User Manual

42/61-50013 EN

ControlIT

Process controller D500

(Digitric 500)

Versatile, universal controller for all standard applications

IndustrialIT enabled

PROFIBUS Process Field Bus

ABB

Process controller D500
(Digitric 500)

Versatile, universal controller for all standard applications

User Manual

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Preface

The documentation included in the D500 (Digitric 500) package consists of the following parts:

Commissioning Instructions D500 (Digitric 500)	42/61-50011
Configuration Instructions P500 (Protronic 500) / D500 (Digitric 500)	42/62-50012
User Manual D500 (Digitric 500)	**42/61-50013**

Also available on request:

User Manual IBIS-R, List Configuration	42/62-50020
User Manual IBIS-R, Free Configuration	42/62-50030

The User Manual in this manual include all important information for menu-guided configuration and parameterization of the device. All necessary entries can be made locally via the device's front panel operating elements, or remotely from a PC with the IBIS-R configuration and parameterization program.

The configuration options of the device menu are also available in the IBIS-R program. The description of this program is beyond the scope of this user manual.

Delivery state

The devices are delivered off stock and without customized settings. The factory setting is adjusted to the following functions:

– Single-loop continuous controller
– Input: 4...20 mA
– Output: 4...20 mA
– Language: German

The factory setting and its definitions are described in detail in this user manual.

Customized versions are available upon special request.

Switching on the device

Upon power-on or return of the power after power failure the device automatically performs a selftest of the internal functions. The progress of the test program can be seen on the display. Usually, no special attention has to be paid to this display.

1 Important information in advance

1.1 Symbols

To ensure optimum use of these user manual and a safe use of the assemblies during commissioning, operation and maintenance, please observe the following explanations regarding the symbols used.

Explanations of symbols used.

	Warning	Indicates a risk or potentially hazardous situation which, if not avoided, could result in death or serious injury.
	Caution	Indicates a potentially hazardous situation or alerts against unsafe practices which, if not avoided, may result in injury of persons or property damage.
	Notice	Indicates a potentially harmful situation which, if not avoided, may result in damage of the product itself or of adjacent objects.
	Important	Indicates useful hints or other special information which, if not observed, could lead to a decline in operating convenience or affect the functionality.

Apart from the information in these user manual you must also observe commonly valid safety and accident prevention directives.

If the information contained in these user manual is not sufficient for an application our service organisation will gladly be at your disposal for further information.

Please read these assembly and user manual carefully prior to installation.

1.2 Conventions used in these user manual

<Enter>	Keys on the device, with their labels
<Ind>, <Loop>	
<Menu>, <Enter>	Keys available at all times for operator actions.
[P-W]	Flashing texts or text fragments from the digital display
P-W, A	Texts or text fragments from the digital display
/8/	Reference to numbers in Fig. 3-1
M❂, A❂, C❂	Light-emitting diodes (LEDs) alongside the keys with the same name are lit.
Menu❂, Enter❂	Light-emitting diodes (LEDs) alongside the keys with the same name are lit.
M●, A●, C●	Light-emitting diodes (LEDs) alongside the keys with the same name are not lit.
Menu●, Enter●	Light-emitting diodes (LEDs) alongside the keys with the same name are not lit.
Sxt	External setpoint source
Hand	Operating mode

2 Application according to designation, general safety instructions

Important instructions for your safety!
Please read and observe.

2.1 Range of application, application according to designation

D500 (Digitric 500) is a 1...4-loop compact controller. The D500 (Digitric 500) is designated for the instrumentation of single control loops and for automating small and medium-sized processes in control engneering.

For proper use it is required to observe the „Technical Data section “ in the Data Sheets. You will find the technical data in the data Sheet 10/61-6.15.

Any other use is considered improper.

2.2 Safe operation

The technology of the D500 (Digitric 500) is state of the art.

The D500 (Digitric 500) is constructed and tested according to EN 61 010-1 = IEC 1010-1 = DIN VDE 0411 Part 1 "Safety Requirements for Electronic Measurement Apparatus" and has left the factory in a safe condition. To maintain this state and guarantee hazard-free operation, all safety instructions in this manual headed by "Warning, Caution or Notice" must be observed.
Otherwise, personnel might be endangered and the mass flow meter itself or other devices and equipment could be damaged.

Prerequisites for safe operation.

These user manual contain important information about the safe and proper operation of the equipment. Observing these instructions is mandatory for safe operation.
Failure to observe the instructions can cause hazards for life and limb of the user respectively property damages at the devices or the entire system.

Proper and safe operation of the mass flow meter requires proper transportation and storage, installation and commissioning by qualified personnel, operation within its design limits, and careful maintenance observing all information in these user manual.

Qualification of personnel

Only personnel familiar with the installation, commissioning, and maintenance of similar devices and having the required qualifications for their tasks are allowed to work on the device.

Operator

The operator of the plant is fully and solely responsible for proper and workmanlike and, thus, safe operation.
The operator must make sure that the user manual have been understood by the target audience.
A copy of the user manual must be stored in a suitable place at the usage location of the device at all times.
Read these user manual prior to commissioning, decommissioning, maintaining, or repairing a device.

National regulations

The regulations, standards, and guidelines mentioned in these user manual are valid for Germany. When using the devices in other countries the appropriate and valid national regulations must be observed.

Notes and regulations to be observed

Observe
– the contents of these user manual and references to other documents and their contents
– the safety regulations affixed to the device
– the appropriate and valid safety instructions for the construction and operation of electrical systems
– the regulations and directives regarding explosion protection.

During operation

The operator must commission a qualified electrician to inspect and examine the system at defined intervals. The examination intervals must be chosen in such a way that any damages that can be expected can be recognised in time.
The examinations must be performed at least every three years.
The examinations can be skipped if the electrical system is continuously monitored by a responsible engineer

Duties of the operator:
– maintain the system in proper condition
– continuously monitor the system
– execute required maintenance and repair work immediately
– carry out required safety measures
If the devices are used in areas where dusts can cause explosion hazards, you must clean the devices frequently.

Use genuine spare parts, only.

3 Operation

3.1 Operating elements on the D500 (Digitric 500) front panel

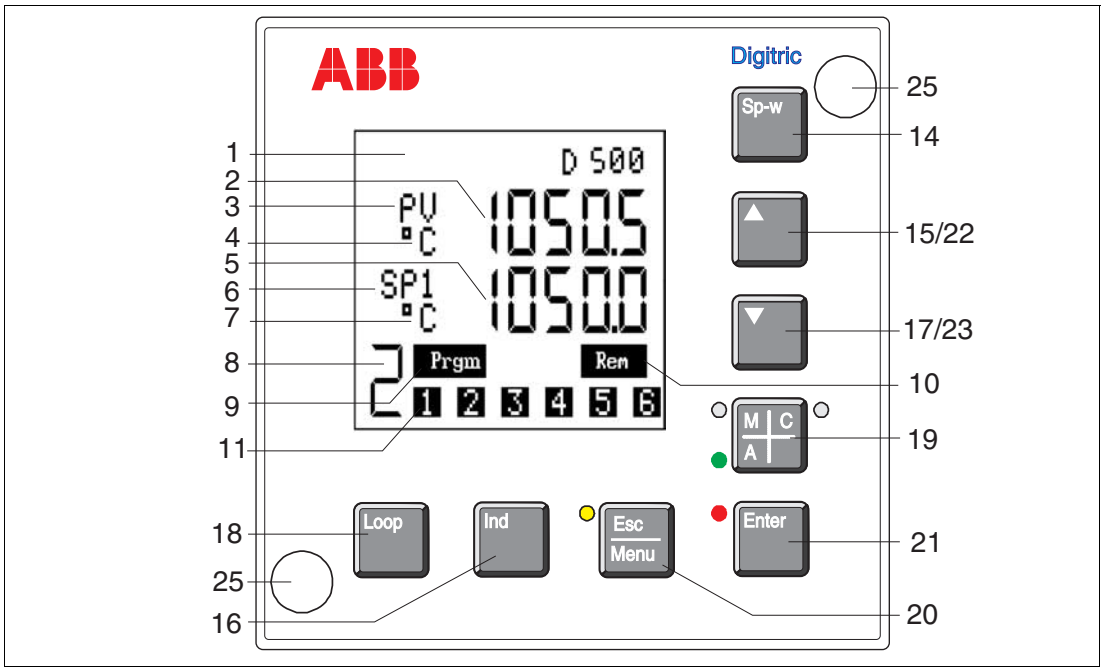


Fig. 3-1 Front panel D500 (Digitric 500)

1 Text line
2 Digital indicator for process value PV
3 Designation of the process value
4 Dimension of the process value
5 Digital indicator: indicates setpoint SP in automatic mode and output value OUT in manual mode

6 Designation of the value indicated in 5
7 Dimension of the value indicated in 5
8 Alarm indicator
9 Indicator for programmer activity
10 Remote control indicator

11 Freely configurable binary messages (6 binary flags)
14 Setpoint changeover (see Section 3.7 “Setpoints“)
15 Button for incrementing the values indicated in 5, 6 and 7
16 Toggle switch for indicators 5, 6 and 7
17 Button for decrementing the values indicated in 5, 6 and 7

18 Loop transfer switch
19 Mode switch for selecting manual or automatic mode, with indicator LEDs
20 Button for accessing the configuration or parameterization level
The appropriate LED lights up as soon as the operator control level is exited; at the same time menu symbol is visible in the text line

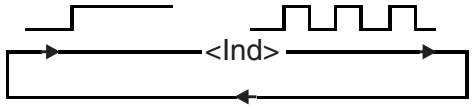
21 Button for alarm acknowledgement and confirmation of data (configuration and parameters)
22 Up button for incrementing in manual mode
23 Down button for decrementing in manual mode
25 Cap for covering fastening elements for panel mounting

The numbers of the individual control and display elements are used consistently throughout the device documentation.

3.2 LC-Display

The values seen in the “2nd line“ column of the table below can be accessed in two different ways:

1. From left to right:
   Press <Ind> button (several times).
2. From right to left:
   Press and hold <Ind> button



Input circuit/ function		1st line	2nd line Controller								Programmer	
Fixed value (FV)		PV	SP1-SP4		Sxt	SPC	P0x	–	Err	OUT	ALi	PS	PGt
Multi components		PV	SP1-SP4		Sxt	SPC	P0x	–	Err	OUT	ALi		
Multiplication		PV	SP1-SP4		Sxt	SPC	P0x	–	Err	OUT	ALi		
Ratio (RPV, SR)		RPV	SR1-SR3		Rxt	SRC	P0x	SR	Err	OUT	ALi		
Ratio (PV,SR*IC2)		PV	SR1-SR3		Rxt	SRC	P0x	SR	Err	OUT	ALi		
Fixed value/Ratio	FV	RPV	SP1	SR1-SR3	Rxt	SRC	P0x	SR	Err	OUT	ALi		
(RPV, SR)	Ratio	RPV	SP1	SR1-SR3	Rxt	SRC	P0x	SR	Err	OUT	ALi		
Fixed value/ratio	FV	PV	SP1	SR1-SR3	Rxt	SRC	P0x	SR	Err	OUT	ALi		
(PV, SR*IC2)	Ratio	PV	SP1	SR1-SR3	Rxt	SRC	P0x	SR	Err	OUT	ALi		
Extreme value (max, Min, PV, SP)		PV	SP1-SP4		Sxt	SPC	P0x	–	Err	OUT	ALi		
Load control – air		same as ratio											
Load control – fuel		same as fixed value											
Manual station		PV	–		–	–	–	–	–	OUT	ALi	–	–
Setpoint station		–	SP1-SP4		Sxt	SPC	P0x	–	–	–	–	PS	PGt
Ratio station		PV	SR1-SR3		Rxt	SRC	P0x	SR	–	–	–		
Positioner		PV=OUTfb	SP1-SP4		Sxt	SPC	P0x	–	Err	OUT	ALi		

Table 3-1 Grayed indicators flash. These values are only displayed, but are currently not active.

PV Measured value (with ratio control: measured value in the quotient numerator)

SP1-SP4 Setpoints 1 to 4
SR1 - SR3 Ratio setpoints 1 -3
Sxt, Rxt External setpoint
SPC, SRC Computer setpoint
P0x Programmer setpoint (indicated as P01 to P10)

Setpoints are only indicated when they are enabled in the configuration.

IC2 With ratio control: measured value in the quotation denominator

SR Setpoint active during ratio control (R* IC2) or (R*IC2)/(1-R)
Err Control deviation
OUT Controller output or position feedback
ALi Alarm limits AL1 to AL4, if enabled

Programmer:
PS Currently executed program segment PS
Pt Program run time since startup

Display color switchover

The Controller D500 with a negativ display (illuminated signs on a dark background, new since August 2003) allows to switch the color of the display between red and green if the firmware of the controller is V1.206 or later.
The switchover has to be done in the menu. First of all you have to navigate to any subitem of „Service/ Display Unit“ (if you see at the „Display Unit“ you must press once „Enter“).
If you are in this subitems and you press the keys <LOOP> and <IND> at once, the color will immediatelly change. The adjusted color will be stored on non volatile memory.
In the future software library 3.70 (controller firmware 1.3xx or later) the color switchover will be realised as separat item in the menu. The description for this will then be written in the configuration manual.

3.3 Alarm handling

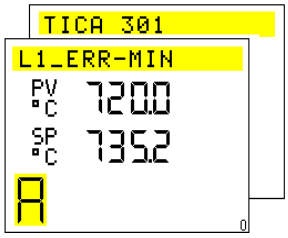


Fig. 3-2 Alarm message
z-19000

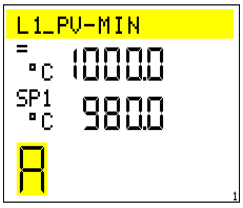


Fig. 3-3 Alarm value is set to 1000.0
z-19001

When an alarm or error occurs or an alarm value is exceeded during an operating cycle,
– a flashing “A“ appears in the bottom right corner of the display,
– the error or alarm source is indicated in the first line of the display instead of the TAG name,
– the <Enter> LED is lighted.

Note

Unconfirmed operating instructions displayed in the text line have priority over error codes. As long as the operating instruction is still unconfirmed, the alarm is only indicated by the flashing “A“. Alarm acknowledgement is not possible in this situation!

Displaying the exceeded alarm value

Press <Ind> to display the alarm value.

Acknowledging the alarm

press <Enter> (standard configuration):

If there is no other alarm:
The display is reset and the normal values are indicated.

The LED is extinguished, whether the alarm is still active or not.

If there are other alarms
More alarms are indicated in the same way as described above and have to be acknowledged individually.

3.4 Channel switching

If several controllers are configured in one device, <Loop> can be used to switch the control cycles. There are up to 4 Loops.

3.5 Automatic mode (A)

Possible operator actions

When the controller is switched over from manual to automatic mode, the active setpoint is seen on the digital indicator. Other values can be selected by pressing the <Ind> button.

<M/A/C>	Switch over from manual to automatic mode
<SP-w>	Switch over the setpoint (if configured)
<▼> <▲>	Increment/decrement the setpoint
<Menu>	Switch over to another menu level

3.6 Manual mode (M)

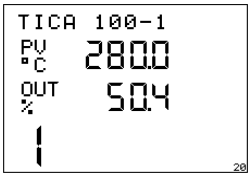


Fig. 3-4 Output OUT is indicated
z-19020

The functions of the < ▲> and <▼> buttons are defined either through configuration or, in case of the step controller, through the appropriate wiring. Usually, a more critical state - e.g. a higher furnace temperature - is reached by pressing the < ▲> button.

After the controller has been changed over from automatic to manual mode, the output variable OUT is shown by the digital indicator. Other values can be selected by pressing the <Ind> button.

In the case of controllers with double output (split range or heating-off-cooling) the display 0...100% corresponds to the full output range of both outputs.

Example:
Heating-off-cooling (with normal characteristic curve)
OUT = 0 % corresponds to 100 % cooling
OUT = 50 % corresponds to 0 % cooling and 0 % heating
OUT = 100 % corresponds to 100 % heating

Possible operator actions

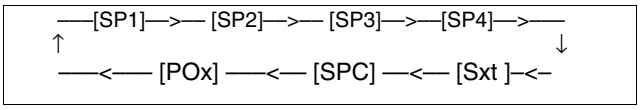
< ▲> <▼>	OUT indicator: change the output signal Press and hold <Enter>, additionally press <▼>: control output jumps to end value -5 % Press and hold <Enter>, additionally press < ▲>: control output jumps to end value +105 %
<▼> < ▲>	SP indicator: increment/decrement the setpoint
<M/A/C>	Switch over between manual, automatic mode, cascade
<SP-w>	Switch over the setpoint (if configured)
<Menu>	Select another menu level

3.7 Setpoints

The <SP-w> button can be used to toggle between several setpoint sources, provided that the controller has been configured accordingly.

Possible setpoint sources are:
– setpoints SP1 to SP4 (or ratio setpoints SR1 to SR3) that can be selected on the device by pressing the < ▲> or <▼> button or
– an external setpoint Sxt (Rxt) via analog input
or
– a computer setpoint SPC (SRC) via serial interface
or
– a programmer with 10 programs P01 to P10

Display in field /6/:



For ratio control:

Unconfigured setpoints are suppressed.

Pressing the <SP-w> button will call up the current setpoint for display by the digital indicator, independent of the number of available setpoints.

The setpoint is indicated immediately, but first flashes and becomes active with a delay of 3 seconds. This means that only the last setpoint selected becomes active when the setpoints are switched over quickly.

3.8 Ratio controller

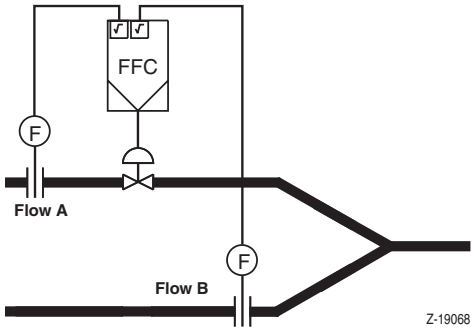


Fig. 3-5 Ratio control
z-.19068

Fig. 3-6 Display RPV and SR1, SR1 is adjustable
z-19018

The ratio controller controls

$$RPV(\text{ratio process value}) = SR(\text{set ratio}) = \frac{FlowA}{FlowB}$$

or, depending on the configuration,

$$RPV = SR = \frac{FlowA}{FlowA + FlowB}$$

The ratio controller can output the actual ratio to an analog output (0/4...20 mA) if configured accordingly.

When the RPV and SR displays are configured, the ratio setpoint is indicated in the fields /5/, /6/ and /7/ of the digital indicator and can be set.

If configured accordingly, several setpoint sources (SR1 to SR3, Rexternal or program generator) can be selected by pressing the <SP-w> button.

The measured actual ratio is indicated in the fields /2/, /3/ and /4/.

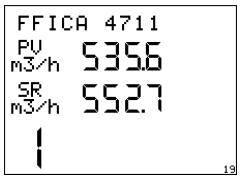


Fig. 3-7 Process value PV= flow A and SP = setpoint flow A
z-19019

Fig. 3-8 SR1 is adjustable
z-190051

When the PV and SP displays are configured, the calculated setpoint of flow A is indicated in the fields /5/, /6/ and /7/.

The fields /2/, /3/, /4/ indicate the measured actual value of flow A.

Press the <Ind> button to call up the SR1value in the display fields (/5/, /6/, /7/) and then change it.

3.9 Programmer

A programmer can be configured in the controller. Up to 10 different programs with 15 segments each can be saved. Refer to „Configuration instruction“ 42/62-50012 for details about setting the values.

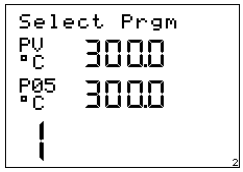


Fig. 3-9 z-19002 Program has been selected, but not yet started

3.9.1 Selecting the program

If the programmer is configured, the [Pxy] display can be selected by pressing the <SP-w> button. The flashing Pxy display indicates the number of the currently selected program.

Press < ▲> or <▼> to toggle between up to 10 saved programs (P01 to P10).

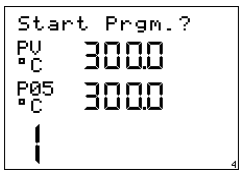


Fig. 3-10 z-19004 Start ?

3.9.2 Starting the program

Once the Pxy display has stopped flashing, the program can be started by pressing the <Enter> button. The question if the program is to be started appears for 3 second in the text line. Confirm with <Enter>. The question mark is replaced with an exclamation mark for a few seconds. If the selection is not confirmed with <Enter> within 3 seconds, the selection is ignored and program selection is enabled again.

Fig. 3-11 z-19006 Displaying the current program setpoint 300,0 °C

Fig. 3-12 z-19007 Program is in the 11th segment

Fig. 3-13 z-19008 Program run time so far 2h:17min:02s

3.9.3 Displays during program execution

Press the <Ind> button to switch over the display, either while the program is being executed or after it has stopped. Besides the current setpoint the following items can be indicated:

– Program segment
– Program run time.

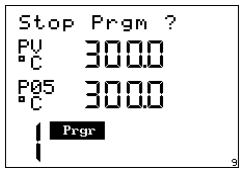


Fig. 3-14 Question: Stop program ?
z-19009

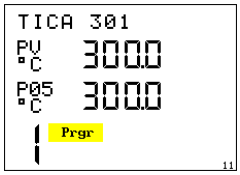


Fig. 3-15 Programmer has stopped.
z-19011 Program (Prgm) is flashing.

3.9.4 Stopping the program

When the <Enter> button is pressed again once the program is running, the question for the system stop seen here appears.

When the question is answered with yes by pressing the <Enter> button, a confirmation is shown for 3 seconds.

The program is stopped, and the [Prgm] indicator flashes. The question mark is replaced with an exclamation mark for a short time to confirm.

Fig. 3-16 Fast forward indication
z-19012

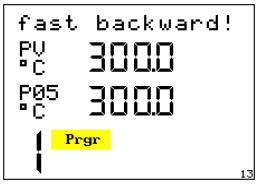


Fig. 3-17 Fast backward indication
z-19013

3.9.5 Fast forward/backward

When a program has been stopped, a fast forward/backward run can be achieved by pressing the < ▲> or <▼> button. Actuating the < ▲> button will shift the program forward to values later in time. When this button is pressed, the fast forward action is confirmed in the display.

How far the program has run forward can be derived from the setpoint, the segment indicator or the time indicator.

A fast backward run of the program can be started by pressing the <▼> button.

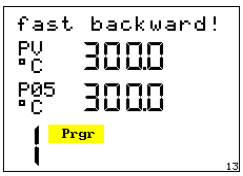


Fig. 3-18 Question: Reset?
z19014

Fig. 3-19 During running program switching
z19016 to other setpoints is not possible

3.9.6 Resetting (cancelling) the program

If a program is restarted after it has been run down completely, it starts automatically in the 1st segment. No reset is required in this case.

A stopped program ca be reset or cancelled by pressing the <SP-w> button.

If the question is answered with yes by pressing the <Enter> button within 3 seconds, the program is reset to the start. The message “Reset!“ appears for a short time.

If the operator attempts to switch during a running program to another setpoint (e.g. SP1) by actuating the <SP-w> button, the warning “Program runs“ appears in the display for 3 seconds, see Fig. 3-19.

3.10 Cascade control

3.10.1 Cascade with one slave controller

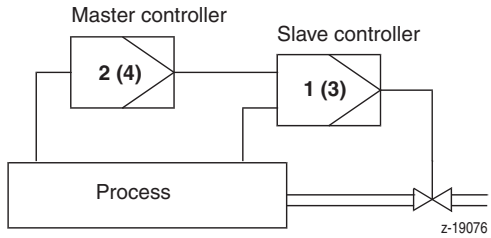


Fig. 3-20 Cascade with a slave controller

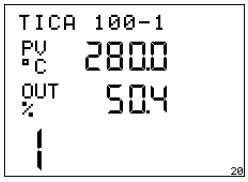


Fig. 3-21 (z-19020) Slave controller TICA 100-1 display, Controller output in display

Cascade operation

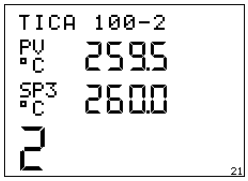


Fig. 3-22 (z-19021) Master controller TICA 100-2

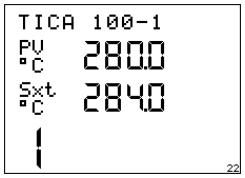
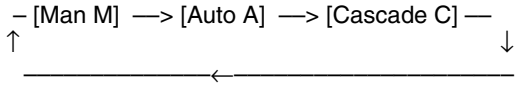


Fig. 3-23 (z-19022) Slave controller TICA 100-1

Operating mode switching
Switching is always in the sequence below:



Manual operation applies only to the slave controller. Both in manual and automatic mode the master controller is always synchronised in such a manner that the switchover can take place smoothly.

When switching, the selected operating mode does not come into effect until 3 s have elapsed since the last key press.

At the same time as the operating mode is changed, the display also switches to the more important loop. It is always possible to switch manually to the other loop.

Manual	→ automatic	on Loop 1
Automatic	→ cascade	on Loop 2
Cascade	→ manual	on Loop 1
Cascade	→ automatic	on Loop 1

OUT always shows the actual output to the final control element or the final control element position reported back.

By switching from automatic to cascade the slave controller switched to **external set point**, the master controller's output. The transition from automatic to cascade is performed smoothly as the master controller's output is synchronised in such manner that the slave controller is not subjected to any control
deviation at the moment of switchover.

When changing from automatic to cascade the system automatically switches to loop 2, the master controller.

Control actions allowed

Display	Keys/Operating mode	Master controller	Slave controller
	Manual M❂		
	<SP-w>	+	+
Sxt	<▲> <▼>	+	+
	<M/A/C>	operates on slave contr.	+
OUT	<▲> <▼>	–	+
	Automatic A❂		
	<SP-w>	+	+
Sxt	<▲> <▼>	+	+
	<M/A/C>	operates on slave contr.	+
OUT	<▲> <▼>	–	–
	Cascade C❂		
	<SP-w>	+	–
Sxt	<▲> <▼>	+	–
	<M/A/C>	operates on slave contr.	+
OUT	<▲> <▼>	–	–

+ operative, can be changed, – inoperative in this operating mode

3.10.2 Cascade with several slave controllers

General

The integral controllers in a device in a cascade with several slave controllers have their own mode selector switches which are largely independent.
Thus the operation of such controllers is similar to the operation of the equivalent cascade comprising individual controllers.
For the master controller there is the additional operating mode **TRACK** in which none of the three LEDs on the <M/A/C> key is lit. This operating mode is imposed through the slave controller's operating mode and cannot be changed at the master controller.

Cascade with two slave controllers with the same set point.

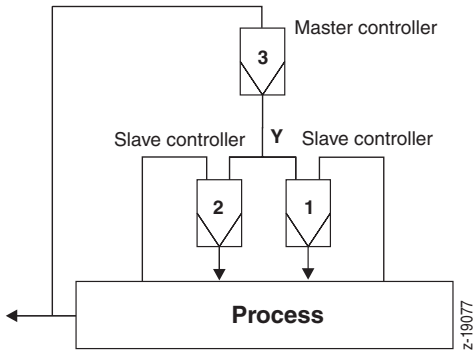


Fig. 3-24

The master controller gives the same set point to both slave controllers. The controller output (OUT = 0...100%) produces the set point range configured in the slave controllers.
The controller output is not displayed on the master controller.
Operating modes available:
Open cascade with
– Manual operation in both slave controllers or
– one slave controller in manual and one in automatic mode or
– both slave controllers in automatic mode
Closed cascade with
– both slave controllers in automatic mode
– just one slave controller in automatic mode

Important

When the first slave controller is switched to cascade the controller is switched to manual. At first the output signal altered, but this can be done manually.
Where there is a large difference between set points following message is displayed before switching over (Fig. 3-25).
A set point jump can be avoided by:
– Resetting: first set both controllers to automatic mode and then adjust set points to equal.
– Defining a set point ramp
As long as one slave controller is still set to automatic, when the master controller is switched to automatic the following message is issued (Fig. 3-26).

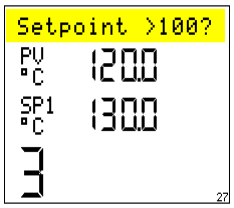


Fig. 3-25
(z-19027)

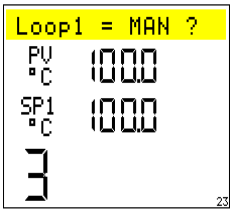


Fig. 3-26 (z-19023)

After this message is acknowledged by pressing <Enter>, the intended switchover is performed. The master controller then operates on only one slave controller.
When slave controllers are reset from cascade to automatic the master controller retains its operating mode as long as one slave controller remains in cascade.

Operating modes

Loop 1: Slave controller 1	Loop 2: Slave controller 2	Loop 3: Master controller
Manual	Manual	Track
Automatic	Manual	Track following slave controller 1
Manual	Automatic	Track following slave controller 2
Automatic	Automatic	Track average
Cascade	Manual or Automatic	Manual or Automatic
Manual or Automatic	Cascade	Manual or Automatic
Cascade	Cascade	Manual or Automatic

Table 3-2 Track following slave controller: The slave controller's setpoint sychronises the master controller
Track average: The master controller is synchronised to the average of the slave controller's setpoints.

Cascade with two slave controllers and ratio station

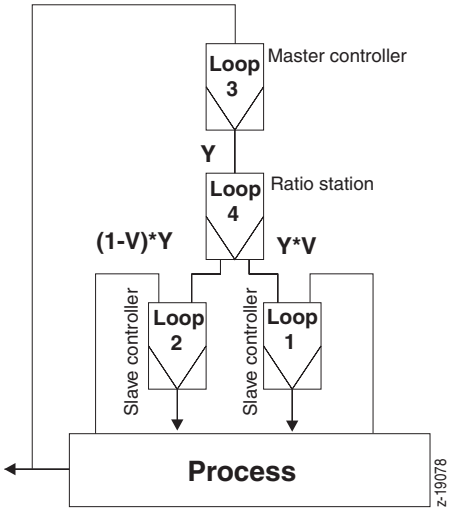


Fig. 3-27 Example:
Loop 3 temperature controller
Loop 2 air flow rate controller
Loop 1 gas flow rate controller

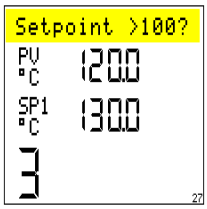


Fig. 3-28
(z-19027)

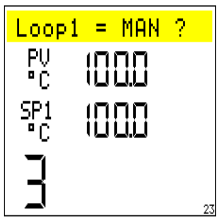


Fig. 3-29
(z-19023)

A ratio station is connected between the master controller and the slave controllers. Using an adjustable ratio, this distributes the master controller's output signal to the two slave controllers as set points.

Operating modes available:
Open cascade with
– Manual operation in both slave controllers or
– one slave controller in manual and one in automatic mode or
– both slave controllers in automatic mode

Closed cascade with
– both slave controllers in automatic mode
– just one slave controller in automatic mode

The ratio station is always in automatic mode, and the input signal apportioned to both outputs.

Important
When the first slave controller is switched to cascade the master controller is switched to manual. At first the output signal is not altered, but this can be done manually.

If the set point total is > 100%, before actually switching over the system issues the message: Fig. 3-28.

A set point jump can be avoided by:
– Resetting: first set both controllers to automatic mode and then adjust set points to equal.
– Defining a set point ramp

As long as one slave controller is still set to automatic, when the master controller is switched to automatic the following message is issued: Fig. 3-29.

After this message is acknowledged by pressing <Enter>, the intended switchover is performed. The master controller then operates on only one slave controller.

When slave controllers are reset from cascade to automatic the master controller retains its operating mode as long as one slave controller remains in cascade.

Operating modes

Loop 1: Slave controller 1	Loop 2: Slave controller 2	Loop 3: Master controller
Manual	Manual	Track not alterable
Automatic: SP = SP1i	Manual	Track: SP1i/SR
Manual	Automatic: SP = SP2i	Track: SP2i/(1-SR)
Automatic: SP = SP1i	Automatic: SP = SP2i	Track: SP1i + SP2i <100 %
Cascade	Manual or Automatic	Manual or Automatic
Manual or Automatic	Cascade	Manual or Automatic
Cascade	Cascade	Manual or Automatic

Table 3-3
SP1i = current set point on controller 1
SP2i = current set point on controller 2
Track SP1i/SR:
The master controller's output is synchronised to the value of SP1i/SR as long as this value is less than 100 %.
Track SP2i/(1-V):
The master controller's output is synchronised to the value of SP2/(1-SR) as long as this value is less than 100 %.
Track SP1i +SP2i < 100%
The master controller's output is synchronised to the value of SP1i + SP2 as long as this value is less than 100 %.

3.10.3 Combustion control

(Load control)

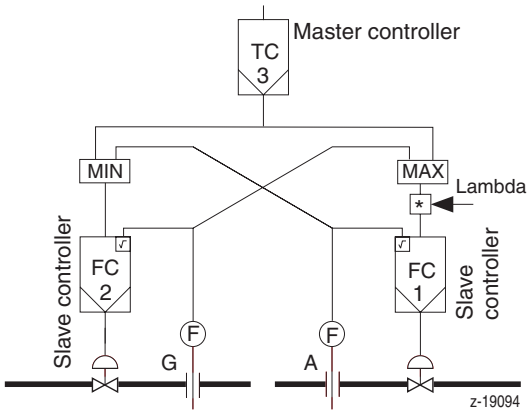


Fig. 3-30 G = gas (fuel)
A = air

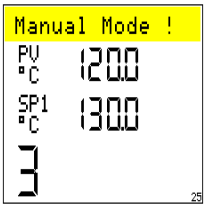


Fig. 3-31
(z-19025)

Load control ensures that as the load changes, a shortage of air is never allowed to occur.

Operating modes available:
Open cascade with
– Manual operation in both slave controllers or
– one slave controller in manual and one in automatic mode or
– both slave controllers in automatic mode

Closed cascade with
– both slave controllers in automatic mode

Some of the operation modes can be locked by changing the configuration.

The master controller cannot be switched to manual mode until the slave controllers are operating in cascade mode.

If this is not the case, the following message is issued if an attempt is made to switch the master controller from track to manual or automatic:
Fig. 3-31.

This message cannot be suppressed.

When both slave controllers are switched commonly from cascade to automatic the master controller is switched to manual. At first the output signal is not altered, but this can be done manually.

When a slave controller is switched back to manual the master controller is automatically switched to track operation.

Operating modes

Loop 1: Slave controller 1	Loop 2: Slave controller 2	Loop 3: Master controller
Manual	Manual	Track
Automatic: Fixed value A, SP= SP1i	Manual	Track: SP1i/SR
Manual	Automatic: Fixed value G, SP= SP2i	Track: SP2i
Automatic: Fixed value A, SP= SP1i	Automatic: Fixed value G, SP= SP2i	Track: A/R
Cascade	Automatic	Manual
Automatic	Cascade	Manual
Cascade	Cascade	Manual or Automatic

Table 3-4 Track:
Controller is locked in Track mode.
Track A/R:
The controller output is synchronised to the air/ratio value
A = Air
R = Ratio
G = Gas (fuel)

3.11 Override-control

(Limiting control)

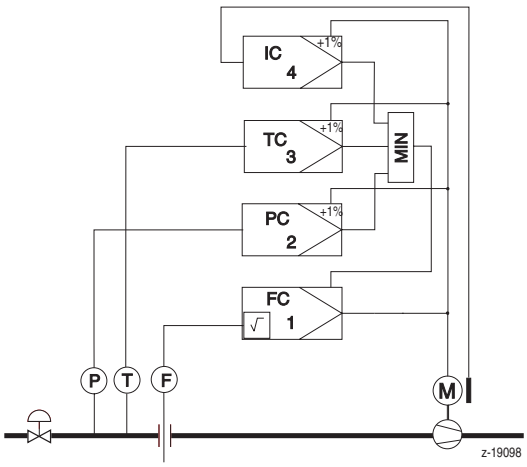


Fig. 3-32 (z-19098)

In override control one primary controlled variable is managed. One or more additional controllers make sure that the (limiting) set points are neither over- nor under-stepped. All the controllers here access a single final control element.

Example:
Primary controlled variable: Flow
Limitation of: Pressure
Temperature
Current drain by the compressor drive

Operating modes available:
The mode selector switches only ever affects loop 1. Every time there is a mode change the system switches automatically to loop 1.

The operation of the limiting controllers is restricted to setting set points.

Manual operation (M❂)
The main controller is in manual mode, the limiting controller(s) is/are in automatic mode.
The limiting controllers can't be switched to manual.
Manual operation is carried out only through loop 1. The limiting controllers are not involved.

Automatic (A❂)
The main controller is in automatic and is the only unit working on the final control element. The limiting controllers are not involved.

Cascade (Switch position C❂)
The main controller and limiting controllers are engaged.

If a limiting controller should become temporarily inoperative its set point must be altered to the limit of the range and thus rendered inoperative.

3.12 DDC-Control (Direct Digital Control)

With DDC control a supervisory computer provides for control. In case of a computer failure the Digitric controller bumplessly takes over control via interface RS 485 (MODBUS RTU) or PROFIBUS DP.
The superimposed computer writes via the bus on the variables Lx_YCOMPUTER of the respective loop X and, thus , determines the controller output. In case the superimposed computer should fail, the controller itself bumplessly takes

Possible operating modes

●	LED is off
⊙	LED is flashing with 0,5 to 1 Hz
⊗	LED is flashing with 2 Hz
☼	LED is on
CR	The computer is ready, i.e. there is regular data traffic via the serial interface.
M, A, C	LEDs to the side of button 19 on the front panel (Fig. 3-1)

DDC configuration with manual backup mode

Operating mode	LED M	LED A	LED C	CR
Manual	☼	●	●	0
Automatic	●	☼	●	0
DDC	disabled			0
Manual	☼	●	⊙	1
Automatic	●	☼	⊙	1
DDC	☼	●	☼	1
Backup mode				
M-backup	☼	●	⊗	0
M-backup	☼	●	☼	1

DDC configuration with automatic backup mode

Operating mode	LED M	LED A	LED C	CR
Manual	☼	●	●	0
Automatic	●	☼	●	0
DDC	disabled			0
Manual	☼	●	⊙	1
Automatic	●	☼	⊙	1
DDC	●	☼	☼	1
Backup mode				
M-backup	●	☼	⊗	0
M-backup	●	☼	⊙	1

DDC configuration with cascade backup mode

Operating mode	LED M	LED A	LED C	CR
Manual	☼	●	●	0
Automatic	●	☼	●	0
Cascade	●	●	☼	0
DDC	disabled			0
Manual	☼	●	⊙	1
Automatic	●	☼	⊙	1
Cascade	●	⊙	☼	1
DDC	●	☼	☼	1
Backup mode				
M-backup	●	⊗	☼	0
M-backup	●	⊙	☼	1

No computer ready signal (CR = 0)

As long as no computer ready (CR) signal is available, the controller cannot be switched to DDC mode.

Computer ready (CR = 1)

The changeover to DDC operation is enabled. In “manual“ mode LED A flashes with low frequency. In “automatic“ backup mode LED M flashes with low frequency.
It is possible to switch from DDC operation to manual or automatic mode at any time.

Computer not ready

If the CR signal is not received any longer, the controller takes over control in the configured mode.
In backup mode "manual" LED A flashes with increased frequency.
In backup mode "automatic" LED M flashes with increased frequency.
It is not possible to switch over to another mode (non-DDC).
The LED of the disabled mode flashes. The LED of the active mode is lighted permanently.

3.13 Stations

3.13.1 Manual station

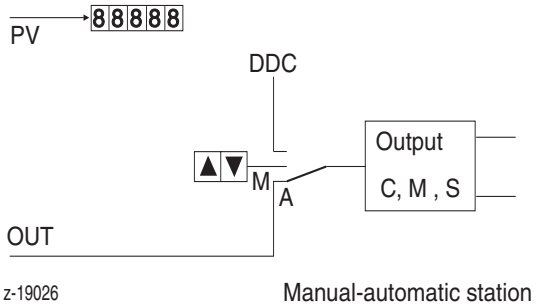


Fig. 3-33
(z-19026)

Operating mode	LED M	A	C	CR
Manual	☼	●	●	0
DDC	disabled			0
Manual	☼	●	⊙	1
DDC	☼	●	☼	1
Backup mode				
M-backup	☼	●	⊗	0
M-backup	☼	●	⊙	1

The manual station is a controller that can be used in “manual“ mode only.
All indicators that can be selected by pressing <Ind> do not display setpoints or the control deviation in this mode.
The PV indicator can indicate a measured value which can be monitored for limit values.
The operation of the manual station depends on the respective configuration.

Manual station

With the manual station the control output can be set manually. All output types of the controller are possible.

Manual/automatic station (not step controller)
In automatic mode, this station applies an externally fed continuous signal to the output. It is possible to switch over to manual mode and set the output manually.
No step output is possible.

DDC manual station (no step controller)
The DDC manual station combines the functionality of the manual station with the manual function of the DDC controller.

3.13.2 Setpoint station

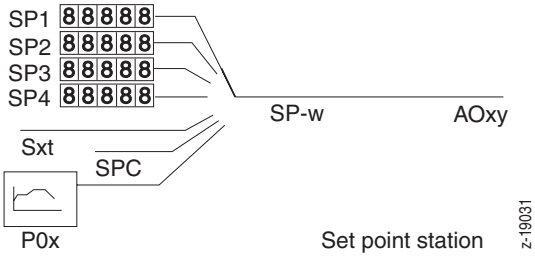


Fig. 3-34

The setpoint station generates setpoints and outputs them as 0/4...20 mA signal.

All indicators for the process value or control deviation are disabled.

The button <Sp-w> can be used to switch between different setpoint sources and the program generator, if configured.

3.13.3 Ratio station

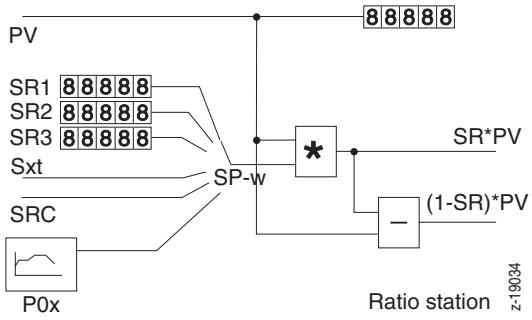


Fig. 3-35

The ratio station multiplies an input signal with a setable ratio factor SR. The input signal is treated as a measured value. Limit values may be set.

The signal (SR * input) is available as output signal.

3.13.4 Positioner

The positioner is a motorized valve controller (step controller) which tracks the actuator position (valve position) to an external setpoint. This task requires position feedback.

The returned position is indicated on the controller as the process value PV and the position feedback OUT.

3.14 Remote control (Profibus or Modbus)

Only remote control

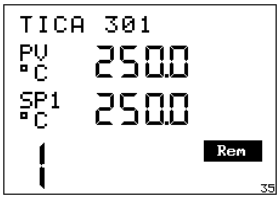


Fig. 3-36 Remote control is active
z-19035

The [Rem] indicator is active. The control buttons on the controller front panel are disabled, with some exceptions.

Possible operator actions

<Ind> Permits to switch over the display

<Menu> Accesses the configuration menu, among other reasons to start remote control.

Press <Menu> to switch to the menu level from which remote control can be disabled.

4 Error information on the display

Operating notes	Meaning	Configuration
locked by BI	Access to parameterization, configuration, service, and supervisor level is blocked through a binary input.	I-B02-Q01 I-B02-Q02
generate	After configuration the instrument is busy with the program generation.	
locked for ST	Self-tuning is blocked for this control loop. It can only be released via the configuration.	L1- B01-Q05
no adjustment possible	The selected input has not been activated for the type intended for the adjustment (e. g. no Pt100 input). This message is displayed for mA position feedback or remote transmitters fed with constant current, if the difference between start and end value is smaller than 10%.	
no adjustment	The configured module does not permit an adjustment respectively does not require an adjustment.	
local only	The instrument has only been configured for local operation. It cannot be switched to exclusive remote operation.	I-B04-Q01
remote only	The instrument has been configured for remote operation. For local operation it must be enabled via menu “Operate 2” or via the configuration.	I-B04-Q01

Table 4-1 Error information

Error message	Cause	Remedy
Error xxxx	An error occurred while processing the program. The number is intended as help for the service.	If this message does not disappear within a few seconds you can try to initiate a restart by switching off the supply voltage for approximately 60 s. If the error persists, the factory settings must be restored via the “supervisor” menu or the configuration must be reloaded via IBIS_*R* .
IP stopped!	Processing has been temporarily stopped. This error occurs during downloading.	If this message does not disappear within a few seconds after downloading you can try to initiate a restart by switching off the supply voltage for approximately 60 s. If the error persists, the factory settings must be restored via the “supervisor” menu or the configuration must be reloaded via IBIS-R .
Slot X!	When downloading a configuration the configuration request a module that is located in the instrument.	Insert the correct module in slot X and register the module (I-B11-Q01 = 1). Note: X = 1 to 4
invalid response	The response entered may be incompatible with other existing settings. Enter is activated together with this message.	Get the invalid response on the display with <Enter> and change it.

Table 4-2 Error information

5 Menu structure

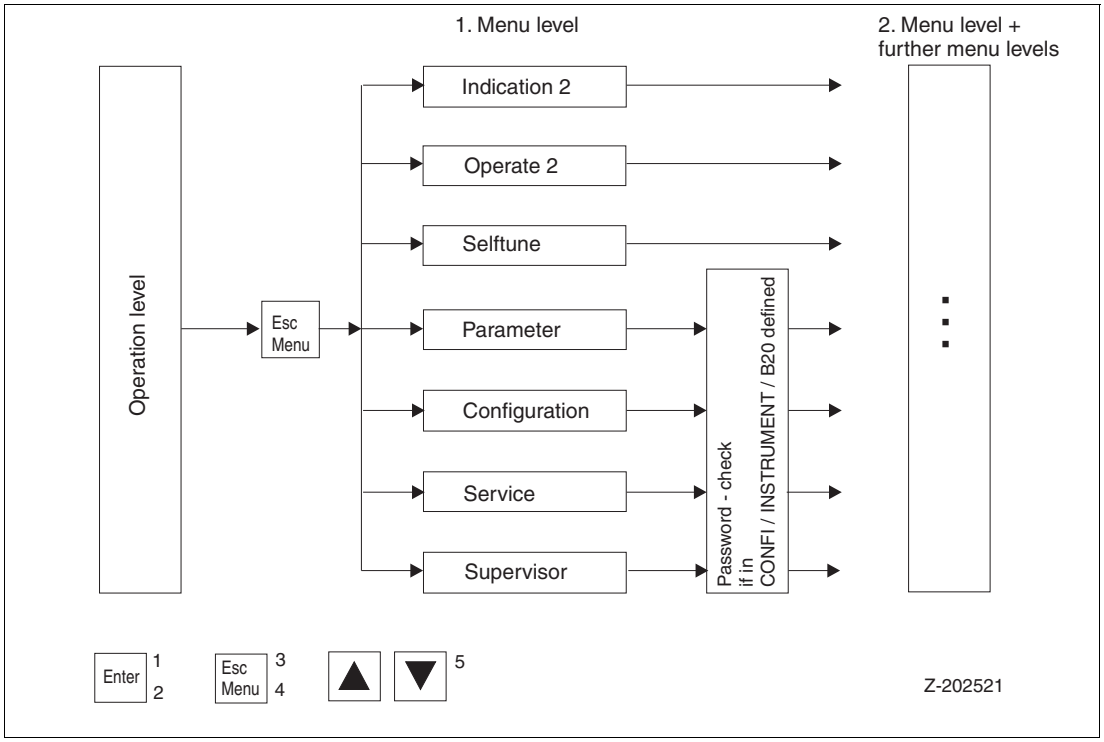


Fig. 5-1 Menu structure
1 Confirm selection, go down one menu level
2 Change or confirm input, go down one menu level
3 Go up one menu level without change(press 3 s → main operating level)
4 From main operating level to menu
5 Move sideways within one menu level

Indication 2

In this menu you can view all parameters, measuring values, and settings of the controller, but you cannot change them (see also chapter 5.1 “Indication 2” on page 26).

Operate 2

In this menu you can toggle between local and remote operation.
(See also chapter 5.2 “Operate 2” on page 28.)

Selftune

Self-tuning is enabled in the configuration menu under
CONFI / LOOP1 / B01 / Q05
After enabling it can be used without knowing a password .
(See Configuration Instruction 42/62-50012.)

Parameter

This menu contains the settings of the parameters required for the configured functionality. During parameterization the control action stays on. (See Configuration Instruction 42/62-50012.)

Configuration

This menu contains sub-menus for instrument function definition (e. g. actuator output type).
During configuration the control action is switched off (actuator outputs are frozen).
(See Configuration Instruction 42/62-50012.)

Service

This menu contains sub-menus for calibration, Adjustment, etc. (see also „Configuration Instruction“ 42/62-50012).
Calibration is only required in exceptional cases. If it is not executed in an expert manner, the instrument is rendered unusable.

Supervisor

This menu contains the sub-menus: Master reset, Plausibility, and Template. (See „Configuration Instruction“ 42/62-50012.)

5.1 Indication 2

Example navigation in menu „Indication 2“

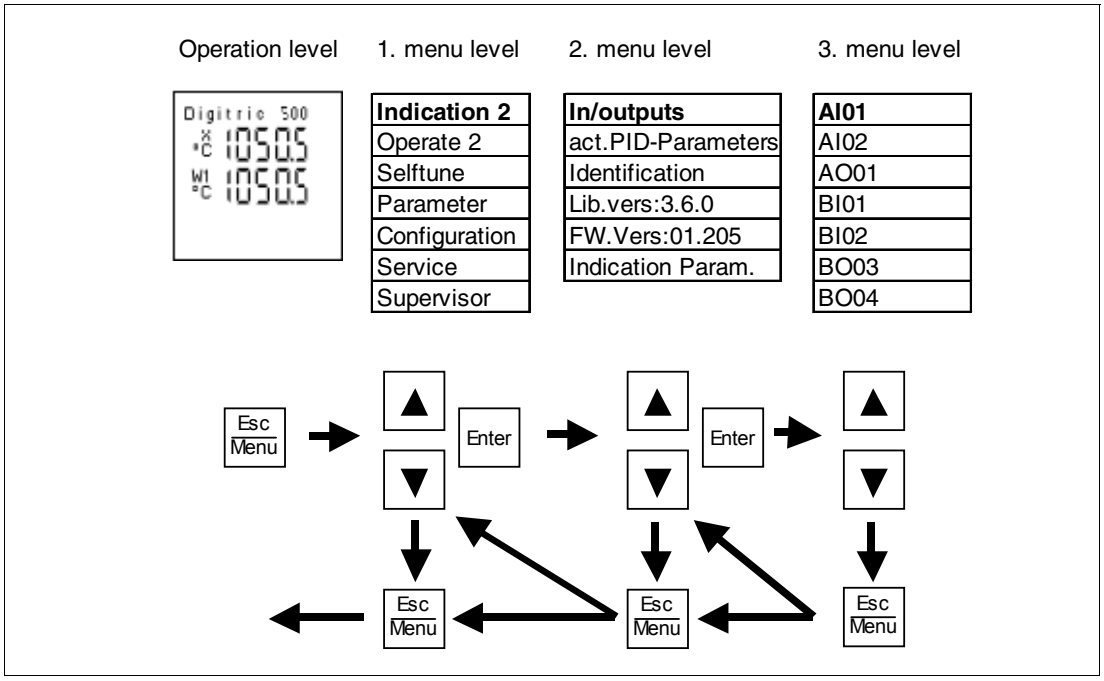


Fig. 5-2 Navigation in menu „Indication 2“

5.1.1 Inputs/outputs

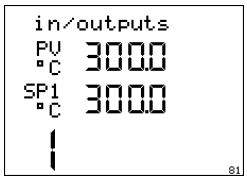


Fig. 5-3 -19081 Start menu for displaying inputs and outputs

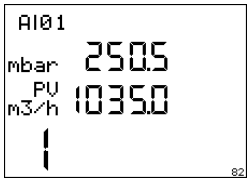


Fig. 5-4 z-19082 Analog input AI01 = 250,5 mbar

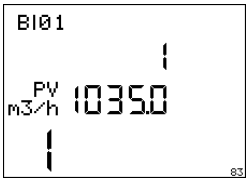


Fig. 5-5 z-19083 Binary input BIE01 = 1

In this menu you can display all binary and analog inputs and outputs used in the application.

Press <Enter> to switch to the next menu level.

The value of analog input AI01 is displayed in the first line of the selected scale.

The bottom line shows the PV. In simple control tasks with only one measuring value both values are identical, possibly with different decimal point position.

Press < ▲> and <▼> to select the desired input or output.

Currently, binary input BI01 has the value logical “1”.

5.1.2 Parameter display

Fig. 5-6 Parameter display
z-19104

In this menu you can display all parameters of the instrument.

Parameter changes can only be performed via the password-protected parameterization menu.

5.1.3 Effective PID parameter

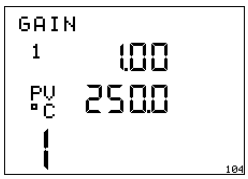


Fig. 5-7 PID parameter display
z-19104

In this menu you can display the effective PID parameters of the instrument.

Parameter changes can only be performed via the password-protected parameterization menu.

5.1.4 Identification

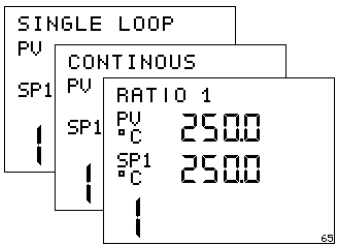


Fig. 5-8 The display shows an example of the information when called from Loop 1.
z-19065

Selecting menu option ”Identification“ displays the function of the selected control loop.

5.1.5 Library identification

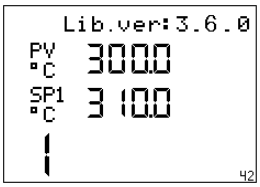


Fig. 5-9 Library identification
z-19080

The configuration is based on library 3.6.0. This information is only relevant for processing the configuration with IBIS-R.

5.1.6 Version display

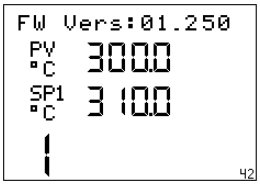


Fig. 5-10 The firmware (instrument software) has the z-19042 Index 01.250

This is the firmware version used in the instrument itself. It may be required to know this version number when using the IBIS-R PC software.

5.2 Operate 2

If the instrument has been configured exclusively for remote operation, the remote operation can be disabled temporarily – e. g. for emergency intervention – via menu “Operate 2”.

Depending on the configuration the following display appears when selecting the menu option:

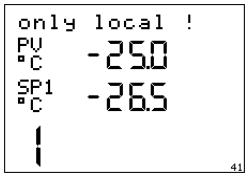


Fig. 5-11 Not intended for remote operation z-19041

Not intended for remote operation

The operation cannot be changed.

Note

Remote operation means that values are input to the instrument via Modbus RTU respectively PROFIBUS DP.

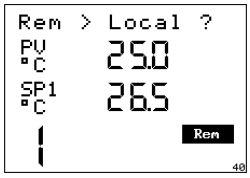


Fig. 5-12 Remote operation is activated z-19040

Rempote operatiopn is activated

Remote operation “Rem” can be toggled to local operation.
The question “Toggle to local operation?“ = "Rem>Local?" is confirmed with <Enter> or negated with <Esc>.

If the instrument is toggled to local operation the keys are enabled and [Rem] starts flashing.

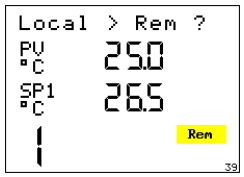


Fig. 5-13 Remote operation is deactivated z-19039

Remote operation is deactivated

Remote operation is – temporarily – switched off. Press <Enter> to restore the operating condition “Remote operation” as defined by the configuration. Then, the instrument can only be remote-operated.

[Rem] stops flashing.

6 Password protection

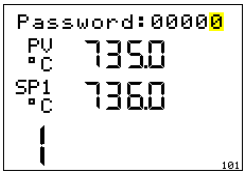


Fig. 6-1 z-19101 Input of password. 1st field from the right

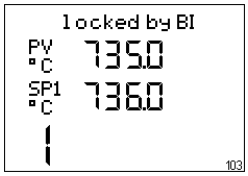


Fig. 6-2 z-19103 Locking the parameterization and configuration level via binary input

If the password protection has been configured (I-B20), you must enter a password to access the protected levels, by changing the predefined value “00000”.

The password is a 5-digit number.

1. Shift a flashing (= changeable) field: <Ind>
2. Change digit: < ▲> and <▼>
3. Confirm password: <Enter>

When the password is correct, the desired level is entered. You can now switch between all levels of the menu system without having to re-enter the password (Question: I-B20-Q01).

If the password is not correct, the main operating level is displayed again.

If a hardware lock has been configured (I-B02-Q01) and the binary input is set, the message “locked by BI” is displayed when attempting to open a protected level.

The message is displayed for 3 s, then the operating level is automatically switched back.

Cancelling the password input

Cancel with<Esc>

Forgotten password

If a password is no longer known, the password can be reset by temporarily rearranging a jumper within the instrument. For this action the control loop must be switched off.

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