JUMO

MEASUREMENT AND CONTROL

JUMO DICON PRS

Microprocessor-controlled Program Controller

Housing to DIN 43 700 for flush panel mounting
Bezel 96 x 96 mm

B 70.6040

9.90/V 00074083

Operating Instructions

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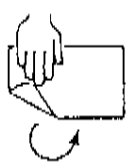
Please fold out this page
for reference
when using the
Operating Instructions



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1 DESCRIPTION

The JUMO DICON PRS is a program controller, size 96 x 96 mm. The unit has a depth of only 121.5 mm due to its state-of-the-art design, including SMD technology. It can be operated as single or double setpoint controller, as modulating controller, or as proportional controller. Three relay outputs are available as control, alarm or operating contacts depending on the control mode selected.
The operating contacts and alarm contacts can be used to actuate additional functions such as "fan on", "solenoid valve on", "feed off" etc. while the program is running.
The program controller has a 4-digit numerical display and a 4-character alphanumerical display. It is designed for direct operation from resistance thermometers in 3-wire or 4-wire circuit, thermocouples, and current or voltage signals. A self-calibrating input circuit ensures a very high class accuracy.
Input of the program does not require any special knowledge of programming. 10 programs, each with up to 10 sections, can be programmed and stored. The control parameters can be entered with the membrane keys, called up at any time, and freely amended. Interactive operation leads to a dialogue between the user and the controller.
The program controller can be integrated into a data system through a V.24(RS232C) or RS422/485 interface.
Two external inputs for program stop, start, fast forward or programming/key block are provided. The unit is of modular construction and therefore particularly convenient to operate and service. Surface-mounted devices (SMD) result in a high packing density together with extended functions and enhanced reliability.

Design features of the controller

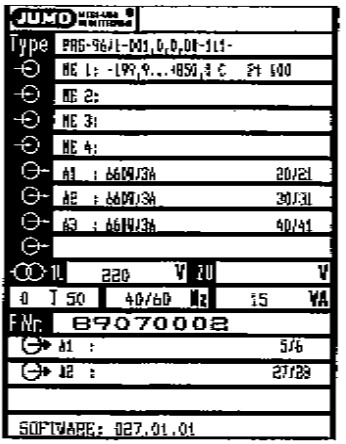
- Simple and user-friendly operation through clear separation of the functions
  - OPERATE
  - PARAMETERS
  - CONFIGURE
- Blockable planes to protect against unintentional changes
- Bright self-luminous displays:
  - 4-digit numerical LED display
  - 4-character alphanumerical LED display
- Operation through membrane keys
- Single-setpoint or double-setpoint controller, modulating controller or proportional controller
- Inputs for thermocouples, resistance thermometers, resistance transmitters and current or voltage signal
- Two external inputs for stop / start / key block / programming block / fast forward run
- Three outputs provided as standard for control contacts / limit comparators / operating contacts as relay, current, voltage or semiconductor output
- Interface V.24 (RS232C) or RS422/485, fully isolated (option)
- Self-optimisation for single setpoint, double setpoint and proportional controller
- Two isolated analogue outputs on proportional controller/process/setpoint/ timing switch (option)
- Supply for 2-wire transmitter, fully isolated

1.1 Type designation

The instrument label is affixed to the housing. It contains all the data on the controller function, the signal inputs and extra codes. The mains supply must agree with the supply voltage on the label.

PRS-96 / . . - . . / . . - . . - . .

- Program controller bezel 96 x 96 mm
- Controller function
- Limit comparator
- Operating contacts
- External inputs
- Interface
- Analogue outputs



Controller function

Description	Code
none	0
Single-setpoint controller with max. contact (relay de-energised for process above setpoint)	1
Single-setpoint controller with min. contact (relay de-energised for process below setpoint)	2
Double-setpoint controller	3
Modulating controller	4
Proportional controller	5

Limit comparators

Description	Code
no limit comparator	0
1 limit comparator	1
2 limit comparators	2
3 limit comparators (proportional controller only)	3

Operating contacts

Description	Code
no operating contacts	0
1 operating contact	1
2 operating contacts	2
3 operating contacts (proportional controller only)	3

External inputs

Description	Code
Stop / start	11
Stop / key block	12
Stop / programming block	13
Stop / fast forward	14
Start / key block	15
Start / programming block	16
Start / fast forward	17
Key block / fast forward	18
Programming block / fast forward	19

Interface

Description	Code
V.24 (RS232C)	24
RS422/485	26

Analogue outputs[1]

Description	Code
Process output	31
Setpoint output	32
Logic output	33
Output 1 process and output 2 setpoint[2]	34

Analogue outputs[1]

Description	Code
Output 1 process and output 2 logic[2]	35
Output 1 setpoint and output 2 logic[2]	36
Output 1 logic and output 2 logic[2]	37

[1] only one analogue output available with integral interface

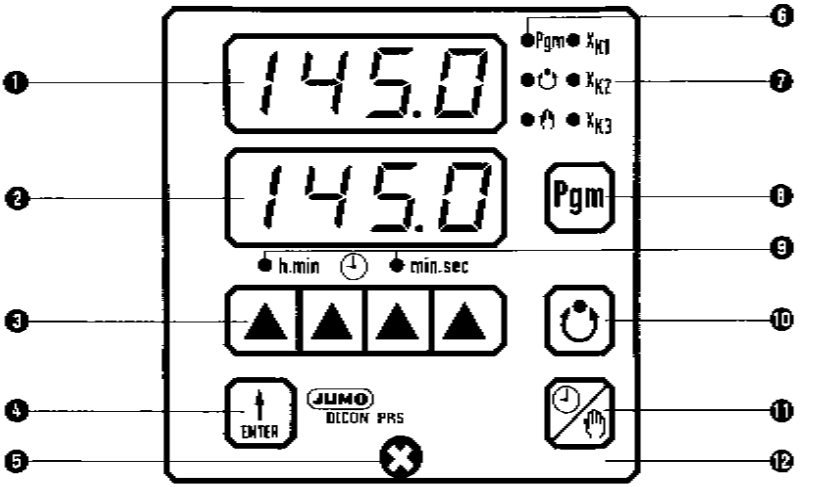
[2] not on proportional controller

Additional options[3]

Logic output instead of relay or semiconductor output instead of relay.

[3] specify in full

1.2 Displays and controls



1 Numerical display
4-digit LED display for process, residual section time, section und program number

2 Alphanumerical display
4-character LED display for setpoint or comments on numerical display

3 Increment keys
for data input

4 ENTER key
for entering inputs, selection of parameter and configuration plane

5 Fixing screw
for program controller chassis

6 LEDs
for programming, automatic and manual operation

7 LEDs
for the switched outputs

8 Programming key
for program input and parameter selection

9 LEDs
for the selected time base

10 Auto start/stop key

11 Changeover to manual operation, changing the time base h:min / min:sec

12 Membrane key panel
front protection IP 54

2 TECHNICAL DATA

Programs
up to 10 programs can be stored

Program sections per program
10

Program run time
1 sec – 99 h : 59 min per program section

Selection of start time
through keys from 1 min to 99 h : 59 min

Program repeat
0 – 99 and cyclic repeat

Data input
through keys or interface

Displays
4-digit numerical LED display for process, residual time, section and program number; 4-character alphanumerical LED display for setpoint or comments on the numerical display

Self-optimisation
on single-setpoint and double-setpoint controller and proportional controller during manual operation

Controller for use with resistance thermometers

Input
Pt 100, Pt 500
in 3-wire or 4-wire circuit

Range (°C or °F)
–199.9 +850.0 °C

Line adjustment
not required with 3-wire or 4-wire circuit. When using a resistance thermometer in 2-wire circuit it is necessary to provide line adjustment. The line adjustment can be made through an external line adjustment resistor. $R_{adjustment} = R_{line}$.

Controller for use with thermocouples

Input
Cu-Con U (T), Fe-Con L (J), NiCr-Ni K, Pt10Rh-Pt S, Pt13Rh-Pt R, Pt30Rh-Pt6Rh B or MoRe5-MoRe41 to IEC or ISA

Ranges (°C or °F)

Cu-Con U – 200 + 600 °C	Fe-Con L – 200 + 900 °C
Cu-Con T – 200 + 400 °C	Fe-Con J – 200 + 900 °C
NiCr-Ni K – 200 + 1400 °C	Pt10Rh-Pt S 0 + 1800 °C
Pt13Rh-Pt R 0 + 1800 °C	Pt30Rh-Pt6Rh B 0 + 1820 °C
MoRe5 – MoRe41 0 + 1990 °C	

Isolation 50 V
signal input to analogue output, analogue outputs from each other

Temperature compensation
internal; external also available (to special order)

Controller for use with linearised transducers with current or voltage signal

Input

0 – 1 mA	Ri = 50 Ω
0 – 20 mA	Ri = 2.5 Ω
4 – 20 mA	Ri = 2.5 Ω
0 – 10 mV	Ri = 100 kΩ min.
0 – 1 V	Ri = 50 kΩ
0 – 10 V	Ri = 500 kΩ

Indication range
relationship between value and voltage (current) can be configured

Controller for use with non-linearised transducers with current or voltage signal

Input
as for linearised transducers with current or voltage signal

Indication range
relationship between value and voltage (current) can be configured

Controller for use with resistance transmitters

Input
range: 0 – 30 Ω min., 0 – 10 kΩ max.; adjusted with keys in the configuration plane, see Item 7.3

Indication range
determined in the configuration plane

Outputs

3 switching and up to 2 **fully isolated** analogue outputs (option) are available (can be used as control, limit comparator or operating contacts).

1. relay outputs with floating contact
   rating:
   660 W 3 A at 220 V 50 Hz, resistive load
   contact life:
   approx. 10^6 operations at rated load
2. logic output
   0/5 V or 0/20 mA, Ri = 240 Ω
3. semiconductor output
   220 V 50 Hz 1 A, p.f. 0.7 min.
4. analogue output

as selected	burden
0(4)–20 mA	500 Ω max.
–20/0/+20 mA	500 Ω max.
0–10 V	500 Ω min.
–10/0/+10 V	500 Ω min.

Resolution of D/A converter

13 bit

Accuracy of output signal

0.25 % or better

General controller data

Controller type

can be used as single-setpoint or double-setpoint controller, modulating or proportional controller

Feedback

PD, PID, PI or PD/PID action

A/D converter

resolution 14 bit

Controller accuracy	ambient temperature error
when used with resistance thermometers and resistance transmitters	
0.05 % max.	0.01 % max. per 10 °C
when used with thermocouples within working range	
0.25 % max.	0.05 % max. per 10 °C
when used with linearised transducers with current signal	
0.05 % max.	0.05 % max. per 10 °C
voltage signal 0–10 mV	
0.02 % max.	0.1 % max. per 10 °C
voltage signal 0–1(10) V	
0.05 % max.	0.05 % max. per 10 °C

These values include the linearisation tolerances.

Signal circuit monitor

on sensor break (resistance thermometers and thermocouples).

1. Controller output
   On on-off controllers the relays are de-energised. On proportional controllers the output signal moves to the start value.
2. Alarm relay
   The alarm relay (Ik9 or Ik10) moves to a defined setting.
3. The limit comparator relays and operating contacts are de-energised.
4. The program run is interrupted.

Action after supply failure

continue, stop or base status (as selected by internal switches)

Data back-up

through lithium battery, Varta Type CR1/3N SLF,
life 5 years min.; nominal voltage 3 V

Supply

normally 220 V, +10 % –15 %, 40–60 Hz, can be changed by internal solder links to 110 V, +10 % –15 %, 40–60 Hz (see Chapter 9);
other voltages to special order

Loading

15 VA approx.

Supply for 2-wire transmitter

20 V 40 mA, **fully isolated**

Electrical connections

through faston connectors to DIN 46 244/A, 4.8 x 0.8 mm

Permitted ambient temperature range

0 to 50 °C

Permitted storage temperature range

–40 to +70 °C

Climatic conditions

Class KWF to DIN 40 040,
relative humidity not exceeding 75 % annual mean, no condensation

Housing

aluminium extrusions, black anodised, with plug-in controller chassis (connected to ground)

Protection

to DIN 40 050
front IP 54
rear IP 20

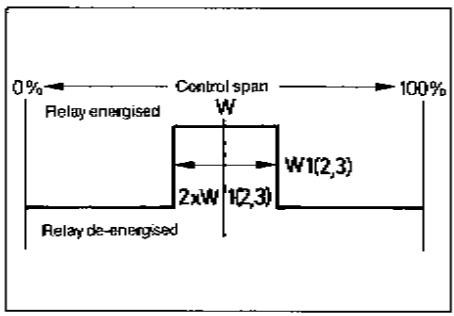
Limit comparators

The controller is provided with up to 3 limit comparators, depending on the model. The desired limit comparator function, the setpoint and the switching differential are adjustable in the configuration plane.

Functions limit comparator lk1 to lk8

❶ Limit comparator lk1

Relay is energised when the process is within selected window, de-energised when the process is outside the window.
Adjustable window width: ±9999 digits

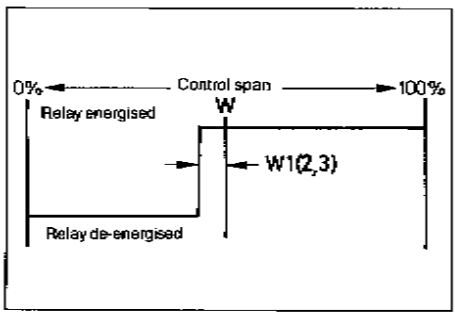


❷ lk2 as lk1

but relay action reversed

❸ lk3 low alarm contact only

Relay is de-energised when process is below alarm level.
Adjustable contact spacing: ±9999 digits

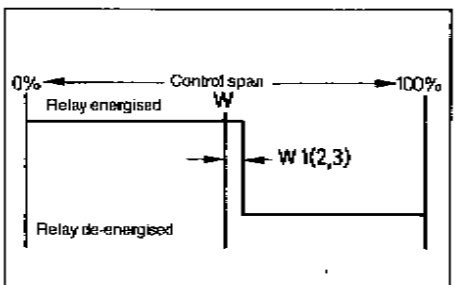


❹ lk4 as lk3

but relay action reversed

❺ lk5 high alarm contact only

Relay is de-energised when process is above alarm level.
Adjustable contact spacing: ±9999 digits

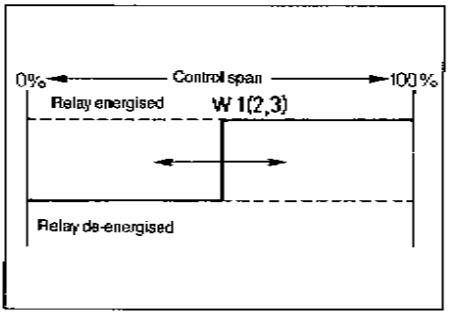


❻ lk6 as lk5

but relay action reversed

❼ Ik7 adjustable over the full control span
Relay is energised when process is above limit.
Adjustment range: ±9999 digits

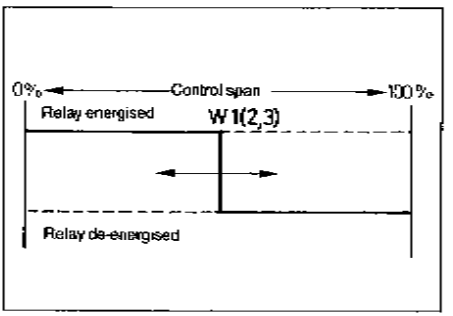
❽ Ik8 as Ik7
but relay action reversed



Alarm functions (output Xk3)

❾ Ik9 adjustable over the full control span
Relay is energised on failure or short-circuit of sensor.
Adjustment range: ±9999 digits

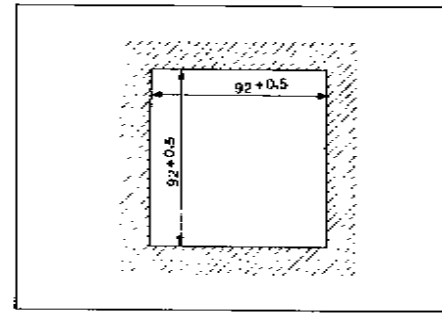
❿ Ik10 as Ik9
but relay action reversed



3 INSTALLATION

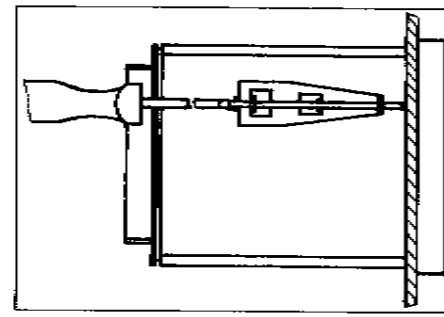
3.1 Location and climatic conditions

The instrument location should as far as possible be free from vibrations. Stray electromagnetic fields, e.g. from motors, transformers etc., should be avoided. The ambient temperature at the instrument location should be between 0 and 50 °C at a relative humidity not exceeding 75 %. Corrosive air or fumes reduce the life of the instrument.

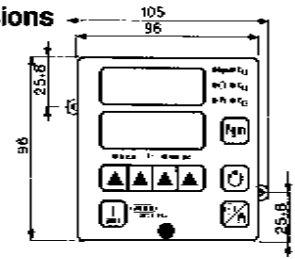


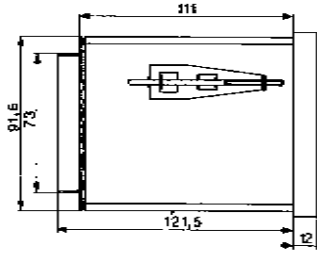
3.2 Fitting in position

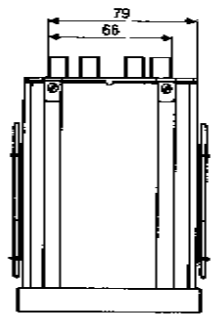
Insert the program controller from the front into the panel cut-out. Slide the mounting brackets into the cut-outs at the sides of the housing. The flat sides of the brackets must lie against the housing. The brackets are then placed against the rear of the panel and tightened up evenly with a screwdriver.



3.3 Dimensions

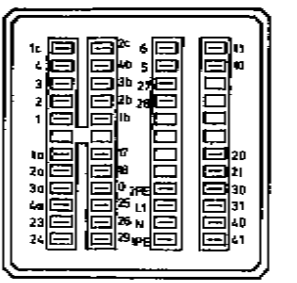






The electrical connections are made in accordance with the connection diagram below. The choice of cable and the connection of the supply line must meet the requirements of VDE 0100 "Regulations on the Installation of Power Circuits with nominal voltages below 1000 V" or the appropriate local regulations.

Illustration on the right:
Rear view with faston connectors
to DIN 46 244/A, 4.8 x 0.8 mm



4.1 Connection diagram

Connection for		Terminals				
Analogue output 1			5 + 6 –			
Analogue output 2			27 + 28 –			
			Relay output	Semiconductor relay output	Logic output 0/5 V or 0/20 mA	
Relay or semiconductor relay or logic outputs	1	Xk1	20 (P) pole 21 (S) closing	20 21	20 + 21 –	
	2	Xk2	30 (P) pole 31 (S) closing	30 31	30 + 31 –	
	3	Xk3	40 (P) pole 41 (S) closing	40 41	40 + 41 –	
Voltage output for 2-wire transmitter			11 + 10 –	20 V / 40 mA		
Supply as on label			L1 line N neutral 1 PE protective ground 2 PE connection for screen			
Serial interface RS232 (V.24)		RxD	23	Received data (receiving line)		
		TxD	25	Transmitted data (transmitting line)		
		CTS	24	Clear to send		
		RTS	26	Request to send (switch on transmitter)		
		GND	29	Signal ground		
Serial interface RS422		A(+) B(–)	23 24	Received data (receiving pair)		
		A(+) B(–)	25 26	Transmitted data (transmitting pair)		
		GND	29	Signal ground		
Serial interface RS485		A(+) B(–)	25 26	Transmitted/received data (transmitting/receiving pair)		
		GND	29	Signal ground		

* Contact protection circuit 22 nF, 56 Ω

** Varistor protection circuit 300 V

4 ELECTRICAL CONNECTION

Input	Terminals			
Thermocouple	t	1 – 4 +		
Resistance thermometer in 3-wire circuit	w	1 2 3		
Resistance thermometer in 4-wire circuit	w...vl	1 2 3 4		
Voltage or current	e	1 – 2 +		
Resistance transmitter with 3-wire connection	w...wfg	1 2 3	S = slider E = end A = start	
External input 1	E 1	17 0		
External input 2	E 2	18 0		

4.2 Important notes on installation

- All sensor and signal lines should where possible be run separately from the control and supply cables.
- Where several electronic units are installed it is preferable for each to have a separate supply cable including ground.
- Use screened signal cables which should only be grounded at the program controller (terminal 2PE or ground terminals of housing on the rear panel).
- Where possible provide physical separation between electronic units and contactor circuits.
- If there are inductive loads close to the unit, such as contactors, solenoid valves etc., it is advisable to reduce interference by fitting an RC module to the contactor coil.
- No control circuit (relays, contactors) should be connected to the supply terminals of the instrument.
- Please observe the appropriate safety regulations for overtemperature monitoring.

5.1 Planes and blocks

For clearer identification of the large number of possible programming inputs the controller parameters are arranged in three distinct planes: operating plane, parameter plane and configuration plane.

Operating plane

In the base status the top display shows the process and the bottom display the horizontal centre segments. During automatic operation the bottom display indicates in addition the setpoint. An increment key can be used to indicate residual program time, section, and program number.

Parameter plane

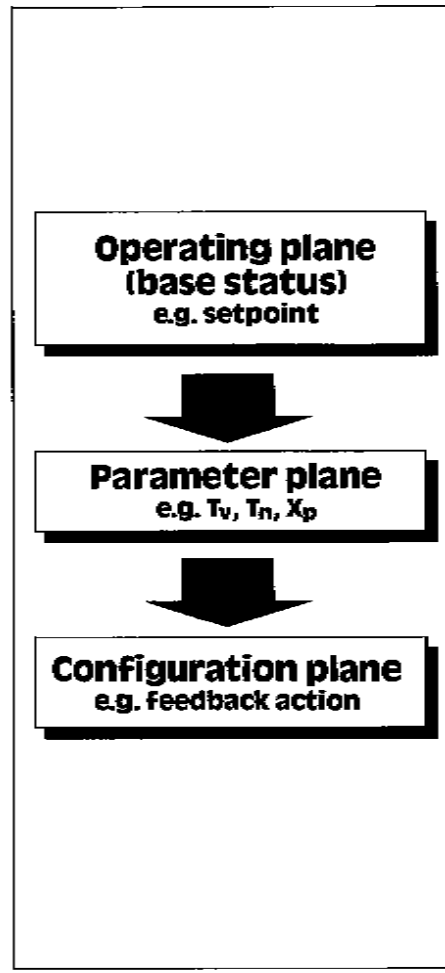
In this plane the controller can be matched to the process. The individual parameters are displayed sequentially as value and symbol.

Configuration plane

The factory settings can be displayed and partly modified (see Chapter 7).

Internal switches are used to set whether the controller operates with the factory-set data of the configuration plane when it is connected to the supply, or whether the data input by the user are used (see Chapter 9).

The three planes can be blocked by internal switches (see Chapter 9).



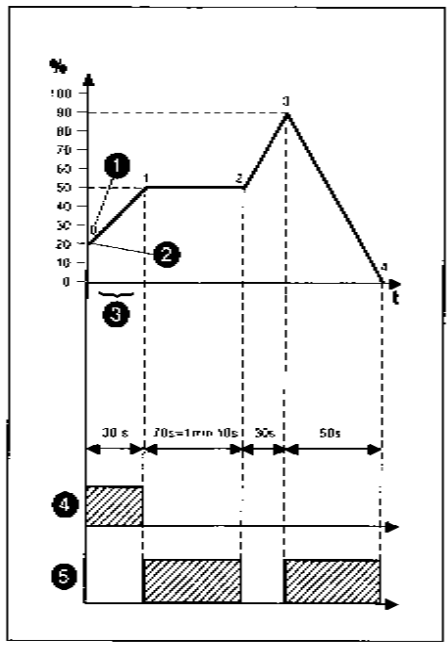
Plane	Block	Controller data
Operating plane	Access possible	Adjustment by user
Parameter plane	Access possible	Set at the factory; user change possible
Configuration plane	Blocked at the factory	Set at the factory; some user changes possible

5.2 Program input

Before programming the curve has to be marked in graphic and tabular form on the program data table (see Chapter 12).

The control range is shown on the instrument label. Setpoints outside the set range are not accepted. The display is flashing with the permitted value. The setpoints and the sign are selected with the increment keys.

The time column of the program data table has to be marked to indicate whether the values will be given in min:sec or h:min. During the subsequent data input it must be remembered that not more than 59 sec or 59 min can be programmed. This means, for example, an entry of 2:10 for a section time of 130 sec.



Each program section is defined by:

❶ the section number (Sc) starting with 0

❷ the setpoint (SETP)

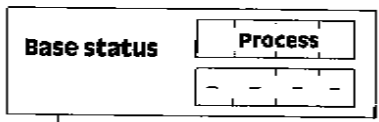
❸ the section time (TIME) in h:min/min:sec

❹ the status of operating contact 1 (Out 1)

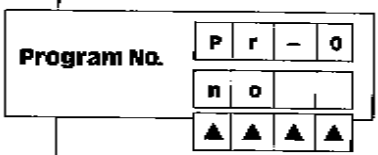
❺ the status of operating contact 2 (Out 2)

Data check and data correction of setpoint curve

The data check is performed in the same way as the programming of the setpoint curve. If required the values for setpoint, time and operating contact are simply overwritten.



Pgm Initiate programming



display –YES– = program available
display –no– = no program available

Select program No.

Enter program No.

❶ Section Sc-. Pr-		❷ Setpoint SETP		❸ Section time TIME h:min mr:sec		❹ Operating contact 1 Out 1		❺ Operating contact 2 Out 2	
0		20		0.30		ON		OFF	
1		50		1.10		OFF		ON	
2		50		0.30		OFF		OFF	
3		90		0.50		OFF		ON	
4		0		0.00		OFF		OFF	

Terminate programming Pgm

Programming can be aborted at any time with Pgm key.

5.3 Automatic operation

5.3.1 Program start and abort

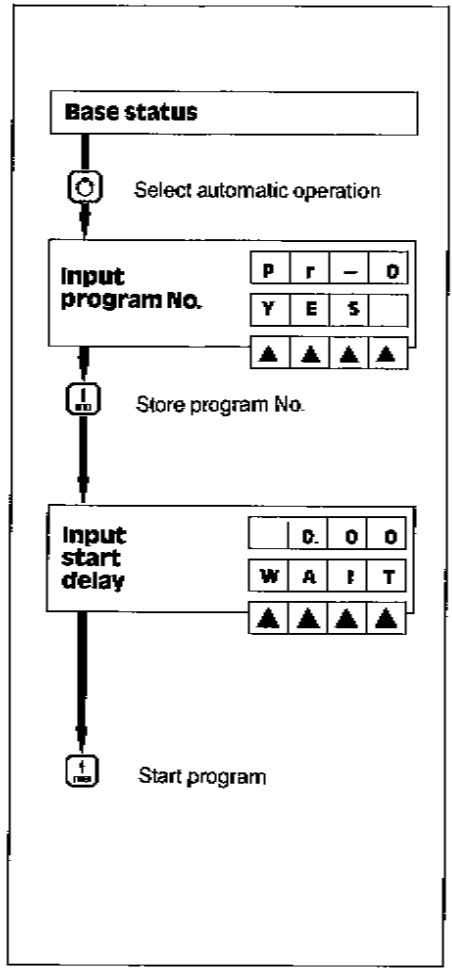
Select automatic operation and input the program number. If required activate the start delay (on the display the time is counted in minute steps down to 0:00).

Aborting the program

The program can be aborted at any time with the ⏻ key.

Stopping the program

The program can be stopped and held at any time with the ⏸ key.
This can be followed by static changes (see Item 5.3.5).



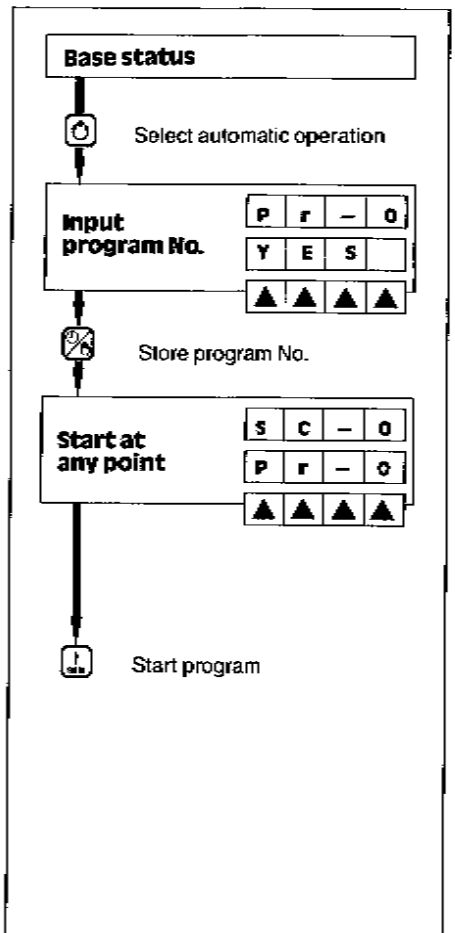
5.3.2 Displays during automatic operation

Using one of the increment keys ▲▲▲▲ the following parameters can be called up during automatic operation:

- process
- setpoint
- residual section time
- section No.
- program No.

5.3.3 Program start at any point

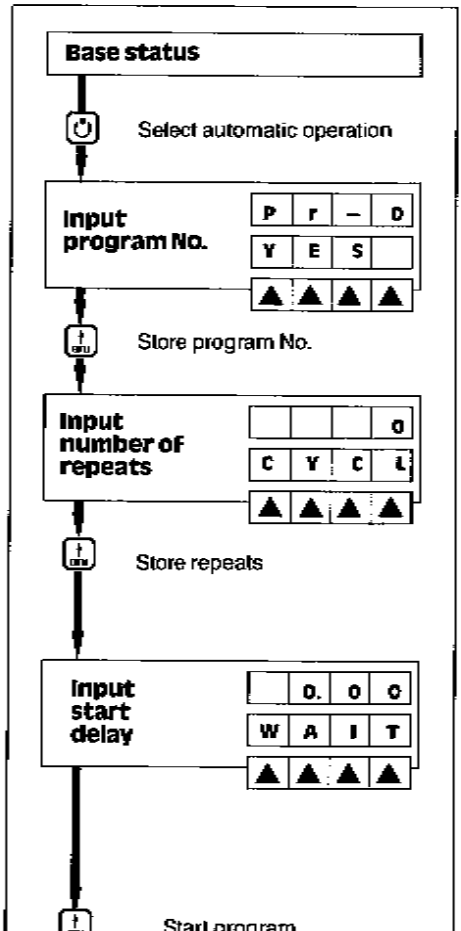
Select automatic operation and input program No. and the required start section.



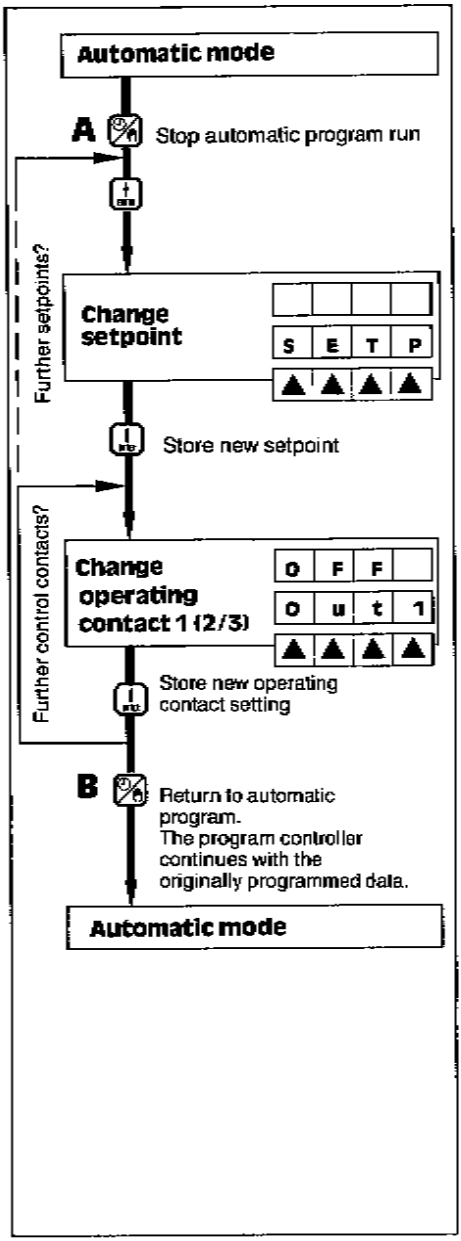
5.3.4 Program start with repeats

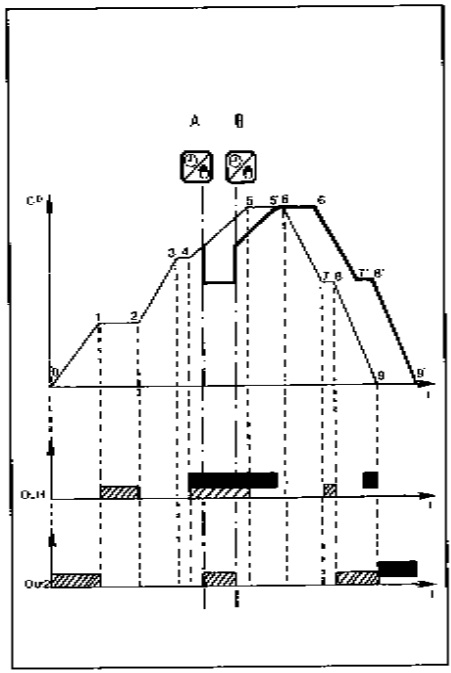
For this operating mode close the internal switch S 302.1 (see Chapter 9).

Select automatic operation and enter program No. and number of repeats.
Activate the start delay if required.



5.3.5 Static changes





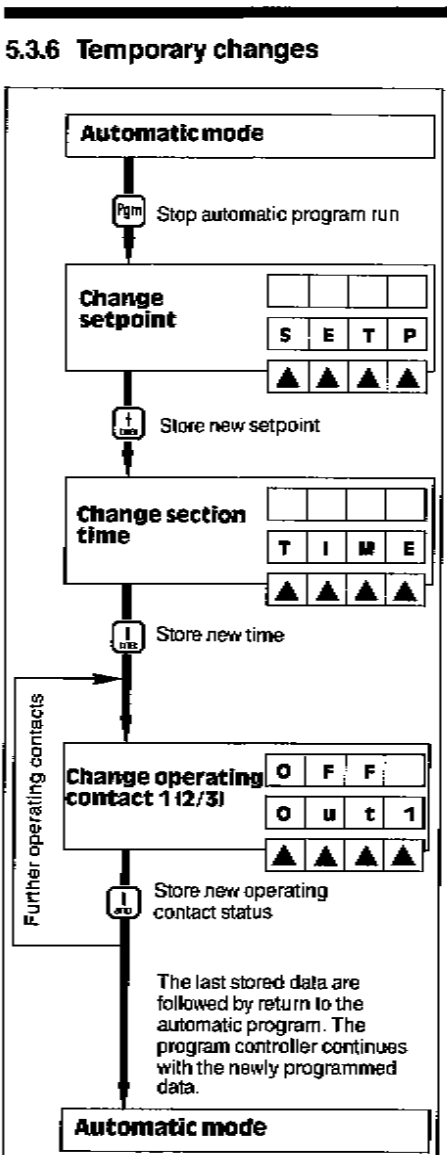
— automatic program according to pre-set diagram

— changed program to new diagram

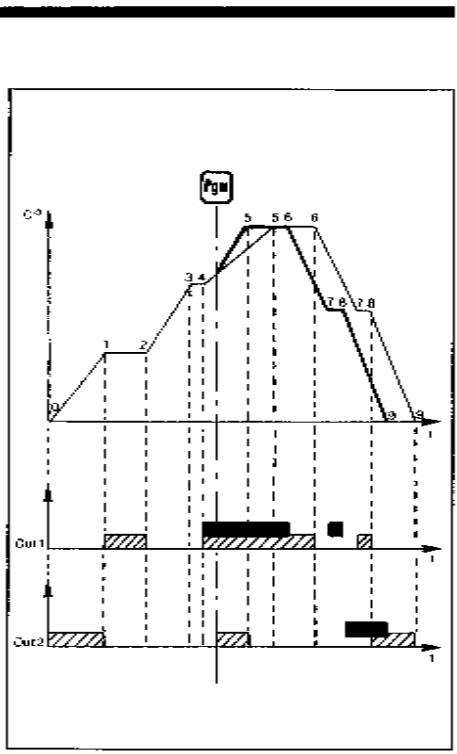
▨ operating contacts of automatic program

■ "time-displaced" operating contacts due to changed program

5.3.6 Temporary changes



The change procedure can be aborted at any time with the Pgm key. Any data entered with "ENTER" up to that instant are included in the program.
The changes are not stored permanently; the next program start calls up the original data.



automatic program according to pre-set diagram

changed program to new diagram

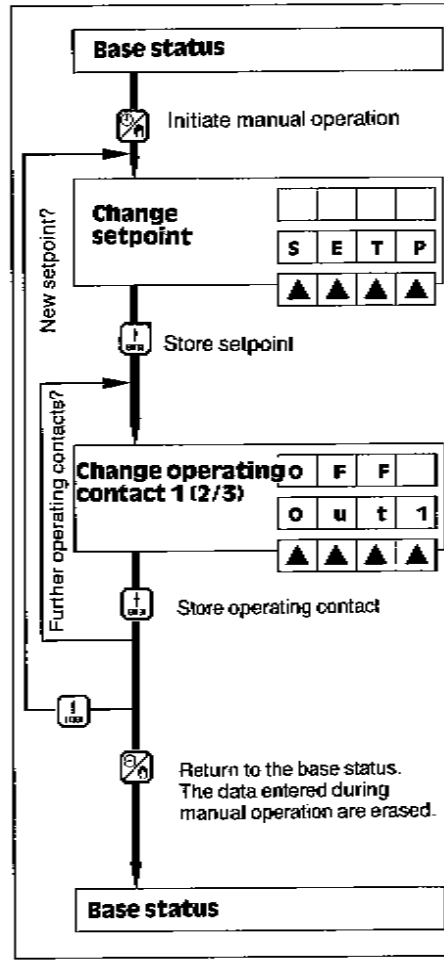
Operating contacts of automatic program

Operating contacts of changed program

5.4 Manual operation

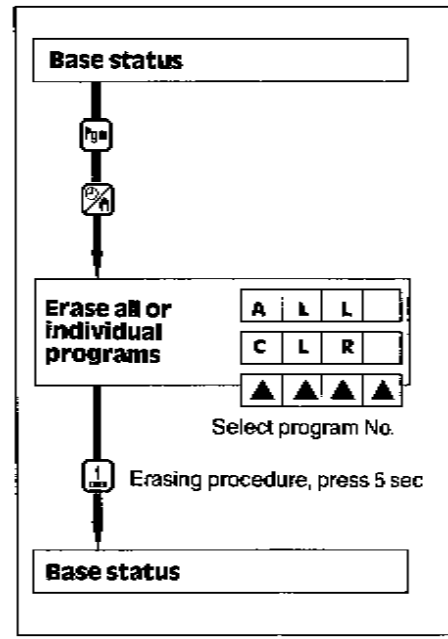
During manual operation the setpoint and the status of the operating contacts can be input without a program being activated. Manual operation is initiated with the "HAND" key, the LED "HAND" lights up.

Using the increment keys, input first the setpoint and then the status of the operating contact relays. The inputs are stored with the "ENTER" key. On pressing the "HAND" key the program controller returns to the base status. The data entered during manual operation are erased.

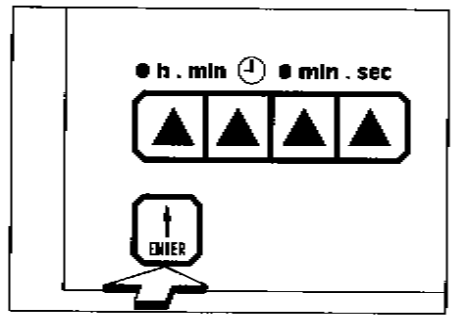


5.5 Deleting programs

The erasing procedure is initiated with the "Pgm" and "HAND" keys. To erase all programs, press the "ENTER" key and hold down for 5 seconds.
To erase a particular program, select the program No. with one of the increment keys and then press the "ENTER" key for 5 seconds.
The erasing procedure is completed when the display has returned to the base status.



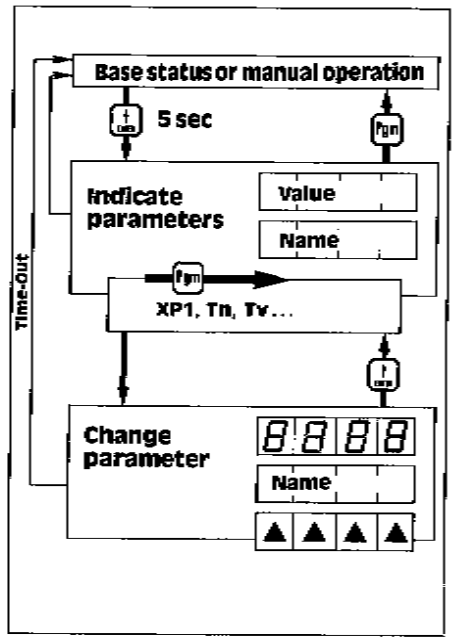
Access to the parameter plane is obtained by pressing the "ENTER" key for 5 seconds.
It can be selected from the base status or from manual operation.
Access to the parameter plane is only possible if the plane is unblocked and if the data transfer of the factory-set parameters is switched off (see Chapter 9).



6.1 Displaying and changing parameters

The parameters are called up in sequence with the "Pgm" key. The parameters of the individual controller versions are listed in the Parameter Table under Item 6.2.
After the last parameter the controller automatically returns to the standard display.
When one of the increment keys is pressed for changing the parameter, the parameter name (e.g. Tv, Tn) flashes in the bottom display. After the changed value has been entered with "ENTER", further parameters are displayed with "Pgm".
In case of inappropriate inputs the top display shows the minimum or maximum value permitted.

All the controller parameters of the parameter table on the next page are indicated (" ■ " and "—"). In accordance with the controller version and the feedback structure, inputs are accepted only on " ■ ", inputs on "—" are not accepted.



6.2 Parameter table

Single-setpoint controller

Symbol	Parameter	Feedback action				Adjustment range[2]	Factory setting[2]
		none[1]	PD	PID	PD/PID		
XP	Proportional band	—	■	■	■	Xp = 0 – 9999 digit	0 digit
XD	Differenbal	■	—	—	—	Xd = 0 – 999.9 digit	1.0 digit
TV	Derivative time	—	■	—*	■	Tv = 1 – 999 sec	80 sec
TN	Reset time	—	—	■	■	Tn = 1 – 9999 sec	350 sec
CY	Cycle time	—	■	■	■	Cy = 0.1 – 99.9 sec	20.0 sec
Y1	Max. valve stroke	—	■	■	■	Y1 = 0 – 100 %	100 %

Double-setpoint controller

Symbol	Parameter	Feedback action				Adjustment range[2]	Factory setting[2]
		none[1]	PD	PID	PD/PID		
XP1	Proportional band (heating contact)	—	■	■	■	Xp1 = 0 – 9999 digit	0 digit
XP2	Proportional band (cooling contact)	—	■	■	■	Xp2 = 0 – 9999 digit	0 digit
XSH	Contact spacing	■	■	■	■	XSh = 0 – 999.9 digit	0 digit
XD1	Differenbal (heating contact)	■	—	—	—	Xd1 = 0 – 999.9 digit	1.0 digit
XD2	Differential (cooling contact)	■	—	—	—	Xd2 = 0 – 999.9 digit	1.0 digit
TV	Derivative time	—	■	—*	■	Tv = 1 – 999 sec	80 sec
TN	Reset time	—	—	■	■	Tn = 1 – 9999 sec	350 sec
CY1	Cycle time (heating contact)	—	■	■	■	Cy1 = 0.1 – 99.9 sec	20.0 sec
CY2	Cycle time (cooling contact)	—	■	■	■	Cy2 = 0.1 – 99.9 sec	20.0 sec
Y1	Max. valve stroke	—	■	■	■	Y1 = 0 – 100 %	100 %
Y2	Min. valve stroke	—	■	■	■	Y2 = 0 to – 100 %	– 100 %

Modulating controller

Symbol	Parameter	Feedback action				Adjustment range[2]	Factory setting[2]
		none[1]	PI	PID	—		
XP	Proportional band	—	■	■	—	Xp = 0 – 9999 digit	0 digit
XSH	Contact spacing	■	■	■	—	XSh = 0 – 999.9 digit	0 digit
XD	Differential	■	—	—	—	Xd = 1 – 999.9 digit	1.0 digit
TN	Reset time	—	■	■*	—	Tn = 1 – 9999 sec	350 sec

Proportional controller

Symbol	Parameter	Feedback action				Adjustment range[2]	Factory setting[2]
		P	PI	PD	PID		
XP	Proportional band	■	■	■	■	Xp = 0 – 9999 digit	100 digit
TV	Derivative time	—	—	■	■	Tv = 1 – 999 sec	80 sec
TN	Reset time	—	■	—	■	Tn = 1 – 9999 sec	350 sec
Y1	Max. valve stroke	■	■	■	■	Y1 = 0 – 100 %	100 %
Y2	Operating point	■	—	■	—	Y2 = 0 – 100 %	50 %

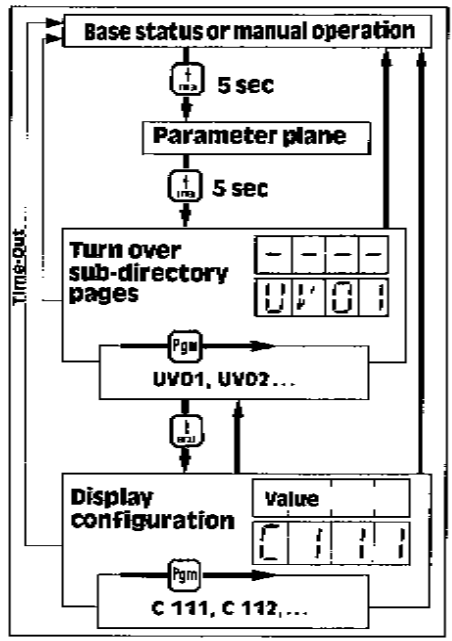
■ adjustable ☐ factory setting * $T_v = T_n/4.5$ [1] Xp = 0 means "feedback switched off"

[2] all parameters with "digit" have to be multiplied as follows: x0.1 when using 1 decimal place, x0.01 when using 2 decimal places etc.

7.1 Displaying configuration data

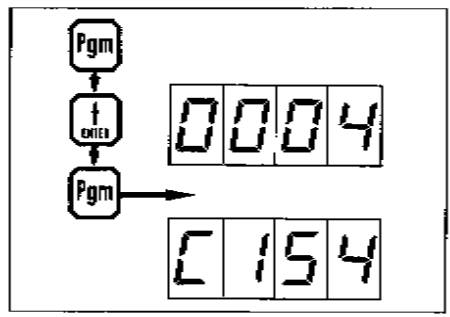
The configuration plane can be accessed from the base status and the manual operation through the parameter plane.
The configuration data are divided into nine sub-directories UV01–09.
The step "Turn pages of sub-directory" permits rapid location of a configuration code.

Access to the configuration plane is only possible if this plane is unblocked and if the data transfer of the factory-set parameters is switched off (see Chapter 9).



Example:

Which feedback structure is shown in the alphanumerical display at Code 154?
Turn pages up to sub-directory UV05 (using the "Pgm" key); after pressing "ENTER" and "Pgm" the display is as shown alongside. As seen from the configuration table, the number 4 in the top display represents the feedback structure PD/PID.
After pressing "Pgm" the pages of the subsequent sub-directories are turned over.



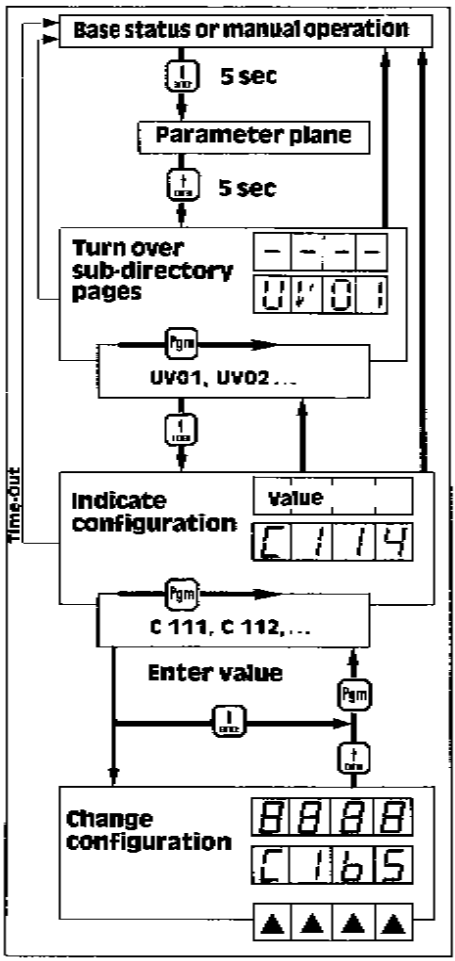
7.2 Changing configuration data

Many changes in configuration data also require adjustment of other parameters. If, for example, the feedback action is changed, the control parameters must also be altered. If a parameter is omitted this would result in an undesirable or faulty control action.

Select configuration parameter, change it if necessary, and enter the input with "ENTER".

Following an incorrect input the top display flashes and requests correction of the input. On pressing "Pgm" the next parameter is indicated.
The status as supplied from the factory can always be restored by reading in the factory-set parameters (see Chapter 9, Data Transfer).

In sub-directory UV06, changing the limit comparator function Ik results in a request for the input of the parameters Ik switching differential and Ik value, as shown by the operator guidance (both displays flashing).



7.3 Configuration Tables

UV01	Inputs (data are indicated only)					
C 111	Function	process	1	0	0	0
C 112	Transducer	resistance thermometer				
		Pt 100 (500)*	1	0	0	0
		thermocouple	2	0	0	0
		resistance transmitter				
		with 3-wire connection	4	0	0	0
		current 0 – 20 mA or				
		voltage 0 – 10 V*)	5	0	0	0
		current 4 – 20 mA	6	0	0	0
		*) if provided in hardware				
C 113	Linearisation	linear – 1999 to + 9999 digit				0
		Pt 100(500*) – 199.9 + 850.0 °C				1
		Fe-Con L – 200 + 900 °C				2
		NiCr-Ni K – 200 + 1400 °C				3
		Pt10Rh-Pt S 0 + 1800 °C				4
		Pt13Rh-Pt R 0 + 1800 °C				5
		Pt30Rh-Pt6Rh B 0 + 1820 °C				6
		Cu-Con U – 200 + 600 °C				7
		MoRe5-MoRe41 0 + 1990 °C				8
		Cu-Con T – 200 + 400 °C				9
		Fe-Con J – 200 + 900 °C		+)	1	0
		*) if provided in hardware				
C 114	Selection °C/°F	temperature °C	0	0	0	0
		temperature °F	0	0	0	1
C 115	Decimal place	no decimal place	0	0	0	0
		one decimal place	0	0	0	1
		two decimal places x)	0	0	0	2
		three decimal places x)	0	0	0	3
		x) only possible with C113 = 0				

+) the zeroes are not displayed!

7 CONFIGURATION PLANE

UV02 Scale with resistance transmitter and current input			▲	▲	▲	▲
C 122	Minimum setpoint (value indicated only)	range to DIN IEC	x'	x'	x'	x'
C 123	Maximum setpoint (value indicated only)	range to DIN IEC	x'	x'	x'	x'
C 124[1]	Start of range process		x	x	x	x
C 125[1]	End of range process		x	x	x	x

x: input within range of values
x': indication as specified in order
[1] only with current, voltage and resistance transmitter inputs
Standard setting: start of range 0 digit, end of range 100 digit. Other ranges can be selected.
☐ = can be configured

UV03 Process variable correction to Item 10.2			▲	▲	▲	▲
C 131	Customer correction to Item 10.2 (factory setting X0 = 0 and X1 = 1)	X0 input	x	x	x	x
C 132		X1 input	x	x	x	x
C 139	Measured values for programmed indication Not programmable (see Item 10.2) (values indicated only)	X0' input 1 0	x'	x'	x'	x'
C 13A		X1' input 1 100	x'	x'	x'	x'

x: input within range of values
x': indication according to change in C 131 and C 132
☐ = can be configured

UV04	Analogue outputs		▲	▲	▲	▲
C 141	Function output 1 (values indicated only)	no function	0	0	0	0
		process x	0	0	0	1
		setpoint w	0	0	0	2
		control deviation xw	0	0	0	3
		controller output Y	0	0	0	5
		logic output (operating contact)	0	0	0	6
C 142[1]	Calibration output 1	value at 0 % output signal (signal start)	x'	x'	x'	x'
C 143[1]		value at 100 % output signal (signal end)	x'	x'	x'	x'
C 144	Signal output 1[2]	0 – 20 mA[2]	0	0	0	0
		4 – 20 mA[2]	0	0	0	1
C 145	Function output 2	no function	0	0	0	0
		process x	0	0	0	1
		setpoint w	0	0	0	2
		control deviation xw	0	0	0	3
		controller output Y	0	0	0	5
		logic output (operating contact)	0	0	0	6
C 146	Calibration output 2	value at 0 % output signal (signal start)	x'	x'	x'	x'
C 147		value at 100 % output signal (signal end)	x'	x'	x'	x'
C 148	Signal output 2[2]	0 – 20 mA	0	0	0	0
		4 – 20 mA	0	0	0	1

[1] not on proportional controller
[2] only if set in hardware, see Chapter 9
x' = indication as order specification

UV05	Controller setting		▲	▲	▲	▲
C 152	Controller type	proportional controller with falling characteristic	0	0	0	0
	(values indicated only)	proportional controller with rising characteristic	0	0	0	1
		single-setpoint controller with max. contact (relay de-energised for process above setpoint)	0	0	0	2
		single-setpoint controller with min. contact (relay de-energised for process below setpoint)	0	0	0	3
		double-setpoint controller	0	0	0	4
		modulating controller	0	0	0	5
C 153	Stroke period (on modulating controller)	range: 15 – 600 sec standard setting: 60 sec	x	x	x	x
C 154	Feedback action[2]	P	0	0	0	0
	[2] The feedback action is only effective for proportional band Xp ≠ 0	PI	0	0	0	1
		PD	0	0	0	2
		PID	0	0	0	3
		PD/PID	0	0	0	4

x = input within range of values
□ = can be configured

UV06	Limit comparators or operating contacts		▲	▲	▲	▲
C 161	Limit comparator or operating contact relay 1[1]	no function	0	0	0	0
		function lk1	0	0	0	1
		function lk2	0	0	0	2
		function lk3	0	0	0	3
		function lk4	0	0	0	4
		function lk5	0	0	0	5
		function lk6	0	0	0	6
		function lk7	0	0	0	7
		function lk8	0	0	0	8
		operating contact	0	0	1	0
C 162	Switching differential relay 1	range: 1 – 9999 digit standard setting: 1 digit	x	x	x	x
C 163	Value relay 1	range: ±9999 digit	x	x	x	x
C 164	Limit comparator or operating contact relay 2[1]	no function	0	0	0	0
		function lk1	0	0	0	1
		function lk2	0	0	0	2
		function lk3	0	0	0	3
		function lk4	0	0	0	4
		function lk5	0	0	0	5
		function lk6	0	0	0	6
		function lk7	0	0	0	7
		function lk8	0	0	0	8
		operating contact	0	0	1	0
C 165	Switching differential relay 2	range: 1 – 9999 digit standard setting: 1 digit	x	x	x	x
C 166	Value relay 2	range: ±9999 digit	x	x	x	x
C 167	Limit comparator or operating contact relay 3	no function	0	0	0	0
		function lk1	0	0	0	1
		function lk2	0	0	0	2
		function lk3	0	0	0	3
		function lk4	0	0	0	4
		function lk5	0	0	0	5
		function lk6	0	0	0	6
		function lk7	0	0	0	7
		function lk8	0	0	0	8
		function lk9	0	0	0	9
		function lk10	0	0	0	A
		operating contact	0	0	1	0
C 168	Switching differential relay 3	range: 1 – 9999 digit standard setting: 1 digit	x	x	x	x
C 169	Value relay 3	range: ±9999 digit	x	x	x	x

[1] The relays are available as control contacts, limit comparators or operating contacts depending on the controller version.

x = input within range

☐ = can be configured

UV06	Limit comparators or operating contacts		▲	▲	▲	▲
C 16A	Limit comparator Program stopped when limit is exceeded	no function	0	0	0	0
		function lk1	0	0	0	1
		function lk2	0	0	0	2
		function lk3	0	0	0	3
		function lk4	0	0	0	4
		function lk5	0	0	0	5
		function lk6	0	0	0	6
		function lk7	0	0	0	7
		function lk8	0	0	0	8
C 16B	Switching differential	range: 1 – 9999 digit standard setting: 1 digit	x	x	x	x
C 16C	Value	range: ±9999 digit	x	x	x	x

x = input within range

☐ = can be configured

UV07	Interface			▲	▲	▲	▲
C 171	Instrument address	range: 0 – 31		x	x	x	x
C 172	Data format **(values indicated only)**	parity bit	no parity	0	0	0	0
			parity odd	0	0	0	1
			parity even	0	0	0	2
		1 stop bit		0	0	1	0
		2 stop bits		0	0	2	0
		7 data bits		0	7	0	0
		8 data bits		0	8	0	0
		baud rate	9600	0	0	0	0
			4800	1	0	0	0
			2400	2	0	0	0
			1200	3	0	0	0
			600	4	0	0	0
			300	5	0	0	0
			150	6	0	0	0
C 173	Special functions **(values indicated only)**	terminal mode	OFF	0	0	0	0
			ON	0	0	0	1
		end character	CR	0	0	0	0
			CR/LF	0	0	1	0

x = input within range

☐ = can be configured

UV08	Software version / time-out (values indicated only)					
C 181	Software version number		x'	x'	x'	x'
C 183	Hold time (time-out)	range: 0 – 225 sec			6	0

x' = indication to order specification

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UV09	Special functions	(values indicated only)				
C 192	Time constant of relay 1[1]	range: 0 – 60 sec				0
C 193	Time constant of relay 2[1]	range: 0 – 60 sec				0
C 194	Functions of external inputs				E1[2]	E2[2]
		no function	0	0	0	0
		keys blocked	0	0	1	1
		Pgm blocked	0	0	2	2
		external fast forward run	0	0	3	3
		external Pgm start	0	0	4	4
		external stop	0	0	5	5

[1] Minimum ON time, e.g. in burner controls

[2] Both inputs (E1 and E2) must not have the same function

8.1 Error messages

Er 10:

The voltage of the built-in lithium battery is insufficient to protect the data in case of supply failure.

Remedy:

The error message can be cancelled with any key. Arrange for the battery to be changed within 4 weeks.

Er 11:

Despite a fault in the processor sequence the "watchdog" (internal monitoring circuit) was not activated.

Remedy:

Cancel the error message by switching the supply off and on again. Return the controller for checking as soon as possible.

Er 20:

The data in the working memory are partially erased.

Remedy:

Read in the factory-set data from the EPROM, i.e. switch off supply, set internal switches S 301.5 to position ↑ and S 301.6 to position ↓ and switch supply on again. The error message may appear again for about ½ sec after switching on: this is not significant. The controller reads in the data set at the factory. The programs should be checked and entered again if necessary.

Er 21:

This may occur when internal program data (programmer section) are corrupted (they are checked when the program is called up). This error can be acknowledged with the "ENTER" key (but this does not correct it.)

Remedy:

Erase the program which was called up, and input it again.

Er 30:

Incorrect process correction through input X0 = X1 or X1 = 0.

Remedy:

The error message can be cancelled by pressing any key.
The parameters X0 and X1 are automatically set to the standard setting, i.e. the incorrect input is ignored. If necessary repeat the process correction.

Er 40:

The process exceeds the display capacity.

Remedy:

Check the process value; in case of current or voltage input check C 124 and C 125.

Er 80:

This message indicates that the interface RS 232 or RS 422/485 is inactive. This is possible during the initialisation phase after a reset or during configuration from the keys.

Remedy:

Await initialisation or reset, or terminate configuration.

Er 81:

Data read in through the interface are outside the configured limits of the program controller.

Remedy:

Change the data being read in.

Er 82:

This parameter (e.g. process) cannot be programmed or the programming is blocked through internal switches.

Remedy:

Omit the parameter or, if permissible, unblock at the internal switch (see Chapter 9).

Er 83:

Parameter is not present in the current instrument configuration (e.g. XP2 on single-setpoint controller).

Remedy:

Omit parameter.

If the fault cannot be rectified, please return the program controller to the supplier with full details of the fault.
Do not return the chassis without the case!

If this should not be possible, the chassis or the individual electronic assembly has to be protected by **electrically conducting foil**.

The employees of our Technical Offices, Subsidiaries or Agents will always be pleased to provide advice and to service your instruments.

8.2 Action on supply failure

Version "Continue"

The instrument continues the program at the exact point where it was interrupted.
There is no report that there was a supply failure.

Version "Stop"

The instrument does not continue the program.
The bottom display shows "stop".

– On pressing the 

key the program continues from the exact point where it was interrupted.

– On pressing the  key the program is aborted.

Supply failure during manual operation

During manual operation the instrument returns to the status before supply failure when the supply is restored. The setpoint settings and the status of the relays are indicated as they were just before the supply failure.

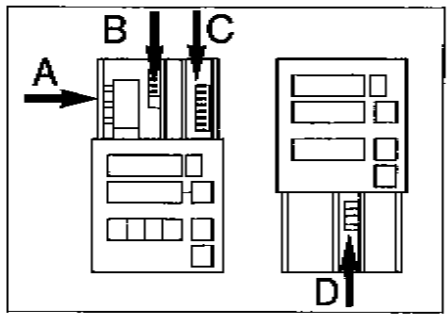
8.3 Action on sensor failure or short-circuit

The control contacts, limit comparators and operating contacts are de-energised.
The alarm relay (if programmed) moves to a defined status.
With resistance thermometer or thermocouple input the top display flashes 1999 (–1999).

9 INTERNAL ADJUSTMENTS

Analogue output

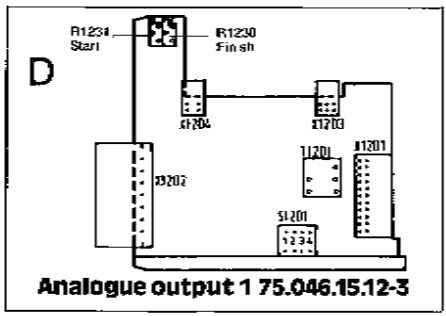
The output signal is set on DIL switches. The changeover between 0–20 mA and 4–20 mA is made at the factory.
The controller is supplied fully adjusted.
If a different output signal is selected on the switches S1001.1–S1001.4 or S1201.1–S1201.4 a slight re-adjustment of the output signal with the potentiometers R1030 and R1031 or R1230 and R1231 is recommended.



Analogue output 1

Output signal	S1201.1	S1201.2	S1201.3	S1201.4
0–10 V	o	x	x	o
–10V0/+10 V	x	x	x	o
0(4)–20 mA	o	o	o	x
–20/0/+20 mA	x	o	o	x

x = closed o = open

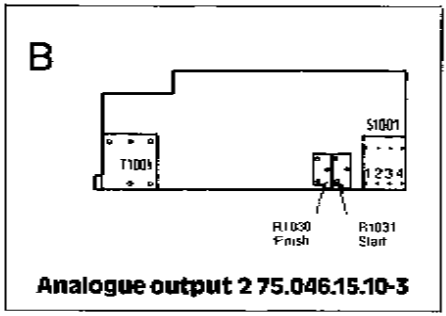


Analogue output 1 75.046.15.12-3

Analogue output 2

Output signal	S1001.1	S1001.2	S1001.3	S1001.4
0–10 V	o	x	x	o
–10V0/+10 V	x	x	x	o
0(4)–20 mA	o	o	o	x
–20/0/+20 mA	x	o	o	x

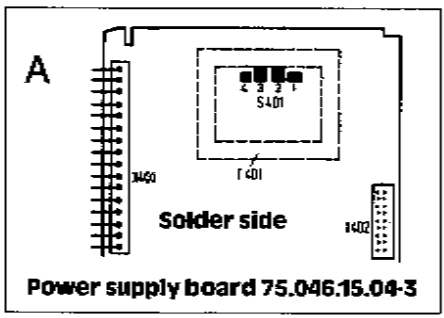
x = closed o = open



Analogue output 2 75.046.15.10-3

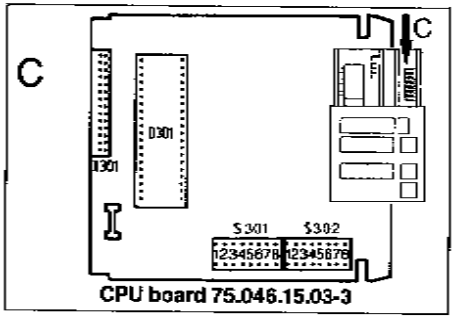
Voltage supply

Voltage	Solder link
220 V	■ ■—■ ■ 4 3 2 1
110 V	■—■ ■—■ 4 3 2 1



Power supply board 75.046.15.04-3

☐: standard setting



CPU board 75.046.15.03-3

Plane blocks

Planes blocked	S301.1	S301.2
Parameter plane Configuration plane		
Configuration plane		
not blocked		

No access to these planes.

No access to this plane.

All planes can be accessed.

Self-optimisation

On fast control processes, better optimisation may be achieved by changing over switch S301.3.

Self-optimisation	S 301.3	
slow process, Tg > 2 min		
fast process Tg < 2 min		

☐: factory setting

Input filter

Digital filter for smoothing the input signal: time constant 1 sec.

Input filter	S301.4	
on	↑	
off	↓	

Data transfer

Configuration data and parameter data are read from the EPROM into the working memory (RAM) when S301.5 is ↑ and S301.6 is ↓.

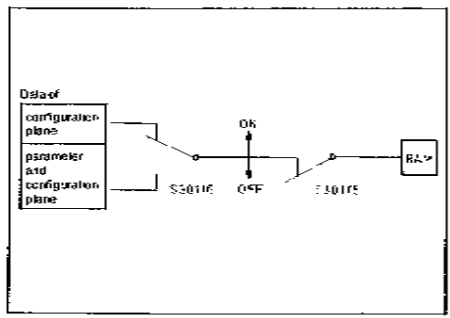
This means the parameters can be called up but cannot be changed.

In position S301.5 ↑ and S301.6 ↑ (factory setting) only the parameter data can be changed.

In position S301.5 ↓ the data transfer is switched off and the controller can be freely re-programmed.

With switch position S301.5 ↑ and S301.6 ↓ it is always possible to return to the base status or the status as supplied from the factory.

Factory data	S301.5	S301.6
yes	↑	
no	↓	
Transfer into		
configuration plane		↑
configuration and parameter plane		↓



Status after supply failure or reset

Version	S301.7	S301.8
continue	↑	↑
stop	↓	↑

Repeats at program start

Repeats	S302.1	
no repeats	↑	
repeat selected	↓	

▭: factory setting

10.1 Function of the external inputs

Two external inputs are provided which are activated through one floating contact each. The inputs are as follows:

Code*	Terminals 0/17	Terminals 0/18
11	stop	start
12	stop	keys blocked
13	stop	programming blocked
14	stop	fast forward run
15	start	keys blocked
16	start	programming blocked
17	start	fast forward run
18	keys blocked	fast forward run
19	programming blocked	fast forward run

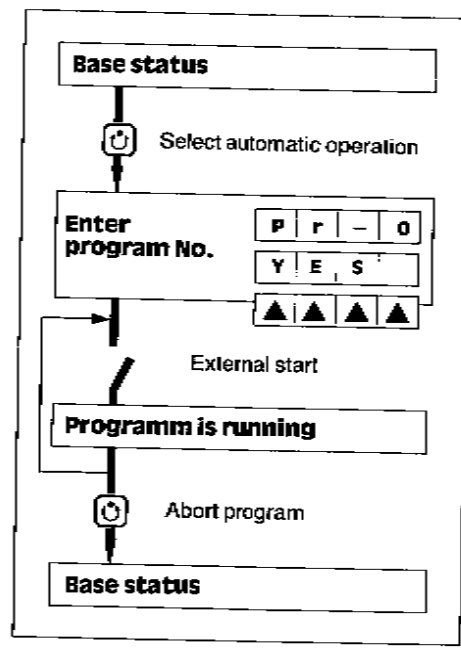
* see Extra Codes or configuration plane C 194

External start

A program selected on the keys can be started with an external contact. When the program has been completed, the same program can be started again externally as often as required. To run a different program this has to be selected on the keys.

External stop

The action corresponds to the "hand" function during automatic operation. The time base is stopped. The current values are retained. After releasing the "external stop" the remainder of the program is run.

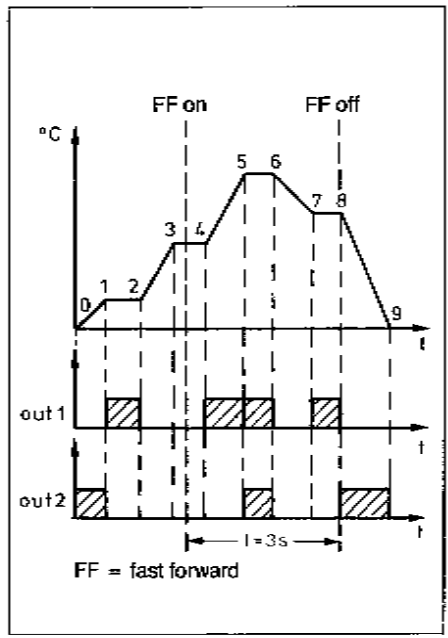


External block keys/programming

- key block
  protection against unauthorised operation
  (all keys are blocked)
- programming block
  protection against unauthorised
  programming
  (key "Pgm" alone is blocked)

External fast forward run

During external fast forward a program is run in 0.6 sec steps from section to section. The signals of the analogue outputs do not change; they retain the same values as before the beginning of the fast forward run. The operating contacts change in accordance with the program. The external fast forward facility can be used e.g. to omit certain parts of the program through operation of a switch or the occurrence of an event.
During fast forward run the two time base LEDs flash alternatively. The display can be changed with one of the increment keys to the required indication (process/setpoint – residual section time – section No./program No.). The display changes according to the program during fast forward run.



10.2 Correcting process indication to customer specification

A process indication differing from the desired or actual value can be corrected with the keys. This is useful, for example, in order to match the indication of several instruments or to compensate for the resistance of the sensor cable.
Two values are input, the intermediate values are interpolated or extrapolated by the controller.

A change in X0 alone causes the line to be displaced parallel to itself from the old value to the corrected value.

A change in X1 alone causes the line to change its slope, rotating about the point 0°C (0°F).

When first X0 and then X1 is changed, the line is moved as explained in the example below.

Example:
When the process value is 15 the process indication should be 40.
When the process value is 90 the process indication should be 60.

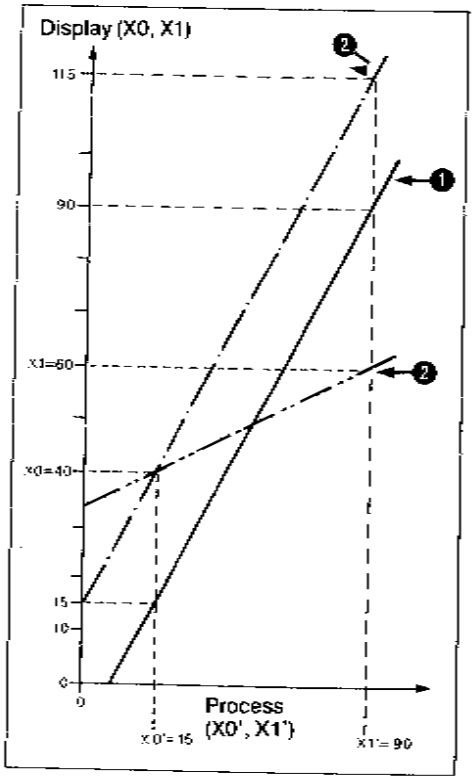
Programming:

❶
With a process value of 15, 40 is programmed in parameter X0 (C131).
Due to this correction the process indication is displaced upwards by 25 parallel to itself. The indicated final value changes from 90 to 115.

❷
Now 60 is programmed in parameter X1 (C132).

Display of X0' (C139) = 15
Display of X1' (C13A) = 90

The corrections should be performed near the start of range and the end of range so that X0' and X1' are sufficiently far apart.
To restore the base setting X0 must equal X1. First X1 and then X0 is programmed to the same value. The error message Er 30 appears and can be cancelled with any key. At the same time X0 and X0' are set to 0 and X1 and X1' to 1.



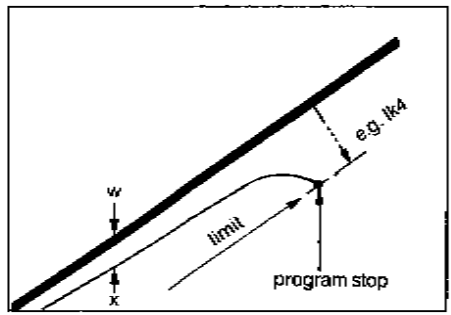
❶ —·— after correction of X0
❷ ---- after correction of X0 + X1

10.3 Program stop when limit setting is exceeded

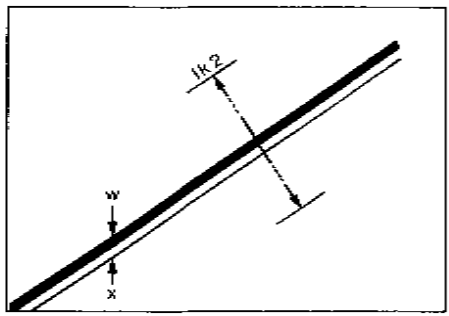
With this function the time is held during automatic operation if setpoint and process drift apart or together.

A limit comparator whose function can be set in sub-directory UV 06 (C16A, C16B and C16C) of the configuration plane monitors deviations of the **process x from the setpoint w** in both upward and downward direction.

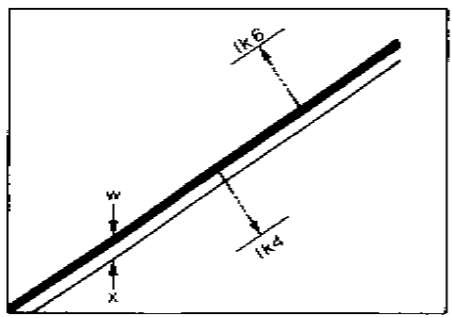
The functions of the limit comparators are shown on page 7 under "Technical data".



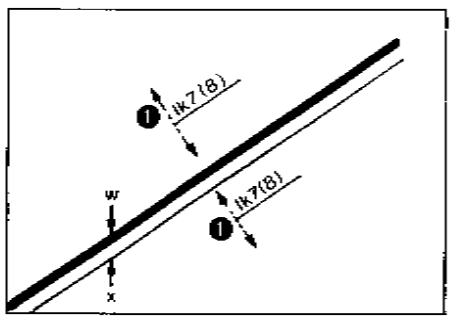
The limit comparator monitors the deviation inside a window whose width is adjustable within the range ±9999 digit. The window is symmetrical with respect to the setpoint of the program.



Limit comparator lk4 monitors downward deviations, limit comparator lk6 operates when the upper limit setting is exceeded. The adjustable contact spacing from the setpoint is ±9999 digit.



The limit comparators lk7 and lk8 can be set anywhere over the entire control range ❶ irrespective of the program controller setpoint.



When the process has returned within the set limits the program controller continues its program.

11 OPTIMISATION

Optimum adjustment means:

1. Good start-up action, i.e. start-up curve as steep as possible without overshoot.

2. Good disturbance and control correction, i.e. to ensure rapid control action without oscillations in case of an external disturbance or if the setpoint is changed.

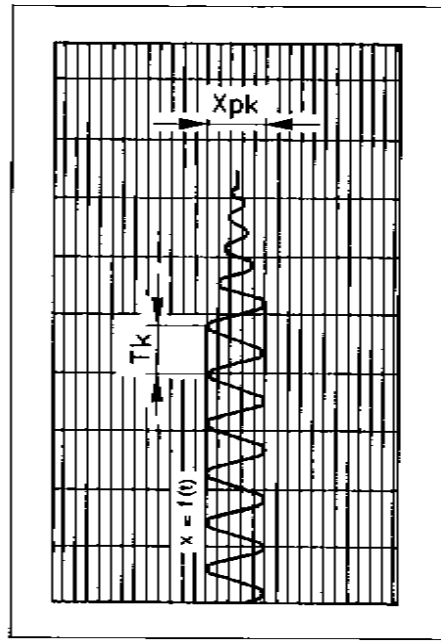
When precise process characteristics are available the control parameters for a defined operating point can be determined precisely by an involved mathematical procedure. In practice, however, precise characteristics are rarely available, and practical adjustment criteria have therefore been developed which have proved satisfactory.
Even here the assumed conditions (e.g. sudden changes of the disturbance or setpoint at the loop input) are in most cases only approximately correct so that the results obtained can only be considered as a rough indication.
In practice it is useful to record a curve of the process variable under operating conditions in order to ascertain the optimum setting by stepwise changes of one parameter at a time.
A basic setting for controllers with PID action, based on measured parameter values, can be obtained by the procedure described below.

Oscillation method according to "ZIEGLER" and "NICHOLS"

This method applies to processes which may be rendered unstable for brief periods (Tg/Tu at least 3). The controller is operated initially with the following settings: on switching controllers PD action with minimum Tv and CY; on proportional controllers P action; Xp1 or Xp1 and Xp2 on maximum. The proportional band Xp is then reduced slowly (by increasing the controller gain) to determine the stability limit at which the process performs undamped oscillations of constant amplitude. This test gives:

a) the critical oscillation amplitude Xpk

b) the critical oscillation period Tk



The optimum settings are then:

$Xp = 1.7\ Xpk \qquad Tn = 0.5\ Tk$

$$Tv = \frac{Tn}{4.5}$$

Adjustment according to the process characteristics

Not all control loops can be rendered unstable for brief periods. This method is therefore based on the process loop data.
The transfer function (response to a sudden setting or disturbance change) is used to evaluate the following characteristic values:

Ks = process transfer coefficient

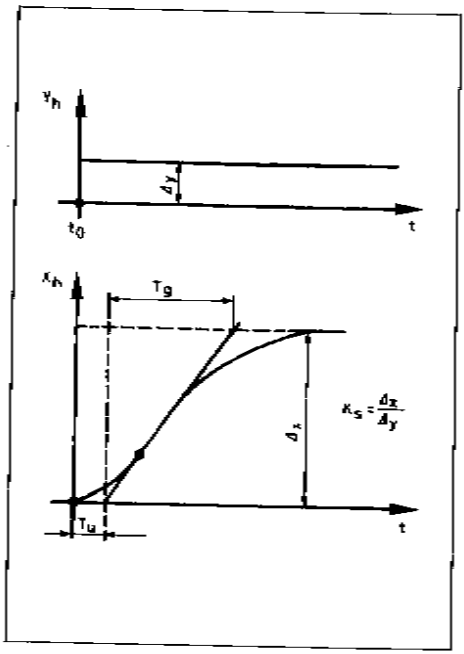
$$Ks = \frac{\Delta x}{\Delta y} = \frac{\text{output change}}{\text{input change}}$$

Tu = delay time and
Tg = response time

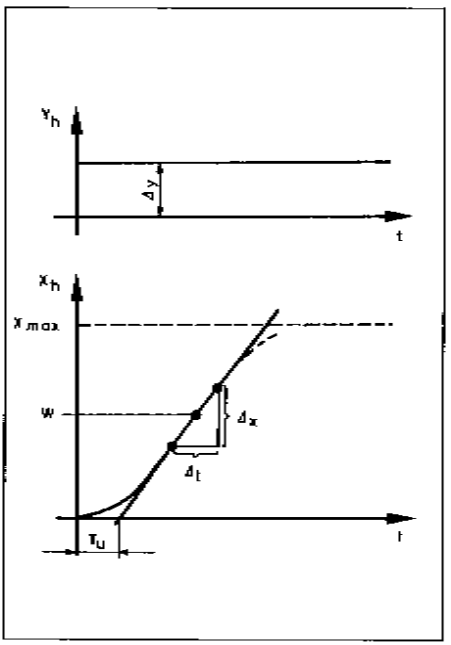
The controllability of the process loop can be estimated from the ratio Tu/Tg.

For Tu/Tg less than 0.1	satisfactory control
0.1 – 0.3	just controllable
more than 0.3	difficult to control

The transfer function should be recorded near the operating point (setpoint). The input to the process is changed suddenly at time t_0 by an amount Δy within the total adjustment range Yh (for example 10 % of Yh). The result is a transfer function with values for Δx, Tu and Tg.



If the power supplied cannot be changed in steps the transfer function is recorded with a 100 % change in power. As the process does not always permit this due to technical reasons, there is another possibility for determining the control parameters. It evaluates the maximum rate of rise of the transfer function.



$$Vmax = \frac{\Delta y}{\Delta t}$$

$$Xp = 0.83\,Vmax \cdot Tu$$

This gives the following values for PID controllers based on the example above:

$Tu = 2\,min$

$\Delta t = 3\,min$

$\Delta x = 90\,°C$

$$Vmax = \frac{\Delta x}{\Delta t} = \frac{90\,°C}{3\,min} = 30\,\frac{°C}{min}$$

$$Xp = 0.83\,Vmax \cdot Tu = 0.83 \cdot 30\,\frac{°C}{min} \cdot 2\,min = 49.8\,°C$$

$Tn = 2\,Tu = 4\,min$

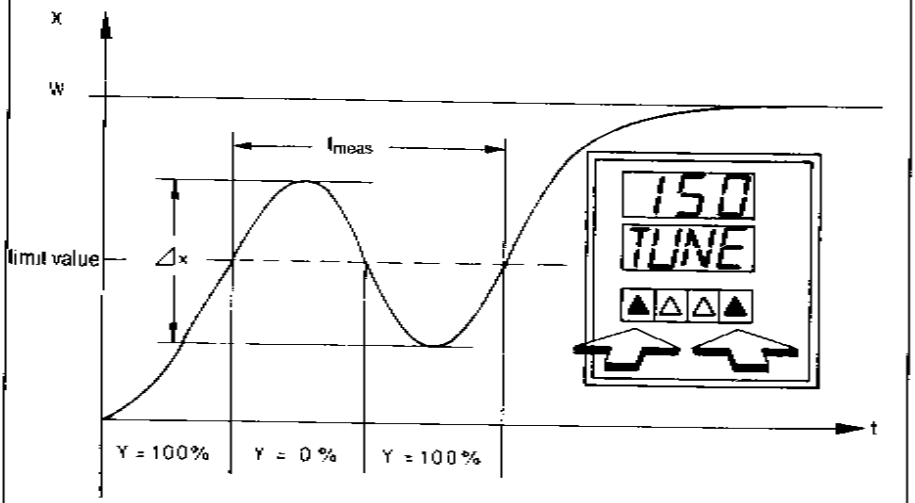
$$Tv = \frac{Tn}{4.5} = 54\,sec$$

Empirical rules for parameter setting

Control action	Setting
P	Xp = Vmax · Tu(°C)
PI	Xp = 1.2 · Vmax · Tu(°C) Tn = 3.3 Tu
PD	Xp = 0.83 · Vmax · Tu(°C) Tv = 0.25 · Tu(min)
PID	Xp = 0.83 · Vmax · Tu(°C) Tn = 2 · Tu(min) Tv = Tn/4.5(min)
PD/PID	Xp = 0.4 · Vmax · Tu(°C) Tn = 2 · Tu(min) Tv = 0.4 · Tu(min)

11 OPTIMISATION

Self-optimisation of DICON PRS (in manual operation, Item 5.4)



Oscillation, shown greatly magnified

The controller incorporates a self-optimisation facility. This applies to single and double setpoint controllers as well as to proportional controllers. The optimisation procedure is based on the "Ziegler" and "Nichols" adjustment rules. The controller is optimised for setpoint response. The setpoint response of a control loop refers to the change in the process variable for a sudden change in the setpoint.

A condition for activating self-optimisation is a difference between process and setpoint of at least 10 % of the control span; this is necessary in order to achieve useful results.

The optimisation procedure is started by simultaneously pressing the right and left increment keys (with the controller on manual operation). During optimisation the word **"TUNE"** is flashing in the alphanumerical display. The controller output signal is set to maximum (Y = 100 %) or minimum (Y = 0 %) depending on whether the setpoint is above or below the process variable. When half the difference between process and setpoint (limit value) has been reached, the output signal Y is reversed.

After the overshoot or undershoot the process passes again through the limit value. The output signal Y is reversed once more, followed by another undershoot or overshoot. The measuring process is terminated when the limit value has been reached again. The calculated control parameters are automatically transferred to the parameter plane of the controller and the control process begins. From the difference between the maximum and the minimum of the amplitude (Δx) and the duration of the period (t_{meas}) the controller calculates:

XP1, XP2 = XP1, Tn, Tv = Tn/4

CY = Tn/10, CY2 = CY1

The parameters determined by optimisation can always be called up and modified.
After the start of self-optimisation the controller is automatically set to PID action.

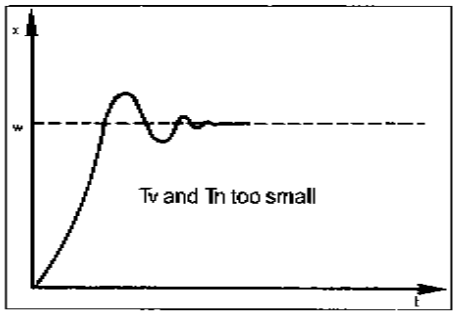
The optimisation procedure can be aborted at any time with the two centre increment keys.

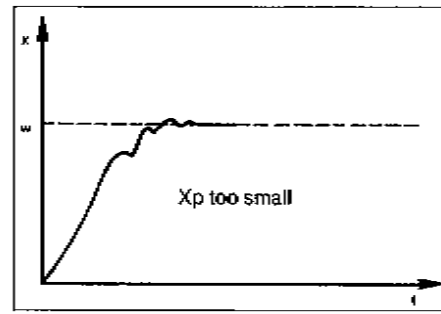
If the optimisation cannot be activated, the parameter plane must be cleared for alterations. (See Section 9)

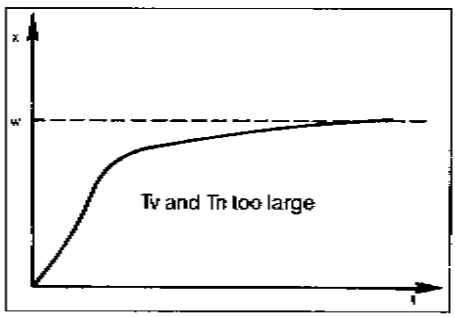
Checking the optimisation for PID action

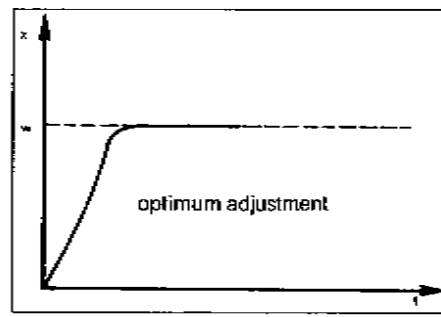
The optimum adjustment of the controller to the process can be checked by recording a start-up with closed process loop.

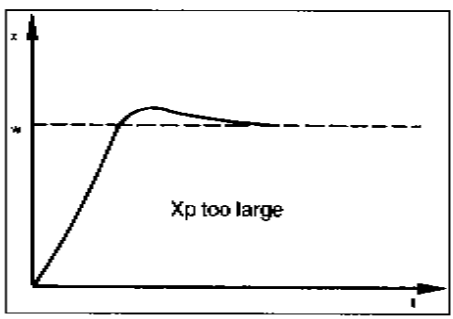
The diagrams below indicate possible incorrect adjustments and the correction required.









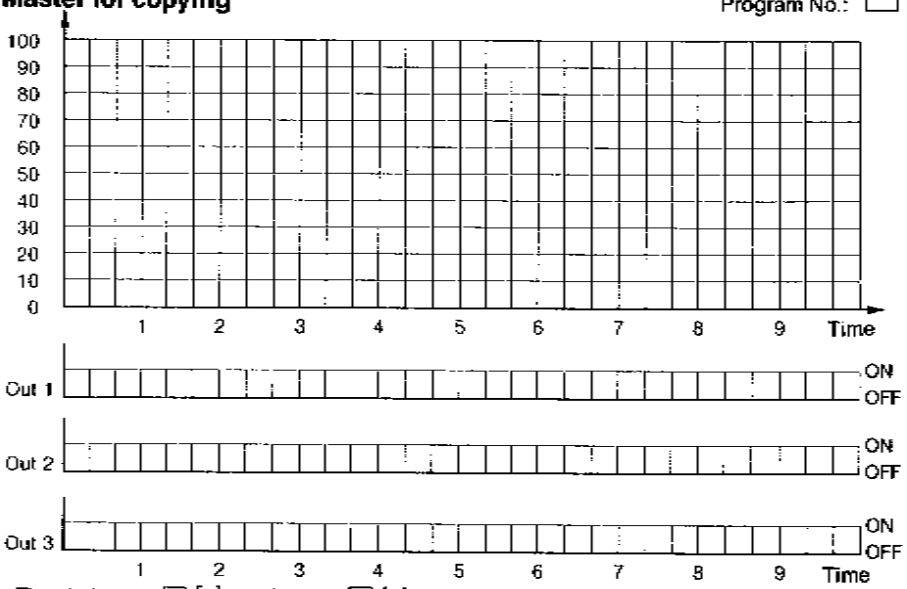


This shows that increased Xp and increased Tn both result in a more stable and more sluggish control action. Smaller Xp or Tn produces a control action with less damping.

mm	inch	mm	inch
0.8	0.031	91.6	3.61
4.8	0.19	$92^{+0.5}$	$3.62^{+0.02}$
12	0.47	96	3.78
25.8	1.02	105	4.13
66	2.60	111	4.37
73	2.87	121.5	4.78
79	3.11		

12 PROGRAMMING DATA TABLE

Master for copying Program No.: ☐



Time in h : min ☐ [ ] or min : sec ☐ [ ]