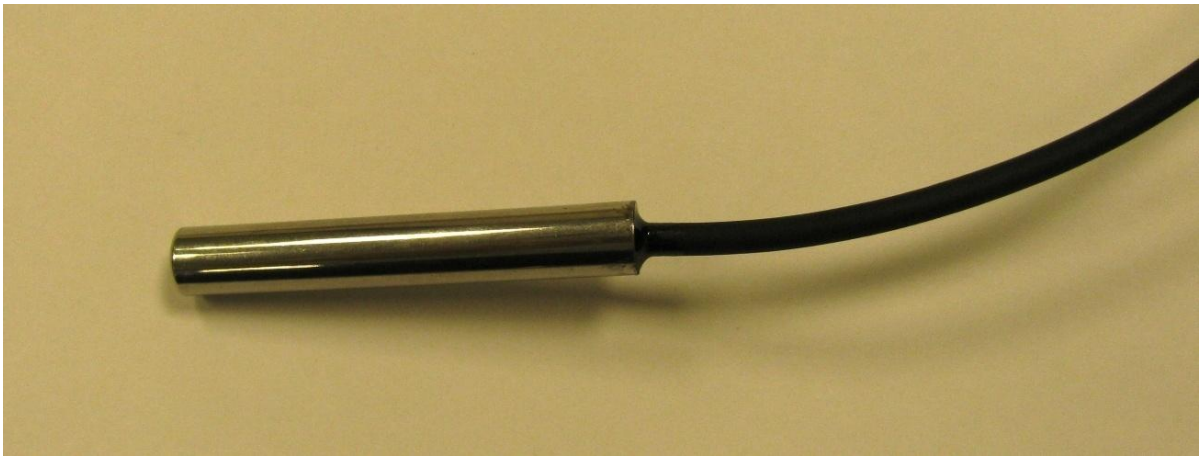
Temperature Sensor Product Overview



Cellocator Division
Pointer Telocation Ltd.

Proprietary and Confidential

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POINTER

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1 General Description

1.1 Overview

The Temperature Sensor connects to the analog input of the Cellocator unit and enables temperature-monitoring in Fleet Management applications.

The Sensor is installed in the area that requires temperature monitoring, and sends analog information of 0-2.5 Volts to the Cellocator unit's analog input as a function of the temperature level. The Cellocator unit sends the received voltage level to the control server on every location update message. The server-side software translates the information to a visual indication of temperature level, alerting the user of breached thresholds and any other application layer activities.

Two Temperature Sensor models are supported:

- AR0204 which supports 5 meter cable
- AR0202 which supports 20 meter cable

Note: The Temperature Sensor can be ordered with customized cable length subject to order quantities and maximum permitted measurement accuracy limitations. For further information please refer to your contact person at Pointer or send an email to sales@pointer.com.

The AR0204 / AR0202 Temperature Sensors replace the AR0187 Temperature Sensor, providing several additional benefits:

- Stainless steel can for better corrosion immunity
- Polypropylene insulated inner cores for better environment protection
- Reverse polarity protection built into the sensor
- Vehicle voltage disturbances protection provided by the Power Protection Device (FL0012), which is particularly needed for 24v installation.

For proper and adequate protection against car electrical disturbances in the vehicle environment, the Power Protection Device (FL0012) should be applied between the vehicle's power source and the Temperature Sensor in several cases. **It must be applied in 24V vehicles.**

Further information can be found in the Power Protection Device (FL0012) section.

1.2 Highlights

- The Temperature Sensor measures temperatures in the range of -50ºC to +75ºC and when integrated with Cellocator unit gives a maximum error range of ±2 ºC (the Sensor itself generates an error of 1 ºC, and the Compact unit adds an error of 1 ºC; the summary of both errors is ±2 ºC).
- The Temperature Sensor outputs 0-2.5 volts in a resolution of 20mV per 1ºC. A temperature of 0ºC results in 1V output.

- The Temperature Sensor output matches the analog input of the Cellocator unit in the specified temperature range.
- The Temperature Sensor is housed in a stainless steel can and terminated in a 5M or 20M cable.
- The Temperature Sensor features Low Current Consumption and no calibration is required.
- The Temperature Sensor has built-in protection against reverse polarity feed.

2 Installation Instructions

The Temperature Sensor is equipped with a 3-channel cable, which should be configured as follows:

1. Connect the black wire to the vehicle's chassis (GND).
2. Connect the red wire to the vehicle's V+.
3. Connect the blue wire to the Cellocator unit's analog input.

The GND and the V+ of the Temperature Sensor and those of the Cellocator unit harness must share the same power source.

Note: Incorrect connections may lead to malfunction and damage.

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3 Technical Specifications

3.1 Mechanical Specifications

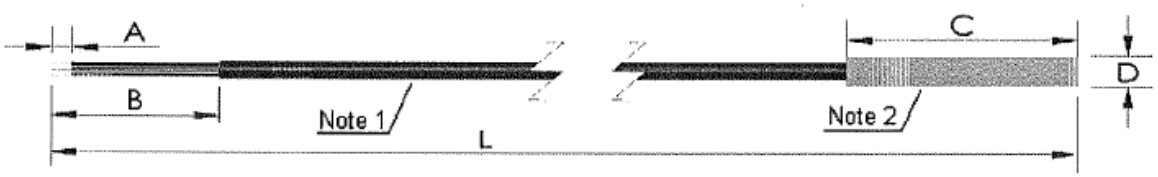

Figure 1: Mechanical Diagram

Pointer PN	A	B	C	D	L
AR0204	5mm±1mm	35mm±1mm	55mm±1mm	8.5mm Max	5M±50mm
AR0202	5mm±1mm	35mm±1mm	55mm±1mm	8.5mm Max	20M±200mm

- **Note 1** = 3 Core 0.22mm^2 TPE sheathed cable with polypropylene insulated inner cores.
- **Note 2** = 8.5x55mm 304 Stainless Steel Can.

3.2 Connection Diagram

Wire Color	Connection
Red	V+
Black	GND
Blue	Vout

Note: Incorrect connections may lead to malfunction and damage.

3.3 Performance Specification

Electrical Ratings	Min	Typical	Max	Units
Supply Voltage	6.2	7	30	V
Supply Current	1	2	5	mA
Signal update rate	-	100	-	mS
Temperature range	-50	-	+105*	ºC
Output Load Resistance	-47	100	-	Kohm
Maximum voltage on Vout			5*	V
Temp response gradient (cooling)	2 ºC			Min-1
Temp response gradient (heating)	4 ºC			Min-1
Maximum measurement error			2	ºC

Cellocator unit analog input measures the Temperature Sensor output between 0 to 2.5V, providing a temperature measurement range of -50ºC to 75ºC.

The Temperature Sensor maximum error is 1ºC. The Cellocator unit analog input measurement features an additional 1ºC error due to internal components value deviation. Hence, the maximum expected temperature measurement error of a system consisting of a Cellocator unit and the Temperature Sensor connected to its analog input is ±2 ºC.

3.4 Temperature / Voltage Response Table

Voltage	Temp.	Voltage	Temp.	Voltage	Temp.	Voltage	Temp.
0	-50ºC	0.8	-10ºC	1.6	30ºC	2.4	70ºC
0.02	-49ºC	0.82	-9ºC	1.62	31ºC	2.42	71ºC
0.04	-48ºC	0.84	-8ºC	1.64	32ºC	2.44	72ºC
0.06	-47ºC	0.86	-7ºC	1.66	33ºC	2.46	73ºC
0.08	-46ºC	0.88	-6ºC	1.68	34ºC	2.48	74ºC
0.1	-45ºC	0.9	-5ºC	1.7	35ºC	2.5	75ºC
0.12	-44ºC	0.92	-4ºC	1.72	36ºC	2.52	76ºC
0.14	-43ºC	0.94	-3ºC	1.74	37ºC	2.54	77ºC
0.16	-42ºC	0.96	-2ºC	1.76	38ºC	2.56	78ºC
0.18	-41ºC	0.98	-1ºC	1.78	39ºC	2.58	79ºC
0.2	-40ºC	1	0ºC	1.8	40ºC	2.6	80ºC
0.22	-39ºC	1.02	1ºC	1.82	41ºC	2.62	81ºC
0.24	-38ºC	1.04	2ºC	1.84	42ºC	2.64	82ºC
0.26	-37ºC	1.06	3ºC	1.86	43ºC	2.66	83ºC
0.28	-36ºC	1.08	4ºC	1.88	44ºC	2.68	84ºC
0.3	-35ºC	1.1	5ºC	1.9	45ºC	2.7	85ºC
0.32	-34ºC	1.12	6ºC	1.92	46ºC	2.72	86ºC
0.34	-33ºC	1.14	7ºC	1.94	47ºC	2.74	87ºC
0.36	-32ºC	1.16	8ºC	1.96	48ºC	2.76	88ºC
0.38	-31ºC	1.18	9ºC	1.98	49ºC	2.78	89ºC
0.4	-30ºC	1.2	10ºC	2	50ºC	2.8	90ºC
0.42	-29ºC	1.22	11ºC	2.02	51ºC	2.82	91ºC
0.44	-28ºC	1.24	12ºC	2.04	52ºC	2.84	92ºC
0.46	-27ºC	1.26	13ºC	2.06	53ºC	2.86	93ºC
0.48	-26ºC	1.28	14ºC	2.08	54ºC	2.88	94ºC
0.5	-25ºC	1.3	15ºC	2.1	55ºC	2.9	95ºC
0.52	-24ºC	1.32	16ºC	2.12	56ºC	2.92	96ºC
0.54	-23ºC	1.34	17ºC	2.14	57ºC	2.94	97ºC
0.56	-22ºC	1.36	18ºC	2.16	58ºC	2.96	98ºC
0.58	-21ºC	1.38	19ºC	2.18	59ºC	2.98	99ºC
0.6	-20ºC	1.4	20ºC	2.2	60ºC	3	100ºC
0.62	-19ºC	1.42	21ºC	2.22	61ºC	3.02	101ºC
0.64	-18ºC	1.44	22ºC	2.24	62ºC	3.04	102ºC
0.66	-17ºC	1.46	23ºC	2.26	63ºC	3.06	103ºC
0.68	-16ºC	1.48	24ºC	2.28	64ºC	3.08	104ºC
0.7	-15ºC	1.5	25ºC	2.3	65ºC	3.1	105ºC
0.72	-14ºC	1.52	26ºC	2.32	66ºC		
0.74	-13ºC	1.54	27ºC	2.34	67ºC		
0.76	-12ºC	1.56	28ºC	2.36	68ºC		
0.78	-11ºC	1.58	29ºC	2.38	69ºC		

3.5 Cellocator Unit Integration

The following rules should be followed for proper Temperature Sensor operation:

- The temperature sensor can be supported only by Cellocator unit providing one or two analog inputs.
- The temperature sensor should be connected to one of these analog inputs (shock or door)
- The relevant input port must be programmed as analog input in the compact unit and as analog backward compatible in the Cello.

3.6 Temperature Information in Cellocator Unit Messages

The Cellocator unit reports the measurement of an analog input (containing the temperature information) in each location update (message type 0, time event, input trigger, etc).

The analog reading is reported in the 4th byte of Analog Inputs (byte 29 of 70) for the first analog input, and in byte 28 for the second analog input, with a resolution of 9.8mV per bit.

Listed below are examples of the message content:

- -20°C will be reported as 0.6V, i.e. 0x3D
- -10°C will be reported as 0.8V, i.e. 0x51
- 0°C will be reported as 1V, i.e. 0x66
- 10°C will be reported as 1.2V, i.e. 0x7A
- 70°C will be reported as 2.4V, i.e. 0xF5

Note: In the Cello family the location and resolution of the measurement report varies per configuration. The default is backward compatible to Compact, i.e. report in byte 29 and resolution of 9.8mV per bit.

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4 The Power Protection Device (FL0012)

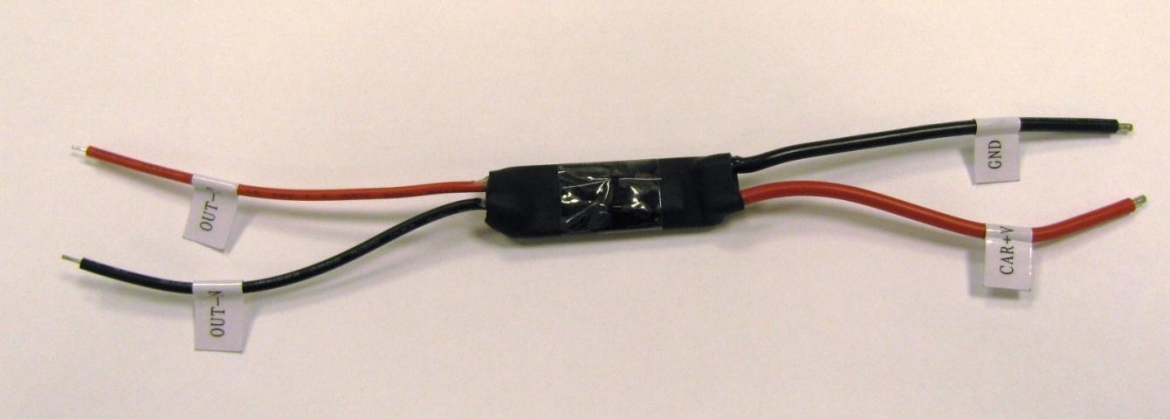

Figure 2: Power Protection Device

4.1 Introduction

The Power Protection Device (FL0012) provides proper and adequate protection against electrical disturbances in the vehicle environment. It should be applied between the vehicle's power source and the Temperature Sensor in several cases. **It must be applied in 24V vehicles.**

It is also recommended to use it in vehicles where high electrical disturbances are expected. Possible scenarios are:

- Old 12v vehicles with poor voltage regulation systems.
- Whenever there is a doubt about the car voltage disturbances.
- When there is a connector between the temperature and the power source with common connections and disconnections (like in a Horse / Trailer), the protection circuit should be installed after the connector at the trailer side.

4.2 Circuit installation

4.2.1 *Wire description*

The protection circuit input wires are:

- The Car battery VCC (+) is **red** and marked with CAR+V label.
- The Car battery GND (-) is **black** and marked with GND label.

The outputs wires are:

- The Temperature Sensor VCC (+) connection is **red** and marked with OUT-P label.
- The Accessory GND (-) connection is **black** and marked with OUT-N label.

4.2.2 *Connection description*

The Car battery GND (-) input should be connected to the car ground or car battery (-).

The Car battery VCC (+) input should be connected to car 12/24V source or battery (+).

The output GND (-) should be connected to the Temperature Sensor GND (-) input.

The output VCC (+) should be connected to the Temperature Sensor VCC (+) input.

4.3 Technical Specifications

Electrical Ratings	Value
Operating voltage range	9-32v
Reverse voltage protection	yes
Maximum short term (up to 200 microseconds) reverse voltage protection	600v
Maximum short term output	35v
Maximum supported current consumed by the protected device	4ma