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Operating Instructions

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CONTENTS

1 ABOUT THESE OPERATING INSTRUCTIONS

1.1 User notes

- Please read these Operating Instructions before you are starting up the indicator.
- Keep these Operating Instructions in a place which is accessible to all users.
- Please assist us to improve these Operating Instructions where necessary.
  We are always grateful for your suggestions.

  Technical Documentation GB II
  Fax Germany (0661) 60 03-500
  abroad (int.+ 49) 661 60 03-500

All necessary settings are described in these Operating Instructions.

If, however, any difficulties should arise during start-up, you are asked not to carry out any manipulations on the instrument which are not permitted. – You could endanger your rights under the instrument warranty. Please contact the nearest subsidiary or the head office.

1.2 Typographical conventions

Format

The following conventions apply to these Operating Instructions:
The page header contains the number and the name of the chapter. The page numbering is arranged in the centre at the bottom.

Warning signs

The signs for **Danger** and **Warning** are used in these Operating Instructions under the following conditions:

Danger This mark is used when there may be **danger to personnel** if the instructions are disregarded or not followed accurately.

Warning This mark is used when there may be **damage to equipment or data** if the instructions are disregarded or not followed accurately.

Note signs

Note This symbol is used if your **special attention** is drawn to a remark.

Reference This symbol refers to **additional information** in other handbooks, chapters or sections.

abcd[1]

Footnote Footnotes are notes which **refer to certain points in the text**. Footnotes consist of 2 parts: the text marking and the footnote text.

The text markings are arranged as continuous raised numbers.

The footnote text (in smaller typeface) is placed at the bottom of the page and starts with a number and a full stop.

*

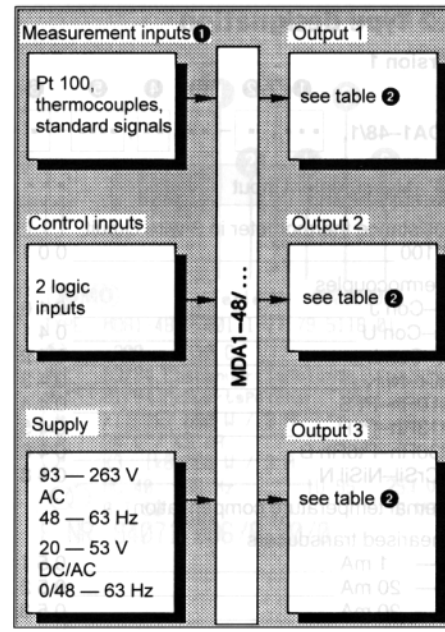
Action This sign refers to the description of an **action to be performed**.

The **individual steps** are indicated by this asterisk, e.g.

* Input limit setting

2.1 Brief description

The MDA1-48 indicator has a mounting depth of 129 mm and permits direct connection to thermocouples, Pt 100 resistance thermometers, and transducers with the usual standard signals. The 4-character LED display indicates the measured value. During programming the display is used for comments and to show the input values. Limit comparators are available for monitoring limit settings. Two logic inputs can be used to activate functions such as taring, measurement hold etc.



❶ Inputs

Three hardware versions are available:

- resistance thermometers, thermocouples
- current
- voltage

❷ Version	Output 1	Output 2	Output 3
Version 1	limit comparator (relay)	limit comparator (relay)	limit comparator (relay/logic)
Version 2	limit comparator (relay)	supply for 2-wire transmitter 24 V 45 mA	limit comparator (relay)
Version 3	actual value (analogue current or voltage output)	—	limit comparator (relay)

2.2 Type designation

Version 1

❶ ❷ ❸ ❹ ❺ ❻

MDA1–48/1, ▪▪▪, ▪ – ▪▪, ▪▪, ▪▪▪▪ – ▪

❶ Measurement input

Resistance thermometer in 3-wire circuit
Pt 100 _____ 0 0 1

Thermocouples
Fe–Con J _____ 0 4 0
Cu–Con U _____ 0 4 1
Fe–Con L _____ 0 4 2
NiCr–Ni K _____ 0 4 3
Pt10Rh–Pt S _____ 0 4 4
Pt13Rh–Pt R _____ 0 4 5
Pt30Rh–Pt6Rh B _____ 0 4 6
NiCrSil–NiSil N _____ 0 4 8

Internal temperature compensation

Linearised transducers
0 — 1 mA _____ 0 5 1
0 — 20 mA _____ 0 5 2
4 — 20 mA _____ 0 5 3

0 — 50 mV _____ 0 6 1
0 — 10 V _____ 0 6 3

Linearisation to customer specification,
10 points max. _____ 9 . .

For standard signals please specify range in full.
If °F is required, please state this in full also.

❷ Logic control input

Level inhibit,
measurement hold _____ 1

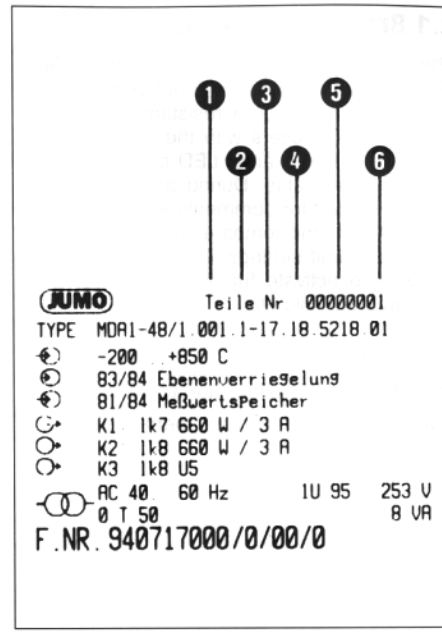
Level inhibit,
reset max/min hold _____ 2

Measurement hold,
reset max/min hold _____ 3

Auto tare,
reset auto tare _____ 4

❸ Relay output 1

Function:
No function _____ 0 0
Limit comparator lk7 _____ 1 7
Limit comparator lk8 _____ 1 8



❹ Relay output 2

Function:
No function _____ 0 0
Limit comparator lk7 _____ 1 7
Limit comparator lk8 _____ 1 8

❺ Output 3

Type:
Relay _____ 51 . .
Logic output 0 / 5 V _____ 52 . .
Logic output 0 / 10 V _____ 53 . .

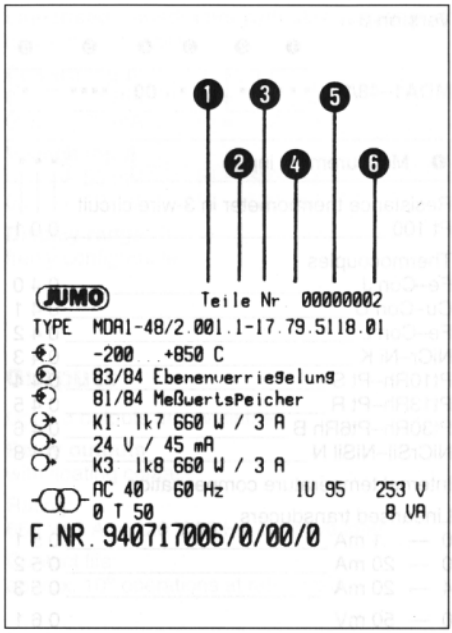
Function:
No function _____ 0000
Limit comparator lk7 _____ . . 17
Limit comparator lk8 _____ . . 18

❻ Supply

93 — 263 V AC 48 — 63 Hz _____ 0 1
20 — 53 V DC/AC 0/48 — 63 Hz _____ 1 7

Version 2

❶	❷	❸	❹	❺	❻
MDA1–48/2, ▪▪▪,	▪	– ▪▪,	79,	▪▪▪▪	– ▪



❶ Measurement input — ▪▪▪

Resistance thermometer in 3-wire circuit
Pt 100 — 001

Thermocouples
Fe–Con J — 040
Cu–Con U — 041
Fe–Con L — 042
NiCr–Ni K — 043
Pt10Rh–Pt S — 044
Pt13Rh–Pt R — 045
Pt30Rh–Pt6Rh B — 046
NiCrSil–NiSil N — 048

Internal temperature compensation

Linearised transducers
0 — 1 mA — 051
0 — 20 mA — 052
4 — 20 mA — 053

0 — 50 mV — 061
0 — 10 V — 063

Linearisation to customer specification,
10 points max. — 9 . .

For standard signals please specify range in full.
If °F is required, please state this in full also.

❷ Logic control input — ▪

Level inhibit,
measurement hold — 1

Level inhibit,
reset max/min hold — 2

Measurement hold,
reset max/min hold — 3

Auto tare,
reset auto tare — 4

❸ Relay output 1 — ▪▪

Function:
No function — 00
Limit comparator lk7 — 17
Limit comparator lk8 — 18

❹ Output 2 — ▪▪

Supply for 2-wire transmitter
24 V 45 mA, isolated — 79

❺ Relay output 3 — ▪▪▪▪

Function:
No function — 0000
Relay — 51 . .
Limit comparator lk7 — 5117
Limit comparator lk8 — 5118

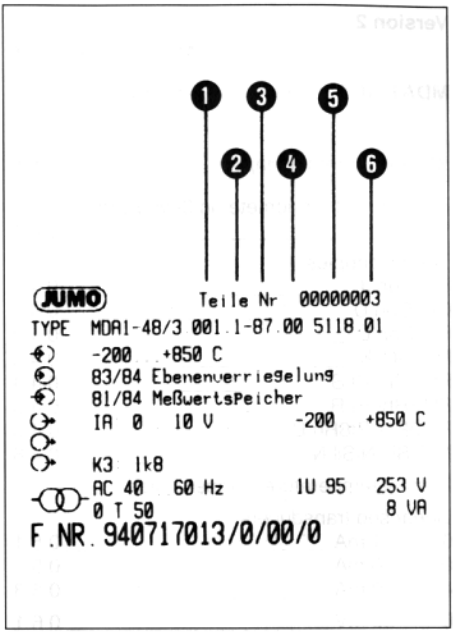
❻ Supply — ▪▪

93 — 263 V AC 48 — 63 Hz — 01
20 — 53 V DC/AC 0/48 — 63 Hz — 17

Version 3

❶ ❷ ❸ ❹ ❺ ❻

MDA1–48/3, [▪▪▪], [▪] – [▪▪], [00], [▪▪▪▪] – [▪]



❶ Measurement input — ▪▪▪

Resistance thermometer in 3-wire circuit
Pt 100 _____ 0 0 1

Thermocouples
Fe–Con J _____ 0 4 0
Cu–Con U _____ 0 4 1
Fe–Con L _____ 0 4 2
NiCr–Ni K _____ 0 4 3
Pt10Rh–Pt S _____ 0 4 4
Pt13Rh–Pt R _____ 0 4 5
Pt30Rh–Pt6Rh B _____ 0 4 6
NiCrSil–NiSil N _____ 0 4 8

Internal temperature compensation

Linearised transducers
0 — 1 mA _____ 0 5 1
0 — 20 mA _____ 0 5 2
4 — 20 mA _____ 0 5 3

0 — 50 mV _____ 0 6 1
0 — 10 V _____ 0 6 3

Linearisation to customer specification,
10 points max. _____ 9 . .

For standard signals please specify range in full.
If °F is required, please state this in full also.

❷ Logic control input — ▪

Level inhibit,
measurement hold _____ 1

Level inhibit,
reset max/min hold _____ 2

Measurement hold,
reset max/min hold _____ 3

Auto tare,
reset auto tare _____ 4

❸ Analogue output 1 — ▪▪

Function:
Measurement output _____ 8 .

Output signal:
Output inactive _____ 00
0 — 20 mA _____ .4
4 — 20 mA _____ .5
0 — 10 V _____ .7

❹ Output 2 — ▪▪

No function _____ 0 0

❺ Relay output 3 — ▪▪▪▪

Function:
No function _____ 0000
Relay _____ 51 . .
Limit comparator lk7 _____ 5117
Limit comparator lk8 _____ 5118

❻ Supply — ▪▪

93 — 263 V AC 48 — 63 Hz _____ 0 1
20 — 53 V DC/AC 0/48 — 63 Hz _____ 1 7

2.3 Technical data

Measurement inputs

Three hardware versions are available:

- resistance thermometer, thermocouples
- current
- voltage

Resistance thermometer

Input
Pt 100 in 3-wire circuit

Display ranges (°C or °F)
–199.9 + 850.0 °C
–200 + 850 °C
–199.9 + 999.9 °F
–328 +1562 °F

Lead compensation
not required with 3-wire circuit.
Lead compensation is required when using a resistance thermometer in 2-wire circuit.
Lead compensation can be performed either at the configuration level (OFFS)[1] or by using an external compensation resistor.

$R_{comp} = R_{lead}$

Thermocouples

Input
Cu–Con U, Fe–Con L, Fe–Con J, NiCrSil–NiSil N, NiCr–Ni K, Pt10Rh–Pt S, Pt13Rh–Pt R, Pt30Rh–Pt6Rh B to IEC, ISA or DIN

Display ranges (°C or °F)

Cu–Con U	Fe–Con L
–200 +600 °C	–200 +900 °C
NiCr–Ni K	Fe–Con J
–200 +1372 °C	–200 +1050 °C
Pt13Rh–Pt R	Pt10Rh–Pt S
0 +1768 °C	0 +1768 °C
NiCrSil–NiSil N	Pt30Rh–Pt6Rh B[2]
–100 +1300 °C	0 +1820 °C

Temperature compensation
internal

1. External link required between terminals 12 and 13
2. Display accuracy applies from 500 °C to 1820 °C

Linearised transducers with standard signal (current or voltage)

Current input
0 — 1 mA, Ri = 50 Ω
0(4) — 20 mA, Ri = 2.5 Ω

Voltage input
0 — 50 mV Ri = 500 kΩ
0(2) — 10 V Ri = 500 kΩ

Display range
freely configurable

Outputs

Up to 3 outputs are available:

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

Logic output

0/5 V	R_{load} = 450 Ω min.
0/10 V	R_{load} = 1 kΩ min.

Analogue output (isolated)

switched	burden
0 — 20 mA	500 Ω max.
4 — 20 mA	500 Ω max.
0 — 10 V	500 Ω min.

Supply for 2-wire transmitter
short-circuit proof, isolated 24 V 45 mA

General data

D/A converter
Resolution 13 bit

A/D converter
Resolution 13 bit

Sampling rate
90 msec

Display accuracy[1]	Ambient temperature error
when used with resistance thermometers	
0.05 % or better	0.01 % / 10 °C or less
when used with thermocouples within their working range	
0.25 % or better	0.05 % / 10 °C or less
when used with linearised transducers with standard signal	
0.05 % or better	0.05 % / 10 °C or less

Signal circuit monitoring
(sensor break or short-circuit)
The outputs take up a pre-configured state.

Isolation
inputs/logic outputs ΔU_{max} = 5 V
inputs/analogue outputs ΔU_{max} = 50 V

Data storage
EEPROM

Supply
93 — 263 V AC 48 — 63 Hz
or
20 — 53 V DC/AC 0/48 — 63 Hz

Power consumption
8 VA approx.

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

Permitted ambient temperature range
0 to 50 °C

Permitted storage temperature range
–20 to +70 °C

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

1. These figures are based on the particular span and include the linearisation tolerances.

Case
Aluminium section, black anodized, plug-in chassis

Protection
to DIN 40 050,
front IP54,
back IP20

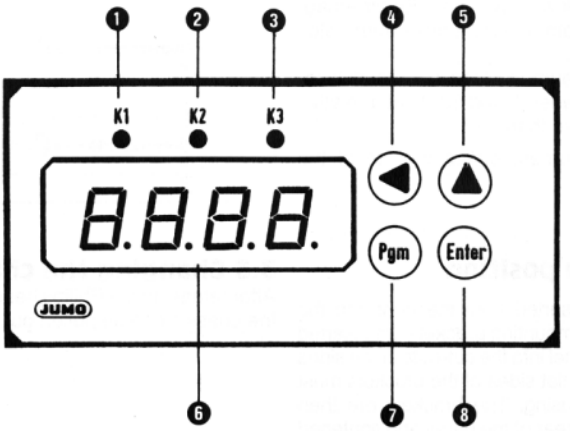
Operating position
unrestricted

Depth behind panel:
129 mm

EM immunity
to IEC 801 Parts 1 to 6

Standard accessories
Operating Instructions B 95.1505
2 mounting brackets

2.4 Indications and controls



❶ Indication for output 1

❷ Indication for output 2

❸ Indication for output 3

❹ Digit key to select digit to be altered

❺ Increment key to alter the selected digit

❻ 14 mm red 4-digit 7-segment display

❼ Programming key to select a value at the operating level or to select the next parameter

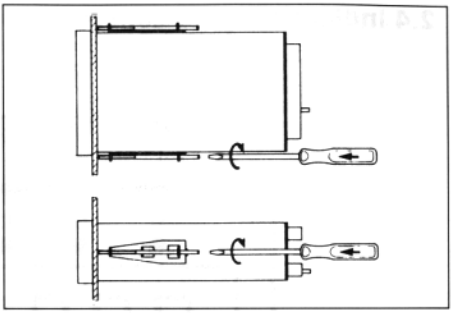
❽ Enter key to enter the selected value

3 INSTALLATION

3.1 Location and climatic conditions

The instrument location should as far as possible be free from shock and vibration. Electro-magnetic 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 of not more than 75 %.

Corrosive air or fumes reduce the life of the indicator.



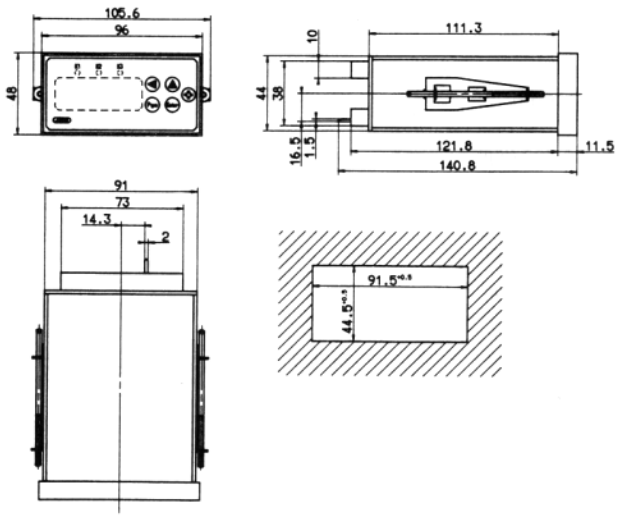
3.2 Fitting in position

The indicator is inserted from the front into the panel cut-out. The mounting brackets are inserted from behind the panel into the cut-outs at the sides of the housing; the flat sides of the brackets must be against the housing. The brackets are then placed against the rear of the panel and tightened up evenly using a screwdriver.

3.3 Changing the chassis

After releasing the Philips head screw at the front the chassis can be pulled out towards the front.

3.4 Dimensions



mm	inch
0.8	0.031
1.5	0.06
2	0.08
4.8	0.19
10	0.39
11.5	0.45
14.3	0.56
16.5	0.65
38	1.50
44	1.73
44.5 +0.5	1.75 +0.02
48	1.89
73	2.87
91	3.58
91.5 +0.5	3.60 +0.02
96	3.78
105.6	4.16
111.3	4.38
121.8	4.80
140.8	5.54

4 ELECTRICAL CONNECTION

4.1 Important notes on installation

☐ The electrical connection must only be made by a qualified electrician.

☐ Isolate the unit on line and neutral from the supply if there may be contact with live parts during work[1].

☐ A built-in fuse or a current limiting resistor interrupts the circuit in case of a short-circuit.

The external fuse of the supply should not be rated above 1 A (slow).

The load circuit has to be fused for the maximum relay current in order to prevent welding of the output relay contacts in case of an external short-circuit[2].

☐ There must be no magnetic or electrical fields in the neighbourhood of the instrument, caused e.g. through transformers, portable telephones or electrostatic discharges[2].

☐ Do not install inductive loads (relays, solenoid valves etc.) near the instrument and suppress any interference by fitting RC modules, arc suppressors or diodes.

☐ Input, output and supply lines should be run separately and not parallel to each other. Run the out and return lines next to each other and twist them together where possible.

☐ Sensor lines should be screened and twisted together. Do not run them close to live components or cables. Ground the screen only at one end at the instrument terminal PE.

☐ Ground the instrument at terminal PE to the protective ground conductor. This line should have the same cross-section as the supply lines. Run the ground lines in a star configuration to a common ground point connected to the ground 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 further loads to the supply terminals of the instrument.

☐ The instrument is not suitable for installation in hazardous areas.

☐ Any electrical connection different from the connection diagram may lead to permanent damage to the instrument.

☐ Several instruments should not be mounted directly above each other (ambient temperature)[2].

☐ In case of a supply subject to interference (e.g. thyristor controls) the instrument should be supplied through an isolating transformer.

☐ Fluctuations in the supply are permitted only within the indicated tolerances[2].

☐ If the instrument is not grounded through PE or if the connection to the PE potential is lost, a dangerous voltage may appear at the PE terminal through the internal Y capacitors.

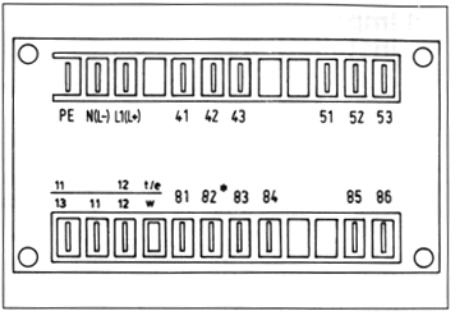
The connection to the PE terminal must not be interrupted when switching off.

1. On instruments with a chassis, the chassis is isolated from the supply when it is pulled out of the housing.
2. see under Technical data.

4.2 Connection diagram

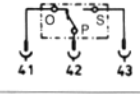
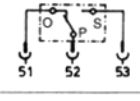
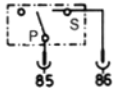
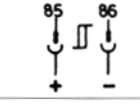
The electrical connection must be made according to the connection diagram alongside. The choice of cable and the installation of the supply line must meet the requirements of VDE 0100 "Regulations on the Installation of Power Circuits with nominal voltages below 1000 V" or the appropriate local regulations.

Illustration right:
Rear view with faston connections

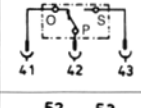
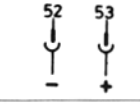
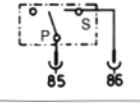


* Terminal 82 is reserved for service use.

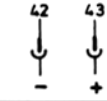
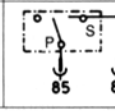
Version 1

Connection for		Terminals			Diagram
Output 1 limit comparator	K1	41 (O) n.c. (break) 42 (P) common 43 (S) n.o. (make)			
Output 2 limit comparator	K2	51 (0) n.c. (break) 52 (P) common 53 (S) n.o. (make)			
Output 3 limit comparator	K3	Relay option: 85 (P) common 86 (S) n.o. (make)		Logic option: 85+ 0 / 5 V or 86– 0 / 10 V	

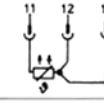
Version 2

Connection for		Terminals	Diagram
Output 1 limit comparator	K1	41 (O) n.c. (break) 42 (P) common 43 (S) n.o. (make)	
Output 2 supply		52– 24 V 45 mA 53+ supply for 2-wire transmitter	
Output 3 limit comparator	K3	85 (P) common 86 (S) n.o. (make)	

Version 3

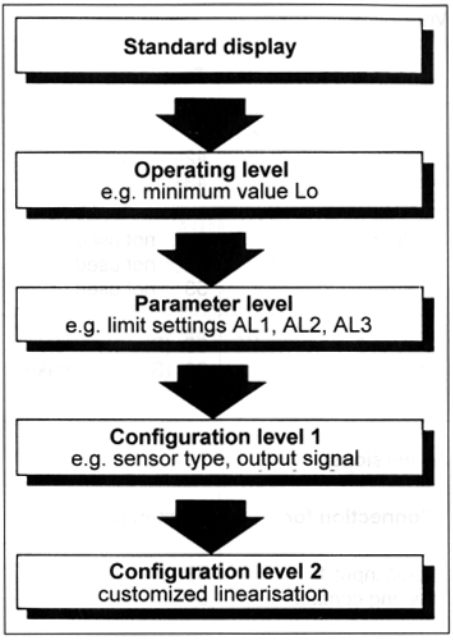
Connection for		Terminals	Diagram
Output 1 analogue output	K1	41 not used 42– 0/4 — 20 mA or 43+ 0/2 — 10 V	
Output 2		51 not used 52 not used 53 not used	—
Output 3 limit comparator	K3	85 (P) common 86 (S) n.o. (make)	

All versions:

Connection for	Terminals		Diagram
Logic input 1 floating contact	83 84	level inhibit or measurement hold or auto tare	
Logic input 2 floating contact	81 84	measurement hold or measurement hold reset or reset auto tare	
Supply as on label	L1 line N neutral AC PE ground	L+ DC L–	
Thermocouples	11+ 12–		
Standard signals current/voltage	11+ 12–		
Resistance thermometer in 3-wire circuit	11 12 13		
Resistance thermometer in 2-wire circuit	11 12 13	$R_{comp} = R_{lead}$ ($R_{compensation} = R_{lead}$)	

5.1 Levels and inhibits

In order to keep the large variety of possible operations in a user-friendly form the parameters are arranged on four distinct levels: operating level, parameter level, configuration level 1 and configuration level 2.



Standard display/operating level

The standard display normally shows the measured value; another standard display can however be selected at the configuration level (C113). To change from the standard display to the operating level press the Pgm key. Minimum value, maximum value, and measurement memory can be checked here in sequence.

Parameter level

The limit settings for the three limit comparators are determined at this level.

Configuration level 1

This level is used to adapt the inputs and outputs of the indicator and for setting the required functions.

Configuration level 2

The 10 pairs of values (linearisation points) and the number of values for the customized linearisation are input here.

Inhibits

The parameter and configuration levels can be inhibited through logic inputs to prevent unauthorised access.

⇨ see Section 9.1

5.2 Indicating the measurements

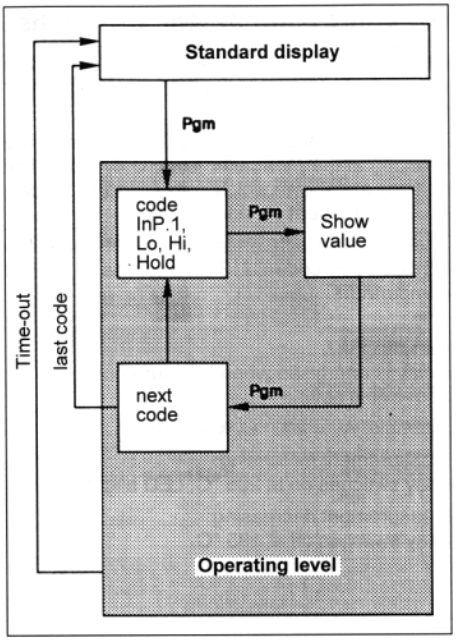
The standard display normally shows the current measurement.
Other parameters can be set under code C113 at configuration level 1.

see Section 7.3

Pressing the Pgm key switches over to the operating level. A code is displayed (e.g. "Hold", see table below) and, after pressing the key again, the corresponding value. After the last measurement the instrument returns to the standard display.

All 4 symbols are always shown in sequence. If the particular function has been configured the symbol is followed by a value, otherwise the display shows four dashes.

When no key has been operated for 23 sec the instrument returns to the standard display.



Measurement	Symbol
instantaneous measurement (input)	InP.1
minimum value (low)	Lo[1]
maximum value (high)	Hi[1]
memory (hold)	Hold[1]

1. These functions are activated through the logic inputs (external contacts), see Section 9.1.

6.1 Limit comparator functions

Depending on the instrument version there are up to 3 limit comparators with the functions lk7 or lk8.

The limit settings AL1 — AL3 (alarm limit) are selected at the parameter level. Only those limit settings are shown which correspond to the particular instrument version.

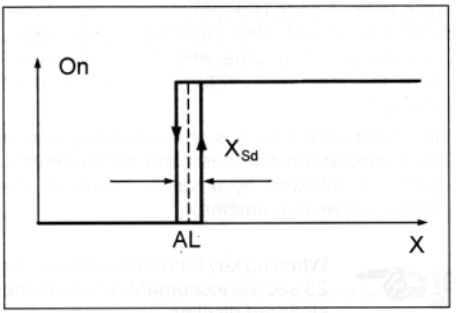
The switching differential X_{Sd} is set under the configuration code C113 and applies to all limit comparators.

Function lk7
Relay is energised when measurement is above limit setting AL.

Example: AL = 200 °C, X_{Sd} = 10

Measurement increasing:
relay switches on at 205 °C, LED alight.

Measurement decreasing:
relay switches off at 195 °C.

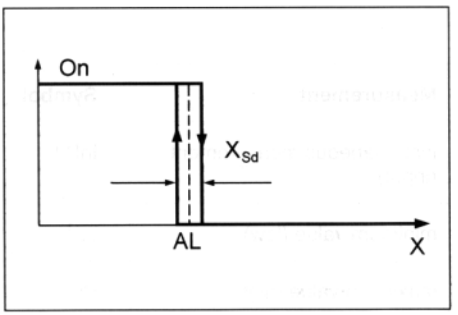


Function lk8
Relay is energised when measurement is below limit setting AL.

Example: AL = 200 °C, X_{Sd} = 10

Measurement increasing:
relay switches off at 205 °C.

Measurement decreasing:
relay switches on at 195 °C, LED alight.



When the input goes above or below the limit setting the appropriate output is activated, the corresponding LED is alight.

Explanation:

■ Function lk7 or lk8 can be programmed
– can not be programmed

Version			Output, output signal	Limit symbol
1	2	3		
■	■	–	K1, relay	AL1
■	–	–	K2, relay	AL2
■	■	■	K3, relay or 0/5 V or 0/10 V	AL3

6.2 Indicating and changing limit settings

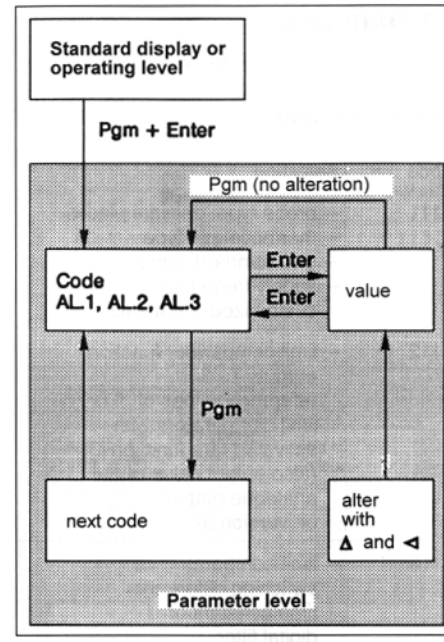
The limit settings can be selected starting from the standard display or the operating level.

Display limit settings:

- ✱ Press Pgm + Enter keys simultaneously
- ✱ Select the required code with Pgm
- ✱ Press Enter key, the corresponding value is shown
- ✱ Press Pgm key, the code is shown again

Altering limit settings:

- ✱ Press Pgm + Enter keys simultaneously
- ✱ Select the required code with Pgm, the display shows a limit symbol AL1/2/3
- ✱ Press Enter key
- ✱ Press ◁ to select the digit to be altered; this digit is then flashing
- ✱ Alter the selected digit by pressing the Δ key
- ✱ Repeat for the other digits
- ✱ Enter the new value by pressing the Enter key
- ✱ Select the next code with Pgm and alter it if necessary.



7.1 Summary

Configuration is divided into two levels:

Configuration level 1

Code	Selection
C111	– probe type, decimal places – thermocouple type – unit/standard signal – supply frequency/ customized linearisation
C112	– limit comparator function outputs 1 - 3 – reference values of limit comparators with activated tare function (also output value of analogue output on version 3)
C113	– limit comparator switching differential – time constant of digital filter – function of logic inputs 1 and 2 – standard display
SC.L	– scaling start (scale low) or analogue output scaling
SC.H	– scaling end (scale high) or analogue output scaling

Configuration level 2

Code	Selection
An	– number of value pairs (calibration points) to be input for customized linearisation
In0 — In9	– measurements before correction
Out0 — Out9	– measurements after correction (required measurement)

7.2 Show and alter configuration data

To alter configuration data, select "Inp.1" at the operating level and then press the Pgm and Enter keys simultaneously twice.

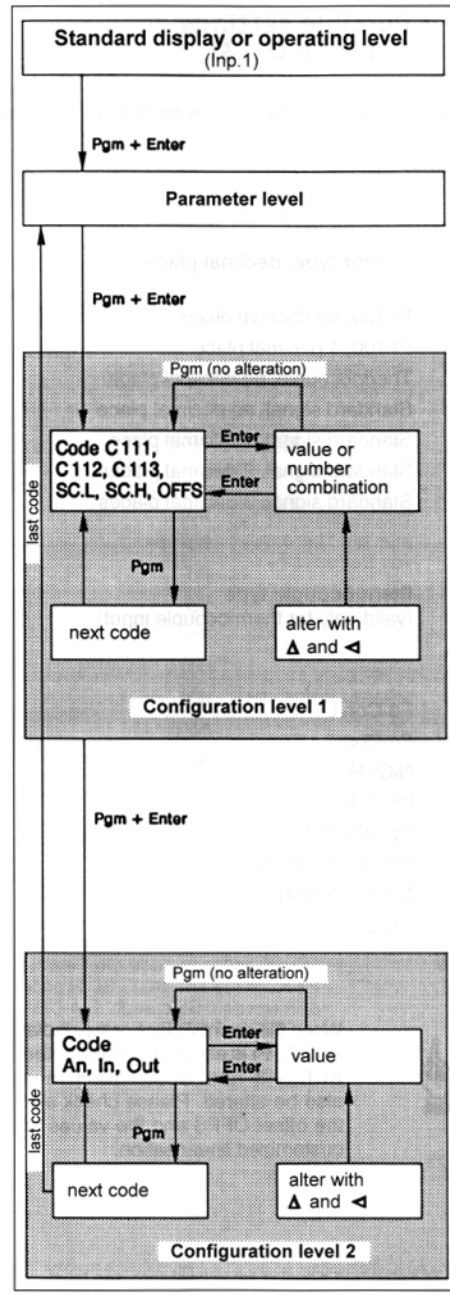
The display shows the first code C111 of configuration level 1; its number combination can be altered.

Show configuration data:

- Press Pgm + Enter simultaneously twice; the display shows the configuration code C111
- Select the required code with Pgm
- Press Enter key
  the display shows the corresponding number combination
- Press Pgm key, the display shows again the code, e.g. C112
- Repeat for the other codes

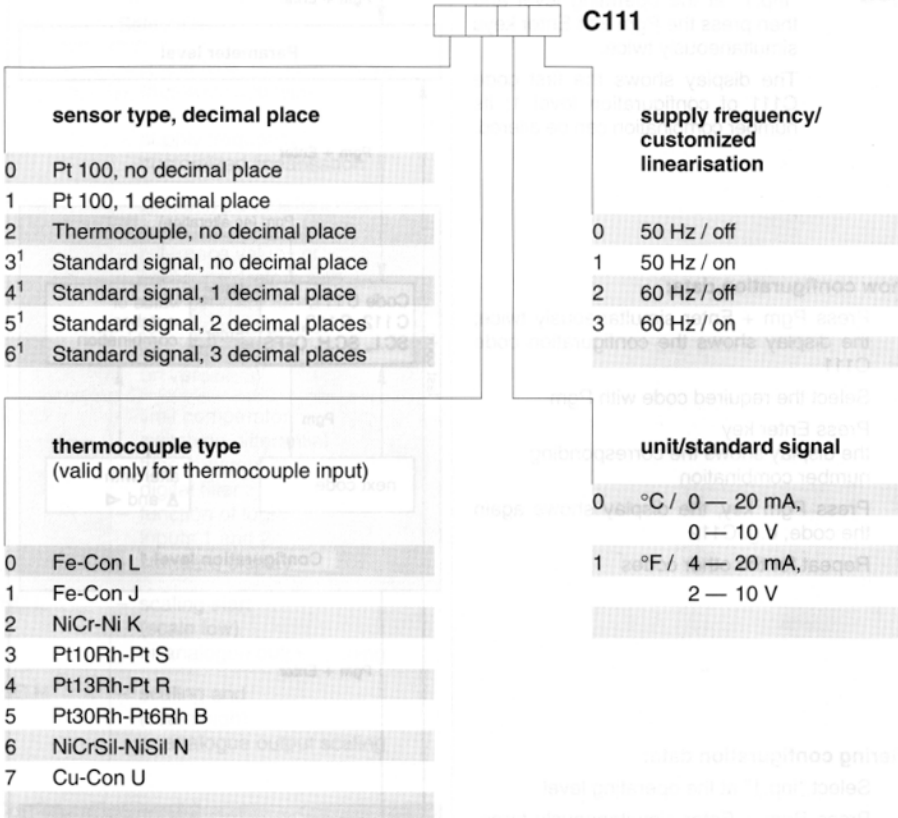
Altering configuration data:

- Select "Inp.1" at the operating level
- Press Pgm + Enter simultaneously twice; the display shows the configuration code C111
- Using Pgm select the code to be altered
- Press Enter key, the last digit is flashing
- Using key ◀ select the digit to be altered; this digit is flashing
- Using key Δ alter the selected digit
- Repeat for the other digits
- Enter the new value with the Enter key
- Select the next code with Pgm and alter if necessary



7.3 Possible settings (C111 to C113)

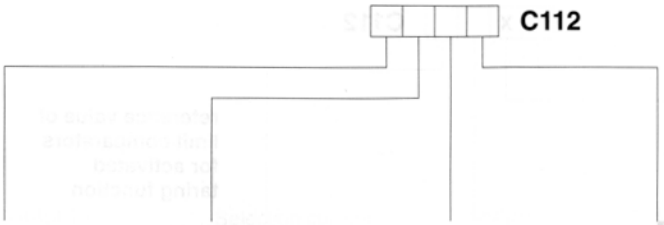
Configuration code C111, identical on all versions



When the decimal place or the display unit (C, F) is altered the parameters AL1 — 3 and SC.L, SC.H must also be altered. Please check also the offset OFFS and the values for customized linearisation.

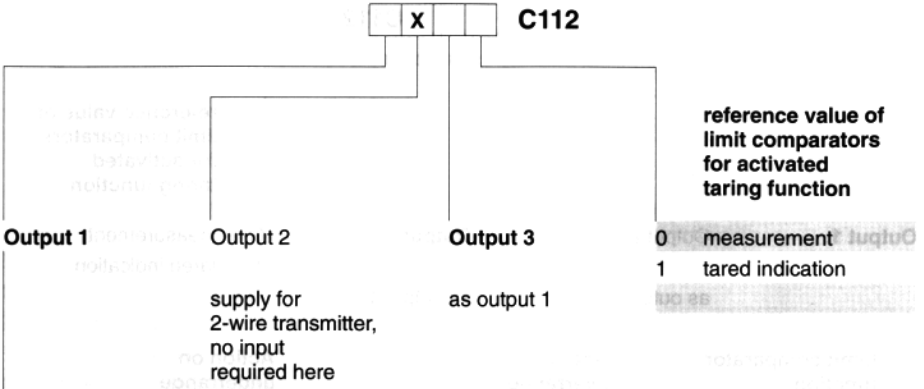
1. The standard signal is set in hardware, see label.

Configuration code C112, version 1



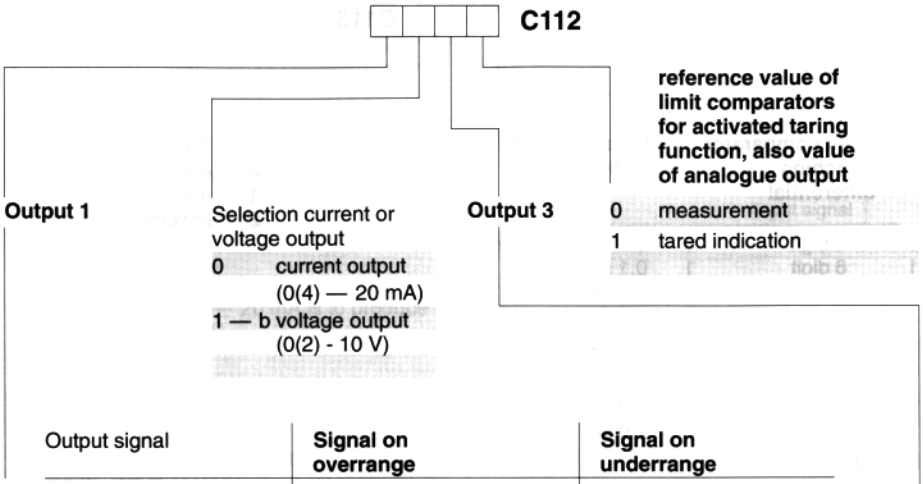
	Limit comparator function	Action on overrange	Action on underrange
0	inactive	off	off
1	lk7	off	off
2	lk8	off	off
3	inactive	on	off
4	lk7	on	off
5	lk8	on	off
6	inactive	off	on
7	lk7	off	on
8	lk8	off	on
9	inactive	on	on
A	lk7	on	on
b	lk8	on	on

Configuration code C112, version 2



	Limit comparator function	Action on overrange	Action on underrange
0	inactive	off	off
1	lk7	off	off
2	lk8	off	off
3	inactive	on	off
4	lk7	on	off
5	lk8	on	off
6	inactive	off	on
7	lk7	off	on
8	lk8	off	on
9	inactive	on	on
A	lk7	on	on
b	lk8	on	on

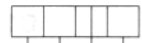
Configuration code C112, version 3



	Output signal	Signal on overrange	Signal on underrange
0	0	0 %	0 %
1	0 — 20 mA, 0 — 10 V	0 %	0 %
2	4 — 20 mA, 2 — 10 V	0 %	0 %
3	0	100 %	0 %
4	0 — 20 mA, 0 — 10 V	100 %	0 %
5	4 — 20 mA, 2 — 10 V	100 %	0 %
6	0	0 %	100 %
7	0 — 20 mA, 0 — 10 V	0 %	100 %
8	4 — 20 mA, 2 — 10 V	0 %	100 %
9	0	100 %	100 %
A	0 — 20 mA, 0 — 10 V	100 %	100 %
b	4 — 20 mA, 2 — 10 V	100 %	100 %

Limit comparator function	Action on overrange	Action on underrange	
inactive	off	off	0
lk7	off	off	1
lk8	off	off	2
inactive	on	off	3
lk7	on	off	4
lk8	on	off	5
inactive	off	on	6
lk7	off	on	7
lk8	off	on	8
inactive	on	on	9
lk7	on	on	A
lk8	on	on	b

Configuration code C113, identical on all versions



C113

	Limit comparator switching differential
0	4 digit
1	6 digit
2	8 digit
3	10 digit
4	20 digit
5	40 digit
6	60 digit
7	200 digit
8	400 digit

	Time constant of digital filter
0	0 sec = filter off
1	0.1 sec
2	0.2 sec
3	0.3 sec
4	0.5 sec
5	1.0 sec
6	1.5 sec
7	2.0 sec

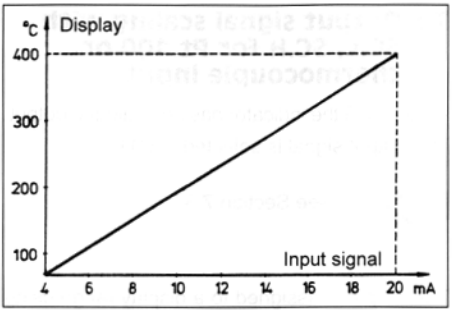
	Standard display
0	current measurement
1	minimum value
2	maximum value

	Function of logic input 1	logic input 2
0	level inhibit	measurement hold
1	level inhibit	reset of max/min hold
2	measurement hold	reset of max/min hold
3	auto tare	auto tare reset

7.4 Setting the display range for standard signal input

Using SC.L and SC.M the input signal is assigned to a display.

SC.L (scale low)	display at 0% input
SC.H (scale high)	display at 100% input



Example: The input 4 — 20 mA is to produce a display of 80 — 400 °C.

Settings:

* SC.L = 80 (= 4 mA)
* SC.H = 400 (= 20 mA)

If there is an analogue output (instrument version 3), this is scaled in the same way as the display range.

In the example above with a 0 — 10 V output the assignment is as follows:

80 °C = 0 V at the output
400 °C = 10 V at the output

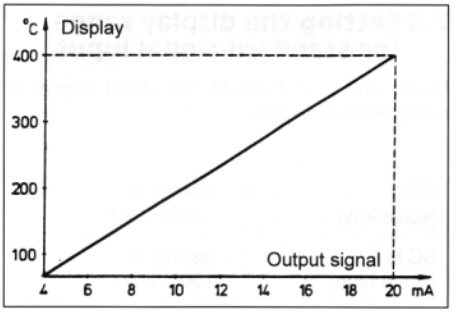
If customized linearisation or measurement correction is required,

see Section 9.3.

7.5 Output signal scaling with SC.L, SC.H for Pt 100 or thermocouple input

In version 3 the indicator has an analogue output.
The output signal is selected in C112.

see Section 7.3.



The output is assigned to a display range using SC.L, SC.H

SC.L (scale low)	at this display the output is 0 %
SC.H (scale high)	at this display the output is 100 %

Example: The display range 80 — 400 °C is to correspond to an analogue output of 4 — 20 mA.

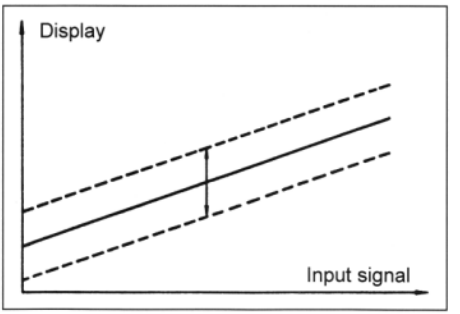
- in C112 select output signal 4 — 20 mA
- Input SC.L = 80 (≡ 4 mA)
- Input SC.H = 400 (≡ 20 mA)

7.6 Display correction

Using the parameter OFFS the display can be adjusted to any required value.
For example, to obtain the same reading on several indicators arranged next to each other on a panel. The offset is added to or subtracted from the actual measurement. The offset can be positive or negative.

Examples:

Display before	Offset	Display after
294.7	+0.3	295.0
195.5	–0.5	195.0



8.1 Customized linearisation

Customized linearisation can be used to match the indicator to a non-linear transducer. It operates with at least 2 and up to 10 pairs of values (calibration points).

Symbol	Explanation
An	number of value pairs to be input (2 to 10)
In0 — In9	values before correction
Out0 — Out9	display required after correction

The values for In have to be input in an increasing sequence, i.e.
value of In0 < value of In1 < value of In2 etc.

The Out values can describe any function. The indicator performs a linear interpolation between the calibration points. Values above or below the defined correction range are extrapolated using the first and last value pairs. The analogue output (on version 3) corresponds to the corrected display and not to the actual input signal.

see Section 9.3.

In the case of a standard signal input the indication range must be pre-selected using SC.L and SC.H, otherwise the indicator may operate with greatly reduced accuracy.

Example of a customized linearisation:

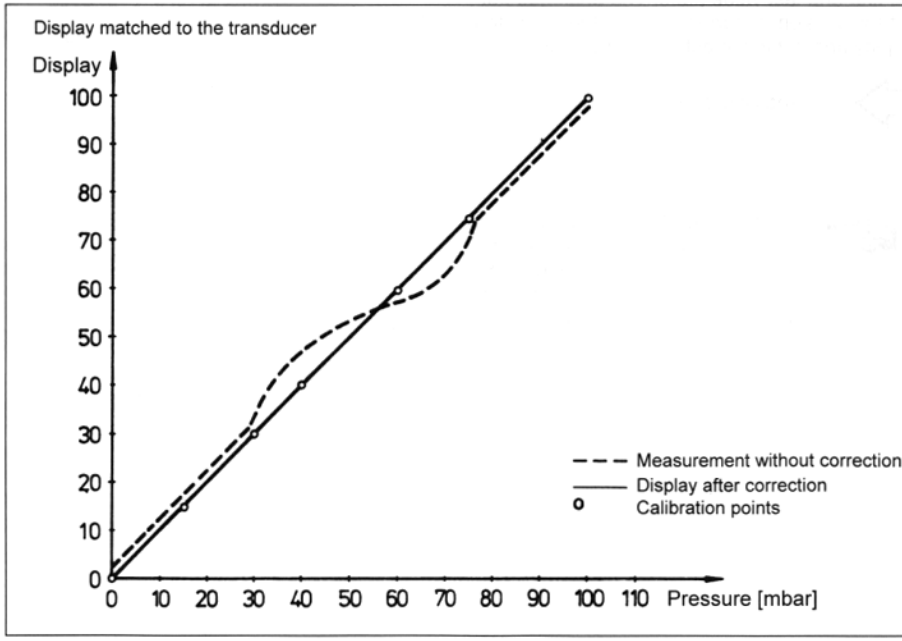
Linearisation for a pressure transmitter, range 0 — 100 mbar, with an output of 0 — 20 mA.

The measurement before correction can either be determined from the known transmitter characteristic or obtained empirically by a test.

Example:
The non-linear range is located between 0 and 75 mbar.

This means for calibration point 2:
At a pressure of 15 mbar the transmitter produces 3.3 mA instead of the ideal value of 3.0 mA. Since 20 mA corresponds to a display of 100.0, 3.3 mA corresponds to a display of 16.5 before correction.

Calibration point No.	Pressure [mbar]	Transmitter output [mA]	Measurement before correction (In)	Display required (Out)
1	0	0.5	2.5	0.0
2	15	3.3	16.5	15.0
3	30	6.2	31.0	30.0
4	40	9.2	46.0	40.0
5	60	11.4	57.0	60.0
6	75	14.7	73.5	75.0
7	100	20.0	100	100

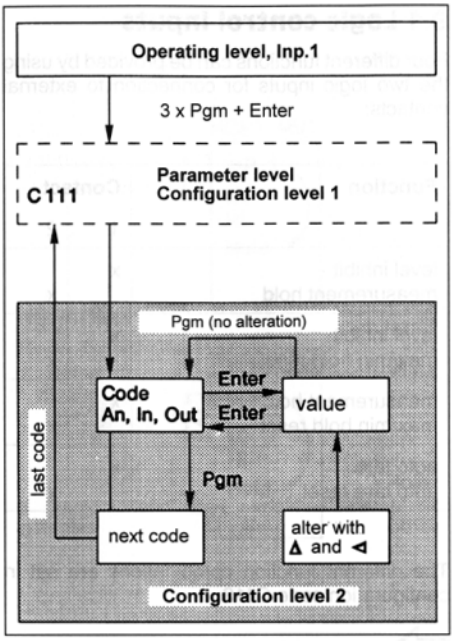


8.2 Inputting value pairs for linearisation

Customized linearisation is activated using the fourth place of configuration code C111.

To input the value pairs proceed as follows:

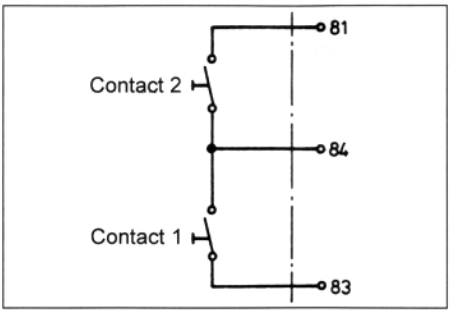
- ✱ Select "Inp.1" at the operating level
- ✱ Press Pgm + Enter simultaneously three times; the display shows "An" for number of value pairs
- ✱ Press Enter key
- ✱ Input the required number (2 — 10) with ▲ and ◀
- ✱ Press Enter, the number is stored
- ✱ Using Pgm select In0
- ✱ Press Enter key
- ✱ Input value with ▲ and ◀
- ✱ Enter the value by pressing the Enter key
- ✱ Using Pgm select Out0
- ✱ Press Enter, input value with ▲ and ◀
- ✱ Enter the value with the Enter key
- ✱ Repeat the procedure for In1 — 9 and Out1 — 9



If there is a change in the number of decimal places in C 111 the In and Out values have to be input again.

9.1 Logic control inputs

Four different functions can be provided by using the two logic inputs for connection to external contacts:



Function	Contact	
	1	2
level inhibit measurement hold	x	x
level inhibit max/min hold reset	x	x
measurement hold max/min hold reset	x	x
auto tare auto tare reset	x	x

The different function combinations are set in configuration code C113.

see Section 7.3

The reaction time of the logic inputs is 0.2 sec.

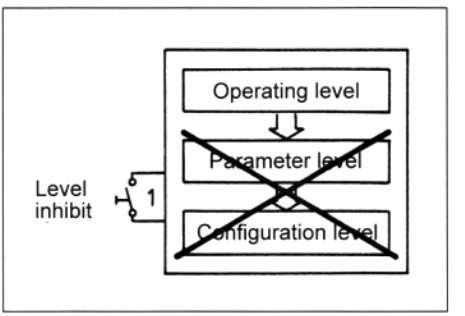
Do not apply an external voltage to the logic inputs.

After a configuration change the memories Hi, Lo, Hold and the tare value of the auto tare are cleared.

Level inhibit

After closing the contact the key combination "Pgm + Enter" is inhibited so that there is no access to the parameter and configuration levels.

Applications:
Safeguard against unauthorised operation, e.g. through a key switch.



Measurement hold

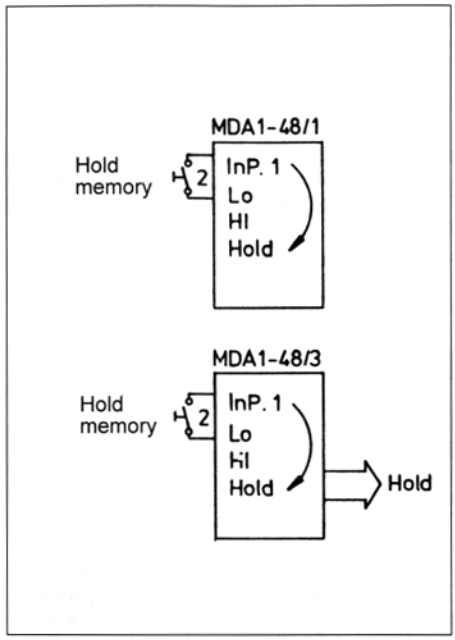
The stored measurement (hold value) can be called up at the operating level under the designation "Hold".

see Section 5.2

Briefly closing the "Hold" contact causes the current measurement to be transferred to the "Hold" memory.

The stored value appears on display as long as the contact remains closed. On instrument version 3 the hold value also appears at the analogue output while the contact remains closed.

If nothing has been stored or if the function is not configured, the display consists of four dashes.



Max/Min hold

The minimum measurement "Lo" and the maximum measurement "Hi" can be called up at the operating level.

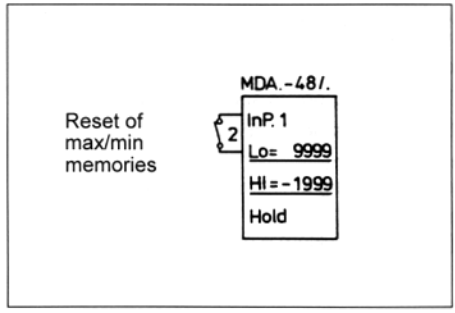
see Section 5.2

The minimum or maximum measurement can also be configured as the standard display.

see Section 7.3, code 113.

Briefly closing the contact "Max/min reset" resets the max/min memories Hi and Lo.
After opening the contact the max/min memories are compared every 90 msec with the current measurement and the memories are updated if required. In case of overrange or underrange or if the function is not configured, the display shows four dashes under "Hi" and "Lo".
If the minimum or maximum value is configured as standard display and there is an overrange or underrange condition, version 3 has at the analogue output

- 100% output signal in case of a minimum
- 0% output signal in case of a maximum



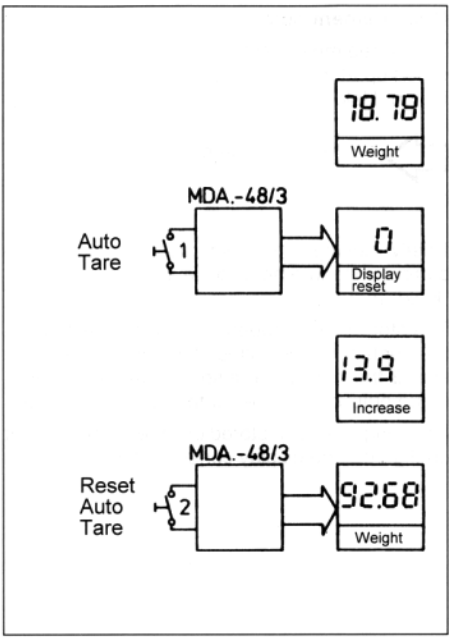
Automatic tare

The automatic tare is employed for difference measurement in case of additive measurements, as used e.g. for weighing.

The external contact "auto tare" resets the display to 0 from any measurement. The function is cancelled with the external contact "Reset Auto Tare", i.e. the true measurement is shown on the display.

On version 3 either the true measurement or the nett value is available as analogue signal, depending on the configuration in C112.

see Section 9.3.



Example (see illustration alongside):
In a multi-component mixture the amount of one substance has to be evaluated.
The starting weight is 78.78 g. An amount of 13.9 g of a substance has to be added.
Before the addition (display 78.78) the "Auto Tare" contact is closed briefly. The display then shows 0. The amount of substance added can now be read directly.

After briefly closing the contact "Reset Auto Tare" the total weight is again shown on the display.

The following points apply to weighings:

true measurement = gross weight

measurement
after activating auto tare = nett weight

tare
(weight of packing) = gross weight – nett weight

9.2 Action on overrange and underrange

The action of the limit comparators and of the analogue output on overrange and underrange is set in configuration code C112.

see Section 7.3

Event	Display
overrange	1999 (flashing)
underrange	–1999 (flashing)

A sensor break or short-circuit is interpreted as overrange or underrange depending on the transducer.

In the case of standard signals there is an overrange or underrange when:

- the display range (-1999 to 9999) is exceeded
- the defined input signal range is exceeded by more than 20 %.

In the case of a 0 — 10 V input there is therefore underrange or overrange when the signal is below –2 V or above +12 V resp.

Transducer	Display on	
	sensor break	sensor short-circuit
Pt 100	1999	–1999
Thermocouples	1999	temperature of short-circuit point
Standard signals:		
0 — 50 mV	1999	0
0 — 10 V	0	0
0 — 20 mA	0	0
2 — 10 V	–1999	–1999
4 — 20 mA	–1999	–1999

9.3 Analogue output

Version 3 incorporates an analogue output.

The following output signals can be configured in C112:

0 — 10 V, 2 — 10 V, 0 — 20 mA, 4 — 20 mA,

see Section 7.3.

Scaling of the analogue output (assignment of display to output signal) is performed at configuration level 1 using the parameters SC.L (scale low) and SC.H (scale high).

In the case of thermocouple and Pt 100 input, SC.L and SC.H are only used for scaling the analogue output.

With standard signals, SC.L and SC.H determine both the display range and the signal at the analogue output.

start of display range = 0 % output signal
end of display range = 100 % output signal

If customized linearisation has been activated, the largest and the smallest Out value determine the signal at the analogue output.

see Section 9.4.

Important note for activated automatic tare:

The last digit of configuration code C112 selects whether the signal at the analogue output corresponds to the true measurement or to the displayed value.

For approx. 1 sec after switching on, the signal at the analogue output is undefined.

In principle the signal at the analogue output is always the same as that appearing on the standard display.

Exception:
If the "Hold" logic input has been activated (contact closed) the "Hold" value appears at the analogue output and on the display.

see Section 9.1.

9.4 Using several measurement corrections

In the case of thermocouple and Pt 100 input the corrections are made in the following order (see example ❶):
- offset,
- customized linearisation,
- scaling (acts only on the analogue output)

With standard signal input the processing is performed in the following order (see example ❷):
- scaling,
- offset,
- customized linearisation.

The input is reproduced on the analogue output independently of SC.L and SC.H, i.e.

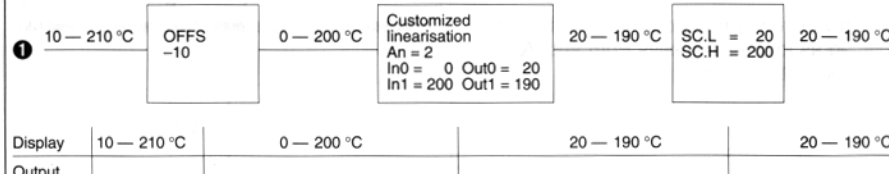
minimum input signal → minimum output signal
maximum input signal → maximum output signal

Overrange and underrange can not be reproduced on the analogue output.

If customized linearisation has been activated, the largest and the smallest Out value define the signal at the analogue output:

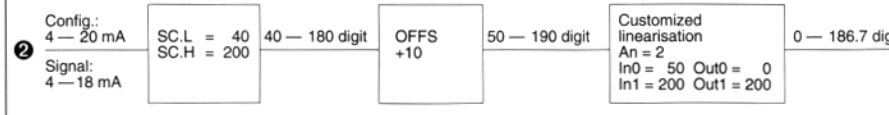
smallest Out value = 0 % output signal
largest Out value = 100 % output signal

❶ Pt 100 input



Display	10 — 210 °C	0 — 200 °C	20 — 190 °C	20 — 190 °C
Output 0 — 10 V	2 — 3.9 V[1]	1.9 — 3.81 V[1]	2.1 — 3.71 V1	0 — 9.44 V

❷ 4 — 20 mA input



Display	0 — 87.5 digit[2]	40 — 180 digit	50 — 190 digit	0 — 186.7 digit
Output 0 — 10 V	0 — 8.75 V	0 — 8.75 V	0 — 8.75 V	0 — 9.33 V

1. as long as the factory setting SC.L = −200 °C, SC.H = 850 °C applies
2. as long as the factory setting SC.L = 0, SC.H = 100 applies

9.5 Using the digital filter

The indicator incorporates a second-order digital filter for the suppression of disturbances in the input signal. The filter constant of the digital filter is set in configuration code C113 (0.0 — 2.0 sec).

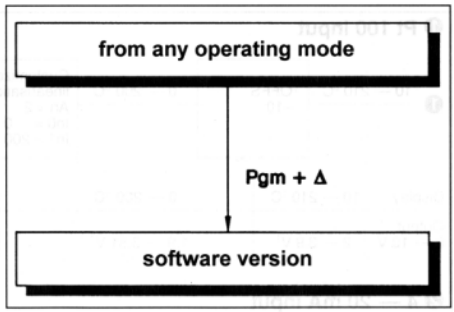
A larger filter constant results in better interference suppression.

At the same time the display becomes more sluggish, and in addition the response time of the limit comparators is increased. As soon as the filter function is switched on the reaction time of the indicator is doubled.

During pressure monitoring the filter should be switched off (filter time constant = 0.0), since pressures are subject to rapid variations.

9.6 Indicating the software version

The software version used in the instrument is displayed as long as the keys Pgm and Δ are pressed simultaneously.



10.1 Record of the actual settings

Code	Setting	Notes
C111		
C112		
C113		
SC.L		
SC.H		
OFFS		
An		
In0/Out0		
In1/Out1		
In2/Out2		
In3/Out3		
In4/Out4		
In5/Out5		
In6/Out6		
In7/Out7		
In8/Out8		
In9/Out9		
AL.1		
AL.2		
AL.3		

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