

## TurboTag™ the Smart Card Logger

TurboTag™ is a small, but accurate, time and temperature monitoring device with an integrated, non-contact RFID data transfer architecture. When combined with its companion system components, TurboTag™ offers end-users the freedom of a cost-effective, dedicated temperature management system. Optional, customer configurable features of TurboTag™ include printable strip charts, product shelf-life monitoring and Internet accessible calibration certificates.

Due to the small form factor (the size of a credit card), light weight and simplified design, TurboTag™ is extremely durable and reliable. It has unlimited reuse potential over the one year service life of the battery. As a result, this smart card allows for a more cost effective means of monitoring temperature in a wide variety of applications.

## How is TurboTag™ Used?

TurboTag™ smart cards can be activated by a simple battery powered device, the TagMateQC™. Just hold the card over the activation surface, press the button and listen for the confirmation tone. No cables, cradles or connectors are required. Tags can be user-configured to run for different recording times, or can be purchased with pre-programmed settings that match a particular application.

Starting can also be initiated with TurboTag™ *Session Manager*™ Software running on a PC with a DR-1 desktop reader attached. Tags can be configured to activate immediately in the desk top environment. The may also be set to start later with the portable starter device or by the time delayed, auto-starting feature.

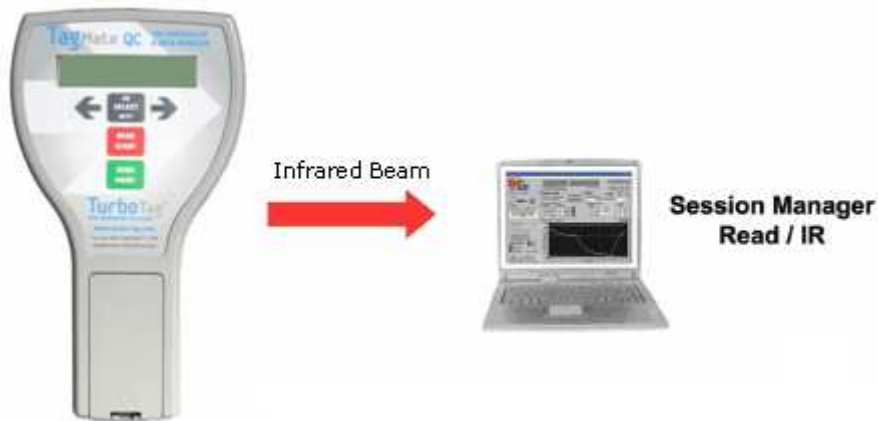


When the recording is finished, at the end of a trip or other monitoring episode, the tag can be downloaded either by a PC with RFID reader attached OR by the portable TagMateQC™ in read mode. A single reading takes less than 2 seconds, even for a tag that is completely

full of data. The reader can then transfer the data to a portable printer<sup>1</sup> to generate an ordinary strip chart that displays the entire time-temperature profile.



Up to 99 data records from tags can be stored in the TagMateQC™ reader (it functions as a "data sponge") and then transferred later to a desktop computer by way of the infrared link. An optional USB interface device is available for PCs that are not equipped with an IR port. The PC, running TurboTag™ *Session ManagerDB*™ software, gathers the data and stores it in an onboard database for further analysis or archiving.



<sup>1</sup> TurboTag™ uses a common portable thermal printer. This unit has long-lasting rechargeable batteries and can be easily carried by personnel using the integrated belt clip.

## TurboTag™ Alarms and Settings

TurboTag™ can be configured to meet almost any temperature monitoring need. A complete range of settings, including maximum and minimum temperatures, averages, special settings for pharmaceutical applications, and actual measurement of product shelf life is possible. Just configure the settings in TurboTag™ *Session Manager*™ Software, or ask us to create a custom protocol for your application. Either way, the tags will be set up to trigger an alarm if out of range conditions are experienced during the monitoring period. See Appendix B for alarm configuration details.

All alarm information, shelf life information, and other summary data can be viewed directly from the TagMateQC™ battery-powered handheld device. This allows field personnel to make on-the-spot decisions regarding temperature abuse and shelf life issues.

## TurboTag™ and Transit Monitoring

TurboTag™ is well adapted for transit monitoring. With up to 702 readings possible, 30 minute recording intervals will permit monitoring for up to 14 days. This covers the majority of transit monitoring applications.

Transit monitoring systems are often designed to recycle the reusable logging devices to reduce costs. TurboTag™ employs a patented system for return and reuse of tags that offers several advantages. Tags may be placed into customized mailer pouches at the start of a transit event and adhered to a container or pallet in a load. At the end of the trip, the mailer conveniently tears away from the carton to be dropped in the mail. Because TurboTag™ is so small and light, standard postage rates apply in the US. The tag does not need to be visible for starting or reading.



For end-users in need of temperature monitoring services including tag placement, tag retrieval and data return, see [www.temptrip.com](http://www.temptrip.com) for details about the *smart and simple* TempTrip™ product offer.

## The Database Difference

TurboTag™ *Session Manager DB*™ Software is an easy-to-use and intuitive interface for the configuration of tags, starting of tags and data capture of tag information. Communication with the tags may occur directly *via* a personal computer connected to a DR-1 reader or indirectly through a portable reader transferring information to the personal computer through an infrared interface. It has a variety of features for viewing data and displaying summary information. One important difference, however, is that Session Manager DB™ can be configured to store tag data in a networked database format rather than a discrete flat file format. This allows for more efficient data sorting and searching and thus creates

additional value in a temperature monitoring program. The database can be networked over systems, LAN and WAN resources, or even the Internet using our secure TagLink™ server system.

User-defined database fields are stored in the same record as the time-temperature information including alarm and shelf life data. For example, data can be recovered based on batch number, customer identity, product ID, shipping point, carrier, shipping method, etc. Databased TurboTag™ records can be exported to company enterprise management systems such as SAP or Oracle. Using the TagLink™ Internet server options, information can also be shared with other designated data users based on preset business rules.

Partnerships with third party service providers can harness this database power and combine it with other cold chain visibility information, linked UHF tag data and other systematic types of data. Your cold chain data does not need to be a “data orphan” any more.

## The Sealed Air Difference

Sealed Air is a leading global manufacturer of materials and systems for protective, presentation and fresh food packaging, and performance solutions in the industrial, food and consumer markets. Reaching nearly 80 percent of the world’s population, many Sealed Air brands are among the most respected names in their markets. Our products protect and preserve our customers’ products from the plant or warehouse through the rigors of the distribution chain.

Now, with TurboTag™, we are taking the next step to provide information that ensures product protection. TurboTag™ is integral to the Sealed Air mission: *Our Products Protect Your Products*™.

## TurboTag™ Makes the Package Smart

TurboTag™ makes controlled temperature packaging “smart” by integrating the benefits of rapid reading, non-contact RFID technology. Packages can now report their temperature history, calculate shelf life and other important determinants of product acceptance and deliver this information without the need to open the package.

Standard format T-700C tags and T-700E tags with external probe tags are CFR validated and compliant with FDA requirements for digital file creation.

Smart thermal packaging combined with our cold-chain data capabilities yields the ultimate solution in real-time perishable tracking.





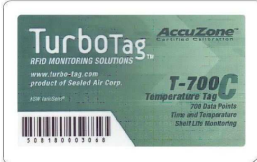


# The Facts

Data Points:	702 [User configured logging interval, start delay and stop time]
Normal Operating Range:	-25°C to +35°C (-13°F to +95°F)
Extended Range:	-30°C to +65°C (-22°F to +149°F)
Temperature Accuracy:	± 0.5°C (± 0.9°F) throughout Normal Operating Range at 95% confidence interval, or better <sup>2</sup>
Monitoring Time Span:	23 minutes minimum, 175 days maximum
Time Accuracy:	<0.5% error [-10°C to +20°C]
Monitoring Delay Option:	0 hours minimum, 21 days maximum
Tag Download Time:	Under 2 seconds
RFID Read Distance:	1 to 3 inches (greater distances possible with large antenna arrays)
RFID Interface:	13.56 MHz passive - ISO 15693-3 compliant – FAA, EC and UL compliant
Alarms:	User-configured high and low alarms / calculates time over/under, max alarm and selectable Mean Kinetic Temperature or arithmetic mean alarm
Averages:	Provides arithmetic mean temperature OR Mean Kinetic Temperature (MKT parameters are user-definable)
Information Field:	Tags can store 16 characters of text OR 24 hexadecimal character EPC code
Software Record:	<i>Session Manager</i> <sup>™</sup> software creates files and/or database records
Shelf Life Parameters:	Calculations based on Arrhenius kinetic model with customer designation of time-temperature tolerance
Shelf Life Monitoring:	Provides <i>Shelf Life Remaining</i> information at reading point with software or handheld reader
Size and Weight:	Credit card shape and size (2.1mm thick – 86 x 54 mm) 8.7 grams weight
Water Resistance:	IP65 or NEMA 4
Battery Life:	One year life with normal start and stop usage at Normal Operating Range temperatures. Store tags below 35° C.



Features / Tag Type	T-700	T-700B	T-700C	T-700D	T-700E	T-700F <sup>3</sup>
Calibrated accuracy ± 0.5 °C	●	●	●	●	●	
One year battery life	●	●	●	●	●	longer
On demand calibration certificate <sup>5</sup>		●	●	●	●	
CFR compliant and validated			●		●	
30 inch sensor extension				●	●	
Long-life battery						●





<sup>2</sup> *AccuZone*<sup>™</sup> calibration certificates are available at our download portal. Go to [www.turbotagdownload.com](http://www.turbotagdownload.com) and click on link. Enter the serial number of the tag to retrieve its certification document in PDF format.

<sup>3</sup> T-700F only available upon customer inquiry with volume commitment; Mandarin language label is available.


Product Code	General Description		Specifications & Limitations
T-700		<p>General Purpose Multi-use Tag calibrated with AccuZone™ TT calibrator</p>	<ul style="list-style-type: none"> <li>• Accuracy ±0.5°C or better</li> <li>• Multi-use product to end user</li> <li>• Works with <i>Session ManagerDB™</i> or <i>Session Manager™</i> Software</li> </ul>
T-700B		<p>Tag calibrated with AccuZone™ TT calibrator – General Purpose Multi-use</p>	<ul style="list-style-type: none"> <li>• Accuracy ±0.5°C</li> <li>• Calibration certificate supplied</li> <li>• Works with <i>Session ManagerDB™</i> or <i>Session Manager™</i> software</li> <li>• Multi-use product to end user</li> </ul>
T-700C		<p>Tag calibrated with AccuZone™ TT calibrator – Validated Tag for Use with pharmaceutical or other regulated applications</p>	<ul style="list-style-type: none"> <li>• Accuracy ±0.5°C</li> <li>• Calibration certificate supplied</li> <li>• Works with Validated <i>Session ManagerDB™</i> software for CFR compliance and security</li> <li>• Validated performance and manufacturing SOP</li> <li>• Multi-use product to end user</li> </ul>
T-700D		<p>External probe tag calibrated with AccuZone™ TT calibrator – General Purpose Multi-use</p>	<ul style="list-style-type: none"> <li>• 30" probe lead</li> <li>• Accuracy ±0.5°C</li> <li>• Calibration certificate supplied</li> <li>• Works with <i>Session ManagerDB™</i> or <i>Session Manager™</i> software</li> <li>• Multi-use product to end user</li> <li>• Standard low limit = -50°C</li> <li>• Tags available to -80°C (inquire)</li> </ul>
T-700E		<p>External probe tag calibrated with AccuZone™ TT calibrator – Validated Tag for Use with pharmaceutical or other regulated applications</p>	<ul style="list-style-type: none"> <li>• 30" probe lead</li> <li>• Accuracy ±0.5°C</li> <li>• Calibration certificate supplied</li> <li>• Works with Validated <i>Session ManagerDB™</i> software for CFR compliance and security</li> <li>• Validated performance and manufacturing SOP</li> <li>• Multi-use product to end user</li> <li>• Standard low limit = -50°C</li> <li>• Tags available to -80°C (inquire)</li> </ul>

## Peripherals and Software:

<p>TagMateQC™ in <i>Read Mode</i></p>		<p>Handheld <u>reader</u> for all tag types.</p>	<ul style="list-style-type: none"> <li>• Holds up to 99 individual tag records (with summary review capability)</li> <li>• Immediate LCD display of <math>T_{max}</math>, <math>T_{min}</math>, <math>T_{std}</math>, MKT and <i>Shelf Life Remaining</i> data and alarms on the screen, with time over and under for temperature limits (for current tag or stored tag data)</li> <li>• Reads tags in less than 2 seconds</li> <li>• Read distance = 3"</li> <li>• User ID Configurable</li> <li>• Reads tags on opposite side from screen</li> <li>• Beams information to portable printer and PC from end of unit</li> <li>• Works with MP-1 (see below) to print charts (IR sending)</li> <li>• Works with BAFO (see below) to send stored tag data to <i>Session Manager™</i> Software (IR sending)</li> <li>• Uses standard alkaline 9V battery</li> </ul>
<p>TagMateQC™ in <i>Start Mode</i></p>		<p>Handheld <u>starter</u> for all tag types.</p>	<ul style="list-style-type: none"> <li>• Sets start date and time to local time and zone</li> <li>• Starts/restarts tags</li> <li>• Audible beep and LCD confirmation</li> <li>• Requires START button press to activate tag</li> <li>• Validated</li> <li>• Starts tags on opposite side from screen</li> </ul>
<p>DR-1</p>		<p>Close-read antenna module for reading all tag types. Connects to PC computer with USB cable (not shown completely here) connection to PC.</p>	<ul style="list-style-type: none"> <li>• RFID antenna interface</li> <li>• Uses USB port for interface to PC</li> <li>• Reads by briefly placing tags on upper surface</li> <li>• Maximum read distance 2" (5cm)</li> <li>• Validated as part of system</li> </ul>

MP-1		<p>Battery powered strip chart printer</p> <p>Includes paper roll, AC battery charger and rechargeable battery pack (installed).</p>	<ul style="list-style-type: none"> <li>• Uses integral rechargeable batteries – includes charger</li> <li>• Uses standard “generic” thermal printer paper rolls</li> <li>• Prints full chart of time-temperature 3” wide by 9.875” long</li> <li>• Point <b>TagMateQC™</b> with highlighted record (or just downloaded) and press SEND button – chart starts print in 5 seconds full printout in under 10 seconds</li> </ul>
BAFO		<p>Accessory IR port for downloaded T-700 files (downloaded <i>via</i> the <b>TagMateQC™</b>) to be transferred to the PC via IR transmission.</p>	<ul style="list-style-type: none"> <li>• Plugs into USB port</li> <li>• <i>Session Manager™</i> Software recognizes IR-port enablement when BAFO is plugged in</li> <li>• Used with <i>Session Manager™</i> Software in <u>IR record-receive mode</u></li> <li>• Requires <b>TagMateQC™</b> Reader</li> </ul>
SM-CD-G <sup>4</sup> <i>Session Manager™</i> Software Package (General Version)		<p>General software package with instruction manuals and peripheral manuals</p>	<ul style="list-style-type: none"> <li>• Reads tags via DR-1 or other competent RFID antenna with PC connection</li> <li>• Gathers tag data via BAFO IR linkage to <b>TagMateQC™</b> Reader</li> <li>• Stores downloaded tag session data in database</li> <li>• Software for data mining, sorting, <i>etc.</i> with TurboTag™ database</li> <li>• Configures and starts tags with or without time delay</li> <li>• Displays graphic and list data</li> </ul>
SM-CD-DB <sup>5</sup> <i>Session Manager DB™</i> Software Package CD (CFR 21 Part 11 compliant for Pharma and for other program compliance users)		<p>Validated software package with database viewer client, instruction manuals and peripheral manuals</p> <p><i>Version 2.1.1 now available</i></p>	<ul style="list-style-type: none"> <li>• Reads tags via DR-1 or other competent RFID antenna with PC connection</li> <li>• Gathers tag data via BAFO IR linkage to <b>TagMateQC™</b> Reader</li> <li>• Stores downloaded tag session data in database</li> <li>• Configures and starts tags with or without time delay</li> <li>• Displays graphic and list data</li> <li>• Requires digital signature for I/O operations</li> <li>• Validated</li> </ul>

<sup>4</sup> Latest versions are available for free download at [www.turbotagdownload.com](http://www.turbotagdownload.com). Installation files for LAN or WAN server-client applications of *Session ManagerDB™* can also be obtained at the download site.

<p>Pouch-700</p>		<p>Non-paper recycling mailer pouch for return of multi-use T-700 tags (shown here with tag, <i>not included</i>)</p> <p>Package includes 1,000 pouches</p>	<ul style="list-style-type: none"> <li>• Supplied to distributors or selected end-user customers according to pre-determined plan</li> <li>• Distributors have the option to use their own mailers or return-facilitation materials with approval of TurboTag™.</li> <li>• Waterproof enclosure</li> <li>• Patented design</li> <li>• Tag can be read without opening pouch-envelope</li> <li>• Prepaid postage</li> </ul>
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# Appendix A - Frequently Asked Questions

## Are the tags waterproof?

Yes, they are rated IP 65, meaning they can be fully immersed for brief periods. Heat sealed or zip-lock pouches offer additional protection for applications requiring extended immersion.

## Can tags be read inside of a carton?

Yes, but there are limits. T-700 tags cannot be read through a metallic barrier or if the tag is close in proximity to a large mass of metal. If a container is cardboard or other non-metallic material, an internal tag close to the wall of the container can be read by the DR-1 or a TagMate™ reader. High water content materials do not interfere with the direct reading of the T-700 tag when a sufficiently powerful antenna is used. Monitoring the interior of a package can also be accomplished with an external probe tag such as the T-700D or T-700E. Tags may be used in conjunction with UHF tags in certain applications. UHF tags may need to be placed on the outside of a container if high water content materials are present.

## Can tags be read from a greater distance than the 3" specified for the readers?

Yes. TurboTag™ technical specialists can recommend larger antenna arrays available from third party vendors to increase the read range. Contact us for details.

## How long does the T-700 tag battery last?

T-700 tags have a battery life up to one year under normal usage. Frequent and continuous monitoring consumes battery life more rapidly. Storage and use temperatures will also impact battery life.

## How is a T-700 tag "stopped" and when and why is that important?

When no longer logging data, you can prolong battery life by making sure the tag is stopped at the time of reading.

Some users will routinely stop a tag at receipt of a monitored shipment to eliminate the recording of unnecessary and potentially confusing data.

You can use either the TagMateQC™ or *Session Manager*™ Software to stop a tag. These actions require that the software or TagMateQC™ have settings which specify "stop on read".

Tags that are monitoring shelf life are usually not stopped. When they are read at an intermediary point, the tag will produce a "shelf life remaining" value. The tag can be retained with the monitored product to continue to measure remaining shelf life. Under this circumstance, the software or peripheral used to read the tag is set to only read, NOT stop.

## How do I know when the remaining battery life is too low to use the tag?

*Session Manager*™ Software has a built-in diagnostic procedure that confirms tag battery life. *Session Manager*™ Software will not permit the configuration of a tag with a low battery voltage. The TagMateQC™ Reader cannot reconfigure a tag with a weak battery. A T-700 tag cannot be re-used (started) unless it is reconfigured, and reconfiguration can normally only be performed by *Session Manager*™ Software<sup>5</sup>.

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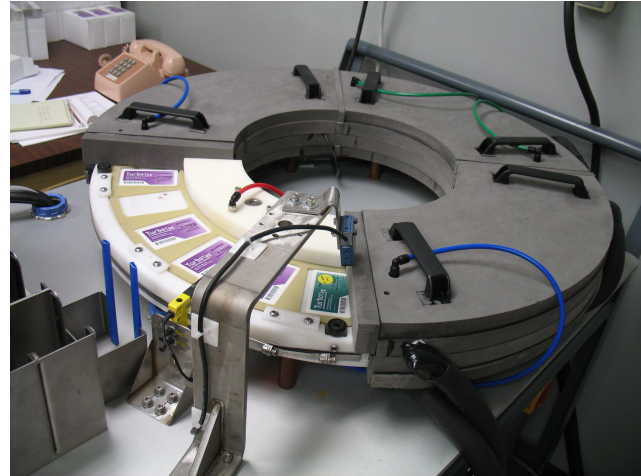
<sup>5</sup> Tags can be restarted using the TagMateQC™ starter with the same configuration.

## Can tags be disposed of in normal trash containers?

TurboTag™ batteries can be disposed of in a regular trash receptacle. An MSDS is available upon request.

## What is AccuZone™ Calibration?

*AccuZone™* is a sophisticated, fully automatic calibration operation that is used to refine the calibration of all T-700 tags to meet high accuracy specifications. Using machine automation, each tag is exposed to known temperatures and adjusted immediately based on individual tag responses. T-700 tags are calibrated based on a two point calibration protocol.



## Can I get a Calibration Certificate?

A significant advantage *AccuZone™* calibration is that the results of the process are directly recorded in a database indexed to the unique serial number of the tags. Software generates a calibration certification document that can be accessed online by any user of T-700B, T-700C, T-700D and T-700E tags. Go to [www.turbotagdownload.com](http://www.turbotagdownload.com) to view the certificate retrieval portal.

## Who validates the TurboTag™ System?

Sealed Air has partnered with a validation engineering firm to perform independent testing of tag performance, to validate *Session Manager DB™* software, and to validate TurboTag™ internal processes of tag assembly and calibration. This firm is a highly respected validation partner used by many companies with validation requirements. Contact us for further information.

## Are the calibration certificates traceable to NIST standards?

Yes. There is a clearly defined and validated traceable sequence from NIST standards to T-700 tags.

## Do I need to have a PC computer to use TurboTag™?

Not if you do not need to store TurboTag™ data. The TagMateQC™ reader is all that is needed to start pre-configured tags and review incoming data and alarm conditions. A graph of the data and summary of alarms can be printed using the MP-1 printer. Configuration does require use of *Session Manager™*.

TurboTag™ configuration, placement and retrieval services are available through Results Oriented Inc. See [www.temptrip.com](http://www.temptrip.com) for details

## Can TurboTag™ use generic RFID readers?

No. In fact, very few active or semi-active RFID tags are universally readable. TurboTag™ uses customized peripheral devices to insure data integrity and prevent unintentional or unauthorized starting and reading by generic devices.

### **What is the minimum operating temperature TurboTag™**

T-700 tags with external probes can record to -80°C<sup>6</sup>. Please contact us for details.

### **I read some tags frequently and notice a temperature “spike”. Is this normal?**

Yes. When tags are set to a very short logging interval and are repeatedly exposed to the DR-1 reader, they can be heated by the electromagnetic field of the reader. A single read event or start event does not normally produce any visible rise in temperature.

### **Can I write an identifying message on a tag to associate it with a particular shipment?**

Yes. When the *Session Manager*™ software application is first started, it looks for a UHF reader input for the purpose of reading a “UHF companion tag”. If a reader is not found, the data entry field for the UHF EPC code becomes the text entry field. In START mode, a total of 16 alphanumeric characters can be entered. The information is stored on the tag.

To Download User Guides for Current Developmental Versions of Session Manager™ Software and Instructions for the TagMateQC™ handheld starter and reader, go to: <http://www.turbotagdownload.com>

## **Appendix B – Alarms and Settings**

### **Tag Configuration (User Programmable)**

The following tag configuration parameters are specified for each tag to enable meaningful interpretation of its monitoring data.

Upper/Lower Alarm Settings (required)

1. Maximum temperature value (Alarm = one data point over maximum temperature)
2. High temperature limit setting (Alarm = time-OVER-temperature limit setting)
3. Low temperature limit setting (Alarm = time-UNDER-temperature limit setting)
4. Standard temperature value (serves as upper limit for average temperature or MKT)

### **Kinetic Shelf Life Analysis Parameters (optional)**

1. Initial Shelf Life (time value at Standard Temperature)
2. Arrhenius activation energy, Ea
3. Alarm Settings:
  - a. Software (Alarm = Remaining Shelf Life > Zero)
  - b. Handheld Reader (Alarm = Remaining Shelf Life < Stored Parameter)

Setting up shelf life monitoring requires: Ea value, and time/temperature values of initial shelf life expressed at the user-inputted standard temperature.

<sup>6</sup> Extreme low range reading requires a special external sensor configuration—call for details.

In addition to these parameters, users can configure the logging time interval, logging delay, and store an EPC OR Info Field Variable for cross-referencing purposes.

## System Outputs

### Upper/Lower Limit Analysis

1. Total hours over upper limit setting (and if the Alarm condition has been exceeded)
2. Total hours below the lower limit temperature setting (and if the Alarm condition has been exceeded)
3. Measured maximum temperature value (in C or F units) (and if the Alarm condition has been exceeded)
4. Measured minimum temperature value (in C or F units)

### Standard Temperature Analysis

1. Average temperature exceeding a standard setting (Alarm)
2. Average temperature value (in C or F units)
3. Mean Kinetic Temperature (MKT) exceeding a standard setting (Alarm)
4. Measured Mean Kinetic Temperature value (in C or F units)
5. Estimated Remaining Shelf Life based on Arrhenius kinetic calculation (Alarm)

In order to enable these outputs, the tag transfers a set of stored analysis "rules" (configuration parameters) to the reader system along with time-temperature history data. The reader then performs an analysis and displays the results, including visual/audible alarms.

## Tag Identifiers

For archival data management, each tag stores three identifiers:

1. A permanent and unique, read-only tag ID (ISO UID)
2. A system assigned session ID (9-digit integer)
3. A user-specified 16 Character Info Field OR EPC (96 bits)

Additional information can be associated with the tag record using database "non-tag fields" through *Session ManagerDB™*.