



Mestek Technology, Inc.

MTI Messenger

Installation and Operation Manual



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# The MTI Messenger Installation and Operation Manual

## Section 1: Introduction

The MTI Messenger is a remote monitor-for-fail control device with an embedded modem and optional features. It is intended for applications where a remote system needs to be monitored. The MTI Messenger monitors up to six channels for an out of tolerance condition. Channels may be configured to measure temperature using a 10k thermistor, TE6000 RTD (1K), or configured as dry contact relay inputs. When a fail condition is encountered, the device dials a designated number using the Public Switched Telephone Network. Once connected to the receiving computer system, a packet of information is uploaded and presented using the logging software. Provisions are also made to use a Pager.

Other features of the device include the ability to dial-in to the MTI Messenger to check on current system status, and use strip chart and logging features. It can also dial a second number, set two levels of failure, dial at specified times, automatic check-in to ensure correct operation, and Outdoor Reset. A set of relay contacts is also provided and enabled during an alarm condition.

## Section 2: Components and Accessories

The basic package includes the MTI Messenger, a 9-pin serial cable, a telephone cable, PC software and the MTI Messenger documentation.

Optional equipment includes a various 10k temperature sensors, 24VAC power supply, a 1K temperature sensor, a 1K SIP PACK (for use with 1k sensors), outdoor air mounting, well assembly, immersion mount, plenum wire, insulating tape, electrical fusing tape, hose clamp, strap clamp, as well as additional cables.

Part Number	Description
JCT1	1k Temp Sensor
JCT2	Outdoor Air Mounting
JCT3	Outdoor Sensor W/housing
JCT4	Well Assembly
JCT5	Immersion Mount
TS1	10k STD Temperature Sensor Pipe Mount (-50 °F to 250 °F)
TS3	10k STD Temperature Sensor Cylinder (-50 °F to 250 °F)
TS5	10k High Temperature Sensor w/ Flange (250°F to 500°F)
TC1	Telephone Cable
SC1	Serial Cable DB9 M/F
WRFt	Wire pair, ft., Plenum
Itape	Insulating Tape, 30' x 2" roll
FT1	Electrical Fusing Tape, 36' roll
THM2	Thermal Grease, 2oz
THM1	Thermal Grease Blister
HCBulk	Hose Clamp, 2 1/16-3, rub, 10ct
SCBulk	Strap Clamp, 1-3.5 ", 10ct
PS1	24 VAC Power Sup

## Section 3: General Operation

The MTI Messenger monitors up to six input channels. If no failure exists the unit can dial-out and “check-in”, reporting correct operation. If a failure exists, the MTI Messenger will check the channels priority. If the channel has been assigned critical priority, then an immediate dial-out is initiated. If the channel has been assigned warning priority, the dial-out will occur at a set time during the day. When a failure is detected an alarm will sound and an associated relay output will be enabled.

The MTI Messenger also has the ability to answer in-coming calls. This feature allows for real time monitoring and logging, as well as remote unit configuration.

Outdoor Reset is used to control a boiler water temperature based on the outside air temperature. This is a proportional control where outside air temperature directly controls the boiler water temperature. This results in a dynamic setpoint controlled by the outside air temperature.

## Section 4: Configuration

This section will cover in detail each setting and how it affects the overall operation of the MTI Messenger. This section can also be treated as a glossary for explaining terms. Please see the “Software Manual” for configuring the unit using the MTI Messenger Software Package.

### MTI Messenger Identity

**Access Code:** The Access Code is an 8 character field which has two main functions. The primary function of the Access Code is it to provide a unique identity to the unit, and therefore, is included in every standard message sent from the MTI Messenger. The Access Code is used by the Logging program to associate a unit with a customer. The second function of the Access Code is to act as a password for Dial-In connections. Without the correct Access Code the MTI Messenger will hang up the line on any Dial-In attempts. The Access Code can be 0 – 9 or A – F.

**Messages (Line 1 and Line 2):** The Message Fields are both 15 character fields which can be used to describe the application or monitored equipment for the unit. These fields are included in every standard message sent from the MTI Messenger.

**Alternate Messages:** The MTI Messenger can be configured to send “alternate messages” instead of it’s standard ones. The Alternate Message Fields are both 32 character fields. If this function is in use, when the unit checks -in it will send the Alternate Pass Field, and if it is reporting an error it will send the Alternate Fail Field. These messages do not change depending on the type of failure, or give any information on the failure that is occurring. The logging program will not know how to interpret these messages because they are user defined. These messages are provided to allow users to receive readable messages without using the logging software.

**Standard Packet:** The standard packet sent from the MTI Messenger, that is interpreted, and displayed by the logging software, consists of the following parts:

Data	Number of Characters
Access Code	8
Input Channel Select*†	2
Input Channel Configuration*†	2
Input Channel Levels*†	2
Input Channels that are Failing*†	2
Sensor Types*†	2
Input Channel 1 Reading*	4

Input Channel 2 Reading*	4
Input Channel 3 Reading*	4
Input Channel 4 Reading*	4
Input Channel 5 Reading*	4
Input Channel 6 Reading*	4
Message Line 1	15
Message Line 2	15
Relay Status*†	2
Time Stamp*	6
Checksum*	4

\* Values are transmitted in Hexadecimal.

† Hexadecimal values that each bit has separate significance.

Sample Packet:

1000000007031F0000F852009300F60F000000000000Communicator 1 Communicator 2 0021212114FA

NOTE : Using the standard packet is recommended since it provides the most information about the current system status and any failures that are occurring.

### Operational Data

**Phone dial type:** This is the type of phone system that the unit is connected to. It can be either “Tone” or “Pulse”. If the phone system type is unknown then use “Pulse”, since it will work on either type of system. However, if “Pulse” is used all Pager features will be disabled.

**Alarm Enable:** When the alarm is enabled the MTI Messenger will emit an alarm when it encounters failures.

**Failure Time:** The amount of time the MTI Messenger must detect a failure condition before taking action on it. The time can be any value from 0 to 10 minutes. A value of at least 1 minute is recommended to prevent spikes from registering erroneous failures.

### Communications

**Auto Answer # of Rings:** This value controls whether the MTI Messenger will answer incoming calls or not. If this value is set to 0, the unit will not answer incoming calls. Setting this value to a number greater than 0 will allow for remote access of the unit and real time monitoring/logging using the MTI Messenger Tool Suite.

**Primary Number:** This is the first number the MTI Messenger will attempt to report all of its messages to. This number can have an Outside Line Prefix Number, and an Area Code associated to it if needed.

**Secondary Number:** This is the second number the MTI Messenger will attempt to report all of its messages to. This number can have an Outside Line Prefix Number, and an Area Code associated to it if needed. If the Secondary Number is selected, but not the Primary Number, the MTI Messenger *will not* attempt to dial the Secondary Number. The Secondary Number is only used as a backup or additional number to the Primary Number.

**Report Messages To Both Numbers:** If this feature is enabled then the MTI Messenger will attempt to report messages to both the Primary and Secondary Numbers. If both numbers are enabled and this feature is not enabled then as soon as the unit reports it’s message to either of the two numbers it will stop trying to report the failure.

**Number is a Pager:** If the number being specified is a Numeric Pager this option must be enabled. This causes the MTI Messenger to transmit the message code to the numeric pager using the tones of the telephone system.

**Pager Script:** The pager script usually consists of the string “@phone #”, or “@message”. The ‘@’ sign signifies a wait for 5 seconds of silence, after a dialed connection. The phone # or a brief message will then be sent to the numeric pager using the tones of the telephone system. For more information on the Pager Script see the Communications Section of this manual.

**Check In Interval:** The MTI Messenger can check-in at regular intervals to report that the system is operating within the specified limits. The check-in interval can be Daily, Weekly, Monthly, or No Check-in. All check-ins take place during the Dial Out Hour, if a Weekly interval is selected then a weekday must also be selected. If Monthly check-in is selected then a numeric day value must also be specified.

**Dial Out Hour:** This setting controls when the MTI Messenger will report it’s Warnings or Check-in. All Warnings and Check-ins of the unit take place within this hour. This setting only affects Warnings and Check-Ins since Critical failures dial out immediately.

### **Channels**

**Channel Type:** Each channel can be configured to use several different types of sensors.

1. **10k STD Temp** – This is the standard temperature to resistance sensor type supplied with the MTI Messenger. It is a NTC thermistor, 10k @ 77°F (25°C), temperature range –50 to 250F. The **10k STD Temp** is currently available in a standard cylindrical or a pipe mount package.
2. **10k High Temp** - This is an optional high temperature to resistance sensor type. It is a NTC thermistor, 10k @ 375°F (190°C ), temperature range 200 to 500F
3. **TE6000** – The Johnson Controls TE6000 is a nickel wire RTD, 1K @ 70°F (21°C), temperature range –50 to 250F.  
\*If TE6000’s are going to be used, the 10K SIP pack on the MTI MTI Messenger must be changed to a 1K SIP Pack. TE6000’s and 10K thermistors CANNOT be used at the same time. See the Installation section of this manual for more information.
4. **Switch** – This selection monitors a set of contacts for an open or closed condition.
5. **Raw Count** – This selection is for using sensor types that are not standard. The MTI Messenger uses the count value returned for the A/D converter (0 – 4096) to determine if a channel is failing or not. With a little experimentation acceptable Upper and Lower Limits of non-standard sensors can be determined.

**Channel Priority:** Each channel has a priority level associated with it. The priority can be either Warning or Critical. The priority of a channel determines when the MTI Messenger will report a failing channel. Warnings are reported only during the Dial Out Time, and Criticals are reported as soon as they occur.

**Upper/Lower Limit:** These settings determine the acceptable operating range of the item being monitored. If the MTI Messenger senses a value greater than the Upper Limit or Lower than the Lower Limit a failure is triggered, and the unit will act on the failure depending on the channel’s priority level.

**Fail on:** This setting appears if the channel is configured as a switch. A switch can be setup to fail on an open condition or on a closed condition. This setting is similar to the Limit settings for a temperature sensor.

**Relay Enable:** This feature determines if Relay1 will be activated when the channel fails. Relay1 can be either normally open or normally closed depending on jumper the jumper position. See the Installation section of this manual for more information on Relay jumper settings.

## Outdoor Reset

**High Outdoor Air Temperature/Water Temperature at High Outdoor Air Temperature:** These 2 settings together set one of the two points needed to determine the dynamic setpoint of the heating water, based on the Outdoor Air Temperature.

**Low Outdoor Air Temperature/Water Temperature at Low Outdoor Air Temperature:** These 2 settings together set one of the two points needed to determine the dynamic setpoint of the heating water, based on the Outdoor Air Temperature.

**Temperature Differential:** The Temperature Differential setting keeps the boiler from cycling too much when maintaining the setpoint temperature. This value will be dependant on the heating system.

**Minimum On-Off Time:** This setting, along with the Temperature Differential, keeps the boiler from cycling by requiring the boiler to remain on or off for a certain time.

**Domestic Hot Water In Use:** This Option is for installations where there is a tankless water heater present in the heating boiler. In these applications the boiler still needs to heat the Domestic Hot Water even though the boiler has been shut down due to high outdoor air temperature. When this feature is enabled channel 6 becomes dedicated to monitor the DHW thermostat switch.

**\*If the DWH thermostat is connected to CH 6, an isolation relay is required.** This is due to the channel sensor's requirement for dry contacts. Applying a control voltage to the channel sensor inputs may damage the unit.

**Maintain Minimum Water Temperature:** Maintaining the minimum water temperature may be required if the supply water temperature needs to be kept above the manufacturer's recommended levels. When this feature is enabled the temperature of the boiler will be maintained at the Water Temperature at High Outdoor Air value.

NOTE: Before beginning the configuration of the MTI Messenger it is recommended to map out the installation using the following MTI Messenger Worksheet in section 7. These worksheets will facilitate the configuration process.

## Section 5: Detailed Operation

- 1) The MTI Messenger samples 6 analog input channels approximately every second.
- 2) Once the 6 channels are captured, the embedded program checks the channels for out of tolerance conditions.
  - A) If an input channel is defined as a temperature sensor, it's value is evaluated against it's upper and lower Limit.
  - B) If a channel is defined as a switch, it is evaluated whether it is open or closed.
  - C) Values checked are based on the counts used by the A/D converter (i.e. 12 bit = 0-4096 counts) over the range of values set by the voltage dividers.
- 3) If no failure exists, normal operation is resumed, and sampling and checking continues. If a periodic time is selected for Check-in. Then at the time set, the MTI Messenger will place a call and check-in, reporting no failures.
- 4) If a failure exists, the MTI Messenger will check if the channel has been configured to report as a critical failure or as a warning.

- A) If the channel has been assigned the critical condition, then an immediate <sup>1</sup>dial-out is initiated.
- B) If the channel has been assigned the warning condition, the dial-out will only occur at the Dial-out hour set in the setup program. In order for the MTI Messenger to dial out at this later time, the warning condition (failure) must still be in effect at the time of the dial-out.
- C) If the Alarm has been enabled, the Alarm will sound approximately every second.
- D) If the Relay enable has been assigned to the failing channel, then the relay will be enabled. *The relay state will not change unless the relay has been in the previous state for 5 seconds. This is the minimum on/off time, and ensures that the relay will not chatter at a failing threshold.*

**\* Special Cases\***

- E) If the "Ch3 AND Ch4" option is enabled then ***BOTH Channel 3 AND Channel 4 must be failing in order for the MTI Messenger to recognize a failing condition on either of the 2 channels.*** If only 1 of the 2 channels is failing the MTI Messenger will not report the failure.
  - F) If Channel 5 is configured as a switch and the "Monitor Only" option is enabled then this channel will ***NEVER*** fail. It is used only to monitor the channel's status.
- 5) The dialing routine uses up to two phone numbers to place a call and provide information of a failing or check-in condition. Critical failures dial-out immediately<sup>1</sup>. Warnings & Check-ins dial-out at the specified time.
- A) After a failing condition occurs, the MTI Messenger waits the specified time to ensure a failure exists. This may be from 0 to 10 minutes ("Failure Time"). After this time elapses and the failure still exists, the unit will begin to dial out.
  - B) The setup information is checked to see if the phone numbers(s) are enabled, if an area code, outside line, and pulse or tone dialing is required. Also, if the number is a pager or standard reporting/logging program.
  - C) If the Primary Phone Number is enabled, then it is dialed and the failure packet is sent. If the line is busy, the MTI Messenger will attempt a retry every "Failure Time" time until the failure is reported. *During this time (dialing), the Alarm will not sound if it is enabled, but will resume after the dial attempt has finished. If the Secondary Phone Number is enabled, but the Primary Phone Number is not enabled, the MTI Messenger WILL NOT attempt to connect to the Secondary Phone Number. The Secondary Phone Number only used as a backup.*
  - D) After the number is dialed, the MTI Messenger program waits for 60 seconds for a carrier, if no carrier, then the program aborts, and then retries after the "Failure Time".
  - E) If the MTI Messenger could not establish a connection with Primary Phone Number, and the Secondary Phone Number is enabled, the MTI Messenger will attempt to connect with the Secondary Number and send it's packet. If both numbers failed, the MTI Messenger will re-try after the "Failure Time".
  - F) If the unit is set up to report messages to both numbers, then the MTI Messenger will dial both numbers to report the failing condition.
  - G) **RETRY** – Critical failures will attempt a connection until established. Warnings and Check-ins will only retry during the Dial Out hour.
  - H) **Hierarchy** – Check-ins always dial. If Warnings are present without Criticals, the Warnings are reported. If a Warning is present and has been reported, and a Critical occurs, the Critical is reported. If Criticals are present, they are reported. If Criticals and Warnings are present at the same time, or a Warning occurs after a Critical, the Criticals are reported. If the Criticals clear, then any warnings present will be reported. *Priority : 1<sup>st</sup> = Check-in, then 2<sup>nd</sup> = Critical, and then 3<sup>rd</sup> = Warning*
  - I) The check-in condition will follow the same rules for dialing as the failing condition dialing.
  - J) Dialing a pager service requires more waits and pauses to allow connections. See Section 6: Communications.
  - K) If alternate packet is selected, the specified alternate packets will be transmitted instead of the standard packet.
  - L) If a failure occurs and the MTI Messenger has dialed and sent packet(s) of data, another dial may take place. If the failure clears and all samples are within tolerance for the amount of time specified in the Failure Time parameter, another dial out may be initiated.

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<sup>1</sup> Immediate dial-outs are still controlled by the Failure Time setting.

- 6) The MTI Messenger **answer mode** is controlled by the # of rings parameter. If the number of rings is set to more than 0, the unit will pick up the line after the amount of rings and run an answer routine.
  - A) After answering the unit will prompt the user or control program for “Access Code}”.
  - B) The access code needs to be entered in order to gain access to the communications program. The access code must be 8 hexadecimal digits consisting of A-F, 0-9, Case sensitive.
  - C) Once the access code has been entered, the real-time monitoring and logging features may be accessed.
  - D) If using the Configuration Program, the “Access Code}” is hidden and will not be displayed. The Setup program will handle entering the access code.

## MTI Messenger LED Indicators .

There are 3 LEDs on the MTI Messenger that show current status: green, yellow, and red.

When the MTI Messenger is first powered on it performs system diagnostics.

First its tests the lights and beeper: The green light will flash, it will beep once and then the yellow light will flash followed by the red.

Second it checks its memory: The green light will come on while it performs the check. If everything is ok the green light will remain on and the unit will check the modem. If it encounters an error while checking the memory it will flash red green red and then beep twice. The unit will continue this sequence until the error is corrected. See Troubleshooting for more information.

The last thing that is checked is the modem: The green light will again light while the MTI Messenger verifies the modem. If the phone/modem switch is in the modem position and the modem is ok, the unit will begin normal operation. If the MTI Messenger cannot communicate with the modem, it will flash the red, the yellow and green lights in sequence 3 times while beeping. The MTI Messenger will then begin normal operations.

Under normal operating conditions the green light generally signifies that no channels are failing, while the red light signifies that at least one channel is failing. The yellow light is lit when the MTI Messenger checks the channels.

Normal Operation, No failures: green and yellow cycle  
Normal Operation, with failing channels: red and yellow cycle

When attempting to dial the yellow light will come on while the MTI Messenger looks for a dial tone. If a dial tone is not found the red light will flash and then the MTI Messenger will go back to normal operations until the next time it tries to dial out. If a dial tone is found the green light will go on while the unit dials. After dialing the yellow light will come on while the MTI Messenger looks for a carrier. If a carrier is not found the red light will flash and the unit will go back to normal operations until the next time it tries to dial out. If a carrier is found the green light will come on as the Messenger sends its data packet. Once the packet is sent the unit hangs up the phone and goes back to normal operations.

## Section 6 Communications

**\*NOTE:** When setting-up the MTI Messenger using a serial port connection, the Serial Port switch must be set to Serial Port in order to allow for communications. Once programming is completed, the Serial Port Switch must be set to Modem. If this is not done, after re-powering the unit, **an alarm will sound** indicating the switch is in the wrong position or the modem is not functioning.

## Telephone for Voice Service

1. Though the unit does not have speech capacity, it may be used to play a song when trying to communicate. This is not the recommended way of using this system since messages are prone to being erased or lost, but does show an example of it's flexibility. To do this, the unit needs to be set up as if it were to connect to a pager service. This will allow the unit to transmit tones instead of the normal mode of sending ASCII text.
2. If an answering machine is to pick up, the '@' **five second** wait may not work, so use ','(s) **instead** to provide two second wait(s) after the number is dialed. You must first test the phone to which you are dialing and count the # of seconds if you are using ','s. This is the time you wish the song to transmit and store on the answering machine. This will take some trial and error to get some answering machine(s)/system(s) to work. Bear in mind, that if someone picks up the phone, the song will be sent and none will.
3. Use the Pager service, and enter the following as a script. Commas are (2) second Pauses.

Mary Had a Little Lamb	@3212333,222,1333,212333322321
Jingle Bells	@333,333,39123,666-663333322329,333
Olympic Fanfare	@3-9-91231,2222-32112312,3-9-91231,2
The Butterfly song	@963,23621,3693236236932362,963,236
Happy Birthday	@112,163,112,196,110,8521,008,121
Auld Lang Syne	@8444684891439
Auld Lang Syne (','s instead)	,,,8444684891439

## Pager Service

### NOTE: Pager Service requires TONE DIALING

1. The pager script usually consists of the string "@phone #", or "@message". The '@' sign signifies a wait for 5 seconds of silence, after a dialed connection. The phone # or a brief message will then be sent. See dialing modifiers. Example: @5551212 After dialing, there is a 5 second wait for silence, then 5551212 is sent. If a telephone # needs to be sent while the Greeting is being played, a delay will probably be in order. Use a ',' to wait 2 seconds, multiple commas wait that many seconds times 2.

Example: ,,,5551212. In this example there is a (6) second wait after the phone # is dialed, then the phone # 5551212 is sent.

2. There is a maximum of 30 seconds for the unit to connect and transmit a message. An abort and retry will occur only if the line is busy or there is no dial tone, since handshaking may or may not be present with the pager service.

The Following is how to understand a pager message.

Example System Configuration:

Channel 1 = 10k STD Temp (used to measure temperature of Outside Air)

Channel 2 = 10k STD Temp (used to measure Water Temperature Out)

Channel 3 = 10k STD Temp (used to measure Water Temperature IN )

Channel 4 = Switch (Fail on Closed Position)

A telephone number is entered in as the Primary Phone Number and an '@' is entered alone in the page script. When a failure is encountered the Primary Phone Number will be dialed and the '@' will inform the modem to wait for 5 seconds of silence. After 5 seconds of silence is encountered at the pager service company, the unit will send the failure code followed by the failure information.

**NOTE:** With STD 10k temperature sensors, temperatures are in the range of –50 F to 250 degrees F. Outside this range the unit is reporting limits, and will indicate a short or an open circuit at the associated channel. This limit could be used to detect a failing temperature sensor, either opening or shorting. The outside air temperature high and low limit could be set to fail using these values (-50F and 250F) *A short relating to temperature, will typically be 250 to 256 F. An open, will typically read –50 to -256 F depending on the sensor used.*

**Message 1:**

**Beeper Display:** 107 – -082 – 200 – 190 – 241- remaining channels truncated by beeper

Interpretation:

107		The first digit is the Critical or Warning indicator, in this case, the failure is critical ‘1’. The next two digits indicate the Failure code ‘07’ (see the following failure code table). In this Case, Channel 1, Channel 2, and Channel 3 Failed.
Channel 1	-082	Since Channel 1 indicates temperature using a STD 10k sensor, this is the reported temperature in degrees F of channel 1. -82° F is out of range, there is probably an open circuit in the sensor channel. Channel values can only be –50 to 250 F. but this value it is below –50 degrees.
Channel 2	200	Channel 2 also indicates temperature using a STD 10k sensor. This is the reported temperature in degrees F. The Water Temperature Out is 200 degrees F. This channel was also set to report a warning or critical failure when a set temperature was reached.
Channel 3	190	Channel 3 also indicates temperature using a STD 10k sensor. This is the reported temperature in degrees F. The Water Temperature Out is 190 degrees F. This channel Was also set to report a warning or critical failure when a set temperature was reached.
Channel 4	241	Channel 4 was set to report (fail or Critical) an open switch (dry relay contacts). This value indicates an open set of contacts. <i>Values above 128 are considered open contacts, while values below 128 are considered closed contacts. The increasing or decreasing values above and below 128 are the result of contact resistance in the relay or switch.</i> Channel 4 was set to fail on an open set of contacts.

The Failure Codes in Table 1 identify the failing channels based on the error code displayed on the pager.

Failure Code Table 1

Failure Code	Channel 1	Channel 2	Channel 3	Channel 4	Channel 5	Channel 6
x01	x					
x02		x				
x03	x	x				
x04			x			
x05	x		x			
x06		x	x			
x07	x	x	x			
x08				x		
x09	x			x		
x10		x		x		
x11	x	x		x		
x12			x	x		
x13	x		x	x		
x14		x	x	x		
x15	x	x	x	x		
x16					x	
x17	x				x	
x18		x			x	
x19	x	x			x	
x20			x		x	
x21	x		x		x	
x22		x	x		x	
x23	x	x	x		x	
x24				x	x	
x25	x			x	x	
x26		x		x	x	
x27	x	x		x	x	
x28			x	x	x	
x29	x		x	x	x	
x30		x	x	x	x	
x31	x	x	x	x	x	
x32						x
x33	x					x
x34		x				x
x35	x	x				x
x36			x			x
x37	x		x			x
x38		x	x			x
x39	x	x	x			x
x40				x		x
x41	x			x		x
x42		x		x		x
x43	x	x		x		x
x44			x	x		x
x45	x		x	x		x
x46		x	x	x		x
x47	x	x	x	x		x
x48					x	x
x49	x				x	x
x50		x			x	x
x51	x	x			x	x
x52			x		x	x
x53	x		x		x	x
x54		x	x		x	x
x55	x	x	x		x	x
x56				x	x	x
x57	x			x	x	x
x58		x		x	x	x
x59	x	x		x	x	x
x60			x	x	x	x
x61	x		x	x	x	x
x62		x	x	x	x	x
x63	x	x	x	x	x	x

## Example 2:

The pager will display the string, usually the phone number (whatever script entered), followed by an error code. The error code may be broken down as follows:

An x = don't care

Ixx	=	Critical Failure
Oxx	=	Warning Failure
x00	=	No failures, (Check-in)
x01	=	Channel 1 Failed
x02	=	Channel 2 Failed
x04	=	Channel 3 Failed
x08	=	Channel 4 Failed
x16	=	Channel 5 Failed
x32	=	Channel 6 Failed
xxx	=	Multiple Channels Failed, subtract the above values from the failure code until a 000 value is reached. The numbers subtracted = the Failing Channels.

Example: Failure code = 45

Failure Code	Channel	Remaining Error	Failing Channel
x45	- x32	= x13	Channel 6 Failed
x13	- x08	= x05	Channel 4 Failed
x05	- x04	= x01	Channel 3 Failed
x01	- x01	= x00	Channel 1 Failed

After the Failure message, the remaining part of the message will include the channel number's data starting with channel 1. A channel's data will be displayed based on the number of numeric characters available. If all 20 numbers are used by a message, then no channel data will be displayed. All (6) channel values are sent, though on a 20 number pager, only 5 channels are displayed.

If the channel has been assigned a temperature sensor value, then the temperature will be sent. If the channel is configured as a switch, the value for an open switch position will typically be greater than 200, and a closed switch will typically be less than 100. Ideally, a perfectly open switch = 256 and a perfectly closed switch with no resistance = 0.

Sample Message (20 digit Beeper): 5551212 -032-244-248 ( **pager script** = @5551212 )

First seven digits	=	Phone# or message
032	=	channel 6 failed, warning
244	=	open switch position if channel was defined as a switch
248	=	open switch position if channel was defined as a switch

Sample Message (20 digit Beeper): 5551212 -104-070-023 ( **pager string** = ( @5551212 )

First seven digits	=	Phone# or message
104	=	channel 3 failed, critical(message sent immediately)
070	=	70 degrees F on channel 1
023	=	23 degrees F on channel 2

\*Note Negative temperatures are signified by 2 hyphens in a row "--"

Sample Message (20 digit Beeper): -102-078-004-239-246 ( **pager string** = @ )

102	=	channel 2 failed, critical(message sent immediately)
078	=	78 degrees F on channel 1
004	=	closed switch if channel defined as a switch
239	=	open switch if channel defined as a switch
246	=	open switch if channel defined as a switch

Dialing Modifiers:

These dialing modifiers are used to control the way in which the modem dials and connects. The most common modifier is the '@', which is usually required as the first entry in the pager script

0-9	Dialing Digits
,	Pause for 2 seconds
@	Wait for a Quiet Answer. Modem listens for 5 seconds of silence before continuing. If 5 seconds of silence does not occur, the modem will hang-up and a retry initiated.
!	Timed break Recall (hookflash), makes the modem hang up the phone for ½ second and then take the phone line off hook again. This is frequently used to access a PBX's call transfer function.
;	Return to the command state after dialing. This allows a connection to be made with another modem without handshaking.

### **Additional Reporting Service**

Provisions for an alternate Pass or Check-In message, and alternate Fail message are provided for connecting to a modem service. This may be used instead of the standard packet used by the reporting software.

### **Remote Connection using Answer Mode**

An auto answer mode is provided to allow dial in access using a remote computer system. To use this feature, the # of Rings needs to be set to a value greater than 0. Refer to the Setup program for use of the dial-in feature. Ensure that the proper access code is present in the setup program, else the dialer will automatically disconnect.

If a phone line is shared with an answering machine, check the operating manual of the answering machine. The answering machine may have a remote enable/disable command sequence that will remotely control the answering machine so that the MTI Messenger may be accessed. The unit must be set to a ring count higher than the answering machine so as to prevent the MTI Messenger from answering the phone before the answering machine. If the answering machine is disabled, the nit will pick-up after meeting it's ring count. Ensure that the proper access code is present in the setup program, else the MTI Messenger will automatically disconnect.

## Section 7: Worksheets

### MTI Messenger Worksheet

#### MTI Messenger/Site Identity

Option	Value
Access Code	
Message 1	
Message 2	

#### Channel Table

Channel	In Use?	Monitoring	Sensor Type	High Limit	Low Limit	Priority	Activate Relay
Channel 1							
Channel 2							
Channel 3							
Channel 4							
Channel 5							
Channel 6							

#### Output Table

Output	Controlling
Relay 1	
Relay 2	

#### Operation

Failure Recognition	
Failure Time ( <i>0 – 10 minutes</i> )	

MTI Messenger Dial-In	
Auto Answer Number of Rings ( <i>0 disables Dial-In Ability</i> )	

Check-In	
Check-In Interval ( <i>None, Daily, Weekly, Monthly</i> )	
Check-In Day ( <i>Numeric for Monthly, Weekday for Weekly</i> )	
Dial-Out Hour ( <i>Warnings are also called in at this time</i> )	

## Communications

Primary Telephone Number	
Telephone Number	
Area Code	
Prefix Number	
Number is Pager	

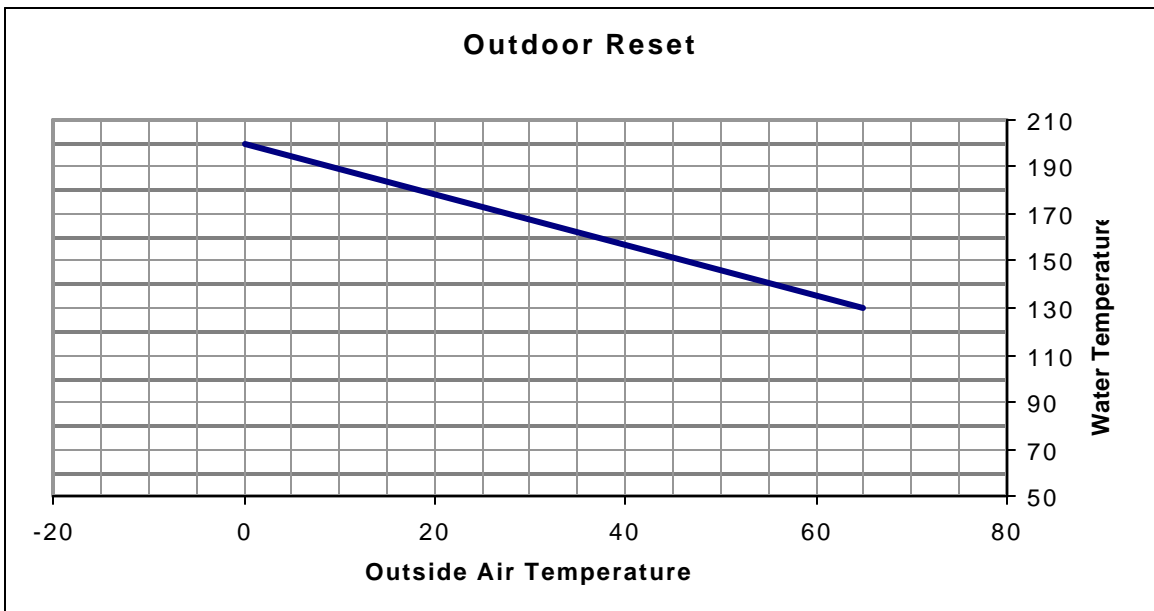
Secondary Telephone Number	
Telephone Number	
Area Code	
Prefix Number	
Number is Pager	

Report Messages to Both Numbers?     Yes     No

Phone system type at installation site:     Pulse     Tone

Pager	
Pager Script	

## Outdoor Reset



**Chart 1 - Outdoor Reset Example**

The chart represents the functionality of the reset control. Based on the outside air temperature, the supply water temperature is kept at the value indicated by the chart. If using the following settings:

Example:

High Outside Air Temperature	= 65°F	Reset shutdown
Water Temperature @ High OA	= 130°F	Minimum supply temp.
Low Outside Air Temperature	= 0°F	Design temperature of building
Water Temperature @ Low OA	= 200°F	Supply at building design temp
Temperature Differential	= 2°F	

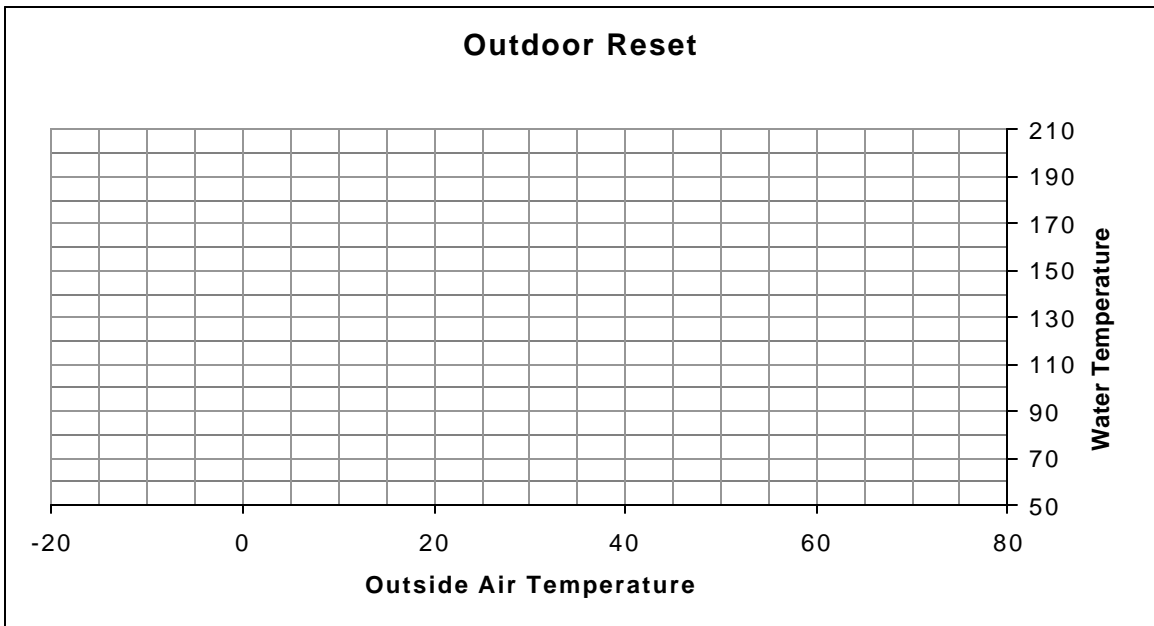


Chart 2 -User Outdoor Reset

Option	Value
High Outdoor Air Temperature	
Water Temperature @ High Outdoor Air Temperature	
Low Outdoor Air Temperature	
Water Temperature @ Low Outdoor Air Temperature	
Temperature Differential	
Minimum On-Off Time	
Maintain a Minimum Water Temperature	
Domestic Hot Water	

## Section 8: Installation

### Operating Environment

The MTI Messenger can operate in a temperature range from 0°C to 70°C (32°F to 158°F)

### Mounting

The MTI Messenger should be mounted using the flanges located on the top and bottom of the unit. It should be located in a place allowing access to the side communications ports and power jacks, as well as the I/O connectors located on the bottom. The unit's location should have access to a phone jack and 24VAC power or a power outlet.

### Connecting Sensors

Determine the type and quantity of the sensors that the application will require. The sensors typically consist of switches and temperature sensors, though other sensors will work. Do not route the sensors in proximity to a spark, motors, breakers, transformers, SCR drives, welders, fluorescent lamp controllers, relays, or a high current carrying conductor. Never run signal-carrying wires in the same conduit that carries power lines, relay contact leads or other high-level voltages or currents

The unit is configured with connections for a wall mounted 24VAC supply through a 2.1mm plug, or direct wired 24VAC using a 2 piece plugable connector.

### Temperature Sensor Locations

When connecting the Water Temperature Outlet Sensor, care must be taken where the sensor is located. A TE6000 Sensor is available that may be mounted in a well, but if the non-invasive (surface type) sensor is used, the sensor must:

1. Be located as close to the jacket or casting of the boiler as possible. When mounting the sensor at this location, there will be a temperature deviation between this location and the internal boiler temperature. Temperature variances of between 10 and 20 degrees F have been measured on some boilers. This may be the result of inaccurate gauges or other factors. Measurements should be taken to minimize these variances between the internal boiler water temperature and the outlet where the sensor will be mounted.
2. Be mounted on the water outlet pipe and insulated from the surrounding ambient air.
4. Recommend the use of a thermal conductor between the pipe and the sensor to maximize heat transfer. This may be a thermal grease or pad.

Establish a suitable location for the Outside Air Temperature Sensor. It should:

1. Be located out of direct sunlight, typically a north wall.
2. Be away from ducts/vents and windy locations.
3. Be protected from damage, snow and ice accumulation, water, and electrical interference (power lines, ham/CB radio antennae, etc).

### Relay Options

Relays K1 & K2 may be assigned the Normally Open (NO) position or the Normally Closed (NC) position using jumpers J2 & J3 on the main board. The unit will need to be disassembled in order to gain access to the jumpers. The default setting on both jumpers is NO.

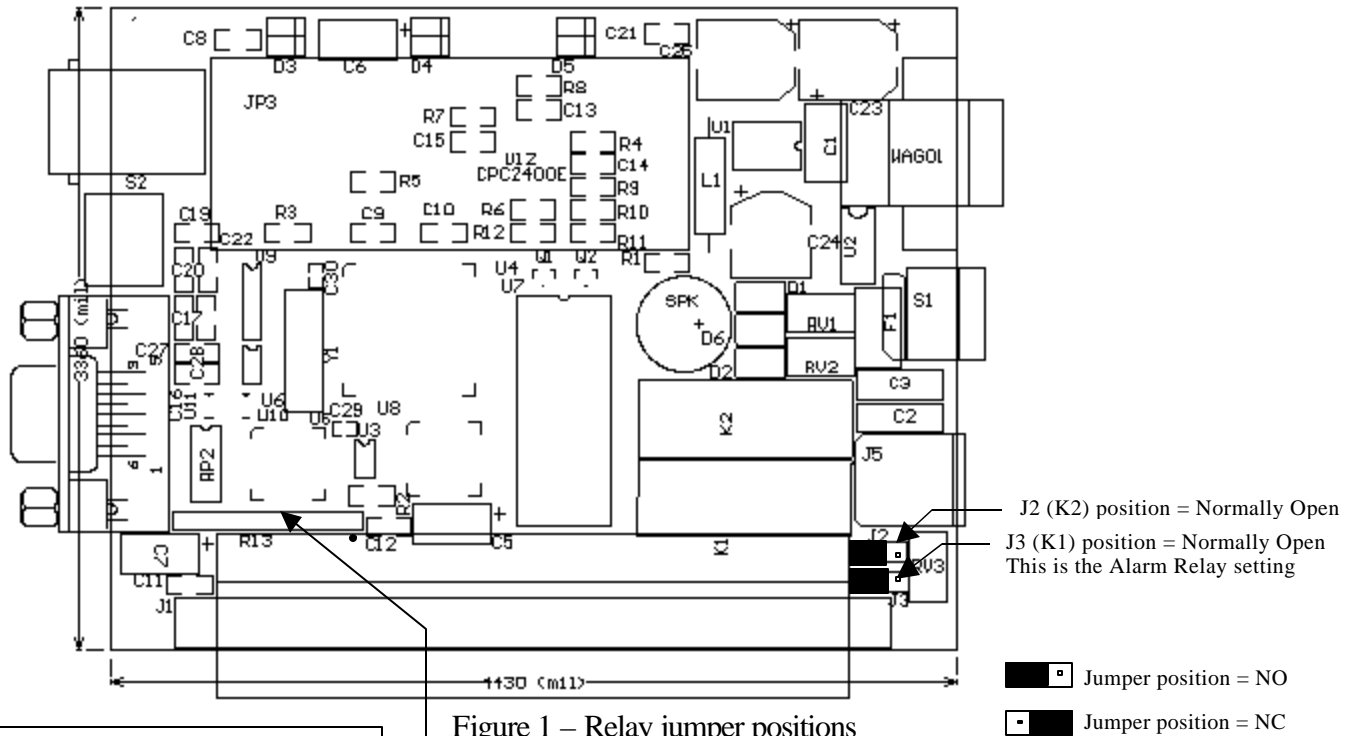


Figure 1 – Relay jumper positions

**R13**; 10,000 ohm or 1000 ohm SIP.  
 Shipped with 10,000 ohm SIP. 10,000 ohm SIP used with thermistor (TS1, TS3 & TS5). 1000 ohm SIP used with TE6000.  
 NOTE  
 If changing observe polarity '•'

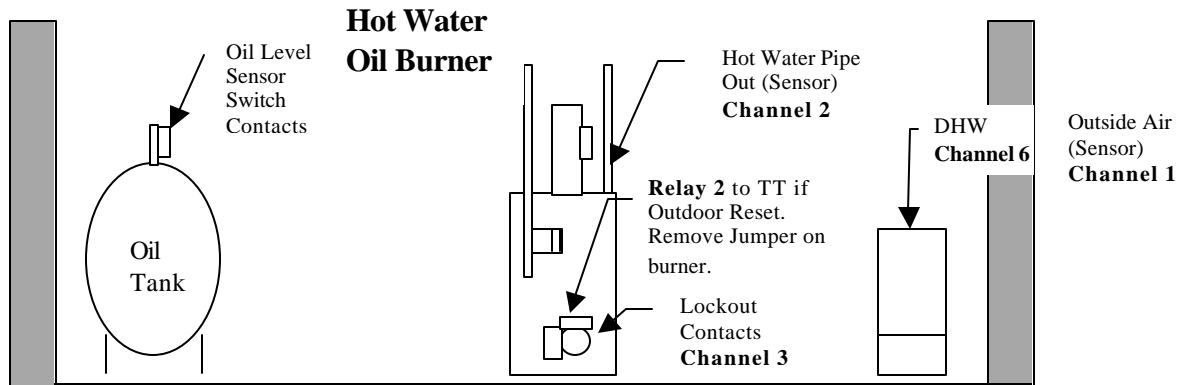
## Section 9: Applications

Although the main application of the MTI Messenger is to monitor remote electro-mechanical systems, it can be used in a variety of other applications.

### 1. Hot Water with Outdoor Reset

Typically, when connecting to a hot water heating system, the application will require that Channel 1 have the outside temperature sensor connected (no polarity of sensor). Channel 2 will have the water temperature sensor connected. The Relay 2 contacts will be used at the TT terminal of the oil burner. This will require the removal of the jumper installed at the TT terminal. The remaining sensors are the discretion of the user. This configuration is only a requirement when the outdoor reset function is used. When the outdoor reset function is disabled, there are no fixed assignments of the channels.

**Warning: Do not apply voltage to the Channel Inputs, Damage to the unit will result. The relay output contacts are dry, and the ratings specified, apply.**



**Figure 12**  
**Heating system**

In this typical application (fig. 2), the unit will perform as a monitor for fail device & as an outdoor reset control. This will utilize (4) of the unit's six channel inputs and (1) set of relay contacts. If DHW is not used, there are (2) remaining channel inputs and one failure relay set of contacts that may still be employed. If DHW is used there is (1) remaining channel (channel 5), since channel 6 will be dedicated to DHW call for heat.

#### Suggestions:

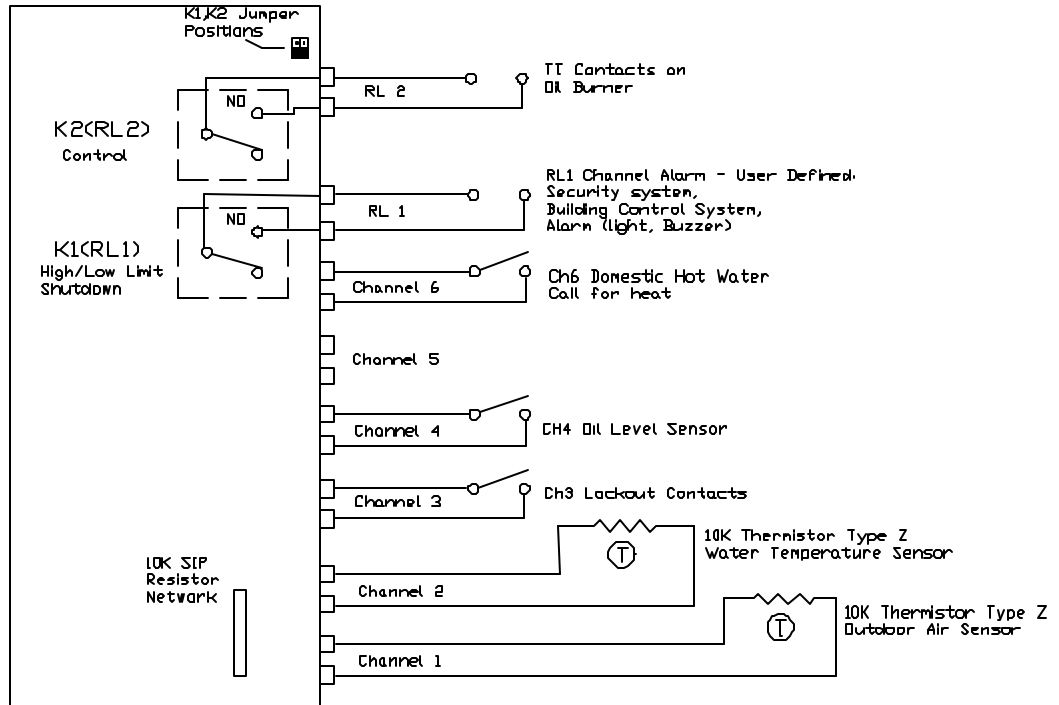
Relay 1 has a set of contacts (if enabled for that channel on a failure). These contacts can be set to open or close in the event of a failure on any channel(s). These may be used to:

1. Link to a security system
2. Enable an Alarm (light or siren).
3. Shut down the system (see fig. 1 for relay open/close jumper setting).
4. Signal a building control system that a problem exists.

#### Remaining (2) channels:

1. Monitor return water temperature using a third sensor.
2. Monitor a Flow Switch .
3. Monitor a Spill Switch (basement flooding).
4. Monitor Hot water tank temperature.
5. Thermostat

**If the DWH thermostat is connected to CH 6, an isolation relay is required.** This is due to the channel sensor's requirement for dry contacts. Applying a control voltage to the channel sensor inputs may damage the unit.



**Figure 3  
Outdoor Reset Connection Diagram**

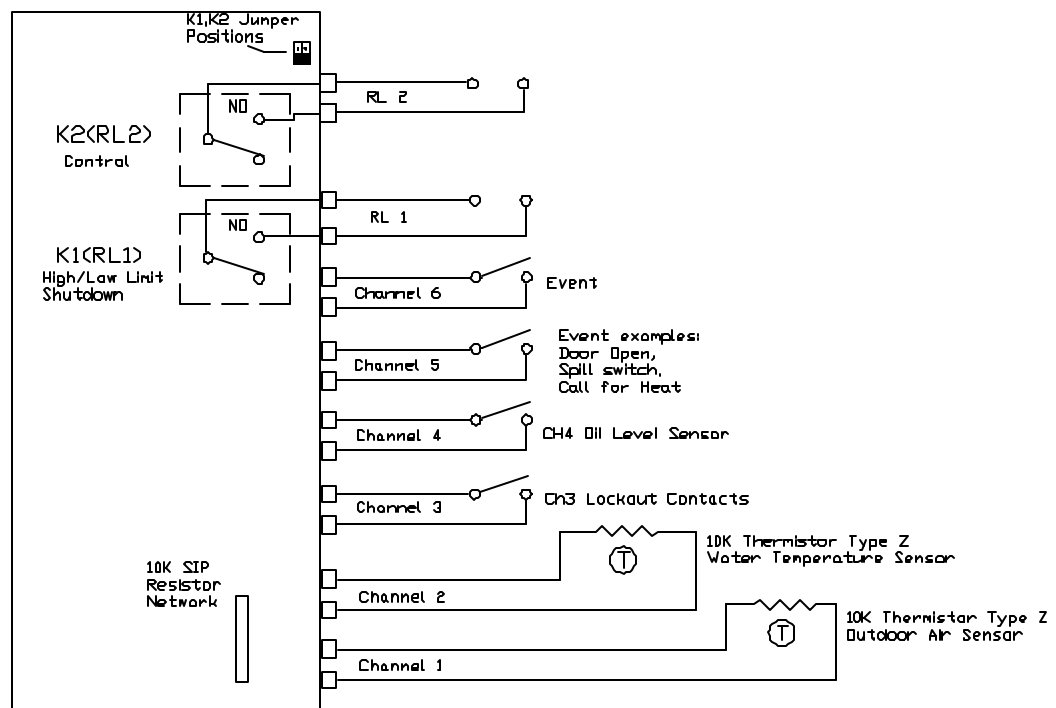
**Note: Do not exceed 24VAC on Relay Contacts.**

If 1K ohm sensors are used, the 10K SIP resistor needs to be replaced with a 1K SIP. (see Fig 1)

## 2. Event Reporting

The MTI Messenger may be used to report on an event. Since the unit will report another failure as long as the first one has cleared, the unit may be used to report continuously when an event occurs. As an example, a channel may be set to a switch and connected in such a way as to report-in when closed/open, such as when the heating system first turns on (switch, fail on closed: critical). The unit will treat the condition as a critical failure and proceed to send the packet of data over the phone line or out the serial port. The logger program will mark the event time plus the time required to make a phone connection (if the phone is used). Once the heating system turns off, the unit will be ready to dial/send again at the next turn-on.

Events should be spaced so that they do not occur less than approximately 15 seconds. More or less time may be incurred due to the phone line connection and speed of the logging computer. Experimentation with the connection will be required to achieve the maximum performance.



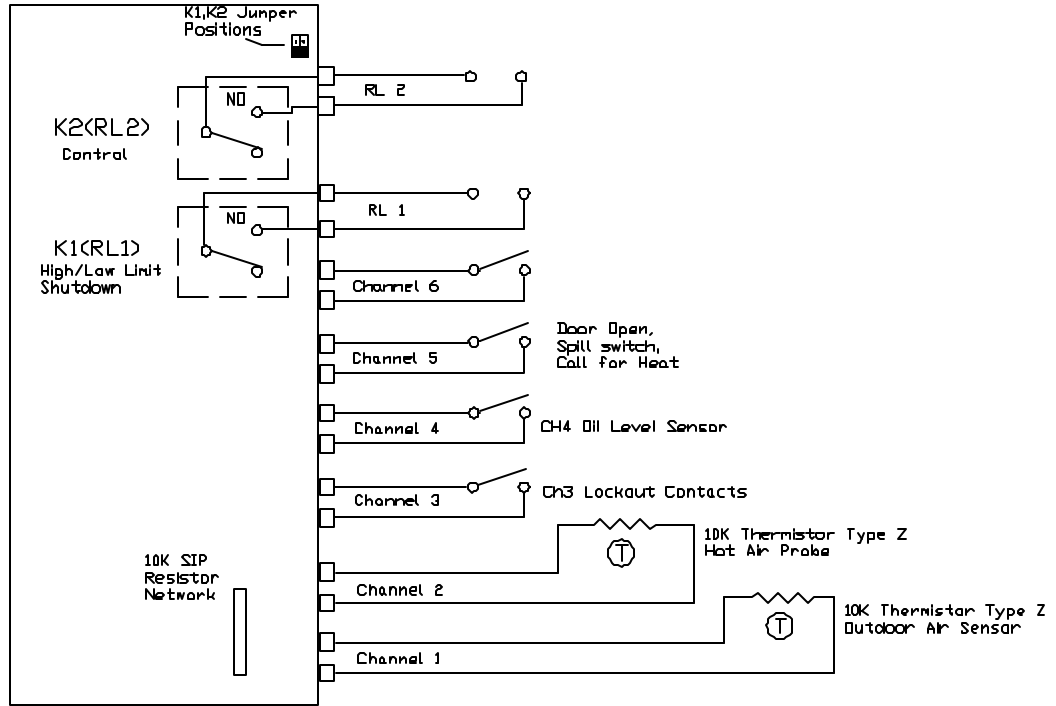
**Figure 3**  
**Event Reporting**

**Note: Do not exceed 24VAC on Relay Contacts**

### 3. Furnace

Monitoring a furnace for conditions can also be done using a different air probe. This probe is inserted into the plenum. The purpose of the air probe is to deflect and average the hot air stream so as to get a more accurate temperature measurement.

**Drawing 3  
Furnace**



**NOTE: Do not use the MTI Messenger as a Safety Control**

#### 4. Temperature Controller

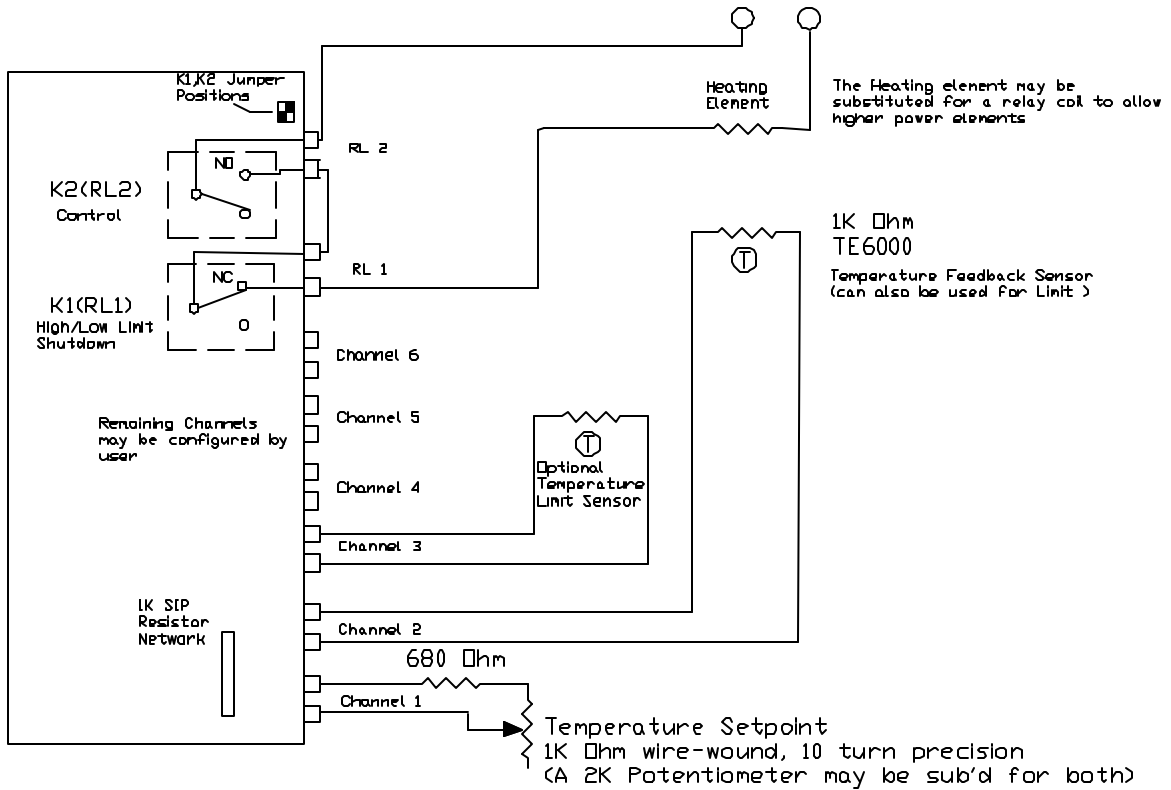
The unit may also be configured as a temperature controller for slowly changing environment variables using the optional Outdoor Reset functionality. A temperature range from  $-50$  to  $250^{\circ}\text{F}$  can be achieved with the standard sensors, but other ranges can be achieved using the raw data mode and other high temperature sensors. See Outdoor Reset

As an example:

1. Enable the Outdoor Reset Function Check Box
2. Set:
 

High Outside Air Temperature	= $250^{\circ}\text{F}$
Water Temperature @ High OA	= $250^{\circ}\text{F}$
Low Outside Air Temperature	= $-50^{\circ}\text{F}$
Water Temperature @ Low OA	= $-50^{\circ}\text{F}$

- |                           |                                          |
|---------------------------|------------------------------------------|
| Minimum On/OFF Time       | = Sec. Adjust for Accuracy               |
| Temperature Differential  | = $^{\circ}\text{F}$ Adjust for Accuracy |
| Domestic Hot Water in Use | Not Checked                              |
| Maintain Temperature      | Not Checked                              |



**Drawing 4**  
**Temperature Controller**

**Note: Do not exceed 24VAC on Relay Contacts**

**NOTE: Do not use the MTI Messenger as a Safety Control**

## Section 10: Terminal Mode

To communicate with the MTI Messenger using a text based communications program, the switch on the dialer is placed in the RS232 position and connected to a PC com. port. The baud rate is set to 2400, no parity, 8 bits data, and 1 stop bit. A terminal communications program is then required. The terminal mode feature may be required in the development of a program.

Commands can only be 1 Character, the address must be (5) hex digits, and the count or data-byte must be (2) hex digits. The format of the command line must be exact. No extra spaces or characters are allowed, with a CR immediately following the command. Memory area outside 0x28000 – 0x2807F is write protected and a response of }?} is returned with an attempt. See the Software Specification for the use of the memory locations.

Commands:

E Address [count in hex]	This is the examine command for viewing memory locations. Example: E 2800E 10 This command examines 10 hex locations starting at address 2800E. The count is optional, and the default value is 1 location. The “ [ ] “ indicates an optional entry.
D Address Data-byte	This is the deposit command for loading bytes into memory. Example: D 2800E 55 This command deposits a 55 hex Into location 2800E.
V	Displays the Firmware Version, First Hex digit = Major Rev. 2 <sup>nd</sup> Hex digit = Minor Rev.
? Help	Displays the command summary

### NOTE:

**The present way of accessing an integer value with only a means of working with bytes, requires the low byte of the integer to be placed in the higher byte address of the integer. This is backwards of what might be expected (compiler).**

**To communicate with the MTI Messenger using the serial port, a communications program such as Hypertermã or the MTI Messenger setup program is required. If using Hyperterm, the following setup is recommended with the serial port switch set on the HVAC Dialer to the serial port position:**

- 1) Run Hyper Terminal using Windows™. Create a NEW CONNECTION. Give it a name. **OK**
- 2) When prompted CONNECT TO: (for Phone # and Modem) enter the communications port the HVAC Dialer is connected to CONNECT USING:(COM 1, COM 2...), not a modem. **OK**
- 3) Port Settings; Bits per Second =2400, Data Bits =8, Parity =None, Flow Control =None **OK**
- 4) Run HyperTerminal. Under File, select Properties, then select the Settings Tab.
- 5) Select the Button, ASCII Setup. Check the boxes marked: Send line feeds with line ends, Echo typed characters locally. **OK**
- 6) Properties screen: **OK**
- 7) Press the Enter key on the keyboard. If everything is setup properly, a ‘}’ and ‘?’ should be displayed.
- 8) Console mode is Active. If not, and an error may be reporting, the **Esc key** may be pressed (**3**) **times** to exit the failure reporting mode. This action will then cause the failure packet to be dumped to the screen. Pressing the ESC key (3) times clears the **Report Fail** bit in the Misc. Flags Reg. 2, and the **Dial Enable** bit in the Misc. Flags Reg. With **Dial Enable** bit clear, a power-on will send self test information out the serial port. These bits may need to be restored if they were previously set. This would allow normal operation to resume.

- 9) If the unit is failing and the failure packet needs to be repeatably sent to the terminal for display, then the **Report Fail** bit in Misc. Flags 2 Register needs to be set (do not set the Dial enable bit in Misc. Flags Reg.).

## Section 11: Certifications

### FCC Part 68

This equipment complies with FCC rules, Part 68. On the, front of this equipment is a label that contains, among other information, the FCC Registration Number and Ringer Equivalence Number (REN) for this equipment. If re-quested, provide this information to your telephone company.

The (REN) is useful to determine the quantity of devices you may connect to your telephone line and still have all of those devices Ring when your number is called. In most, but not all areas, the sum of the REN's of all devices should not exceed five (5.0). To be certain of the number of devices you may connect to your line, as determined by the REN, you should call your local telephone company to determine the maximum REN for your calling area.

If this equipment causes harm to the telephone network, the Telephone Company may discontinue your service temporarily. If possible, they will notify you in advance. But if advance notice isn't practical, you will be notified as soon as possible. You will be advised of your right to file a complaint with the FCC.

Your telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the proper operation of your equipment. If they do, you will be given advance notice so as to give you an opportunity to maintain uninterrupted service.

If you experience trouble with this equipment, please contact Mestek, Inc at (413) 568-9571 for warranty/repair information. The telephone company may ask that you disconnect this equipment from the network until the problem has been corrected or until you are sure that the equipment is not malfunctioning.

This equipment may not be used on coin service provided by the telephone company. Connection to party lines is subject to state tariffs.

FCC rules prohibit the use of non-hearing aid compatible telephones in the following locations or applications:

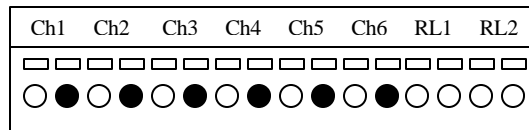
- (1) All public or semipublic coin-operated or credit card telephones.
- (2) Elevators, highways, tunnels (automobile, subway, railroad or pedestrian) where a person with impaired hearing might be isolated in an emergency.
- (3) Places where telephones are specifically installed to alert emergency authorities such as fire, police, or medical assistance personnel.
- (4) Hospital rooms, residential health care facilities, convalescent homes, and prisons.
- (5) Workstations for the hearing impaired.
- (6) Hotel, motel, apartment lobbies; in stores where telephones are used by patrons to order merchandise; in public transportation terminals where telephones are used to call taxis, or to reserve lodging or rental cars.
- (7) Hotel and motel rooms. At least ten percent of the rooms must contain hearing aid compatible telephones; or jacks or plug-in hearing-aid compatible telephones which will be provided to hearing impaired customers upon request.

## Section 12: Troubleshooting

### Sensor Accuracy

1. If bounce in the temperature reading is noticed, then a ground loop may have formed or a significant noise source is being introduced to the system. The ground is floating on the Dialer and may need to be tied to a stable earth ground.
  - A. If a laptop PC is being used, it may be one source of the ground loop or noise, since it also has a floating ground (different ground not referenced to the earth or other equipment) and is a source of radio frequency noise. If this is the case, a stable common ground is required. This ground may be introduced by connecting an earth ground to one of the signal ground pins on the sensor connectors. The signal ground is located on the right side of the inputs of any channel. The **darkened** channel Hole connections represent the Signal grounds. The ideal ground connection is on Ch6 then Ch5, etc. Ideally, the laptop should also be connected to this ground point (star config.)

Channel Connections



- B. The Sensors may be in close proximity to a spark, motors, breakers, transformers, SCR drives, welders, fluorescent lamp controllers, relays, or a high current carrying conductor. If this is the case reroute the sensor wires or move the sensor(s) until a stable temperature measurement is realized. Never run signal-carrying wires in the same conduit that carries power lines, relay contact leads or other high-level voltages or currents. If a shielded wire is used, only connect one end of the shield to ground connections as stated in A.
- C. The unit may be in an environment which is too hot or too cold. Check the operating temperature of the unit – See Specifications. The present A/D converter is not rated below 0° F. The resistive divider SIP is rated @ 100PPM/° C, +/-2%. If higher accuracy is required, a .1% SIP may be substituted.

Bourns PN:

Molded SIPs

4311S-101-1002BB = 10K, .1%, 50 PPM/°C

4311S-101-1001BB = 1K, .1%, 50 PPM/°C

Conformal coated SIPs

4611S-101-1002BB = 10K, .1%, 50 PPM/°C

4611S-101-1001BB = 1K, .1%, 50 PPM/°C

### **Red LED Blinking (channel(s) failing)**

- A. Load the setup/configuration program and click on the Black upload button on the toolbar. Wait for the data to load from the unit. Next, click on the Red Triangle toolbar button. This will bring up the meters that display the channel values. Determine which channel is failing by observing each meter. A failing channel is indicated in red and will state “failing”. In order for the channel not to be failing, the current reading should fall between the High and Low limit. An Open sensor will read –50 or less. A shorted sensor will read 250 or more.
- B. Channel Limits may be improperly set. If a channel is to be used, but not to be checked for a failing condition, the channel limits need to be set beyond the limits.  
Enter 260 for the Upper Limit and –60 for the Lower Limit. The normal limits cannot exceed –50 Low Limit and 250 High Limit. By entering values outside the limits effectively disables error checking on a channel.
- C. If Fast-On type connections are used, the orientation of the female connectors may be shorting against adjacent connectors. Orient the female connectors so they all face the same way or use insulated Fast-On female connectors
- D. 1. Indicators  
Everything is OK, within limits: LED’s Cycling GREEN-YELLOW  
Failure on one or more Channels: LED’s Cycling YELLOW- RED  
Dial-Out, if Red, part of the dial-out sequence Failed:  
LED’s Yellow-Green-Yellow-Green  
Self Test Green-Yellow-Red-BEEP
- E. If the Yellow LED is flashing very fast, few or no channels are being checked. The rate of flashing is relative to the number of channels checked.

### **Green LED ON, Yellow does no Blink or Blinks Slowly**

- A. If the Green LED is on and there appears to be no indication of the Yellow LED, then the number of channels selected may be minimal. The Yellow LED is the check indicator. If none, or only 1 or 2 channels are selected, the Yellow LED will blink very fast. This may be observed by looking very closely at the LED and shielding stray light with your hand.
- B. The speed at which the blinking takes place is dependent on the number of channels which are active (selected). There is no fixed rate of blinking. The amount of samples the unit will take in 1 second decreases with the number of channels that are selected. With the maximum activity (all channels selected), the unit will sample and check all channels within 1 second.

### **Setup & Logger Software Problems**

- A. The Setup program will not communicate with the unit.
  - 1. Connected to the Serial Port.  
The unit may be attempting a dial-out and can not be interrupted at that time.  
If the LEDs are not cycling RED-YELLOW or GREEN-YELLOW this is probably the case. You may need to retry the connection multiple

times, clear the fault (RED-YELLOW cycle), or wait until the warning hour has expired.

Also, ensure the Serial Port/Modem switch is set to Serial Port and the proper Comm. Port is set in the Setup Program.

2. Connected remotely.

The unit may be attempting a dial-out and can not be interrupted at that time.

When a remote connection is used, the time the unit waits before attempting a connection (Failure Time) when failing is a factor. If a failure is occurring and the unit is attempting to dial out, but cannot establish a connection, a re-dial occurs. The time between re-dials/failures is set by the "Failure Time" in the Setup program. The "Failure Time" setting is a way of ensuring a failure exists for a minimum amount of time. If the time is set too low or immediate, not enough time will be allowed to answer an incoming call. You may need to retry the connection multiple times, clear the fault (RED-YELLOW cycle), wait until the warning hour has expired, or reset the value associated with the "Failure Time".

B. Check the Help located on each program

C. Unit does not Dial-in anymore.

Not closing communications with a dialer properly will cause the dialer to possibly not dial-out any more. If this happens simply re-connect to the unit (using a serial port or dial-in, if # of rings set) and exit the configuration software correctly, leaving the dialer with the desired settings for communications. A broken connection will be indicated by the setup program when exiting.

1. If the unit was logging or displaying run-time information (gauges), then the unit will restore the last dial state if a carrier is lost. In this mode, setup parameters should be stable and a redial-in may not be necessary, but would be good practice.

2. While in the normal setup mode, when setup screens are being displayed, the unit loses carrier (someone picks up the phone on a shared telephone line), the failure reporting and the dial-out function are disabled. This protects the system from erroneous setup values. These may have been caused by partial data being entered during the disconnect. The unit will need to be called and the setup parameters checked.