advanced temperature control technology

MYDAX, INC.

INSTRUCTION/OPERATIONS MANUAL

1M9W-S WATER COOLED CHILLER

Serial Number 120-07XX

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TABLE OF CONTENTS

SPECIFICATIONS

SYSTEM CAPACITIES

Cooling Capacity @ +20°C	2500 Watts
Coolant Temperature Setpoint Range	+15°C to +25°C
Coolant Output Temperature Stability	± 0.05°C
Polypropylene Reservoir Volume	10 Gallons
Recirculating Coolant	Low Conductivity Water
Coolant Flow/Pressure	10 Gpm @ 100 Psi (Bypass Provided)
Recirculating Supply/Return Fittings	1" Stainless Steel FPT
Condenser Water @ 75°F	1.5 Gpm Required (ΔP = 20 Psi)
Condenser Water Connections	1/2" Stainless Steel FPT
Electrical Service	208/230 volt, 60 Hz, 3 phase, 20 amp With 10' line cord and L15-30P plug.
Physical Parameters	42"H x 24"W x 33"D, 450 lbs.

STANDARD FEATURES

System is complete with microprocessor-controlled low-stress refrigeration circuit, recirculating pump and fluid reservoir. R-22 refrigeration circuit uses all-brazed construction for extra strength. The heavy-duty frame is constructed of welded steel tubing equipped with locking casters.

The microprocessor-based control system includes an extensive monitoring capability including comprehensive controls, error messages and diagnostics. System status is indicated via a two-row (40 characters each) alphanumeric LCD (liquid crystal display) and with red light-emitting diodes (LED's). The control keyboard employs membrane switches with a sealed polycarbonate overlay for protection from liquid spills. This chiller is complete with a liquid-filled panel mounted pressure gauge, an internal pressure bypass circuit, a full-flow 10 micron particulate filter and an RS-232C Interface for remote control and monitoring.

SAFETY FEATURES

1. Warning & Error Messages: including coolant over-temperature warning & shutdown, low tank level warning & shutdown and others (see ERROR MESSAGES section).
2. System Diagnostics: including coolant & freon temperatures, valve and heater drives and others (see DIAGNOSTIC DISPLAYS section).
3. Integral compressor refrigerant high pressure protection.
4. Circuit breaker & contactor.
5. Interlock loop, including reset switch.
6. Thermal protection of pump and compressor motors.
7. Manufactured and wired in accordance with IBM Non-Product Safety Design Standards.

SYSTEM OVERVIEW

System Fluid Schematic

Refer to drawing #B2343, the fluid schematic. The heart of the design is the evaporator valve. This is a thermal-electric expansion valve, controlled directly by the system's embedded microprocessor. Hermetically sealed, it consists of a spring-loaded needle valve in contact with a bimetallic plate. The plate is wound by a coil of wire connected to terminals on top of the valve. The curvature of the plate, and therefore the position of the needle valve, varies with its temperature which is controlled by electrical current flow through the coil. So by controlling the duration of electrical pulses applied to the valve terminals, the microprocessor opens the valve to a precisely determined point. This passes a precisely determined flow of freon to the evaporator, allowing for exceptionally stable recirculating temperatures. This system is designed to control the recirculating output temperature to ±0.05°C across the system operating range.

The microprocessor sets the exact position of the valve based upon the system heat load. If the load increases, the evaporator valve is opened slightly, passing more refrigerant. If the load decreases, the valve is closed slightly, passing less refrigerant. During normal operation, the position of this valve stays nearly constant. Only major changes in heat load or system-wide power cycling cause large changes in the valve opening. In the case of a step-wise change in heat load, the microprocessor quickly drives the valve to the new setting and refrigerant flow soon settles at the proper level.

The valve drive setting is based primarily upon data received from RTD's (resistance temperature devices) located about the circuit. The drawing shows RTD's at the evaporator valve, at the discharge line from the pump, at the reservoir and between the condenser and receiver. The microprocessor "reads" these and other sensors constantly and sets the refrigerant valve accordingly.

Thus refrigerant flow is truly proportioned, through a valve which only rarely cycles all the way open or shut. Besides precise temperature control, this allows continuous compressor operation without the normal addition of cycling, and therefore failure-prone, pressure-actuated hot gas bypass valves. All other refrigeration circuit components are used as in conventional systems. All permanent copper joints in the refrigeration circuit are brazed for extra strength. Much of the circuitry is insulated to eliminate cooling capacity loss and unpredictable operation due to drafts or fluctuating ambient air conditions.

This system is designed to recirculate water. It is not designed to recirculate solutions of automotive antifreeze. Approximately 10 gallons are required to fill the polypropylene reservoir. The heating elements are stainless steel cartridge heaters. The freon evaporator is a coaxial heat exchanger, located in the recirculating return line leading to the reservoir.

The reservoir is fitted with two level sensors. One level sensor drives a FILL TANK alarm at the main panel, indicating coolant level has dropped somewhat. The second sensor, the TANK EMPTY sensor, is connected to the safety interlock loop and shuts the system down if tripped. Note that "empty" is a relative term only. The real function of this sensor is to prevent the coolant level from dropping so low as to expose the pump suction line.

System Electrical Diagram

Refer to drawing #B2344, the system electrical diagram. The central component of the electrical system is the M1001 controller. It is microprocessor-based and communicates with and/or controls various other circuit boards and components. Most controller circuitry is laid out on circuit boards mounted in the main control cabinet. The controller is powered as long as the system circuit breaker is set, receiving 24 VAC power from a bulkhead-mounted transformer.

The controller "reads" the RTD's in the system via board M1002. RTD's are included for the recirculating output temperature and the reservoir, as well as for the freon circuit. Also routed through this board are the 100 and 120 • precision RTD calibration resistor circuits. The evaporator valve drive signal is routed through board M1004, as is the phase detector circuit.

The system interlock loop is controlled by the M1002 circuit board. In this application the interlock loop consists of the freon high pressure switch, the tank over-temperature switch, the TANK EMPTY level sensor, the RESET momentary switch, one power relay coil and a relay pole (1R 5-8). The RESET switch serves to feed power to the relay, which energizes the contactor. When energized, the contactor feeds power back to the relay so the RESET switch may open up without cutting off power to the relay. If the freon pressure switch, the over-temperature switch or the level sensor trips, power to the loop is interrupted. The microprocessor senses this via the M1002 board. Provided the system has power, if the loop trips out, the controller drives the PUSH RESET error message. The loop must be reset when the fault condition is resolved.

The M1002 board also routes signals for the FILL TANK level sensor. If this sensor trips, the microprocessor drives the FILL TANK error message.

INSTALLATION

POWER CONNECTION

This chiller requires a 20 amp or larger circuit, 208/230 volt, 60 Hz, 3 phase and is equipped with a line cord and twist-lock L15-30P electrical plug.

PLUMBING INTERFACE CONNECTIONS

The chiller's 1" female pipe thread (FPT) fitting labeled "TANK OUT" must be plumbed to the inlet of the device to be cooled. The outlet of the device to be cooled must be plumbed to the chiller's 1" FPT fitting labeled "TANK IN". This system is equipped with a ½" FPT fitting labeled "DRAIN". It may be desirable to install a valve at this location prior to the initial filling of the reservoir, for the convenience of future draining procedures.

The condenser cooling water supply must be plumbed to the chiller's ½" FPT fitting labeled "CONDENSER IN". The chiller's ½" FPT fitting labeled "CONDENSER OUT" must be plumbed to either a drain or the return path of the condenser cooling water circuit. Verify that condenser cooling water into and out of the chiller is unobstructed. Obstructions may cause loss of cooling capacity and eventual overheating.

Both the recirculating loop and the condenser cooling water loop are under pressure when the system is operating. Check all fluid interface connections now to ensure against leaks.

CIRCUIT BREAKER

Set the circuit breaker mounted on the front of the system. Upon setting the circuit breaker, a message similar to the following appears on the 2 by 40-character main display:

```
Output   --- Warmup Delay ---   Local Set
 20.02°C                          20.0°C
```

This display indicates that the system's phase monitor circuit is checking for correct electrical power phase relationship. Should a live and ground line be reversed, the phase detector reads PHASE MISSING. Correct the error and the controller no longer indicates PHASE MISSING. If the display reads PHASE REVERSED, disconnect and switch two of the three phases.

WARNING

The system should be powered for a period of ½ hour before starting, to allow the crankcase heater to separate the refrigerant from the oil.

FILL RESERVOIR

To fill the system's reservoir, unscrew the fill plug on the top of the vertical stand-pipe for the tank and pour in the recirculating fluid. If the system is powered before the tank is filled, the "FILL TANK" error message is displayed at the main panel, the alarm LED is lighted and the audible alarm sounds. Filling the tank eliminates the alarms. Replace the plug.

PUSH RESET BUTTON

The Reset button, located below the main panel, must be pushed upon powering the system. This resets the power safety interlock loop, which protects the operator and electrical circuitry.

FRONT PANEL CONTROLS

All Mydax chillers are controlled by a microprocessor which is accessed via the system control panel. System controls are simple, yet powerful and in concert with built-in diagnostics and error messages, are exceptionally comprehensive.

POWER LED: Indicates unit is powered (the circuit breaker is set).

RESET: Must be pressed prior to system start-up to energize the interlock loop.

START: Starts compressor and pump and turns on LED's. Once the start-up routine is complete the display changes to the MAIN DISPLAY:

```
Output        --- MYDAX ---      Local Set
 20.02°C                            20.0°C
```

Shows the actual Output Temperature and Setpoint Temperature in °C. Also indicates that the local SET TEMPERATURE MODE can be enabled.

STOP: Stops both the compressor and pump and blanks the display.

MUTE ALARM: May be used to deactivate audible alarm for 10 minutes, leaving alarm LED on. Pressing the CLEAR key reactivates the alarm, which sounds until the fault condition is eliminated or the MUTE ALARM switch is depressed again. Pressing MUTE ALARM when no alarm is active causes the alarm to sound once and the TEST ALARM display to appear.

SET: Enables SET TEMPERATURE MODE. SET MODE is disabled from panel if an alarm is active or if the unit is in REMOTE. To set, depress:

- **SET:** "Set Mode" appears at the right of the display. Cursor flashes at "units" digit of the temperature display.
- **ARROWS KEYS:** Changes temperature setting in one degree increments unless "." (decimal) key is depressed.
- **"." (DECIMAL):** Moves cursor to the "tenths" digit of the temperature display and causes arrow keys to change setting in tenths of a degree.
- **KEYPAD:** Changes temperature setting by entering numbers directly.
- **CLEAR:** Erases an incorrect entry.
- **ENTER:** Selects temperature setting and deselects SET mode.

TEST: Initiates Test Mode. See description under DIAGNOSTIC DISPLAYS section of this manual.

ENTER: Enters temperature selections while in the SET mode.

CLEAR: Erases incorrect temperature selections; exits Test Mode; clears Mute Alarm selection.

MODE: Toggles between the RS-232C remote control mode and Local Set mode.

ARROW KEYS: Changes temperature setpoint by 0.1° or 1°C increments/decrements; toggles tank

temperature, setpoint temperature and evaporator data view modes for multiple channel systems.

"." (DECIMAL): Display shows model number and software revision date and copyright:

```
1M9W-S                  2001.01.18
Copyright 2001 Mydax, Inc.
```

RUN PUMP: Inactive in this system.

X & Y: For future use.

Z: See Test Panel 9 in the Diagnostic Displays Section.

EMO SWITCH: This is a large red emergency off switch mounted on the left of the main panel. It shuts down the entire system, excluding the controller.

ERROR MESSAGES

A unique feature of Mydax systems is the error messages displayed on the 2 by 40-character liquid crystal display (LCD). The microprocessor constantly checks various points and parameters throughout the system and automatically displays messages when error conditions are sensed. Many displays are announced by an audible alarm and LED indicator. The error message persists until the fault condition is resolved, provided that the fault condition was not fatal, resulting in a system shutdown.

Condenser Hot Indicates high discharge pressure condition with temperature over +50°C. This is a warning message only. A separate mechanical overpressure switch, part of the safety interlock loop, shuts the system down in case of an overpressure condition. The purpose of this message is to allow maintenance workers to correct the problem at an early stage. (Caused by a clogged filter, low or warm condenser cooling water flow or condenser scale build-up.)

Fill Tank Indicates low tank liquid level.

Tank Too Hot Indicates that the reservoir temperature is more than 10°C above the highest allowable set point. Microprocessor shuts down the system.

Push Reset Indicates that the reset button has not been pushed since the last system power-up or that the system interlock loop has a fault condition.

A series-wired safety interlock loop protects all Mydax systems, disconnecting AC power from nearly all circuitry. The loop consists of the freon pressure switch, tank "hot" sensor and low level switch. If any link in the loop is opened, the "Push Reset" error message is displayed. Once the fault is corrected, the Reset button must be used to re-establish loop integrity. The reset button must also be pushed at system power up.

Phase Missing Indicates that one or more electrical phases are missing.

Phase Reversed Indicates that electrical phases are incorrectly connected. Reverse any two legs.

Low AC Line Indicates a low voltage condition exists on the input AC line.

Open RTD Indicates that an RTD connected to the M1002 Input Board has failed and that the system has shut down to prevent damage due to lack of data. The RTD at fault may be located by accessing Test Panel #8. The RTD must be replaced for the system to operate again.

DIAGNOSTIC DISPLAYS

Mydax chillers are provided with a computerized self-diagnostic capability. This system is equipped with 9 different test panels, which are accessed by pressing the TEST key, followed by the test panel number. Diagnostic mode is terminated by pressing the CLEAR key, and results in a display similar to that below:

MAIN DISPLAY

```
Output       --- MYDAX ---       Local Set
20.02°C                            20.0°C
```

Diagnostic messages are displayed on the main 2 by 40-character LCD. Display #5 automatically appears when the TEST key is first depressed. Once in diagnostic mode, other displays can be selected by depressing number keys 1 through 9. The following describes each of the test displays:

TEST PANEL #1:

```
Valve      7                       Htr  8
Avg Valve  5                       Htr  6
```

Numbers represent the drive signals for the evaporator valve and tank heater. The range is 0 (minimum) to 20 (maximum drive). Each digit represents 5% of the available 24VDC drive voltage. Avg Valve shows a 32 second running average of the valve's drive, displayed above it.

TEST PANEL #2:

```
  4.0   -4.8   48.2                      35.0
Limit   Suct   Psig   Sup.Ht   SHavg   Condr
```

This display shows the refrigerant circuit RTD temperatures in °C. The display reads:

Limit = Max Evaporator Temp Suct = Suction Temp Psig = Suction Pressure
Sup.Ht = Superheat Temp SHavg = Avg Super Ht Temp Cond = Condenser Temp

The condenser reading is a direct indicator of condenser temperature and pressure. The microprocessor sends the CONDENSER HOT error message if the condenser temperature exceeds +54°C.

TEST PANEL #3:

```
302B 0000 091F  Z  0.00 G 51.95     14.4
SS-1 SS-2 SS-3    RTD Reference   SH Avg
```

The first 3 sets of 4-digit numbers are hexadecimal. They represent correction values for the slow gain servos for up to 3 reservoirs. The function of this servo is to dynamically adjust the main temperature control servo to near zero error and thereby maintain temperature stability.

The first 2 digits in each set of 4 show the gain offset. Each increment equals 0.05°C, so 14 Hex = 20 decimal = 1.0°C. This value is internally subtracted from the operator-entered temperature setpoint if the actual temperature is above the setpoint, thus reducing the coolant temperature. When the actual coolant temperature is below setpoint, the main servo is driving a heater and no adjustment is made to the setpoint. The setpoint offset is continuously monitored by the controller and adjusted according to current conditions.

The second 2 digits in each set of 4 show the time prescaler. This is a counter which increments or decrements once a second and times the next update of the setpoint offset. A typical value is 20 seconds per offset change. When the count reaches "00", the offset may or may not be changed and the count resets to "0A" Hex (10 decimal). Together these numbers show that the controller is internally changing the control setpoint to maintain temperature stability, and give the magnitude and timing of the change.

The center of the display shows readings for the RTD "Zero" and "Gain" calibration resistors. Precision resistors 100Ω and 120Ω (0.1% tolerance or better, representing ideal nominal RTD's) are used as a reference. Typical readings are shown.

TEST PANEL #4:

```
-5.294  -1.292  -1.308  +26.46  0   255
 Ext 1   Ext 2   Ext 3   VAC       Secs
```

This display shows auxiliary voltmeter readings of Ext 1, Ext 2 and Ext 3. These are not used in this system. VAC is the 24 VAC internal control voltage; a typical value is in the range of 22 to 28. To the right of this value is a 0. At the far right of this display is a time indicator in seconds. The timer stops at 255 seconds and is used internally for turn on routine procedures.

TEST PANEL #5:

```
 20.00   20.0     0.0
  Tank    Set    DgMin
```

This diagnostic shows the **Output** RTD (coolant) temperature in °C, the Output Setpoint temperature and Output temperature slope. Slope is a measure of the direction and amount of the output temperature change per 60 seconds.

TEST PANEL #6:

```
19.80  19.79  20.00  20.02
```

This diagnostic shows the Tank temperature with resolutions of 0.05°C and 0.01°C, and the Output temperature with resolutions of 0.05°C and 0.01°C.

TEST PANEL #7:

```
+ 0.000  + 0.000  + 0.000   R22  6.00  0
- 0.000  - 0.000  - 0.000        Bat. OK
```

This display shows voltmeter readings for up to 3 optional water resistivity monitor interface raw data outputs. Each resistance monitor channel has a positive and a negative voltage reading. These readings are approximately equal, but are of opposite polarity.

The refrigerant type that the control system is calibrated for is shown. For example: **R22**

The two numbers at the top, far right-hand side of this display represent the internally computed maximum evaporator temperature and a counter ranging from 0 to 99, which are used to adjust the valve drives and regulate the superheat temperature.

The second line of the right side of this display indicates the status of the lithium battery, mounted on the M1001 circuit board, used to run the system's elapsed run-time clock depicted in Test Panel 8 and the run/event recorder depicted in Test Panel 9. A "Bat. OK" message indicates that the battery is operational, while a "No Bat." message indicates that the battery is dead and should be replaced.

TEST PANEL #8:

```
Alarms:   Fill Tank !
               KEY      Run 356d 11:31:25
```

The top left side of this display shows the alarm (error message) history. If there have been no alarms since the

last history reset, the display reads "No Alarms". If alarms have occurred, the display shows them in sequence, like the main display. The history can be cleared 3 ways:

1. Power Off/On
2. Press START Key when unit is stopped
3. Press 0 Key when viewing Test Panel 8

The second line of the display can be read when the chiller is stopped. It indicates the reason that the chiller was last stopped: KEY, FATAL, RS232 or EXT. The right side of the second line indicates the elapsed run time on the system in days (from 0 to 9999), hours, minutes and seconds. This system is equipped with a battery which, if operational, saves the elapsed run time value when the system is stopped and restarted. The elapsed run time is reset each time the system is restarted.

TEST PANEL #9:

```
T-  0: 0: 0  20.02  20.0  No Alarms.....
Tank 1   4Ev   0By  37Cd 13Sh 14SA   Gpm
```

This display provides run/event recorder data. The run/event recorder continuously records important information into a non-volatile memory while the system is operating. Data is stored at one-second intervals for the last 120 seconds of run time and it is also stored at two-minute intervals for the last 240 minutes of run time.

The first line of this display indicates the run time in hours, minutes and seconds prior to the last system shutdown, the output and setpoint temperatures of whichever recirculating channel was last selected at the Main Display and the system-wide alarm history. The second line indicates which recirculating channel was last selected at the Main Display, the evaporator, bypass, condenser and superheat RTD temperatures in °C, the average superheat temperature from Test Panel 3 and the flow rate. Both the evaporator temperature and the flow rate are specific to the recirculating channel being viewed. All freon circuit RTD temperatures are truncated to the nearest 1°C for this display.

After the system is stopped and Test Panel 9 is selected, the memory is displayed at the last or most recent second (T- 0: 0: 0). The downward arrow key can be used to decrement time into the past. There are 120 "1-second slots" and 120 "2-minute slots". If the downward arrow key is held down, the time slots decrement at the rate of two slots per second. The upward arrow key increments to more recent time slots. If the "Z" key is depressed, the display goes to the oldest 1-second slot (T- 0: 1:59 if the actual run time was of at least that duration). If the "9" key is depressed while viewing Test Panel 9, the display reverts back to "T- 0: 0: 0", the stop time.

The alarm messages are accurate for the slot that is current. If the display is on the minutes slot, then the alarms indicated are any which have occurred during that 2-minute interval. Alarm messages cycle or flash in an identical fashion to those appearing in either the Main Display or in Test Panel

SERVICE & WARRANTY

If a unit malfunctions, please contact the Mydax Service Department as soon as possible. Many small problems can lead to large problems if not dealt with immediately. Please have the serial number and model number on hand when calling.

Mydax Service Department: (530) 888-6662
FAX: (530) 888-0962

RETURN OF UNIT FOR SERVICE

Many problems may be repaired by field exchanges of a module, pump, controller, etc. If return is required, please obtain a return authorization number from the Mydax Service Department or the unit may not be accepted at our receiving dock.

Please refer to the shipping instructions which follow.

SERVICE OF REFRIGERATION UNIT

Nearly all repairs to the refrigeration unit involve brazing or silver soldering. This should only be done by a person trained in refrigeration service and familiar with the Mydax system.

NOTE: Before servicing any refrigeration unit involving brazing, remove all freon from the system. Evacuate to a 400 micron vacuum to remove freon residues, then open all service valves to dry air or dry nitrogen before use of a torch.

In particular, service of Mydax refrigeration circuits requires attention to the following:

1) Use caution to protect components from heat damage.

2) Prevent any moisture from entering the circuit, as Mydax proportional valves do not function with moisture present. Once moisture has entered the system it cannot be removed.

3) Remove insulation and instrumentation wiring or use heat shields to protect them from torch heat during work.

4) Before recharging the circuit, evacuate it to 200 microns at a minimum room temperature of 75°F for three hours.

ONE YEAR WARRANTY

Mydax, Inc. warrants that its temperature control system, and the component parts thereof, will be free from defects in workmanship and materials for a period of one year from the date of delivery. In the event that warranty service is required, the customer is requested to send the equipment freight prepaid to the factory for service. Mydax will then perform the appropriate service and will return the equipment freight prepaid.

If field service is required during the warranty period, the customer will be responsible for all travel expenses including mileage. The customer will not be invoiced for any warranty service performed, with regard to either labor or materials, during a field service visit.

RESHIPPING & LONG-TERM STORAGE PREPARATION

Reshipped systems should be protected from freezing temperatures in shipment or serious damage may occur. Freezing temperatures can be encountered in air and over-mountain surface shipments in any month of the year. In-transit freeze-up can occur in the recirculating coolant loop and in a water-cooled condenser's cooling loop. To protect against freezing, all water must be removed from these circuits, or ethylene glycol must be added.

This system has a **water-cooled** refrigeration condenser. The following instructions apply to shipment or storage preparation:

1. Feed in a charge of water-glycol mix into the condenser through the "Condenser In" connection. This can be done by pump or gravity flow.

2. Feed water-glycol until mixture is visibly flowing out of the "Condenser Out" connection.

3. Plug the "Condenser In" and "Condenser Out" fittings to avoid leakage in shipment.

4. Since the system has been run with water, remove it from the reservoir via the "Drain" fitting. As much water as possible should be drained from the system before shipment. Water adds significant shipping weight and may damage electrical parts if it sloshes out of the tank.

5. Continue to remove as much water as possible with a wet/dry vacuum to prevent ice-up in the small "nooks & crannies" of the plumbing.

6. Plug the "Tank In", "Tank Out" and "Drain fittings.

Call Mydax for any help
needed at (530) 888-6662

-Appendix A -
RS-232 Serial Interface Operation

RS-232C INTERFACING

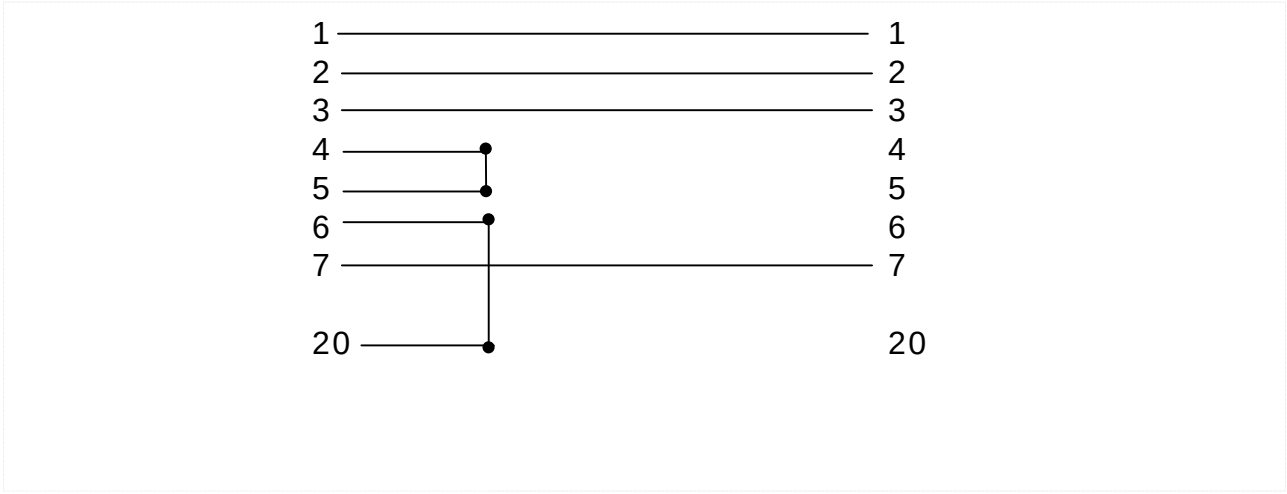
The use of an embedded microprocessor allows Mydax to offer an RS-232C (remote) interfacing capability. Mydax systems can be controlled from a computer with either the *MYDAX REMOTE* Window's ™ software package or any control software of the user's choice. Full control and monitoring is possible, allowing complete system operation from any convenient location.

Cable connection is via a rear panel DB-25S connector. Connector pin-out is as follows:

Pin 1	Shield
Pin 2	Transmit Data
Pin 3	Receive Data
Pin 7	Common

A typical interconnect cable for an IBM-PC COM port should be wired as follows:

IBM-PC	MYDAX
DB-25S Female Connector	DB-25P Male Connector



RS-232C COMMANDS

The following ASCII commands can be transmitted to the system MPU via the RS-232C link:

RO Enables RS-232C control.

RF Disables RS-232C control. With remote disabled, system only responds to RO.

GO Starts the compressor and pump.
HA Stops the compressor and pump.

RP Run Pump only, active only on selected systems.

S?xy.z Sets fluid temperature (x, y and z are any numbers) of tank A, B or C. Settings outside the range default to the nearest limit. Entering a decimal point is optional, as the last digit is assumed to be the tenths digit. For example: "SA180" selects +18.0°C for tank A, "SA245", "SA24.5" & "SA+24.5" all select +24.5°C for tank A, "SA93.2" selects +30.0°C for tank A.

TE1 Sends a transmission of abbreviated status including system on/off status, actual tank temperature and the set point temperature.

TE2 Causes transmission of flow and resistance, if the options exist. For example:

TE3 Transmits the contents of the 2 by 40-character main display over the RS-232 line.

TE4 Same output as TE1 plus RTD temperatures and valve & heater drive signals.

TR or **TR0** Turns off repeat transmission mode.

TRx Enables automatic periodic repeat transmission (x= 1-60 and represents the number of seconds between transmissions). The instructions which follow the **TRx** command are repeated at the transmission rate that was set by the **TRx** command. **TE1**, **TE2**, **TE3** and **TE4** are commands that can be repeated in all or any combination.

TPx Changes the 2 by 40-character display at the main control panel to Test Panel "x" "0" = normal main display; "1" - "8" = diagnostic displays. See section on DIAGNOSTIC DISPLAYS. Does NOT cause transmission of the display over the RS-232C line (see command **TE3**)

ID Causes transmission of the model number and software revision date. For example:

"ID: 1VLH14W 1-24-2000"

AL Causes transmission of the alarm status. For example:

"ALARM: 0" denotes no alarm condition.

AH Causes transmission of the alarm history status. For example:
"ALHIS: 13" denotes one alarm.

This history is the same as the Test 8 display. The history represents all alarms that have occurred since the last "Start" command.

CH Clears alarm history. This can also be cleared with the "Start" key or with the "0" key when viewing Test Panel 8.

A delimiter between command strings can be a carriage return (CR), a semi-colon (;) or a comma (,). If a command is understood, a (>) is returned for acknowledgment. If a command is not understood or ignored then a (?) is returned.

RS-232C STATUS MESSAGES

TE1 status messages include the following:

ON 19.95 20.0 (CR)(LF)
A B C

Key: A) System is ON or OFF
B) Actual Tank Temperature in °C
C) Set point Temperature in °C

A TE4 status message consists of TE1/TE3 data plus RTD temperatures and valve & heater drives:

ON 19.9 20 -63 -8 41.5 34.5 102 0 2 2 0 4 10 8 2 11 (CR)(LF)
A B C D E F G H I J K L M N O P Q

An alarm status message is transmitted whenever there is an alarm that occurs for the first time and whenever the alarm status changes:

ALARM: 4 13 (CR)(LF)
R S T

A halt indication is transmitted when the system is stopped for any reason:

STOP: KEY (CR)(LF)
U V

Key: A) System is ON or OFF

B) Actual Tank Temperature in °C, as sensed by the Output RTD

C) Set point Temperature in °C

D) Calculated temperature in °C of the refrigerant line at the suction pressure transducer

E) Pressure in PSIg of the refrigerant line at the suction pressure transducer

F & G) Temperature in °C in the refrigerant line at the Superheat and Condenser RTDs

H) Temperature in °C in the refrigerant line at the Discharge RTD (2-stage design only)

I) Temperature in °C in the refrigerant line at the Subcooler RTD (inactive)

J & K) Valve drives of evaporator valves 1 and 2; valve 2 is inactive in single channel systems (See "DIAGNOSTIC DISPLAYS, Test Panel 1" for explanation of drive signals.)

L, M & N) Bypass, Superheat, and Desuperheat valve drives. Desuperheat is not available in all designs.

O & P) Heater drive signals; Heater 2 is inactive in single channel systems (See "DIAGNOSTIC DISPLAYS, Test Panel 1" for explanation of drive signals.)

Q) Flow rate in gallons-per-minute(GPM) of recirculation fluid. On systems without a flow meter, this number has no meaning.

R) Any active alarms, by code # (See the next section for a description of alarm codes.)

S & T) Actual code # for the alarm

U) Stop is displayed whenever the system is halted

V) Indicates the origin of the Stop Command (status message "S") whether it is from the system front panel (**KEY**), the external stop line (**EXT.)**, an RS-232C command (**RS232**) or it originated from a fatal alarm (**FATAL**).

RS-232C ALARM CODES

The following alarm codes may be transmitted in an **AL** or **AH** status message. Not all of these codes are possible in every system:

1 **CONDENSER HOT**: The reading from the condenser RTD indicates a temperature in excess of +50°C. The system microprocessor incrementally reduces the evaporator valve drive to reduce the flow of refrigerant into the evaporator. This effectively reduces the heat-rejecting capacity of the system, which keeps the temperature in the condenser at acceptable levels.

2 **LOW FREON:** Indicates pressure of refrigerant is low. Have unit serviced by Mydax or a qualified service center.

3 **RTD OPEN**: Indicates that one of the system RTD's has failed and the system has shut down to protect itself. The main display shows which RTD is faulty by giving its pin number location on the M1002 or M1005 circuit board.

4 **PUSH RESET**: The interlock loop has been broken and the reset switch must be depressed to re-establish it.

5 **FILL TANK #1**: The tank 1 low level sensor has tripped. If coolant is not added "soon", the "empty" sensor trips and the system shuts down.

6 Inactive in this system.

7 **FILL TANK #2**: The tank 2 low level sensor has tripped. If coolant is not added "soon", the "empty" sensor trips and the system shuts down.

8 **LOW FLOW**: Indicates that a low flow condition exists in one of the recirculating channels.

9 Inactive.

10 **PHASE MISSING**: Indicates one or two of the three electrical power phases is missing. Inactive on single-phase units.

11 **PHASE REVERSED**: Indicates incorrect electrical power phase relationship. May be corrected by reversing any 2 phases. Inactive on single-phase units.

12 Inactive in this system.

13 **LOW AC LINE**: Indicates a low voltage condition exists on the input AC line.

14 **RESISTANCE LOW**: Indicates that the deionized water resistivity has dropped below the programmed limit.

15 **TANKx TOO HOT / EXTREME TEMP**: Indicates that the tank temperature is either more than +10.0°C above its upper maximum set point, or too close to freezing and that the system has shut down.

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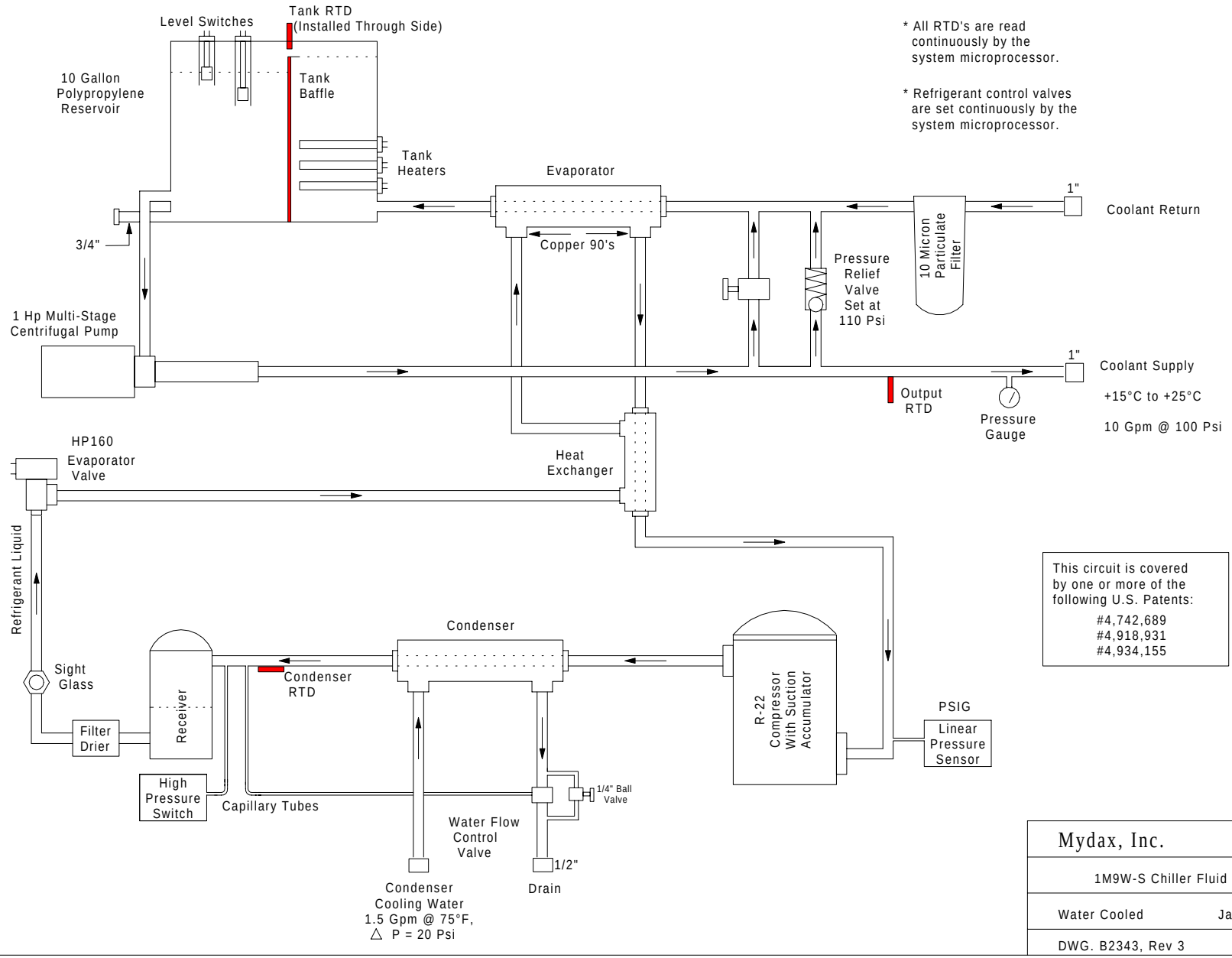
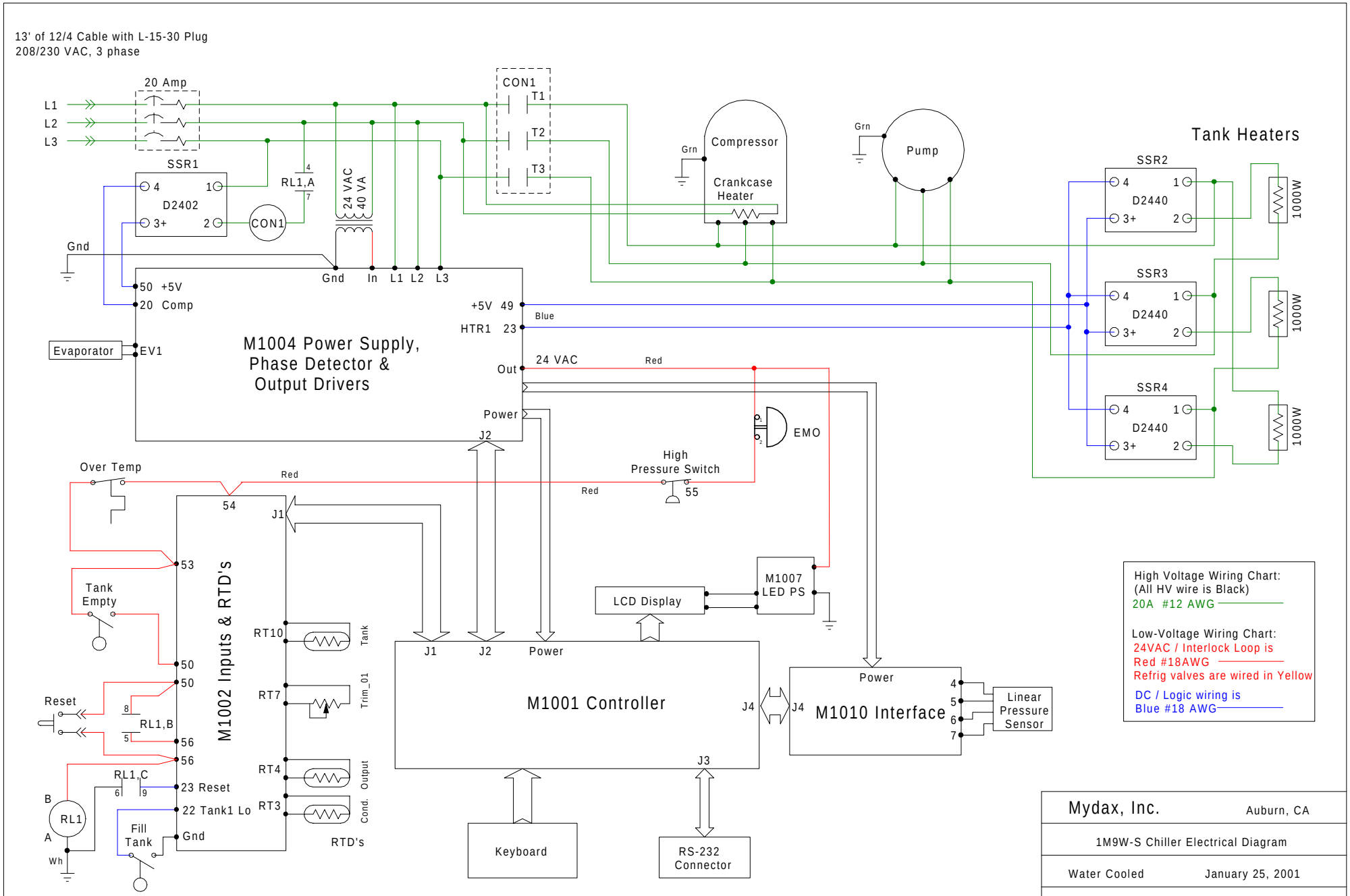
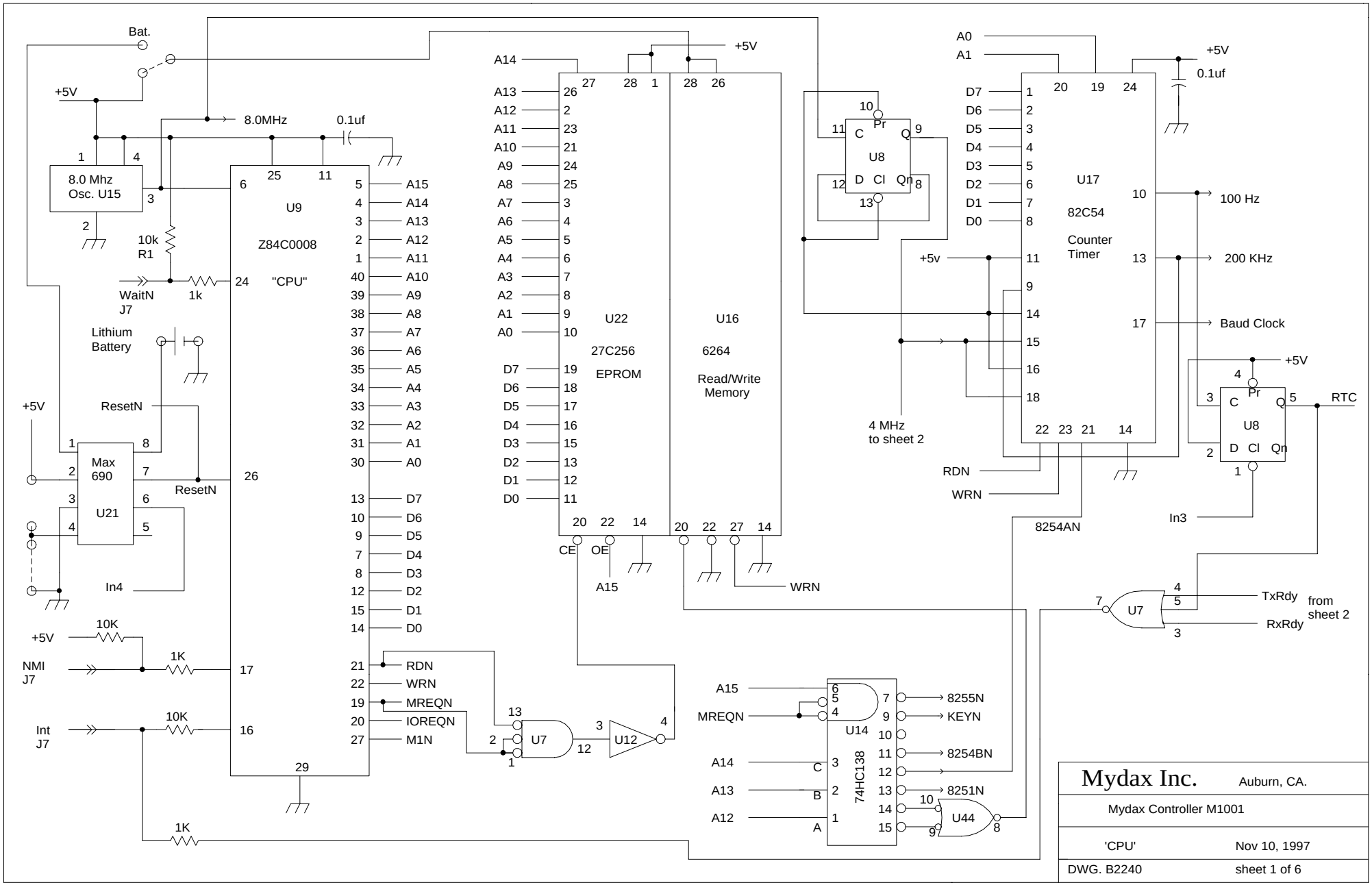
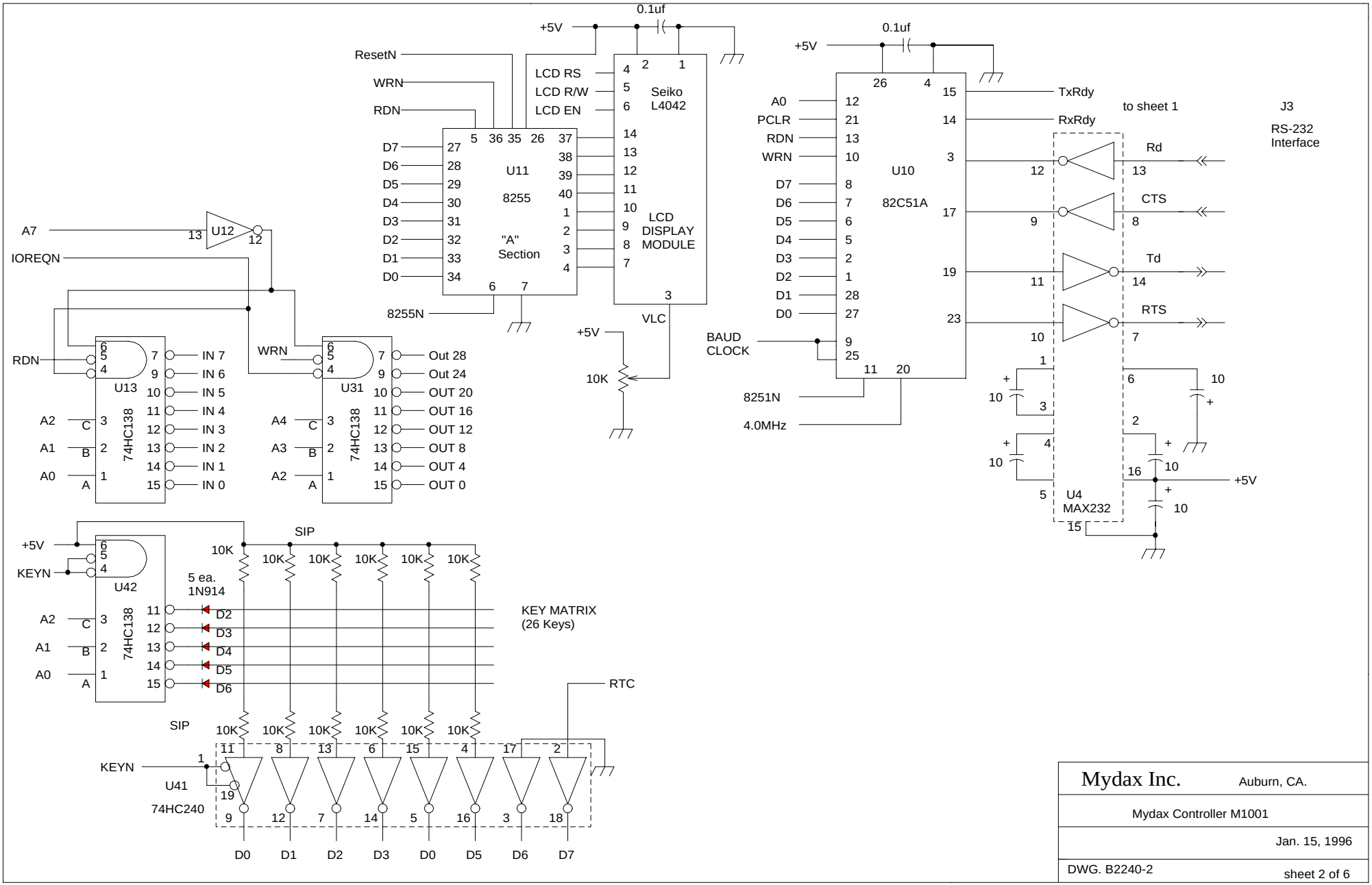

Level Switches
Tank RTD
(Installed Through Side)
10 Gallon
Polypropylene
Reservoir
Tank
Baffle
Tank
Heaters
Evaporator
* All RTD's are read continuously by the system microprocessor.
* Refrigerant control valves are set continuously by the system microprocessor.
1"
Coolant Return
3/4"
Copper 90's
Pressure
Relief
Valve
Set at
110 Psi
10 Micron
Particulate
Filter
1 Hp Multi-Stage
Centrifugal Pump
1"
Coolant Supply
+15°C to +25°C
10 Gpm @ 100 Psi
Output
RTD
Pressure
Gauge
HP160
Evaporator
Valve
Heat
Exchanger
Refrigerant Liquid
Sight
Glass
Condenser
Condenser
RTD
Receiver
Filter
Drier
High
Pressure
Switch
Capillary Tubes
R-22
Compressor
With Suction
Accumulator
PSIG
Linear
Pressure
Sensor
1/4" Ball
Valve
Water Flow
Control
Valve
1/2"
Drain
Condenser
Cooling Water
1.5 Gpm @ 75°F,
△ P = 20 Psi
This circuit is covered by one or more of the following U.S. Patents:
#4,742,689
#4,918,931
#4,934,155
Mydax, Inc.
Auburn, CA
1M9W-S Chiller Fluid Schematic
Water Cooled
January 25, 2001
DWG. B2343, Rev 3
sheet 1 of 1

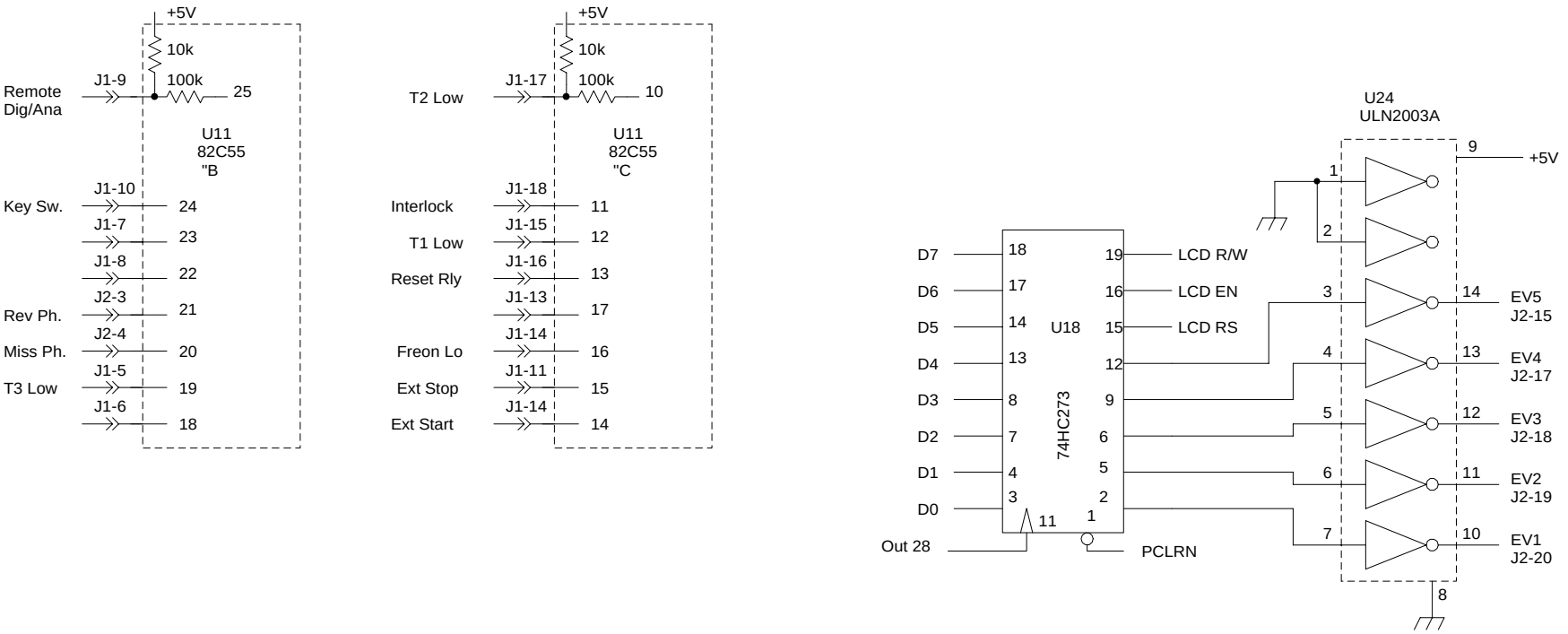


13' of 12/4 Cable with L-15-30 Plug

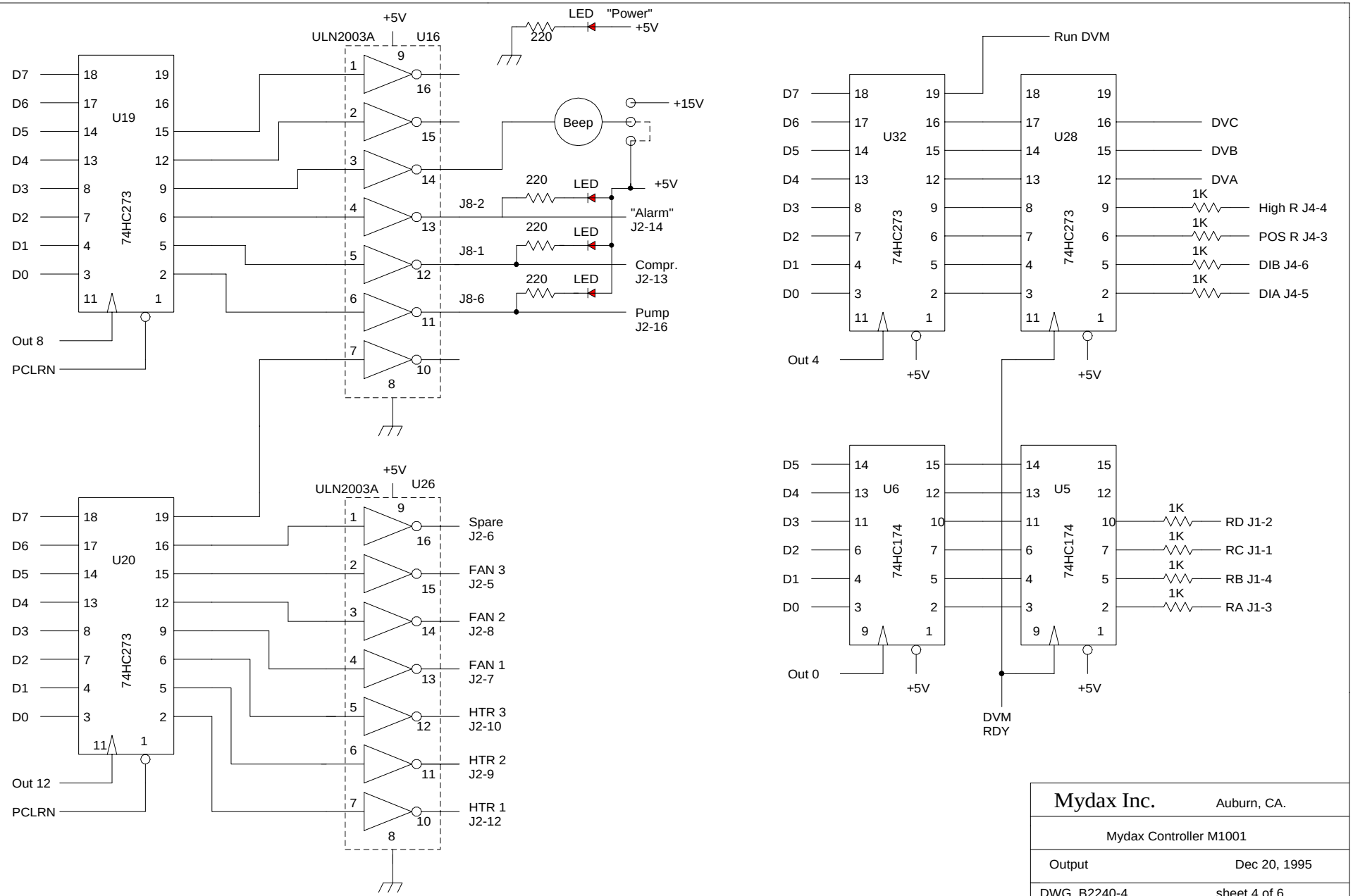

Bat.
+5V
8.0MHz
0.1uf
8.0 Mhz
Osc. U15
10k
R1
WaitN
J7
1k
U9
Z84C0008
"CPU"
Lithium
Battery
ResetN
Max
690
U21
In4
10K
NMI
J7
Int
J7
A14
A13
A12
A11
A10
A9
A8
A7
A6
A5
A4
A3
A2
A1
A0
D7
D6
D5
D4
D3
D2
D1
D0
U22
27C256
EPROM
U16
6264
Read/Write
Memory
CE
OE
A15
WRN
RDN
MREQN
IOREQN
M1N
U7
U12
U8
U14
74HC138
8255N
KEYN
8254BN
8251N
U44
A0
A1
D7
D6
D5
D4
D3
D2
D1
D0
U17
82C54
Counter
Timer
0.1uf
100 Hz
200 KHz
Baud Clock
4 MHz
to sheet 2
RDN
WRN
8254AN
In3
RTC
TxRdy
RxRdy
from
sheet 2
Mydax Inc.
Auburn, CA.
Mydax Controller M1001
'CPU'
Nov 10, 1997
DWG. B2240
sheet 1 of 6



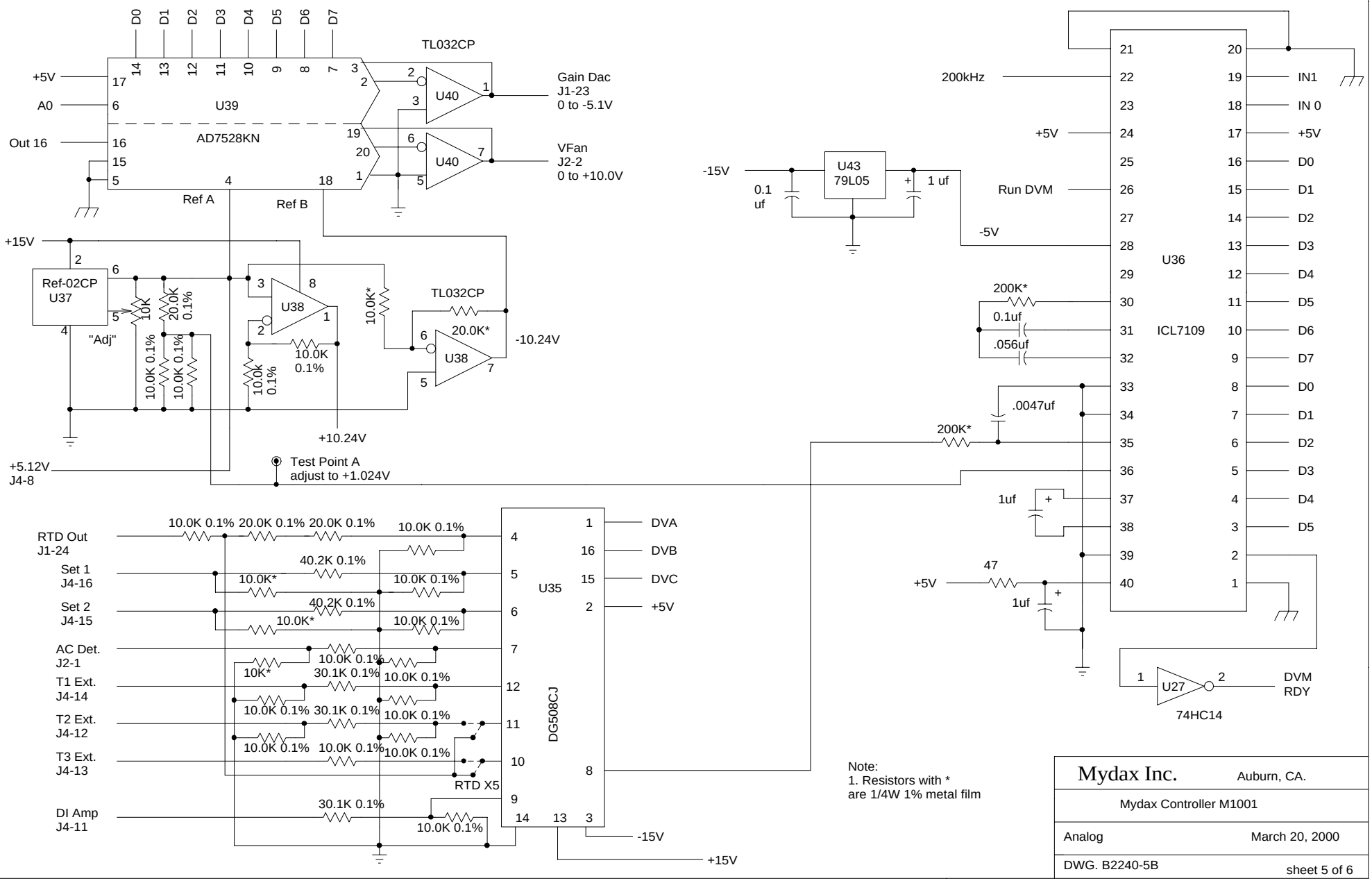
Mydax Inc.	Auburn, CA.
Mydax Controller M1001	
	Jan. 15, 1996
DWG. B2240-2	sheet 2 of 6



Mydax Inc.	Auburn, CA.
Mydax Controller M1001	
Input-Output	April 24, 1996
DWG. B2240-3	sheet 3 of 6

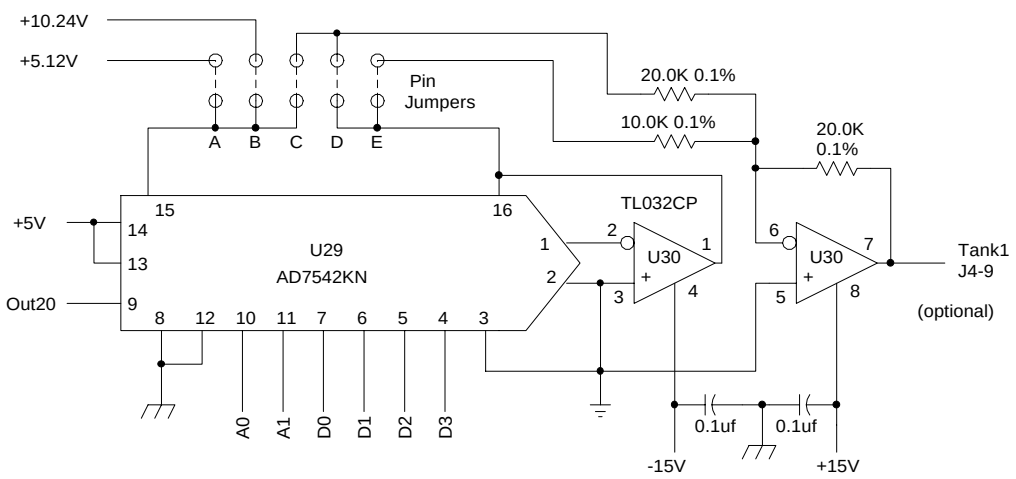


Mydax Inc.	Auburn, CA.
Mydax Controller M1001	
Output	Dec 20, 1995
DWG. B2240-4	sheet 4 of 6

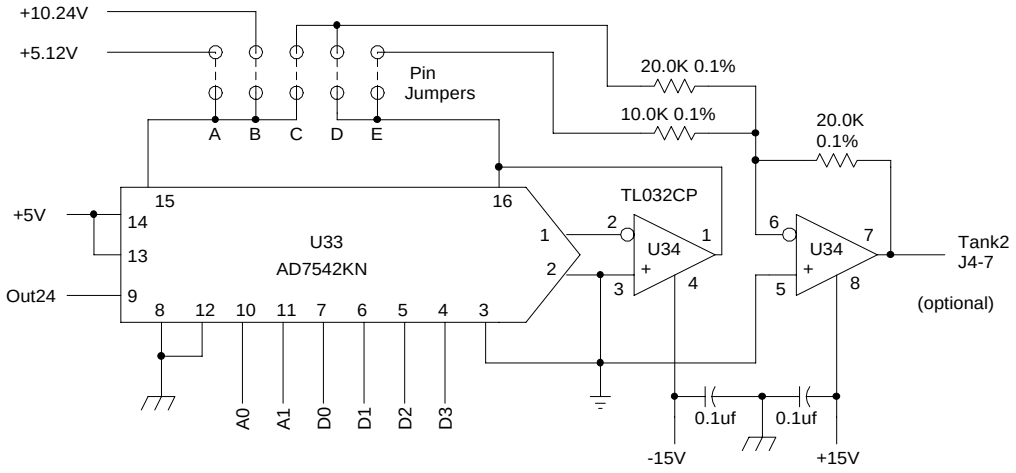


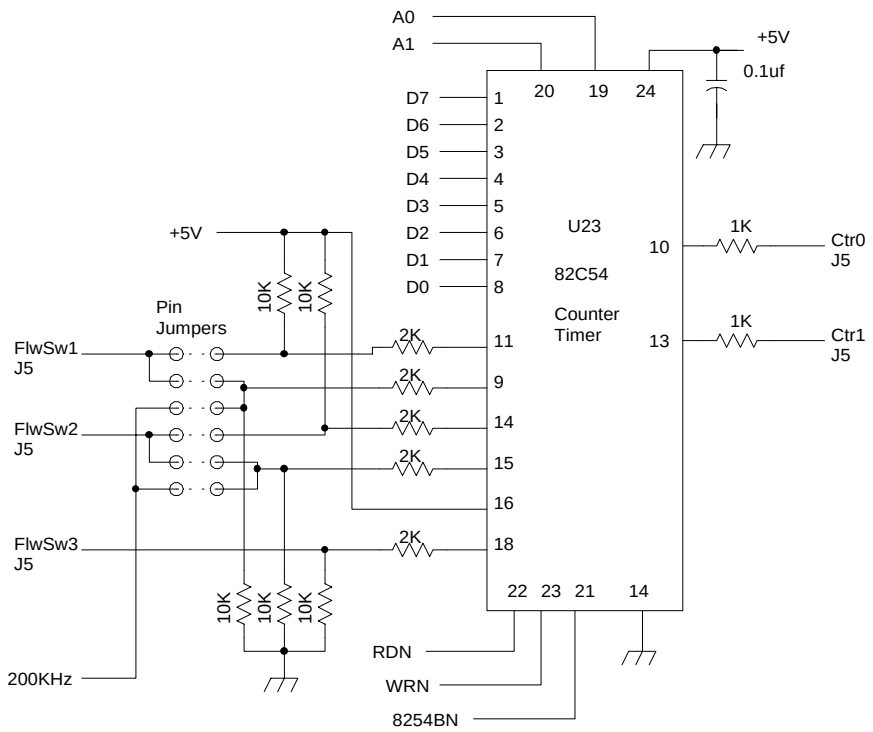
Note:
1. Resistors with * are 1/4W 1% metal film

Mydax Inc.	Auburn, CA.
Mydax Controller M1001	
Analog	March 20, 2000
DWG. B2240-5B	sheet 5 of 6

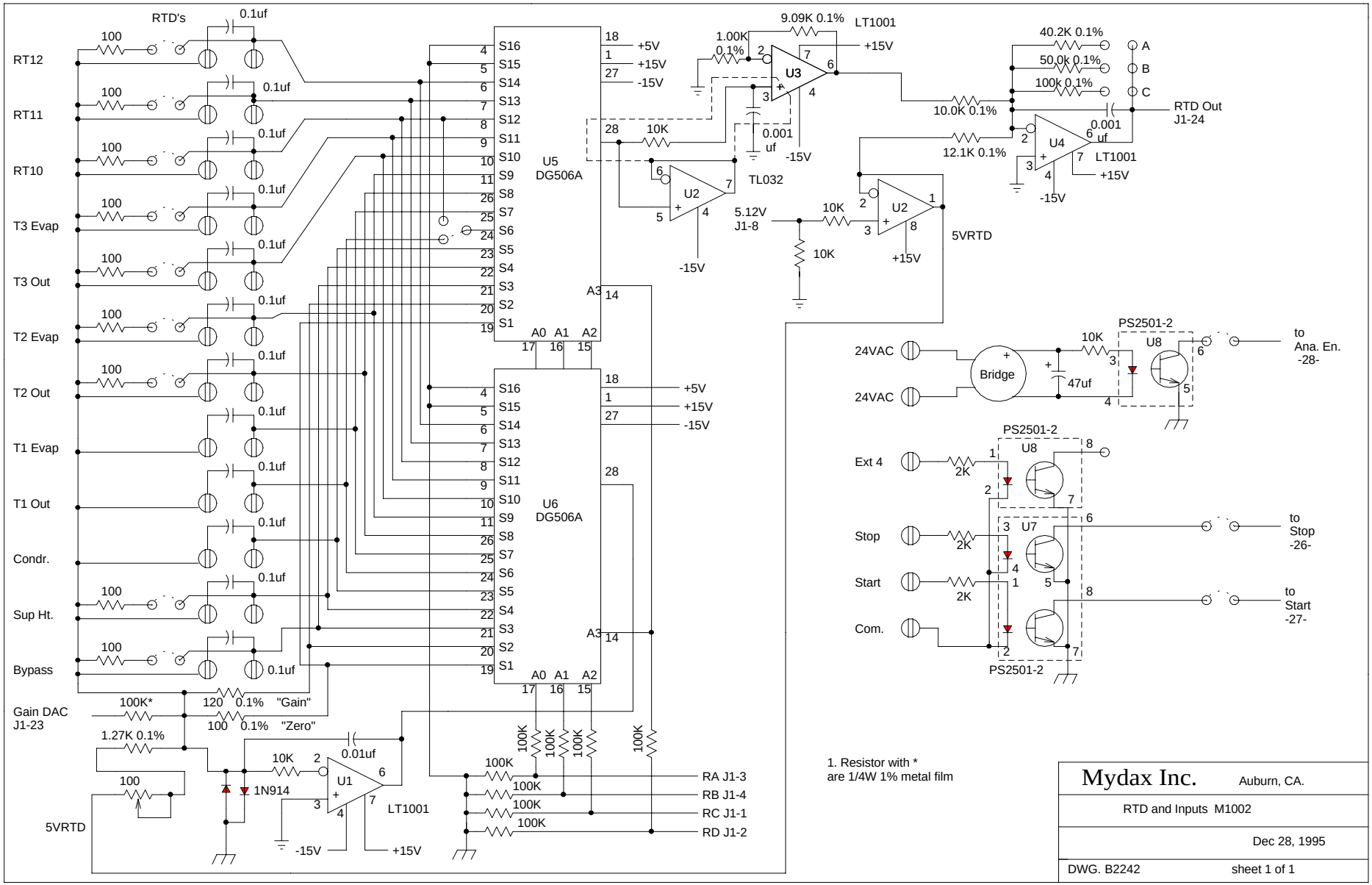


Range	A	B	C	D	E
+5.12V	on	-	-	on	-
+10.24V	-	on	-	on	-
+-5.12V	on	-	on	-	on
+-10.24V	-	on	on	-	on



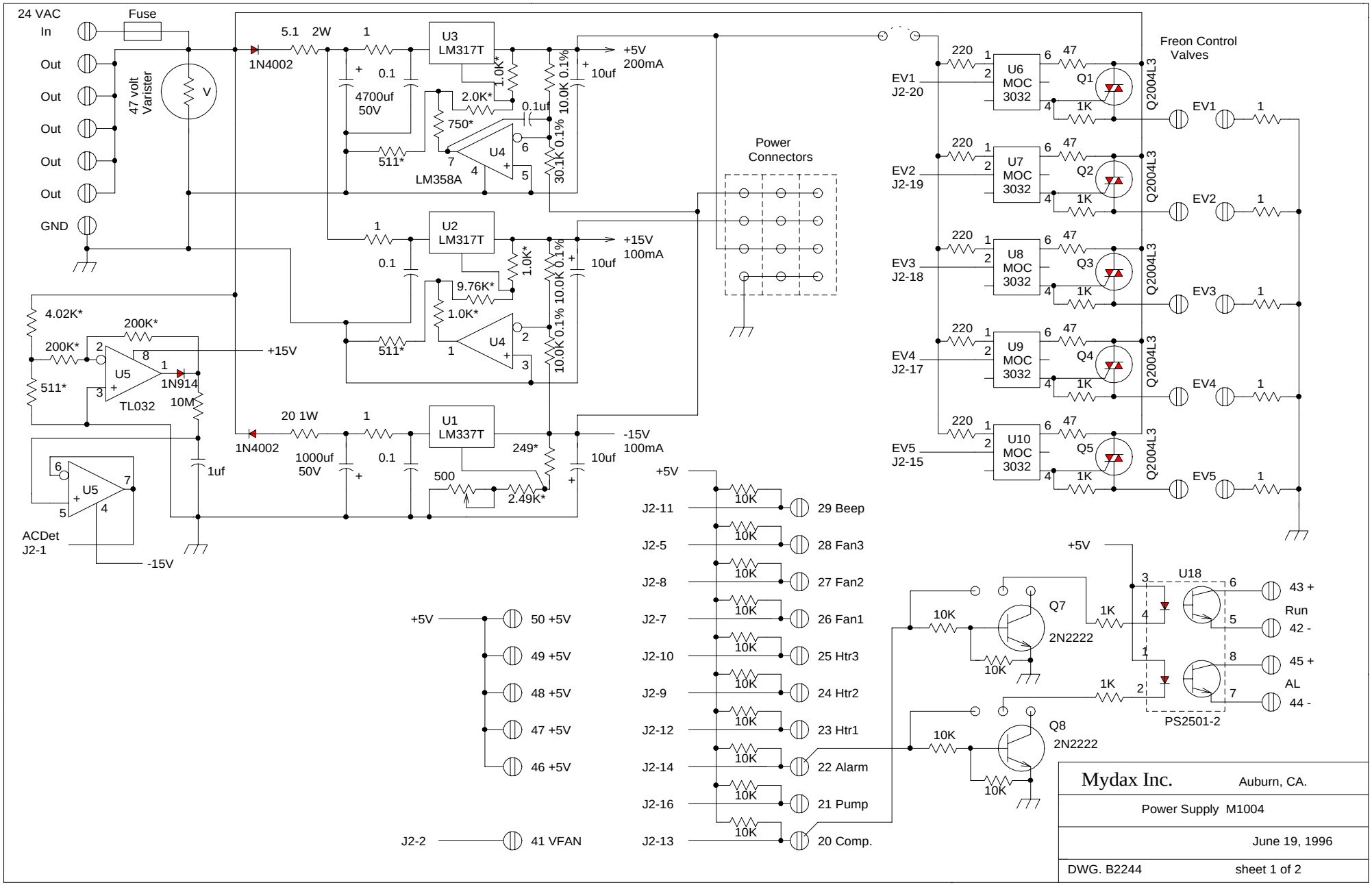


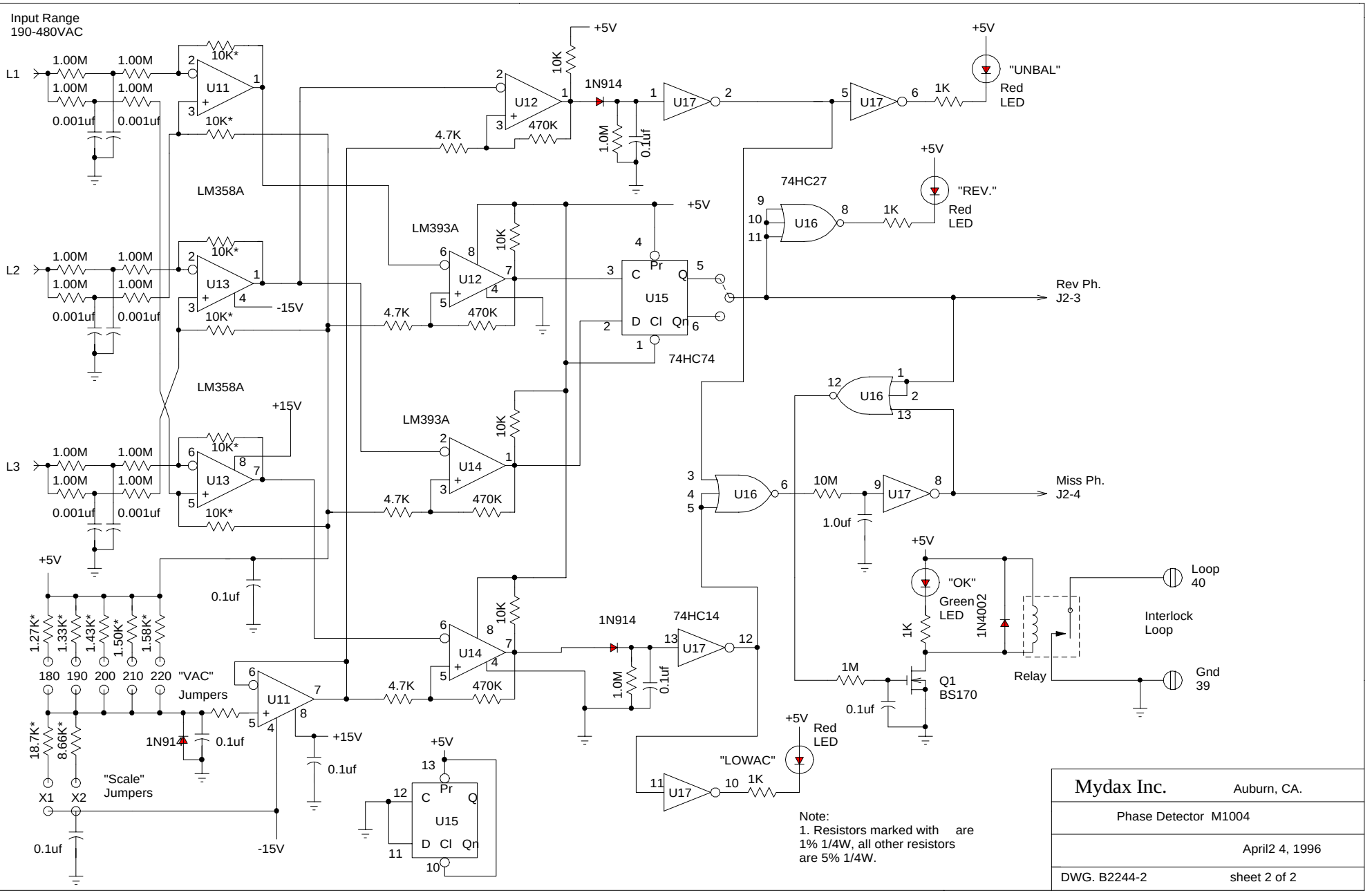
Mydax Inc.	Auburn, CA.
Mydax Controller M1001	
Optional	Jan. 15, 1996
DWG. B2240-6	sheet 6 of 6

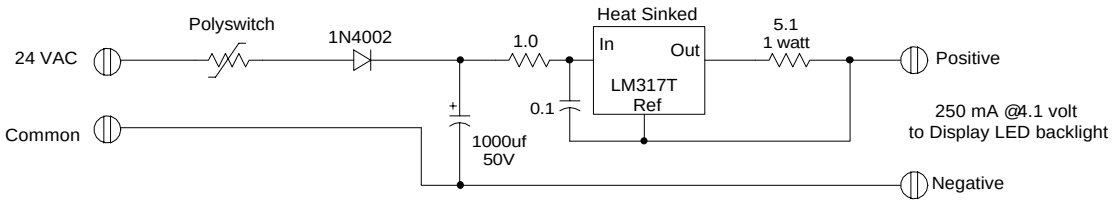


1. Resistor with * are 1/4W 1% metal film

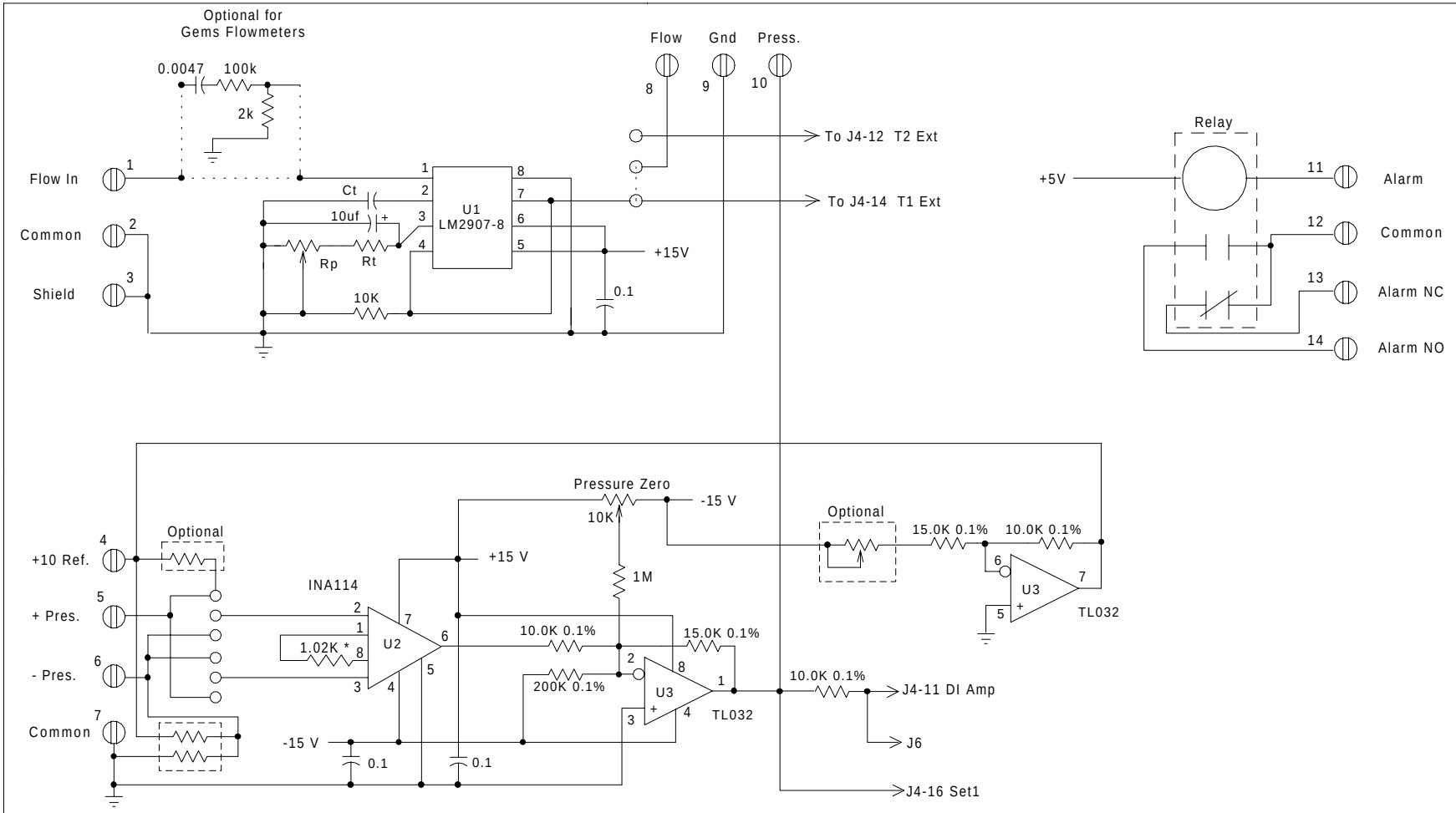
Mydax Inc.	Auburn, CA.
RTD and Inputs M1002	
	Dec 28, 1995
DWG. B2242	sheet 1 of 1


24 VAC
In
Out
Out
Out
Out
Out
GND
Fuse
47 volt
Varister
V
1N4002
5.1 2W
1
0.1
4700uf
50V
U3
LM317T
+5V
200mA
10uf
1.0K*
2.0K*
0.1uf
750*
511*
U4
LM358A
30.1K 0.1%
10.0K 0.1%
U2
LM317T
+15V
100mA
9.76K*
1.0K*
4.02K*
200K*
200K*
U5
TL032
1N914
511*
10M
1uf
20 1W
1N4002
1000uf
50V
U1
LM337T
-15V
100mA
249*
500
2.49K*
ACDet
J2-1
-15V
Power
Connectors
Freon Control
Valves
EV1
J2-20
EV2
J2-19
EV3
J2-18
EV4
J2-17
EV5
J2-15
220
U6
MOC
3032
U7
MOC
3032
U8
MOC
3032
U9
MOC
3032
U10
MOC
3032
47
Q1
Q2
Q3
Q4
Q5
Q2004L3
1K
+5V
J2-11
J2-5
J2-8
J2-7
J2-10
J2-9
J2-12
J2-14
J2-16
J2-13
10K
29 Beep
28 Fan3
27 Fan2
26 Fan1
25 Htr3
24 Htr2
23 Htr1
22 Alarm
21 Pump
20 Comp.
+5V
50 +5V
49 +5V
48 +5V
47 +5V
46 +5V
J2-2
41 VFAN
Q7
2N2222
Q8
2N2222
U18
PS2501-2
43 +
Run
42 -
45 +
AL
44 -
Mydax Inc.
Auburn, CA.
Power Supply M1004
June 19, 1996
DWG. B2244
sheet 1 of 2


Input Range
190-480VAC
L1
L2
L3
1.00M
0.001uf
10K*
U11
U12
U13
U14
LM358A
LM393A
4.7K
470K
10K
+5V
+15V
-15V
1N914
1.0M
0.1uf
U15
74HC74
74HC27
74HC14
U16
U17
"UNBAL"
Red
LED
"REV."
"LOWAC"
Rev Ph.
J2-3
Miss Ph.
J2-4
10M
1.0uf
"OK"
Green
LED
1N4002
Loop
40
Interlock
Loop
Relay
Gnd
39
Q1
BS170
1M
1K
1.27K*
1.33K*
1.43K*
1.50K*
1.58K*
180 190 200 210 220 "VAC"
Jumpers
18.7K*
8.66K*
"Scale"
Jumpers
X1 X2
0.1uf
Note:
1. Resistors marked with are
1% 1/4W, all other resistors
are 5% 1/4W.
Mydax Inc.
Auburn, CA.
Phase Detector M1004
April2 4, 1996
DWG. B2244-2
sheet 2 of 2



Mydax Inc.	Auburn, CA.
M1007 LED Power Supply	
	Sept 24, 1997
DWG. D2729	sheet 1 of 1



Note:
1. Resistors with *
are 1/4W 1% metal film.

2. For Proteus 500C-high
Ct=0.0047uf, Rt=69.8K*
Rp=50K, 100Hz=0.714V

3. For Proteus 550C
Ct=0.01uf, Rt=49.9K*
Rp=50K, 100Hz=0.97V

4. For Gems 1/2" Lo range,
Rp= 20k, Rt=30.1k, Ct= 0.01uf
100 Hz=0.595 V

Using Sensym STImV300G1A sensor:
0 psig= 1.125 volt, 300 psig= 8.625 volt

Using Sensym STImV300A1A sensor:
0 psia= 1.125 volt, 300 psia= 8.625 volt
Sea level mean pressure= 14.7 psia = 1.4925 volt

Mydax Inc.	Auburn, CA.
Interface M1010	
	Jan 25, 2000
DWG. D2616	sheet 1 of 1