

TempMux-8

8 channel temperature-multiplexer

User guide and
Modbus and communication specification

Version: 0.5

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Revision history

Version	Author	Date	Description
0.5	ABS/Kjærulf Pedersen a/s KRE/Kjærulf Pedersen a/s	October 26, 2020	This the prototype version

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Introduction

The TempMux-8 is an 8-input temperature multiplexer. It removes the need for multiple temperature sensors by multiplexing between multiple PT1000 inputs, calculating the resistance and temperature for each.

It also features the ability to monitor each input and detect if a sensor is connected, not connected, or not working.

Furthermore, each of the TempMux-8's input can be calibrated through a zero-point calibration algorithm.

Features

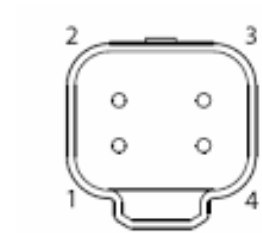
Parameters	Value
Supply voltage	10-28Vdc
Output: 8 x Temperature 1 x Average 8 x PT1000 Status	-60°C - 50°C. -60°C - 50°C. Connected, Not Connected, Not Working
Features: Bootloader	
Communication: Connection Protocol	4 pin deutsch, female Modbus RTU RS485

Connection

The TempMux-8 uses a female 4 pin deutch connection.

It has the following pinout:

- Pin 1: RS485A
- Pin 2: RS485B
- Pin 3: Ground
- Pin 4: Positive supply



Protocol specification

Physical interface

Physical media	RS485
Protocol	Modbus RTU
Modbus address	Default 247
Baudrate	115200
Databits	8
Stopbits	1
Timeout	100ms

Modbus supported messages

The following Modbus messages is supported.

- 0x03 Read holding.
- 0x04 Read input.
- 0x10 Write multiple.

Table columns descriptions

In the following sections the holding and input register layouts are described. The tables have the following columns:

- Reg: The Modbus register address
- Type: The register's type
- Register name: A descriptive name.
- Def: The default value of the register.
- Scale: The scale of the register's value. For example, if the scale is 10 and the temperature is 5° the register contains the value 50.
- Max/Min: The maximum and minimum value of the register
- Description: A description of the contents in the register.

Modbus input registers layout

Input							
Reg	Type	Register name	Def.	Scale	Max	Min	Description
0	Int16	R1 connected	-	-	2	0	<p>Contains the connection status of output R1.</p> <ul style="list-style-type: none"> 0: A PT1000 is connected and not working. 1: No PT1000 is connected 2: A PT1000 is connected and working
1	Int16	R2 connected	-	-	2	0	<p>Contains the connection status of output R2.</p> <ul style="list-style-type: none"> 0: A PT1000 is connected and not working. 1: No PT1000 is connected. 2: A PT1000 is connected and working.
2	Int16	R3 connected	-	-	2	0	<p>Contains the connection status of output R3.</p> <ul style="list-style-type: none"> 0: A PT1000 is connected and not working. 1: No PT1000 is connected. 2: A PT1000 is connected and working.
3	Int16	R4 connected	-	-	2	0	<p>Contains the connection status of output R4.</p> <ul style="list-style-type: none"> 0: A PT1000 is connected and not working. 1: No PT1000 is connected. 2: A PT1000 is connected and working.
4	Int16	R5 connected	-	-	2	0	<p>Contains the connection status of output R5.</p> <ul style="list-style-type: none"> 0: A PT1000 is connected and not working. 1: No PT1000 is connected. 2: A PT1000 is connected and working.
5	Int16	R6 connected	-	-	2	0	<p>Contains the connection status of output R6.</p> <ul style="list-style-type: none"> 0: A PT1000 is connected and not working. 1: No PT1000 is connected. 2: A PT1000 is connected and working.
6	Int16	R7 connected	-	-	2	0	<p>Contains the connection status of output R7.</p> <ul style="list-style-type: none"> 0: A PT1000 is connected and not working. 1: No PT1000 is connected. 2: A PT1000 is connected and working.
7	Int16	R8 connected	-	-	2	0	<p>Contains the connection status of output R8.</p> <ul style="list-style-type: none"> 0: A PT1000 is connected and not working. 1: No PT1000 is connected. 2: A PT1000 is connected and working.
8	Int16						
9	Int16						

Input

Reg	Type	Register name	Def.	Scale	Max	Min	Description
10	Int16	R1 resistance	-	1	1200	750	The resistance of the PT1000 element connected to input R1 measured in Ohm.
11	Int16	R2 resistance	-	1	1200	750	The resistance of the PT1000 element connected to input R2 measured in Ohm.
12	Int16	R3 resistance	-	1	1200	750	The resistance of the PT1000 element connected to input R3 measured in Ohm.
13	Int16	R4 resistance	-	1	1200	750	The resistance of the PT1000 element connected to input R4 measured in Ohm.
14	Int16	R5 resistance	-	1	1200	750	The resistance of the PT1000 element connected to input R5 measured in Ohm.
15	Int16	R6 resistance	-	1	1200	750	The resistance of the PT1000 element connected to input R6 measured in Ohm.
16	Int16	R7 resistance	-	1	1200	750	The resistance of the PT1000 element connected to input R7 measured in Ohm.
17	Int16	R8 resistance	-	1	1200	750	The resistance of the PT1000 element connected to input R8 measured in Ohm.
18	Int16						
19	Int16						
20	Int16	Temp R1	-	10	50°	-60°	The temperature of input R1. The value is lowpass filtered.
21	Int16	Temp R2	-	10	50°	-60°	The temperature of input R2. The value is lowpass filtered.
22	Int16	Temp R3	-	10	50°	-60°	The temperature of input R3. The value is lowpass filtered.
23	Int16	Temp R4	-	10	50°	-60°	The temperature of input R4. The value is lowpass filtered.
24	Int16	Temp R5	-	10	50°	-60°	The temperature of input R5. The value is lowpass filtered.
25	Int16	Temp R6	-	10	50°	-60°	The temperature of input R6. The value is lowpass filtered.
26	Int16	Temp R7	-	10	50°	-60°	The temperature of input R7. The value is lowpass filtered.

Input

Reg	Type	Register name	Def.	Scale	Max	Min	Description
27	Int16	Temp R8	-	10	50°	-60°	The temperature of input R8. The value is lowpass filtered.
28	Int16						
29	Int16						
30	Int16	Raw temp R1	-	10	50°	-60°	The temperature of input R1. The value is not lowpass filtered.
31	Int16	Raw temp R2	-	10	50°	-60°	The temperature of input R2. The value is not lowpass filtered.
32	Int16	Raw temp R3	-	10	50°	-60°	The temperature of input R3. The value is not lowpass filtered.
33	Int16	Raw temp R4	-	10	50°	-60°	The temperature of input R4. The value is not lowpass filtered.
34	Int16	Raw temp R5	-	10	50°	-60°	The temperature of input R5. The value is not lowpass filtered.
35	Int16	Raw temp R6	-	10	50°	-60°	The temperature of input R6. The value is not lowpass filtered.
36	Int16	Raw temp R7	-	10	50°	-60°	The temperature of input R7. The value is not lowpass filtered.
37	Int16	Raw temp R8	-	10	50°	-60°	The temperature of input R8. The value is not lowpass filtered.
38	Int16						
39	Int16						
40	Int16	Average temp	-	10	50°	-60°	The average temperature of all inputs.

Modbus holding registers layout

Input							
Reg	Type	Register name	Def.	Scale	Max	Min	Description
0	Int16	Modbus address	247	-	247	1	The Modbus address.
1	Int16	Baud rate	1152	-	1152	1152	The baud rate (only supports 115200 baud)
2	Int16	Parity bit	0	-	0	0	The parity bit (only supports even)
3	Int16	Reset	0	-	0	0	Writing 1 to this register restarts the TempMux-8.
4	Int16						
5	Int16						
6	Int16						
7	Int16						
8	Int16						
9	Int16						
10	Int16	Calibrate R1	0	-	1	0	Writing 1 to this register starts a calibration of the PT1000 element connected to input R1. Writing 0 to this register deletes the calibration value.
11	Int16	Calibrate R2	0	-	1	0	Writing 1 to this register starts a calibration of the PT1000 element connected to input R2. Writing 0 to this register deletes the calibration value.
12	Int16	Calibrate R3	0	-	1	0	Writing 1 to this register starts a calibration of the PT1000 element connected to input R3. Writing 0 to this register deletes the calibration value.
13	Int16	Calibrate R4	0	-	1	0	Writing 1 to this register starts a calibration of the PT1000 element connected to input R4. Writing 0 to this register deletes the calibration value.
14	Int16	Calibrate R5	0	-	1	0	Writing 1 to this register starts a calibration of the PT1000 element connected to input R5.

Input

Reg	Type	Register name	Def.	Scale	Max	Min	Description
							Writing 0 to this register deletes the calibration value.
15	Int16	Calibrate R6	0	-	1	0	Writing 1 to this register starts a calibration of the PT1000 element connected to input R6. Writing 0 to this register deletes the calibration value.
16	Int16	Calibrate R7	0	-	1	0	Writing 1 to this register starts a calibration of the PT1000 element connected to input R7. Writing 0 to this register deletes the calibration value.
17	Int16	Calibrate R8	0	-	1	0	Writing 1 to this register starts a calibration of the PT1000 element connected to input R8. Writing 0 to this register deletes the calibration value.
18	Int16						
19	Int16						
20	Int16	Average enable R1	1	-	1	0	<ul style="list-style-type: none"> • 1: Input R1 is used to calculate the average. • 0: Input R1 is not used to calculate the average.
21	Int16	Average enable R2	1	-	1	0	<ul style="list-style-type: none"> • 1: Input R2 is used to calculate the average. • 0: Input R2 is not used to calculate the average.
22	Int16	Average enable R3	1	-	1	0	<ul style="list-style-type: none"> • 1: Input R3 is used to calculate the average. • 0: Input R3 is not used to calculate the average.
23	Int16	Average enable R4	1	-	1	0	<ul style="list-style-type: none"> • 1: Input R4 is used to calculate the average. • 0: Input R4 is not used to calculate the average.
24	Int16	Average enable R5	1	-	1	0	<ul style="list-style-type: none"> • 1: Input R5 is used to calculate the average. • 0: Input R5 is not used to calculate the average.
25	Int16	Average enable R6	1	-	1	0	<ul style="list-style-type: none"> • 1: Input R6 is used to calculate the average. • 0: Input R6 is not used to calculate the average.
26	Int16	Average enable R7	1	-	1	0	<ul style="list-style-type: none"> • 1: Input R7 is used to calculate the average. • 0: Input R7 is not used to calculate the average.

Input

Reg	Type	Register name	Def.	Scale	Max	Min	Description
27	Int16	Average enable R8	1	-	1	0	<ul style="list-style-type: none">• 1: Input R8 is used to calculate the average.• 0: Input R8 is not used to calculate the average.

Note on calibration commands:

The calibration used in the TempMux-8 is a zero-point calibration. When the calibration addresses are written to the sensor measures the error relative to 0 °C. The difference is used to compensate future temperature measurements. Therefore, the calibration should be performed at 0 °C.