Microprocessor Transmitter/Controller for conductivity Type 262520

B 20.2520 Operating Instructions

6.96 / 00339807

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Important installation notes:

The choice of cable and the connection of the supply line must conform to the requirements of VDE 0100 "Regulations on the Installation of Power Circuits with nominal voltages below 1000 V" or the appropriate local regulations.
Both the electrical connection and any work inside the unit must only be carried out to the extent described and exclusively by properly qualified personnel.
The instrument has to be isolated from the supply before carrying out any maintenance or service operations.
A current limiting resistor interrupts the supply circuit in case of a short-circuit. The external fuse of the supply should not be rated above 1 A (slow). The load circuit must be fused for the maximum relay current1) in order to prevent welding of the output relay contacts in case of an external short-circuit.
In the neighbourhood of the unit there must be no magnetic or electrical fields, e.g. through transformers, portable telephones or electrostatic discharges.
Inductive loads (relays, solenoid valves etc.), if installed close to the instrument, must be fitted with RC modules to prevent interference.
When the network is subject to severe interference (e.g. thyristor controls) the instrument should be supplied through an isolating transformer since supply fluctuations are only permitted within the specified voltage range1).
During maintenance or service operations on the instrument (sensors, controllers, recorders etc.) it is essential to prevent any undesired processes (e.g. due to the switching of relay contacts).
Input, output and supply lines should be run separately and not parallel to each other.
Sensor and interface lines should be arranged as twisted and screened cables. Do not run them close to current-carrying components or cables. Ground the screen at one end at the instrument on terminal TE.

Ground the instrument at terminal PE to the earth conductor. This line must have at least the same cross-section as the supply lines. Ground lines should be run in a star-shaped lay-out to a common earth point which is connected to the earth conductor of the supply. Do not loop the ground connections, i.e. do not run them from one instrument to another.
Do not connect any additional loads to the supply terminals of the instrument.
The instrument is not suitable for installation in hazardous areas.
Apart from faulty installation, there is a possibility of interference or damage to controlled processes due to incorrect settings on the controller (setpoint, data of parameter and configuration levels, internal adjustments). Safety devices independent of the controller should always be provided and should be capable of adjustment only by specialist personnel. Please refer to the appropriate safety regulations in this connection.

1) see Technical data

1 DESCRIPTION

NOTE:
All necessary adjustments are described in these Operating Instructions. If, however, any difficulties should arise during start-up, you are asked not carry out any manipulations on the instrument which are not permitted. You could endanger your rights under the instrument warranty. Please contact the supplier.

1.1 Introduction

Microprocessor transmitters/controllers Series 262520 are used in conjunction with suitable sensors for continuous conductivity measurement in liquids.
The microprocessor transmitter/controller has a 4-digit display for measurements and settings and a 2-digit display for indicating the matrix position as guidance for the user.
The transmitter has a current or voltage output proportional to the measured value.
The unit can be provided with a second current or voltage output to reproduce the liquid temperature.
The version 262520 can be equipped with two relay contacts adjustable over the measuring range. They can be arranged as changeover contacts with pull-in or drop-out delay, or as control contacts with pulse-duration or pulse-frequency action.
A monitoring circuit switches the alarm relay (third relay) with a pulse or steady contact at the end of an adjustable time delay. There is also a visual indication through a flashing alarm LED.
The parameters cell constant and temperature coefficient can be adjusted by a program procedure on the conductivity microprocessor transmitter/controller. Control parameters can be input. The solution temperature can be either pre-set or optionally determined by automatic product temperature compensation using a Pt 100 resistance thermometer.
The conductivity transmitter can be re-configured for different ranges using internal links and by a change at the configuration level.

The microprocessor transmitter/controller can be used to operate valves, interlocks, blocking systems, pumps, motors or signal

ling units. Other applications must be agreed with the manufacturer and confirmed in writing.

1.2 Type designation

The following selections describe the standard versions. Each selection is provided with a code number which is entered in the appropriate field of the type designation. If a controller with customized configuration is required, additional ordering details in plain language have to be given.

Conductivity microprocessor transmitter/controller

(1)		(2)		(3)		(4)		(5)		(6)		(7)
262520	/	..	-	..	-	...	-	..	-	..	/	...

(1) Basic type
Conductivity 262520

(2) Controller function ..
No control contacts 00
with 2 control contacts and alarm-contact, controller type and structure can be configured 60

(3) Inputs ..
Pt 100 input for temperature measurement in 3-wire circuit provided as standard
Basic type conductivity 00
Conductivity difference input 70*
Third input current/voltage 80*
* version under development

(4) Outputs ...

Conductivity output provided as standard

on controller type 00 000

Second output (temperature) 060

Relay contacts 100

Relay contacts and second output (temperature) 160

(5) Supply ..

93 - 263 v AC, 48 - 63 Hz 01

20 - 43 V AC, 48 - 63 Hz and

20 - 53 V DC 10

(6) Interface (isolated) ..

none 00

RS232C 51*

RS422/485 .... 52*

(7) Extra Codes ...

none 000

Surface-mounting housing 110

Stock versions:

262520/00-00-000-01-00/000
262520/60-00-100-01-00/000

*version under development!

Ordering example

Conductivity microprozessor transmitter/ controller

(1)	(2)	(3)	(4)	(5)	(6)	(7)
262520	**/ 60**	**- 00**	**- 100**	**- 01**	**- 00**	**/ 000**

(1) conductivity microprocessor tranmitter/controller

(2) Alarm contact, controller type and structure can be configured

(3) Basic type conductivity

(4) Relay contacts

(5) 93 - 263 V AC, 48 - 63 Hz

(6) none

(7) none

1.3 Accessories

1.3.1 Standard

2 mounting brackets
1 operating Instruction

1.3.2 Recommended

Conductivity simulator Type 2H-SLf-1 (Data Sheet 26.2712)for testing and calibrating the conductivity transmitter

1.4 Displays/controls

(1) 4-digit LED display to indicate measurement and settings

(2) Step key for selecting the digit to be altered, and switching manual mode off/ on

(3) Up key to alter the selected digit; in manual mode activates relay contact 1

(4) Down key to alter the selected digit; in manual mode activates relay contact 2

(5) ENTER key to enter the input value

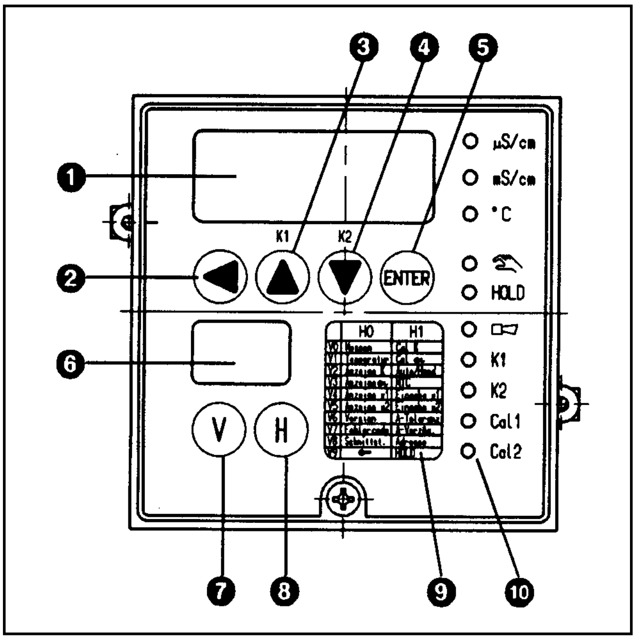
(6) 2-digit LED display to indicate the matrix position (operator display)

(7) V key for vertical movement to select the horizontal line in the matrix field

(8) H key for horizontal movement to select the vertical column in the matrix field

(9) Brief matrix for indication and operating level

(10)LED line to indicate operating status and unit of display (µS/cm, mS/cm, °C)



1.5 Technical data

1.5.1 Microprocessor transmitter/ controller for conductivity

Input

conductivity cell with two electrodes and cell constants C of 0.01 to 10.
(see Data Sheets 20.2900 and 20.2921)

Measurement frequency and ranges

see Table page 12

Measuring voltage

approx. 500 mV AC

Accuracy of indication

conductivity: ±1 digit
temperature: 0.1 °C

Measurement spans

freely adjustable within the selected range
Reference temperature 25°C

Reference temperature

25°C

Liquid temperature compensation

manually from -50 to +250°C or automatically within the range -50 to +250°C using Pt 100 resistance thermometer in 2-wire or 3-wire circuit

Lead compensation Pt 100

not required with 3-wire circuit. When using a resistance thermometer in 2-wire circuit it is necessary to provide lead compensation using an external compensating resistance.

Relay output with floating contact

rating:
690 W 3 A at 230 V AC 50 Hz, p.f. = 1
contact life:
approx. 10^6 operations at rated load

Range table

Range	Cell constant C (1/cm)					Meas. frequency coded
	0.01	0.1	1.0	3.0	10.0	Hz
to 0.50 µS/cm	x					85
to 1.00 µS/cm	x					85
to 2.00 µS/cm	x					85
to 3.00 µS/cm	x					85
to 5.00 µS/cm	x	x				85
to 10.0 µS/cm	x	x				85
to 20.0 µS/cm		x				85
to 50.0 µS/cm		x	x			85
to 100 µS/cm			x			85
to 100 µS/cm		x				1000
to 300 µS/cm		x	x			1000
to 500 µS/cm		x	x			1000
to 1000 µS/cm		x	x	x		1000
to 2000 µS/cm			x			1000
to 1.00 mS/cm		x	x	x		1000
to 2.00 mS/cm			x			1000
to 3.00 mS/cm			x	x		1000
to 5.00 mS/cm		x	x			4000
to 10.0 mS/cm			x	x		4000
to 20.0 mS/cm			x	x		4000
to 30.0 mS/cm			x	x	x	4000
to 50.0 mS/cm			x			4000
to 100 mS/cm			x		x	4000
to 200 mS/cm					x	4000

Analogue output
Conductivity and temperature
(proportional to measured value and isolated)

selected	burden
0 - 20 mA*	500 Ωmax.
4 - 20 mA	500 Ωmax.
0 - 10 V	500 Ωmin.

Max deviation of output signal from characteristic: 0.25%
* factory setting

1.5.2 General controller data
Deviation from characteristic
when connected to conductivity cell:
1% max.

when used with resistance thermometer:
0.20% max.

Ambient temperature error
when connected to conductivity cell:
0.25% max. per 10°C

when used with resistance thermometer:
0.05% max. per 10°C

Signal circuit monitoring with ATC
break or short-circuit of the temperature probe is recognised and reported.

Data back-up
EEPROM

CE mark
EN 50081 Part 1
EN 50082 Part 2

Interference immunity/compatibility
NE 21 (5/93)

Supply
93 - 263 V AC 48 - 63 Hz or
20 - 43 V AC 48 - 63 Hz or
20 - 53 V DC

Power consumption
8 VA approx.

Electrical connection
faston tags to DIN 46 244/A, 4.8 x 0.8 mm

Permitted ambient temperature
0 to +50°C

Transmitter/controller in surface-mounting housing
-5 to +50°C

Permitted storage temperature
-40 to +70°C

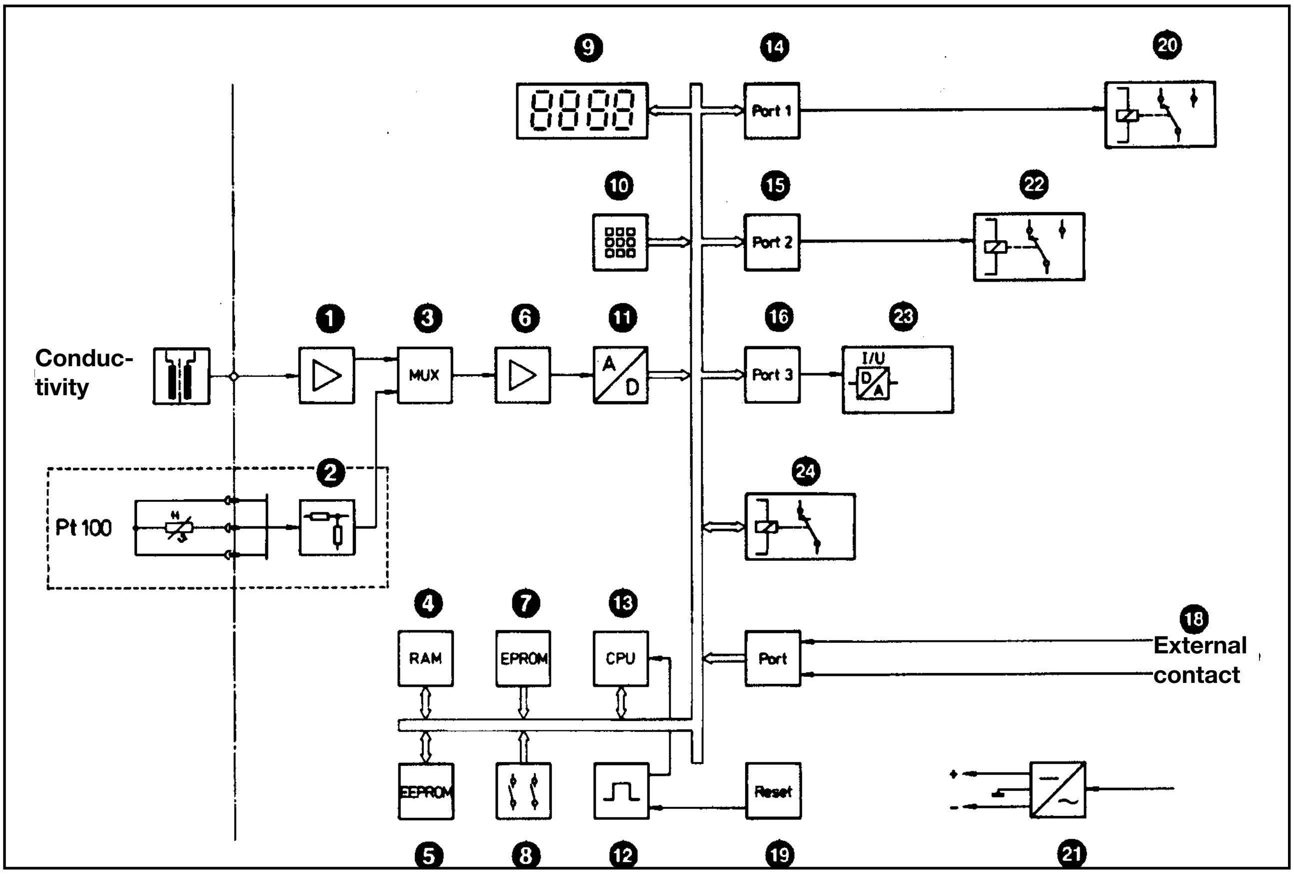
Climatic conditions
Class KWF to DIN 40 040,
rel. humidity not exceeding 75% annual mean, no condensation

Housing
aluminium extrusions, black anodised
with plug-in controller chassis (connected to protective earth)

Protection
to EN 60 529
front IP 54
rear IP 20
(not suitable for hazardous areas)

Operating position
unrestricted

1.6 Block diagram



1.7 Operation

The signals of the two inputs pass through the range cards (1) and (2), an analogue multiplexer (3) and an amplifier (6) to the analogue/digital converter (11). The measurements, together with the key inputs (10), are processed in the computer core which consists of CPU (13), EPROM (7), RAM (4) and EEPROM (5).
The EEPROM stores the operating, parameter and configuration data. The DIL switch (8) can be used for various settings. An additional function is activated through the external contact (18). The output signals pass through the ports (14) to (16) to the output stages (20), (22), (23) and (24) and to the display (9). Each of these output stages can be equipped independently.
A watchdog circuit (12) resets the CPU (13) to a defined initial status in case of faults in the program sequence. On power-up the reset circuit (19) activates the program start.
The power supply (21) provides the supplies for the individual modules.

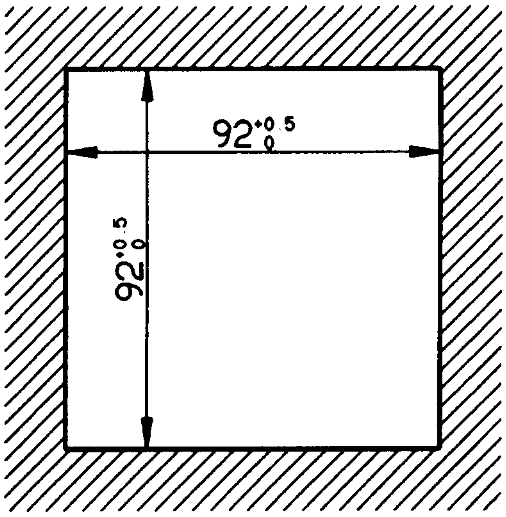
2 INSTALLATION

2.1 Location and climatic conditions

The location should be as free as possible from shock and vibration. Electro-magnetic fields, e.g. caused by motors, transformers etc., should be avoided. The ambient temperature at the location must not be outside 0 to +50°C, the relative humidity not exceed 75%. Corrosive air and fumes reduce the life of the instrument.

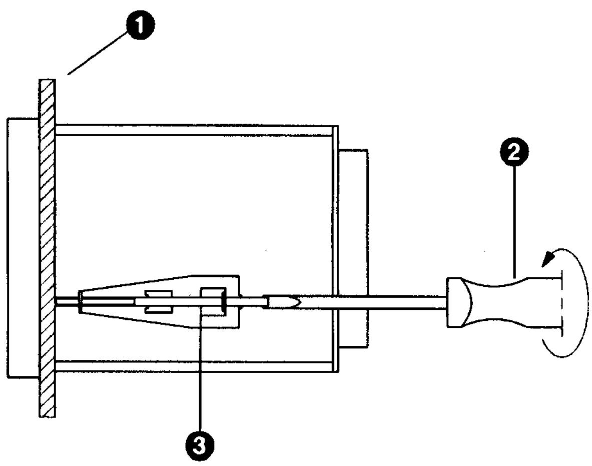
2.2 Fitting in position

The unit is inserted from the front into the panel cut-out. The mounting brackets are hooked from the back of the panel into the recesses at the sides of the housing. The flat sides of the brackets must be against the housing. Place the mounting brackets against the back of the panel and tighten them evenly using a screwdriver.



(1) panel
(2) screwdriver
(3) mounting bracket

mm	inch
0.8	0.031
4.5	0.18
4.8	0.19
7	0.28
7.5	0.30
21	0.83
$92^{+0.5}$	$3.62^{+0.02}$
100	3.94
120	4.72
138	5.43
150	5.91
270	10.63



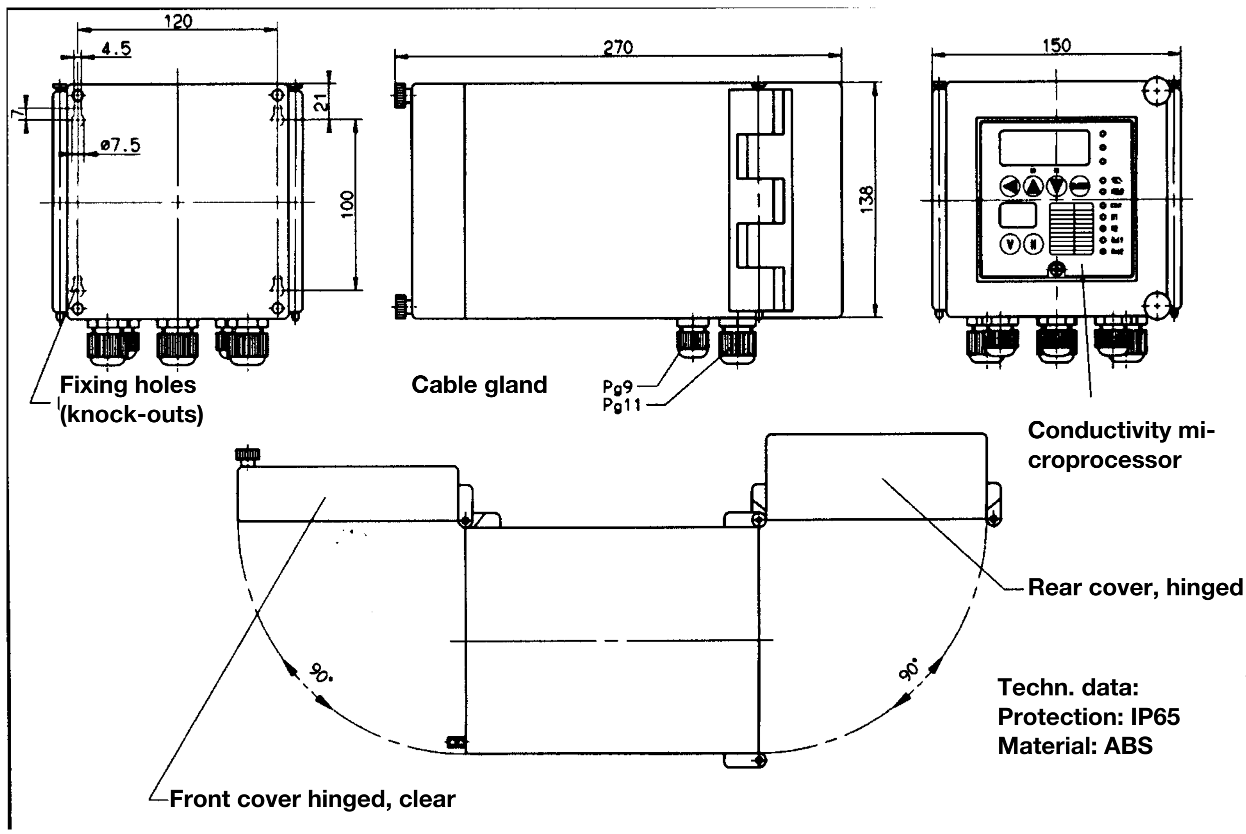
INSTALLATION

The folllowing important installation notes must be observed:

- Fuses for the fitted transmitter and for the relay contacts must be provided by the installer.
- Separate fuses must be provided for the transmitter and for the relay contracts.
- Do not connect any control circuit (relay, contactor) to the supply terminals.
- The wiring must be connected directly to the transmitter.
- External environmental conditions must not cause the permitted ambient conditions inside the transmitter surface-mounting housing to be exceeded.
- The ambient temperature must not be outside the permitted range of -5 to +50°C.

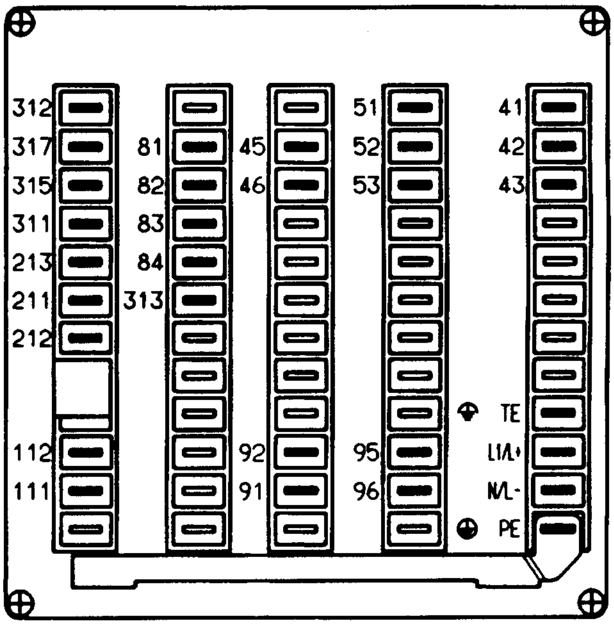
2.3 Installation in the surface-mounting housing

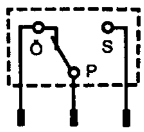
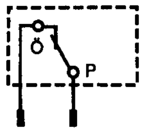
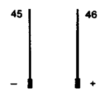
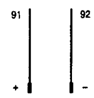
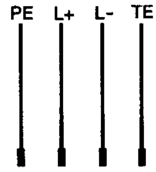
Code /110



Techn. data:
Protection: IP65
Material: ABS

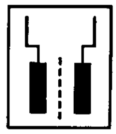
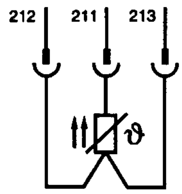
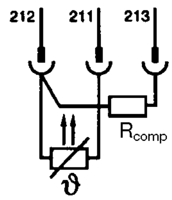
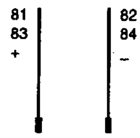
3 ELECTRICAL CONNECTION



Connection for	Terminals		
Relay	K1*	41 (O) n.c. (break) 42 (P) common 43 (S) n.o. (make)	
	K2	51 (O) n.c. (break) 52 (P) common 53 (S) n.o. (make)	
	K4*	95 (O) n.c. (break) 96 (P) common	
Measurement output	Conductivity	45 - 46 +	
(isolated)	Temperature	91 + 92 -	
Supply as on label	AC/DC	L1 line AC L+ N neutral L- PE protective earth TE screen	positive DC negative 

* contact protection circuit 22 nF/56 Ω between common and make contact or common and
break contact

ELECTRICAL CONNECTION

Input	Terminals		
Conductivity cell	111 112		
Resistance thermometer in 3-wire circuit	211 212 213		
Resistance thermometer in 2-wire circuit	211 212 213	R_{comp} = lead resistance	
Logic input 1	81 82	82 and 84 are linked internally	
Logic input 2	83 84		

* contact protection circuit 22 nF/56 Ω between common and make contact or common and break contact

	Conductivity cell with		Transmitter
	connector	attached cable	
Outer electrode		white	112
Inner electrode	⏚	brown	111
Temperature compensation	1 + 3	yellow + green	211 + 212 extra link 212 + 213

4 OPERATION

4.1 Matrix/level scheme

The instrument is operated solely using six front keys. The individually adjustable parameters (e.g. control parameters) and configuration data (e.g. range changeover) are stored in a matrix consisting of 10 x 10 = 100 fields. A matrix field can be reached with the keys V (vertical movement) and H (horizontal movement). The matrix is divided into four levels to ensure a clear presentation of the many different actions.
The individual levels are inhibited by number passwords to prevent unauthorised alteration.

Indication level e.g. conductivity, temperature

This level consists of 10 matrix fields (V0H0 - V9H0). Data can be indicated here but can not be altered. From the matrix field V9H0 the next level can be reached by input of the appropriate number password.

Operating level e.g. calibration, select setpoints

This level consists of the 20 matrix fields V0H0 - V9H1.

Parameter level e.g. Tv, Tn, Xp

This level consists of 80 matrix fields (V0H0 - V9H7)

Configuration level e.g. controller type

This level consists of the 100 matrix fields (V0H0 - V9H9).

The number passwords are as follows:
(input in matrix field V9H0)

- ❑ to open the indicating level: **no password required**
- ❑ to open the operating level: **0110**
- ❑ to open the parameter level: **0020**
- ❑ to open the configuration level: **0300**

A special password permits viewing all the matrix fields but no alteration of the data contained in them. This password is: **0009**

Input of a different number inhibits the operating level. This status of the instrument corresponds to the status after power-up.

Note:

following any setting or servicing operations the levels should be inhibited again in order to prevent unintended alterations of the setting

4.2 Value and function input

The functions of the matrix fields can be divided into six categories. In general, any not successfully completed inputs and procedures are followed by retention of the previous status after return to the measurement mode.

4.2.1 Indication of values

Indication of values without any possibility of altering them is available only at the indication level, i.e. in the fields of the first matrix column, apart from matrix field V9H0.
After inputting the password 0009 via matrix field V9H0 it is possible to show the current value of all other matrix fields on the display. Matrix field V7H0 (Indicate fault codes) is an exception; additional existing errors codes can be displayed using the keys ▲ and ▼.

4.2.2 Input of a number password

On the matrix field V9H0 any number between 0000 and 9999 can be input (negative numbers can not be set).
After selecting the matrix field (direct selection via ENTER, see also 4.2.10) the number 0000 appears on the display, with the units digit flashing. It can be altered using the keys ▲ and ▼. The tens digit is selected with the key ‹ and can again be altered using the keys ▲ and ▼. This procedure can be continued up to the last digit. If a mistake is made during the input you can return to the units digit with the key ‹.
Operating the ENTER key causes the instrument to accept the value which has been input. The display returns to 0000.
If a wrong value has been input it is possible to repeat the input procedure by pressing the ENTER key again.
The input of a number password is explained in Section 4.2.7 example 1.

4.2.3 Input of values

When inputting values other than number passwords it must be noted that the range of values is limited and is generally set to particular default values. This leads to certain special features for otherwise similar input sequence:

a) After selecting the matrix field the display shows the default setting (factory settings or previous setting by the user).

b) Decimal point and negative sign can appear on the display.

c) When attempting to input a value outside the value range of the parameter, pressing the ENTER key is followed by the display flashing the limit which the input has exceeded upwards or downwards. The input is taken as unsuccessfully completed and can be restarted by pressing the ENTER key again.

d) When the input has be completed successfully (after pressing ENTER) the edited value remains steady on the display without flashing.

Example 2 (Section 4.2.8) explains the input of a value.

4.2.4 Selection from given alternatives

Several matrix fields permit a selection from given possibilities (software switch). After the matrix field has been selected the display flashes the symbol for the default alternative (a figure or alphanumerical characters such as "no"). The keys ▲ and ▼ can be used to display all other possible settings which can be entered by pressing the ENTER key. The symbol of the selected alternative then appears steady on the display without flashing. The matrix fields V9H2, V1H2 and V0H3 are exceptions; when selected, they display a flashing "no" which changes to a flashing "YES" on pressing the ▲ and ▼ key. On pressing the ENTER key in the case of V9H2, the display flashes BUSY for about 15 seconds and then changes to a steady "no" (see Example 3 in Section 4.9.2). During the BUSY phase it is not possible to leave this matrix field and the instrument must not be switched off. If the supply fails during this phase the factory setting has to be accepted initially. In the case of V0H3 and V1H2 the BUSY does not appear, the display immediately shows "no". In all cases the entry of the required data is then completed.

4.2.5 Activating a procedure

The matrix fields which come under this heading are V0H1 "Calibration of cell constant" and V1H1 "Experimental evaluation of temperature coefficient" which are described in detail in Section 6.

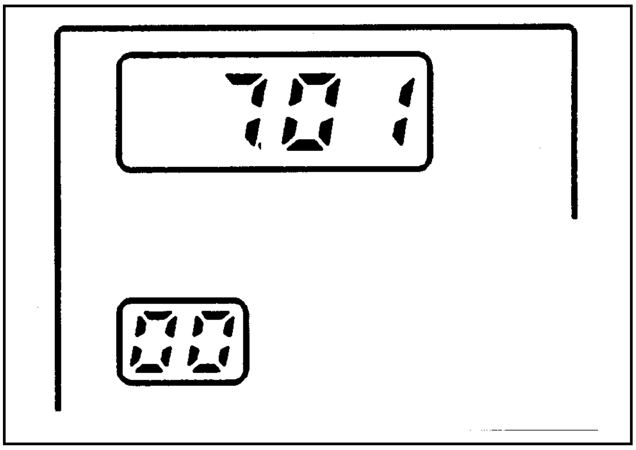
4.2.6 Matrix fields not in use

In the case of matrix fields not being used the display "_ _ _ _" is shown.

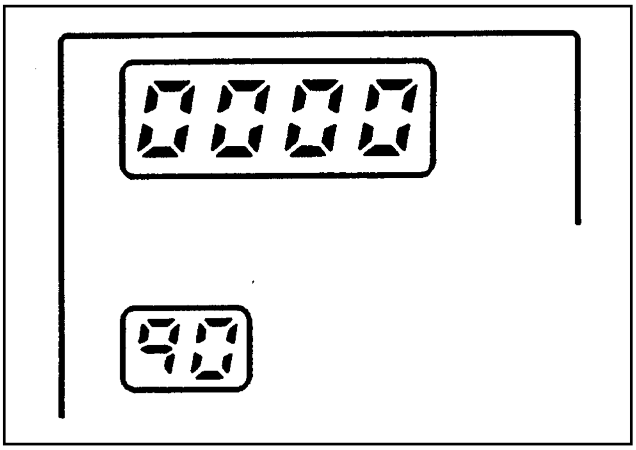
4.2.7 Example 1: De-inhibiting the operating level

input of the number password 0110)

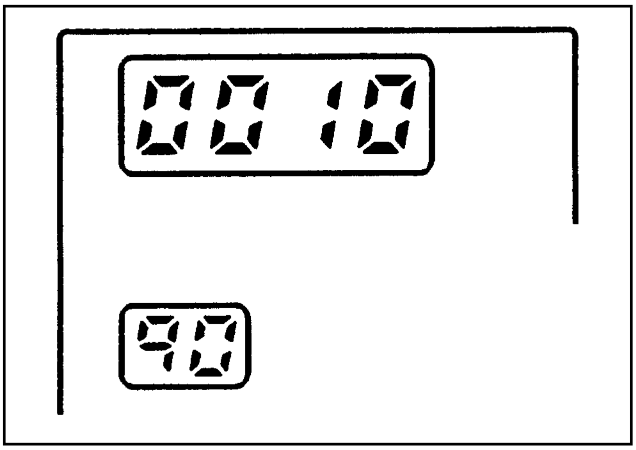
Initial status:
Instrument in measurement mode
Displayed matrix position: V0H0



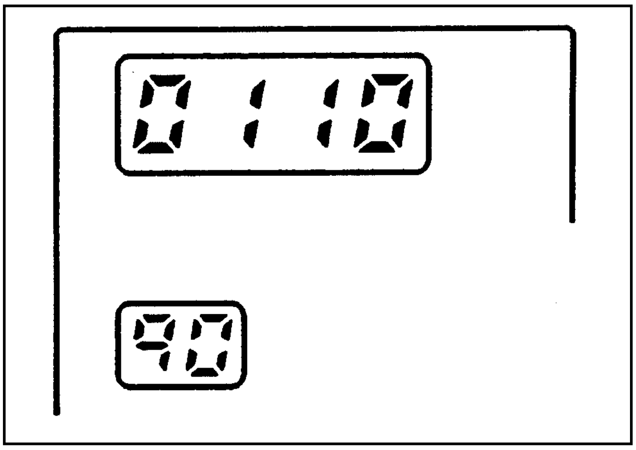
Step 1:
Press ENTER key.
Matrix field V9H0 is selected.
The units digit is flashing.



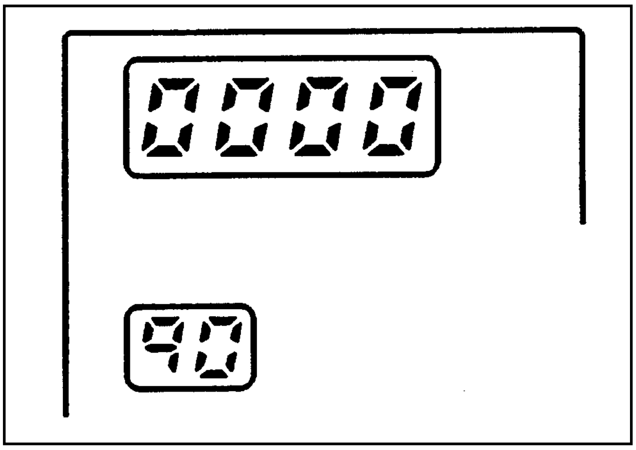
Step 2:
Using the key ‹ switch to the tens digit.
Using the ▲ and ▼b key set the figure 1.



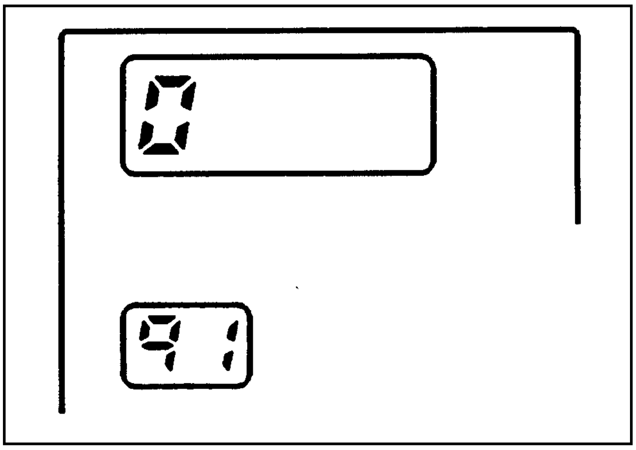
Step 3:
Using the ‹ key switch to the hundreds digit.
Using the ▲ and ▼ key set figure 1.



Step 4:
Using the ENTER key enter the 4-digit number. The display changes to 0000.

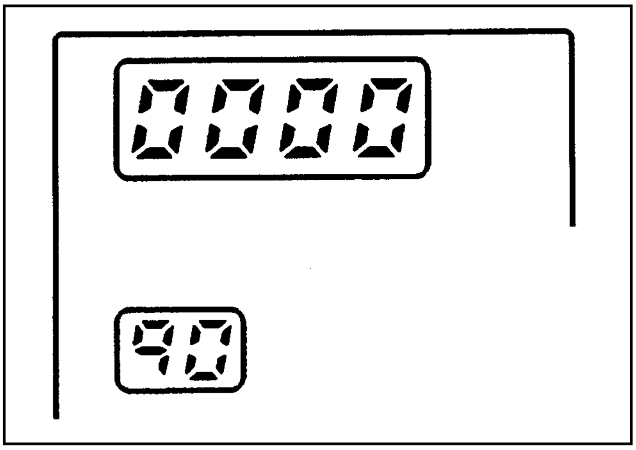


Step 5:
Following the correct input the operating level is now de-inhibited.
Check: using the H key it is possible now to alternate between 0 and 1. If this is not possible, repeat steps 1 to 5.
The other number passwords are input similarly.

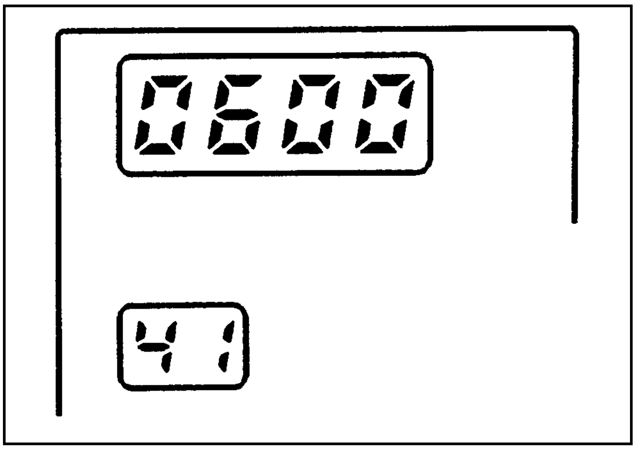


4.2.8 Example 2:
Setpoint input w_1 as 545 µS/cm

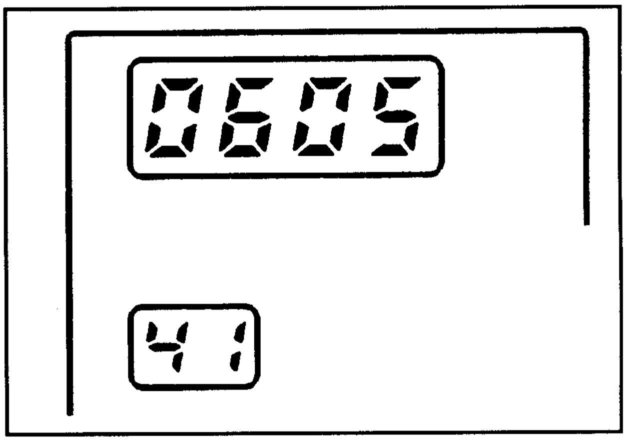
Initial status:
Operating level de-inhibited.
Indicated matrix position V9H0



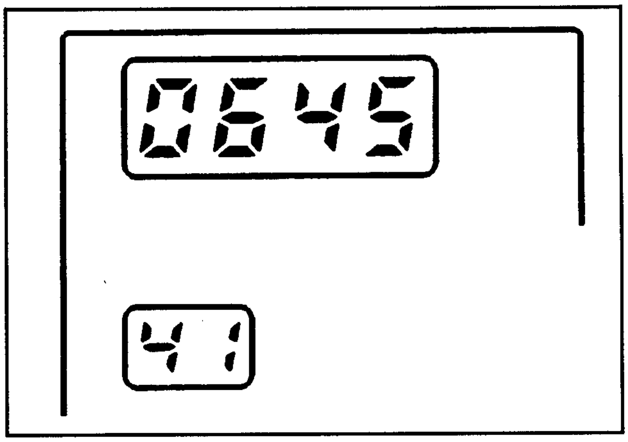
Step 1:
Select matrix field V4H1 using the V and H keys.
The units digit is flashing.



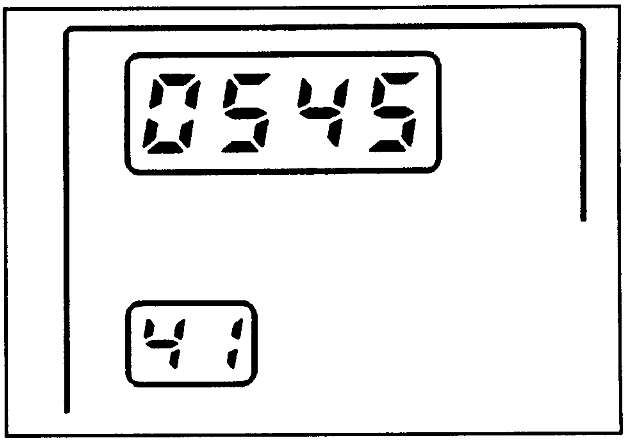
Step 2:
Using the ▲ and ▼ key set the figure 5.



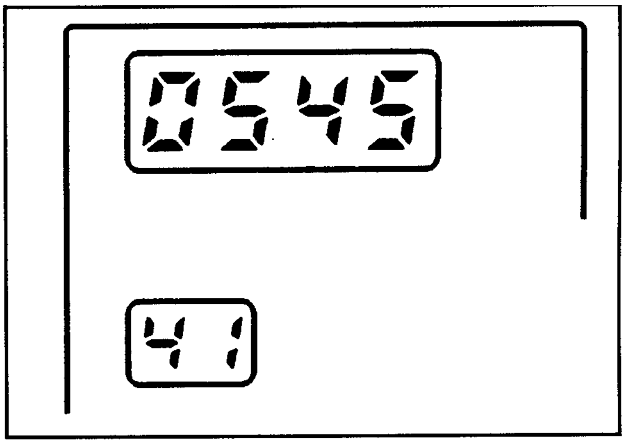
Step 3:
Using the ‹ key change to the tens digit. Using the ▲ and ▼ key set the figure 4.



Step 4:
Using the ‹ key change to the hundreds digit. Using the ▲ and ▼ key set the figure 5.



Step 5:
Using the ENTER key enter the 4-digit number. The display changes to 0545 steady.
This completes the procedure. After inhibiting the level it is possible if required to return to the measurement mode by selecting the matrix field V0H0.



4.2.9 Example 3: Entering factory setting

Initial status: instrument in measurement mode. Indicated matrix position: V0H0

- ✶ De-inhibit the parameter level by input of the number password 0020 (see example 1, Section 4.2.7)
- ✶ Select matrix field V9H2, the display flashes "no".
- ✶ Press ▲ and ▼ key, the display flashes "YES".
- ✶ Press ENTER key. The display flashes BUSY. After about 15 seconds the display changes automatically to "no" (steady).

This completes the procedure.
After inhibiting the level it is possible if required to return to the measurement mode by selecting the matrix field V0H0.

4.2.10 Special key functions.

At the indicating level, operating the ENTER key produces a jump to the matrix field V9H0.
At all levels, simultaneous operation of the V and H keys produces a jump to the matrix field V0H0.

4.3 Manual operation

4.3.1 De-inhibiting

Manual operation is de-inhibited inside the instrument (see Section 10) using switch S201.1 (normally de-inhibited) and through the matrix field V2H1 (normally inhibited).
If switch S201.1 is inhibited (position 0) manual operation is not possible.
When manual operation is activated the LED *HAND* lights up.

4.3.2 Auto/manual changeover

When changeover is not inhibited, key ‹ in matrix field V0H0 (measurement mode) can be used to switch between auto and manual operation.

4.3.3 Operating the relay contacts

The relay contacts can only be activated on matrix field V0H0 (measurement mode) using the following keys:

Operating key ▲ (K1) activates relay contact K1.
Operating key ▼ (K2) activates relay contact K2.
Pulse operation: Select 0 in matrix field V3H9
The relay contact is activated only while the corresponding key is pressed.
When the key is released the corresponding relay contact is immediately inactive (0/manual).
Switch operation: Select 1 in matrix field V3H9
When key ▲ and ▼ is operated for the first time, the corresponding relay contact is activated and remains so until the same key is pressed again.
When the HOLD LED is alight no manual operation is possible.

4.3.4 Switching action of the controller types

Limit controller

The appropriate relay contact switches permanently.

Pulse duration controller

The appropriate relay contact switches for the duration of the pulse.

Pulse frequency controller

The maximum pulse frequency is output as set in matrix field V6H4 or V7H4.

Modulating controller

The actuator is opened or closed.

4.4 Temperature compensation

The temperature compensation corrects the actually present conductivity to the 25°C reference temperature, using pairs of values for liquid temperature and temperature co-efficient. This corrected value is then indicated. Up to a product temperature of 150°C the max. temperature coefficient is 5.5%/°C; it then decreases as follows:
to 200°C down to 4%/°C
and then
to 250°C down to 3%/°C
Matrix field V3H2 decides whether the temperature is determined manually or automatically:
0 = MTC (manual input of liquid temperature in °C in matrix field V3H1)
1 = ATC (automatic evaluation of liquid temperature using a Pt 100 resistance thermometer connected to the unit)

4.4.1 Manual temperature compensation (MTC)

The liquid temperature in °C is input in matrix field V3H1.

4.4.2 Automatic temperature compensation (ATC)

With automatic temperature compensation a Pt 100 resistance thermometer is used to evaluate liquid temperatures between -50°C and +250°C.
The conductivity transmitter/controller is intended for the use with a Pt 100 resistance thermometer in 3-wire circuit (for connection diagram see Section 3, Electrical connection).
When using a resistance thermometer in 2-wire circuit a lead compensating resistance Rcomp must be connected into the circuit. Rcomp must correspond to the resistance of one lead of the connection from Pt 100 resistance thermometer to the transmitter/controller (for connection diagram see Section 3, Electrical connection).

4.5 Matrix summary

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
CONFIGURATION LEVEL										
PARAMETER LEVEL										
OPERATING LEVEL										
INDICATING LEVEL										
V0	Indicate measurement [µS/cm or mS/cm]		Calibration of cell constant with calibration solution see Section 6	Read in old cell constant data see Section 6	Supply frequency 0 = 50 Hz 1 = 60 Hz				Select range µS/cm or mS/cm see Section 1	
V1	Indicate temperature [°C]	Experimental evaluation of temperature coefficient see Section 6	Read in old temp. coefficient data see Section 6	Start meas. conductivity output [%] see Section 7	End meas. conductivity output [%] see Section 7	Output changeover 0 = 0-20 mA 0-10 V 4 = 4-20 mA see Section 7	Simulation output [%] see Section 7	Simulation 0 = off 1 = on see Section 7	Changeover 0 = µS/cm 1 = mS/cm see Section 1	Measurement output 0 = linear 1 = dual-slope see Section 7
V2	Indicate cell constant	Changeover 0 = auto 1 = manual see Section 4		Start meas. temperature output [°C] see Section 7	End meas. temperature output [°C] see Section 7				Select cell constant see Section 1, 5	Input/ indicate cell constant [%] see Section 5
V3	Indicate temperature coefficient [%/°C]	Input MTC temperature see Section 4	Changeover 0 = MTC 1 = ATC see Section 4						Input temp. coefficient [%/°C] see Section 6	Changeover manual 0 = pulse op. 1 = switch op. see Section 4
V4	Indicate setpoint 1 [µS/cm or mS/cm]	Set setpoint 1 [µS/cm or mS/cm]	Proportional band Xp 1 [µS/cm or mS/cm]	Derivative time 1 Tv 1 [sec]	Reset time 1 Tn 1 [sec]	Output limit Y 1 [%]	Min. ON time 1 or Pulse duration 1 [sec]	Differential 1 [µS/cm or mS/cm]	Controller structure 1	Controller type 1
V5	Indicate setpoint 2 [µS/cm or mS/cm]	Set setpoint 2 [µS/cm or mS/cm]	Proportional band Xp 2 [µS/cm or mS/cm]	Derivative time 2 Tv 2 [sec]	Reset time 2 Tn 2 [sec]	Output limit Y 2 [%]	Min. ON time 2 or Pulse duration 2 [sec]	Differential 2 [µS/cm or mS/cm]	Controller structure 2	Controller type 2
V6	Version (indication of software version)	Alarm tolerance [µS/cm or mS/cm]	Pull-in delay relay 1 [sec]	Drop-out delay relay 1 [sec]	Max. pulse frequency 1 [1/h]	Pulse period 1 [sec]	Changeover 0 = break cont. 1 1 = make cont. 1	Changeover 0 = min contact 1 1 = max contact 1	Working point [%]	Alarm changeover 0 = steady contact 1 = pulse contact
V7	Indicate fault codes see Section 9	Alarm delay [sec]	Pull-in delay relay 2 [sec]	Drop-out delay relay 2 [sec]	Max. pulse frequency 2 [1/h]	Pulse period 2 [sec]	Changeover 0 = break cont. 2 1 = make cont. 2	Changeover 0 = min contact 2 1 = max contact 2	Actuator stroke time [sec]	Probe break monitor 0 = off / 1 = on see Section 11
V8	Interface	Instrument addresses	under development							
V9	Inhibit/de-inhibit see Section 4	HOLD 0 = off 1 = on see Section 11	Factory settings (default) see Section 11	Input filter constant [sec] see Section 11						

(shaded box) Observe notes in Section 8

5 SWITCHING THE RANGE

Instruments supplied from stock without specific ordering details have a basic configuration (incl. span = 0 - 1 mS/cm, cell constant C = 1.0 /cm; see Section 12).
If the user requires a different configuration he has to set this himself. The parameters involved in the range are the unit of the range (µS/cm or mS/cm, matrix field V1H8), the upper range limit (matrix field V0H8) and the nominal size of the cell constant (matrix field V2H8). It is essential that the choice is restricted to the combinations shown in the range table (see Section 1). The additional hardware change required consists of recoding the input card (see Section 10.4) which also sets the correct measurement frequency.

Important:

Before opening the case, observe the Notes in Section 10: "Adjustments inside the instrument"!
On switching the range, all previous settings are overwritten by a default setting (see Section 11.4).

6 CALIBRATION

6.1 Introduction

After considering Section 5 the instrument can be placed into operation in conjunction with a cell of the given cell constant, without requiring any additional settings.
The actual value of the cell constant is subject to individual variations, and in addition the temperature coefficient depends on the product being tested; it may therefore be desirable to determine these two parameters more precisely in order to obtain a better measurement accuracy. There are several methods to achieve this which are described below.

6.2 Numerical input of cell constant and temperature coefficient

If the values of cell constant and temperature coefficient are known, they can be input after opening the configuration level, using the fields V2H9 (cell constant in % of nominal size as input at V2H8), and V3H8 respectively.

6.3 Calibrating the cell constant using a calibration solution

When the precise value of the cell constant is unknown it can be determined with the aid of a calibration solution.
After selecting field V0H1 the temperature compensation is suppressed. The cell is immersed in the calibration solution and the display then shows a value based on the true value of the cell constant but without reference to temperature. The subsequent editing procedure presumes an accurate knowledge of the conductivity of the calibration solution at the current temperature. From the value input the instrument calculates the cell constant and transfers it to the memory.

6.3.1 Procedure for calibrating the cell constant with a calibration solution

Note:

Before calibration it is necessary to de-inhibit the operating level!

✶ **Select matrix field V0H1**

Temperature compensation is suppressed. The current value at the input is indicated, taking into account the true value of the cell constant.

✶ **Press ENTER**

The HOLD LED lights up.
The LED Cal 1 lights up - immerse the sensitive part of the cell in the calibration solution. Wait until the reading has become steady.

✶ **Press ENTER**

The indicated value is "frozen" (i.e. the display no longer responds to the input).

The indicated value can now be edited (for editing of values see Example 2, Section 4.2.8). The purpose of editing is to bring the indicated value to the true value of the calibration solution.

✶ **Press ENTER**

The newly determined cell constant is stored in matrix field V2H9 as a percentage.

The LED HOLD lights up.
The calibration procedure is now completed.

Note:

After moving away from matrix field V0H1 the LED HOLD goes dark.

6.4 Experimental determination of the temperature coefficient

An experimental determination of the product temperature coefficient after selection the field V1H1 requires activating the automatic temperature compensation (matrix field V3H2). The display shows the temperature-compensated value of the current conductivity. The value of the current cell constant is taken as being correct. After pressing the ENTER key the display shows the temperature measured by the temperature sensor.
The method is based on measuring the non-temperature-compensated conductivities (temp. coeff. = 0) at two temperatures, the reference temperature 25°C and a second temperature T which usually corresponds to the temperature of the subsequent measurement. When accepting the measured values it is important to allow for the delay of the temperature sensor, i.e. a steady temperature reading on the display has to be obtained before pressing the ENTER key.
Technical reasons sometime prevent exact setting of the product temperature to the reference temperature; values within the range 25.0 ± 2.5°C are therefore accepted by the instrument. The temperature coefficient is calculated from the two pairs of values and transferred to the memory.
In case the reference temperature is not within the indicated limits there is an error message. This disappears when making a fresh experimental determination of the temperature coefficient using field V3H8, or on entering the old value using field V1H2.

6.4.1 Procedure for experimental determination of the temperature coefficient

Note:

Before calibration, the operating level must be de-inhibited and in Matrix field V3H2 the selection ATC = 1 must be made.

✶ **Select matrix field V1H1**
The current value at the input (conductivity) is indicated. The current temperature coefficient and the current cell constant are being used.

✶ **Press ENTER**
The HOLD LED lights up.
The LED Cal 1 lights up.
Immerse the sensitive part of the cell in the calibration solution.
Wait until the reading has become steady (liquid temperature 25°C ± 2.5°C).

✶ **Press ENTER**
The HOLD LED lights up.
The LED Cal 1 is flashing; the pair of values conductivity 1 and temperature 1 is being accepted.
After the first pair has been accepted the LED Cal 2 lights up.
Bring the solution to the later working temperature. (Check using the indication on the display. The sensitive part of the cell must remain immersed in the liquid).
Note:

When accepting the measured values it is important to allow for the delay of the temperature sensor, i.e. a steady temperature reading has to be obtained before pressing the ENTER key.

✶ **Press ENTER**
The HOLD LED lights up.
The LED Cal 2 is flashing; the value pair conductivity 2 and temperature 2 is being accepted.
After the second value pair has been accepted the LED HOLD is alight.

The temperature coefficient is calculated from the two pairs of values and stored in matrix field V3H8.
The value currently at the input (conductivity(is indicated.
It is based in the newly calculated temperature coefficient and on the current cell constant.

Note:

After moving away from matrix field V0H1 the HOLD LED goes dark.

6.5 Accepting old calibration data

Following successful completion of the calibration procedures and measurements as described above, it may be decided not to accept the new values. The previous value can then be restored by using the matrix fields V0H3 (cell constant) and/or V1H2 (temperature coefficient), or fresh inputs can be made using V2H9 and/or V3H8.

7 ANALOGUE OUTPUT

7.1 Process value output

The transmitter/controller can output the following standard signals proportional to the inputs conductivity (and temperature if configured):

0 - 20 mA
4 - 20 mA
0 - 10 V

The selection between current and voltage is made with a DIL switch, see Section 10.1, Analogue output.
The change between the current outputs 0 - 20 mA and 4 - 20 mA is made in matrix field V1H5 for conductivity and temperature. When the analogue output is being operated as a voltage output the matrix field V1H5 must be set to current output 0 - 20 mA.
The measurement span to be converted into the analogue output can be selected in matrix fields V1H3 Start conductivity output and V1H4 End conductivity output, also V2H3 Start temperature output and V2H4 End temperature output.
The simulation of the output signal for conductivity and temperature is activated by switching the matrix field V1H7 from 0 to 1 using the keys ▲ and ▼ and pressing ENTER. The simulated output value for conductivity and temperature, set in matrix field V1H6 as percentage of span, is then output.
The process output conductivity can be represented in two ways:

linear: select 0 in matrix field V1H9

dual-slope: select 1 in matrix field V1H9

With a dual-slope signal, the output reaches mid-range at 10% of the span between start and end of conductivity range.

ANALOGUE OUTPUT

Example:

Selected range
500 µS/cm

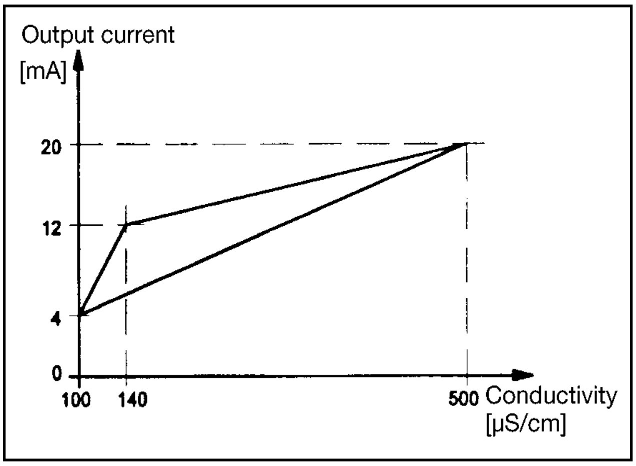
Start of conductivity output
20.0% of 500 µS/cm = 100 µS/cm

End of conductivity output
100.0% of 500 µS/cm = 500 µS/cm

Span
500 µS/cm - 100 µS/cm = 400 µS/cm

Selected output signal
4 - 20 mA

The output signal is 12 mA at 140 µS/cm,
20 mA at 500 µS/cm



8 CONTROLLER

8.1 Concepts

Alarm contact

The limit controller monitors the active time of the relay. If this time is exceeded by an adjustable value (delay time) the alarm contact is activated.
The proportional and the modulating controller monitors the size of the control deviation. If this exceeds an adjustable value (alarm tolerance) an adjustable delay time is started and at its end the alarm contact is activated.
With both functions the delay time is reset when the alarm conditions are no longer fulfilled.

Changeover break/make contact

0 = break contact (common connected to n.c. contact)

1 = make contact (common connected to n.o. contact

Alarm delay

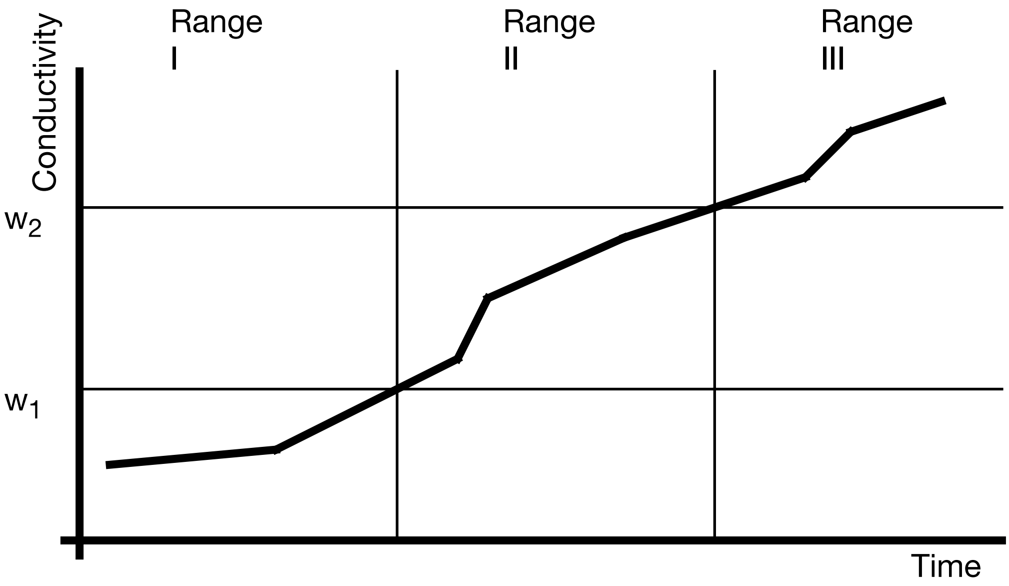
The time during which the alarm condition must be fulfilled before the alarm relay and the alarm LED are activated.

Alarm tolerance

If the control deviation exceeds the alarm tolerance the alarm delay is started. At the end of the alarm delay the alarm contact is activated.

Example

break-make contact



		Range I		Range II		Range III	
		LED	Contact	LED	Contact	LED	Contact
min	break	ON	0	OFF	1	OFF	1
	make	ON	1	OFF	0	OFF	0
max	break	OFF	1	OFF	1	ON	0
	make	OFF	0	OFF	0	ON	1

Break contact

As long as the controller is inactive the common is connected to the n.c. (break) contact and the corresponding LED is off.

Make contact

As long as the controller is inactive the common is connected to the n.o. (make) contact and the corresponding LED is off.

Changeover min/max contact

Min contact means that the controller is active when the process value is below the setpoint.
Max contact means that the controller is active when the process value is above the setpoint.

0 = min contact
1 = max contact

Changeover steady/pulse contact

Applies only to the alarm contact and defines the action on activating the alarm contact.

0 = steady contact
The alarm relay is energised and remains so until the cause of the alarm has been removed. The alarm LED is flashing.

1 = pulse contact
The alarm relay switches once for approx. 1 second and then returns to its original status. The alarm LED continues to flash until the cause of the alarm has been removed.

Controller structure

Determining the controller structure of a proportional or quasi-proportional controller or modulating controller.

0 = P (proportional)
1 = I (integral)
2 = PD (proportional, differential)
3 = PI (proportional, integral)
4 = PID (proportional, integral, differential)

Controller type

It defines the controller as:
0 = controller off
1 = limit controller
2 = quasi-proportional controller with pulse duration output
3 = quasi-proportional controller with pulse frequency output
5 = modulating controller

Derivative time T_V

(differentiation constant)
Control parameter in a PD and PID controller. It determines effect and filtering of the process variable change.

Differential

In the case of a non-analogue controller the differential is the change in process variable required to produce changeover of a relay contact with increasing and with decreasing process variable.

Drop-out delay

The time interval which has to elapse until the relay contact switches over when the switching conditions are no longer fulfilled.

Limit controller

Single-setpoint controller with pull-in and/or drop-out delay.

Maximum pulse frequency

The value based on the technical data of the dosing pumps (e.g. with magnetic dosing pumps).

Minimum ON time

The value given by the technical data of the dosing element (in dosing pumps or solenoid valves).

Output limit

The maximum value of the output signal of a proportional or quasi-proportional controller.

Proportional band X_p

The range of a P controller within which there is a proportional relationship between control deviation and controller output change.

Pull-in delay

The time interval until the control contact switches over when the switching condition is fulfilled.

Pulse period

The value indicates the period during which the pulse duration modulation takes place.

Quasi-proportional controller with pulse duration output

When a control deviation occurs the relay starts to output pulses of different duration (parameter: minimum ON time).
The duration of the pulses depends on the magnitude of the deviation and on the set control parameters. This output can be used to control solenoid valves, for example.

Quasi-proportional controller with pulse frequency output

When a control deviation occurs the relay starts to output pulses of constant duration (parameter: minimum ON time).
The repeat frequency of the pulses depends on the magnitude of the deviation and on the set control parameters. This output can be used to operate magnetic dosing pumps, for example.

Reset time T_n

(integral constant)
Control parameter of a PI, PID and I controller. The value determines the rate at which the control deviation is integrated in the integrator.

Stroke time

Adjustable on modulating controller. This value must be obtained from the data of the actuator manufacturer (e.g. for a motorised valve).

Working point

Output on P and PD controllers for zero control deviation.

8.2 Possible combinations

Two of the following controllers can be combined as required. The selection is made in the matrix fields V4H9 Controller type 1 and V5H9 Controller type 2.

- Controller off
- Limit controller
- Pulse duration controller
- Pulse frequency controller

The modulating controller can only be selected in matrix field V4H9 Controller type 1. A selection in matrix field V5H9 Controller type 2 is then ineffective.

8.3 Controller switched off

Selection 0 (controller off)

in matrix field V4H9, Controller type 1
and/or
matrix field V5H9, Controller type 2

Relevant control parameters:
none

8.4 Limit controller

Selection 1 (limit controller)

in matrix field V4H9, Controller type 1
and/or
matrix field V5H9, Controller type 2.

Relevant parameters:

in matrix field V6H2, Pull-in delay relay 1
and/or
matrix field V7H2, Pull-in delay relay 2
or
in matrix field V6H3, Drop-out delay relay 1
and/or
matrix field V7H3, Drop-out delay relay 2

in matrix field V6H7, Changeover min/max contact 1
and/or
matrix field V7H7, Changeover min/max contact 2

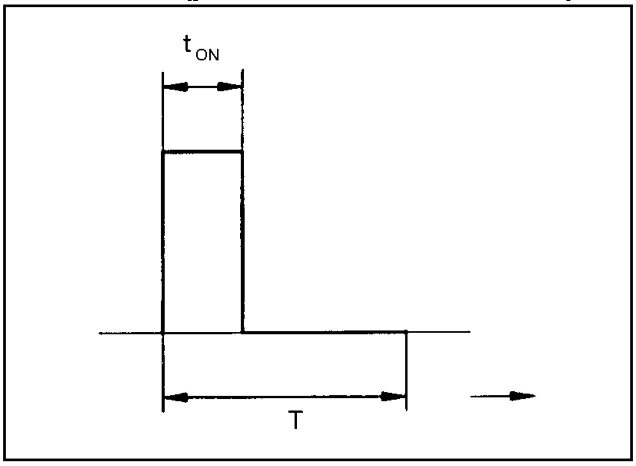
in matrix field V6H6, Changeover break/make contact 1
and/or
matrix field V7H6, Changeover break/make contact 2

in matrix field V4H7, Differential 1
and/or
matrix field V5H7, Differential 2

in matrix field V4H1, Set setpoint 1
and/or
matrix field V5H1, Set setpoint 2

8.5 Pulse duration controller

Selection 2 (pulse duration controller)



T = pulse period
t_{ON} = minimum ON time
t_{ON} < T

Important:

If both relay contacts switch for process value below setpoint then there must be w1 < w2!

If both relay contacts switch for process value above setpoint then there must be w1 > w2!

in matrix field V4H9, Controller type 1
and/or
matrix field V5H9, Controller type 2.

Relevant parameters:

in matrix field V4H8, Controller structure 1
and/or
matrix field V5H8, Controller structure 2

in matrix field V4H3, Derivative time 1
(for PD and PID control action)
and/or
matrix field V5H3, Derivative time 2
(for PD and PID control action)
or
in matrix field V4H4, Reset time 1
(for I, PI and PID control action)
and/or
matrix field V5H4, Reset time 2
(for I, PI and PID control action)

in matrix field V4H2, Proportional band X_{P1}
(for P, PI and PID control action)
and/or
matrix field V5H2, Proportional band X_{P2}
(for P, PI, PID control action)
in matrix field V6H5, Pulse period 1
and/or
matrix field V7H5, Pulse period 2

in matrix field V4H6, Minimum ON time 1
and/or
matrix field V5H6, Minimum ON time 2

in matrix field V6H7, Changeover min/max contact 1
and/or
matrix field V7H7, Changeover min/max contact 2

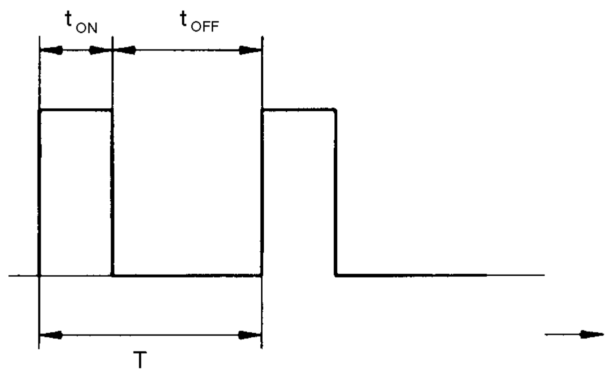
in matrix field V6H6, Changeover break/make contact 1
and/or
matrix field V7H6, Changeover break/make contact 2

in matrix field V6H8, Working point
in matrix field V4H5, Output limit Y_1
and/or
matrix field V5H5, Output limit Y_2

in matrix field V4H1, Set setpoint 1
and/or
matrix field V5H1, Set setpoint 2

8.6 Pulse frequency controller

Selection 3 (pulse frequency controller)



t_{ON} = minimum ON time
$t_{ON} + t_{OFF} = T$
t_{ON} = 0.2 sec min.
T = 0.4 sec min.
pulses/h = (3600 sec/h)/T

If t_{OFF} would have to be less than 0.2 sec there is no steady output signal and the relay contact goes to inactive.

Important:

If both relay contacts switch for process value below setpoint then there must be w1 < w2!

If both relay contacts switch for process value above setpoint then there must be w1 > w2!

in matrix field V4H9, Controller type 1
and/or
matrix field V5H9, Controller type 2.

Relevant parameters:

in matrix field V4H8, Controller structure 1
and/or
matrix field V5H8, Controller structure 2

in matrix field V4H3, Derivative time 1
(for PD and PID control action)
and/or
matrix field V5H3, Derivative time 2
(for PD and PID control action)
or
in matrix field V4H4, Reset time 1
(for I, PI and PID control action)
and/or
matrix field V5H4, Reset time 2
(for I, PI and PID control action)

in matrix field V4H2, Proportional band X_{P1}
(for P, PI and PID control action)
and/or
matrix field V5H2, Proportional band X_{P2}
(for P, PI, PID control action)

in matrix field V6H4, Max. pulse frequency 1
and/or
matrix field V7H4, Max. pulse frequency 2

in matrix field V4H6, Minimum ON time 1
and/or
matrix field V5H6, Minimum ON time 2

in matrix field V6H7, Changeover min/max contact 1
and/or
matrix field V7H7, Changeover min/max contact 2

in matrix field V6H6, Changeover break/make contact 1
and/or
matrix field V7H6, Changeover break/make contact 2

in matrix field V6H8, Working point

in matrix field V4H5, Output limit Y_1
and/or
matrix field V5H5, Output limit Y_2

in matrix field V4H1, Set setpoint 1
and/or
matrix field V5H1, Set setpoint 2

8.7 Modulating controller

Selection 5 (modulating controller)

in matrix field V4H9, Controller type 1

Relevant parameters:

in matrix field V4H8, Controller structure 1
(only PI and PID action appropriate)

in matrix field V4H4, Reset time 1
(for PI and PID control action)

in matrix field V7H8, Stroke time

in matrix field V4H2, Proportional band X_{P1}

(for PI and PID control action)

in matrix field V4H6, Min. ON time 1
and/or
matrix field V5H6 Min. ON time 2

in matrix field V4H5, Output limit Y_1
and/or
matrix field V5H5, Output limit Y_2

in matrix field V4H1, Set setpoint 1
and/or
matrix field V5H1, Set setpoint 2

Note:

with PID action there is a fixed ratio
Tv = Tn/4.

8.8 Alarm contact

in matrix field V6H1, Alarm tolerance
and/or
in matrix field V7H1, Alarm delay

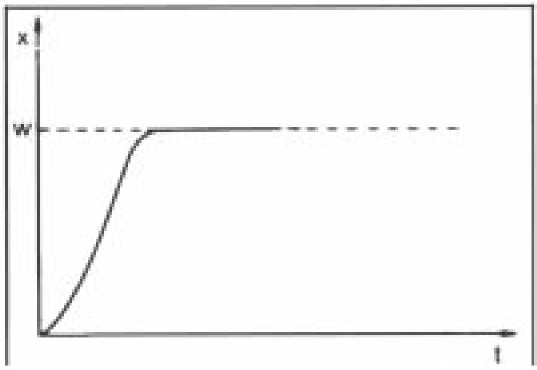
in matrix field V6H9, Changeover steady alarm contact/pulse alarm contact

Note:

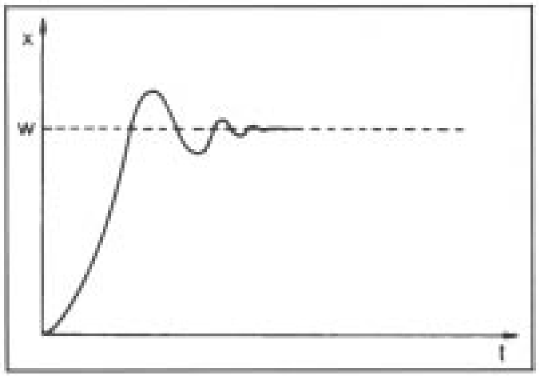
In controller type "limit controller" the alarm tolerance is fixed internally at 0.

8.9 Notes on possible incorrect controller settings and their correction

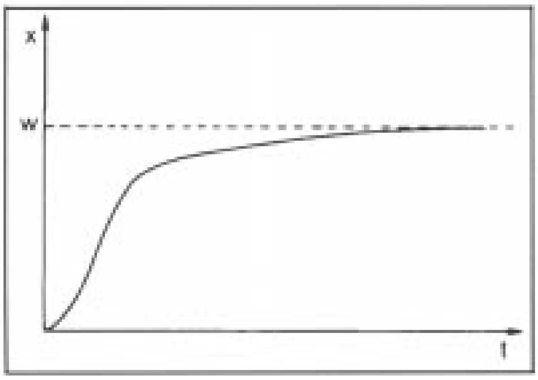
The optimum adjustment of the controller to the process loop can be tested by recording a start-up with the control loop closed.
The diagrams below relate to PID action and indicate possible incorrect settings and their correction.
It is found that increasing X_P and increasing Tn both produce a more stable and more sluggish control action.
Reducing X_P or T_n leads to a less damped control action.



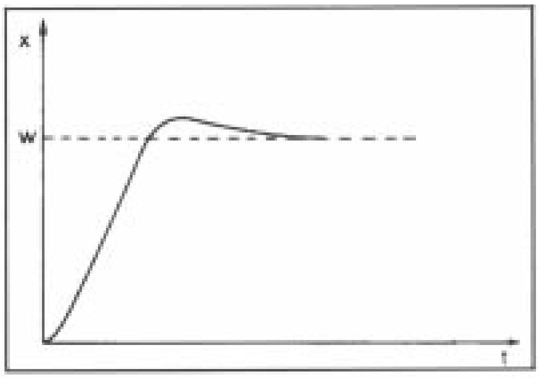
Optimum



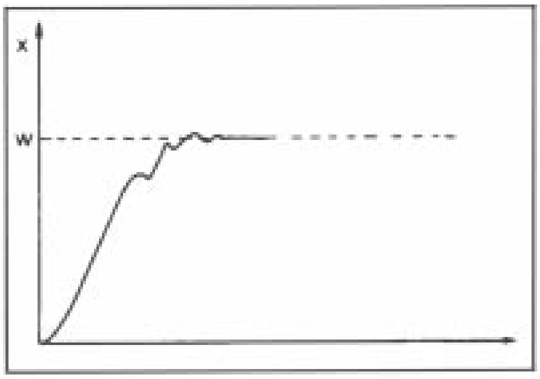
T_n too small



T_n too large



X_P too small



X_P too large

9.1 Introduction

The fault codes are shown in matrix field V7H0. If several faults occur simultaneously the code with the smallest number is shown first. All other codes can be called up with key ▲ in increasing order. Correspondingly pressing key ▼ calls up the code with the next lower number.

Fault codes are updated continuously. If a fault code is cleared while on display, the code with the next lower number (if it exists) is displayed. Otherwise the code with the next higher number is displayed. If there is no fault and no warning the display shows F000.

Certain faults shift the controller to the HOLD status for the time they are present. These are the faults F020, F021, F022, F023, F024 and F025.

9.2 Faults

Faults activate the alarm relay while they are present.

F010

Measurement above/below alarm tolerance and controller alarm delay exceeded

Remedy: check control parameters.

F020

Outside permitted tolerance range of cell constant

The cell constant differs by more than ±20% from the nominal value.

Remedy: repeat the calibration; possibly clean cell or check calibration solutions.

F021

Outside permitted range of temperature coefficient

The temperature coefficient is less than 0%/°C or larger than 5.5%/°C.

Remedy: repeat the calibration (see Section 6).

F022

Conductivity underrange

Measurement below 0
or
probe break monitor has operated

The probe break monitor is activated and the measurement is below 2% of the measuring range.

Possible cause:
break in cable, conductivity of liquid less than 2% of range, or cell not immersed in liquid.

F023

Conductivity overrange

Measurement above set range

Possible cause:
short-circuit in cable, range too small or temperature coefficient of liquid too high.

F024

Incorrect temperature measurement

(only relevant with ATC)

Possible cause:
Pt 100 resistance thermometer has short-circuit, break, is not connected, or temperature is outside the range -50 to +250°C.

F025

Combination of range with cell constant not permitted

Remedy:
use only a combination shown on page 12.

F030

Process value output below permitted minimum

The process value output is smaller than the set value.

Remedy:
change value in matrix field V1H3
or
change value in matrix field V2H3

F031

Process value output above permitted maximum

The process value is larger than the set value.

Remedy:
change value in matrix field V1H4
or
change value in matrix field V2H4.

9.3 Warnings

Warnings do not activate the alarm relay but the alarm LED is flashing. If the instrument is controlling it continues to do so during warnings without being influenced.

F050

Parameter limits for process value interchanged

The end value of the process value output is smaller than the start value of the process value output.

Remedy:
interchange value in matrix field V1H3 with value in matrix field V1H4
or
interchange value in matrix field V2H3 with value in matrix field V2H4.

F060

Pulse duration controller

Minimum ON time 1 is not less than pulse period 1

Remedy:
reduce minimum ON time in matrix field V4H6
and/or
increase the pulse period in matrix field V6H5.

Pulse frequency controller

Pulse duration 1 [sec] is not less than

$$\frac{3600\ [\text{sec/h}]}{\text{max. pulse frequency 1 [1/h]}}$$

Remedy:
reduce the pulse duration in matrix field V4H6
and/or
reduce the maximum pulse frequency in matrix field V6H4.

F061

Pulse duration controller

Minimum ON time 2 is not less than pulse period 2

Remedy:
reduce minimum ON time in matrix field V5H6
and/or
increase the pulse period in matrix field V7H5.

Pulse frequency controller

Pulse duration 2 [sec] is not less than

$$\frac{3600 \text{ [sec/h]}}{\text{max. pulse frequency 2 [1/h]}}$$

Remedy:
reduce the pulse duration in matrix field V5H6
and/or
reduce the maximum pulse frequency in matrix field V7H4.

F070

Actual liquid temperature differs by more than 2.5°C from the 25°C reference temperature.

Remedy:
repeat calibration
see Calibration (Section 6)

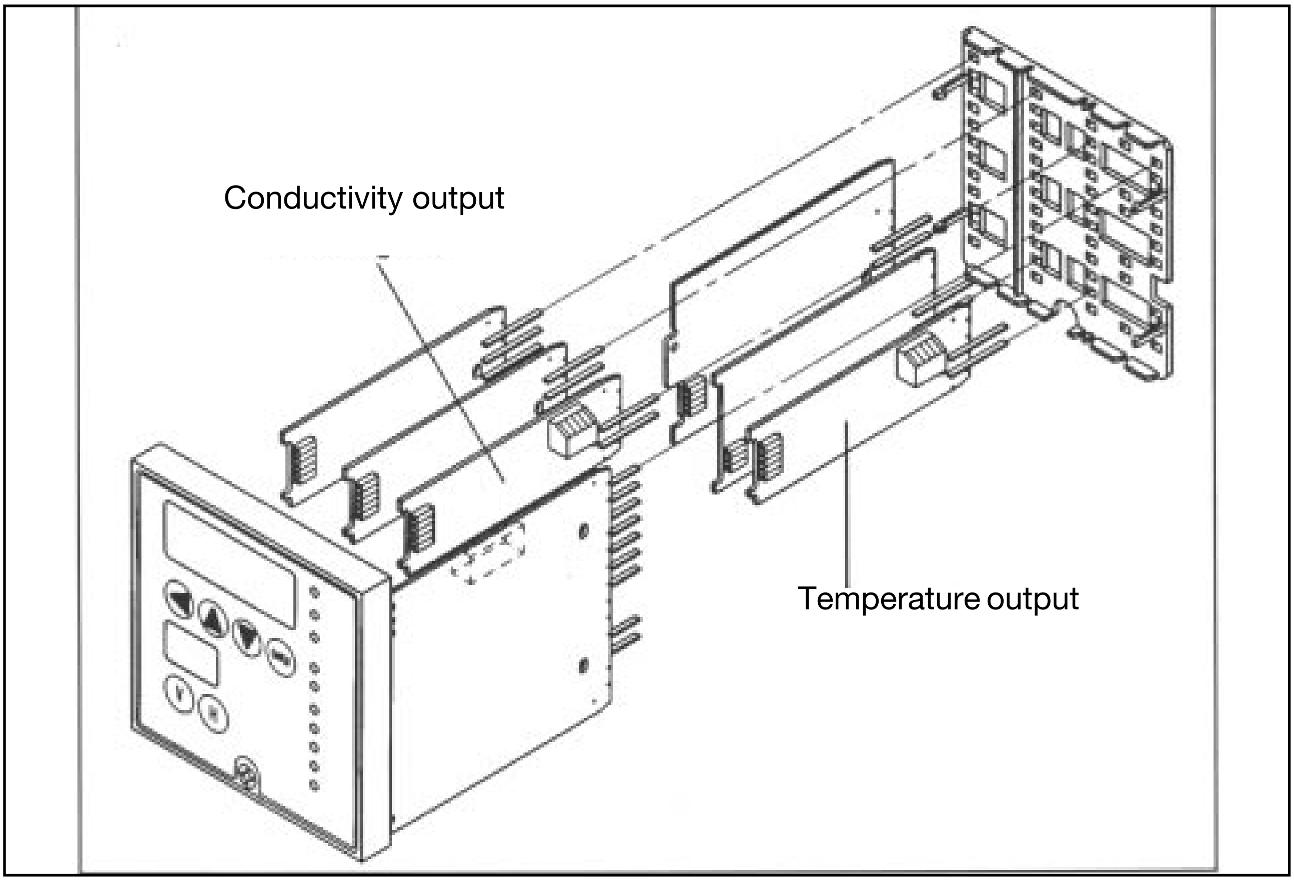
Note:

This warning appears only with ATC and during the first calibration step for experimental determination of the temperature coefficient.

10 ADJUSTMENTS INSIDE THE INSTRUMENT

Warning:

When working on the microprocessor transmitter/controller observe the VDE and ESD requirements!



10.1 Analogue output

The output signal is selected through DIL switches. The changeover from 0 - 20 mA to 4 - 20 mA is made in software using matrix field V1H5 (see Section 7.1).

The instrument is supplied fully calibrated. If a different output signal is selected on the switches S1101.1 to S1101.4 it may be necessary to make a slight adjustment to the output signal using the "start" and "end" trimmers.

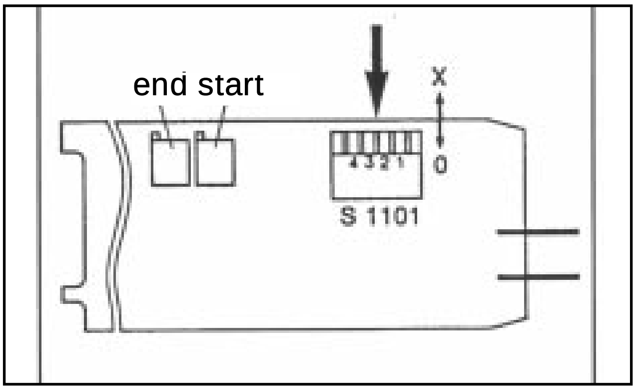
Note:

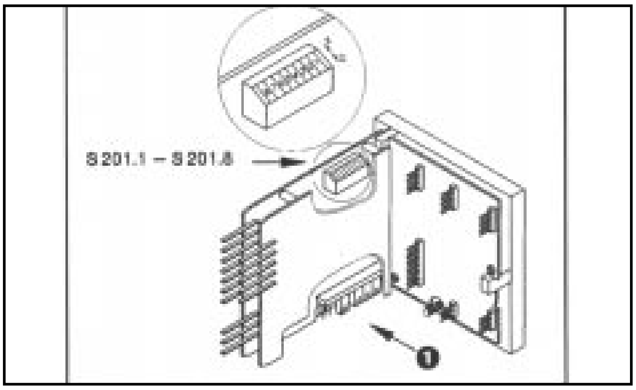
When the instrument is provided for temperature output, the switches on the temperature card must be altered similarly!

Analogue output

Signal	Switches			
	S1101.1	S1101.2	S1101.3	S1101.4
0 - 10 V	O	X	X	X
0(4)-20 mA	O	O	O	X

O = off X = on





(1) Jumper for code setting on the conductivity input card

10.2 Manual operation

Important:

Switch S201.7 is provided for servicing only and is factory-set to position 0.

The setting of switch S201.7 must not be altered!

Switch S201.1

inhibited 0
de-inhibited X

For description see Section 4.3

10.3 Input filter

Switch S201.4

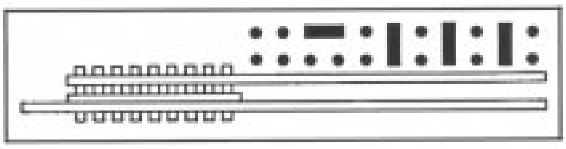
on 0
off X

For description see Section 11.3

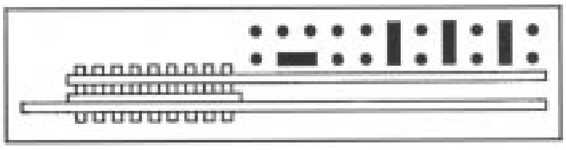
10.4 Code setting on the conductivity input card

The location of the conductivity input card is shown in Section 10.1 Analogue output.

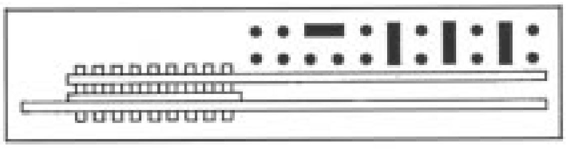
Range:	**Cell constant**
up to 0.50 µS/cm	C = 0.01 1/cm
up to 1.00 µS/cm	C = 0.01 1/cm
up to 2.00 µS/cm	C = 0.01 1/cm
up to 3.00 µS/cm	C = 0.01 1/cm



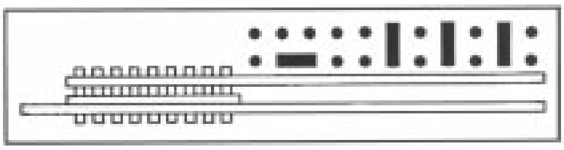
up to 5.00 µS/cm	C = 0.01 1/cm
up to 10.0 µS/cm	C = 0.01 1/cm



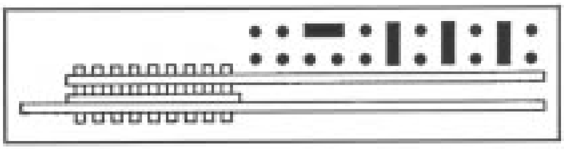
up to 5.00 µS/cm	C = 0.1 1/cm
up to 10.0 µS/cm	C = 0.1 1/cm
up to 20.0 µS/cm	C = 0.1 1/cm



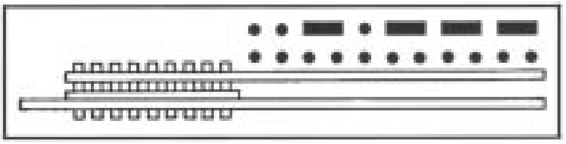
up to 50.0 µS/cm	C = 0.1 1/cm



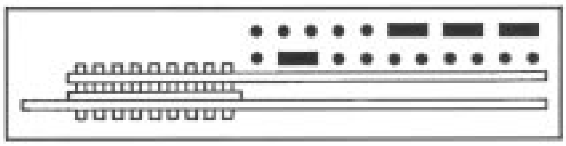
up to 50.0 µS/cm	C = 1.0 1/cm
up to 100 µS/cm	C = 1.0 1/cm



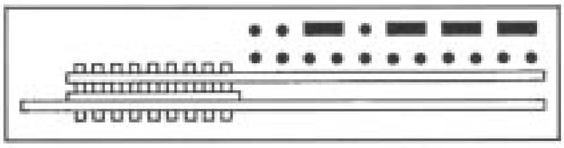
Range:	**Cell constant**
up to 100 µS/cm	C = 0.1 1/cm



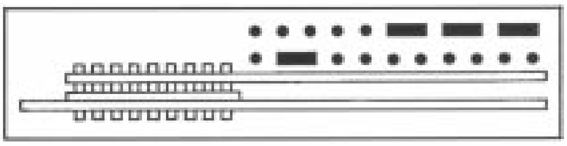
up to 300 µS/cm	C = 0.1 1/cm



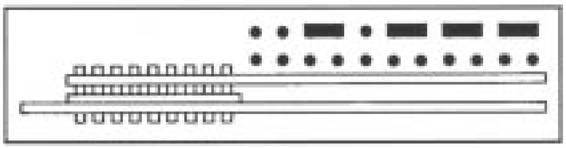
up to 300 µS/cm	C = 1.0 1/cm



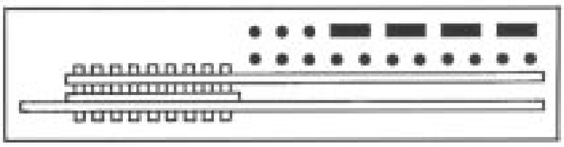
up to 500 µS/cm	C = 0.1 1/cm



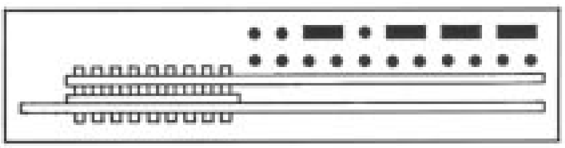
up to 500 µS/cm	C = 1.0 1/cm



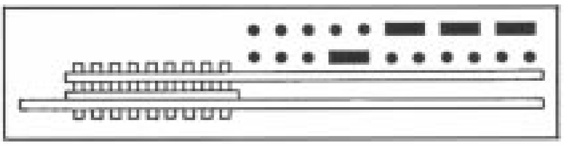
up to 1000 µS/cm	C = 0.1 1/cm



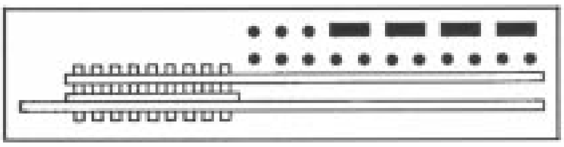
up to 1000 µS/cm	C = 1.0 1/cm
up to 1000 µS/cm	C = 3.0 1/cm



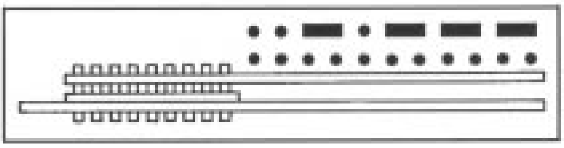
Range:	**Cell constant**
up to 2000 µS/cm	C = 1.0 1/cm



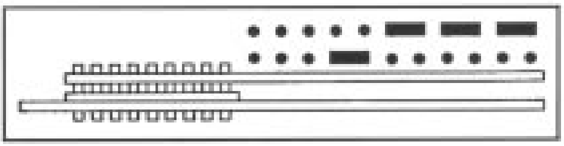
up to 1.00 mS/cm	C = 0.1 1/cm



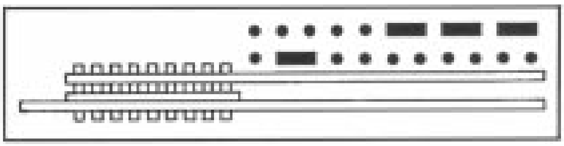
up to 1.00 mS/cm	C = 1.0 1/cm
up to 1.00 mS/cm	C = 3.0 1/cm



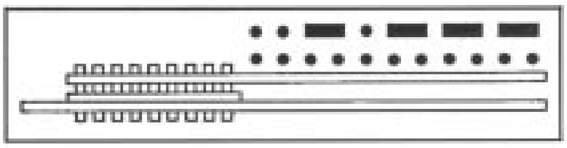
up to 2.00 mS/cm	C = 1.0 1/cm



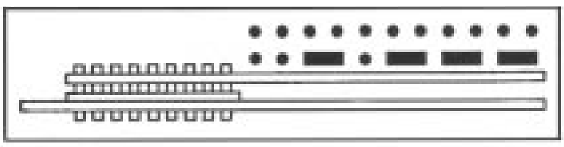
up to 3.00 mS/cm	C = 1.0 1/cm



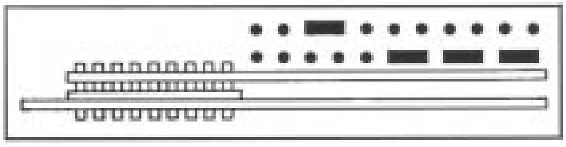
up to 3.00 mS/cm	C = 3.0 1/cm



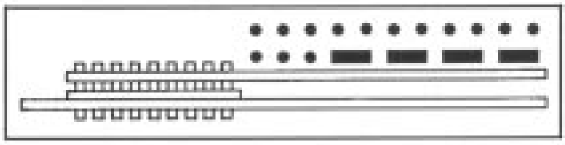
up to 5.00 mS/cm	C = 0.1 1/cm



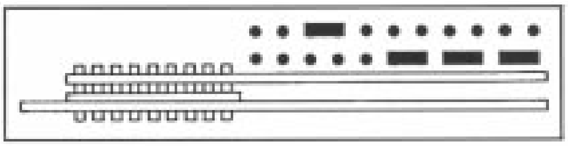
Range:	Cell constant
up to 5.00 mS/cm	C = 1.0 1/cm
up to 10.0 mS/cm	C = 1.0 1/cm
up to 10.0 mS/cm	C = 3.0 1/cm



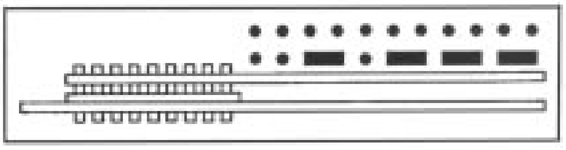
up to 20.0 mS/cm	C = 1.0 1/cm



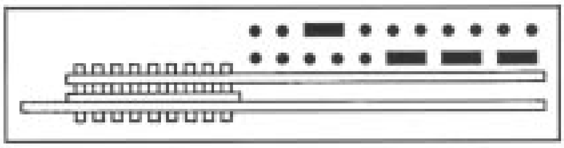
up to 20.0 mS/cm	C = 3.0 1/cm



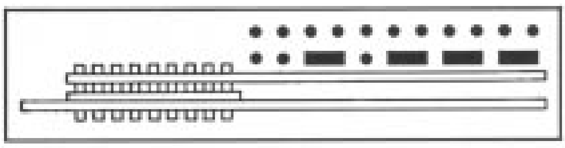
up to 30.0 mS/cm	C = 1.0 1/cm



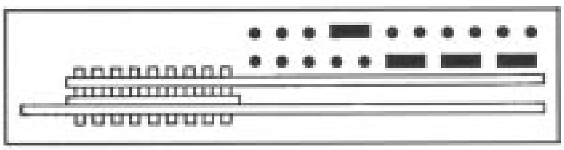
up to 30.0 mS/cm	C = 3.0 1/cm
up to 30.0 mS/cm	C = 10.0 1/cm



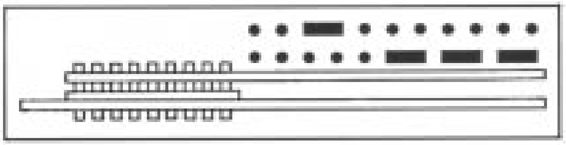
up to 50.0 mS/cm	C = 1.0 1/cm



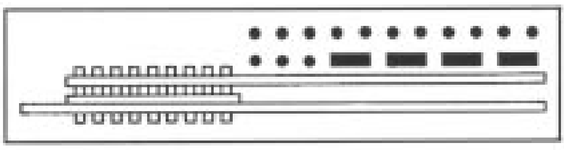
up to 100.0 mS/cm	C = 1.0 1/cm



Range:	Cell constant
up to 100.0 mS/cm	C = 10.0 1/cm



up to 200.0 mS/cm	C = 10.0 1/cm



11.1 Function of the logic inputs

The instrument can be brought to the HOLD status by a link (short-circuit) at logic input 1 (terminals 81, 82).
The alarm via the alarm relay can be suppressed by a link across logic input 2 (terminals 83, 84). The alarm LED continues to operate normally.

11.2 HOLD function

Activating the HOLD function makes the relays inactive. Any started time periods on the controller (e.g. derivative time) and of the alarm (alarm delay) are reset.

11.2.1 Internal HOLD

The HOLD function is activated internally by switching the indication in matrix field V9H1 from 0 to 1 using the key ▲ or ▼, followed by pressing the ENTER key.
In addition the HOLD function is automatically activated internally when fundamental alterations to the instrument settings are made. Examples: changeover to calibration, changing the controller type. After completing the alteration and leaving the corresponding matrix field the automatic HOLD is de-activated.

11.2.2 External HOLD

The HOLD function is activated externally by a link across the connections of the logic input 1. In this way the HOLD function can be operated from a PLC, for example.

11.3 Input filter

The input variables conductivity and temperature are passed through a second-order digital filter which suppressed undesirable effects such as noise or interference pulses. The filter constant is factory-set at 0.6 seconds. This value can be altered in matrix field V9H3.

Exception: the function of the digital filter has been switched off with the switch S201.4. In this case the setting in matrix field V9H3 is ineffective.

11.4 Reading-in the factory setting

The instrument offers the facility of reading in the parameter set of the factory setting. After reading in, all parameters are occupied by the data which are stored when the instrument is supplied.

Exception: the measuring range, the unit (µS/cm or mS/cm), the cell constant and the temperature coefficient remain unchanged when reading in the factory setting. For adjusting these parameters see Section 6, Calibration.
Reading in the parameters takes place by switching the indication in matrix field V9H2 from "no" to "YES" using the key ▲ or ▼, followed by pressing the ENTER key.

When altering the measuring range the values in the following matrix fields are altered:
V6H1 Alarm tolerance
V4H1 Setpoint 1
V5H1 Setpoint 2
V4H2 Proportional band X_{P1}
V5H7 Proportional band X_{P2}
V4H7 Differential 1
V5H7 Differential 2

Example 1:

range 0 - 1 mS/cm	Cell constant C = 1.0 1/cm	
V6H1 Alarm tolerance	0.00 mS/cm	(= 0% of range)
V4H1 Setpoint 1	0.00 mS/cm	(= 0% of range)
V5H1 Setpoint 2	1.00 mS/cm	(= 100% of range)
V4H2 Proportional band X_{P1}	0.50 mS/cm	(= 50% of range)
V5H7 Proportional band X_{P2}	0.50 mS/cm	(= 50% of range)
V4H7 Differential 1	0.02 mS/cm	(= 2% of range)
V5H7 Differential 2	0.02 mS/cm	(= 2% of range)

Example 2:

range 0 - 500 µS/cm	Cell constant C = 0.1 1/cm	
V6H1 Alarm tolerance	0 µS/cm	(= 0% of range)
V4H1 Setpoint 1	0 µS/cm	(= 0% of range)
V5H1 Setpoint 2	500 µS/cm	(= 100% of range)
V4H2 Proportional band X_{P1}	250 µS/cm	(= 50% of range)
V5H7 Proportional band X_{P2}	250 µS/cm	(= 50% of range)
V4H7 Differential 1	10 µS/cm	(= 2% of range)
V5H7 Differential 2	10 µS/cm	(= 2% of range)

11.5 Probe break monitor

When the probe break monitor is activated in matrix field V7H9, a conductivity less than 2% of range is recognised as probe break. This is indicated by the instrument as fault F022.

12.1 Table for parameter and configuration settings

As guidance for later changes of the instrument settings it is possible to enter here the appropriate parameter and configuration data. Certain parameters are omitted depending on the particular transmitter and controller version.

Transmitter		Factory setting conductivity	User setting
V2H1	auto .... 0 manual 1	0	
V3H9	manual operation pulse operation .... 0 switch operation 1	0	
V9H1	HOLD off .... 0 HOLD on 1	0	
V9H3	Input filter constant .... 0 - 20 sec	0.6 sec*	
V0H4	Supply frequency 50 Hz .... 0 Supply frequency 60 Hz 1	0	
V0H8	Measuring range 0.5; 1.00; 2.00; 3.00; 5.00; 10.0; 20.0; 30.0, 50.0; 100; 200; 300; 500; 1000; 2000	1.00*	
V1H8	Unit µS/cm .... 0 mS/cm 1	1*	
V2H8	Cell constant 0.01; 0.1; 1.0; 3.0; 10.0	1.0	
V2H9	nput / indicate cell constant 50.0 to 150.0%	100%	
V7H9	Probe break monitor off .... 0 on 1	0	

* see Section 11.4

Calibration		Factory setting conductivity	User setting
V3H1	MTC temperature ....-50 to +250°C	25.0°C	
V3H2	MTC manual temp compensation .... 0 ATC automatic temp. comp. 1	0	
V3H8	Temperature coefficient input 0 - 5.5%/°C	2.30	

Alarm		Factory setting conductivity	User setting
V6H1	Alarm tolerance 0 to ranges in µS/cm or mS/cm	0*	
V7H1	Alarm delay .... 0-6000 sec	20 sec	
V6H9	Steady contact .... 0 Pulse contact 1	0	

* see Section 11.4

Process output		Factory setting conductivity	User setting
V1H3	Start conductivity output (conductivity at 0/4 mA or 0 V) .... 0 - 100%	0%	
V1H4	End conductivity output (conductivity at 20 mA or 10 V) .... 0 - 100%	100%	
V1H5	Process value output 0-20 mA/0-10 V .... 0 Process value output 4-20 mA 4	0	
V1H6	Simulation output 0-100%	50.0%	
V1H7	Simulation off .... 0 Simulation on 1	0	
V1H9	Process output linear .... 0 dual-slope 1	0	
V2H3	Start temperature output -50 to +250°C	-50°C	
V2H4	End temperature output -50 to +250°C	250°C	

Interface		Factory setting conductivity	User setting
V8H0	Interface (under development)	0	
V8H1	Instrument address (under development)	0	

Controller		Factory setting conductivity	User setting
V4H1	Setpoint 1 0 to end of range in mS/cm or mS/cm	0*	
V5H1	Setpoint 2 0 to end of range in µS/cm or mS/cm	1.00 mS/cm*	
V4H2	Proportional band X_{P1} .... 0 digit .... 999 or 9999 digit	0.5 mS/cm	
V5H2	Proportional band X_{P2} .... 0 digit .... 999 or 9999 digit	0.5 mS/cm	
V6H2	Pull-in delay relay contact 1 .... 0-999.9 sec	1.0 sec	
V7H2	Pull-in delay relay contact 2 .... 0-999.9 sec	1.0 sec	
V4H3	Derivative time 1 Tv1 .... 0-9999 sec	80 sec	
V5H3	Derivative time 2Tv2 .... 0-9999 sec	80 sec	
V6H3	Drop-out delay relay contact 1 .... 0-999.9 sec	0.2 sec	
V7H3	Drop-out delay relay contact 2 .... 0-999.9 sec		
V4H4	Reset time 1 T_{n1} .... 0-9999 sec	350 sec	
V5H4	Reset time 2 T_{n2} .... 0-9999 sec	350 sec	
V6H4	Maximum pulse frequency 1 ....0-9000 /h	6000/h	
V7H4	Maximum pulse frequency 2 ....0-9000 /h	6000/h	
V4H5	Output limit Y_1 .... 0-100%	100%	
V5H5	Output limit Y_2 ....-100-100%	-100%	
V6H5	Pulse period 1 .... 1-999.9 sec	20.0 sec	
V7H5	Pulse period 2 .... 1-999.9 sec		
V4H6	Min. ON time 1 or pulse duration 1 .... 0.2-999.9 sec	0.2 sec	

Controller		Factory setting conductivity	User setting
V5H6	Min. ON time 2 or pulse duration 2 .... 0.2-999.9 sec	0.2 sec	
V6H6	Break contact 1 .... 0 Make contact 1 1	0	
V7H6	Break contact 2 .... 0 Make contact 2 1	0	
V4H7	Differential 1 .... within measuring range	0.02 mS*	
V5H7	Differential 2 .... within measuring range	0.02 mS*	
V6H7	Min. contact 1 .... 0 Max. contact 1 1	0	
V7H7	Min. contact 2 .... 0 Max. contact 2 1	1	
V4H8	Controller structure 1 P action .... 0 I action .... 1 PD action .... 2 PI action .... 3 PID action 4	0	
V5H8	Controller structure 2 P action .... 0 I action .... 1 PD action .... 2 PI action .... 3 PID action 4	0	
V6H8	Working point ....-100-+100%	0%	
V7H8	Strke time (modulating controller) .... 15-3000 sec	60 sec	
V4H9	Controller type 1 off .... 0 Limit controller .... 1 Pulse duration controller .... 2 Pulse frequency controller .... 3 Modulating controller 5	1	
V5H9	Controller type 2 off .... 0 Limit controller .... 1 Pulse duration controller .... 2 Pulse frequency controller 3	1	

CONFIGURATION LEVEL										
PARAMETER LEVEL										
OPERATING LEVEL										
INDICATING LEVEL										
	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0	Indicate measurement [µS/cm or mS/cm]		Calibration of cell constant with calibration solution see Section 6	Read in old cell constant data see Section 6	Supply frequency 0 = 50 Hz 1 = 60 Hz				Select range µS/cm or mS/cm see Section 1	
V1	Indicate temperature [°C]	Experimental evaluation of temperature coefficient see Section 6	Read in old temp. coefficient data see Section 6	Start meas. conductivity output [%] see Section 7	End meas. conductivity output [%] see Section 7	Output changeover 0 = 0-20 mA or 0-10 V 4 = 4-20 mA see Section 7	Simulation output [%] see Section 7	Simulation 0 = off 1 = on see Section 7	Changeover 0 = µS/cm 1 = mS/cm see Section 1	Measurement output 0 = linear 1 = dual-slope see Section 7
V2	Indicate cell constant	Changeover 0 = auto 1 = manual see Section 4		Start meas. temperature output [°C] see Section 7	End meas. temperature output [°C] see Section 7				Select cell constant see Section 1, 5	Input/ indicate cell constant [%] see Section 5
V3	Indicate temperature coefficient [%/°C]	Input MTC temperature see Section 4	Changeover 0 = MTC 1 = ATC see Section 4						Input temp. coefficient [%/°C] see Section 6	Changeover manual 0 = pulse op. 1 = switch op. see Section 4
V4	Indicate setpoint 1 [µS/cm or mS/cm]	Set setpoint 1 [µS/cm or mS/cm]	Proportional band Xp 1 [µS/cm or mS/cm]	Derivative time 1 Tv 1 [sec]	Reset time 1 Tn 1 [sec]	Output limit Y 1 [%]	Min. ON time 1 or Pulse duration 1 [sec]	Differential 1 [µS/cm or mS/cm]	Controller structure 1	Controller type 1
V5	Indicate setpoint 2 [µS/cm or mS/cm]	Set setpoint 2 [µS/cm or mS/cm]	Proportional band Xp 2 [µS/cm or mS/cm]	Derivative time 2 Tv 2 [sec]	Reset time 2 Tn2 [sec]	Output limit Y 2 [%]	Min. ON time 2 or Pulse duration 2 [sec]	Differential 2 [µS/cm or mS/cm]	Controller structure 2	Controller type 2
V6	Version (indication of software version)	Alarm tolerance [µS/cm or mS/cm]	Pull-in delay relay 1 [sec]	Drop-out delay relay 1 [sec]	Max. pulse frequency 1 [1/h]	Pulse period 1 [sec]	Changeover 0 = break cont. 1 1 = make cont. 1	Changeover 0 = min contact 1 1 = max contact 1	Working point [%]	Alarm changeover 0 = steady contact 1 = pulse contact
V7	Indicate fault codes see Section 9	Alarm delay [sec]	Pull-in delay relay 2 [sec]	Drop-out delay relay 2 [sec]	Max. pulse frequency 2 [1/h]	Pulse period 2 [sec]	Changeover 0 = break cont. 2 1 = make cont. 2	Changeover 0 = min contact 2 1 = max contact 2	Actuator stroke time [sec]	Probe break monitor 0 = off / 1 = on see Section 11
V8	Interface	Instrument addresses	under development							
V9	Inhibit/de-inhibit see Section 4	HOLD 0 = off 1 = on see Section 11	Factory settings (default) see Section 11	Input filter constant [sec] see Section 11						

(shaded cells) Observe notes in Section 8