Model 712 Burnoff Controller

Instruction Manual

Integrated Time Systems, Inc.

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1. DESCRIPTION

The Model 712 Burnoff Controller is a microprocessor based system designed to monitor and control the safe burnoff of flammable gases in an effluent process gas stream. In typical installations, a flexible stainless steel tube attaches to the process tube at the load end of a diffusion furnace via a silicone O-ring sealed compression connector. This tube ducts the flammable gases away from the process tube and into a burn box installed in the scavenger box wall. The flammable gases are mixed with air via a venturi and ignited by one of two silicon carbide heating elements within the burn box. A stainless steel sheathed thermocouple provides temperature feedback to the controller to insure safe operation of the system. Heater load current is monitored to determine the condition of the two heating elements providing automatic crossover should the primary heater fail.

The Model 712 Burnoff Controller contains all electronics in a standard ½ width instrument rack enclosure which permits easy access to all components. The controller permits either manual control or remote activation of the redundant heater elements and provides a variety of interlock signals for use by the host process sequencer or DDC[1] system.

1.1. Circuitry

The circuit design of the Model 712 is based on a CMOS, 8-bit microcontroller. Only the panel meter operates independently of the microcontroller (MCU).

1.1.1. Temperature Monitor

A special-purpose integrated circuit (IC) on the printed circuit board receives a voltage from the Type "K" thermocouple mounted in the burn box. The IC performs cold-junction compensation on the signal, linearizes it and amplifies it before presenting it to an analog comparator and to the panel meter circuit. The comparator outputs a digital signal which is then processed by a digital filter before being sent to the microcontroller as **"LO TEMP"**.

1.1.2. Pressure Monitor

A 0 to 5 volt analog signal from an optional pressure monitor is buffered and sent to two analog comparators and to the panel meter circuit. The comparators output digital signals which are then processed by digital filters before being sent to the microcontroller as **"LO PRESSURE"** and **"HI PRESSURE"**.

1.1.3. Heater Monitor

The current flowing through the active heater is monitored by a Hall-effect device with a predetermined threshold. The output signal is then processed by a digital filter before being sent to the microcontroller as **"HTR FAIL"**.

[1]DDC: Direct Digital Control system - Computer-controlled system which sequences gas valves, furnace temperature, boat loaders etc. in response to time-based recipes and external sensors.

1.1.4. Heater Control

Power for the two heater elements is controlled by the microcontroller via a mechanical relay and two solid state relays. The solid state relays provide electrically-quiet switching of the two high power loads, while the mechanical relay provides a reliable, high-isolation disconnect during maintenance procedures.

During operation, the MCU makes every attempt to keep at least one heater element energized. The following sequence of events occurs when the heaters are first commanded on:

- The pressure out-of-range alarm is enabled.
- Both heaters are energized for up to 60 seconds or until the temperature interlock is satisfied.
- A 60 second timer is triggered to inhibit the **LO TEMP** alarm while the temperature is stabilizing.

After the temperature interlock is satisfied, the MCU reverts to normal operation wherein only one heater is energized. Under these conditions, if the primary heater fails, the secondary heater is automatically energized. Depending on the settings of the dip switches, an audible alarm is sounded either when the primary heater fails or when both heaters fail.

While the secondary heater is in use, the MCU checks the primary heater every twenty seconds in an attempt to make it available in case the secondary heater fails. Even if the primary heater has been found to be restored, the secondary heater remains in use until the next time the heaters have been commanded off.

When both the primary and the secondary heaters have failed, the MCU tries to energize both heaters. Each twenty seconds, new current measurements are taken in an attempt to restore normal operation. The *Heater OK* interlock relay reports back to the host process sequencer only after both heaters are known to have failed.

When the Model 712 Burnoff Controller is in the **REMOTE** mode awaiting a command from the host, it exercises an *autosense* function. Unless this function is disabled by its dip switch, every sixty minutes the MCU energizes each heater for 0.1 seconds to detect its condition. Should a heater fault occur, the appropriate alarms are sounded. This function permits faulty heaters to be detected in advance of a *Remote CMD* from the host process seguencer.

1.1.5. Software Configuration

Eight internal dip switches provide for user-configured options. These switches are continuously monitored by the microcontroller and do not require that the controller be powered down before changes take effect. One of the functions of the switches is to permit the installer to selectively disable audible alarms. Another function permits the *Remote CMD* signal to be inverted to adapt to various host process sequencers.

1.1.6. Watchdog Timer

A hardware watchdog timer monitors operation of the MCU. Should the MCU go astray for longer than 1.2 seconds (highly unlikely), a reset command is sent to the MCU and all interlock outputs are forced off (fail-safe).

1.2. Front Panel

The front panel of the Model 712 Burnoff Controller permits easy adjustment of pressure and temperature setpoints while displaying the status of all heaters and sensors. The various front panel displays and switches are described below:

1.2.1. Mode Control

Two 3-position toggle switches determine the operating mode of the controller. The switches are labeled:

TEST
OFF
RESET

and

LOCAL
OFF
REMOTE

The first switch momentarily selects a **TEST** function or a system **RESET** function. When this switch is toggled to the **TEST** position, a sequence is initiated which, among other things, tests all LED's, the panel meter and heating elements. The **RESET** position is used to silence the audible alarm and/or to reset latched interlock conditions.

The second toggle switch latches in each of its three positions. When this switch is in the **LOCAL** position, the selected heater element is energized full time. The **OFF** position disables both heaters and the **REMOTE** position permits the selected heater to be commanded on or off by a host process sequencer. *(Note: Choice of which heater to energize is performed automatically as described earlier in this manual.)*

1.2.2. Status LEDs

Five LEDs indicate the status of the heaters and the status of the command signal from the optional host process sequencer. The functions of the displays and their colors are as follows:

HEATER A FAIL	red
HEATER B FAIL	red
HEATER A SELECT	green
HEATER B SELECT	green
REMOTE COMMAND	amber

When either or both heater elements are known to have failed, the appropriate red **HTR FAIL** LED(s) are lighted. If the controller is powered-up with both mode switches in the **OFF** position, neither **HTR FAIL** LED would be lighted even if one or more of the heaters is defective or disconnected. This is due to the fact that it is not considered safe to energize or test a heater element until specifically commanded by the **TEST**, **RESET**, **LOCAL**, or **REMOTE** mode switches.

The green **HTR SEL** LED(s) light to indicate which of the heater elements is currently energized. When no heater elements are energized, the green LED's flash to indicate which of the heater elements is not known to have failed.

The amber **REMOTE COMMAND** LED indicates the status of the **REMOTE** switch as well as the status of the *Remote Command* input from the host process sequencer as described below:

- If the controller is not in the **REMOTE** mode and the *Remote Command* input is not active, the **REMOTE COMMAND** LED is unlighted.
- If the controller is in the **REMOTE** mode and the *Remote Command* input is not active, the **REMOTE COMMAND** LED flashes slowly indicating that the controller is waiting for a command from the host.
- If the controller is not in the **REMOTE** mode and the host is sending a *Remote Command*, the **REMOTE COMMAND** LED flashes fast indicating an error condition (host is not in control). Note: Unless disabled by a dip switch, an audible alarm is also sounded at this point.
- If the controller is in the **REMOTE** mode and the host is sending a *Remote Command*, the **REMOTE COMMAND** LED lights steady indicating proper operation.

1.2.3. Process Parameter LEDs

Five LEDs indicate the status of the pressure and temperature readings with respect to their adjustable limits. The functions of the displays and their colors are as follows:

HI PRESSURE	red
LO PRESSURE	red
LO TEMP	red
PRESSURE	green
TEMPERATURE	green

When the actual pressure is between the high and low limits, the green **PRESSURE** led is lighted, the *Pressure OK* interlock relay is energized, and the red **LO PRESSURE** and **HI PRESSURE** LED's are unlighted.

When the temperature is above the **LO TEMP** setpoint, the green **TEMP** led is lighted, the *Temperature OK* interlock relay is energized, and the red **LO TEMP** LED is unlighted.

The following alarms occur when the controller is in **LOCAL** mode, and also, when the controller is in **REMOTE** mode with *Remote Command* activated from the host process sequencer:

When the pressure is below the **LO PRESSURE** setpoint, the red **LO PRESSURE** led flashes and, unless disabled by the dip switch, an audible alarm sounds.

When the pressure is above the **HI PRESSURE** setpoint, the red **HI PRESSURE** led flashes and, unless disabled by the dip switch, an audible alarm sounds.

When the temperature is below the **LO TEMP** setpoint, the red **LO TEMP** led flashes and, unless disabled by the dip switch, an audible alarm sounds. The audible alarm is inhibited for the first 60 seconds after the heater has been turned on to provide time for the temperature to stabilize.

Finally, To avoid operator confusion in applications where the pressure monitor is not used, an internal dip switch disables all three pressure LED's.

1.2.4. Process Parameter Potentiometers

Three recessed potentiometers are provided to permit front panel adjustment of interlock limits. The functions of the potentiometers are as follows:

HI PRESSURE SETPOINT	Sets upper pressure limit
LO PRESSURE SETPOINT	Sets lower pressure limit
LO TEMP SETPOINT	Sets lower temperature limit

These setpoints do not affect the operation of the heaters. The setpoints cause audible alarms to sound and determine interlock signals sent back to the host process sequencer, but have no effect on the operation of the heater elements.

1.2.5. Panel Meter

A 3½ digit panel meter is provided to display process parameters (temperature and pressure) and their setpoints. A rotary selector switch determines which of the following parameters is displayed:

HI PRESSURE SETPOINT
LO PRESSURE SETPOINT
LO TEMP SETPOINT
ACTUAL PRESSURE
ACTUAL TEMPERATURE

A sixth position of this switch, labeled **DISPLAY OFF**, disables the panel meter display without affecting the operational status of the controller.

As the display selector is rotated, one of five amber LED's lights to emphasize switch position.

During the **TEST** modes, all segments of the panel meter are forced to flash so the display can be visually evaluated.

The display is also flashed when the display selector is in the **DISPLAY OFF** position and either heater or pressure faults are detected. This prompts the user to turn on the display to check the process parameters.

1.2.6. Buzzer

An audible alarm is included on the front panel to alert the operator to interlock failures. In installations where a host process sequencer manages alarms, most audible alarms may be disabled via the internal dip switches (See *Dip Switches*, page 11).

Disabling the audible alarms does not affect the operation of the controller nor does it affect the interlock signals sent back to the host.

There are five possible faults which might cause the buzzer to sound:

1.2.6.1. Remote Fault

Host computer has asserted a *Remote Command* while the **REMOTE** switch is off.

1.2.6.2. Temperature Fault

The actual temperature is below the setpoint and the heater has been commanded ON and the 60 second timer has timed out.

1.2.6.3. Heater Fault

One or both heaters have failed or the current sensor has failed.

1.2.6.4. Pressure Fault

The actual pressure is below the **LO PRES** setpoint or above the **HI PRES** setpoint and the heater has been commanded ON.

1.2.6.5. Sensor Fault

The software has decided that readings from the current sensor are erroneous. This type of fault cannot be silenced by a dip switch. When the fault occurs, the software flashes both red **HTR FAIL** LED's and sounds the buzzer.

1.3. Rear Panel

> Note: Throughout this manual, connector pins are identified by a connector label followed by a pin number. For example, J10.7 indicates connector J10, Pin 7.

All electrical connections to the Model 712 are available at the rear panel. Following is a description of those connections.

1.3.1. Remote Connector, J1

The controller contains a 25-pin female “D” connector on the rear panel for connection to a host process sequencer or DDC system. Following is a description of the various signals accessible on this connector (See *Remote Connector Pinout*, page 18):

1.3.1.1. Remote Command

When the front panel **LOCAL/OFF/REMOTE** switch is in the **REMOTE** position, the burnoff controller remains inactive until a digital *Remote Command* is received from the host computer or process sequencer. An internal dip switch controls whether the *Remote Command* is “asserted to activate” or “open to activate” (fail-safe). This input is optically-isolated from all internal electronics, but may be powered from the internal power supply if desired.

1.3.1.2. Analog Outputs

Analog signals are available on the *Remote Connector* which represent the burn box temperature and differential pressure between the process tube and atmosphere. These signals may be monitored by the host controller for data acquisition purposes or by a technician for trouble-shooting purposes.

The temperature output is a DC voltage in the range of 0 to 10 volts with a scale factor of 1 volt = 100 degrees Celsius. Thus, an output of 6.25 volts represents a temperature of 625 degrees. This signal can be scaled down to 0 to 5 volts by means of an optional resistor divider on the circuit board.

The pressure output is a DC voltage in the range of 0 to 5 volts with a scale factor of 1 volt = 1 inch H_2O (assuming a 5" pressure transducer is used).

1.3.1.3. Interlock Status

Four sets of isolated interlock signals are generated by the burnoff control module. These relay contacts may provide feedback to digital inputs on the host controller or they may be used to control process gas valves.

Two sets of relay contacts are provided for each interlock function. One set of contacts, identified on the connector pinout table as COM.A and NO.A (see *Remote Connector Pinout*, page 18), close when AC power is applied and the particular interlock function is satisfied or "safe". The other set of contacts, identified as COM.B and NC.B close when the interlock function is "unsafe" and also during power failures.

If the host controller is capable of accepting only one "safe when energized" interlock signal, an appropriate subset of the four "normally open" (NO.A) contacts may be connected in series.

If the host controller is capable of accepting only one "unsafe when energized" interlock signal, an appropriate subset of the four sets of "normally closed" (NC.B) contacts may be connected in parallel.

Remote OK

This interlock output function is satisfied (or "safe") when the front panel **LOCAL/OFF/REMOTE** switch is in the **REMOTE** position and the internal power supplies are powered and functioning.

Temp OK

This interlock output function is satisfied when the chamber temperature is above the *Lo Temp* set point as adjusted on the front panel potentiometer and the burnoff controller is powered up.

Heater OK

This interlock output function fails when both heaters have failed. When only one heater has failed, an audible alarm may be triggered, but the interlock output remains "safe".

Pressure OK

This interlock output function is satisfied when the differential pressure (burn box with respect to atmospheric) is above the *Lo Pressure* setpoint and below the *Hi Pressure* setpoint as adjusted on the front panel potentiometers.

1.3.2. Pressure Transducer Connector, J2

This connector provides for an analog transducer which measures the pressure differential between the diffusion tube and atmosphere.

1.3.3. Thermocouple Connector, J3

An industry standard, 2-pin connector provides for installation of a Type “K” thermocouple. This sensor monitors the burn box temperature to insure adequate ignition temperature. Open-thermocouple protection is provided.

1.3.4. Heater Connector, J4

A 4-pin connector provides for installation of the (2) heater elements. Each heater wire is individually secured by a screw terminal and the entire connector housing can be unplugged from the controller as an assembly.

1.3.5. AC Power Entry

The Model 712 contains a power-entry module on the rear panel and a universal input power supply which permit connection to either 120 volts AC or 240 volts AC. The standard configuration, however, contains solid state relays which are rated for operation at 120 volts only, **not** 240 volts. Units which operate at 240 volts are available on special order. In any case, appropriate heaters must be installed according to the available line voltage.

2. INSTALLATION

2.1. Physical Requirements

The standard Model 712 Burnoff Controller is designed to occupy a 3.5" tall, half-width section of a standard 19" instrumentation rack cabinet. The controller protrudes 8.5 inches behind the front panel and requires an additional 2 inches of clearance at the rear for connectors and 1 inch at the front for front panel controls. The enclosure must be mounted in a non-corrosive environment at a temperature between 0 and 40 degrees Celsius.

2.2. Remote Connector, J1

> Note: Throughout this manual, connector pins are identified by a connector label followed by a pin number. For example, J10.7 indicates connector J10, Pin 7.

A 25-pin female "D" connector on the rear panel facilitates connection to a host process sequencer or DDC system. Following is a description of the signals accessible on this connector (Also see *Remote Connector Pinout*, page 18).

2.2.1. Remote Command

If a host computer or process sequencer is to be used to activate the **Model 712**, a digital output from the process sequencer must be connected to the *Remote Command* input on the burnoff controller. The *Remote Command* signal is optically isolated and requires a minimum of 5 mA at 5 volts to activate. Power for the *Remote Command* signal may be obtained from the host process sequencer or from the internal power supplies which are also accessible at J1. An internal 2200 ohm series resistor limits current through the *Remote Command* circuit. If a voltage higher than 15 volts is used to power the signal, an additional 2200 ohm external series resistor should included to avoid excess current.

2.2.2. Analog Outputs

Analog outputs on pins J1.12 & J1.13 represent the burn box temperature and differential pressure respectively. Both signals are referenced to analog common on pin J1.24.

The temperature output is a DC voltage in the range of 0 to 10 volts with a scale factor of 1 volt = 100 degrees Celsius. Thus, an output of 6.25 volts represents a temperature of 625 degrees.

The pressure output is a DC voltage in the range of 0 to 5 volts with a scale factor of 1 volt = 1 inch H_2O.

2.2.3. Interlock Relays

Four sets of isolated interlock signals are available for use by the host controller or to control process gas valves. These relay contacts may be wired in various series-parallel combinations as required by the application.

2.3. Pressure Transducer Connector, J2

A 9-pin female "D" connector on the rear panel facilitates connection to an optional pressure transducer. The circuit is designed for a pressure transducer that operates on +12 volts DC and outputs a 0 to 5 volt signal corresponding to 0 to 5 inch water column. An appropriate transducer is part number P3061-005WD from Schaevitz Engineering. (Also see *Pressure Transducer Pinout*, page 19).

2.4. Thermocouple Connector, J3

An industry standard, 2-pin connector is provided for installation of a Type "K" thermocouple. This sensor monitors the burn box temperature to insure adequate ignition temperature. Run either compensated wire or Chromel-Alumel thermocouple wire from the thermocouple to J3 and observe the polarity markings that are present on most thermocouple connectors. The (-) wire of type "K" thermocouples is color-coded RED, while the (+) wire is color-coded YELLOW.

2.5. Heater Connector, J4

Note: Do not contact the heater connections with AC power connected to the controller!

A 4-pin connector is provided for installation of (2) heater elements using Belden #8620 wire. (See *Heater Connector Pinout*, page 19).

Each heater wire is individually secured by a screw terminal and the entire connector housing can be unplugged from the controller as an assembly. Extra connector plugs may be obtained from **ITS** (See *Spare Parts List*, page 18).

2.6. Heater Replacement

Note: Choice of heater elements depends on the operating voltage being used. For 110 volt operation, replacement heater elements may be obtained from **ITS** (See *Spare Parts List*, page 18).

2.6.1. Remove the terminal strip cover from the burn box assembly.

2.6.2. Disconnect the thermocouple from the terminal strip and carefully slide it out of the mounting hole.

2.6.3. Disconnect the defective heater(s) from the terminal strip.

2.6.4. Remove the igniter retaining bracket from the igniter housing.

2.6.5. Remove the defective heater(s).

2.6.6. Reassemble in the reverse order.

Caution! Never block the top opening of the burn box as the heat from the burning H_2 must have a free path to the scavenger exhaust port.

2.7. Gas Connections

Connect the burn box to the end cap or process tube with a 3/8" OD stainless steel flex line assembly having a modified 12mm O-Ring sealed fitting at one end and a 1/4" compression nut and ferrule at the other. The length of the flex line will be determined by the placement of the burn box. The standard flex line is 12.0" long. Note: Use only the high temperature red silicone O-Rings (uniform size #014) for the flex line to process tube seal.

2.8. Dip Switches

Review the function of the various dip switches as listed below. Should it become necessary to change the operation of the controller to adapt to a particular installation, remove the two screws at the rear of the top panel and slide the top panel back three or four inches to expose the switches. Change the switches as required and resecure the top panel.

Note: Some manufacturers of dip switches label the off position of their switches **"OPEN"** while others label the closed position **"ON"**. The unit is shipped from the factory with all switches in their **"OPEN" OR "OFF"** position.

Caution! Do not remove either the top panel or the bottom panel with AC power connected to the controller.

SWITCH #	FUNCTION (WHEN "OPEN" OR "OFF")	FUNCTION (WHEN "CLOSED" OR "ON")
1	Enable **REMOTE** audible alarm	Disable **REMOTE** audible alarm
2	Enable **LO TEMP** audible alarm	Disable **LO TEMP** audible alarm
3	Enable **HEATER** audible alarm	Disable **HEATER** audible alarm
4	Enable **PRESSURE** audible alarm	Disable **PRESSURE** audible alarm
5	Enable **PRESSURE** LED's	Disable **PRESSURE** LED's
6	Enable **HEATER AUTOSENSE**	Disable **HEATER AUTOSENSE**
7	Enable audible alarm on 1st. heater failure	Disable audible alarm till 2nd. heater failure
8	**REMOTE COMMAND** is "*energize to deactivate*"	**REMOTE COMMAND** is "*energize to activate*"

2.9. AC Power

The unit is fitted with a 4 amp, 250 volt, 3AG fuse. Disconnect the AC power connector before servicing the fuse or heater elements. Using the line cord provided, connect the

controller to either a 115 volt or a 220 volt AC power source. If the controller is operated from a 220 volt source, appropriate high-voltage heater elements must be used.

3. USER INSTRUCTIONS

3.1. Power Up

3.1.1. After installation is complete, place the **LOCAL/OFF/REMOTE** switch in the **OFF** position and connect the linecord to an AC power outlet. Note that in normal operation, the controller would often be powered up with the **LOCAL/OFF/REMOTE** switch in the **LOCAL** or **REMOTE** position. This is a completely acceptable operating mode.

3.1.2. As the controller completes its power-on-self-test, observe that the buzzer beeps three times and the displays activate for a period of 1.5 seconds.

Note: Upon power-up with the **LOCAL/OFF/REMOTE** switch in the **OFF** position, the microcontroller hasn't yet been authorized to energize the heaters to test their condition. Under this condition, both **HTR FAIL** LED's and both **HTR SEL** LED's remain unlighted.

3.2. Test

The **TEST** mode permits the user to exercise all displays, relays and heaters. There are two versions of this function; a shortened test is performed when the **TEST** switch is pressed while the **LOCAL/OFF/REMOTE** switch is in the **LOCAL** or **REMOTE** position, and a second, more complete version which is performed when the **TEST** switch is pressed while the **LOCAL/OFF/REMOTE** switch is in the **OFF** position. The more thorough version of the **TEST** mode operates as follows:

3.2.1. If the process tube is not in use, place the **LOCAL/OFF/REMOTE** switch in the **OFF** position.

3.2.2. Rotate the display selector switch to the **DISPLAY OFF** position.

3.2.3. Press and hold the **TEST** switch while the controller exercises the following sequence:

- All four interlock relays are turned off. This sends interlock failure signals back to the host process sequencer.
- All displays are turned on for 0.7 seconds and the alarm beeps three times.
- Both the primary and the secondary heaters are tested. This takes 0.3 seconds.
- Each front panel LED is sequenced on for 0.3 second and then off for 0.1 second. This takes an additional 3.4 seconds.
- All discrete LED's are quickly sequenced on. The panel meter flashes ON for 0.3 seconds and then OFF for 0.2 seconds. This repeats as long as the **TEST** switch is pressed.

- When the **TEST** switch is released, the interlock relays return to the appropriate status.

3.3. Setup

3.3.1. Rotate the **DISPLAY SELECTOR** switch to the **LO TEMP SET** position.

3.3.2. Using a screwdriver with a 0.1 inch or 2.5 millimeter flat blade, adjust the potentiometer adjacent to the **LO TEMP SET** LED for an appropriate low temperature setpoint. (The panel meter reads out in degrees Celsius.)

3.3.3. If the pressure monitor option is being used, rotate the **DISPLAY SELECTOR** switch to the **LO PRESSURE SET** position and adjust the potentiometer adjacent to the **LO PRESSURE SET** LED for an appropriate low pressure setpoint. (The panel meter reads out in inches water column.)

3.3.4. If the pressure monitor option is being used, rotate the **DISPLAY SELECTOR** switch to the **HI PRESSURE SET** position and adjust the potentiometer adjacent to the **HI PRESSURE SET** LED for an appropriate high pressure setpoint.

3.3.5. Rotate the **DISPLAY SELECTOR** rotary switch to the **PRESSURE**, **TEMPERATURE** or **DISPLAY OFF** position as desired.

3.4. Operation Notes

3.4.1. For continuous operation, place the **LOCAL/OFF/REMOTE** switch in the **LOCAL** position.

3.4.2. For activating the heater(s) from the host process sequencer, place the **LOCAL/OFF/REMOTE** switch in the **REMOTE** position. When in the **REMOTE** mode, the controller waits for the *Remote CMD* input to be activated before turning on the heater. The controller then heats to operating temperature just as if the mode switch were in the **LOCAL** position. Note that an internal dip switch determines whether an activated host output turns the heater(s) on or off. *(See Dip Switches on page 11).*

3.4.3. To display actual burn box temperature, rotate the **DISPLAY SELECTOR** switch to the **TEMPERATURE** position.

3.4.4. To display differential pressure, rotate the **DISPLAY SELECTOR** switch to the **PRESSURE** position.

3.4.5. To silence any audible alarms, press **RESET**.

3.4.6. To check the displays and alarm while the heaters are on, press **TEST**. This abbreviated test mode does not affect heater operation or the interlock relays.

3.4.7. During the first 90 seconds after the heater has been commanded ON, or until **LO TEMP** is satisfied, both heaters are energized simultaneously. This reduces the amount of time required for the temperature to stabilize. During the first 60 seconds of heat-up, the **LO TEMP** audible alarm is disabled.

4. SPECIFICATIONS

The specifications listed below relate to the requirements and capabilities of the components contained in the electronics enclosure only. The requirements of the heater elements and any external solenoids must be considered separately.

4.1. AC Power Requirements

Frequency:	50 or 60 Hertz.
Voltage:	100 to 125 vac (200 to 240 vac available on special order).
Current:	fused internally at 4 amps.

4.2. Remote Input

Quantity:	(1)
Trigger:	1 mA @ 5 to 40 volts DC, level sensitive.

4.3. Interlock Outputs

Quantity:	(4) relays, each with (2) sets of contacts.
Contact Rating:	0.3A @125VAC or 0.3A @110VDC or 1A @30VDC.

4.4. Physical

Width:	8.0 inches (Standard front panel with rack-mounting ears is 9.0 inches wide).
Height:	3.5 inches.
Depth:	8.5 inches behind front panel. (1.0 inch additional clearance is required for front panel controls.)
Weight:	4.5 pounds.
Surface Finish:	Black anodized.

5. MODIFICATIONS LOG

5.1. Proposed Hardware Changes

- Add a 100uF capacitor near the watchdog monitor to reduce its sensitivity.
- Reposition components on board to ease front panel assembly.
- Connect the setpoint signals that exit at J2 to the opposite side of the buffers.
- Replaced hinged power supply standoff with latched version.
- Change value of R10 from 22M to 270k.
- Change value of R21 from 470 to 220 ohm.
- Change value of RP5,6,7 & 8 to 5.9 Kohm.
- Change value of C4 from 470 pF to 300 pF.
- Change value of RP1 & RP2 on potentiometer board from 3.92 Kohm to 3.74 Kohm.

5.2. Proposed Software Modifications

- None planned.

5.3. Completed Modifications

3/15/93

- Improved current sensor fault detect to deal with delayed turnoff of solid-state relays.
- Added Meter prompt if meter is off and temp/pressure fail.
- Changed startup time that both heaters are on from 60 to 90 seconds.
- Added test to check backup heater every 20 seconds.

12/9/95

- Changed manual to indicate that the standard configuration permits operation at 120 vac only, not 120 or 240vac.

6. APPENDIX

Appendix 6.1. - Spare Parts List

Qty	Item	ITS Part Number
-	Model 712	P/N 505-80416
1	Thermocouple, Type "K", S.ST. sheathed	P/N 050-905749
A/R	Compensation wire, 20 guage, Type "K"	P/N 903-900619
2	Silicon Carbide Igniter	P/N 048-905752 (FSP #279311)
1	Heater Connector	Phoenix Contact #17 54 481
1	Red silicone O-Ring	P/N 150-910955
A/R	Belden cable #8620 for heater connection	P/N 903-908418
1	Manual	

Appendix 6.2. - Remote Connector Pinout, J1

Pin	Function	Pin	Function
1	Remote COM.A	14	Remote COM.B
2	Remote NO.A	15	Remote NC.B
3	Temp COM.A	16	Temp COM.B
4	Temp NO.A	17	Temp NC.B
5	Heater COM.A	18	Heater COM.B
6	Heater NO.A	19	Heater NC.B
7	Pressure COM.A	20	Pressure COM.B
8	Pressure NO.A	21	Pressure NC.B
9	Remote CMD (+)	22	Remote CMD (-)
10	+12V	23	-12V
11	+5V	24	Power Common
12	Actual Temperature	25	Analog Common
13	Actual Pressure		

Appendix 6.3. - Pressure Transducer Pinout, J2

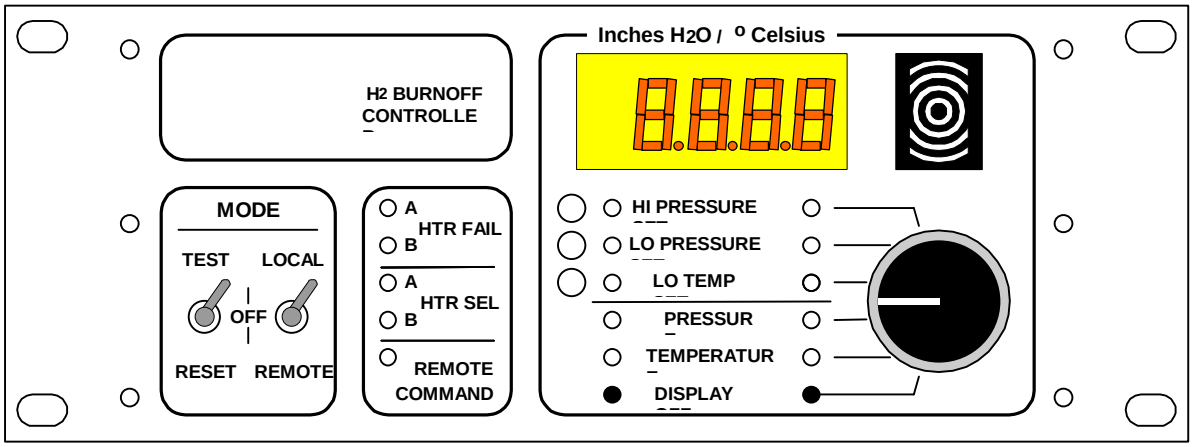
Pin	Function	Transducer Signal Name	Wire Color
1	+12V for Transducer	EXCITATION POWER (+)	Red
2	Power Common	POWER COMMON	Black
3	Pressure Reading from Transducer	OUTPUT SIGNAL	Green
4	Analog Common	OUTPUT COMMON	White
5	Chassis	SHIELD	Shield

6	Hi Pres Setpoint
7	Lo Pres Setpoint
8	Temp Setpoint
9	Analog Common

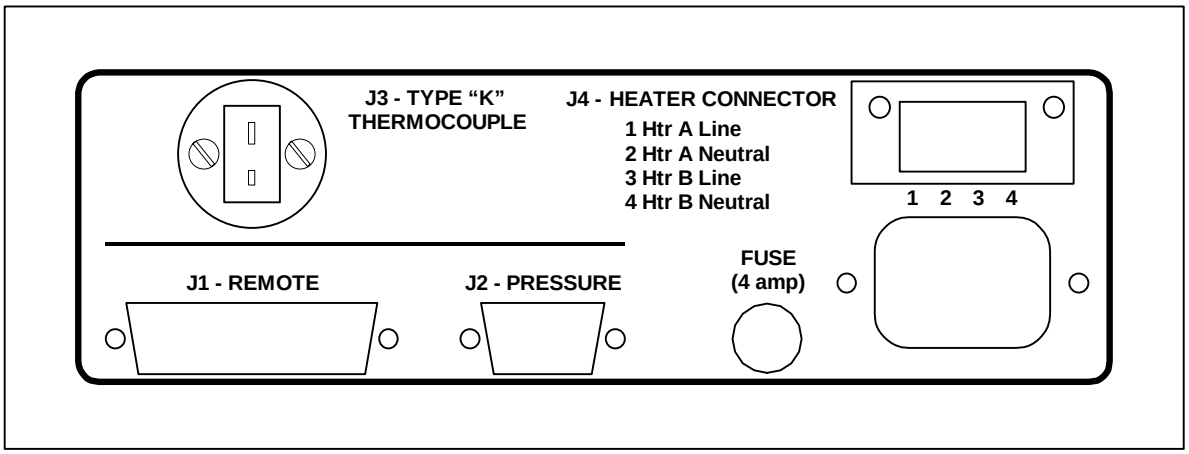
Appendix 6.4. - Heater Connector Pinout, J4

Pin	Function	Preferred Wire Color
1	Heater A Line	Black
2	Heater A Neutral	Green
3	Heater B Line	Red
4	Heater B Neutral	White

Appendix 6.5. - Front Panel Drawing

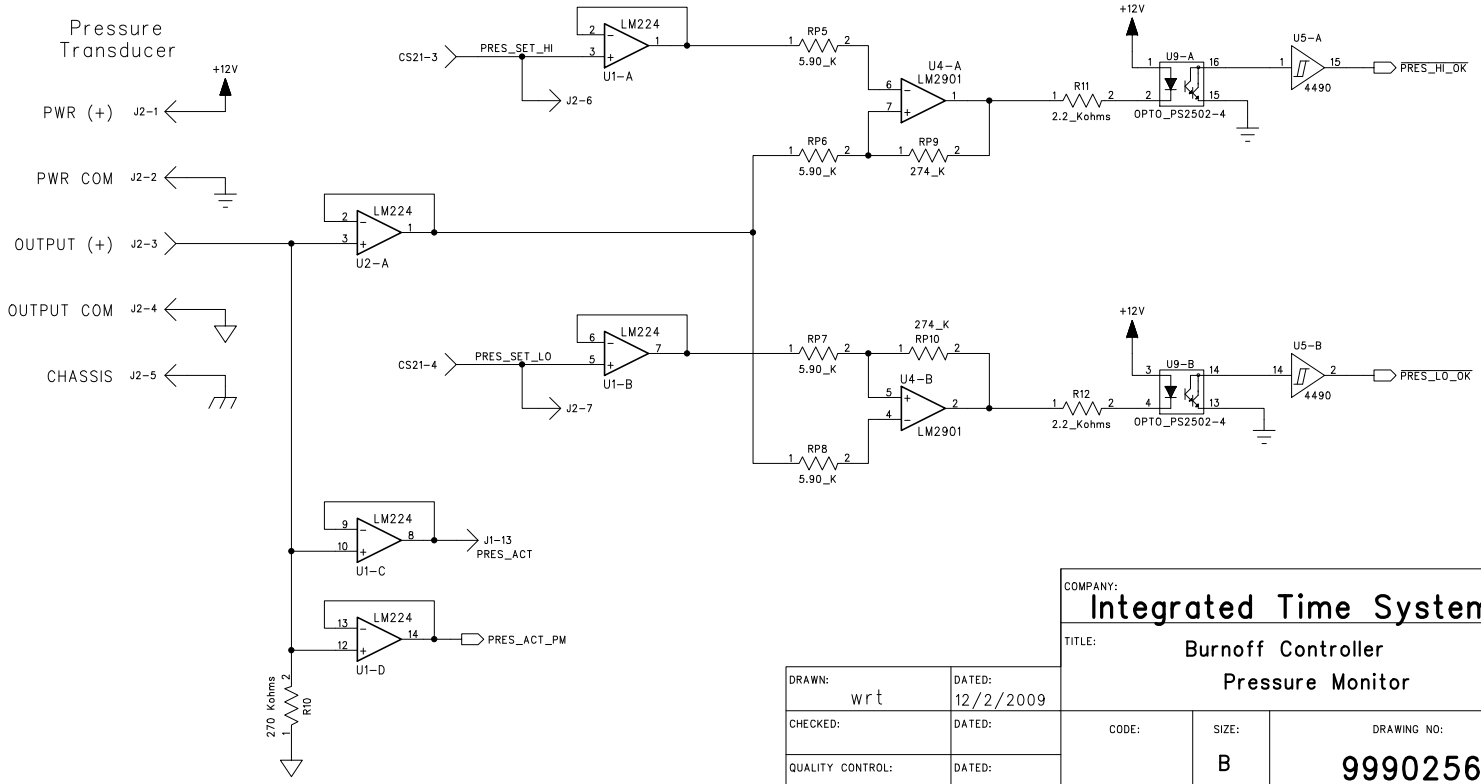


Appendix 6.6. - Rear Panel Drawing



1.) 11/30/2009 – Changed R10 to 270 Kohms
2.) 11/30/2009 – Changed R21 to 220 ohms
3.) 11/30/2009 – Changed RP5, RP6, RP7 & RP8 to 5.90 Kohms
4.) 11/30/2009 – Changed C4 from 470 pF to 330 pF
5.) 11/30/2009 – Added C19, 100 uF

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:



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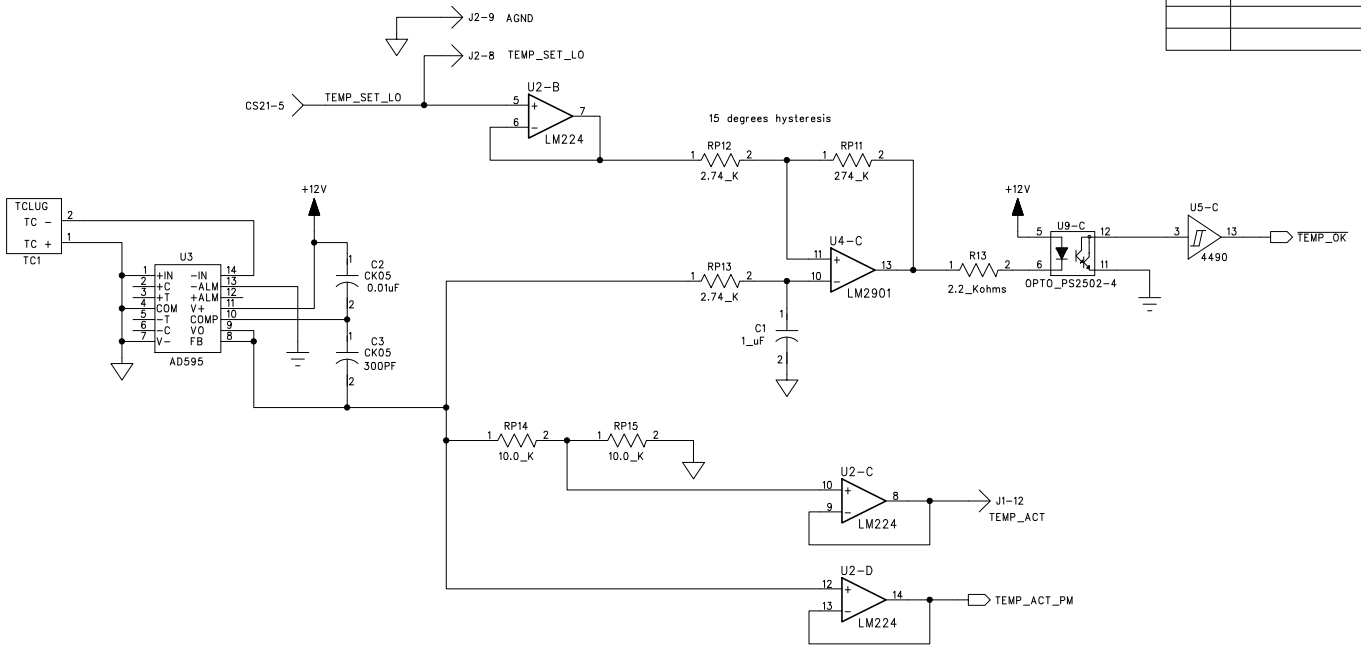
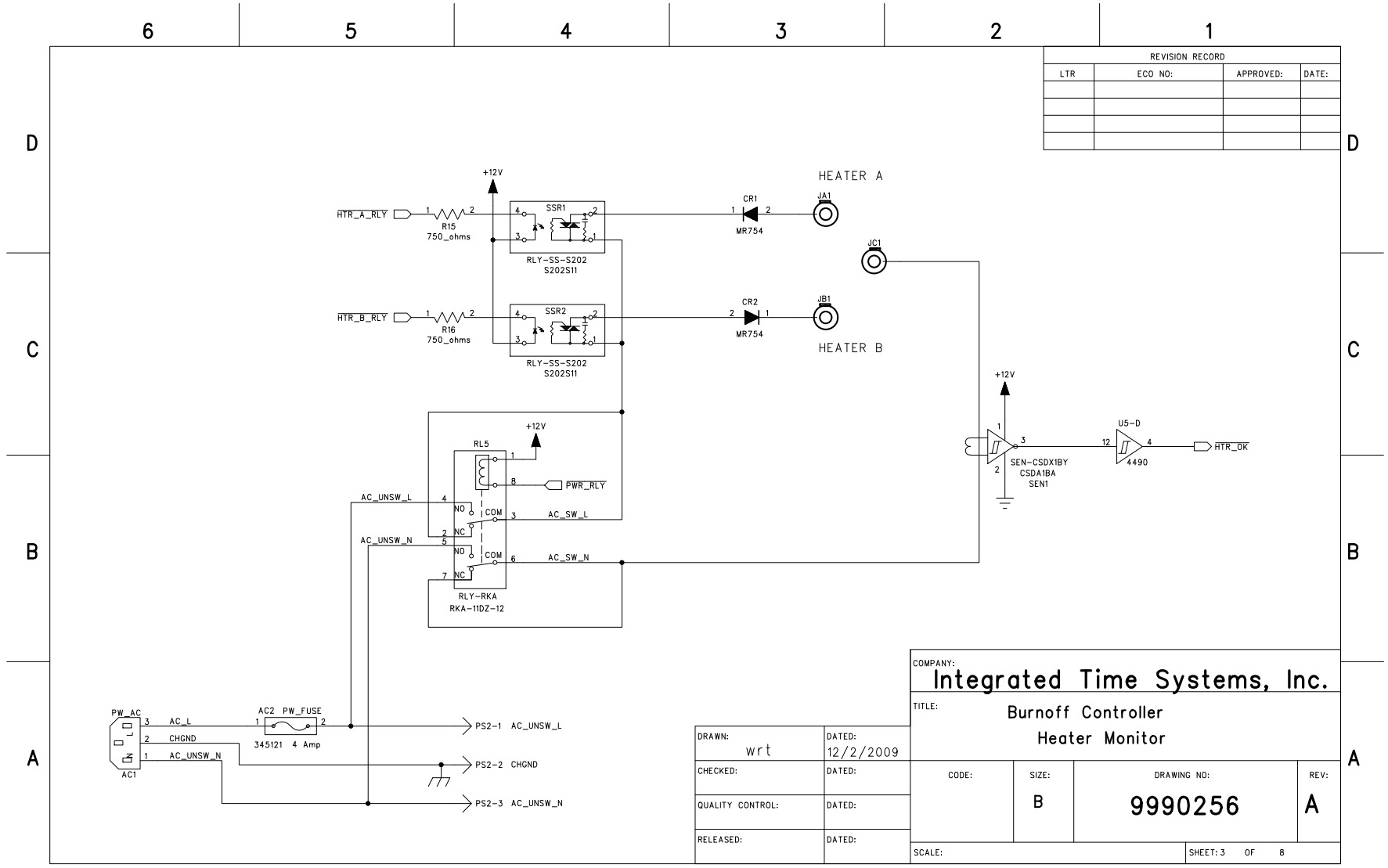
CHECKED:	DATED:	TITLE: Burnoff Controller Pressure Monitor			
QUALITY CONTROL:	DATED:	CODE:	SIZE: B	DRAWING NO: 9990256	REV: A
RELEASED:	DATED:	SCALE:	SHEET: 1 OF 8		

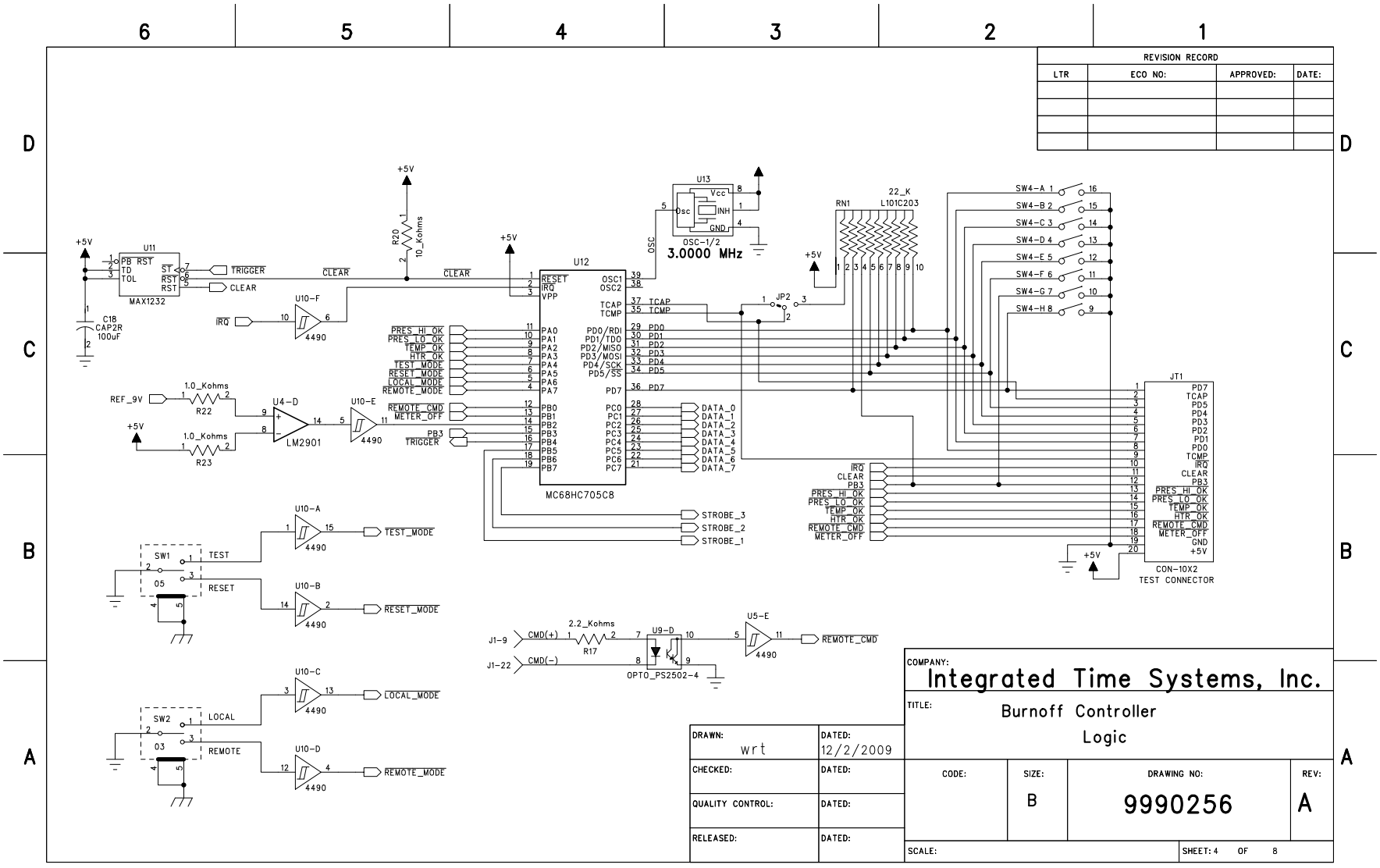
REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

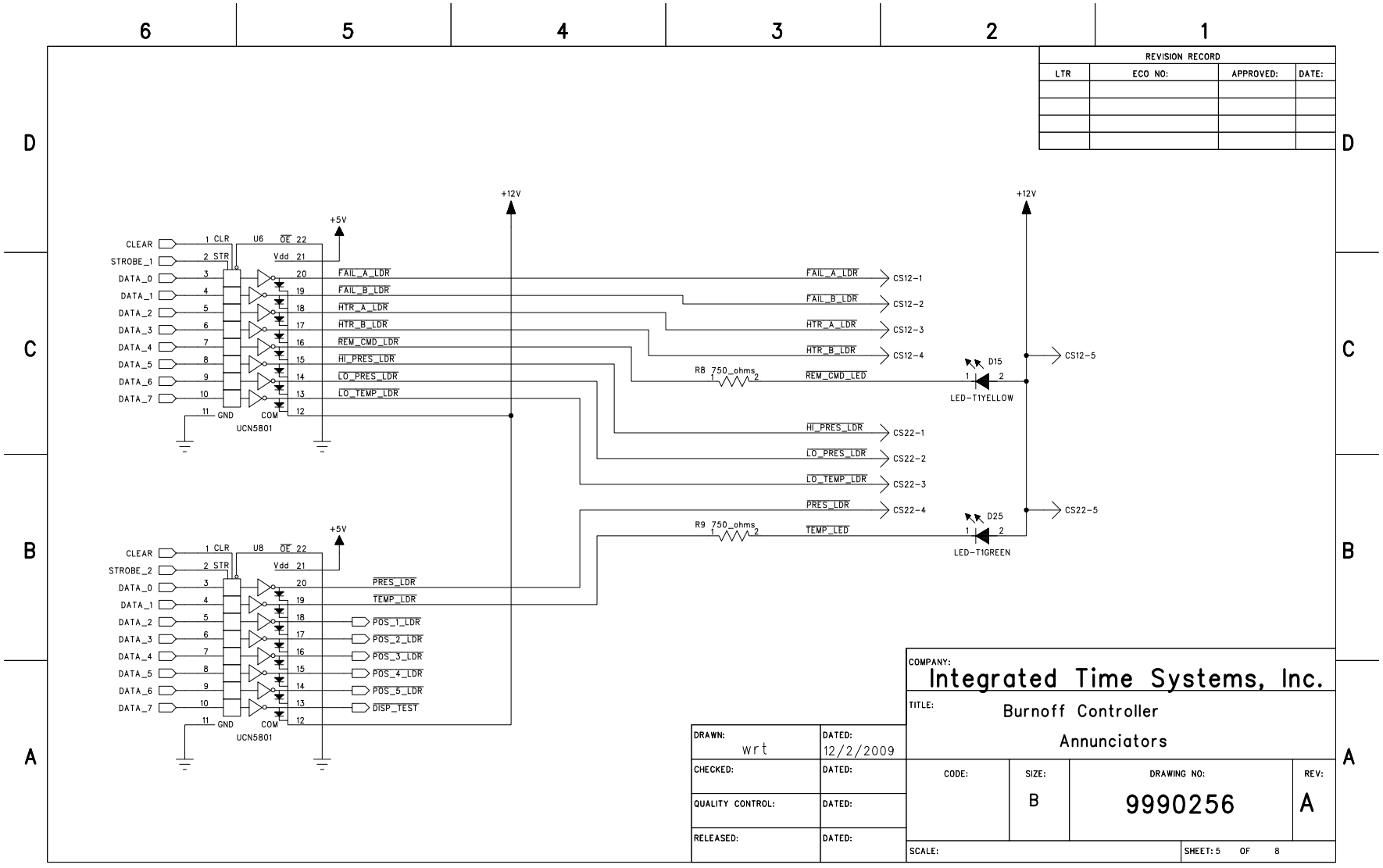


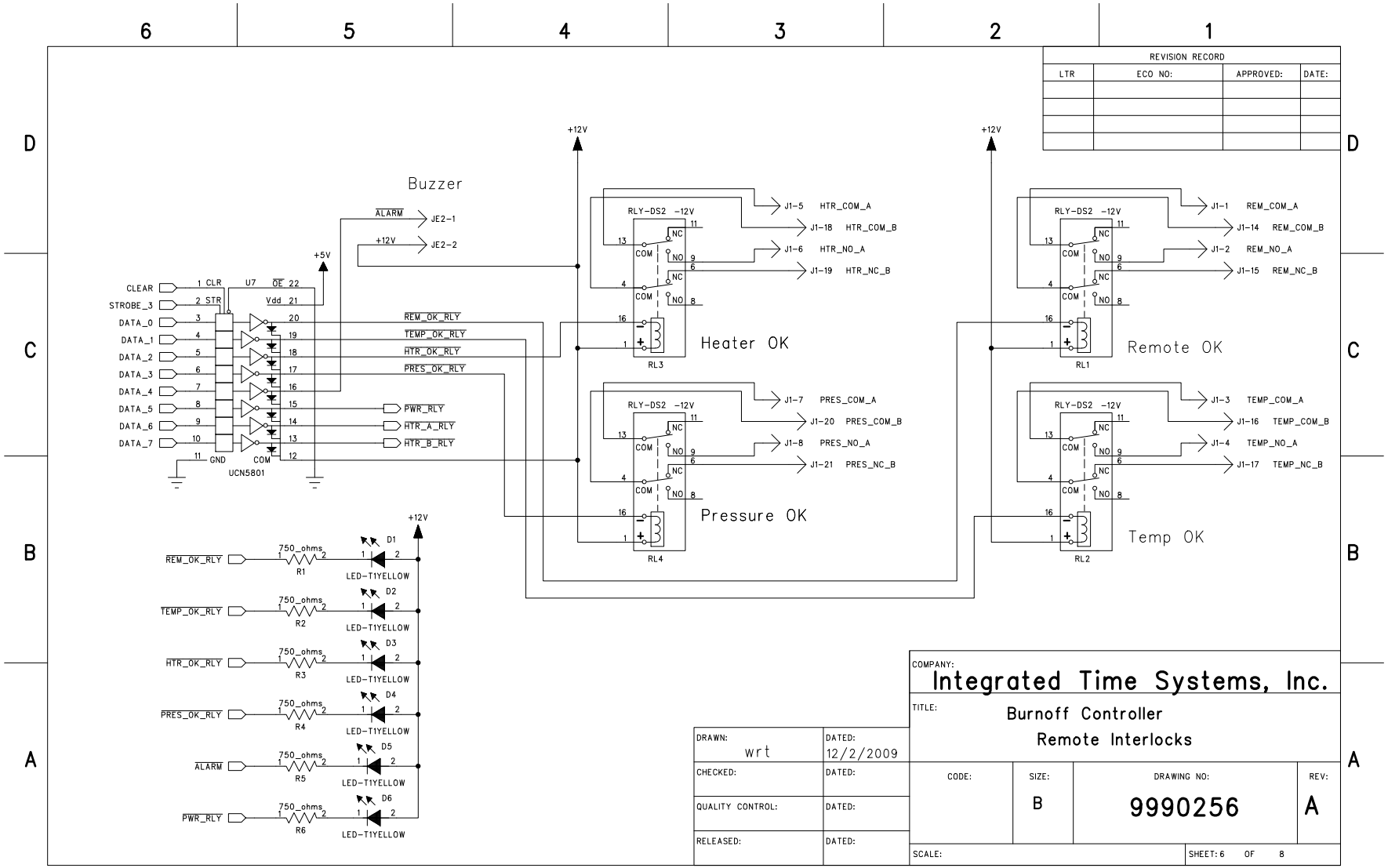
Note: RP14 and RP15 form an optional voltage divider should the external host sequencer require a 0–1 or 0–5 volt signal. If unused, omit RP15 and install a shorting jumper at RP14.

DRAWN: wrt	DATED: 12/2/2009	COMPANY: Integrated Time Systems, Inc.	
CHECKED:	DATED:	TITLE: Burnoff Controller Temperature Monitor	
QUALITY CONTROL:	DATED:	CODE:	SIZE: B / DRAWING NO: 9990256 / REV: A
RELEASED:	DATED:	SCALE:	SHEET: 2 OF 8

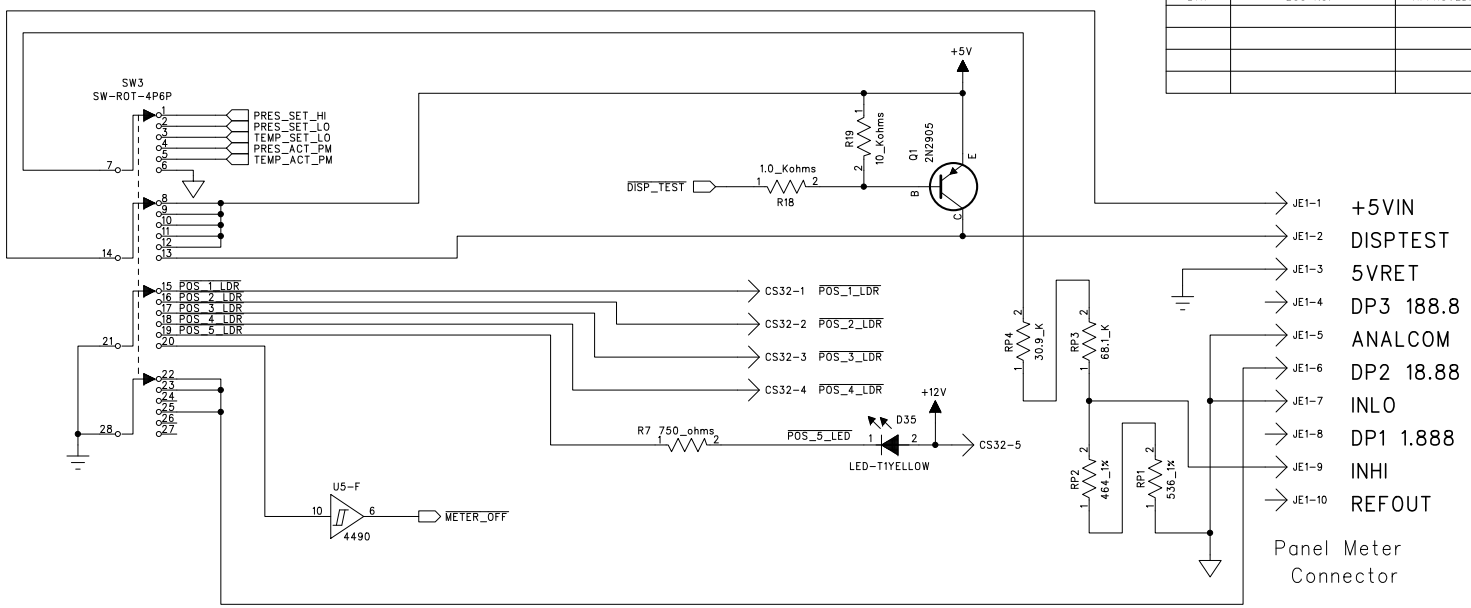

6
5
4
3
2
1
D
C
B
A
REVISION RECORD
LTR
ECO NO:
APPROVED:
DATE:
+12V
HEATER A
HTR_A_RLY
R15
750_ohms
SSR1
RLY-SS-S202
S202S11
CR1
MR754
JA1
JC1
HTR_B_RLY
R16
750_ohms
SSR2
RLY-SS-S202
S202S11
CR2
MR754
JB1
HEATER B
+12V
U5-D
SEN-CSDX1BY
CSDA1BA
SEN1
4490
HTR_OK
+12V
RL5
PWR_RLY
AC_UNSW_L
NO
COM
AC_SW_L
NC
AC_UNSW_N
NO
COM
AC_SW_N
NC
RLY-RKA
RKA-11DZ-12
PW_AC
AC_L
CHGND
AC_UNSW_N
AC1
AC2 PW_FUSE
345121 4 Amp
PS2-1 AC_UNSW_L
PS2-2 CHGND
PS2-3 AC_UNSW_N
DRAWN: wrt
DATED: 12/2/2009
CHECKED:
DATED:
QUALITY CONTROL:
DATED:
RELEASED:
DATED:
COMPANY:
Integrated Time Systems, Inc.
TITLE:
Burnoff Controller
Heater Monitor
CODE:
SIZE: B
DRAWING NO: 9990256
REV: A
SCALE:
SHEET: 3 OF 8


REVISION RECORD
LTR
ECO NO:
APPROVED:
DATE:
U11
MAX1232
PB RST
TD
TOL
ST
RST
RST
TRIGGER
CLEAR
C18
CAP2R
100uF
R20
10_Kohms
U10-F
4490
IRQ
CLEAR
U12
MC68HC705C8
RESET
IRQ
VPP
OSC1
OSC2
TCAP
TCMP
PA0
PA1
PA2
PA3
PA4
PA5
PA6
PA7
PB0
PB1
PB2
PB3
PB4
PB5
PB6
PB7
PD0/RDI
PD1/TDO
PD2/MISO
PD3/MOSI
PD4/SCK
PD5/SS
PD7
PC0
PC1
PC2
PC3
PC4
PC5
PC6
PC7
PRES_HI_OK
PRES_LO_OK
TEMP_OK
HTR_OK
TEST_MODE
RESET_MODE
LOCAL_MODE
REMOTE_MODE
REMOTE_CMD
METER_OFF
TRIGGER
DATA_0
DATA_1
DATA_2
DATA_3
DATA_4
DATA_5
DATA_6
DATA_7
STROBE_3
STROBE_2
STROBE_1
U13
OSC-1/2
3.0000 MHz
Vcc
Osc
INH
GND
OSC
JP2
RN1
22_K
L101C203
SW4-A 1
SW4-B 2
SW4-C 3
SW4-D 4
SW4-E 5
SW4-F 6
SW4-G 7
SW4-H 8
JT1
CON-10X2
TEST CONNECTOR
REF_9V
1.0_Kohms
R22
R23
U4-D
LM2901
U10-E
SW1
TEST
RESET
05
U10-A
U10-B
TEST_MODE
RESET_MODE
SW2
LOCAL
REMOTE
03
U10-C
U10-D
LOCAL_MODE
REMOTE_MODE
J1-9
J1-22
CMD(+)
CMD(-)
2.2_Kohms
R17
U9-D
OPTO_PS2502-4
U5-E
REMOTE_CMD
COMPANY:
Integrated Time Systems, Inc.
TITLE:
Burnoff Controller
Logic
DRAWN:
wrt
DATED:
12/2/2009
CHECKED:
QUALITY CONTROL:
RELEASED:
CODE:
SIZE:
B
DRAWING NO:
9990256
REV:
A
SCALE:
SHEET: 4 OF 8


6
5
4
3
2
1
D
C
B
A
REVISION RECORD
LTR
ECO NO:
APPROVED:
DATE:
+5V
+12V
CLEAR
STROBE_1
DATA_0
DATA_1
DATA_2
DATA_3
DATA_4
DATA_5
DATA_6
DATA_7
1 CLR
2 STR
U6
OE 22
Vdd 21
GND 11
COM 12
UCN5801
FAIL_A_LDR
FAIL_B_LDR
HTR_A_LDR
HTR_B_LDR
REM_CMD_LDR
HI_PRES_LDR
LO_PRES_LDR
LO_TEMP_LDR
CS12-1
CS12-2
CS12-3
CS12-4
CS12-5
R8 750_ohms
REM_CMD_LED
D15
LED-T1YELLOW
CS22-1
CS22-2
CS22-3
CS22-4
CS22-5
R9 750_ohms
PRES_LDR
TEMP_LDR
TEMP_LED
D25
LED-T1GREEN
STROBE_2
U8
POS_1_LDR
POS_2_LDR
POS_3_LDR
POS_4_LDR
POS_5_LDR
DISP_TEST
DRAWN: wrt
DATED: 12/2/2009
CHECKED:
QUALITY CONTROL:
RELEASED:
COMPANY: Integrated Time Systems, Inc.
TITLE: Burnoff Controller
Annunciators
CODE:
SIZE: B
DRAWING NO: 9990256
REV: A
SCALE:
SHEET: 5 OF 8


6
5
4
3
2
1
D
C
B
A
REVISION RECORD
LTR
ECO NO:
APPROVED:
DATE:
Buzzer
ALARM
JE2-1
+12V
JE2-2
+5V
CLEAR
STROBE_3
DATA_0
DATA_1
DATA_2
DATA_3
DATA_4
DATA_5
DATA_6
DATA_7
1 CLR
2 STR
U7
OE 22
Vdd 21
GND
COM
UCN5801
REM_OK_RLY
TEMP_OK_RLY
HTR_OK_RLY
PRES_OK_RLY
PWR_RLY
HTR_A_RLY
HTR_B_RLY
+12V
750_ohms
R1
R2
R3
R4
R5
R6
D1
D2
D3
D4
D5
D6
LED-T1YELLOW
RLY-DS2 -12V
RL3
Heater OK
J1-5 HTR_COM_A
J1-18 HTR_COM_B
J1-6 HTR_NO_A
J1-19 HTR_NC_B
RL4
Pressure OK
J1-7 PRES_COM_A
J1-20 PRES_COM_B
J1-8 PRES_NO_A
J1-21 PRES_NC_B
RL1
Remote OK
J1-1 REM_COM_A
J1-14 REM_COM_B
J1-2 REM_NO_A
J1-15 REM_NC_B
RL2
Temp OK
J1-3 TEMP_COM_A
J1-16 TEMP_COM_B
J1-4 TEMP_NO_A
J1-17 TEMP_NC_B
DRAWN: wrt
DATED: 12/2/2009
CHECKED:
QUALITY CONTROL:
RELEASED:
COMPANY: Integrated Time Systems, Inc.
TITLE: Burnoff Controller
Remote Interlocks
CODE:
SIZE: B
DRAWING NO: 9990256
REV: A
SCALE:
SHEET: 6 OF 8

REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:



Function	Max	Scale to	Ratio	Dec Pt	Display
Temperature	12v	120.0mv	1/100	NONE	1200 C
Pressure	5v	50.0mv	1/100	DP2	5.00 "

DRAWN: wrt	DATED: 12/2/2009
CHECKED:	DATED:
QUALITY CONTROL:	DATED:
RELEASED:	DATED:

COMPANY: Integrated Time Systems, Inc.

TITLE: Burnoff Controller
Panel Meter

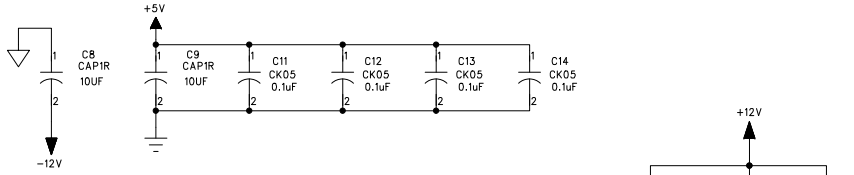
CODE:	SIZE:	DRAWING NO:	REV:
	B	9990256	A

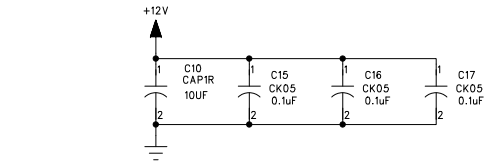
SCALE: | SHEET: 7 OF 8

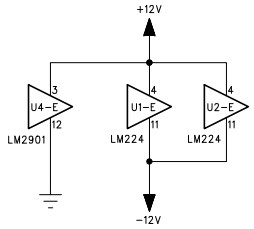
REVISION RECORD			
LTR	ECO NO:	APPROVED:	DATE:

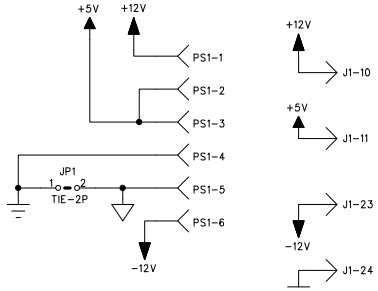
1.) 2/12/93 - Added 100UF capacitor to stabilize DS1232/MAX1323.

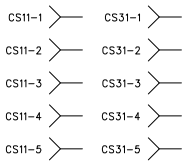
1.) 2/12/93 - Changed R21 to 220 ohms.

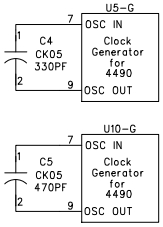


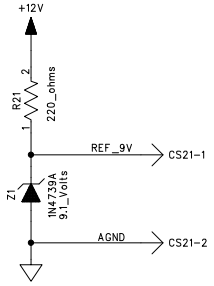












XP1
PW_SUP_MAP40
MAP40-3000

XL1
ITS LOGO

DRAWN: wrt	DATED: 12/2/2009	COMPANY: Integrated Time Systems, Inc.	
CHECKED:	DATED:	TITLE: Burnoff Controller Miscellaneous	
QUALITY CONTROL:	DATED:	CODE:	SIZE: B / DRAWING NO: 9990256 / REV: A
RELEASED:	DATED:	SCALE:	SHEET: 8 OF 8