

501A



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Instruction manual

**UNIVERSAL PROGRAMMABLE
CONTROLLER**

TECON 501A

Program 501A - 122.4
Program 501A - 123.3
Program 501A - 124.2
Program 501A - 125.3



TECON 501 Universal Programmable Controller

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1. Safety Regulations

1.1. Purpose Of Application Of The Unit

The TECON 501 is designed to control heating and/or cooling systems. The unit is fitted with a temperature sensor for the control function and if required, a second sensor can be fitted for monitoring. According to execution of type, the unit can be fitted with relay contacts and voltage (=signal), or current outputs. Before using the unit, the type indication should be consulted to see which components are fitted for the relevant application.

1.2. Range Of Application

This unit must **not** be used in explosion hazarded areas. The unit must not be exposed to rain , nor must it be used in any moist environment

The unit is designed for use at temperatures between 0 and 50°C and a relative humidity of air of between 10 and 90%. The supply voltage must correspond with the one on the type indication and may fluctuate 10% at the most. It is imperative that the protective earth (PE) is connected.

Depending on the connected temperature sensor, the unit can control temperatures up to 2000°C. The user carries all responsibility for any hazards forthcoming from the generation of high temperatures.

1.3. Control Range

The control range has to be adapted. (s. Sensors, on page 35 ff.). The nominal value can be adjusted within this range.

1.4. Maximum And Minimum Temperature

The maximum temperature, above which no more heating is effected, and the minimum temperature, below which no more cooling is effected, have to be adjusted (s. Adaptation of alarm data, page 23 ff.).

1.5. Operating Safety Of The Control System

When correctly adjusted and providing the system is operating correctly, the control range (pt. 1.3) and maximum and minimum temperature (pt. 1.4) avoid false operations .

In case damage can be caused in the event that the controller does not operate correctly, it is recommendable to install a safety cut-out

TECON will gladly advise you

1.6. Instruction, Manipulations On The Unit

It is the responsibility of the user that he understands the operating instructions and that no manipulations are made on the unit which could affect its safe functioning. In particular, the unit must not be opened.

2. Specifications And Functions

Temp. sensors	programmable	
	Thermocouples :	Measuring range:
	NiCr-Ni (K)	-200 to 1200 °C
	Fe-Ko (J)	-200 to 750°C
	Pt10Rh-Pt (S)	0 to 1600°C
	Pt13Rh-Pt (R)	200 to 1600°C
	PtRh18 (B)	200 to 1800°C
	Nicrosil-Nisil (N)	-200 to 1200°C
RTD:	Pt 100	-200 to 750°C
	Pt 100 with Zener barrier 84 Ohm	-200 to 400°C
Standard signal :	4- 20 mA	-200 to 2000 units
	0- 20 mA	-200 to 2000 units

Temperature measurement

	accuracy:	0.3% of the range
	resolution :	32000 points
	number of measurements per second	10

Actual value	indication :	4 digit LED, 14 mm high
	resolution :	programmable 0.1C or 1C
	range :	acc. to selected sensor

Nominal value	indication :	4 digit LED, 14 mm high
	resolution :	programmable 0.1°C or 1°C (units)
	range :	can be adjusted and limited
	Input :	with 2 keys via serial interface
		or via external analogue signal (current or voltage)

Limit values The following values can be programmed, displayed and directed to an output alternatively:

- Max. temperature
- Min. temperature
- Deviation from nominal value, upwards
- Deviation from nominal value, downwards
- Program - end
- Power down

Control system	The control unit contains 2 PID-controllers which can be programmed for heating and cooling.	
	Range of the control parameters :	
	Proportional band	0 to 999 °C
	Lead time	0 to 999 s
	Lag time	0 to 9999 s
	Relay interval time	1 to 999 s
	Dead range between heating/cooling	0.1 to 99.9 °C

Outputs	2 controller outputs alternatively:	
	- Relay contact (normally open contact)	230 V, 2 A
	- signal output for thyristors etc.	24 V, 20 mA
	- current output (max. Load 500 Ohm)	0/4 20 mA
	1 Limit-value output:	
	- relay contact (change-over contact)	230 V, 2A

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Analogue outputs	Sensor temperature, nominal value, control deviation or control signal (capacity) programmable on 2 outputs 1 mV/°C range -0.2 V to 2.0 V 10 mV/°C range -2.0 to 10.0 V Voltage programmable 0 to 10 V Current programmable 4-20 mA or 0-20 mA Resolution of the DA-converter 8000 points
Digital input	for external controlling of the control unit programmable 24 V, 8 mA
Digital output	for external linkage of the controller passive (NPN transistor), programmable 24 V, 20 mA
Serial interface	for linking of controllers to master-slave systems or for connection to other control systems (RS 485) : - baud rate 9600 - parity odd - data bits 7 - stop bits 1
Temp. programs	99 program sectors, free linkable, consisting of 1 ramp, 1 dwell temperature, 1 dwell time, and the number of the following sector Temperature ramp none or 0,1 - 999.9°C/h Dwell temperature acc. to setpoint range Dwell time 0 to 99 h 59 min or infinite
Special executions	TECON programs the controller according to specifications as required by the customer
Mains supply	alternately 230/115 V, 50/60 Hz, 24 V, 10 VA
Ambient temperature	0 to 50°C
Ambient humidity	10 to 90% r.h.
Dimensions	Front frame 96 x 96 mm , 5 mm high Controller with housing can be exchanged from the front, can be mounted in any position mounting depth 127 mm
Weight	1,2 kg
Type of protection	Panel IP 64 Enclosure IP 20
Safety	EN 60065
EMC	Immunity pr EN 50 082-2 Emission EN 50 081-1

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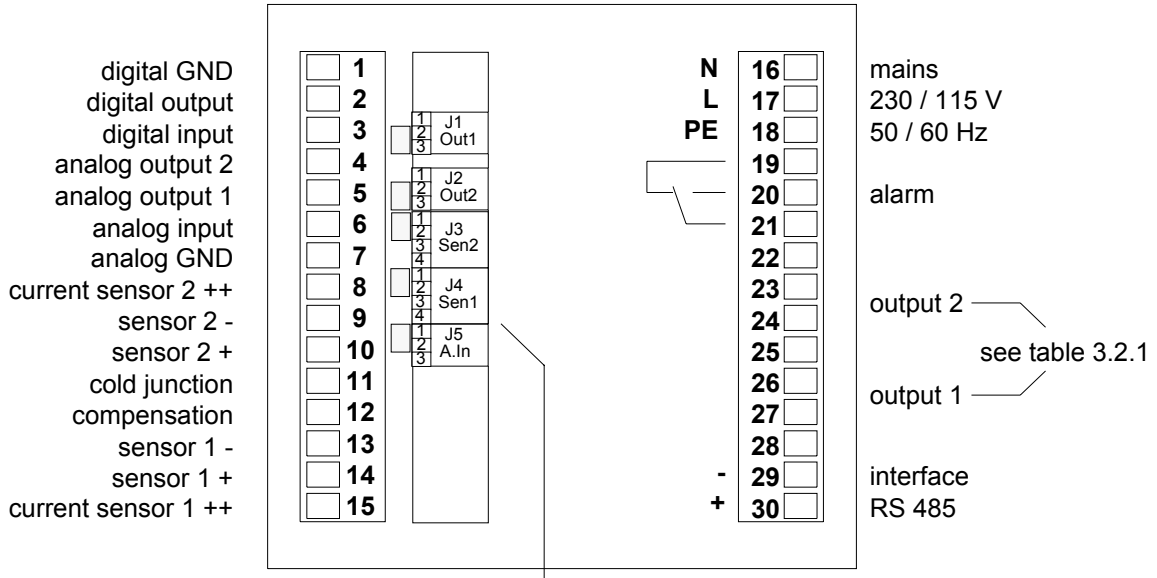
3. Installation

3.1. Connections

On the back wall of the unit there are 2 rows of plug-in type screw terminals with 15 connections each. The section of the connecting wires is max. 1.5 mm.

It is essential that the protective earth (PE) is connected.

3.2. Rear View Of The Unit

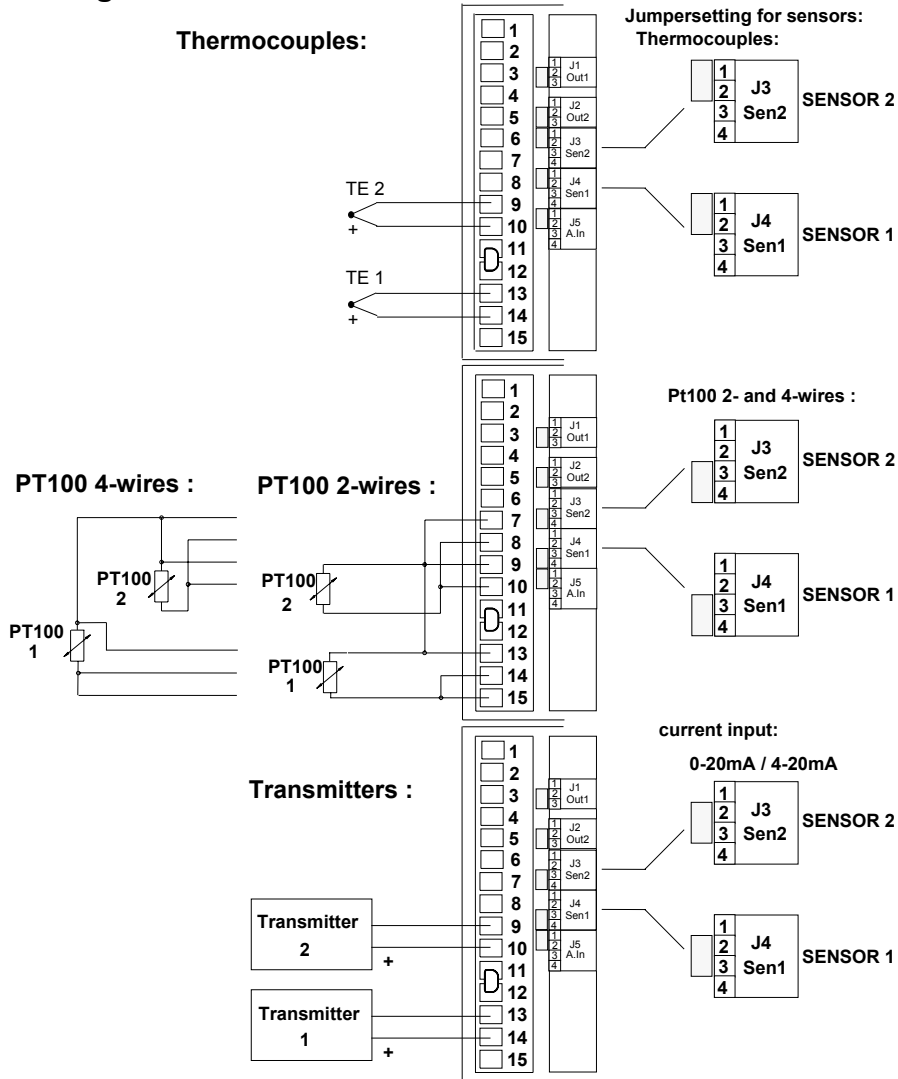


3.2.1. Controller output 1 and 2:

Designation Code: 230-XXXX.X-XXX.X	output 1	output 2
↓		
0	26 <input type="checkbox"/> Relay contact 27 <input type="checkbox"/>	23 <input type="checkbox"/> Relay contact 24 <input type="checkbox"/>
1	⊕ 26 <input type="checkbox"/> signal 24V ⊖ 27 <input type="checkbox"/>	23 <input type="checkbox"/> Relay contact 24 <input type="checkbox"/>
2	26 <input type="checkbox"/> Relay contact 27 <input type="checkbox"/>	⊕ 23 <input type="checkbox"/> signal 24V ⊖ 24 <input type="checkbox"/>
3	⊕ 26 <input type="checkbox"/> signal 24V ⊖ 27 <input type="checkbox"/>	⊕ 23 <input type="checkbox"/> signal 24V ⊖ 24 <input type="checkbox"/>
4	⊕ 26 <input type="checkbox"/> current ⊖ 27 <input type="checkbox"/> 0/4-20mA	23 <input type="checkbox"/> Relay contact 24 <input type="checkbox"/>
5	26 <input type="checkbox"/> Relay contact 27 <input type="checkbox"/>	⊕ 23 <input type="checkbox"/> current ⊖ 24 <input type="checkbox"/> 0/4-20mA
6	⊕ 26 <input type="checkbox"/> current ⊖ 27 <input type="checkbox"/> 0/4-20mA	⊕ 23 <input type="checkbox"/> current ⊖ 24 <input type="checkbox"/> 0/4-20mA
7	⊕ 26 <input type="checkbox"/> signal 24V ⊖ 27 <input type="checkbox"/>	⊕ 23 <input type="checkbox"/> current ⊖ 24 <input type="checkbox"/> 0/4-20mA
8	⊕ 26 <input type="checkbox"/> current ⊖ 27 <input type="checkbox"/> 0/4-20mA	⊕ 23 <input type="checkbox"/> signal 24V ⊖ 24 <input type="checkbox"/>

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3.3. Connecting The Sensors



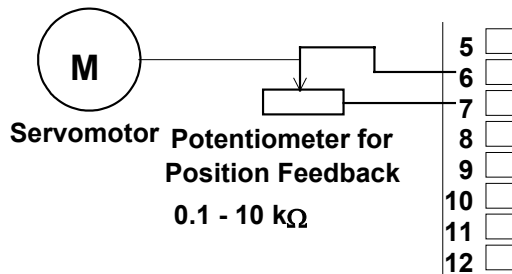
3.4. 3-Point Step Controller

Connecting the position feedback (Adjusting see 'Analogous In/Outputs').
Jumper analogous input on 'signal input'

Voltage V_p at potentiometer:

$$V_p = 5 \text{ V} \left(\frac{R_p}{100 \text{ k}\Omega + R_p} \right)$$

(R_p = Resistance of potentiometer in $\text{k}\Omega$)



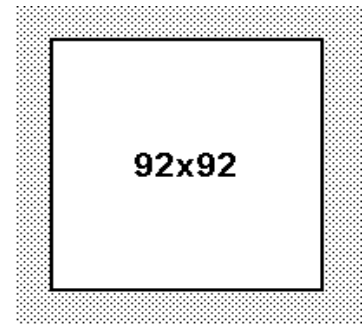
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3.5. Mounting

Cut-out of control panel: 92 x 92 mm
Thickness of the control panel: 1 - 4 mm

Insert the two terminal strips through the cut-out of the panel and plug them in. (The mains input side is coded and can only be plugged in on that side)

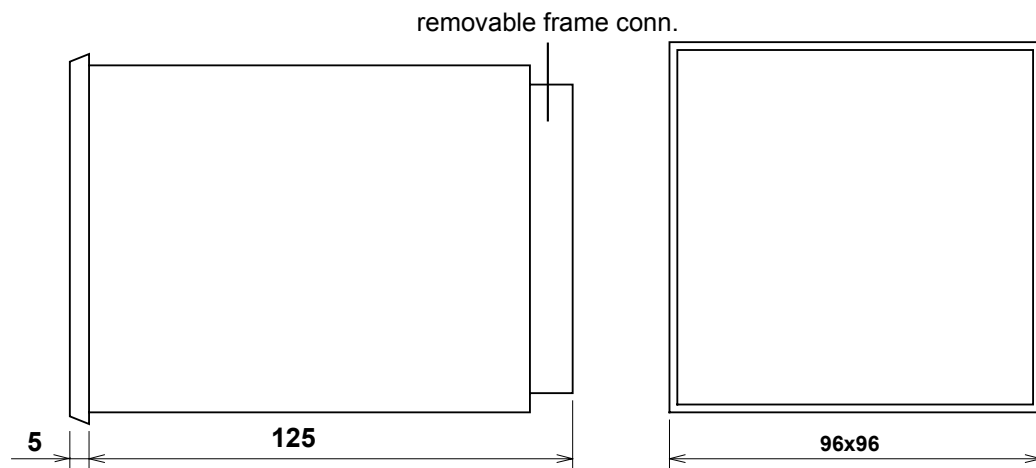
The controller is slid into the cut-out of the panel from the front and is fixed to the front panel by means of 2 screws.



3.6. Dismounting

Undo the two screws in the front panel so that the controller can be pulled out from the front. Disconnect the two connector strips.

3.7. Dimensional Drawing



4. Function Of The Controller

Temperature controlling can be realised under various conditions. That is why the controller can be adjusted to different modes of operation.

4.1. Controller For Heating And Cooling

This is the normal operation. As the actuators for heating and cooling often have different effects on the plant, the control parameters for heating and cooling can be adjusted separately. The signal 'heating' and 'cooling' have an output each. If as a result of the different time reactions both outputs are activated, cooling has got priority. This means the heating signal will be suppressed. Using the controller unit in this way needs just one sensor.

4.2. Controller For Heating

In that case the 2nd output is not needed, it is switched to the digital output. So it can be used for different tasks. The controller works in this mode with one sensor only. The 2nd sensor can be turned off or it can be used as a supervisory device.

4.3. Controller For Cooling

In that case the 2nd output is not needed. It is switched to the digital output. So it can be used for different tasks. The controller works in this mode with one sensor only. The 2nd sensor can be turned off or it can be used as a supervisory device.

4.4. Controller For 2 Zones Heating

2 separate adjustable controllers generate the heating signals for both outputs. Both controllers work with the same nominal value, but an offset can be programmed for the 2nd controller. Both controllers will be turned on and off simultaneously. Both sensors are needed for controlling.

4.5. Controller For 2 Zones Cooling

2 separate programmable controllers send the cooling signals on both outputs. Both controllers work with the same nominal value, but an offset can be programmed for the 2. controller. Both controllers will be turned on and off simultaneously. Both sensors are needed for controlling.

4.6. Controller For Heating With Y/Δ -Control

Output 1 gives the signal for the Δ -contractor, output 2 the one for the Y -contractor. The Δ -contractor is not pulsed but the Y -contractor is in the lower third of the proportional band. The controller works in this way with only one sensor. The 2nd sensor can be turned off or can be used as a supervisory device.

4.7. Controller For 2 Step Heating

If a heater separated in 2 heating registers they can be controlled directly with the outputs. In the upper half of the proportional band output 1 does the proportional switching, output 2 is turned on all the time. In the lower half output 2 does the switching, and output 1 is turned off all the time. Using the controller unit in this way needs only one sensor. The 2nd sensor can be turned off or can be used as a supervisory device.

4.8. 3-Point Step Controller For Servos

The controller actuates 'open' with output 1, and 'close' with output 2. If the controlling is turned off the signal 'close' is sent all the time. The controller can be used with or without feedback of the servo motor position. In both cases the total servo time has to be programmed. The feedback must be made with a potentiometer within the limits of 500 and 10 000 Ohm. The external nominal value input is not free anymore if the feedback is used. The controller works in this mode with one sensor only. The 2nd sensor must not be a Pt 100 resistor .

4.9. Adapting The Controlling

There are 1 or 2 PID controllers available. The parameters have to be adjusted to the plant (proportional band, lag time, lead time). The adaptation can be done by the controller itself, as far as no ramp is programmed at turning on, and if the temperature difference is high enough. TECON offers several tools including a disc with the 'TECON-PID' program. To optimise controlling the program 'OPTITEC' is used. It identifies the plant, recommends parameters, and allows optimising by simulation on the PC.

4.10. Sensor Correcting

There are two possibilities to correct a sensor:

4.10.1. Offset

Serving mainly to compensate the conductor resistance of resistors. The offset is added to all measurements in the complete range.

4.10.2. Correcting

Allows a not linear correction of the sensor , it is used if it is not possible to place the sensor where the temperature is needed. At 8 selectable temperatures, distributed over the complete range, 8 correcting values can be programmed.

4.11. Alarm Relay

The alarm relay can be used for alarm indication with the possibility to acknowledge as well as for limit indication. Maximum value, minimum value, and deviation of the setpoint can be programmed or turned off for both sensors. It can be selected that power on and program end are indicated. The alarm "sensor break" can not be turned off. Normally (no alarm) the alarm relay is pulled up, and releases by alarming. The currentless controller indicates alarm.

4.12. Sensor Break Down

A sensor break down is, in every case, turning off controlling, the alarm relay is released. On the display the symbol of the programmed sensor is flashing. The alarm relay can be acknowledged, but to turn on controlling again, the sensor break has to be repaired.

Sensor break thermocouples: open thermocouple

Sensor break RTD Pt 100: Break or short circuit

Sensor break current input 4 - 20 mA: current < 4 mA or > 20 mA

Sensor break current input 0 - 20 mA: current < 0 mA or > 20 mA

4.13. Digital Input

The digital Input allows to turn on and off control by an external contact. Interruption by external contact can also be programmed.

4.14. Digital Output

The digital output can be programmed, to send out impulses of 0.25 seconds if the controller is turns on or off, or if a ramp, a program section or the program is ending. It can be sending a continuous signal at exceeding a programmable limit or if controlling is running.

4.15. Temperature Program

The control unit can be used with or without a temperature program. If first, by turning on the controller, a program number is selected, the control unit is working with the selected program, else it is working without program. If a temperature program is running, the LED in the 'Prog' key is illuminated. A temperature program contains one or more sections. They can be sequenced in any order. A program section contains a setpoint, a dwell time, a temperature range and a following section number. The following section number decides which section is working next. If 0 is set, the program stops at the end of this section. In program section 0 the working sector is loaded. Thus it may not be used in a program storage but the running program can be manipulated there.

4.16. Serial Interface

Can be used for 2 different tasks:

4.17. Master-Slave-Connections

One controller is programmed as master and one or more others as slaves.

All connected slaves are operating in the same manner as the master acc. to the preset. This is an advantage for more-zone-controlling because only the master has to be manipulated.

If the slaves take the masters setpoint direct or with a programmed difference, or if they should work only in the same sequence but with their own data, can be programmed.

4.18. Operation On Superior Control Unit

As many as 30 controllers can be connected over serial interface with a up to 1000 m long wire to the superior control unit. Every control unit gets an individual address and can be programmed and enquired. The control unit has access to all process variables and of most of the parameters.

TECON offers several PC-programs for central supervision, recording process data and for connections of the set points of several controllers.

4.19. Options

4.19.1. 7 -Day Clock

For every day of the week an individual time for starting and ending is available. In addition a starting and ending time which applies for every day can be programmed. If no starting times are programmed, a start time can be programmed manually.

4.19.2. External Keyboard

If the controller should be operated or controlled at a second place, an external keyboard can be connected, working in the same way as the controller. Additional all the keys on the controllers front can be arranged in parallel on this board . If this option is used, the additional channels and the galvanic sensor separation can not be applied anymore.

4.20. Additional Channels

It is offering 4 supplement inputs (on or off, 230 V) and 6 supplement relay outputs (230 V, 1 A), which can be programmed for different functions as temperature threshold or timer. This option excludes all others.

4.21. Galvanic Separated Sensor Inputs

At high temperatures or strong electric fields, inducted voltages can disturb an exact measurement. If thermocouples are taken as temperature sensors, these influences can be reduced by galvanic separation of sensor and controller. If this option is used, the external keyboard as well as additional channels can not be applied anymore.

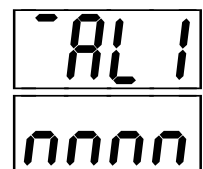
4.22. Indication of software version, alarms and system errors

On power on, the software version is shown for a few seconds



If an alarm comes up, for which the indication is programmed, it is shown blinking in the upper display.

(Alarm programming see page 35).



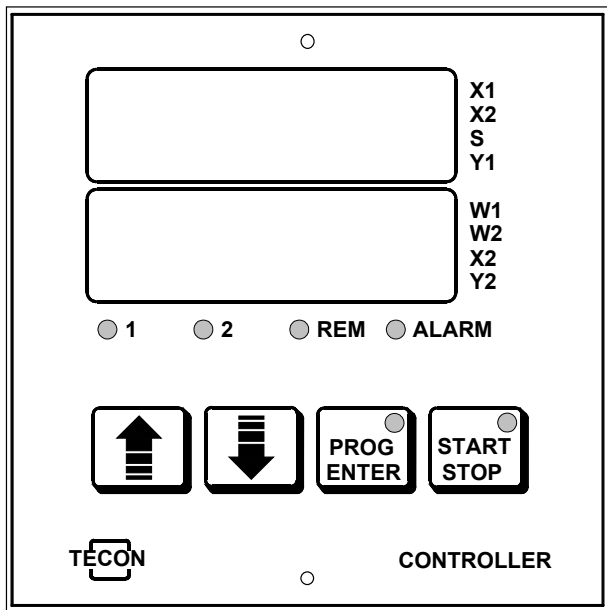
On power on, the device executes several self-tests. An error is shown in the following way:



The code of the error numbers is given in 'Error messages, faults' on page 35) .

5. Operating

5.1. Indication And Operation Elements



Upper display:
4 different values, marked with 4 LEDs
actual value 1, 2
system configuration
output 1

Lower display:
4 different values, marked with 4 LEDs
Set point 1, 2
actual value 2
output 2

4 LED for functional control:
Controller output 1 and 2
Remote access (serial interface)
Alarm

4 keys and 2 LED for operation:
LED START: Controlling on
LED PROG: Program running

5.2. Operating The Controller

The controller can be used in different manners:


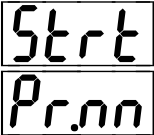


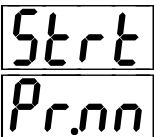

5.2.1. Operation without temperature program

The control unit leads the temperature to the indicated setpoint (lower display, LED SET 1 or SET 2). The 1. setpoint can be set with the arrow keys. If the LED in the key 'START/STOP' is lighted, the controller is working. Turned on or off is the controller by the key 'START/STOP' or, with corresponding system, via external Start/Stop-key or via the serial interface. If the controller is set for double heating or double cooling, the 2nd setpoint can not be programmed. By pressing the key 'PROG' repeatedly, power and the ev. second nominal and actual values can be observed.

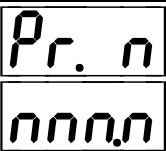
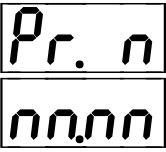
5.2.2. Operation with temperature program

Before starting, the programs have to be programmed (see section 6 programming). If at the beginning first a program is selected and then started, the unit works as a program controller. This kind of operation is indicated by the lightened LEDs in the keys 'PROG' and 'START/STOP'. By pressing the key 'PROG' repeatedly while the controller is running, program conditions, power and ev. 2nd nominal and actual values can be controlled. Data of the running program are in the sector 0. They can be controlled and, if displayed, changed. If displayed, the remaining time of the running program can be changed, too.

5.2.3. Starting with programs

Step	Key	Indication	Function
1			The starting sector is indicated.
2	 		The starting sector is set.
3			Immediate start off the selected sector. The LED in the key Start/Stop is lightened until program ending or until manual stop.

5.2.4. Indication of program conditions with running unit:(briefly pressing the key 'PROG')

	<p>The controller performs a programmed ramp: Upper display: program sector number Lower display: ramp in °C/h or min/s</p>
	<p>A programmed dwell time is running: Upper display: program sector number Lower display: remaining time in hours, minutes or minutes, seconds. It can be altered by the arrow keys .</p>

5.2.5. Adapting the control parameters

To get an adequate control of the proportional band, the lag and lead time have to be adapted on the controlled system. If the following conditions are fulfilled the controller can also make the adaptation by itself :

- At start no ramp may be executed.
- Difference between start temperature and setpoint must exceed 5% of the set control range and must be more than 10°C.
- During the adaptation the setpoint may not be changed.
- The controller works without external setpoint.
- control modes 0-3,6 and 8-11 only.
- heating parameters only.

If these conditions are fulfilled, the controller carries out the adaptation, if at start of the control process the key 'START/STOP' is pressed for a minimum of 3 seconds.

Adaptation is indicated by flashing of the LED in this key.

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5.2.6. Controlling with clock (Option)


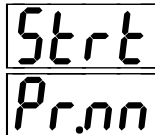

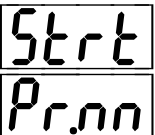

Instruction to start without clock and without program:

At start key 'START/STOP' is pressed for a minimum of 3 seconds: the controller starts at once.


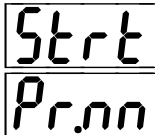

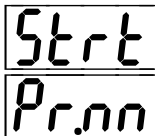

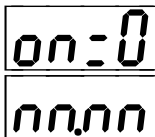
Instruction to start with clock but without program

Briefly pressing the key 'START/STOP' : the controller indicates the next start time, the LED in the key 'START/STOP' is flashing.

Instruction to start without clock but with program:

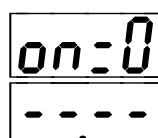
Step	Key	Indication	Function
1			The starting sector is indicated.
2			The starting sector is set.
3	 during 3 sec.	.	Immediate start of the selected sector. The LED in the key Start/Stop is lightened until program end or until manual stop. Briefly, the next start time of the clock is indicated

5.2.7 Instruction to start with clock and program

Step	Key	Indication	Function
1			The starting sector number is indicated.
2			Set starting sector.
3			The next start time of the clock is indicated. The LED in the key Start/Stop is flashing and indicates, that the controller will start automatically . By pressing the key 'PROG' repeatedly, start time and start sector can be observed.

5.2.8 Direct input of a delayed starting time:

If no turn-on time is programmed, the following display appears as starting time:



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In this case, the upper most LED flashes beside the upper display. The desired weekday (1 - 7) can now be entered with the arrow keys. The input is to be confirmed with the press button ,PROG'. The upper most LED beside the lower display then begins to flash. The desired starting time (0.00 - 23.59) can now be entered with the arrow keys. This input too is to be confirmed by the press button ,PROG'. No LED now flashes beside the display. However, the LED in the ,Start/Stop' key flashes and announces that the automatic controller waits for starting time. The chosen start section, the clock time and the starting time can be checked by repeated activating the press button ,PROG'.

If the press button ,Start/Stop' is pressed during the delay time to start, the automatic controller is switched off. The LED in the Start/Stop key goes out.

Adaptation of the control parameters for controller with clock:

Pressing the key 'START/STOP' during 5 sec.

After pressing for 3 seconds, the blinking LED in the Start/Stop key goes on und the heating starts. After 5 seconds, the LED in the Start/Stop key starts to blink again and indicates the adaptation.

6. Programming The Controller

6.1. Program Input


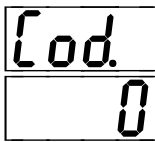

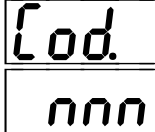





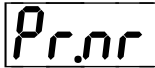



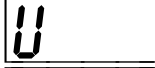


For program inputs the key 'PROG' is pressed during 3 seconds. The programs can be protected by a code. If no key is actuated during more than one minute the unit returns to normal indication.

At any time it is possible to leave the programming mode by pressing the key 'PROG' during 3 seconds .







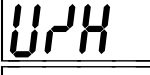














The programming mode is indicated by the flashing of the green LED in the key 'PROG'.

Program sectors can not be deleted but they can be superscribed.

For input, observation and changes go on as followed :

Step	Key	Indication	Function
1	 during 3 sec.		Setting of the selected code (new unit = 0) then, programming can be started . Without valid code the data can only be observed.
2			Programming of the code. This step is only necessary if program data must by programmed.
3			The set code is acknowledged. If the code is wrong, it switches over to step 6. If required and the code was right a new code can be set.
4			
5			The code indicated at step 4 is now the valuable code for program input. The program sector number can be selected.
6			
7			The selected program sector number is acknowledged. The following data belongs to this sector. If required a new setpoint can be set. The range can be programmed at system data input, sensor selection .
8			

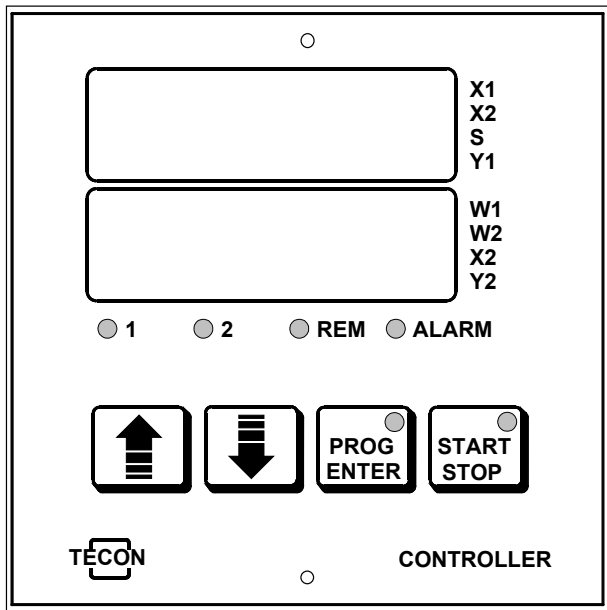
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Step	Key	Indication	Function
9			Dwell time is set in hours and minutes. Range: 0 to 99 h 59 min
10	 		--.-- means infinite dwell time. Is set by selecting a dwell time < 0
11			The ramp is set in °C per hour. Range: 0 - 999.9 °C/h.
12	 		If 0 is set the controller directly switches to the set nominal value.
13			Only with option additional channels: The condition of the 4 selectable outputs is set.
14	 		0: acc. output is turned off. 1: acc. output is turned on. For software version 501-139 see 'Additional logic'
15			The following sector is selected.
16	 		Every sector from 0 to 99 can be set as following sector. If zero is set, the program ends. If a number between 100 and 199 is set, the program waits for an extern signal, before it switches at the set number -100.
17			After short pressing: going on with step 6. Pressing during 3 sec.: program input or observation is ok. Return to operation mode.

The programs are stored during 10 years in the controller. Nevertheless it is highly recommended to record these data. For this purpose see the list of program data on page 52).

7. Adapting The Controller

7.1. Indication And Operation Elements



Upper display:
4 different parameters, marked with 4 LEDs: S = Adapting the controller

Lower display:
4 different parameters, marked with 4 LED

4 LED for function control

4 keys and 2 LED for operation

7.2. Possibilities

The temperature controller TECON 501 can be adapted to the respective application in a wide range. The adaptation happens in ranges, protected by codes for :

- alarm data
- control parameters
- system configuration
- analogue input and output
- sensors
- serial interface
- offset
- sensor correcting
- options

7.3. Alarm Data

By using an alarm code conditions are set under which the alarm relay is operating and indicating. For both sensors a minimum and maximum temperature and admissible difference of the nominal value can be set.

7.4. Controller Parameters

Here the controllers values are set, such as :

- proportional band
- lead time
- lag time
- relay interval time
- maximum permissible rating/ capacity
- dead band

7.5. System Configuration

Here is selected if the controller shall be heating, heating and cooling or if it shall be 2 zones heating or 2 zones cooling .

Also, the type of indication, type of program sector and the digital inputs and outputs are determined here.

7.6. Analogue Inputs And Outputs

There function and the setting of the scale is programmed here.

7.7. Sensor

The type of sensor used and the nominal-value range can be determined. For every sensor a maximal change of temperature per second as a not linear filter can be programmed.

7.8. Serial Interface

The function of the serial interface can be set here.

7.9. Offset

In order to compensate a possible sensor error an offset can be determined for every input, which corrects the measurement over the entire range by this constant amount.

7.10. Sensor Correcting

The sensors measured values can be corrected at 8 free selected temperatures. In-between this correcting values interpolation is linear.

7.11. Options

The option '7-day clock' can be programmed and set.

The option 'additional channels' is programmed.


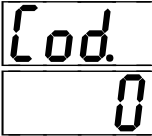

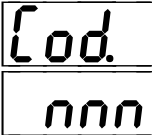

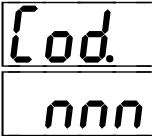



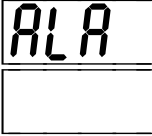
7.12. Execution

The configuration level can be accessed by simultaneously pressing the "UP" and the "DOWN" key for 3 seconds.

In order to make changes a code must be known. Without this code the values can only be observed and not altered. The factory-set code = 0, though, it can be changed to any figure by the user.

The data ranges are selected by means of the arrow keys (forwards or backwards). The operating level can be accessed again at any time by pressing the "PROG" key during 3 seconds. If no key is pressed for more than 60 seconds the unit automatically changes back to the operating level. Pressing the "PROG" key for a short instant switches the display and the entry one step forward within a data range. If the "PROG" key is pressed between 1 and 2 seconds the display and the entry are switched back one step.

7.13. Access To Configuration

Step	Key	Indication	Function
1	 simultan. during 3 sec.		By entering the code defined by the user, (with new unit = 0) programming will be enabled. Without valid code the data can only be checked. This step is only necessary when data have to be altered.
2			Select the code. This step is only necessary if data must be programmed.
3			The code is acknowledged and if correct, can now be readjusted. If the code was wrong these two steps are skipped.
4			
5			The code which was reprogrammed at step 4 is now valid. Now the required data range can be selected.

7.14. Selection Of Data Range

With the arrow-key the data range is selected (for - and backwards).

TIME = 7-day clock (option)

ALA = Alarm data

PAr = Controller parameters

SYS = System configuration

A.IO= Analogue in and outputs

SEn= Sensors

LoG = Additional channels (option)




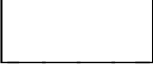






























SEr = Serial interface

oFF = Offsets (correction of the actual value)










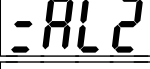





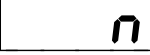







Cor = Not linear sensor correction

The "PROG" key gives access to the data of the selected range.

7.15. Alarm Data

Step	Key	Indication	Function
1	 	 	Alarm data range.
2			Adjusting the maximum temperature for sensor 1. If this temperature is exceeded the heating of controller 1 is turned off. An alarm results only when this has been programmed.
3	 		
			Range: according to the set sensor.
4			Adjusting the minimum temperature for sensor 1. If the temperature falls below the set limit the cooling of controller 1 is turned off. An alarm results only when it has been programmed.
5	 		
			Range according to the set sensor.
6			Setting the over temperature limit 1. If the actual value exceeds the nominal value by this value an alarm is set.
7	 		
			Range: 0-99 °C (0 = Alarm off).
8			Setting the under temperature limit 1. If the actual value falls below the nominal value by this amount an alarm is set.
9	 		
			Range: 0-99°C (0 = Alarm off).
10			Setting the alarm code for sensor 1. For denotation see following table. (Par. 7.15.1).
11	 		
			Range : 0 - 4
12			Adjusting the maximum temperature of sensor 2. If this temperature is exceeded, the heating is turned off. An alarm is set only when it has been programmed.
13	 		
			The range depends on the selected sensor.

TECON 501 Universal Programmable Controller

Step	Key	Indication	Function																
14			Adjusting the minimum temperature of sensor 2 . If the temperature falls below this value the cooling is turned off. An alarm is set only when it has been programmed.																
15				The range depends on the selected sensor.															
16			Setting the over temperature alarm limit 2. When the actual value exceeds the nominal value by this amount alarm is set.																
17				Range: 0 - 99°C. If zero is set, over temperature 2 is turned off.															
18			Setting the under temperature alarm limit 2. When the actual value falls below the nominal value by this amount alarm is set.																
19				Range: 0 - 99°C. If zero is set, under temperature 2 is turned off.															
20			Setting the alarm code for sensor 2. For denotation see following table. (par. 7.15.1)																
21				Range: 0 - 4															
22			Setting the alarm code 3. Range : 0-3, denotation:																
23				<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Code</th> <th style="text-align: left;">Power on</th> <th style="text-align: left;">Program end</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>no alarm</td> <td>no alarm</td> </tr> <tr> <td>1</td> <td>alarm</td> <td>no alarm</td> </tr> <tr> <td>2</td> <td>no alarm</td> <td>alarm</td> </tr> <tr> <td>3</td> <td>alarm</td> <td>alarm</td> </tr> </tbody> </table>	Code	Power on	Program end	0	no alarm	no alarm	1	alarm	no alarm	2	no alarm	alarm	3	alarm	alarm
Code	Power on	Program end																	
0	no alarm	no alarm																	
1	alarm	no alarm																	
2	no alarm	alarm																	
3	alarm	alarm																	
24			End of the alarm data range. A new range can be selected with the arrow key.																
																			

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7.15.1. Alarm code table for code 1 and 2 :

Cod	Function	Indication	acknowl.
0	Alarm is turned off	none	none
1	The alarm relay is open as long as the alarm conditions are fulfilled. Acknowledgement is not possible.	none	none
2	As for 1, but the alarm indication can be acknowledged; the alarm relay is not effected by the acknowledgement.	yes	just monitoring
3	The alarm relay is released when the alarm condition ensues and remains released until acknowledged, also when the alarm condition is eliminated.	yes	yes
4	As for 3 but if the acknowledgement is given while the alarm condition is still pending the alarm relay remains released until the alarm condition vanishes.	yes	just monitoring

An alarm is acknowledged by pressing the Start/ Stop key while the alarm is indicated.

7.15.2. Alarm range




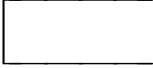

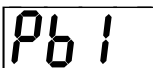




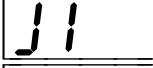




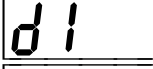









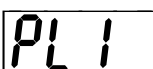




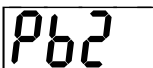




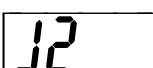



If for over- and under temperature each a limit > 0 is set, this range is supervised as alarm range. The temperature has first to be in this range that an alarm is possible. If the nominal value is changed, this condition must be fulfilled again.

7.15.3. Alarm types and indication in order of priority







































Alarm type	Indication	Alarm condition
1. Power on	P-o	power down
2. Sensor break	sensor symbol	the relevant sensor 1 sends no valid signal
3. Maximum value 1	— °C1	value sensor 1 > programmed alarm value
4. Minimum value 1	_ °C1	value sensor 1 < minimal alarm value
5. Over temperature 1	= °C1	value sensor 1 exceeds the nominal value by more then the programmed value.
6. Under temperature 1	= °C1	value sensor 1 falls below the nominal value by more then the programmed value.
7. Maximum value 2	— °C2	value sensor 2 > programmed alarm value.
8. Minimum value 2	_ °C2	value sensor 2 < minimal alarm value
9. Over temperature 2	= °C2	value sensor 2 exceeds the nominal value by more then the programmed value.
10. Under temperature 2	= °C2	value sensor 2 falls below the nominal value by more then the programmed value.
11. Program end	End	end of the running program.

7.16. Controlling Parameters

After passing into the adapting level the following values are programmable:


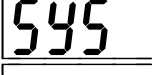
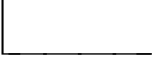

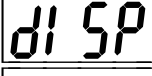





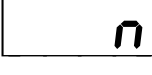
Step	Key	Indication	Function
1	 	 	Parameter range.
2			Setting the proportional band for controller 1. Within the proportional band the output is controlled in proportion to the deviation between nominal and actual value. Range: 0 - 999°C (0 = On/ Off controller)
3	 		
4			Setting the lag time 1 (integral). With the lag time the deviation caused by the proportional control is compensated. Range: 0 - 999 seconds (0 = no integral action)
5	 		
6			Setting the lead time (differential) 1. The lead time effects in switching off before the nominal value is reached, thus avoiding overshoots. Range: 0 - 999 seconds (0 = no differential action)
7	 		
8			Setting the relay interval-time 1. With quasi proportional control the output with constant interval time, is effected by changing the pulse-pause ratio. Range: 1 - 999 seconds.
9	 		
10			Setting the maximum output 1 (in %) is set. The output rating can be limited so as to obtain a smoother controlling effect. Range: 10 - 100%
11	 		
12			Setting the proportional band for controller 2. Within the proportional band the output is controlled in proportion to the deviation between nominal and actual value. Range: 0 - 999°C (0 = On/ Off controller)
13	 		
14			Setting the lag time 2 (integral). With the lag time the deviation caused by the proportional control is compensated. Range: 0 - 999 seconds (0 = no integral action)
15	 		

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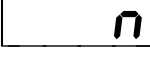



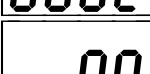




Step	Key	Indication	Function
16			Setting the lead time (differential) 2. The lead time effects in switching off before the nominal value reached, thus avoiding overshoots.
17	 	 	Range: 0 - 999 seconds (0 = no differential action)
18			Setting the relay interval-time 2. With quasi-proportional control with constant interval-time, the output is controlled by changing the pulse-pause ratio.
19	 	 	Range: 1 - 999 seconds.
20			Setting maximum output 2 (in %). The output rating can be limited so as to obtain a smoother controlling effect.
21	 	 	Range: 10 - 100%
22			Setting the dead band. Within this band, between heating and cooling, neither heating nor cooling active (only with controller type 0 or 1)
23	 	 	Range: 0-99.9°C
24			Setting the nominal value offset . With controllers type 6 or 7 the nominal value of the 2nd controller is offset from the 1st controller by the amount entered here.
25	 	 	Range: -99,9 to 99.9°C.
26			Setting the floating time. With controller type 12 or 13 the response time of the motor must be entered. This influences the duration of the control pulses.
27	 	 	Range: 1 - 999 seconds.
28			End of the parameter range. A new range can be selected with the arrow keys.

7.17. System Configuration









On this controller the indication, the ramp inclination, the digital inputs and outputs as well as the type of controller can be adapted to the requirements of the user.

Step	Key	Indication	Function																																				
1		 	System-data range.																																				
2			Setting the display code.																																				
3			<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Code</th> <th style="text-align: center;">Resolution</th> <th style="text-align: center;">Upper display</th> <th style="text-align: center;">Lower display</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">1°C</td> <td style="text-align: center;">actual value 1</td> <td style="text-align: center;">nominal value 1</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">0.1°C</td> <td style="text-align: center;">actual value 1</td> <td style="text-align: center;">nominal value 1</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">1°C</td> <td style="text-align: center;">actual value 1</td> <td style="text-align: center;">actual value 2 (1)</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">0.1°C</td> <td style="text-align: center;">actual value 1</td> <td style="text-align: center;">actual value 2 (1)</td> </tr> <tr> <td style="text-align: center;">4</td> <td style="text-align: center;">1°C</td> <td style="text-align: center;">actual value 2</td> <td style="text-align: center;">nominal value 2 (2)</td> </tr> <tr> <td style="text-align: center;">5</td> <td style="text-align: center;">0.1°C</td> <td style="text-align: center;">actual value 2</td> <td style="text-align: center;">nominal value 2 (2)</td> </tr> <tr> <td style="text-align: center;">6</td> <td style="text-align: center;">1°C</td> <td colspan="2" style="text-align: center;">no automatic switch-over to</td> </tr> <tr> <td style="text-align: center;">7</td> <td style="text-align: center;">0.1°C</td> <td colspan="2" style="text-align: center;">normal indication.</td> </tr> </tbody> </table> <p style="margin-left: 40px;">(1): Indication only when sensor is fitted (2): Only with controller code 6 or 7</p>	Code	Resolution	Upper display	Lower display	0	1°C	actual value 1	nominal value 1	1	0.1°C	actual value 1	nominal value 1	2	1°C	actual value 1	actual value 2 (1)	3	0.1°C	actual value 1	actual value 2 (1)	4	1°C	actual value 2	nominal value 2 (2)	5	0.1°C	actual value 2	nominal value 2 (2)	6	1°C	no automatic switch-over to		7	0.1°C	normal indication.	
Code	Resolution	Upper display	Lower display																																				
0	1°C	actual value 1	nominal value 1																																				
1	0.1°C	actual value 1	nominal value 1																																				
2	1°C	actual value 1	actual value 2 (1)																																				
3	0.1°C	actual value 1	actual value 2 (1)																																				
4	1°C	actual value 2	nominal value 2 (2)																																				
5	0.1°C	actual value 2	nominal value 2 (2)																																				
6	1°C	no automatic switch-over to																																					
7	0.1°C	normal indication.																																					
4			Setting the program sequence code																																				
5			<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Code</th> <th style="text-align: center;">Function</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0 / 5</td> <td style="text-align: center;">Dwell time begins when the setpoint ramp =</td> </tr> <tr> <td style="text-align: center;">1 / 6</td> <td style="text-align: center;">Dwell time begins when the setpoint ramp = setpoint $\pm 2^\circ\text{C}$.</td> </tr> <tr> <td style="text-align: center;">2 / 7</td> <td style="text-align: center;">Dwell time begins when the setpoint ramp =</td> </tr> <tr> <td style="text-align: center;">3 / 8</td> <td style="text-align: center;">Dwell time begins with the program sector.</td> </tr> <tr> <td style="text-align: center;">4 / 9</td> <td style="text-align: center;">The ramp begins at the momentary setpoint.</td> </tr> <tr> <td colspan="2" style="text-align: center;">For Code 0 / 1 / 2 / 3 / 4 dwell time in h.min. Ramp in °C/h</td> </tr> <tr> <td colspan="2" style="text-align: center;">For Code 5 / 6 / 7 / 8 / 9 dwell time in min.sec. Ramp in °C/min</td> </tr> </tbody> </table>	Code	Function	0 / 5	Dwell time begins when the setpoint ramp =	1 / 6	Dwell time begins when the setpoint ramp = setpoint $\pm 2^\circ\text{C}$.	2 / 7	Dwell time begins when the setpoint ramp =	3 / 8	Dwell time begins with the program sector.	4 / 9	The ramp begins at the momentary setpoint.	For Code 0 / 1 / 2 / 3 / 4 dwell time in h.min. Ramp in °C/h		For Code 5 / 6 / 7 / 8 / 9 dwell time in min.sec. Ramp in °C/min																					
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TECON 501 Universal Programmable Controller

Step	Key	Indication	Function																								
6			Setting the code for the digital input.																								
7			<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Code</th> <th style="text-align: left;">Function</th> </tr> </thead> <tbody> <tr><td style="text-align: center;">0</td><td>Control function off when ext. contact closed.</td></tr> <tr><td style="text-align: center;">1</td><td>Control function on when ext. contact closed.</td></tr> <tr><td style="text-align: center;">2</td><td>Control starts and stops with ext. puls.</td></tr> <tr><td style="text-align: center;">3</td><td>Program starts and goes on with ext. puls</td></tr> <tr><td style="text-align: center;">4</td><td>Program run interrupts if extern contact is closed.</td></tr> <tr><td style="text-align: center;">5</td><td>Control function on when ext. contact closed. Control function off when ext. contact closed</td></tr> </tbody> </table>	Code	Function	0	Control function off when ext. contact closed.	1	Control function on when ext. contact closed.	2	Control starts and stops with ext. puls.	3	Program starts and goes on with ext. puls	4	Program run interrupts if extern contact is closed.	5	Control function on when ext. contact closed. Control function off when ext. contact closed										
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9			<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Code table</th> <th colspan="2" style="text-align: center;">Polarity:</th> </tr> <tr> <th></th> <th style="text-align: center;">+</th> <th style="text-align: center;">-</th> </tr> </thead> <tbody> <tr><td>Impulse at program end</td><td style="text-align: center;">0</td><td style="text-align: center;">1</td></tr> <tr><td>Impulse at start and stop</td><td style="text-align: center;">2</td><td style="text-align: center;">3</td></tr> <tr><td>Impulse at sector beginning</td><td style="text-align: center;">4</td><td style="text-align: center;">5</td></tr> <tr><td>Impulse at beginning dwell time</td><td style="text-align: center;">6</td><td style="text-align: center;">7</td></tr> <tr><td>Temperature threshold (1)</td><td style="text-align: center;">8</td><td style="text-align: center;">9</td></tr> <tr><td>controlling on</td><td style="text-align: center;">10</td><td style="text-align: center;">11</td></tr> </tbody> </table> <p>(1): Temperature threshold of sensor 2, if sensor 1 is missing . +: 4.7 kOhm to 24 V DC -: Gnd</p>	Code table	Polarity:			+	-	Impulse at program end	0	1	Impulse at start and stop	2	3	Impulse at sector beginning	4	5	Impulse at beginning dwell time	6	7	Temperature threshold (1)	8	9	controlling on	10	11
Code table	Polarity:																										
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Temperature threshold (1)	8	9																									
controlling on	10	11																									
12			Setting the controller code. Range: see table page down.																								
13																											

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Step	Key	Indication	Function
14			Setting the temperature threshold. Range: -200 to 2000°C
15	 		The function of this threshold is set in step 9. It is related to sensor 2. If sensor 2 is not fitted, it is related to sensor 1.
16		 	End of the system range. A new range can be selected with the arrow keys.

7.17.1. Table of controller types

Code	Controller 1	Controller 2	Output 1	Output 2	Sensor 2
0	increase	decrease	increase	decrease	not fitted
1	increase	decrease	increase	decrease	monitoring
2	increase	off	increase	dig.out	not fitted
3	increase	off	increase	dig.out	monitoring
4	decrease	off	decrease	dig.out	not fitted
5	decrease	off	decrease	dig.out	monitoring
6	increase	increase	increase 1	increase 2	heating 2
7	decrease	decrease	decrease 1	decrease 2	decrease 2
8	increase	off	Δ	Y	not fitted
9	increase	off	Δ	Y	monitoring
10	increase	off	level 1	level 2	not fitted
11	increase	off	level 1	level 2	monitoring
12	increase	off	open	close	not fitted
13	increase	off	open	close	monitoring
14	decrease	off	open	close	not fitted
15	decrease	off	open	close	monitoring
16	increase	decrease	output	decrease>0	not fitted
17	increase	decrease	output	decrease>0	monitoring



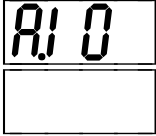

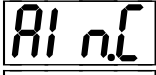


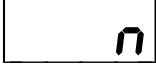










Remarks

controller code 6 and 7: 2 individual controllers operate with the same nominal value. With the parameter "Offset set point controller 2" the nominal value of controller 2 can be offset by a fixed value








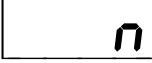

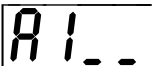



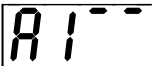





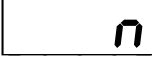
Controller code 12 to 15: 3-Point-controller for servo motors. This controller code can be used with or without feedback. For the feedback the analogue input has to carry code 9 and it has to be scaled.

controller code 16 and 17: To control peltier elements e.g.


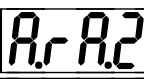



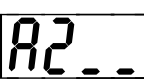



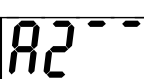



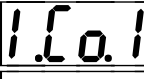

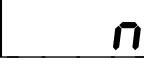

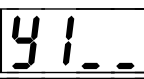



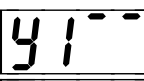



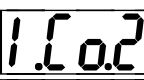

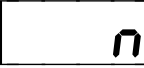
7.18. Analogue Inputs And Outputs

Step	Key	Indication	Function																						
1	 		Range analogue inputs and outputs.																						
2			Setting the code for the analogue input. For code 4 and 5 connect intern shunt. (see page 37)																						
3	 		<table border="1"> <thead> <tr> <th>Code</th> <th>Function</th> </tr> </thead> <tbody> <tr><td>0</td><td>No extern setpoint</td></tr> <tr><td>1</td><td>ext. setpoint 1 mV/°C</td></tr> <tr><td>2</td><td>ext. setpoint 10 mV/°C</td></tr> <tr><td>3</td><td>ext. setpoint 0 - 10 V</td></tr> <tr><td>4</td><td>ext. setpoint 4 - 20 mA</td></tr> <tr><td>5</td><td>ext. setpoint 0 - 20 mA</td></tr> <tr><td>6</td><td>ext. setpoint 0 - 10 V *</td></tr> <tr><td>7</td><td>ext. setpoint 4 - 20 mA *</td></tr> <tr><td>8</td><td>ext. setpoint 0 - 20 mA *</td></tr> <tr><td>9</td><td>feedback servo position. 500-10' 000 Ohm</td></tr> </tbody> </table> <p>*: no switch off if out of range</p>	Code	Function	0	No extern setpoint	1	ext. setpoint 1 mV/°C	2	ext. setpoint 10 mV/°C	3	ext. setpoint 0 - 10 V	4	ext. setpoint 4 - 20 mA	5	ext. setpoint 0 - 20 mA	6	ext. setpoint 0 - 10 V *	7	ext. setpoint 4 - 20 mA *	8	ext. setpoint 0 - 20 mA *	9	feedback servo position. 500-10' 000 Ohm
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7	ext. setpoint 4 - 20 mA *																								
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9	feedback servo position. 500-10' 000 Ohm																								
4			Setting of the lower range limit of the analogue input. Input range: Code 3 - 8 : -200 to 2000°C.																						
5	 		Code 9: 0 - 10'000 Ohm This indication appears only when range code 3 - 8 has been selected. For code 9 the lower value is the lower limit for the servo potentiometer.																						
6			Setting of the upper range limit of the analogue input. Range: Code 3 - 8 : -200 to 2000°C. Code 9 : 0 - 10'000 Ohm																						
7	 		For code 9 the difference between upper and lower value has to be min. 480 Ohm . This indication appears only when range code 3 - 8 has been selected. For code 9 the upper value is the upper limit for the servo potentiometer.																						

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Step	Key	Indication	Function																		
8			Setting of the code for the 1st analogue output.																		
9			<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Code</th> <th style="text-align: left;">analogue value</th> </tr> </thead> <tbody> <tr><td>0</td><td>actual value 1</td></tr> <tr><td>1</td><td>actual value 2</td></tr> <tr><td>2</td><td>nominal value 1</td></tr> <tr><td>3</td><td>nominal value 2</td></tr> <tr><td>4</td><td>output 1</td></tr> <tr><td>5</td><td>output 2</td></tr> <tr><td>6</td><td>actual value 1 - nominal value 1</td></tr> <tr><td>7</td><td>actual value 2 - nominal value 2</td></tr> </tbody> </table>	Code	analogue value	0	actual value 1	1	actual value 2	2	nominal value 1	3	nominal value 2	4	output 1	5	output 2	6	actual value 1 - nominal value 1	7	actual value 2 - nominal value 2
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10			Setting the range of the 1st analogue output.																		
11			<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Code</th> <th style="text-align: left;">Range</th> <th style="text-align: left;">Availability</th> </tr> </thead> <tbody> <tr> <td>- 0</td> <td>10 mV/°C</td> <td></td> </tr> <tr> <td>1</td> <td>1 mV/°C</td> <td rowspan="5">Jumper on analogue-print to switch between voltage and current (see page 37)</td> </tr> <tr> <td>2</td> <td>0 - 10V</td> </tr> <tr> <td>3</td> <td>0 - 2 V</td> </tr> <tr> <td>4</td> <td>4 - 20 mA</td> </tr> <tr> <td>5</td> <td>0 - 20 mA</td> </tr> </tbody> </table>	Code	Range	Availability	- 0	10 mV/°C		1	1 mV/°C	Jumper on analogue-print to switch between voltage and current (see page 37)	2	0 - 10V	3	0 - 2 V	4	4 - 20 mA	5	0 - 20 mA	
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4	4 - 20 mA																				
5	0 - 20 mA																				
12			Setting the lower range limit of the 1st analogue output.																		
13			<p>Range: -200 to 2000°C.</p> <p>This indication appears only when range code 2 - 5 has been selected.</p>																		
14			Setting the upper range limit of the 1st analogue output. Range: -200 to 2000°C.																		
15			This indication appears only when range code 2 - 5 has been selected.																		
16			Setting the code for the 2nd analogue output.																		
17			<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Code</th> <th style="text-align: left;">analogue value</th> </tr> </thead> <tbody> <tr><td>0</td><td>actual value 1</td></tr> <tr><td>1</td><td>actual value 2</td></tr> <tr><td>2</td><td>nominal value 1</td></tr> <tr><td>3</td><td>nominal value 2</td></tr> <tr><td>4</td><td>output 1</td></tr> <tr><td>5</td><td>output 2</td></tr> <tr><td>6</td><td>actual value 1 - nominal value 1</td></tr> <tr><td>7</td><td>actual value 2 - nominal value 2</td></tr> </tbody> </table>	Code	analogue value	0	actual value 1	1	actual value 2	2	nominal value 1	3	nominal value 2	4	output 1	5	output 2	6	actual value 1 - nominal value 1	7	actual value 2 - nominal value 2
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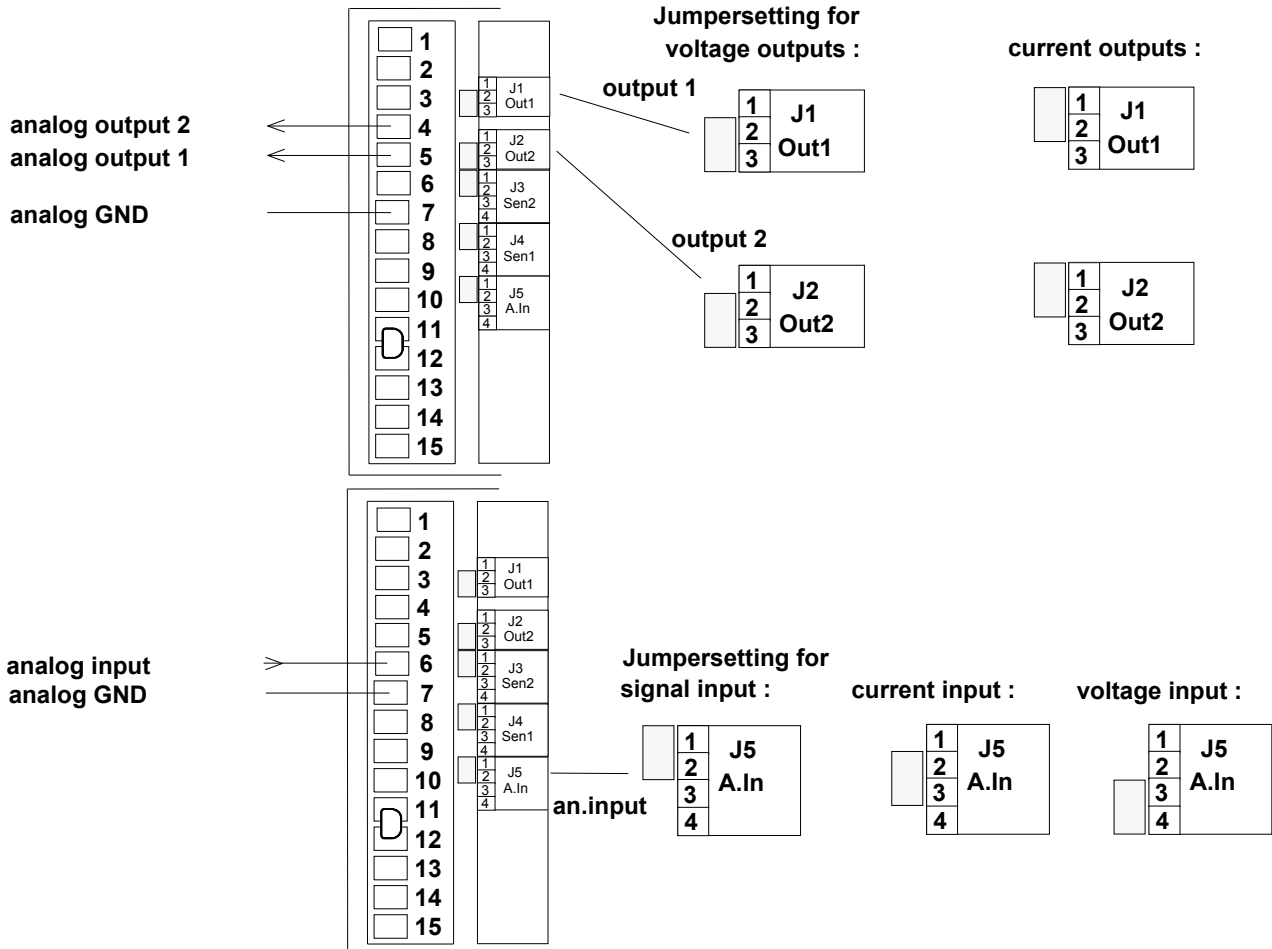
TECON 501 Universal Programmable Controller

Step	Key	Indication	Function																					
18			Setting the range for the 2nd analogue output.																					
19			<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Code</th> <th style="text-align: left;">Range</th> <th style="text-align: left;">Availability</th> </tr> </thead> <tbody> <tr> <td>- 0</td> <td>10 mV/°C</td> <td></td> </tr> <tr> <td>1</td> <td>1 mV/°C</td> <td rowspan="5">Jumper on analogue-print to switch between voltage and current (see page 37)</td> </tr> <tr> <td>2</td> <td>0 - 10V</td> </tr> <tr> <td>3</td> <td>0 - 2 V</td> </tr> <tr> <td>4</td> <td>4 - 20 mA</td> </tr> <tr> <td>5</td> <td>0 - 20 mA</td> </tr> </tbody> </table>	Code	Range	Availability	- 0	10 mV/°C		1	1 mV/°C	Jumper on analogue-print to switch between voltage and current (see page 37)	2	0 - 10V	3	0 - 2 V	4	4 - 20 mA	5	0 - 20 mA				
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1	1 mV/°C	Jumper on analogue-print to switch between voltage and current (see page 37)																						
2	0 - 10V																							
3	0 - 2 V																							
4	4 - 20 mA																							
5	0 - 20 mA																							
20			Setting the lower range limit of the 2nd analogue output. Range : -200 to 2000°C.																					
21			This indication appears only when range code 2 - 5 has been selected.																					
22			Setting the upper range limit of the 2nd analogue output. Range: -200 to 2000°C.																					
23			This indication appears only when range code 2 - 5 has been selected.																					
24			Setting the code for current output 1																					
25			<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Code</th> <th style="text-align: left;">Function</th> <th style="text-align: left;"></th> </tr> </thead> <tbody> <tr> <td>0</td> <td>power up</td> <td>4 - 20 mA</td> </tr> <tr> <td>1</td> <td>power up</td> <td>0 - 20 mA</td> </tr> <tr> <td>2</td> <td>power down</td> <td>4 - 20 mA</td> </tr> <tr> <td>3</td> <td>power down</td> <td>0 - 20 mA</td> </tr> <tr> <td>4</td> <td>power up and down</td> <td>4 - 20 mA</td> </tr> <tr> <td>5</td> <td>power up and down</td> <td>0 - 20 mA</td> </tr> </tbody> </table>	Code	Function		0	power up	4 - 20 mA	1	power up	0 - 20 mA	2	power down	4 - 20 mA	3	power down	0 - 20 mA	4	power up and down	4 - 20 mA	5	power up and down	0 - 20 mA
Code	Function																							
0	power up	4 - 20 mA																						
1	power up	0 - 20 mA																						
2	power down	4 - 20 mA																						
3	power down	0 - 20 mA																						
4	power up and down	4 - 20 mA																						
5	power up and down	0 - 20 mA																						
26			Setting the lower limit of output 1.																					
27			Range: -100 to +100 %																					
28			Setting the upper limit of output 1.																					
29			Range: -100 to +100 %																					
30			Setting the code for current output 2																					
31			<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Code</th> <th style="text-align: left;">Function</th> <th style="text-align: left;"></th> </tr> </thead> <tbody> <tr> <td>0</td> <td>power up</td> <td>4 - 20 mA</td> </tr> <tr> <td>1</td> <td>power up</td> <td>0 - 20 mA</td> </tr> <tr> <td>2</td> <td>power down</td> <td>4 - 20 mA</td> </tr> <tr> <td>3</td> <td>power down</td> <td>0 - 20 mA</td> </tr> <tr> <td>4</td> <td>power up and down</td> <td>4 - 20 mA</td> </tr> <tr> <td>5</td> <td>power up and down</td> <td>0 - 20 mA</td> </tr> </tbody> </table>	Code	Function		0	power up	4 - 20 mA	1	power up	0 - 20 mA	2	power down	4 - 20 mA	3	power down	0 - 20 mA	4	power up and down	4 - 20 mA	5	power up and down	0 - 20 mA
Code	Function																							
0	power up	4 - 20 mA																						
1	power up	0 - 20 mA																						
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3	power down	0 - 20 mA																						
4	power up and down	4 - 20 mA																						
5	power up and down	0 - 20 mA																						

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Step	Key	Indication	Function
32			Setting the lower limit of output 2. Range: -100 to +100 %
33			
34			Setting the upper limit of output 2. Range: -100 to +100 %
35			
36			End of the range for analogue inputs and outputs. A new range can be selected with the arrow keys



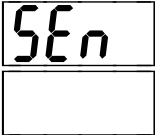





















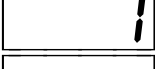



7.19. Jumper settings for analogue input and outputs :




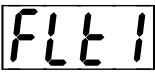



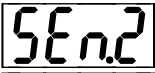















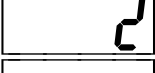



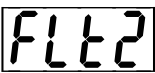





TECON 501 Universal Programmable Controller

7.20. Sensors

Following sensors can be programmed: (at current input a supplementary programming contact PL 9 resp. PL 10, has to be plugged new). see page 35 .

Step	Key	Indication	Function																																				
1	 		Sensor range.																																				
2			Setting the first sensor.																																				
3	 		<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Sensor</th> <th style="text-align: left;">Range</th> <th style="text-align: left;">lower display</th> </tr> </thead> <tbody> <tr> <td>NiCr-Ni (K)</td> <td>-200 - 1200°C</td> <td>CA</td> </tr> <tr> <td>Fe-Co (J)</td> <td>-200 - 750°C</td> <td>FECo</td> </tr> <tr> <td>PtRh10% (S)</td> <td>0 - 1600°C</td> <td>PT10</td> </tr> <tr> <td>PtRh13% (R)</td> <td>0 - 1600°C</td> <td>PT13</td> </tr> <tr> <td>Pt100</td> <td>-200 - 750°C</td> <td>P100</td> </tr> <tr> <td>Pt100 an 84-Ohm</td> <td>-200 - 400°C</td> <td>P184</td> </tr> <tr> <td>Z-Barrier</td> <td></td> <td></td> </tr> <tr> <td>4-20 mA</td> <td>-200 - 2000 u</td> <td>4-20</td> </tr> <tr> <td>0-20 mA</td> <td>-200 - 2000 u</td> <td>0-20</td> </tr> <tr> <td>Nicrosil-Nisil (N)</td> <td>-200 - 1200°C</td> <td>NISI</td> </tr> <tr> <td>PtRH18% (B)</td> <td>200 - 1800°C</td> <td>Pt18</td> </tr> </tbody> </table>	Sensor	Range	lower display	NiCr-Ni (K)	-200 - 1200°C	CA	Fe-Co (J)	-200 - 750°C	FECo	PtRh10% (S)	0 - 1600°C	PT10	PtRh13% (R)	0 - 1600°C	PT13	Pt100	-200 - 750°C	P100	Pt100 an 84-Ohm	-200 - 400°C	P184	Z-Barrier			4-20 mA	-200 - 2000 u	4-20	0-20 mA	-200 - 2000 u	0-20	Nicrosil-Nisil (N)	-200 - 1200°C	NISI	PtRH18% (B)	200 - 1800°C	Pt18
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PtRH18% (B)	200 - 1800°C	Pt18																																					
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5	 		Adjusting the lower limit of the current input. Range : -200 to 2000 units																																				
6			This indication only appears when a current input is used for sensor. Adjusting the upper limit of the current input.																																				
7	 		Range : -200 to 2000 units																																				
8			Adjusting the lower limit of the 1st control range limits the nominal-value input.																																				
9	 																																						
10			Adjusting the upper limit of the 1st control range. This control range limits the nominal-value input.																																				
11	 																																						

TECON 501 Universal Programmable Controller

Step	Key	Indication	Function																																				
12			Adjustment of the filter constant for sensor 1 (see table below).																																				
13			Range: 0 - 99 (0 = filter switched off)																																				
14			Adjusting the second sensor.																																				
15			<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Sensor</th> <th style="text-align: left;">Range</th> <th style="text-align: left;">lower display</th> </tr> </thead> <tbody> <tr> <td>NiCr-Ni (K)</td> <td>-200 - 1200°C</td> <td>CA</td> </tr> <tr> <td>Fe-Co (J)</td> <td>-200 - 750°C</td> <td>FEC_o</td> </tr> <tr> <td>PtRh10% (S)</td> <td>0 - 1600°C</td> <td>PT10</td> </tr> <tr> <td>PtRh13% (R)</td> <td>0 - 1600°C</td> <td>PT13</td> </tr> <tr> <td>Pt100</td> <td>-200 - 750°C</td> <td>P100</td> </tr> <tr> <td>Pt100 an 84-Ohm</td> <td>-200 - 400°C</td> <td>P184</td> </tr> <tr> <td>Z-Barrier</td> <td></td> <td></td> </tr> <tr> <td>4-20 mA</td> <td>-200 - 2000 u</td> <td>4-20</td> </tr> <tr> <td>0-20 mA</td> <td>-200 - 2000 u</td> <td>0-20</td> </tr> <tr> <td>Nicrosil-Nisil (N)</td> <td>-200 - 1200°C</td> <td>NISI</td> </tr> <tr> <td>PtRH18% (B)</td> <td>200 - 1800°C</td> <td>Pt18</td> </tr> </tbody> </table>	Sensor	Range	lower display	NiCr-Ni (K)	-200 - 1200°C	CA	Fe-Co (J)	-200 - 750°C	FEC _o	PtRh10% (S)	0 - 1600°C	PT10	PtRh13% (R)	0 - 1600°C	PT13	Pt100	-200 - 750°C	P100	Pt100 an 84-Ohm	-200 - 400°C	P184	Z-Barrier			4-20 mA	-200 - 2000 u	4-20	0-20 mA	-200 - 2000 u	0-20	Nicrosil-Nisil (N)	-200 - 1200°C	NISI	PtRH18% (B)	200 - 1800°C	Pt18
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PtRH18% (B)	200 - 1800°C	Pt18																																					
16			This indication only appears when a current input is used for sensor. Adjusting the lower limit of the current input.																																				
17				Range : -200 to 2000 units																																			
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19				Range : -200 to 2000 units																																			
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25			Range: 0 - 99 (0 = filter switched off)																																				
26			End of sensor range. A new range can be selected with the arrow keys.																																				
																																							

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Filter code:

X X









	Spike suppression	Low-pass filter
1	50 units during 0.9s	time constant 1s
2	20 units during 0.8s	time constant 2s
3	10 units during 0.7s	time constant 5s
4	5 units during 0.6s	time constant 10s
5	2 units during 0.5s	time constant 20s
6	1 units during 0.4s	time constant 50s
7	0.5 units during 0.3s	time constant 100s
8	0.2 units during 0.2s	time constant 200s
9	0.1 units during 0.1s	time constant 500s

Spike suppression: If the measured value changes between 2 measurements (interval 0.1 s) more than the value of spike suppression, the measured value is not considered. At the completion of the suppression time, the measured value is however always accepted.







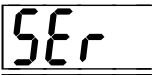

Low-pass filter: If the measured value carries out a step, the measurement achieves 63% of the step after 1 time constant, after 7 time constants 99%. The amplitude of an oscillation with periodic time of one time constants is for instance halved. With a time constant of 10 oscillations, the amplitude is reduced to about 1/100.

7.21. Serial Interface

Every unit is fitted with a interface used mainly for master-slave operations. Type of coupling on the master can be selected. A 2nd interface is possible as option, it must be programmed according to the customers instructions.

Step	Key	Indication	Function
1	 	<div style="border: 1px solid black; padding: 2px; display: inline-block;">SEr</div> <div style="border: 1px solid black; width: 60px; height: 20px; margin-top: 5px;"></div>	Range serial interface.
2		<div style="border: 1px solid black; padding: 2px; display: inline-block;">Adr.</div>	Setting the unit address. Range: 0 - 31
3	 	<div style="border: 1px solid black; padding: 2px; display: inline-block;">nn</div>	
4		<div style="border: 1px solid black; padding: 2px; display: inline-block;">SEr.1</div>	Setting the code of the 1st serial interface. For denotation see code table below.
5	 	<div style="border: 1px solid black; padding: 2px; display: inline-block;">nn</div>	

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Step	Key	Indication	Function
6			Setting the monitoring time of the interface in seconds. If no message is identified at the interface after this interval (e.g. because of wire break) the control system carries the program sector 99 out. The alarm relay falls of and on the display "Ser.1" flashes. Range : 0 - 1000 seconds. 0 = supervision turned off
7	 		
8		 	End of range serial interface. A new range can be selected with the arrow keys.

7.21.1. Data for the 1st interface:

Baudrate	9600
Parity	odd, 1bit
Start bit	1
Stop bit	1
Data bit	7

Are several controllers connected over longer distances, it is recommended to terminate the line with 120 Ohm.

7.21.2. Code table for the serial interface

Value	Addr	Function
0	--	off (no data are received or emitted)
1	99	master
2	--	not used
3	--	not used
4	99	slave without reply, regards start/stop, nominal value
5	99	slave without reply, regards start/stop, nominal value, alarm data
6	99	slave without reply, regards start/stop, nominal value, controller parameters
7	99	slave without reply, regards start/stop, nominal value, alarm data, controller p.
8	99	slave without reply, regards start/stop, nominal value = progr. nom. val. + master nom. val.
9	99	slave without reply, regards start/stop, alarm data, nominal value = progr. nom. value + masters nom. value
10	99	slave without reply, regards start/stop, controller parameters, nominal value = progr. nominal value + master nominal value
11	99	slave without reply, regards start/stop, alarm data, controller parameters, nominal value = progr. nominal value + master nominal value
12	99	slave without reply, regards start/stop, progr. nr.
13	99	slave without reply, regards start/stop, progr. nr. , alarm data
14	99	slave without reply, regards start/stop, progr. nr. controller parameters
15	99	slave without reply, regards start/stop, progr. nr. alarm data, controller parameters
16	1-31	slave regards all commands and replies, intervention at controller possible
17	1-31	slave regards all commands and replies, no intervention at controller possible

7.21.3. Master-slave-connections:

One of the connected controllers is made the master by setting its code 1. This controller now continually sends its data to all the other connected controller. These must have a code between 4 and 15 so that they do not reply. It is important that only one controller is emitting as master and all others are receiving, because otherwise there will be a disarray of emitting units on the common line.

The slaves can be connected to the master in different manners, depending on their code (4 -15) they take over more or less data of their master. Neither master nor slaves require an address. Therefore it is irrelevant which value is shown at the address (Addr.). Internally master and slaves use the address 99 for their data exchange. However, the alarm time can be used to switch off the slaves which have no longer a connection with the master in the event of a defect in the data transfer, and to give an alarm message.



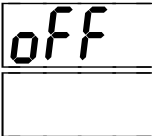

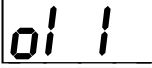














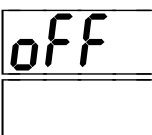
Operation with higher ranking control unit with ser. Code 16 or 17:

Contrary to master-slave operation, always only the addressed controller subjects to the commands of the master, i.e. every connected controller has to be operated individually, unless the master uses address 99. This is observed by all connected controllers also when code 16 or 17 is given.

See "Serial standard interface of the TECON 500 controllers".



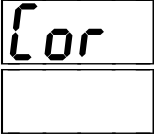

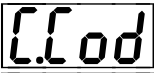


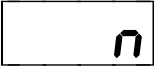

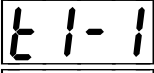




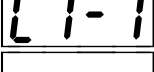












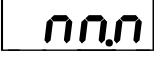

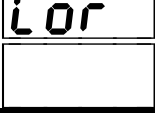
7.22. Offsets

The offset shifts the reading in the whole range. It compensates wire resistance and sensor errors.

Step	Key	Indication	Function
1	 		Offset range.
2			Setting offset 1. (Sensor 1)
3	 		Range: -99.9 to +99.9°C.
4			Setting offset 2. (Sensor 2)
5	 		Range: -99.9 to +99.9°C.
6			Setting offset 3. (ext. nominal-value input or analogue input)
7	 		Range: -99.9 to +99.9 °C.
8			End of the offset range.



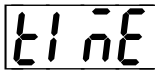





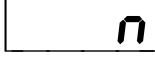

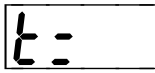














7.23. Sensor Correcting

Both sensors can be corrected at 8 selectable temperature points for a programmable value. This correction can be turned off. In-between this temperature points interpolation is linear.




















Step	Key	Indication	Function
1	 		Correction range.
2			Setting the correction code.
3	 		Range: 0 - 1 0: Correction turned off 1: Correction turned on
4			Setting the 1st correcting point of the 1st sensor.
5	 		Range: -200 to 2000°C.
6			Setting the correction value of the 1st point of the 1st sensor.
7	 		Range: -99.9 to +99.9 °C.
8			Setting the 2nd correction point of the 1st sensor.
9	 		Range: -200 to 2000°C.
66			Setting the correction value of the 8th point of the 2nd sensor.
67	 		Range: -99.9 to +99.9°C.
68			End of the correction range. A new range can be selected with the arrow keys.

7.24. 7- Days Clock (Option)

In this range the clock is set. Times of start and stop of the 7-days clock are here programmed.

Step	Key	Indication	Function
1	 	 	7-day clock range.
2			The week-day is displayed.
3	 		If the clock must be set, setting of the week-day. Any arrangement of days and numbers is possible, but we recommend following order: 1 = Monday 2 = Tuesday 3 = Wednesday 4 = Thursday 5 = Friday 6 = Saturday 7 = Sunday
4			The time is displayed.
5	 		Setting of the time if needed. Range: 0.00 to 23.59 If no setting is necessary go on with step 7 ("PROG" key).
6			By pressing the "START/STOP" key the set time is taken over.
7			Setting the start time of day 1. Range: 0.00 to 23.59
8	 		24.00 sets the starting time out of service.
9			Setting the stop time of day 1. Range: 0.00 to 23.59
10	 		24.00 sets the stopping time out of service.

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Step	Key	Indication	Function
11	  	<div style="border: 1px solid black; padding: 2px; display: inline-block;">on. 2</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">nn.nn</div>	Setting the start time of the 2nd day. Range: 0.00 to 23.59 24.00 sets this time out of service.
Step 12 - 32: days 2 - 7. Setting of start and stop times.			
33	  	<div style="border: 1px solid black; padding: 2px; display: inline-block;">off. 7</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">nn.nn</div>	Setting the stop time of day 7. Range: 0.00 to 23.59 24.00 sets the stop time out of service.
34	 	<div style="border: 1px solid black; padding: 2px; display: inline-block;">nn.nn</div>	
35	  	<div style="border: 1px solid black; padding: 2px; display: inline-block;">on. A</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">nn.nn</div>	Setting the every day valid start time. Range: 0.00 to 23.59 24.00 sets the start time out of service.
36	 	<div style="border: 1px solid black; padding: 2px; display: inline-block;">nn.nn</div>	
37	  	<div style="border: 1px solid black; padding: 2px; display: inline-block;">off. A</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">nn.nn</div>	Setting the every day valid stop time. Range: 0.00 to 23.59 24.00 sets the stop time out of service.
38	 	<div style="border: 1px solid black; padding: 2px; display: inline-block;">nn.nn</div>	
39		<div style="border: 1px solid black; padding: 2px; display: inline-block;">E1 nE</div> <div style="border: 1px solid black; padding: 2px; display: inline-block; width: 60px; height: 20px; margin-top: 5px;"></div>	End o the 7-day clock range. A new range can be selected with the arrow keys.

If no starting times are programmed, a start time can be programmed manually.

8. Additional Channels (Option)

8.1. Application

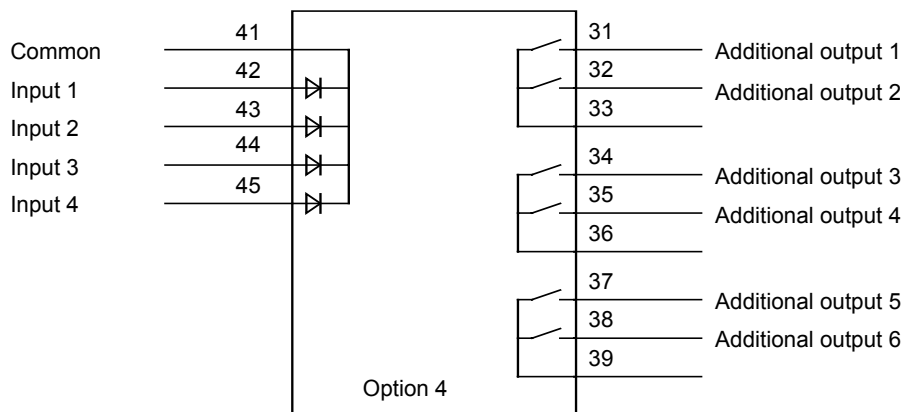
For controllers, working in a larger system additional control possibilities are needed. Starting, stopping and interrupting must be possible for a running temperature program. By reaching a programmed temperature threshold or after a certain time signals are send to the system.

This option 2 offers 6 additional inputs and outputs, they form together with the software-expansion "Logic" universal usable interconnections.

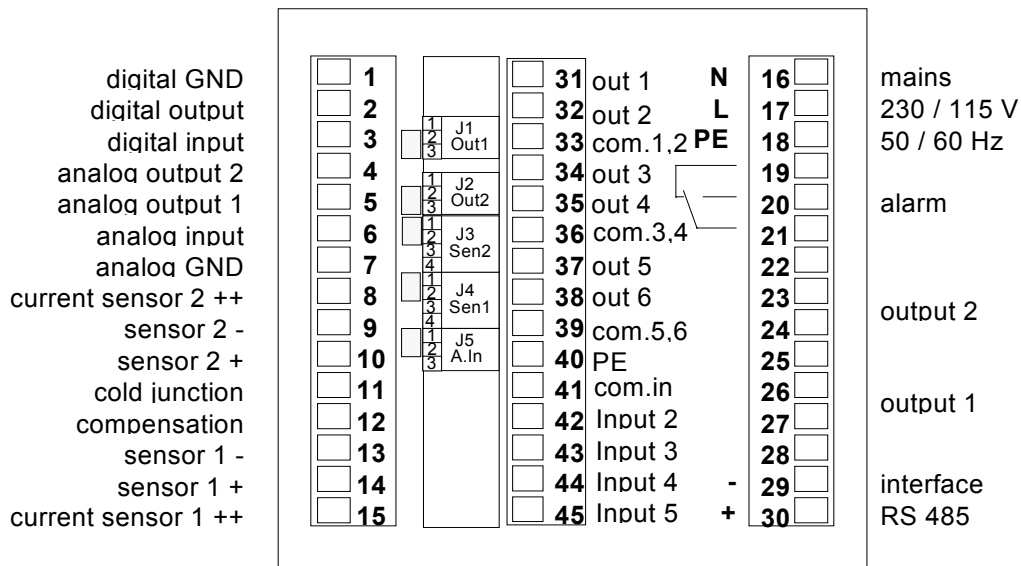
For special functions, e.g. 6-step controllers, TECON offers special software.

8.2. Technical Data Of The Hardware

additional inputs and outputs:



rear view of the unit:



Input voltage: 24 or 230V, 50/60 Hz
 Input current: 2 mA
 Output voltage: 24 or 230V
 Output current: max. 1A per contact, max. 3A total

8.3. Function Of The Input:

Input 1:	according to the digital input (see config. TECON 501)
Input 2:	starts the controller with an impulse (during > 0.5s)
Input 3:	stops the controller with an impulse (during > 0.5s)
Input 4:	interrupts the running program (ramp stops , rest time stays constant, controlling works)

The input 4 is only useful when working with temperature programs.

8.4. Function Of The Output

outputs 1-4:	function according to the logic-code
output 5:	corresponding to the digital output (see config. TECON 501)
output 6:	end of program

Software-Version 501A-139:

With software version 501A-139 the outputs 5 and 6 have always logic code 0. So they can be programmed for each program section. (Programming see par. 8.6).

If the logic code for output 4 is set to 12 (control via serial interface), with this version the outputs 5 and 6 are controlled via interface too.

The function of output 1 - 4 can be selected with a code:



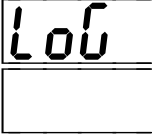






















Logic-code: 0	= on if programmed (without temp. prog.: controller on)
1	= off if controller is running
2	= threshold: on when sensor temp. 1 > limit in units
3	= threshold: off when sensor temp. 1 > limit in units
4	= threshold: on when sensor temp. 2 > limit in units
5	= threshold: off when sensor temp. 2 > limit in units
6	= threshold: on when sensor temp. 1 and 2 > limit in units
7	= threshold: off when sensor temp. 1 and 2 > limit in units
8	= time function: on when time in sector > limit in seconds
9	= time function: off when time in sector > limit in seconds
10	= time function: on when time in sector > limit in minutes
11	= time function: off when time in sector > limit in minutes
12	= operated via serial interface
13	= threshold: on when sensor 1 > set point 1 + limit in units
14	= threshold: off when sensor 1 > set point 1 + limit in units
15	= threshold: on when sensor 2 > set point 2 + limit in units
16	= threshold: off when sensor 2 > set point 2 + limit in units

For the codes 2 - 11 a limit must be set, too.

The codes 2 - 7 (temperature thresholds) work independent if the program is on or off. The codes 8 - 11 make sense only in relation with programs. They relay to the begin of a program section.

8.5. Configuration Of The Logic

Codes and limits are set in the configuration of the additional range "Logic" (see adaptation of the controller, configuration).

Step	Key	Indication	Function
1	 		Logic-range.
2			Setting the logic-code for output 1. For denotation see below.
3	 		
4			Setting the limit for output 1. Its denotation is set by the code of output 1.
5	 		Range: temperature: -200 to 3000°C times: 0 - 3000 sec. or min.
6			Setting the code for output 2. For denotation see below.
	 		
Step 7 - 15: analogue adjustment of codes and limits for the outputs 2 - 4.			
16			Setting the limit for output 4 . Its denotation is set by the code of output 4 .
17	 		Range: temperature: -200 to 3000°C times: 0 - 3000 Sec. or Min.
18			End of the logic-range. A new range can be selected with the arrow keys.

The range for the limits is always -200 to 3000. For codes 8 to 11 no negative values are allowed.

8.6. Operations With Logic At Temperature Programs

For every program sector it can be selected which of the 4 outputs shall be in function. These functions are selected with 0 for off and 1 for on.

Function of the codes in temperature programs:

Code	Function = 0 (off)	Function = 1 (on)
0	off in the whole sector	on in the whole sector
1	independent of the program: on if controller is off	
2	independent of the program: on when sensor 1 > threshold	
3	independent of the program: off when sensor 1 > threshold	
4	independent of the program: on when sensor 2 > threshold	
5	independent of the program: off when sensor 2 > threshold	
6	independent of the program: on when sensor 1 and 2 > threshold	
7	independent of the program: off when sensor 1 and 2 > threshold	
8	immediately off	on after delay (sec)
9	immediately off	on until delay (sec)
10	immediately off	on after delay (min)
11	immediately off	on until delay (min)
12	unabhängig vom Programm über die serielle Schnittstelle	
13	off	on when sensor 1 > set point 1 + threshold.
14	off	off when sensor 1 > set point 1 + threshold.
15	off	on when sensor 2 > set point 2 + threshold.
16	off	off when sensor 2 > set point 2 + threshold.

Display at program input:

4321
nnnn

outputs 1-4: function 0(off) or 1(on).

With software version 501A-139 all 6 additional relays can be controlled by the program.
















Display at program input:

L-65
4321

The relays which are switched on in this section are displayed with their number. If e.g. relay 3 is switched off in this section, the lower display reads '4 21'

8.7. Control Of The Logic Inputs And Outputs

To control the logic inputs and outputs follow the steps below :

Step	Key	Indication	Function
1	  for 3 seconds	 	Inputs 1 - 2 are displayed.
2	  up or down	 	Select the next display. (up or down). Inputs 1 - 2 are displayed
3	  up or down	 	Select the next display. (up or down). outputs 1 - 3 are displayed.
4	 for 3 seconds	 	Select the next display. (up or down). outputs 4 - 6 are displayed. Back to normal display

8.8. Example:

Configuration
Logic:

code 1:	(whole sector on or off)	0
threshold 1:	xxxx	
code 2:	(on when sensor temp. 1 > 120°C)	2
threshold 2:	120°C	
code 3:	(off when sensor temp. 2 > 100°C)	5
threshold 3:	100°C	
code 4:	(on when sector time > 120s)	8
threshold 4:	120s	

Program:

sector 1:	(output 1 off, time function 4 off)	relay = 0xx0
sector 2:	(outp. 1 on, outp. 4 delayed on)	relay = 1xx1
sector 3:	(outp. 1 off, outp. 4 on)	relay = 1xx0
sector 4:	(outp. 1 on, outp. 4 off)	relay = 0xx1

(x = no denotation)

9. Error Messages, Faults

9.1. Error Messages Of The Controller

When the controller is switched on it carries out various self-tests. If an error is found an error message is given.

In the event of errors "SYST" appears on the upper display and the lower display shows "Err" and a number. The numbers have following denotation:

Indication	Cause	Remedy
Err1	Data loss	Press Start/Stop button. The controller is initialised. The data entered by the user are erased and have to be re-entered.
Err2	Memory fault int. RAM	Switch controller off and on again.
Err3	Fault in the EEPROM	Switch controller off and on again.
Err4	Fault in the program memory	Switch controller off and on again.
Err5	Fault in the AD-converter	Switch controller off and on again.
Err6	EPROM is not compatible (Illegal manipulation on the controller).	Press the Start / Stop key. The controller is initialised. The data entered by the user are erased and have to be re-entered.
Err7	The controller is not calibrated	send it back to TECON together with the controllable.

If the error message appears repeatedly the unit must be sent to the manufacturers for repair.

9.2. Faults During Operation

9.2.1. The controller can not be started

The controller has been programmed for external start/stop (see page 35, System data level, digital input).

9.2.2. Actual value indication

The actual-value indication flashes with the indication of the programmed sensor: The sensor is not connected correctly, is defective or it does not concord with the programmed type.

The actual-value indication is wrong: The connected sensor does not concord with the programmed type.

Remedies: Check the sensor. Check the sensor programming. (Sensor level, sensor type see page 35).

9.2.3. The nominal value can not be set

Cause: The control range limits have not been set correctly (see par. 7, sensor level, controlling range below or above).

Or: The unit is programmed for external nominal value (see par. 7, level system data, analogue input).

Or: The controller works as slave with code 17 (see par. 7, level serial interface).

9.2.4. The control system is not functioning correctly

If the green LED with the arrow pointing upward is lit and the temperature does not rise, the heating is not connected correctly or it is not powerful enough. If the green LED with arrow pointing downward is lit and the cooling does not function, check the cooling system for correct functioning.

If the green LED with the arrow pointing upward does not indicate heating although the controller is switched on and the nominal value is above the actual value, the maximum temperature should be checked (see par. 7, level alarm data, maximum temperature).

The exceeding of the maximum temperature is only indicated when alarm code has been set accordingly (see par. 7, level alarm data, alarm code).

If the green LED with the arrow pointing downward does not indicate cooling although the controller is switched on and the nominal value is below the actual value, the set minimum temperature should be checked. (See par. 7, Level alarm data, minimum temperature).

The falling short of the minimum temperature is only indicated when an alarm code has been set accordingly (see par. 7, level alarm data, alarm code).

9.2.5. The controller can not be configured

The code for the entry of the configuring level was wrong. The code can be entered by the user and thus, also has to be managed by him. On a new unit the code is 0 The handling of the code is described under par. 7. Adaptation. If the code number has been lost, please contact the manufacturers.

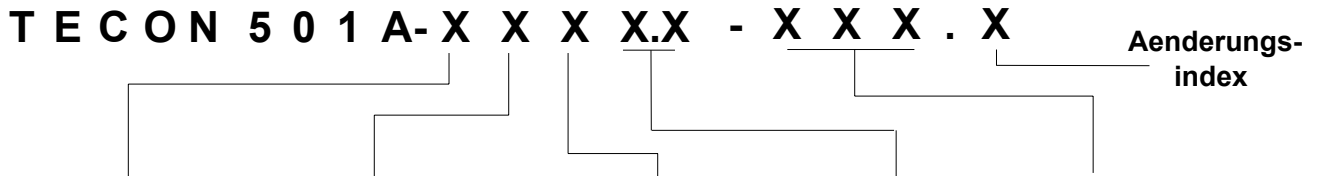
9.3. Repairs And Guarantee

If the user can not eliminate a fault the unit has to be sent to the manufacturers for repair. The unit must not be opened by the user nor must it be altered in any way.

The manufacturers guarantee faultless operation of the unit during one year after date of purchase. During this period a defective unit will be repaired at our works in Oberuzwil or it will be replaced, providing the damage is not caused by inappropriate use or by unauthorised manipulation. No other claims are recognised.

TECON 501 Universal Programmable Controller

10. Designation Code



Nr.	Input	Output		Analog. output		Option	Program Version
		1	2	1	2		
0	NiCr-Ni (K)	relay	relay	V	V	none	102: 6-steps
1	FeKo (J)	signal	relay	mA	V	dig. I/O ext. panel	122: Standard
2	PtRh10%(S)	relay	signal	V	mA	ext. printer	123: with logic.
3	PtRh13%(R)	signal	signal	mA	mA	galvanic sep. thermocouples	124: with clock
4	Pt100	current	relay			4 inputs, 6 outputs in out 230V relays 24V relays 230V signal 24V signal	125: with logic and clock
4.1							
4.2							
4.3							
4.4							
5	Pt100 + Z-Barr.	relay	current				139: with logic and clock (6 channels)
6	4-20mA	current	current				
7	0-20mA	signal	current				
8	NiSil (N)	current	signal				
9	PtRh18%(B)						

Ordering specifications:

Standard model:

Supply voltage 230 V, 50/60 Hz

Special execution
(please state in the order)

Supply voltage 115 V, 50/60 Hz
Supply voltage 24 V AC/DC

TECON 501 Universal Programmable Controller

11. Program Code

Nr.	Set point	Dwell time	Ramp	Logic Option	Follow. prog.	Rem.
1						
2						
3						
4						
5						
6						
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Nr.	Set point	Dwell time	Ramp	Logic Option	Follow. prog.	Rem.
51						
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99						

Code for programming: _____

12. List Of Adjustment Data

Alarm data	ALR
Maximum temp. 1	$\overline{AL1}$
Minimum temp. 1	$\underline{AL1}$
Over temp. 1	$\overline{AL1}$
Under temp. 1	$\underline{AL1}$
Alarm code 1	$ALC1$
Maximum temp. 2	$\overline{AL2}$
Minimum temp. 2	$\underline{AL2}$
Over temp. 2	$\overline{AL2}$
Under temp. 2	$\underline{AL2}$
Alarm code 2	$ALC2$
Alarm code 3	$ALC3$

System data	SY5
Display Code	$dl5P$
Ramp inclination	Prq
Digital input	$dl n$
Digital output	$dout$
R-code (controller type)	$rCod$
temperature threshold	$tCon$

Control parameters	PAR
Proportional band 1	$Pb1$
Integral time 1	$J1$
Differential time	$d1$
Relay interval time 1	$r1$
max. capacity 1	$PL1$
Proportional band 2	$Pb2$
Integral time 2	$J2$
Differential time 2	$d2$
Relay interval time 2	$r2$
max. capacity 2	$PL2$
Dead band	db
Offset set point contr. 2	$OFr2$
Set time servo motor	tY

Analogue in- and outputs	AI o
Code for analogue input	$AI nC$
Set point input lower limit	$AI n\underline{\quad}$
Set point input upper limit	$AI n\overline{\quad}$
Code 1. analogue output	$ALo1$
Range 1. analogue output	$RrAL1$
Lower limit output 1	$AI \underline{\quad}$
Upper limit output 1	$AI \overline{\quad}$
Code 2. analogue output	$ALo2$
Range 2. analogue output	$RrAL2$
Lower limit output 2	$AI \underline{\quad}$
Upper limit output 2	$AI \overline{\quad}$
Control output 1	$ICo1$
Lower limit 1	$Y1 \underline{\quad}$
Upper limit 1	$Y1 \overline{\quad}$
Control output 2	$ICo2$
Lower limit 2	$Y2 \underline{\quad}$
Upper limit 2	$Y2 \overline{\quad}$

Sensors	SEN
Sensor 1	$SEn1$
Current input 1, lower limit	$uuU1$
Current input 1, upper limit	$nnU1$
Nomin. value 1, lower limit	$\underline{\quad}1$
Nomin. value 1, upper limit	$\overline{\quad}1$
Filter 1	$FLt1$
Sensor 2	$SEn2$
Current input 2, lower limit	$uuU2$
Current input 2, upper limit	$nnU2$
Nomin. value 2, lower limit	$\underline{\quad}2$
Nomin. value 2, upper limit	$\overline{\quad}2$
Filter 2	$FLt2$

Serial interface	SEr
Unit address	$Adr.$
Code serial interface 1	$SEr.1$
Alarm time serial interface 1	$ALR.1$

Code for adaptation: _____

TECON 501 Universal Programmable Controller

Sensor correction		<i>Cor</i>
Correction code		<i>Cor</i>
1. Correct. sensor 1		<i>E1-1</i>
1. Correct. value sensor 1		<i>[1-1]</i>
2. Correction sensor 1		<i>E1-2</i>
2. Correct. value sensor 1		<i>[1-2]</i>
3. Correction sensor 1		<i>E1-3</i>
3. Correct. value sensor 1		<i>[1-3]</i>
4. Correction sensor 1		<i>E1-4</i>
4. Correct. value sensor 1		<i>[1-4]</i>
5. Correction sensor 1		<i>E1-5</i>
5. Correct. value sensor 1		<i>[1-5]</i>
6. Correction sensor 1		<i>E1-6</i>
6. Correct. value sensor 1		<i>[1-6]</i>
7. Correction sensor 1		<i>E1-7</i>
7. Correct. value sensor 1		<i>[1-7]</i>
8. Correction. sensor 1		<i>E1-8</i>
8. Correct. value sensor 2		<i>[1-8]</i>
1. Correction sensor 2		<i>E2-1</i>
1. Correct. value sensor 2		<i>[2-1]</i>
2. Correction. sensor 2		<i>E2-2</i>
2. Correct. value sensor 2		<i>[2-2]</i>
3. Correction . sensor 2		<i>E2-3</i>
3. Correct. value sensor 2		<i>[2-3]</i>
4. Correction sensor 2		<i>E2-4</i>
4. Correct. value sensor 2		<i>[2-4]</i>
5. Correction sensor 2		<i>E2-5</i>
5. Correct. value sensor 2		<i>[2-5]</i>
6. Correction sensor 2		<i>E2-6</i>
6. Correct. value sensor 2		<i>[2-6]</i>
7. Correction sensor 2		<i>E2-7</i>
7. Correct. value sensor 2		<i>[2-7]</i>
8. Correction. sensor 2		<i>E2-8</i>
8. Correct. value sensor 2		<i>[2-8]</i>

Offsets	<i>OFF</i>
Offset sensor 1	<i>ol 1</i>
Offset sensor 2	<i>ol 2</i>
Offset analogue input	<i>ol 3</i>

7-day Clock (Option)	<i>El nE</i>
on 1 (switch on 1st day)	<i>on 1</i>
off 1 (switch off 1st day)	<i>off 1</i>
on 2 (switch on 2nd day)	<i>on 2</i>
off 2 (switch off 2nd day)	<i>off 2</i>
on 3 (switch on 3rd day)	<i>on 3</i>
off 3 (switch off 3rd day)	<i>off 3</i>
on 4 (switch on 4th day)	<i>on 4</i>
off 4 (switch off 4th day)	<i>off 4</i>
on 5 (switch on 5th day)	<i>on 5</i>
off 5 (switch off 5th day)	<i>off 5</i>
on 6 (switch on 6th day)	<i>on 6</i>
off 6 (switch off 6th day)	<i>off 6</i>
on 7 (switch on 7th day)	<i>on 7</i>
off 7 (switch off 7th day)	<i>off 7</i>
on A (switch on every day)	<i>on A</i>
off A (switch off every day)	<i>off A</i>

additional channels (Option)	<i>LoG</i>
Code output 1	<i>Lcd 1</i>
Limit output 1	<i>Li n 1</i>
Code output 2	<i>Lcd 2</i>
Limit output 2	<i>Li n 2</i>
Code output 3	<i>Lcd 3</i>
Limit output 3	<i>Li n 3</i>
Code output 4	<i>Lcd 4</i>
Limit output 4	<i>Li n 4</i>