Instruction Manual

Instrument Amplifier

HE 017

List of contents

INSTRUCTION MANUAL: HE 017 **Date:** 20.4.99 **Art.-No.:** 320999

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1 General Description

The instrument amplifier HE 017 is a microprocessor controlled digital indicator in a standard DIN sized housing.

A 10 bit A/D converter enables the digital processing of the standard signals, pressure (strain gage) signals or signals from Pt100-sensors.

The 5-button membrane keyboard on the front panel facilitates operator control and enables easy menu-guided programming of the parameters.

Two additional limit value contacts are provided with adjustable switching behaviour (min./max.), fail-safe, hold-function and switching delay.

1.1 Features

- Inputs: - 0 to (5)10 V
  - 0(4) to 20 mA,
  - pressure (strain gauge), sensitivity 3.3 mV/V
  - Pt 100 (3-wire)
- menu-guided programming
- Transducer supply:
  - 11 V / 40 mA for 2-/3-wire transmitters
  - ± 5 V / 40 mA for pressure
- 4-digit LED-display
- two limit-value-contacts with adjustable switching behaviour (min./max.), fail-safe, Hold-function and switching delay
- Peak value memory (digital)
- Serial interface RS 485 (option)
- analog outputs (option):
  - 0 - 10 V
  - 0(4) - 20 mA
- Code-protection against unauthorized access

1.2 Application Range

The instrument amplifier HE 017 is designed for industrial application range, particularly for use in packing machines, filling machines and galvanic systems.

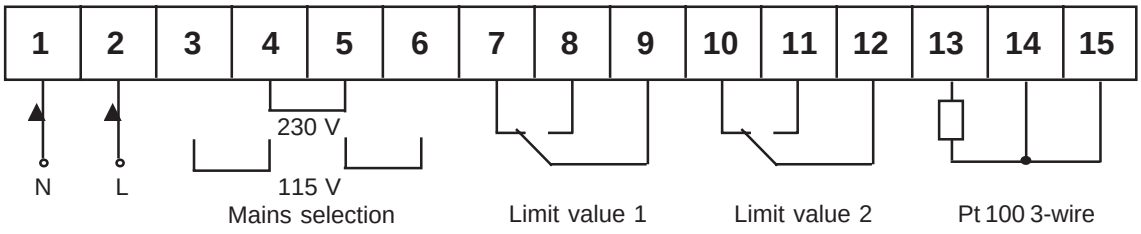
2 Connection

2.1 Notes on Connection Wires

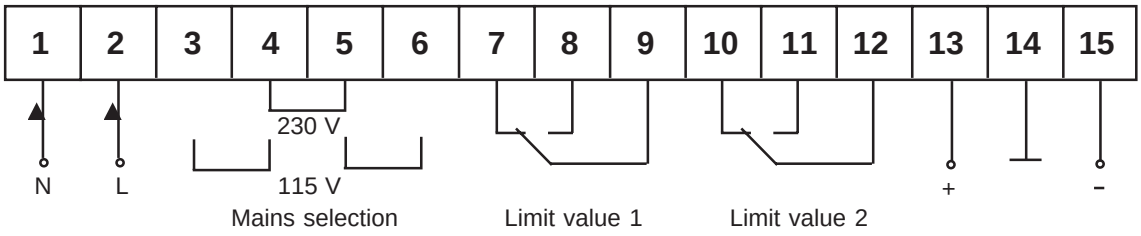
The used wires for installation should be as short as possible. The connection bar is suited for cords with a cross-section of max. 1,5 mm². For connecting all analog signals there must be used shielded cords.

The connection must be like following diagrams.

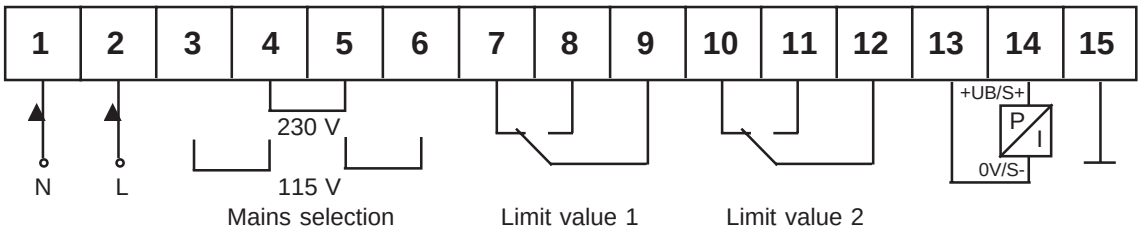
2.2 Pin Assignment Version 'PT 100 3-wire'



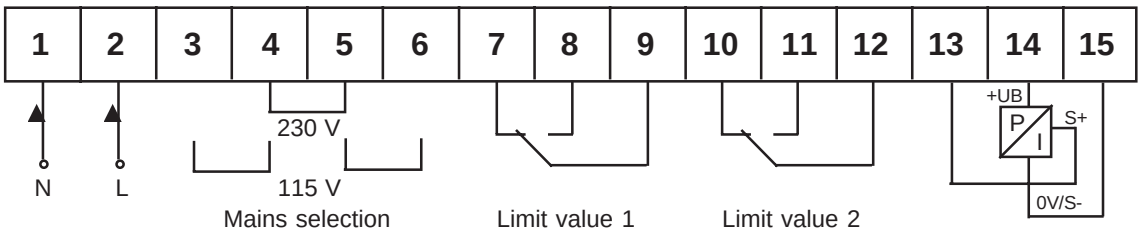
2.3 Pin Assignment Version 'Voltage or Current' (0 to 10 V, 0(4) to 20 mA)



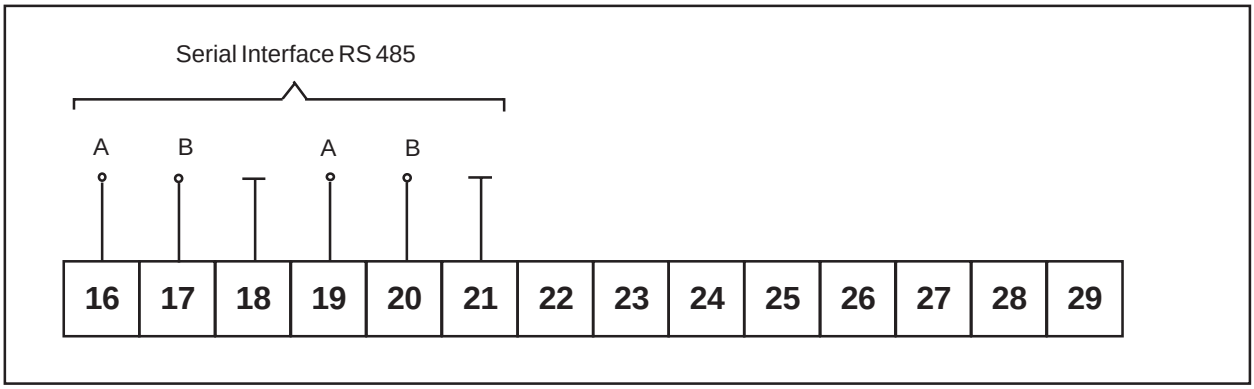
2.4 Pin Assignment Version '2-wire-Transmitter' (4 to 20 mA)



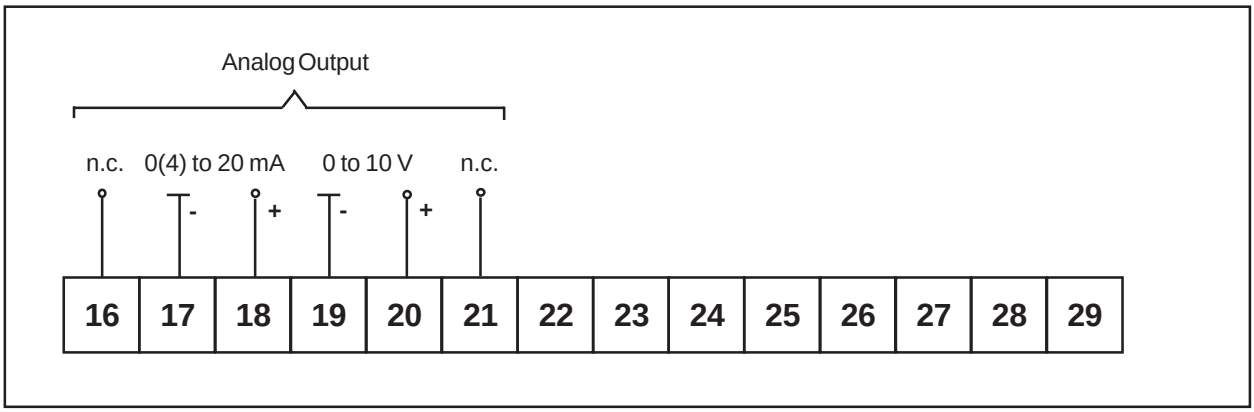
2.5 Pin Assignment Version '3-wire-Transmitter' (0(4) to 20 mA)



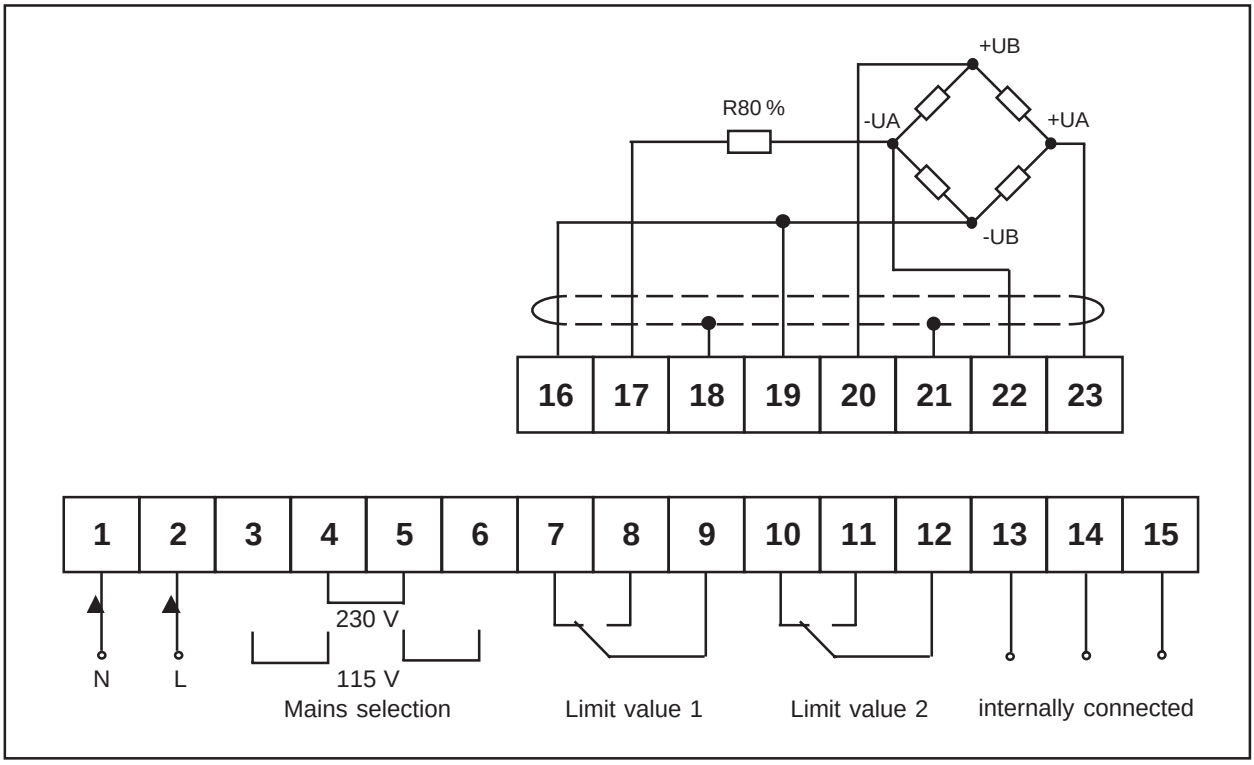
2.6 Pin Assignment (additional to 2.2 to 2.5) for Option 'Serial Interface'



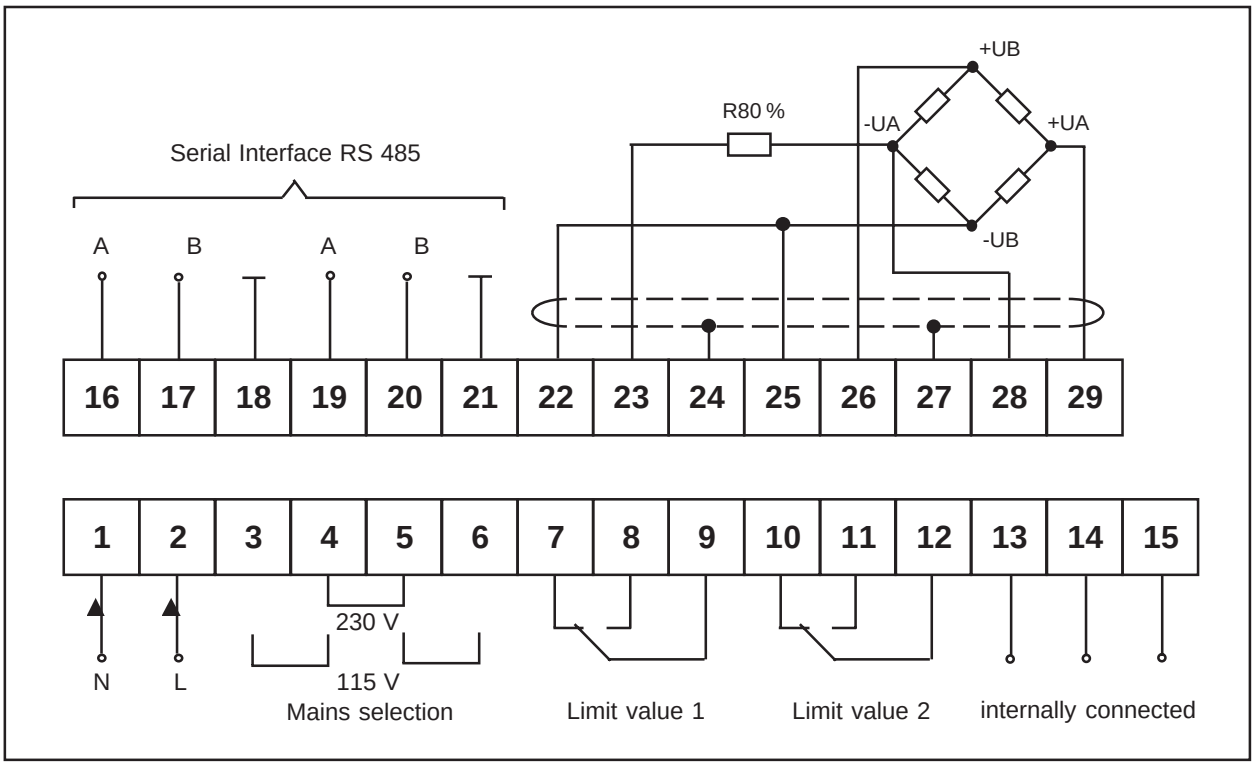
2.7 Pin Assignment (additional to 2.2 to 2.5) for Option 'Analog-Output'



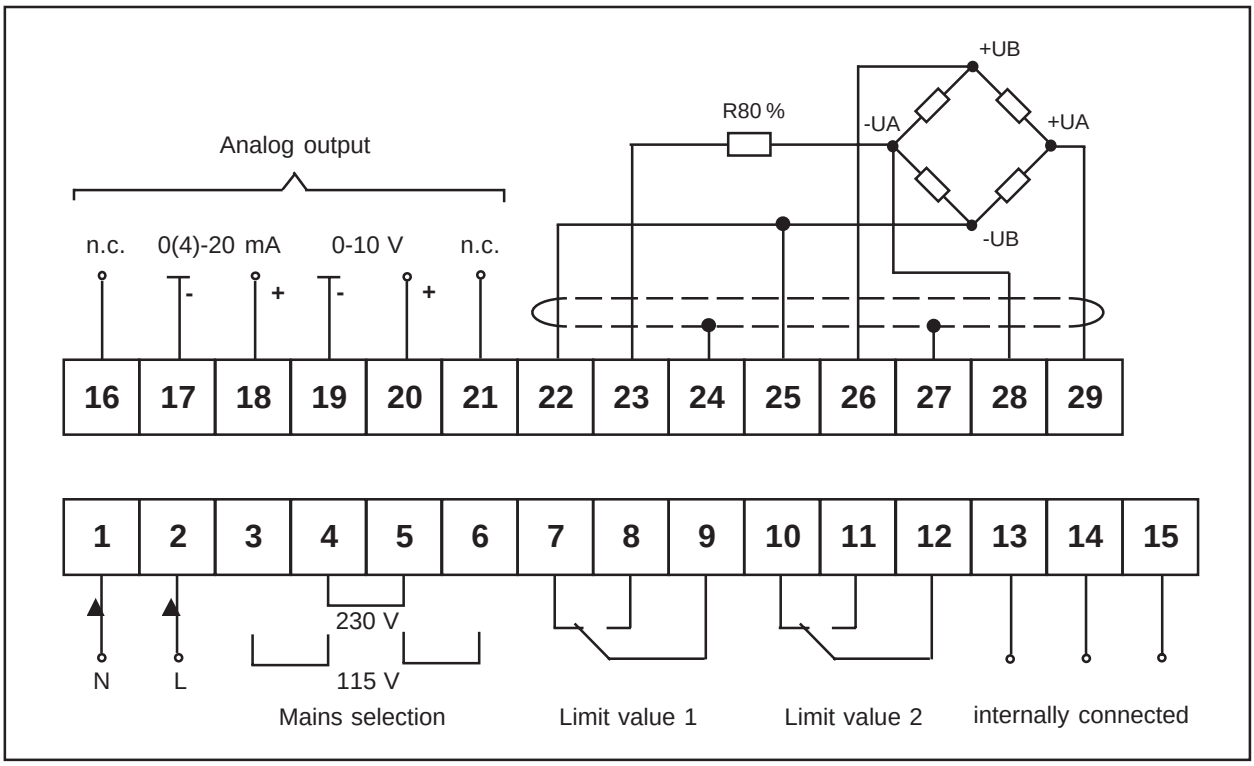
2.8 Pin Assignment Version 'Strain Gage'



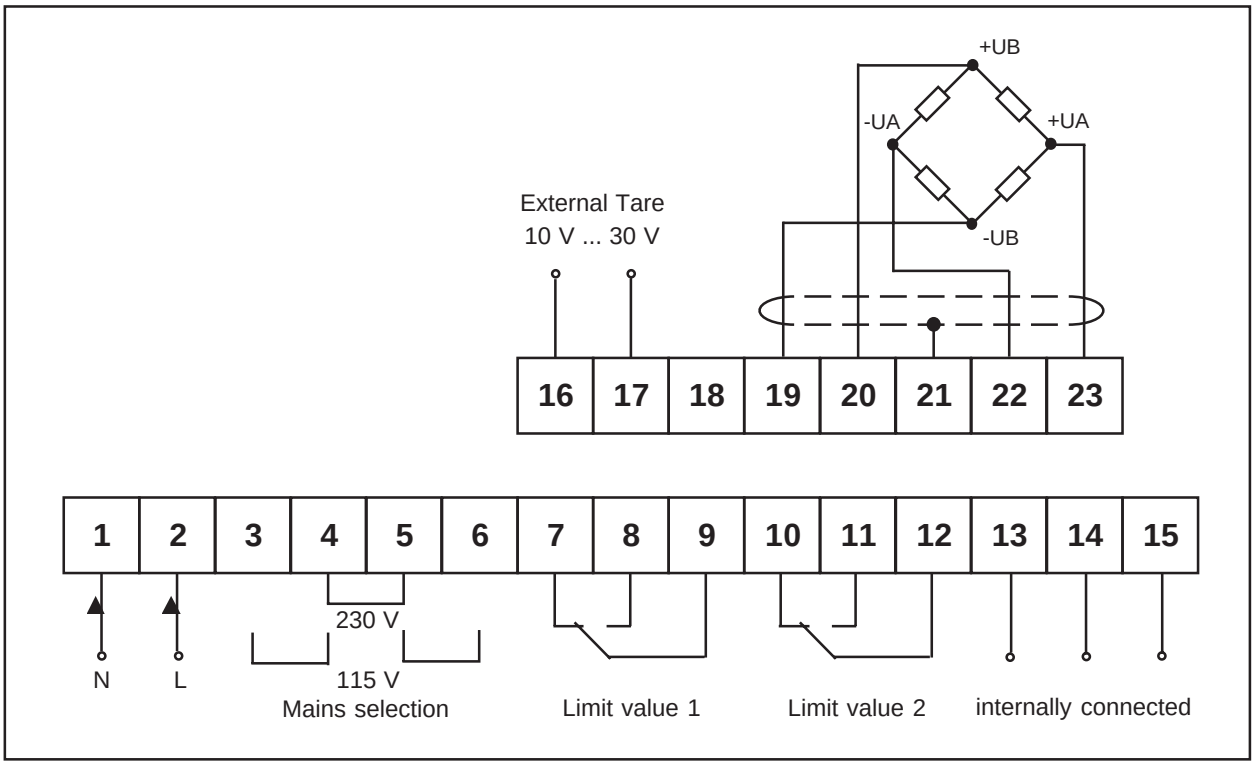
2.9 Pin Assignment Version 'Strain Gage' with Option 'Serial Interface'



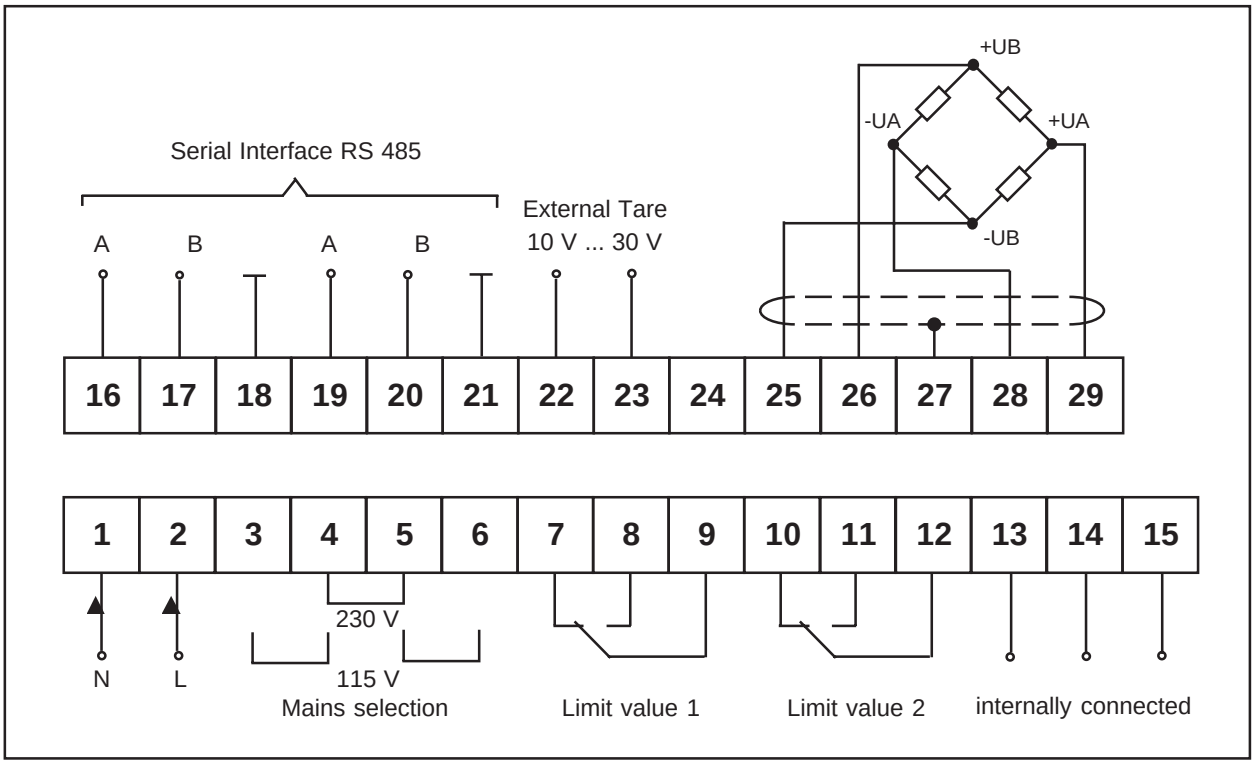
2.10 Pin Assignment Version 'Strain Gage' with Option 'Analog Output'



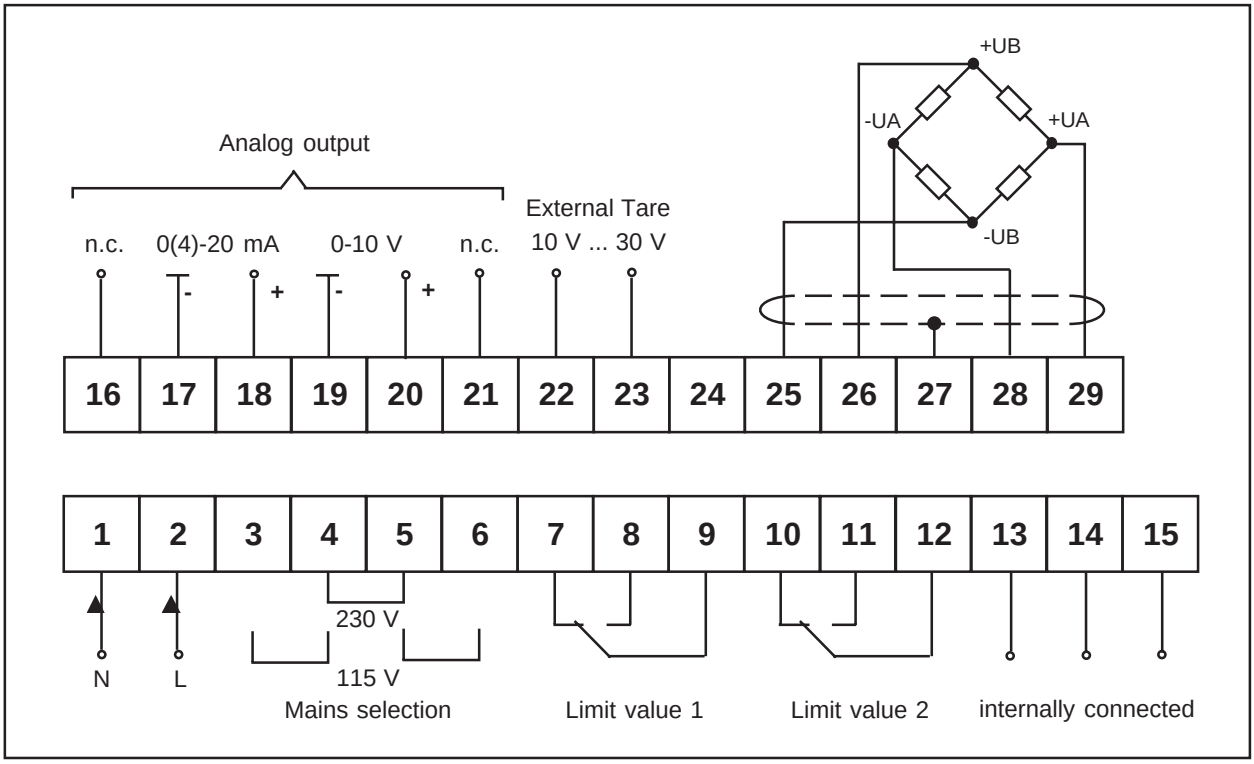
2.11 Pin Assignment Version 'Strain Gage' with Option 'External Tare'



2.12 Pin Assignment Version 'Strain Gage' with Option 'External Tare' and 'Serial Interface'



2.13 Pin Assignment Version 'Strain Gage' with Option 'External Tare' and 'Analog Output'



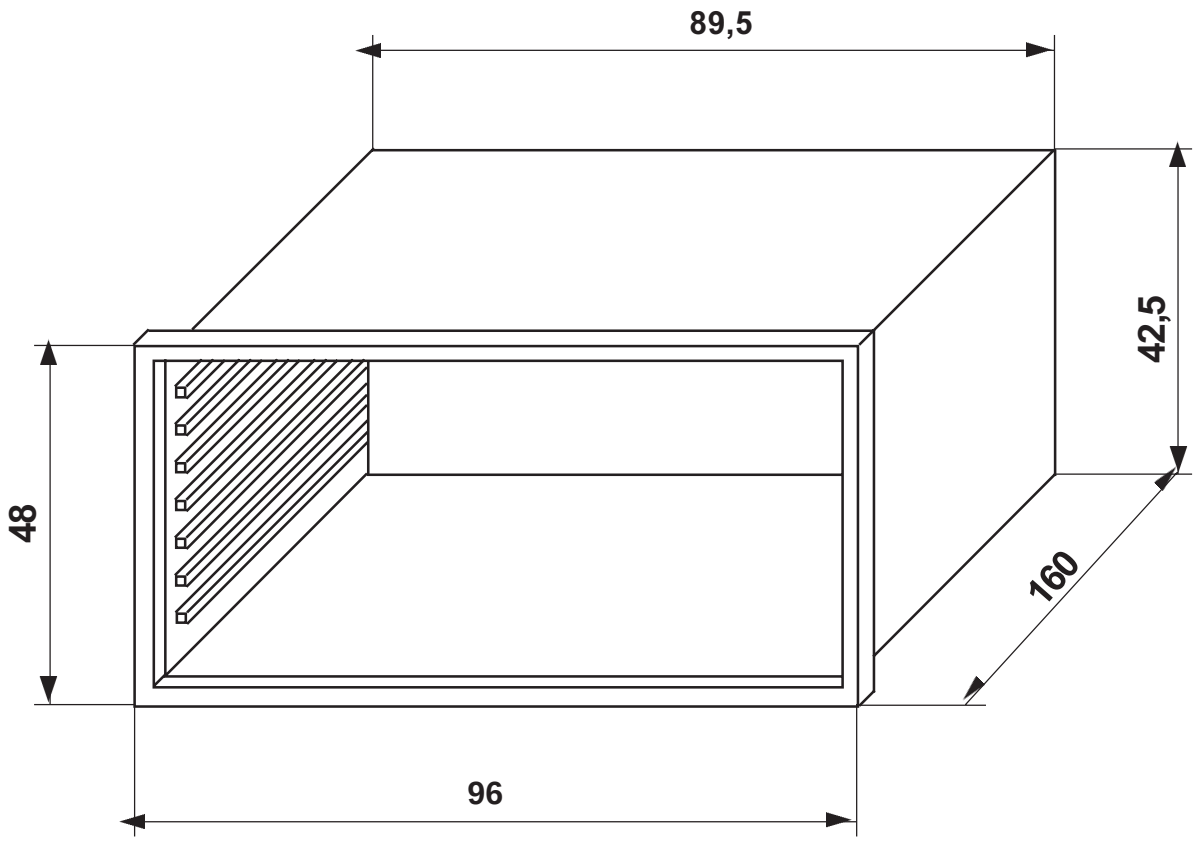
3 Installation and Dimension

The instrument features its own built-in mains filter. An additional external mains filter may, nonetheless, be necessary if irregularities occur.

The connections for auxiliary energy, actuators and measuring transducers should be made in accordance with the connecting diagram.

Dimensions of instrument: 48 x 96 x 160 mm (h x w x d)

Panel-Cutout dimensions: 44 x 92 mm (h x w)

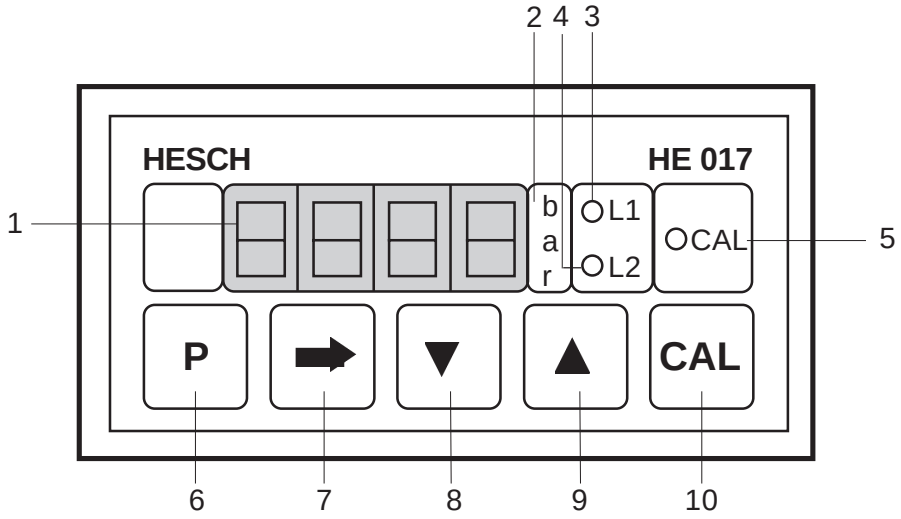


4 Preventative

These device has an overvoltage protection (varistor) and a fuse model TR 5.

5 Operation

5.1 Operating and Display Elements



1 Seven-segment display: The actual value is displayed in the seven-segment display. The parameter names and the selected parameter values can also be displayed by activation of a button or a button combination.

2 Units window: The measurement unit applicable is indicated in this window (e.g. °C, mV, mA, bar, PSI).

3-4 Limit value LEDs: The respective LED illuminates if limit values **L1** to **L2** are exeeded in positive or negative direction.

5 **CAL**-LED: Illuminates during calibration.

6 **P**-button: Pushing the **P** and the ▼ button while in actual value display will reset the hold function for both alarms.

Pressing **P**- and **CAL**-button for approx. 3 seconds on a voltage, current or pressure instrument will enter the calibration menue.

Pushing the **P**-button while in a submenu will abort a parameter setting.

7 ➡ button: Pushing the ➡ button, while in a menu, will enter a parameter setting or switch to the next decimal.

8 ▼ button: The ▼ button is used to move down through menus or to change a parameter (depending on the position in the menu).

9 ▲ button: The ▲ button is used to move up through menus or to change a parameter (depending on the position in the menu).

10 **CAL**-button: While in a parameter-setting the **CAL**-button accepts the current value and swiches to the next parameter.

5.2 Programming of Parameters

The parameters are programmed via a main menu which has various submenus.

When the device is switched on, the actual value is displayed. Then you can use the ▲ or ▼ button to select an item from the main menu. Pressing the ➡ button enables you to access a submenu or parameter setting.

Unlike the actual value or a menu item, a programmable parameter flashes on the display. Then you can change it by pressing the ▲ or ▼ button. Multi-digit values are altered one digit at a time. Press the ➡ button to move on to the next digit.

A programmed value is transferred to the memory when the ➡ button is pressed while the last digit is flashing. Pressing the **P**-button will abort the parameter setting without changes. If you wish to confirm an entered value without changing all of the digits, you can do this at any time by pressing the **CAL**-button.

5.2.1 Entering of Codes

You can protect HE 017 against unauthorized operation by entering an access code. To do this, select the '**codE**' item from the '**conF**' menu and enter a code which is not equal to zero. You can also use the '**Prio**' parameter to specify whether the user may view the parameters (prio = **LO**) or whether access to the menu is prohibited (prio = **HI**).

If an attempt is made to leave the actual-value display or to change a parameter by pressing the ▲ or ▼ button, the '**COdE**' prompt appears on the display, requesting the user to enter the programmed code. Pressing the ➡ button accesses the code input level. If the code is entered correctly, the user may use all of the operator control facilities until the actual value is displayed again. The unit returns to the actual-value display automatically after three unsuccessful attempts to enter the code.

5.2.2 Code Interrogation

A code interrogation facility has been provided to ensure that the unit can still be used if the code has been lost.

Press the **P**-button while switching the HE 017 on. The instrument will display alternately the software-version and the code in the display. The unit returns to normal operation when the **P**-button is released.

5.2.3 Enabling an Encoded Unit

The code request prompt is triggered by the user's attempt to leave actual-value display mode or to change a parameter. The '**COdE**' prompt appears on the display.

Pressing the ➡ button accesses the code programming level, where you can use the ▲, ▼ and ➡ buttons to enter the code.

If the code is entered incorrectly, the '**COdE**' prompt appears again on the display. The unit returns to the actual-value display automatically after three unsuccessful attempts to enter the code.

5.2.4 Canceling a User Calibration

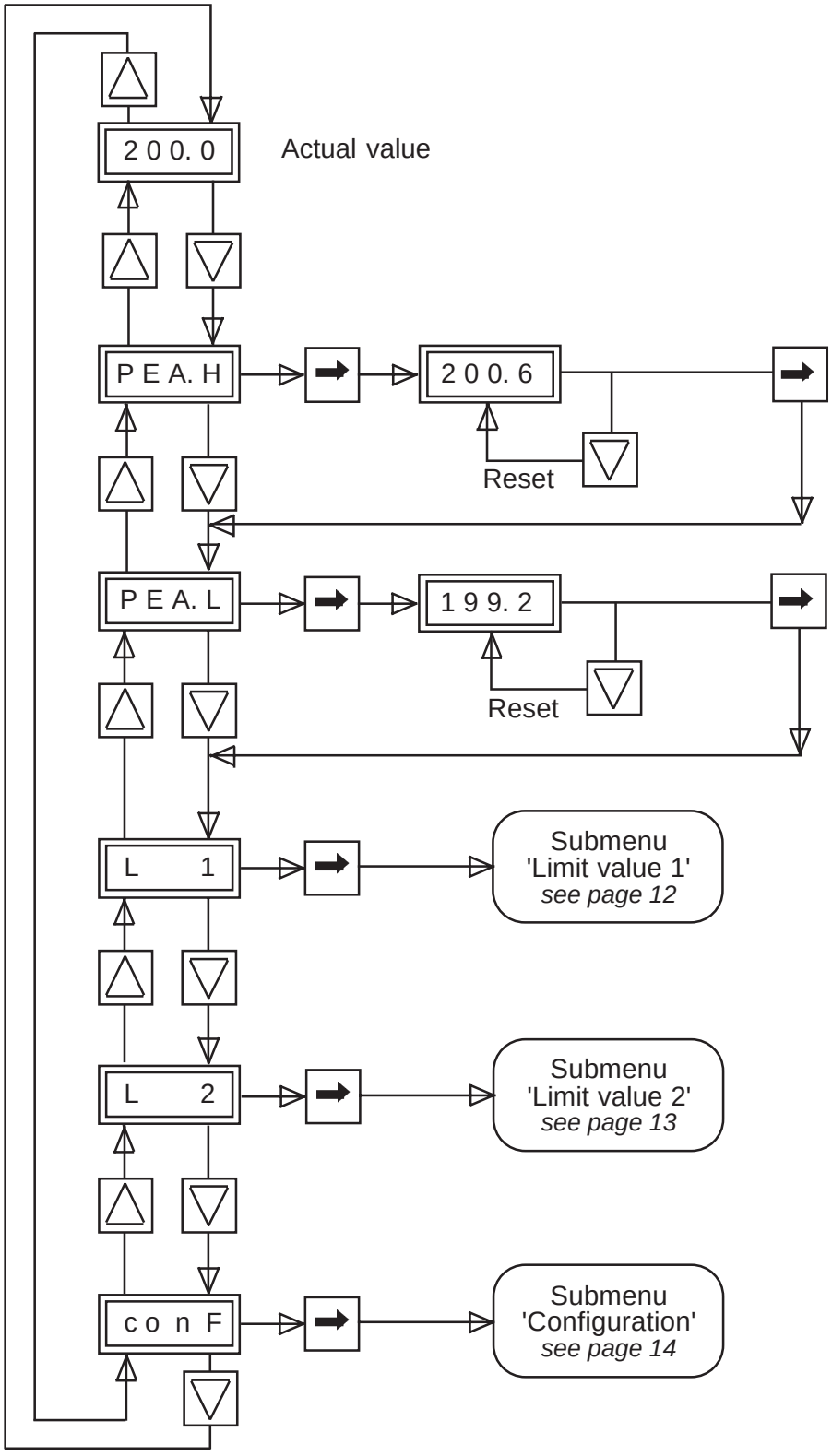
If you miscalibrated the HE 017, you can reset it to factory calibration by pressing the **CAL**-button while switching the instrument on.

5.3 Operating Menus

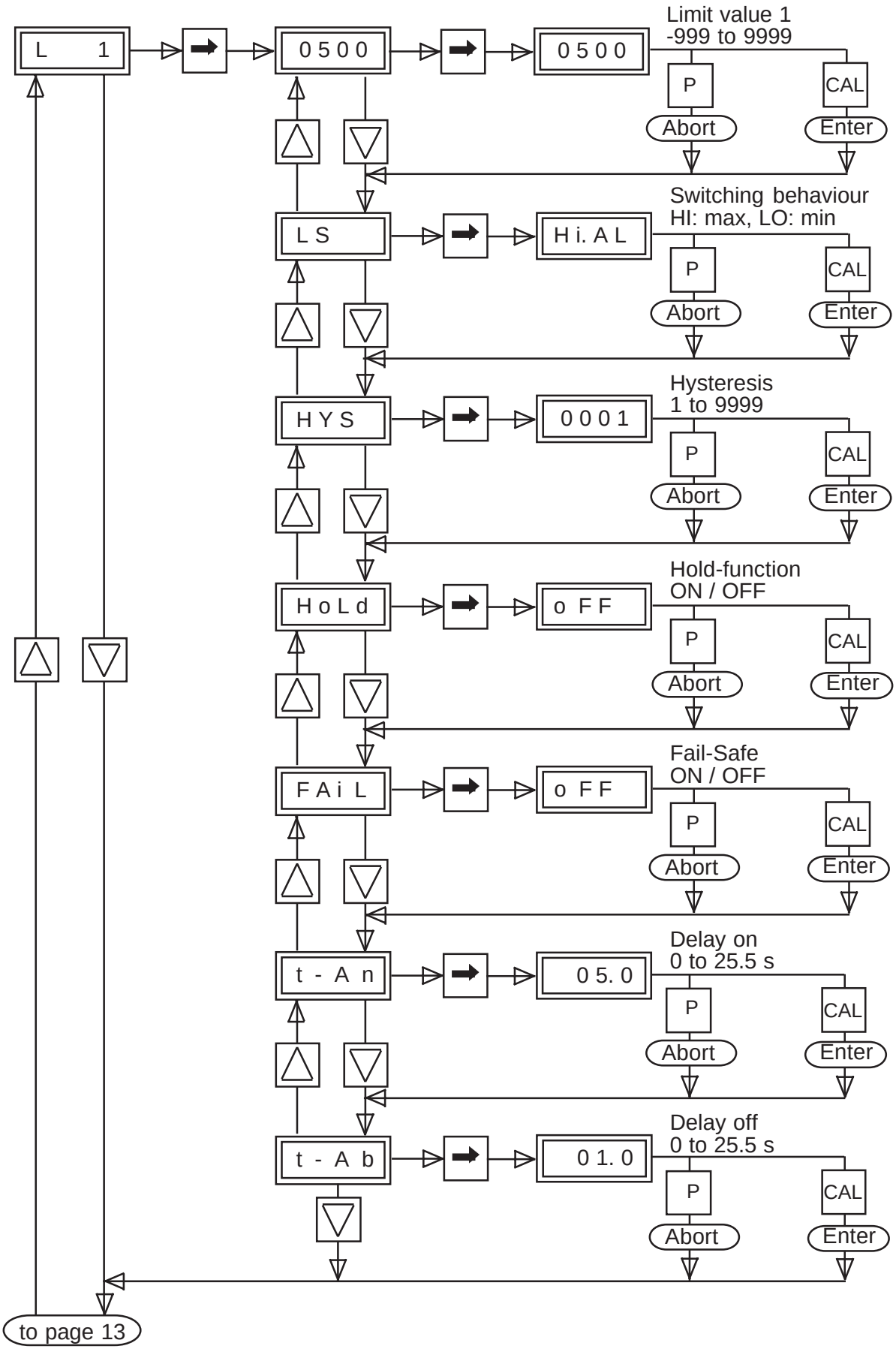
General remarks for changing parameters:

Button	Function
▲ or ▼	• changing flashing decimal
➡	• enters a submenu or a parameter setting • turns to next digit • at the final position: turns to next parameter
P	• during parameter settings: interrupts procedure without changing parameters and switches to the next parameter
CAL	• during parameter settings: accepts the modified parameter and switches to the next parameter

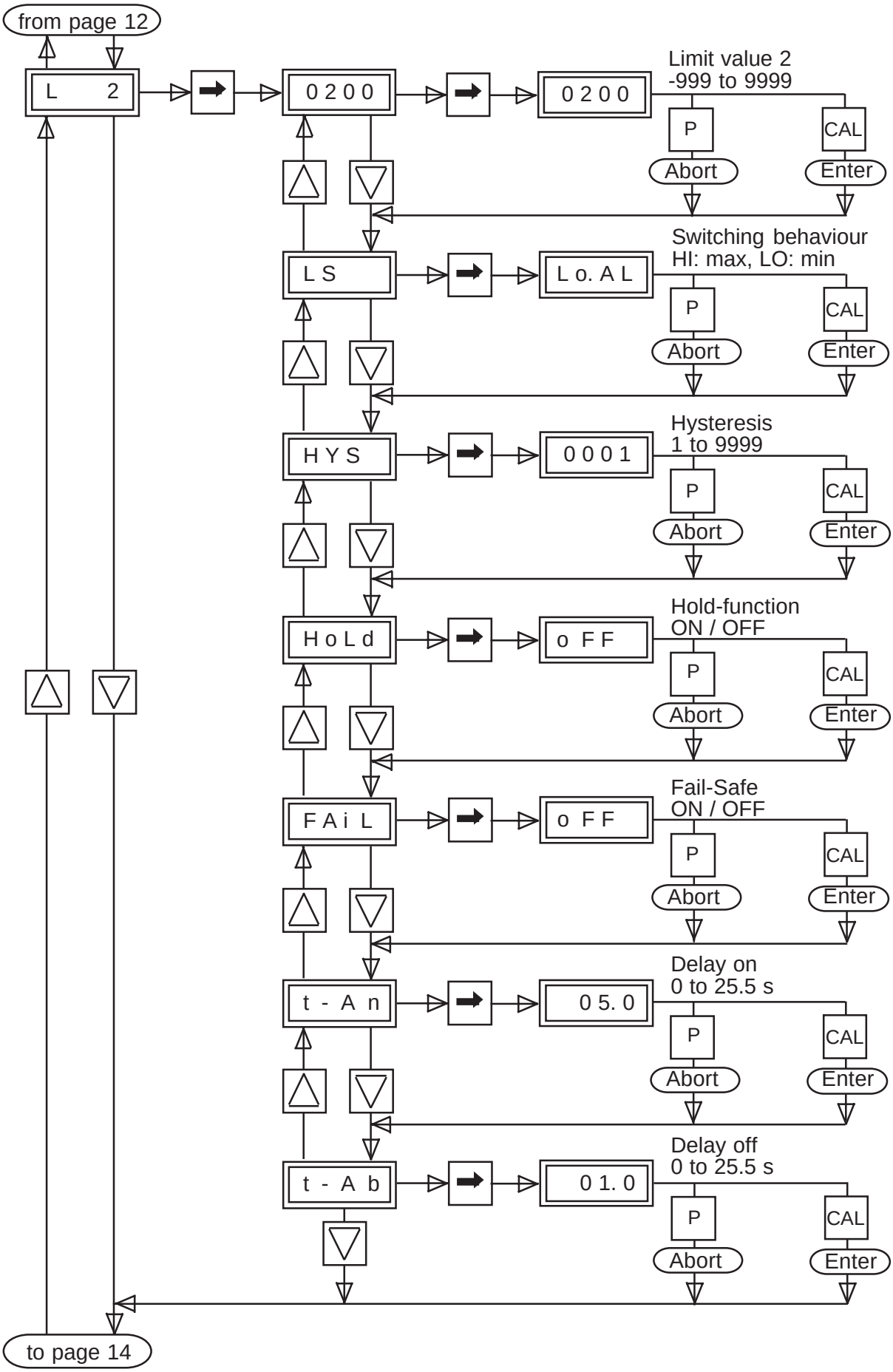
5.3.1 Flow Chart 'General Operation'



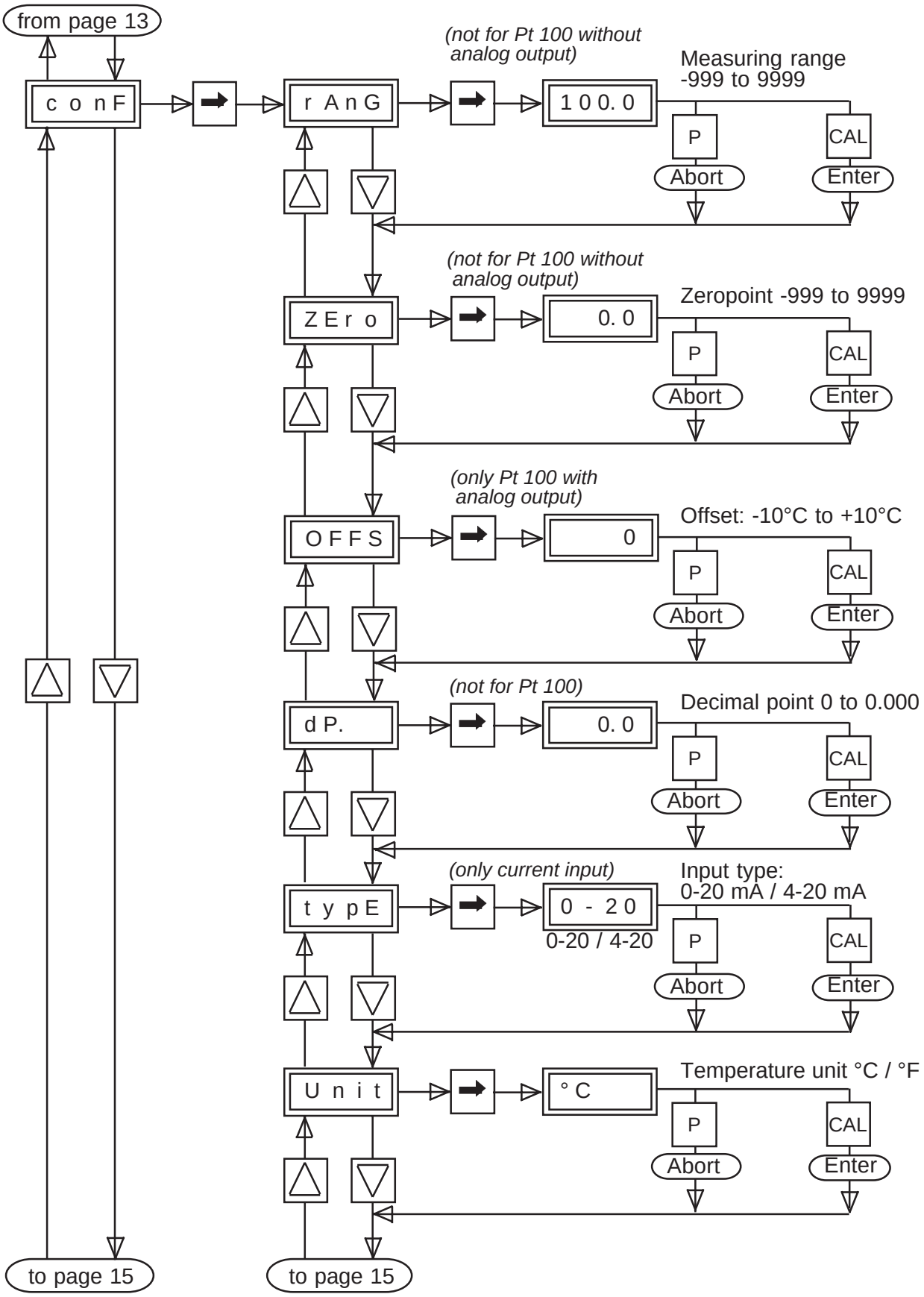
5.3.2 Flow Chart 'Limit Value 1'

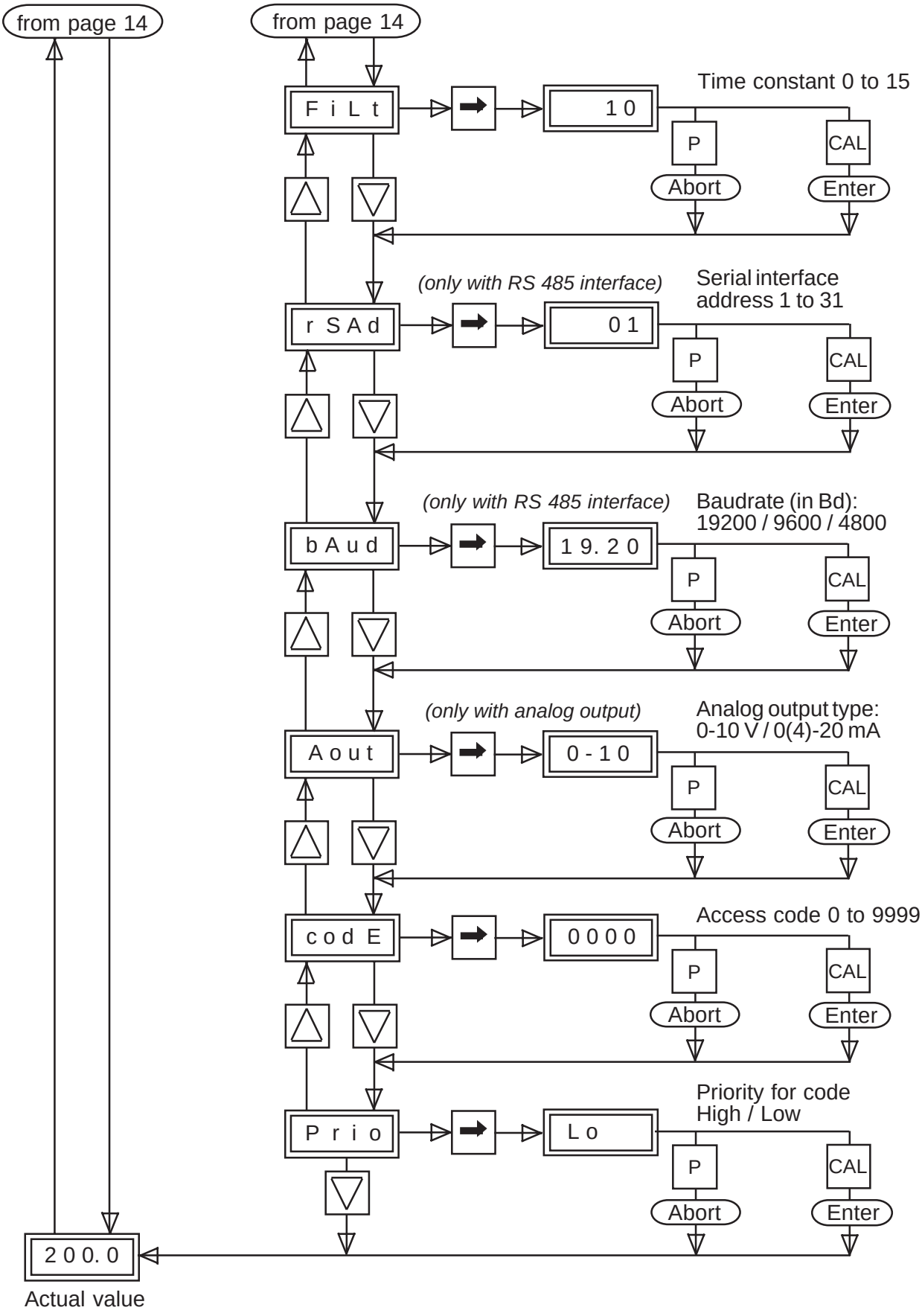


5.3.3 Flow Chart 'Limit Value 2'



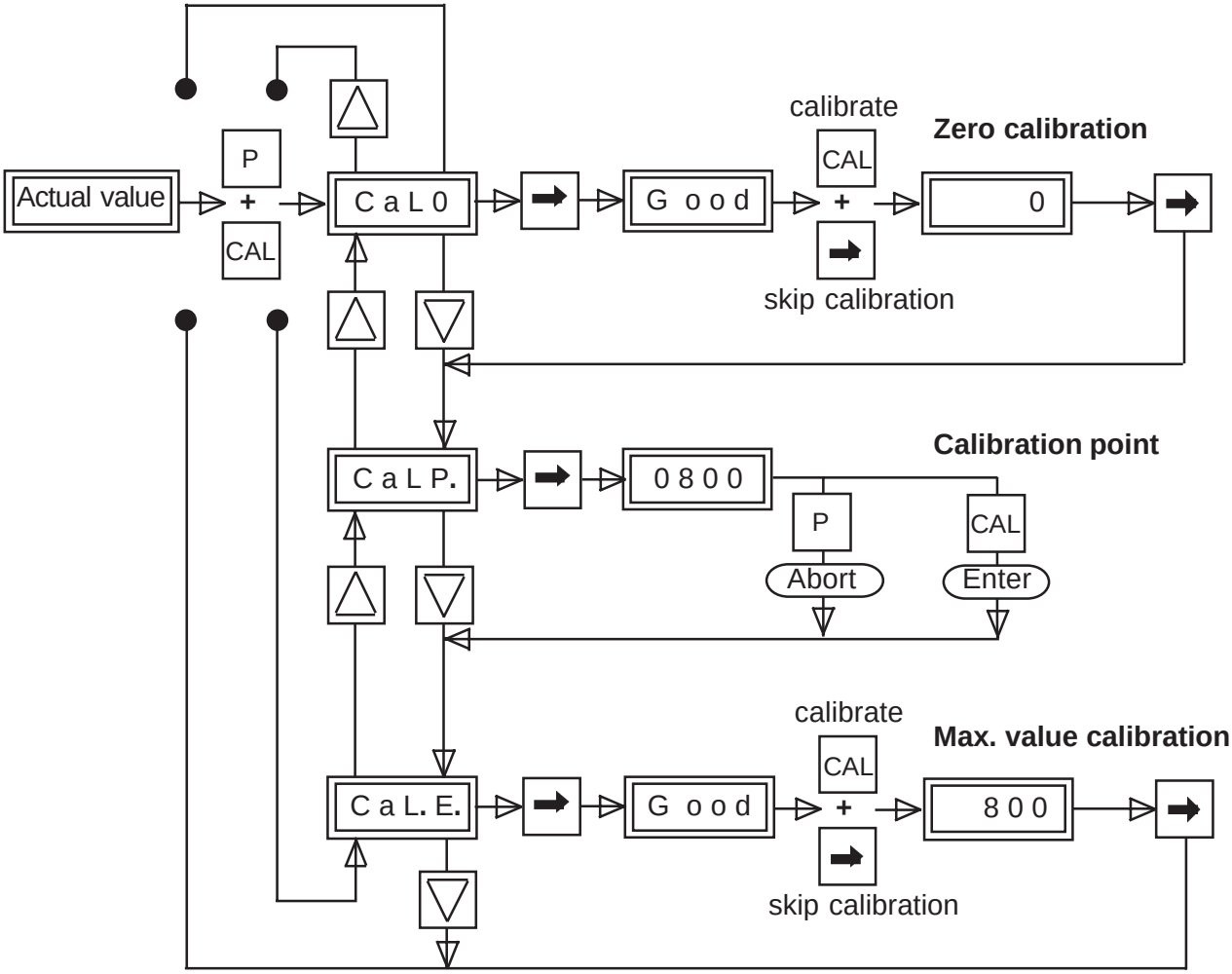
5.3.4 Flow Chart 'Configuration'




from page 14
from page 14
F i L t
1 0
Time constant 0 to 15
P
CAL
Abort
Enter
(only with RS 485 interface)
r S A d
0 1
Serial interface
address 1 to 31
P
CAL
Abort
Enter
(only with RS 485 interface)
b A u d
1 9. 2 0
Baudrate (in Bd):
19200 / 9600 / 4800
P
CAL
Abort
Enter
(only with analog output)
A o u t
0 - 1 0
Analog output type:
0-10 V / 0(4)-20 mA
P
CAL
Abort
Enter
c o d E
0 0 0 0
Access code 0 to 9999
P
CAL
Abort
Enter
P r i o
L o
Priority for code
High / Low
P
CAL
Abort
Enter
2 0 0. 0
Actual value

5.3.5 Flow Chart 'Calibration' *(not in Pt 100)*

Press the buttons **P** and **CAL** simultaneously for approx. 3 sec. while in actual value display to enter the calibration menu.



P + **CAL** accept new calibration

▲ + ▼ abort calibration

6 Instrument Amplifier

The instrument amplifier installed in the HE 017 is subdivided into pressure (strain gauges), current, voltage and temperature (Pt 100) sections.

6.1 Measuring Range in Current, Voltage and Pressure

The measuring range will be defined by the parameter '**RANG**' and '**ZERO**'. This parameters can be set in a range of -999 to +9999.
If the input of the amplifier reaches the end-value, the amplifier will display the maximum of range (parameter '**RANG**'), if the input reaches the zero point, the amplifier will display the minimum of range (parameter '**ZERO**').
The parameter '**ZERO**' can be set to a higher value than the parameter '**RANG**'. E.g. to display a low pressure you might set '**ZERO**' to 0.00 bar and '**RANG**' to -1.00 bar.

The measuring range in Pt 100 is set by factory to -100°c to 800°C and can not be changed.

Option 'Analog output': An offset for Pt 100 between -10°C to +10°C can be set by the para-meter '**OFFS**' in the calibration menu. The parameters '**RANG**' and '**ZERO**' only have an effect on the analog output.

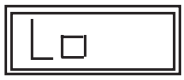
6.2 Detection of Sensor Breakage and Sensor Short-Circuit

6.2.1 Sensor Breakage

Sensor breakage is detected if the input is open or the maximum input value is exceeded. Sensor breakage is indicated on the display by means of the following error message:

6.2.2 Sensor Short-Circuit

A sensor short-circuit is detected if the input value is less than the minimum input value. Sensor short-circuit is indicated on the display by means of the following error message:



6.3 User Calibration *(not for Pt 100)*

6.3.1 Zero Calibration

A user calibration is initiated by pressing the **P**- and **CAL**-button simultanouesly for approximately 3 seconds while in actual value display. The instrument will switch to calibration menu and show '**CALO**'.

For executing the zero calibration press the ➡ button. The instrument will now show whether the input signal is to high **('Hi')**, to low **('Lo')** or ok **('good')** for a zero calibration.

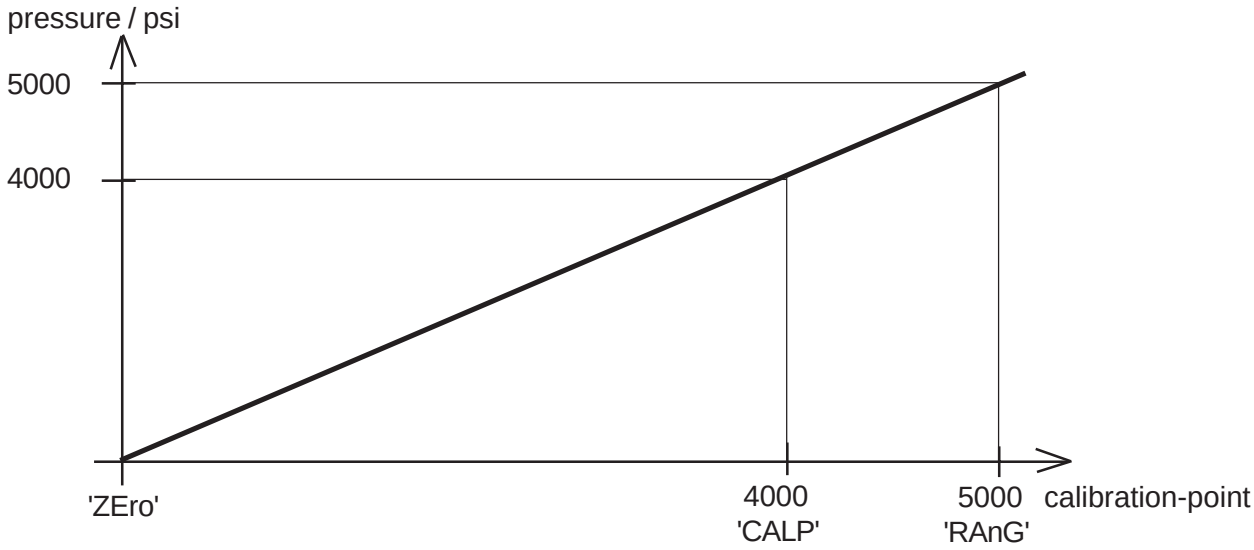
By pressing the **CAL**-button at the display '**good**' the instrument will accept the actual value as new zero point. By pressing the ➡ at the display '**good**', '**Hi**', or '**Lo**' the instrument will skip the zero calibration.

After pressing the ➡ button then the instrument will show '**CALP**'.

6.3.2 Calibration Point

The reference for maximum calibration is set by the parameter '**CALP**' in the calibration menue. The parameter may be set to any value between 40 % and 120 % of span. The calibration point is set as the actual value of the reference.

To calibrate a strain gauge pressure transducer with an 80 % shunt and a range of 5000 psi the CALP has to be set 4000 (80 % of 5000).



6.3.3 Maximum Value Calibration

A correct zero calibration and calibration point is an absolute requirement for a maximum value calibration. To perform a maximum value calibration move to parameter '**CAL.E**' in calibration menue. Press the ➡ button. Now the instrument will show '**good**' if the input value is ok for a calibration or '**Hi**' or '**Lo**' if it is not. To accept the new maximum value press the **CAL**-button. To skip the maximum value calibration press the ➡ button.
The new calibration is accepted by pressing the **P**- and **CAL**-button simultaneously. To abort the calibration menu without taking over the new calibration press ▼ and ▲ simultaneously.

6.4 Transducer Test *(pressure only)*

To test a pressure transducer (strain gauge) for correct connection press the **CAL**-button. The instrument will then close the 80 % switch. The changing of the actual value while pressing the **CAL**-button does not effect on the alarms, and peak value memory..

6.5 Tare Function *(not for Pt 100)*

By pressing the **P**- and ➡ button simultaneously the display is set to zero (tared).
For neutralization the ➡ and ▼ button must be pressed simultaneously.

Option 'External Tare': Tare function can also be triggered by an external impulse (10 to 30 V DC) at terminal 16 (+) and 17 (-).

7 Peak Value Memory

The instrument stores the minimum and maximum value while operating. These values are reset by pressing the ▲ button while in peak value display.

8 Limit Contacts L1 and L2

The two limit values can be set to any value between -999 and +9999 (see flow charts).

8.1 Hysteresis

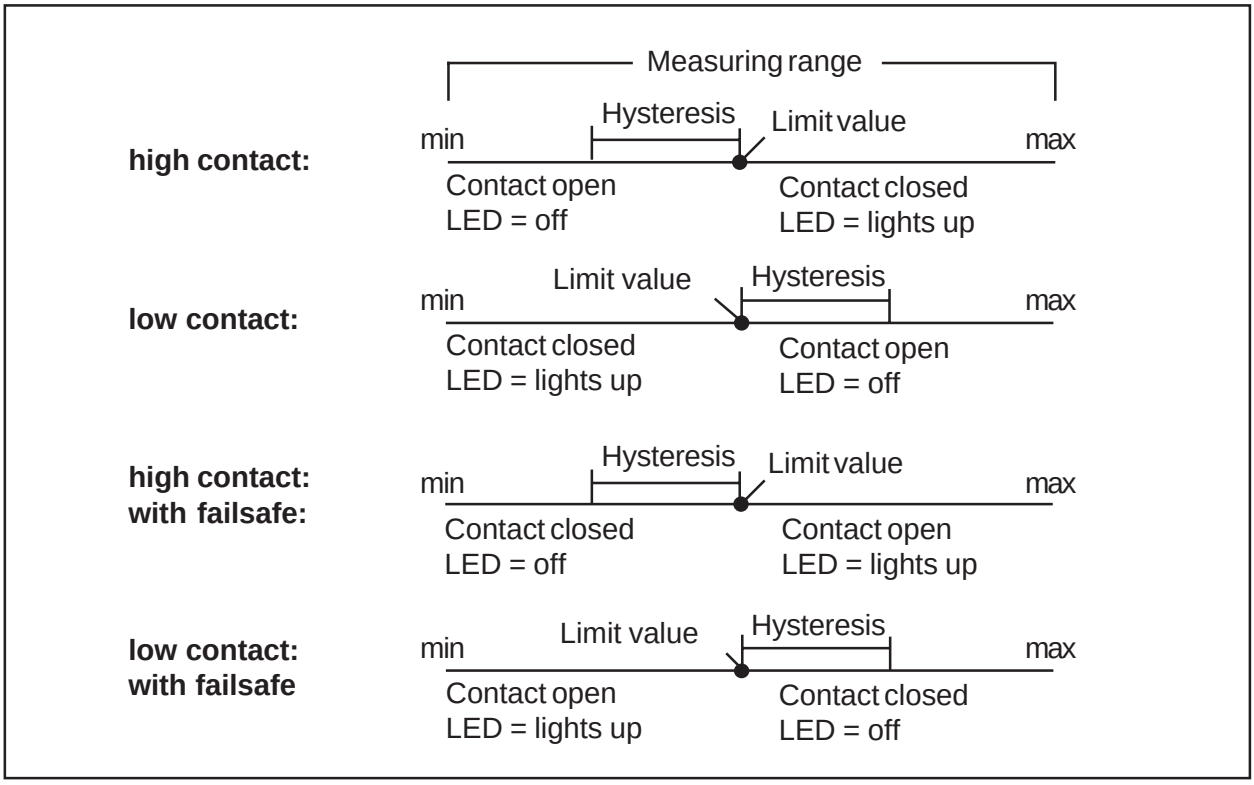
The limit contacts are working with free adjustable switching hysteresis (parameter '**HYS**' in submenu **L1** or **L2**).

8.2 Switching Behaviour

The switching behaviour is set by the parameters '**LS**' and '**FAIL**'.

LS determines whether the alarm is activated if the actual value is higher (**Hi.AL**) or lower (**LO.AL**) than the limit value.

FAIL determines the fail-safe function whether the relay is closed (**OFF**) or open (**ON**) if the alarm is activated. With **fail-On** the alarm is active if the HE 017 has no power.



8.3 Hold Function

If the hold function has been programmed, the respective relay remains active even after leaving the limit value. The stored upper-limit violation of the limit value is reset by pressing button combination **P** and ▼ in actual value mode.

9 Error Message ERR.C

Once the power-on test has been conducted successfully, the HE 017 checks the stored data. If the instrument detects an error, the '**ERR.C**' error message will appear on the display after two unsuccessful repetitions of the read cycle.

Pressing the **P**-button quits the '**ERR.C**' display status. The device adjustments must be checked.

The HE 017 must be new calibrated. The device versions 'current, 'voltage' and 'pressure' can be calibrated by the user. The version 'temperature' must be recalibrated in the factory.

Causes of the error message ERR.C, apart from a defect in the instrument itself, may be an excessively high level of interference on the supply voltage, i.e., non-suppressed power relays. The supply lines should be interference-suppressed if this malfunction occurs frequently.

10 Technical Specification

Inputs:	● 0 to (5)10 V / 0(4) to 20 mA ● Strain gage, sensitivity 3.3 mV/V **(option)** ● Pt 100 3-wire **(option)**
Output:	0 to 10 V / 0(4) to 20 mA **(option)**
Displays:	● 4 digits 7 segment display, 10 mm character height ● 3x 3mm-LED to indicate alarms and user-calibration
Display range:	● -999 to 9999, free scalable ● Pt 100 (-100 to +800 °C)
Dislpay accuracy:	0,2 % ± 1 Digit
Resolution:	10 bit
Measuring speed:	10 scanning cycles per second
Input-filter:	Software selectable time-constant for input-filter
Detection of sensor-breakage and sensor short-circuit:	PT 100 display 'Hi' for sensor breakage and 'Lo' for short-circuit
Peak value-memory:	Min. and max. peak value memory
Transducer supply:	● 11 V / 40 mA (2-/3-wire transmitter) ● ± 5 V / 40 mA for strain gage
Limit value:	2 relays (SPDT) 250 V AC / 5 A with latch function, selectable switching behaviour, fail-safe, hysteresis, on/off delay, hold-function **(option)**
Interface:	1 serial interface RS 485 to read and set instrument parameters **(option)**
Programming:	● touch-type keyboard with 5 buttons (menue-guided) ● serial interface **(option)**
Code protection:	against unauthorized access by a code of up to 4 digits
Calibration:	● factory calibration according to customer requirements ● user recalibration for current, voltage or pressure applications ● device can be reseted to factory calibration
Power supply:	230 / 115 V AC ± 10%, 50 to 60 Hz, customer selectable
Immunity to interference:	according to VDE 843 und IEC 801 (1-6)
Electrical connection:	removable rear-panel terminal connector 2,5 mm^2
Housing:	Installation per DIN 43700 (standard DIN size)
Dimensions:	48 x 96 x 160 mm (h x w x d), panel cutout 44 x 92 mm
Degree of protection:	Front panel conforms to IP54
Ambient temperature:	0 to 50 °C
Humidity:	≤ 75% rel. humidity, no condensation
Amount of delivery:	Instrument, mounting brackets, instruction manual
Options:	● 2 limit values ● Serial interface RS 485 ● Analog outputs

Subject to technical alterations !

Appendix: Serial Interface

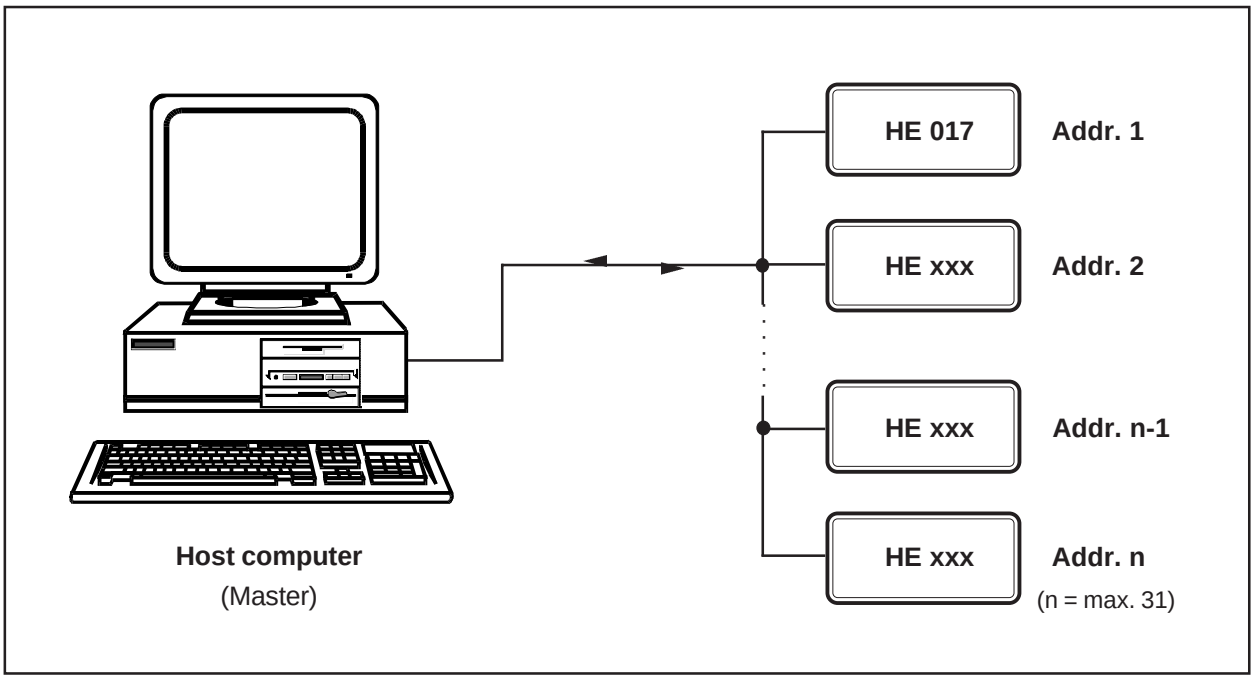
A.1 RS 485 Interface

The built-in RS485 interface provides HESCH instruments with a buscapability link to a host computer.

A maximum of 31 HESCH instruments can be addressed on a master/slave configuration by a higher-level computer. The host computer is the master.

Data format is set to 19200 Bd (default), 8 Bit, 1 Stop Bit, no parity.

A twisted pair or screened two-conductor cable is used as the transmission line.



A.1.1 Data Record

The initiative for a data exchange operation is always taken by the higher-level computer (master).

A check sum (abbreviated **cs**) is formed for every data package. The check sum is derived from the sum of all bytes transmitted in the data package. Only the LOW-Byte is transmitted. Though a checking of a correct data transmission is possible.

A.1.2 Address Format

Before commencement of a data exchange cycle, the respective slave instrument must first be addressed. The job is supplemented defined in the address format.

Differentiation is made between the ASK mode and the SET mode. In accordance with the meanings of these terms, the slave is asked for data in ASK mode, and thus requested to transmit a message. In the SET mode a message is transmitted to the slave.

This is effected using the addressing format shown below:

Byte	0	1	2	3	4	5	6	7	8
	0	ADR	JOB	D1	D2	D3	D4	D5	cs

Addressing format: ASK mode (JOB-MSB=0) and SET mode (JOB-MSB=1)

Example: SET mode
Limit value 1 on slave ADR=1 is to be set to a value of 1789.

ADR = 1
JOB = 131

D1 = Limit value 1 / 256 = 6 (integer division!)
D2 = Limit value 1-256*D1 = 253
D3 = 0
D4 = 0
D5 = 0

D3 to D5 are reserved (arbitrary value)

cs = 0 + 1 + 138 + 6 + 253 + 0 + 0 + 0 = 398
cs = low (398) = 142

Corresponding data format:

Byte	0	1	2	3	4	5	6	7	8
	0	1	138	6	253	0	0	0	142

A.1.3 SET Mode Acknowledgement

When the slave instrument has received a message in SET mode, it acknowledges the job with the following data format:

Byte	0	1	2	3	4	5	6	7	8
	ADR	0	KW	0	0	0	0	0	cs

Acknowledgement format in SET mode

ADR: Address of the slave instrument

KW: 0 = carrying out job
255 = incorrect check sum
240 = impermissible job received

A.1.4 ASK Mode Acknowledgement

If the slave instrument has received a message in ASK mode, it acknowledges this message in accordance with the ASK job.

Byte	0	1	2	3	4	5	6	7	8
	ADR	0	KW	D1	D2	D3	D4	D5	cs

Acknowledgement format in ASK mode

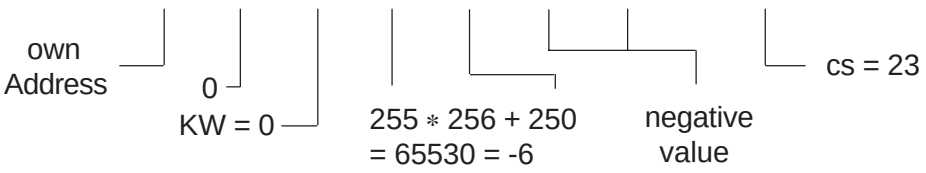
ADR: Address of the slave instrument

KW: 0 = carrying out job
255 = incorrect check sum
240 = impermissible job received
85 = sensor short-circuit, e.g.
187 = sensor breakage

D1 - D5: Data (see JOB-table)

Example: The HE 017 instrument (address = 32) has received Job 1 (scan actual value). The appurtenant acknowledgement is:

Byte	0	1	2	3	4	5	6	7	8
	32	0	0	255	250	255	255	0	23



A.1.5 Key-Lock Mode (remote)

In key-lock-mode (remote) it is not possible to operate the HE 017 with the keyboard. The key-lock-mode is set by JOB 255.

It may be reasonable to lock the HE 017 during sending parameters from the host computer to the instrument. So writing the same parameter by user with keyboard and by host is not possible. For locking it is neccessary to transmit a **1** in the second databyte from JOB 255. Any other value unlocks the keyboard.

Example: Following transmission locks the keyboard of the HE 017.
The HE 017 turns to display actual-value mode.

Byte	0	1	2	3	4	5	6	7	8
	ADR	0	255	**1**	0	0	0	0	cs

Following transmission unlocks the keyboard of the HE 017.

Byte	0	1	2	3	4	5	6	7	8
	ADR	0	255	**0**	0	0	0	0	cs

A.1.6 JOB-Table

JOB-No.	ASK-MODE	JOB-No.	SET-MODE	RANGE
0	--	128	--	--
1	Actual Value	129	--	-999 to 9999
2	Peak Value high	130	Reset Peak	-999 to 9999
3	Peak Value low	131	Reset Peak	-999 to 9999
10	Alarm 1	138	Alarm 1	-999 to 9999
11	Switching Behaviour	139	Switching Behaviour	0 to 1
12	Hysteresis	140	Hysteresis	1 to 9999
13	Hold-Mode	141	Hold-Mode	0 to 1
14	Fail-Safe	142	Fail-Safe	0 to 1
15	Delay On	143	Delay On	0 to 255
16	Delay Off	144	Delay Off	0 to 255
20	Alarm 2	148	Alarm 2	-999 to 9999
21	Switching Behaviour	149	Switching Behaviour	0 to 1
22	Hysteresis	150	Hysteresis	1 to 9999
23	Hold-Mode	151	Hold-Mode	0 to 1
24	Fail-Safe	152	Fail-Safe	0 to 1
25	Delay On	153	Delay On	0 to 255
26	Delay Off	154	Delay Off	0 to 255
50	Measuring Range	178	Measuring Range	-999 to 9999
53	Zero Point	181	Zero Point	-999 to 9999
56	Decimal Point	184	Decimal Point	1 to 5
63	Filter	191	Filter	0 to 15
65	CAL-P	193	CAL-P	10 to 100% of span
66	Access Code	194	Access Code	0 to 9999
67	Priority	195	Priority	0 to 1