INSTRUCTION MANUAL

MODEL 6012

DIGITAL DISPLAY \ CONTROLLER

July 2003

Version 1a

For software V 2.01
X.XX Display

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TABLE OF CONTENTS

I. INTRODUCTION

The Model 6012 Digtial Display and Controller is designed to be used as a readout for a number of different detectors. It has several alarms and trip points that are user set. The front panel display shows the radiation level and the status of the instrument. The following manual will discuss the various settings and functions of the instrument.

II. OPERATION

The operation of the 6012 is very simple. The first line of the display shows the radiation level from the detector. It is updated every second. The second line shows the status of the alarms and is updated every second. Overrange is indicated on the first line in place of the radiation level and shows the text “over” followed by the overrange level. The lights on the front panel also show the status of the alarms. There are no controls that are accessible from the front panel.

When the instrument is first turned on there is a wait until the instrument stabilizes. The number of intervals remaining until normal operation begins is shown on the display along with the version number of the software. The detector may take longer than the wait period to completely stabilize to background levels, however this should not effect the alarms because the level is close to background.

III. INSTALLATION

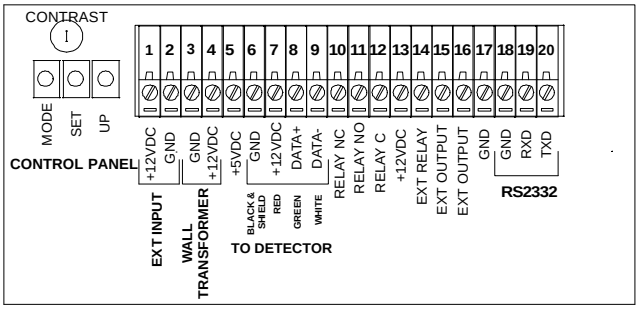
The 6012 is easily installed. It usually consists of 2 parts, the detector unit and the display unit although it may also be used as a slave display. There is a single 4 wire connection between the detector and the 6012. It has a terminal strip for connections and it unplugs from the circuit board to permit removal of the units without unscrewing the cable. The detector and display can be remoted up to 100 feet. We recommend Belden 8723, a 2 pair shielded cable. For short distances any 4 conductor cable will work. For longer distances or if it is used in a noisy environment we recommend a shielded cable.

The display is installed by first mounting the mounting bracket. The display unit may be in any orientation. The display sets into the mounting bracket and is held in place with the two thumbscrews. There are 2 cables that connect to the display. The first is the 2 conductor power cable from the wall mounted power supply. The second is the 4 conductor cable from the detector. In addition, wires for RS-232, external alarms, or remote drivers may also be connected to the terminal strip.

Remove the bottom half of the front panel by removing the two screws on the front panel and the single screw on the bottom. The power cable and detector cable are connected according to figure 1. Additional cables may be connected to the display as needed for RS-232, relay contacts, or other needs. The cable leads out through the openings on the bottom of the display. Replace the cover unless you want to change the factory settings. There is no on-off switch since this instrument should be operational 24 hours a day. The only way to turn it on and off is to plug and unplug the wall transformer. After the instrument is installed it may be turned on by plugging in the wall transformer. See section X Maintenance/testing/display for testing alarms.

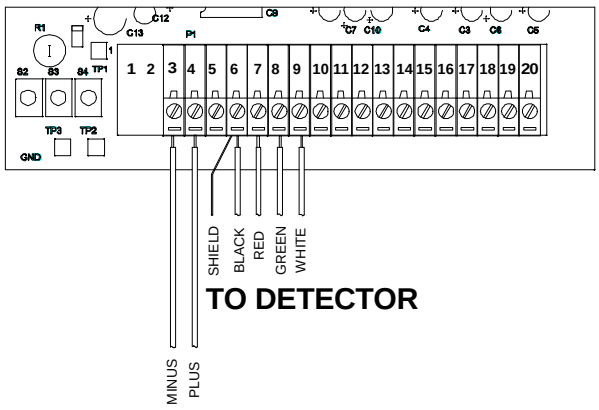
INTERFERENCE

Interference can cause annoying false alarms. The most likely cause of interference is from noisy AC switches and lamp dimmers. Plugging the 6012 into a line filter, or the offending product into a line filter can help to eliminate the interference.



CONNECTIONS TO TERMINALS

DISPLAY CIRCUIT BOARD



WALL TRANSFORMER

CONNECTIONS TO DISPLAY AND POWER

Figure 1 CONNECTIONS TO DISPLAY

DISPLAY CONNECTIONS

PIN #	DESCRIPTION	WIRE COLOR To Detector	USE
1	+12 VDC Input		External Power, Diode isolated
2	Ground		External Power with pin 1 for bat backup
3	Ground		Wall Transformer
4	+12 VDC Input		Wall Transformer
5	+5 VDC		External Use
6	Ground	Black and Shield	To Detector (also shield)
7	+12 VDC Output	Red	To Detector
8	Data +	Green	To Detector
9	Data -	White	To Detector
10	Relay NC		External Alarm (normally closed)
11	Relay C		External Alarm (center pole)
12	Relay NO		External Alarm (normally open)
13	+12 VDC Output		External Relay
14	Relay Driver		External Relay
15	External Output		
16	External Output		
17	Ground		
18	Ground		RS232
19	RXD		RS232
20	TXD		RS232

CONTACT CLOSURE FOR EXTERNAL ALARM

The contact closure from the internal relay is on pins 10,11 and 12. Normally an external interlock system would be connected between pin 11 and 12. This alarm operates in the fail-safe mode. If you were to remove power to the display, the relay would open the contacts between pin 11 and 12. Contacts are rated 0.5 A 115 VAC, 1 A 24 VDC resistive.

REMOTE RELAY DRIVER

If you do not want to use the internal relay you can install an external 12 volt relay between pin # 13 and 14. Remove the internal relay by unplugging it before connecting an external relay. The external relay should not draw more than 300 mA.

EXTRA DRIVERS

Extra drivers are available on pins 15 and 16. PIN 15 driver duplicates the Remote Relay Driver but is not fail-safe. Pin # 16 is programmable (See section on setup). Both are open collector drivers that need their load between ground and either +5 volts or +12 volts.

RS232/485

An RS232 output is available between pin 18 (ground) and pin 20 (TX). The status is output every second. Pin 19 (RX) is not supported in this version nor is the RS485.

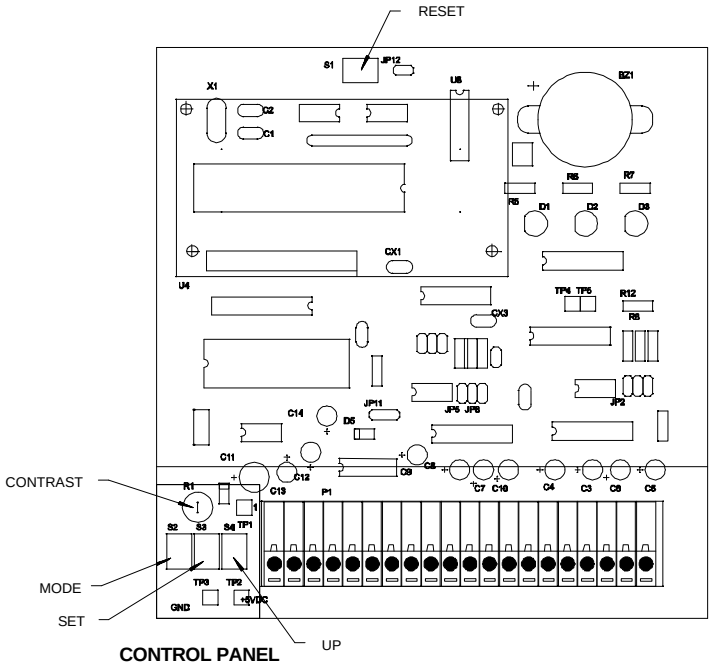


FIGURE 2 CONTROLS, ADJUSTMENT AND CONTROL PANEL

IV. CONTROL PANEL

The control panel is under the bottom half of the front panel. Remove the two screws on the front panel and the single screw on the bottom. The control panel is located on the left side of the circuit board and consists of the three push-buttons and the small round trimmer above them (see Figure 2). The three buttons are from left to right, MODE, SET and UP. These names are derived from their use during setup. In this manual they will be referred to as left, center and right push-buttons. The trimmer is to adjust the contrast of the LCD. Turn the trimmer to increase or decrease the contrast of the display. The best setting is where the black squares around the characters just disappear.

PUSH-BUTTON SUMMARY

Name	Location	Primary USE
MODE	LEFT	This is used for changing the settings.
SET	CENTER	Pointing to the digit to set when changing settings
UP	RIGHT	Increment the digit

PUSH-BUTTON ACTION

During Warmup Wait period

Left	Enter into setup mode
Center	Test mode for alarms
Right	Start normal operation immediately

Normal operation

Left	Enter into setup mode
Center	Reset Alarms

Right	Display Alarm status and radiation level without background subtract

During Setup mode

Left	Advance to next item
Center	Move arrow that points to a digit
Right	Increment the digit pointed to by the arrow

V. ALARMS

There are 4 alarms built into the instrument. All are based on count rate and all are adjustable both for count rate and for their control over the indicators and relays. The only thing that is not adjustable is their priority.

Alarm 1, 2, and 3 all trip if the count level exceeds the alarm setting. The 4th alarm, a Fail alarm, occurs if there are no counts from the detector for a preset time. Each alarm has different settings, and each alarm is designed to look at a different part of the level. Each alarm may be individually turned off if it is not needed. Alarm 1, 2, and 3 all have several settings associated with them. The different parts of the settings are:

1. Trip set This is the alarm level. This setting is a 4 digit number that is compared with the level in counts/interval from the detector.
2. Interval This is the number of seconds that the alarm uses for its time base. It counts the counts from the detector for that time and compares it to the trip set.
3. Delay This is the number of intervals that the alarm must be consecutively activated to actually trip the alarms.
4. Pause This is the number of seconds after the level has decreased below the trip set that the alarm will remain activated. It is used to keep the alarm on longer than one interval. It is usually set around 10 seconds.

ALARM ACTIVATION

Alarms 1, 2, and 3 work in the following manner. When the level rises above the tripset, the delay counts down every interval period from its preprogrammed level. When it reaches zero it turns the alarm on. Until the alarms are activated if the level decreases below the tripset, the delay will reset to its preprogrammed level. This helps to keep noise from tripping the alarm.

The pause works like the delay in that it too counts down every second from its preprogrammed level once the level drops below the tripset. When it reaches zero the alarms will be deactivated for that alarm. If other alarms are still activated they will continue to activate their alarms. If during the pause period the level rises above the tripset again, even for one interval, the pause will be reset to the preprogrammed level. Thus once activated the alarms will stay on for at least the pause period following the last occurrence of a trip. This helps to keep the alarms from cycling on and off in a marginal situation.

ALARM 1

This alarm has the highest priority. It trips if the level rises above the tripset. It is usually setup to trip the front panel Trip High LED and to activate the relay and beeper. When tripped it will show ALARM 1 on the second line of the display.

ALARM 2

This alarm has the second highest priority. It is usually reserved for special uses and the tripset is set to zero to turn it off.

ALARM 3

This alarm has the third highest priority. It is usually setup to trip the front panel Trip Low LED and to NOT activate the relay and beeper. When tripped it will show ALARM 3 on the second line of the display.

FAIL

This alarm is used to indicate that the detector is not functioning. It turns off the alarms and indicators and shows FAILURE in the display. It will not activate the relay. This alarm will activate if there are no counts from the detector for a number of seconds. The number of seconds is the only setting.

PRIORITY

The following table shows the priority of the alarms. Alarm 1 has the highest priority which means its action will supersede the lower priority alarms. Fail has the lowest priority because if the instrument fails, it obviously has no counts and cannot set the other alarms.

Alarm 1 Highest Priority
Alarm 2
Alarm 3
Fail Lowest Priority

NO ALARM

The No Alarm setting is fixed with the OK LED turned on, the relay and beeper turned off and the display showing OK.

FACTORY SETTINGS

The following table lists the factory settings for the alarms.

TRIP

Alarm	Use	Interval	Delay	Trip High LED	Trip Low LED	OK LED	RELAY	BEEPER
1	High Levels	short	short	ON	OFF	OFF	ON	ON
2	Not used	short	short	ON	OFF	OFF	ON	ON
3	Warning	short	short	OFF	ON	OFF	OFF	OFF
FAIL	Detector Failure	n/a	n/a	OFF	OFF	OFF	OFF	OFF
Normal	No Trip			OFF	OFF	ON	OFF	OFF

VIEWING ALARMS

The delay and pause and trip status can be viewed on the 2nd line of the LCD during normal operation by pushing the right hand push-button under the front panel cover. When the push-button is down, the status of the three alarms will be displayed on the LCD. The three groups represent the alarms and are in the following order from left to right: alarm 1, alarm 2, and alarm 3.

The first character of each group is an '*' if the alarm is not tripped and a 'T' if the alarm is tripped. The next number is a 2 digit hex number of either the delay or the pause. If the alarm is not tripped then it is the delay. If the alarm is tripped then it is the pause. If the alarm is turned off because the tripset is set to 0, then the alarm will be shown by three dashes (---) in place of the group.

As an example, assume for alarm 3 the delay is set to 5 and the pause is set to 8. Normally, with no trip, it would read '*05'. The '*' indicates it is not tripped and the '05' is the delay. If the level was brought higher than the tripset then the delay would start to count down every interval period until it reached zero. This shows the delay period. If the level were to decrease below the trip set during the time it was counting down, then the delay would revert back to its preprogrammed level which is 5. When the delay reaches zero, the indicator will change from a '*' to a 'T' to indicate it has been tripped, and the alarms will be set. The display will then show 'T8' and will continue to show 'T8' until the level is brought down below the tripset. When the level is brought below the tripset the pause will start counting down, decreasing by 1 every second. When it reaches zero, the 'T' will change back to a '*' and the alarms will be set to the no alarm condition.

VI. SETUP

The instrument has been setup with its preset values. These values are programmed into the EEPROM (changeable permanent memory). They can be changed by the user. This section shows how to change the presets. APPENDIX I contains blank forms for recording your settings. We recommend that you copy this page and use it to figure out your changes.

The setup mode is different from the normal operation of the instrument. To enter into the setup mode first access the control panel on the display by removing the bottom half of the front panel. At any time push and hold down the left hand button on the control panel. The display will change to the setup mode in about 1 second and show the first adjustment. Release the button as soon as the setup menu appears. The buttons on the control panel will do the following:

MODE (left hand button) will bring up the next item to adjust. Repeatedly pushing the mode button will cycle through all the adjustments.

SET (center button) will move the arrow on the bottom line from one digit to the next. Every time it is pushed the arrow will move to the next digit. When it gets to the last digit it will jump to the first digit.

UP (right hand button) will increment the digit that the arrow points to. Every time the button is pushed the digit will increase.

It only takes a few seconds of playing with the buttons to understand how they function.

Some adjustments have 3 digits and some have 4. All settings are decimal. The adjustments with 3 digits have a maximum setting of 255. If they are set above 255 they will actually be set to 255. The bottom line of the display reminds you that they have a maximum value of 255. The four digit adjustments have no restrictions; they can be adjusted from 00.00 to 99.99.

Repeatedly pushing the mode button will cycle the display through all of the adjustments. After the last adjustment the program will go to the same display as at turn on. Remember you can cycle right back into setup from the turn on display, by again pushing down the MODE button until the setup menu appears. Most of the settings are saved in EEPROM after the last item, consequently if you are part way through changing the settings and decide you don't want the new values hold down the left hand button until the turn-on menu appears, then quickly release the button, this will reset the 6012 and put you back in the Setup Mode. You can also turn power off then back on or if the front panel is removed push the reset button.

The following is a list of the parameters in the order that they are seen on the display along with the factory presets. The letters A1, A2 etc. refer to alarm 1, alarm 2 etc. DELAY A2 is the delay value for alarm 2.

Presets @255	
TRIPSET 1	1.00
TRIPSET A2	0
TRIPSET A3	0.50
DELAY A1	0
DELAY A2	0
DELAY A3	0
INTERVAL A1	1
INTERVAL A2	1
INTERVAL A3	1
PAUSE A1	10
PAUSE A2	10
PAUSE A3	10
Alm Setup A1	9
Alm Setup A2	9
Alm Setup A3	132
No alm Setup	130
Start Time	100
Fail Time 255	
Zero Offset	0.50

Please read the section on the alarms to become familiar with the action of the alarms. All of the parameters are reviewed below. You must cycle through all of the parameters to get back to a normal display.

PRESET

Set this to 255 or above if you want all of the adjustments to be set to their factory preset values. If you do not want the factory preset settings, then push mode again to go to the next item.

TRIPSET

This is the alarm level. This setting is a 4 digit number is compared with the level from the detector during the interval.

DELAY

This is the number of intervals that the alarm must be consecutively activated to actually trip the alarms.

INTERVAL

This is the number of seconds that the alarm uses for its time base. It counts the counts from the detector for that time and compares it to the trip set. If this setting is set to 1 it will have a 1 second time base which is the same time base as the display.

The interval will effect the tripset. If the interval is set to 1 (1 second) then the tripset level will be compared to the counts that arrive in 1 second. If it is set to 10 (10 seconds) then the tripset level will be compared to the counts that arrive in 10 seconds, or 10 times MORE sensitive than the 1 second choice. Thus if the 1 second example had its tripset set to 20, the 10 second example would have to have its tripset set to 2 to be the same sensitivity. We recommend that this be set to 1 second.

PAUSE

This is the number of seconds after the level has decreased below the trip set that the alarm will remain activated. It is used to keep the alarm on longer than one interval. It is usually set around 10 seconds. It can be set longer but it usually is determined by how long the beeper (or external alarm) needs to be on to arouse someone that there is a problem.

ALM SETUP (ALARM SETUP)

This is a number that is used to set the condition of the alarms, indicators and external outputs. There are 4 setups, one for each of the three alarms and one for no alarms. Below is a description of the alarms, indicators and external outputs. Each can be set to only two values, 0 or 1. Following the descriptions is the method used to calculate the values and to determine the decimal value.

RELAY

This controls the relay. The contacts of the relay are brought out to the terminal strip (TS). When the relay is set to 1, TS10 and TS11 are shorted, and TS11 and TS12 are open. When the relay is 0, pin TS10 and TS11 are open and TS11 and TS12 are shorted. The relay is operated in the fail-safe mode. The signal that drives the relay is also routed to pin 14 on the terminal strip. When the relay is set to 0 the pin is at 12 volts and the relay is not energized. When the relay is set to 1 the pin is at 0 volts and the relay is energized. This setting also controls an extra external output on the terminal strip. When the relay is set to 1 then pin 15 on the terminal strip is low.

TS16

This is pin #16 on the terminal strip. When TS16 is set to 1 then pin #16 on the terminal strip is low. This is only used for external control of additional relays or devices and is not used in normal operation of the monitor.

TP4

This is an internal test pin on the circuit board. When TP4 is set to 1 then the testpoint #4 on the display circuit board is high. This pin has no normal function and is not used in normal operation of the monitor.

TP5

This is an internal test pin on the circuit board. When TP5 is set to 1 then the testpoint #5 on the display circuit board is high. This pin has no normal function and is not used in normal operation of the instrument.

RED LED

This is the front panel red LED. It is marked TRIP HIGH on the front panel. If the RED LED is set to 1 then the LED is on.

YELLOW LED

This is the front panel yellow LED. It is marked TRIP LOW on the front panel. If the YELLOW LED is set to 1 then the LED is on.

GREEN LED

This is the front panel green LED. It is marked OK on the front panel. If the GREEN LED is set to 1 then the LED is on.

BUZZER

This is the front panel buzzer. If BUZZER is set to 1 then the buzzer is turned on and emits a loud continuous beep.

DECIMAL

The following table is a compilation of the settings of all the parts of the alarm setup. The decimal is the value that is calculated from the results of the table. The line of one's and zero's on a row is actually a binary number. This number is converted to decimal and that is the decimal number. For example the third line of the table below shows:

Alarm3 1 * * * 0 1 0 0

If you change the * to zeros it becomes the number 10000100. This is a binary number. To find its decimal equivalent, look at the binary to decimal conversion table in the appendix. Look at the third binary column from the left and about 10 numbers down. You should find the number 10000100. Next to it is the number 132. This is the decimal conversion. 10000100 in binary is 132 in decimal. This decimal number is the number you enter into the alarm setup.

The following is a table that shows the normal operation of the instrument, as it is setup using the factory presets.

	RELAY	TS16	TP4	TP5	RED LED	YELLOW LED	GREEN LET	BEEPER	DECIMAL VALUE
Alarm 1	0	*	*	*	1	0	0	1	9
Alarm 2	0	*	*	*	1	0	0	1	9
Alarm 3	1	*	*	*	0	1	0	0	132
No Alarm	1	*	*	*	0	0	1	0	130

*Setting does not matter for normal operation. We suggest each of these be set to 0.

The decimal calculations assume that the items marked * are set to 0.

START TIME

When the instrument is turned on it waits before going into normal operation. This gives time for the instrument to stabilize and to gather an average for alarm 4. The display shows the seconds counting down until normal operation. The start time is the starting number for the countdown. It can also be thought of as the start delay. If it is set to a low number the detector may not stabilize in time for the alarms. If it is set to a high value, it only delays normal operation longer than necessary.

FAIL TIME

If the display does not receive a count from the detector it will show a failure in the display. The fail time is the number of seconds after the last count before the instrument will show FAILURE in the display. If the fail time is set to 60 seconds, it will take 60 seconds after the detector fails before the instrument will display FAILURE. The factory setting is 255 which is the maximum value. The detector should send a count out at least every 2 seconds if it is operating normally.

Zero Offset

The zero offset is for detectors that require it. The 6012 subtracts this value from the reading before it is used to set the alarms or view on the display. Set it to the value specified in the manual for the detector. The radiation level can be viewed without the zero offset by pushing the up button on the control panel.

TURNING THE ALARMS OFF

Each of the alarms can be turned off. To turn off alarm 1, 2 or 3, set the tripset to zero. You can check if the alarm is turned off reading Viewing Alarms on page 7.

VIII. RS232 SERIAL OUTPUT

Every second the display sends out a packet of data via the RS232 serial output. The packet is the data at the time it was sent and should look like:

000001 0064 0000 0032 FF 00

The data from left to right is:

1	XXXXXX	6 hex digits Counts per second from detector. The same value as on the display.
2	XXXX	2 hex digits Alarm level for alarm 1
3	XXXX	2 hex digits Alarm level for alarm 2
4	XXXX	2 hex digits Alarm level for alarm 3
5	XX	1 hex digit This is the fail. This starts as the fail number and counts down to zero. At zero it shows FAILURE in the display.
6	XX	1 hex digit This is the status byte. See below for a description.

STATUS BYTE

The status byte consists of 8 bits. The bits are represented as follows: Bit 0 is the LSB and bit 7 is the MSB. Only bits 0 thru 4 are used.

BIT FUNCTION

0 0=no trip, 1=trip for alarm 1
1 0=no trip, 1=trip for alarm 2
2 0=no trip, 1=trip for alarm 3
3 0=no fail, 1=fail
4 0=normal, 1=overflow

VII. CALIBRATION

The instrument has no calibration adjustments. The calibration adjustments are in the detector. The display is derived from a crystal controlled clock.

The instrument should be adjusted to as low a setting as possible but with no false alarms. The primary problem with setting it too low is noise from the detector. Temperature, shock and ambient electrical noise can cause the level to fluctuate. Inaccuracies in the detector and other parts of the circuit can also cause noise.

The noise can be of two types:

1. Transient noise. This type of noise typically comes from the detector. It is short and typically lasts 1 to 2 seconds.
2. Long term noise. This type of noise will cause the output to rise with no radiation. This type of noise is usually caused by fast temperature changes and high ambient temperature.

The alarms should be setup to trip as close to 0 as possible. The factory settings are conservative. They are designed to be the same for all units. You may want to alter some settings or all of them. You can approach this in several ways but we suggest that you make one alarm more sensitive and then run it awhile and see if you get any false trips. This way you can keep track of which alarm may be alarming on noise. Alternatively you could hook up a computer to log the data on the RS-232 and look for the highest noise. This will give you a figure that is averaged for 1 second, but it will still give you an idea of the noise in the instrument.

The different alarms are designed to overcome some of the noise. Any of the alarms that are setup with a long interval are designed to overcome type 1 noise because they average the readings over several seconds.

IX. CIRCUIT DESCRIPTION

DISPLAY

The display is controlled by the microprocessor, U5. U1 is an address latch that separates the address and data for the EPROM U7. U4 is the LCD display. U2 is the EEPROM that stores the variables. U8 is the address decoder for U4. U11 is a shift register that shifts data in and has a parallel out. It is used, though the buffer U10 to drive the buzzer and the front panel LEDs. The relay is connected directly to the microprocessor through U10:G and U8:D. This is done to make the relay fail-safe. If the microprocessor is reset either by power on or by the watchdog timer U3, then the output pin P1.4 will float high opening the relay. U6 divides the incoming counts by 2 to slow them down. U9 and U12 are RS232 and RS485 outputs respectively. U13 and U14 are used as inputs and outputs to the detector. In this case only U14 is used as an input. U15 is a 5 volt voltage regulator and U16 converts this to -5 volts for the LCD contrast. R1 adjusts the contrast. U3 is a watchdog timer for the MPU and it needs a pulse on the DACCL at least every second to keep the watchdog from timing out.

MODIFICATIONS

Not all of the parts on the circuit board and schematic are included in this model. They are included for future changes or to allow this circuit board to be used in different ways. This includes jumpers for RS232 and RS485 inputs and outputs on both the communications lines and the data lines from the detectors. The lines from the detector are designed to accept pulses or serial data from the detector. The watchdog can be disabled by JP12.

X. MAINTENANCE

This section discusses the circuit of the instrument and any adjustments that may be needed.

SHORTCUTS

Push the right hand button on the control panel during the warm-up period to cancel the warm-up period. Also remember to push the right hand button on the control panel to see the action of the alarms and to tell which alarm is tripping. Push the center button on the control panel during normal operation to cancel the alarms. This is almost as good as a reset, but it does not clear the average or the current reading, it just quiets the buzzer.

If you have the complete cover off of the display, the reset button on the top of the board above the display can be used to abort the setup routine. Just push it while in the setup routine. You can also abort the setup routine by turning off the power or by holding down the left hand button until the LCD shows the startup display.

If you are testing the alarms and the noise is too loud, put a piece of tape over the beeper. It will not make it quiet but it will reduce the volume.

ADJUSTMENTS

There is 1 adjustment. The contrast is located on the control panel under the bottom cover on the front of the display. Turning it will change the contrast of the display. The best adjustment is to turn the control until the display is too dark, then lighten it up to the point where the black squares around the characters just disappear.

TESTING

DISPLAY

The display alarms and annunciators can be tested by pushing down the center button when the display is counting down the startup time. Startup time can be initiated by pushing the reset button on the display if the entire front panel is removed or by interrupting the power. When the center button is held down the instrument will cycle through 9 different annunciators in the following order:

Red LED, Yellow LED, Green LED, Front panel buzzer, Relay (operated fail safe), TS15, TS16, TP4, TP5

The cycle will then repeat as long as the button is held down.

The watchdog timer can be checked by pushing the left hand button and holding it down. The display will alternate between the turn-on display and the first preset menu about every 2 seconds and the relay will be de-energized and energized. The pulse is the watchdog timing out and resetting the microprocessor.

APPENDIX I

USER TABLES

The blank tables below are useful to determine how you want the alarms setup. Copy it and fill it out not only for ease of programming, but also for your records.

DATE_____ SERIAL NUMBER_____ _____

LOCATION _____BY_____

ALARM SETUP

	RELAY	TS16	TP4	TP5	RED LED	YELLOW LED	GREEN LET	BEEPER	DECIMAL VALUE
Alarm 1									
Alarm 2									
Alarm 3									
No Alarm									

ENTER THE DECIMAL NUMBERS ABOVE INTO THE SETUP BOXES BELOW

SUMMARY OF SETTINGS

	TRIPSET	DELAY	INTERVAL	PAUSE	SETUP
ALARM 1					
ALARM 2					
ALARM 3					
NO ALARM			Preset to 10		

START TIME _____

FAIL TIME _____

.APPENDIX II

DECIMAL/HEX/BINARY
CONVERSION TABLE

DEC	HEX	BINARY
0	00	00000000
1	01	00000001
2	02	00000010
3	03	00000011
4	04	00000100
5	05	00000101
6	06	00000110
7	07	00000111
8	08	00001000
9	09	00001001
10	0A	00001010
11	0B	00001011
12	0C	00001100
13	0D	00001101
14	0E	00001110
15	0F	00001111
16	10	00010000
17	11	00010001
18	12	00010010
19	13	00010011
20	14	00010100
21	15	00010101
22	16	00010110
23	17	00010111
24	18	00011000
25	19	00011001
26	1A	00011010
27	1B	00011011
28	1C	00011100
39	1D	00011101
30	1E	00011110
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33	21	00100001
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35	23	00100011
36	24	00100100
37	25	00100101
38	26	00100110
39	27	00100111
40	28	00101000
41	29	00101001
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43	2B	00101011
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45	2D	00101101
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69	45	01000101
70	46	01000110
71	47	01000111
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73	49	01001001
74	4A	01001010
75	4B	01001011
76	4C	01001100
77	4D	01001101
78	4E	01001110
79	4F	01001111
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82	52	01010010
83	53	01010011
84	54	01010100
85	55	01010101
86	56	01010110
87	57	01010111
88	58	01011000
89	59	01011001
90	5A	01011010
91	5B	01011011
92	5C	01011100
93	5D	01011101
94	5E	01011110
95	5F	01011111
96	60	01100000
97	61	01100001
98	62	01100010
99	63	01100011
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101	65	01100101
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103	67	01100111
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109	6D	01101101
110	6E	01101110
111	6F	01101111
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116	74	01110100
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133	85	10000101
134	86	10000110
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137	89	10001001
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166	A6	10100110
167	A7	10100111
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171	AB	10101011
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184	B8	10111000
185	B9	10111001
186	BA	10111010
187	BB	10111011
188	BC	10111100
189	BD	10111101
190	BE	10111110
191	BF	10111111
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193	C1	11000001
194	C2	11000010
195	C3	11000011
196	C4	11000100
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198	C6	11000110
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202	CA	11001010
203	CB	11001011
204	CC	11001100
205	CD	11001101
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220	DC	11011100
221	DD	11011101
222	DE	11011110
223	DF	11011111
224	E0	11100000
225	E1	11100001
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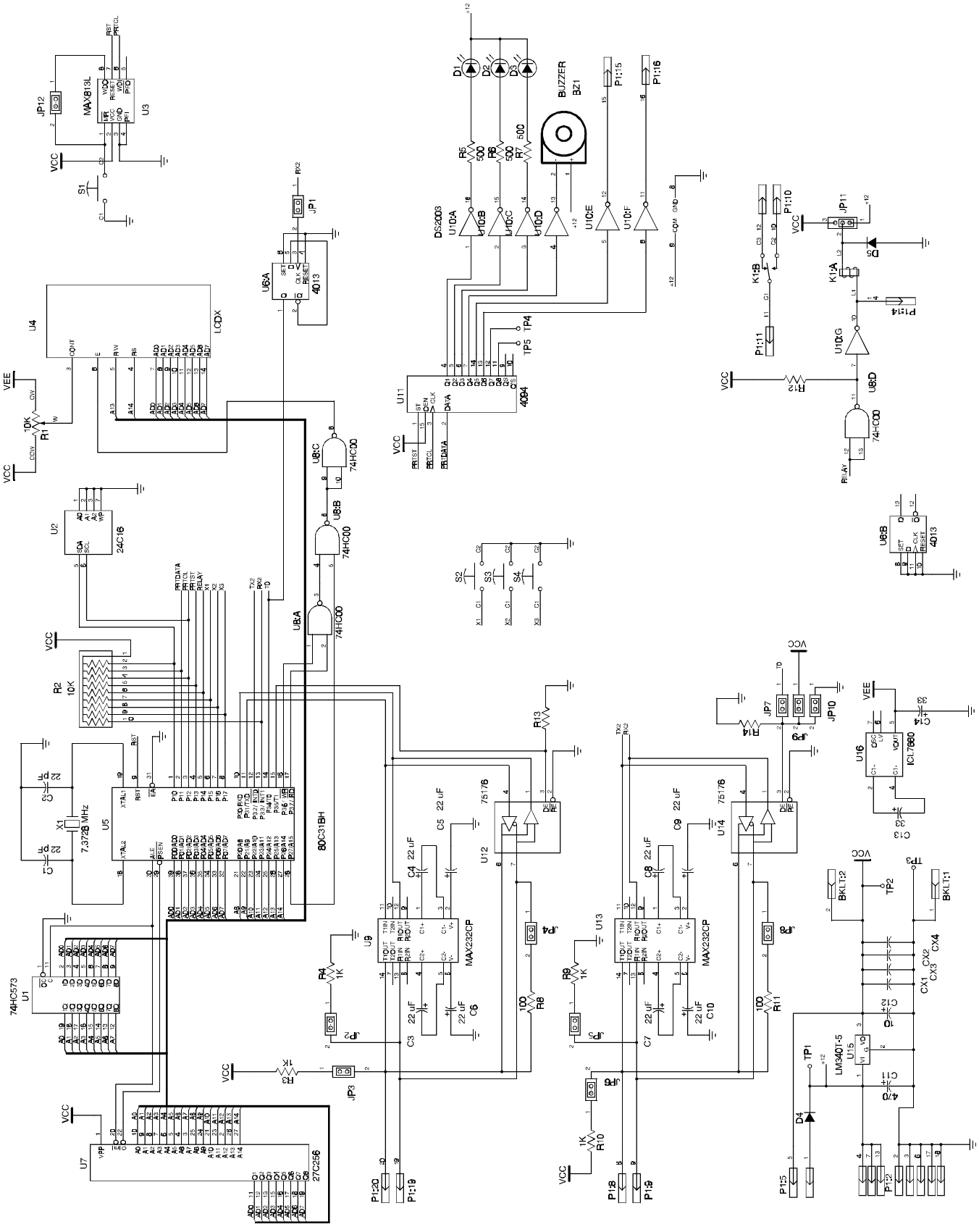
245	F5	11110101
246	F6	11110110
247	F7	11110111
248	F8	11111000
249	F9	11111001
250	FA	11111010
251	FB	11111011
252	FC	11111100
253	FD	11111101
254	FE	11111110
255	FF	11111111

DISPLAY PARTS LIST

DESIGN	QUAN	PART NO	TYPE	DESCRIPTION	MFG	SUPPLIER	DRAWING #
BZ1	1	EFB-CB37C11		Buzzer	Panasonic	Digikey	6012-001
C01	1		22 pF	Calpacitor, Mono			6012-001
C02	1		22 pF	Calpacitor, Mono			6012-001
C03	1		22 uF 10 VDC	Capacitor, Electro			6012-001
C04	1		22 uF 10 VDC	Capacitor, Electro			6012-001
C05	1		22 uF 10 VDC	Capacitor, Electro			6012-001
C06	1		22 uF 10 VDC	Capacitor, Electro			6012-001
C11	1		100 uF 25 VDC	Capacitor, Electro			6012-001
C12	1		10 uF 10 VDC	Capacitor, Tantalum			6012-001
C13	1		10 uF 10 VDC	Capacitor, Tantalum			6012-001
C14	1		10 uF 10 VDC	Capacitor, Tantalum			6012-001
CX1	1		0.1 uF	Capacitor, Mono			6012-001
CX2	1		0.1 uF	Capacitor, Mono			6012-001
CX3	1		0.1 uF	Capacitor, Mono			6012-001
CX4	1		0.1 uF	Capacitor, Mono			6012-001
D1	1		RED T1 ¾	LED			6012-001
D2	1		YELLOW T1 ¾	LED			6012-001
D3	1		GREEN T1 ¾	LED			6012-001
D4	1	1N4004		DIODE			6012-001
D5	1	1N4004		DIODE			6012-001
K1	1	G2E-184PM-US-DC12	12V SPDT	Relay, Dip	Omron	Digikey	6012-001
P1A	1	EDSTLZ950/20	20 Position	Header, Terminal	OST	Digikey	6012-001
P1B	1	EDZ950/18	18 Position	Plug, Terminal	OST	Digikey	6012-001
P1C	1	EDZ950/2	2 Position	Plug, Terminal	OST	Digikey	6012-001
R1	1		10K 1 Turn	Trimmer			6012-001
R2	1		10K x 9	Resistor Network			6012-001
R5	1		470 5% 1/4W CF	Resistor			6012-001
R6	1		470 5% 1/4W CF	Resistor			6012-001
R7	1		470 5% 1/4W CF	Resistor			6012-001
S1	1		Min EVQ	Switch, Pushbutton	Panasonic	Digikey	6012-001
S2	1		Min EVQ	Switch, Pushbutton	Panasonic	Digikey	6012-001
S3	1		Min EVQ	Switch, Pushbutton	Panasonic	Digikey	6012-001
S4	1		Min EVQ	Switch, Pushbutton	Panasonic	Digikey	6012-001
U01	1	74HC573	8 bit	Latch			6012-001
U02	1	27LC02		EEPROM	Microchip	Digikey	6012-001
U03	1	MAX813LCPA		Supervisor, Micro	Maxim	Digikey	6012-001
U04	1	MDLS-16265-G-LVLED04	2 x 16 Alphanumeric	LCD Display	VARITRONIX	Digikey	6012-001
U05	1	P80C32GBPN	8 bit	Microprocessor	Signetics		6012-001
U06	1	4013B	Dual D type	Flip Flop			6012-001
U07	1	27C256	32K x 8	EPROM			6012-001
U08	1	74HC00		QUAD NAND			6012-001
U09	1	MAX232CPE		RS232 Driver	Maxim	Digikey	6012-001
U10	1	DS2003N	Darlington	Drivers	National	Digikey	6012-001
U11	1	4094B	8 bit	Shift Register			6012-001
U14	1	DS75176BN	RS485	Driver/Rcvr	National	Digikey	6012-001
U15	1	7805	5 Volt	Voltage Regulator			6012-001
U16	1	ICL7660CSPA	5 Volt	Voltage Inverter	Harris	Digikey	6012-001
X1	1		HC-49 7.3728 MHz	Crystal	CTS	Digikey	6012-001
M01	1	6012-002		BASE	HPI	Neal Feay	6012-005
M02	1	6012-003		COVER	HPI	Neal Feay	6012-005
M03	1	6012-004		COVER SHIELD	HPI	Neal Feay	6012-005
M04	4		#4 x ¾	Nylon Spacer			6012-005
M05	5		6-32 x ¼	Hex Spacer			6012-005
M06	13		6-32 x ¼	Screw, Pan X			6012-005
M07	13		#6, Int Star	Locwasher			6012-005
M08	2		#4 x ½	Spacer, Nylon			6012-005
M09	2		4-40 x ¾	Screw, Pan X			6012-005
M10	2		#4 Int Star	Lockwasher			6012-005
M11	1		6-32 X 1″	Spacer, Hex			6012-005
M12	1		6-32 X ¼	Screw, FH, X			6012-005
M13	2		3/8-24 x 3/8	Thumbscrew			6012-005
M14	1	2030-004		Wall Bracket			6012-005
M15	1		Lexan	Window			6012-005
M16	4		#6 Nylon	Washser			6012-005
M17	4		6-32 x 3/8	Screw, Pan X			6012-005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S1
JP1
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4013
LCDX
U4
VEE
R1
10K
U8:C
74HC00
U8:B
74HC00
U2
24C16
U8:A
74HC00
R2
10K
X1
7.3728 MHz
U5
80C31BH
74HC573
U1
U7
27C256
R3
1K
JP3
U9
MAX232CP
U12
75176
C4 22 uF
C5 22 uF
C3 22 uF
C6 22 uF
R4
1K
R6
100
JP4
JP2
U13
MAX232CP
U14
75176
C8 22 uF
C9 22 uF
C7 22 uF
C10 22 uF
R9
1K
R11
100
JP8
JP5
JP6
R10
1K
P1:20
P1:19
P1:18
P1:9
D1
D2
D3
BUZZER
BZ1
R5
500
R6
500
R7
500
P1:15
P1:16
DS2003
U10:A
U10:B
U10:C
U10:D
U10:E
U10:F
U11
4094
TP4
TP5
K1:B
K1:A
P1:10
P1:11
P1:14
U10:G
R12
U8:D
74HC00
U6:B
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S2
S3
S4
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R14
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C13
C14
TP3
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TP2
CX1
CX2
CX3
CX4
C12
C11
U15
LM340T-5
TP1
D4
P1:5
P1:12
VCC
VEE
GND