Operating Manual

Temperature Controller
DC10

Translation of the German original
## Table of contents

1. Introduction 1
   1.1 Structure and use of the manual 1
   1.2 Manufacturer details 1
2. Description of the temperature controller 2
   2.1 Product description 2
   2.2 Technical specifications 4
   2.3 Intended use 5
   2.4 EC Declaration of Conformity 6
3. Essential safety instructions 7
   3.1 Safety symbols used 7
   3.2 Primary hazards 8
4. Wall mounting 9
5. Electrical connection 10
6. Configuration 12
   6.1 Start-up 12
   6.2 Auto tuning 13
   6.3 Limiter function 14
   6.4 Set value limits 16
   6.1 Menu structure and parameter values 19
1. Introduction

Summary
In this chapter you will find the following sections:

• Structure and use of the manual
• Manufacturer details

1.1 Structure and use of the manual

Validity
This manual applies to the following device:

Identification: Temperature controller type DC10
Application: Temperature controlling of non-inductive loads

Date of Issue
May 2013

1.2 Manufacturer details

Manufacturer
PSG Petro Service GmbH & Co. KG
Industriestr. 8a
D-61449 Steinbach/Ts.
Germany

Phone: +49 (0) 6171 / 9750-0
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Email: info@psg-petroservice.de
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2. Description of the temperature controller

Summary

In this chapter you will find the following sections:

• Product description
• Technical specifications
• Intended use
• EC Declaration of Conformity

2.1 Product description

Description

The temperature controller is an electronic microprocessor-based PID temperature controller. The set value and the process value are permanently indicated by a two color display. Additional LEDs indicate process information allowing to monitor your heating system even at a glimpse.

Featuring a wall mounted quick coupling frame the temperature controller can be both used as table top unit and as stationary installed unit.

The housing of the temperature controller is made of aluminium making the device ideal for the use in rough industrial environments and labs.

Features & Benefits

• clear display with process value and set value as well as deviation indicators

• compact & easy to handle

• convenient and easy operation

• intelligent auto tuning for PID parameters

• internal solid state relay for pulsed control of the heating system (zero-crossing)

• limiter function

• switching capacity up to 10 A

• robust aluminium housing
### 2.2 Technical specifications

<table>
<thead>
<tr>
<th>Technical Data</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nominal voltage:</strong></td>
<td>115 or 230 V (see type plate)</td>
</tr>
<tr>
<td><strong>Max. load:</strong></td>
<td>10 A</td>
</tr>
<tr>
<td><strong>Frequency:</strong></td>
<td>50...60 Hz</td>
</tr>
<tr>
<td><strong>Power consumption:</strong></td>
<td>6 W (w/o load)</td>
</tr>
</tbody>
</table>
| **Temperature sensor:** | Thermocouple type J (-200...+1.000°C)  
                        | type K (-200...+1.370°C)  
                        | (see type plate)                                                |
| **Control accuracy:**   | ± 0,3% of the measuring range                                           |
| **Solid state relay:**  | Zero crossing                                                           |
| **Power connection:**   | Power cable with CEE connector  IP44                                    |
| **Load connection:**    | 6-pole Amphenol® plug socket type “Ecomate” (standard)                  |
| **Housing:**            | Aluminium light grey                                                    |
| **Protection grade:**   | IP 65                                                                   |
| **Dimensions:**         | 130x90x70 mm                                                            |
| **Weight:**             | 800 g                                                                   |
| **Ambient temperature:**| 0...+50 °C                                                              |
2.3 Intended use

**Intended Use**  
The temperature controller is deemed to be used as intended only if attention is paid to the following points:

- The temperature controller is designed for industrial applications according to EN 61326.

- The temperature controller is used for the controlling of non-inductive loads.

- The temperature controller is used interior and as mobile device (hand-held or table-top unit) or as stationary device (wall mounted).

- The directives of the operating company must be obeyed.

- The legal regulations for the prevention of industrial accidents must be satisfied.

**Unintended Use**  
Considered as an unintended use in terms of a foreseeable misuse are:

- the controlling of inductive loads.

- the operation under conditions other than assumed in this manual

- the operation of the temperature controller by uninstructed or unauthorized personnel.
2.4 EC Declaration of Conformity

pursuant to EC low voltage directive 2006/95/EG

The manufacturer

PSG Petro Service GmbH & Co. KG
Industriestr. 8a
61449 Steinbach/Ts.
Germany

hereby declares, that the below-mentioned device

Temperature controller, type DC10

complies with the regulations of the following directives:

• EC low voltage directive 2006/95/EG
• EMC directive 2004/108/EG

Adopted standards and specifications:

• DIN EN 61010
  Safety requirements for electrical equipment for measurement, control, and laboratory use

Steinbach/Ts., 02.05.2013

Place, Date

Signature

Jörg Erens, Managing Director
3. Essential safety instructions

Summary
In this chapter you will find the following sections:

- Safety symbols used
- Primary hazards

Preface
The following essential safety instructions are to be regarded supplementary to already nationally applicable rules and legal regulations for the prevention of industrial accidents. According to this, you must always obey applicable rules and legal regulations for the prevention of industrial accidents in addition to these essential safety instructions.

3.1 Safety symbols used

This symbol indicates an electrical hazard arising from exposure to electrical voltages.

DANGER OF DEATH!
Possible lethal hazards are indicated separately by the expression “DANGER OF DEATH!”.
3.2 Primary hazards

Summary
Here you will find information on the essential safety instructions that allow for a safe handling of the temperature controller.

DANGER OF DEATH!

The temperature controller utilizes voltages of 230 V with correspondingly high amperages. Since amperages as of 40 mA can be lethal, appropriate precautions are to be taken.

Preventive measures:

• Do not touch any current-conducting parts.
• Keep all coverings of the electrical installations shut.
• Immediately report damaged cables or parts to the person responsible for the temperature controller.
• Installation work may only be carried out by qualified personnel.
4. Wall mounting

**Coupling frame**

To install the temperature controller on a wall take out the quick coupling frame. To do so, unlock the latch by pushing it inside at the lower face side using an appropriate tool. Install the frame on a wall or another surface being suitable for using the following pattern of drilling.

**Pattern of drilling quick coupling frame**

[Diagram of quick coupling frame with dimensions]

**Attaching the temperature controller**

Once the quick coupling frame is installed attach the temperature controller on the frame. To do so, hook the controller on the upper connection fins being inclined backwards. Then tilt the controller parallel to the frame until the latch is snapping into the controller housing.
5. Electrical connection

**Competence**  The electrical connection of the temperature controller may only be carried out by "authorized personnel".

The manufacturer assumes no liability for installation work performed by the operator and for thereby resulting damages or injuries.

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**Safeguarding**  The power supply of the temperature controller must be safeguarded by means of a residual-current circuit breaker (RCCB) together with an overcurrent circuit breaker (OCB). Alternatively, a combined residual current operated circuit-breaker with overcurrent protection (RCBO) can be employed.

---
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Preventive measures:

- Do not touch any current-conducting parts.
- Immediately report damaged cables or parts to the person responsible for the temperature controller.
- Installation work may only be carried out by qualified personnel.
6. Configuration

Summary
In this chapter you will find the following sections:

- Start-up (quick guide)
- Auto tuning
- Limiter function
- Set value limits
- Menu structure and parameter values

6.1 Start-up (quick guide)

As long as the temperature controller is not factory-preset for your application, obey the following instructions to put the controller into operation.

**power supply**
Connect the controller to the power supply voltage. The controller will display the following symbols for 3 seconds:

**temperature sensor**
Press the ▲▼ keys synchronously for 3 seconds. The process value display is showing the following symbols:

**input type**
The set value display is showing the sensor type. To modify the sensor type press the ▲ or ▼ key.

For a thermocouple type K select
- for °C (-200...+1.370°C) or
- for °F (-320...+2.500°F)

For a thermocouple type J select
- for °C (-200...+1.000°C) or
- for °F (-320...+1.800°F)
Now press the mode key repeatedly until you get back to the PV/SV display mode. Then the process value is empty (- - - -) and the set value is showing zero (0).

**set value**

Press the mode key again. The set value display is showing the following symbol:

**set value (SV)**

Adjust your specific set value using the ▲ or ▼ keys. By using the shift key ► the digits can also be selected directly. The active digit is blinking.

Finally press the mode key again to go back to the display mode.

**connecting heating circuit**

Connect the heating circuit to the controller via the plug socket. Ensure the connector pin assignment scheme corresponds to that of the plug (see wiring diagram, chapter 5).

**status output**

The orange coloured LED “ENERGIZED” indicates the status of the output. The heating circuit is energized if the LED is lit.

**ON / OFF**

To switch the controller on or off press the shift key ► for 3 seconds. If the controller is off the process value is showing the following symbols:

---

### 6.2 Auto tuning

The PID parameter of the temperature controller are factory-pre-set to standard values. However, you can manually modify the control performance in order to optimize it for your application. To do so, select the corresponding parameter values according to section 6.5.

You can also have the optimal PID values being automatically determined. To do so, proceed as follows:

Press the ▲ key and the mode key synchronously. The process value display is showing the following symbols:
Press the ▲ or ▼ key until the set value display is also showing AUTO TUNE.

Confirm the setting by pressing the mode key. The controller is switching to the display mode and starting the auto tuning function. While the controller is calculating the PID values the yellow LED “AUTO TUNE” is lit. As soon as the values are calculated the auto tuning function switches off automatically and the LED “AUTO TUNE” is unlit. The auto tuning procedure will take at least as long as the set value is reached for the first time.

You can access the calculated values by selecting the corresponding parameters as described under chapter 6.5.

6.3 Limiter function

The temperature controller offers a limiter function which opens the output circuit, i.e. switches off the heating system, if a set temperature limit is exceeded. Then the red LED “ALARM” is lit. The controller output circuit remains open as long as the process value exceeds the set limit value.

To use the limiter function proceed as follows:

Press the ▲ and ▼ key synchronously for 3 seconds. The process value display is showing the following symbols:

Now press the mode key repeatedly until the process value display is showing inner event 3 type.

Press the ▲ or ▼ key until the set value display is showing the following symbols:
Confirm the setting by pressing the mode key. The process value display is showing the symbols.

Set the digits in the set value display to.

To do so, select the corresponding digit using the shift key ➤ and change the value using the ▲ or ▼ key. Confirm the setting by pressing the mode key. Then press the mode key as many times until the process value display is showing.

Press the ▲ or ▼ key until the set value display is showing.

Confirm the setting by pressing the mode key. Then press the mode key as many times until the process value is showing.

Set the digits in the set value display to.

To do so, select the corresponding digit using the shift key ➤ and change the value using the ▲ or ▼ key. Confirm the setting by pressing the mode key.

Now press the mode key repeatedly until you get back to the display mode. Then the process value display and the set value display are showing the measured value and the set value respectively.

Now you can set the limits in the “main setting mode”. To do so, again press the mode key until the process value display is showing the following symbols:

inner event 3 main setting
Set the required limit value using the ▲ or ▼ key. Using the shift key ► the digits can also be selected directly. The active digit is blinking.

Now press the mode key repeatedly until you get back to the display mode. Then the process value display and the set value display are showing the measured value and the set value respectively.

### 6.4 Set value limits

<table>
<thead>
<tr>
<th>IN RANGE</th>
<th>OUT RANGE</th>
</tr>
</thead>
</table>

The temperature controller is able to indicate a defined temperature deviation by the green LED “IN RANGE” and the red LED “OUT RANGE”. Therefore at first the limits must be set defining the acceptable range of the process value.

The required settings will be demonstrated assuming a tolerable temperature deviation of ± 2K as an example: The green LED “IN RANGE” shall be lit as long as the process value is 2K or less lower or higher than the set value. The red LED “OUT RANGE” shall be lit as soon as the process value is 3K or more lower or higher than the set value.

Press the ▲▼ keys synchronously for 3 seconds. The process value display is showing the following symbols:

#### inner event 1 type

Press the ▲ or ▼ key until the set value display is showing:

#### high/low limit range alarm

Confirm the setting by pressing the mode key. The process value display is showing the symbols:

#### inner event 1 function
Set the digits in the set value display to

no function 0000.

To do so, select the corresponding digit using the shift key ➤ and change the value using the ▲ or ▼ key. Confirm the setting by pressing the mode key. Then press the mode repeatedly until the process value display is showing

inner event 2 type E12A.

Press the ▲ or ▼ key until the set value display is showing

high/low limit alarm H.

Confirm the setting by pressing the mode key. The process value display is showing the symbols

inner event 3 type E12A.

Set the digits in the set value display to

no function 0000.

To do so, select the corresponding digit using the shift key ➤ and change the value using the ▲ or ▼ key. Confirm the setting by pressing the mode key.

Now press the mode key repeatedly until you get back to the display mode. Then the process value display and the set value display are showing the measured value and the set value respectively.

To define the admissible temperature limits go to the “main setting mode”. To do so, press the mode key until the process value display is showing the following symbols:

inner event 1 main setting E.

Set the admissible positive temperature deviation using the ▲ or ▼ key (2 for a.m. example). Using the shift key ➤ the digits can also be selected directly. The active digit is always blinking. Confirm the setting by pressing the mode key. The process value display is showing the symbols

inner event 1 sub setting E156.
Set the admissible negative temperature deviation using the ▲ or ▼ key (2 for a.m. example). Confirm the setting by pressing the mode key. Now press the mode key repeatedly until you get back to the display mode. Then the process value display and the set value display are showing the measured value and the set value respectively.

To set the inadmissible temperature limits go to the “sub setting mode”. To do so, press the ▲ key and the mode key synchronously. The process value display is showing the following symbols:

Press the mode key repeatedly until the process value display is showing:

inner event 2 main setting

Set the inadmissible positive temperature deviation using the ▲ or ▼ key (2+1=3 for a.m. example). Confirm the setting by pressing the mode key. The process value display is showing the symbols

inner event 2 sub setting

Set the inadmissible negative temperature deviation using the ▲ or ▼ key (2+1=3 for a.m. example). Confirm the setting by pressing the mode key. Now press the mode key repeatedly until you get back to the display mode. The process value display and the set value display are then showing the measured value and the set value respectively.
6.5 Menu structure and parameter values

<table>
<thead>
<tr>
<th>Standby mode</th>
<th>PV/SV display mode</th>
<th>Output MV indication mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode Key</td>
<td>Mode Key</td>
<td>Mode Key</td>
</tr>
</tbody>
</table>

- **Standby mode**
  - Mode Key
  - **Main setting mode**
    - SV: SV low limit to SV high limit
  - **Sub setting mode**
    - Inner event 1
      - Main setting (Table 3-1)
      - **Mode Key**
      - Proportional band 0 to 1000000 or 0 to 2000
    - **Mode Key**
      - Integral time 0 to 1000 sec
    - **Mode Key**
      - Derivative time 0 to 300 sec
  - **Mode Key**
  - **Main setting mode**
  - **Sub setting mode**
    - Inner event 3
      - **Mode Key**
      - **Table 3-1**
      - Proportional cycle 1 to 120 sec
      - Relay contact output
      - Mode Key
      - Proportional cycle 1 to 120 sec
      - Non-contact voltage output
      - Unavailable for DC current output

- **PV/SV display mode**
  - **Mode Key**
  - **Auxiliary function setting mode**
    - Input type
      - Lock 1: Off
      - Lock 2: Auto-reset
    - **Mode Key**
    - SV filter time 0.0 to 10.0 sec
  - **Mode Key**
  - **Auxiliary function setting mode**
  - **Mode Key**
  - **Mode Key**

- **Output MV indication mode**
  - The 1st dot from the right on the SV display flashes in 500ms cycles during MV indication.

**Table 3-1**
- Innerevent1
  - **Mode Key**
  - **Mode Key**
  - **Mode Key**
- Innerevent2
  - **Mode Key**
  - **Mode Key**
  - **Mode Key**
- Innerevent3
  - **Mode Key**
  - **Mode Key**
  - **Mode Key**

**Table 3-2**
- Inner event type
  - Table (3-9)
- Table (3-10)
- Table (3-11)
- Table (3-12)
- Table (3-13)

**Table 3-3**
- Inner event hysteresis
  - (Table 3-7)

**Table 3-4**
- Inner event ON delay timer
  - (Table 3-5)

**Table 3-5**
- Control output allocation reverse
  - (Table 3-8)

**Table 3-6**
- Control output allocation
  - (Table 3-9)

**Table 3-7**
- Control output allocation
  - (Table 3-10)

**Table 3-8**
- Control output allocation reverse
  - (Table 3-11)

**Table 3-9**
- Output MV indication
  - (Table 3-12)

<table>
<thead>
<tr>
<th>Power ON</th>
<th>Shift Key (3 sec)</th>
<th>Mode Key (3 sec)</th>
<th>Mode Key (3 sec)</th>
<th>Mode Key (3 sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a FF is indicated on the PV display</td>
<td>PV/SV display mode</td>
<td>Output MV indication mode</td>
<td>The 1st dot from the right on the SV display flashes in 500ms cycles during MV indication.</td>
<td></td>
</tr>
</tbody>
</table>

**Event 3 only**
- **Mode Key**
  - **Mode Key**
  - **Mode Key**

**Event 2 only**
- **Mode Key**
  - **Mode Key**
  - **Mode Key**

**Event 1 only**
- **Mode Key**
  - **Mode Key**
  - **Mode Key**

**Usual operation**
- **Output allocation A**
  - **Output allocation B**
    - The same as those of Output allocation A
  - **Output allocation C**
    - The same as those of Output allocation A
  - **Output allocation D**
    - The same as those of Output allocation A

**Output forced OFF**
- **Output forced OFF**
  - **Output assisted**
    - **Output assisted**
      - **Output assisted**
        - **Output assisted**
          - **Output assisted**
<table>
<thead>
<tr>
<th>Event Type</th>
<th>Main Setting Description</th>
<th>Sub Setting Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>High limit alarm</td>
<td>Main setting: (-) (input span) () to () input span, () () to () input span, () () to () input span</td>
<td>Sub setting: Unavailable () () or () 0, Unavailable () () or () 0, Unavailable () () or () 0</td>
</tr>
<tr>
<td>Low limit alarm</td>
<td>Main setting: (-) (input span) () to () input span, () () to () input span, () () to () input span</td>
<td>Sub setting: Unavailable () () or () 0, Unavailable () () or () 0, Unavailable () () or () 0</td>
</tr>
<tr>
<td>H/L limit range alarm</td>
<td>Main setting: 0 to () input span, () () to () input span, () () to () input span</td>
<td>Sub setting range: 0 to () input span () () or () 0, Unavailable () () or () 0, () () or () 0</td>
</tr>
<tr>
<td>Process high alarm</td>
<td>Main setting: Input range low limit to Input range high limit, () () to () input span, () () to () input span</td>
<td>Sub setting: Unavailable () () or () 0, Unavailable () () or () 0, Unavailable () () or () 0</td>
</tr>
<tr>
<td>High/Low limits alarm</td>
<td>Main setting: Input range low limit to Input range high limit, () () to () input span, () () to () input span</td>
<td>Sub setting: Unavailable () () or () 0, Unavailable () () or () 0, Unavailable () () or () 0</td>
</tr>
<tr>
<td>Process low alarm</td>
<td>Main setting: Input range low limit to Input range high limit, () () to () input span, () () to () input span</td>
<td>Sub setting: Unavailable () () or () 0, Unavailable () () or () 0, Unavailable () () or () 0</td>
</tr>
<tr>
<td>High limit with standby</td>
<td>Main setting: (-) (input span) () to () input span, () () to () input span, () () to () input span</td>
<td>Sub setting: Unavailable () () or () 0, Unavailable () () or () 0, Unavailable () () or () 0</td>
</tr>
<tr>
<td>Low limit with standby</td>
<td>Main setting: (-) (input span) () to () input span, () () to () input span, () () to () input span</td>
<td>Sub setting: Unavailable () () or () 0, Unavailable () () or () 0, Unavailable () () or () 0</td>
</tr>
<tr>
<td>H/L limits with standby</td>
<td>Main setting: 0 to () input span, () () to () input span, () () to () input span</td>
<td>Sub setting: Unavailable () () or () 0, Unavailable () () or () 0, Unavailable () () or () 0</td>
</tr>
<tr>
<td>Loop break alarm (EVT2 only)</td>
<td>Main setting (Loop break alarm time): 0 to 200 minutes, () () to () input span, () () to () input span</td>
<td>Sub setting (Loop break alarm span): 0 to 150 () or () 0.0 to 150.0, Unavailable () () or () 0, Unavailable () () or () 0, Unavailable () () or () 0</td>
</tr>
<tr>
<td>Heater burnout alarm (W option) (EVT3 only)</td>
<td>Main setting (Heater burnout alarm): 0.0 to 20.0A, () () to () input span, () () to () input span</td>
<td>Sub setting: Unavailable () () or () 0, Unavailable () () or () 0, Unavailable () () or () 0, Unavailable () () or () 0</td>
</tr>
</tbody>
</table>