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Instruction manual

Temperature control system for CEM

Doc. no.: 9.17.017F Date: 25-07-2011

ATTENTION
Please read this instruction manual carefully before installing and operating the instrument.
Not following the guidelines could result in personal injury and/or damage to the equipment.

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Bronkhorst High-Tech B.V.
July 2011

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The products of Bronkhorst High-Tech B.V. are warranteed against defects in material and workmanship for a period of three years from the date of shipment, provided they are used in accordance with the ordering specifications and the instructions in this manual and that they are not subjected to abuse, physical damage or contamination. Products that do not operated properly during this period may be repaired or replaced at no charge. Repairs are normally warranteed for one year or the balance of the original warranty, whichever is the longer.
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1 INTRODUCTION

1.1 General description

The Bronkhorst High-Tech B.V. serie E-7000 is a modular built digital readout and control system for mass flow/pressure sensors and controllers. Basically a system consists of one or more (14TE) single channel readout/control units.
The CEM temperature controllers are capable to control and to power the heater section of CEM systems (Controlled Evaporator Mixer).

1.2 System configuration

	Housing	Supply		Module A		Module B		Module C		
E-7	#	#	0 -	##	-	##	-	##	-	… etc.

Housing	Code
½ 19" table top (42 TE)	1
½ 19" table top (84 TE)	2
½ 19" rack (42 TE)	3
½ 19" rack (84 TE)	4
Table top cassette (14 TE)	5
Panel mount cassette (14 TE)	6
Other/Specifiy	9

Supply voltage	Code
100 ... 240 Vac	0
220 ... 240 Vac	1
110 ... 120 Vac	2
24 Vac	3
24 Vdc	4
Other/Specify	9

Modules with blind front (14 TE)	**Code**
Blind front only	01
Blind front + power supply (linked to module with mains entr.)	03
Blind front + power supply + mains entrance (incl. cable) + FLOW-BUS connection	04
Blind front + power supply + RJ45 conn. for +15Vdc supply voltage + mains entrance (incl. cable)	05
Blind front + power supply + RJ45 conn. for +15Vdc supply voltage (linked to module with mains entrance)	06
Modules with single channel Readout/Control-panel (14 TE)	**Code**
R/C-panel + power supply + mains entrance (incl. cable) analog model	10
R/C-panel + power supply (linked to module with mains entry) analog model	11
R/C-panel (linked to module with power supply) analog model	12
R/C-panel + power supply + mains entrance (incl. cable) digital model	13
R/C-panel + power supply (linked to module with mains entry) digital model	14
R/C-panel (linked to module with power supply) digital model	15
Modules with R/C-panel and Ex-proof functions (14 TE) **	**Code**
R/C-panel + transmitter supply unit for MFM/EPT (Ex-proof)	20
R/C-panel + supply for MFM/EPT (Ex-proof) + valve with XB-coil	21
R/C-panel + supply for MFM/EPT (Ex-proof) + valve with XC-coil	22
Modules for temperature control for CEM-systems (14TE)	**Code**
Temp. R/C-panel + 10 W supply for low capacity CEM-system for W-101 / W-102	33
Temp. R/C-panel + 10 W supply for low capacity CEM-system for W-202	34
Temp. R/C-panel **excl.** supply for high capacity CEM-system * for W-303	35
R/C-panel (E7000)+ 1000W supply / 230Vac operation for W-303	36
R/C-panel (E7000)+ 1000W supply / 120Vac operation for W-303	37
Blind front + Flow-Bus/RS232 Interface	40
Blind front + Flow-Bus/Profibus-DP Interface	41
None	00
Other/Specify	99

* 1000W power supply will be supplied and charged separately

** Always in combination with powermodule

1.3 Modul configuration

Module X		Sensor Out	IO Output	IO Input
##	-	#	#	#

Module
See table Modules, System configuration

***Sensor output signal**	**Code**
0 - 5 Vdc	A
0 - 10 Vdc	B
0 - 20 mA dc (Sinking)	C
4 - 20 mA dc (Sinking)	D
15 - 20 mA dc	E
0 - 20 mA (Sourcing)	F
4 - 20 mA (Sourcing)	G
FLOW-BUS	R
Other/Specify	Z

*Not applicable for CEM modules.

I/O output signal	**Code**
0 - 5 Vdc	A
0 - 10 Vdc	B
0 - 20 mA (Sourcing)	C
4 - 20 mA (Sourcing)	D
Other/Specify	Z

I/O input signal	**Code**
0 - 5 Vdc	A
0 - 10 Vdc	B
0 - 20 mA (Sourcing)	C
4 - 20 mA (Sourcing)	D
Other/Specify	Z

The temperature control unit offers the ability to set the desired temperature for the heater system of the CEM. The temperature inside the CEM is monitored with a PT-100 temperature sensor, the signal of which is being used by the temperature controller to control the adjusted temperature.
Power for the CEM heater is provided for by the R/C module.

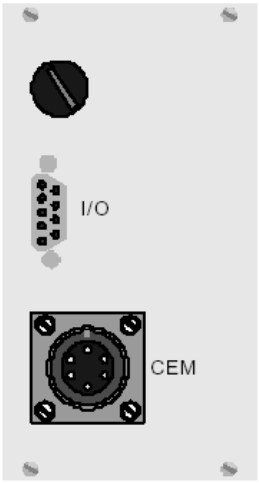
For safety reasons the CEM heater W-300 42 Vac is powered with 42 Vac. Because of the high currents involved, the high power CEM (1000 Watt) has a separate power supply, which is being controlled by the temperature R/C module, intended for use with this system.

The power for the CEM heater W-300 direct 120 Vac / 230 Vac power supply operation is provided by the R/C module and does not require a separate power supply.
For detailed information consult manual 9.17.042.

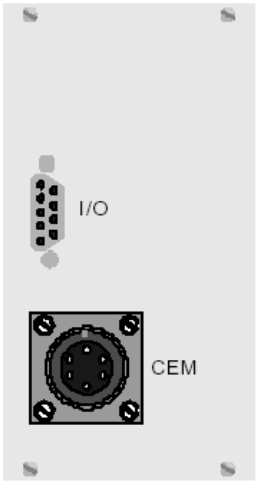
1.4 In/Output signals

If applicable, connection of cables, carrying in- or/and output signals is further explained in the customer system description.

1.4.1 Rear panel connector



module code 33/34



module code 35

1.4.2 Connection to remote equipment, I/O.

The female I/O (sub-miniature 9-pin) D-connector has the following pin configuration:

Pinnumber	description
1	output signal
2	input signal
3	0 V (common)
4	not connected
5	relay contact MC
6	relay contact NO
7	relay contact NC
8	reset input
9	ground (shield)

1.4.2.1 Analog input/output signals

Analog input signals should be connected to pin 2 (+) and 0 V/common.
Analog output signals are available at pin 1 (+) and 0 V/common.
Signals are according to one of the Bronkhorst HIGH-TECH B.V. standards. The model configuration contains a code, describing the input/output signals.

Notes:
a. Max. load current output (sourcing) : 375 Ohm
b. Min. load voltage output : 10 kOhm
c. Input load resistance (voltage) : 22K4
d. Input load resistance (current) (sinking) : 200 Ohm

1.4.2.2 Relay contacts

The (isolated) relay contacts are available at the following pins:
pin 5: common
pin 6: normally open
pin 7: normally closed

Note: contact arrangement during "power on"/"no alarm".
The specifications of the relay contacts are:
Contact arrangement : SPCO (Single Pole Changeover)
Contact rating : Switch voltage : 24 Vac/dc max.
Switch current : 0,2 A ac/dc max.
Switch power : 3 W/3 VA max.

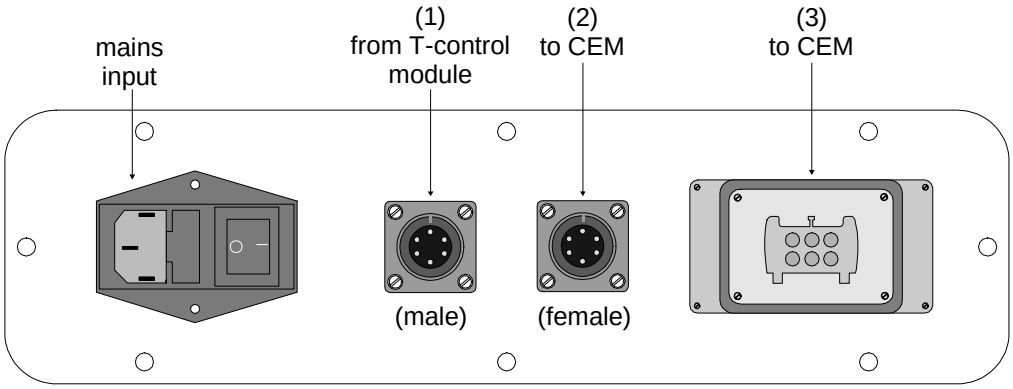
1.4.2.3 Reset input

The reset input signal should be connected to pin 8 (+ V) and pin 3 (0 V/common).
Reset can be achieved by either pulling the + V input (pin 8) to 0 V (pin 3) by means of a contact or a transistor, or by applying an active low logic signal to pin 8 (+ V) and pin 3 (0 V). The logic signal level should be 5 V (high) or 0 V (low).

1.4.3 CEM connector for modules 33,34 and 35.

Pinnumber	description
A	heater
B	heater
C	PT100 (T-sensor)
D	PT100 (T-sensor)
E	safety switch
F	safety switch

1.5 Connector panel 1000 Watt power supply 42Vac power supply



Connector panel separate power supply

connector (1)

Pinnumber	description
A	NC
B	NC
C	PT100 (T-sensor)
D	PT100 (T-sensor)
E	Heater control signal
F	Heater control signal

connector (2)

pinnumber	Description
A	NC
B	NC
C	PT100 (T-sensor)
D	PT100 (T-sensor)
E	safety switch
F	safety switch

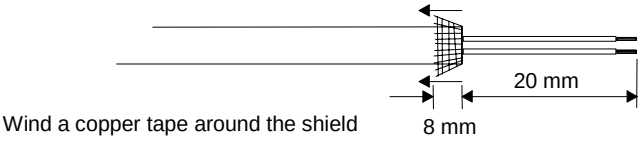
connector (3)

Pinnumber	description
A	Heater 1
B	NC
C	Heater 2
D	Heater 1
E	NC
F	Heater 2

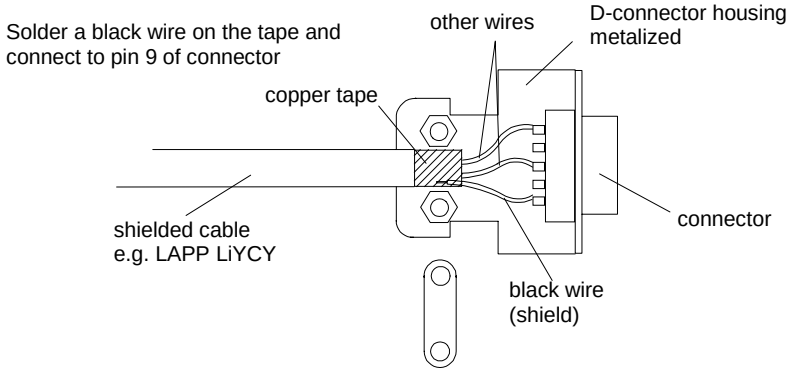
1.5.1 EMC and cables

All system setups described in this manual carry the CE-mark. Therefore they have to comply with the EMC requirements as are valid for this kind of equipment.
However compliance with the EMC requirements is not possible without the use of proper cables and connector assemblies.
For good results Bronkhorst HIGH-TECH B.V. can provide standard cables. Otherwise follow the guidelines as stated below. For cables with 9-pin sub D-connectors:

Fold the shield of the cable back over the cable (the shield must be around the cable).



Wind a copper tape around the shield



NOTE:
For FLOW-BUS SFTP data (patch)cable connection to RJ45 connectors follow the instructions of the supplier. It is important to use shielded twisted pair cables and shielded RJ45 modular jack connectors.

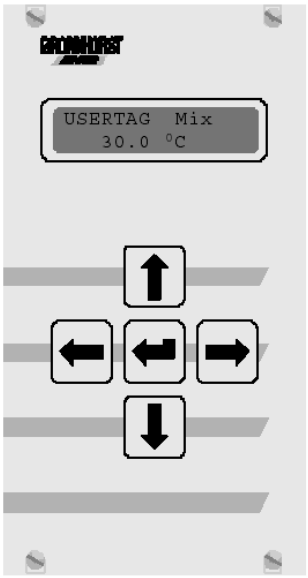
1.6 Readout and control unit CEM 120Vac / 230Vac power supply

For information of the direct 120Vac / 230Vac operation CEM unit consult manual 9.17.042.

2 OPERATION

2.1 Foreword

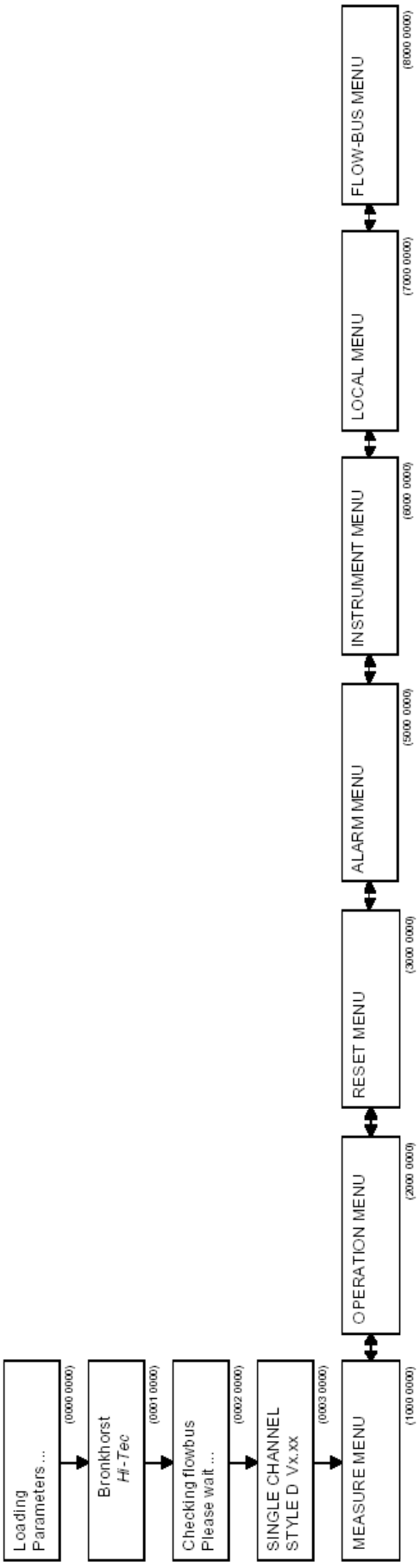
This part describes the operation manual for an E7000 based R/C panel (module code 33,34,35,36 and 37).



2.2 General information

Use 'cursor' keys to scroll through the menu-structure and to select the required menu level.
The 'enter' key is used to acknowledge a selected setting and to enter a edited value and/or text.
Editing can be performed by using the 'cursor' keys to select the character to be edited (← / →) and to scroll through the available character set or units (↑ / ↓).
After power-up the display will show the usual start-up sequence for some seconds.

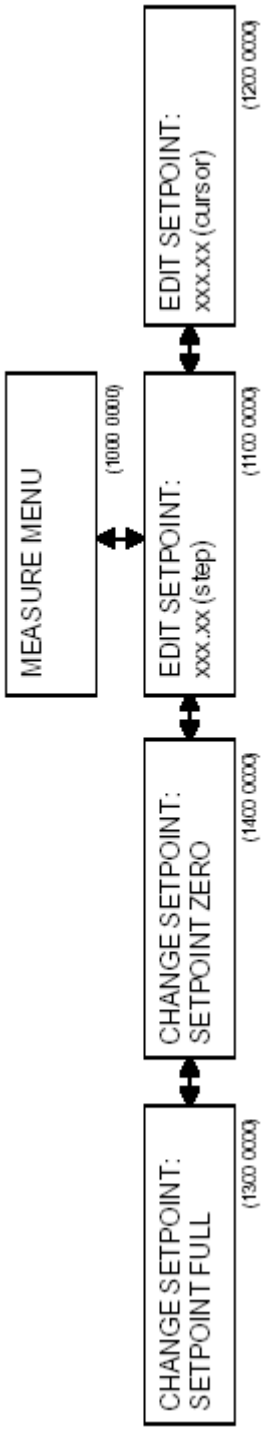
2.3 Startup and menu selection



Menu descriptions

0001 0000	Startup screen showing company name
0002 0000	Startup screen showing communication check with FLOW-BUS in progress. Takes a short time (few seconds), depending on system size. If the FLOW-BUS address of the module is occupied, you can reinstall the module on a new address.
0003 0000	Startup screen showing software revision level
1000 0000	Measure menu or 'Readout Display' for reading the temperature and/or setpoint. When there is an alarmlimit reached it will be shown here. For editing the setpoint/slave factor go down one level.
2000 0000	Operation menu for selecting setpoint source (and master/slave), fluidset and setpoint slope for the device to be operated. Also for editing setpoint offset.
3000 0000	Reset menu for quick reset of the alarm by keyboard. Also password input location to enable advanced use of this module.
5000 0000	Alarm menu for configuration of all alarm options. This menu is secured by means of a password.
6000 0000	Instrument menu for configuration of the instrument to be operated, such as instrument type, capacity, sensor type, identification and fluid sets with calibration values. This menu is secured by means of a password.
7000 0000	Readout menu for configuration of the measure menu. You can select the wanted information for your display.
8000 0000	FLOW-BUS menu to install module on the FLOW-BUS or start/stop communication with the bus. This menu is secured by means of a password.

2.4 Measure menu



Menu descriptions

1100 0000 Stepsize editor for editing setpoint/slave-factor by a 0.1% step up or down. By holding down UP/DOWN key continuously, the step size will increase. Changes are used by the controller immediately. What is displayed here in this menu depends on the selection of the setpoint source. Analog setpoints can not be edited.

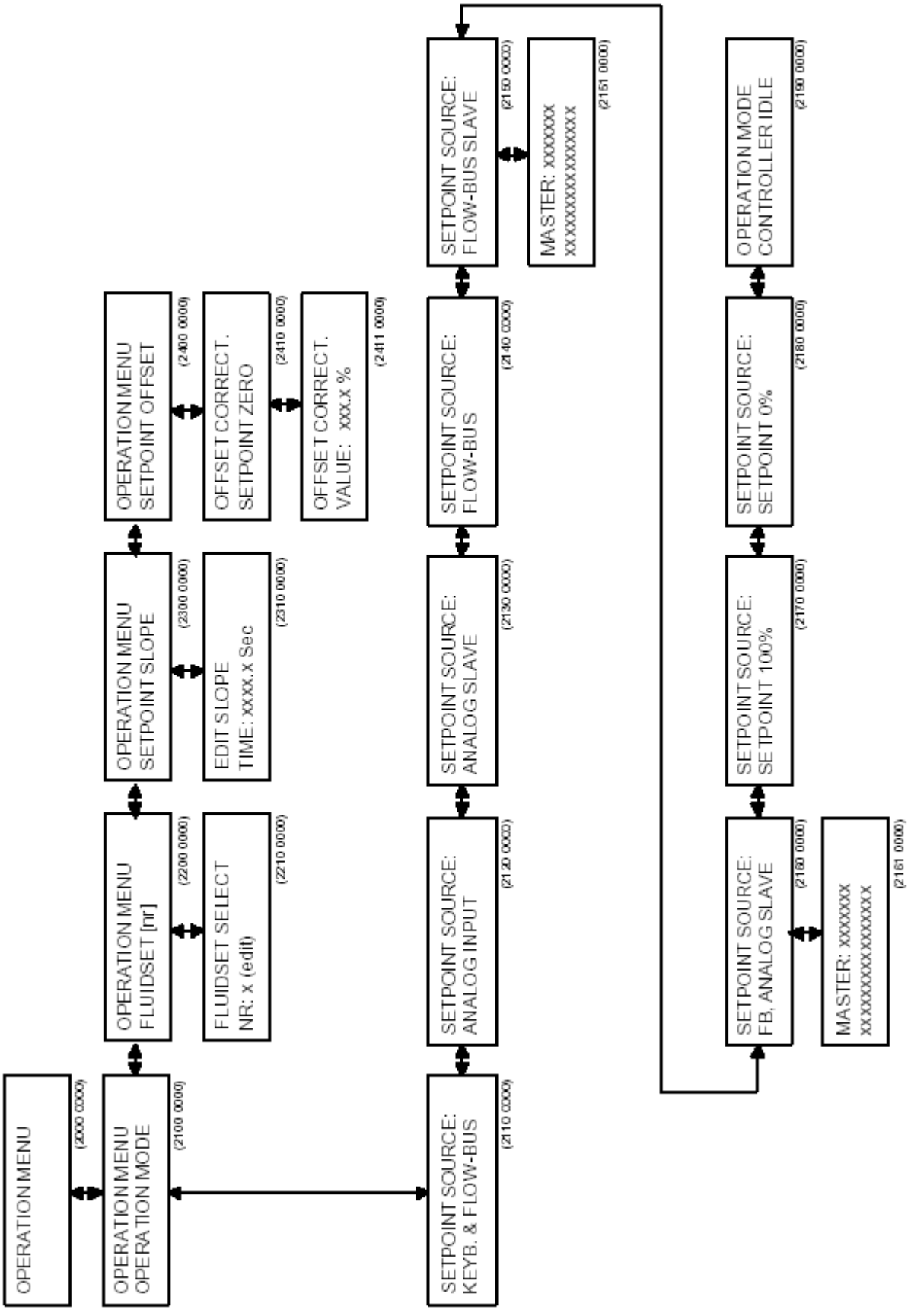
1200 0000 Cursor editor for editing setpoint/slave-factor by entering the exact (new) value. After pressing 'enter', the changes will be used by the controller. Could be used for large setpoint steps. What is displayed here in this menu depends on the selection of the setpoint source. Analog setpoints can not be edited.

1300 0000 Setpoint full. After pressing 'enter', setpoint for controller will be 100% unconditionally (controller valve will be opened in almost all situations).

1400 0000 Setpoint zero. After pressing 'enter', setpoint for controller will be zero unconditionally (controller valve will be closed in almost all situations). You will return to the readout display now. Setpoint will not respond to selected source again until 'enter' has been pressed in the edit setpoint menu.

NOTE:
Measured values could be readout up to 110.0%, sensor signals > 110.0% will be cut-off.
Setpoint can be entered up to 100.0%. Also you can use setpoint offset correction to eleminate cable offsets in your system (see operation menu).

2.5 Operation menu



Menu descriptions

2100 0000 Operation mode. Here you can change the source of the setpoint for the operating instrument

2110 0000 This option selects a setpoint change with the keyboard or by means of a FLOW-BUS device (operation module or Personal Computer).

2120 0000 This option selects a setpoint change coming from an analog input.

2130 0000 This option selects a setpoint change coming from an analog input, multiplied by a slave-factor (analog master/slave).

2140 0000 This option selects a setpoint change by means of a FLOW-BUS device (operation module or Personal Computer).

2150 0000 This option selects a setpoint change coming from an output signal of a master device, via FLOW-BUS, multiplied by a slave-factor (FLOW-BUS master-slave).

2151 0000 Choose a master channel. With LEFT/RIGHT you can search for the master device on the FLOW-BUS. Your instrument module will be slave.

Each time a possible master device has been found on the bus, the type and identification number will be displayed. When '----' is displayed, this means that no master could be found. With UP you can stop the search, and with 'enter' you select the currently displayed device. Slave factor must be entered at the position where setpoint is normally entered

2160 0000 This option selects a setpoint change coming from an output signal of a master device, via FLOW-BUS, multiplied by a slave-factor (FLOW-BUS master-slave), coming from an analog input.

2161 0000 Choose a master channel. With LEFT/RIGHT you can search for the master device on the FLOW-BUS. Your instrument module will be slave.

Each time a possible master device has been found on the bus, the type and identification number will be displayed. When '----' is displayed, this means that no master could be found. With UP you can stop the search, and with 'enter' you select the currently displayed device.

2170 0000 This function sets a setpoint of 100%

2180 0000 This function sets a setpoint of 0%

2190 0000 Controller idle. This option disables the controller.

2200 0000 Fluidset selection. Here you can change the actual fluidset. Your current settings will be saved and the settings of the selected fluidset will become the new active settings for your instrument. When fluidset changes, the instrument will use the calibration settings in the memory for sensor signal/setpoint adjustments for that fluid.

2210 0000 Select the active fluidset by selecting a number from 1 to 8. Settings will be active after pressing 'enter'. This is for selection fluidsets only. For changing fluid calibration settings use Instrument menu.

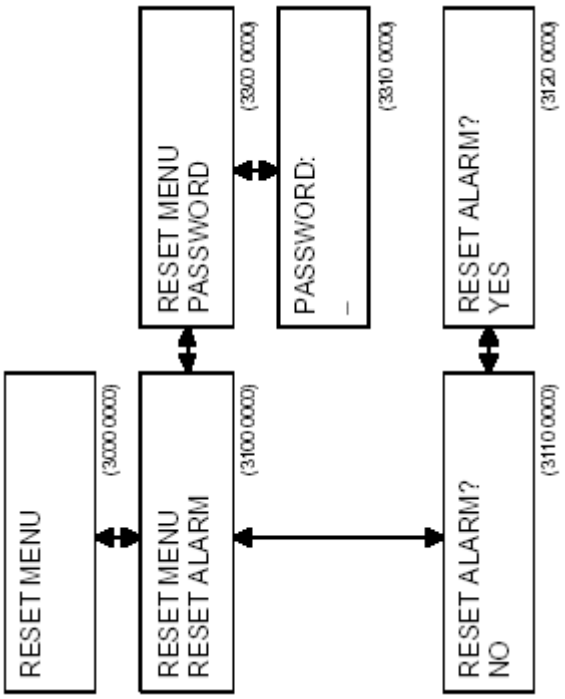
2300 0000 Setpoint Slope. Here you can enter a setpoint slope for this device. When the setpoint has been changed and not overruled by counter limit or an alarm, the setpoint will (smoothly) increase to the set value.

2310 0000 Edit the setpoint slope time.This is the time it will take for the setpoint value to increase from 0% to 100% (and vice versa). The value can be entered from 0...3000.0 seconds.

2400 0000 Setpoint offset correction. Here you can enter a setpoint offset. This could be used to remove cable offsets.

2411 0000 Edit setpoint zero offset. A value can be entered from -2.5%...+2.5%.

2.6 Reset menu



Menu descriptions

3100 0000 Reset Alarm.

Here you can reset an alarm if it is active. This will result in removing the alarm situation defined to take place at the potential free contact and/or at the (temporary) alarm setpoint. If the alarm condition is still present, the alarm will activate again after a few seconds until alarm condition is removed (temperature into save area again) or when alarm mode will be changed.

3300 0000 Password input location.

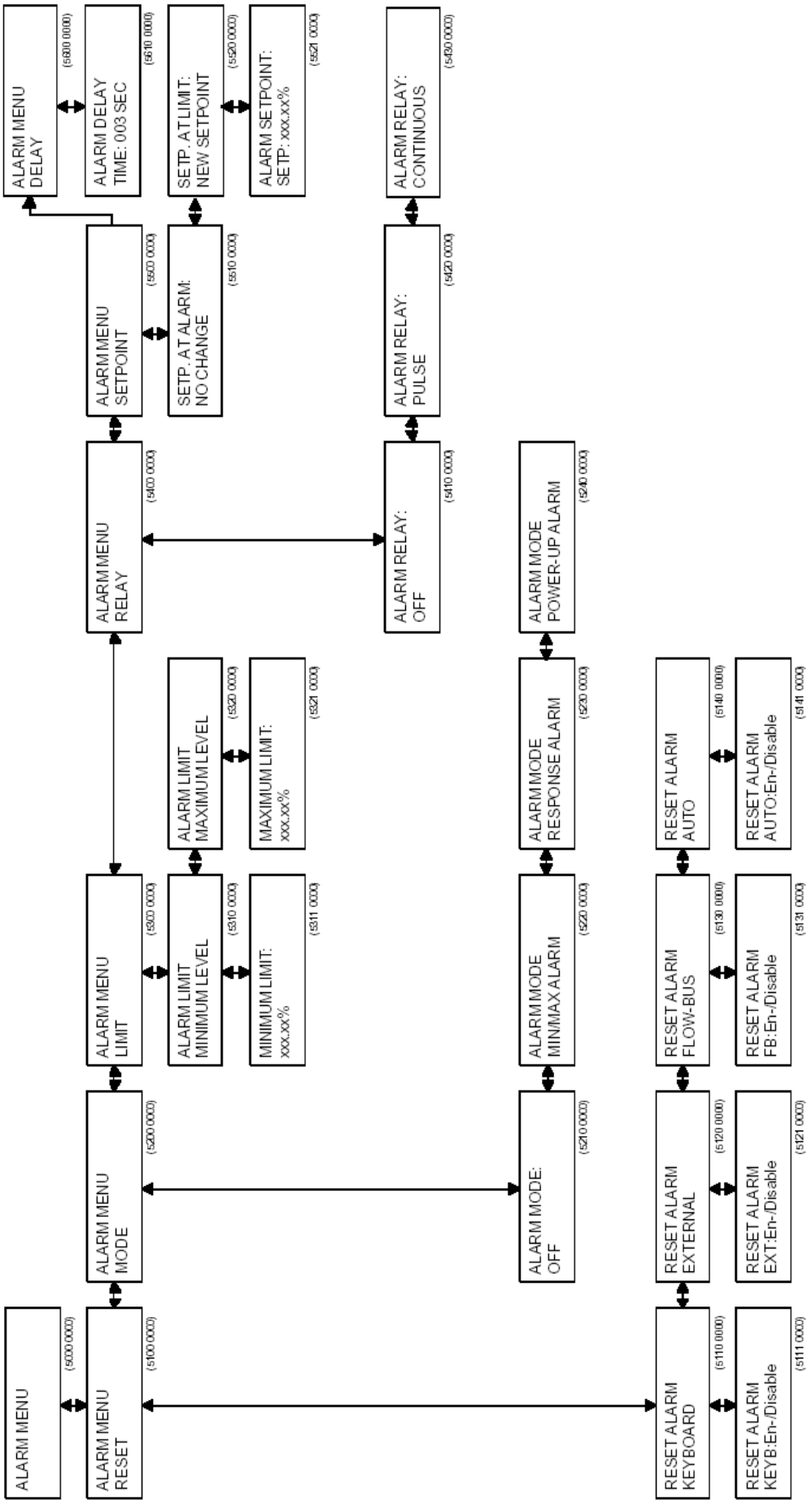
Here you can enter a password to be allowed to edit the alarm, instrument and FLOW-BUS configurations. The password consists of 5 characters and can not be changed. Cursor can be controlled with LEFT/RIGHT keys. Characters can be selected with UP/DOWN keys. When password has been entered correctly, you have access to all menu's and it is possible to change settings for an instrument. Without password input it is only possible to **operate** an instrument.

Password will be erased and access to settings-menu's will be denied when:

1) Module has been switched-off and on again (at power-up).
2) A wrong password has been entered.
3) Automatically after 3 minutes when no key has been pressed.

Password is: **ABABC** and can not be changed.

2.7 Alarm menu



Menu descriptions

5100 0000 Alarm Reset Enable.
Here you can enter which way the alarm may be reset.

5110 0000 Keyboard Reset.
Here you can enable/disable an alarm reset by the keyboard.

5120 0000 External Reset.
Here you can enable/disable an alarm reset by an external signal.

5130 0000 FLOW-BUS Reset.
Here you can enable/disable an alarm reset via the FLOW-BUS by means of an operation module or a Personal Computer.

5140 0000 Auto Reset.
Here you can enable/disable an automatic reset of an alarm. This reset will be activated after a few seconds when the cause of the alarm has been removed.

5200 0000 Alarm Mode.
Here you can enter how the alarm-process must react.

5210 0000 This option will disable the alarm

5220 0000 Min/Max Alarm. This option will enable the alarm to detect if the measured value exceeds a minimal and/or maximal limit. If the measured value exceeds these limits for a given time, the alarm will be activated. The time can be set with the option Alarm Delay.

5230 0000 Response Alarm. This option will enable the alarm to detect if the measured value exceeds a minimal or maximal limit related to the setpoint. If the measured value exceeds these limits for a given time, the alarm will be activated. The time can be set with the option Alarm Delay.

5240 0000 Power-up Alarm. This alarm will enable the alarm to detect if the instrument had a power failure. At power-up this alarm will be active. The alarm-setpoint can be used to give a setpoint at power-up. The delay time can only be used in combination with auto-reset and the Limit settings have no effect.

5300 0000 Edit Alarm Limit.
Here you can edit the minimal and maximal limits.

5310 0000 Alarm Minimum Limit. Select minimum value for the alarm.

5311 0000 Edit Minimum Limit. Here you can change the minimum percentage value for the alarm.
For the Min/Max alarm mode this limit gives the absolute minimal value below which the alarm will be activated. Values below 2% have no effect.
For the Response alarm mode this limit indicates how many percent the measured value may differ below the setpoint before the alarm will be activated.

5320 0000 Alarm Maximal Limit. Select maximal value for the alarm.

5321 0000 Edit Maximal Limit. Here you can change the maximal percentage value for the alarm.
For the Min/Max alarm mode this limit gives the absolute maximal value above which the alarm will be activated. Values below 2% have no effect.
For the Response alarm mode this limit indicates how many percent the measured value may differ above its setpoint before the alarm will be activated.

NOTE: If minimum or maximum limit should not be in use, make limit = 0%. In that case it will be inactive.

5400 0000 Relay At Alarm.
Here you can enter what you want the relay to do at an alarm situation.

5410 0000 This option will disable a relay action at an alarm.

5420 0000 This option will let the relay pulse at an alarm.

5430 0000 This option will let the relay be continuously on at an alarm.

5500 0000 Limit Setpoint.
Here you can configure what to do with the setpoint at an alarm. You can make the setpoint go to a predefined value temporarily until reset situation.

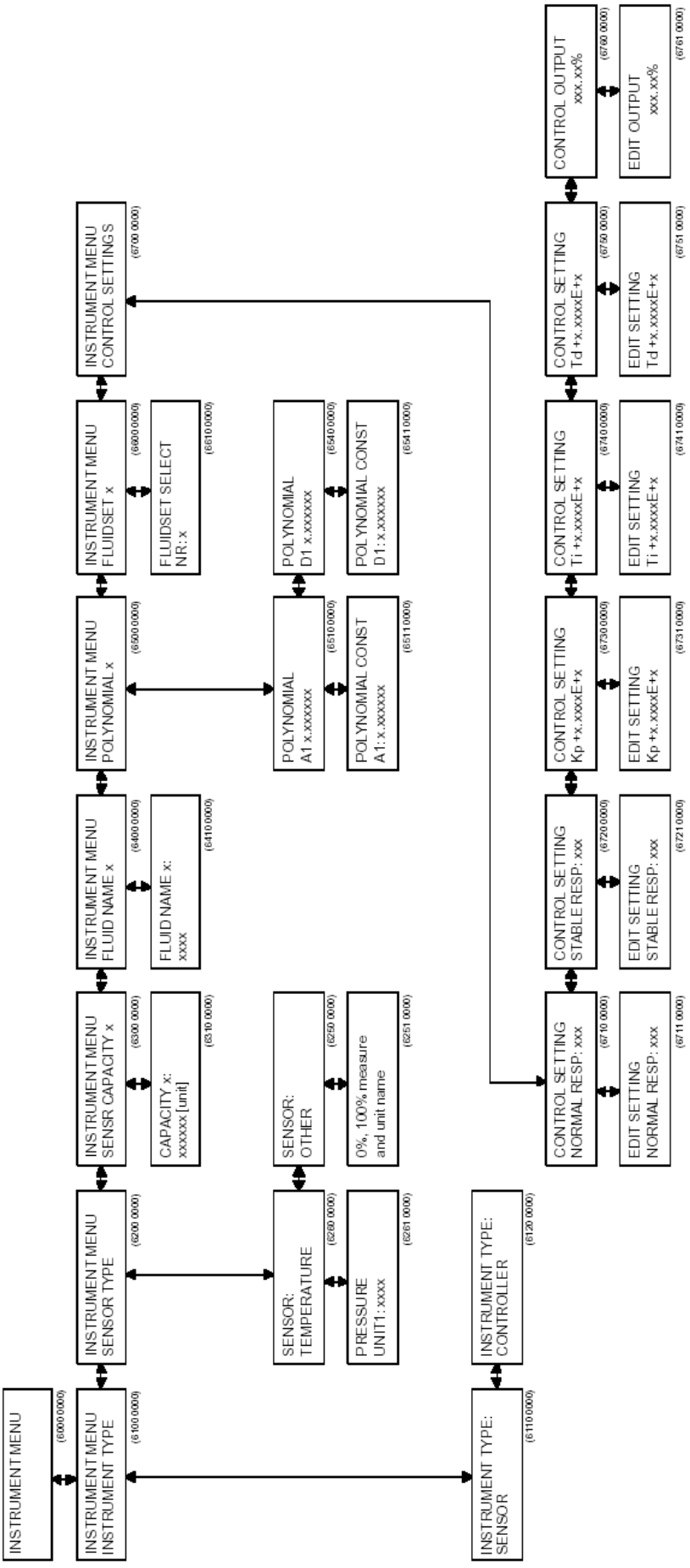
5510 0000 This option will not change the setpoint.

5520 0000 This option will change the setpoint to the entered value.

5521 0000 Setpoint At Alarm Editor.
Here you can enter the setpoint value to be active until reset.

5600 0000 Alarm delay.
Here you can edit the delay in seconds before an alarm message will be given or disappear.

2.8 Instrument menu



Menu descriptions

6100 0000 Instrument Type. Here you can change if the instrument will control or only measure temperature

6110 0000 This will only let you measure the process. You can not give setpoints.

6120 0000 This will let you control the process. You can edit the setpoint.

6200 0000 Sensor Type. Here you can select the used sensor type from the device.
This is mainly to obtain correctly direct reading in absolute values. Together with the capacity you can define what 100% signal means. After 'UNIT' the selected fluid number will be shown on the display.

6260 0000 Temperature sensor. This prepares module for readout in temperature units.

6261 0000 Select the temperature sensor readout unit with UP/DOWN key.

6250 0000 Other Sensor Type. This prepares module for readout in customized units. In this mode you can not enter a capacity.

6251 0000 Here you can define your own sensor type. In order, you must enter the zero scale value (0%), the full scale value (100%) and the unit type.

6300 0000 Sensor Capacity. Here you can enter the sensor capacity. This is the value which goes with 100% signal at the selected readout unit.

6310 0000 Edit the sensor capacity. The capacity can be entered in a range from 0.0001 to 9999.9.

6400 0000 Fluid Name. Here you can edit the fluid name (max. 10 characters).

6410 0000 Edit the fluid name.

6500 0000 Polynomial Constants. Here you can change the polynomial correction constants for this instrument Normally these factors are obtained at calibration and represent a 3rd grade polynomial function.

6510 0000 Here you can edit the polynomial constant A for selected fluidnr.

6511 0000 Edit constant A. (6521 to 6541 likewise for constants B...D)

6600 0000 Fluidset Select. Here you can change the actual fluidset. Your current settings will be saved and the settings of the selected fluidset will be the active settings.

6610 0000 Select the active fluidset with UP/DOWN keys.The fluidname will be displayed also (when filled-in).

6700 0000 Control Settings

6710 0000 Normal Response. With this parameter you can increase or decrease the controller speed during normal response. The controller is in the normal response mode when the difference between the temperature and setpoint is more than 1%.

6711 0000 Edit Normal Response. Here you can enter a value in the range from 0 to 255. Values below 128 will decrease the controller speed, above 128 will increase the controller speed.

6720 0000 Stable Response. With this parameter you can increase or decrease the controller speed during stable response. The controller is in the normal response mode when the difference between the temperature and setpoint is more than 1%.

6721 0000 Edit Stable Response. Here you can enter a value in the same range as for Normal response.

6730 0000 Kp factor of the PID-controller.

6731 0000 Edit Kp factor

6740 0000 Ti factor of the PID-controller.

6741 0000 Edit Ti factor

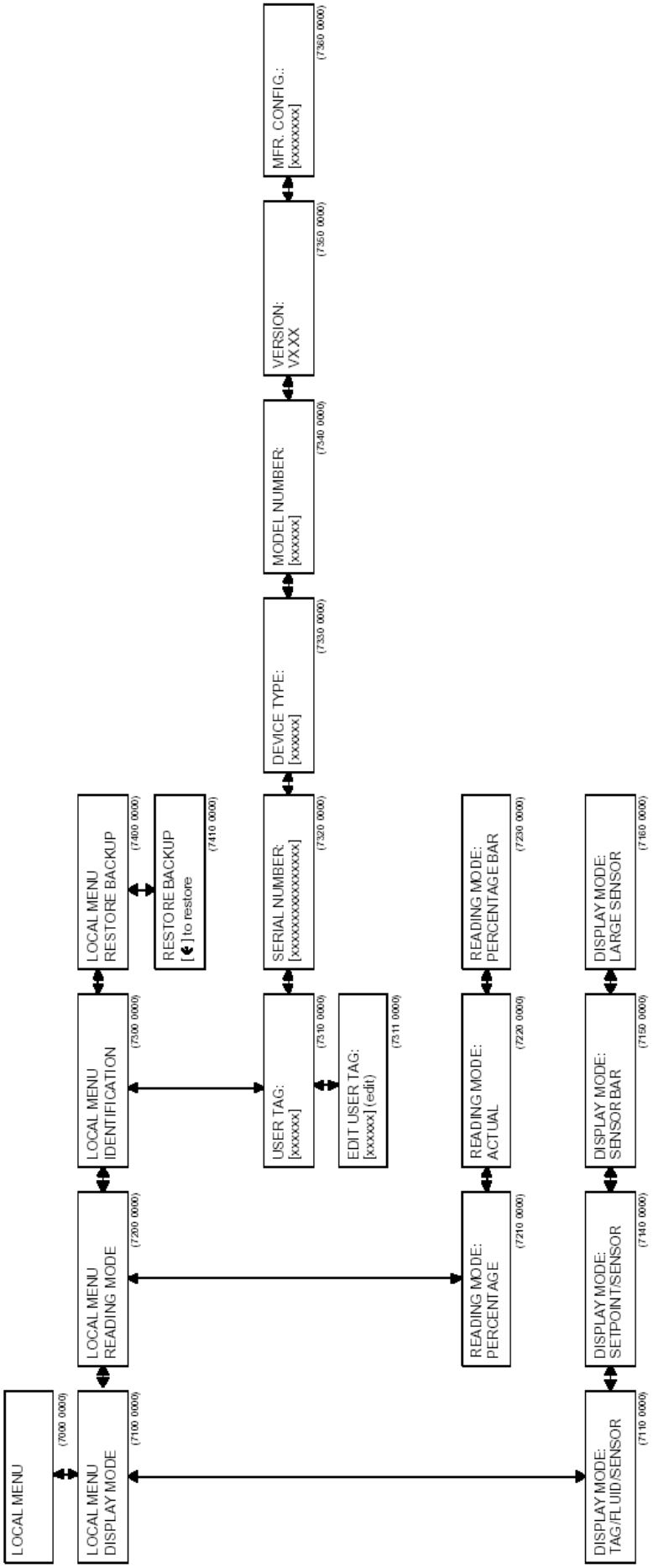
6750 0000 Td factor of the PID-controller.

6751 0000 Edit Td factor

6760 0000 Controller output.

6761 0000 Edit output. With this parameter you can change the controller output when the controller mode is idle.

2.9 Local menu



Menu descriptions

7100 0000 Display Mode.
Here you can change the values that will be displayed on the Readout Display.

7110 0000 This option will display the **usertag**, the **fluidname** and the **measured value** in the measure menu readout screen.

7140 0000 This option will display the **setpoint** and the **measured value.**

7150 0000 This option will display the **measured value** in a percentage bar from 0 to 100%.

7160 0000 This option will display the **measured value** in large characters.

7200 0000 Reading Mode. Here you can switch between direct/percentage reading.

7210 0000 Switch to percentage reading.

7220 0000 Switch to direct reading in absolute values. Absolute values can be selected at sensor type and capacity of the instrument menu.

7230 0000 Switch to percentage bar reading.

7300 0000 Local Identification. Here you can change the User Tag and check the hard- and software identification settings of this module.

7310 0000 User Tag. Here you can view the user tag of this module.

7311 0000 Edit Tag. Here you can change the user tag.

7320 0000 Serial number. Here you can view the serial number of this single channel module. The Bronkhorst HIGH-TECH B.V. serial number is a unique identification for FLOW-BUS modules/ instruments.

7330 0000 Device Type. Here you can view as which type the device is configured.

7340 0000 Model Number. Here you can view the model number of the module.

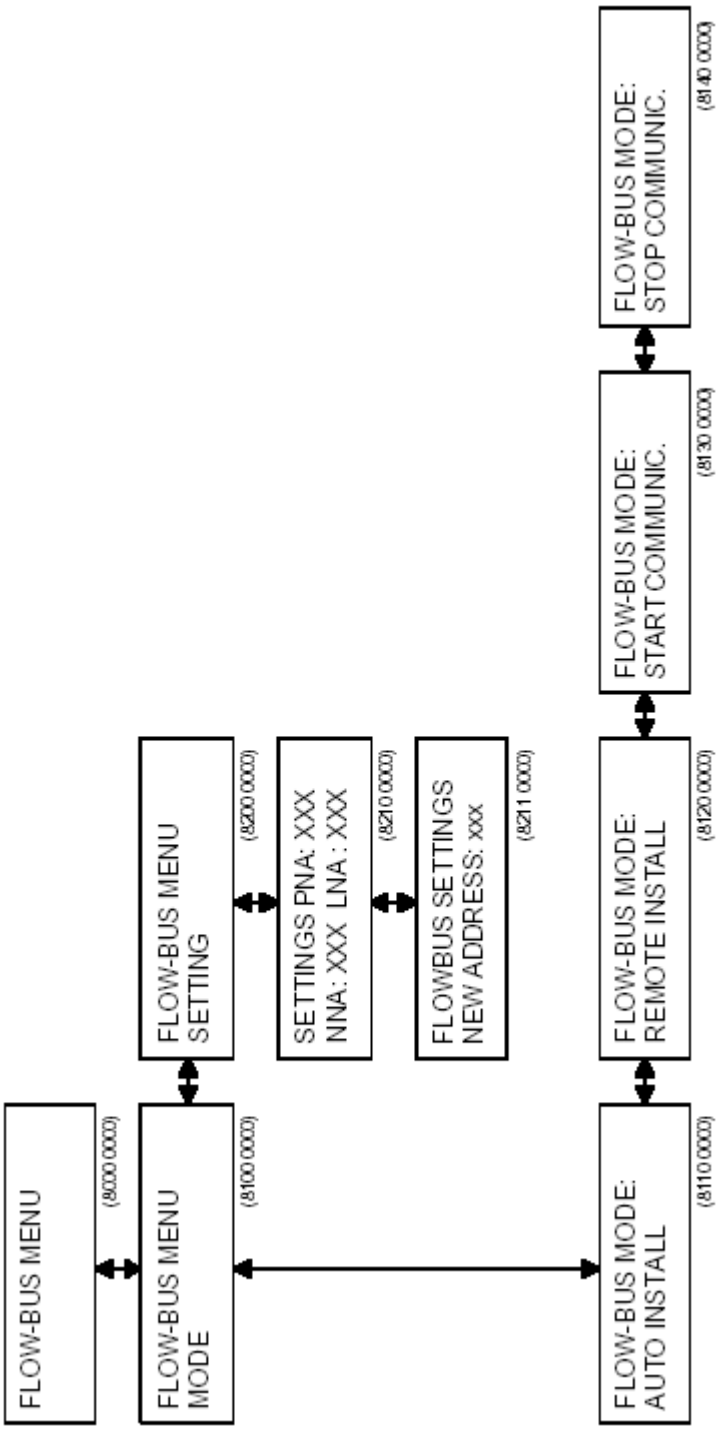
7350 0000 Version. Here you can view the software version.

7360 0000 Manufacture Configuration. Here you can view the manufacture configuration

7400 0000 Restore Backup. This function restores the backup (the factory settings) which was made after the final test in de factory.

7410 0000 Press ‘enter’ to restore backup.

2.10 FLOW-BUS menu



Menu descriptions

8100 0000 FLOW-BUS Mode.
Here you can install this module on the FLOW-BUS or start/stop the communication.

8110 0000 Auto install.
Press 'enter' to install this module on the FLOW-BUS. It will search for a free address on the bus by itself and install there.

8120 0000 Remote Install.
Press 'enter' to let this module get into INIT mode so it can be installed to the bus by an external device (operation module or PC). You have one minute now to perform the installation procedure.

8130 0000 Start Communication.
When you press 'enter' in this menu communication with the bus will be (re)started (use after stopping communication temporarily). When the device is properly installed, it will start communication at power-up and after a reset automatically.

8140 0000 Stop Communication.
When you press 'enter' in this menu communication with the bus will be stopped until ‘Start communication' will be selected or at a reset of the module.

8200 0000 Check Settings. Here you check FLOW-BUS settings of this module.

8210 0000 PNA means Primary Node Address of module on the FLOW-BUS.
NNA means Next Node Address. This address points to the next module on the FLOW-BUS and will be changed automatically if a new module is add to the FLOW-BUS behind this module. If the module is the last module on the FLOW-BUS, its NNA points to zero.

8211 0000* Here you can change the PNA of the module. If you give a new address, the module will restart the communication. The NNA is default set to PNA+1. During communication NNA values may change automatically because FLOW-BUS optimises it self for optimum communication speed.

NOTE 1:
Normally installation on the FLOW-BUS has to be performed only one time. Mostly this will be done at Bronkhorst High-Tech B.V. when your module has been built and tested. The address on the bus for this module will be stored when the module powers-off. At future power-on situations, it will be part of the FLOW-BUS on the same address each time. However, there can be situations you have to install your module on the bus again. For example:
1) When you want to rebuild your FLOW-BUS system.
2) When you want to add this module to another FLOW-BUS system.
3) When, at the check at start-up, the module finds out that its address to be on the FLOW-BUS is occupied already by another module. You will get a message on your display That you have to re-install the module on the bus.

NOTE 2:
Make sure this module has been switched-off before connecting it to the FLOW-BUS.
First make FLOW-BUS connection, then switch-on the power. Only in this order the module is able to perform its communication checkings properly.

For information how to operate E-7000 modules on the FLOW-BUS network, see the information on the diskettes with your FLOW-BUS interface:
PC(ISA)/FLOW-BUS interface
RS232/FLOW-BUS interface.

* LNA means last Node Address. This is an indication of the size of the FLOWBUS network. The next module added to the network should have a PNA below this LNA. When a module is automatic installed on the network, this LNA will be changed automatically.

2.11 Calibration with polynomial functions

2.11.1 General information

A normally calibrated device will have linearized transfer functions within 1% accurate. This means that the real temperature is proportional to the output signal (0-5 V, 0-10 V, 0-20 mA or 4-20 mA) within 1%.
A polynomial function is a method of approximation which mathematically describes a continue transfer function.
By means of a few samples, a polynomial function can be obtained. After determining the polynomial function, the original calibration points and an infinite amount of values in between, can be calculated with high accuracy.
In a system where pressure- and/or flow meters and -controllers should be readout and set with high accuracy, these polynomial functions often are used for approximation of their transfer function. For instance the function which describes the relation between output voltage and measured temperature.

2.11.2 General form

The general form of a polynomial function of the n-N.D. degree is as follows:

$$y = a0 + a1 \cdot X + a2 \cdot X^2 + a3 \cdot X^3 + \ldots + an \cdot X^n$$

Where 'a0' to 'an' are polynomial parameters, which can be calculated.
When you have 'n + 1' measure-points, they can be approximated by means of a 'n-N.D.' degree polynomial function.

2.11.3 Polynomial functions of sensor signal and setpoint

By means of a calibration at Bronkhorst HIGH-TECH B.V. several measure points will be used to obtain a polynomial function.
The form of this function is:

$$Y = a + b \cdot X + c \cdot X^2 + d \cdot X^3$$

In which 'Y' is the measured value in correct unit (e.g. temperature in [°C]) and 'X' is the value of output signal in correct unit (e.g. Uout in [V]).
Characters 'a - d' are polynomial parameters, which can be obtained by a mathematical program. These parameters can be filled in and the polynomial function is completed.
Now a flow can be calculated out of the sensor output signal of the device.

2.11.4 Presentation of parameters

Parameters 'a - d' are polynomial function parameters, which can be obtained with a mathematical program out of measured calibration points.

All parameters will be printed on the calibration certificate. They will be presented in scientific notation with 3 significant digits, where the last digit is obtained by rounding-off. Parameter 'b' (the linear factor) however, are exceptions: they are the most important parameters and therefore will be presented in 5 significant digits.

Example:

a	$= 7.67 \cdot 10^{-2}$
b	$= 4.3076$
c	$= 1.11 \cdot 10^{-1}$
d	$= 1.73 \cdot 10^{-2}$

Polynomial function for sensor signal:

$$Y = 7.67 \cdot 10^{-2} + 4.3076 \cdot X - 1.11 \cdot 10^{-1} \cdot X^2 + 1.73 \cdot 10^{-2} \cdot X^3$$

2.11.5 Using polynomial functions at readout/control unit

The parameters for the polynomial function is stored at the readout and control-module and can be changed from the keyboard.
Normally the transfer function of the sensor signal is linear Y = X. The connected device will have linearized transfer functions after (normal) calibration.The accuracy however, will be ≤ 1 % full scale.
When a special polynomial function calibration is wanted, the parameters 'a-d' will be destillated and printed on the calibration certificate. In the 'INSTRUM. CONFIG'-menu you just have to enter these values.
Now you can connect and operate the concerned device.

Note:
Only this device will operate correctly; if you want to connect an other device to this channel, first change the polynomial function parameters.

3 MAINTENANCE

- Be sure you operate under the correct input specifications.
- Be sure the system operates within its temperature range.
- When replacing a defective fuse, first solve the problem.
- Only install a fuse with the correct current rating (see label).
- Only clean the housing (keyboard and display) with a (moist) polishing cloth. Do not use aggressive cleaning fluids.

4 TROUBLESHOOTING

LCD is not lit after 'power on'	check power input check fuse
Display is blinking	check cable to CEM unit
Improper reading	check module settings
No reading/control	check instrument cabling
Improper system operation (alarm)	check module settings
Instrument does not respond to setpoint given at keyboard	1) setpoint source at operation menu should enable setpoint at "keyb. & FLOW-BUS". (other settings means different behaviour). 2) setpoint could have been overruled at an alarm situation (first perform reset) 3) setpoint slope has a large value. (setpoint will slowly change in time). Change slope value if necessary. 4) Setpoint could be changed by other devices connected to the FLOW-BUS. 5) check polynomial factors at instrument menu.
Setpoint menu cannot be reached	check setting of connected instrument type at instrument menu. For sensor (meter) types setpoint facilities will be disabled.
Alarm is not responding to reset.	check if reset-source has been enabled at reset menu of reset.
Instrument seems to give inaccurate values	check if correct fluid set (with calibration factors) has been selected see fluidname).

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