INSTRUCTION MANUAL

Model T100H

UV FLUORESCENCE SO2 ANALYZER

Addendum to T100 Operation Manual, PN 068070000

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072650000
REV. A
June 2011

SAFETY MESSAGES

Important safety messages are provided throughout this manual for the purpose of avoiding personal injury or instrument damage. Please read these messages carefully. Each safety message is associated with a safety alert symbol, and are placed throughout this manual; the safety symbols are also located inside the instrument. It is imperative that you pay close attention to these messages, the descriptions of which are as follows:

WARNING: Electrical Shock Hazard

HAZARD: Strong oxidizer

GENERAL WARNING/CAUTION: Read the accompanying message for specific information.

CAUTION: Hot Surface Warning

Do Not Touch: Touching some parts of the instrument without protection or proper tools could result in damage to the part(s) and/or the instrument.

Technician Symbol: All operations marked with this symbol are to be performed by qualified maintenance personnel only.

Electrical Ground: This symbol inside the instrument marks the central safety grounding point for the instrument.

CAUTION

This instrument should only be used for the purpose and in the manner described in this manual. If you use this instrument in a manner other than that for which it was intended, unpredictable behavior could ensue with possible hazardous consequences.

NEVER use any gas analyzer to sample combustible gas(es)!

Note

Technical Assistance regarding the use and maintenance of the T100H or any other Teledyne ML product can be obtained by contacting Teledyne ML's Customer Service Department:

Telephone: 800-846-6062

Email: tml_support@teledyne.com

or by accessing various service options on our website at http://www.teledyne-ml.com

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WARRANTY PROCEDURE

- Customer shall notify TML of a defect within the warranty period and request a return authorization number and designated TML repair facility. Customer shall return the defective part or parts to the designated TML Customer Service Facility as set forth below, freight prepaid by the customer. TML will prepay the return freight.
- TML will notify the customer of TML's decision to repair or replace the defective part and the expected shipment date.
- At the customer's request, TML may elect to repair defective product(s) located in North America on site, in which case travel expenses, travel time, and related expenses incurred by TML personnel (excluding repair time) shall be paid by the customer.

Teledyne Monitor Labs Service Response Center 1-800-846-6062 www.teledyne-ml.com

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ABOUT THIS MANUAL

This T100H manual, PN xxxxx, is to be used in conjunction with the T100 manual (PN 068070000); it is comprised of multiple documents, in PDF format, as listed below.

Part No.	Rev	Name/Description

NOTE

Please read in its entirety before making any attempt made to operate the instrument.

REVISION HISTORY

yyyy Mmm dd, MxxxX Manual, PNxxxxx Rev [X], DCN [xxxx]				
Document	**PN**	**Rev**	**DCN**	**Change Summary**
	00000			•
				•
				•

2010, T100H Manual, PN0 Rev A, DCN				
Document	**PN**	**Rev**	**DCN**	**Change Summary**
Xxxx Manual	0xxxx	X	xxxx	Initial Release
For the purpose of capturing this manual's construct at its initial release, the following list documents the current Rev of each part comprising Rev A of this manual. Any future changes to this manual will be recorded in this *Revision History* section, most recent changes at the top. Their new Rev letters will be updated in the preceding *About This Manual* section:				

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1. INTRODUCTION

This addendum is based on the Model T100 Operators Manual (P/N 068070000). In most ways the T100H analyzer is identical to the T100 in design and operation, therefore most of the basic set up information, operating instructions as well as calibration, maintenance, troubleshooting and repair methods are found in that manual. This addendum documents only those areas where the T100H is different in design or operating method from the T100.

1.1. T100H Documentation

NOTE

Throughout this addendum, words printed in capital, bold letters, such as SETUP or ENTR represent messages as they appear on the analyzer's front panel display

NOTE

The menu flowcharts in this addendum contain typical representations of the analyzer's display during the various operations being described. These representations are not intended to be exact and may differ slightly from the actual display of your instrument.

1.2. Using This Manual Addendum

This manual addendum has the same overall structure as that of the T100 operator's manual, to simplify referring between the two. The manual has the following sections:

Table of Contents:

Outlines the contents of the addendum in the order the information is presented. This is a good overview of the topics covered in the manual. There is also a list of tables, a list of figures and a list of appendices.

Specifications and Warranty

This section contains a list of the analyzer's performance specifications, a description of the conditions and configuration under which EPA equivalency was approved and Teledyne Instrument's warranty statement.

Getting Started:

A concise set of instructions for setting up, installing and running your analyzer for the first time.

FAQ:

Answers to the most frequently asked questions about operating the analyzer.

Optional Hardware & Software

A description of optional equipment to add functionality to your analyzer.

Operation Instructions

This section includes step by step instructions for operating the analyzer and using its various features and functions.

Calibration Procedures

General information and step by step instructions for calibrating your analyzer.

Instrument Maintenance

Description of preventative maintenance procedures that should be regularly performed on you instrument to assure good operating condition.

Theory of Operation

This section describes the aspects of T100H operation that differ from the T100 manual.

Maintenance & Troubleshooting Section:

This section includes pointers and instructions for diagnosing problems that are specific to the T100H. The T100 manual has a more complete troubleshooting section, most of which also applies to the T100H.

Appendices:

For easier access and better updating, some information has been separated out of the manual and placed in a series of appendices at the end of this addendum. These include: software menu trees, warning messages, definitions of DAS & serial I/O variables, spare parts list, repair questionnaire, interconnect listing and drawings, and electronic schematics.

2. SPECIFICATIONS, APPROVALS & WARRANTY

2.1. Specifications

Table 2-1: Model T100H Basic Unit Specifications

Min/Max Range (Physical Analog Output)	In 1ppb increments from 10ppm to 5,000 ppm, dual ranges or auto ranging
Measurement Units	ppm, mg/m3 (user selectable)
Zero Noise[1]	0.05 ppm rms
Span Noise[1]	< 0.5% of reading (above 50 ppm)
Lower Detectable Limit[2]	0.1 ppm rms
Zero Drift (24 hours)	< 1 ppm
Zero Drift (7 days)	< 2 ppm
Span Drift (7 Days)	< 0.5% FS
Linearity	1% of full scale
Precision	0.5% of reading[1]
Temperature Coefficient	< 0.1% per ^{o}C
Voltage Coefficient	< 0.05% per V
Lag Time[1]	5 sec
Rise/Fall Time[1]	95% in < 30 sec
Sample Flow Rate	700 cm^3/min. ±10%
Temperature Range	5-40^{o}C
Humidity Range	0 - 95% RH, non-condensing
Dimensions H x W x D	7" x 17" x 23.5" (178 mm x 432 mm x 597 mm)
Weight, Analyzer (Basic Configuration)	45 lbs (20.5 kg) w/internal pump
Weight, Pump Pack	16 lbs (7 kg)
AC Power Rating	100 V, 50/60 Hz (3.25A); 115 V, 60 Hz (3.0 A); 220 – 240 V, 50/60 Hz (2.5 A)
Environmental	Installation category (over-voltage category) II; Pollution degree 2
Analog Outputs	Three (3) Outputs
Analog Output Ranges	100 mV, 1 V, 5 V, 10 V, 2-20 or 4-20 mA isolated current loop. All Ranges with 5% Under/Over Range
Analog Output Resolution	1 part in 4096 of selected full-scale voltage
Status Outputs	8 Status outputs from opto-isolators
Control Inputs	6 Control Inputs, 3 defined, 3 spare
Serial I/O	One (1) RS-232; One (1) RS-485 (2 connecters in parallel) Baud Rate : 300 – 115200: Optional Ethernet Interface
Certifications	EN61326 (1997 w/A1: 98) Class A, FCC Part 15 Subpart B Section 15.107 Class A, ICES-003 Class A (ANSI C63.4 1992) & AS/NZS 3548 (w/A1 & A2; 97) Class A. IEC 61010-1:90 + A1:92 + A2:95,
1 As defined by the USEPA. 2 Defined as twice the zero noise level by the USEPA.	

2.2. CE Mark Compliance

Emissions Compliance

The Teledyne-Advanced Pollution Instrumentation UV Fluorescence SO_2 Analyzer was tested and found to be fully compliant with:

EN61326 (1997 w/A1: 98) Class A, FCC Part 15 Subpart B Section 15.107 Class A, ICES-003 Class A (ANSI C63.4 1992) & AS/NZS 3548 (w/A1 & A2; 97) Class A.

Safety Compliance

The Teledyne-Advanced Pollution Instrumentation UV Fluorescence SO_2 Analyzer was tested and found to be fully compliant with:

IEC 61010-1:90 + A1:92 + A2:95,

3. GETTING STARTED

3.1. Unpacking and Initial Setup

	**CAUTION** **To avoid personal injury, always use two persons to lift and carry the Model T100H.**

	**WARNING** **Ensure that the power source voltage and frequency match those of the instrument specs on the rear panel model label. Never disconnect electronic circuit boards, wiring harnesses or electronic subassemblies while the unit is under power.**

	**CAUTION – Avoid Warranty Invalidation** **Printed circuit assemblies (PCAs) are sensitive to electro-static discharges too small to be felt by the human nervous system. Damage resulting from failure to use ESD protection when working with electronic assemblies will void the instrument warranty.** See *A Primer on Electro-Static Discharge* in the main manual for more information on preventing ESD damage.

1. Inspect the received packages for external shipping damage. If damaged, please advise the shipper first, then T-ML.

2. Included with your analyzer is a printed record (Form number 04989) of the final performance characterization performed on your instrument at the factory. This record is an important quality assurance and calibration record for this instrument. It should be placed in the quality records file for this instrument.

3. Carefully remove the top cover of the analyzer and check for internal shipping damage.

    - Remove the set screw located in the top, center of the rear panel
    - Remove the screws fastening the top cover to the unit (four per side).
    - Lift the cover straight up.

4. Inspect the interior of the instrument to make sure all circuit boards and other components are in good shape and properly seated.

5. Check the connectors of the various internal wiring harnesses and pneumatic hoses to make sure they are firmly and properly seated.

6. Verify that all of the optional hardware ordered with the unit has been installed. These are checked on the paperwork (Form 04989) accompanying the analyzer.

3.1.1. Electrical Connections:

For full details on the electrical connections of the T100H, please refer to the T100 user's manual (#068070000), Electrical Connections section.

3.1.1.1. External Pump

The T100H is equipped with an external pneumatic pump. This pump is powered separately from the instrument via it's own power cord. The pump has no ON/OFF switch and should begin operating as soon as it is plugged into a live power supply.

<table>
<tr>
<td>  </td>
<td>

WARNING

- **Check the voltage / frequency label on the rear panel of the instrument and on the external pump for compatibility with the local power. Do not plug in either the analyzer or the pump unless the voltages or frequencies are correct.**
- **Power connection must have a functioning ground connection. Do not defeat the ground wire on power plug.**
- **Turn off analyzer power before disconnecting or connecting eletrical subassemblies.**
- **Do not operate with cover off.**

</td>
</tr>
</table>

3.2. Pneumatic Connections

NOTE

To prevent dust from getting into the analyzer, it was shipped with small plugs inserted into each of the pneumatic fittings on the rear panel. Make sure that all dust plugs are removed before attaching exhaust and supply gas lines. Store for future use.

Table 3-1: Inlet / Outlet Connector Descriptions

REAR PANEL LABEL	FUNCTION
Sample	Connects the sample gas to the analyzer. When operating the analyzer without zero span option, this is also the inlet for any calibration gases.
Exhaust	Connect an exhaust gas line to this port to the inlet of the external pump.
Zero Air	On Units with zero/span valve option installed, this port connects the zero air gas or the zero air cartridge to the analyzer.

Figure 3-5 of the T100 Manual (P/N 068070000) shows the internal pneumatic flow of the T100 in its standard configuration. For a diagram of the internal pneumatic flow of the T100H, see Figure 3-2 of this addendum.

3.2.1.1. Pneumatic Connections to T100H Basic Configuration:

The pneumatic connections for the T100H analyzer in its basic configuration are nearly identical to those described the T100 Manual (P/N 068070000) Section 3.5 except that the T100H has an external pump. Therefore:

- A pneumatic line of ¼" PTEF must be attached between the analyzer's exhaust port and the inlet port of the pump.
- The exhaust from must be vented outside the shelter or immediate area surrounding the instrument using a maximum of 10 meters of 1/4" PTFE tubing.

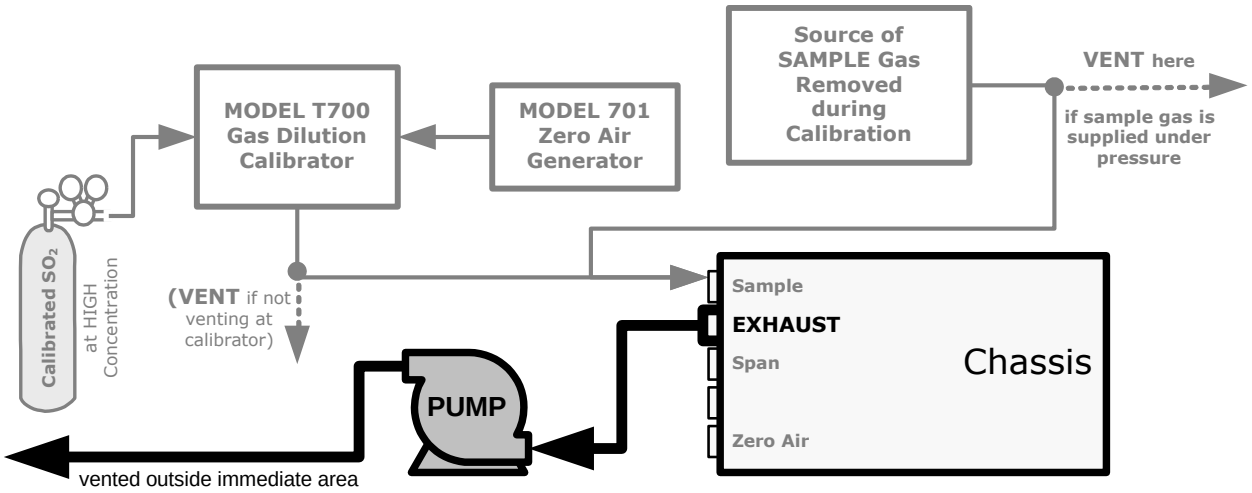


Figure 3-1: Example of Pneumatic Connections to T100H External Pump

This change is true for all configurations and variations of the T100H.

3.2.1.2. Connections with Internal Valve Options Installed

- There is no IZS option available for the T100H .
- An additional valve option (Option 52 - Zero & Two Span Points) is available on the T100H. The pneumatic set up for this option is:

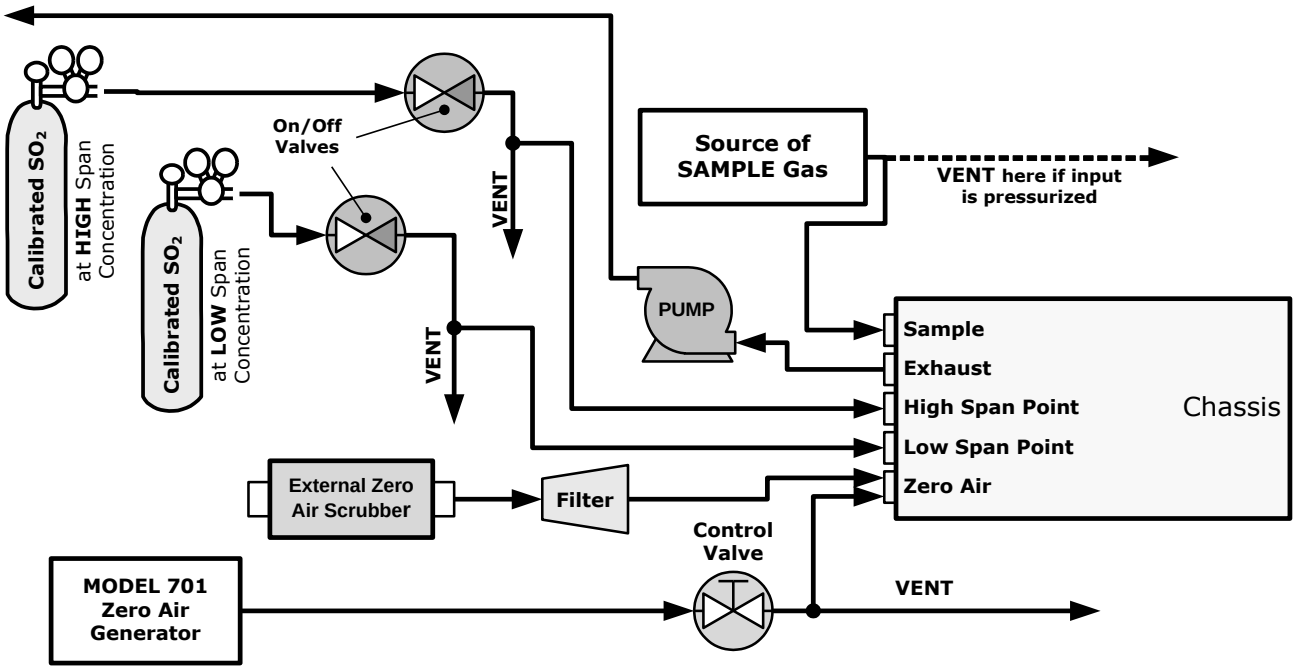


Figure 3-2: Pneumatic Connections to T100H with Zero and Two Span Point Valve Option

3.2.2. T100H Layout

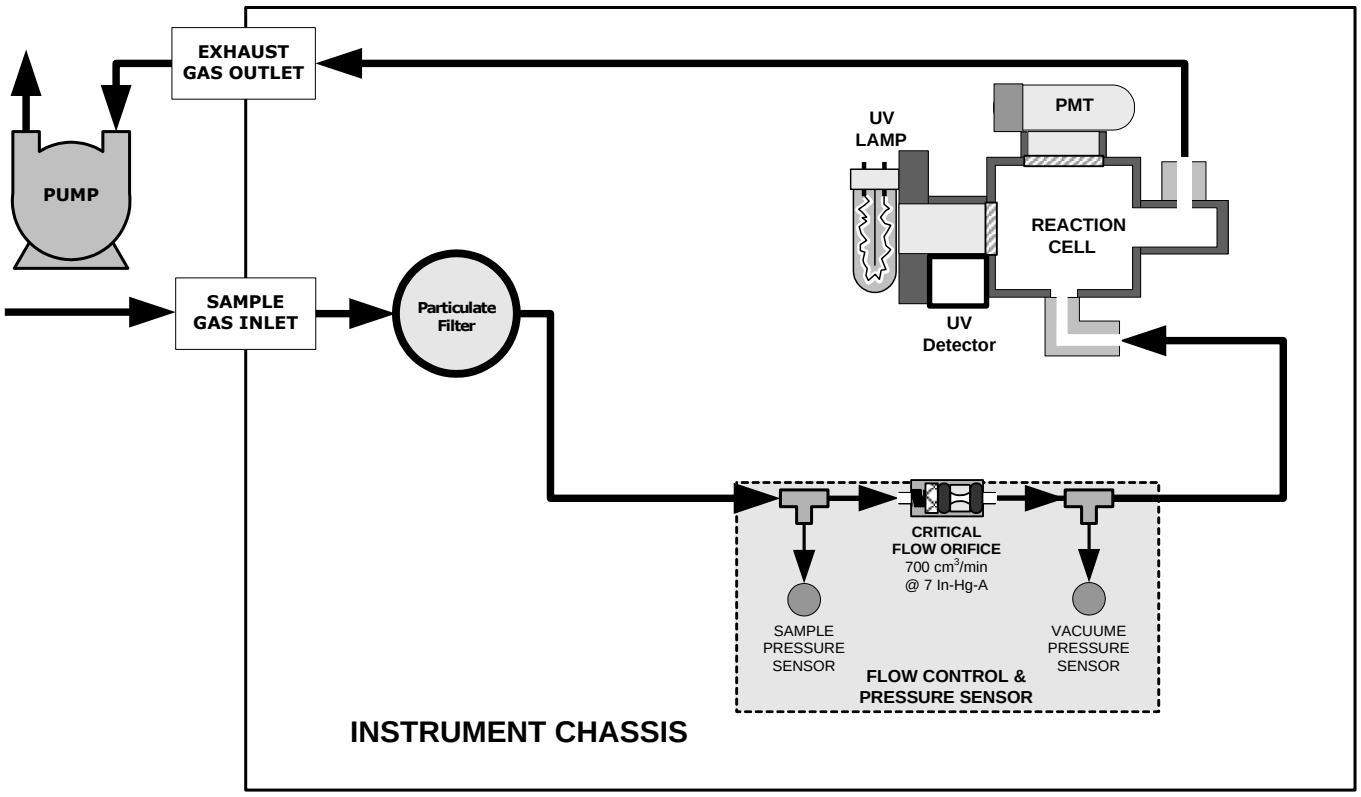


Figure 3-3: Internal Pneumatic flow for T100H in Basic Configuration

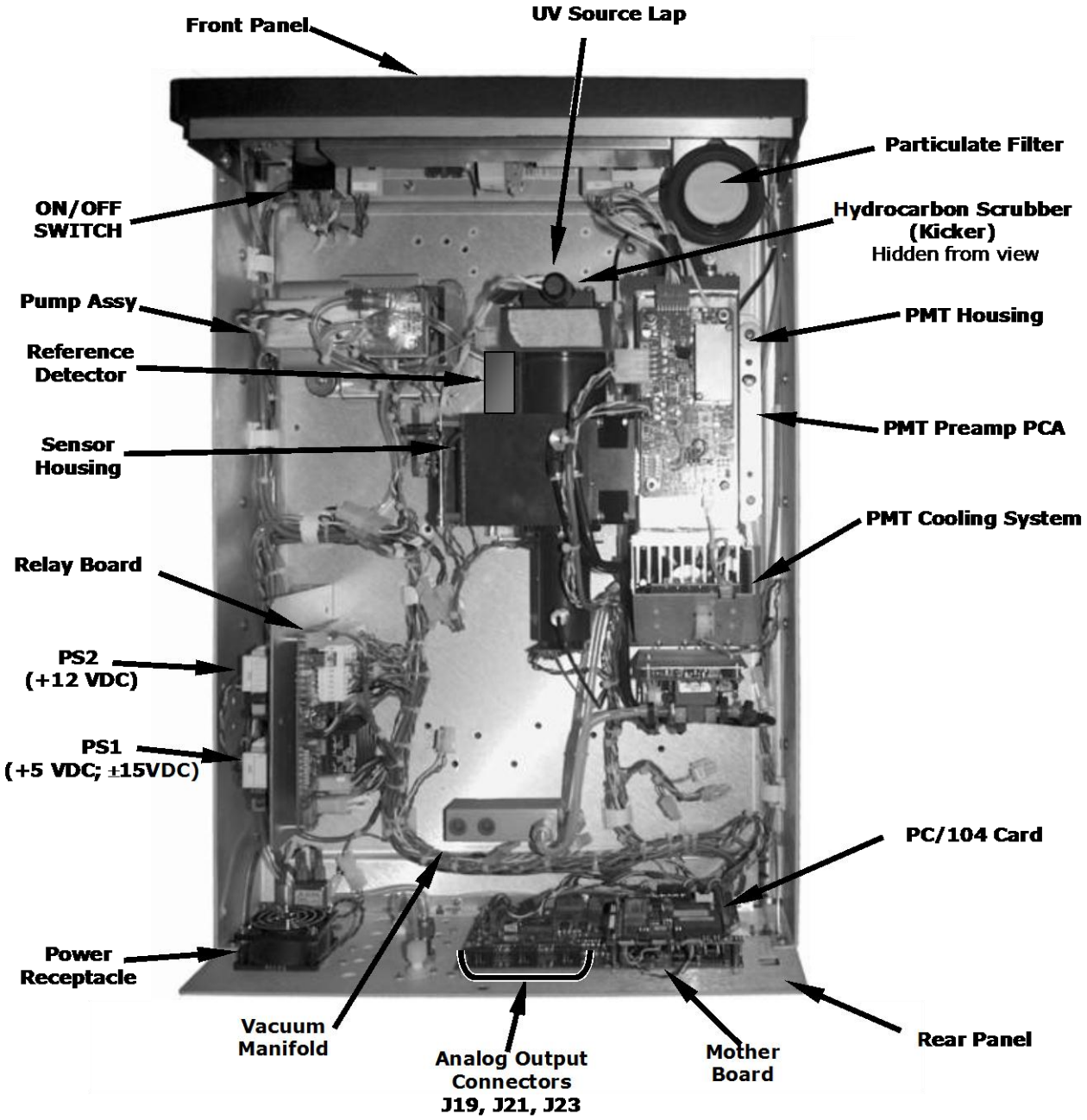


Figure 3-4: T100H Layout (Basic Unit – No Valve Options)

3.3. Initial Operation

With the following exceptions, the operation of the T100H is nearly identical to that of the T100. Please refer to the T100 User's Manual, Section 3, for details on initial operation, including common warning messages, functional check, and initial calibration and common interferents for the T100H.

3.3.1. Warning Messages

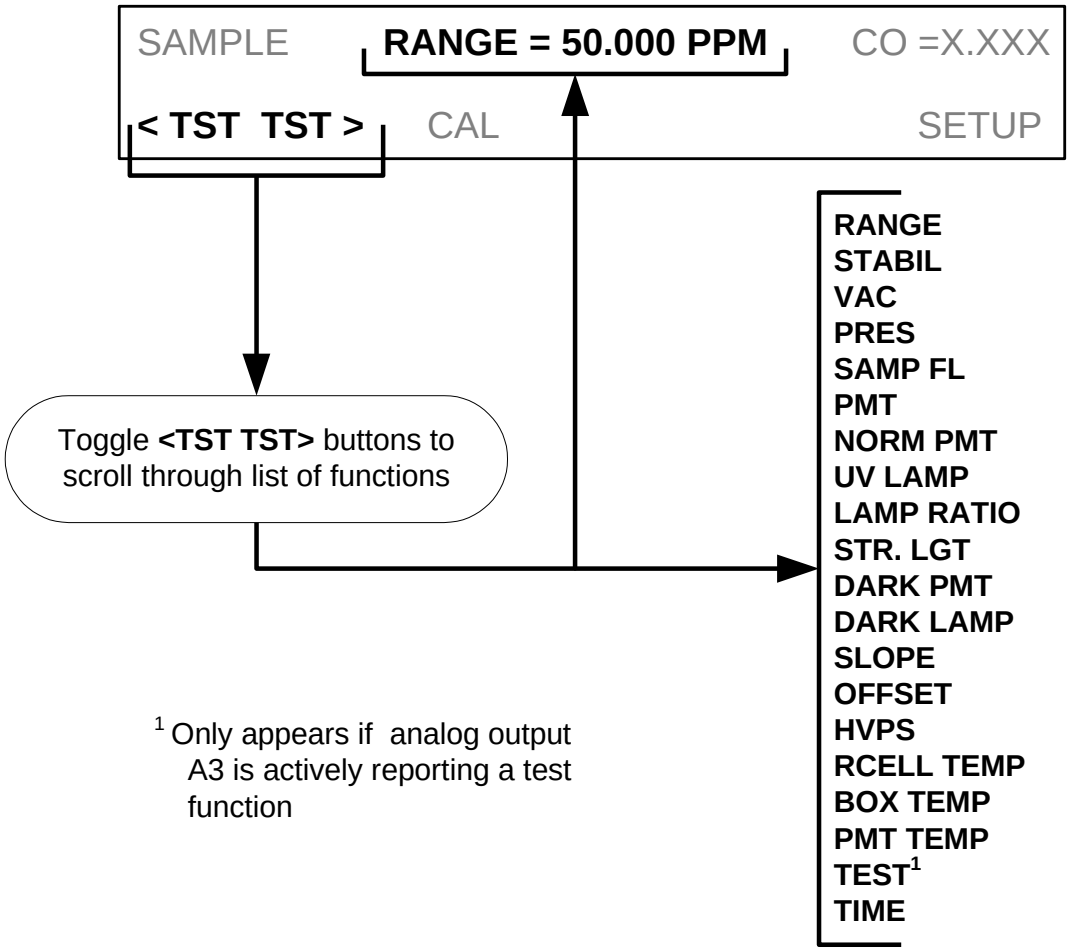
Please refer to the T100 User's Manual (068070000), Section 3, for a complete listing of warnings for the T100H. The following table lists warnings that differ in the T100H from those described in the T100 manual.

Table 2-1: Possible Warning Messages at Start-Up

MESSAGE	MEANING
Vacuum Pressure Warning	The vacuum pressure reading is out of its allowed range. The pump may have failed, or the instrument may have a leak or obstruction in the flow path.

3.3.2. Test Functions

Check to make sure that the analyzer is functioning within allowable operating parameters as described in the T100 Manual (P/N 068070000). The available test functions for the T100H are:



[1] Only appears if analog output A3 is actively reporting a test function

3.3.3. Interferents for SO_2 Measurements

Hydrocarbons are a significant interferent for UV fluorescent SO_2 measurements, however, the typical T100H application does not have hydrocarbons in the sample stream. Therefore, in order to reduce cost to the customer, the T100H in its standard configuration does not include a hydrocarbon kicker/scrubber.

If your application includes hydrocarbons in the sample gas stream, it is very important that they be removed from the sample gas prior to the it entering the analyzer's sample chamber. A hydrocarbon Kicker Option (OPT 65) package (see Section 5 of this manual) is available for this purpose.

4. FREQUENTLY ASKED QUESTIONS (FAQS)

More FAQs are included in the T100 manual, which also includes a glossary of terms.

Q: How long does the sample pump last?

A: The sample pump should last about one year and the pump diaphragms should to be replaced annually or when necessary.

To determine if the diaphragm on a T100H needs replacing check the **VAC** test function (instead of the **PRES** function as described in the T100 Manual - P/N 068070000). If the **VAC** value is > 10 in-Hg-A, the diaphragm should be replaced.

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5. OPTIONAL HARDWARE AND SOFTWARE

With the following additions, changes and exceptions, the options listed in Table 1-1 of the T100 Manual (P/N 068070000) are also available for the T100H.

5.1. Ambient Zero/Ambient Span Valves (Option 50A)

The T100H zero/span valve option is identical to that of the T100 in respect to operation and valve states (see Table 3-10 of the T100 Manual). The internal pneumatic connections are slightly different.

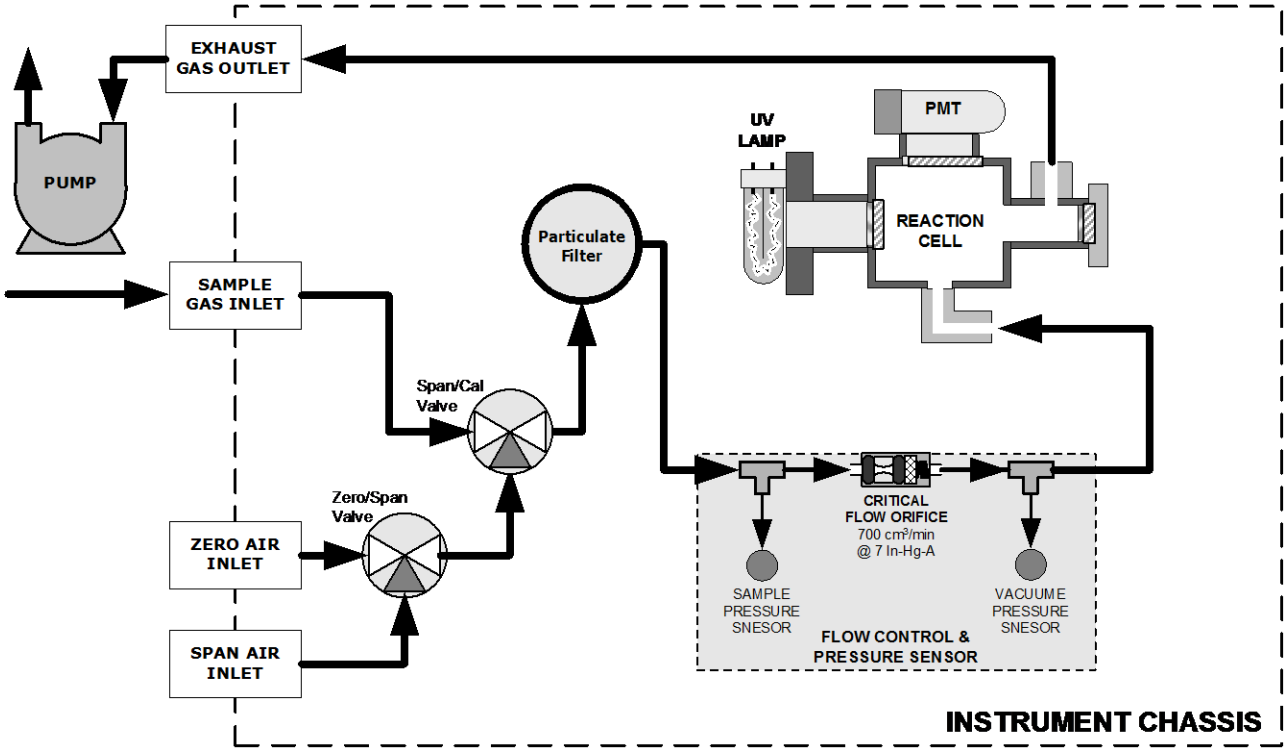


Figure 5-1: Pneumatic Diagram of the T100H With Z/S Option Installed.

5.2. Ambient Zero / Two Ambient Span Valve Option (OPT 50C)

This option includes a special set of valves that allows two separate SO_2 mixtures to enter the analyzer from two independent sources. Typically these two gas mixtures will come from two, separate, pressurized bottles of certified calibration gas: one mixed to produce a SO_2 concentration equal to the expected span calibration value for the application and the other mixed to produce a concentration at or near the midpoint of the intended measurement range. Individual gas inlets, labeled HIGH SPAN and LOW SPAN are provided at the back on the analyzer.

The valves allow the user to switch between the two sources via keys on the front panel or from a remote location by way of either the analyzer's digital control inputs or by sending commands over it's serial I/O port(s).

NOTE

The analyzer's software only allows the SLOPE and OFFSET to be calculated when sample is being routed through the HIGH SPAN inlet.

The LOW SPAN gas is for midpoint reference checks only.

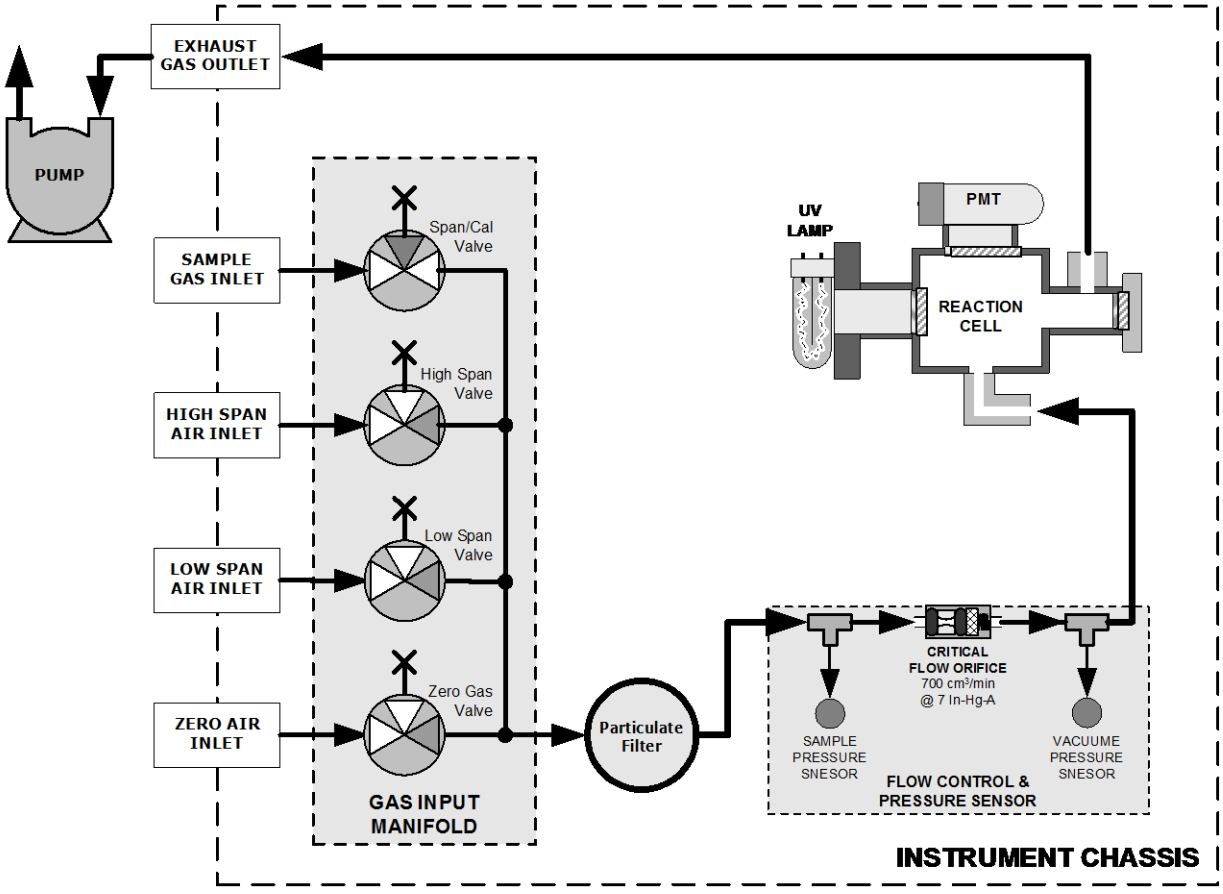


Figure 5-2: Pneumatic Diagram of the T100H with Option 50C Installed

Table 5-1 describes the state of each valve during the analyzer's various operational modes.

Table 5-1: Two-Point Span Valve Operating States

MODE	VALVE	CONDITION
SAMPLE	Sample/Cal	**Open to SAMPLE inlet**
	Zero Gas Valve	Closed to ZERO AIR inlet
	High Span Valve	Closed to HIGH SPAN inlet
	Low Span Valve	Closed to LOW SPAN inlet
ZERO CAL	Sample/Cal	Closed to SAMPLE inlet
	Zero Gas Valve	**Open to ZERO AIR inlet**
	High Span Valve	Closed to HIGH SPAN inlet
	Low Span Valve	Closed to LOW SPAN inlet
HIGH SPAN CAL	Sample/Cal	Closed to SAMPLE inlet
	Zero Gas Valve	Closed to ZERO AIR inlet
	High Span Valve	**Open to HIGH SPAN inlet**
	Low Span Valve	Closed to LOW SPAN inlet
Low Span Check	Sample/Cal	Closed to SAMPLE inlet
	Zero Gas Valve	Closed to ZERO AIR inlet
	High Span Valve	Closed to HIGH SPAN inlet
	Low Span Valve	**Open to LOW SPAN inlet**

5.3. Hydrocarbon Kicker Option (OPT 86D)

This option is specifically designed for those applications where hydrocarbons are present in the sample gas stream. It includes an internal, scrubber consisting of a tube of a specialized plastic that absorbs hydrocarbons very well located within an outer flexible plastic tube shell.

As gas flows through the inner tube, hydrocarbons are absorbed into the membrane walls. and transported through the membrane wall and into the hydrocarbon free, purge gas flowing through the outer tube (see Figure 5-3). This process is driven by the hydrocarbon concentration gradient between the inner and outer of the tubes.

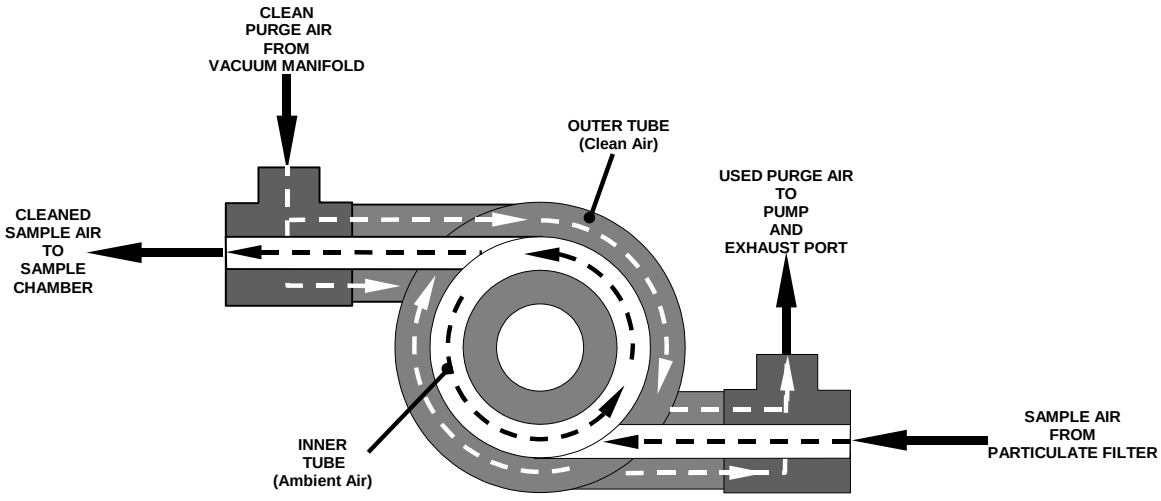


Figure 5-3: Hydrocarbon Scrubber (Kicker) – OPT 86D

The scrubbed air from the inner tube is returned to be used as the purge gas in the outer tube after it passes through the analyzers reaction cell. This means that when the analyzer is first started, the concentration gradient

between the inner and outer tubes is small and the scrubber's efficiency is relatively low. When the instrument is turned on after having been off for more than 30 minutes, it takes a certain amount of time for the gradient to become large enough for the scrubber to adequately remove hydrocarbons from the sample air.

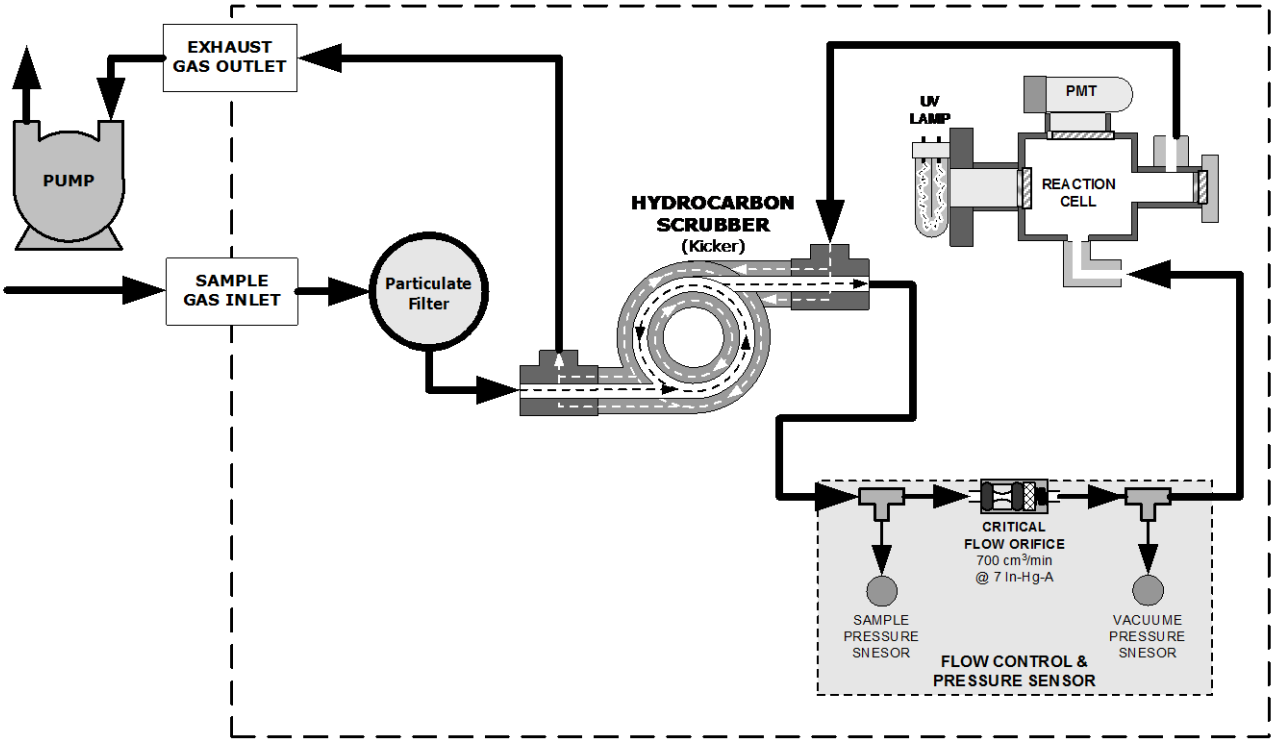


Figure 5-4: T100H Internal Pneumatic Diagram with Hydrocarbon Scrubber Installed

6. OPERATING INSTRUCTIONS

6.1. Warning Messages

Please refer to the T100 User's Manual (068070000), Section 4.2.2, for a list of warnings for the T100H. The following table list describes an additional warning in the T100H.

Table 6-1: Additional M101EH Warning Messages

MESSAGE	MEANING
Vacuum Pressure Warning	The vacuum pressure reading is out of its allowed range. The pump may have failed, or the instrument may have a leak or obstruction in the flow path.

6.2. Test Functions

Please refer to the T100 Manual (068070000), Section 4.2.1, for a list of test functions for the T100H. The following table lists test functions that are in addition to or differ from those listed there.

Table 6-2: Additional T100H Test Functions

DISPLAY	PARAMETER	UNITS	DESCRIPTION
VAC	Vacuum Pressure	In-Hg-A	The actual pressure measured on the vacuum side of the T100H's critical flow orifice. This is the pressure of the gas in the instrument's sample chamber.
PRES	Sample GAS Pressure	in-Hg-A	The current pressure of the sample gas as it enters the sample inlet at the back of the analyzer, but upstream of the critical flow orifice and before the gas enters the reaction cell.

6.2.1. Test Channel Output

When activated, output channel **A3** can be used to report one of the test functions viewable from the SAMPLE mode display. To activate the A3 channel and select a test function, follow instructions in Section 6.9.10 of the T100 Manual (P/N 068070000).

The following table lists test functions that are in addition to or differ from those listed in Table 6-14 of the T100 Manual.

Table 6-3: Additional M101EH Test Parameters Available for Analog Output A3

TEST CHANNEL	TEST PARAMETER RANGE
VACUUM PRESSURE	0-40 in-Hg-A

6.2.2. Range Units

The T100H only displays concentrations in parts per million (10^6 mols per mol, **PPM**) or milligrams per cubic meter (mg/m^3, **MGM**).

- NOT AVAILABLE: Parts per billion (10^9 mols per mol, **PPB**) and micrograms per cubic meter ($\mu g/m^3$, **UGM**).

To change the concentration units of the T100H follow the instructions found in Section 6.7.7 of the T100 Manual.

6.2.3. Using the T100H with a Hessen Protocol Network

The set up and use of the T100H in Hessen protocol networks is the sane as described in Section 6.12.4 of the T100 Manual (P/N 068070000) except that there are minor differences in the status flags. The following table supercedes Table 6-27 of the T100 Manual.

Table 6-4: T100H Default Hessen Status Bit Assignments

STATUS FLAG NAME	DEFAULT BIT ASSIGNMENT
WARNING FLAGS	
SAMPLE FLOW WARNING	0001
PMT DET WARNING	0002
UV LAMP WARNING	0002
HVPS WARNING	0004
DARK CAL WARNING	0008
RCELL TEMP WARNING	0010
PMT TEMP WARNING	0040
INVALID CONC	0080
OPERATIONAL FLAGS	
In Manual Calibration Mode	0200
In Zero Calibration Mode	0400
In Low Span Calibration Mode	0800
In Span Calibration Mode	0800
UNITS OF MEASURE FLAGS	
UGM[1]	0000
MGM	2000
PPB[1]	4000
PPM	6000
SPARE/UNUSED BITS	0020, 0100, 8000
UNASSIGNED FLAGS	
Box Temp Warning	System Reset
Sample Press Warning	Front Panel Warning
Vacuum Press Warning	Analog Cal Warning
Rear Board Not Detected	Cannot Dyn Zero
Relay Board Warning	Cannot Dyn Span
[1] Although assigned flags, these units are not available on the T100H	

6.2.4. Default DAS Channels

The default Data Channels included in the M101EH analyzer's software include the **CONC, PNUMT** & **CALDAT** channels. The **FAST** & **DETAIL** preset channels are not included.

6.2.5. Remote Operation Using the External Digital I/O

6.2.5.1. Status Outputs

The function and pin assignment5s for the T100H digital status outputs are:.

Table 6-5: Status Output Signals

SATUS CONNECTOR PIN NUMBER[1]	STATUS DEFINITION	CONDITION
1	**SYSTEM OK**	ON if no faults are present.
2	**CONC VALID**	OFF any time the HOLD OFF feature is active, such as during calibration or when other faults exist possibly invalidating the current concentration measurement (example: sample flow rate is outside of acceptable limits). ON if concentration measurement is valid.
3	**HIGH RANGE**	ON if unit is in high range of the AUTO Range Mode
4	**ZERO CAL**	ON whenever the instrument's ZERO point is being calibrated.
5	**HIGH SPAN CAL**	ON whenever the instrument is set for **DUAL** or **AUTO** reporting range mode an it's high range span point is being calibrated .
6	**DIAG MODE**	ON whenever the instrument is in DIAGNOSTIC mode
7	**LOW SPAN CAL**	ON whenever the instrument is set for **DUAL** or **AUTO** reporting range mode an it's lows range span point is being calibrated .
8	**SPARE**	
D	**EMITTER BUS**	The emitters of the transistors on pins 1-8 are bussed together.
	SPARE	
+	**DC POWER**	+ 5 VDC, 300 mA source (combined rating with Control Output, if used).
⏚	**Digital Ground**	The ground level from the analyzer's internal DC power supplies

[1] Located on Rear Panel

6.2.5.2. Control Inputs

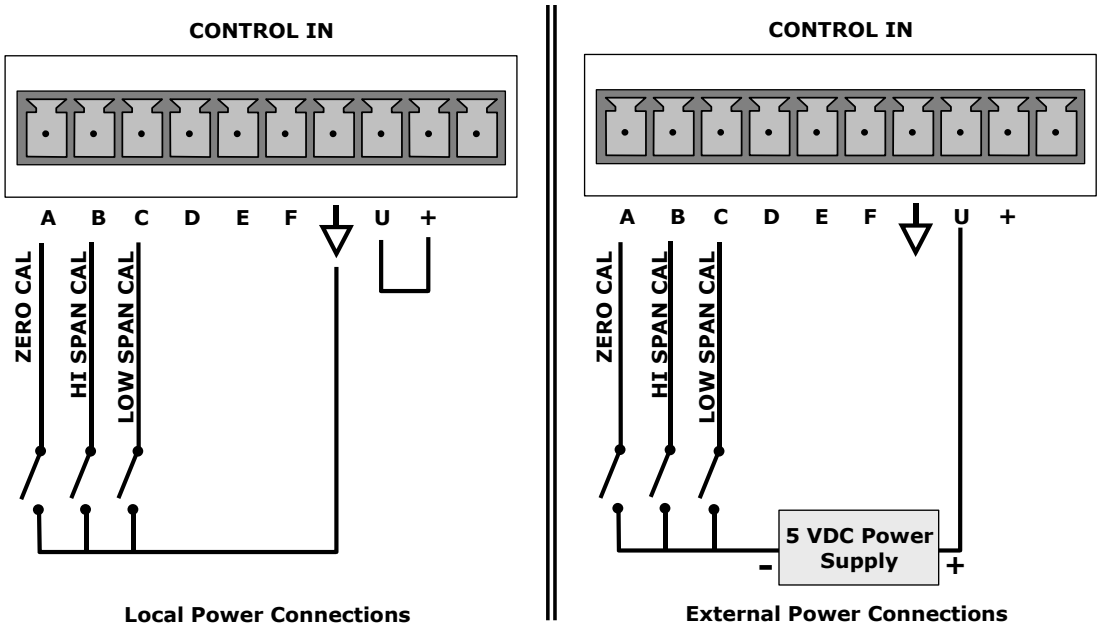


Figure 6-1: Control Input Connector

Table 6-6: Control Input Signals

INPUT #	STATUS DEFINITION	ON CONDITION
A	**REMOTE ZERO CAL**	The analyzer is placed in Zero Calibration mode. The mode field of the display will read ZERO CAL R.
B	**REMOTE HIGH SPAN CAL**	If the instrument is set for **DUAL** or **AUTO** reporting rang mode, activating this input causes the analyzer to enter high range span calibration mode. The mode field of the display will read SPAN CAL R.
C	**REMOTE LO SPAN CAL**	The analyzer is placed in low span calibration mode as part of performing a low span (midpoint) calibration. The mode field of the display will read LO CAL R.
D, E & F	**SPARE**	
⏚	**Digital Ground**	The ground level from the analyzer's internal DC power supplies (same as chassis ground)
U	**External Power input**	Input pin for +5 VDC required to activate pins A – F.
+	**5 VDC output**	Internally generated 5V DC power. To activate inputs A – F, place a jumper between this pin and the "U" pin. The maximum amperage through this port is 300 mA (combined with the analog output supply, if used).

7. CALIBRATION AND CALIBRATION CHECK PROCEDURES

Calibration procedures for the T100H are the same as those for the T100. One exception to this statement is that the T100H has a special valve option, Zero and Two Span Point Valve Option - OPT 52 (See Section 5.1), that allows a mid-span point be checked.

7.1. Manual Calibration with the Zero and Two Span Point Valve Option (OPT 52)installed.

NOTE

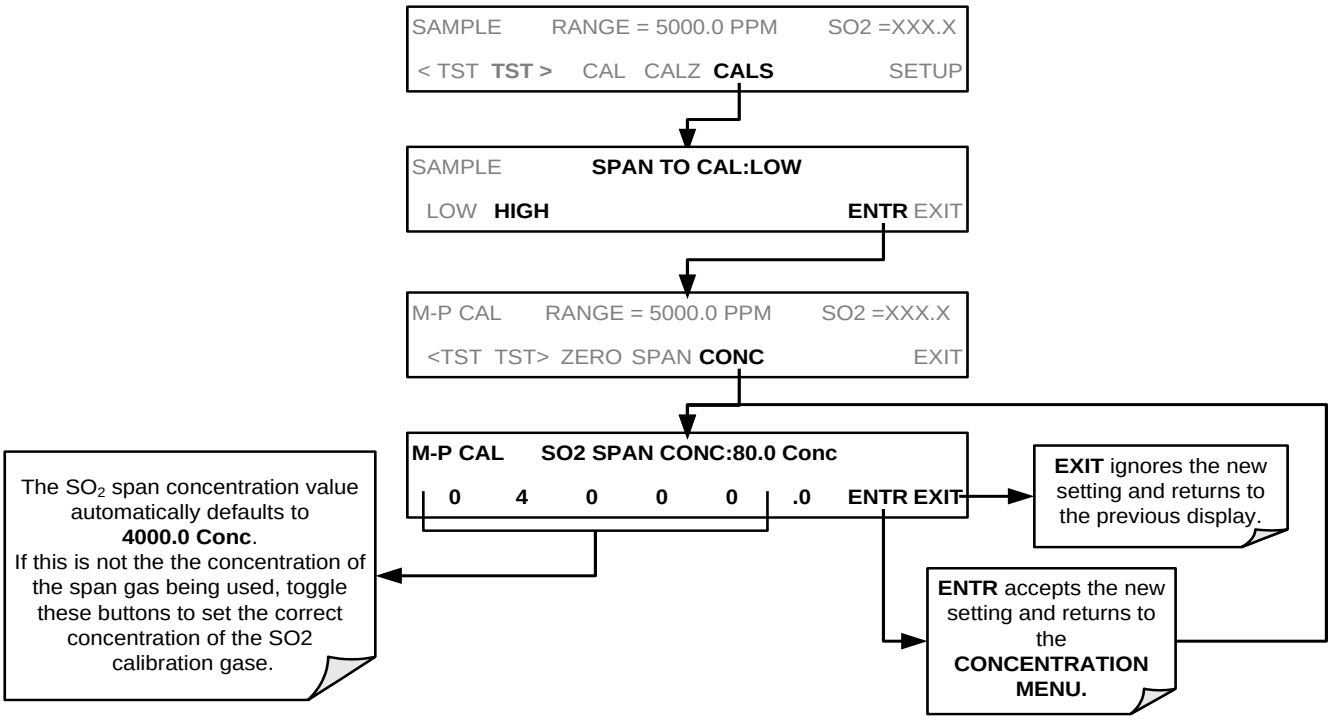
It is only possible to calibrate to the high span **gas. The low span gas is only used for calibration checks.**

Zero and Span calibrations using the Zero and two Span Valve option are similar to that described in Section 7.2, except that:

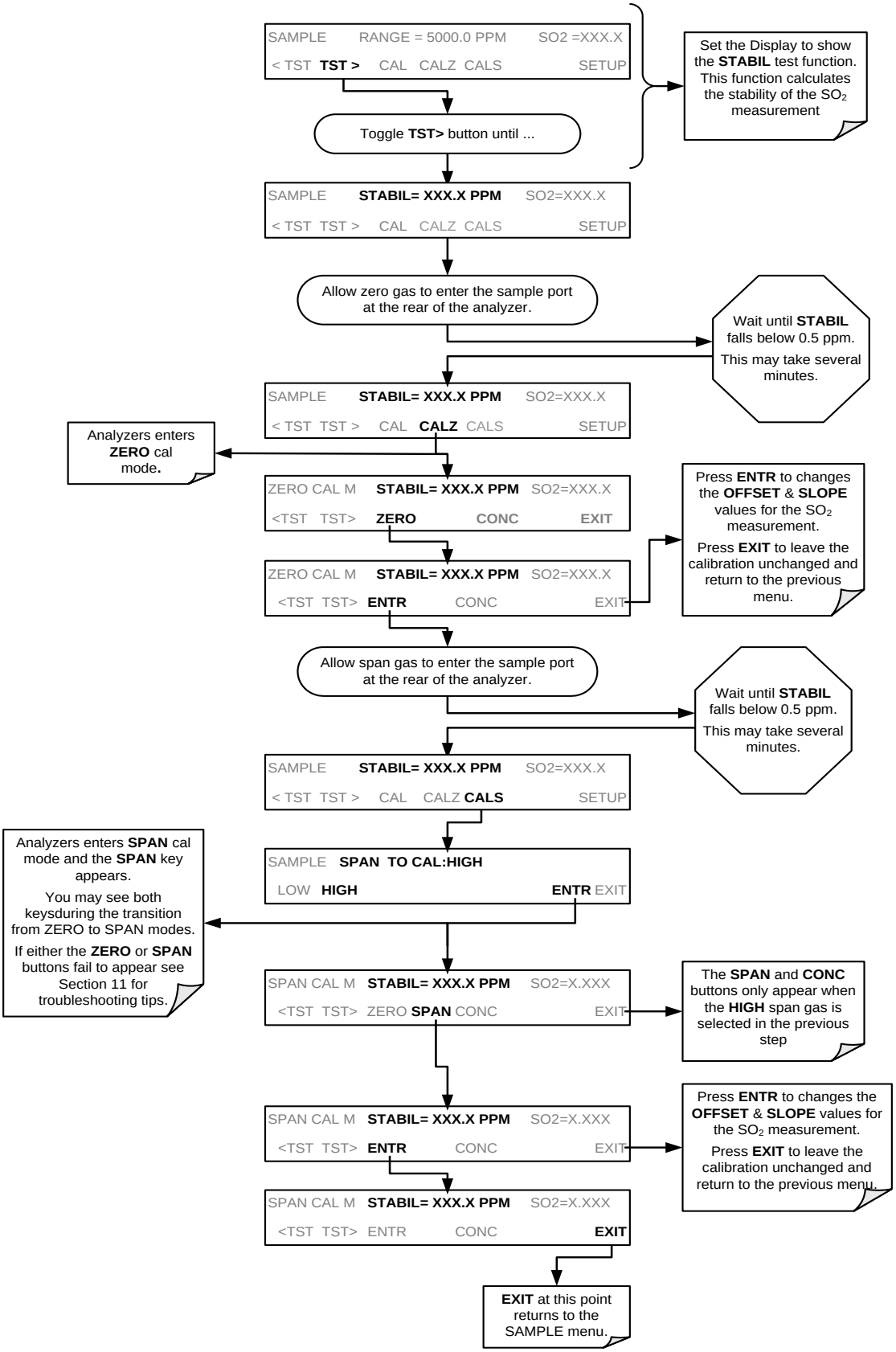
- Zero air and both span gas is supplied to the analyzer through the zero gas and span gas inlets rather than through the sample inlet.
- The zero and cal operations are initiated directly and independently with dedicated keys (**CALZ** & **CALS**)

STEP ONE: Connect the sources of zero air and span gas to the respective ports on the rear panel (see Figure 3-2 of this addendum).

STEP TWO: Set the expected SO_2 high span gas value:

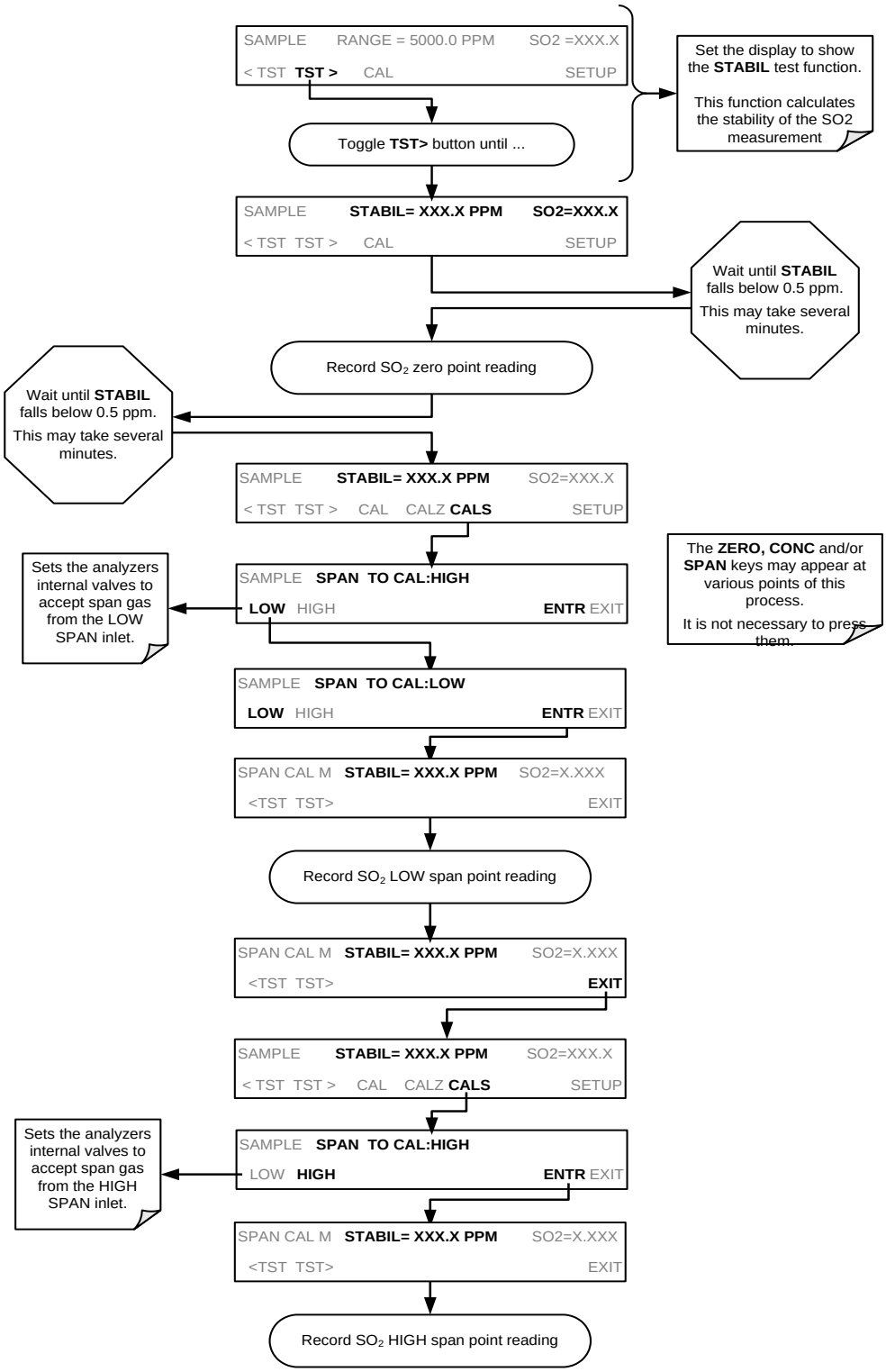


STEP THREE: Perform the calibration according to the following flow chart:



7.2. Manual Calibration Check with Ambient Zero and Two Ambient Span Valve Option (OPT 50C) Installed

Set up is identical to that shown in **STEP ONE** of the preceding section. To perform the zero/span check:



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8. INSTRUMENT MAINTENANCE

8.1. Maintenance Schedule

There is no Internal IZS offered for the T100H.

8.2. Predictive Diagnostics

Because the T100H's internal pneumatics are monitored in a different manner than those of the T100 there are some differences in how the instrument's test functions are used as predictive diagnostics. Table 8-1 of this addendum supersedes Table 9-2 of the T100 Manual

Table 8-1: Predictive Uses for Test Functions

TEST FUNCTION	DAS FUNCTION	CONDITION	BEHAVIOR		INTERPRETATION
			EXPECTED	ACTUAL	
PRES	**SMPPRS**	Sample gas pressure upstream of the critical flow orifice.	Constant within atmospheric changes	Slowly increasing	• Flow path is clogging up. - Check critical flow orifice & sintered filter. - Replace particulate filter
				Slowly decreasing	• Developing leak in pneumatic system to vacuum (developing valve failure)
PRES	**SMPPRS**	Sample gas pressure upstream of the critical flow orifice.	Constant within atmospheric changes	Slowly increasing	• Flow path is clogging up. - Check critical flow orifice & sintered filter. - Replace particulate filter
				Slowly decreasing	• Developing leak in pneumatic system to vacuum (developing valve failure)
VAC	**VACUUM**	Gas pressure downstream of the critical flow orifice (e.g. inside reaction cell.	Constant within atmospheric changes	Fluctuating	• Developing leak in pneumatic system
SAMP FL	**SMPFLW**	Standard Operation	Stable	Slowly Decreasing	• Flow path is clogging up. - Check critical flow orifice & sintered filter. - Replace particulate filter
DRK PMT	**DRKPMT**	PMT output when UV Lamp shutter closed	Constant within ±20 of check-out value	Significantly increasing	• PMT cooler failure • Shutter Failure
SO_2 Concentration	**CONC1**	Standard configuration at span	stable for constant concentration	Decreasing over time	• Drift of instrument response; UV Lamp output is excessively low.
				Fluctuating	• Leak in gas flow path.
LAMP RATIO	**LAMPR**	Standard Operation	Stable and near 100%	Fluctuating or Slowly increasing	• UV detector wearing out • UV source Filter developing pin holes
				Slowly deceasing	• UV detector wearing out • Opaque oxides building up on UV source Filter • UV lamp aging

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9. THEORY OF OPERATION

9.1. The UV Light Path

The UV light path of the T100H is similar to that of the T100 (see Section 10.2 of the T100 Manual). The main differences between the T100H and the T100 are:

- The location of the reference detector (See Section 9.1.1 of this addendum).
- The methods used to reject for certain measurement interferents is different (see Section 9.1.2 of this addendum).

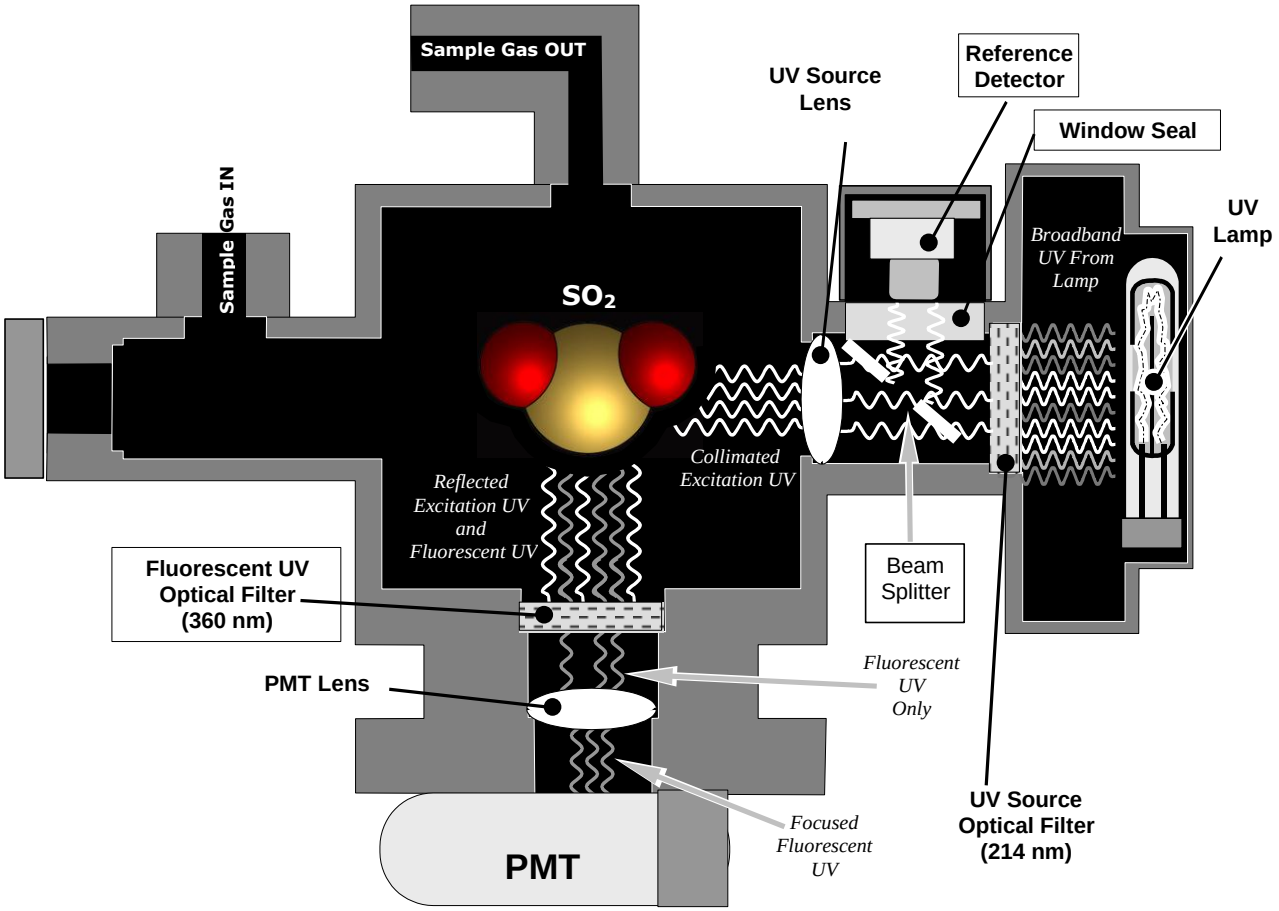


Figure 9-1: UV Light Path

9.1.1. The Reference Detector

A vacuum diode UV detector that converts UV light to a DC current is used to measure the intensity of the excitation UV source lamp. The location of the T100H reference detector differs from that of the T100.

- On the T100 this detector is located directly across the reaction cell from the lamp where it can measure the output of the lamp directly. Because the T100 is designed to measure relatively low concentrations of SO_2, enough of the lamp's 214 nm source light makes it through the reaction cell to get a reliable reading.

- On the T100H the detector is located between the UV lamp and the reaction cell and to the side. A beam splitter reflects a portion of the lamp output 90 degrees, through a window and onto the detector. This arrangement is required because nearly all of 214 nm UV source light entering the reaction cell is absorbed by the higher concentrations of SO_2 typically measured by the T100H.

A window transparent to UV light provides an air-proof seal that prevents ambient gas from contaminating the sample chamber.

9.1.2. Direct Measurement Interferents

The most common source of interference when measuring SO_2 is from other gases that fluoresce in a similar fashion to SO_2 when exposed to UV Light. The most significant of these are:

- A class of hydrocarbons called poly-nuclear aromatics (PNA) of which xylene and naphthalene are two prominent examples.

- Nitric oxide (NO), which fluoresces in the a spectral range near to SO_2. For critical applications where high levels of NO are expected an optional 360 nm optical filter is available that improves the rejection of NO (contact customer service for more information).

The methods by which the Model T100H rejects interference for these substances differs from the T100 as follows.

- Since the typical application for which the T100H rarely includes the presences of hydrocarbons or PNA's, no hydrocarbon scrubber (kicker) is included in the T100H's base configuration. An optional scrubber (see Section 5.3of this addendum) is available.

- On the other hand the typical T100H application often includes much higher concentrations of Nitric Oxide (NO), which fluoresces in a spectral range near that of SO_2. Therefore a 360 nm filter replaces the 330nm UV filter located between the PMT and the reaction cell in order to more efficiently reject for interference due to the higher concentrations of NO.

9.2. Pneumatic Operation

9.2.1. Sample Gas Flow

The flow of gas through the T100H UV Fluorescence SO2 Analyzer is created by a small external pump that pulls air through the instrument. The T100H has no kicker to scrub hydrocarbons from the sample stream. Typical applications for the T100H do not have hydrocarbons in the sample stream.

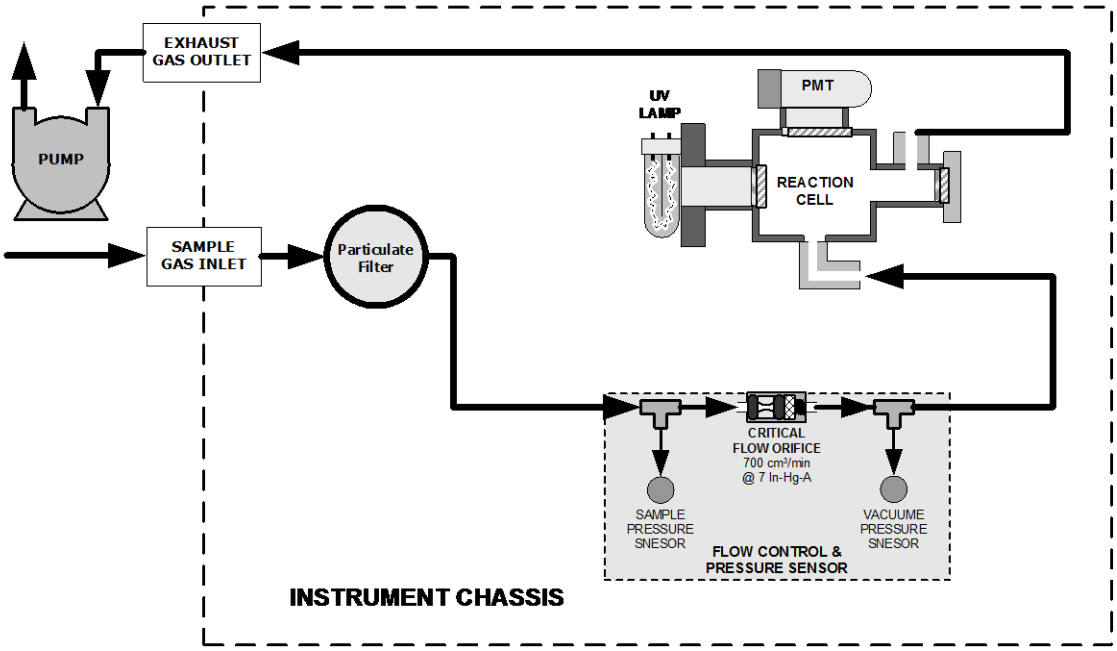


Figure 9-2: Pneumatic Diagram of the T100H – Base Configuration

9.2.2. Pneumatic Sensors

The T100H uses two pneumatic sensors to verify gas flow. These sensors are located on a printed circuit assembly, called the pneumatic pressure/flow sensor board. This PCA is attached to a manifold containing the critical flow orifice that sets the instrument flow rate.

9.2.2.1. Sample Pressure Sensor

An absolute pressure transducer plumbed to the input of the analyzer's sample chamber is used to measure the pressure of the sample gas before it passes through the critical flow orifice. This is used to validate the critical flow condition (2:1 pressure ratio) through the instrument's critical flow orifice.

The actual sample gas pressure measurement is viewable through the analyzer's front panel display as the test function **PRES**

9.2.2.2. Vacuum Pressure Sensor

An absolute pressure transducer measures the pressure on the vacuum side of the critical flow orifice and is used to measure the sample gas pressure in the reaction cell. If the vacuum pressure is not in the correct range, a warning will be displayed by the software. Also, if the temperature/pressure compensation (TPC) feature is turned on, the output of this sensor is also used to supply pressure data for that calculation.

The actual pressure of the gas downstream from the critical flow orifice (including the gas inside the reaction cell) viewable through the analyzer's front panel display as the test function **VAC**

9.2.2.3. Sample Flow Calculation

Unlike the T100, which uses a thermal-mass flow sensor to directly measure the gas flow though the instrument, the T100H calculates the gas as follows.

- The ratio of the two pressures is measured and used to validate critical flow. If the ratio is not correct (< 2:1) the **SAMPLE FLOW WARN** message is activated. Also, the value of the **SAMP FL** test function is set to **XXXX**.

If the pressure ratio between the two sensors is valid (≥ 2:1), the instrument calculates the flow based on sample gas pressure level (**PRES)** and is viewable via the front panel as the **SAMP FL** test function.

9.3. Electronic Operation

The following figures replace Figures 10-10 & 10-19 of the T100 Manual (P/N 068070000). There is no IZS option, a vacuum pressure sensor replaces the T100's thermal-mass flow sensor and provision is made for the two ambient span valve option.

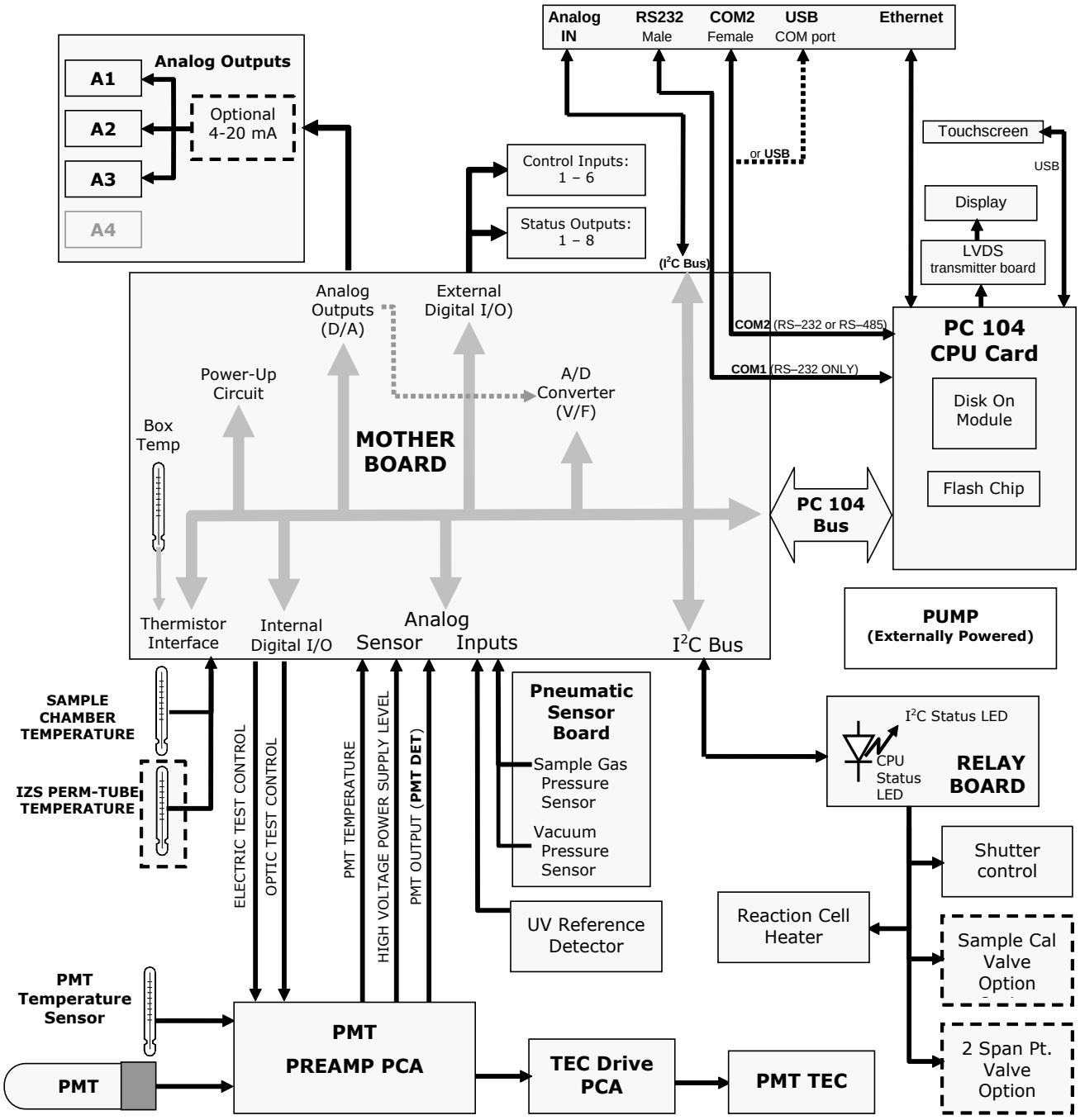


Figure 9-3: T100H Electronic Block Diagram

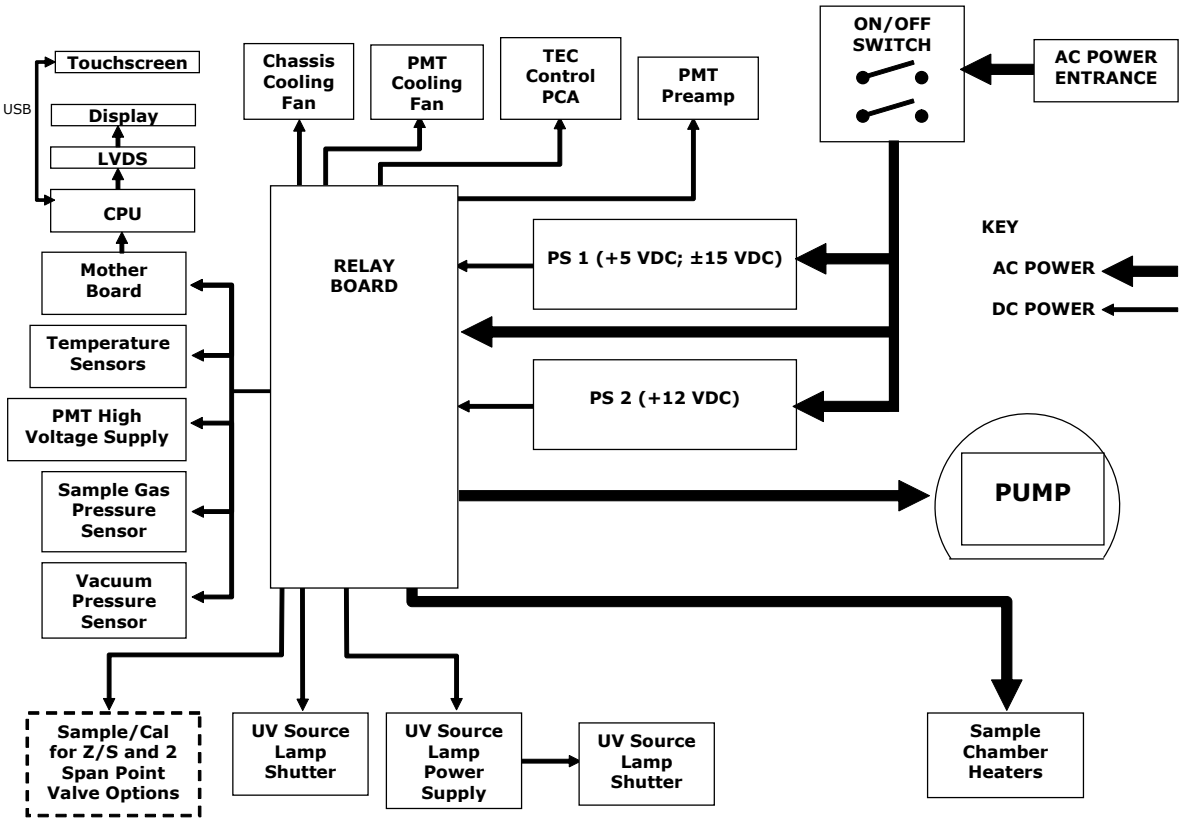


Figure 9-4: T100H Power Distribution Block Diagram

10. TROUBLESHOOTING & REPAIR

For the most part the information contained in Section 11 of the T100 Manual (P/N 068070000) is also applicable to the T100H. There are a few exceptions however.

10.1.1. Fault Diagnosis with Warning Messages

Table 10-1: Warning Messages - Indicated Failures

WARNING MESSAGE	FAULT CONDITION	POSSIBLE CAUSES
VACUUM PRESS WARN	Gas pressure inside the reaction cell outside of warning limits.	If sample pressure is > 10 in-Hg: ○ Pneumatic Leak ○ Bad Pump → Rebuild Pump ○ Failed pressure sensor/circuitry

10.1.2. Fault Diagnosis with Test Functions

Table 10-2: Test Functions - Possible Causes for Out-Of-Range Values

TEST FUNCTION	NOMINAL VALUE(S)	POSSIBLE CAUSE(S)
VAC	<9.1 IN-HG-A	Incorrect sample gas pressure could be due to: pneumatic leak; malfunctioning valve; malfunctioning pump; clogged flow orifices; sample inlet overpressure; faulty pressure sensor

10.2. Subsystem Checkout

10.2.1. Pneumatic Sensor Assembly

The pneumatic sensor assembly of the T100H differs from that of the T100 in that there is no flow sensor. Instead the assembly includes two pressure sensors located on either side of a critical flow orifice. The T100H software infers the gas flow rate by mathematically comparing the two pressure readings.

If you suspect that one of the two pressure sensors is failing:

1. Cap the sample inlet.
2. After a few seconds, check the **VAC** and **PRES** test functions and verify that:
   - The **VAC** value matches the **PRES** value to within 1 In-Hg-A, and;
   - Both are less than 10 in-Hg-A (i.e. under vacuum).
3. Uncap the sample inlet and unplug the pump.
4. After a few minutes, the value **VAC** and **PRES** should match within 1 In-Hg-A, and read atmospheric pressure.
   - If the two sensors do not match or are significantly different from ambient atmospheric pressure, call Teledyne Instruments customer service.

10.3. Repair Procedures

10.3.1. Repairing the Sample Gas Flow Control Assembly

The Critical Flow Orifice is part of the pressure sensor and flow control assembly. The jewel orifice is protected by a sintered filter, so it is unusual for the orifice to need replacing, but it is possible for the sintered filter and o-rings to need replacing. See the Spare Parts list in Appendix B for part numbers and kits.

To replace the filter and/or orifice

1. Turn off Power to the analyzer.
2. Locate the pressure sensor / flow control assembly.
3. Disconnect the signal cable and pneumatic fittings.
4. Remove the assembly from the optical bench by removing the 2 screws at each end of the assembly.
5. The inlet end of the assembly is located at the end with the straight pneumatic fitting. Remove the fitting and the components as shown in the exploded view.
6. Replace the o-rings (p/n:OR01) and the sintered filter (p/n:FL01).
7. if you are replacing the Critical Flow Orifice itself (p/n:00094100), make sure that the side with the colored window (usually RED) is facing upstream to the flow gas flow.
8. Re-assemble in reverse order. See the Spares List in Appendix B for part numbers.
9. After re-connecting the power and pneumatic lines, flow check the instrument as described in the Section 1.5.2 of the T100 Operator's Manual.

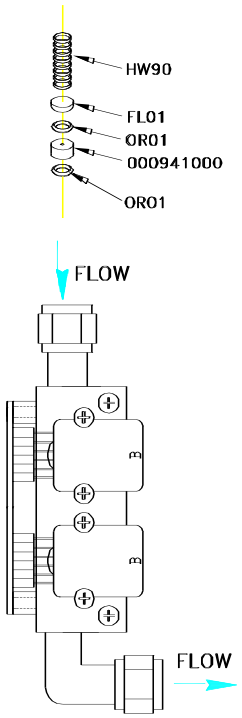


Figure 10-1: Flow Control Assembly

10.3.2. Sensor Module Repair & Cleaning

NOTE:

After any repair or service has been performed on the sensor module, the T100H should be allowed to warm up for 60 minutes.

Always perform a perform a leak check (See Section 11.5.1) and calibrate the analyzer (see Section 7) before placing it back in service.

The most significant difference between the T100 sensor module and the T100H sensor module is the location of the reference detector. Therefore most of the procedures described in Section 11.6.3 apply to the T100H as well.

Exceptions are noted below:

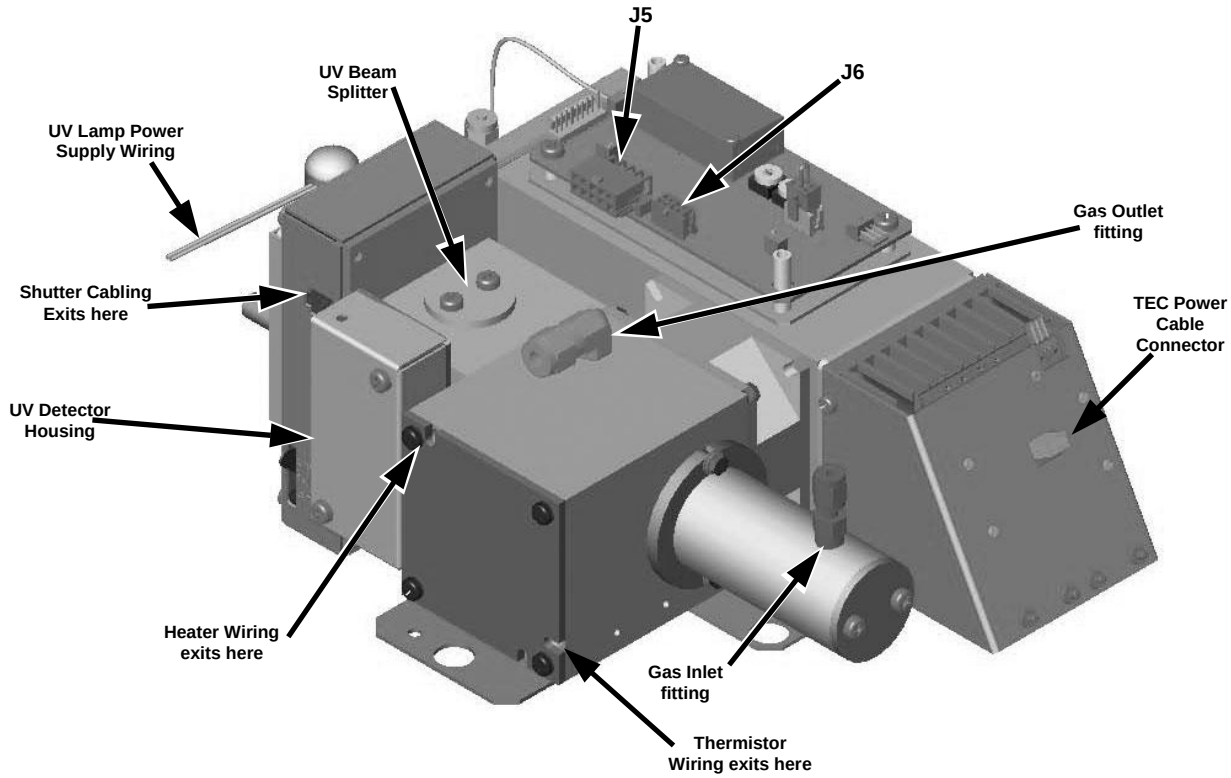


Figure 10-2: Sensor Module Wiring and Pneumatic Fittings

10.3.2.1. Adjusting the UV Lamp (*Peaking the Lamp*)

There are three ways in which ambient conditions can effect the UV Lamp output and therefore the accuracy of the SO_2 concentration measurement. These are:

Line Voltage Change: UV lamp energy is directly proportional to the line voltage. This can be avoided by installing adequate AC Line conditioning equipment such as a UPS/surge suppressor.

Lamp Aging - Over a period of months, the UV energy will show a downward trend, usually 30% in the first 90 days, and then a slower rate, until the end of useful life of the lamp. Periodically running the UV lamp calibration routine (see Section 6.9.7) will compensate for this until the lamp output becomes too low to function at all.

Lamp Positioning – The UV output level of the lamp is not even across the entire length of the lamp. Some portions of the lamp shine slightly more brightly than others. At the factory the position of the UV lamp is adjusted to optimize the amount of UV light shining through the UV filter/lens and into the reaction cell. Changes to the physical alignment of the lamp can affect the analyzers ability to accurately measure SO_2.

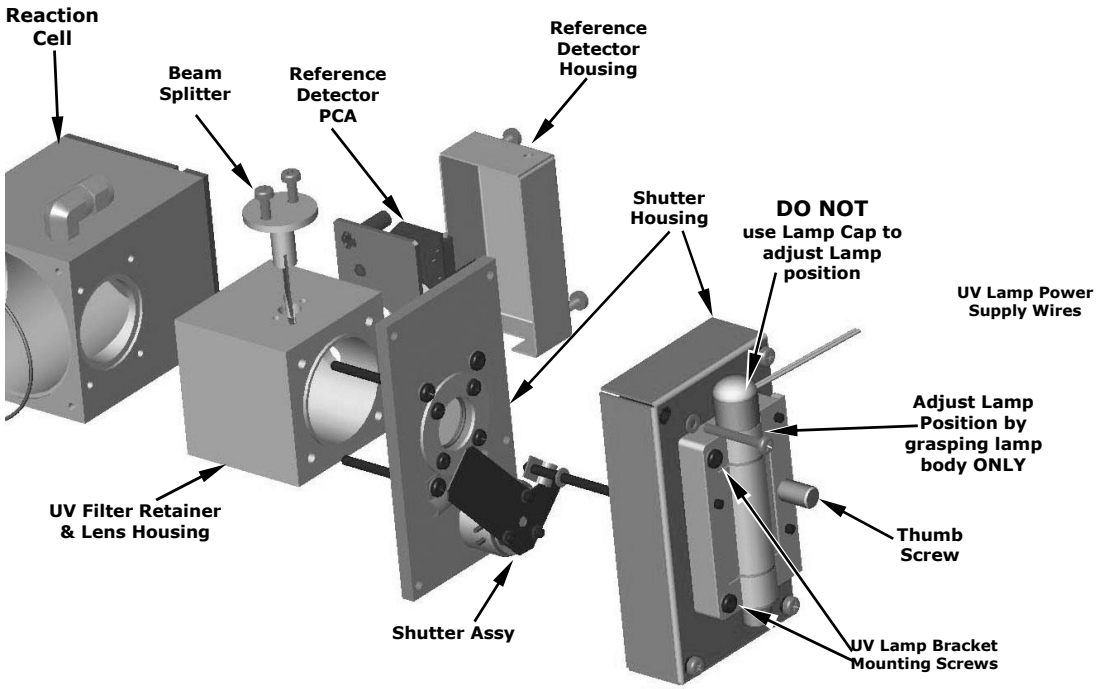


Figure 10-3: Shutter Assembly - Exploded View

	**CAUTION:** **ALWAYS wear UV-Protective, Safety Glasses when working with the UV Lamp Assembly**

1. Set the analyzer display to show the signal I/O function, **UVLAMP_SIGNAL** (see Section 11.1.3). **UVLAMP_SIGNAL** is function 33.
2. Slightly loosen the large brass thumbscrew located on the shutter housing (see Figure 10-3) so that the lamp can be moved.
3. While watching the **UVLAMP_SIGNAL** reading, slowly rotate the lamp or move it back and forth vertically until the **UVLAMP_SIGNAL** reading is at its maximum.
   - **DO NOT** grasp the UV lamp by its cap when changing its position (see Figure 10-3). Always grasp the main body of the lamp.
4. Compare the **UVLAMP_SIGNAL** reading to the information in Table 10-3 and follow the instructions there.

Table 10-3: Example of HVPS Power Supply Outputs

UVLAMP_SIGNAL	ACTION TO BE TAKEN
3500mV±200mV.	No Action Required
> 4900mV at any time.	Adjust the UV reference detector potentiometer (see Figure 10-4) until **UVLAMP_SIGNAL** reads approximately 3600mV before continuing to adjust the lamp position.
>4500mV or < 1000mV	Adjust the UV reference detector potentiometer (see Figure 10-4) until **UVLAMP_SIGNAL** reads as close to 3500mV as possible.
.< 600mV	Replace the lamp.

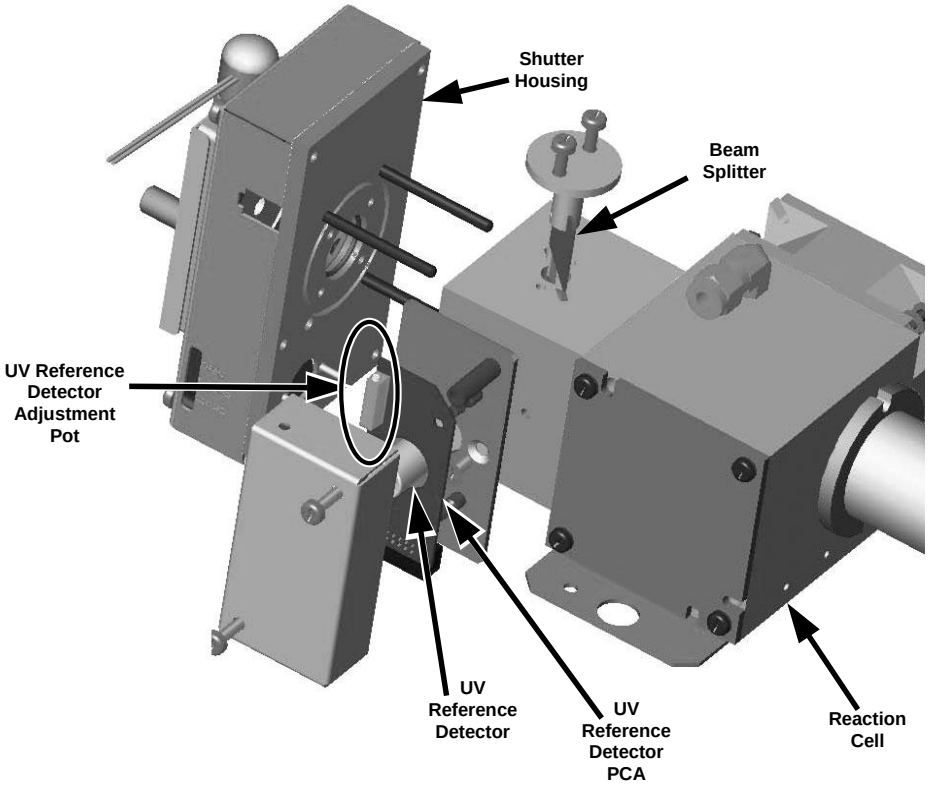


Figure 10-4: Location of UV Reference Detector Potentiometer

5. Finger tighten the thumbscrew.

NOTE:

DO NOT over-tighten the thumbscrew.

10.3.2.2. PMT Hardware Calibration (*FACTORY CAL*)

The sensor module hardware calibration adjusts the slope of the PMT output when the instrument's slope and offset values are outside of the acceptable range and all other more obvious causes for this problem have been eliminated.

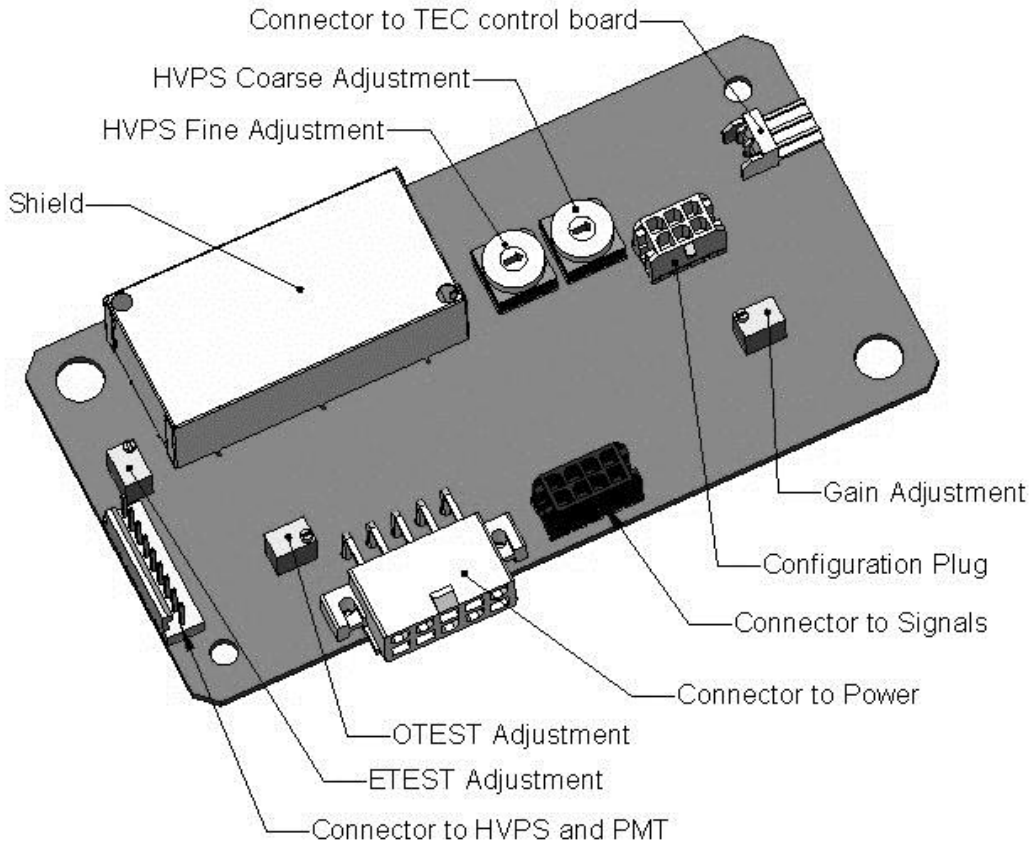


Figure 10-5: Pre-Amplifier Board Layout

1. Set the instrument reporting range type to **SNGL** (see Section 6.7.4 of the T100 Manual)
2. Perform a zero–point calibration using zero air (see Section 7 of the T100 Manual).
3. Let the instrument stabilize by allowing it to run for one hour.
4. Adjust the UV Lamp. (See Section 10.3.2.1 of this addendum)
5. Perform a **LAMP CALIBRATION** procedure (see Section 6.9.7 of the T100 Manual).
6. Locate the Preamp board (see Figure 3-4 of this addendum).
7. Locate the Following Components On the Preamp board (see Figure 10-5 of this addendum):
   - HVPS coarse adjustment switch (Range 0-9, then A-F)
   - HVPS fine adjustment switch (Range 0-9, then A-F)
   - Gain adjustment potentiometer (Full scale is 10 to 12 turns).

8. Set the HVPS coarse adjustment to its minimum setting (0).

9. Set the HVPS fine adjustment switch to its maximum setting (F).

10. Turn the gain adjustment potentiometer clockwise to its maximum setting.

11. Set the front panel display to show **STABIL** (see Section 6.2.1 of the T100 Manual)

12. Feed span gas into the analyzer.

13. Wait until the **STABIL** value is below 0.5 ppm,

NOTE

Use a span gas equal to 80% of the reporting range.

Example: for a reporting range of 200 ppm, use a span gas of 160 ppm.

14. Scroll to the **OFFSET** function and record the value.

15. Scroll to the **NORM PMT** value.

NOTE

Do not overload the PMT by accidentally setting both adjustment switches to their maximum setting. This can cause permanent damage to the PMT.

16. Determine the target **NORM PMT** value according to the following formulas.

- If the reporting range is set for ≤ 500 ppm (the instrument will be using the 500 ppm physical range):

  Target **NORM PMT** = (8 x span gas concentration) + **OFFSET**

- If the reporting range is set for ≥ 2,001 ppb(the instrument will be using the 5,000 ppm physical range):

  Target **NORM PMT** = (0.8 x span gas concentration) + **OFFSET**

  EXAMPLE: If the **OFFSET** is 33 mV, the Reporting Range is 1000 ppm, the span gas should be 800 ppm SO_2 and the calculation would be:

  Target **NORM PMT** = (0.8 x 800) + 33 mV
  Target **NORM PMT** = 640 + 33 mV
  Target **NORM PMT** = 673 mV

17. Set the HVPS coarse adjustment switch to the lowest setting that will give you more than the target NORM PMT signal from Step 16.

- The coarse adjustment typically increments the **NORM PMT** signal in 100-300 mV steps.

18. Adjust the HVPS fine adjustment such that the **NORM PMT** value is at or just above the target NORM PMT signal from Step 16.

19. Continue adjusting the both the coarse and fine switches until **NORM PMT** is as close to (but not below) the target NORM PMT value from Step 16.

20. Adjust gain adjustment potentiometer until the **NORM PMT** value is ±10 mV of the target level from Step 16.

21. Perform span calibration (see Section 7 of the T100 Manual)

22. Scroll to the **SLOPE** function and record the value.

23. If the value of the **SLOPE** is between 0.900 and 1.100 the PMT Hardware calibration is complete.

24. If the value of the **SLOPE** is less than 0.900 or greater than 1.100:

    1. Multiply the slope value from step 22 by the norm PMT value from step 19.

    2. Repeat steps 17 through 24 using this new value for **NORM PMT**.

10.4. Technical Assistance

If this manual and its trouble-shooting / repair sections do not solve your problems, technical assistance may be obtained from Teledyne Monitor Labs, Inc., Customer Service, 35 Inverness Drive East, Englewood, CO 80112. Phone: 1-800-846-6062. Fax: 1-303-799-4853. Email: tml_support@teledyne.com

Before you contact customer service, fill out the problem report form in Appendix C, which is also available online for electronic submission at http://www.teledyne-ml.com/manuals.asp

User Notes:

APPENDIX A - Version Specific Software Documentation

APPENDIX A - VERSION SPECIFIC SOFTWARE DOCUMENTATION

NOTE

As the menu tree structure for the T100H and 100EH menu tree structure varies from that of the T100 and M100E, they are included in this appendix. Please refer to Appendix A of the "parent" manual (either the T100 or the 100EH) for all other software documentation.

APPENDIX A-1: Software Menu Trees, Rev C.0

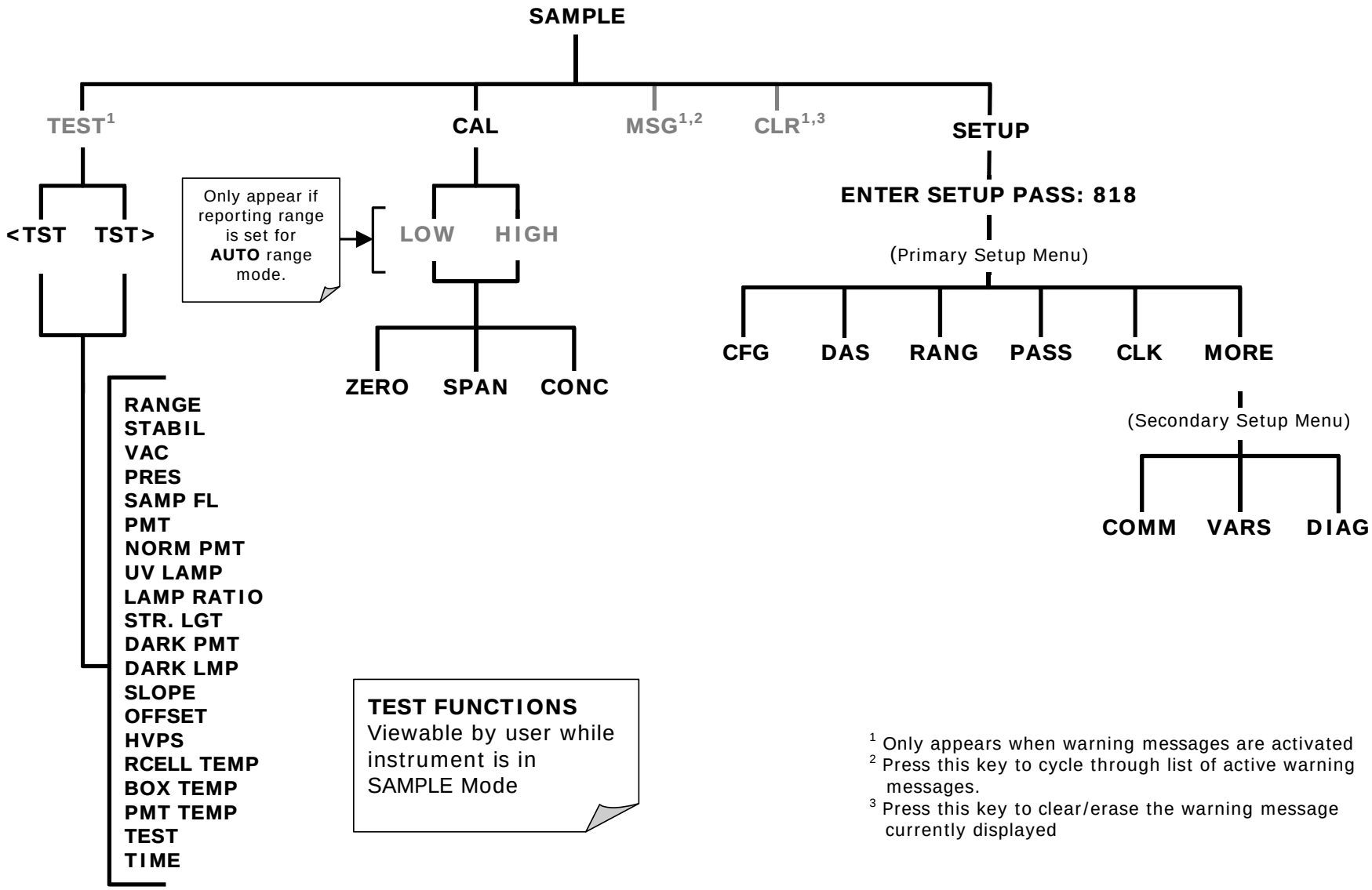


Figure A-1: Basic Sample Display Menu

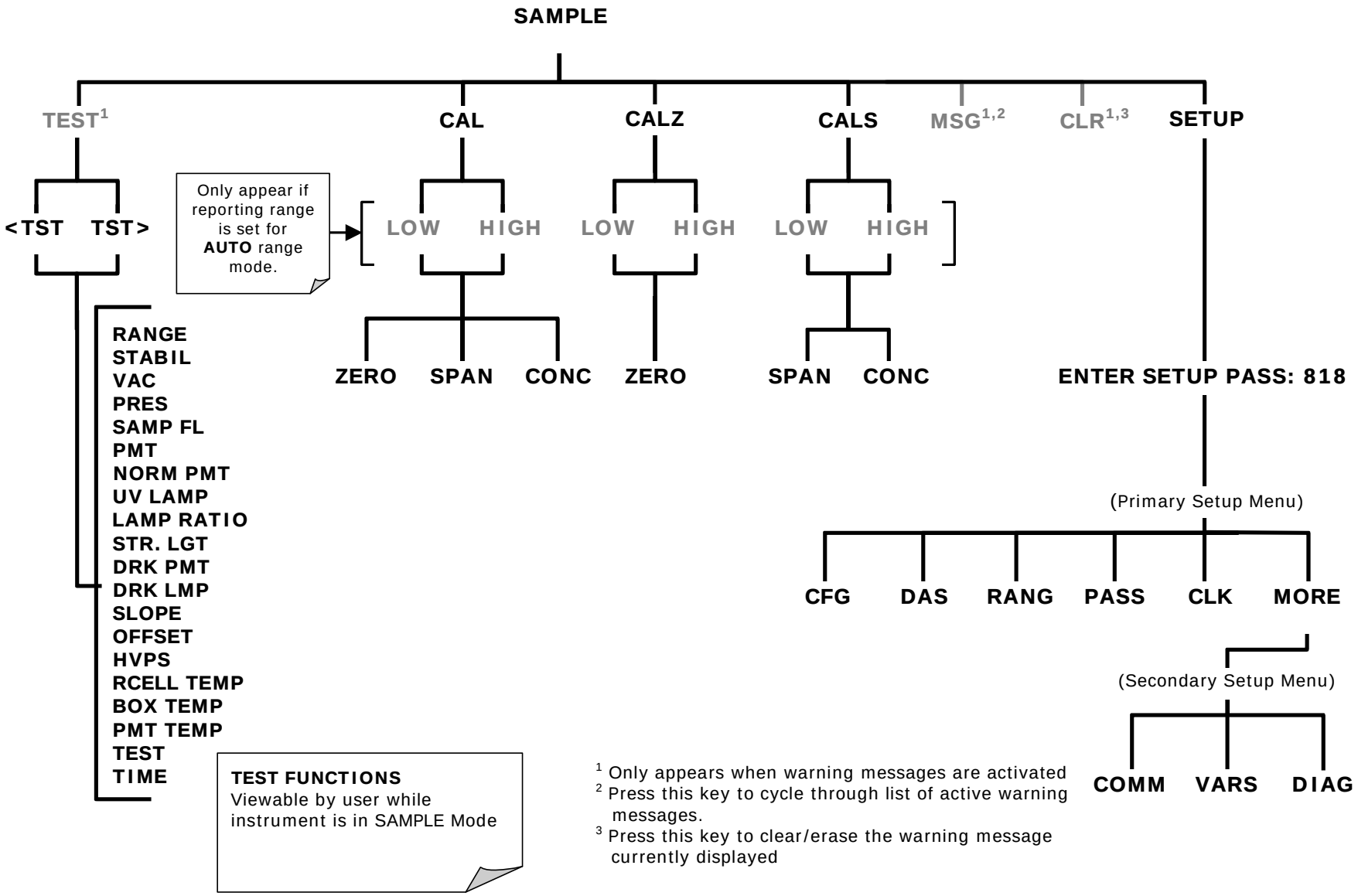


Figure A-2: Sample Display Menu - Z/S Valve Option installed

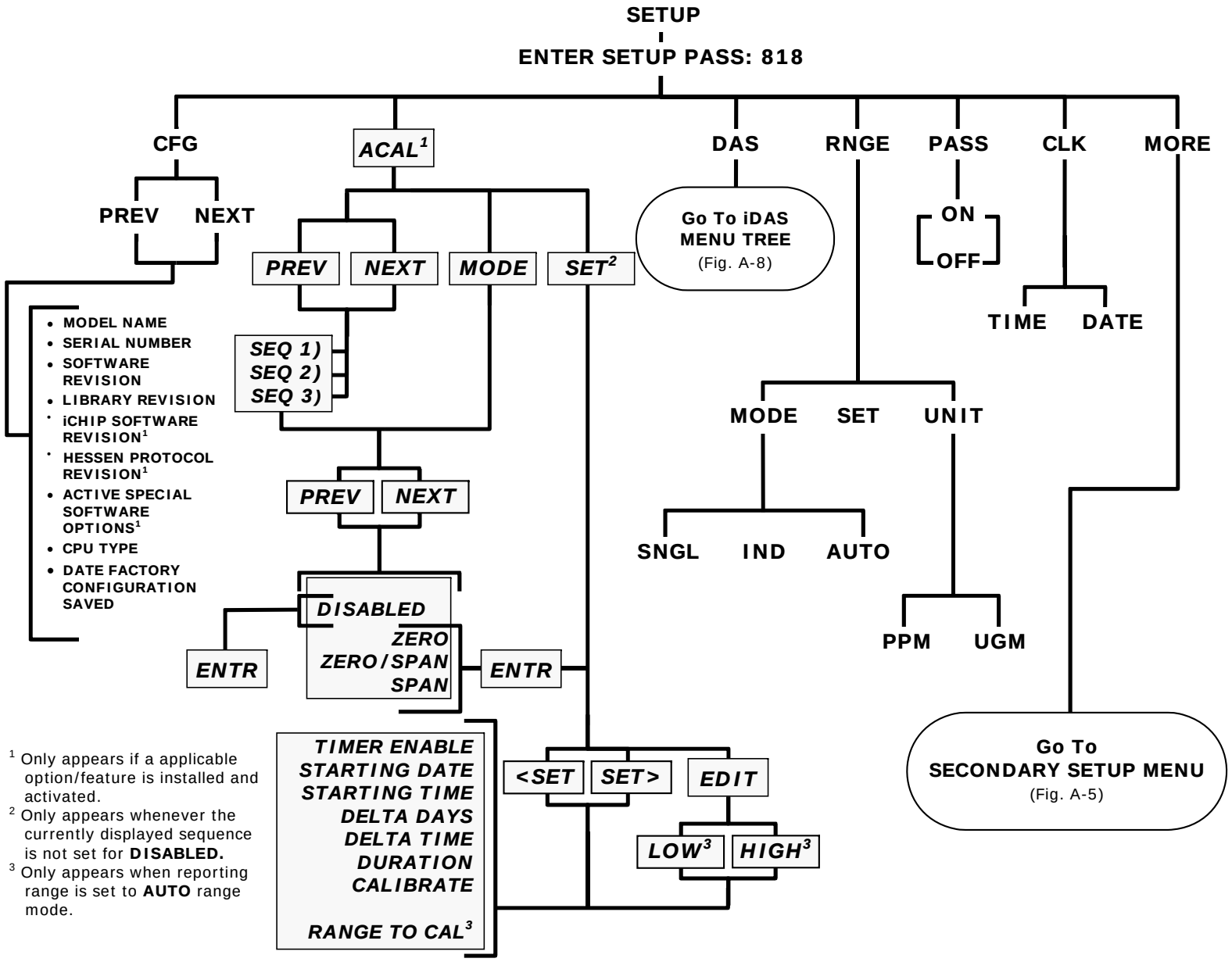


Figure A-3: Primary Setup Menu (Except iDAS)

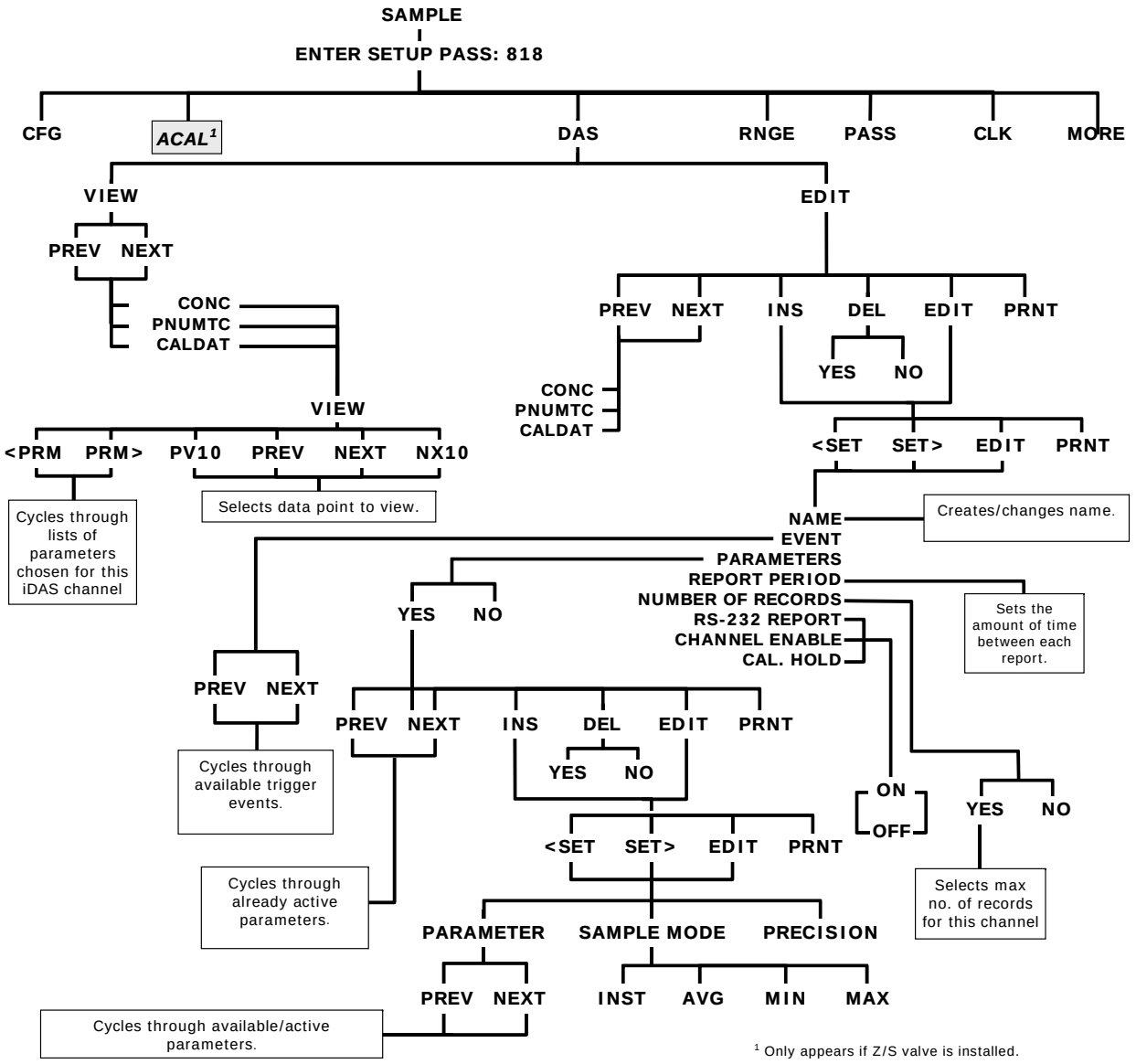


Figure A-4: Primary Setup Menu (iDAS)

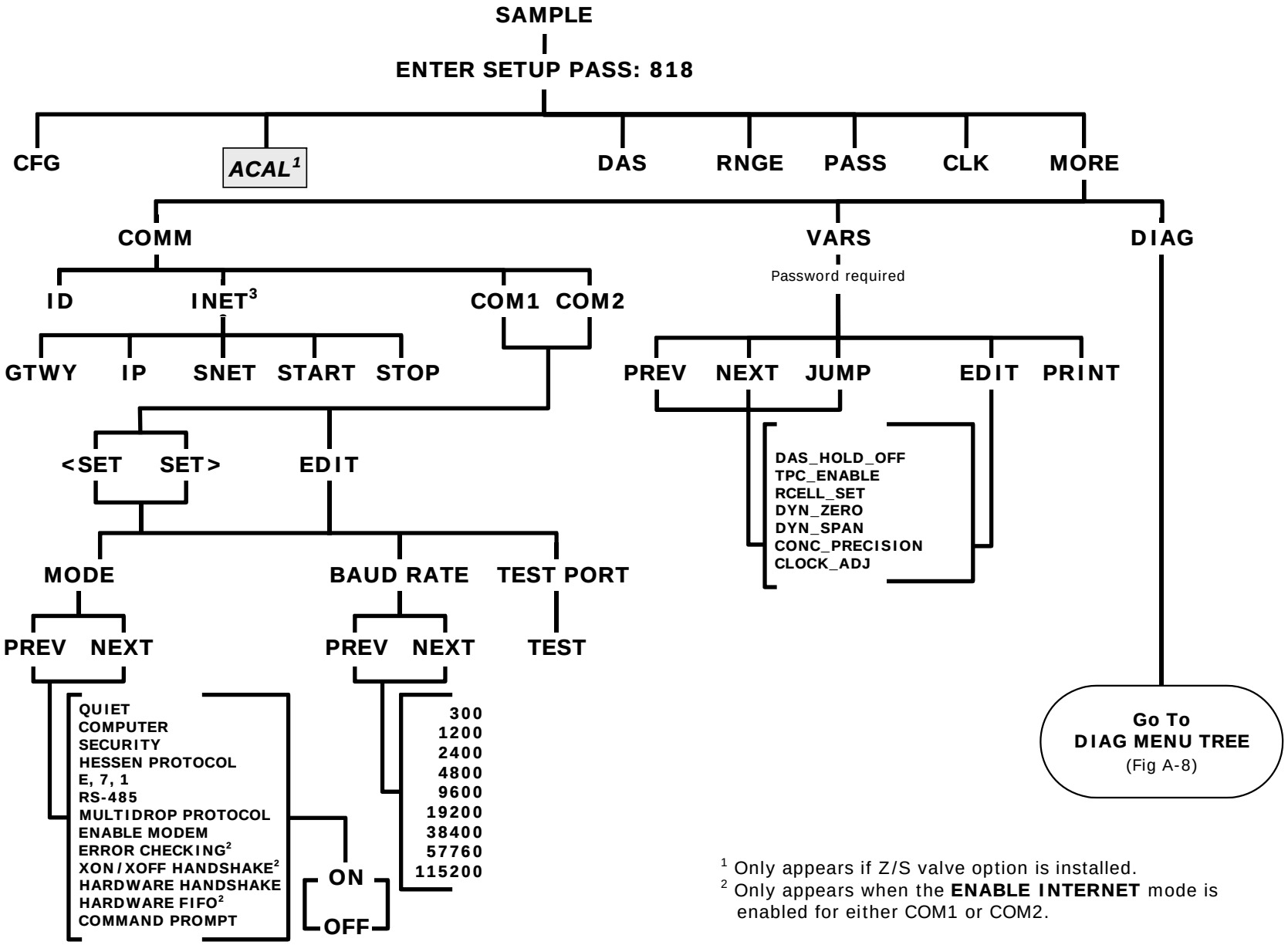
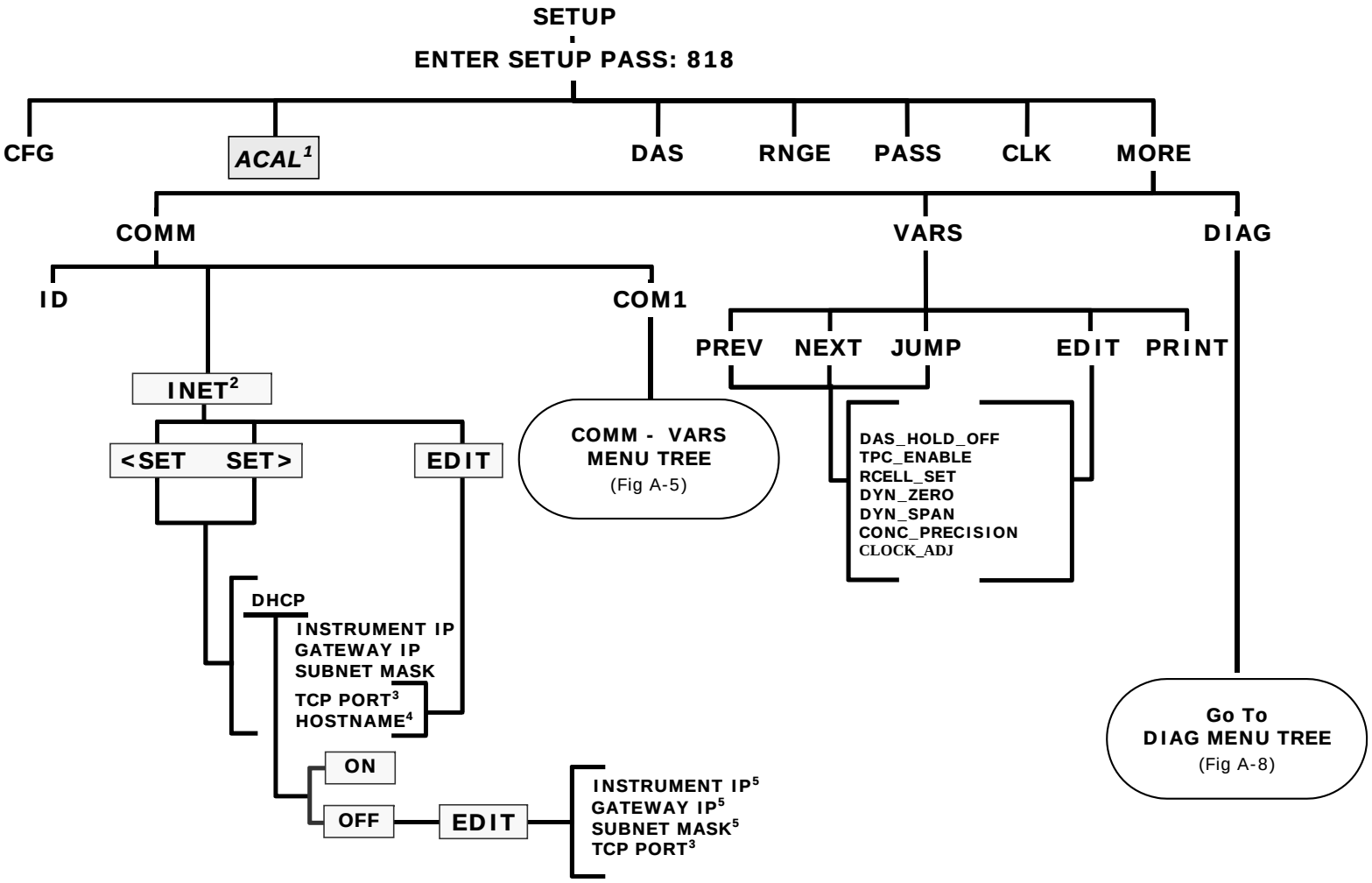


Figure A-5: Secondary Setup Menu (COMM & VARS)



[1] Only appears if a valve option is installed.
[2] Only appears when the Ethernet card (option 63) is installed.
[3] Although **TCP PORT** is editable regardless of the **DHCP** state, do not change the setting for this property unless instructed to by Teledyne Instruments Customer Service personnel.
[4] **HOST NAME** is only editable when DHCP is **ON**.
[5] **INSTRUMENT IP**, **GATEWAY IP** & **SUBNET MASK** are only editable when DHCP is **OFF**.

Figure A-6: Secondary Setup Menu (COMM Menu with Ethernet Card)

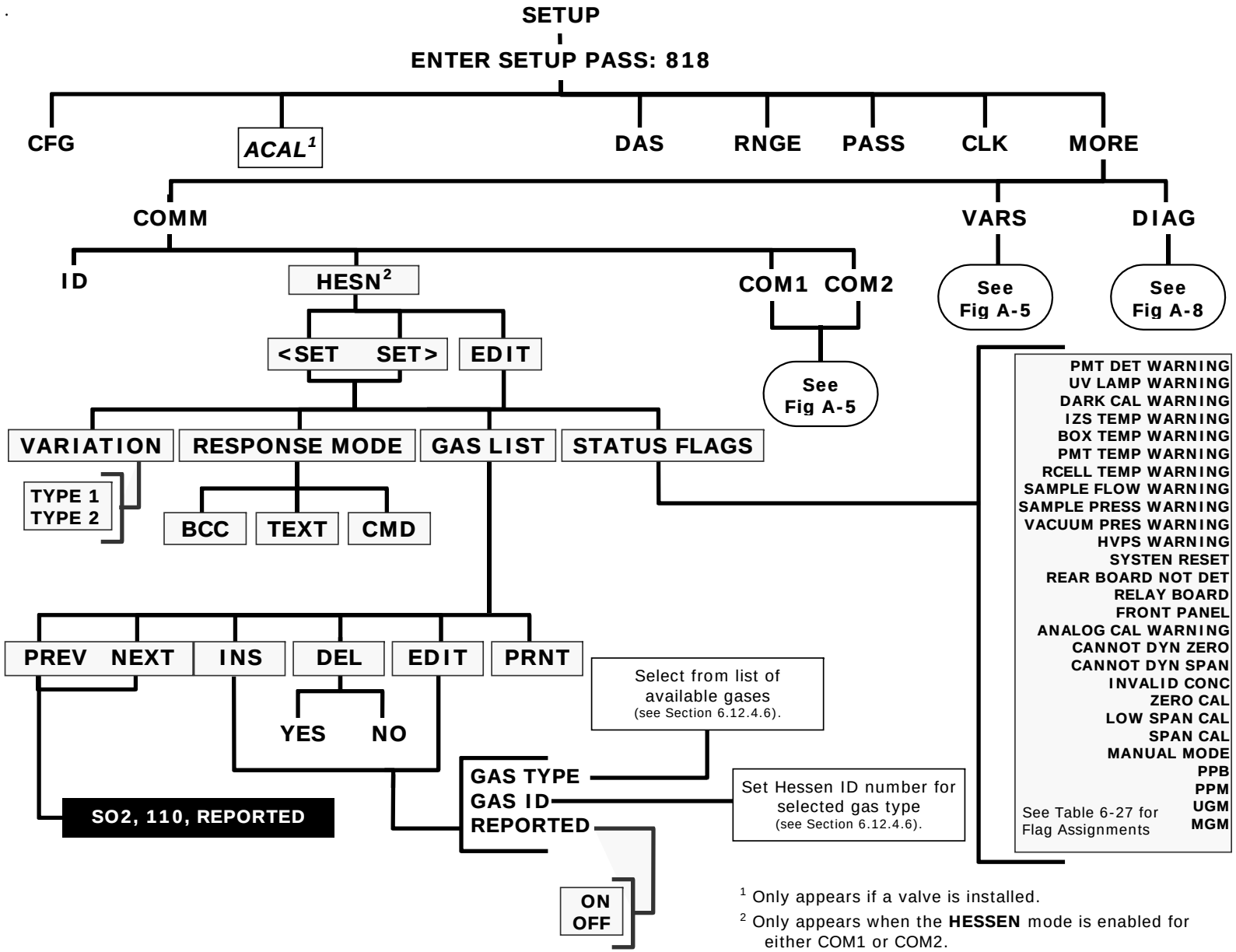


Figure A-7: Secondary Setup Menu - HESSEN Submenu

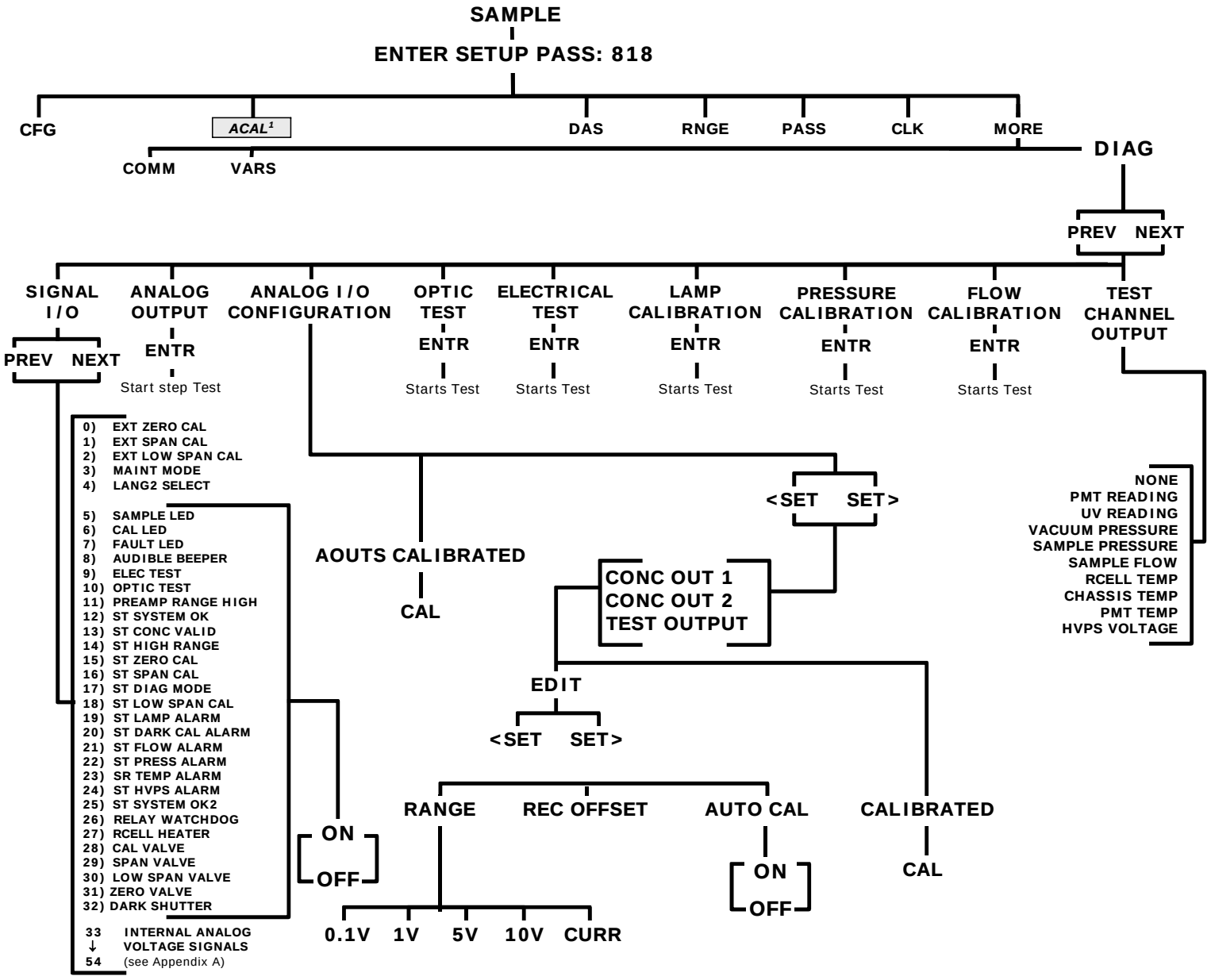


Figure A-8: Secondary Setup Menu (DIA

APPENDIX A-9: Setting up Communications

Setting up the communications for integration with a Teledyne Monitor Labs system.

The following describes the settings that should be entered into the analyzer's COMM sub menus.

Ethernet Communication

The following settings must be entered into the comm. menus in order to achieve Ethernet communication. Analyzers shipped with systems are setup at the factory.

ID: Analyzer specific. See table below.

INET:

DHCP: OFF

INST IP: site specific

GATEWAY IP: leave as factory default or site specific.

SUBNET MASK: leave as factory default or site specific.

TCP PORT: 3000

ONLINE: ON

BAUD RATE: 115200

Analyzer ID Table

	SO_2	TRS	NO_x	CO	CO_2	O2	O_2/CO_2
MACHINE ID	100	102	200	300	360	802	
GAS ID	150	160	141	130	120	170	

Serial Communication

Teledyne Monitor Labs systems communicate to the analyzers via the PLC using serial communication. The communication protocol used in the analyzer is the Hessen two protocol. When an analyzer is first turned on, the Hessen variables do not exist in the non-volatile memory. In order to create these variables, the Hessen protocol must be turned on in COM 1 and then the power must be cycled.

HESN:

HESSEN VARIATION: TYP2

HESSEN RESPONSE MODE: BCC

HESSEN GAS LIST:

Any gas to be reported via the serial string needs to be entered here. Enter the gas, a gas ID and whether it is reported or not. Please note that this ID is different form the machine or internet ID stated above. For example: SO2, 150, Reported. See table below for gas ID's needed for each analyzer. When more than one analyzer is in a system, the second analyzer will be 2XX e.g. SO2, 250, Reported. Refer to system prints for system specific ID's.

HESSEN STATUS FLAGS:

Set any the flag number to 0001 for any warning that should sent out on the serial string as a common analyzer fault. All other flags should be set to 0000 except for the PPM UNITS which should be set to 4000. Please see table below for TML recommended list of analyzer specific flags which should be set to 0001

COM1:

COM1 MODE: *This number is a hexadecimal based on the following settings. It may change with software revisions and therefore is not listed here.

QUITE MODE: ON

COMPUTER MODE: ON

SECURITY MODE: OFF

HESSEN PROTOCOL: ON

E,7,1 MODE: OFF

RS-485 MODE: OFF

MULTIDROP MODE: ON

ENABLE MODEM: OFF

ERROR CHECKING: OFF

XON/XOFF HANDSHAKE: OFF

HARDWARE HANDSHAKE: OFF

HARDWARE FIFO: ON

COMMAND PROMPT: OFF

COM1 BAUD RATE: 2400

Warning / ID	SO_2	TRS	NO_x	CO	CO_2	O2	O2/CO2
PMT DET	X	X					
UV LAMP	X	X					
BOX TEMP	X	X	X	X	X	X	X
PMT TEMP	X	X	X				
RCELL TEMP	X	X	X				
SAMPLE FLOW	X	X	X	X	X	X	X
SAMPLE PRESSURE	X	X	X	X	X	X	X
HVPS	X	X	X				
MANIFOLD TEMP			X				
CONV TEMP			X				
RCELL PRESSURE	X *High Range		X				
OZONE FLOW			X				
OZONE GEN OFF			X				
SYNC WARN				X	X		
SOURCE WARN				X	X		
BENCH TEMP				X	X		
WHEEL TEMP				X	X		
SAMPLE TEMP				X	X		
PHOTO TEMP				X	X		
O2(CO2) CELL TEMP						X	X
OPTIONAL GAS CELL TEMP	X *1		X *1	X *1	X *1	X *1	
ID (machine or internet)	100	102	200	300	360	802	
ID (Hessen Gas)	150	160	141	130	120	122	

*1 If the analyzer has an optional gas sensor installed, i.e. a CO_2 cell in a T300, set the temperature flag for that option.

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APPENDIX B – T100H Spare Parts List

NOTE

Use of replacement parts other than those supplied by TML may result in non-compliance with European standard EN 61010-1.

- T100HSP – T100H Spare Parts List

TELEDYNE
MONITOR LABS
A Teledyne Technologies Company

T100H ANALYZER SPARE PARTS LIST

REVISION HISTORY

LTR	DESCRIPTION	DATE	INCORP	APPR
A	Initial Release per ECO 6988	7/15/2011	JN/CAD	JN

T100H INDIVIDUAL SPARE PARTS LIST

Part Number	Description	Level
000940400	ORIFICE, 4 MIL, BLUE	2
000940800	ORIFICE, 012 MIL, RXCELL	2
002690000	LENS, UV	2
002700000	LENS, PMT	2
002740000	FILTER, PMT OPTICAL, 360 NM	2
003290000	ASSY, THERMISTOR	3
011630000	GASKET, HVPS INSULATOR	2
013140000	ASSY, COOLER FAN (NOX/SOX)	3
013400000	CD, PMT, SO2, TML50/E	2
013420000	ASSY, ROTARY SOLENOID, TML50	2
013570000	ASSY, THERMISTOR (COOLER)	3
014080100	ASSY, HVPS, SOX/NOX	2
016290000	WINDOW, SAMPLE FILTER, 47MM	3
016300700	ASSY, SAMPLE FILTER, 47MM, ANG BKT, TFE	3
018080000	KIT, DESSICANT BAGGIES (12)	1
023410000	PCA, FLOW/PRESSURE TML50H	2
037860000	ORING, TFE RETAINER, SAMPLE FILTER	1
040010000	ASSY, FAN REAR PANEL, E SERIES	3
045870100	PCA, TML50H UV REF DETECTOR	3
046210000	ADDENDUM, MANUAL, TML50H	3
046250000	ASSY, RXCELL HEATER/FUSE, TML50	2
046260000	ASSY, THERMISTOR, RXCELL, TML50	3
049310100	PCA, TEC CONTROL, E SERIES	2
050610100	CONFIGURATION PLUGS, 115V/60Hz	3
050610200	CONFIGURATION PLUGS, 115V/50Hz	3
050610300	CONFIGURATION PLUGS, 220-240V/60Hz	3
050610400	CONFIGURATION PLUGS, 220-240V/50Hz	3
058021100	PCA, MOTHERBOARD, E SERIES, GEN 5-I	2
066970000	PCA, INTRF.LCD TOUCH SCRN, F/P	3
067240000	CPU,PC-104	3
067300100	PCA, AUX-I/O BOARD, ETHERNET	3
067900000	LCD MODULE, W/TOUCHSCREEN	3
068810000	PCA, LVDS TRANSMITTER BOARD	3
069340100	DISK ON MODULE, w/SOFTWARE, STD, T100H	3
069500000	PCA,SERIAL & VIDEO INTERFACE BOARD	3
072150000	ASSY. TOUCHSCREEN CONTROL MODULE	3
072650000	MANUAL, OPERATORS, T100H	3
884-017300	PUMP ASSY, EXTERNAL, 115V/60 HZ, THOMAS	2
98415105-1	EXTERNAL SCRUBBER ASSY., CHARCOAL	2

T100H INDIVIDUAL SPARE PARTS LIST

Part Number	Description	Level
CN0000458	CONNECTOR, REAR PANEL, 12 PIN	3
CN0000520	CONNECTOR, REAR PANEL, 10 PIN	3
FL0000001	FILTER, SS	1
HW0000005	FOOT, CHASSIS	3
HW0000036	TFE TAPE, 1/4" (48 FT/ROLL)	1
HW0000090	SPRING, SS, FLOW CONTROL	1
HW0000453	SUPPORT, CIRCUIT BD, 3/16" ICOP	3
HW0000685	LATCH, MAGNETIC, FRONT PANEL	3
KIT000095	REPLACEMENT, COOLER KIT, TML50/41	2
KIT000253	KIT, SPARE PS37, E SERIES	2
KIT000254	POWER SUPPLY, SWITCHING, 12V/60W	2
OR0000001	ORING, FLOW CONTROL/IZS	1
OR0000084	ORING, UV FILTER	1
RL0000015	RELAY, DPDT, GORDOS PREFERRED	2
SW0000051	SWITCH, POWER, CIRC BR	3
SW0000059	PRESSURE XDUCER, 0-15 PSIA	2
041800400	PCA, PMT PREAMP, TML50	R2
043570000	AKIT, EXPENDABLES, TML50/87	R1
045230200	PCA, RELAY CARD W/RELAYS, E SERIES, S/N'S >455	R2
047280000	KIT, SPARE PARTS, TML50	R2
061930000	PCA, UV LAMP DRIVER, GEN-2	R2
98000242	KIT, PUMP SERVICE, THOMAS PUMP	R2
850-056500	REFILL KIT, ACTIVATED CHARCOAL, 1 LB.	R1
KIT000093	REPLACEMENT KIT, 214NM FILTER (03187)	R2
KIT000236	KIT, UV LAMP REPLCMNT w/E-A ADPTR.	R2
OR0000004	ORING, OPTIC/CELL, CELL/TRAP	R1
OR0000006	ORING, CELL/PMT	R1
OR0000007	ORING, PMT/BARREL/CELL	R1
OR0000015	ORING, PMT FILTER	R1
OR0000016	ORING, UV LENS	R1
OR0000027	ORING, COLD BLOCK/PMT HOUSING & HEATSINK	R1
OR0000048	ORING, REF DETECTOR	R1
OR0000060	ORING, PRESSURE TRANSDUCER	R1
OR0000083	ORING, PMT SIGNAL & OPTIC LED	R1
OR0000094	ORING, SAMPLE FILTER	R1

SPARE PARTS FOR ANALYZER OPTIONS ARE ON FOLLOWING PAGE(S)

INDEX OF OPTIONS FOR T100H

Option	Description
41	Current Loop Analog Output
64A	PCA, AUX-I/O BOARD, ETHERNET & USB
64B	PCA, AUX-I/O BD, ETHERNET, ANALOG & USB
65A	Oxygen Sensor
67A	Carbon Dioxide Sensor
FLTR	TFE Filter Elements
PU71	Pump, External, Ultraquiet, KNF, 115V/60HZ

T100H INDIVIDUAL OPTIONS SPARE PARTS LIST
(Not Included in Standard Analyzer Configuration)

Option	Part Number	Description	Level
41	KIT000219	PCA, 4-20MA OUTPUT, (E-OPTION)	3
64A	067300200	PCA, AUX-I/O BOARD, ETHERNET & USB	3
64B	067300000	PCA, AUX-I/O BD, ETHERNET, ANALOG & USB	3
65A	000940400	ORIFICE, 4 MIL, O2 OPTION	R2
65A	043420000	ASSY, HEATER/THERMISTOR O2 OPTION	3
65A	OP0000030	OXYGEN TRANSDUCER	3
67A	054250000	OPTION, CO2 SENSOR 20% VAISALA	3
67A	OP0000033	CO2 MODULE, 0-20%, VAISALA	2
67A	OR0000101	ORING, CO2 OPTION	R1
FLTR	009690000	AKIT, TFE FLTR ELEMENT, 47MM, (FL6) (100)	2
FLTR	009690100	AKIT, TFE FLTR, 47MM, (FL6) (30)	1
PU71	PU0000071	PUMP, EXTERNAL, ULTRAQUIET, KNF, 115V/60HZ	2
PU71	PU0000073	REBUILD KIT FOR PU71	R1

Levels marked with an "R" are TML recommended parts to have on hand for typical repairs and maintenance.

Level 1: General maintenance supplies and expedables such as filters, O-rings, lamps, etc.

Level 2: Critical items that are known from experience to have a higher failure rate, such as pumps, heaters, converters, valves, and circuit boards.

Level 3: Other miscellaneous items not included in Level 1 or 2. This level includes other spare parts that are not expected to fail over a given time frame.

Warranty/Repair Questionnaire T100H

TELEDYNE MONITOR LABS
A Teledyne Technologies Company

Customer: _____ Phone: _____

Contact Name: _____ Fax No: _____

Site Address: _____

Serial No.: _____ Firmware Revision: _____

1. Are there any failure messages? _____

_____

Please complete the following table: (Note: Depending on options installed, not all test parameters shown below will be available in your instrument)

PARAMETER	DISPLAYED AS	OBSERVED VALUE	UNITS	NOMINAL RANGE
Range	**RANGE**		PPM UG/M^3	1-5000 PPM Standard
Stability	**STABIL**		PPM UG/M^3	<.1 PPM with Zero Air
Vacuum	**VAC**		In-Hg-A	4 – 10 “Hg
Sample Pressure	**PRES**		In-Hg-A	24 – 29
Sample Flow	**SAMP FL**		cc/min	700 ±10%
PMT Signal	**PMT**		mV	0 ± 100 with Zero Air
Normalized PMT Signal	**NORM PMT**		mV	0 ± 100 with Zero Air
UV Lamp	**UV LAMP**		mV	1000 – 4800
UV Lamp Ratio	**LAMP RATIO**		%	35 – 120%
Stray Light	**STR. LGT**		PPM	-50 to +100
Dark PMT	**DRK PMT**		mV	<200
Dark Lamp	**DRK LMP**		mV	-30 to 50
Slope	**SLOPE**		-	1.0 ± 0.3
Offset	**OFFSET**		mV	<200
High Voltage Power Supply	**HVPS**		V	400 – 750*
Reaction Cell Temperature	**RCELL TEMP**		°C	50 ± 1
Box Temperature	**BOX TEMP**		°C	Ambient + (3-7)
PMT Temperature	**PMT TEMP**		°C	7 ± 2
Time of Day	**TIME**		HH:MM:SS	

TELEDYNE ML CUSTOMER SERVICE
EMAIL: tml_support@teledyne.com
PHONE: (303) 792-3300 TOLL FREE: (800) 846-6062 FAX: (303) 799-4853

Warranty/Repair Questionnaire T100H

TELEDYNE MONITOR LABS
A Teledyne Technologies Company

Test Settings		
Test Value	**Observed Value**	**Acceptable Value**
ETEST PMT Reading		2000 ± 1000MV
OTEST PMT Reading		2000 ± 20 MV

2. Have you performed a leak check and flow check? _____

3. What are the failure symptoms? _____

_____

_____

_____

4. What test have you done trying to solve the problem? _____

_____

_____

_____

_____

5. If possible, please include a portion of a strip chart pertaining to the problem. Circle pertinent data.

Other information: _____

_____

_____

_____

_____

_____

_____

_____

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_____

_____

_____

_____

_____

Thank you for providing this information. Your assistance enables Teledyne ML to respond faster to the problem that you are encountering.

TELEDYNE ML CUSTOMER SERVICE
EMAIL: tml_support@teledyne.com
PHONE: (303) 792-3300 TOLL FREE: (800) 846-6062 FAX: (303) 799-4853

APPENDIX D - ELECTRONIC SCHEMATICS

Table D-1: List of Included Electronic Schematics

DOCUMENT #	DOCUMENT TITLE
0690801	Interconnect List, T100
06908	Interconnect Drawing, T100
04354	PCA, 04003, Pressure/Flow Transducer Interface
04524	PCB, Relay, T100
04181	PCA, PMT Preamp, T100
05064	PCA, UV Ref, Dual Out, T100
04693	Driver, Bursting UV Lamp, T100
04932	PCB, TEC Amplifier, T100
04468	PCA, Analog Output Isolator, T100
05083	PCA, G5 Motherboard PN 05802
06698	GUI Interface
06882	LVDS, Transmitter Board
06731	Auxiliary I/O Board (Power-Ethernet)

User Notes:

Interconnect List, T100

(Reference 0690801A)

Revision	Description						Checked	Date	DCN
A	Initial Release						KV	9/3/10	5833
		FROM				TO			
Cable PN	Signal	Assembly	PN	J/P	Pin	Assembly	PN	J/P	Pin
0364901	CBL ASSY, AC POWER								
	AC Line	Power Entry	CN0000073		L	Power Switch	SW0000025		L
	AC Neutral	Power Entry	CN0000073		N	Power Switch	SW0000025		N
	Power Grnd	Power Entry	CN0000073			Shield			
	Power Grnd	Power Entry	CN0000073			Chassis			
	AC Line Switched	Power Switch	SW0000025		L	PS2 (+12)	068020000	SK2	1
	AC Neu Switched	Power Switch	SW0000025		N	PS2 (+12)	068020000	SK2	3
	Power Grnd	Power Entry	CN0000073			PS2 (+12)	068020000	SK2	2
	AC Line Switched	Power Switch	SW0000051		L	PS1 (+5, ±15)	068010000	SK2	1
	AC Neu Switched	Power Switch	SW0000025		N	PS1 (+5, ±15)	068010000	SK2	3
	Power Grnd	Power Entry	CN0000073			PS1 (+5, ±15)	068010000	SK2	2
	AC Line Switched	Power Switch	SW0000025		L	Relay PCA	045230100	J1	1
	AC Neu Switched	Power Switch	SW0000025		N	Relay PCA	045230100	J1	3
	Power Grnd	Power Entry	CN0000073			Relay PCA	045230100	J1	2
03829	CBL ASSY, DC POWER TO MOTHERBOARD								
	DGND	Relay PCA	045230100	J7	1	Motherboard	058021100	J15	1
	+5V	Relay PCA	045230100	J7	2	Motherboard	058021100	J15	2
	AGND	Relay PCA	045230100	J7	3	Motherboard	058021100	J15	3
	+15V	Relay PCA	045230100	J7	4	Motherboard	058021100	J15	4
	AGND	Relay PCA	045230100	J7	5	Motherboard	058021100	J15	5
	-15V	Relay PCA	045230100	J7	6	Motherboard	058021100	J15	6
	+12V RET	Relay PCA	045230100	J7	7	Motherboard	058021100	J15	7
	+12V	Relay PCA	045230100	J7	8	Motherboard	058021100	J15	8
	Chassis Gnd	Relay PCA	045230100	J7	10	Motherboard	058021100	J15	9
04023	CBL, I2C, RELAY BOARD TO MOTHERBOARD								
	I2C Serial Clock	Motherboard	058021100	P107	3	Relay PCA	045230100	P3	1
	I2C Serial Data	Motherboard	058021100	P107	5	Relay PCA	045230100	P3	2
	I2C Reset	Motherboard	058021100	P107	2	Relay PCA	045230100	P3	4
	I2C Shield	Motherboard	058021100	P107	6	Relay PCA	045230100	P3	5
0402602	CBL, IZS HTR/TH, RXCELL & OB TH								
	RTHA	Motherboard	058021100	P27	7	RX Cell Thermistor	046260000		2
	RTHB	Motherboard	058021100	P27	14	RX Cell Thermistor	046260000		1
	IZTA	Motherboard	058021100	P27	6	IZS Therm/Htr	052660000		2
	IZTB	Motherboard	058021100	P27	13	IZS Therm/Htr	052660000		3
	IZS-L	Relay PCA	045230100	P18	1	IZS Therm/Htr	052660000		4
	IZS-N	Relay PCA	045230100	P18	2	IZS Therm/Htr	052660000		1
	GND	Relay PCA	045230100	P18	11	Shield			
	O2-L	Relay PCA	045230100	P18	6	O2 Sensor Therm/Htr	043420000		4
	O2-N	Relay PCA	045230100	P18	7	O2 Sensor Therm/Htr	043420000		2
	TS3	Relay PCA	045230100	P18	3	Relay PCA	045230100	P18	4
	TS4	Relay PCA	045230100	P18	8	Relay PCA	045230100	P18	9
	N/C	Relay PCA	045230100	P18	12	Shield			
	O2TA	Motherboard	058021100	P27	4	O2 Sensor Therm/Htr	043420000		3
	O2TB	Motherboard	058021100	P27	11	O2 Sensor Therm/Htr	043420000		1
0402701	CBL, RX CELL HEATERS								
	RH1B	Relay PCA	045230100	P2	1	RX Cell Heaters	046250000		4
	RH2B	Relay PCA	045230100	P2	1	RX Cell Heaters	046250000		6
	RH1A	Relay PCA	045230100	P2	2	RX Cell Heaters	046250000		3
	RTS1	Relay PCA	045230100	P2	3	RX Cell Heaters	046250000		1
	RTS2	Relay PCA	045230100	P2	4	RX Cell Heaters	046250000		2
	RH2A	Relay PCA	045230100	P2	5	RX Cell Heaters	046250000		5
		Relay PCA	045230100	P2	13	Relay PCA	045230100	P2	14
		Relay PCA	045230100	P2	8	Relay PCA	045230100	P2	9
04105	CBL, KEYBD TO MTHBRD								
	Kbd Interupt	LCD Interface PCA	066970000	J1	7	Motherboard	058021100	J106	1
	DGND	LCD Interface PCA	066970000	J1	2	Motherboard	058021100	J106	8
	SDA	LCD Interface PCA	066970000	J1	5	Motherboard	058021100	J106	2
	SCL	LCD Interface PCA	066970000	J1	6	Motherboard	058021100	J106	6
	Shld	LCD Interface PCA	066970000	J1	10	Motherboard	058021100	J106	5

Interconnect List, T100

(Reference 0690801A)

		FROM				TO			
Cable PN	**Signal**	**Assembly**	**PN**	**J/P**	**Pin**	**Assembly**	**PN**	**J/P**	**Pin**
04176	**CBL, DC POWER TO RELAY BOARD**								
	DGND	Relay PCA	045230100	P8	1	Power Supply Triple	068010000	J1	3
	+5V	Relay PCA	045230100	P8	2	Power Supply Triple	068010000	J1	1
	+15V	Relay PCA	045230100	P8	4	Power Supply Triple	068010000	J1	6
	AGND	Relay PCA	045230100	P8	5	Power Supply Triple	068010000	J1	4
	-15V	Relay PCA	045230100	P8	6	Power Supply Triple	068010000	J1	5
	+12V RET	Relay PCA	045230100	P8	7	Power Supply Single	068020000	J1	3
	+12V	Relay PCA	045230100	P8	8	Power Supply Single	068020000	J1	1
04437	**CBL, PREAMPLIFIER TO TEC**								
	Preamp TEC drive VREF	Preamp PCA	041800400	J1	1	TEC PCA	049310100	J3	1
	Preamp TEC drive CTRL	Preamp PCA	041800400	J1	2	TEC PCA	049310100	J3	2
	Preamp TEC drive AGND	Preamp PCA	041800400	J1	3	TEC PCA	049310100	J3	3
0448501	**CBL, SHUTTER TO RELAY BOARD**								
	+12V RET	Shutter	013420000		1	Relay PCA	045230100	P6	1
	+12V	Shutter	013420000		2	Relay PCA	045230100	P6	2
04488	**CBL, MAIN HARNESS**								
	AGND	Relay PCA	045230100	P5	1	O2 Sensor	049210000	P1	5
	-V15	Relay PCA	045230100	P5	2	O2 Sensor	049210000	P1	6
		Motherboard	058021100	P109	10	O2 Sensor	049210000	P1	9
	O2 SIGNAL-	Motherboard	058021100	P109	7	O2 Sensor	049210000	P1	10
	O2 SIGNAL+	Motherboard	058021100	P109	1	Shield			
	PMT TEMP	Motherboard	058021100	P109	4	PMT Preamp PCA	041800400	P6	5
	HVPS	Motherboard	058021100	P109	5	PMT Preamp PCA	041800400	P6	6
	PMT SIGNAL+	Motherboard	058021100	P109	6	PMT Preamp PCA	041800400	P6	7
	AGND	Motherboard	058021100	P109	12	PMT Preamp PCA	041800400	P6	8
	AGND	Motherboard	058021100	P109	11	Shield			
	ETEST	Motherboard	058021100	P108	8	PMT Preamp PCA	041800400	P6	1
	OTEST	Motherboard	058021100	P108	16	PMT Preamp PCA	041800400	P6	2
	PHYSICAL RANGE	Motherboard	058021100	P108	7	PMT Preamp PCA	041800400	P6	4
	AGND	Motherboard	058021100	P109	9	UV Ref PCA	050630100	P1	4
	CH7	Motherboard	058021100	P109	3	UV Ref PCA	050630100	P1	1
	CH2	Motherboard	058021100	P109	2	UV Ref PCA	050630100	P1	5
	+15V	Relay PCA	045230100	P10	4	UV Ref PCA	050630100	P1	2
	-15V	Relay PCA	045230100	P10	6	UV Ref PCA	050630100	P1	3
	TEC +12V RET	Relay PCA	045230100	P10	7	TEC PCA	049310100		2
	TEC +12V	Relay PCA	045230100	P10	8	TEC PCA	049310100		1
	DISP RET	Relay PCA	045230100	P10	1	LCD Interface PCA	066970000	P14	8
	+5 DISP	Relay PCA	045230100	P10	2	LCD Interface PCA	066970000	P14	1
	EGND	Shield				LCD Interface PCA	066970000	P14	4
	SDA	Lamp Driver PCA	061930000	P1	4	LCD Interface PCA	066970000	P14	5
	SCL	Lamp Driver PCA	061930000	P1	3	LCD Interface PCA	066970000	P14	6
	+12V	Lamp Driver PCA	061930000	P1	1	Relay PCA	045230100	P9	8
	+12RET	Lamp Driver PCA	061930000	P1	2	Relay PCA	045230100	P9	7
	DGND	PMT Preamp PCA	041800400	P5	1	Relay PCA	045230100	P9	1
	VCC	PMT Preamp PCA	041800400	P5	2	Relay PCA	045230100	P9	2
	+15V	PMT Preamp PCA	041800400	P5	4	Relay PCA	045230100	P9	4
	-15V	PMT Preamp PCA	041800400	P5	6	Relay PCA	045230100	P9	6
	DGND	LCD Interface PCA	066970000	P14	2	Relay PCA	045230100	P11	1
	VCC	LCD Interface PCA	066970000	P14	3	Relay PCA	045230100	P11	2
	+12RET	Fan	040010000		1	Relay PCA	045230100	P11	7
	+12V	Fan	040010000		2	Relay PCA	045230100	P11	8
	AGND	Flow Module PCA	040030100	P1	3	Relay PCA	045230100	P11	3
	+15V	Flow Module PCA	040030100	P1	6	Relay PCA	045230100	P11	4
	PRESS SIGNAL 1	Flow Module PCA	040030100	P1	2	Motherboard	058021100	P110	6
	PRESS SIGNAL 2	Flow Module PCA	040030100	P1	4	Motherboard	058021100	P110	5
	FLOW SIGNAL 1	Flow Module PCA	040030100	P1	5	Motherboard	058021100	P110	4
	FLOW SIGNAL 2	Flow Module PCA	040030100	P1	1	Motherboard	058021100	P110	3
	SHIELD	Shield				Motherboard	058021100	P110	12
	SHIELD	Shield				Motherboard	058021100	P110	9
	TC SIGNAL 1	Relay PCA	045230100	P17	1	Motherboard	058021100	P110	2
	TC 1 SIGNAL DGND	Relay PCA	045230100	P17	2	Motherboard	058021100	P110	8
	TC SIGNAL 2	Relay PCA	045230100	P17	3	Motherboard	058021100	P110	1
	TC 2 SIGNAL DGND	Relay PCA	045230100	P17	4	Motherboard	058021100	P110	7

Interconnect List, T100

(Reference 0690801A)

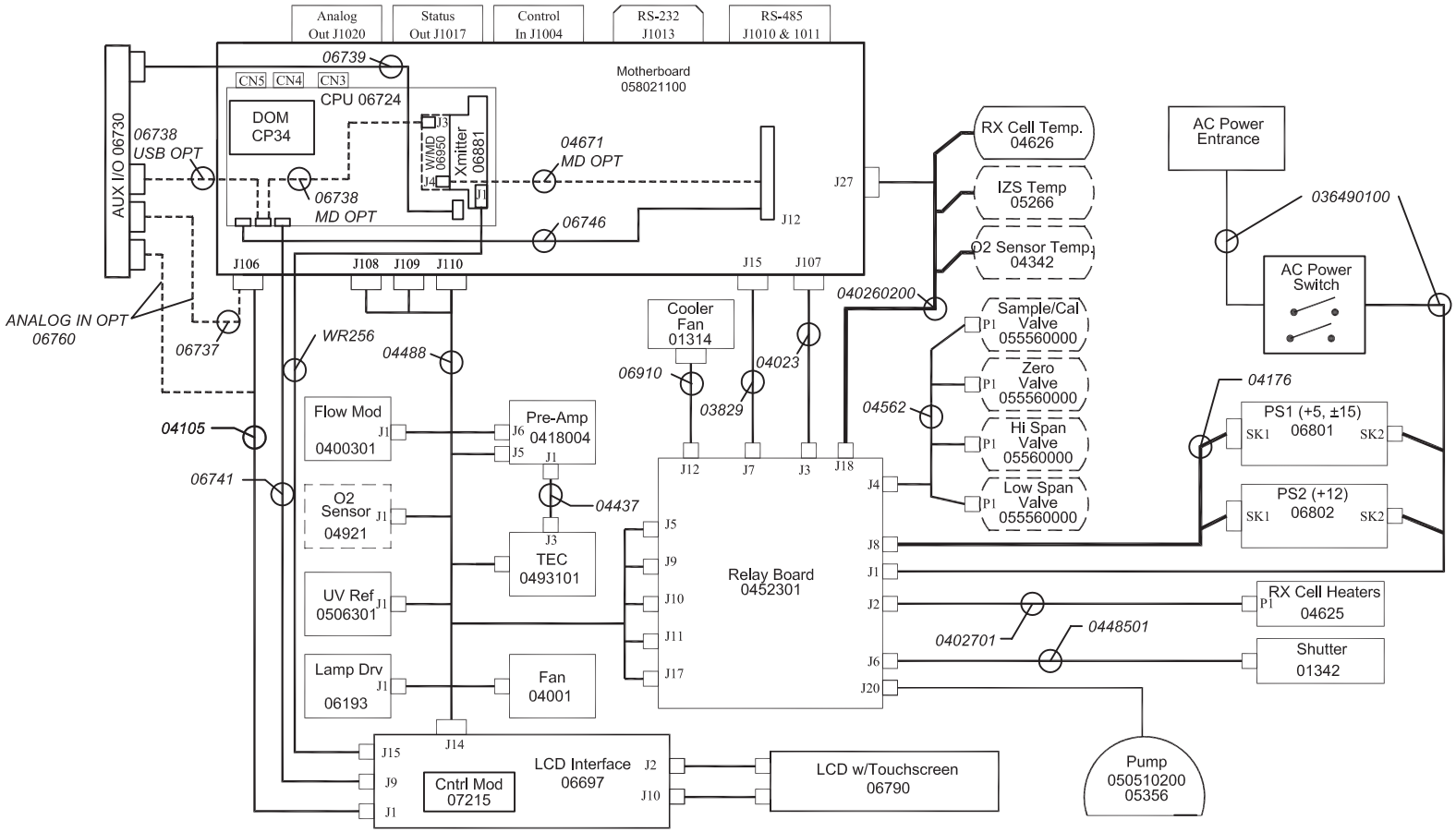
		FROM				TO			
Cable PN	**Signal**	**Assembly**	**PN**	**J/P**	**Pin**	**Assembly**	**PN**	**J/P**	**Pin**
04562	**CBL, Z/S IZS VALVES**								
	Sample Valve +12V	Relay PCA	045230100	P4	1	SMP/CAL	055560000		1
	Sample Valve +12V RET	Relay PCA	045230100	P4	2	SMP/CAL	055560000		2
	Zero/Span valve +12V	Relay PCA	045230100	P4	3	ZS/HI S	055560100		1
	Zero/Span valve +12V RE	Relay PCA	045230100	P4	4	ZS/HI S	055560100		2
	Low Span Valve +12V	Relay PCA	045230100	P4	5	Lo Span	055560100		1
	Low Span Valve +12V RE	Relay PCA	045230100	P4	6	Lo Span	055560100		2
	AutoZero Valve +12V	Relay PCA	045230100	P4	7	Zero	055560000		1
	AutoZero Valve +12V RE	Relay PCA	045230100	P4	8	Zero	055560000		2
04671	**CBL, MOTHERBOARD TO XMITTER BD (MULTIDROP OPTION**								
	GND	Motherboard	058021100	P12	2	Xmitter bd w/Multidrop	069500000	J4	2
	RX0	Motherboard	058021100	P12	14	Xmitter bd w/Multidrop	069500000	J4	14
	RTS0	Motherboard	058021100	P12	13	Xmitter bd w/Multidrop	069500000	J4	13
	TX0	Motherboard	058021100	P12	12	Xmitter bd w/Multidrop	069500000	J4	12
	CTS0	Motherboard	058021100	P12	11	Xmitter bd w/Multidrop	069500000	J4	11
	RS-GND0	Motherboard	058021100	P12	10	Xmitter bd w/Multidrop	069500000	J4	10
	RTS1	Motherboard	058021100	P12	8	Xmitter bd w/Multidrop	069500000	J4	8
	CTS1/485-	Motherboard	058021100	P12	6	Xmitter bd w/Multidrop	069500000	J4	6
	RX1	Motherboard	058021100	P12	9	Xmitter bd w/Multidrop	069500000	J4	9
	TX1/485+	Motherboard	058021100	P12	7	Xmitter bd w/Multidrop	069500000	J4	7
	RS-GND1	Motherboard	058021100	P12	5	Xmitter bd w/Multidrop	069500000	J4	5
	RX1	Motherboard	058021100	P12	9	Xmitter bd w/Multidrop	069500000	J4	9
	TX1/485+	Motherboard	058021100	P12	7	Xmitter bd w/Multidrop	069500000	J4	7
	RS-GND1	Motherboard	058021100	P12	5	Xmitter bd w/Multidrop	069500000	J4	5
06737	**CBL, I2C to AUX I/O (AN**	**ALOG IN OPTION**							
	ATX-	Motherboard	058021100	J106	1	Aux I/O PCA	067300000	J2	1
	ATX+	Motherboard	058021100	J106	2	Aux I/O PCA	067300000	J2	2
	LED0	Motherboard	058021100	J106	3	Aux I/O PCA	067300000	J2	3
	ARX+	Motherboard	058021100	J106	4	Aux I/O PCA	067300000	J2	4
	ARX-	Motherboard	058021100	J106	5	Aux I/O PCA	067300000	J2	5
	LED0+	Motherboard	058021100	J106	6	Aux I/O PCA	067300000	J2	6
	LED1+	Motherboard	058021100	J106	8	Aux I/O PCA	067300000	J2	8
06738	**CBL, CPU COM to AUX I/O (USB OPTION**								
	RXD	CPU PCA	067240000	COM1	1	Aux I/O PCA	0673000 or -02	J3	1
	DCD	CPU PCA	067240000	COM1	2	Aux I/O PCA	0673000 or -02	J3	2
	DTR	CPU PCA	067240000	COM1	3	Aux I/O PCA	0673000 or -02	J3	3
	TXD	CPU PCA	067240000	COM1	4	Aux I/O PCA	0673000 or -02	J3	4
	DSR	CPU PCA	067240000	COM1	5	Aux I/O PCA	0673000 or -02	J3	5
	GND	CPU PCA	067240000	COM1	6	Aux I/O PCA	0673000 or -02	J3	6
	CTS	CPU PCA	067240000	COM1	7	Aux I/O PCA	0673000 or -02	J3	7
	RTS	CPU PCA	067240000	COM1	8	Aux I/O PCA	0673000 or -02	J3	8
	RI	CPU PCA	067240000	COM1	10	Aux I/O PCA	0673000 or -02	J3	10
06738	**CBL, CPU COM to AUX I/O (MULTIDROP OPTION**								
	RXD	CPU PCA	067240000	COM1	1	Xmitter bd w/Multidrop	069500000	J3	1
	DCD	CPU PCA	067240000	COM1	2	Xmitter bd w/Multidrop	069500000	J3	2
	DTR	CPU PCA	067240000	COM1	3	Xmitter bd w/Multidrop	069500000	J3	3
	TXD	CPU PCA	067240000	COM1	4	Xmitter bd w/Multidrop	069500000	J3	4
	DSR	CPU PCA	067240000	COM1	5	Xmitter bd w/Multidrop	069500000	J3	5
	GND	CPU PCA	067240000	COM1	6	Xmitter bd w/Multidrop	069500000	J3	6
	CTS	CPU PCA	067240000	COM1	7	Xmitter bd w/Multidrop	069500000	J3	7
	RTS	CPU PCA	067240000	COM1	8	Xmitter bd w/Multidrop	069500000	J3	8
	RI	CPU PCA	067240000	COM1	10	Xmitter bd w/Multidrop	069500000	J3	10
06739	**CBL, CPU ETHERNET TO AUX I/O**								
	ATX-	CPU PCA	067240000	LAN	1	Aux I/O PCA	06730XXXX	J2	1
	ATX+	CPU PCA	067240000	LAN	2	Aux I/O PCA	06730XXXX	J2	2
	LED0	CPU PCA	067240000	LAN	3	Aux I/O PCA	06730XXXX	J2	3
	ARX+	CPU PCA	067240000	LAN	4	Aux I/O PCA	06730XXXX	J2	4
	ARX-	CPU PCA	067240000	LAN	5	Aux I/O PCA	06730XXXX	J2	5
	LED0+	CPU PCA	067240000	LAN	6	Aux I/O PCA	06730XXXX	J2	6
	LED1	CPU PCA	067240000	LAN	7	Aux I/O PCA	06730XXXX	J2	7
	LED1+	CPU PCA	067240000	LAN	8	Aux I/O PCA	06730XXXX	J2	8
06741	**CBL, CPU USB TO FRONT PANEL**								
	GND	CPU PCA	067240000	USB	8	LCD Interface PCA	066970000	J9	
	LUSBD3+	CPU PCA	067240000	USB	6	LCD Interface PCA	066970000	J9	
	LUSBD3-	CPU PCA	067240000	USB	4	LCD Interface PCA	066970000	J9	
	VCC	CPU PCA	067240000	USB	2	LCD Interface PCA	066970000	J9	

Interconnect List, T100

(Reference 0690801A)

		FROM				TO			
Cable PN	**Signal**	**Assembly**	**PN**	**J/P**	**Pin**	**Assembly**	**PN**	**J/P**	**Pin**
06746	**CBL, MB TO 06154 CPU**								
	GND	Motherboard	058021100	P12	2	Shield			
	RX0	Motherboard	058021100	P12	14	CPU PCA	067240000	COM1	1
	RTS0	Motherboard	058021100	P12	13	CPU PCA	067240000	COM1	8
	TX0	Motherboard	058021100	P12	12	CPU PCA	067240000	COM1	4
	CTS0	Motherboard	058021100	P12	11	CPU PCA	067240000	COM1	7
	RS-GND0	Motherboard	058021100	P12	10	CPU PCA	067240000	COM1	6
	RTS1	Motherboard	058021100	P12	8	CPU PCA	067240000	COM2	8
	CTS1/485-	Motherboard	058021100	P12	6	CPU PCA	067240000	COM2	7
	RX1	Motherboard	058021100	P12	9	CPU PCA	067240000	COM2	1
	TX1/485+	Motherboard	058021100	P12	7	CPU PCA	067240000	COM2	4
	RS-GND1	Motherboard	058021100	P12	5	CPU PCA	067240000	COM2	6
	RX1	Motherboard	058021100	P12	9	CPU PCA	067240000	485	1
	TX1/485+	Motherboard	058021100	P12	7	CPU PCA	067240000	485	2
	RS-GND1	Motherboard	058021100	P12	5	CPU PCA	067240000	485	3
06910	**CBL, COOLER FAN**								
	+12V RET	Relay PCA	045230100	P12	7	Cooler Fan	013140000		2
	+12V	Relay PCA	045230100	P12	8	Cooler Fan	013140000		1
WR256	**CBL, XMITTER TO INTERFACE**								
		LCD Interface PCA	066970000	J15		Transmitter PCA	068810000	J1	

REVISIONS				
REV	DESCRIPTION	DATE	DCN	APPROVED
A	INITIAL RELEASE	9/3/10	5833	KV



KEY:
1. All part numbers in *Italic* identify cables that are refered to in the accompanying document 069080100.
2. All items in Dashed boxes are optional.

PRINTED DOCUMENTS ARE UNCONTROLLED

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± 1/32 DECIMALS ±.03[0.76] ±.010[0.25] ANGULAR ±0° 30'
DO NOT SCALE DRAWING
TREATMENT: NA
FINISH
SIMILAR TO
THIRD ANGLE PROJECTION

CONTRACT: NA

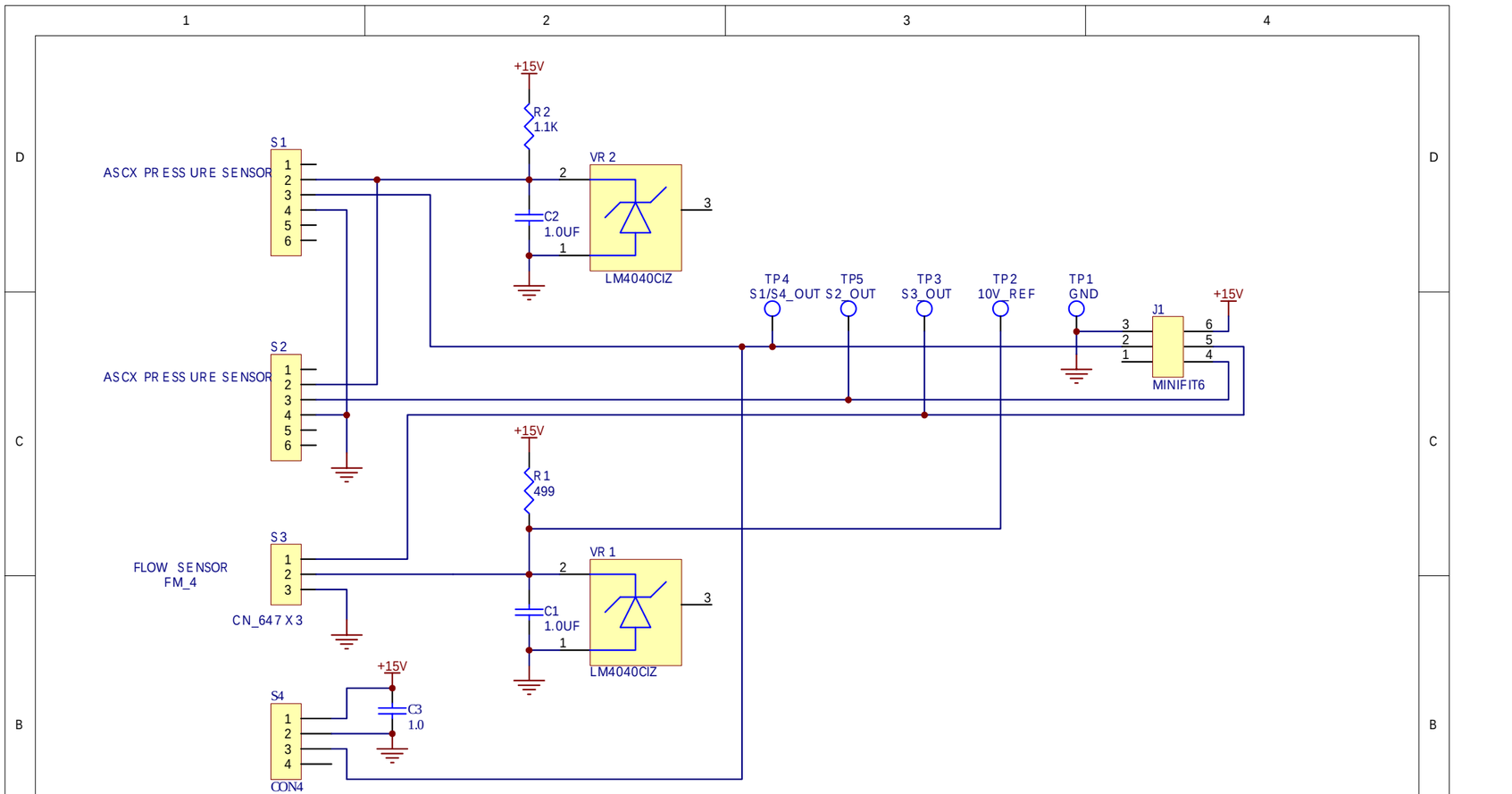
APPROVALS	DATE
DRAWN KV	4/10
CHECK	
CCB	
ISSUED	

TELEDYNE MONITOR LABS
A Teledyne Technologies Company

TITLE: INTERCONNECT DRAWING T100

SIZE	CAGE CODE NO.	DWG. NO.	REV
B	1JZF4	06908	A

SCALE DNS FILE 06908 SHEET 1 OF 1



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TELEDYNE MONITOR LABS
A Teledyne Technologies Company

APPROV ALS	DATE	SCH, PCA 04003, PRESS/FLOW, 'E' SERIES
DRAWN		
CHECKED		SIZE B · DRAWING NO. 04354 · REVISION D
APPROV ED		LAST MOD. 3-Dec-2007 · SHEET 1 of 1

General Trace Width Requirements
1. Vcc (+5V) and I2C VCC should be 15 mil
2. Digitial grounds should be at least 20 mils
3. +12V and +12V return should be 30 mils
4. All AC lines (AC Line, AC Neutral, RELAY0 - 4, All signals on JP2) should be 30 mils wide, with 120 mil isolation/creepage distance around them
5. Traces between J7 - J12 should be top and bottom and at least 140 mils.
6. Traces to the test points can be as small as 10 mils.

J1 4 PIN — AC_Line, AC_Neutral

VCC — R1 2.2K, R2 2.2K

JP1 HEADER 4X2

RN1 330 — I2C_Vcc

RELAY0, RELAY1, RELAY2 — K1, K2, K3 — SLD-RLY

D1 WDOG RED; D2 YEL RL0; D3 YEL RL1; D4 YEL RL2; D7 GRN VA0; D8 GRN VA1; D9 GRN VA2; D10 GRN VA3

C1 0.1

U1 PCF8575 — A0, A1, A2, INT, SCL, SDA, Vdd, Vss, P00–P07, P10–P17, IO3–IO15

J3 CON5

U2A SN74HC04; U2B; U2C; U2D; U2E

Q1 IRF7205

R3 20K; R5 10K; R6 10K; R4 1M; C3 1; C4 10/16; C5 10/16; C2 0.001

U4 MAX693 — VBATT, VOUT, VCC, GND, BATT_ON, LOW LINE', OSC IN, OSC SEL, RESET, RESET', WDO', CD IN', CD OUT', WDI, PFO', PFI

JP4 WTCDG OVR

D17 DL4148

JP3 HEADER 1X2

VLV_ENAB

JP2 Heater Config Jumper — TS0, TS1, TS2, AC_Neutral

J2 16 PIN — COMMON0, LOAD0, TS0, RELAY0, COMMON1, LOAD1, TS1, RELAY1, COMMON2, LOAD2, TS2, RELAY2

+12V — F1, F2 4A PTC INTERRUPTOR; DD4, DD1 6A RECTIFIER

VALVE_POWER

U5 UDN2540B(16) — IN 4, IN 3, ENABLE, IN 2, IN 1, GND, VCC, OUT4, K, OUT 3, OUT 2, K, OUT 1

J4 8 PIN — VALVE0, VALVE1, VALVE2, VALVE3

C16 22 uF; C6 2000/25 find low ESR electroytic; DD2 15V TVS

+12RET

J5 DC PWR IN — DGND, VCC, AGND, +15V, AGND, -15V, +12RET, +12V, EGND, CHS_GND

J7 KEYBRD; J8 MTHR BRD; J9 SYNC DEMOD; J10; J11 SPARE; J12; J13

TP1 DGND, TP2 +5V, TP3 AGND, TP4 +15V, TP5 -15V, TP6 +12RT, TP7 +12V

CON10THROUGH

Printed documents are uncontrolled

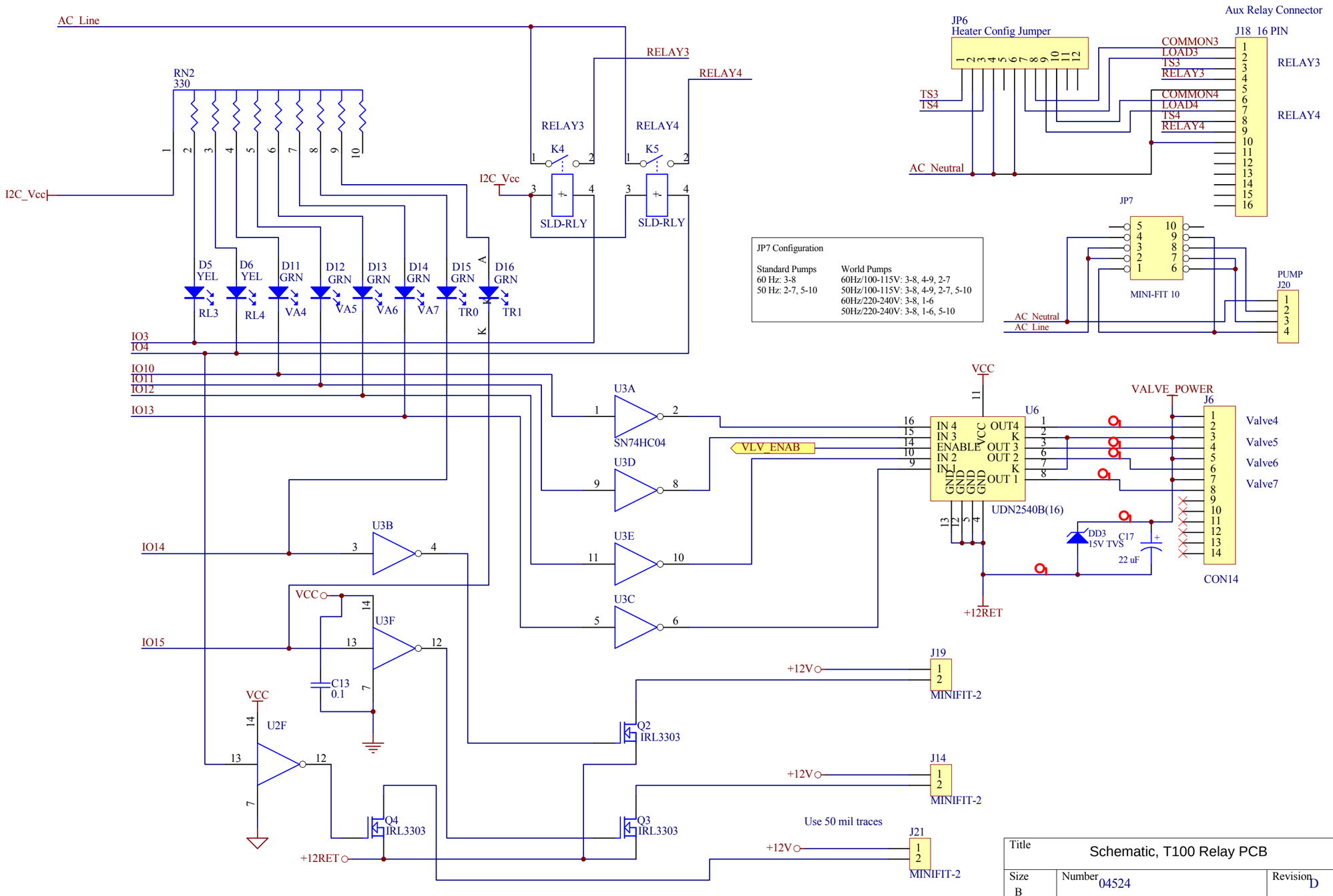
REV	AUTH	DATE	
B	CAC	10/3/02	CE MARK LINE VOLTAGE TRACE SPACING FIX
D	RJ	5/16/07	Add alternate thermocouple connectors

Title: Schematic, T100 Relay PCB

Size: B | Number: 04524 | Revision: D

Date: 16-May-2007 | Sheet 1 of 3

File: N:\PCBMGR\04522cc\source\04522dd.ddb | Drawn By:


AC_Line
RN2
330
I2C_Vcc
RELAY3
RELAY4
K4
K5
SLD-RLY
D5 YEL
D6 YEL
D11 GRN
D12 GRN
D13 GRN
D14 GRN
D15 GRN
D16 GRN
RL3
RL4
VA4
VA5
VA6
VA7
TR0
TR1
IO3
IO4
IO10
IO11
IO12
IO13
IO14
IO15
U3A
SN74HC04
U3D
U3E
U3C
U3B
U3F
U2F
C13
0.1
VCC
Q2
IRL3303
Q3
IRL3303
Q4
IRL3303
+12RET
+12V
J19
J14
J21
MINIFIT-2
Use 50 mil traces
VLV_ENAB
U6
UDN2540B(16)
VALVE_POWER
J6
CON14
Valve4
Valve5
Valve6
Valve7
DD3
15V TVS
C17
22 uF
JP6
Heater Config Jumper
TS3
TS4
AC_Neutral
Aux Relay Connector
J18 16 PIN
COMMON3
LOAD3
TS3
RELAY3
COMMON4
LOAD4
TS4
RELAY4
JP7
MINI-FIT 10
PUMP
J20
AC_Neutral
AC_Line
JP7 Configuration
Standard Pumps
60 Hz: 3-8
50 Hz: 2-7, 5-10
World Pumps
60Hz/100-115V: 3-8, 4-9, 2-7
50Hz/100-115V: 3-8, 4-9, 2-7, 5-10
60Hz/220-240V: 3-8, 1-6
50Hz/220-240V: 3-8, 1-6, 5-10
Printed documents are uncontrolled
Title
Schematic, T100 Relay PCB
Size
B
Number
04524
Revision
D
Date:
16-May-2007
Sheet 2 of 3
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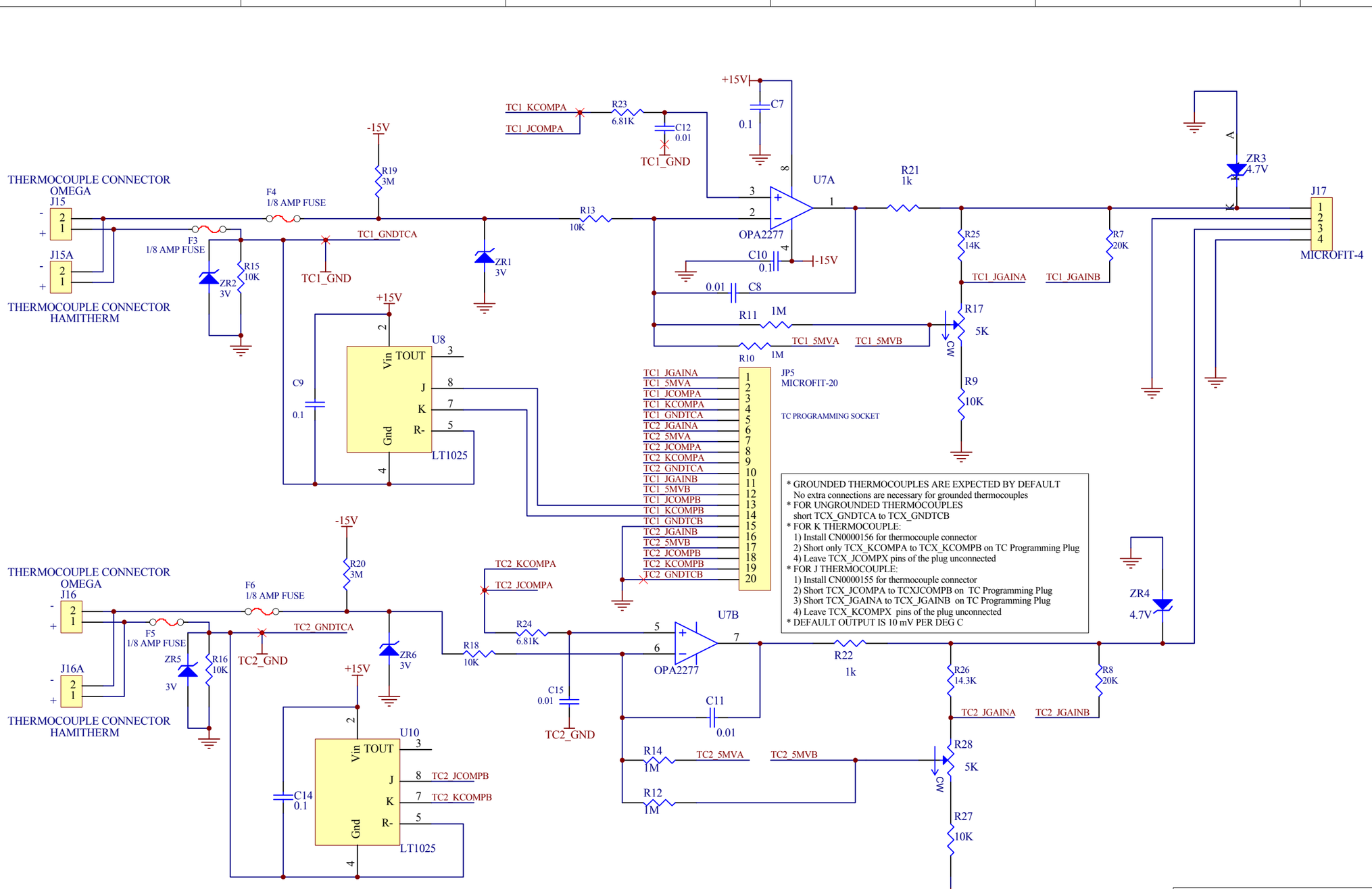
THERMOCOUPLE CONNECTOR
OMEGA
J15
J15A
THERMOCOUPLE CONNECTOR
HAMITHERM
F3
1/8 AMP FUSE
F4
1/8 AMP FUSE
R19
3M
-15V
TC1_GNDTCA
TC1_GND
ZR1
3V
ZR2
3V
R15
10K
+15V
C9
0.1
U8
Vin
TOUT
J
K
R-
Gnd
LT1025
TC1_KCOMPA
TC1_JCOMPA
R23
6.81K
C12
0.01
TC1_GND
+15V
C7
0.1
U7A
OPA2277
R13
10K
R21
1k
C10
0.1
-15V
0.01
C8
R11
1M
R10
1M
TC1_5MVA
TC1_5MVB
R25
14K
TC1_JGAINA
TC1_JGAINB
R7
20K
R17
5K
CW
R9
10K
ZR3
4.7V
J17
MICROFIT-4
JP5
MICROFIT-20
TC PROGRAMMING SOCKET
TC1_JGAINA
TC1_5MVA
TC1_JCOMPA
TC1_KCOMPA
TC1_GNDTCA
TC2_JGAINA
TC2_5MVA
TC2_JCOMPA
TC2_KCOMPA
TC2_GNDTCA
TC1_JGAINB
TC1_5MVB
TC1_JCOMPB
TC1_KCOMPB
TC1_GNDTCB
TC2_JGAINB
TC2_5MVB
TC2_JCOMPB
TC2_KCOMPB
TC2_GNDTCB
* GROUNDED THERMOCOUPLES ARE EXPECTED BY DEFAULT
No extra connections are necessary for grounded thermocouples
* FOR UNGROUNDED THERMOCOUPLES
short TCX_GNDTCA to TCX_GNDTCB
* FOR K THERMOCOUPLE:
1) Install CN0000156 for thermocouple connector
2) Short only TCX_KCOMPA to TCX_KCOMPB on TC Programming Plug
4) Leave TCX_JCOMPX pins of the plug unconnected
* FOR J THERMOCOUPLE:
1) Install CN0000155 for thermocouple connector
2) Short TCX_JCOMPA to TCXJCOMPB on TC Programming Plug
3) Short TCX_JGAINA to TCX_JGAINB on TC Programming Plug
4) Leave TCX_KCOMPX pins of the plug unconnected
* DEFAULT OUTPUT IS 10 mV PER DEG C
THERMOCOUPLE CONNECTOR
OMEGA
J16
J16A
THERMOCOUPLE CONNECTOR
HAMITHERM
F5
1/8 AMP FUSE
F6
1/8 AMP FUSE
R20
3M
-15V
TC2_GNDTCA
TC2_GND
ZR5
3V
R16
10K
ZR6
3V
+15V
C14
0.1
U10
Vin
TOUT
J
K
R-
Gnd
LT1025
TC2_KCOMPA
TC2_JCOMPA
R24
6.81K
R18
10K
C15
0.01
TC2_GND
U7B
OPA2277
R22
1k
C11
0.01
R14
1M
R12
1M
TC2_5MVA
TC2_5MVB
R26
14.3K
TC2_JGAINA
TC2_JGAINB
R8
20K
R28
5K
CW
R27
10K
ZR4
4.7V
Printed documents are uncontrolled
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Schematic, T100 Relay PCB
Size
B
Number
04524
Revision
D
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16-May-2007
Sheet 3 of 3
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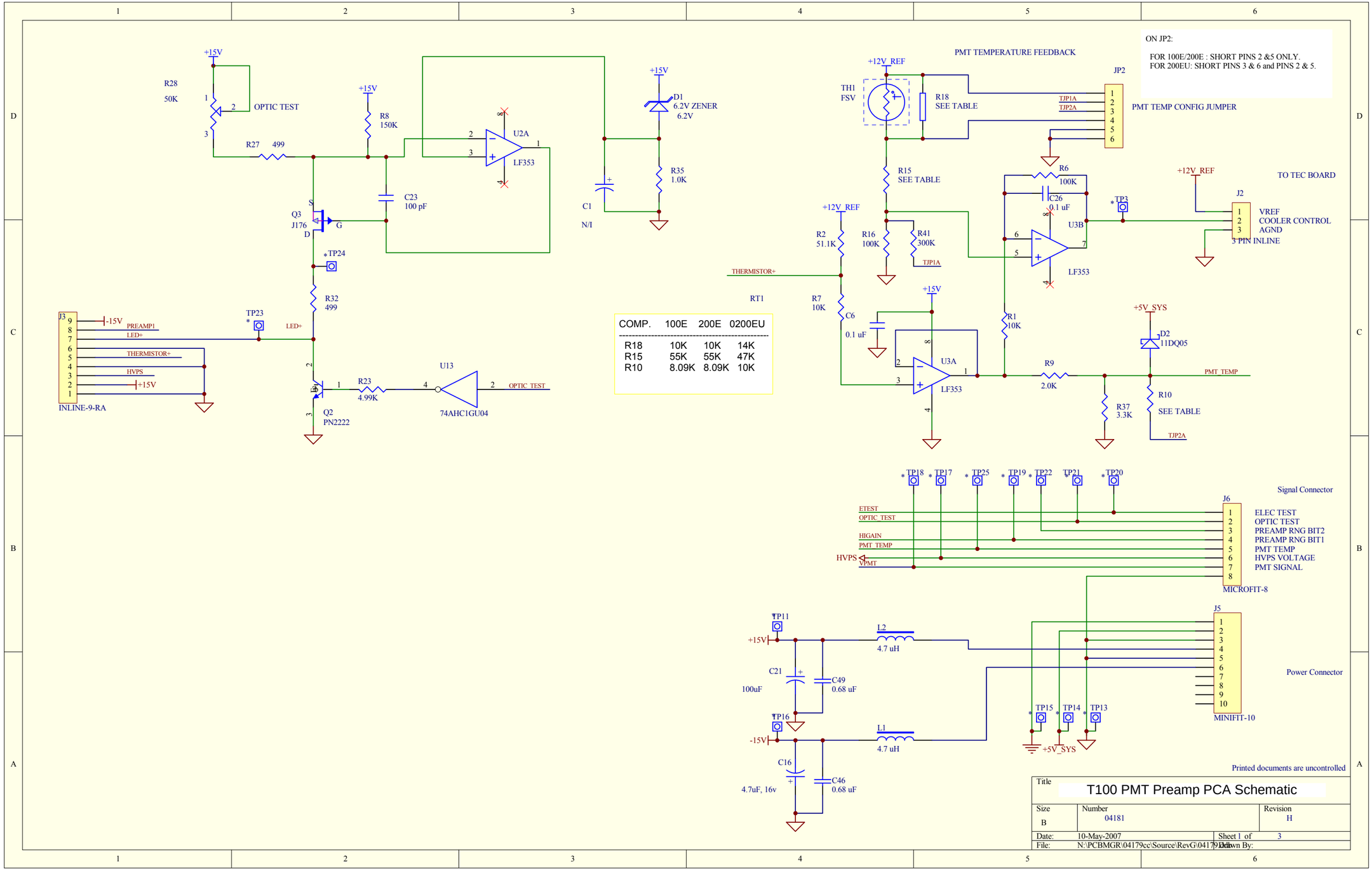
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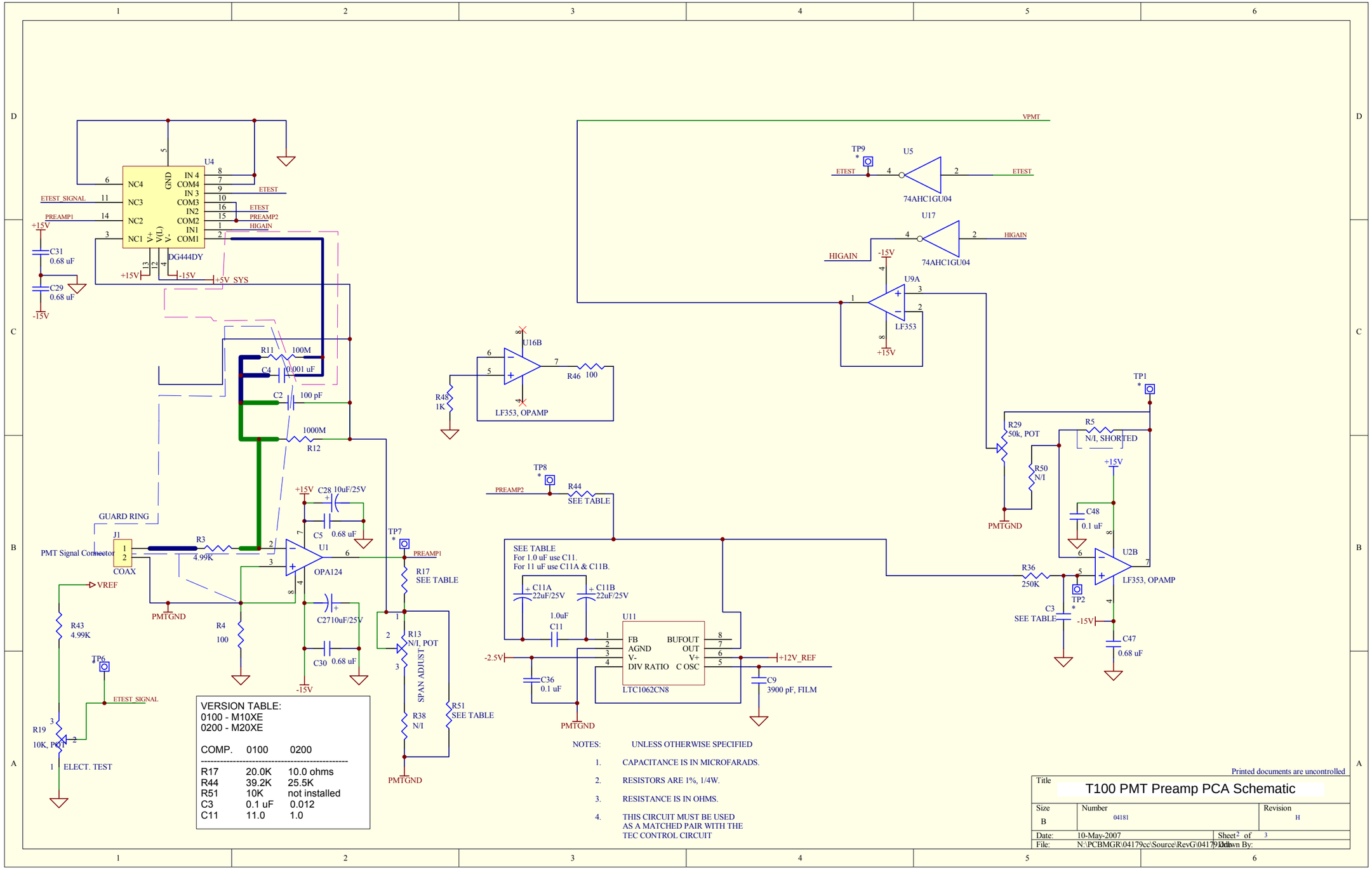
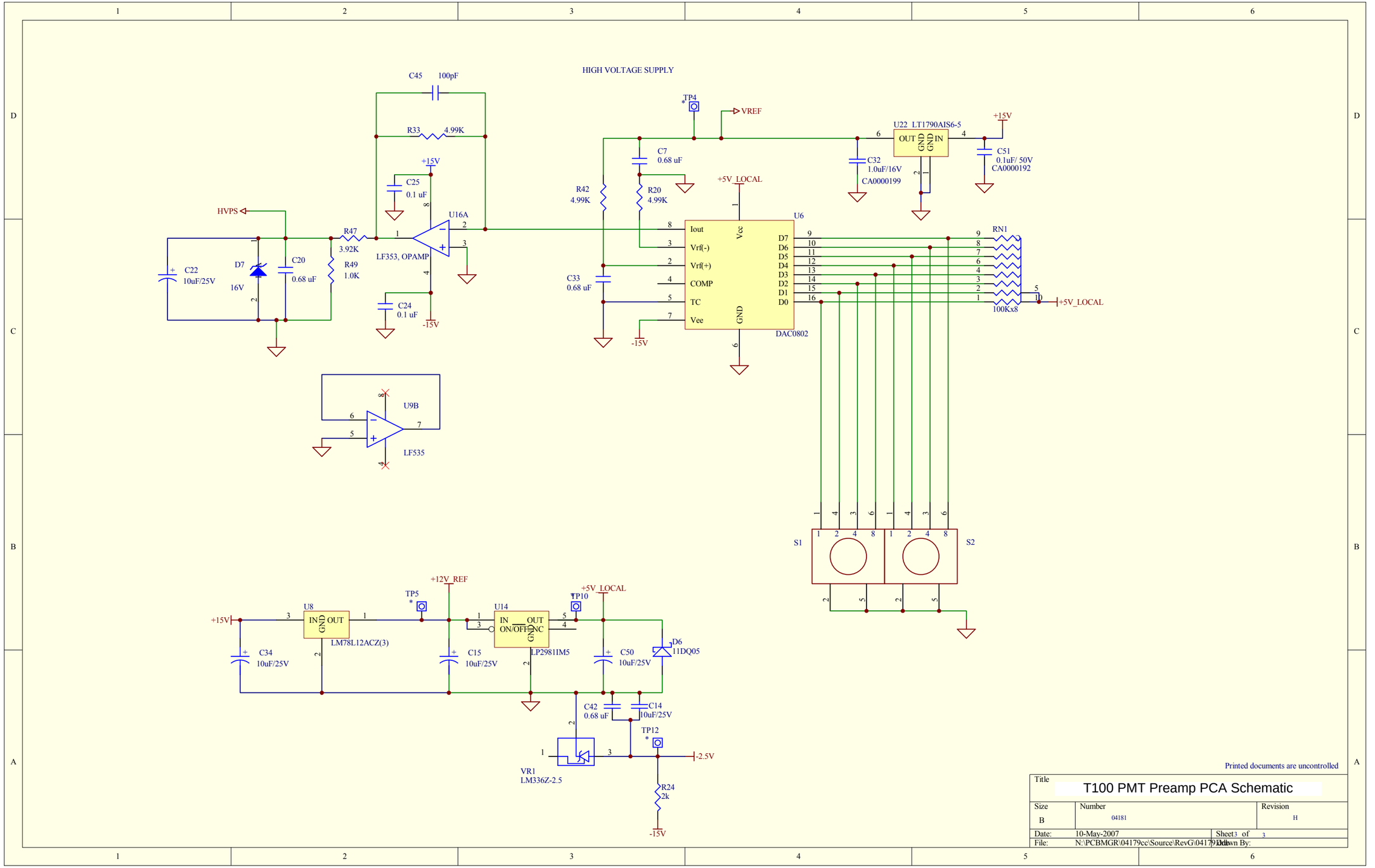
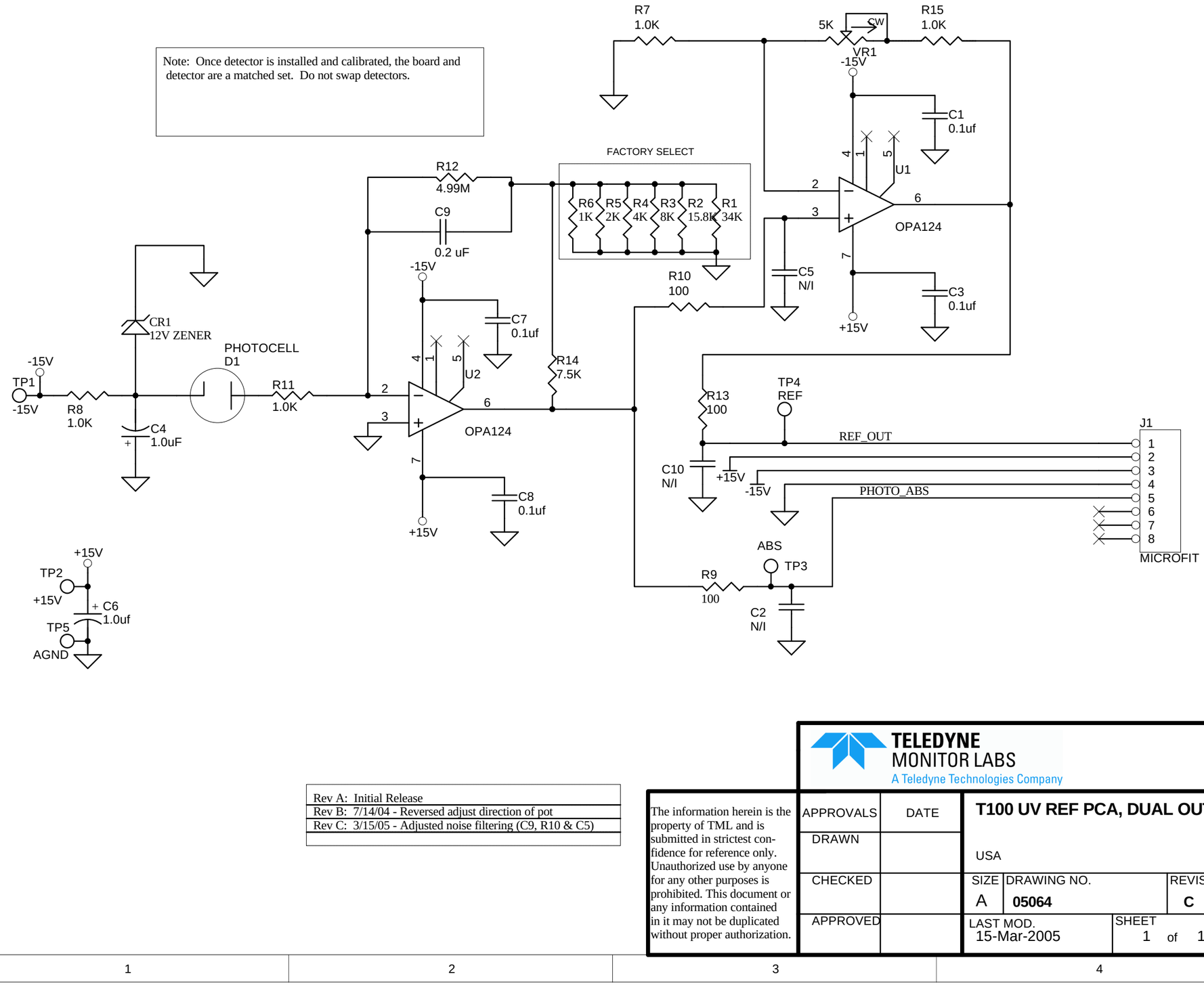
R28
50K
OPTIC TEST
R27 499
R8
150K
U2A
LF353
C23
100 pF
Q3
J176
D
G
S
*TP24
R32
499
TP23
LED+
J3
-15V
PREAMP1
LED+
THERMISTOR+
HVPS
+15V
INLINE-9-RA
R23
4.99K
Q2
PN2222
U13
74AHC1GU04
OPTIC_TEST
D1
6.2V ZENER
6.2V
C1
N/I
R35
1.0K
COMP. 100E 200E 0200EU
R18 10K 10K 14K
R15 55K 55K 47K
R10 8.09K 8.09K 10K
PMT TEMPERATURE FEEDBACK
+12V_REF
TH1
FSV
R18
SEE TABLE
JP2
TJP1A
TJP2A
PMT TEMP CONFIG JUMPER
R15
SEE TABLE
R6
100K
C26
0.1 uF
*TP3
U3B
LF353
+12V_REF
TO TEC BOARD
J2
VREF
COOLER CONTROL
AGND
3 PIN INLINE
R2
51.1K
R16
100K
R41
300K
TJP1A
THERMISTOR+
RT1
R7
10K
C6
0.1 uF
+15V
U3A
LF353
R1
10K
R9
2.0K
+5V_SYS
D2
11DQ05
PMT_TEMP
R37
3.3K
R10
SEE TABLE
TJP2A
ON JP2:
FOR 100E/200E : SHORT PINS 2 &5 ONLY.
FOR 200EU: SHORT PINS 3 & 6 and PINS 2 & 5.
*TP18 *TP17 *TP25 *TP19 *TP22 TP21 *TP20
Signal Connector
J6
ETEST
OPTIC_TEST
HIGAIN
PMT_TEMP
HVPS
VPMT
ELEC TEST
OPTIC TEST
PREAMP RNG BIT2
PREAMP RNG BIT1
PMT TEMP
HVPS VOLTAGE
PMT SIGNAL
MICROFIT-8
J5
Power Connector
MINIFIT-10
TP11
+15V
L2
4.7 uH
C21
100uF
C49
0.68 uF
TP16
-15V
L1
4.7 uH
C16
4.7uF, 16v
C46
0.68 uF
TP15 TP14 TP13
+5V_SYS
Printed documents are uncontrolled
Title
T100 PMT Preamp PCA Schematic
Size
B
Number
04181
Revision
H
Date:
10-May-2007
Sheet 1 of 3
File:
N:\PCBMGR\04179cc\Source\RevG\04179cc.dd
Drawn By:


U4
NC4
NC3
NC2
NC1
GND
V+
V(L)
V-
IN 4
COM4
IN 3
COM3
IN2
COM2
IN1
COM1
DG444DY
ETEST_SIGNAL
PREAMP1
+15V
-15V
+5V_SYS
C31
0.68 uF
C29
0.68 uF
R11
100M
C4
0.001 uF
C2
100 pF
1000M
R12
+15V_C28 10uF/25V
C5
0.68 uF
GUARD RING
J1
COAX
PMT Signal Connector
R3
4.99K
U1
OPA124
VREF
R43
4.99K
R4
100
C27
10uF/25V
C30
0.68 uF
TP6
ETEST_SIGNAL
R19
10K, POT
ELECT. TEST
TP7
PREAMP1
R17
SEE TABLE
R13
N/I, POT
SPAN ADJUST
R38
N/I
R51
SEE TABLE
PMTGND
VERSION TABLE:
0100 - M10XE
0200 - M20XE
COMP. 0100 0200
R17 20.0K 10.0 ohms
R44 39.2K 25.5K
R51 10K not installed
C3 0.1 uF 0.012
C11 11.0 1.0
U16B
R48
1K
R46 100
LF353, OPAMP
TP8
PREAMP2
R44
SEE TABLE
SEE TABLE
For 1.0 uF use C11.
For 11 uF use C11A & C11B.
C11A
22uF/25V
C11B
22uF/25V
1.0uF
C11
U11
FB
AGND
V-
DIV RATIO
BUFOUT
OUT
V+
C OSC
LTC1062CN8
-2.5V
+12V_REF
C36
0.1 uF
C9
3900 pF, FILM
NOTES: UNLESS OTHERWISE SPECIFIED
1. CAPACITANCE IS IN MICROFARADS.
2. RESISTORS ARE 1%, 1/4W.
3. RESISTANCE IS IN OHMS.
4. THIS CIRCUIT MUST BE USED AS A MATCHED PAIR WITH THE TEC CONTROL CIRCUIT
VPMT
TP9
ETEST
U5
74AHC1GU04
U17
HIGAIN
74AHC1GU04
U9A
LF353
TP1
R29
50k, POT
R5
N/I, SHORTED
R50
N/I
PMTGND
C48
0.1 uF
U2B
LF353, OPAMP
R36
250K
TP2
C3
SEE TABLE
C47
0.68 uF
Printed documents are uncontrolled
Title
T100 PMT Preamp PCA Schematic
Size
B
Number
04181
Revision
H
Date: 10-May-2007
Sheet 2 of 3
File: N:\PCBMGR\04179cc\Source\RevG\04179.ddb
Drawn By:


HIGH VOLTAGE SUPPLY
C45 100pF
R33 4.99K
+15V
C25 0.1 uF
HVPS
U16A
R47 3.92K
LF353, OPAMP
C22 10uF/25V
D7 16V
C20 0.68 uF
R49 1.0K
C24 0.1 uF
-15V
TP4
VREF
C7 0.68 uF
R42 4.99K
R20 4.99K
+5V_LOCAL
U6
Iout
Vrf(-)
Vrf(+)
COMP
TC
Vee
Vcc
GND
DAC0802
C33 0.68 uF
-15V
U22 LT1790AIS6-5
OUT GND GND IN
C32 1.0uF/16V CA0000199
+15V
C51 0.1uF/ 50V CA0000192
RN1
100Kx8
+5V_LOCAL
D7 D6 D5 D4 D3 D2 D1 D0
U9B
LF535
S1
S2
+12V_REF
TP5
U8
IN GND OUT
LM78L12ACZ(3)
+15V
C34 10uF/25V
C15 10uF/25V
U14
IN ON/OFF GND OUT NC
LP2981IM5
TP10
+5V_LOCAL
C50 10uF/25V
D6 11DQ05
C42 0.68 uF
C14 10uF/25V
TP12
VR1 LM336Z-2.5
-2.5V
R24 2k
-15V
Printed documents are uncontrolled
Title
T100 PMT Preamp PCA Schematic
Size B
Number 04181
Revision H
Date: 10-May-2007
Sheet 3 of 3
File: N:\PCBMGR\04179cc\Source\RevG\04179cc.dd
Drawn By:



Rev A: Initial Release
Rev B: 7/14/04 - Reversed adjust direction of pot
Rev C: 3/15/05 - Adjusted noise filtering (C9, R10 & C5)

TELEDYNE MONITOR LABS
A Teledyne Technologies Company

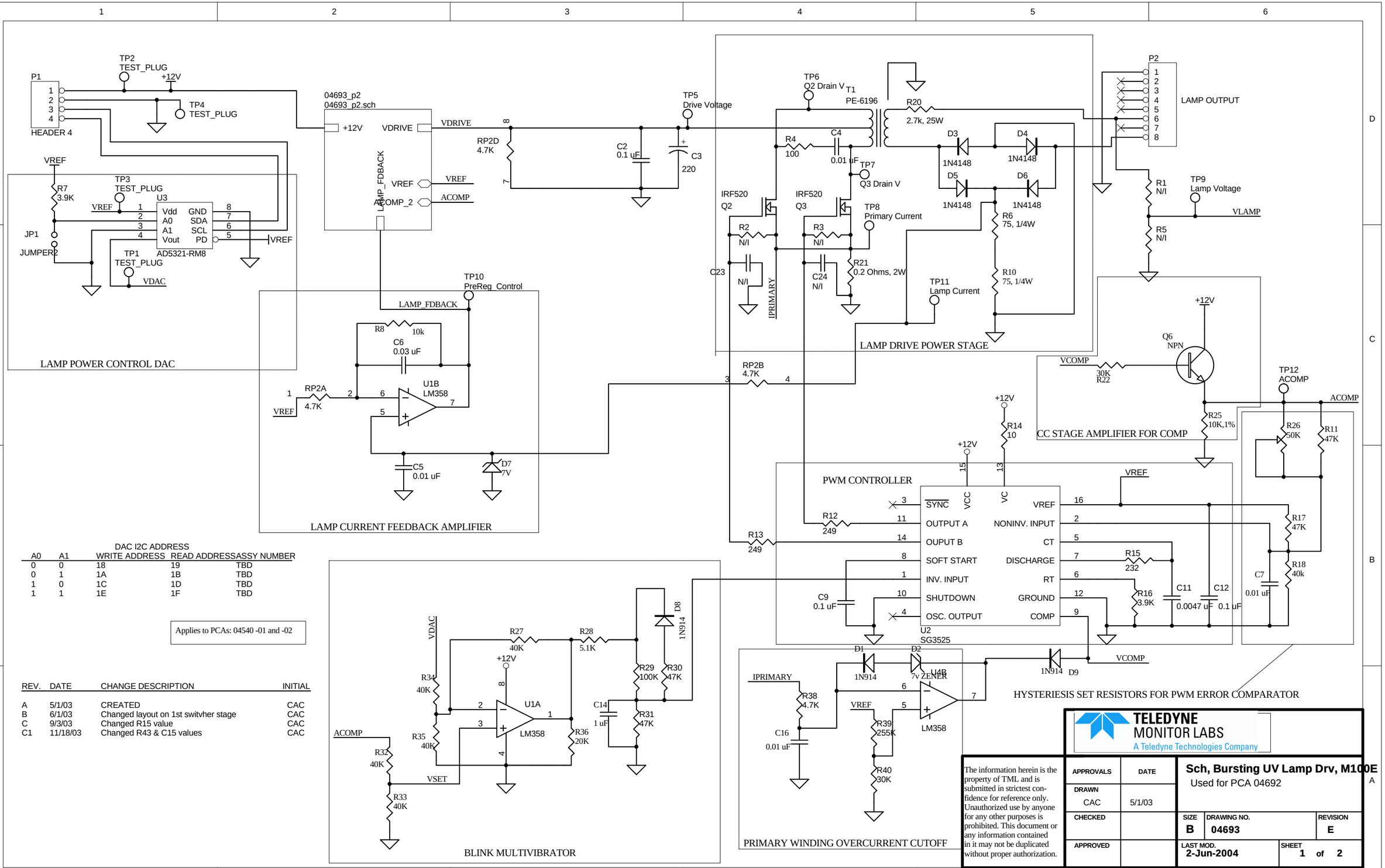
APPROVALS	DATE
DRAWN	
CHECKED	
APPROVED	

T100 UV REF PCA, DUAL OUT

USA

SIZE	DRAWING NO.	REVISION
A	**05064**	**C**

LAST MOD.	SHEET
15-Mar-2005	1 of 1



DAC I2C ADDRESS

A0	A1	WRITE ADDRESS	READ ADDRESS	ASSY NUMBER
0	0	18	19	TBD
0	1	1A	1B	TBD
1	0	1C	1D	TBD
1	1	1E	1F	TBD

Applies to PCAs: 04540 -01 and -02

REV.	DATE	CHANGE DESCRIPTION	INITIAL
A	5/1/03	CREATED	CAC
B	6/1/03	Changed layout on 1st switvher stage	CAC
C	9/3/03	Changed R15 value	CAC
C1	11/18/03	Changed R43 & C15 values	CAC

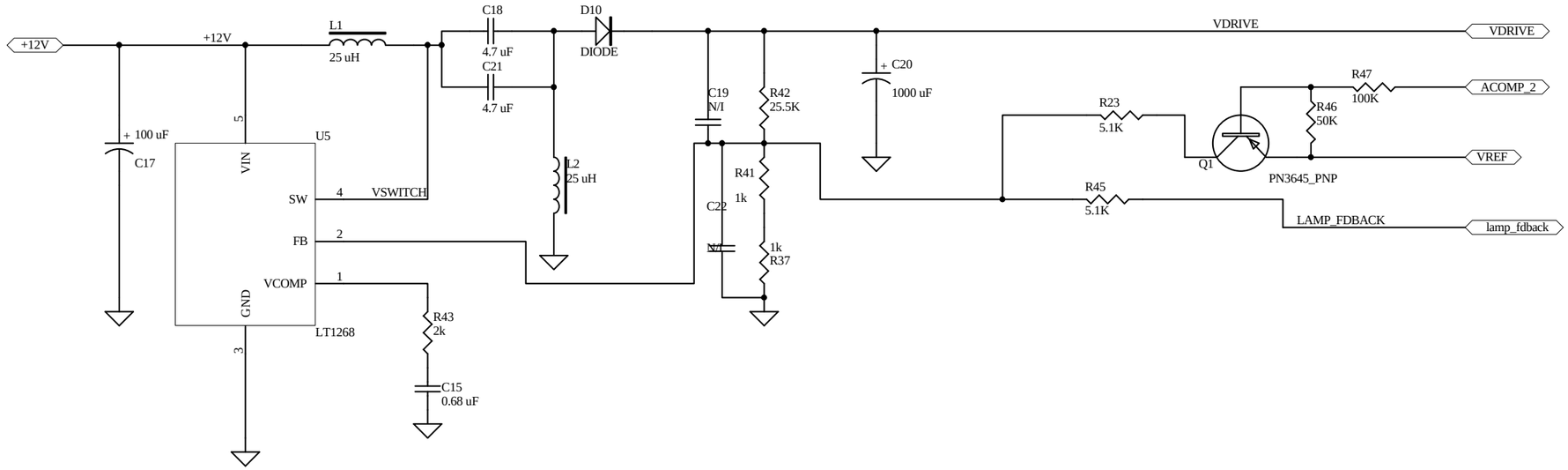
TELEDYNE MONITOR LABS
A Teledyne Technologies Company

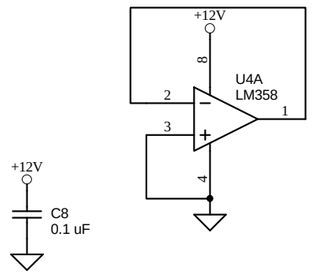
APPROVALS	DATE
DRAWN CAC	5/1/03
CHECKED	
APPROVED	

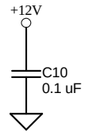
Sch, Bursting UV Lamp Drv, M100E
Used for PCA 04692

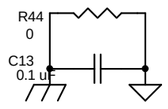
SIZE	DRAWING NO.	REVISION
B	04693	E

LAST MOD. 2-Jun-2004 | SHEET 1 of 2

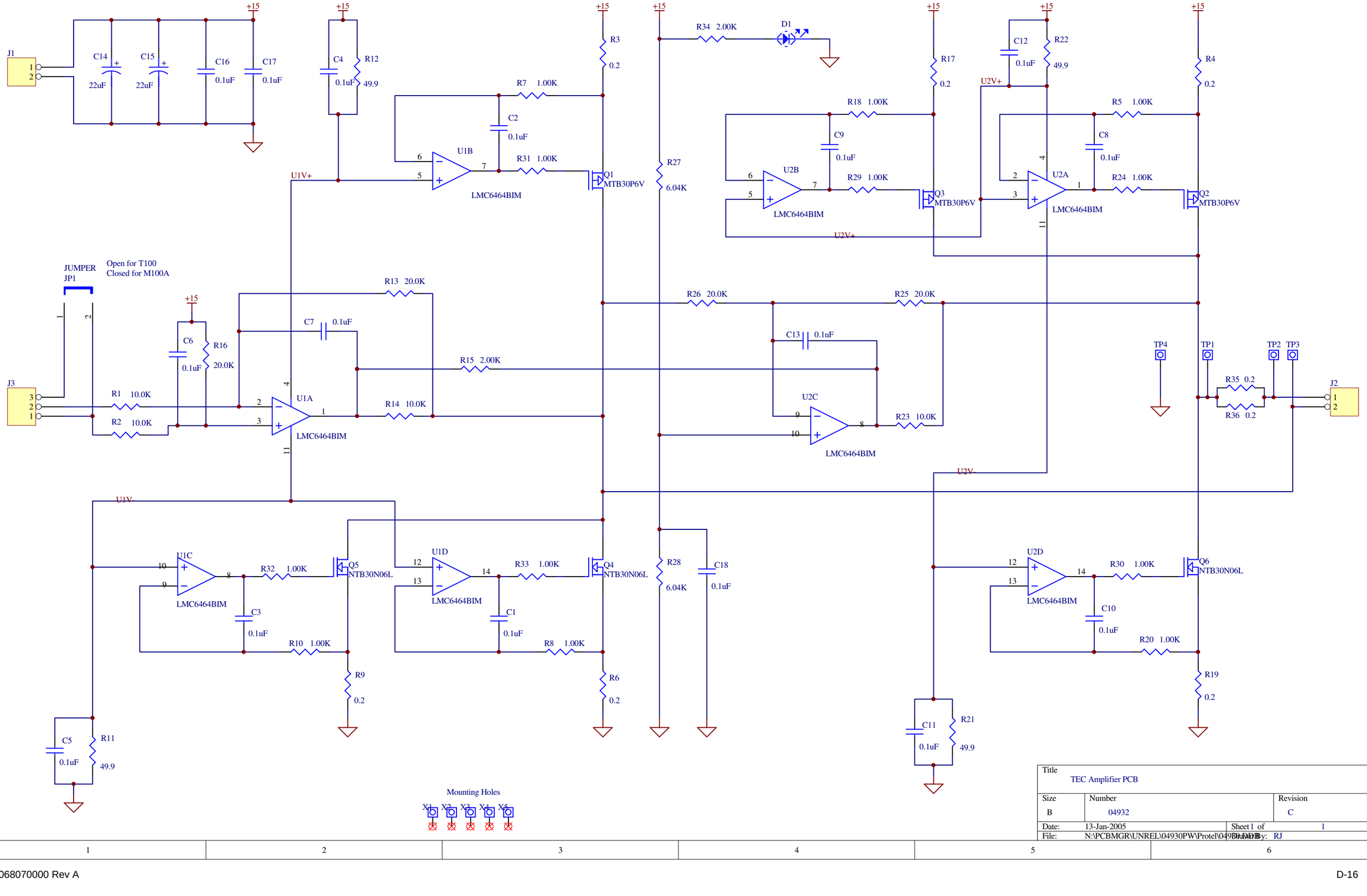


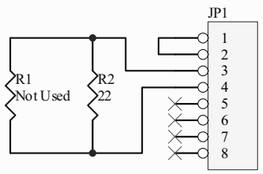




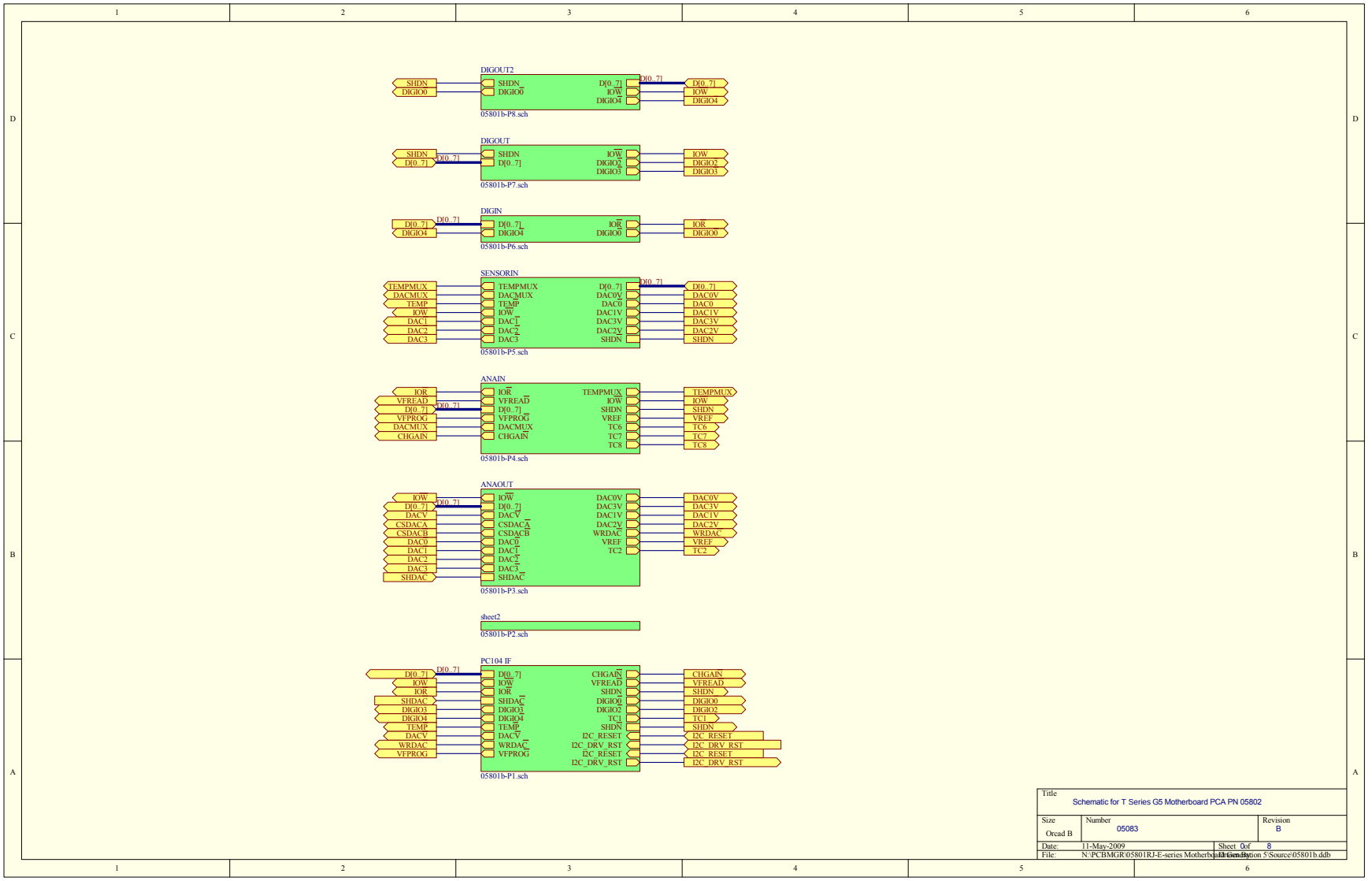


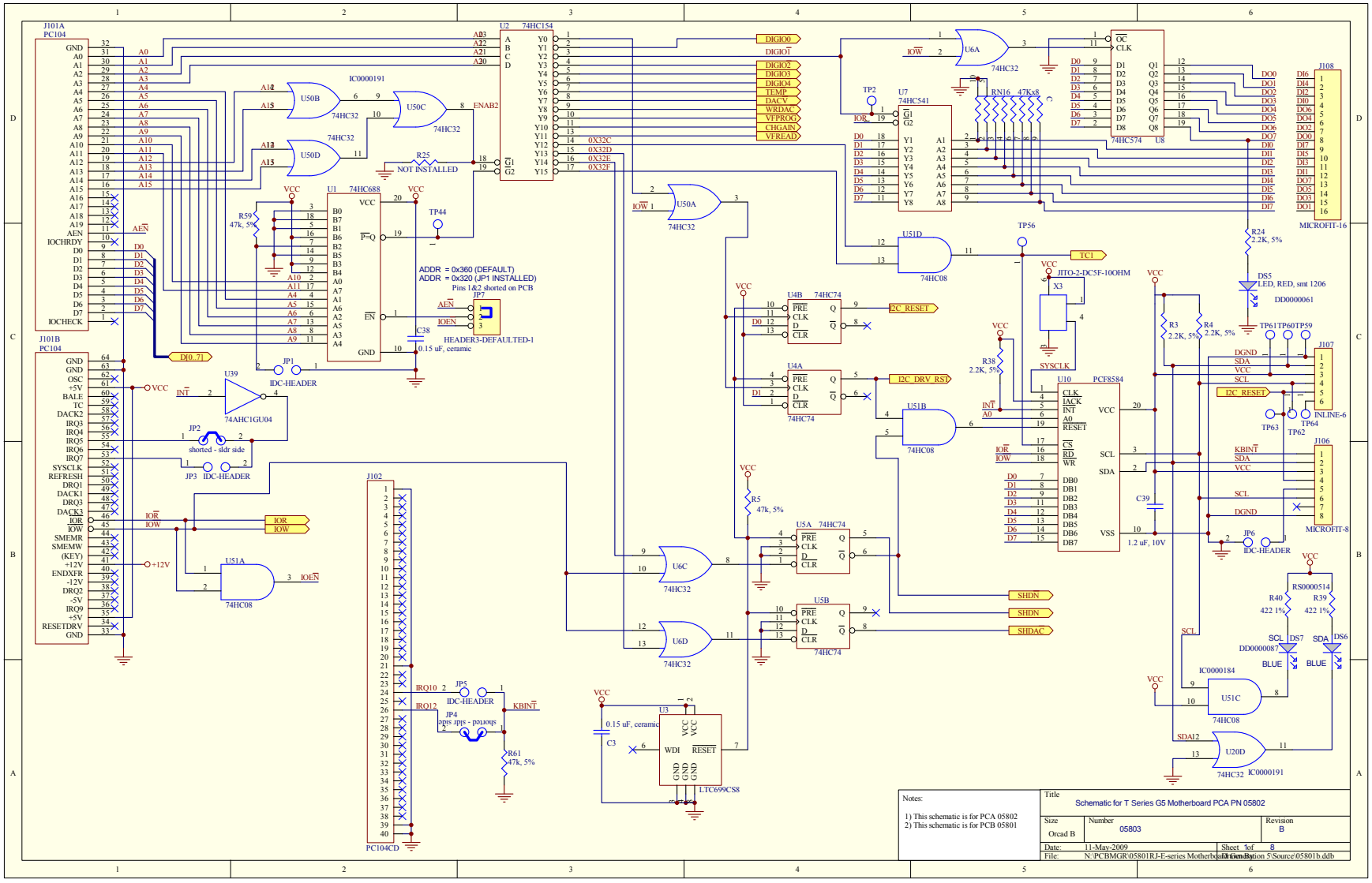
Title: Sch, Bursting UV Lamp Drv, T100		
Size: B	Number: 04693	Revision: E
Date: 2-Jun-2004	Sheet of 2	2
File: N:\PCBMGR\RELEASED\04691CC\source\04693e.ddb	Drawn By:	


J1
C14 22uF
C15 22uF
C16 0.1uF
C17 0.1uF
+15
C4 0.1uF
R12 49.9
U1V+
R3 0.2
R7 1.00K
C2 0.1uF
U1B
R31 1.00K
Q1 MTB30P6V
LMC6464BIM
R27 6.04K
R34 2.00K
D1
R17 0.2
R18 1.00K
C9 0.1uF
U2B
R29 1.00K
Q3 MTB30P6V
U2V+
C12 0.1uF
R22 49.9
R4 0.2
R5 1.00K
C8 0.1uF
U2A
R24 1.00K
Q2 MTB30P6V
JUMPER
JP1
Open for T100
Closed for M100A
J3
R1 10.0K
R2 10.0K
C6 0.1uF
R16 20.0K
R13 20.0K
C7 0.1uF
R15 2.00K
U1A
R14 10.0K
R26 20.0K
R25 20.0K
C13 0.1uF
U2C
R23 10.0K
TP4
TP1
TP2
TP3
R35 0.2
R36 0.2
J2
U1V-
U2V-
U1C
R32 1.00K
Q5 NTB30N06L
C3 0.1uF
R10 1.00K
R9 0.2
U1D
R33 1.00K
Q4 NTB30N06L
C1 0.1uF
R8 1.00K
R6 0.2
R28 6.04K
C18 0.1uF
U2D
R30 1.00K
Q6 NTB30N06L
C10 0.1uF
R20 1.00K
R19 0.2
C5 0.1uF
R11 49.9
C11 0.1uF
R21 49.9
Mounting Holes
X1 X2 X3 X4 X5
Title
TEC Amplifier PCB
Size
B
Number
04932
Revision
C
Date: 13-Jan-2005
Sheet 1 of 1
File: N:\PCBMGR\UNREL\04930PW\Protel\04932.DDB
Drawn By: RJ



Title	SCH, T-Series Analog Output Isolator, PCA 04467	
Size: A	Number: 04468	Revision: B
Date: 6/28/2004		Sheet of
File: N:\PCBMGR\..\04468B.sch		Drawn By:


DIGOUT2
SHDN
DIGIO0
SHDN
DIGIO0
D[0..7]
IOW
DIGIO4
D[0..7]
D[0..7]
IOW
DIGIO4
05801b-P8.sch
DIGOUT
SHDN
D[0..7]
D[0..7]
SHDN
D[0..7]
IOW
DIGIO2
DIGIO3
IOW
DIGIO2
DIGIO3
05801b-P7.sch
DIGIN
D[0..7]
DIGIO4
D[0..7]
D[0..7]
DIGIO4
IOR
DIGIO0
IOR
DIGIO0
05801b-P6.sch
SENSORIN
TEMPMUX
DACMUX
TEMP
IOW
DAC1
DAC2
DAC3
TEMPMUX
DACMUX
TEMP
IOW
DAC1
DAC2
DAC3
SHDN
D[0..7]
DAC0V
DAC0
DAC1V
DAC3V
DAC2V
SHDN
D[0..7]
D[0..7]
DAC0V
DAC0
DAC1V
DAC3V
DAC2V
SHDN
05801b-P5.sch
ANAIN
IOR
VFREAD
D[0..7]
VFPROG
DACMUX
CHGAIN
IOR
VFREAD
D[0..7]
VFPROG
DACMUX
CHGAIN
TEMPMUX
IOW
SHDN
VREF
TC6
TC7
TC8
D[0..7]
TEMPMUX
IOW
SHDN
VREF
TC6
TC7
TC8
05801b-P4.sch
ANAOUT
IOW
D[0..7]
DACV
CSDACA
CSDACB
DAC0
DAC1
DAC2
DAC3
SHDAC
IOW
D[0..7]
DACV
CSDACA
CSDACB
DAC0
DAC1
DAC2
DAC3
SHDAC
DAC0V
DAC3V
DAC1V
DAC2V
WRDAC
VREF
TC2
D[0..7]
DAC0V
DAC3V
DAC1V
DAC2V
WRDAC
VREF
TC2
05801b-P3.sch
sheet2
05801b-P2.sch
PC104 IF
D[0..7]
IOW
IOR
SHDAC
DIGIO3
DIGIO4
TEMP
DACV
WRDAC
VFPROG
D[0..7]
IOW
IOR
SHDAC
DIGIO3
DIGIO4
TEMP
DACV
WRDAC
VFPROG
CHGAIN
VFREAD
SHDN
DIGIO0
DIGIO2
TC1
SHDN
I2C_RESET
I2C_DRV_RST
I2C_RESET
I2C_DRV_RST
D[0..7]
CHGAIN
VFREAD
SHDN
DIGIO0
DIGIO2
TC1
SHDN
I2C_RESET
I2C_DRV_RST
I2C_RESET
I2C_DRV_RST
05801b-P1.sch
Title
Schematic for T Series G5 Motherboard PCA PN 05802
Size
Orcad B
Number
05083
Revision
B
Date:
11-May-2009
Sheet 0of 8
File:
N:\PCBMGR\05801RJ-E-series Motherboard\Revision 5\Source\05801b.ddb


J101A
PC104
J101B
PC104
J102
PC104CD
U2 74HC154
U1 74HC688
ADDR = 0x360 (DEFAULT)
ADDR = 0x320 (JP1 INSTALLED)
Pins 1&2 shorted on PCB
HEADER3-DEFAULTED-1
IDC-HEADER
shorted - sldr side
U39
74AHC1GU04
74HC32
74HC08
74HC574 U8
74HC541
RN16 47Kx8
MICROFIT-16
MICROFIT-8
INLINE-6
JITO-2-DC5F-10OHM
LED, RED, smt 1206
DD0000061
U10 PCF8584
1.2 uF, 10V
RS0000514
422 1%
DD0000087
BLUE
IC0000184
IC0000191
0.15 uF, ceramic
LTC699CS8
74HC74
74HC08
Notes:
1) This schematic is for PCA 05802
2) This schematic is for PCB 05801
Title
Schematic for T Series G5 Motherboard PCA PN 05802
Size
Orcad B
Number
05803
Revision
B
Date:
11-May-2009
Sheet 1of 8
File:
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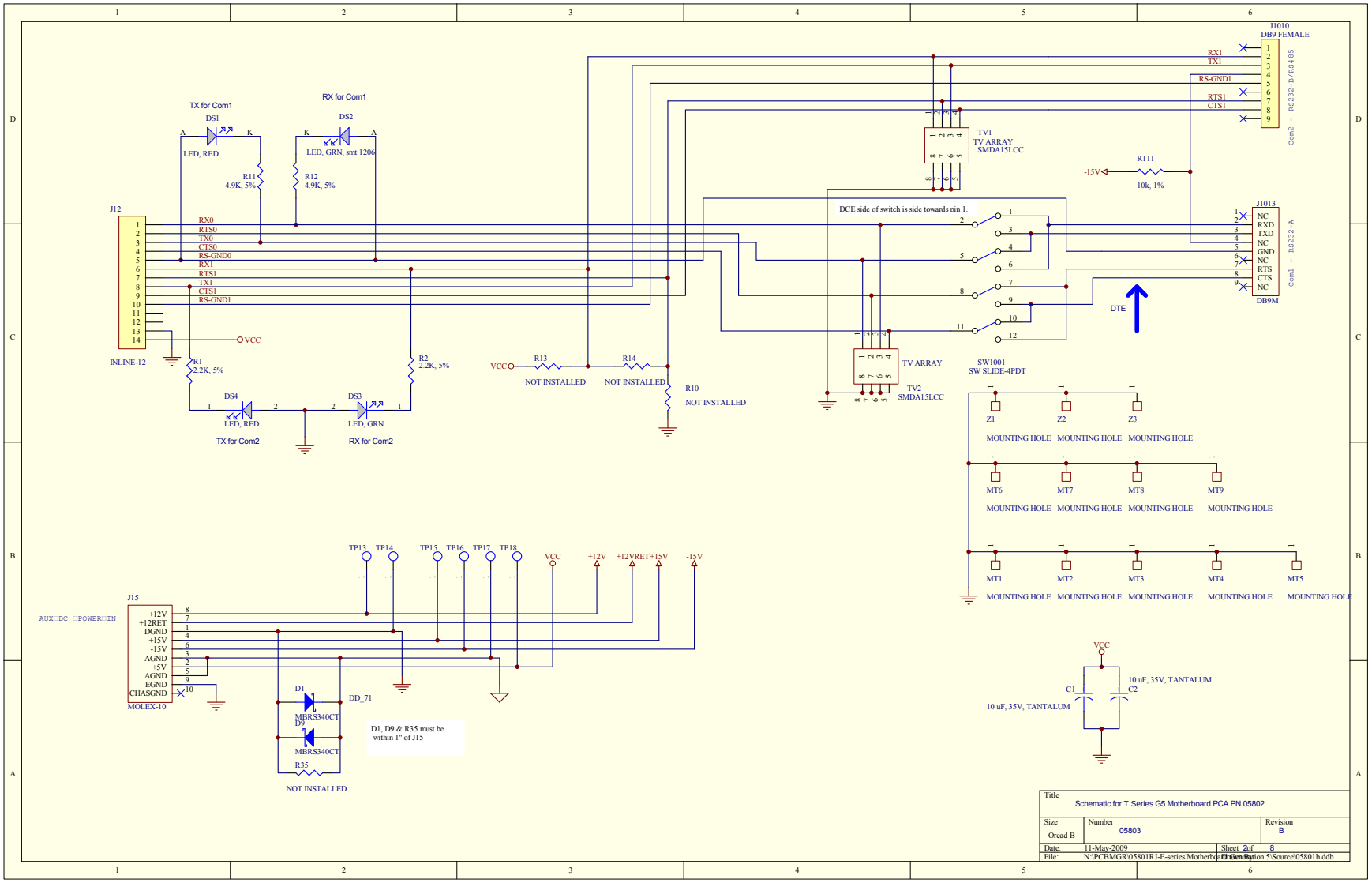
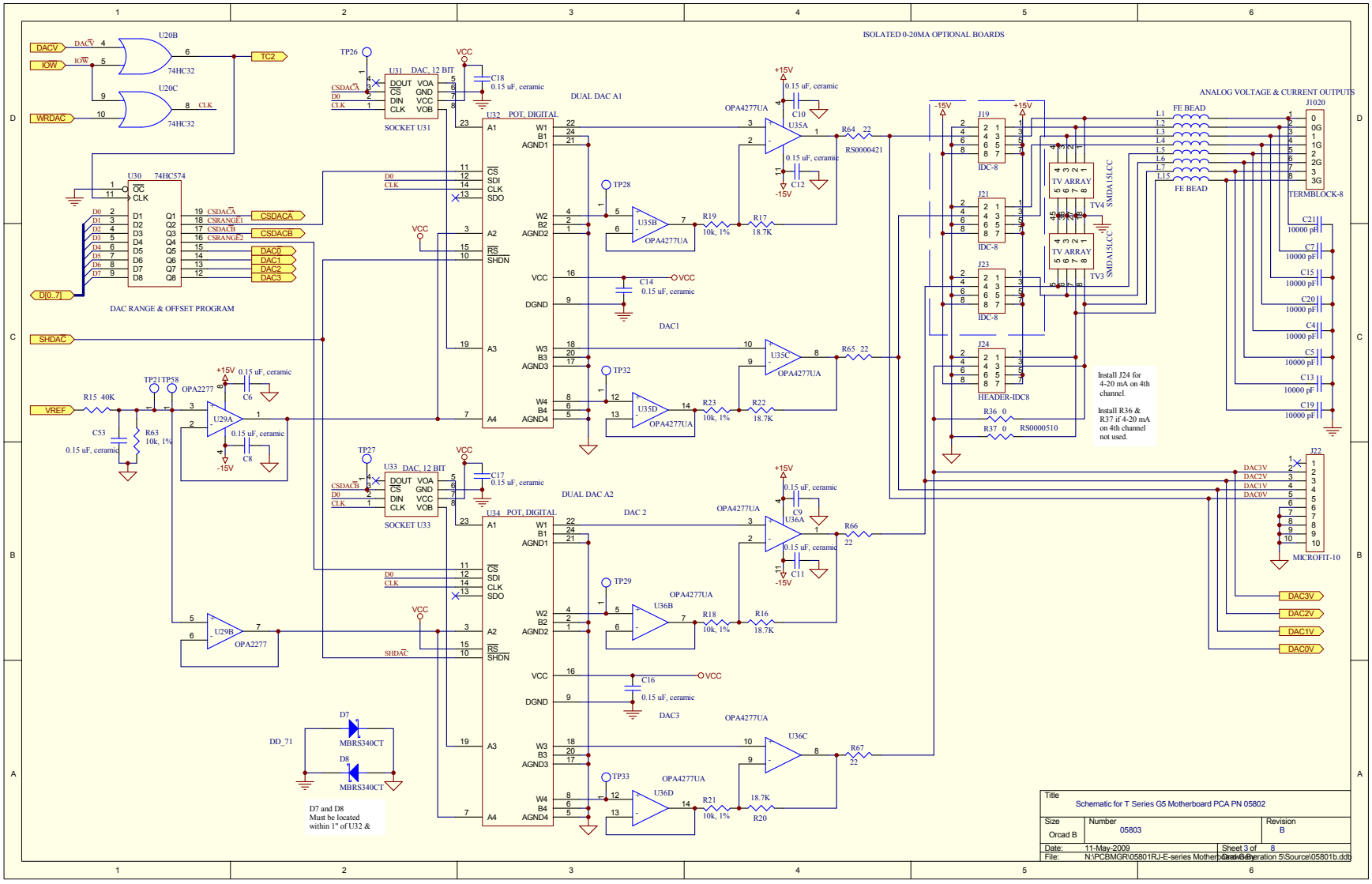
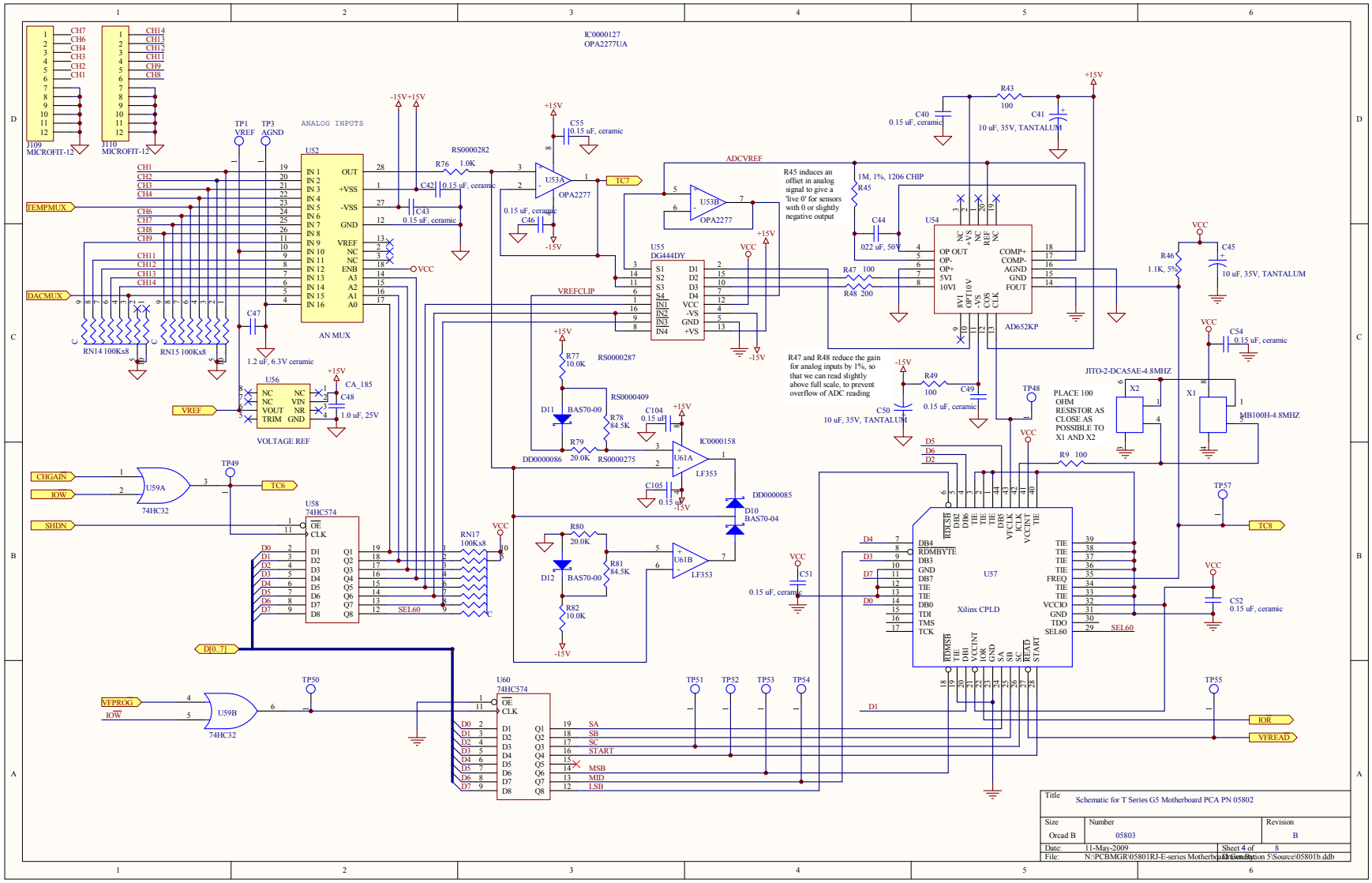
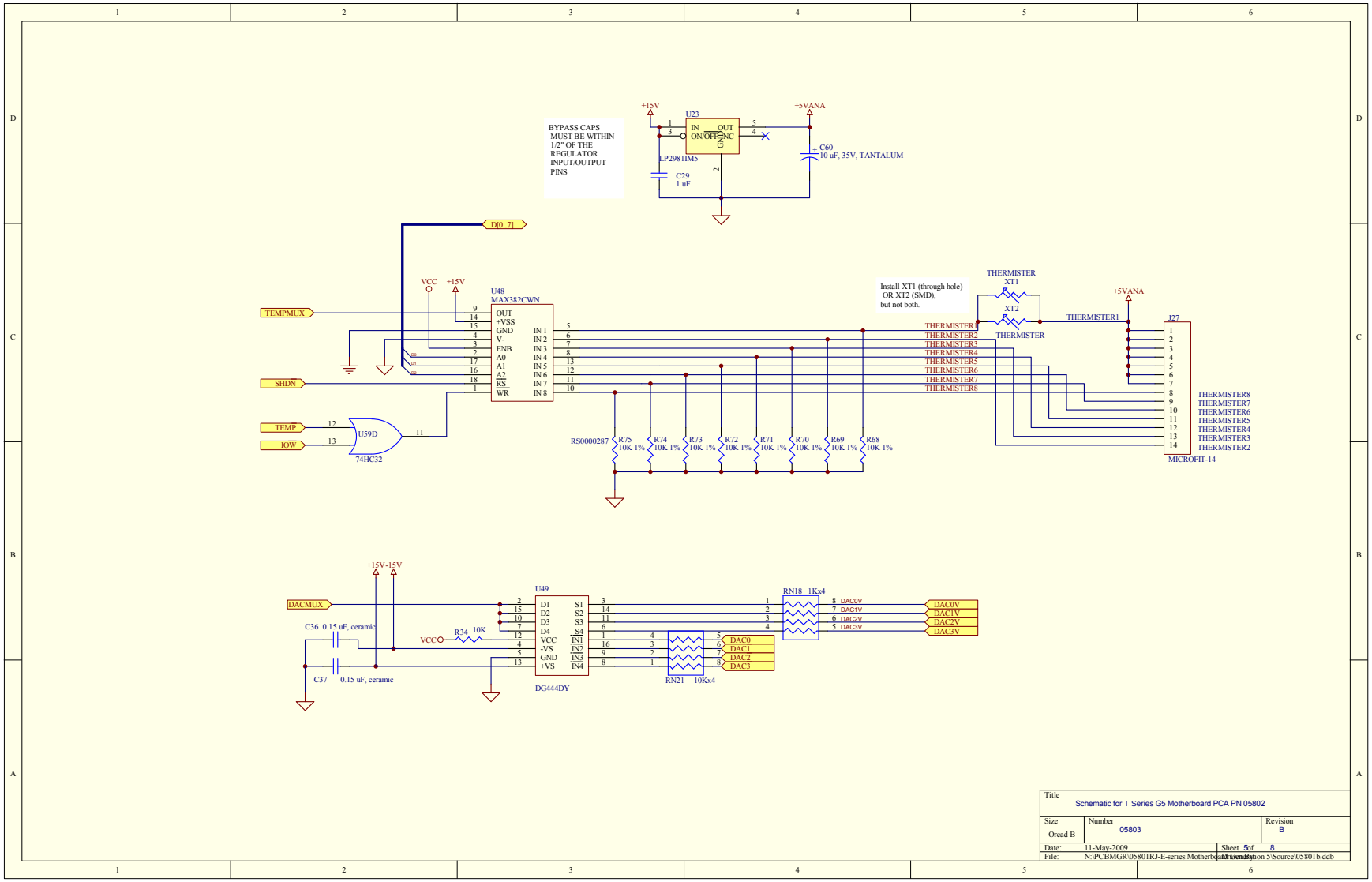
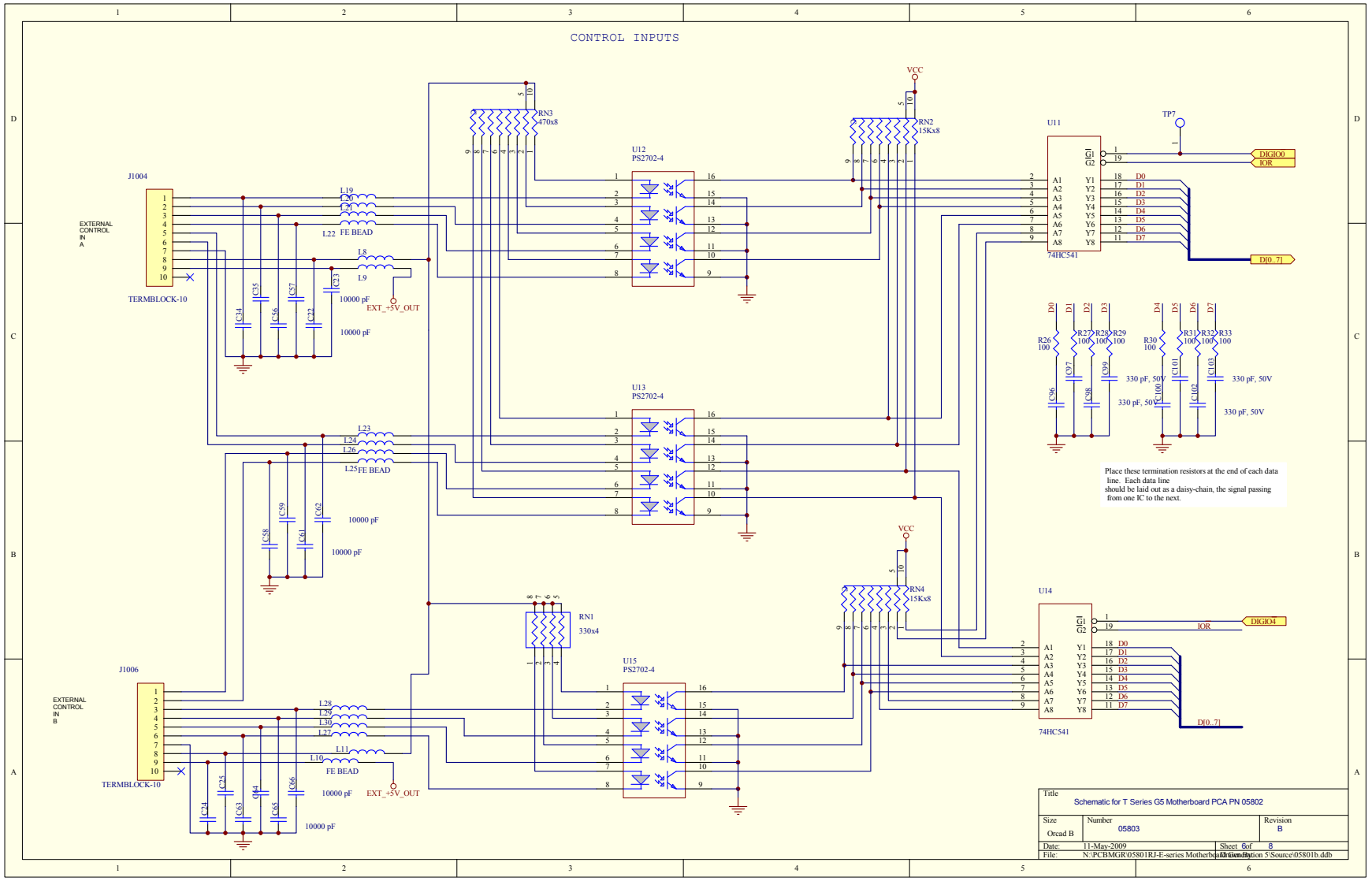
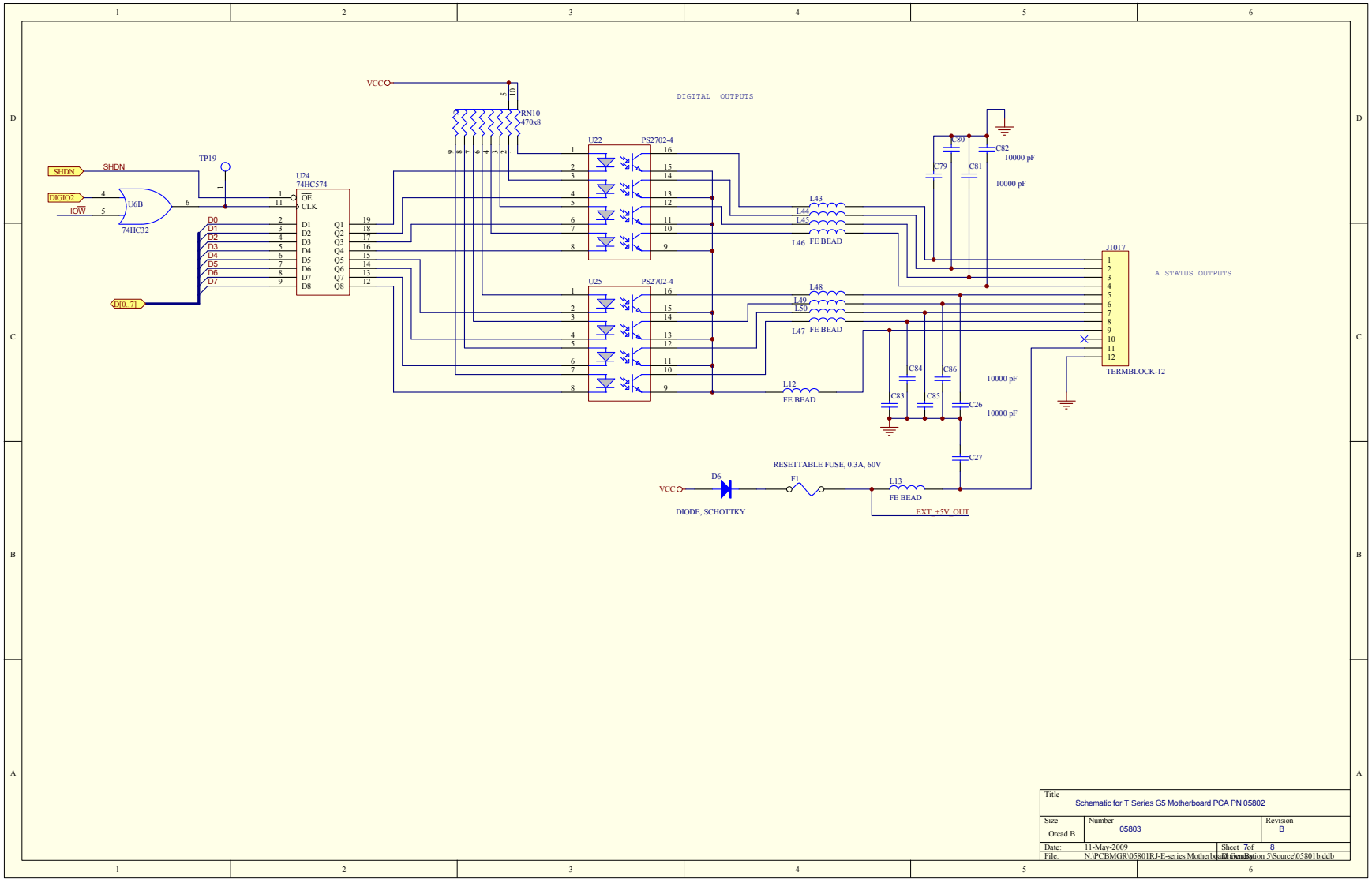

J1010
DB9 FEMALE
RX1
TX1
RS-GND1
RTS1
CTS1
Com2 - RS232-B/RS485
TX for Com1
DS1
LED, RED
RX for Com1
DS2
LED, GRN, smt 1206
R11
4.9K, 5%
R12
4.9K, 5%
TV1
TV ARRAY
SMDA15LCC
R111
-15V
10k, 1%
J1013
NC
RXD
TXD
NC
GND
NC
RTS
CTS
NC
DB9M
Com1 - RS232-A
J12
RX0
RTS0
TX0
CTS0
RS-GND0
RX1
RTS1
TX1
CTS1
RS-GND1
INLINE-12
VCC
DCE side of switch is side towards pin 1.
DTE
R1
2.2K, 5%
R2
2.2K, 5%
DS4
LED, RED
TX for Com2
DS3
LED, GRN
RX for Com2
R13
NOT INSTALLED
R14
NOT INSTALLED
R10
NOT INSTALLED
TV ARRAY
TV2
SMDA15LCC
SW1001
SW SLIDE-4PDT
Z1
Z2
Z3
MOUNTING HOLE
MT6
MT7
MT8
MT9
MT1
MT2
MT3
MT4
MT5
TP13
TP14
TP15
TP16
TP17
TP18
VCC
+12V
+12VRET
+15V
-15V
J15
AUX DC POWER IN
+12V
+12RET
DGND
+15V
-15V
AGND
+5V
AGND
EGND
CHASGND
MOLEX-10
D1
MBRS340CT
DD_71
D9
MBRS340CT
R35
NOT INSTALLED
D1, D9 & R35 must be within 1" of J15
C1
C2
10 uF, 35V, TANTALUM
Title
Schematic for T Series G5 Motherboard PCA PN 05802
Size
Orcad B
Number
05803
Revision
B
Date:
11-May-2009
Sheet 2 of 8
File:
N:\PCBMGR\05801RJ-E-series Motherboard\Revision 5\Source\05801b.ddb

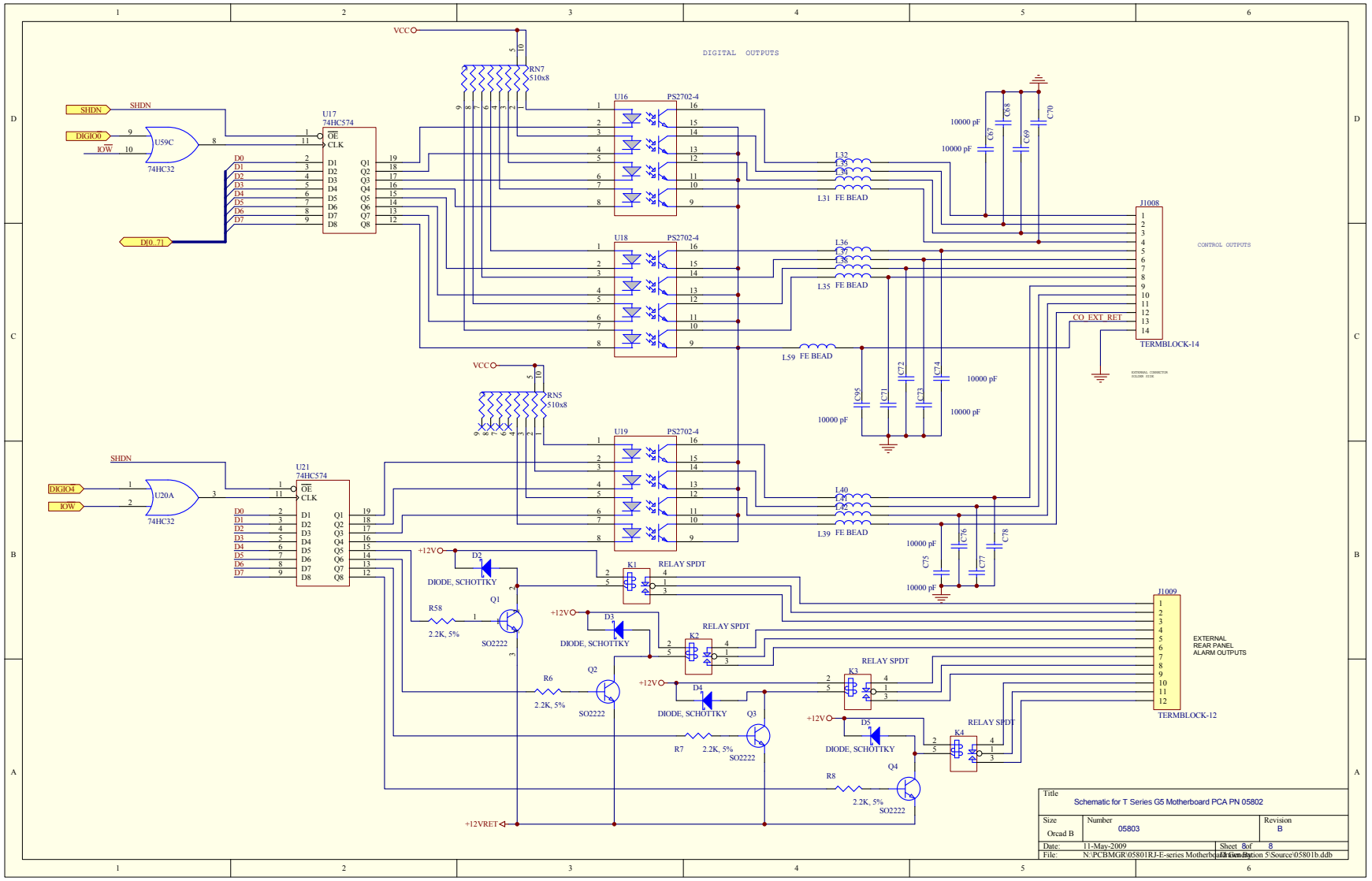

ISOLATED 0-20MA OPTIONAL BOARDS
ANALOG VOLTAGE & CURRENT OUTPUTS
DUAL DAC A1
DUAL DAC A2
DAC 2
DAC1
DAC3
DAC RANGE & OFFSET PROGRAM
SOCKET U31
SOCKET U33
FE BEAD
TERMBLOCK-8
MICROFIT-10
HEADER-IDC8
IDC-8
TV ARRAY
Install J24 for 4-20 mA on 4th channel.
Install R36 & R37 if 4-20 mA on 4th channel not used.
D7 and D8 Must be located within 1" of U32 &
Title
Schematic for T Series G5 Motherboard PCA PN 05802
Size
Orcad B
Number
05803
Revision
B
Date:
11-May-2009
Sheet 3 of 8
File:
N:\PCBMGR\05801RJ-E-series Motherboard\Gen 5 Generation 5\Source\05801b.ddb

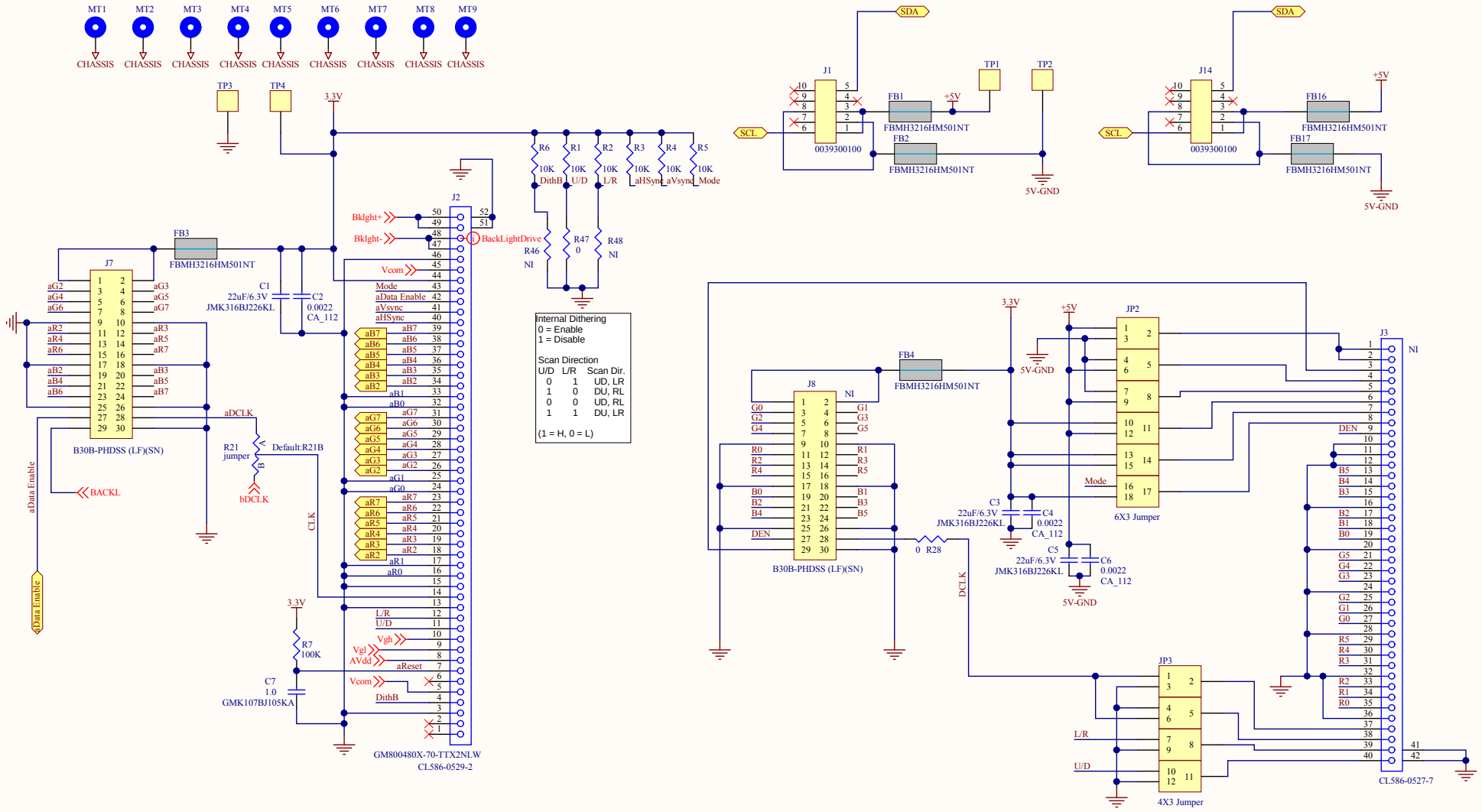

IC0000127
OPA2277UA
ANALOG INPUTS
J109 MICROFIT-12
J110 MICROFIT-12
U52
AN MUX
RN14 100Kx8
RN15 100Kx8
U56
VOLTAGE REF
U53A
U53B
OPA2277
U55
DG444DY
U54
AD652KP
R45 induces an offset in analog signal to give a 'live 0' for sensors with 0 or slightly negative output
R47 and R48 reduce the gain for analog inputs by 1%, so that we can read slightly above full scale, to prevent overflow of ADC reading
PLACE 100 OHM RESISTOR AS CLOSE AS POSSIBLE TO X1 AND X2
JITO-2-DCA5AE-4.8MHZ
MB100H-4.8MHZ
U59A
U59B
74HC32
U58
74HC574
U60
74HC574
RN17 100Kx8
U57
Xilinx CPLD
U61A
U61B
LF353
BAS70-00
BAS70-04
TEMPMUX
DACMUX
CHGAIN
IOW
SHDN
VFPROG
VREF
VCC
D[0..7]
SEL60
SA
SB
SC
START
MSB
MID
LSB
IOR
VFREAD
Title
Schematic for T Series G5 Motherboard PCA PN 05802
Size
Orcad B
Number
05803
Revision
B
Date:
11-May-2009
Sheet 4 of 8
File:
N:\PCBMGR\05801RJ-E-series Motherboard\Revision 5\Source\05801b.ddb


BYPASS CAPS MUST BE WITHIN 1/2" OF THE REGULATOR INPUT/OUTPUT PINS
+15V
U23
IN
ON/OFF
GND
OUT
NC
+5VANA
LP2981IM5
C29
1 uF
C60
10 uF, 35V, TANTALUM
D[0..7]
VCC
+15V
U48
MAX382CWN
TEMPMUX
SHDN
TEMP
IOW
U59D
74HC32
OUT
+VSS
GND
V-
ENB
A0
A1
A2
RS
WR
IN 1
IN 2
IN 3
IN 4
IN 5
IN 6
IN 7
IN 8
Install XT1 (through hole) OR XT2 (SMD), but not both.
THERMISTER XT1
XT2
THERMISTER
THERMISTER1
THERMISTER2
THERMISTER3
THERMISTER4
THERMISTER5
THERMISTER6
THERMISTER7
THERMISTER8
+5VANA
J27
MICROFIT-14
RS0000287
R75 10K 1%
R74 10K 1%
R73 10K 1%
R72 10K 1%
R71 10K 1%
R70 10K 1%
R69 10K 1%
R68 10K 1%
+15V-15V
U49
DACMUX
C36 0.15 uF, ceramic
C37 0.15 uF, ceramic
R34 10K
VCC
D1
D2
D3
D4
VCC
-VS
GND
+VS
S1
S2
S3
S4
IN1
IN2
IN3
IN4
DG444DY
RN18 1Kx4
RN21 10Kx4
DAC0V
DAC1V
DAC2V
DAC3V
DAC0
DAC1
DAC2
DAC3
Title
Schematic for T Series G5 Motherboard PCA PN 05802
Size
Orcad B
Number
05803
Revision
B
Date:
11-May-2009
Sheet 5 of 8
File:
N:\PCBMGR\05801RJ-E-series Motherboard\Design Station 5\Source\05801b.ddb


CONTROL INPUTS
J1004
EXTERNAL CONTROL IN A
TERMBLOCK-10
J1006
EXTERNAL CONTROL IN B
TERMBLOCK-10
RN3 470x8
RN2 15Kx8
RN1 330x4
RN4 15Kx8
U12 PS2702-4
U13 PS2702-4
U15 PS2702-4
U11
U14
74HC541
74HC541
VCC
VCC
TP7
DIGIO0
IOR
DIGIO4
IOR
D[0..7]
D[0..7]
L19
L20
L21
L22 FE BEAD
L8
L9
L23
L24
L26
L25 FE BEAD
L28
L29
L30
L27
L11
L10 FE BEAD
10000 pF
EXT_+5V_OUT
330 pF, 50V
Place these termination resistors at the end of each data line. Each data line should be laid out as a daisy-chain, the signal passing from one IC to the next.
Title
Schematic for T Series G5 Motherboard PCA PN 05802
Size
Orcad B
Number
05803
Revision
B
Date:
11-May-2009
Sheet 6 of 8
File:
N:\PCBMGR\05801RJ-E-series Motherboard\Revision 5\Source\05801b.ddb

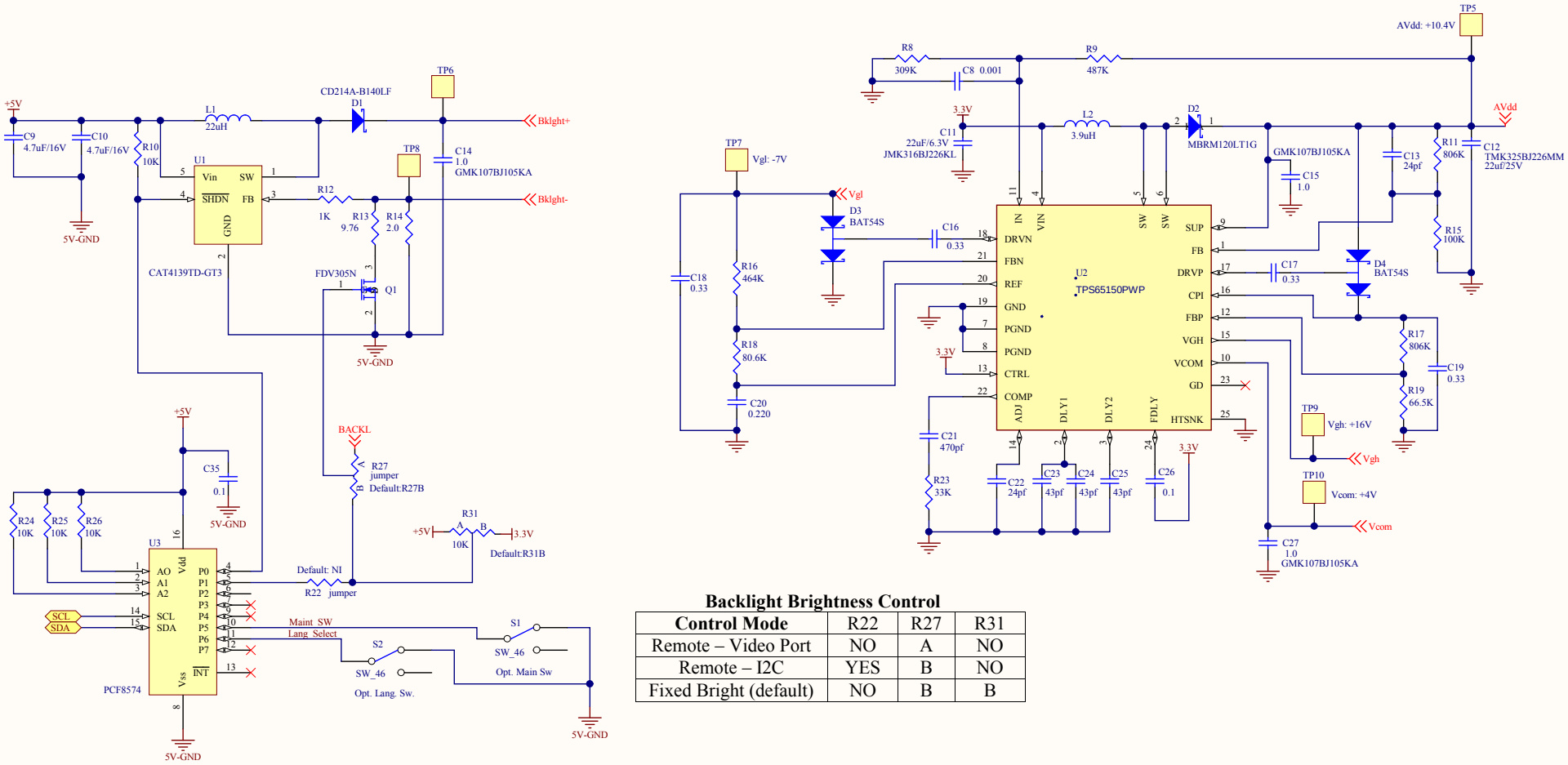

DIGITAL OUTPUTS
A STATUS OUTPUTS
VCC
RN10
470x8
SHDN
TP19
U6B
74HC32
U24
74HC574
D[0..7]
U22
PS2702-4
U25
PS2702-4
L43
L44
L45
L46 FE BEAD
L48
L49
L50
L47 FE BEAD
L12
FE BEAD
C79
C80
C81
C82
10000 pF
C83
C84
C85
C86
C26
C27
RESETTABLE FUSE, 0.3A, 60V
D6
F1
L13
FE BEAD
DIODE, SCHOTTKY
EXT +5V OUT
J1017
TERMBLOCK-12
Title
Schematic for T Series G5 Motherboard PCA PN 05802
Size
Orcad B
Number
05803
Revision
B
Date:
11-May-2009
Sheet 7of 8
File:
N:\PCBMGR\05801RJ-E-series Motherboard\Design Station 5\Source\05801b.ddb


DIGITAL OUTPUTS
VCC
RN7
510x8
SHDN
DIGIO0
IOW
U59C
74HC32
U17
74HC574
OE
CLK
D0
D1
D2
D3
D4
D5
D6
D7
D[0..7]
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
U16
PS2702-4
U18
PS2702-4
L32
L34
L31 FE BEAD
L36
L35 FE BEAD
L59 FE BEAD
10000 pF
C67
C68
C69
C70
C72
C74
C95
C71
C73
J1008
CONTROL OUTPUTS
CO_EXT_RET
TERMBLOCK-14
RN5
510x8
U21
74HC574
U20A
DIGIO4
U19
PS2702-4
L40
L39 FE BEAD
C75
C76
C77
C78
+12V
D2
DIODE, SCHOTTKY
K1
RELAY SPDT
Q1
R58
2.2K, 5%
SO2222
D3
K2
R6
Q2
D4
K3
Q3
R7
D5
K4
Q4
R8
+12VRET
J1009
EXTERNAL
REAR PANEL
ALARM OUTPUTS
TERMBLOCK-12
Title
Schematic for T Series G5 Motherboard PCA PN 05802
Size
Orcad B
Number
05803
Revision
B
Date:
11-May-2009
Sheet 8of 8
File:
N:\PCBMGR\05801RJ-E-series Motherboard\Revision 5\Source\05801b.ddb



Make	Model	JP2	JP3
FEMA	GM800480W	1-2, 4-5, 7-8, 10-11, 13-14, 16-17	1-2, 4-5, 7-8, 10-11
Data Image	FG0700A0DSWBG01	3-2, 6-5, 9-8, 12-11, 15-14, 18-17	2-3, 5-6, 8-9, 11-12
United Radiant Tech.	UMSH-8173MD-1T	2-3, 4/5/6 NC, 7/8/9 NC, 10-11, 13-14, 16/17/18 NC	2-3, 5-6, 8-9, 11-12

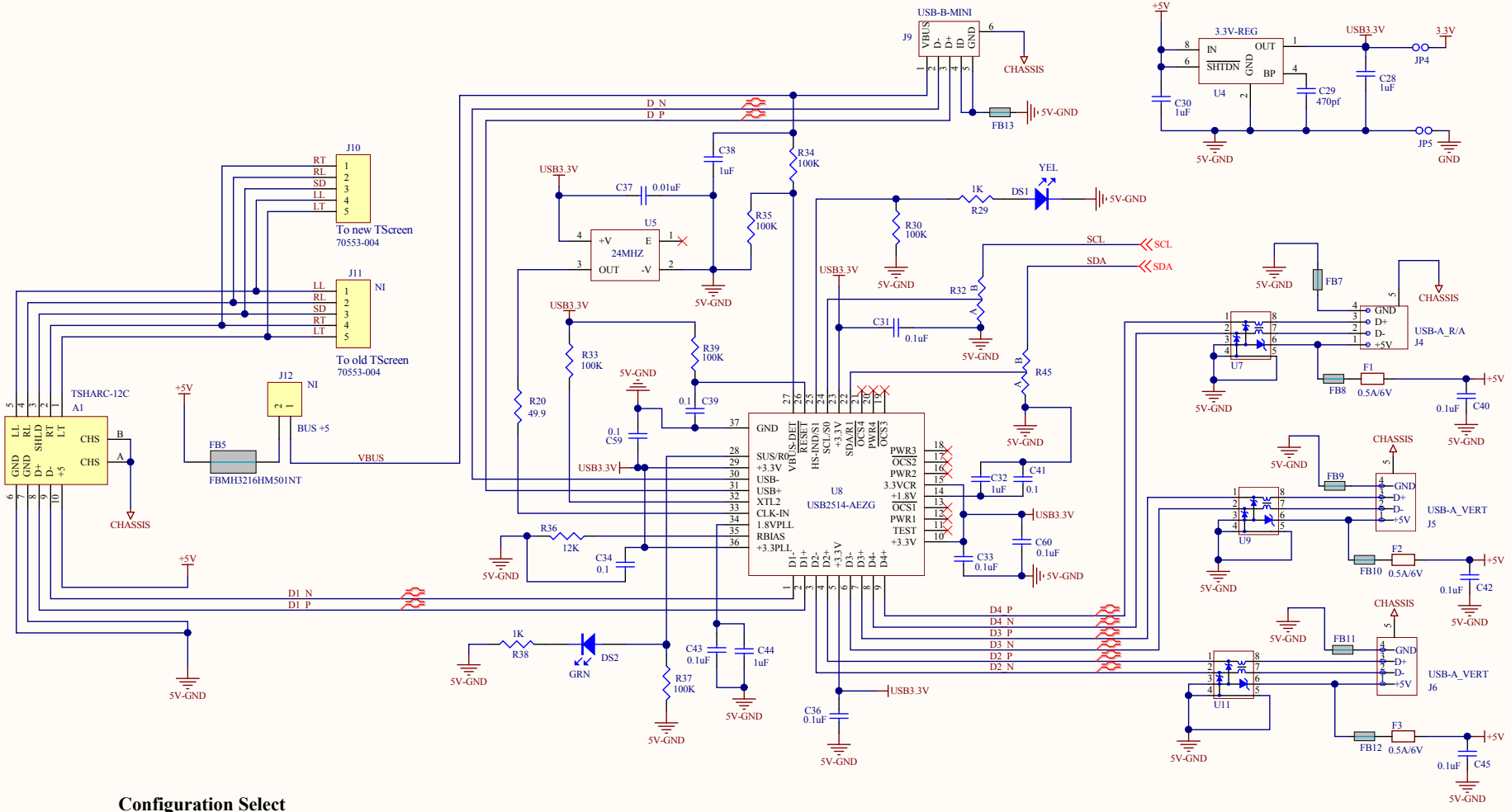
Title	GUI Interface	
Size: B	Number: 06698	Revision: D
Date: 6/24/2010	Sheet 1 of 4	
File: N:\PCBMGR\..\06696.P1_R3.schdoc	Drawn By: RT	



Backlight Brightness Control

Control Mode	R22	R27	R31
Remote – Video Port	NO	A	NO
Remote – I2C	YES	B	NO
Fixed Bright (default)	NO	B	B

Title: GUI Interface		
Size: B	Number: 06698	Revision: D
Date: 6/24/2010		Sheet 2 of 4
File: N:\PCBMGR\..\06696.P2.R3.schdoc		Drawn By: RT

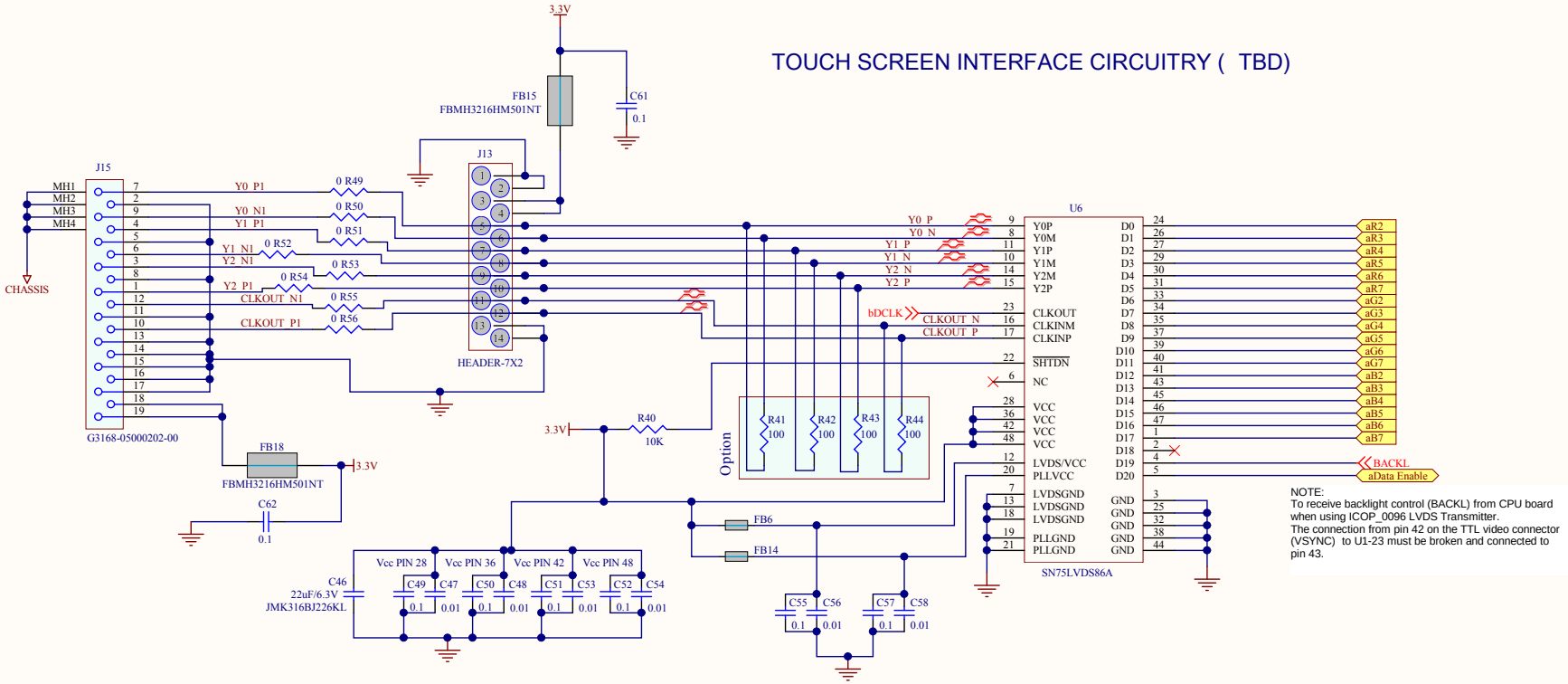


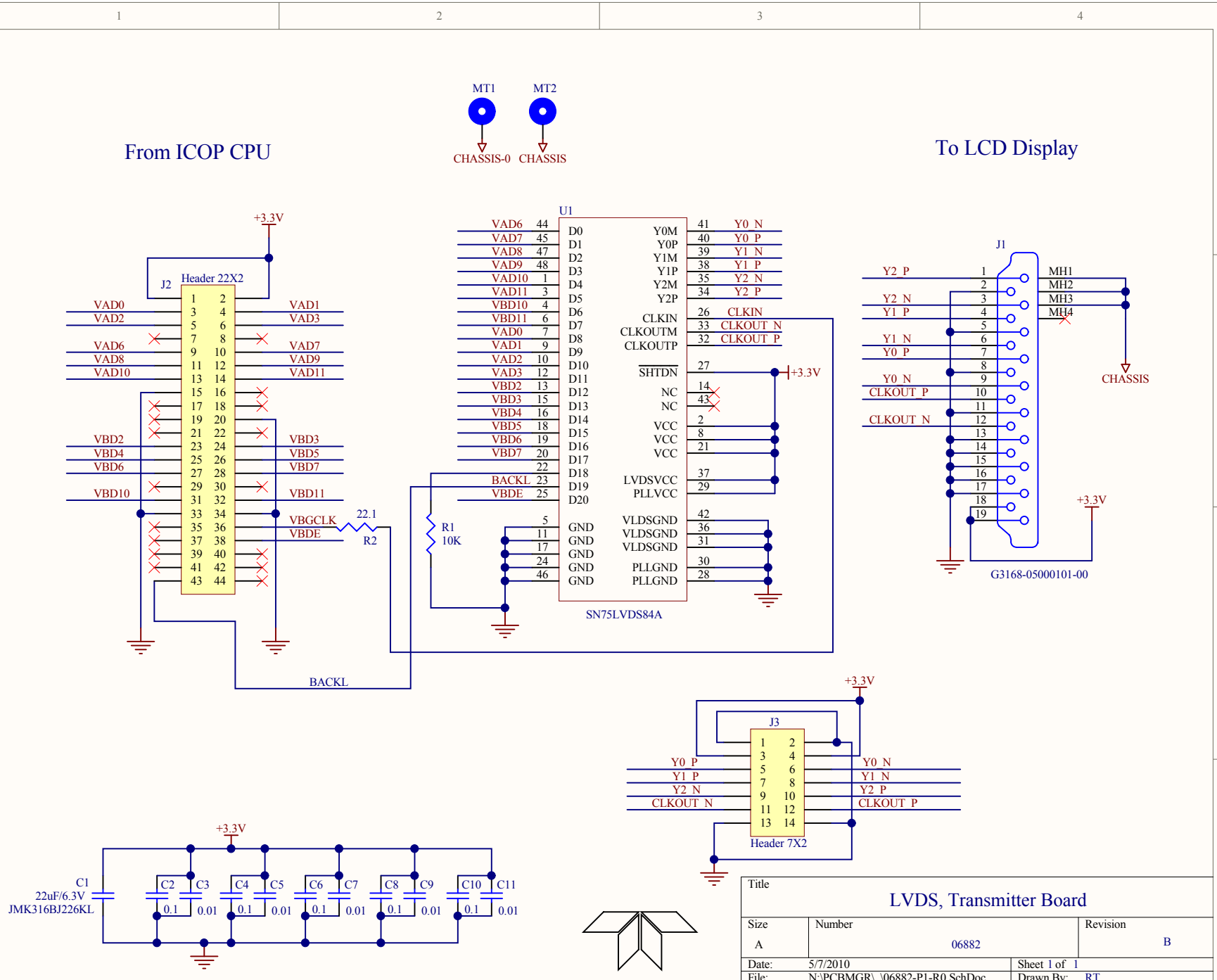
Configuration Select

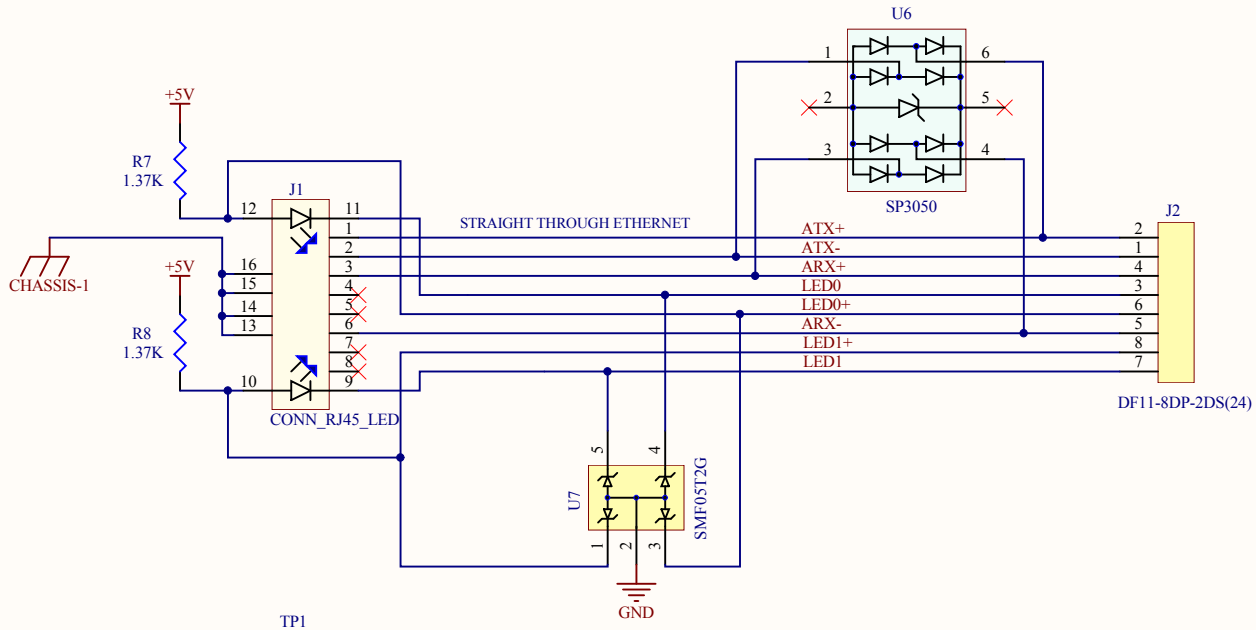
Mode	R32	R45
Default	A	A
MBUS	B	B

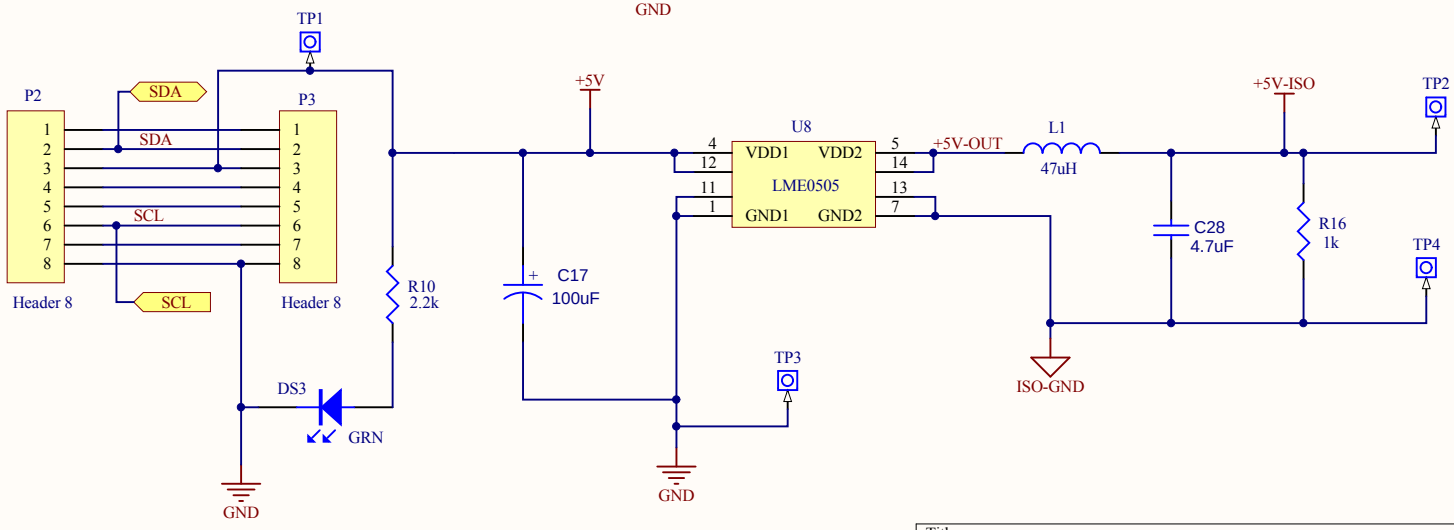
Install 100K for A, 0 Ohm for B

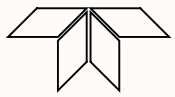
Title	GUI Interface	
Size: B	Number: 06698	Revision: D
Date: 6/24/2010		Sheet 3 of 4
File: N:\PCBMGR\..\06696.P3_R3.schdoc		Drawn By: RT


TOUCH SCREEN INTERFACE CIRCUITRY (TBD)
3.3V
FB15
FBMH3216HM501NT
C61
0.1
J13
J15
MH1
MH2
MH3
MH4
CHASSIS
G3168-05000202-00
HEADER-7X2
Y0_P1
Y0_N1
Y1_P1
Y1_N1
Y2_N1
Y2_P1
CLKOUT_N1
CLKOUT_P1
0 R49
0 R50
0 R51
0 R52
0 R53
0 R54
0 R55
0 R56
FB18
FBMH3216HM501NT
C62
0.1
3.3V
R40
10K
Option
R41
R42
R43
R44
100
U6
Y0P
Y0M
Y1P
Y1M
Y2M
Y2P
CLKOUT
CLKINM
CLKINP
SHTDN
NC
VCC
LVDS/VCC
PLLVCC
LVDSGND
PLLGND
D0
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
D15
D16
D17
D18
D19
D20
GND
SN75LVDS86A
bDCLK
CLKOUT_N
CLKOUT_P
Y0_P
Y0_N
Y1_P
Y1_N
Y2_N
Y2_P
aR2
aR3
aR4
aR5
aR6
aR7
aG2
aG3
aG4
aG5
aG6
aG7
aB2
aB3
aB4
aB5
aB6
aB7
BACKL
aData Enable
FB6
FB14
C46
22uF/6.3V
JMK316BJ226KL
Vcc PIN 28
Vcc PIN 36
Vcc PIN 42
Vcc PIN 48
C49
C47
C50
C48
C51
C53
C52
C54
0.01
C55
C56
C57
C58
NOTE:
To receive backlight control (BACKL) from CPU board when using ICOP_0096 LVDS Transmitter.
The connection from pin 42 on the TTL video connector (VSYNC) to U1-23 must be broken and connected to pin 43.
Title
GUI Interface
Size
B
Number
06698
Revision
D
Date:
6/24/2010
Sheet 4 of 4
File:
N:\PCBMGR\..\06696.P4.R3.schdoc
Drawn By:
RT

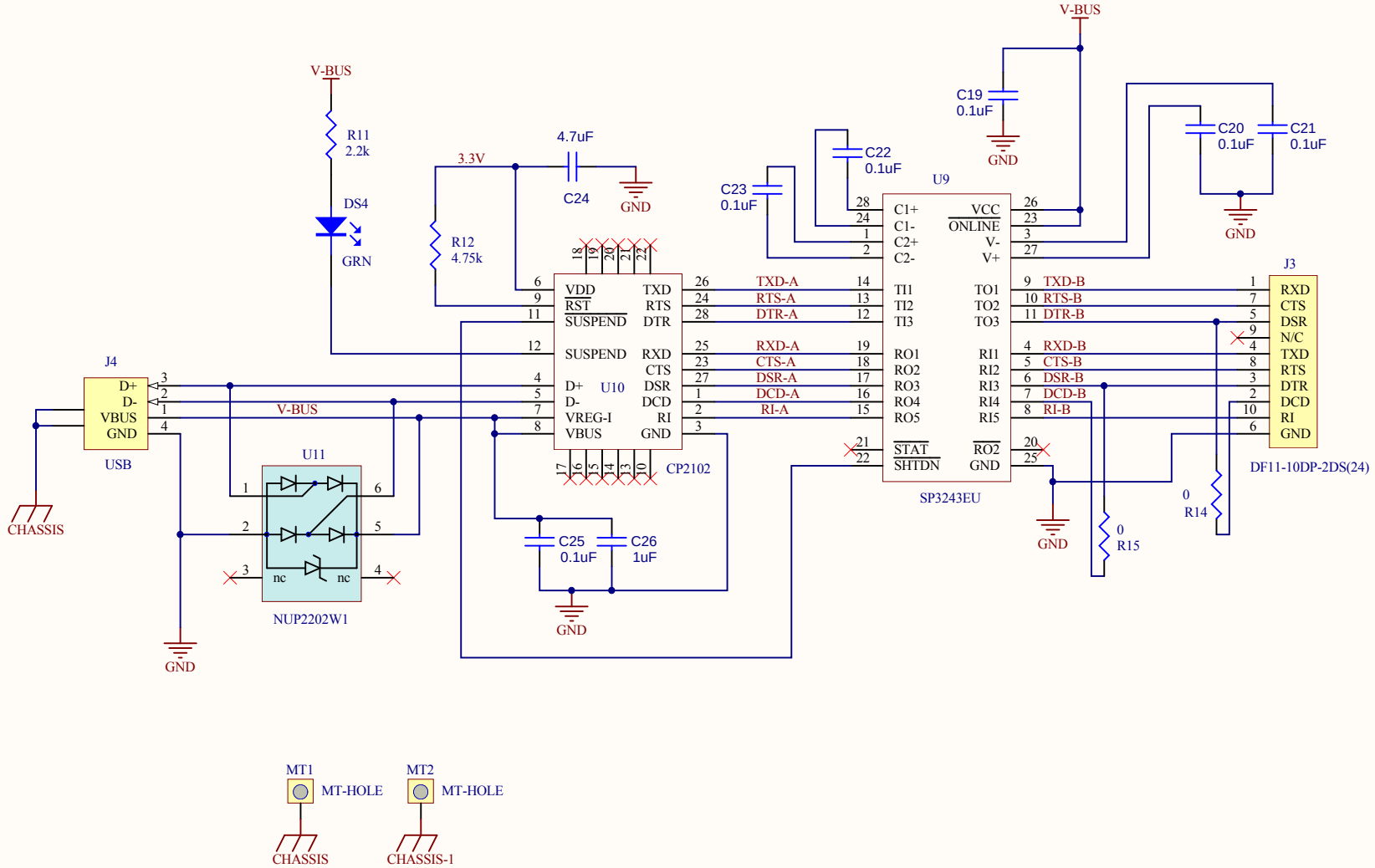

From ICOP CPU
To LCD Display
MT1
MT2
CHASSIS-0
CHASSIS
J2
Header 22X2
+3.3V
VAD0
VAD1
VAD2
VAD3
VAD6
VAD7
VAD8
VAD9
VAD10
VAD11
VBD2
VBD3
VBD4
VBD5
VBD6
VBD7
VBD10
VBD11
VBGCLK
VBDE
22.1
R2
R1
10K
BACKL
U1
SN75LVDS84A
J1
G3168-05000101-00
J3
Header 7X2
C1
22uF/6.3V
JMK316BJ226KL
Title
LVDS, Transmitter Board
Size
A
Number
06882
Revision
B
Date:
5/7/2010
Sheet 1 of 1
File:
N:\PCBMGR\..\06882-P1-R0.SchDoc
Drawn By:
RT



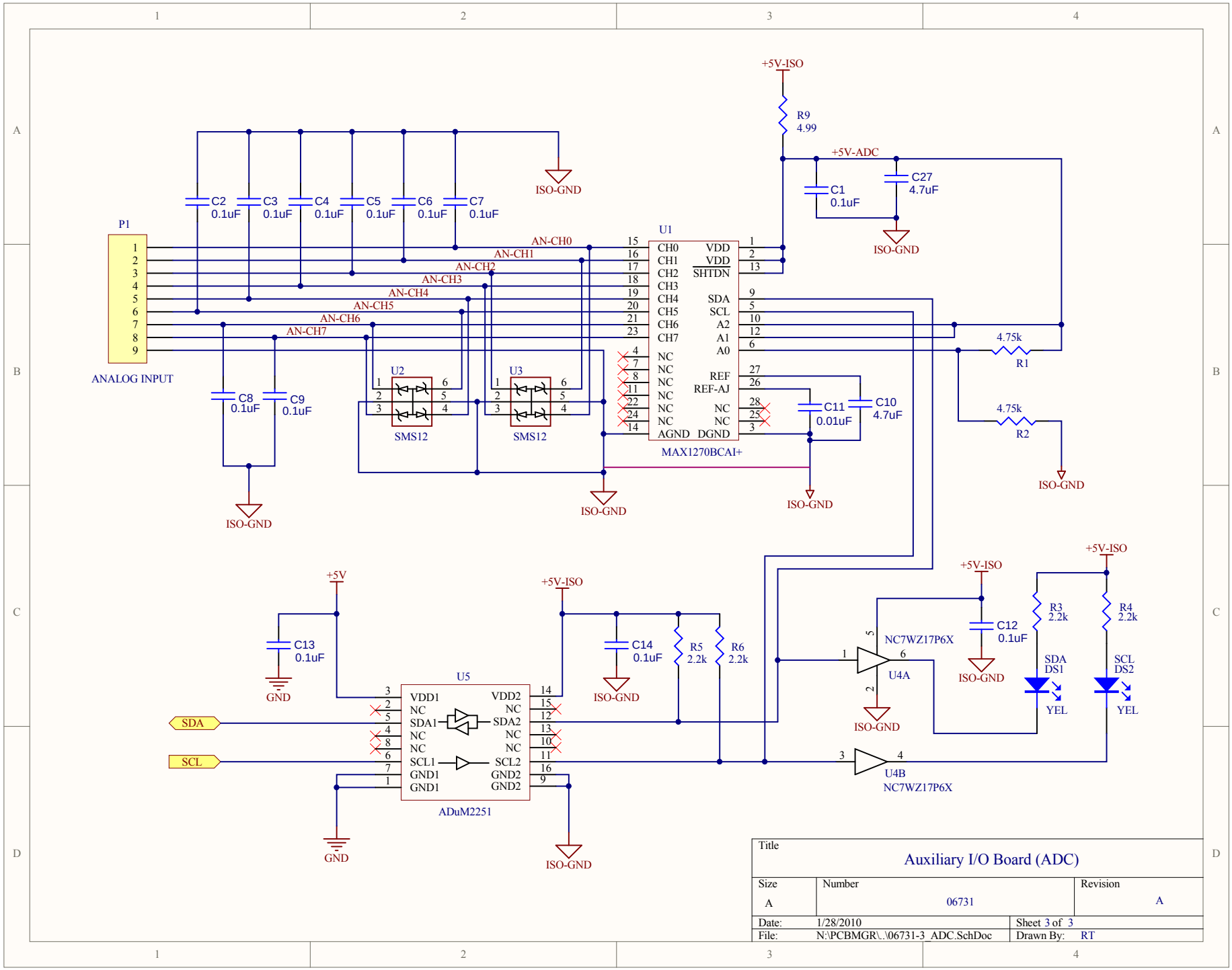




Title: Auxiliary I/O Board (PWR-ETHERNET)		
Size: A	Number: 06731	Revision: A
Date: 1/28/2010	Sheet 1 of 3	
File: N:\PCBMGR\..\06731-1_ETHERNET.SchDoc	Drawn By: RT	



Title	Auxiliary I/O Board (USB)	
Size: A	Number: 06731	Revision: A
Date: 1/28/2010		Sheet 2 of 3
File: N:\PCBMGR\..\06731-2_USB.SchDoc		Drawn By: RT


+5V-ISO
R9
4.99
+5V-ADC
C1
0.1uF
C27
4.7uF
ISO-GND
C2
0.1uF
C3
0.1uF
C4
0.1uF
C5
0.1uF
C6
0.1uF
C7
0.1uF
P1
ANALOG INPUT
AN-CH0
AN-CH1
AN-CH2
AN-CH3
AN-CH4
AN-CH5
AN-CH6
AN-CH7
U1
CH0
CH1
CH2
CH3
CH4
CH5
CH6
CH7
NC
NC
NC
NC
NC
NC
NC
AGND
VDD
VDD
SHTDN
SDA
SCL
A2
A1
A0
REF
REF-AJ
DGND
MAX1270BCAI+
4.75k
R1
4.75k
R2
C8
0.1uF
C9
0.1uF
U2
SMS12
U3
SMS12
C11
0.01uF
C10
4.7uF
+5V
C13
0.1uF
GND
+5V-ISO
C14
0.1uF
R5
2.2k
R6
2.2k
U5
VDD1
NC
SDA1
NC
NC
SCL1
GND1
GND1
VDD2
NC
SDA2
NC
NC
SCL2
GND2
GND2
ADuM2251
SDA
SCL
NC7WZ17P6X
U4A
U4B
NC7WZ17P6X
C12
0.1uF
R3
2.2k
R4
2.2k
SDA
DS1
SCL
DS2
YEL
YEL
Title
Auxiliary I/O Board (ADC)
Size
A
Number
06731
Revision
A
Date:
1/28/2010
Sheet 3 of 3
File:
N:\PCBMGR\..\06731-3_ADC.SchDoc
Drawn By:
RT