

Instruction manual

ATEX Temperature Limiter ThermControl TC400-LI / TC400-LI-SA

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1 General information

The safety temperature limiter TC400-LI that you have purchased is designed as a two-channel model which conducts self-monitoring. Following standards were applied:

- IEC61508 SIL2 Safety category
- EN 60079-0 ATEX: Equipment for explosive atmospheres - general requirements
- EN 60079-30-1: 2007 ATEX: Electrical resistance trace heating
- EN 50495: 2010 Safety devices for the safe operation of equipment with respect to explosion risks
- EN 61508-1: 2010 Functional safety, general requirements
- EN 61508-2: 2010 Functional safety, requirements
- EN 61508-3: 2010 Functional safety, requirements for software
- EN 61508-6: 2010 Functional safety, requirements for software

A shutdown, i.e. an interruption of the safety circuit occurs, if the configured target value is exceeded, with errors in the measuring input or in the unit as such. Upon discovery of an error, the limiter switches to a safety state and remains there.

Unlocking is only manually possible and only after elimination of the interference.

The PT100 measuring input has a three-wire circuit so that line resistances are automatically aligned.

The limiting temperature T (target value) is configured via a potentiometer on the front panel of the unit. This potentiometer is flush mounted to the unit's front panel to prevent unintentional adjustment of the target value.

2 Safety features and precautions

The limiter may only be used outside any area with potentially explosive atmosphere!

This limiter is a safety device according to ATEX Directive 94/9/EC and is certified for use on heating circuits in hazardous areas.

When used properly in accordance with the instructions, the safety of user and device is guaranteed.

Read the instruction manual carefully and completely before using your unit. Observe and follow the instruction manual in all respects. Make this instruction manual available to all other user.

Observe the following safety measures:

Maintenance interval: Have the connected sensor tested on its functionality, by testing the unit's 1-sensor-operation at least every 3 years. Only a completely functional sensor can guarantee low failure rates as specified for the unit.

Connect this unit only to a safety transformer according to DIN EN61558, VDE 0570 or better (according to the connection diagram and type plate).

Do not use the limiter:

- If there are recognizable signs of damage;
- if it no longer works properly; or
- after prolonged storage under unfavorable conditions (e.g. humidity, dust, temperature).

In these cases, disconnect the unit from the power supply and secure it against unintentional restarting.

Based on Standard EN 60079-30, observe following points:

- Do not change the setting of the safety temperature limiter during the operation.
- Set the limits in observance with relevant standards (e.g. point 4.4.1 of EN 60079-30-1) for applications in potentially explosive atmospheres. Hence, for temperature classes T6, T5, T4 and T3, the **maximum** limit must be equal to the maximum permissible temperature value for the respective temperature class minus 5 Kelvin and for temperature classes T2 and T1 minus 10 Kelvin.





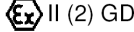

3 Identification of device type

The type plate is located on the side panel of the unit. The connected power supply must be the same as the voltage indicated on the type plate.

All necessary settings are described in this instruction manual.

If you nevertheless should experience difficulties during the start-up, please contact us. Unauthorized tampering with the device may void the warranty!

Information on the type plate:

O. Thimm GmbH		44866 Bochum Germany www.thimmtherm.de
Typ	TC400-LI-SA	
Un=	24V DC -15 /+10%, In= 100 mA	
	Pt100 -50...+500 °C	
	AC1: 230V / 3A, DC1: 24V / 3A	
F-NR	DN-123456789	23.05.2013
 0158		BVS 11 ATEX F 007 X
		
		SW: V1.0, HW: V2.3

Type: TC400-LI options

↓
-options

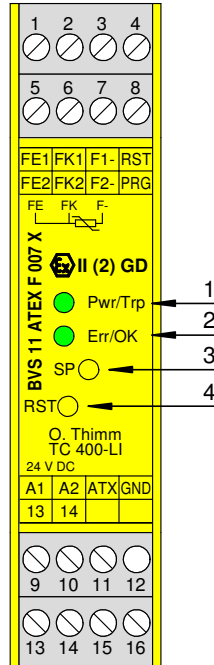
SA = Version with internal display of set value and actual value

ATEX limiter is equipped with one PT100 measuring input (terminal 1, 2, 3) by default.

If you wish two measuring inputs, please contact us.

4 Connector pin assignment of type: TC400-LI

- 1 LED indicator for Power/Tripped
- 2 LED indicator for Alarm/OK
- 3 Potentiometer to configure the target value (flush mounted)
- 4 Reset button (flush mounted)

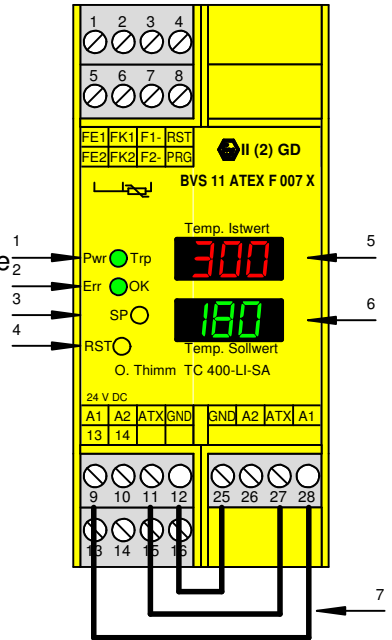


Terminal connection assignment:

- Terminal 1: sensor 1: PT-100 (FE)
 Terminal 2: sensor 1: PT-100 (FK)
 Terminal 3: sensor 1: PT-100 (F-)
 Terminal 4: remote reset (applying 24 voltage to this terminal has the same function as pressing the reset button on the front panel of the unit housing)
 Terminal 5: sensor 2: PT-100 (FE)
 Terminal 6: sensor 2: PT-100 (FK)
 Terminal 7: sensor 2: PT-100 (F-)
 Terminal 8: Programming terminal (applying 24V to this terminal causes the limiter to switch to the programming mode)
 Terminal 9: power supply safety electronics 24V DC
 Terminal 10: Power supply safety electronics 0V DC
 Terminal 11: ATEX communication interface controller - limiter
 Terminal 12: GND for the ATEX communication interface
 Terminals 13/14: Safe output contact

5 Connector pin assignment of type TC400-LI-SA

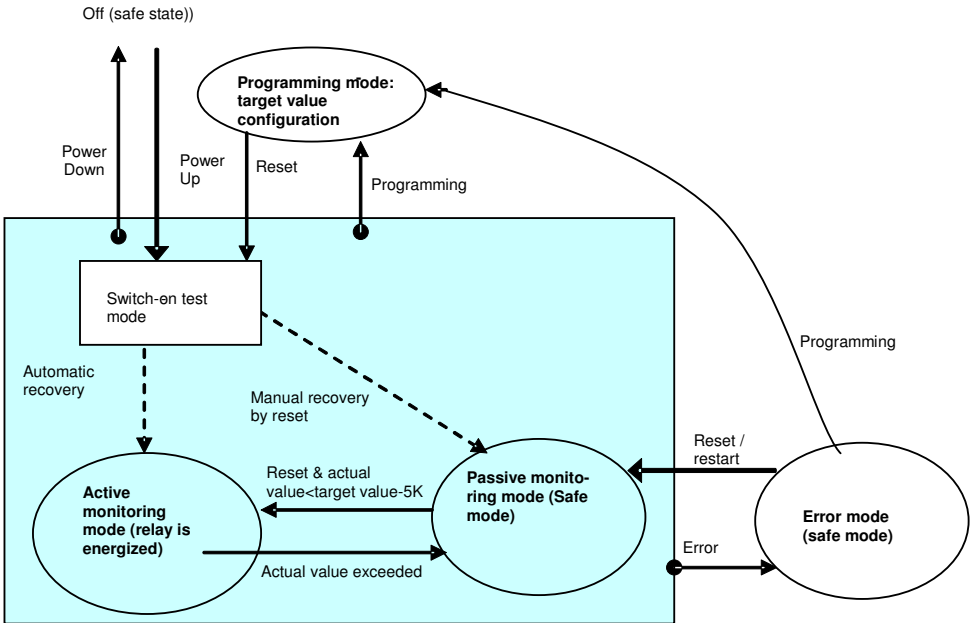
- 1 LED indicator for Power/Tripped
- 2 LED indicator for Alarm/OK
- 3 Potentiometer to configure the target value (flush mounted)
- 4 Reset button (flush mounted)
- 5 Display actual value
- 6 Display target value
- 7 External wiring for actuation of the displays



Terminal connection assignment:

- Terminal 1: sensor 1: PT-100 (FE)
 Terminal 2: sensor 1: PT-100 (FK)
 Terminal 3: sensor 1: PT-100 (F-)
 Terminal 4: remote reset (applying 24V to this terminal has the same function as pressing the reset button on the front panel of the unit housing)
 Terminal 5: sensor 2: PT-100 (FE)
 Terminal 6: sensor 2: PT-100 (FK)
 Terminal 7: sensor 2: PT-100 (F-)
 Terminal 8: Programming terminal (applying 24V to this terminal causes the limiter to switch to the programming mode)
 Terminal 9/28: power supply safety electronics +24V DC
 Terminal 10: Power supply safety electronics 0V DC
 Terminal 11/27: ATEX communication interface
 Terminal 12/25: GND for the ATEX communication interface
 Terminals 13/14: Safe output contact

6 Monitoring modes



The limiter can perform in four different monitoring modes:

- Passive monitoring mode
- Active monitoring mode
- Error mode
- Programming mode (set point configuring mode)

Passive monitoring mode: The temperature to be monitored is reached or exceeded (actual value > target value). There are no errors. In this state, the output contacts of the load circuit are open. To close the load circuit again, the following three conditions must be met.

- There can be no error.
- The actual value temperature must be lower than the target value by at least 5K.
- The user must press the reset button.

Active monitoring mode: In this state, the output contacts of the load circuit are closed. The monitored temperature value is greater than the measured temperature value (actual value < target value). There are no errors.

Error mode: This state is reached when detecting an error. In this state, the output contacts of the load circuit are open. The cause of the error must be eliminated to be able to acknowledge the error by pressing the reset button. This enables the limiter to switch to the passive monitoring mode.

Programming mode: This state allows the user to configure a new target value or to acknowledge an actual value error. By applying 24V DC to the programming terminal, a new temperature target value can be configured. Once the reset button is pressed, the value is acknowledged and programmed into the limiter. After removing the electric tension of 24V from the programming terminal, the limiter leaves this mode and switches to the passive monitoring mode.

7 Status display / Functional description of the LEDs

The two LEDs on the front panel of the TC400-LI serve as signals of the various operating states of the TC400-LI.

POWER/Tripped-LED

- FLASHES when the limit is reached (actual value > target value).
- ON if voltage is applied and the limit has not been reached.
- This LED may never turn to state OFF once the TC400-LI is connected to the operating voltage. If OFF is the case, either the LED or the TC400 -LI is defective. In that case, the unit must be immediately repaired.

ERR/OK-LED

- OFF indicates that user may operate the unit.
- ON indicates that there are no errors and the unit is active.
- FLASHING indicates errors.

LED	State	Description
POWER/Tripped-LED ERR/OK-LED	OFF OFF	The limiter is not connected to the power supply or there are internal errors. If power is supplied to the unit and the operating status LED does not light up, the unit must be sent in for tests.
POWER/Tripped-LED ERR/OK-LED	ON ON	The limiter runs perfectly and is in use (monitoring takes place currently).
POWER/Tripped-LED ERR/OK-LED	ON FLASHES	An error was detected. Limiter is in a safe state. Remove unit from the power supply, check sensor connections, and reconnect unit again after a minute. Acknowledge error by pressing the reset button (>2sec). If the error returns, send the unit in for tests.
POWER/Tripped-LED ERR/OK-LED	FLASHES ON	Configured target value is reached. Limiter is in a safe state. After the actual temperature drops by 5K below the preset target value, the limiter can be reactivated through pressing of the button (>2sec).
POWER/Tripped-LED ERR/OK-LED	ON OFF	After reaching the target value, the temperature dropped again by at least 5K below the target value. By pressing the reset button (>2sec), the limiter can be turned back to the active monitoring mode (closing load circuit).
POWER/Tripped-LED ERR/OK-LED	FLASHES fast FLASHES fast	The limiter is in programming mode. 24V are applied to the programming terminal. A new target value can be configured now. By pressing the reset button (>2sec), this value will be accepted. Remove voltage to the programming terminal thereafter, and if needed, reconfigure unit by pressing the reset button (>2sec).

The limiter TC400 -LI is intended to be mounted in a switch cabinet. The mounting location should be as vibration-free as possible. Aggressive vapors affect the product life of the limiter. Observe the VDE 0100 regulations when carrying out work. Only a skilled worker who is aware of the associated dangers may work on the unit.

In general, ensure that there is unobstructed air circulation when installing one or more units. The ambient temperature below the unit may not exceed 50 °C .

8 Error Messages / Error acknowledgement

When an error occurs, the limiter reacts immediately by transitioning to the safe state. Relays are deactivated, whereupon the output contacts open. Error data are permanently saved internally. The cause of the error must be eliminated; otherwise it is not possible for the limiter to return to the passive monitoring mode. After error elimination, return to the massive monitoring mode by pressing the reset button (>2sec). If an error occurs, the error LED blinks and turns off, when all errors are taken care of.

8.1 Target value error

The limiter is with various safety measures equipped.

- Adjust the target value via the potentiometer on the front panel of the unit. Change this target value only under certain conditions (see Chapter 12).
- The target value is monitored for unintended changes (e.g. caused by aging of the potentiometer, pollution or vibration). A change of the target value without user consent will result in an error. Acknowledge a target value error only if a new target value is configured in the programming mode.

8.2 Other errors

Other errors detected by the unit (e.g. sensor defects or errors in the measurement lines) can be acknowledged by pressing the reset button after the error cause is eliminated. If the unit fails to accept an error acknowledgement after the reset button was pressed, it is either a target value error or, alternatively, the error cause could not be acknowledged by the user.

9 Status- and diagnostic information display

Model TC400-LI:

Model TC400-LI has no display unit for details. Status information such as target temperature value, actual temperature value, and diagnostic information can be only be displayed in connection with the controller module TC400 RMR.

The limiter must be connected to the controller via terminals 11 and 12 to display this information. For equipotential bonding, terminal 12 is only required if controller and limiter unit are powered by different power supply units. In this case, connect terminal 12 (GND) to the mass of the controller.

All required status and diagnostic information are send embedded to a V24 protocol to the display unit via terminal 11 (Atex communication terminal).

Model TC400-LI-SA

Model TC400-LI-SA is equipped with a display unit that shows the target temperature value and the actual temperature value.

For this purpose, terminals 9 to 28, 11 to 27 and 12 to 25 at the limiter must be connected (see Chapter 5).

All required status and diagnostic information are send embedded to a V24 protocol to the display unit via terminal 11 (Atex communication terminal).

9.1 Status information

The status information of target temperature value and actual temperature value is updated every second to the ATEX communication terminal. The output relay state is also continuously updated and displayed.

9.2 Diagnostic information

In addition to the status information, the limiter sends several diagnostic data on occurred errors to the display unit. This information will help to find and eliminate errors quickly and to save valuable time.

10 Start-up of the limiter

10.1 Initial start-up of the limiter

The limiter must be connected first to the power supply according to the specifications.

Do not connect the programming terminal to the power supply.

Connect the PT100 Sensor for the initial start-up (an error is emitted otherwise).

After connecting to the operating voltage, the POWER/Tripped-LED indicates the operating voltage connection through a permanent ON. The limiter runs an initial self-test.

Upon successful completion of the test, the following states are displayed depending on the recorded temperature:

- State 1: POWER/Tripped-LED flashes and ERR/OK-LED is on.
- State 2: POWER/Tripped-LED is permanently on and ERR/OK-LED is off.
- The limiter is in passive monitoring mode.

If the limiter should indicate status 1, this means that the temperature captured by the PT100 is greater than the configured target value. Wait until the current temperature has fallen by at least 5K below the configured actual value in order to be able to activate the active monitoring mode of the limiter - or configure a new target value.

If the limiter indicates status 2, it means that the configured target value is not yet reached. A new target value can be configured or alternatively, the limiter can be set to the active monitoring mode by pressing the reset button.

If there are no errors and the monitored target temperature is reached during the active monitoring phase, the limiter goes in the passive monitoring mode and the output contacts are opening and remain open.

11 Limiter behavior after power supply failure

Upon discovery of an error during monitoring, the limiter switches in a safety state and remains there. The limiter switches to the error mode. Information on the error is stored and prevents the limiter switches again to the monitoring mode after power supply interruption.

If there are no errors and the monitored target temperature is reached during the active monitoring phase, the limiter goes into the passive monitoring mode and the output contacts are opening and remain open. Even after a power supply failure, the output contacts remain open.

Power supply interrupted:

After interruption of the power supply, the limiter continues its operation from the point at which the monitoring was interrupted.

If the limiter, for example, was in active monitoring mode (output contacts closed, target value temperature not reached), the unit will switch again back to the active monitoring mode - if there are no errors after reconnecting the power supply.

12 Input of new target value

To configure a new target value, 24V must be applied to the programming terminal. Thereinafter, the limiter switches into the programming mode.

- The configured target value and the actual value can be viewed as follows:
 - TC400-LI Via the display and control unit of the controller TC400-RMR (Channel 5)
 - TC400-LI-SA Via the internal display.
- While the programming terminal connects to 24V, the user can adjust the potentiometer to configure a value on the front panel of the unit by using a tool (screwdriver) and change the target value accordingly.
- The target value can be changed randomly between 0°C and 500°C. For acceptance of the new target value, press the reset button for about 2 seconds. Thereafter, the user may exit the programming mode.
- The user can exit the programming mode by disconnecting the 24V from the programming terminal.

Important:

Before each target value change, the user must push the reset button, before leaving the programming mode.

The limiter is programmed to monitor the potentiometer configurations against unintended changes and to evaluate not acknowledged changes as errors.

13 Permissible sensors

All PT100 temperature sensors that are certified according to Directive 94/9/EC may be used.

14 Characteristic values

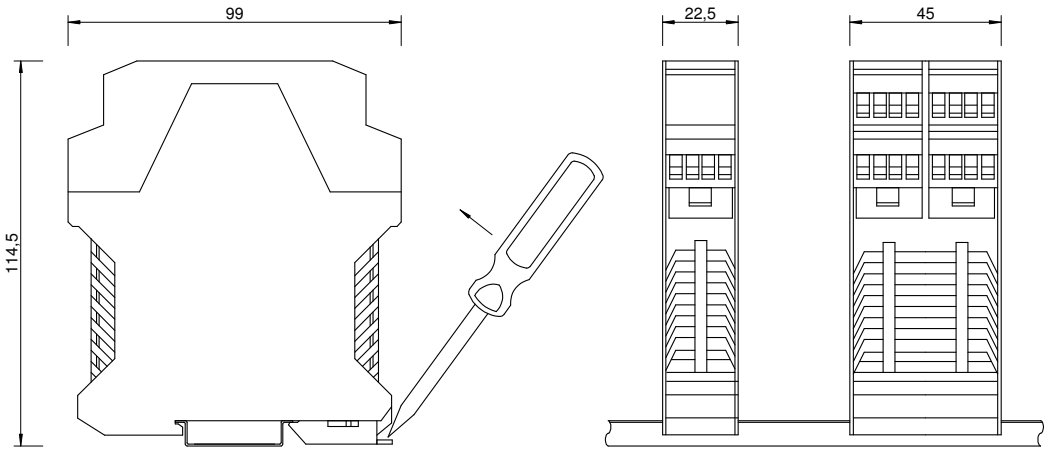
- Certificate no. BVS 11 ATEX F 007 X
- Input: 1 x Pt 100
- Measuring range: 0°C ... + 500°C
- Target value configuration: by means of flush mounted potentiometer
- Output: 2 relays, max. switching voltage 250 V, max. limiting continuous current 3 A
- Switching hysteresis: 5K +/- 1K
- Resolution: < 1K
- Guaranteed accuracy: +/- 5K in the entire working area
At temperatures of >100°C and the resulting measured values, the linearization inaccuracy improves to a maximum of +/- 1K.
- Housing: 22.5mm and/or 45mm PVC ME housing for mounting on a 35mm standard rail according to EN 50 022
- Power supply: 24 V DC via safety transformer according to DIN EN61558, VDE 0570 or better.
- Power consumption: approx. 2VA
- Fuse protection: On the output side: T 3A
On the input side: T 200mA
- Protection class according to EN 60529: IP 20 - for installation in a housing with at least IP 41
- Permitted ambient temperature: 0°C...55°C, nominal temperature: 20°C
- Storage/transport temperature: -20°C...+80°C
- Resistance to climatic conditions: rel. humidity 10-85% non-condensing
- EM: According to EN 61326, industrial requirements
- Mounting position: in any order
- Insulation coordination: according to EN50178:1998, pollution degree 1 Overvoltage category II
- IEC61508 SIL2
- EN 60079-0 Equipment for explosive atmospheres - general requirements
- EN 60079-30-1: 2007 Electrical resistance trace heating

- EN 50495: 2010 Safety devices for the safe operation of equipment with respect to explosion risks
- EN 61508-1: 2010 Functional safety, general requirements
- EN 61508-2: 2010 Functional safety, requirements for safety-related electrical/electronic/programmable electronic systems
- EN 61508-3: 2010 Functional safety, requirements for software
- EN 61508-6: 2010 Functional safety, requirements for software

15 Dimensions:

TC400-LI

TC400-LI-SA



16 Meaning of the symbols on the unit



EU conformity marking



Warning of a danger zone. Caution! Please observe this documentation.



ATEX marking

17 Maintenance

Housing:

Special maintenance of the housing is not required. Keep surface is clean. For cleaning, use a slightly damp cloth. Avoid the use of solvents, cleansing agents and abrasives.

Repair and exchange of parts:

Any repair or replacement of parts on the opened unit powered by voltage may only performed within the plant of O. Thimm GmbH.

Return and environmentally compatible disposal:

According to WEEE 2002/96/EC, the units may not be disposed of with household waste. Concerning the return of older units, please contact our repair and spare part service.

18 Repair and spare parts service / Product support

For further information, please contact:

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44866 Bochum

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