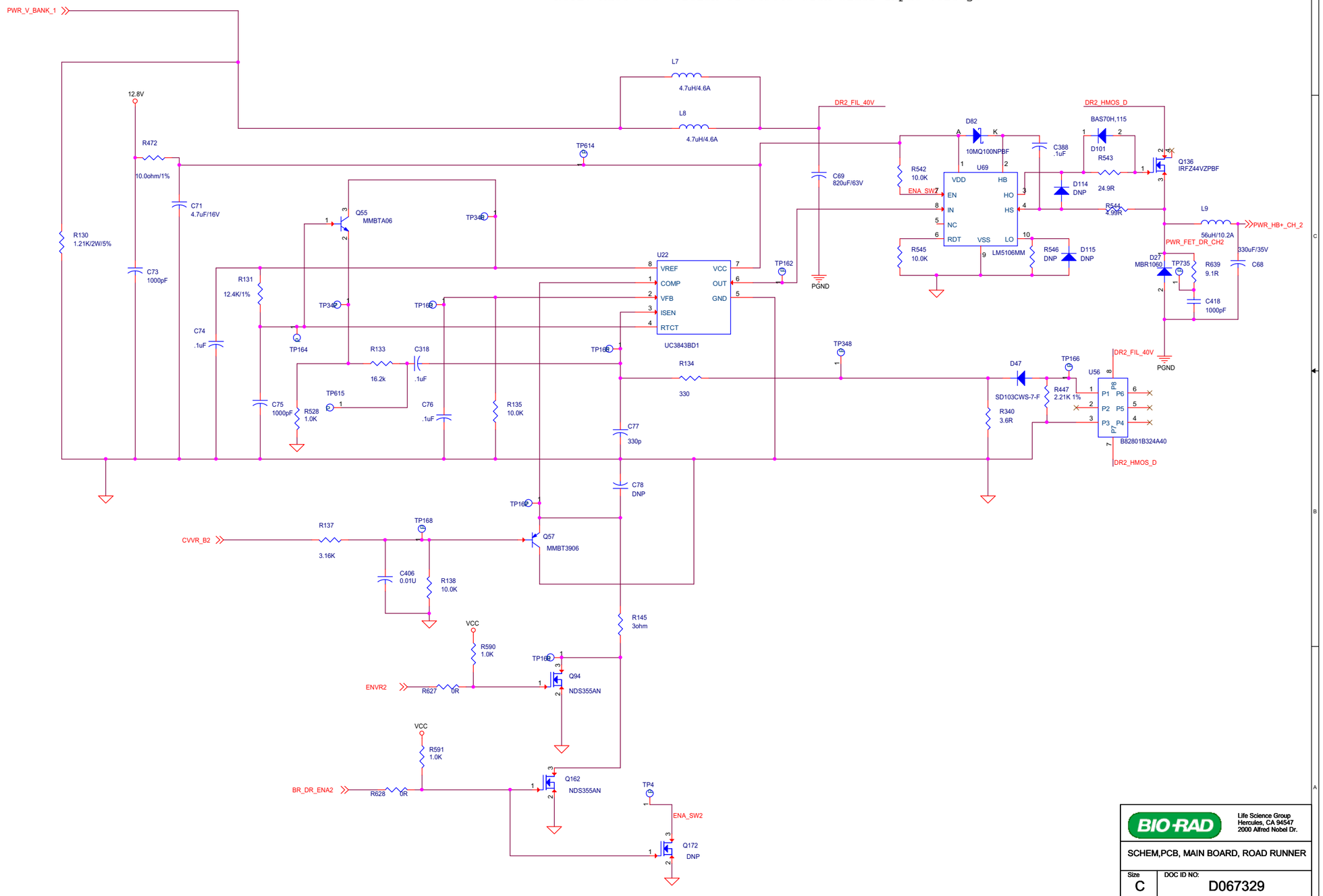
NOTE: Must use version of UC3843 with wider input voltage



BIO-RAD	Life Science Group Hercules, CA 94547 2000 Alfred Nobel Dr.	
SCHEM,PCB, MAIN BOARD, ROAD RUNNER		
Size C	DOC ID NO: D067329	
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DRIVER CHANNEL 2

NOTE: Must use version of UC3843 with wider input voltage



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DRIVER CHANNEL 3

NOTE: Must use version of UC3843 with wider input voltage

PWR_V_IN
F2
0154010.DR
PWR_V_BANK_2
C79 1000uF/63V
R139 1.21K/2W/5%
12.8V
R473 10.0ohm/1%
C83 4.7uF/16V
C85 1000pF
L10 4.7uH/4.6A
L11 4.7uH/4.6A
TP616
TP349
TP175
Q58 MMBTA06
TP350
R140 12.4K/1%
C86 .1uF
C87 1000pF
R529 1.0K
R142 16.2k
C319 .1uF
TP173
TP618
C88 .1uF
R144 10.0K
U23
VREF
COMP
VFB
ISEN
RTCT
VCC
OUT
GND
UC3843BD1
TP172
TP171
PGND
R143 330
C89 330p
C90 DNP
TP175
TP176
CVVR_B3
R146 3.16K
C407 0.01U
R147 10.0K
Q60 MMBT3906
R154 3ohm
VCC
R592 1.0K
TP177
ENVR3
R629 0R
Q95 NDS355AN
VCC
R593 1.0K
BR_DR_ENA3
R630 0R
Q163 NDS355AN
TP10
ENA_SW3
Q173 DNP
DR3_FIL_40V
C81 820uF/63V
R547 10.0K
ENA_SW3
R550 10.0K
D84 10MQ100NPBF
U70
VDD
EN
IN
NC
RDT
HB
HO
HS
VSS
LO
LM5106MM
C390 .1uF
D116 DNP
R551
D117 DNP
DR3_HMOS_D
BAS70H,115
D103
R548 24.9R
Q137 IRFZ44VZPBF
R549 4.99R
L12 56uH/10.2A
PWR_FET_DR_CH3
PWR_HB+_CH_3
D28 MBR1060
TP736
R640 9.1R
C419 1000pF
330uF/35V
C80
PGND
DR3_FIL_40V
TP617
D48 SD103CWS-7-F
R341 3.6R
TP174
U57
R449 2.21K 1%
B82801B324A40
DR3_HMOS_D
SPC2
Single Point Connection
PGND

MISC31 M3 HX-NU-STYLE1-SS
MISC32 M3 HX-NU-STYLE1-SS
MISC40 M3 HX-NU-STYLE1-SS
MISC41 M3 HX-NU-STYLE1-SS
MISC34 M3-SPLT-LK-WA-SS-D
MISC35 M3-SPLT-LK-WA-SS-D
MISC42 M3-SPLT-LK-WA-SS-D
MISC43 M3-SPLT-LK-WA-SS-D

HS2 Mounting Nuts and Washers

HS2
82975-05000

Q50, D25, Q53, D26, Q56, D27 are mounted to this heatsink. Silpads are used for isolation

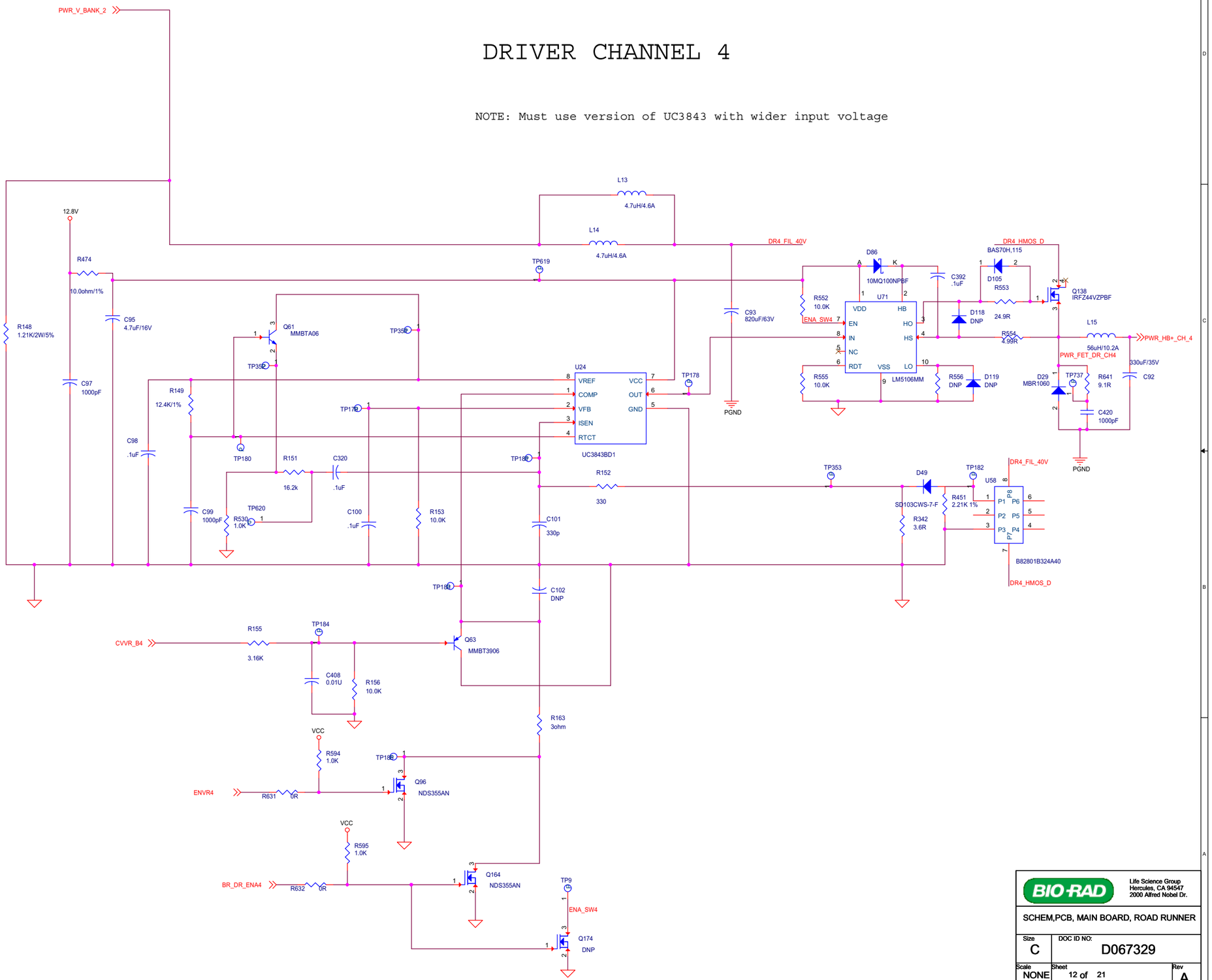
MISC2 12269

MISC19 MAX01HG
MISC22 MAX01HG
MISC20 MAX01HG
MISC24 MAX01HG
MISC21 MAX01HG
MISC23 MAX01HG

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SCHEM,PCB, MAIN BOARD, ROAD RUNNER	
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DRIVER CHANNEL 4

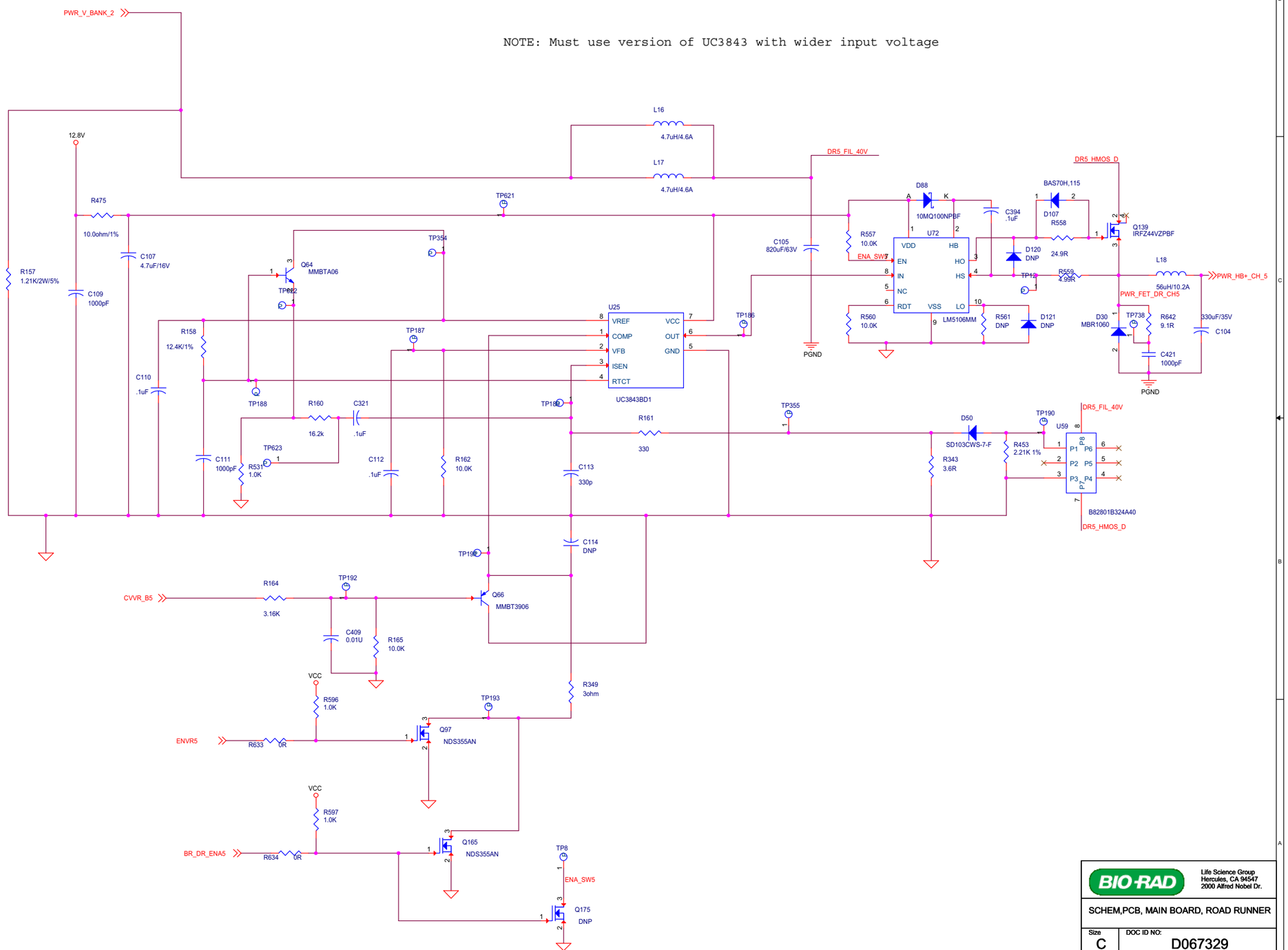
NOTE: Must use version of UC3843 with wider input voltage



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SCHEM,PCB, MAIN BOARD, ROAD RUNNER	
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DRIVER CHANNEL 5

NOTE: Must use version of UC3843 with wider input voltage



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MODC	MODB	MODA	Mode Description
0	0	0	Special single chip - BDM enabled by serial command
0	0	1	Emulation expanded narrow - BDM allowed
0	1	0	Special test expanded wide - BDM allowed
0	1	1	Emulation expanded wide - BDM allowed
1	0	0	Normal single chip- BDM allowed
1	0	1	Normal expanded narrow - BDM allowed (default)
1	1	0	Peripheral - factory test mode
1	1	1	Normal expanded wide - BDM allowed

Resistor vaules need to be tweeked

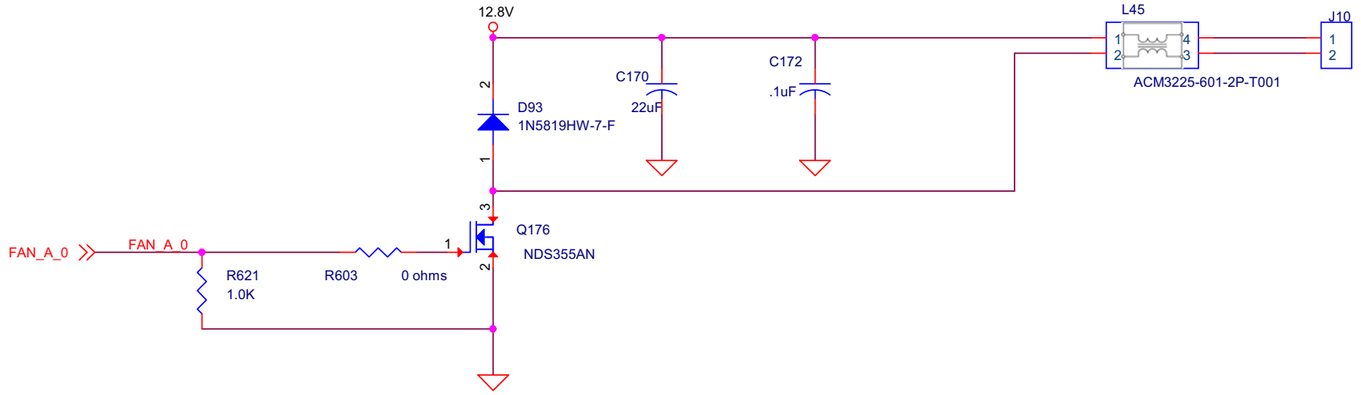
Internal flash EN=1, DIS=0

PLACE CLOSE TO HEATSINKS

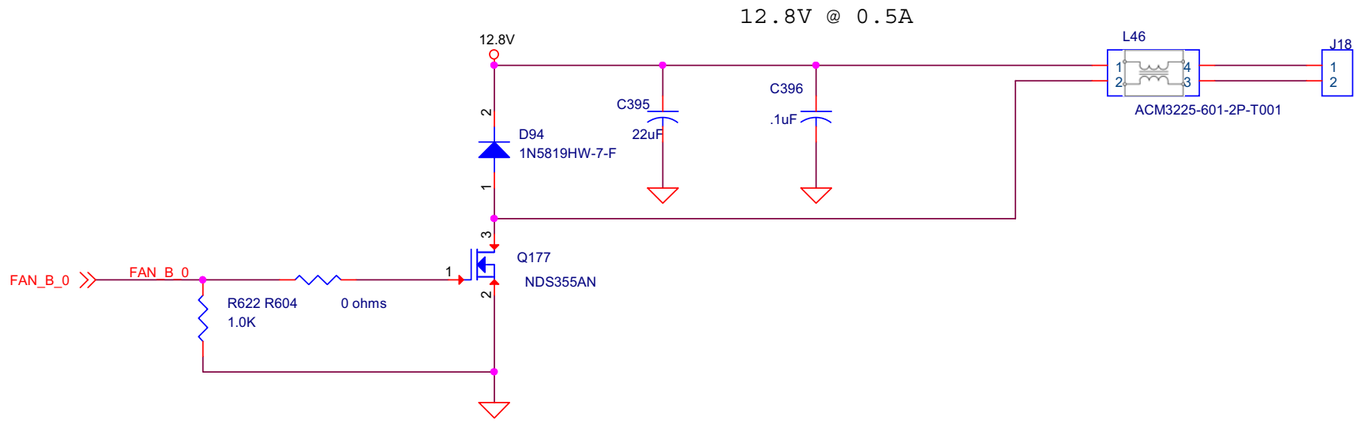
FRONT PANEL INTERFACE

BIO-RAD	Life Science Group, Hercules, CA 94547, 2000 Alfred Nobel Dr.
SCHEM,PCB, MAIN BOARD, ROAD RUNNER	
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12.8V @ 0.5A



12.8V @ 0.5A



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SCHEM,PCB, MAIN BOARD, ROAD RUNNER	
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USB INTERFACE

U41 — FX1/FX2

Pin	Net
100	CLKOUT
98	PD7/FD15 — FX2_UNUSED18
97	PD6/FD14 — FX2_UNUSED19
96	PD5/FD13 — FX2_UNUSED20
95	PD4/FD12 — FX2_UNUSED21
93	PE7/GPIFADR8 — FX2_UNUSED26
92	PE6/T2EX — FX2_UNUSED27
91	PE5/INT6 — FX2_UNUSED28
90	PE4/RXD1OUT — FX2_UNUSED29
89	PE3/RXD0OUT — FX2_UNUSED30
88	PE2/T2OUT — FX2_UNUSED31
87	PE1/T1OUT — FX2_UNUSED32
86	PE0/T0OUT
84	INT5
83	PD3/FD11 — FX2_UNUSED22
82	PD2/FD10 — FX2_UNUSED23
81	PD1/FD9 — FX2_UNUSED24
80	PD0/FD8 — FX2_UNUSED25
79	WAKEUP
77	RESET — FX2_RST
76	CTL5
74	PA7/FLAGD/SLCS — FX2_UNUSED33
73	PA6/PKTEND — FX2_UNUSED34
72	PA5/FIFOADR1 — FX2_UNUSED35
71	PA4/FIFOADR0 — FX2_UNUSED36
70	PA3/WU2 — FX2_UNUSED37
69	PA2/SLOE — FX2_UNUSED38
68	PA1/INT1 — FX2_UNUSED39
67	PA0/INT0 — FX2_UNUSED40
64	PC7/GPIFADR7 — FX2_UNUSED41
63	PC6/GPIFADR6 — FX2_UNUSED42
62	PC5/GPIFADR5 — FX2_UNUSED43
61	PC14/GPIFADR4 — FX2_UNUSED44
60	PC3/GPIFADR3 — FX2_UNUSED45
59	PC2/GPIFADR2 — FX2_UNUSED46
58	PC1/GPIFADR1 — FX2_UNUSED47
57	PC0/GPIFADR0 — FX2_UNUSED48
56	CTL2/FLAGC
55	CTL1/FLAGB
54	CTL0/FLAGA
52	CTL4
51	CTL3
15	NC
14	NC
13	NC
3	RDY0/SLRD — FX2_UNUSED0
4	RDY1/SLWR — FX2_UNUSED1
5	RDY2 — FX2_UNUSED2
6	RDY3 — FX2_UNUSED3
7	RDY4 — FX2_UNUSED4
8	RDY5 — FX2_UNUSED5
9	AVCC
10	XTALOUT — FX2_XTALOUT
11	XTALIN — FX2_XTALIN
16	AVCC
17	DPLUS — USB1_D+
18	DMINUS — USB1_D-
22	INT4 — FX2_UNUSED6
23	T0 — FX2_UNUSED7
24	T1 — FX2_UNUSED8
25	T2 — FX2_UNUSED9
26	*IFCLK
27	RESERVED
28	BKPT
29	SCL
30	SDA
31	RD
32	WR
34	PB0/FD0 — FX2_UNUSED10
35	PB1/FD1 — FX2_UNUSED11
36	PB2/FD2 — FX2_UNUSED12
37	PB3/FD3 — FX2_UNUSED13
40	TXD0 — TX_Lid_3V
41	RXD0 — RX_Lid_3V
42	TXD1 — RXD1
43	RXD1 — TXD1
44	PB4/FD4 — FX2_UNUSED14
45	PB5/FD5 — FX2_UNUSED15
46	PB6/FD6 — FX2_UNUSED16
47	PB7/FD7 — FX2_UNUSED17
85, 66, 53, 1, 49, 38, 20, 33, 78	VCC
2, 21, 39, 48, 50, 65, 75, 94, 99	GND
12	AGND
19	AGND

- C184 1.0uF, C185 .1uF, C190 .1uF, C186 10uF, L23 10uH, TP514, FX2_AVCC, FX_GND
- Y1 24 MHz, C188 18pF, C189 18pF, TP515, TP516, FX2_XTALOUT, FX2_XTALIN
- TP225, TP226, USB1_D+, USB1_D-
- TP652, TP232, R267 1.50K
- C194 1uF, R265 2.21K 1%, R266 2.21K 1%
- U43 24LC128-I/SN (A0, A1, A2, Vss, Vcc, WP, SCL, SDA)
- TP714, TP233, TP517, R337 100, J19 CON2
- TP519, TX_Lid_3V, RX_Lid_3V, RXD1, TXD1
- C196 10uF, C199 10uF, C200 10uF, C201 .1uF, C202 .1uF, C203 .1uF, C204 .1uF
- L24 10uH, FX_GND, TP234
- R261 1.50K, R262 1.50K, R263 1.50K, TP649, TP650, TP651, C192 .1uF
- NOTE: 9.35V replaces VF
- U44 TPS3809K33DBVR (VDD, RESET, GND), TP516
- J12 87831-2020, USB1_D+, USB1_D-, R643 0R, TP5, USB_VCC, 12.8V
- USB2_D+, USB2_D-, USB2_VBUS, USB2_SHIELD, R644 0R, C195 10uF, TP227, TP228, TP229, TP230, TP231, J13 22-11-2052

RS232 to HCS12

- U45 MAX222/LT1180ACSW (V+, T1IN, T2IN, R1OUT, R2OUT, C1+, C1-, V-, SHDN, VCC, GND, T1OUT, T2OUT, R1IN, R2IN, C2+, C2-)
- C198 .1uF, C205 .1uF, C206 .1uF, C207 .1uF, C208 .1uF, C209 .1uF, C210 .1uF, C211 .1uF, C212 .1uF
- R268 10.0K, TP522, TP523, TP524, TP525, TP526, TP527, TP528, TP530, TP531, TP532
- TXD_HC12, DTR_HC12, RXD_HC12, DSR_HC12, DSR_232

RS232 to REAL TIME LID

- U46 MAX222/LT1180ACSW (V+, T1IN, T2IN, R1OUT, R2OUT, C1+, C1-, V-, SHDN, VCC, GND, T1OUT, T2OUT, R1IN, R2IN, C2+, C2-)
- C209 .1uF, C210 .1uF, C211 .1uF, C212 .1uF, C208 .1uF
- R269 10.0K, TP533, TP534, TP535, TP537, TP538, TP539, TP540, TP541, TP542
- TX_Lid_3V, RX_Lid_3V, FX_TX_Lid, FX_RX_Lid

USB_RS232

- J17 CON2, C277 .1uF, R339 10.0K, USB_RS232, VCC 3.3V
- J16 HEADER 3X2, 12.8V

Pull ups

- R650 100, R669 100, R651 100, TP750, TP747, TP748
- FX2_UNUSED0, FX2_UNUSED1, FX2_UNUSED2, FX2_UNUSED3, FX2_UNUSED4, FX2_UNUSED5, FX2_UNUSED14, FX2_UNUSED15, FX2_UNUSED33, FX2_UNUSED34, FX2_UNUSED35, FX2_UNUSED36, FX2_UNUSED37, FX2_UNUSED38, FX2_UNUSED39, FX2_UNUSED40
- Unused 14 and 15 - possibly DTR and DSR in Sierra

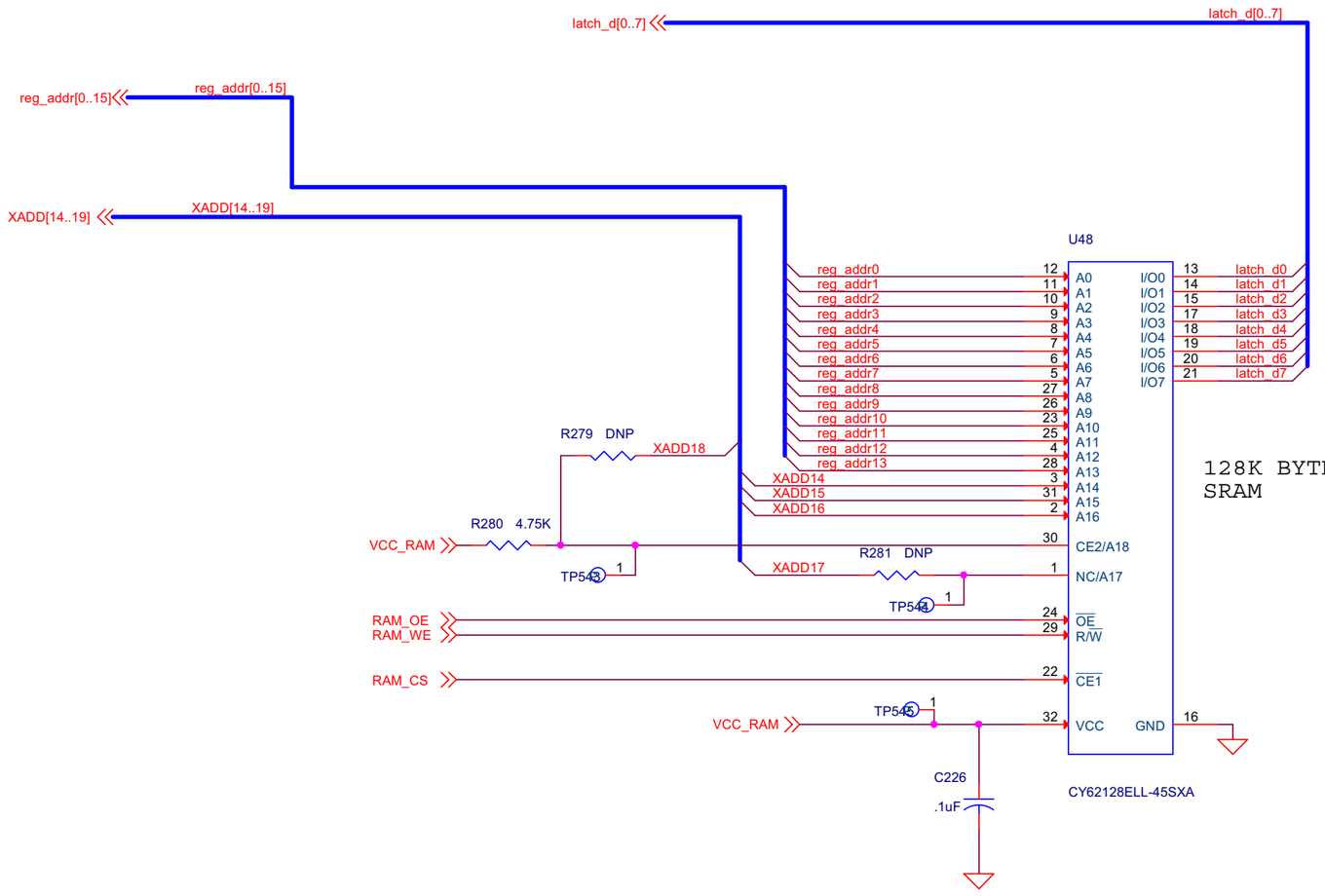
Pull Downs

- TP742, TP743, TP744, TP745, TP746, TP749
- R647 100, R648 100, R649 100, R654 100, R652 100, R653 DNP, R655 100
- FX2_UNUSED6, FX2_UNUSED7, FX2_UNUSED8, FX2_UNUSED9, FX2_UNUSED10, FX2_UNUSED18, FX2_UNUSED19, FX2_UNUSED20, FX2_UNUSED21, FX2_UNUSED26, FX2_UNUSED27, FX2_UNUSED28, FX2_UNUSED29, FX2_UNUSED41, FX2_UNUSED42, FX2_UNUSED43, FX2_UNUSED44, FX2_UNUSED46, FX2_UNUSED47, FX2_UNUSED48, FX2_UNUSED11, FX2_UNUSED12, FX2_UNUSED13, FX2_UNUSED16, FX2_UNUSED17, FX2_UNUSED30, FX2_UNUSED31, FX2_UNUSED32, FX2_UNUSED22, FX2_UNUSED24, FX2_UNUSED25, FX2_UNUSED45

U61 — TPS62110RSA

- VIN, VIN, EN, VINA, AGND, LBI, SYNC, SW, SW, PG, LBO, FB, GND, GND, PWPD, PGND, PGND
- L28 6.8u/2.3A, C218 1.0uF, C220 10uF, C217 10p, C219 22uF
- R454 0R, R455 0R, R457 0R, R461 DNP, R462 DNP, R465 0R, R466 560k, R467 300k
- TP586, TP587, TP588, TP589, TP590, TP591, TP592, TP593, TP594, TP595
- 12.8V, 3.3V

E9 FASTON



BIO-RAD

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SCHEM,PCB, MAIN BOARD, ROAD RUNNER

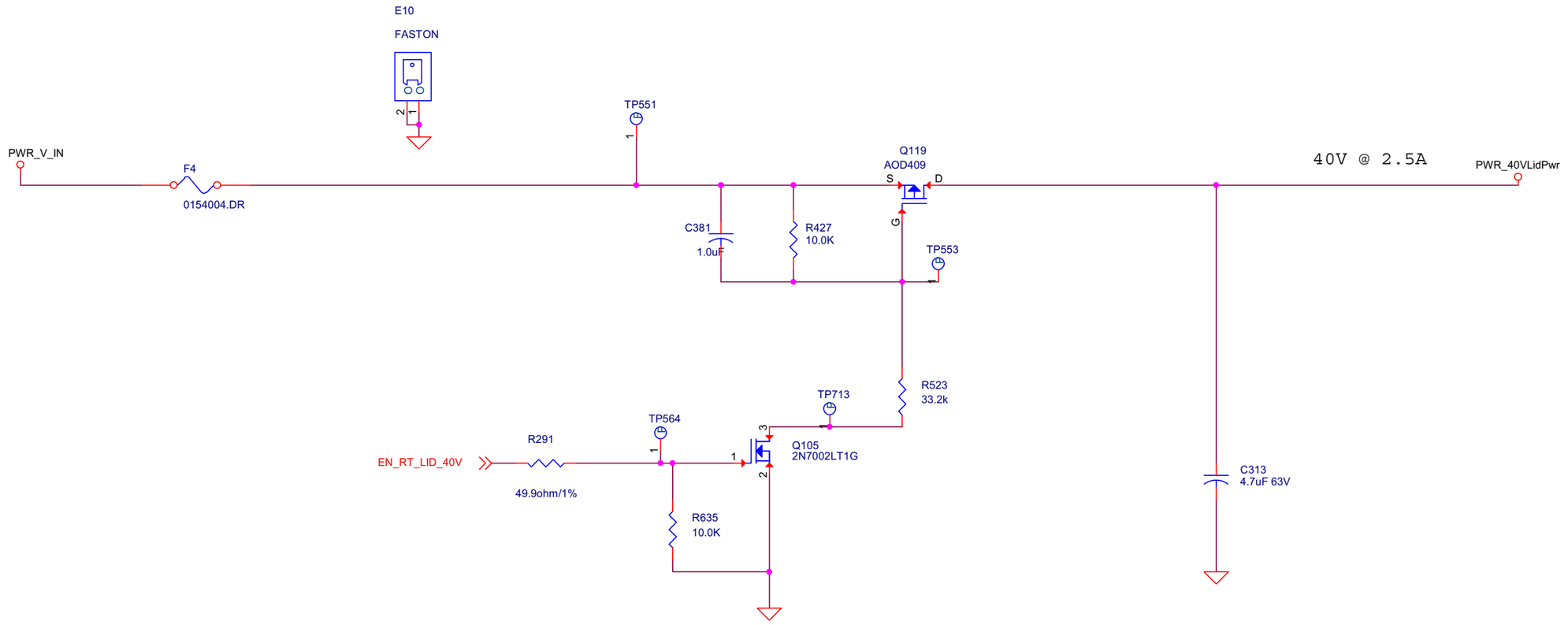
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B	D067329	
Scale	Sheet	Rev
NONE	17 of 21	A

PWR_V_POWER_IN = 40V

5V VCC 2.5A

12.8V, need to change net to 12.8V later, so as not to release Layout release

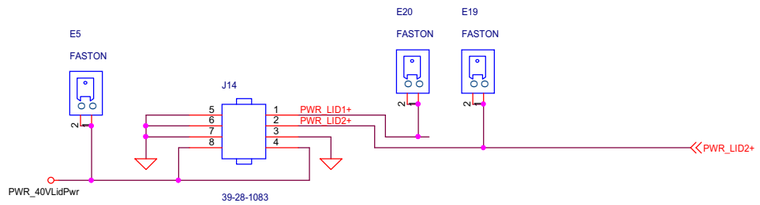
BIO-RAD	Life Science Group Hercules, CA 94547 2000 Alfred Nobel Dr.
SCHEM,PCB, MAIN BOARD, ROAD RUNNER	
Size: C	DOC ID NO: D067329
Scale: NONE	Sheet: 18 of 21
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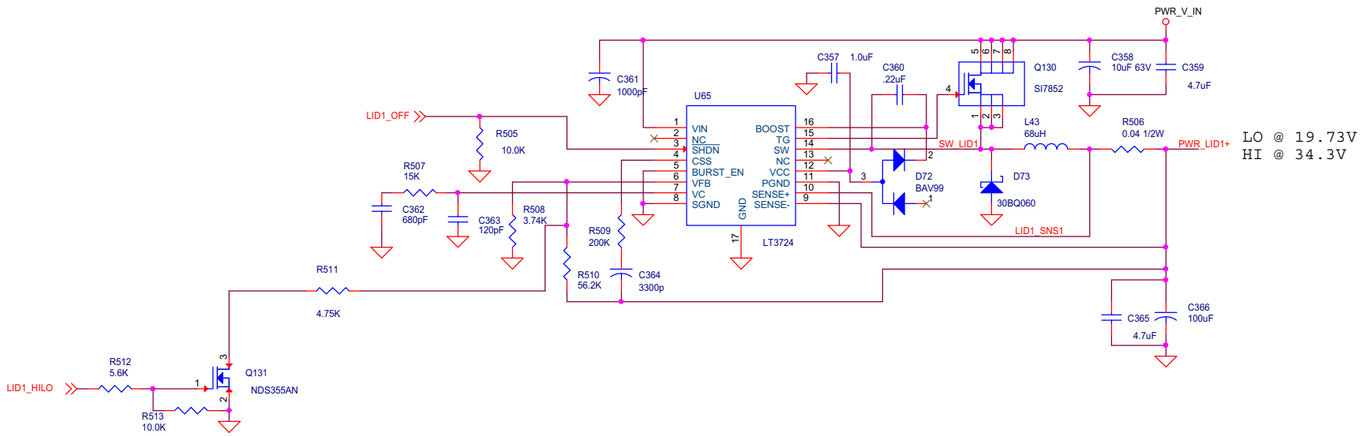


Life Science Group
Hercules, CA 94547
2000 Alfred Nobel Dr.

SCHEM,PCB, MAIN BOARD, ROAD RUNNER

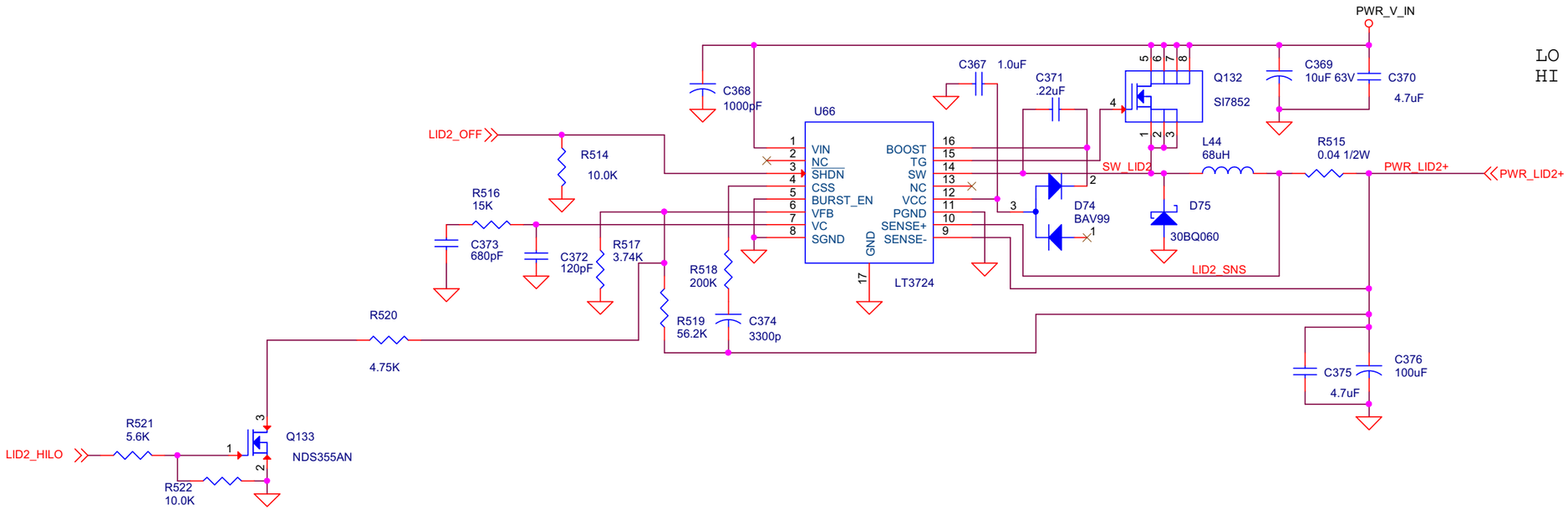
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B	D067329	
Scale	Sheet	Rev
NONE	19 of 21	A





LO @ 19.73V
HI @ 34.3V

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SCHEM,PCB, MAIN BOARD, ROAD RUNNER		
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Section 11
Appendix

Appendix A

11.1 C1000-Touch Installation Report

This section is the Installation Report for the C1000-Touch thermal cycler as performed in the Installation section with additional recording of information on the report. Successful completion of the Installation section represents the verification of instrument installation. This report should be filed for record keeping.

C1000-Touch Thermal Cycler

Installation Report

Customer:	Instrument Model
Case Number:	Instument Serial Number

Test	Specification	Results
Visual Inspection		
	No signs of damage	❑ Pass ❑ Fail
	All contents and accessories received:	❑ Pass ❑ Fail
	C1000-Touch Chassis	❑ Pass ❑ Fail
	Alpha Reaction Block: Record Sample Well Type:_____	❑ Pass ❑ Fail
	Power Cord	❑ Pass ❑ Fail
	Fuses	❑ Pass ❑ Fail
	Operating Manual	❑ Pass ❑ Fail
	Warranty Card	❑ Pass ❑ Fail
Power Line Requirements	Line Voltage Check: Record AC line voltage_____	❑ Pass ❑ Fail
Serial Number	Instrument Serial Number:	
	C1000-Touch Chassis S/N_____	❑ Pass ❑ Fail
	Alpha Reaction Block S/N_____	❑ Pass ❑ Fail
Instrument Software	Firmware Version:	
	C1000-Touch Chassis HC12 Firmware Version-_____	❑ Pass ❑ Fail
	C1000-Touch Chassis PAX270 Firmware Version_____	❑ Pass ❑ Fail
Start Up	Power-up self-test	❑ Pass ❑ Fail
	Display Check	❑ Pass ❑ Fail
	Fan Check	❑ Pass ❑ Fail
Diagnostic test		❑ Pass ❑ Fail

The above referenced instrument has been installed and meets all Installation requirements.
Comments:

Bio–Rad Labs Service	Date

11.2 S1000 Installation Report

This section is the Installation Report for the S1000 thermal cycler as performed in the Installation section with additional recording of information on the report. Successful completion of the Installation section represents the verification of instrument installation. This report should be filed for record keeping.

S1000 Thermal Cycler

Installation Report

Customer:	Instrument Model
Case Number:	Instument Serial Number

Test	Specification	Results
Visual Inspection		
	No signs of damage	❑ Pass ❑ Fail
	All contents and accessories received:	❑ Pass ❑ Fail
	S1000 Chassis	❑ Pass ❑ Fail
	Alpha Reaction Block: Record Sample Well Type:_____	❑ Pass ❑ Fail
	Power Cord	❑ Pass ❑ Fail
	Fuses	❑ Pass ❑ Fail
	Operating Manual	❑ Pass ❑ Fail
	Warranty Card	❑ Pass ❑ Fail
Power Line Requirements	Line Voltage Check: Record AC line voltage_____	❑ Pass ❑ Fail
Serial Number	Instrument Serial Number:	
	S1000 Chassis S/N_____	❑ Pass ❑ Fail
	Alpha Reaction Block S/N_____	❑ Pass ❑ Fail
Instrument Software	Firmware Version:	
	S1000 Chassis Firmware Version _____	❑ Pass ❑ Fail
Start Up	Power-up self-test	❑ Pass ❑ Fail
	Display Check	❑ Pass ❑ Fail
	Fan Check	❑ Pass ❑ Fail
Diagnostic test	The diagnostic test can be performed if the S1000 is connected to a C1000 Cycler	❑ Not Applicable ❑ Pass ❑ Fail

The above referenced instrument has been installed and meets all Installation requirements.
Comments:

Bio–Rad Labs Service	Date

11.3 C1000-Touch Operational Report

This section is the Operational Report of the C1000-Touch thermal cyclers as performed in the System Checkout section. Successful completion of the tests in the System Checkout section represents a complete functional check of all system components.

C1000-Touch Thermal Cycler

Operational Report

Customer	Instrument Serial Number:
Case Number:	AC Input Voltage: ❑ 100v ❑ 120v ❑ 220v ❑ 240v

Test	Specification	Results
Instrument Condition	Alpha Block Cleanliness LCD Display Function Power-on Self-Test	❑ Pass ❑ Fail ❑ Pass ❑ Fail ❑ Pass ❑ Fail
Instrument Software	Firmware Version: C1000-Touch Chassis HC12 Firmware Version-_____ C1000-Touch Chassis PAX270 Firmware Version_____	 ❑ Pass ❑ Fail ❑ Pass ❑ Fail
Diagnostic Test	 C1000-Touch Diagnostic Test First Attached S1000 Diagnostic Test ❑ N/A Second Attached S1000 Diagnostic Test ❑ N/A Third Attached S1000 Diagnostic Test ❑ N/A	 ❑ Pass ❑ Fail ❑ Pass ❑ Fail ❑ Pass ❑ Fail ❑ Pass ❑ Fail
USB Thumb key	Transfer Diagnostic test Result to PC using USB thumbkey	❑ Pass ❑ Fail
Lid Heater Test (OPTIONAL)	Record Lid Temperature _____°C	 ❑ Pass ❑ Fail

Thermal Validation Test	Validation Result Printout Attachment ❑ Yes ❑ No ❑ N/A C1000-Touch Certificate Printout Completed ❑ Yes ❑ No ❑ N/A Thermal Validation Contract ❑ Yes ❑ No ❑ N/A Specification: Accuracy _____ Uniformity _____	❑ Not Applicable ❑ Not Applicable ❑ Not Applicable ❑ Pass ❑ Fail ❑ Pass ❑ Fail ❑ Pass ❑ Fail

Test Equipment Standards

Calibration Control Number	Model Description	Serial Number	Cal Date	Cal Due Date

The above referenced instrument meets all performance specifications requirements.

Comments:

Bio-Rad Labs Service	Date

11.4 S1000 Operational Report

This section is the Operational Report of the S1000 thermal cyclers as performed in the System Checkout section. Successful completion of the tests in the System Checkout section represents a complete functional check of all system components.

S1000 Thermal Cycler

Operational Report

Customer	Instrument Serial Number:
Case Number:	AC Input Voltage: ❑ 100v ❑ 120v ❑ 220v ❑ 240v

Test	Specification	Results
Instrument Condition	Alpha Block Cleanliness LCD Display Function Power-on Self-Test Firmware Version Record version_____ _____	❑ Pass ❑ Fail ❑ Pass ❑ Fail ❑ Pass ❑ Fail ❑ Pass ❑ Fail
Diagnostic Test	The diagnostic test can be performed if the S1000 is connected to a C1000 Cycler	❑ Not Applicable ❑ Pass ❑ Fail
USB Thumb key	Transfer Diagnostic test Result to PC using USB thumbkey	❑ Pass ❑ Fail
Lid Heater Test (OPTIONAL)	Record Lid Temperature _____°C	❑ Pass ❑ Fail
Thermal Validation Test	Validation Result Printout Attachment ❑ Yes ❑ No ❑ N/A C1000 Certificate Printout Completed ❑ Yes ❑ No ❑ N/A Thermal Validation Contract ❑ Yes ❑ No ❑ N/A Specification: Accuracy _____ Uniformity _____	❑ Not Applicable ❑ Not Applicable ❑ Not Applicable ❑ Pass ❑ Fail ❑ Pass ❑ Fail ❑ Pass ❑ Fail

Test Equipment Standards

Calibration Control Number	Model Description	Serial Number	Cal Date	Cal Due Date

The above referenced instrument meets all performance specifications requirements.

Comments:

Bio-Rad Labs Service	Date

Appendix B

B-1 Diagnostic Test result sample

Following is a sample Diagnostic test report that will be generated upon completion of the diagnostic test on a C1000-Touch thermal cycler and any attached S1000 thermal cycler system. the report can be viewed on the C1000-Touch LCD screen or transferred to PC using USB thumbkey flash drive. A copy of the diagnostic test should be printed and attached to Operation report of the C1000-Touch thermal cycler.

Operator ID Test Engineer

Instrument SN: EP200001

Block SN: RD018660

Block Type: 96 Deep Well

PXA270: 1.101.422.514

HC12: 1.0.165.0

FX2: 1.35.0.0

LED Test

LED test passed. The LED turned on and off.

Fans Test

Fan low speed test passed.

Fan medium speed test passed.

Fan high speed test passed.

Beeper Test

Beeper test passed. Beeper was audible to operator.

Self Test

System self test passed.

Protocol Test

Protocol 1

METHOD CALC

HOTLID 105,30

VOLUME 30

TEMP 100.0,10

TEMP 4.0,10

TEMP 100.0,10

GRAD 46.0,70.0,10

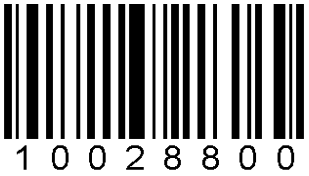
TEMP 55.0,10

END

Protocol 1 PASSED

Start Time: 05/27/2011 13:57:58

End Time: 05/27/2011 14:08:03





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