# IAT

-Intake air temperature sensor

Technical Spec

ECOTRONS LLC

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Note: If you are not sure about any specific details, please contact us at info@ecotrons.com.

**Product:** **Intake Air Temperature Sensor**

**Part#:** **ET-IA202**

**Note:** All data given in this document are nominal values and might be subject of change at any time

| Index | Page | Revision | Date | Note |
|---|---|---|---|---|
| 1 | ---- | **First Edition** | 11.26.2013 | V1.3 |
| 2 | ---- | **Second Edition** | 12.16.2013 | V1.3.1 |
| 3 | ---- | **Third Edition** | 12.20.2013 | V1.3.2 |
| 4 | ---- | **Fourth Edition** | 2.17.2017 | V1.3.3 |
| | | | | |

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# General Description

IAT sensor is the short name of Intake Air temperature sensor. It is a standard abbreviation of SAE J1979. Our IAT sensor is designed to be placed in Air-box, and measures the air temperature directly.

IAT sensor signal is used as an important input for an engine control unit (ECU) to adjust the fuel metering and AFR controls; and also finely tune the other control parameters in variant operating conditions. It is also used as a measurement value which is logged in a data acquisition system.

This IAT sensor has a NTC sensing element, which means Negative Temperature Characteristics. This means, with the temperature rising, the resistance of the sensing element drops.

# 1 Characteristic

## 1.1 Sensor Picture



## 1.2 Characteristics Parameters

| | | |
|---|---|---|
| Zero power resistance | R25=2KΩ+1% | 25 $^{o}$C |
| B-value | B25/50=3470k±1% | |
| Thermal time constant | 7s max | in static air |
| Dissipation constant | 0.6mW/$^{o}$C | in static air |


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| | | |
|---|---|---|
| | ~0.95mW/ °C | |
| Power rating | 3mW | |
| Operating temperature range | -40 °C ~150 °C | |
| Storage temperature range | 0~120 °C | |
| Weight | 7g | |

## 1.3 Characteristic data

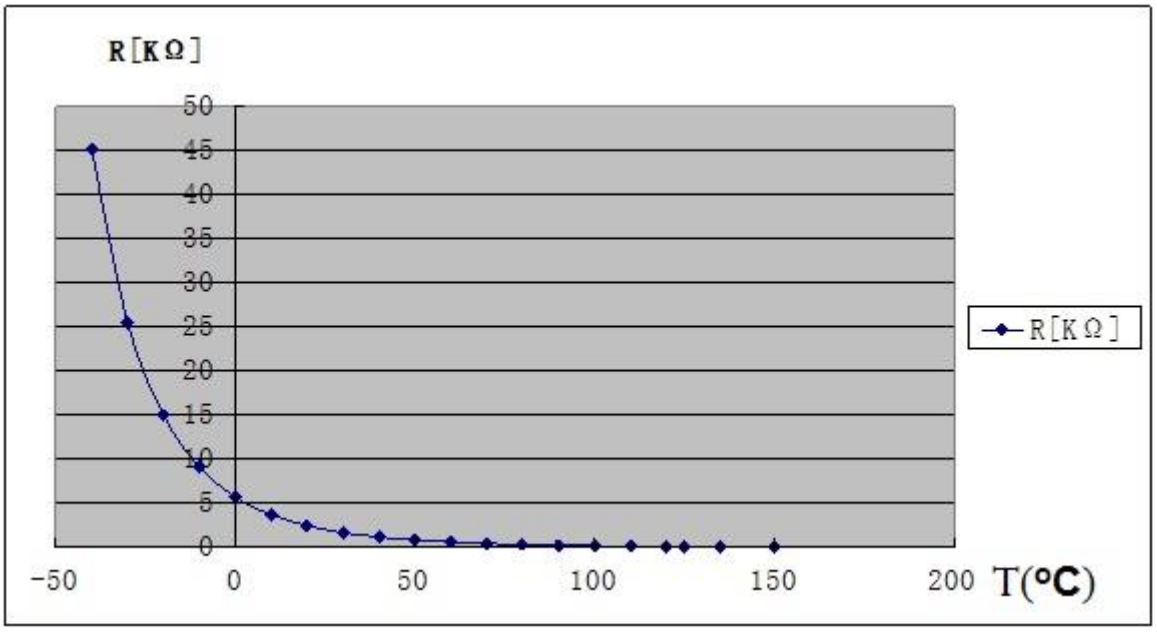
**Rnor: nominal resistance**
**R+1%: nominal resistance with +1 % error.**
**R-1%: nominal resistance with -1 % error.**

| T(°C) | R +1%(kΩ) | Rnor(kΩ) | R -1%(kΩ) |
|---|---|---|---|
| -40 | 47.0831 | 45.186 | 43.361 |
| -30 | 26.47022 | 25.54894 | 24.65726 |
| -20 | 15.4542 | 14.996 | 14.54994 |
| -10 | 9.33748 | 9.10596 | 8.87928 |
| 0 | 5.82072 | 5.70302 | 5.58714 |
| 10 | 3.73668 | 3.67722 | 3.61834 |
| 20 | 2.46434 | 2.43514 | 2.40604 |
| 30 | 1.67186 | 1.65214 | 1.6325 |
| 40 | 1.16396 | 1.14604 | 1.12828 |
| 50 | 0.82814 | 0.81258 | 0.79724 |
| 60 | 0.59836 | 0.5852 | 0.57228 |
| 70 | 0.43878 | 0.42778 | 0.41702 |
| 80 | 0.32624 | 0.31712 | 0.30822 |
| 90 | 0.24658 | 0.239 | 0.23164 |
| 100 | 0.18846 | 0.18218 | 0.17608 |
| 110 | 0.14578 | 0.14056 | 0.1355 |


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| | | | |
|---|---|---|---|
| 120 | 0.11404 | 0.10968 | 0.10548 |

### 1.4 Nominal characteristic curve plotted




**R-T characteristics**

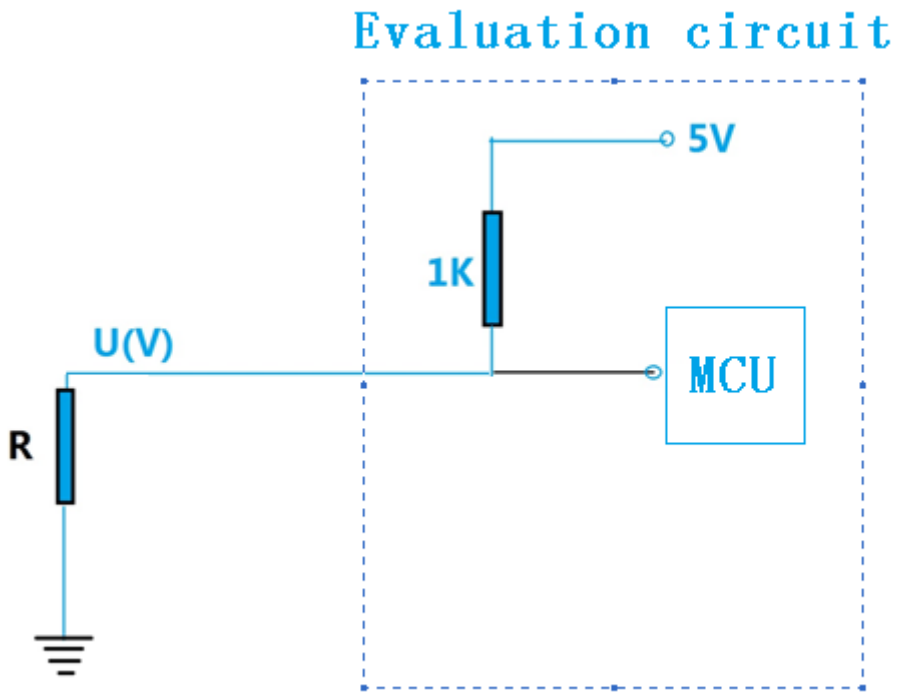
# 2 Applications

## 2.1 Typical Applications

**This IAT sensor** is normally used to measure intake air temperature. It should be placed in the Air-box.

## 2.2 Electrical application notes

Here is a reference design of the circuit to be used for the IAT sensor:




R: the resistance of IAT sensor
U (V): the voltage of IAT sensor to input ECU

$$U(V)=\frac{R}{R+1}*5$$

20 °C: $R_{20}$=2.43514 $U_{20}(V)=\frac{2.43514}{2.43514+1}*5$ V=3.5445V

100 °C: $R_{100}$= 0.18218 $U_{100}(V)=\frac{0.18218}{0.18218+1}*5$ V=0.77053V

(B25/50=3470K ±1%)

# 3 Sensor testing

## 3.1 Mechanical testing

| Items | Test condition | Requirement |
|---|---|---|
| vibration | Vibration frequency:50±10Hz;<br>Vibration acceleration: 10±1g;<br>Vibration direction: horizontal and vertical<br>Vibration time: one hour in two directions | No visible damage, parameters<br>are within definition |
| impact | Impact frequency: 50±10 times/min;<br>Impact acceleration:100±10g;<br>Impact direction: horizontal and vertical;<br>Impact cycles: 1000 times in two directions | No visible damage, parameters<br>are within definition |
| Free fall | Free fall from height of 1m on glass surface for 15 times | No visible damage, parameters<br>are within definition |

## 3.2 Environmental testing

| items | Test condition | Requirement |
|---|---|---|
| High temp | T=175 $^{o}$C±2 $^{o}$C, t=96h | R25<=±3%<br>R25/50<=±2% |
| Low temp | T= -30 $^{o}$C±2 $^{o}$C, t=96h | R25<=±3%<br>R25/50<=±2% |
| Temperature cycling | -30 $^{o}$C~150 $^{o}$C<br>30 minutes per cycle, 5 cycles total | No visible damage, parameters<br>are within definition |
| Humidity test | 60 $^{o}$C, 95%R.H, 1000 hour | R25<=±3%<br>R25/50<=±2% |

## 3.3 Other testing

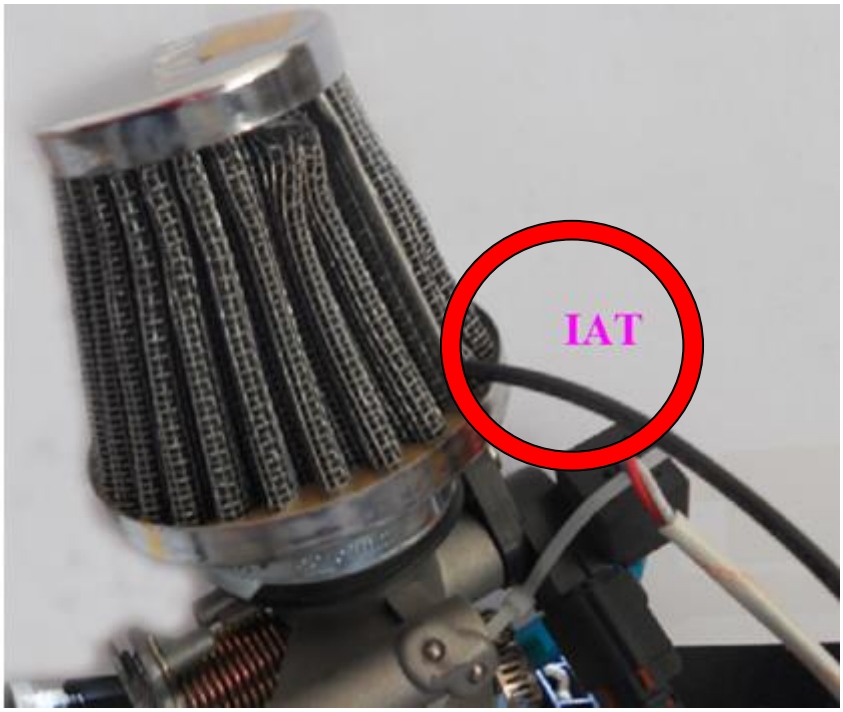
| items | Test condition | Requirement |
|---|---|---|
| Lead wire welding ability | Soak lead wires with flux, immerse into flux at 230-260 $^{o}$C, for 3 to 5 seconds | Tim covered area should be larger than 90% |
| Lead wire stretching test | Fix the product and apply 1.5kg force on axial | ---------- |


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| | | |
|---|---|---|
| | direction of each lead wire, for 10 seconds. | |
| Lead wire bending test | Fix the product and apply 250g force on axial direction of each lead wire, then bend both lead wires to same direction slowly, before bending them back to original location, for 3 times. | No visible damage, parameters are within definition |

# 4 Installation instructions

Please insert the IAT sensor into the air filter or somewhere between the air filter and the throttle body (**if a hole is drilled on the air box, make sure all the debris are cleaned immediately after the drilling!**).




# 5 Sensor diagnostics

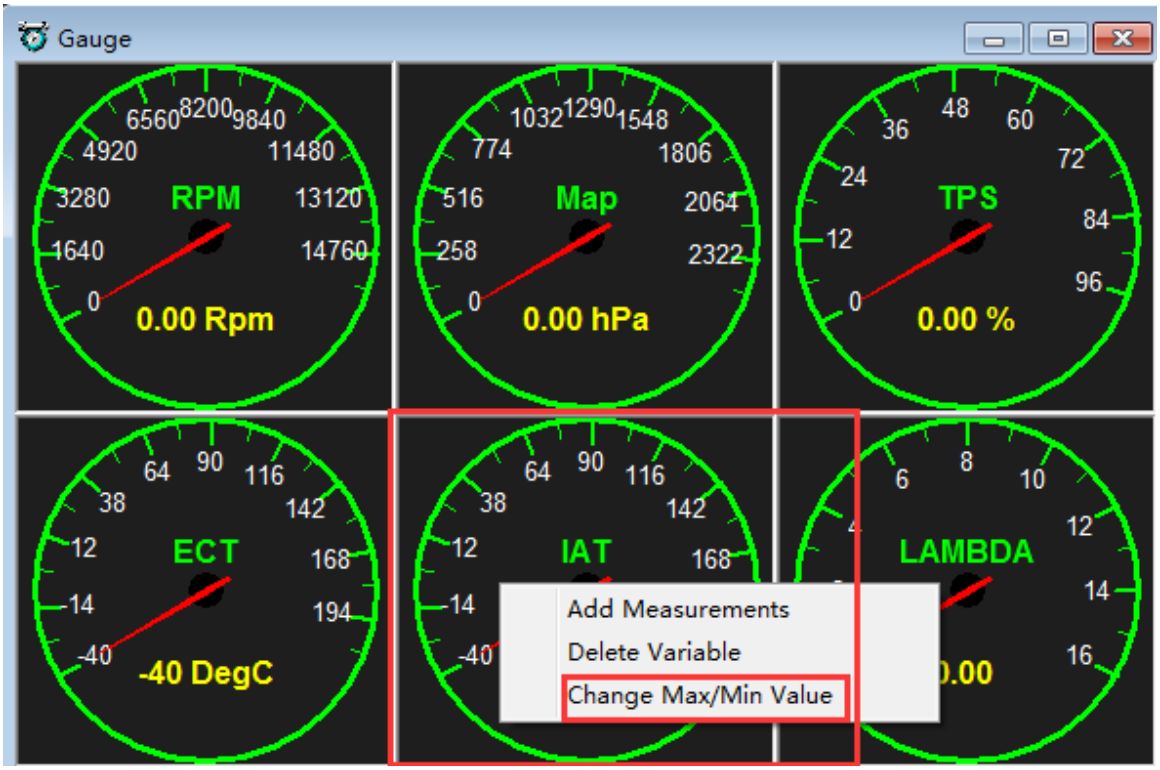
With an Ecotrons EFI system, you can use EcoCAL software to do quick diagnosis on the IAT sensor.

Here is the link to get the EcoCAL user Manual .

http://www.ecotrons.com/support/

EcoCAL screen, by default, shall show a group of the gauges, one is the IAT gauge. You can read the gauge to determine whether it makes sense or not. For example, before you start the engine in the morning, the IAT should read as the ambient temperature.

Note, the gauge, by default, reads Celsius temperature. You can go to the "Menu → Setting →Toggle Units" to change to "Imperial units". You also can change Max /Min Value of IAT Gauge, please Right click on the ECT Gauge, choose "Change Max /Min Value".





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