



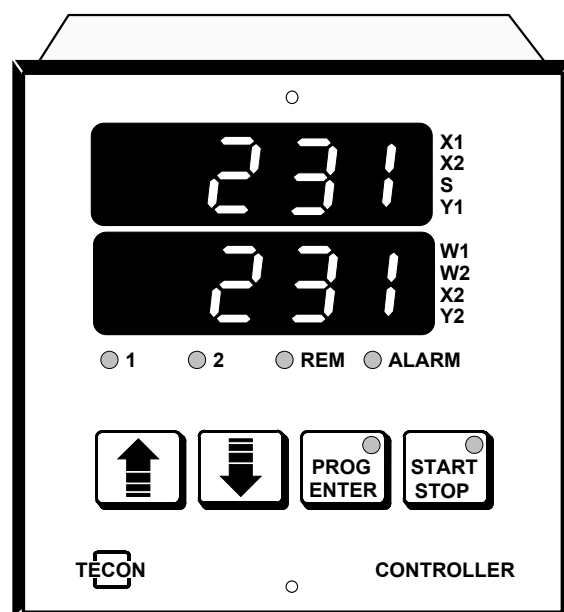
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Instruction manual

**UNIVERSAL
 DIGITAL CONTROLLER**

TECON 231

Program 231 - 012.1



UNIVERSAL DIGITAL CONTROLLER TECON 231

Contents:

1. Safety regulations	3
1.1. Purpose of application of the unit.....	3
1.2. Range of application	3
1.3. Control range	3
1.4. Maximum and minimum temperature.....	3
1.5. Operating safety of the control system.....	3
1.6. Instruction, Manipulations on the unit.....	3
2. Technical data, functions	4
2.1. Overview	4
2.2. Method of function	6
3. Installation.....	8
3.1. Connections	8
3.2. View of back wall:.....	8
3.3. Dimension sketch.....	9
3.4. Connection of the sensors	9
3.5. Mounting	10
3.6. Dismounting	10
4. Operation of the controller.....	11
4.1. Indicating and operating elements	11
4.2. Setting the nominal value.....	11
4.3. Starting the controller	11
4.4. Stopping the control function.....	11
4.5. Alarm.....	11
4.6. Procedure in case of a power down	12
4.7. Function check	12
4.8. Control quality	12
4.9. Indication of software version, alarms and system errors	12
5. Adapting the controller	13
5.1. Possibilities	13
5.2. Adaptation within the protected range.....	14
5.3. Alarm data.....	15
5.4. Serial interface	18
5.5. Sensors.....	19
5.6. Control parameters	22
5.7. System configuration.....	24
5.8. Analog inputs and outputs.....	27
5.9. Jumper settings for analog input and outputs :	30
5.10. Offsets.....	31
6. Serial interface	32
6.1. General	32
6.2. Operation with higher ranking control unit:.....	32
7. Error messages, faults	34
7.1. Error messages of the controller	34
7.2. Faults during operation	34
7.3. Repairs and guarantee.....	35
8. Designation code:	36
9. List of adjustment data	37

1. Safety regulations

1.1. Purpose of application of the unit

The TECON 231 is designed to control various systems. The unit is fitted with a 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 type description 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 19 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 15 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. Technical data, functions

2.1. Overview

Temperature sensors	Thermocouples:	Measuring range:
	NiCr-Ni (K)	-200 to 1200 °C
	Fe-Co (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
	Resistor:	
	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°C	
0- 20 mA	-200 to 2000°C	
Temperature measurement	Accuracy :	0.3% of the range
	Resolution :	32000 points
	Number of measurements per second	10
Actual-value indication:	Indication :	4 digits, LED 14 mm height
	Resolution:	programmable, max. 0.1 units
	Range :	according to selected sensor
Nominal value	Indication :	4 digits, LED 14 mm height
	Resolution :	programmable, max. 0.1 units
	Range :	can be adjusted and limited
	Entry :	with 2 keys or through external analog signal or via die serial interface
Limit value	Following values can be programmed and indicated and alternatively be sent to an output:	
	- Maximum temperature	
	- Minimum temperature	
	- Deviation from nominal value upward	
	- Deviation from nominal value downward	
	- 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 units
	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 units

UNIVERSAL-DIGITAL CONTROLLER TECON 231

Outputs	2 controller outputs alternatively: - Relay contact (normally open contact) 230 V, 2 A - signal output for thyristors etc. 24 V, 20 mA - continuous current output 4-20 mA or 0-20 mA 1 Limit-value output: - relay contact (change-over contact) 230 V, 2 A
Analog outputs	Sensor temperature, nominal value, control deviation or control signal (capacity) programmable on 2 outputs 1mV/°C range -0.2 V to 2.0 V (min.10 kΩ) 10mV/°C range -2.0 to 10.0 V (min.10 kΩ) Voltage programmable 0 to 10 V (min.10 kΩ) Current programmable 4-20 mA or 0-20 mA (max.500 Ω) Resolution of the DA-converter 8000 points
Digital input	for external controlling of the control unit 24 V, 20 mA programmable
Digital output	for external linkage of the controller 24 V, 20 mA programmable
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 - handshake none
Special executions	TECON programs the controller according to specifications as required by the customer
Mains supply	alternately 230/115 V, 50/60 Hz, 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 case can be exchanged from the front, can be mounted in any position mounting depth 125 mm front panel cut-out 92 x 92 mm front panel thickness 1 to 3.5 mm (without rubber seal) 2 to 4.5 mm
Weight	approx. 0.6 kg
Type of protection	Panel IP 64 Enclosure IP 20
Safety EMC	EN 60065 pr EN 50 082-2 EN 50 081-1

2.2. Method of function

The TECON 231 controller contains 2 PID controllers which, according to requirements, can form one controller for heating and one for cooling, 2 controllers for heating, or 2 controllers for cooling. However, if the controller is used for 2 control systems both systems work with the same nominal value and both are started and stopped together (2-zone control).

The controller can switch heaters on and off directly via thyristors or relays and can control the heating capacity by changing the pulse-spacing ratio. But also a servo motor can be controlled via the two outputs. Continuous final control elements, such as control valves or phase control systems, can be actuated via the current outputs or one of the two analog outputs.

If the controller has to function within a higher ranking system it can be linked in various manners. The nominal value can be applied as analog signal. Nominal value and actual value, the difference between nominal value and actual value and the correcting variable (capacity) are available in form of analog values. A digital input can be used for external controlling and a digital output signals the condition of the controller. The values of the nominal and actual temperature, the correcting variable, the controller condition, the alarm data and of the control parameters can be polled and entered via the serial interface.

The range of control can be programmed. A relay contact is available as output for various monitoring systems. It can be set for a fixed temperature threshold, or for a certain deviation of the temperature from the nominal. Whether the function is to be used as an alarm or merely as a message to control other devices, can be selected, since the alarm indications can be suppressed. If a band around the set-point is monitored, it can be selected whether the controlled value has to be within the band before an alarm is generated or not.

To protect the controlled system, ramps can be set to limit the changing rate of the controlled value.

Proportional Band depending on the set point:

If the power requirement of the plant to be controlled is set point dependent, the proportional band and therefore the open-loop gain can be determined by the set point. 2 boundaries can be set, in between is interpolated linear.

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Example: Set point boundary below: 20° P-Band below: 50°
Set point boundary above: 220° P-Band above: 10 °C
at set point = 70° a P-Band of 40° results.

If this adaptation is not needed, both proportional bands are to be set to the same value. The self adaptation also sets both values equal.

Feedforward circuit:

If the controlling is depending from known size, it is reasonable, to feed it into the arrangement. It can be connected at the analog input, its form is programmable (see page 27).

Function:

linear connection: Power variation = input signal x. (boundary above - boundary below)

example: Code for analogous input: 8
input boundary above 50
input boundary below 0
increase of power in the case of input signal = 12 milliamperes: 25%

the connection can also occur as a square:

$$\text{Power variation} = \frac{(\text{input signal x. (boundary above - boundary below)})^2}{(\text{area boundary above - area boundary below})}$$

example: Code for analogous entry: 11
input boundary above 50
input boundary below 0
increase of power in the case of input signal = 12 milliamperes: 12.5%

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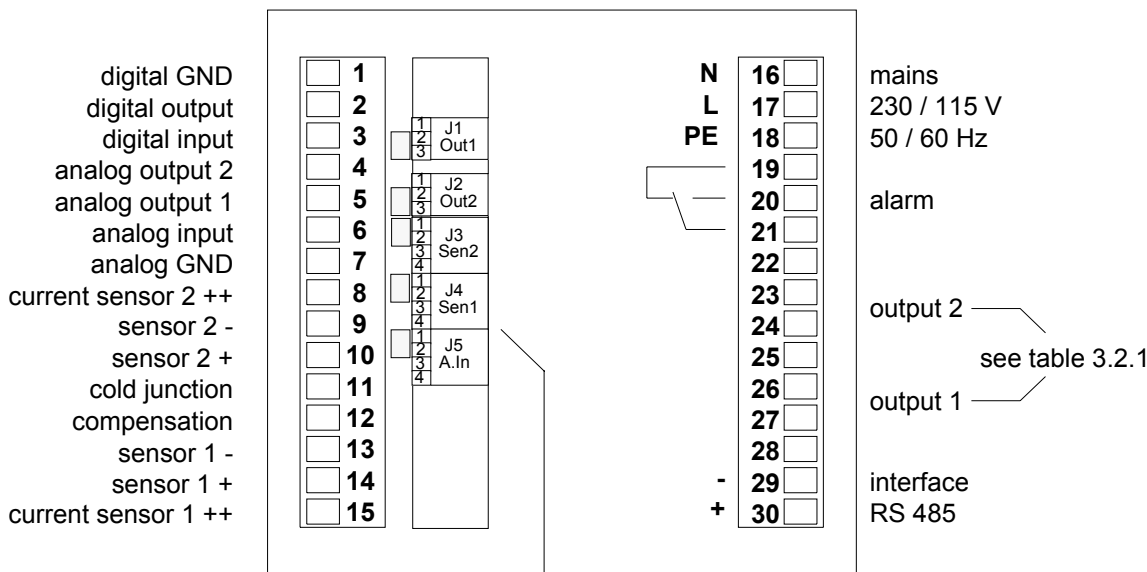
3. Installation

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. View of back wall:



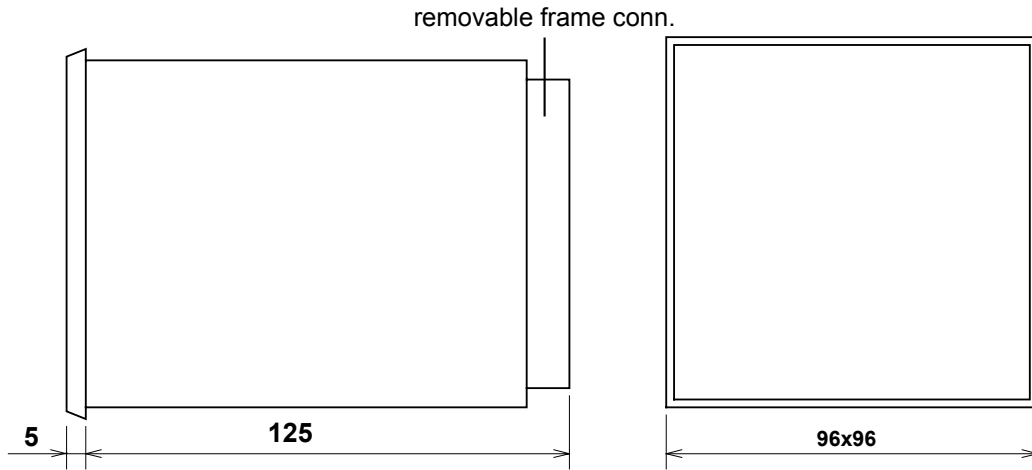
Jumper for modifying sensors , analog input and analog outputs

3.2.1. Controller output 1 and 2:

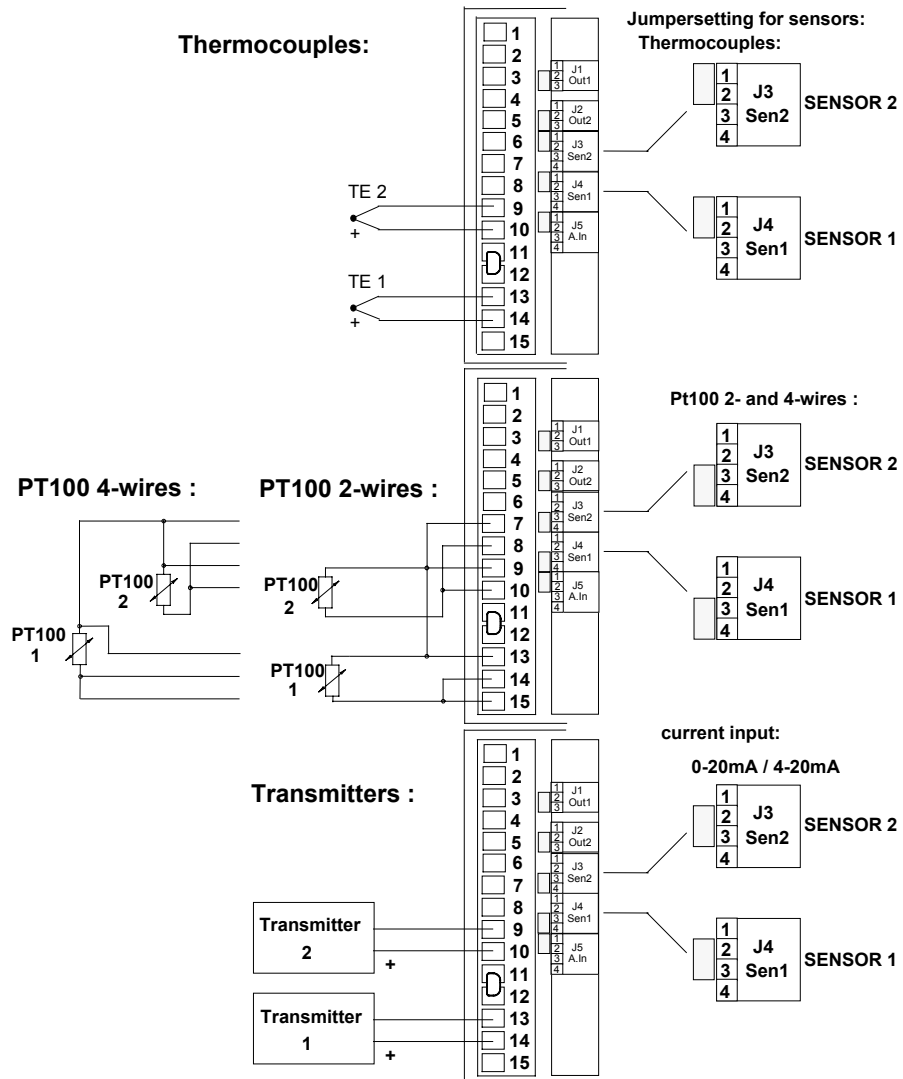
Designation Code: 230- XXX .X-XXX.X	output 1	output 2
0	26 <input type="checkbox"/> Relay contact 27 <input type="checkbox"/> Relay contact	23 <input type="checkbox"/> Relay contact 24 <input type="checkbox"/> Relay contact
1	26 <input type="checkbox"/> signal 24V 27 <input type="checkbox"/> signal 24V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

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3.3. Dimension sketch



3.4. Connection of the sensors



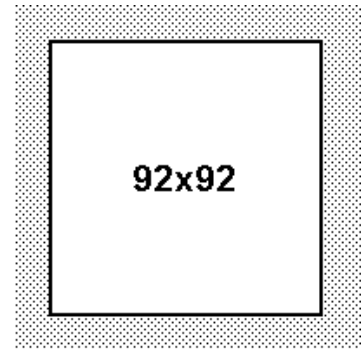
3.5. Mounting

Cut-out of control panel: : 92 x 92 mm
Thickness of 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.

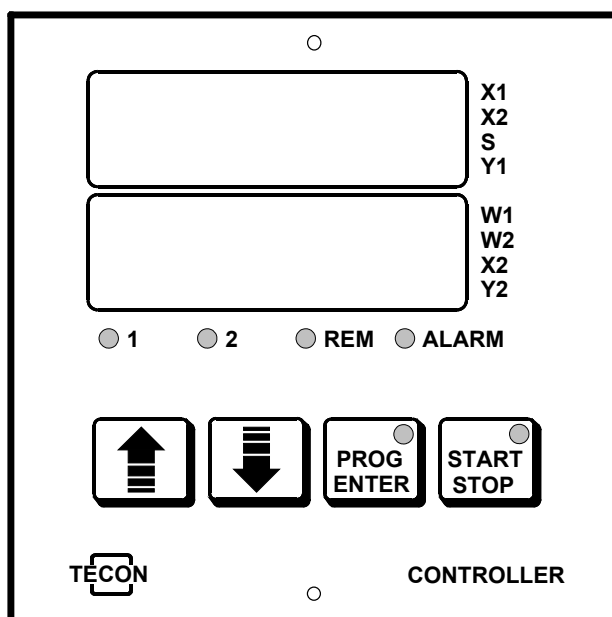
3.6. Dismounting

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



4. Operation of the controller

4.1. Indicating and operating elements



Upper indication
(LED, according to selected indication)

X1: Actual value 1
X2: Actual value 2
S: System data (configuration)
Y1: Performance 1

Lower indication

W1: Nominal value 1
(Led flash rampevalue 1)
W2: Nominal value 2
(Led flash rampevalue 2)
X2: Actual value 2
Y2: Performance 2

4 LED's for function check :

1 : condition of controller 1
2 : Condition of controller 2

REM : interface active

ALARM : Condition of alarm relay

START : Control system switched on

4 keys for operation

4.2. Setting the nominal value
with the keys



4.3. Starting the controller
with key

The LED in the key 'START/STOP' indicates that the control unit is on



4.4. Stopping the control function
with key

When ramps are programmed (see system data, page 25) , the nominal value first runs over this inclination towards 20°C and the control system does not switch off before this has been reached within ±10°C. During this time the LED 'ON' flashes at short intervals.

When the control system is switched off, the LED in the key 'START/STOP' is not lit.



4.5. Alarm

When an alarm is triggered the red LED indicated with Alarm lights up. At the same time the alarm indication flashes on the upper display providing the indication has been programmed with the relevant alarm code (see page 15). The alarm is acknowledged with the key



4.6. Procedure in case of a power down

After the power has been restored the controller continues running at the same condition as before the power down event. An alarm is triggered if such has been configured (Alarmcode 3).

4.7. Function check

When the control system is running the LED '1' shows that the first controller is switched on. The LED '2' shows the condition of the 2nd controller. The current output can be polled with key



If 2 individual controllers have been programmed their values can also be polled with key



4.8. Control quality

In case the controlling quality is not up to standard it is advisable to adapt the parameters. To that end see page 22 ff.

However, the controller can perform this adaptation also of its own accord if following conditions have been fulfilled:

- No ramp must be run during start-up.
- The difference between starting temperature and the set nominal value must be 5% bigger than the adjusted control range and higher than 10°C.
- The nominal value must not be altered during the adaptation process.
- The controller is not operating with external nominal value.
- Adaptation is only possible for the heating parameters, and only when controller 1 has been configured as heating controller.

When these conditions are fulfilled the controller performs the adaptation when the 'START/STOP' key is pressed for at least 3 seconds. The adaptation is indicated by the flashing of the LED in the key 'START/STOP'.

4.9. Indication of software version, alarms and system errors

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

231-

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

0116

(Alarm programming see page 15).

-0[

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

nnnn

The code of the error numbers is given in 'Error messages, faults' on page 34.

545t

Err.2

5. Adapting the controller

5.1. Possibilities

The temperature controller can be adapted to the specific case of application within wide limits. The adaptation takes place within code protected areas for:

- alarm data
- serial interface
- sensors
- control parameters
- system data
- analog inputs and outputs
- offsets

5.1.1. Alarm data

The conditions under which the alarm relay should switch and when an alarm indication has to take place can be programmed with alarm codes for the two sensor inputs and a code for the general alarm routine. Since the alarm indication and acknowledgement can be switched off, the two different alarm values can also be used for temperature related releases and interlockings.

5.1.2. Serial interface

The transmitting data, the device address and an alarm time for stopping the control in the event of failure of the connection, can be adjusted for linking with other controllers or with higher ranking systems.

5.1.3. Sensors

The type of sensor used and the nominal-value range can be determined.

5.1.4. Controlling parameters

Here, those values are entered for the two controllers, which are determinative according to the system to be controlled, such as:

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

5.1.5. System data

Here, the type of indication, type of program sequence and the digital in- and outputs are determined.

5.1.6. Analog inputs and outputs

The available additional analog input can be configured within wide limits for an external nominal-value input (see page 27).

The two analog outputs can be programmed in relation with the value to be represented, as well as with the range.

5.1.7. 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.

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5.2. Adaptation within the protected range

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 checked and not altered. The factory-set code = 0, though, it can be changed to any figure by the user.


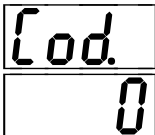

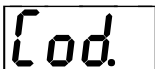




The 7 data ranges are selected by means of the arrow keys (forward or backward)

The operating level can be accessed again at any time by pressing the 'ENTER' 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 'ENTER' key for a short instant switches the display and the entry one step forward within a data range.

If the 'ENTER' key is pressed between 1 and 2 seconds the display and the entry are switched back one step.

5.2.1. Access to configuration

Step	Press key	Indication	Function
1	 simultan. for 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			The code is acknowledged and if correct, can now be readjusted. If the code was wrong these two steps are skipped.
3			
4			The code which was reprogrammed at step 3 is now valid. Now the required data range can be selected.

5.2.2. Selection of the data range



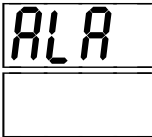

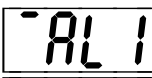




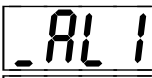




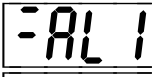




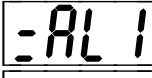







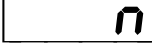

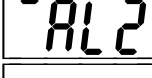













The data range is selected with the arrow keys (forward and backward)

- ALA = alarm data
- SER = serial interfaces
- SEN = sensors
- PAR = control parameter
- SYS = system configuration
- A.IO = analog inputs and outputs
- OFF = offsets (correction of the actual-value measurement and the external nominal value)


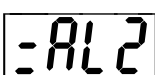




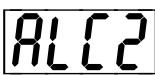








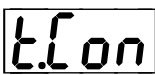






The 'ENTER' key gives access to the data of the selected range.

The data are stored in the controller. It is recommendable to record these also in print. See the list of adjustment data, page 37.

5.3. Alarm data

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

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Step	Press key	Indication	Function															
18			Setting the under actual-value-difference alarm limit 2.															
19	 		When the actual value exceeds the nominal value by this amount alarm is set off. Range : 0- 99 unit (0=alarm is switched off)															
20			Setting the alarm code for sensor 2. For denotation see following table.															
21	 																	
22			Setting the alarm code 3.															
23	 		<table style="width: 100%; border: none;"> <tr> <td style="width: 10%;">Code</td> <td style="width: 50%;">power on condition</td> <td style="width: 40%;"></td> </tr> <tr> <td>0,4</td> <td>no alarm</td> <td></td> </tr> <tr> <td>1,5</td> <td>alarm</td> <td></td> </tr> <tr> <td>2,6</td> <td>no alarm</td> <td>controller off</td> </tr> <tr> <td>3,7</td> <td>alarm</td> <td>controller off</td> </tr> </table> <p>Code 0 - 3: Bandalarm only after the band was reached.</p>	Code	power on condition		0,4	no alarm		1,5	alarm		2,6	no alarm	controller off	3,7	alarm	controller off
Code	power on condition																	
0,4	no alarm																	
1,5	alarm																	
2,6	no alarm	controller off																
3,7	alarm	controller off																
24			Setting the threshold value (value.contact).															
25	 		If sensor 2 has been programmed the threshold relates to this, otherwise to sensor 1. Range : according to selected sensor (see code for digital output, page 25)															
26		 	End of the alarm data range. A new range can be selected with the arrow keys.															

5.3.1. Alarm code table for codes 1 and 2:

Code	Function	Indication
0	Alarm is switched off	none
1,5	The alarm relay is open as long as the alarm conditions are fulfilled. Acknowledgement is not possible.	none
2,6	As for 1, but the alarm indication can be acknowledged; the alarm relay is not effected by the acknowledgement.	yes
3,7	The alarm relay is released when the alarm condition ensues and remains released until acknowledged, also when the alarm condition is eliminated.	yes
4,8	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

Alarm code > 4: Alarm with controlling switched off, too

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

UNIVERSAL-DIGITAL CONTROLLER TECON 231



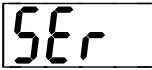







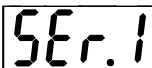


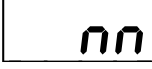






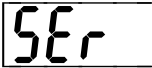

5.3.2. Alarm band alarm

With the 2 difference values, a band on both sides of the setpoint can be checked. To get an alarm, the actual value must first be within the monitored range. The alarm comes up if the actual value leaves the band. If the setpoint is altered, the condition must be fulfilled again (programmable, see alarm code 3).

5.3.3. Alarm types and indications in their sequence of priority:

Alarm type	Indication	Alarm condition
1. Power on	P-on	power down
2. Sensor break	Sensor symbol	the relevant sensor does not supply a valid signal
3. Maximum value 1	¬AL1	Value sensor 1 > programmed alarm value
4. Minimum value	_AL1	Value sensor 1 < min. alarm
5. Overtemperature 1	= AL1	Value sensor 1 exceeds nominal value by more than the programmed value
6.Undertemperature 1	= AL1	Value sensor 1 falls below the nominal value by more than the programmed value
7. Maximum value 2	¬AL2	Value sensor 2 > programmed alarm value
8. Minimum value 2	_AL2	Value sensor 2 < min.alarm
9. Overtemperature 2	= AL2	Value sensor 2 exceeds the nominal value by more than the programmed value
10.Undertemperature 2	= AL2	Value sensor 2 falls below the nominal value by more than the programmed value
11. Serial interface	SER 1	Timeout of the serial interface

5.4. Serial interface





















Step	Press key	Indication	Function
1	 	 	Range serial interface
2			Setting the unit address. Range: 0 - 31
3	 		
4			Setting the code of the 1st serial interface. For denotation see code table below.
5	 		
6			Setting the monitoring time of the 1st interface in seconds. If no message is identified at the interface after this interval (e.g. because of wire break) the control system switches off, the relay falls off and on the display "Ser.1" flashes.
7	 		Range : 0 - 1000 seconds. 0 = monitoring switched off.
8		 	End of range serial-interface. A new range can be selected with the arrow keys.

5.4.1. Code table for the serial interface


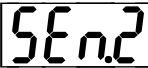



















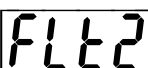

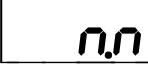



Value	Adr.	Function
0	--	off (no data are received or emitted)
1	99	master, emits nominal value 1
2	--	not used
3	99	slave without reply, regards start/stop, nominal value
4	99	slave without reply, regards start/stop, nom. value = progr. nom. value + master nom. value
5-15	--	not used
16	0-31	Slave regards all commands and replies, intervention at controller possible
17	0-31	Slave regards all commands and replies, no intervention at controller possible

If the controller is operated with function code 16 and in combination with non-TECON units, we recommend to request the description "Serial standard interface of the TECON controllers".

5.5. Sensors

Step	Press key	Indication	Function																																				
1	 	SEn []	Sensor range																																				
2		SEn.1	Adjusting the first sensor.																																				
3	 	nnnn	<table border="1"> <thead> <tr> <th>Sensor</th> <th>Range</th> <th>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>200 - 1600 °C</td> <td>PT13</td> </tr> <tr> <td>Pt100</td> <td>-200 - 750 °C</td> <td>P100</td> </tr> <tr> <td>Pt100 on 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 unit</td> <td>4-20</td> </tr> <tr> <td>0-20 mA</td> <td>-200 -2000 unit</td> <td>0-20</td> </tr> <tr> <td>PtRh18% (B)</td> <td>200 - 1800 °C</td> <td>PT18</td> </tr> <tr> <td>Nicrosil-Nisil (N)</td> <td>-200 - 1200 °C</td> <td>NISI</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)	200 - 1600 °C	PT13	Pt100	-200 - 750 °C	P100	Pt100 on 84-Ohm	-200 - 400 °C	P184	Z-Barrier			4-20 mA	-200 -2000 unit	4-20	0-20 mA	-200 -2000 unit	0-20	PtRh18% (B)	200 - 1800 °C	PT18	Nicrosil-Nisil (N)	-200 - 1200 °C	NISI
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4		uuu	This indication only appears when a current input is used for sensor.																																				
5	 	nnnn	Adjusting the lower limit of the current input. Range : -200 to 2000 unit																																				
6		nnn	This indication only appears when a current input is used for sensor.																																				
7	 	nnnn	Adjusting the upper limit of the current input. Range : -200 to 2000 unit																																				
8		---	Adjusting the lower limit of the 1st control range. This control range limits the nominal-value input.																																				
9	 	nnnn																																					
10		---	Adjusting the upper limit of the 1st control range. This control range limits the nominal-value input.																																				
11	 	nnnn																																					
12		FLt	Adjustment of the filter constant for sensor 1. Function: See table below Range: 0 to 99 (0 = filter off)																																				
13	 	nn																																					

UNIVERSAL DIGITAL CONTROLLER TECON 231

Step	Press key	Indication	Function																																				
14			Adjusting the second sensor.																																				
15			<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 indication</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>200 - 1600 °C</td> <td>PT13</td> </tr> <tr> <td>Pt100</td> <td>-200 - 750 °C</td> <td>P100</td> </tr> <tr> <td>Pt100 on 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 unit</td> <td>4-20</td> </tr> <tr> <td>0-20 mA</td> <td>-200 -2000 unit</td> <td>0-20</td> </tr> <tr> <td>PtRh18% (B)</td> <td>200 - 1800 °C</td> <td>PT18</td> </tr> <tr> <td>Nicrosil-Nisil (N)</td> <td>-200 - 1200 °C</td> <td>NISI</td> </tr> </tbody> </table>	Sensor	Range	lower indication	NiCr-Ni (K)	-200 - 1200 °C	CA	FE-Co (J)	-200 - 750 °C	FECo	PtRh10% (S)	0 - 1600 °C	PT10	PtRh13% (R)	200 - 1600 °C	PT13	Pt100	-200 - 750 °C	P100	Pt100 on 84-Ohm	-200 - 400 °C	P184	Z-Barrier			4-20 mA	-200 -2000 unit	4-20	0-20 mA	-200 -2000 unit	0-20	PtRh18% (B)	200 - 1800 °C	PT18	Nicrosil-Nisil (N)	-200 - 1200 °C	NISI
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20			Setting the lower limit of the 2nd control range. This control range limits the nominal-value input.																																				
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22			The upper limit of the 2nd control range is being set. This control range limits the nominal-value input.																																				
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26		 	End of sensor range. A new range can be selected with the arrow keys.																																				

UNIVERSAL-DIGITAL CONTROLLER TECON 231

Filter code:



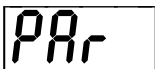
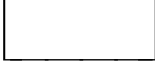











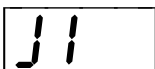




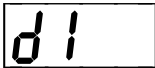




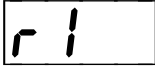




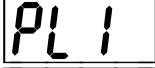








X X

	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












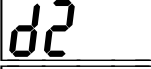




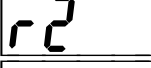




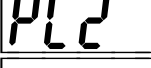












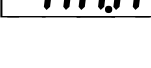

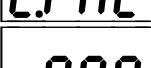




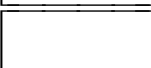
Spike suppression: If the measured value changes between 2 measurements (interval 0.1 s) more than the value of spike suppression, the measured value is not considered. At the completion of the suppression time, the measured value is however always accepted.

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.

5.6. Control parameters

Step	Press key	Indication	Function
1	 	 	Parameter range.
2			Setting the proportional band for controller 1, lower limit of set point range. Within the proportional band the output is controlled in proportion to the deviation between nominal and actual value. Range: 0 - 999 unit (0 = on/off controller)
3	 		
4			Setting the proportional band for controller 1, upper limit of set point range. Within the proportional band the output is controlled in proportion to the deviation between nominal and actual value. Range: 0 - 999 unit (0 = on/off controller) P-band low and high = 0: 0n/ff with hystereses, see 'dead band'
5	 		
6			Setting the lag time time 1 (integral). With the lag time the deviation caused by the proportional control is compensated. Range: 0 - 9999 seconds (0 = no integral action).
7	 		
8			Setting the lead time (differential) 1. The lead time effects in switching off before the nominal value is reached, thus avoiding overshoot. Range: 0 - 999 seconds (0 = no differential action).
9	 		
10			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.
11	 		
12			Setting the maximum output 1 (in %). The output rating can be limited so as to obtain a smoother controlling effect. Range: 10 - 100%
13	 		
14			Setting the proportional band for controller 2, lower limit of set point range. Within the proportional band the output is controlled in proportion to the deviation between nominal and actual value. Range: 0 - 999 unit (0 = on/off controller)
15	 		




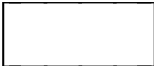




















UNIVERSAL-DIGITAL CONTROLLER TECON 231

Step	Press key	Indication	Function
16			Setting the proportional band for controller 2, upper limit of set point range. Within the proportional band the output is controlled in proportion to the deviation between nominal and actual value. Range: 0 - 999 unit (0 = on/off controller, hystereses see 'dead band')
17	 		
18			Setting the lag time time 2 (integral). With the lag time the deviation caused by the proportional control is compensated. Range : 0 - 9999 seconds (0=no integral action).
19	 		
20			Setting the lead time (differential) 2. The lead time effects in switching off before the nominal value is reached, thus avoiding overshoot Range: 0 - 999 seconds (0= no differential action).
21	 		
22			Setting the relay interval-time 2. With quasi-proportional control with constant interval time, the output is controlled by changing the pulse-pause ratio. Range: 1 - 999 seconds.
23	 		
24			Setting the maximum output 2 (in %). The output rating can be limited so as to obtain a smoother controlling effect. Range: 10 - 100%
25	 		
26			Setting the dead band. Within this band, between heating and cooling, neither heating nor cooling is active (active only with controller type 0 or 1, all others: if p-band = 0, it is the hystereses). Range: 0 - 99.9 unit
27	 		
28			Setting the nominal-value offset. With controller type 6, 7 the nominal value of the 2nd controller is offset from the 1st controller by the amount entered here. Controller types 16 to 21, it is the offset of threshold Range: -99.9 to 99.9 unit.
29	 		
30			Setting the actuator time. With controllers type 10 to 15 the actuator time must be entered. This influences the duration of the control pulses. Range: 1 - 999 seconds.
31	 		
32			End of the parameter range. A new range can be selected with the arrow keys.










UNIVERSAL DIGITAL CONTROLLER TECON 231

5.7. System configuration

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

Step	Press key	Indication	Function
1	 	 	System-data range.
2			Setting the display code 1.
3	 		Code temp.-controller, universal-controller
			00 1°C 1 corresponds to 1 unit
			01 1°C 0.1 corresponds to 1 unit
			02 1°C 0.01 corresponds to 1 unit
			03 1°C 0.001 corresponds to 1 unit
			10 0.1°C 10 corresponds to 1 unit
			11 0.1°C 1.0 corresponds to 1 unit
			12 0.1°C 0.10 corresponds to 1 unit
			13 0.1°C 0.010 corresponds to 1 unit
4			Setting the display code 2.
5	 		Code upper display, lower display
			0 actual value 1 end set value 1
			1 actual value 1 rampe set value 1
			2 actual value 2 end set value 2 (2)
			3 actual value 2 rampe set value 2 (2)
			4 actual value 1(1) actual value 2 (1)
			5 output 1 output 2 (2)
			6 no automatic switch-over to normal indication.
			(1): Indication only when sensor is fitted
			(2): Only with controller code 6 or 7
6			Setting of the ramp for increasing controlled value.
7	 		Range : 0.0 - 999.9 unit/h When 0 is set the controller directly goes to the set nominal value.
8			Setting the ramp for decreasing controlled value.
9	 		Range : 0.0 - 999.9 unit/h When 0 is set the controller directly goes to the set nominal value.









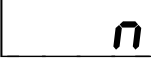











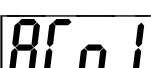



UNIVERSAL-DIGITAL CONTROLLER TECON 231

Step	Press key	Indication	Function																																																																																												
10			Setting the code for the digital input.																																																																																												
11	 	<div style="border: 1px solid black; padding: 2px; display: inline-block;">di n</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">n</div>	<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>0</td><td>Control function off when ext. contact closed.</td></tr> <tr><td>1</td><td>Control function on when ext. contact closed.</td></tr> <tr><td>2</td><td>Control function off when ext. contact open</td></tr> <tr><td>3</td><td>Control function starts and stops with ext. pulse</td></tr> <tr><td>4</td><td>switch between two nominal values (contact open: nominal value 1, contact closed: nominal value 2).</td></tr> <tr><td>5</td><td>as 3, but the controlling is always on</td></tr> <tr><td>6</td><td>if the contact is closed the nominal value offset is set to zero</td></tr> <tr><td>6</td><td>if the contact is closed the int. value is active, if the contact is open the ext. value is active.</td></tr> </tbody> </table>	Code	Function	0	Control function off when ext. contact closed.	1	Control function on when ext. contact closed.	2	Control function off when ext. contact open	3	Control function starts and stops with ext. pulse	4	switch between two nominal values (contact open: nominal value 1, contact closed: nominal value 2).	5	as 3, but the controlling is always on	6	if the contact is closed the nominal value offset is set to zero	6	if the contact is closed the int. value is active, if the contact is open the ext. value is active.																																																																										
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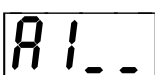



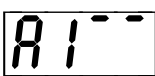



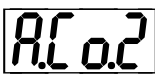



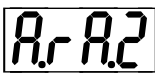

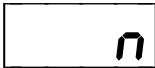
UNIVERSAL DIGITAL CONTROLLER TECON 231

Step	Press key	Indication	Function
			Code 1 + 2: 1 controller with 2 sets of parameters. If p-band = 0, it is an on/off-controller with a hystereses of 1 unit. Code 6 + 7: 2-Zone-Controlling : 2 controllers use the same setpoint. The setpoint of controller 2 can be shifted with parameter "Offset nominal value controller 2". Code 8 + 9: Controller for heating with 2 stages Code 10 - 15: With controlling switched off: 10, 11: no output on 12, 13: output 2 on 14, 15: output 1 on Code 16 + 17: Heating with threshold on sensor 1 Code 18 + 19: Cooling with threshold on sensor 1 Code 20: Heating with threshold on sensor 2 Code 21: Cooling with threshold on sensor 2 Controller 1 is a normal PID-controller. Controller 2 is an on-off-controller, its setpoint can be shifted with the parameter "Offset nominal value controller 2". The hystereses is set with the parameter "dead band".
	Contr.-Code 16-21: Relay on Hystereses Relay off Offset pos. Set point Offset neg. Relay off Hystereses Relay on		
16			End of the system range. A new range can be selected with the arrow keys.


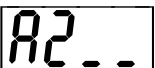









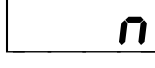

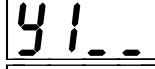



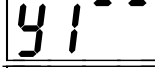





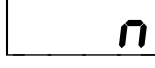




5.8. Analog inputs and outputs

Step	Press key	Indication	Function																												
1	 	 	Range analog inputs and outputs.																												
2			Setting of the analog input. (External nominal-value input.)																												
3	 		<table border="1"> <thead> <tr> <th>Code</th> <th>Range</th> </tr> </thead> <tbody> <tr><td>0</td><td>Nominal value input switched off</td></tr> <tr><td>1</td><td>1 mV/unit</td></tr> <tr><td>2</td><td>10 mV/unit</td></tr> <tr><td>3</td><td>0 - 10 V</td></tr> <tr><td>4</td><td>4 - 20 mA *</td></tr> <tr><td>5</td><td>0 - 20 mA *</td></tr> <tr><td>6</td><td>4 - 20 mA * out of limits: switch to internal set point</td></tr> <tr><td>7</td><td>Feedforward 0-10 V, linear</td></tr> <tr><td>8</td><td>Feedforward 4-20 mA, linear</td></tr> <tr><td>9</td><td>Feedforward 0-20 mA, linear</td></tr> <tr><td>10</td><td>Feedforward 0-10 V, square</td></tr> <tr><td>11</td><td>Feedforward 4-20 mA, square</td></tr> <tr><td>12</td><td>Feedforward 0-20 mA, square</td></tr> </tbody> </table>	Code	Range	0	Nominal value input switched off	1	1 mV/unit	2	10 mV/unit	3	0 - 10 V	4	4 - 20 mA *	5	0 - 20 mA *	6	4 - 20 mA * out of limits: switch to internal set point	7	Feedforward 0-10 V, linear	8	Feedforward 4-20 mA, linear	9	Feedforward 0-20 mA, linear	10	Feedforward 0-10 V, square	11	Feedforward 4-20 mA, square	12	Feedforward 0-20 mA, square
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4			Setting of the lower range limit of the analog input. Range: -200 to 2000 unit.																												
5	 		This indication appears only when range code 3 - 5 has been selected.																												
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8			Setting of the code for the 1st analog output.																												
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UNIVERSAL DIGITAL CONTROLLER TECON 231

Step	Press key	Indication	Function																						
10			Setting the range of the 1st analog output. Code Range Availability																						
11			<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">10mV/unit</td> <td></td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">1 mV/unit</td> <td style="text-align: center;">231 -XX0X / XX2X</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">0 - 10V</td> <td style="text-align: center;">(see page 30)</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">0 - 2 V</td> <td></td> </tr> <tr> <td style="text-align: center;">4</td> <td style="text-align: center;">4 - 20 mA</td> <td style="text-align: center;">231 - XX1X / XX3X</td> </tr> <tr> <td style="text-align: center;">5</td> <td style="text-align: center;">0 - 20 mA</td> <td style="text-align: center;">(see page 30)</td> </tr> </table>	0	10mV/unit		1	1 mV/unit	231 -XX0X / XX2X	2	0 - 10V	(see page 30)	3	0 - 2 V		4	4 - 20 mA	231 - XX1X / XX3X	5	0 - 20 mA	(see page 30)				
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12			Setting the lower range limit of the 1st analog output. Range: -200 to 2000unit.																						
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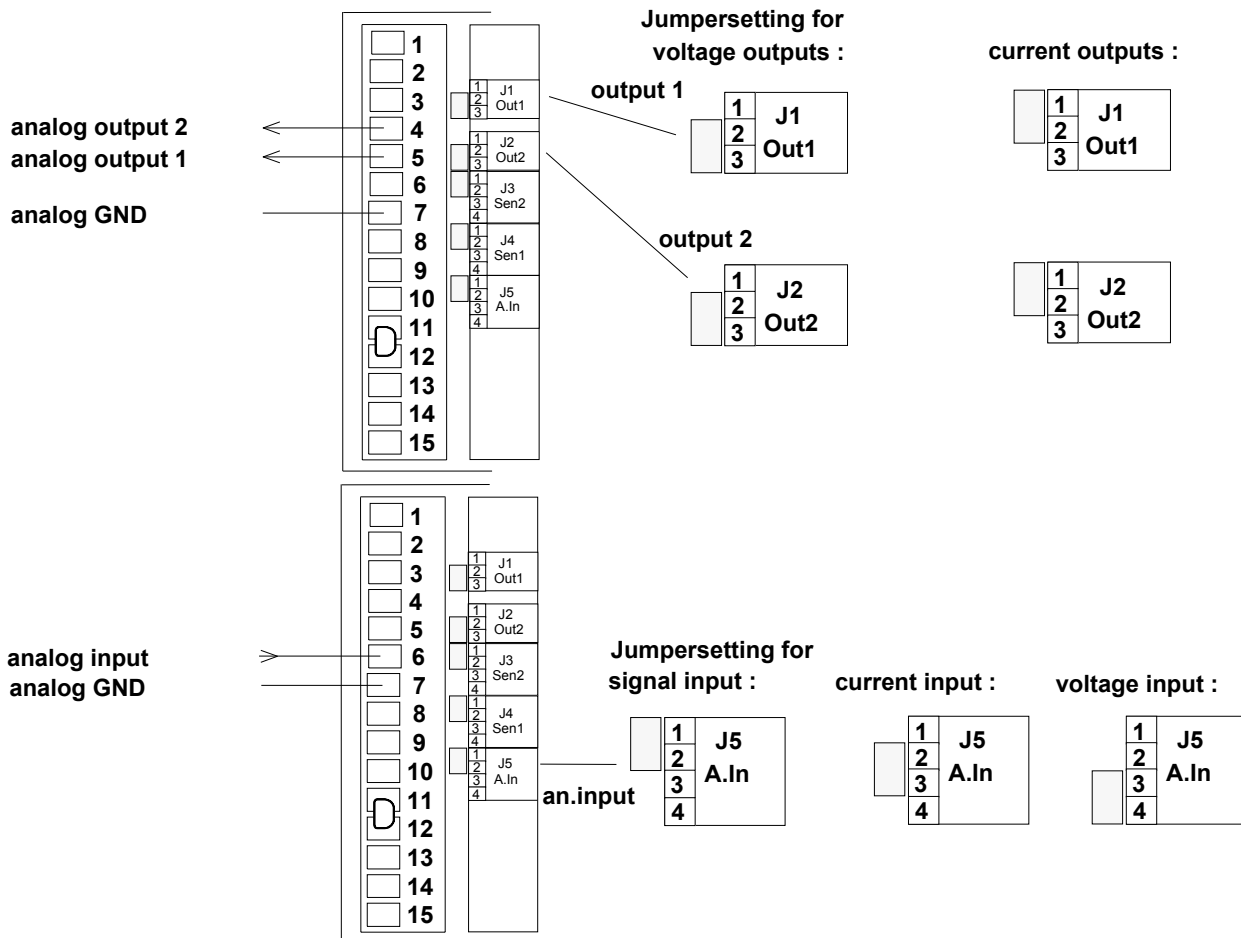
UNIVERSAL-DIGITAL CONTROLLER TECON 231

Step	Press key	Indication	Function																					
20			Setting the range limit of the 2nd analog output. Range : -200 to 2000 unit.																					
21			This indication appears only when range code 2 - 5 has been selected. The unit of the output signal Code 4 and 5 is % (-100 to 100).																					
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32			Lower limit of output 2 is set. Range: -100 to +100 %																					
33																								













UNIVERSAL DIGITAL CONTROLLER TECON 231

Step	Press key	Indication	Function
34			Upper limit of output 2 is set. Range: -100 to +100 %
35			
36			End of the range for analog inputs and outputs. A new range can be selected with the arrow keys.

5.9. Jumper settings for analog input and outputs :



5.10. Offsets

Step	Press key	Indication	Function
1	 	<i>off</i> <input type="text"/>	Offset range.
2		<i>01 1</i> <input type="text"/>	Setting offset 1. (Sensor 1)
3	 	<i>nn.n</i> <input type="text"/>	Range: -99.9 to +99.9 unit.
4		<i>01 2</i> <input type="text"/>	Setting offset 2. (Sensor 2)
5	 	<i>nn.n</i> <input type="text"/>	Range: -99.9 to +99.9 unit.
6		<i>01 3</i> <input type="text"/>	Setting offset 3. (ext. nominal-value input or analog input)
7	 	<i>nn.n</i> <input type="text"/>	Range: -99.9 to +99.9 unit.
8		<i>off</i> <input type="text"/>	End of the offset range.

6. Serial interface

6.1. General

The TECON 200 controller series are standard fitted with an RS 485 interface, which allows the connecting up of several controllers, thus simplifying their operation. In this case one controller is programmed as master and all the others as slaves. The connected slaves, according to preselection, do more or less the same as the master. Thus, only the master has to be operated.

The operating performance of the controllers is determined by the code "SER1". This code is described in Chapter "Adapting the controller" under "serial interface". One of the connected controllers is made the master by setting its code on 1. This controller now continually sends its data to all the other connected controllers. These must have a code set between 3 and 4 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 2 manners:

Code 3 has the effect that the slaves are switched off together with the master, though do not take over its nominal value, but only its program section. This is of importance when controllers which do not control the same value, have to operate together, for instance temperature controllers together with pressure controllers. Here, the nominal value of the temperature controller does not make sense for the pressure controller. On the other hand, a temperature program and a pressure program can run simultaneously.

Neither master nor slaves require an address. Therefore, it is irrelevant which value is shown at the address (Adr.). 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 from the slaves, and to give an alarm message.

6.2. Operation with higher ranking control unit:

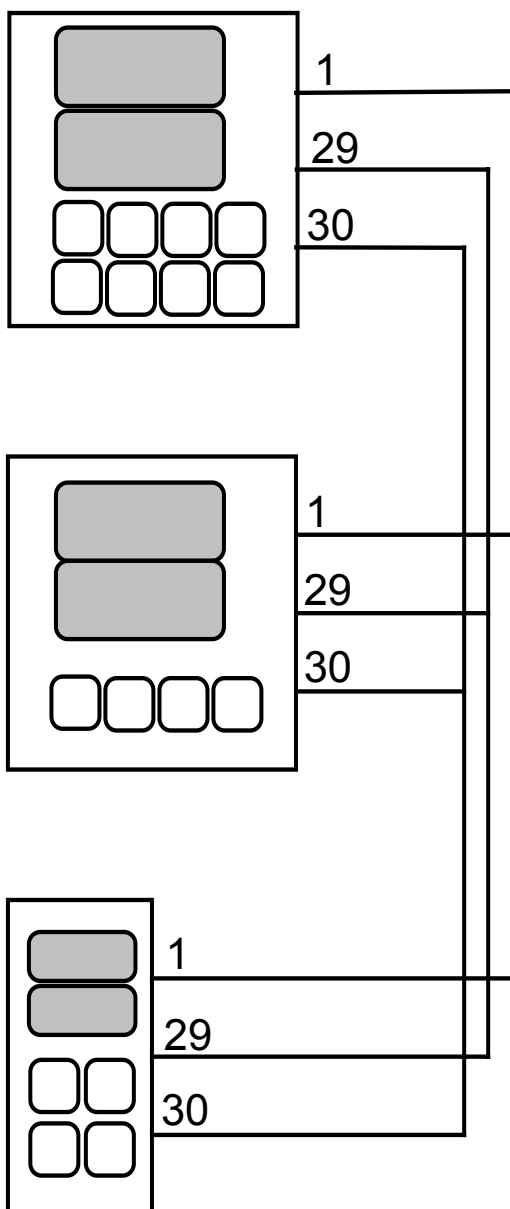
If the controller is operated as slave of a higher ranking control system, e.g. a PC, the code has to be set at 16 and each unit should have a different address. The controllers reply to inquiries from the higher ranking unit with code 16. This, to make sure that only one controller is polled at a time and that no further message is given as long as the reply has not been received completely.

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 is given.

TECON offer various programs for operation of units with a PC so as to optimise, document and monitor control systems.

UNIVERSAL-DIGITAL CONTROLLER TECON 231

Example: Master-slave operation of 3 controllers.



Master: TECON 230

Data of the serial interface:

Adr.: 0

Ser.1: 1

Alarm: 0

Function:

Only this controller is operated.

Slave 1: TECON 231 heating / cooling

Data of the serial interface:

Adr.: 0

Ser.1: 3

Alarm: 10

Function:

This slave starts and stops with the master. It controls the same nominal value. 10 seconds after termination of the connection with the master it stops.

Slave 2: TECON 202, heating/heating

Data of the serial interface:

Adr.: 0

Ser.1: 5

Alarm: 0

Function:

This slave starts and stops with the master and it is always in the same program section as the master. After disconnection it continues running with its own program.

Maximum number of controllers

Maximum conductor length

Conductor cross-section:

(long lines to be screened, screen onto PE)

32

1000 m

0.5 – 1 mm²

7. Error messages, faults

7.1. 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	Program 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 Err8	The controller is not calibrated	Press the Start / Stop key. Although the controller can operate, the inputs and outputs are no longer sufficiently accurate.
Err9	Memory overwritten	Switch controller off and on again.

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

7.2. Faults during operation

7.2.1. The controller cannot be started.

The controller has been programmed for external start/stop. See Chapter 6. System data level, digital input.

7.2.2. 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, page 19 ff)

7.2.3. The nominal value cannot be set

Cause: The control range limits have not be been set correctly (see page 19)

Or: The unit is programmed for external nominal value (See page 27)

7.2.4. The control system is not functioning correctly

UNIVERSAL-DIGITAL CONTROLLER TECON 231

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 page 15).

The exceeding of the maximum temperature is only indicated when alarm code 1 has been set accordingly (Level alarm data, alarm code, page 15).

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 page 15).

The falling short of the minimum temperature is only indicated when alarm code 2 has been set accordingly (Alarm level, alarm code, page 15).

7.2.5. The controller cannot 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 Chapter 6, Adaptation. If the code number has been lost, please contact the manufacturers.

7.3. Repairs and guarantee

If the user cannot 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.

UNIVERSAL DIGITAL CONTROLLER TECON 231

8. Designation code:

TECON 2 3 1 – X X X X - X X X . X ——— Änderungsindex

No.	Input	Control outputs		Analog outputs		Option	Program version
		1	2	1	2		
0	NiCr-Ni (K)	relay	relay	voltage	voltage	none	01x:Standard
1	FeCo (J)	signal	relay	current	voltage	dig. I/O and ext. keyboard	
2	PtRh10%(S)	relay	signal	current	voltage	ext. Printer	008: 2 Set points
3	PtRh13%(R)	signal	signal	current	voltage	galvanic separated inputs	100: Additional I/O (Option 4)
4 4.1 4.2 4.3 4.4	Pt100	current relay				4 Inp. 6 Outp 230V relay 24V relay 230V signal 24V signal	300: Manual / Auto mode
5	Pt100 with Z-Barr.	relay	current				
6	4-20mA	current	current				
7	0-20mA	signal	current				
8	NiSil (N)	current	signal				
9	PtRh18%(B)						
A	according to customers specifications						
B		0-10 V relay					
C		relay	0-10 V				
D		0-10V	0-10 V				

Ordering specifications

Standard execution:

Supply voltage 230 V, 50/60 Hz

Special execution

please state in the order:

Supply voltage 115 V, 50/60 Hz
or 24V, 50/60 Hz

Subject to modification without prior notice.

Art. No. Instruction manual : 096033

Controller outputs:

Normally output 1 is used for heating and output 2 for cooling

The analog outputs can be programmed for nominal value, actual value, difference nominal - actual , or controller output

9. List of adjustment data

Code for adaptation : _____

Alarm data	
Maximum temp. 1	
Minimum temp. 1	
Overtmp. 1	
Undertemp. 1	
Alarm code 1	
Maximum temp. 2	
Minimum temp. 2	
Overtmp. 2	
Undertemp. 2	
Alarm code 2	
Alarm code 3	
Threshold sensor	

Serial interface	
Unit address	
Code serial interface	
Alarm time serial interface	

Offsets	
Offset 1 (Sensor 1)	
Offset 2 (Sensor 2)	
Offset 3 (Nominal value)	

Control parameters	
Proportional band 1 low	
Proportional band 1 high	
Integral time 1	
Differential time 1	
Relay interval time 1	
max. capacity 1	
Proportional band 2 low	
Proportional band 2 high	
Integral time 2	
Differential time 2	
Relay interval time 2	
max. capacity 2	
Dead band	
Offset nomin. value controller 2	
Adjustment time servo motor	

Sensors	
Sensor 1 : Type	
Current inp. 1, lower limit	
Current inp. 1, upper limit	
Nominal value 1, lower limit	
Nominal value 1, upper limit	
Filter constant sensor 1	
Sensor 2 : Type	
Current inp.2, lower limit	
Current inp.2, upper limit	
Nominal value 2, lower limit	
Nominal value 2, upper limit	
Filter constant sensor 2	

System data	
Display code 1	
Display code 2	
Ramp up	
Ramp down	
Digital input	
Digital output	
R-code (controller function)	

Analog inputs and outputs	
Code for analog input	
Nominal value input lower limit	
Nominal value input upper limit	
Code analog output 1	
Analog output 1 range	
Analog output 1 lower limit	
Analog output 1 upper limit	
Code analog output 2	
Analog output 2 range	
Analog output 2 lower limit	
Analog output 2 upper limit	
Current output 1	
lower limit current 1	
upper limit current 1	
Current output 2	
lower limit current 2	
upper limit current 2	