

# DATA LOGGING SOLUTIONS GEOHERMAL ENERGY STUDIES



Pressure



Temperature

# THE MADGETECH ADVANTAGE

Ensure safety, quality and efficiency by measuring and recording crucial data for inconsistencies that directly impact the success of a business. Our customizable data logging solutions provide real-time monitoring for applications where the slightest change in environment could be destructive. Coupled with the accuracy and reliability of our products, we also offer free software and cloud services, making compliance and validation reporting a breeze.

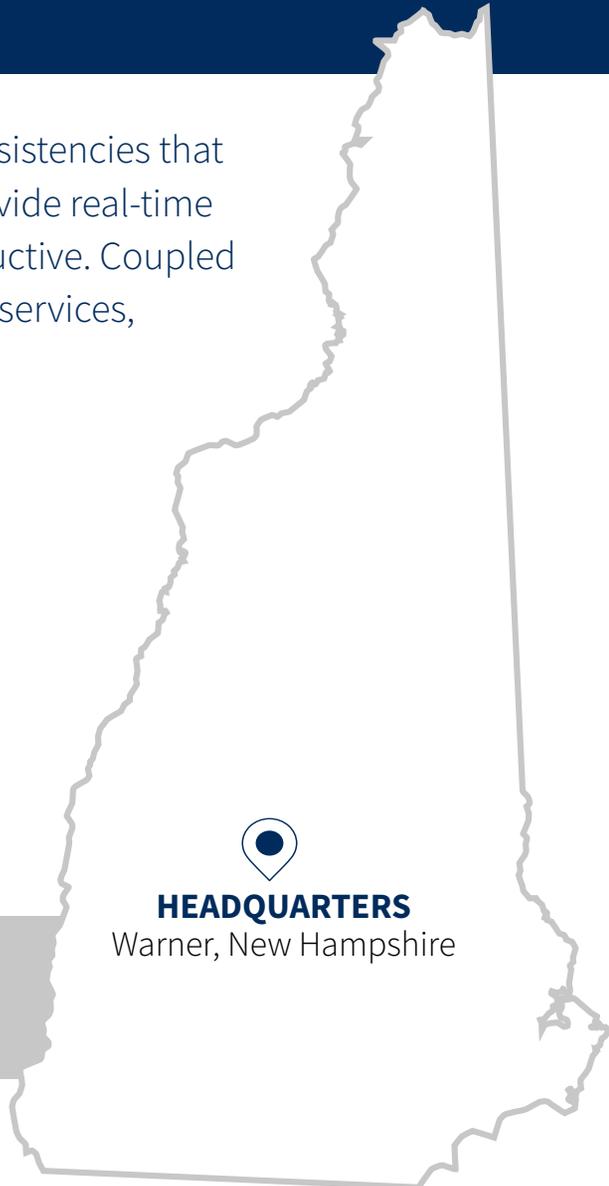
## Why Choose MadgeTech?

At MadgeTech we take pride in maintaining meaningful relationships with our customers, going above and beyond to turn their everyday problems into new data logging solutions. To ensure the instrument's accuracy, MadgeTech offers in-house standard and customized calibration services, including ISO/IEC 17025 accredited calibrations for certain products.

### Benefits:

-  Calibration
-  ISO/IEC 17025 Accreditation
-  IQ/OQ/PQ On-Site Services
-  Free Technical Support
-  Free Software
-  Cloud Services
-  21 CFR Part 11 Compliance

MadgeTech data loggers are designed, manufactured and serviced in the USA and distributed worldwide.



**HEADQUARTERS**  
Warner, New Hampshire

# DATA LOGGING SOLUTIONS FOR GEOTHERMAL APPLICATIONS

Geothermal energy is an ever expanding industry relying on renewable resources from the earth's core. The process of converting pressurized water into steam requires specific temperature and pressure conditions to be maintained and monitored consistently.

Historically, strip chart recorders have been used in the field to monitor flow rates and pressure levels on wellheads and pipes. These outdated tools require high maintenance and can introduce problems. Paper and ink need frequent replenishing and are unable to withstand being exposed to harsh weather conditions.

Data loggers provide a durable, simple and reliable process for monitoring temperature, pressure and flow rate without the maintenance and data loss risk associated with strip chart recorders. MadgeTech data loggers are rugged enough to survive even the harshest weather conditions and feature long battery lives to allow for long term deployment. With a variety of styles and options available, MadgeTech data loggers offer the ideal solution for monitoring and recording geothermal energy data collection and conversion.



Geothermal  
Energy Studies



Geothermal  
Well Testing



Orifice Plate  
Monitoring



Absolute, Gauge  
and Differential  
Pressure Logging



Wellhead  
Monitoring



High Temperature  
Logging

# PRESSURE AND TEMPERATURE DATA LOGGERS

MadgeTech data loggers are an ideal choice for measuring and recording water and steam pressure. Rugged and easy to use in the field, they are available in multiple ranges from 30 PSI to 5000 PSI.

## Rugged Pressure & Temperature Data Logger

The **PRTemp1000** is a pressure and temperature data logger that accurately records data at user programmable reading rates, over long periods of time. The device can be deployed in the field to record data for weeks or even months based on the user selected reading rate. The rugged stainless steel design allows it to be placed in harsh environments which makes it well suited for steam pressure systems. The PRTemp1000 comes standard with a .25 inch NPT fitting, which allows it to be connected to almost any pressure adapter. The submersible logger is also available in an intrinsically safe option, known as the **PRTemp1000IS**.



Intrinsically Safe version also available!

### PRTemp1000 Pressure Range (PSIA)

Range	0 to 30	0 to 100	0 to 300	0 to 500	0 to 1000	0 to 5000
Resolution	0.002	0.005	0.02	0.05	0.05	0.2

## Process Pressure & Temperature Data Logger



The **PRTC210** is a compact pressure and thermocouple temperature data logger with a .125 inch NPT fitting. The device accepts one thermocouple input which allows customers to measure process pressure and temperature. In addition, the PRTC210 also measures ambient temperature, allowing for a complete pressure and temperature analysis.

### PRTC210 Pressure Range (PSIA)

Range	0 to 30	0 to 100	0 to 300	0 to 500	0 to 1000	0 to 5000
Resolution	0.002	0.005	0.02	0.05	0.05	0.2

### Thermocouple Range

Thermocouple	Range (°C)	Resolution	Accuracy
J	-210 °C to +760 °C	0.1 °C	±0.5 °C
K	-270 °C to +1370 °C	0.1 °C	±0.5 °C
T	-270 °C to +400 °C	0.1 °C	±0.5 °C
E	-270 °C to +980 °C	0.1 °C	±0.5 °C
R	-50 °C to +1760 °C	0.5 °C	±2.0 °C
S	-50 °C to +1760 °C	0.5 °C	±2.0 °C
B	+50 °C to +1820 °C	0.5 °C	±2.0 °C
N	-270 °C to +1300 °C	0.1 °C	±0.5 °C

# DIFFERENTIAL PRESSURE DATA LOGGER

MadgeTech data loggers are a perfect solution for monitoring and recording orifice plates on geothermal sites. Our differential pressure and temperature data logger was designed specifically for the harsh conditions of geothermal monitoring.

## Differential Pressure & Temperature Data Logger

The **PRTemp1000D** is a rugged, submersible data logger that records ambient temperature and differential pressure. The device is designed to record over long periods of time at the user selected reading rate and has a pressure accuracy of  $\pm 0.25\%$  over the Full Scale Range, making the device extremely accurate. The stainless steel enclosure allows it to withstand harsh environments and the flexible cable is equipped with dual .25 inch NPT connections for easy installation.

The PRTemp1000D is available in four pressure ranges. The pressure range determines the amount of differential pressure the device will measure between the dual .25 inch NPT connections.

### PRTemp1000D Pressure Range (PSIA)

Range	0 to 30	0 to 100	0 to 300	0 to 500
Resolution	0.002	0.005	0.02	0.05



## Customer Testimonial

Chevron Geothermal Philippines is installing MadgeTech PRTemp1000 pressure data loggers and PRTemp1000D differential pressure data loggers at remote locations in the MakBan and Tiwi geothermal fields, Philippines to record data from orifice plate installations used to measure hot water and steam flow rates. The MadgeTech units are replacing circular paper chart recorders, from which the differential pressure data must presently be read manually, and are expected to improve the monitoring of changes in flow rates by providing digital data at preset time intervals that can be downloaded directly to an Excel spreadsheet for analysis. The small size of the units also simplifies installation while battery operation, which a service life of over one year, means that it will not be necessary to provide external power sources at the measurement locations. — *Chevron Geothermal Philippines Holding, Inc.*



# PRESSURE DATA LOGGERS

## Rugged Transient Pressure Data Logger

The **PRTrans1000** is a transient pressure data logger with a stainless steel enclosure. It is designed to monitor and record transitory pressure drops or spikes within a three day window of time. The device samples constantly at 100 Hz, but only records to memory when the user selectable trigger settings are exceeded, only capturing the transient pressure event. The device also records pre and post trigger pressure data to memory for in depth analysis.

### PRTrans1000 Pressure Range (PSIA)

Range	0 to 30	0 to 100	0 to 300	0 to 500	0 to 1000	0 to 5000
Resolution	0.02	0.1	0.2	0.5	1.0	5.0



Intrinsically Safe version also available!

## Real-Time Pressure Data Logger

The **PR2000** is a pressure data logger equipped with an LCD screen. The 8 button key pad and large LCD provide convenient access to current data and recorder setup. Available on-screen data include: statistics (min, max and average), recording status (start, stop and recording rate), and calibration information (data calibrated, date for recalibration). The LCD also displays a graph of the last 100 readings to show data trends.



This rugged, splash-proof (IP65) device has one of the largest memory capacities of any similar data recorder on the market, logging up to 262,143 readings. The non-volatile memory will retain recorded data, even when battery power is lost. The PR2000 is ideal for applications requiring precise displayed pressure readings, such as the real-time monitoring of outdoor geothermal pipelines.

### PR2000 Pressure Range (PSIA)

Range	0 to 30	0 to 100	0 to 300	0 to 500	0 to 1000	0 to 5000
Resolution	0.002	0.005	0.02	0.05	0.05	0.2

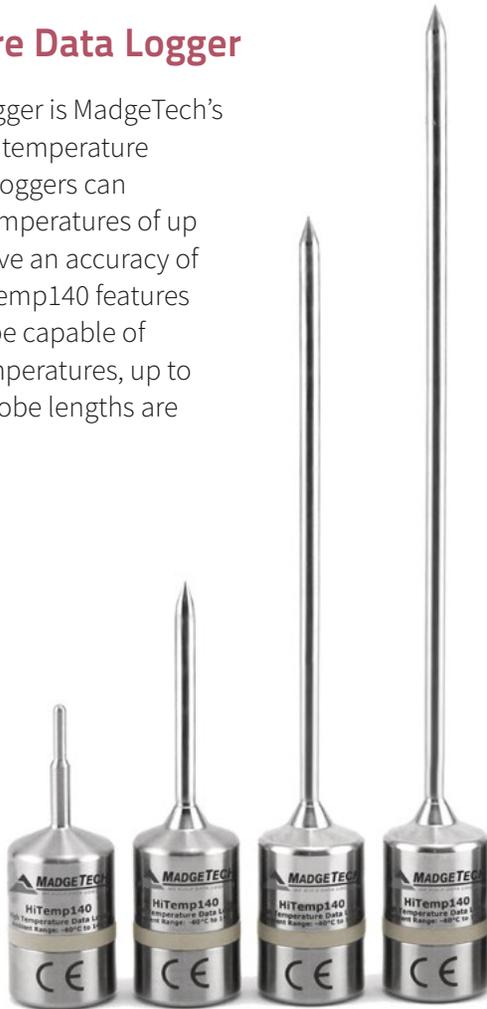


# HIGH TEMPERATURE DATA LOGGERS

MadgeTech offers a wide variety of rugged, data loggers to monitor and record high temperatures for geothermal processes. Featuring a one year typical battery life and user replaceable battery, the HiTemp140 is ideal for long deployments and has an IP68 rating, meaning it is completely submersible.

## High Temperature Data Logger

The **HiTemp140** data logger is MadgeTech's solution for precise high temperature monitoring. These data loggers can indefinitely withstand temperatures of up to 140 °C (284 °F) and have an accuracy of ±0.1 °C (0.18 °F). The HiTemp140 features a rigid external RTD probe capable of measuring extended temperatures, up to 260 °C (500 °F). Varied probe lengths are available up to 7 inches.



## Extended High Temperature Monitoring

For applications above 140 °C (284 °F), a **Thermal Shield** is available for most models of the HiTemp140 series data loggers. The Thermal Shield extends the operating temperature of the data logger, allowing it to be exposed to higher temperatures for a longer amount of time. Flush-top and vented models are available to help provide probe protection.

### Time vs Temperature Chart

Ambient Temperature	Exposure Time in Air
-40 °C to +140 °C	Indefinitely
150 °C	88 minutes
200 °C	45 minutes
250 °C	32 minutes
300 °C	n/a
350 °C	n/a

*\*Please consult the measurement range of your data logger for temperatures over 250 °C (482 °F). (The thermal barrier extends the operating temperature of the data logger up to, but not exceeding the measurement range).*



HiTemp140 shown in vented and flush-top Thermal Shield models.

# MADGETECH DATA LOGGER SOFTWARE

The simple, easy-to-use, Windows-based software enables the user to effortlessly collect, display and analyze data. A variety of powerful tools can be used to examine, export, and print professional quality reports with just a click of the mouse. This software can be downloaded for free from the MadgeTech website.



## MadgeTech 4 Software Customizable Features and Options

**MadgeTech 4 Software** can communicate with multiple loggers through multiple interface cables. Capable of simultaneous start, stop and download of over 100 devices, this software serves as your virtual command center for large scale facilities and small. Display your data in graphs, with tabbed views and multi-monitor support. Utilize the infinite graphing flexibility by combining channels and datasets as desired. All graphing makes use of accelerated graphics hardware for real-time updating and high performance visuals.

MadgeTech 4 Software is designed with a built-in database for automatic storage of downloaded data. The look and feel is organized much like standard email programs to aid in user friendliness and ease of use. MadgeTech 4 Software also offers extensive alarming options across multiple devices, wireless and non-wireless. Alarm output options include email, on-screen, text message and run-a-program alerts.

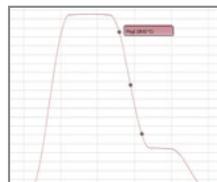
MadgeTech 4 Software has a powerful and comprehensive statistics system that allows the user to customize and view statistics as desired. Another feature is customizable engineering units. This enables users to support and program devices with many different unit types as well as the ability to display them as an alternate unit if desired.

### Software Features

- Multiple Graph Overlay
- Statistics
- Digital Calibration
- Zoom In / Zoom Out
- Cooling Flags
- Lethality Equations (F0, PU)
- Mean Kinetic Temperature
- Full Time Zone Support
- Data Annotation
- User Friendly File Management
- Min. / Max. / Average Lines
- Timeslice
- Data Table View
- Automatic Report Generation
- Summary View
- Workflows / Automation



Cooling Flags

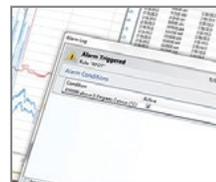


Graph View

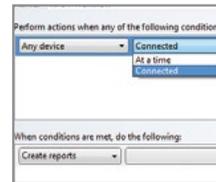
A screenshot of the 'Tabular Data View' in the software. It shows a table with columns for Time, Time Zone, and Delta. The data is organized in a grid format with alternating row colors.

Time	Time Zone	Delta
1:13:37 PM	-04:00	-00:00:00
1:14:37 PM	-04:00	+00:01:00
1:15:37 PM	-04:00	+00:02:00
1:16:37 PM	-04:00	+00:03:00
1:17:37 PM	-04:00	+00:04:00
1:18:37 PM	-04:00	+00:05:00
1:19:37 PM	-04:00	+00:06:00
1:20:37 PM	-04:00	+00:07:00
1:21:37 PM	-04:00	+00:08:00
1:22:37 PM	-04:00	+00:09:00
1:23:37 PM	-04:00	+00:10:00
1:24:37 PM	-04:00	+00:11:00
1:25:37 PM	-04:00	+00:12:00

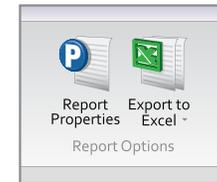
Tabular Data View



Alarm Notifications



Automation



Export to Excel