## ENV–TMP–D

# DIGITAL ALL WEATHER TEMPERATURE SENSOR AND DATA LOGGER

- Wide temperature range: -20 Celsius to 133 Celsius
- Resolution within two significant figures (XXX.XX)
- Accuracy: ± 1°C
- Continuous readings every 520 ms
- Output temperature in Celsius, Kelvin or Fahrenheit
- Built in data logger storing up to 100 individual temperature readings.
- Programmable high temp and low temp alarms
- One step calibration (optional)
- Simple asynchronous serial connectivity (voltage swing 0-VCC)
- 8 different selectable baud rates from 300 baud to 115.2k baud
- Wide operating voltage range: 3.3V to 5.5V
- Shock resistant: 16,126,837 Pascals (2,339 pounds per square inch)
- Submersible
- Water Tight
- Dust Tight
- Ice/sleet tolerant
- Non reactive to salt water
- Sensor will sink when submerged
- Dimensions 12mm X 35mm (1/2" X 1.4")

LEAD FREE RoHS COMPLIANT

## Typical Applications:

**Aquarium Environmental Monitoring**
**Storm-Water/CSO**
**Laboratory Equipment**
**Robotics**
**Fish Farming**
**Hydroponics**
**Swimming Pool**
**Non solvent chemical manufacturing**

The Atlas Scientific ENV-TMP-D temperature sensor is a rugged all weather temperature sensor specifically designed for environmental monitoring applications. The ENV-TMP-D temperature sensor exceeds the NEMA 6P and IP 68 standard for device enclosures - **Submersible, Water Tight, Dust Tight, & Ice/Sleet Resistant - Indoors/Outdoors**. The sensor can be submerged in both fresh and salt water for an indefinite amount of time and withstand temperatures of -20 Celsius to 133 Celsius.

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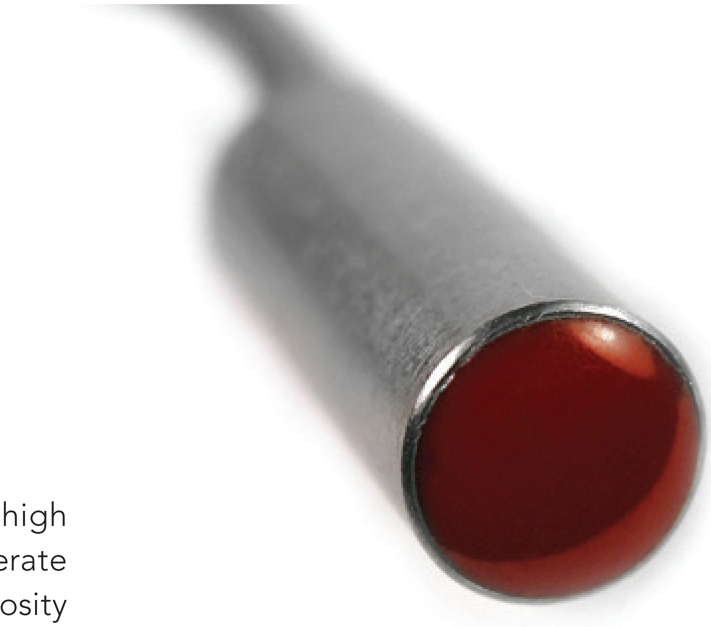
# Physical Properties

The sensor consists of a 34mm long (1.3 inch), 316 grade molybdenum bearing stainless steel tube. With a diameter of 12.7 mm (0.5 inches); the stainless steel tube is capable of withstanding a pressure of 16,126,837 Pascals (2,339 pounds per square inch).



The bottom of the sensor is made of a high viscosity moderate porosity epoxy. This moderate porosity epoxy is further encased in a low viscosity no porosity red epoxy. This allows for high temperature and pressure resistance, as well as being 100% water impermeable.

The top of the ENV-TMP-D temperature sensor is made up of the same epoxy matrix as the bottom of the temperature sensor however a 1 meter (39.37 inch) gray cable exists from the center of the sensor.

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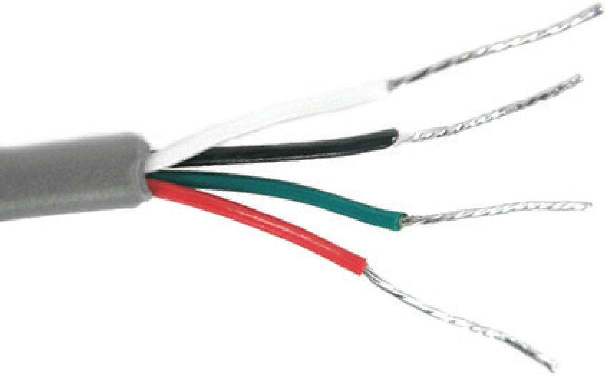
The gray cable is a shielded 4 conductor cable with a 4.5 mm diameter (0.18 inches). Each conductor is a 24 AWG stranded copper conductor which terminates to 4 tinned conductors; **black** • **red** • **white** • **green**. Where **black** is GND, **red** is VCC, **white** is RX and **green** is TX.



### Cable Data Table

| Parameter | SI (International System of Units) | Imperial system |
|---|---|---|
| Cable length | 1 meter | 39.37 inches |
| Cable diameter | 4.5 mm | 0.18 inches |
| Maximum Pulling Tension | 97.86 Newtons | 22 pounds force |
| Insulation wall thickness | 0.054 mm | 0.01 inches |
| Insulation wall material | PVC - Polyvinyl Chloride | N/A |
| Conductors X4 | 24 AWG | N/A |
| Max Cable Temperature | -30°C to 80°C | -22°F to 176°F |

### Sensor Enclosure Table

| Parameter | SI (International System of Units) | Imperial system |
|---|---|---|
| Enclosure length | 34mm | 1.3 inches |
| Enclosure diameter | 12.7 mm | 0.25 inches |
| Enclosure burst pressure | 16,126,837 pascals | 2,339 psi |

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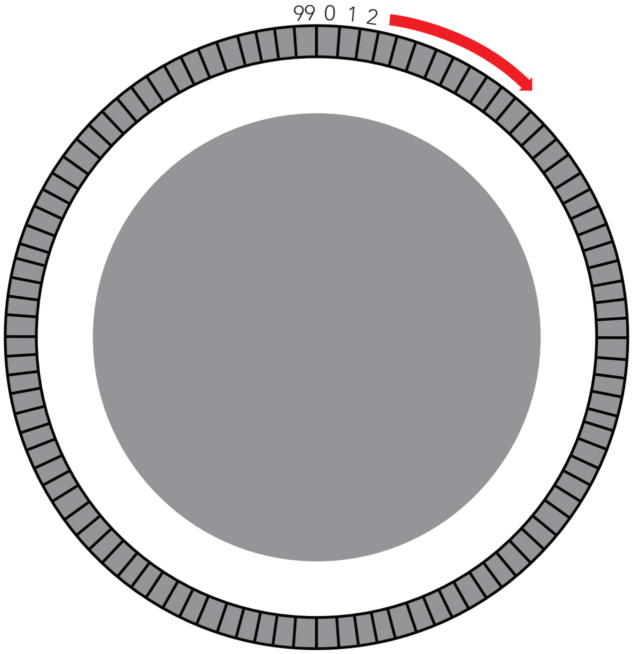
# On Board Data Logger

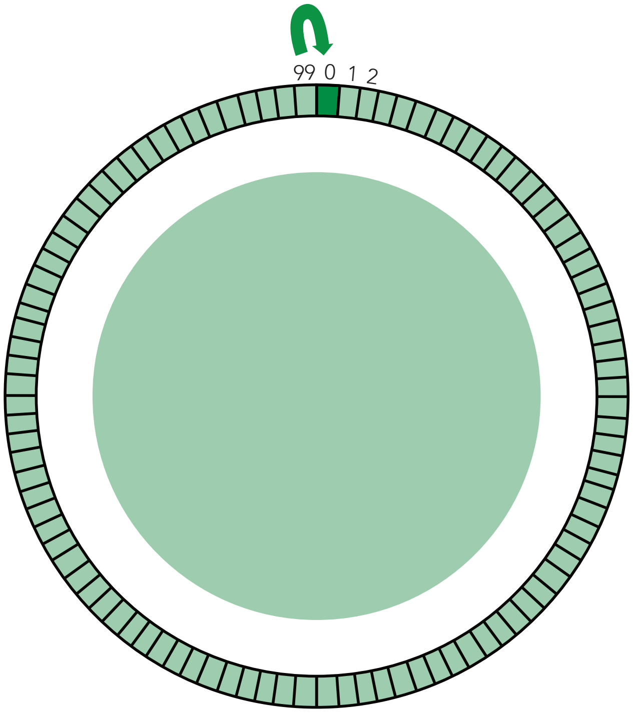
The ENV-TMP-D comes equipped with an on board data logger capable of storing 100 temperature readings. Each memory location is numbered, the first reading is stored in memory location 0 and the last reading is stored in memory location 99.

Temperature readings that are stored to the data logger will be retained even if the power is cut.



The onboard data logger can be programmed to store readings at an interval as small as once every 10 seconds and as large as once every 320,000 seconds (3.7 days). The onboard data logger stores the readings in a circular buffer beginning at memory location 0.

If the memory buffer becomes full the data logger will write over memory location 0 with the newest reading.



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# Device Operation

When the ENV-TMP-D is connected to a power supply (3.3v to 5.5v) the device will immediately enter continuous mode and begin transmitting temperature data in degrees Celsius.

There are a total of 17 different commands that can be given to the ENV-TMP-D.
**All commands must be followed by a carriage return <CR>.**
**Commands are not case sensitive.**

## Command list Quick reference

| Command | Function | Default state |
|---|---|---|
| R | Takes a single temperature reading | N/A |
| C | Takes continuous readings every 520 ms | Enabled |
| E | Stops all readings. Enter standby/quiescent mode. | N/A |
| SC | Set temperature output to Celsius | Enabled |
| SF | Set temperature output to Fahrenheit | N/A |
| SK | Set temperature output to Kelvin | N/A |
| S? | Queries the state of the output temperature | N/A |
| D[n] | Enables the internal data logger where “n” is the number of 10 second intervals between data longing events | N/A |
| D0 | Disables the internal data logger | N/A |
| MR[0,1] | Memory read back in CSV format (MR0) or<br>Memory read back in numbered order format (MR1) | N/A |
| MC | Clear data logger | N/A |
| A[A,B][ttt.tt] | Set temperature alarm A or B where “ttt.tt” is a temperature value | No ID Set |
| A[A,B]X | Disable temperature alarm A or B | No ID Set |
| # (nnnn, !, ?) | Set Device ID | No ID Set |
| Z(1-8) | Set fixed baud rate | Z6 (38,400 bps) |
| T[ttt.tt] | Calibrates the ENV-TMP-D | N/A |
| TX | Reset temperature calibration | N/A |

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## Command Definitions

**R** Instructs the ENV-TMP-D to return a single temperature reading.

*This instruction takes 520 milliseconds to complete

**Full proper syntax: r<cr> or R<CR>**
The ENV-TMP-D will respond: TTT.TT<CR>

**C** Instructs the ENV-TMP-D to operate in continuous mode.
Delivering a temperature reading every 520 milliseconds until the "e" command is transmitted.

**Full proper syntax: c<cr> or C<CR>**

The ENV-TMP-D will respond: TTT.TT (where TTT.TT represents a temperature reading)

TTT.TT<CR> (520 milliseconds)
TTT.TT <CR> (1040 milliseconds)
TTT.TT<CR> (1560 milliseconds)
TTT.TT<CR> (n+ 520 Seconds)

**E** This instructs the ENV-TMP-D to end continuous mode and enter standby/quiescent mode.

Delivering the "E" (END) instruction when not in continuous mode will have no effect on the ENV-TMP-D.

**Full proper syntax: e<cr> or E<CR>**

The ENV-TMP-D will respond by ceasing data transmission.
There is no ASCII response to this instruction.

**SC** Standing for scale Celsius, this command will set the ENV-TMP-D to output its reading in Celsius.

**Full proper syntax: sc<cr> or SC<CR>**

Although there is no direct response to this command, all transmitted temperature readings will now be in Celsius

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**SF** Standing for scale Fahrenheit, this command will set the ENV-TMP-D to output its reading in Fahrenheit.

**Full proper syntax: sf<cr> or SF<CR>**

Although there is no direct response to this command, all transmitted temperature readings will now be in Fahrenheit

**SK** Standing for scale Kelvin, this command will set the ENV-TMP-D to output its reading in Kelvin.

**Full proper syntax: sk<cr> or SK<CR>**

Although there is no direct response to this command, all transmitted temperature readings will now be in Kelvin

**S?** Queries the scale of the output temperature

**Full proper syntax: s?<cr> or S?<CR>**

The ENV-TMP-D will respond:

SC<CR> if the scale is set to Celsius
SF<CR> if the scale is set to Fahrenheit
SK<CR> if the scale is set to Kelvin

**Dn** (where n is a number >0) This command will enable the ENV-TMP-D’s onboard data logger. The D character followed a number (from 1 to 32000) will start a countdown timer from the time period entered. When the timer has counted down a temperature reading will be stored in the data logger.

The number entered is seconds multiplied by 10.
D1<CR> is read as “store a reading every 10 seconds”
D6<CR> is read as “store a reading every 60 seconds”
D10<CR> is read as “store a reading every 100 seconds”

The countdown period must be completed before the first reading is stored.
Entering d1<CR> or D1<CR> will enable the data logger and store a reading every 10 seconds.

The ENV-TMP-D will respond:

```
Q10<CR>
```

Where 10 represents the number of seconds between each reading.
The first reading will not be stored until the programmed number of seconds has passed.

Once a reading has been stored the ENV-TMP-D will output that reading with an asterisk in front of it.
Example:

*23.67<CR> (this reading has been stored to the data logger)
The ENV-TMP-D will output an asterisk and temperature reading each time a temperature reading has been stored to the data logger no matter what state the device is in.

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**D0** Disables the internal data logger.

**Full proper syntax: d0<cr> or D0<CR>**

The ENV-TMP-D will respond:

```
off<CR>
```

To re-enable the onboard data logger the Dn (where n is a number>0) command must be reissued.

Pervious data stored in the onboard data logger will not be lost.

**MR0** Issuing this command will read the contents of the internal data logger in a single CSV formatted string.

**Full proper syntax: mr0<cr> or MR0<CR>**

(Assuming the ENV-TMP-D has 5 readings stored to memory)

The ENV-TMP-D will respond:

```
23.52,23.74,23.35,23.45,23.01<CR>
```

If the memory is empty only a <CR> will be issued.

The scale of the temperature data stored in the data logger is not fixed.
Using the SC, SF and SK commands will change the way the temperature data is read back. Setting the scale to Fahrenheit will cause the memory output to be in Fahrenheit. Setting the scale to Kelvin will cause the memory to output the exact same data in Kelvin.

**MR1** Issuing this command will read the contents of the internal data logger in a numbered order starting at memory location 0 and ending with count of the total samples stored.

**Full proper syntax: mr1<cr> or MR1<CR>**

(Assuming the ENV-TMP-D has 3 readings stored to memory)

The ENV-TMP-D will respond:

```
0:23.52<CR>
1:23.74<CR>
2:23.35<CR>
Total samples: 3<CR>
```

If the memory is empty the ENV-TMP-D will respond with:

```
Total samples: 0
```

The scale of the temperature data stored in the data logger is not fixed.
Using the SC, SF and SK commands will change the way the temperature data is read back. Setting the scale to Fahrenheit will cause the memory output to be in Fahrenheit. Setting the scale to Kelvin will cause the memory to output the exact same data in Kelvin.

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**MC** This command will clear the data stored in the memory.

**Full proper syntax:** **mc<cr> or MC<CR>**

The ENV-TMP-D will respond:

clr<CR>

Deletion of the data stored in the data logger is permanent and cannot be undone.

**AA[ttt.tt]** This command, along with a temperature (either a floating point value (23.67) or an integer value 23) will set temperature alarm A. Once the temperature alarm is enabled the data output will change

From: 22.67<CR>
To: 22.67,0,0<CR>

This new data output represents the status of the temperature alarms.

22.67,0,0<CR>
⬆

This first 0 represents the status of temperature alarm A.
0= Alarm has not been triggered
1= Alarm has been triggered

Setting temperature alarm A to 35˚c would be done as such:

**Full proper syntax:** **aa35<cr> or AA35<CR>**

The ENV-TMP-D will respond with:

AA 35.00 <CR>

The alarm settings will be retained even if the power is cut.

When the temperature goes above the set point the alarm has been triggered.
When the temperature goes above the set point the ENV-TMP-D will enter continues mode.
It will stay in continues mode until the "E" command has been sent.

**AB[ttt.tt]** This command, along with a temperature (either a  floating point value (23.67) or an integer value  23) will set temperature alarm B. Once the temperature alarm is enabled the data output will change

From:  22.67<CR>
To:  22.67,0,0<CR>

This new data output represents the status of the temperature alarms.

22.67,0,0<CR>
⬆

This first 0 represents the status of temperature alarm B.
0= Alarm has not been triggered
1= Alarm has been triggered

Setting temperature alarm B to 35˚c would be done as such:

**Full proper syntax:** **ab35<cr> or AB35<CR>**

The ENV-TMP-D will respond with:

AB 35.00 <CR>

The alarm settings will be retained even if the power is cut.

When the temperature goes above the set point the alarm has been triggered.
When the temperature goes above the set point the ENV-TMP-D will enter continues mode.
It will stay in continues mode until the "E" command has been sent.

**AA?** Query the state of alarm A

**Full proper syntax:** **aa?<cr> or AA?<CR>**

The ENV-TMP-D will respond with:
AA ttt.tt,[0,1] <CR>

Where ttt.tt is the temperature that alarm A has been set to.
Where 0 or 1 is the state of alarm A.
0= Alarm has not been triggered
1= Alarm has been triggered

**AB?** Query the state of alarm B

**Full proper syntax: ab?<cr> or AB?<CR>**

The ENV-TMP-D will respond with:

AB ttt.tt,[0,1] <CR>

Where ttt.tt is the temperature that alarm B has been set to.
Where 0 or 1 is the state of alarm B.
0= Alarm has not been triggered
1= Alarm has been triggered

**AAX** This command will disable temperature alarm A.

If alarm B has not been set or has been disabled the output readings will return to normal.

From: 22.67,0,0<CR
To: 22.67<CR>

**ABX** This command will disable temperature alarm B.

If alarm A has not been set or has been disabled the output readings will return to normal.

From: 22.67,0,0<CR
To: 22.67<CR>

**#nnnn** Set 4 digit programmable ID number

Where nnnn is an ID number consisting of numbers 0-9 and letters A-Z.

Setting the ENV-TMP-D's ID number is done by issuing the # command followed by any combination of 4 ASCII letters or numbers. The ID does not come set.

**Full proper syntax: #nnnn<cr>**

Example:

Setting the device ID number to "12AB"
#12AB<cr>

The ENV-TMP-D will respond:
Set 12AB<cr>

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**#!** Reset ID number.

Where nnnn is an ID number consisting of numbers 0-9 and letters A-Z.

Setting the ENV-TMP-D's ID number is done by issuing the # command followed by any combination of 4 ASCII letters or numbers. The ID does not come set.

**Full proper syntax:** **#!<cr>**

The ENV-TMP-D will respond: clr<cr>

**#?** Query ID number.

**Full proper syntax:** **#?<cr>**

The ENV-TMP-D will respond with the ID number that it has been given:

nnnn<cr>

If the ID number has not been set the ENV-TMP-D will respond:

No ID set<cr>

# Setting baud rate

The Atlas Scientific ENV-TMP-D is set to a default rate of 38,400 bps. This baud rare can be changed to one of eight possible different baud rates.

1: 300 baud
2: 1200 baud
3: 2400 baud
4: 9600 baud
5: 19.2k baud
6: 38.4k baud
7: 57.6k baud
8: 115.2k baud

**Z(1-8)** Set fixed baud rate

Sending the Z(1-8) command will instantly set the ENV-TMP-D to a new baud rate.
This new baud rate will be stored to EEPROM and will be retained even if the ENV-TMP-D is powered off.

**Example**

(at default baud rate 38.4k bps)

**z4<cr> OR Z4<CR>**

The ENV-TMP-D baud rate has now been changed from 38.4k bps to 9600 bps
The baud rate can be changed at any time, and as many times as you like.

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**T[ttt.tt]** Entering the “T” command followed by a number will calibrate the ENV-TMP-D to a know tempature.

**Example**

After placing the ENV-TMP-D into boiling water the reported tempature in 99.45˚C
However, the tempature is actualy 100˚C.
Entering t100.00<CR> or T100.00<CR> will calibrate the ENV-TMP-D to 100˚C

Calibration can be done at any tempature.

**TX** The command “TX” (not to be confused with the abrevation for transmit) will reset the tempature calibration.

**Full proper syntax:** **tx<cr> or TX<CR>**

The ENV-TMP-D will respond:

Q10<CR>

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# Warranty

Atlas Scientific warranty's the ENV-TMP-D to be free of defect during the debugging phase of device implementation, or 30 days after receiving the ENV-TMP-D (whichever comes first).

# The debugging phase

The debugging phase is defined by Atlas Scientific as the time period when the ENV-TMP-D is inserted into a bread board or shield and is connected to a microcontroller according to this **wiring diagram**. Reference this **wiring diagram** for a connection to USB debugging device, or if a shield is being used, when it is connected to its carrier board.

If the ENV-TMP-D is being debugged in a bread board, the bread board must be devoid of other components. If the ENV-TMP-D is being connected to a microcontroller, the microcontroller must be running code that has been designed to drive the ENV-TMP-D exclusively and output the ENV-TMP-D's data as a serial string.

**It is important for the embedded systems engineer to keep in mind that the following activities will void the ENV-TMP-D's warranty:**

- **Soldering any part of the ENV-TMP-D**
- **Running any code that does not exclusively drive the ENV-TMP-D and output its data in a serial string**
- **Embedding the ENV-TMP-D into a custom made device**
- **Removing any potting compound**

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# Reasoning behind this warranty

Because Atlas Scientific does not sell consumer electronics; once the device has been embedded into a custom made system, Atlas Scientific cannot possibly warranty the ENV-TMP-D against the thousands of possible variables that may cause the ENV-TMP-D to no longer function properly.

**Please keep this in mind:**

1. **All Atlas Scientific devices have been designed to be embedded into a custom made system by you, the embedded systems engineer.**
2. **All Atlas Scientific devices have been designed to run indefinitely without failure in the field.**
3. **All Atlas Scientific devices can be soldered into place.**

*****Atlas Scientific is simply stating that once the device is being used in your application, Atlas Scientific can no longer take responsibility for the ENV-TMP-D continued operation. This is because that would be equivalent to Atlas Scientific taking responsibility over the correct operation of your entire device.