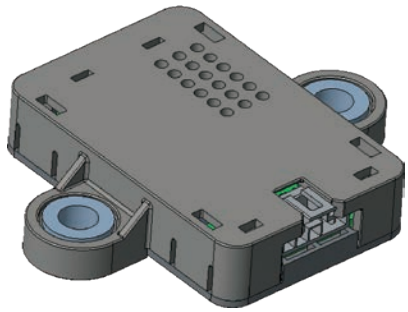
TELAIRE®

T3650 Series

Relative Humidity, Temperature, Pressure and Hydrogen Concentration



Overview

A combination sensor capable of providing up to four measurements including humidity, temperature, pressure, and hydrogen concentration specifically for battery system applications. These measurements are designed for the detection and measurement of Hydrogen range of applications.

Features

- High accuracy temperature, pressure, hydrogen and humidity sensing elements
- CAN2.0B Communication per J1939
- Rugged design incorporates sensing elements with demonstrated reliability

Applications

- Power Battery Banks

Amphenol
Sensors

Telaire T3650 Series Specifications

Environmental Ratings

Ratings	Min	Max	Unit
Storage Temperature	-55	105	°C
Operating Temperature	-40	105	°C
Pressure	0	30	psi
Relative Humidity	0	100	%
Vibration	0	2.0	G_{RMS}
Flammability	94V-0		

Electrical Performance

Characteristic	Min	Typical	Max	Unit
Supply Voltage	9	12 or 24	48	Volts
Power Consumption Peak (measurement mode)	-	0.18 [1]	0.45 [2]	W
Power Consumption Idle	-	0.087 [1]	0.20 [2]	W

Notes:

1. Typical value is calculated at 12V
2. Maximum value is calculated at 48V
3. The device was designed to work within the min/max voltage conditions. This device has an under-voltage lockout to prevent communication errors, however operating below the minimum voltage may result in inaccurate sensor readings.

CAN Bus

Characteristic	Min	Typical	Max	Unit
Differential Output Voltage – Dominant[1]	1.5	2	3	V
Differential Output Voltage – Recessive[1]	-0.120	-	0.012	V
Voltage Range – CANH/CANL	-36	-	36	V
Voltage Input, Transient Pulse – CANH/CANL	-100	-	100	V
Unique Source Address[2,3]	-	0xEB	-	-
Bit Rate[2, 3]	-	.5	-	Mbps
Broadcast rate	-	100	-	ms

1. RL=60Ω
2. Configurable
3. Default Value

Humidity Performance

Characteristic	Min	Typical	Max	Units
Relative Humidity Accuracy[1]	-4	±2	+4	%
Relative Humidity Response Time (63%)[2]		17	18	sec
Long Term Drift			0.25	%RH/YR

1. All operating conditions.
2. Measured at 25°C 1m/sec airflow from 33%RH to 90%RH

Pressure Performance

Characteristic	Min	Typical	Max	Unit
Pressure Accuracy (0 to 85°C)	-4.6		+4.6	kPa
Pressure Accuracy (-40 to 125°C)	-6.9		+6.9	kPa
Calibration Range	50		200	kPa
Pressure Response Time (63%)		0.2	0.4	sec

1. All operating conditions.

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Temperature Performance

Characteristic	Min	Typical	Max	Unit
Temperature Accuracy (-5 to 75°C)	-2	-	+2	°C
Temperature Accuracy (-40 to 125°C)	-5	-	+5	°C
Temperature Response Time (τ 63%)[1]	-	30	40	sec

1. 5m/s Airflow

Hydrogen Performance

Characteristic	Min	Typical	Max	Unit
Sensing Resolution	-	5	-	ppm
Sensing Output Range	0	-	160,000	ppm
H2 Accuracy – 0 to 80,000 ppm	-8000	-	8000	ppm
H2 Accuracy – 80,000 to 160,000 ppm	-12000	-	12000	ppm
H2 Response Time (τ 63%)	-	1	3	sec

Operation

The sensor has two modes of operation: Active and Low Power.

In Active Mode, the sensor module is running with a normal CAN message broadcast interval and all internal peripheral sensor monitoring intervals are at maximum speed. In this mode all available CAN messages are active.

In Low Power Mode the sensor module is running without CAN message broadcast and all internal peripheral sensor monitoring is at a user defined interval period. In this mode all only START/STOP CAN messages are active.

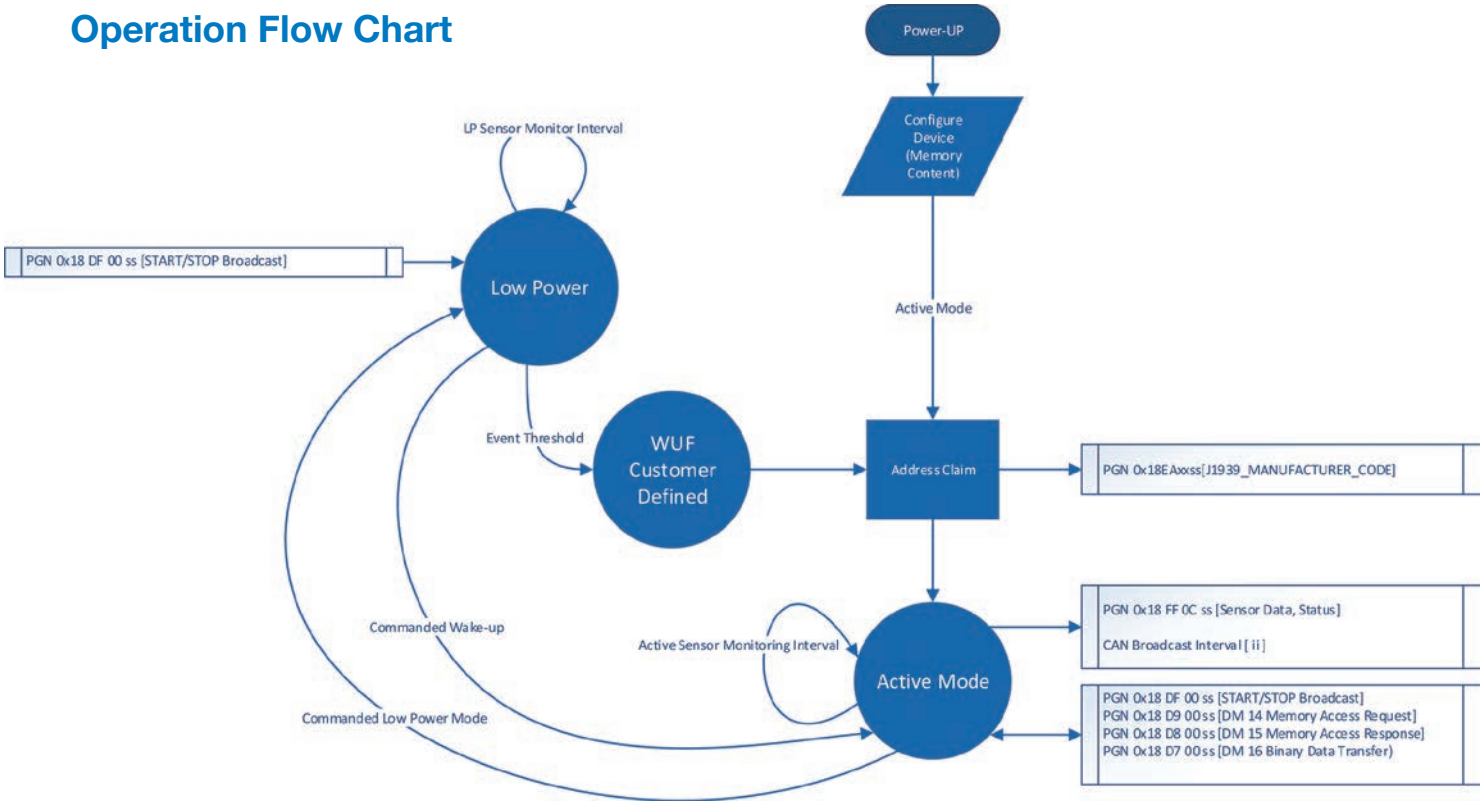
Internal Sensor Peripheral	Monitor Interval	
	Active Mode	Low Power Mode
Pressure	100ms	100ms to 6425500ms
Relative Humidity	400ms	400ms to 6425500ms
H2 Concentration	500ms	500ms to 6425500ms
Temperature	100ms	100ms to 6425500ms
Internal Temperature	100ms	100ms to 6425500ms
Internal Voltage Levels	100ms	100ms to 6425500ms

The sensor enters Low Power mode by sending STOP Broadcast Command via CAN bus.

From Low Power mode, the T3650 will switch to Active mode when one of any of the sensor threshold values is breached. It can also be commanded to Active mode using the START Broadcast Command. The sensor will not wake up from low-power mode due to the sensor failure status. It will only wake up by breaching the sensor wake-up threshold.

Telaire T3650 Series Specifications

Operation Flow Chart

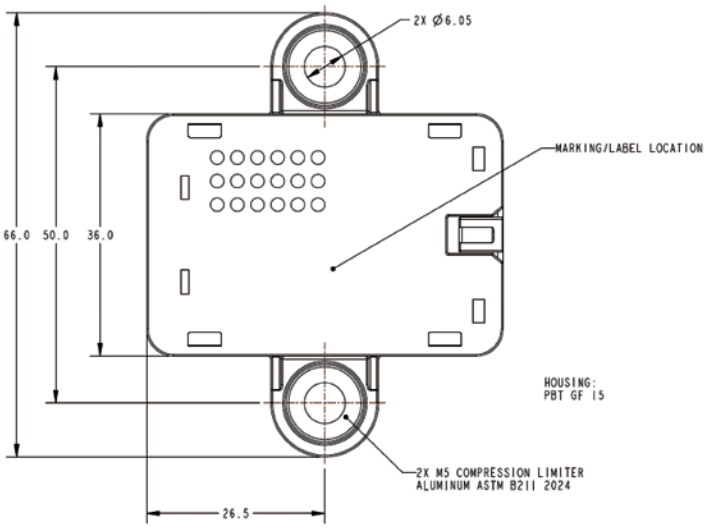


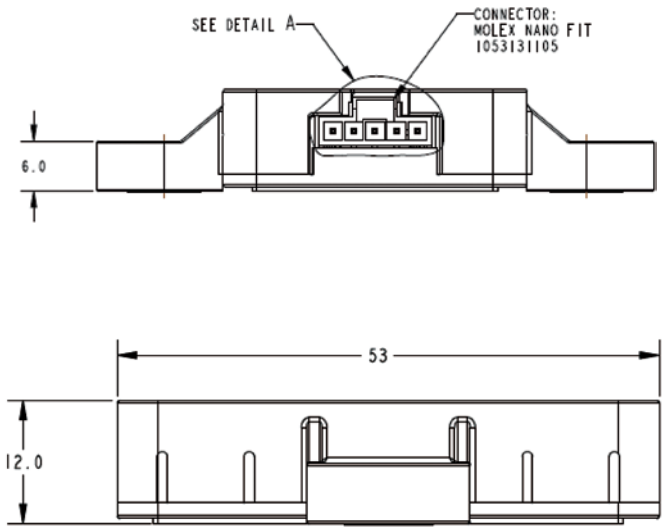
Mechanical Specifications

Housing Detail:

Housing Material: PBT 15GF Black + 5% PC

Mass: ~ 19 grams





Telaire T3650 Series Specifications

Connector

Molex Nano-Fit 1053131105

Contact Material: Brass

Contact Finish: Tin

Mating Connector

Molex Nano-Fit 5 pin 1053071205 Connection System

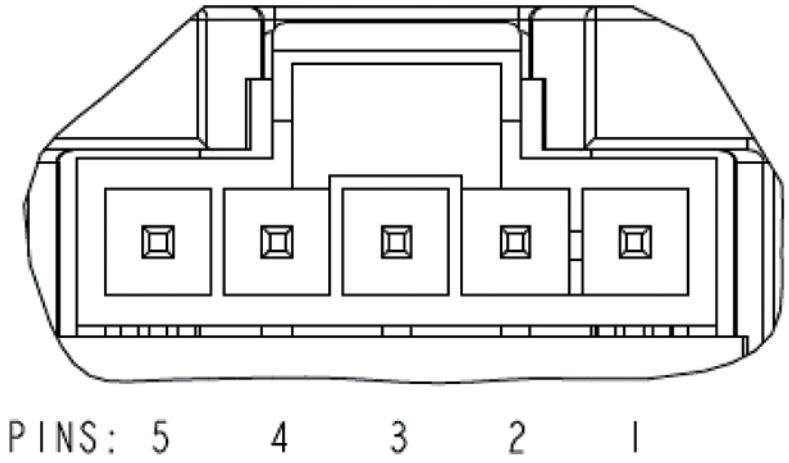
Contact: Molex 105300 series (depending on lead wire size)

Contact Material: High Conductivity Copper Alloy

Contact Finish: Tin

Pin Out

1. NC
2. CAN High
3. CAN Low
4. Power
5. Ground



Marking / Label

Marking/Label shall be on top side of the sensor (vent side)

Handling

Sensor contains sensitive electronic components and are tested to withstand ESD levels of both HB and MM (Standard: IEC 61000-4-2). Sensor is capable of being handled in a normal manufacturing environment.

Care shall be taken to keep the sensor dry and free from long exposure of VOCs.

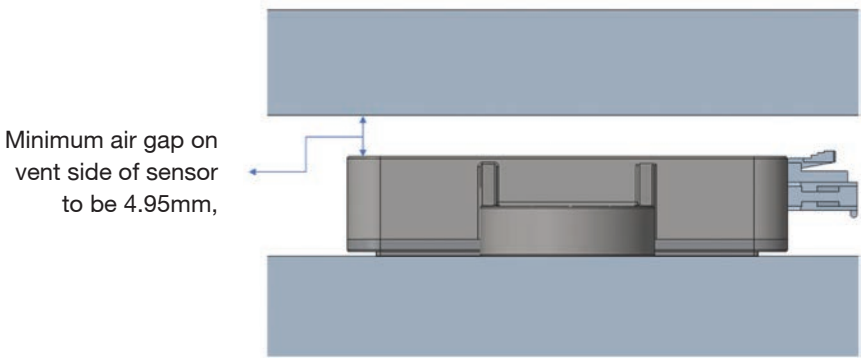
Dropped sensors shall be discarded.

Certain environmental conditions may affect sensor long term performance, please contact Telaire for further information.

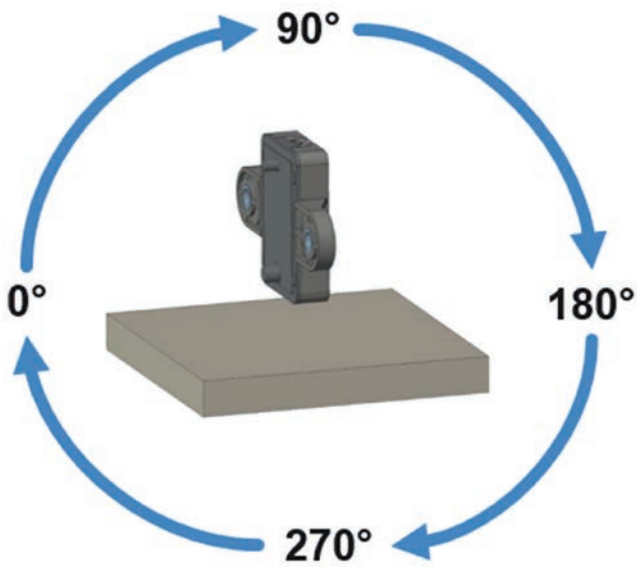
Telaire T3650 Series Specifications

Mounting

The space claim of this sensor shall not exceed the envelope shown below.



- The sensor requires 4.95 mm (Minimum distance) around the vents to allow for proper sensing.
- The sensor clearance requirement for the device to allow the proper sensing.
- The sensor mounting features contain metal compression limiters.
- The sensor is designed to be mounted using M5 X 0.8 X 12 mm hardware with 11Nm maximum torque.
- Sensor orientation is not restricted but shall meet clearance specification above



Wire harness is recommended to be secured on customer geometry no further than 50.8 millimeter perpendicular from the connector side of sensor.

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Decommissioning

This sensor is an electronic device constructed to meet regulatory requirements listed in the regulatory section of this document. Please follow local eWaste or electronic disposal guidelines when discarding this device.

Communication

Sensor Message PGN

PGN Name	N/A	PGN ID	N/A
PGN Short Name	N/A	Destination Address	N/A
PGN Number	65292 (0xFF0C)	DPQ	0 (0x00)
Command Byte 1&2	N/A	PDUF	255 (0xFF)
Data Length (bytes)	8	PDUS	12 (0x0C)
Default Priority	6	PDU Type	N/A
Rep. Rate (ms)	100	Max Bytes	N/A
Variable Length	No	Creation Date	N/A
Incremented By	N/A	Exp/Prod Status	Production
Standards Group	-	Production Date	-
Standards Document	-	Owner/Contact	N/A
SAE Status	Proprietary Only	-	-

Byte #	SPN	Description	Scale	Offset	Data Range	Units
0-1	-	Pressure	0.0078125	-250	-250 to 251.99	kPa
2	-	Relative Humidity	0.4	0	0 to 100	%
3-4	-	H2 Concentration	0.0025	0	0 to 160.6375	%
5-6	-	Temperature	0.03125	-273	-273 to 1734.96875	°C
7	-	Sensor Status #1	NA	NA	0 to 255	NA

Telaire T3650 Series Specifications

Diagnostics

The CAN message data/parameters shall be as the following for error handling (diagnostics):

Sensor Status #1 Parameters (Byte 8)

Bit #	Value/Definition	Description
1	0 = Normal operation 1 = Error detected	H2 Concentration: Error = Internal sensor failure detected
2	0 = Normal operation 1 = Error detected	Temperature: Error = Internal sensor failure detected
3	0 = Normal operation 1 = Error detected	Humidity: Error = Internal sensor failure detected
4	0 = Normal operation 1 = Error detected	Pressure: Error = Internal sensor failure detected
5	0 = Normal operation 1 = Error detected	Internal Diagnostics #1 (Voltage Level #1)
6	0 = Normal operation 1 = Error detected	Internal Diagnostics #2 (EEPROM Failure)
7	0 = Normal operation 1 = Error detected	Internal Diagnostics #3 (Internal Temperature)
8	0 = Normal operation 1 = Brown Out detected	Internal Diagnostics #4 (Brown Out Recovery)

Sensor Signal Range with Error Conditions

SPN	Parameter Name	Signal Range
TBD	Pressure	$FEXX_{16}$ XX = FMI value as described in SAE J1939-73, appendix A
TBD	Temperature	$FEXX_{16}$ XX = FMI value as described in SAE J1939-73, appendix A
TBD	Relative Humidity	FE_{8}
TBD	H2 Concentration	$FEXX_{16}$ XX = FMI value as described in SAE J1939-73, appendix A

Telaire T3650 Series Specifications

Memory Map

- The highlighted grey area in memory map is inaccessible. Power cycle or reboot the device after CAN Write command is executed to see the effective changes implemented on the sensor thresholds.
- Maximum number of bytes written in the EEPROM memory should be restricted to 15. Exceed byte number will cause EEPROM data discrepancies issue.
- Maximum number of bytes read in one command is 15.

Memory Content Summary

Memory Map		
Page	Page Contents	Details
0x00	Lock Byte	Protection Byte
0x10	Serial Number	Read Only
0x20	Firmware Revision	Read Only
0x30	Reserved	
0x40	Device ID	ID Range
0x50	Baudrate	Baudrate kbit/s 500K Fixed
0x60	Reserved	
0x70	Reserved	
0x80	Pressure Thresholds	Pressure wake-up thresholds
0x90	RH Thresholds	Relative Humdity wake-up thresholds
0xA0	H2 Thresholds	Hydrogen wake-up thresholds
0xB0	Temp Thresholds	Temperature wake-up thresholds
0xC0	Return to Default	
0xD0	Life Counter	Read Only
0xE0	Diagnostics	Read Only
0xF0	Reserved	

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Serial Number Memory Content

Memory Map

Page	0x10	Type	Read only
Description	Serial Number		

Address Page	Memory Location	Address Location	Type	Format	Description	Value Range	Default Value
0x10	0	0x10	R	ASCII	Day of the year DDD	0x30...0x33	0xFF
0x10	1	0x11	R	ASCII	Day of the year DDD	0x30...0x39	0xFF
0x10	2	0x12	R	ASCII	Day of the year DDD	0x30...0x39	0xFF
0x10	3	0x13	R	ASCII	Year YY	0x30...0x39	0xFF
0x10	4	0x14	R	ASCII	Year YY	0x30...0x39	0xFF
0x10	5	0x15	R	ASCII	Man. Location	0x43, 0x50, 0x53	0xFF
0x10	6	0x16	R	ASCII	Sensor # ZZZZ	0x30...0x39	0xFF
0x10	7	0x17	R	ASCII	Sensor # ZZZZ	0x30...0x39	0xFF
0x10	8	0x18	R	ASCII	Sensor # ZZZZ	0x30...0x39	0xFF
0x10	9	0x19	R	ASCII	Sensor # ZZZZ	0x30...0x39	0xFF
0x10	10	0x1A	NA	NA	NA	NA	NA
0x10	11	0x1B	NA	NA	NA	NA	NA
0x10	12	0x1C	NA	NA	NA	NA	NA
0x10	13	0x1D	NA	NA	NA	NA	NA
0x10	14	0x1E	NA	NA	NA	NA	NA
0x10	15	0x1F	NA	NA	NA	NA	NA

Absolute Pressure Thresholds

Memory Map

Page	0x80	Type	Read/Write
Description	Pressure Threshold		

Address Page	Memory Location	Address Location	Type	Format	Description	Value Range	Default Value
0x80	0	0x80	R/W	HEX	Threshold LSB	0x00-0xFF	0xE6
0x80	1	0x81	R/W	HEX	Threshold MSB	0x00-0xFF	0xB1
0x80	2	0x82	R/W	HEX	Rate of Change LSB	0x00-0xFF	0x80
0x80	3	0x83	R/W	HEX	Rate of change MSB	0x00-0xFF	0x7F
0x80	4	0x84	NA	HEX	Interval LSB	NA	0xFF
0x80	5	0x85	NA	HEX	Interval MSB	NA	0xFF
0x80	6	0x86	NA	HEX	NA	NA	0xFF
0x80	7	0x87	NA	HEX	NA	NA	0xFF
0x80	8	0x88	NA	HEX	NA	NA	0xFF
0x80	9	0x89	NA	HEX	NA	NA	0xFF
0x80	10	0x8A	NA	HEX	NA	NA	0xFF
0x80	11	0x8B	NA	HEX	NA	NA	0xFF
0x80	12	0x8C	NA	HEX	NA	NA	0xFF
0x80	13	0x8D	NA	HEX	NA	NA	0xFF
0x80	14	0x8E	NA	HEX	NA	NA	0xFF
0x80	15	0x8F	NA	HEX	Page checksum	0x00-0xFF	-

Telaire T3650 Series Specifications

H2 Concentration Thresholds

Memory Map

Page	0xA0	Type	Read/Write
Description	H2 Thresholds		

Address Page	Memory Location	Address Location	Type	Format	Description	Value Range	Default Value
0xA0	0	0xA0	R/W	HEX	Threshold LSB	0x00-0xFF	0xB0
0xA0	1	0xA1	R/W	HEX	Threshold MSB	0x00-0xFF	0x04
0xA0	2	0xA2	R/W	HEX	Rate of Change LSB	0x00-0xFF	0x80
0xA0	3	0xA3	R/W	HEX	Rate of change MSB	0x00-0xFF	0x02
0xA0	4	0xA4	NA	HEX	Interval LSB	NA	0xFF
0xA0	5	0xA5	NA	HEX	Interval MSB	NA	0xFF
0xA0	6	0xA6	NA	HEX	NA	NA	0xFF
0xA0	7	0xA7	NA	HEX	NA	NA	0xFF
0xA0	8	0xA8	NA	HEX	NA	NA	0xFF
0xA0	9	0xA9	NA	HEX	NA	NA	0xFF
0xA0	10	0xAA	NA	HEX	NA	NA	0xFF
0xA0	11	0xAB	NA	HEX	NA	NA	0xFF
0xA0	12	0xAC	NA	HEX	NA	NA	0xFF
0xA0	13	0xAD	NA	HEX	NA	NA	0xFF
0xA0	14	0xAE	NA	HEX	NA	NA	0xFF
0xA0	15	0xAF	NA	HEX	Page checksum	0x00-0xFF	-

Relative Humidity Thresholds

Memory Map

Page	0x90	Type	Read/Write
Description	RH Thresholds		

Address Page	Memory Location	Address Location	Type	Format	Description	Value Range	Default Value
0x90	0	0x90	R/W	HEX	Threshold LSB	0x00-0xFF	0xFA
0x90	1	0x91	R/W	HEX	Threshold MSB	0x00-0xFF	0x00
0x90	2	0x92	R/W	HEX	Rate of Change LSB	0x00-0xFF	0x0F
0x90	3	0x93	R/W	HEX	Rate of change MSB	0x00-0xFF	0x00
0x90	4	0x94	NA	HEX	Interval LSB	NA	0xFF
0x90	5	0x95	NA	HEX	Interval MSB	NA	0xFF
0x90	6	0x96	NA	HEX	NA	NA	0xFF
0x90	7	0x97	NA	HEX	NA	NA	0xFF
0x90	8	0x98	NA	HEX	NA	NA	0xFF
0x90	9	0x99	NA	HEX	NA	NA	0xFF
0x90	10	0x9A	NA	HEX	NA	NA	0xFF
0x90	11	0x9A	NA	HEX	NA	NA	0xFF
0x90	12	0x9C	NA	HEX	NA	NA	0xFF
0x90	13	0x9D	NA	HEX	NA	NA	0xFF
0x90	14	0x9E	NA	HEX	NA	NA	0xFF
0x90	15	0x9F	NA	HEX	Page checksum	0x00-0xFF	-

Telaire T3650 Series Specifications

Temperature Thresholds

Memory Map

Page	0xB0	Type	Read/Write
Description	Temp Threshold		

Address Page	Memory Location	Address Location	Type	Format	Description	Value Range	Default Value
0xB0	0	0xB0	R/W	HEX	Threshold LSB	0x00-0xFF	0xC0
0xB0	1	0xB1	R/W	HEX	Threshold MSB	0x00-0xFF	0x2C
0xB0	2	0xB2	NA	HEX	Rate of Change LSB	0x00-0xFF	0x90
0xB0	3	0xB3	NA	HEX	Rate of change MSB	0x00-0xFF	0x22
0xB0	4	0xB4	NA	HEX	Interval LSB	NA	0xFF
0xB0	5	0xB5	NA	HEX	Interval MSB	NA	0xFF
0xB0	6	0xB6	NA	HEX	NA	NA	0xFF
0xB0	7	0xB7	NA	HEX	NA	NA	0xFF
0xB0	8	0xB8	NA	HEX	NA	NA	0xFF
0xB0	9	0xB9	NA	HEX	NA	NA	0xFF
0xB0	10	0xBA	NA	HEX	NA	NA	0xFF
0xB0	11	0xBB	NA	HEX	NA	NA	0xFF
0xB0	12	0xBC	NA	HEX	NA	NA	0xFF
0xB0	13	0xBD	NA	HEX	NA	NA	0xFF
0xB0	14	0xBE	NA	HEX	NA	NA	0xFF
0xB0	15	0xBF	NA	HEX	Page checksum	0x00-0xFF	-

Note: Last Byte of each Page is reserved for checksum.

Instance for Setting Threshold

Let us assume that we want to update Absolute Pressure threshold to 107.3 kPa. we need to create a Hexa-decimal number Which will be stored in Address Location i.e., 0x80(LSB) and 0x81(MSB) in this case. It is accomplished using the scale and offset values in Sensor Output #1 and Sensor Output #2.

Absolute Pressure Threshold = 107.3 kPa

Decimal number = (Absolute Pressure Threshold + Offset) / Scale

Decimal number = (107.3 + 250) / 0.0078125 = 45734.4 ≈ 45734

Hexa-decimal number = (45734)16 = 0xB2A6

The LSB value will be stored at 0x80 and the MSB value will be stored at 0x81.