MODEL 400 HCLD

INSTRUCTION MANUAL

This manual describes installation, calibration and operation of California Analytical Model 400 HCLD heated oxides of nitrogen gas analyzer. To assure correct operation and accurate results, it is recommended that the user carefully read this document.

November 2003

Version 1.05

P/N 970027 0009

FACTORY PRESSURE SETTINGS SHEET

SERIAL NUMBER ______________________

SAMPLE PRESSURE ______________________

AIR PRESSURE ______________________

FACTORY SET OUTPUT _____________

DATE ______________________

DANGER

POSSIBLE EXPLOSION HAZARD

Do not apply power to the analyzer or attempt to energize the ozone supply or converter until **ALL** leak checks have been performed and until the analyzer environment has been determined to be non-hazardous.

This analyzer is designed for use in a **NON-HAZARDOUS** environment.

This analyzer is designed for use with a hazardous sample.

DANGER

Tampering or use of substitute components may cause a safety hazard. Use only factory authorized replacement parts.

ELECTRICAL SHOCK HAZARD

Do not operate without the cover secured. Servicing requires access to live electrical components which can cause death or serious injury. Refer servicing to qualified service personnel. For safety and proper performance, this instrument must be connected to a properly grounded three wire receptacle.

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SECTION I

UNPACKING INSTRUCTIONS

Open the shipping container and carefully remove the analyzer from the packing materials. Inspect the instrument for any sign of damage. Remove the Top Cover retaining screws. Visually check for loose parts or connectors that are not properly seated. Verify all circuit boards and circuit board connections are secure. If all internal components look normal, re-install the cover.

REPORTING DAMAGE

Should there be any apparent damage to either the inside or outside of the instrument, due to shipping or handling, immediately notify the shipper. Shipping container or packing materials should be saved for inspection by the shipper.

SECTION II

INTRODUCTION

The CAI Model 400 HCLD Analyzer is a highly sensitive heated chemiluminescent (CLD) gas analyzers for measuring gas concentrations in industrial and vehicle emission applications. The analyzer includes a unique internal oven which maintains ALL plumbing components in contact with the sample gas, before the detector, at an elevated temperature of approximately 60 degrees Centigrade.

The Model 400 HCLD contains a front panel, six position, range switch which allows the selection of either five full scale factory set ranges or remote from 10 to 1,000 or 30 to 3,000 ppm NO/NOx. The instrument has a 0 to 10 VDC and 4-20 MADC analog (recorder) output signal for each selected range. The ranges may be remote selected by external sources.

The analyzer is available with an optional internal heated sample pump.

The contents of this manual include:

- **Electrical Specifications**
- **Installation Requirements, Mechanical & Electrical**
- **Operation & Calibration Instructions**
- **Reaction Chamber Description with Procedures for Disassembly of its Component Parts**
- **Function Explanation of the Electronic Circuitry**
- **Complete Schematic Circuit Diagrams**

INTRODUCTION (Continued)

SPECIFICATIONS

ANALYSIS METHOD: Chemiluminescence (CLD)

RANGES: 0-10, 30, 100, 300, 1,000 (Range A)
0-30, 100, 300, 1,000, 3,000 (Range B)
ppm NO or NOx

RESOLUTION: 0.1 ppm NO/NO_X

REPEATABILITY: Better than 0.5 % of Full Scale

LINEARITY: Better than 1% of Full Scale

CO_2 EFFECT: Less than 1% with 10% CO_2

H_2O EFFECT: Less than 1% with 3% H_2O

CONVERTER: Carbon Material @ 215 Degrees C; 90 to 100% Efficiency

OZONIZER: Ultraviolet Lamp

RESPONSE TIME: 1.5 Seconds to 90% of Full Scale

SAMPLE FLOW RATE: 3.0 L/min. ±1.0 L/min.

SAMPLE PRESSURE: 6 to 25 psig (Less Internal Pump)

NOISE: Less than 0.5% of Full Scale

ZERO & SPAN DRIFT: Less than 1% of Full Scale per 24 Hours

ZERO & SPAN ADJUSTMENT: Ten Turn Potentiometer

FLOW CONTROL: Electronic Proportional Pressure Valve, Sample & O3

AIR or O^2 REQUIREMENTS: Less than 1 ppm NO_X at 500 cc/Min. @ 25 psig

NOTE: O^2 Required above 3,000 ppm

DISPLAY: 4½ Digit Panel Meter. Selectable 0-100% Full Scale or Direct Reading

DIAGNOSTICS: 4½ Digit Panel Meter with 6 Position Switch

Sample Pressure	Oven Temperature
Cell Temperature	Pump Temperature
Air Pressure	Converter Temperature

ANALOG OUTPUT: 0-10 VDC and 4-20 MADC

O_3 CONTROL: Automatic Shutdown With Loss Of Air Pressure

NO/NOx CONTROL: Manual Push-Button or Remote

AMBIENT TEMPERATURE: 5 to 40 Degrees C

SAMPLE TEMPERATURE: 0 to 50 Degrees C

WARM-UP TIME: 1 Hour

FITTINGS: 1/4 Inch Tube

POWER REQUIREMENTS: 115/230 (±10%) VAC 50/60 Hz; 130 Watts

DIMENSIONS: 5¼ H × 19 W × 20 D (Inches)

RELATIVE HUMIDITY: Less than 90% RH

WEIGHT: 42 Pounds

HCLD OPTIONS

Heated Internal Sample Pump
19 Inch Rack Mount Slides
Remote In-Line Filter

SECTION III

INSTALLATION

GENERAL

The instrument is designed for industrial and vehicle emission applications. These installation instructions are for a typical site. Any questions regarding specific installation situations should be directed to the **Technical Service** Department of California Analytical Instruments, Inc.

SITE & MOUNTING

NOTE

The following **precautions** must be carefully observed.

1. Select a site free from direct sunlight, radiation from a high temperature surface, or abrupt temperature variations.
2. When installed outdoors, shelter the instrument from wind and rain.
3. Select a site where the air is clean. Avoid exposing the instrument to corrosive or combustible gases.
4. The instrument must not be subject to severe vibration. If severe vibration is present, use isolation mounts.
5. The instrument is designed for rack-mounting. Optional rack-mount slides are available.

NOTE

A rear supporting brace or equivalent is required if the rack-mount slides are not used.

6. Do not install near equipment emitting electromagnetic interference (EMI). See page 6.

INSTALLATION (Continued)

ELECTRICAL

All output and control wiring is terminated in a connector at the rear of the instrument. Connect wiring as shown in Figure 1. The 115 VAC, 60 Hz power enters the plug/switch assembly.

NOTE

A defective ground may affect the operation of the instrument.

A rear mounted connector is provided for the output and control signals. For Model 400 HCLD, these are the remote range change and ID for ranges 1 through 5 and the analog output signal.

Remote Range Operation

Remote range identification and range selection are obtained by the rear panel connections (Page 12). When a range is selected, the corresponding control line is pulled low to zero VDC. Ranges not selected will remain at approximately 5 VDC. When remote range control is selected on the front panel switch, a contact closure is provided at the rear panel connector. Remote range selection is made by connection of the control line for the desired range to the analyzers zero VDC line provided in the connector. Five VDC is also provided (Dwg 200499). Remote NOx On is selected by connection to the common line. This contact closure turns on the NOx function by flowing the sample first through the NO/NOx converter.

NOTE

Shielded wiring is recommended for output signals.

CAUTION

Electromagnetic interference (EMI) may affect the operation of the instrument. Do not install the instrument in the vicinity of electrical noise (such as high frequency furnaces, electric welding machines, etc.). If the instrument must be installed at such locations, a separate power line and ground must be used. Noise from a relay or solenoid valve should be controlled by the use of a spark suppresser (RC circuit) across the power wiring component (see Figure 2).

INSTALLATION (Continued)

ELECTRICAL (Continued)

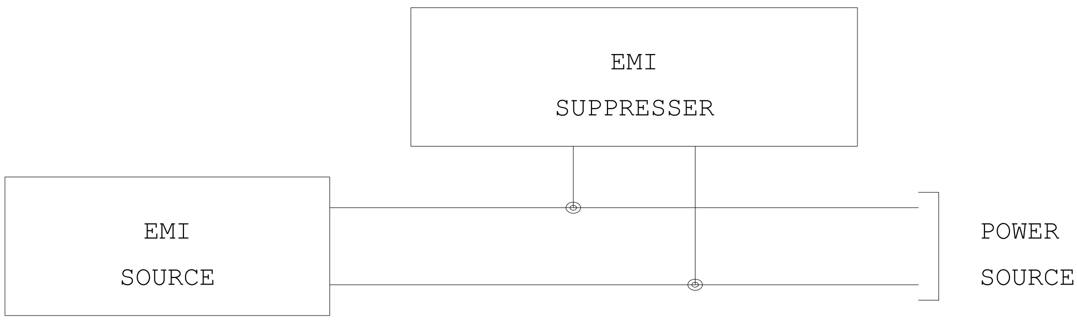


Figure 1: EMI Noise Control

NOTE

The spark suppresser must be placed close to the noise source.

INSTALLATION (Continued)

GASES

1. Air or O_2 (Ozone Air, < 1 ppm C) in pressurized cylinder.
2. Standard span gas(es) near full scale concentration with a nitrogen balance, in a pressurized, certified cylinder.

GAS HANDLING EQUIPMENT

1. Pressure regulators for zero gas (Air or N_2), ozone supply (air or O_2) and span gas cylinders.
2. Corrosive - resistant gas tubing.

NOTE

High levels of NH_3 (greater than 10 PPM NH_3) may reduce the NO_2 to NO Converter's conversion efficiency to a level that is unacceptable. It is therefore recommended that the customer purchase a commercially available NH3 scrubber and install it in the path of the sample gas prior to its introduction into the analyzer.

GAS CONNECTIONS

The tubing from the sampling system to the gas analyzer should be made from corrosive-resistant material such as Teflon*, stainless steel or polyethylene. Even when the gases being sampled are corrosive themselves, rubber or soft vinyl tubing should not be used since readings may be inaccurate due to gas absorption into the piping material. To obtain fast response, the tube should be as short as possible. Optimum tube internal diameter is 0.16 inch (4 mm). Couplings to the instrument are ¼ Inch tube.

NOTE

Be sure tubing and joints are clean.
Dust entering the instrument may cause it to malfunction.

SAMPLING REQUIREMENTS

1. **Filtration**

   Dust must be eliminated completely. Use filters as necessary. The final filter must be capable of removing particles larger than 4 microns.

2. **Condensation**

   Dew point of the sample gases must be lower than the temperature of the oven to prevent accidental condensation within the instrument. When sample dew point is greater than 50° C, pass the sample through a dehumidifier to reduce the dew point to about 50°C or less.

If the sample contains an acid mist, use an acid mist filter, cooler or similar device to remove all traces of the mist.

NOTE

*Teflon is a trademark of Du Pont.

INSTALLATION (Continued)

SAMPLING REQUIREMENTS (Continued)

3. **Presence of Corrosive Gases**

   Useful service life of the instrument will be shortened if high concentrations of corrosive gases such as Cl_2, SO_2, F_2, HCl, etc., are present in the sampled gas.

4. **Gas Temperature**

   When measuring high temperature gases, take care that the maximum rating of the instrument 122 ºF (50 ºC) is not exceeded.

5. **Pressure and Flow Rates**

   The air or oxygen supply entering the instrument is controlled by an electronically controlled proportional flow (EPC) controller. The regulator is factory adjusted for optimum analyzer performance. The ozone supply (Air or O^2) air cylinder pressure should be set at approximately 25 PSIG.

   The sample entering the instrument is controlled by a factory set precision electronically controlled proportional flow (EPC) controller. The EPC is factory set for optimum analyzer performance as indicated by the sample pressure. If the analyzer does not contain the optional heated sample pump, the sample gas entering the instrument should be at a pressure between 10 and 25 PSIG with a flow capacity at a minimum of 3 liters/min. If the analyzer contains the optional sample pump, do not apply a pressurized sample. The optional pump is capable of drawing a sample through a ¼ inch heated sample line of approximately 75 feet.

   The calibration/span gas cylinder pressures should be set at 25 PSIG for delivery into the optional zero and span inlets located on the rear panel.

6. **Sample Gas Bypass Outlet (Vent)**

   A sample gas bypass outlet connector is located on the rear panel (¼ Inch Tube). Pressure at this outlet should be kept at atmospheric level. **ANY** back pressure will cause an error in reading. The vent outlet is located on the rear panel and may contain high levels of ozone which should be vented away from the instrument.

SECTION IV

CALIBRATION & OPERATION

IDENTIFICATION OF CONTROLS, INDICATORS & MAJOR COMPONENTS

Front Panel

(Numbers refer to annotations on Figure 3)

1. **Digital Indicator (4 1/2 Digits):** Displays analyzer output.

2. **Digital Indicator (4 1/2 Digits):** Displays diagnostic functions.

3. **Diagnostic Switch:** Five position switch displays:

Sample pressure (PSIG)	Cell Temperature (C)
Converter Temperature (C)	Oven Temperature (C)
Air pressure (PSIG)	Pump Temperature (C)

4. **Span Control:** Sets fine gain of instrument. (Adjusted while span gas is flowing through instrument.)

5. **Zero Control:** Sets the zero level of instrument. (Adjusted while zero gas is flowing through instrument.)

6. **NO/NOx Switch:** Depressing the push-button switches in and out the NO/NOx converter. NOx mode ON condition has the switch depressed. Remote NO/NOx is accomplished via a contact closure on the rear panel connector.

7. **Range Switch (Model 400 HCLD):** Allows selection of ranges 1 through 5 or remote. The remote position allows for remote computer control of ranges via a contact closure on the rear panel connector.

8. **Calibration Switch:** Allows selection of either span, zero, sample or remote.

9. **Heater LED's:** Indication of heater cycles (Cell, Oven, Pump and Converter).

10. **Pump Switch:** Activates internal heated sample pump.

CALIBRATION & OPERATION (Continued)

IDENTIFICATION OF CONTROLS, INDICATORS & MAJOR COMPONENTS (Continued)

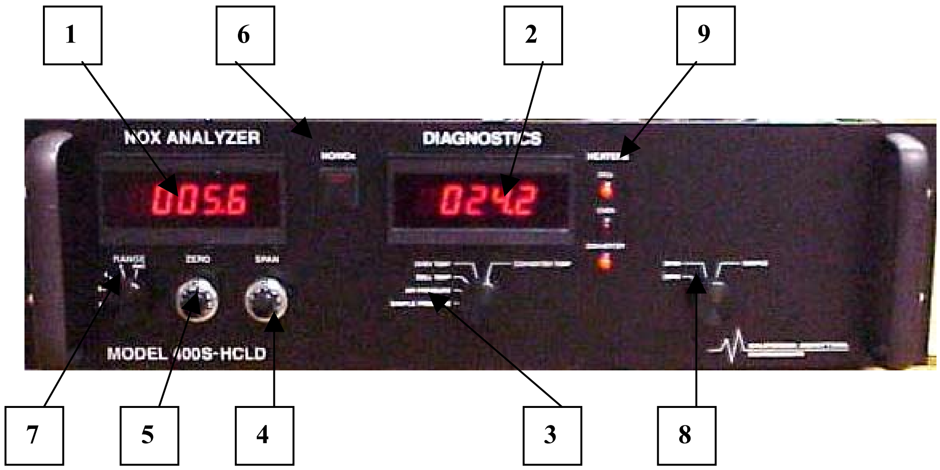


Figure 2A: Front Panel (Non Pump Version)

Figure 2B: Front Panel (Pump Version)

CALIBRATION & OPERATION (Continued)

IDENTIFICATION OF CONTROLS, INDICATORS & MAJOR COMPONENTS (Continued)

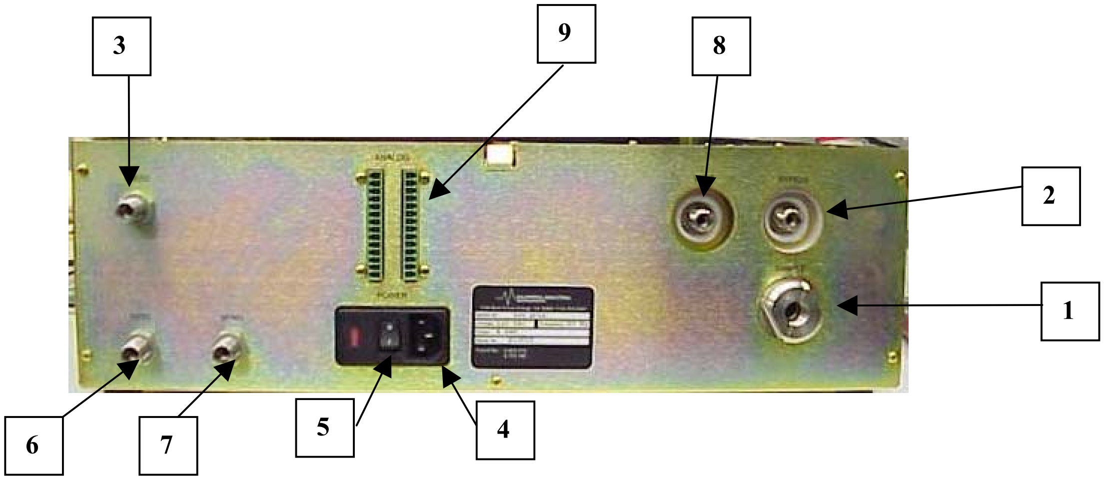


Figure 3: Rear Panel

1. **Sample Gas Inlet:** Feeds sample gas to the analyzer. ¼ Inch Tube.

2. **Sample Gas Bypass Outlet (Vent):** Exhaust for sample. ¼ Inch Tube.

3. **Ozone Air Inlet:** For feeding hydrocarbon free air or oxygen to the ozone generator.

4. **Power Entry Module:** Power cord connection, power switch, fuse compartment (2 Amp).

5. **Rear Panel Power ON/OFF Switch:** Turns ON/OFF line power to instrument.

6. **Zero Gas Inlet:** For feeding hydrocarbon free zero air to the analyzer.

7. **Span Gas Inlet:** For feeding calibration gas to the analyzer.

8. **Vent:** Exhaust from reaction chamber, ¼ inch tube fitting.

9. **Output Connector:** Analog Outputs and Remote Functions.

9. Connector for External Wiring:

1. Analog Out Common	9. Zero	17.	25. Remote Range ID
2. Sample P(10mv/PSI)	10. Span	18. R1 ID/Control	26. Remote Range Common
3. 0- 10 VDC	11. O3 Loss Common	19. R2 ID/Control	27. 12 VDC
4. I Out Common	12. O3 Loss	20. R3 ID/Control	28. 12 VDC Common
5. I Out (4-20 MADC)	13. NOx Mode	21. R4 ID/Control	
6. Conv Temp (10mv/C)	14. NOx Mode Common	22. R5 ID/Control	
7. Oven Temp (10mv/C)	15. Sample	23.	
8.	16. S/Z/S Common	24.	

CALIBRATION & OPERATION (Continued)

MAJOR INTERNAL COMPONENTS

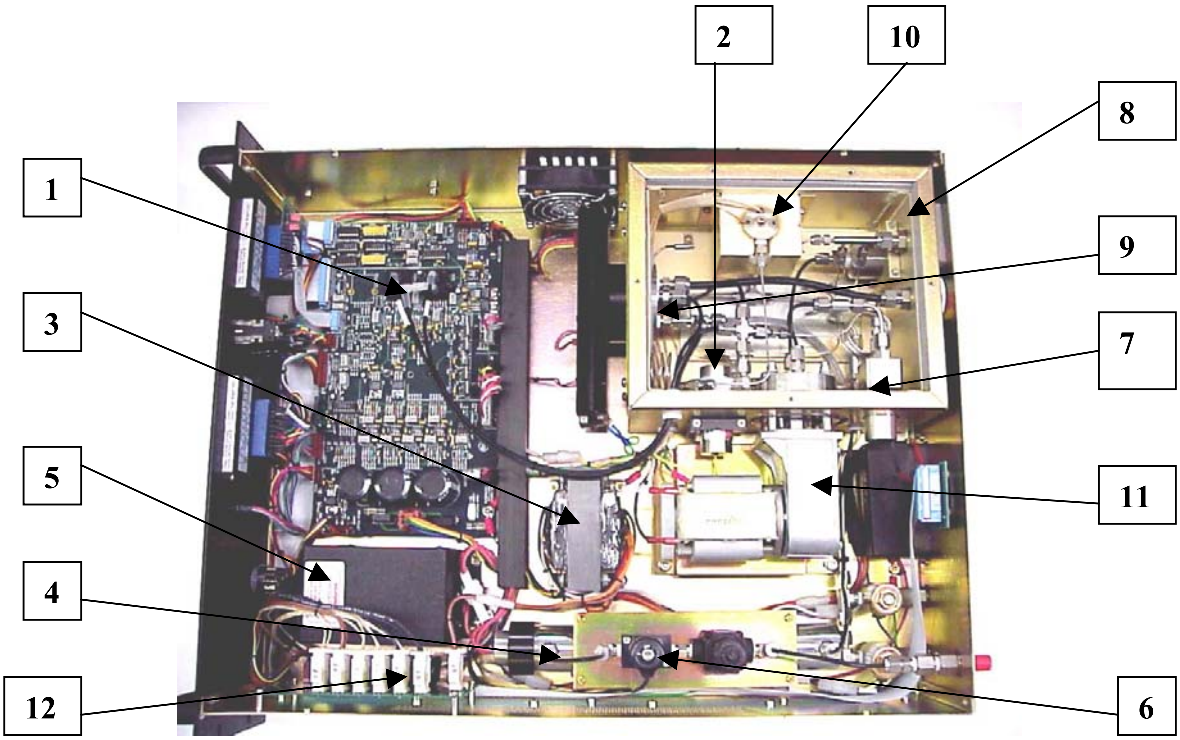


Figure 4 Major Internal Components

1. **Electronics:** Includes instrument electronics. (See Main Electronic Board)
2. **NO/NOx Solenoid Valve:** Switches flow between the NO and NOx mode.
3. **Power Transformer:** Converts line voltage to several lower AC voltages.
4. **Ozonator:** Contains UV Lamp.
5. **Ozonator High Voltage Supply:** Produces High Voltage to UV lamp.
6. **Proportional Flow Pressure Regulator:** Regulates flow of ozone.
7. **Proportional Flow Pressure Regulator:** Regulates flow of sample.
8. **Main Oven:** Heated Oven.
9. **Reaction Chamber & Detector Assembly:** See Figure 8.
10. **NO/NOxConverter**: Converts NO2 to NO for total NOx
11. **Heated Sample Pump:** Provides Sample to the Detector (Pump Version).
12. **Relay Control Board:** Provides AC Voltage to Heaters, Pump and UV Transformer.

CALIBRATION & OPERATION (Continued)

MAIN ELECTRONIC BOARD COMPONENTS

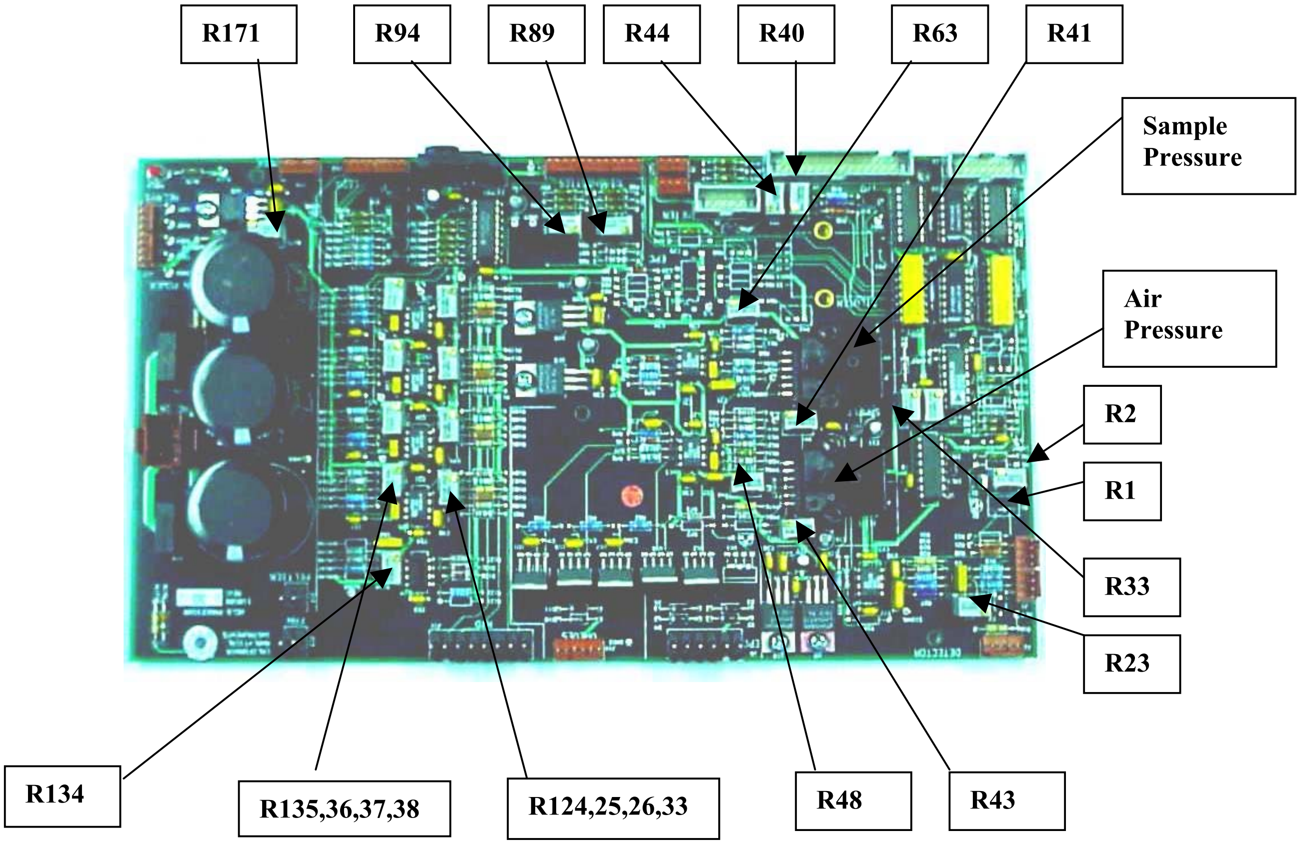


Figure 5A Main Electronic Board Components (Potentiometers)

R1	:	Range Adjust For D Term
R2	:	Range Adjust For D2,4,5,6 Term
* **R23**	:	Buffer Gain Adjust
R33	:	PGA Offset Adjust
R40	:	Meter Scale Adjust
R41	:	Sample Pressure Zero
R43	:	Air Pressure Zero
R44	:	Meter Scaling Adjust
* **R48**	:	Air Pressure Set
* **R63**	:	**Sample** Pressure Set
R89	:	Air Span Adjust
R94	:	Sample Span Adjust
R124	:	Cell temp Span
R125	:	**Oven Temp Span**
R126	:	**Pump Temp Span**
R133	:	**Converter Temp Span**
R134	:	Ozone HV Shutoff
* **R135**	:	Cell Temp Set
* **R136**	:	Oven Temp Set
* **R137**	:	Pump Temp Set
* **R138**	:	Converter Temp Set
R171	:	+ 12,000 V Adjust

*

NOTE: All Potentiometers **ARE FACTORY SET**.

* Indicates Potentiometers which MAY be field aadjjusted

CALIBRATION & OPERATION (Continued)

MAIN ELECTRONIC BOARD COMPONENTS (Continued)

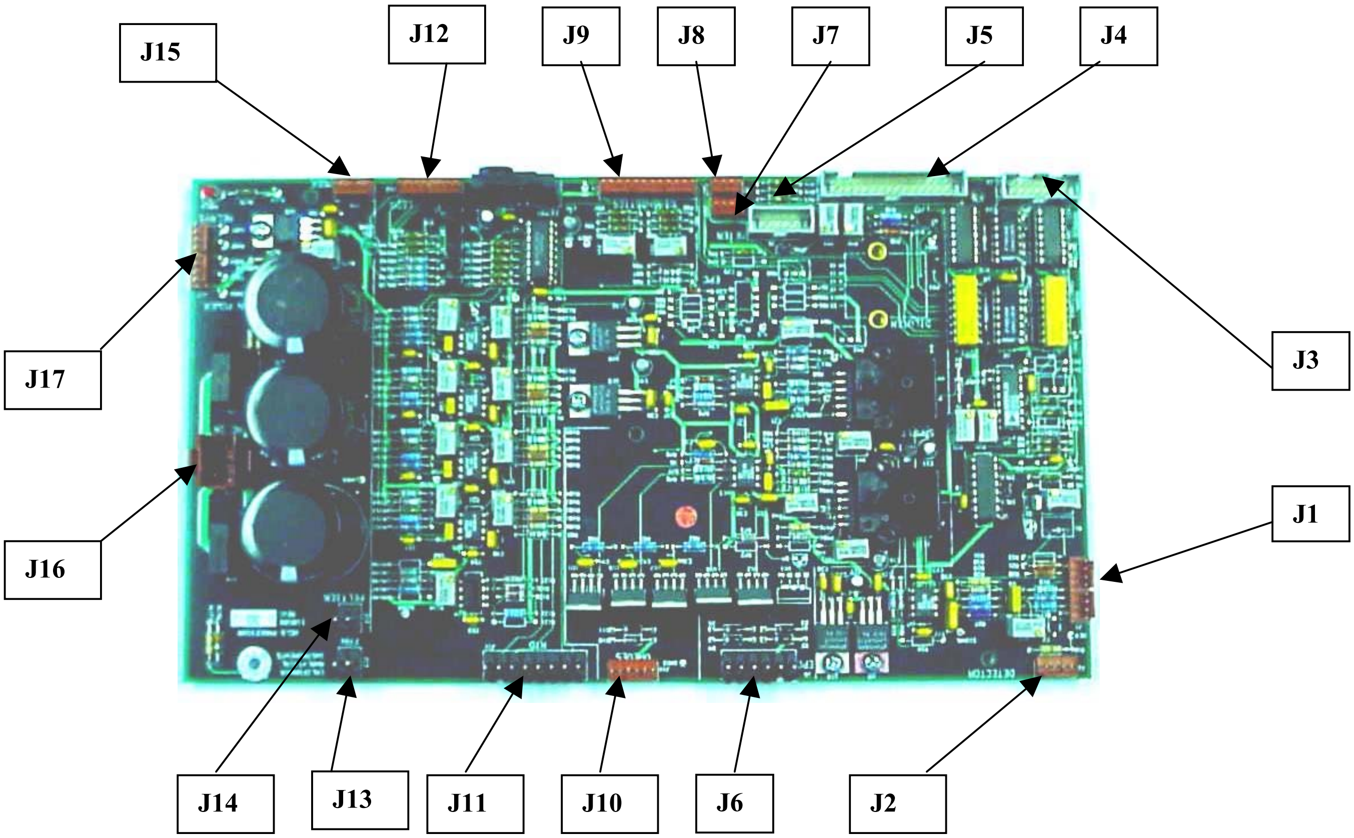


Figure 5B Main Electronic Board Components (Connectors)

J1	Span/Zero Adjust Pot	**J2**	Detector
J3	Range Switch Board	**J5**	Sample Meter
J4	Remote I/O	**J7**	NO/NOx Switch
J6	EPC Valves	**J9**	Diagnostic Switch
J10	Solenoid Valves	**J11**	RTD Sensors
J12	LED's	**J14**	Secondary Peltier Chiller
J13	Cooling Fan	**J16**	AC Power Input
J15	Mode Switch	**J8**	Pump Switch
J17	AC Relay Logic Board		

CALIBRATION & OPERATION (Continued)

REACTION CHAMBER ASSEMBLY

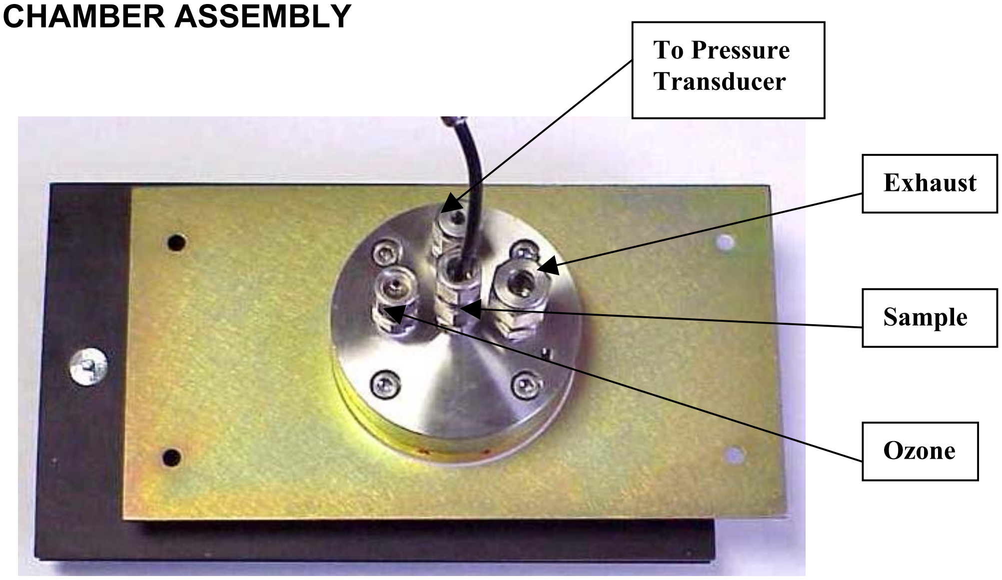
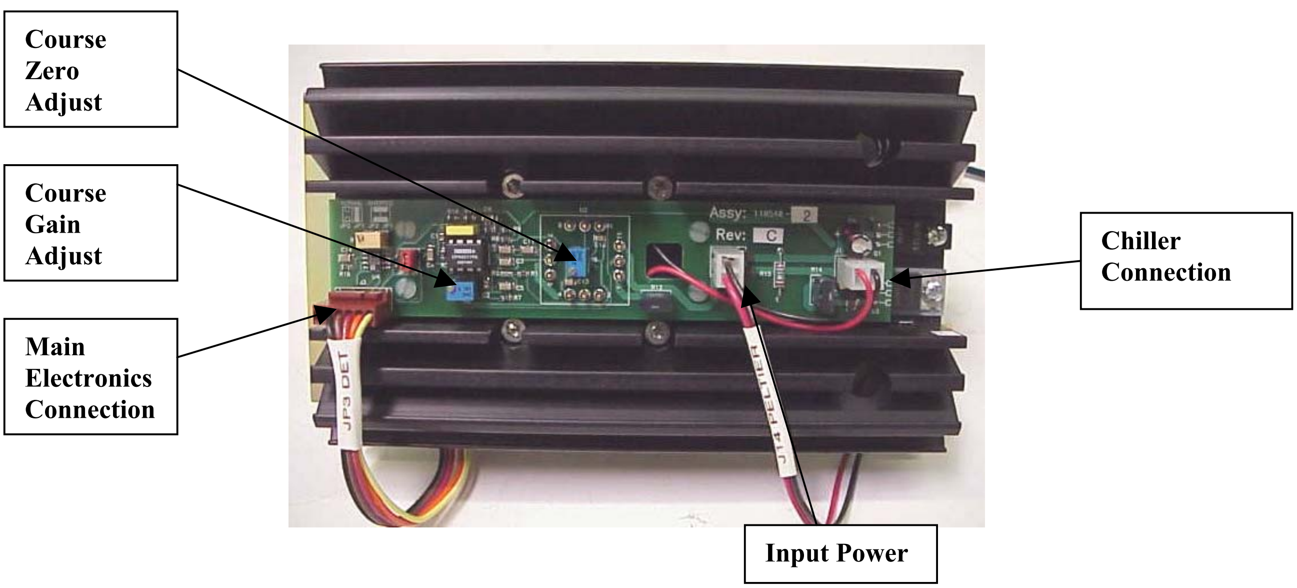


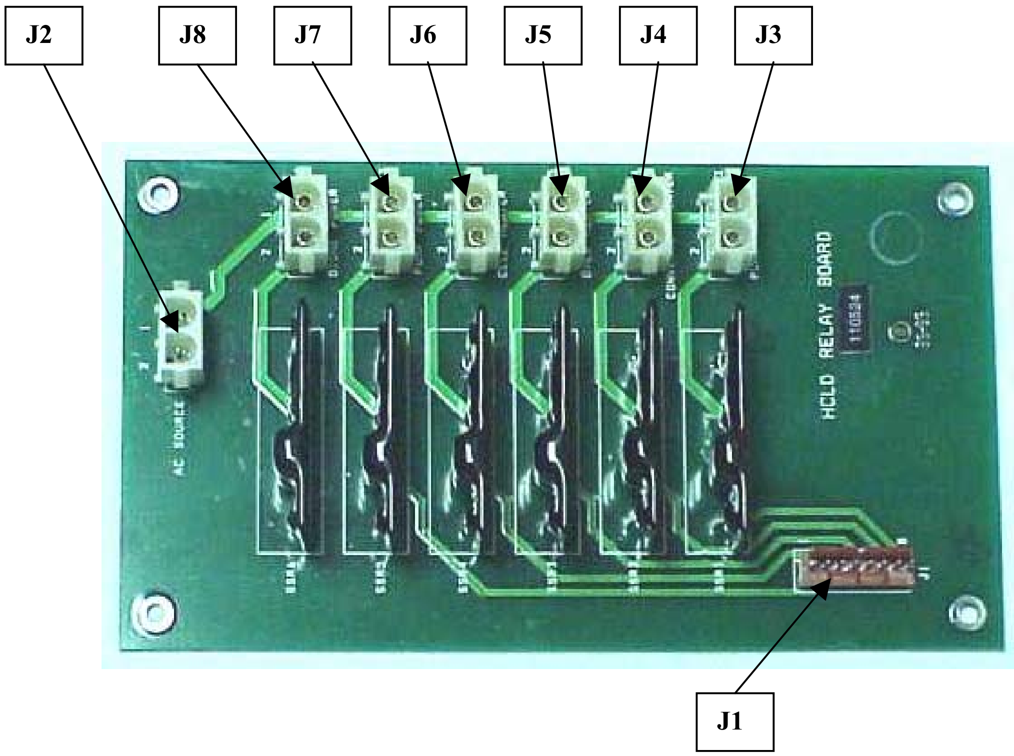
Figure 6A Reaction Chamber Assembly (Oven Side)

Figure 6B Reaction Chamber Assembly (Instrument Side)



<u>CALIBRATION & OPERATION</u> (Continued)

RELAY BOARD CONNECTIONS



<u>Figure 7</u> Relay Board Connections

J1 Connection to Main Electronic Board

J2 AC Power In

J3 Pump Heater

J4 Converter Heater

J5 Oven Heater

J6 Cell Heater

J7 Pump Power

J8 Ozone Power

CALIBRATION & OPERATION (Continued)

PREPARATION FOR OPERATION

1. Check that the external plumbing and wiring have been connected correctly, as described in Section III of this manual.

OPERATION

1. **Power On**: Turn ON the power switch on the rear panel. The digital panel meters should illuminate. Also note the heater LED's. These will stay on continuously until the heaters reach temperature. They will the cycle on and off.

2. **Introduce Ozone Supply (Air or O^2)**: Adjust the cylinder output pressure to 25 PSIG. The internal air pressure is factory set to deliver the air pressure required for optimum analyzer performance as indicated in the factory pressure settings sheet.

3. **Air or O^2 Pressure Settings:** Check the air pressure setting by placing the diagnostic switch to air pressure. The pressure should read as indicated in the factory pressure settings sheet.

4. **Zero Adjustment**: Flow zero gas through the instrument by selecting "Zero" from the front panel switch. **NOTE:** The instrument may be operated by an external computer if the Zero/Span/Sample/Remote switch is set in "Remote". Adjust the zero control on the front panel until the digital panel meter (or recorder reading, if an external recorder is attached) reads exactly zero.

5. **Span Adjustment**: Flow span gas through the instrument by selecting "Zero" from the front panel switch. **NOTE:** The instrument may be operated by an external computer if the front panel Zero/Span/Sample/Remote switch is set in "Remote". The front panel range switch should be set to the appropriate full scale setting corresponding to the calibration gas value. **NOTE:** The full scale range set may also be operated by an external computer if the range switch is set in "Remote". Adjust the span control on the front panel until the digital panel meter, or recorder, reading is at the value specified for the span gas concentration. The instrument is available from the factory in two range groups:

    Ranges 30, 100, 300, 1,000 & 3,000 ppm NO/NOx Full Scale

    Ranges 10, 30, 100, 300, & 1,000 ppm NO/NOx Full Scale

    The instrument is supplied with a 4 ½ digital panel meter for direct readout of gas concentration.

6. **NO/NOx Switch**: This switches the NOx converter in and out of the sample stream. In the NO mode, the sample by-passes the converter and the resultant analysis produces the value of NO (Only) in the sample. In the NOx mode, the sample passes through converter and the resultant analysis produces the value of NOx (NO + NO2) in the sample. The NO mode may be switched in and out remotely by a contact closure or computer, however, the front panel switch **must** be in the NOx mode. Remote control wiring is terminated in the rear panel connector. (See Page 12).

7. **Sample Pressure Check**: With sample gas flowing through the instrument, place the diagnostic switch in the sample position. The sample pressure should read as indicated in the factory pressure settings sheet.

CALIBRATION & OPERATION (Continued)

START-UP & ROUTINE MAINTENANCE

CAUTION: Never supply a "wet" sample to a cold analyzer as damage may occur.

1. **Sample Pump**: If the analyzer is supplied with the optional internal heated sample pump, make certain the pump switch is OFF. Switch position should be out before turning the analyzer on.

2. **Heated Sample Line**: Make certain the heated sample line is up to temperature and flushed before connecting to the analyzer sample inlet.

3. **Instrument Power**: Turn instrument power on and allow the oven temperature to stabilize before turning on the sample pump and/or connecting the heated sample line.

4. **Sampling System**: Prepare and check the sample system. Check the sample pressure and bypass flow.

5. **Air or O^2 Pressure:** Check the Air/O^2 pressure for proper setting as indicated in the manual factory pressure setting sheet. Readjust internal pressure as required. Note: Cylinder pressure should be set at 25 PSIG.

6. **Zero & Span Calibration:** Zero and span adjustment should be checked every 2 hours.

   a. Check the zero reading while flowing zero gas, and readjust, if necessary, using the front panel zero control.

   b. Check the span reading while flowing span gas, and readjust, if necessary, using the front panel zero control.

7. **Reaction Chamber Assembly:** Dust, water droplets, or mist entering the reaction chamber assembly may cause drift due to contamination. If the front panel zero level control(s) fails to bring the meter to zero, check the chamber for contamination.

CALIBRATION & OPERATION (Continued)

SHUT-DOWN PROCEDURE

1. Turn off the zero, span and air/O2 cylinders.

2. Disconnect the heated sample line from the rear inlet port. Do **NOT** turn off the sample pump or analyzer power at this point.

3. Allow the analyzer to draw in room air for approximately 5 minutes. This will flush out any remaining sample which may cause condensation as the analyzer cools.

4. Turn off the pump switch.

5. Turn off the analyzer power.

6. Back-flush the heated sample line (and filter) of any sample before disconnecting and powering down.

SECTION V

FUNCTIONAL DESCRIPTION

OPERATING PRINCIPLE

The California Analytical Model 400 CLD Analyzer utilize the chemiluminescent method of determination of oxides of nitrogen (NO or NOx) in a sample gas. In the NO mode, the NO in the sample is quantitatively converted to NO2 by gas phase oxidation with molecular ozone produced by the UV reaction of cylinder air. Generally, 10 to 15 percent of these NO2 molecules are elevated to an electronically-excited state. This reaction is immediately followed by reversion to a non-excited state and emission of photons. The photons impinge on a photodiode detector (PHOTODIODE) which generates a low DC current directly proportional to the NO contained in the sample gas. This current is amplified by a precision electrometer and presented to digital panel meter and recorder output. In the NOx mode, the sample is first routed to the NOx converter where the NO2 component is reduced to NO. The complete sample is analyzed by the PHOTODIODE as above. The instrument contains heated sections which keep the sample above 50 degrees C prior to the reaction chamber. All temperatures are measured by N.I.S.T. tracable standards.

REACTION CHAMBER ASSEMBLY (Figure 6.)

The sample and ozone are delivered to the reaction chamber via the unique regulated flow system described below. The sample and ozone are mixed together at the center of the chamber where the reaction takes place. The sample is vented from the chamber through a 1/8 inch stainless steel tube. The chamber contains a red filter which is sealed with an integral O Ring. The chamber assembly is O Ring mounted to the PHOTODIODE. The complete chamber and PHOTODIODE assembly is housed in an RFI shielded enclosure.

FLOW SYSTEM (See Drawing 210003)

The basic function is to deliver highly regulated flows of sample and air or O2 to the ozonator and reaction chamber assemblies. The EPC valve delivers approximately 3.0* PSIG to a pre-set capillary and consequently accurately predetermines the ozone flow rate. The air supply cylinder should be set to 25 psig. The sample is presented to the reaction chamber via a precision, factory set electronically controlled proportional pressure valve through a capillary. This pressure is factory set at approximately 2.0* PSIG. A close coupled by-pass capillary minimizes "dead volume" and improves response time. Sample inlet pressure and regulated air pressures are monitored by internal pressure transducers and presented in PSIG via the diagnostics meter. NOTE: The correct pressures are determined by the factory

FUNCTIONAL DESCRIPTION (Continued)

for optimum analyzer performance and measured by N.I.S.T. tracable standards. They are recorded on the Factory Pressure Setting Sheet.

ELECTRONICS

Main Electronics Board (Figure 5.)

The main electronics board contains the instrument power supplies and required instrument electronics. A single transformer provides power to the main circuit board and includes provisions for 110/220 VAC at 50/60 Hz input.

Relay Board (Figure 7.)

The relay circuit board contains the logic circuitry required to control and switch the AC power to the required heaters and sample pump.

SECTION VI

DISASSEMBLY PROCEDURES

REACTION CHAMBER ASSEMBLY

1. **Removal** (Refer to Figure 6)

   a. Shut off ALL gas flow.

   b. Remove power from the instrument.

   c. Remove the top cover retaining screws.

   d. Remove all 4 tubes from the 4 way cross.

   e. Remove the 4 screws securing the photodiode and reaction chamber from the oven.

   f. Remove the photodiode electrical connector from the main circuit board.

   g. Remove the chiller connection from the photodiode/reaction chamber.

   h. Separate the photodiode and heat sink assembly from the reaction chamber by removing the 4 Allen screws from the front of the heat sink. Save the 2 black rubber “O” rings.

   i. Separate the mounting plate and the glass filter from the reaction chamber. Save the 2 Teflon spacers and “O” ring.

   j. Separate the manifold from the gold reaction chamber. NOTE the position of the holes in the Tefoln gasket relative to the assembly screw holes. The large hole is ozone.

REACTION CHAMBER ASSEMBLY

   a. Wash the reaction chamber glass filter and manifold separately in detergent using a test tube brush. Be careful of the sample tube in the manifold. Do not use abrasives.

   b. Dry by blowing clean with dry nitrogen.

   c. Reassemble the chamber assembly in reverse order per the above. Make certain the sample tube is centered when assembling the manifold to the reaction chamber.

SECTION VII

TROUBLESHOOTING - GENERAL INFORMATION

ELECTRONICS

For ease of service, **ALL** electrical connections terminate on the main circuit board using plug-in connectors.

FLOW SYSTEM

Ozone Air/O2 Supply

The Air/O2 flow is controlled by an EPC valve. It requires 25 psig cylinder supply pressure and is factory set to deliver approximately 10 to 20 psig to the ozone capillary. This pressure may be monitored by the diagnostics meter. The flow rate from the capillary is very low and will require a bubble flow meter to accurately determine proper flow.

Sample Supply

The sample flow is controlled by an adjustable electronic proportional pressure valve. This valve requires a 10 to 25 PSIG sample supply pressure to deliver the proper pressure to the sample capillary. This pressure may be monitored by the diagnostics meter at any time after inlet sample has been applied. The sample flow rate from the capillary is very low and will require a bubble flow meter to determine proper flow rate. If the pressure is properly set, and a clogged capillary is suspected, replace the sample capillary.

NO/NOx CONVERTER

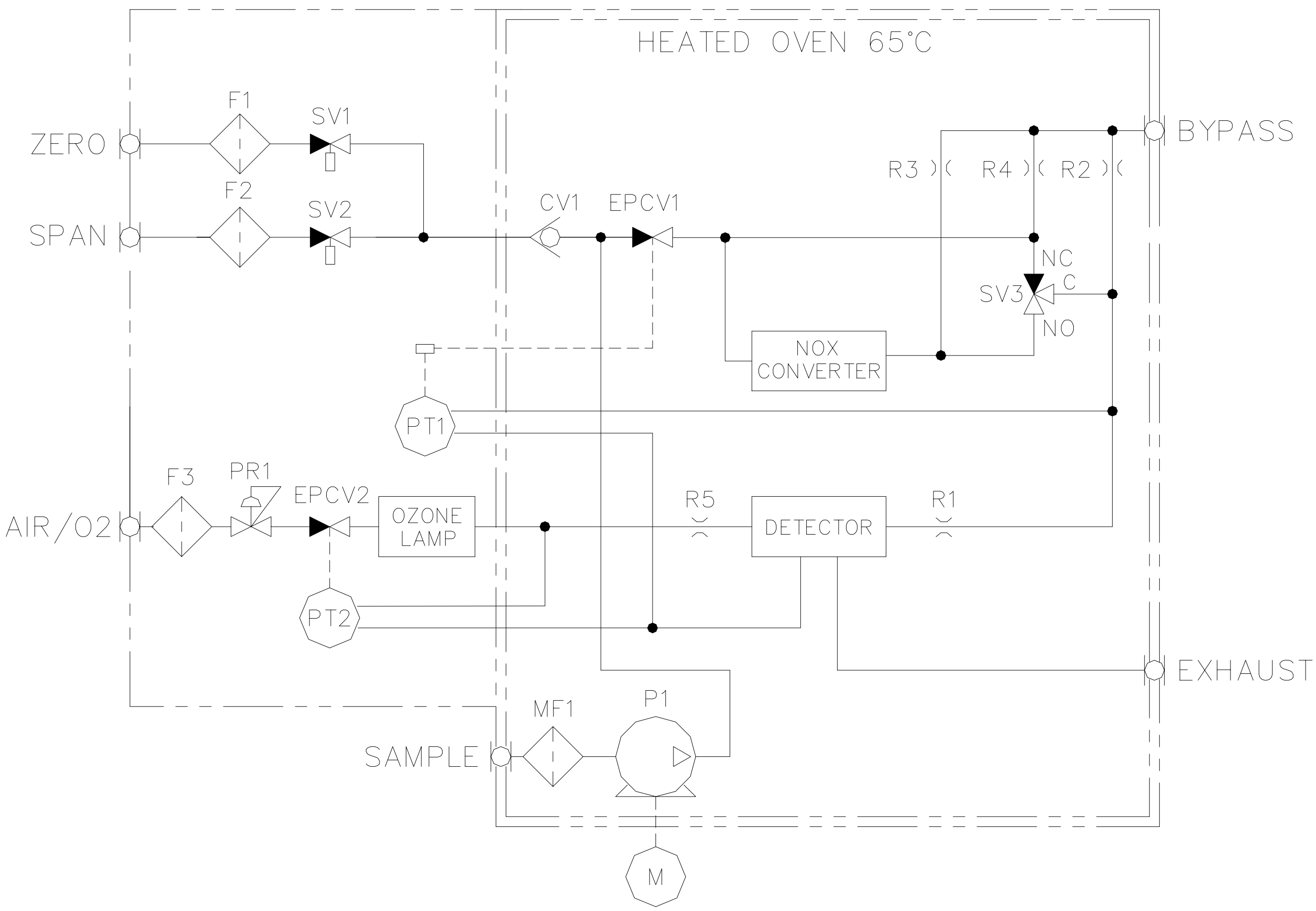
Several published test procedures require periodic NOx efficiency tests to be performed on the converter to determine NO2 to NO conversion efficiency utilizing a NOx generator. The CAI Model NOxGen may be used for this procedure. CAI also provides an optional internal NOx generator to test for efficiency. A short test using NO2 calibration gas is also defined in the U.S Federal Register, Title 40, Part 86.332.79 (e).

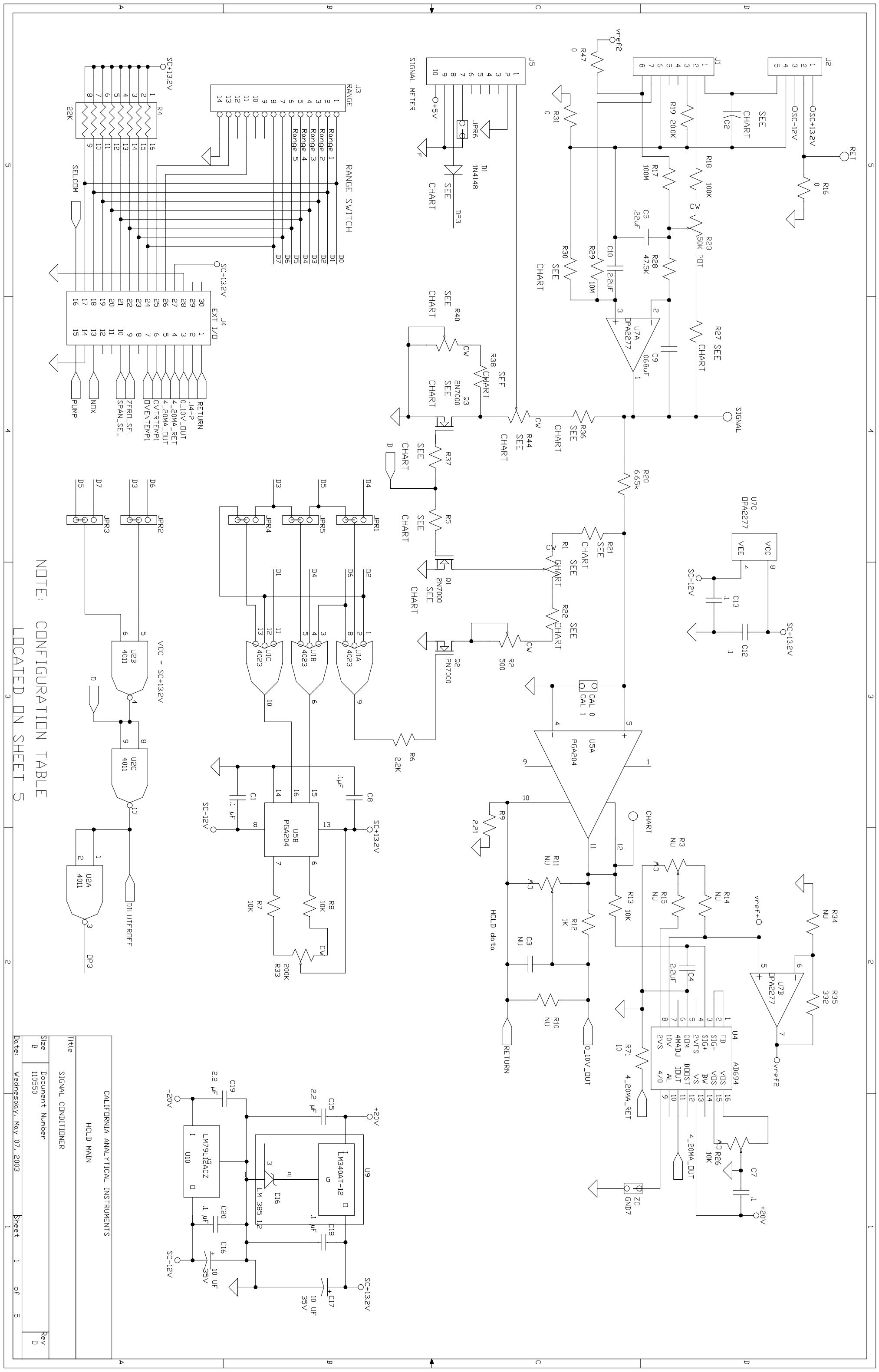
SECTION VIII

SCHEMATIC & ASSEMBLY DIAGRAMS

SEE ATTACHED

MODEL 400 HCLD Flow Diagram




NOTE: CONFIGURATION TABLE LOCATED ON SHEET 5
CALIFORNIA ANALYTICAL INSTRUMENTS
HCLD MAIN
SIGNAL CONDITIONER
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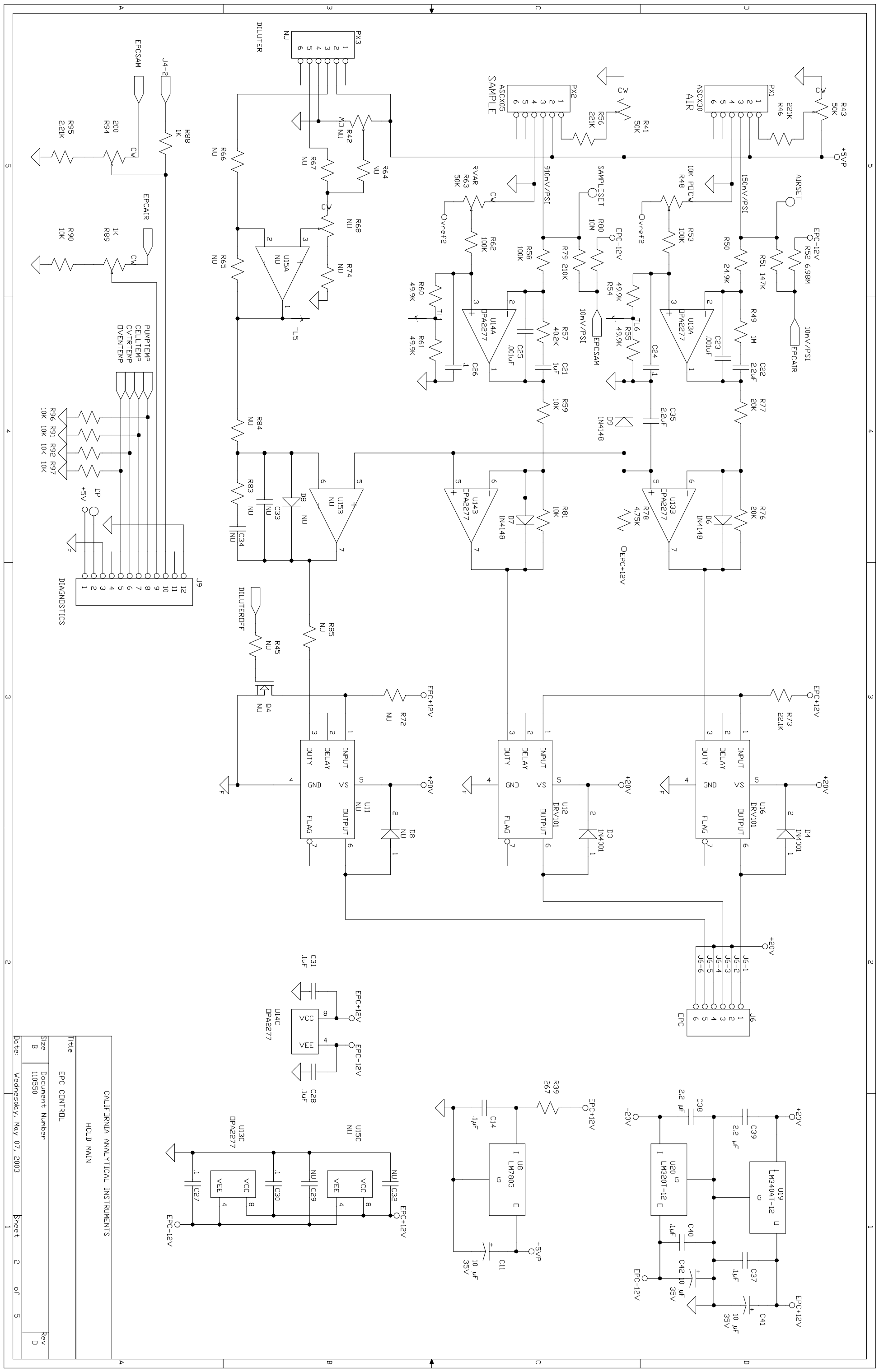
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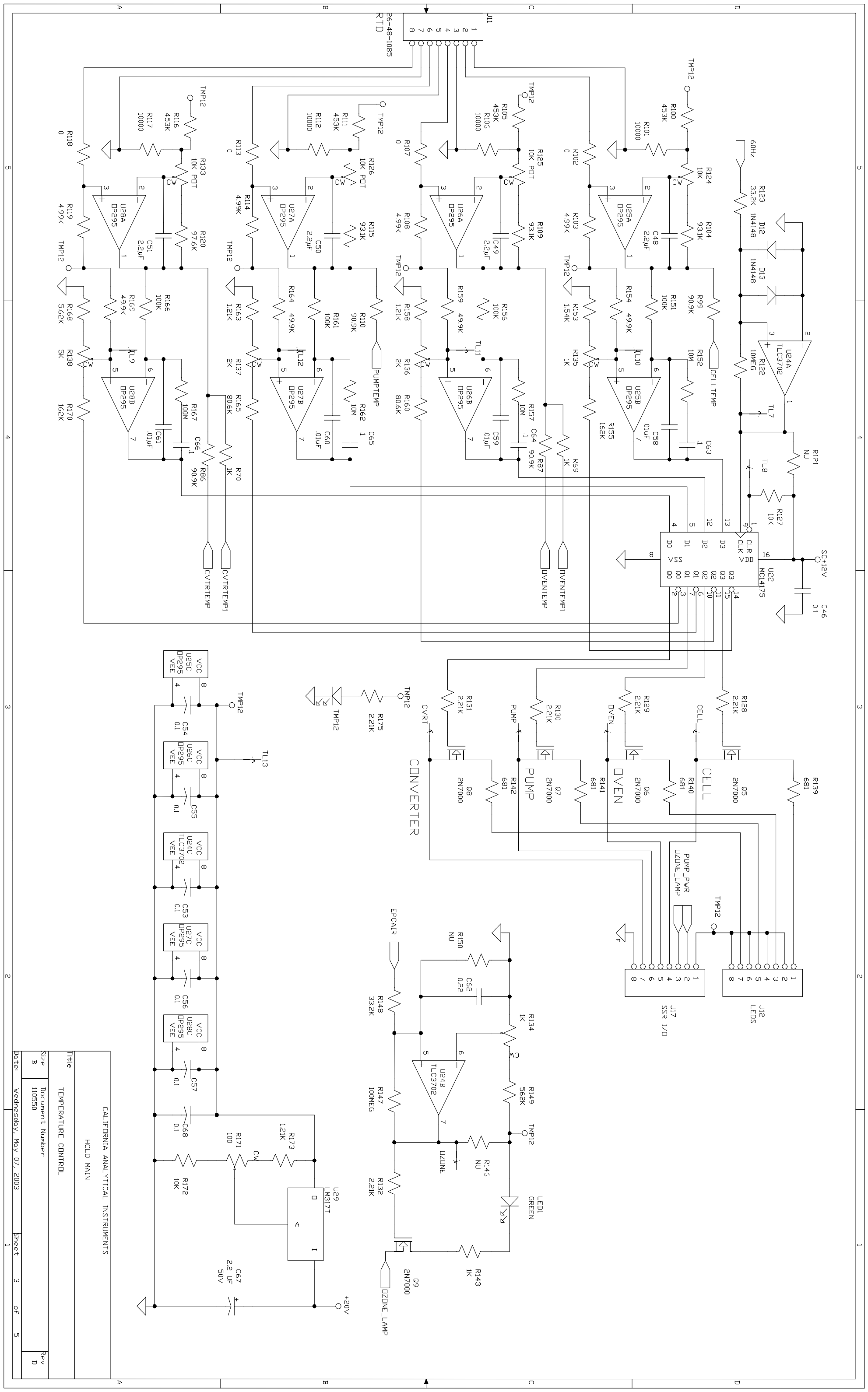
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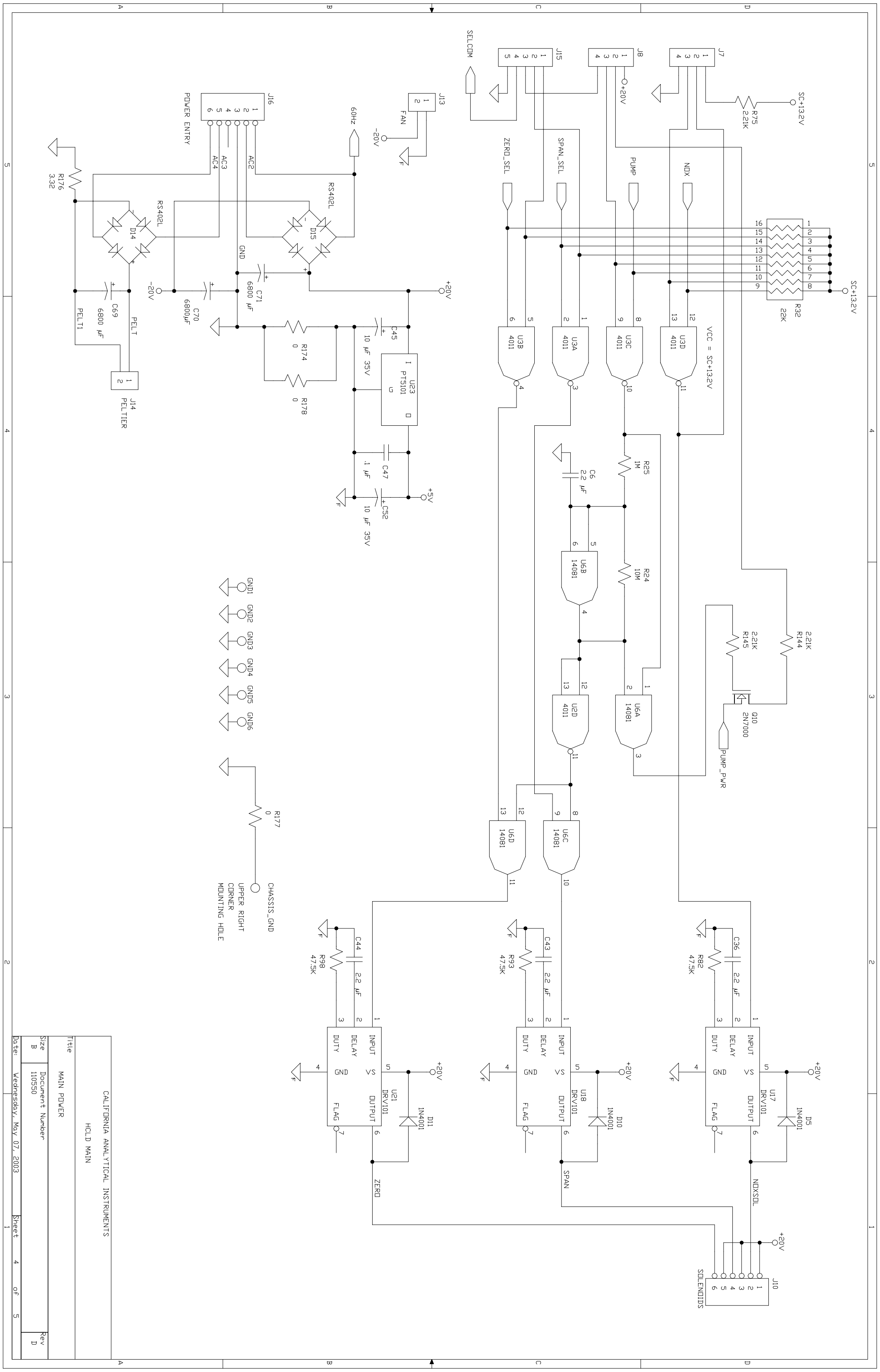
Rev D
Date Wednesday, May 07, 2003
Sheet 3 of 5
CONVERTER
PUMP
OVEN
CELL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HCLD MAIN
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MAIN POWER
Size
B
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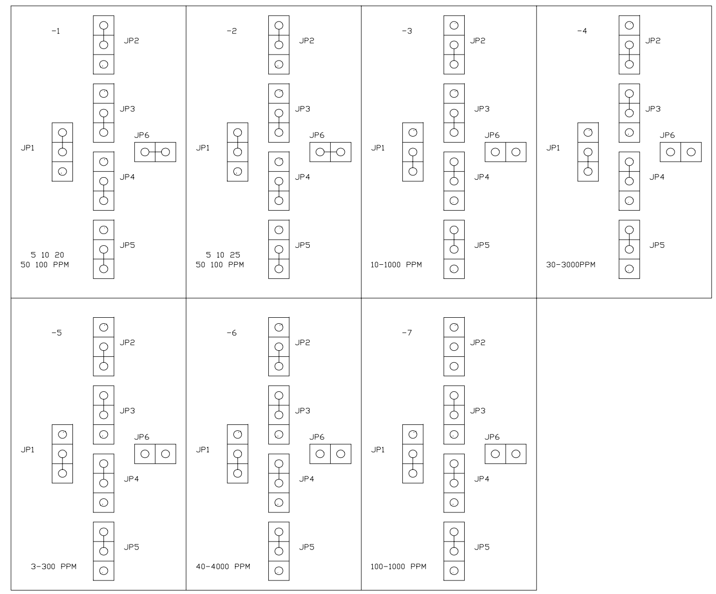
CONFIGURATION TABLE

	RANGE	3-300	5 10 20 50 100	5 10 25 50 100	10-1000	30-3000	40-4000	100-10000
DESCRIPTION	DASH	-5	-1	-2	-3	-4	-6	-7
C2		220μF	NU	NU	NU	NU	NU	NU
JPR 1		D4	D5	D5	D4	D4	D4	D4
JPR 2		D6	D3	D3	D6	D6	D6	NU
JPR 3		D5	D7	D7	D7	D5	D5	D5
JPR 4		D2	D3	D3	D2	D2	D2	D2
JPR 5		D3	D5	D5	D3	D3	D3	D3
JPR 6		OFF	ON	ON	OFF	OFF	OFF	OFF
DIODE D1		INSTALL	NU	NU	INSTALL	INSTALL	INSTALL	INSTALL
R1		JUMPER	200 POT	200 POT	JUMPER	JUMPER	JUMPER	JUMPER
R5		OPEN	2.2K	2.2K	NU	NU	NU	NU
R21		2.74K	2.1K	1.54K	3.24K	2.74K	4.22K	3.24K
R22		JUMPER	4.22K	4.75K	JUMPER	JUMPER	JUMPER	JUMPER
R27		1.5M	475K	475K	243K	243K	243K	243K
R30		20K	13.3K	13.3K	13.3K	13.3K	13.3K	15K
R36		9000	9000	9000	9000	9000	9000	909
R37		2.2K	NU	NU	NU	2.2K	2.2K	2.2K
R38		3.32K	9000	9000	1000	3.32K	5.62K	NU
R40		500 POT	JUMPER	JUMPER	JUMPER	500 POT	500 POT	NU
R44		500 POT	JUMPER	JUMPER	JUMPER	500 POT	500 POT	500 POT
Q1		OPEN	INSTALL	INSTALL	NU	NU	NU	NU
Q3		INSTALL	NU	NU	NU	INSTALL	INSTALL	INSTALL



Title	HCLD MAIN	
Size B	Document Number 110550	Rev D
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