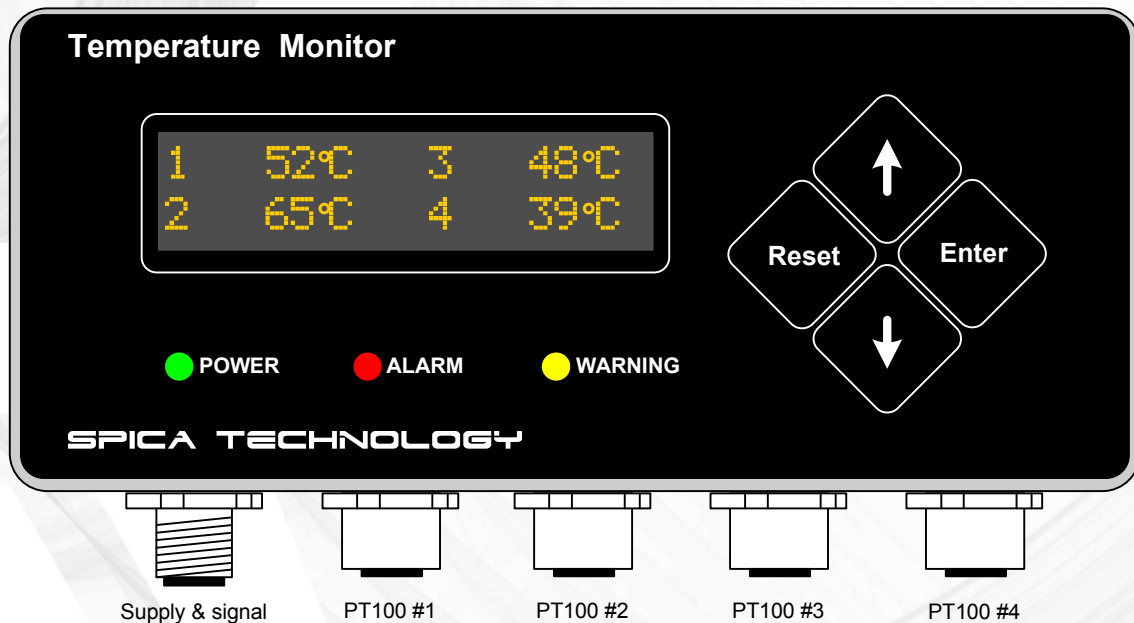


Temperature Monitor



- **Four PT100 temperature inputs**
- **Four alarm levels and four warning levels**
- **Individual high, low level or window Alarm and Warning function settings**
- **Readout of actual, min, average and max for temperatures**
- **Two dry contact relay outputs, for alarm and warning signaling**
- **Fast and easy installation - Magnets and standard M12 connectors**
- **Relays and Serial port galvanic isolated from the control system**
- **Built-in data logger - approx 114 days capacity**
- **Built-in RS485 interface for remote monitoring**
- **Suited for use in wind turbine nacelles or other harsh environments (-30°C...+70°C, vibration resistant and IP65 protected)**
- **O-LED display gives clear readout even in direct sunlight**

Temperature Monitor description

The Temperature Monitor provides added surveillance to existing or new construction/machines (e.g. wind turbines) where critical parts need to be monitored (e.g. bearings or cooling liquid). Due to the magnets on the backside of the module, the Temperature Monitor can easily be mounted anywhere on a metal (iron) surface. All connections are done through prefabricated cables with moulded plugs to ensure a reliable and water tight connection (IP67).

The PT100 sensors are delivered with 3 or 5 meter silicone cable (standard), complete with moulded M12 connector. Other cable length can be delivered on request.

The Temperature Monitor is as standard delivered as a kit where all basic parts needed for installation is included. As standard two temperature sensors are included, if needed more sensors can be purchased separately.

The Temperature Monitor is powered by 24VDC from the control system (e.g. from topbox or panel). Internally the system is galvanic isolated to prevent electrical surges (e.g. from lightning strike) from entering the control system.

The signals to the control system (alarm and warning) are provided by galvanic isolated relay contacts (dry contacts). The signals and the power supply share the same cable to the topbox.

The alarm output is wired to the external stop input of the turbine controller, using extra wires in the cable from topbox to CPU panel. If other equipment is connected to the external stop input, the relay contact from the Temperature Monitor can be connected in series. The relay contacts are Normally Closed.

Function

The Temperature Monitor has four temperature sensor inputs. A Warning level and an Alarm level can be set for each sensor. Furthermore a specific function can be selected for each sensor.

Temperature HIGH – Trips when the temperature rises ABOVE the trip level.

Temperature LOW - Trips when the temperature falls BELOW the trip level.

Temperature WINDOW – Trips when the temperature moves OUTSIDE the window (Trip high or low).

Disabled – No sensor attached (Not in use).

The functions can be selected individually for Alarm and Warning for each sensor.

Three examples are given for the working mode of the Alarm and Warning settings; The LOW trip, the HIGH trip and the Window functions. Study these three examples to gather knowledge of the functionality of the relay outputs.

First example: ALARM is set to 'Temp HIGH' – triggers an alarm if the temperature increases above a certain level.

WARNING is set to 'Temp WINDOW' – triggers a warning if the temperature moves outside the window limits.

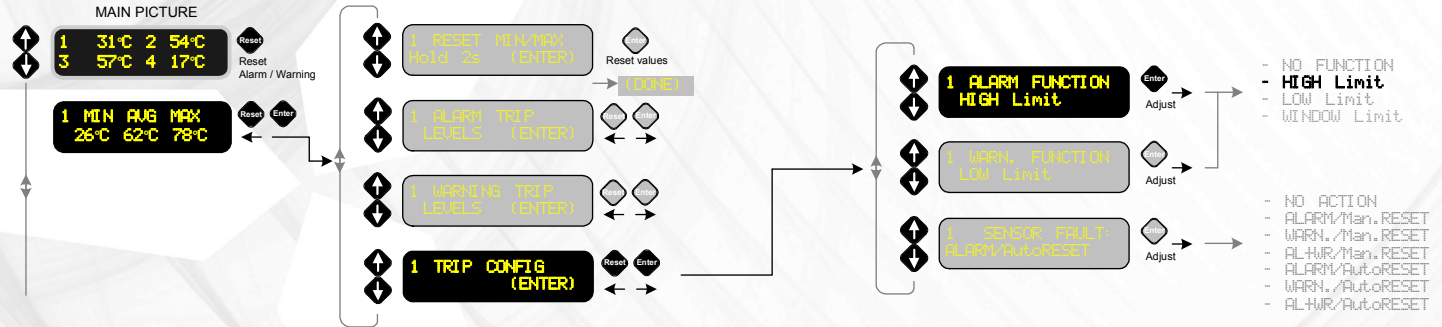
In the following paragraphs, the term 'not defined state' is used in the description of the Alarm and Warning RESET level. To achieve this, it is necessary to adjust the level setting of the function to the max. (190°C) or min. (-40°C) value. Then roll the value to the next step (the value between -40 and 190), and the display will show '---'. This is the setting for 'not defined'.

Temperature HIGH function

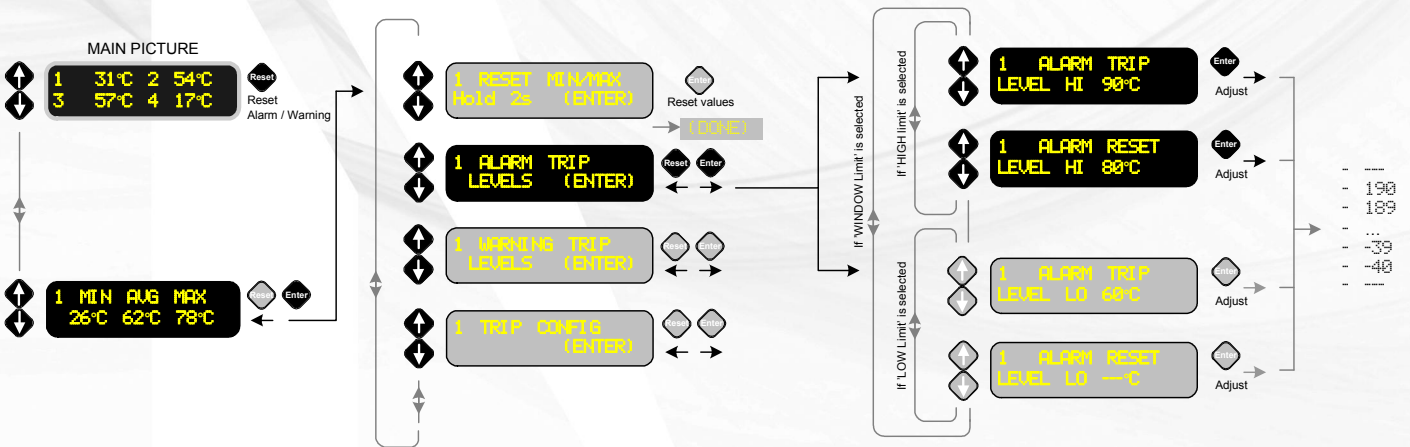
1 ALARM FUNCTION
HIGH Limit

(Shown here: T1 Alarm relay is set to HIGH limit operation)

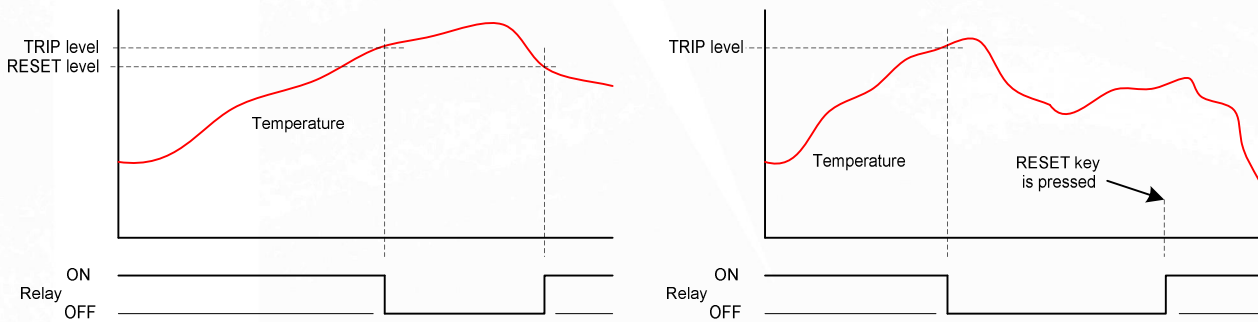
First, make sure that the Alarm function of the Trip Config is set properly:



When this is set correct, then the working mode of the Alarm is selected:

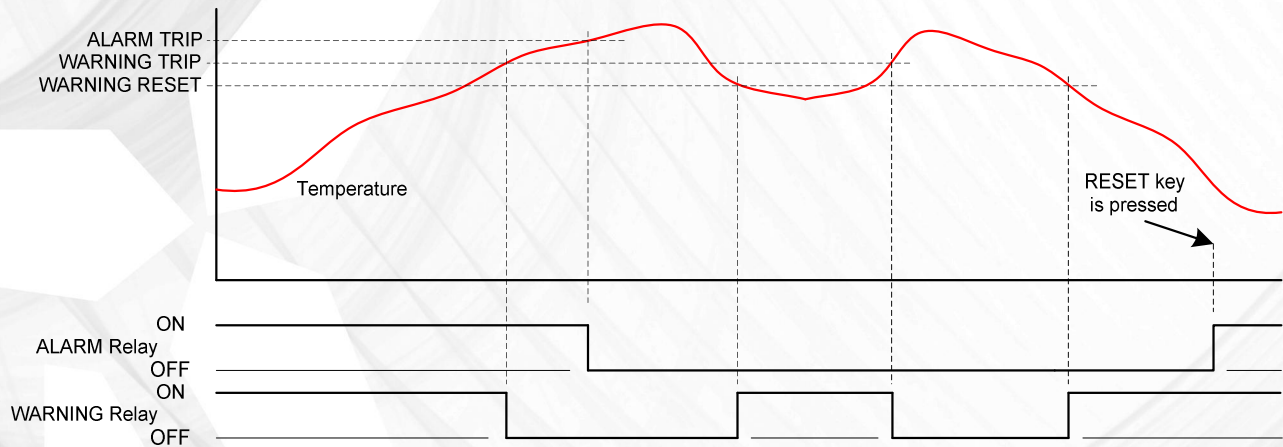


When the temperature rises above the Alarm or Warning 'TRIP' level, the relay contact opens (in order to make it fail safe). The corresponding LED will also be lit, indicating the relay 'open position'. If an Alarm or Warning 'RESET' level is defined, the relay contact closes when the temperature falls below the 'RESET' level (auto reset). The corresponding LED switches off.



Left: RESET level defined. Right: No RESET level defined – here the Reset key needs to be pressed.

For each input it is possible to have both an Alarm and a Warning level. In the below graph the Warning RESET is defined and the Alarm RESET level is not defined – this means that if the Alarm levels is reached, it is necessary for the service crew to reset the Temperature Monitor manually. If the warning level is reached the warning relay opens, and it closes again if the temperature falls below the RESET level (auto reset).



The Alarm and Warning levels can be set in the range from -40..+190 °C.
When set above or below, the limit (trip or reset) is not active and the display shows '---'.

In the 'TEST / CONFIG' menu it is possible to force the outputs relays 'OPEN' or 'CLOSED' individually in order to test the connection to the control system.

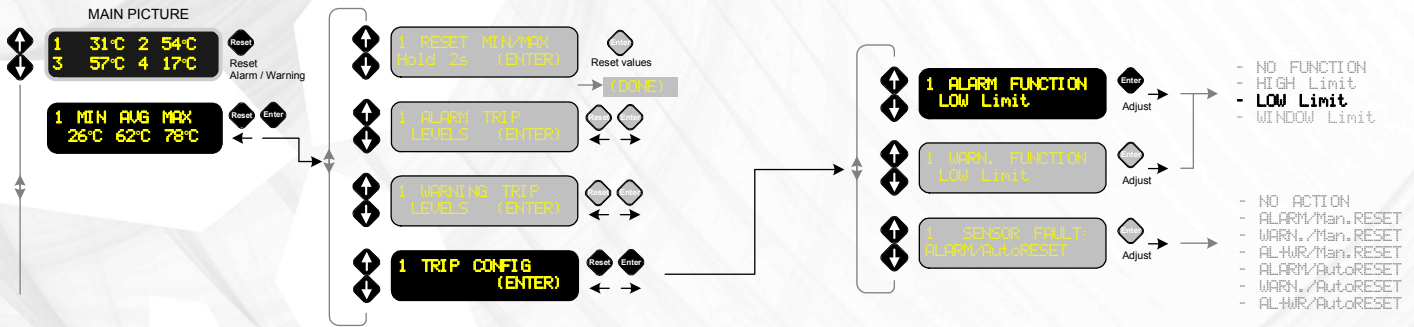
The relays will restore to their current positions according to the relevant measurements and settings when the menu is left.

Temperature LOW function

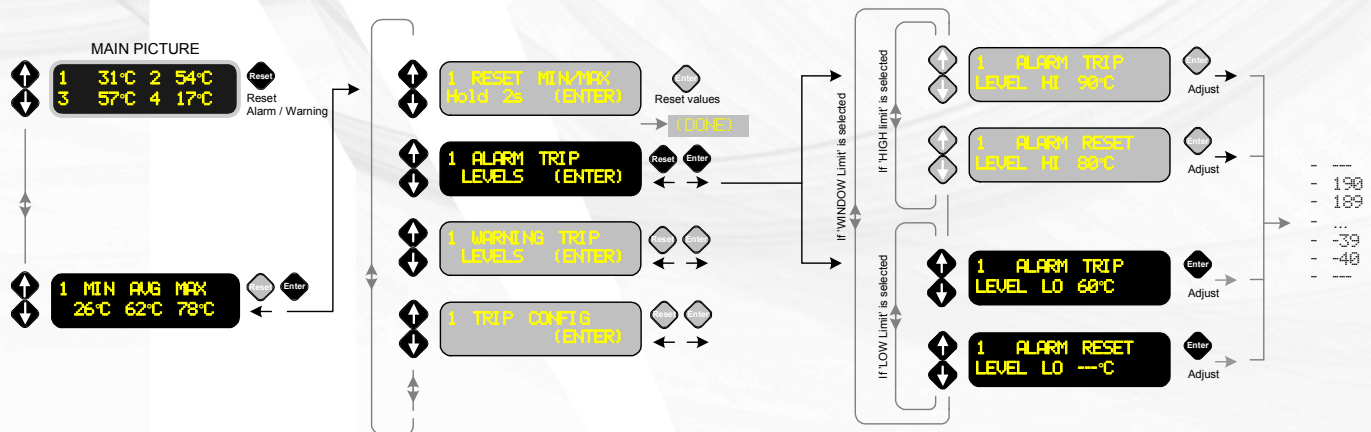
1 ALARM FUNCTION
HIGH Limit

(Shown here: T1 Alarm relay is set to LOW limit operation)

First, make sure that the Alarm function of the Trip Config is set according to the wanted function:

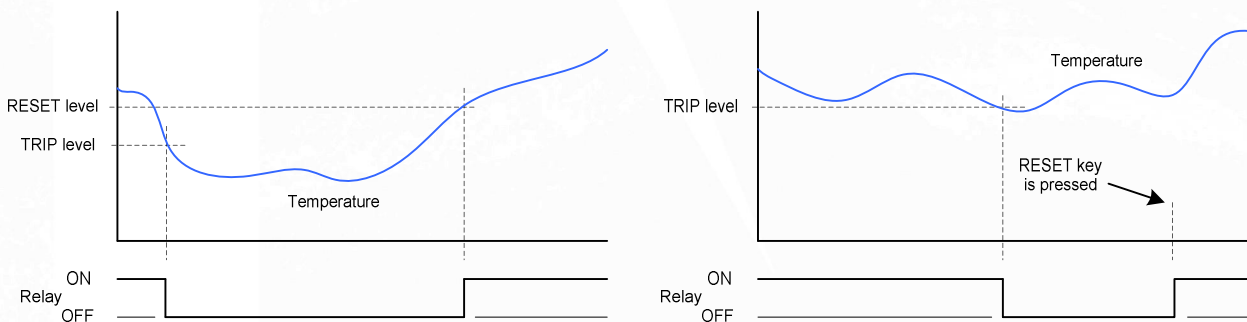


When this is set properly, the working mode of the Alarm is selected:



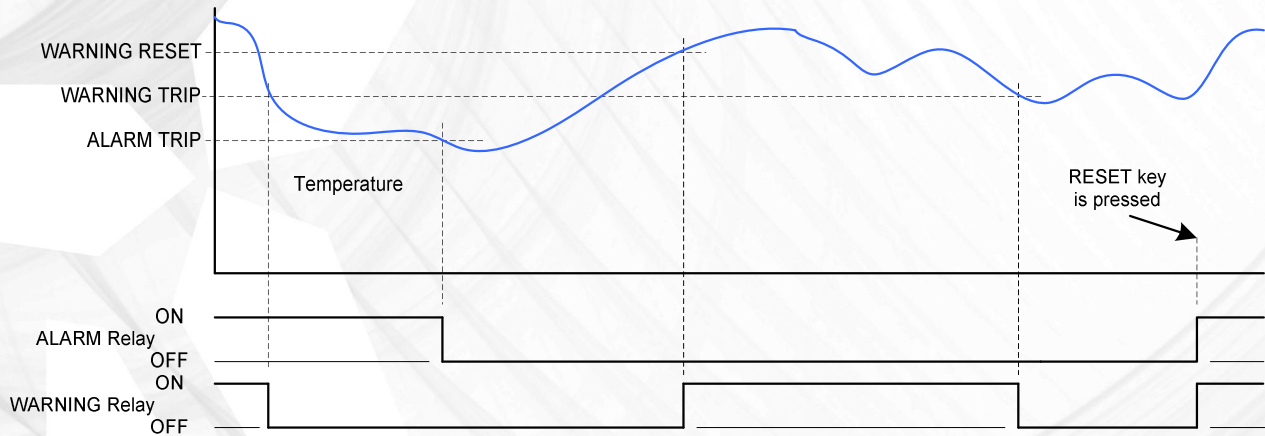
Mode of operation:

When the temperature falls below the Alarm or Warning 'TRIP' level, the relay contact opens (in order to make it fail safe). The corresponding LED will also be lit, indicating the relay 'open position'. If an Alarm or Warning 'RESET' level is defined, the relay contact closes when the temperature rises above the 'RESET' level (auto reset). The corresponding LED switches off.



Left: RESET level defined. Right: The RESET level is not defined – here the Reset key needs to be pressed.

For each input it is possible to have both an Alarm and a Warning level. In the below graph the Warning RESET is defined and the Alarm RESET level is not defined – this means that if the Alarm levels is reached, the service crew need to reset the Temperature Monitor manually. If the warning level is reached the warning relay is opened, and it closes again if the temperature falls below the RESET level (auto reset).



The Alarm and Warning levels can be set in the range from $-40...+190$ °C. When set above or below, the limit (trip or reset) is not active and the display shows '---'.

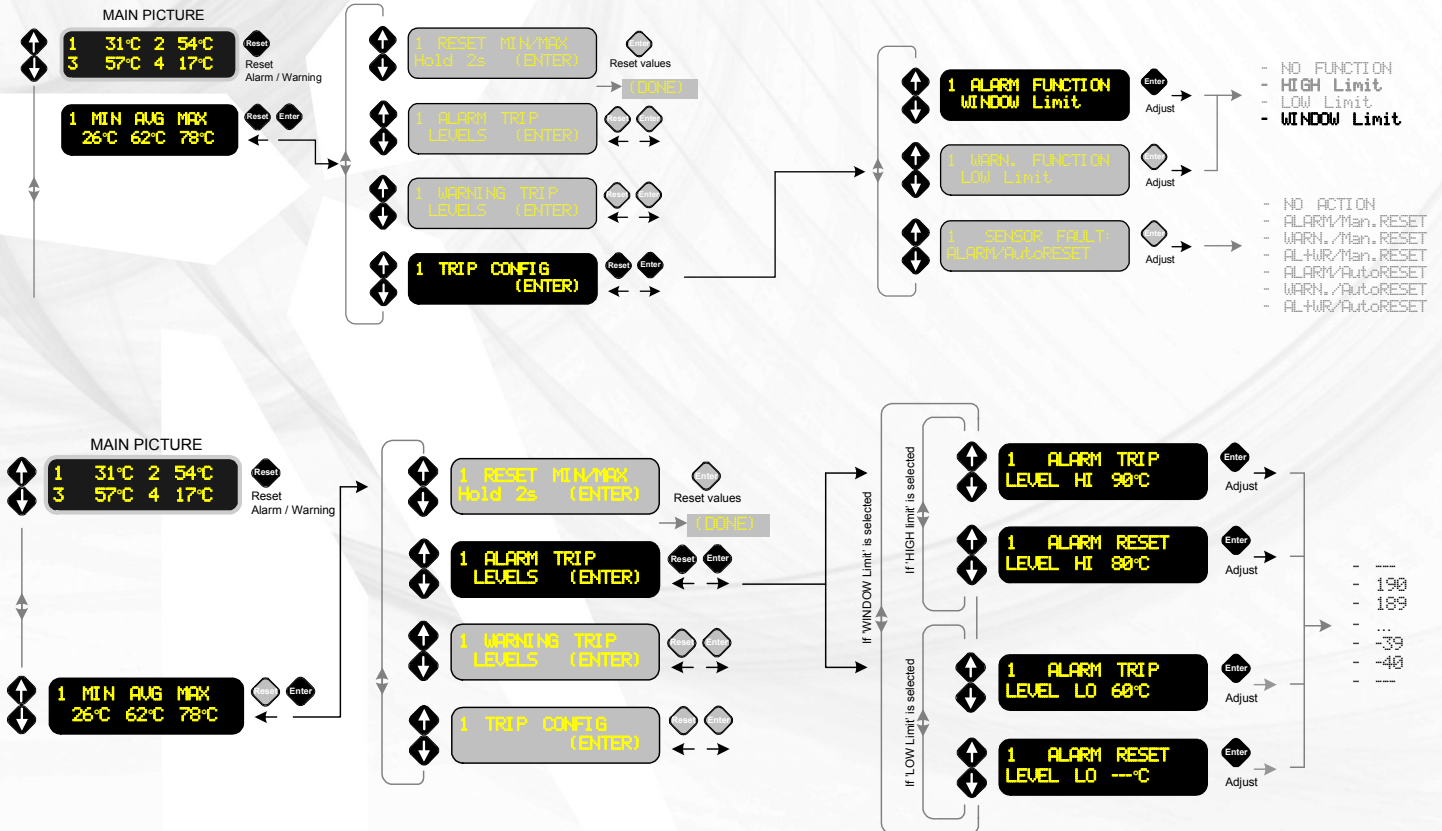
In the 'TEST / CONFIG' menu it is possible to force the outputs relays 'OPEN' or 'CLOSED' in order to test the connection to the control system.

Temperature WINDOW function

1 ALARM FUNCTION
WINDOW Limit

(Shown here: T1 Alarm relay is set to WINDOW limit operation)

Again, first thing to do is to set the Alarm function of the Trip Config correct:

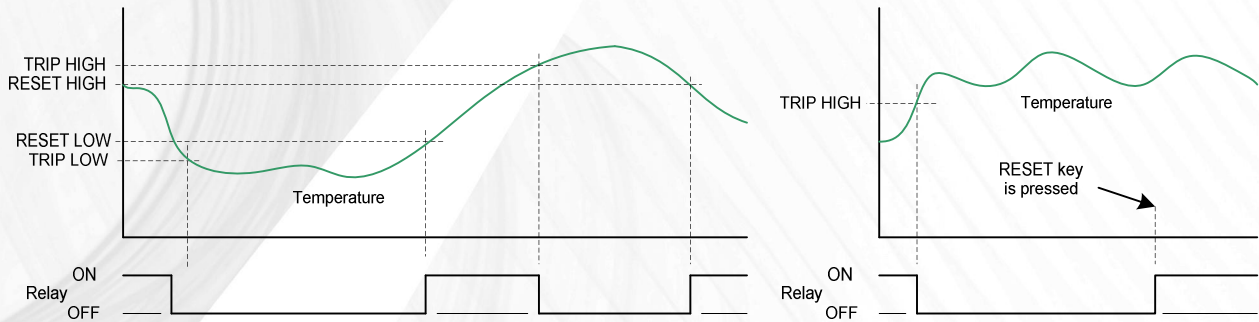


Then the settings of the levels can be made:

Mode of operation

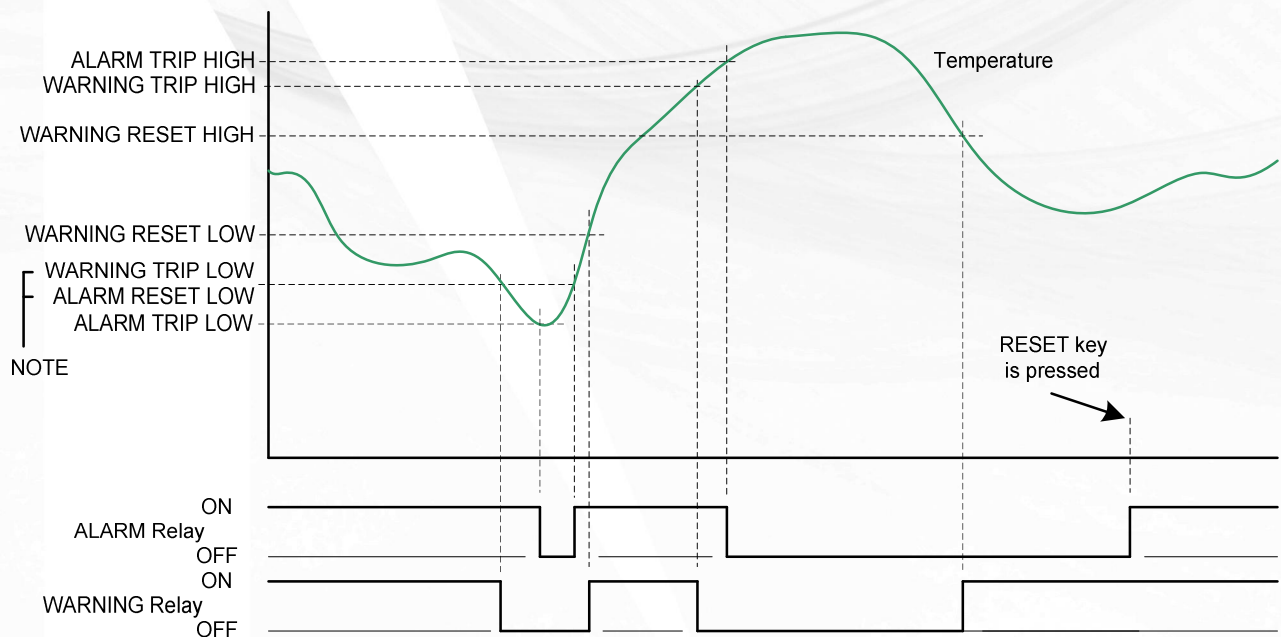
When the temperature level rises above HIGH TRIP OR if it falls below the LOW TRIP setting, the Alarm or Warning relay contact opens (in order to make it fail safe). The corresponding LED will also be lit, indicating the relay 'open position'.

If an Alarm or Warning 'RESET' (HIGH/LOW) level is defined, the relay contact closes when the temperature moves within the two 'RESET' levels (auto reset), and the corresponding LED switches off. It is possible to have only one reset level, and one disabled. e.g. auto reset on low trip and manual reset on high trip.



Left: RESET level defined. Right no RESET level defined – The Reset key needs to be pressed. To have the RESET level not defined, select the value between -40°C and 190°C in the "Warn. RESET" level field.

For each input it is possible to have both an Alarm and a Warning level. In the below graph the Warning RESET HIGH/LOW and Alarm RESET low levels are defined. Alarm RESET HIGH is not defined – this means that if the Alarm HIGH level is reached, the service crew needs to reset the Temperature Monitor manually. However, if alarm LOW is reached, it will auto reset in the same way as if the warning level is reached, the warning relay is opened, and it closes again if the temperature moves within the RESET levels (auto reset).



NOTE: In this example WARNING TRIP LOW and ALARM RESET LOW are set to the same temperature.

Sensor fault function behavior

For each sensor, it is possible to determine how the output should react in case of a faulty sensor (shorted or open circuit is defined as sensor fault). When a temperature sensor is disconnected, or if a sensor wire breaks, the display value will show '---' as an error indication for the current temperature sensor. If a faultless sensor is reconnected, either by itself (e.g. a periodic broken wire) or manually, the display value will flash between '---' and the measured temperature until the 'Reset' button is pressed. This indicates that the sensor has been faulty, but has recovered. The below list shows the possible settings for the sensor fault function:

NO ACTION	No reaction in case of sensor fault. Select this if no sensor is connected.
ALARM/Man. RESET	Alarm relay is opened in case of sensor fault – manual reset acquired (Press RESET).
WARN./Man. RESET	Warning relay is opened in case of sensor fault – manual reset acquired (Press RESET).
AL+WR/Man. RESET	Alarm and Warning relay is opened in case of sensor fault – manual reset acquired (Press RESET).
ALARM/AutoRESET	Alarm relay is opened in case of sensor fault – Resets automatically when the fault is removed/repaired.
WARN./AutoRESET	Warning relay is opened in case of sensor fault – Resets automatically when the fault is removed/repaired.
AL+WR/AutoRESET	Alarm and Warning relay is opened in case of sensor fault – Resets automatically when the fault is removed/repaired.

The two relay contacts are common for all Alarm/Warning levels functions. This means that one or more alarm/warnings are able to open the relay contact. In case of trip or fault, the 'normal' display window will show an "A" or "!" sign to the right for the sensor number. This indicates that the actual sensor / function is causing an alarm or warning. In case of both alarm AND warning the display changes between "A" (Alarm) and "!" (Warning).

Two LEDs on the front indicate the status of the alarm and warning relay. If lit = contact open.

Temperature data

The Temperature Monitor updates the actual temperature measurement approx. every second. The highest measured temperature is stored as 'MAX' and the lowest as 'MIN'. At the same time an average temperature is calculated and is stored as 'AVG'. MIN, MAX and AVG can be readout and, if decided, the values can be reset individually (manually).

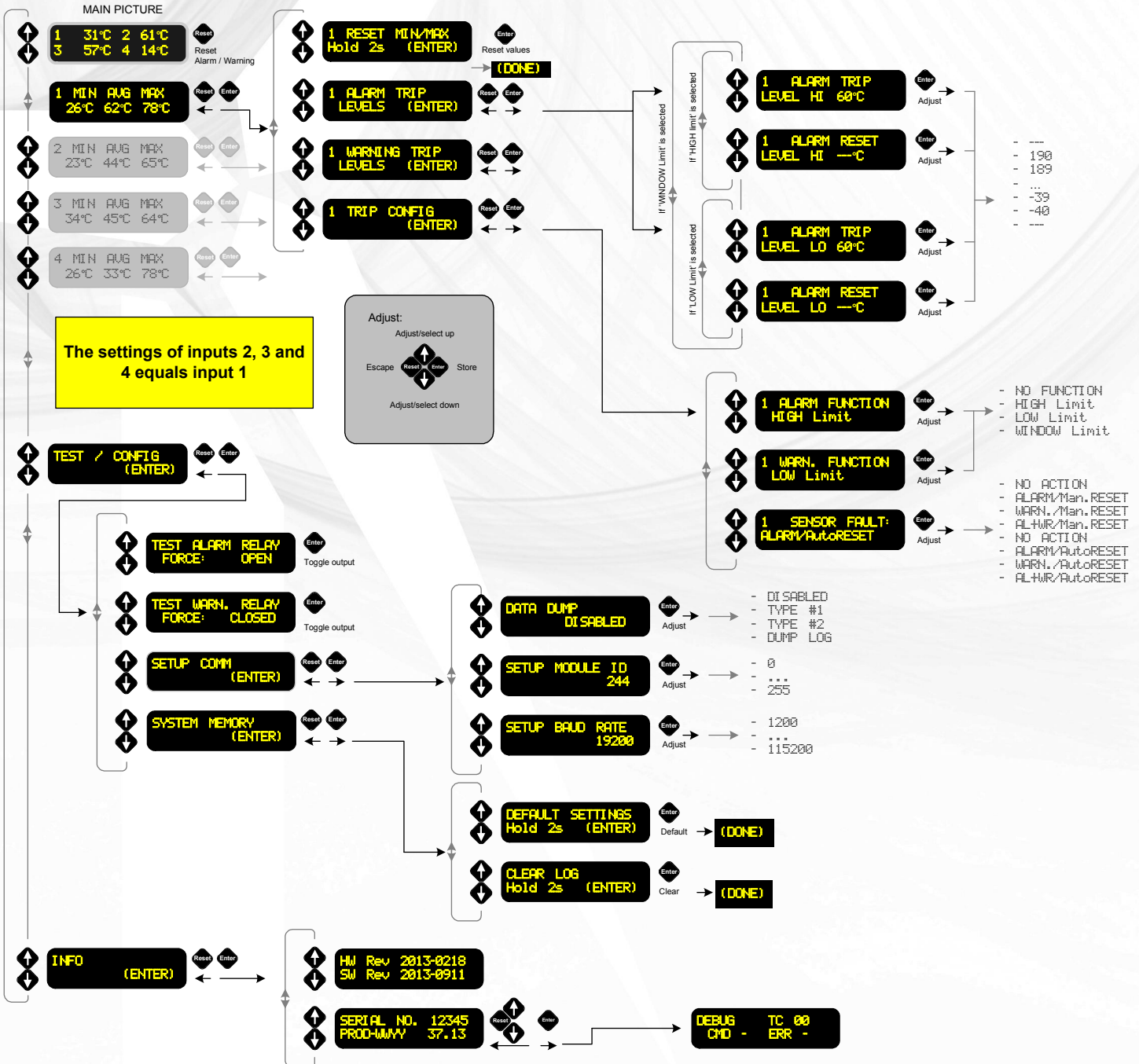
Every 5 minutes all three actual temperatures are stored in the internal memory (data logger). The memory contains 4 x 32767 values which are all temperatures, approx. 2730 hours back in time (equal to approx.114 days).The data can be extracted using the RS485 interface. The RS485 interface is intended for future connection to e.g. SCADA systems. For further information about the port, please contact us.

Menu system

The Menu structure of the Temperature Monitor is made as a tree structure. The four keys on the front is used to navigate, and in some cases also used to adjust values.

Menu system overview

Rev 2013-09-11



My settings (See next page for default values)

Temperature sensor #1

ALARM TRIP LEVEL HI:
ALARM RESET LEVEL HI:
ALARM TRIP LEVEL LO:
ALARM TRIP LEVEL LO:

Temperature sensor #1

Warn. TRIP LEVEL HI:
Warn. RESET LEVEL HI:
Warn. TRIP LEVEL LO:
Warn. TRIP LEVEL LO:

ALARM FUNCTION
- NO FUNCTION
- HIGH Limit
- LOW Limit
- WINDOW Limit

SENSOR FAULT

- NO ACTION
- ALARM/Man.RESET
- WARN./Man.RESET
- ALtWR/Man.RESET
- ALARM/AutoRESET
- WARN./AutoRESET
- ALtWR/AutoRESET

WARN. FUNCTION
- NO FUNCTION
- HIGH Limit
- LOW Limit
- WINDOW Limit

Temperature sensor #2

ALARM TRIP LEVEL HI:
ALARM RESET LEVEL HI:
ALARM TRIP LEVEL LO:
ALARM TRIP LEVEL LO:

Temperature sensor #2

Warn. TRIP LEVEL HI:
Warn. RESET LEVEL HI:
Warn. TRIP LEVEL LO:
Warn. TRIP LEVEL LO:

ALARM FUNCTION
- NO FUNCTION
- HIGH Limit
- LOW Limit
- WINDOW Limit

SENSOR FAULT

- NO ACTION
- ALARM/Man.RESET
- WARN./Man.RESET
- ALtWR/Man.RESET
- ALARM/AutoRESET
- WARN./AutoRESET
- ALtWR/AutoRESET

WARN. FUNCTION
- NO FUNCTION
- HIGH Limit
- LOW Limit
- WINDOW Limit

Temperature sensor #3

ALARM TRIP LEVEL HI:
ALARM RESET LEVEL HI:
ALARM TRIP LEVEL LO:
ALARM TRIP LEVEL LO:

Temperature sensor #3

Warn. TRIP LEVEL HI:
Warn. RESET LEVEL HI:
Warn. TRIP LEVEL LO:
Warn. TRIP LEVEL LO:

ALARM FUNCTION
- NO FUNCTION
- HIGH Limit
- LOW Limit
- WINDOW Limit

SENSOR FAULT

- NO ACTION
- ALARM/Man.RESET
- WARN./Man.RESET
- ALtWR/Man.RESET
- ALARM/AutoRESET
- WARN./AutoRESET
- ALtWR/AutoRESET

WARN. FUNCTION
- NO FUNCTION
- HIGH Limit
- LOW Limit
- WINDOW Limit

Temperature sensor #4

ALARM TRIP LEVEL HI:
ALARM RESET LEVEL HI:
ALARM TRIP LEVEL LO:
ALARM TRIP LEVEL LO:

Temperature sensor #4

Warn. TRIP LEVEL HI:
Warn. RESET LEVEL HI:
Warn. TRIP LEVEL LO:
Warn. TRIP LEVEL LO:

ALARM FUNCTION
- NO FUNCTION
- HIGH Limit
- LOW Limit
- WINDOW Limit

SENSOR FAULT

- NO ACTION
- ALARM/Man.RESET
- WARN./Man.RESET
- ALtWR/Man.RESET
- ALARM/AutoRESET
- WARN./AutoRESET
- ALtWR/AutoRESET

WARN. FUNCTION
- NO FUNCTION
- HIGH Limit
- LOW Limit
- WINDOW Limit

DATA DUMP

- DISABLED
- TYPE #1
- TYPE #2
- DUMP LOG

SETUP MODULE ID

- 0
- :
- 255

SETUP BAUD RATE

- 1200
- :
- 115200

Default values

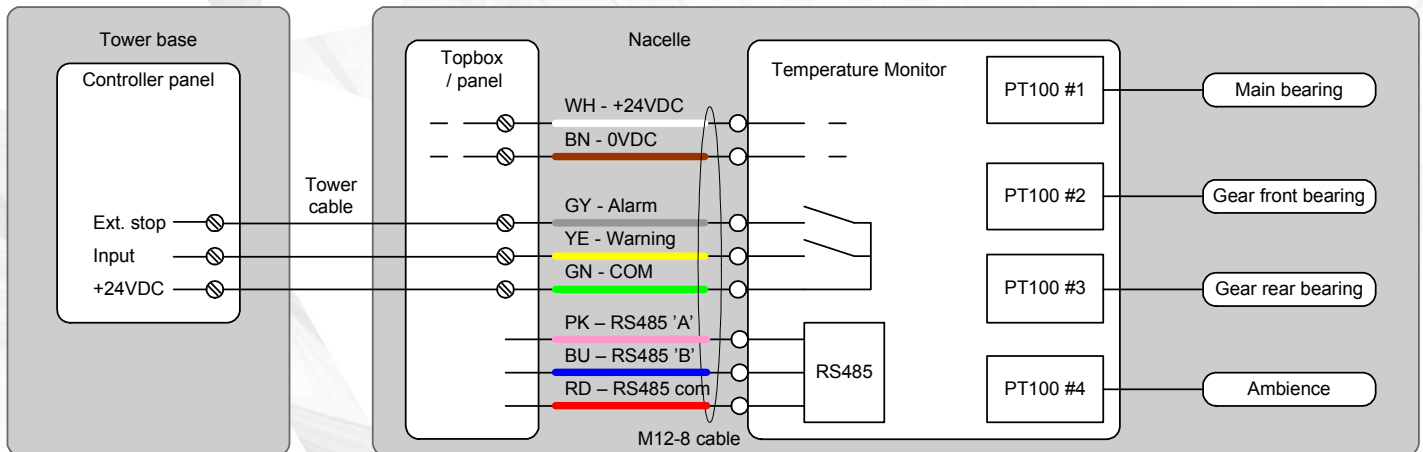
The values shown in the table refers to the default values of the Alarm and Warning functions.

Alarm Setup:	PT100 #1	PT100 #2	PT100 #3	PT100 #4
Alarm Hi Trip	75	75	75	75
Alarm Hi Reset	65	65	65	65
Alarm Lo Trip	0	0	0	0
Alarm Lo Reset	0	0	0	0
Warning Hi Trip	60	60	60	60
Warning Hi Reset	50	50	50	50
Warning Lo Trip	0	0	0	0
Warning Lo Reset	0	0	0	0
Function Setup:				
Alarm Function	HIGH Lim	HIGH Lim	NO FUNCTION	NO FUNCTION
Warning Function	HIGH Lim	HIGH Lim	NO FUNCTION	NO FUNCTION
Sensor Error:	ALARM/Man.RES	ALARM/Man.RES	NO FUNCTION	NO FUNCTION

Technical Data

Data	Rating	Range	Notes
Power supply voltage	24VDC	18...34VDC	
Current consumption	Approx. 70mA		2,2W max
Relay contact	Max 0.1A/30V		(AC/DC)
Temperature sensor	PT100 2/4W	-40...+190°C	

Connections

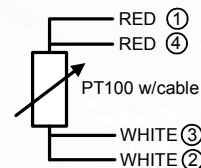


8 pole M12

Pin	Color	Signal	Notes
Pin 1	White	+24VDC, Supply	(isolated from ground)
Pin 2	Brown	0VDC, Supply	(isolated from ground)
Pin 3	Green	Relay common	(isolated from supply and ground)
Pin 4	Yellow	Warning relay, NO	(isolated from supply and ground)
Pin 5	Gray	Alarm relay, NO	(isolated from supply and ground)
Pin 6	Pink	RS485 'A'/'+'	(isolated from supply and ground)
Pin 7	Blue	RS485 'B'/'-'	(isolated from supply and ground)
Pin 8	Red	RS485 GND	(isolated from supply and ground)

8 pole M12 for temperature sensors

Pin	Color	Signal	PT100 side
Pin 1	Brown	Signal 1	PT100 side A
Pin 2	White	Signal 2	PT100 side B
Pin 3	Blue	Signal 3	PT100 side B
Pin 4	Black	Signal 4	PT100 side A



RS485 port

Standard 2-wire RS485 levels.

Serial protocol

Contact us for further information.

Outline

