TECHNICAL DATASHEET

# RTD1

## Resistance Temperature Detector Module (1x PT100 Input)


### Summary

The iMAC RTD1 Module is an Intrinsically Safe temperature input module. The RTD1 provides a single channel RTD PT100 sensor input for monitoring temperature. The Module is powered directly from the iMAC L1 Fieldbus communication line.

The iMAC RTD1 Module publishes two 16 bit words onto the iMAC Fieldbus communication line; One 16 bit word for the PT100 temperature value and one 16 bit word for the PT100 flags and error bits.

There is a precision resistor used in the RTD1 Module to calculate the resistance of the PT100 sensor. The RTD1 Module uses a 10 bit Analog to Digital Converter and corrects the parabolic RTD response using a high order piecewise linear approximation method. The RTD1 Module corrects for the temperature effects on reference voltages.



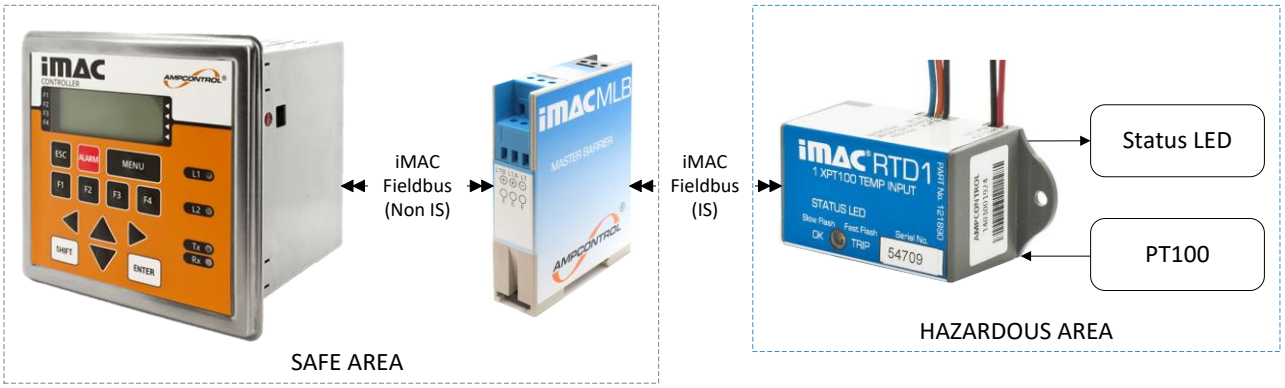
### Data Register(s)

2 (Flags, Temperature)

### Features

- Intrinsically Safe Ex ia Group I Ma
- Compatible with RTD PT100 temperature sensors (-20°C to 300°C)
- Compact, encapsulated design
- Down-line powered from the iMAC L1 Fieldbus
- Multifunction diagnostic status LED
- Remotely monitored and configured via iMAC Controller
- Optional DIN rail mounting kits are available

### Minimum System

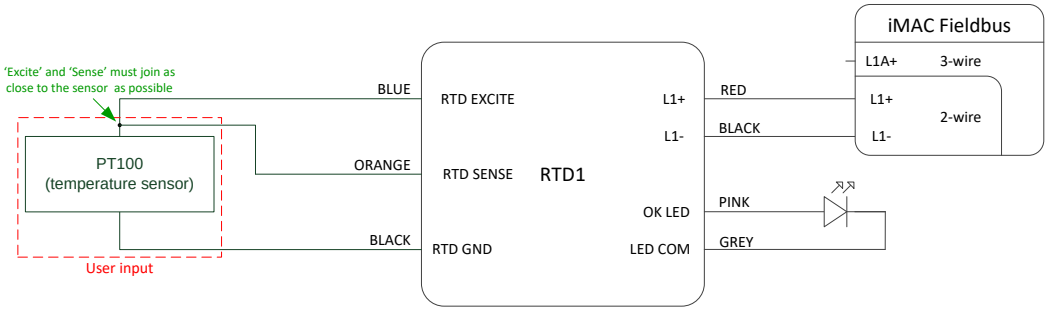



**CAUTION!**

Modules used in non-I.S. systems shall not be re-used in I.S. systems

(as the integrity of internal components upon which intrinsic safety depends may have been compromised).

## Electrical Connections




*The excite and sense must connect together as close as possible to the sensor to ensure accurate temperature readings.*

*Note: refer to iMACB094 – iMAC Installation Requirements*

| Label | Wire colour | Type | Description |
|---|---|---|---|
| *L1+* | Red | L1 Comms | iMAC Fieldbus (2 wire) |
| *L1-* | Black | | |
| *RTD EXCITE* | Blue | PT100 Inputs | Excite |
| *RTD SENSE* | Orange | | Sense |
| *RTD GND* | Black | | Common |
| *OK LED* | Pink | LED Output | Status/OK |
| *LED COM* | Grey | | Common (cathode) |

## Data Register(s)

| Flags Register | | | |
|---|---|---|---|
| **Bit** | **Description** | **Bit Value** | **R / W** |
| *15* | - | X | r |
| *14* | - | X | r |
| *13* | - | X | r |
| *12* | - | X | r |
| *11* | - | X | r |
| *10* | - | X | r |
| *9* | - | X | r |
| *8* | - | X | r |
| *7* | - | X | r |
| *6* | - | X | r |
| *5* | High temperature warn | 1 = Warn | r |
| *4* | Low temperature warn | 1 = Warn | r |
| *3* | Temperature out of range | 1 = Fault | r |
| *2* | RTD Sense Wire Fault | 1 = Fault | r |
| *1* | RTD Open circuit | 1 = Fault | r |
| *0* | RTD Short circuit | 1 = Fault | r |

| Temperature Register | |
|---|---|
| **Temperature (°C)** | **Register Value Signed (read only)** |
| 65 | 0000 0000 0100 0001 (0041h) |
| 28 | 0000 0000 0001 1100 (001Ch) |
| -5 | 1111 1111 1111 1011 (FFFBh) |
| -20 | 1111 1111 1110 1100 (FFECh) |
| 999 (FAULT) | 0000 0011 1110 0111 (03E7h) |

## Configuration Parameters

(Refer to document IMACB005 - iMAC module parameters programming procedure)

| Flags Register Parameters (roll-call name: RTD1 Flags) | | | | | |
|---|---|---|---|---|---|
| **No** | **Description** | **Range** | **Default** | **Units** | **R/W** |
| *1* | Flags register address | 1 - 255 | 255 | - | r / w |
| *2* | Not used | - | - | - | r |
| *3* | Not used (Factory use) | - | - | - | r |
| *4* | Not used (Factory use) | - | - | - | r |

*Parameter Details…*

Parameter 1: The iMAC Address into which the flag bits will be published. Selecting 0 will put the flags register offline.

| Temperature Register Parameters (roll-call name: RTD1 Temp) | | | | | |
|---|---|---|---|---|---|
| **No** | **Description** | **Range** | **Default** | **Units** | **R/W** |
| *1* | Temperature register address | 1 - 255 | 255 | - | r / w |
| *2* | Low set point (signed 16 bit value) | -19 | 40 | - | r / w |
| *3* | Not used (Factory use) | - | - | - | r / w |
| *4* | High set point (signed 16 bit value) | 299 | 160 | - | r / w |

*Parameter Details…*

Parameter 1: The iMAC Address into which the temperature value will be published. Selecting 0 will put the temperature register offline.

Parameter 2: Temperature LOW set point for the warn bit in the Flags Register. Set point is a 16 bit, 2's compliment representation of the temperature in Celsius.

Parameter 4: Temperature HIGH set point for the warn bit in the Flags Register. Set point is a 16 bit, 2's compliment representation of the temperature in Celsius.

## Functional Logic

*Flags Register…*

RTD sensor wire fault: Indicates abnormal sensing signal.

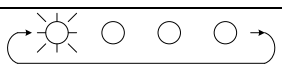
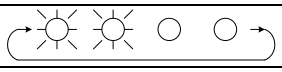
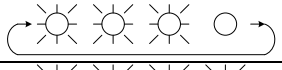
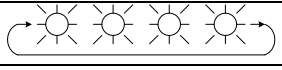
RTD open circuit: Indicates the RTD sensor resistance is greater than ~250Ω.

RTD short circuit: Indicates the RTD sensor resistance is less than ~50Ω.

*Temperature Register…*

A 16 bit 2's compliment signed representation of the temperature in 1-degree increments.

If there is a fault, the temperature value is set to 999.

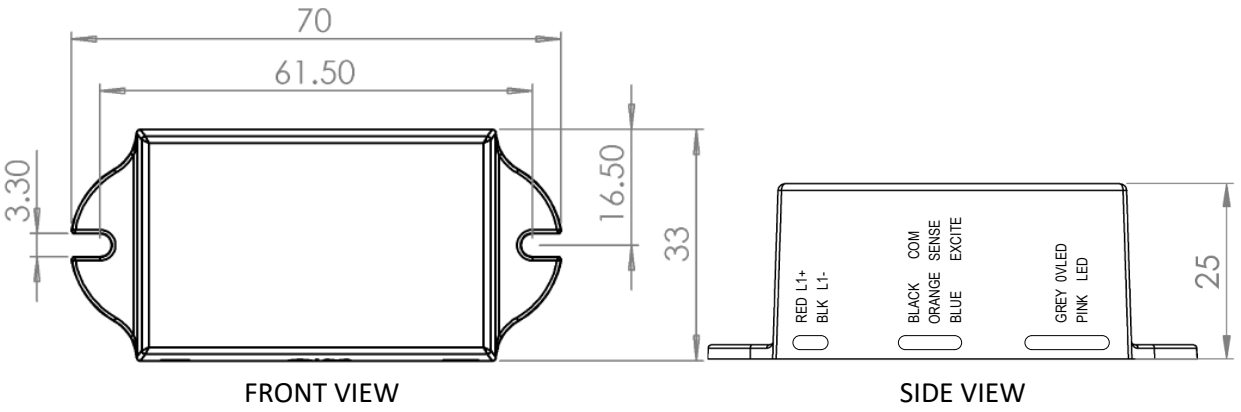
| LED Indicators | | | |
|---|---|---|---|
| **Status LED (RED)** | | | |
| **Flash Sequence** | | **Module - iMAC Comms Status** | **Module - Function Status** |
| *Off* | | Unknown (check connections) | Unknown (check connections) |
| *Slow Flash* |  | Healthy | All status register warn and fault bits = 0 |
| *2 Flashes* |  | Healthy (has been roll-called) | - |
| *3 Flashes* |  | Error (address clash) | - |
| *Fast Flash* |  | Warn (general) | Any flags register warn or fault bit = 1 |

| Certification / Approvals | | |
|---|---|---|
| **Intrinsic Safety** | | |
| *Type* | Ex ia I MA (for use in zone 0, 1 or 2) | |
| *Certificate number* | IECEx ITA 07.0017X | |
| *Module type* | GM1 | |
| *IP rating* | Must be installed in an enclosure not less than IP20 (IP54 recommended) | |
| *Other* | Must be mounted in such a manner that the encapsulation is not exposed<br>Must be connected in accordance with iMAC system drawing IMACZ032.<br>L1+ L1- terminals must only connect to a single MLB (Master Line Barrier). | |
| *I/O parameters* | L1+ (red), L1- (black) | Ui = 21.5V (44.65R source resistor)<br>Ci = Negligible<br>Li = Negligible |
| | RTD EXCITE (blue), RTD SENSE (Orange), RTD GND (Black), OK LED (pink), LED COM (grey) | Uo = 21.5V<br>Io = 0.202A<br>Po = 1.09W<br>Co = 0.27uF<br>Lo = 11.4m H<br>Ci = 5.83uF<br>Li = negligible |
| *Ambient temperature (Ta)* | -20°C to +40°C (refer to operating environment specifications) | |
| *RTD PT100* | Metal case shall contain by mass not more than 6% in total of magnesium and titanium together and not more than 15% in total of aluminium, magnesium or titanium, singly or in combination.<br>Surface area must be > 20mm$^2$. | |
| *This table is provided for quick reference purposes only: refer to latest issue of the Certificate of Conformity for all system designs.* | | |
| **QPS** | | |
| *File Number* | LR1527 | |
| *Model* | 121889 MODULE IMAC RTD1 IS C/W LED IECEx | |
| *Environment* | Indoor use (or must be installed in a suitable outdoor enclosure with minimum IP54 rating)<br>Altitude up to 2000m<br>Pollution Degree 2 | |
| *The specified values approved by these standards may differ from the general specifications detailed elsewhere in this datasheet.* | | |

| Specifications | |
|---|---|
| **Mechanical** | |
| *Dimensions* | 33mm x 70mm x 25mm (See diagram below) |
| *Weight* | 60g |
| *IP Rating* | Module is fully encapsulated |
| *Mounting* | Enclosure includes 2 mounting tabs, each with a 3mm slot (screws not supplied) |
| *Electrical Connections* | Individual 450mm flying leads<br>(0.4mm$^2$ PVC insulated multi-strand flexible wire with an overall outside diameter of 1.5mm) |
| **Environmental** | |
| *Operating Temperature* | -10°C to +60°C |
| *Relative Humidity* | <95% RH |
| **Inputs** | |
| *Analogue (measured)* | 1 (requires external PT100 temperature sensor) |
| *Limits* | -20°C to 300°C |
| *Accuracy* | ± 2°C |
| **Outputs (excluding 121890)** | |
| *Status LED* | Internally current limited 3VDC source - via 330R resistor |
| *Limits* | < 2mA (external resistor may be required) |

| **Communications (iMAC L1)** | |
|---|---|
| *Hardware interface* | 2 wire (+/-18VDC I.S via MLB barrier. or +/-21VDC non-I.S. iMAC Fieldbus) |
| *Line Speed* | 300 - 1000 baud |
| *Bit protocol* | iMAC proprietary |
| *L1 Isolation* | None |
| *L1 Line Loading (baud)* | 0.56mA (300) / 1.44mA (1000) |
| **Find Out More** | |
| For more information on this product, contact Ampcontrol Customer Service on +61 1300 267 373 or *customerservice@ampcontrolgroup.com* or visit the Ampcontrol website: www.ampcontrolgroup.com | |

## Dimensions




## Equipment List

| ***Part Number*** | **Description** |
|---|---|
| *121890* | MODULE IMAC RTD1 IS NO LED IECEx |
| *121889* | MODULE IMAC RTD1 IS C/W LED IECEx |
| *142323* | KIT IMAC DIN RAIL MOUNT |