ThermoBiscuit™

Wireless 8-Channel Thermocouple Monitor for Extreme Temperature Environments

Revision A **(06/2008)**

Warranty

General Terms

Magna Systems, L.L.C. warrants this product to be free from defects in material and workmanship for a period of one year from the date of shipment. If this product is found to be defective during the warranty period, the product will either be repaired or replaced at Magna Systems' sole option.

To Use This Warranty

To exercise this warranty, write or telephone your local Magna Systems representative or contact Magna Systems headquarters in California. Detailed contact information may be found on the Magna Systems web site, www.magnasystems.net . You will receive prompt assistance and return instructions. Send the product, shipping prepaid, to the indicated service facility. The repaired or replacement product will be returned to you with shipping prepaid. The repaired or replaced product will be warranted for the remainder of the original warranty term or ninety days whichever is longer.

Limitation of Warranty

This warranty does not apply to defects or malfunctions resulting from modification or misuse of any product or part. This warranty does not apply to fuses or other circuit protection components, to batteries, damage from battery leakage or damage resulting from improper battery installation.

Entire Warranty

This warranty is the complete warranty and stands in lieu of any or all other warranties, expressed or implied, including any implied warranty of merchantability or suitability for a particular use. Magna Systems, L.L.C. shall not be liable for any indirect, special or consequential damages.

Symbols Used in This Manual

CAUTION Indicates potential for equipment damage or injury. Refer to procedures or instructions.

CAUTION Indicates potential risk of electrical shock. Take suitable precautions.

Regulatory Statements

Industry Canada Notice to Users

Operation is subject to the following two conditions: (1) This device may not cause interference and (2) This device must accept any interference, including interference that may cause undesired operation of the device. See RSS-GEN 7.1.5

FCC Notice to Users

Magna Systems has not approved any changes or modifications to the ThermoBiscuit™ made by the user. Antenna modification, antenna replacement or use of an antenna not approved by Magna Systems is not authorized. Any changes or modifications could void the user's authority to operate this equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio / TV technician for help.

Battery Disposal

Please do not throw batteries in the trash. Used batteries must be disposed of in accordance with local regulation. For information about how to recycle batteries in your area, visit the Rechargeable Battery Recycling Corporation (RBRC©) at www.rbrc.org.

Important Safety Information

Electrical Shock Hazard

There are no hazardous voltages present in the ThermoBiscuit, however the American National Standards Institute (ANSI) states that a shock hazard exists when probes or sensors are exposed to voltages greater than 42 VDC or 42 V peak AC. In some applications thermocouples may be attached to objects or surfaces between which voltages in excess of the ANSI shock hazard standard exist. Despite the electrical isolation designed into the thermocouple assemblies, conditions may exist such that hazardous voltages could be conducted by attached thermocouples and present within the ThermoBiscuit. In such cases, users must handle the ThermoBiscuit in a manner consistent with the presence of hazardous voltages.

Exposure to Radio Frequency (RF) Energy

The ThermoBiscuit contains a radio transmitter and receiver. Whenever powered, the ThermoBiscuit will receive and emit radio frequency energy. The ThermoBiscuit is designed to comply with local regulatory requirements including those concerned with the exposure of human beings to RF energy.

Use of Rechargeable Batteries

Under conditions of heavy use it may be advantageous to use rechargeable batteries to power the ThermoBiscuit. Most rechargeable batteries, due to the chemical recombination process within the batteries, will vent non-corrosive gases to the ambient atmosphere. Ensure that the ThermoBiscuit is used with adequate ventilation when rechargeable batteries are used.

Explosive Environments

DO NOT USE THE ThermoBiscuit IN EXPLOSIVE ENVIRONMENTS.

Areas with potentially explosive atmospheres are often, but not always, posted. Such areas may include, but are not limited to, fueling areas, enclosed areas where fumes may accumulate (such as below decks on boats or areas near poorly ventilated gas powered appliances), chemical transfer or storage areas, laboratories, and areas when there are airborne particulates such as grain, dust, aerosolized paints or fine metal powders. DO NOT USE THE ThermoBiscuit IN SUCH AREAS. The installation or removal of batteries may cause sparks which could cause an explosion or fire.

Not Vacuum Compatible

The ThermoBiscuit is not vacuum compatible. Do not use the ThermoBiscuit in vacuum as this could damage the ThermoBiscuit and / or contaminate your vacuum chamber and associated hardware.

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Care of Your New ThermoBiscuit

DO NOT EXPOSE YOUR ThermoBiscuit TO ANY OF THE FOLLOWING-

Liquids
Don't immerse your ThermoBiscuit in water or expose it to cleaning solvents, fuels, or other liquids.

CAUTION

Extreme Heat or Cold
Avoid temperatures outside of the operating range of -200ºC to 427ºC (-328ºF to 800ºF).

ALWAYS BE SURE TO OPERATE WITHIN THE TIME vs TEMPERATURE LIMITS GIVEN IN TABLE 1 ON PAGE 10. PROLONGED EXPOSURE TO EXTREME TEMPERATURES WILL DAMAGE THE ThermoBiscuit.

Microwaves or Intense RF Energy
Do not place your ThermoBiscuit in a microwave oven or expose it to direct radio frequency (RF) energy such as from a RF power transmitter.

Extreme Dust or Dirt
Don't expose your ThermoBiscuit to extreme dust, dirt, sand, or environments containing metal particles.

Shock
Do not expose your ThermoBiscuit to mechanical shock in excess of a three (3) foot drop or vibration in excess of 10 g's.

Cleaning
Dirt and dust can be removed from the outside of the ThermoBiscuit by wiping with a damp cloth. In addition, the ThermoBiscuit may be cleaned with hot water or steam spray, but AVOID SPRAYING DIRECTLY INTO THE THERMOCOUPLE SLOT. Do not clean the ThermoBiscuit with abrasive pads or cleansers as this may remove or blur the markings on ThermoBiscuit surfaces. Do not use solvents to clean the ThermoBiscuit.

Calibration
Your ThermoBiscuit comes factory calibrated and does not require any initial calibration before use. The ThermoBiscuit has an automatic re-calibration alert which will be displayed through the DataLink software when re-calibration is required. Should the re-calibration message appear, please follow the instructions displayed.

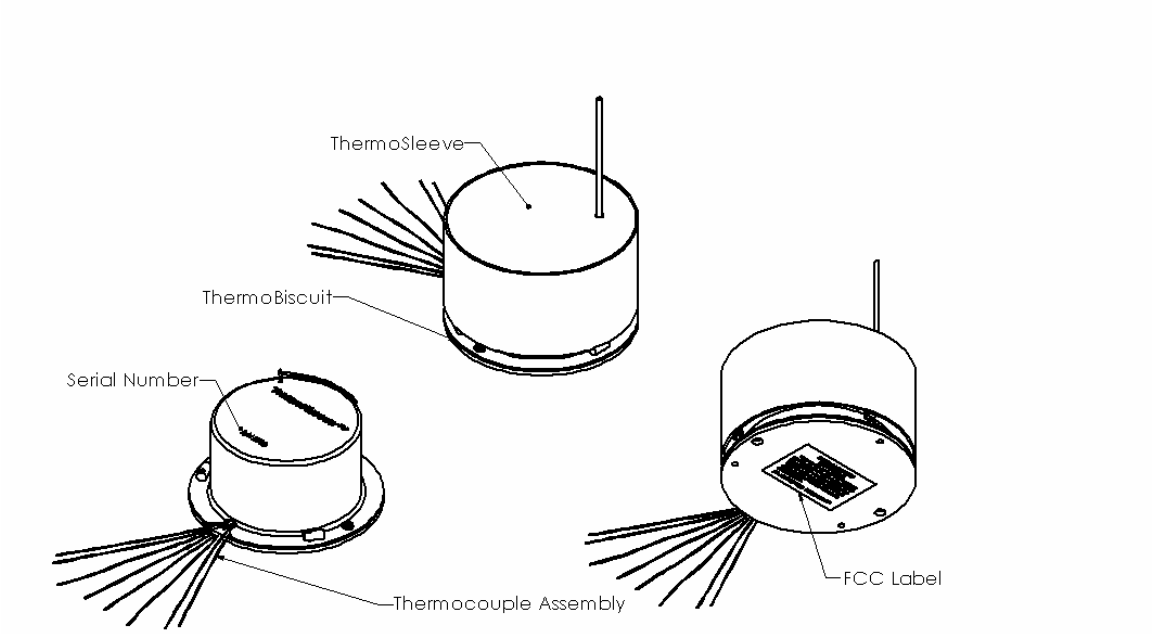
Maintenance & Service

The only user maintenance operation is battery installation or replacement which is described in the Getting Started section of this manual. The ThermoBiscuit should always be used with its cover installed. The ThermoBiscuit has no user serviceable parts and does not require any adjustment by the user.

Getting Started

The figure below shows three different views of your new ThermoBiscuit. Your ThermoBiscuit has been designed to provide accurate thermocouple based temperature measurements while requiring almost no user intervention.

Users typically perform three types of operations while using the ThermoBiscuit, namely, battery installation or replacement, installation of a ThermoSleeve and mounting, each described below.

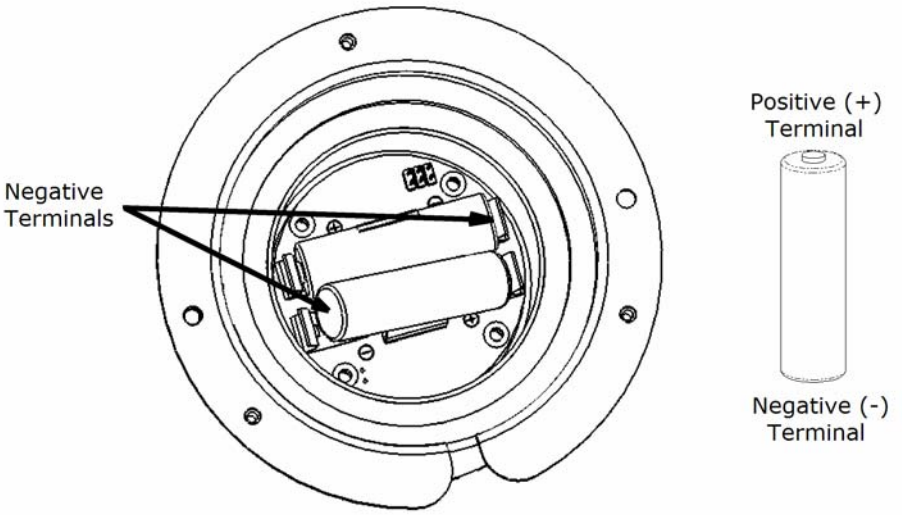


Turning the ThermoBiscuit ON

The ThermoBiscuit is powered by two (2) AA type batteries which are installed in the battery clip area. THERE IS NO ON / OFF SWITCH. To turn the ThermoBiscuit ON, simply install the batteries as shown in the diagram using the procedure below.

CAUTION

Installing batteries in the wrong direction will damage the ThermoBiscuit. Please double check the orientation of the batteries during the installation process.



Battery Installation Procedure-

1. Remove the two screws that secure the base plate to the main ThermoBiscuit body.
2. Separate the base plate from the ThermoBiscuit so that the battery area is clearly visible.
3. Inspect the battery clip area and note the battery orientations indicated.

NOTE: BATTERIES ARE INSTALLED IN OPPOSITE ORIENTATIONS

4. Place the positive end of the first battery against the positive contact and rotate it down into place.

5. Place the positive end of the second battery against the remaining positive contact and rotate the battery into position. The second battery will “click” into position; however no sound may be heard.
6. Reposition the thermocouples making sure that they are all positioned in the exit slot and will not be pinched when the base plate is reattached.
7. Reposition the base plate such that the screw holes and mounting holes properly align and the insulation fits into the recess in the ThermoBiscuit and seals the unit.
8. Once oriented, hold the base plate in position and re-secure it to the ThermoBiscuit using the two (2) screws that were previously removed.

TIP: *You can extend the life of the ThermoBiscuit by carefully reinstalling the screws. As shipped from the factory, the screws on your ThermoBiscuit are coated with a Teflon® impregnated dry lubricant to keep them from “cold-welding” into the stainless steel captive nuts. Magna Systems recommends occasionally lubricating the screws to maintain the resistance to “cold-welding.”*

Once the batteries are installed, the ThermoBiscuit is ready to take measurements using the GateWay Network Access Point and your DataLink software.

Using the ThermoSleeve

To extend the length of time a ThermoBiscuit can withstand high temperature environments Magna Systems offers a heat shield called a ThermoSleeve. The ThermoSleeve has been design for easy installation before beginning a measurement and rapid removal after a measurement is completed. When long exposure times are required the ThermoSleeve may be chilled in a refrigerator or freezer prior to use. The ThermoSleeve should always be removed as soon as the ThermoBiscuit is taken out of the high temperature environment to facilitate cooling.

ThermoSleeve Installation Procedure-

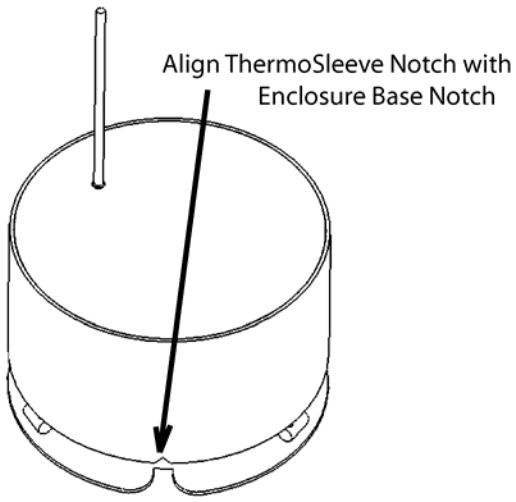
1. Straighten the ThermoBiscuit antenna so that it can be easily fed through the antenna tube of the ThermoSleeve.

2. Hold the ThermoSleeve such that the major bore of the ThermoSleeve faces you and that you can clearly see the inner antenna tube opening. At the same time, hold the ThermoBiscuit with its antenna pointing toward the antenna tube opening.

3. Thread the end of the ThermoBiscuit antenna into the antenna tube opening of the ThermoSleeve.

4. Continue to move the ThermoBiscuit toward the ThermoSleeve and rotate it as required to allow it to enter the major bore of the ThermoSleeve.

5. Complete the ThermoSleeve installation by rotating the ThermoBiscuit / ThermoSleeve assembly such that the notch in the side of the ThermoSleeve coincides with the thermocouple exit slot of the ThermoBiscuit and allowing the ThermoBiscuit to rest as far inside the ThermoSleeve as possible. When finished the ThermoBiscuit / ThermoSleeve assembly should look like the figure below.



6. Check for full antenna extension by gently pulling on the antenna protruding from the ThermoSleeve.

ThermoSleeve Removal Procedure-

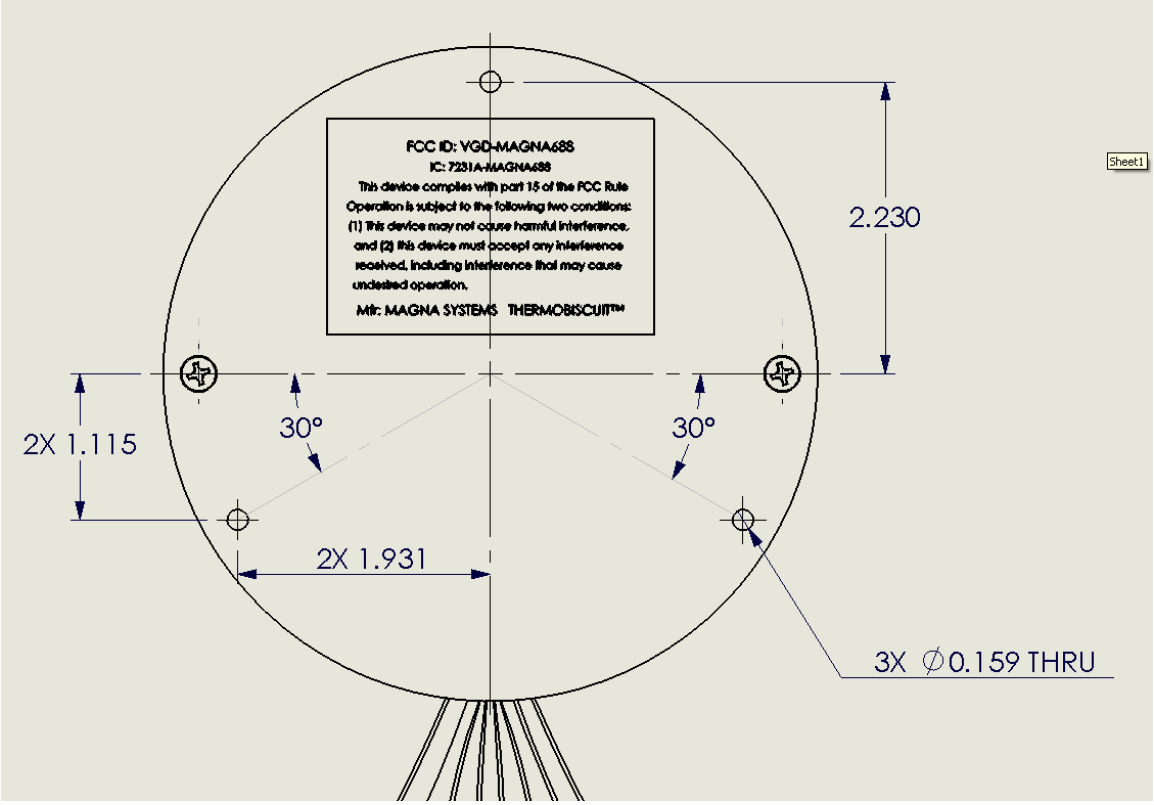
CAUTION- POSSIBLE BURN HAZARD

After exposure to elevated temperatures the ThermoSleeve and ThermoBiscuit will be **HOT**! To avoid burns, be sure to wear protective clothing before touching a hot ThermoSleeve and or ThermoBiscuit.

To remove the ThermoSleeve, simply pull the ThermoSleeve off of the ThermoBiscuit and set it aside in an appropriate location to cool.

Mounting the ThermoBiscuit

In some applications it may be desirable to mount the ThermoBiscuit either in a permanent location or to some fixture which facilitates passage through process equipment (e.g., an oven or freezer). The ThermoBiscuit has a mounting flange with three through holes to facilitate mounting. These holes, located 120º apart on a 4.460" diameter bolt circle, have a diameter of 0.159 inches (4.04 mm). The holes will accommodate #6 size English screws or M3.5 metric screws. The figure below may be used as a drill template to arrange for mounting the ThermoBiscuit.



Care of Thermocouples

CAUTION !

DESPITE THE ELECTRICAL ISOLATION PROVIDED BY DESIGN, IF THE THERMOCOUPLES ARE ATTACHED TO OBJECTS WHICH HAVE HIGH VOLTAGES PRESENT THE ThermoBiscuit™ MAY PRESENT A SHOCK HAZARD. HANDLE THE ThermoBiscuit™ IN A MANNER CONSISTENT WITH THE PRESENCE OF A SHOCK HAZARD.

To measure temperature, each ThermoBiscuit uses a set of permanently attached thermocouples or a ThermoAdapter / thermocouple assembly. Thermocouples are devices comprised of two wires made from different metals which have been joined at one end. Because of the dissimilar metals, thermocouples generate a small temperature dependent voltage.

Typically 30 AWG T-type (Cu-Constantan) thermocouples which have a temperature measurement range from -270ºC to 400ºC (-454ºF to 752ºF) are used, however for higher temperature measurements K-type (Nichrome / Alumel) thermocouples with a temperature measurement range from -270ºC to 1372ºC (-454ºF to 2502ºF) may be used. The use of 30 AWG diameter wire tends to provide a good compromise between ease of handling and thermal performance. Due to its single, solid wire construction thermocouple wire tends to be stiff and thicker gauge wire becomes difficult to handle while thinner wire tends to break easily. The 30 AWG wire should be handled with some care; mechanical stresses, such as pulling on the wire, should be avoided if possible.

Unless otherwise specified, the thermocouples that come with your ThermoBiscuit are Teflon® insulated and will withstand temperatures up to 370ºC. Teflon® is a thermoplastic and will melt above ~ 370ºC. Thermocouple wires can be easily cleaned by wiping with a wet cloth or paper towel. Since Teflon® is chemically inert solvents may be used to clean only the thermocouples in cases where contaminating materials persist.

TIP: *If your ThermoBiscuit has a ThermoAdapter / thermocouple assembly you can make network initialization easier if you install the thermocouples before starting to test. During network initialization, DataLink checks for open thermocouples so having the thermocouples connected to the ThermoBiscuit speeds the initialization step.*

Once the ThermoBiscuit is powered, mounted, and thermocouples have been connected the ThermoBiscuit is ready to record temperature data.

Turning the ThermoBiscuit OFF / Replacing the Batteries

During routine use it should not be necessary to turn the ThermoBiscuit OFF and so THERE IS NO ON / OFF SWITCH. However, if it is anticipated that the ThermoBiscuit will not be used for an extended period, it may be desirable to remove the batteries from the ThermoBiscuit. To remove or replace the batteries, please use the same steps found in the battery installation procedure.

Into The Oven (or Freezer) We Go!

Now that the batteries have been installed and DataLink is recording data, the ThermoBiscuit is ready for the oven (or freezer). The key question at this point is- ***how long can the ThermoBiscuit stay in the oven or freezer?***

The ThermoBiscuit has been designed to have the broadest operating temperature range possible; however, batteries limit the internal operating temperature to a maximum of ~ 80ºC. The batteries will fail if used above this temperature limit.

In Table 1 we give the high temperature exposure duration (time limit). The second column presents the maximum exposure time for a ThermoBiscuit used **without** a ThermoSleeve, while the third column presents the maximum exposure time for a ThermoBiscuit used **with** aThermoSleeve. In both cases it is assumed that the ThermoBiscuit and ThermoSleeve (if used) are initially at room temperature (22ºC or ~ 72ºF). In addition, it is **REQUIRED** that the ThermoSleeve be removed from the ThermoBiscuit at the end of the run.

Table 1: High temperature exposure time limit versus environmental temperature

Temperature ºF (ºC)		Maximum exposure time without ThermoSleeve		Maximum exposure time with ThermoSleeve	
375 ºF	(191 ºC)	51	minutes	66	minutes
425 ºF	(218 ºC)	42	minutes	54	minutes
475 ºF	(246 ºC)	39	minutes	48	minutes

Making Accurate Temperature Measurements

It seems that making accurate temperature measurements should be simple, but experience tells a different story. Accurate temperature measurements are made by understanding the factors that can effect the measurement and controlling or eliminating them.

One of the most important factors in making accurate temperature measurements is good thermal contact. To make an accurate measurement, the thermocouple needs to be in intimate thermal contact with the measurement point. In achieving intimate thermal contact air is your enemy. Air is an excellent thermal insulator and even a small air gap between the measurement point and the thermocouple can produce a significant error. Air can be excluded from the region between the thermocouple and the measurement point by using a thermally conductive adhesive or by using appropriately designed attachments.

It is also important to consider the effect that the measurement set up has on the accuracy of the measurement. For example, the addition of thermal mass to the measurement point will slow its thermal response, while the addition of thermally insulating material which impedes normal convective or radiative heat transfer will lead to inaccuracies too. In other cases, when measuring at low temperatures, even the thermal conductivity of the thermocouple itself can lead to an inaccurate measurement by introducing a heat source into the low temperature system.

In other measurement configurations, chemical corrosion and time may conspire to thwart a previously accurate measurement. At elevated temperatures chemical reactions proceed more quickly and since thermocouples depend on the properties of the dissimilar metals comprising the thermocouple, the corrosion of one or more thermocouple wires can give rise to inaccurate measurements.

So by understanding and controlling these and any other factors that affect your measurement you can make simple, robust and accurate temperature measurements. By allowing the selection of thermocouple material, insulation type, wire gauge and termination style you can readily optimize your measurement and avoid problems.

We hope that Magna Systems has furnished the tools you need to achieve your measurement goals and that our products provide value through simplicity, ease of use and accuracy.

Setting Up For Accurate Measurements
The ThermoBiscuit is designed to easily make accurate and repeatable temperature measurements utilizing up to eight (8) thermocouples manufactured

and tested by Magna Systems. Magna Systems manufactures thermocouples with three different termination types:

- Standard termination- designed for use in immersion applications
- Bare termination- used for surface temperature measurements
- Ring-Lug termination- designed for attachment using threaded fasteners

The design of these termination types has taken into account several factors that affect measurement accuracy. Among these factors are electrical isolation of the thermocouple itself, addition of minimal thermal mass, ensuring good thermal contact with the measurement point, maintaining good thermal conductivity between the measurement point and the thermocouple, and minimizing the insulating effect of thermocouple attachment.

The Standard termination will provide optimal results for immersion measurements. Immersion measurements are those in which the probe is immersed in the measurement environment. Typical examples of immersion measurements are:

- Measuring the temperature of the air flowing past a cooling fan
- Measuring the air temperature above a heatsink
- Measuring the temperature of a container of water by immersing the probe
- Measuring the temperature of a metal block by embedding a thermocouple probe in a hole in the block

The Standard termination is simply a thermocouple junction that has been encapsulated in a thin layer of Teflon® to provide electrical isolation, mechanical toughness, and make the thermocouple more chemically inert.

The Bare termination is the traditional bare wire thermocouple end. Bare termination is useful when thermocouples are soldered in place or when measuring the temperature of a surface.

CAUTION

Bare termination users should be aware that, because the ThermoBiscuit uses all solid state electronics, either all measurement points must be at the same electrical potential (voltage) or some sort of electrical insulation must be used to provide isolation between the channels.

To illustrate the use of the Bare termination, consider two typical applications, measurement of temperature on a sample printed circuit board (PCB) and temperature measurement on an electrically “live” heatsink where Kapton® tape is used to provide electrical isolation.

In the first case we are interested in measuring the temperature profile of a PCB sample during heating. To measure the temperature at various points on the bare board, we decide to use a high temperature solder to attach Bare

thermocouple tips to the board. In this case, the board does not have any active components attached and all the ThermoProbe points are near ground potential. In this case, the high temperature solder provides good thermal conductivity and fills any voids, thus eliminating any air pockets.

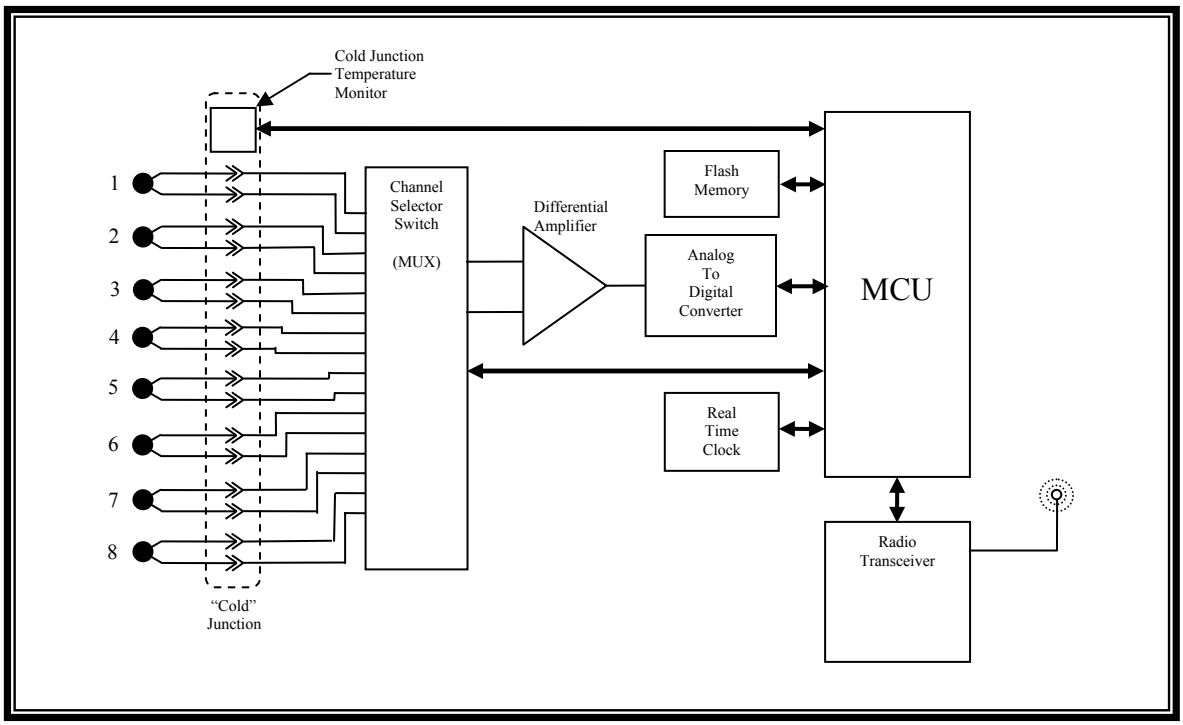
In the second case, we are interested in measuring the temperature distribution across the surface of a heatsink. The heatsink happens to be attached to a live component that is holding the heatsink at an elevated voltage. To be sure that there are no voltage differences between the ThermoProbe tips we choose to place a small piece of Kapton® tape onto the heatsink at each of the measurement locations, then we place the Bare termination ThermoProbe end and secure it to the heatsink with another piece of Kapton® tape. After placing the Kapton® tape over the Bare termination we are careful to press on the contact point to make sure that the tip is actually in contact with the heatsink / Kapton® tape and to remove as much air as possible from between the two layers of Kapton® tape.

The Ring-Lug termination is designed to meet the need to attach a thermocouple to a location where a threaded fastener is available. Typical applications of this type of termination include measurement of the temperature of a bolt-on style heatsink, measurement of the temperature of a motor or other applications where a temperature measurement at a fixed location is desired. In making this termination available, Magna Systems hopes to eliminate the frustration experienced when a bare thermocouple is clamped under the head of bolt and the pressure beaks the thermocouple or the thermocouple slips from under the head of the bolt. The Ring-Lug termination is comprised of a Standard termination that has been affixed in a specially selected ring lug. This construction allows the electrical isolation of the thermocouple while ensuring a good thermal connection to the measurement point.

Thermocouple assemblies having custom lengths or configurations are available either through the Magna Systems web site (www.MagnaSystems.net) or by contacting Sales at Magna Systems.

How the ThermoBiscuit Works

A simplified block diagram of the ThermoBiscuit with a thermocouple assembly attached is shown below.



To make a measurement, the microcontroller unit selects the desired thermocouple by sending control signals to the channel selector switch. The switch connects the selected thermocouple across the inputs of the differential amplifier. This low-noise, zero-drift amplifier magnifies the relatively small thermocouple voltage such that an effective measurement can be made. The amplified voltage is presented to the input of the analog to digital converter where it is converted to a digital code. The digital code is read by the microcontroller unit and stored in memory. In order to interpret the digital code representing the thermocouple temperature correctly, the "cold" junction voltage must be compensated. The ThermoBiscuit uses an integrated circuit temperature sensor to accurately measure the "cold" junction temperature and the microcontroller then performs software based compensation. The microcontroller then selects the next channel to be measured and the process is repeated as required. The radio transceiver is used to periodically transfer acquired temperature data to DataLink using the GateWay network access node. If, for any reason, the data is not transferred to DataLink, the ThermoBiscuit stores the data in the flash memory and transmits the data later. The ability to store over 20,000 data points and report them later means that no measurement data will be lost.

Judging the Accuracy of Your Results

Making good measurements isn't hard, but occasionally an unexpected result will crop up and it is useful to know how to judge the accuracy of your results.

Different errors can occur depending on the type of measurement attempted. Temperature measurements almost always involve temperature and time; in some cases a measurement of the "steady-state" temperature is important while in other cases we are interested in temperature transients.

The accuracy of a "steady-state" temperature measurement is essentially determined by good thermal contact and calibration. Calibration is handled by the processes we use at Magna Systems to provide ThermoBiscuit units that meet specification. We take care in the design and maintenance of our processes so that you may be confident that by using a ThermoBiscuit you are capable of making excellent and accurate measurements. The most likely issue then becomes the existence of intimate thermal contact at the measurement point. This can be checked by introducing a heat impulse near the measurement point and ascertaining that the thermocouple response is sufficiently rapid. A slow response or a response of insufficient amplitude indicates a lack of thermal conductivity between the measurement point and the thermocouple. This is often easily remedied by thermocouple reattachment.

When making measurements of thermal transients the most common worry is the thermocouple response time; is the thermocouple response fast enough to provide an accurate measurement of temperature versus time? To judge this, again a heat impulse may be used. By applying a thermal impulse or step function one can assess the thermocouple response time. This is most easily done by rapidly immersing the thermocouple in an environment at a different temperature while taking temperature data. The trace of temperature versus time for such a step function transient will give a good sense of the thermocouple thermal response time. When performing this test one must remember that the environment must be uniform such that the thermal mass of the thermocouple is insignificant. For example, if a thermocouple is suddenly immersed in hot water, it is important to move the thermocouple such that the water is stirred and that the water which is initially near the thermocouple is replaced with water at the elevated temperature. When using the temperature versus time trace to measure thermal response time, bear in mind that the initial transient will provide a more accurate measure of the response time than the later portions of the curve.

Troubleshooting

Symptom: ThermoBiscuit does not appear during network initialization.

Possible Problem- ThermoBiscuit may have depleted batteries.

Solution- Check to be sure the batteries in the ThermoBiscuit are still charged and replace as required.

Symptom: ThermoBiscuit does not read temperatures correctly.

Possible Problem- Wrong type of thermocouple specified in DataLink

Solution- Check thermocouple specification in the node configuration used for network initialization and revise as required.

Possible Problem- Thermocouple could be broken

Solution- Use the thermocouple continuity test feature in DataLink to test the thermocouple. If DataLink indicates that the thermocouple is broken, please contact Magna Systems for a replacement thermocouple.

Possible Problem- Temperature data is outside of the ThermoBiscuit's rated temperature range.

Solution- Use the thermocouple within the rated temperature range. If an extended temperature range is required, please contact Magna Systems for an extended range thermocouple.

Symptom: ThermoBiscuit drops out during data collection.

Possible Problem- ThermoBiscuit is too far from the GateWay or there is significant radio frequency interference.

Solution- Reposition the ThermoBiscuit closer to the GateWay.

Possible Problem- Sampling rate is too high.

Solution- Cancel test and set sampling rate to a longer interval (slower rate).

Possible Problem- Weak battery condition.

Solution- Cancel test and replace batteries.

Technical Specifications

Thermocouple Inputs-

Number of Channels: 8

Thermocouple Types: T-type standard (E, J, K, R & S available by special order)

Cold Junction Compensation: Automatic, software based

Thermocouple Input: Integral thermocouples or ThermoAdapter inputs

T-type Thermocouple Temperature Range: -270ºC to +400ºC

T-type Thermocouple Characteristics:	Accuracy*	Resolution
	± 0.5ºC	0.1 ºC

*Errors are for the ThermoBiscuit only and do not include the thermocouple error

Monitoring & Data Recording-

Sampling rate user settable from days to 5 samples / second

All samples time stamped at acquisition

Programmable start time or start on command

Programmable test end time or end on command

Measurements stored or relayed in real-time

General Specifications-

Operating Environment: -200ºC to 427ºC (-328ºF to 800ºF)
5% to 95% Relative Humidity (non-condensing)

Vibration: 10 g (rms 20 Hz to 2000 Hz)

Shock: 3 foot drop

Power: Two AA style batteries

Battery Life: 1.5 yrs at 1 sample / min.

Time Accuracy: ± 1 min / month

Communications Interface: ISM band radio (868 / 915 MHz)
+5 dBm maximum TX power
RX sensitivity better than -100 dBm

Storage Temperature Range: -40 to 120 ºC

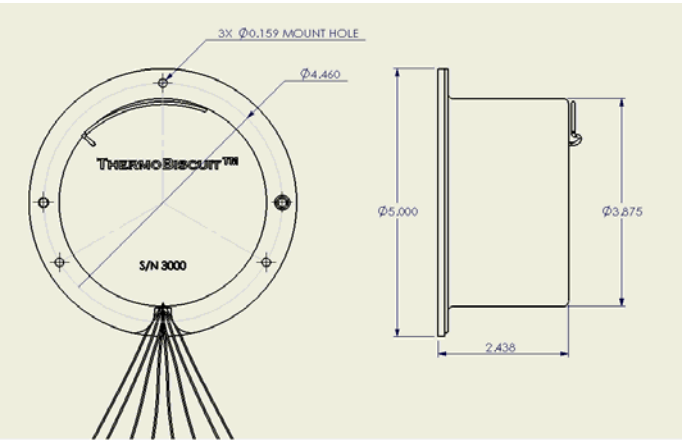
Weight:

ThermoBiscuit only: ~ 900 gm (2 lbs.)

ThermoBiscuit with batteries: ~ 950 gm (2 lbs. 1.5 oz)

Enclosure: Stainless steel

Dimensions:



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