

 Read the operating and mounting instructions before commissioning!

 Work on the automatic burner control system may only be performed by specialist personnel.

 Never perform work when the control system is live! This also applies when replacing or installing low-voltage components such as servomotors, display or communication components.

 If a fuse blows, test the automatic burner control system for safe functioning. Otherwise, there is a danger of contact welding due to short-circuiting!

 Operating parameters shall only be adjusted by specialist personnel.

 The communication port shall only be used in connection with components expressly approved for this purpose.

 The equipment shall be connected in correct phase sequence and the protective conductor connected as shown in the terminal diagram and tested prior to commissioning.

 Tampering with the electronics or improper storage voids the warranty covering the control system.

 The data given herein serve to specify the automatic burner control system and do not imply guaranteed characteristics.

 Failure to follow these instructions can result in personal injury or damage to property.

Operation and assembly instructions

Automatic burner control system MPA51 S02

DUNGS®
Combustion Controls



Description

The MPA22 is a microprocessor-controlled, automatic burner control system designed for intermittent operation. It is used to control and monitor pneumatic modulating fan assisted gas burners with speed-controlled fan and output control input.
eBUS connection for connecting service tools or external eBUS-compatible heating controller.

Accessories

Display unit AM01 (231 580)
MPA-Vision Service Package MV5

Ordering data

Type MPA 51 S02

Order No.

249 581 MPA 51 S02 230V / 50 Hz

Classification as per EN 298

FMCLBN, FMLLBN

The classification is dependent on the configuration for the restart.

Approvals

EU type test approval
as per EU Gas Appliance Directive.

MPA 51

CE-0085 BL 0048

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Old documentation - Only for your information!
Product is not available anymore!

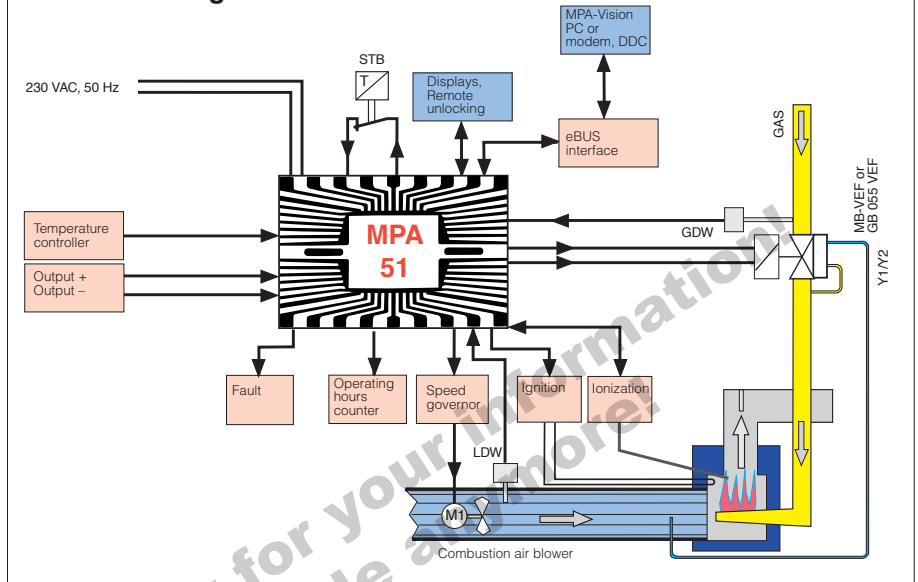
Overview

MPA51 S02 control and watchdog unit for gas fired boilers and water heaters with output dependent pneumatic modulating operation

The MPA51 S02 has the following functions for control and supervision of a gas fired boiler unit.

- Automatic burner control system as per EN 298 for intermittent operation
- Operation: pneumatic modulation via PWM-controlled fan
- Ionization flame supervision
- Ignition output for external 230 VAC ignition module
- Installation in housing as per IP 40
- Connector 41 and 90 for modulating burner, RAST5 and RAST2,5 for ignition, fuel valves etc.
- Gas valve output Y1/Y2 230VAC
- Temperature controller input
- Air pressure switch input
- Min gas pressure switch input
- Min gas pressure switch input for valve proving system
- Output to 230 VAC operated hours counter
- 230 VAC fault output
- Additional input for a safety circuit
- Burner output control via power input
- Alternative: burner output control via eBUS

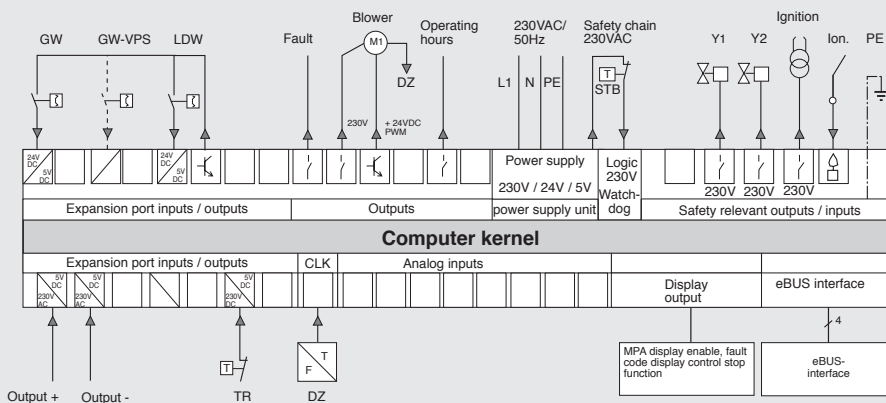
Schematic diagram



- Restart attempt
- Output dependent fan speed control or fan control
- Restart attempt
- Restart delay, time dependent
- Controller stop function
- Presetting at factory via PC
- Through display settings of operating parameters

- eBUS-connection for connecting MPA-Vision
- eBUS interface for intelligent heating system components (e.g. heating controller)
- Visualization of operating parameters with MPA-Vision

Block diagram MPA51 S02



Legend of block diagram

- DZ Speed measurement
- GW Gas pressure switch
- GW-VPS Gas pressure switch of valve proving system (option prepared)
- Ion Ionisation monitoring device
- LDW Air pressure switch
- M1 Fan motor
- PE Burner earth
- STB Safety temperature limiter (overheat thermostat)
- TR Temperature controller
- Y1/Y2 Gas safety valves

Overview

Microprocessor controlled system MPA51 S02, description

MPA51 S02 is a microprocessor controlled automatic burner control system for intermittent operation supervision of pneumatic modulating gas fired fan assisted burners or pre-mix burners with PWM-controlled blower.

Fuel valves

- Switching the fuel valves ON/OFF via relay contacts.
- Opening fuel valves Y1/Y2 on commencement of startup safety period SZA.
- Closing the fuel valves if ignition attempt fails after expiration of the safety period.
- Closing the fuel valves after controlled shut-down or safety shut-down or after flame failure during operation. Operating safety period SZB < 1 second.
- Fault if feedback signal of output indicates OFF during operation.
- Fault if feedback signal of output indicates ON during idle state.

Ignition

- Switching an external ignition module ON/OFF via relay contact.
- The ignition is switched on on commencement of the pre-ignition period or safety period.
- Switch-off of the ignition at the end of the safety period or a period defined by EEPROM parameters before the safety period expires.
- Pre-ignition period can be programmed via EEPROM.
- Safety period can be programmed in the EEPROM.

Ionization flame supervision device

Flame simulation detection > 0.8 μ A
Switch-on sensitivity after safety period > 1.2 μ A
Switch-off sensitivity during operation < 1.4 μ A

- A digital signal is generated for the microprocessor from the ionization current.
- A flame simulation test is performed at startup and triggers a fault shut-down if flame simulation is indicated.
- Following fuel release and ignition, a flame must be present after the safety period „SZA“ expires at the latest. If no flame is indicated, the MPA enters fault state or initiates a restart attempt.
Max. 1 restart (EEPROM parameter).
- Flame failure after expiration of the safety period during operation leads to a restart attempt or to a fault shut-down
- Flame detector test during operation. If a fault is indicated, the burner control system enters the invariable fault state.

Air pressure switch

Signals:

contact closed = air pressure present
contact open = air pressure out of range

- Supervision of min. combustion air pressure
- Idle state check prior to start-up

- Triggers a fault shut-down if the air pressure switch does not switch during the pre-purge period. In this case, the anti-reciprocation function is active; this means that the system performs 5 startup attempts before entering the invariable fault state.
- Triggers a safety shut-down during operation if the air pressure switch opens.
- The idle state check can be deactivated via an EEPROM parameter. It is also possible to configure a test that is only performed during the start-up period (idle state and pre-purge period) or during operation if the maximum speed is greater than the starting speed.
- Enters the non-volatile lock-out state if the input test indicates a fault.
- Tolerance period after failure < 1 s.
- The air pressure is additionally checked during startup and operation via the fan speed for a defined range and triggers a fault shut-down during startup or a fault shut-down during operation if this range is overshoot/undershot for longer than the tolerated failure period.
- 24VDC supply is not electrically isolated but, connected to system potential. The contact is fritted.

Gas pressure switch

Signals:

contact closed = gas pressure present
contact open = gas pressure out of range

- Monitors the min. gas pressure.
- Triggers a safety shut-down, if the gas pressure switch indicates gas failure and enters the gas failure state after 5 startup attempts for 30 minutes. If gas pressure is again indicated during this period, then the MPA switches to the start position
- Enters the invariable fault state if the input test indicates a fault.
- Tolerance period after failure < 1 s.
- 24VDC supply is not electrically isolated, connected to line potential. The contact is fritted.
- the gas pressure switch is not monitored during the safety period.

Safety circuit

- The safety circuit is connected upstream of the second switch-off circuit (hardware watchdog).
- Startup is inhibited when the safety chain is interrupted. The system remains in the start position (Standby)
- When the safety chain is interrupted, the system switches to the start position from any state except restart inhibit and fault lock-out.
- If water STB is connected to supply, then this input must be bridged.

Overview

Gas pressure switch for valve proving system

MPA 51 is prepared for a possible valve proving system in connection with MB-VEF.

Signals:

contact closed = gas pressure present

contact open = gas pressure out of range

- Monitors the gas pressure during the integrated valve leakage test
- Triggers a fault shutdown if a leakage is detected.
- Enters the invariable fault state if input test indicates the presence of a fault.
- 24VDC supply is not electrically isolated -> connected to line potential. The contact is fritted.

Fan

- Activation/deactivation of fan with relay output
- PWM output for fan speed control (4 kHz)
- Closed-loop fan control by means of speed measurement
- Fan supervision by means of LDW function. For this purpose, the HALL sensors are required to return the speed signal directly.
- Idle state check is performed before startup.
- Not electrically isolated -> connected to mains potential.

Operating hours counter

- Signal for external operating hours counter
- The output is connected to the fuel valves.

Fault output

- Relay output 230 VAC
- Output switches if system enters fault lock-out state.

Temperature controller

- Input 230 VAC, fritted
- The system starts up when the temperature controller is „ON“ unless startup is inhibited by another signal (e.g. fault)
- Controlled shutdown if the temperature controller is opened.

Power inputs

Input + 230 VAC, fritted

Input - 230 VAC, fritted

- Increases or decreases the degree of modulation within the range from 0 to 100%, where 100% modulation corresponds to 100% burner output and 0% modulation corresponds to the min. burner output.
- The degree of modulation is changed by 0.5% in each case in dependence on the sampling rate, which can be configured in the EEPROM.

Fan speed

Sensors: tacho, Hall

- Speed measurement as function test
- For open-loop control of the fan, the speed measurement and the monitoring function are deactivated
- Triggers a safety shutdown if a limit overshoot is detected.

Range of values: 10 - 810 Hz

Operating area: 300 - 8100 rpm

Resolution: 32 rpm

Undervoltage supervision

If the min. voltage is undershot, the system is not started or shut down, i.e. the system remains in the start position.

Display and control panel

The AM01 control panel is connected to the MPA via a 6-pin cable. The control panel is used for status display and for setting and interrogating user and service parameters. Parameterization mode, Service mode or Info mode can be activated with the individual keys. The control panel can also be used to indicate faults display and re-enable the system after a fault shutdown.

Display operation

Display operation and the individual functional level are described in the Annex.



Operation and assembly instructions

Assembly

The automatic gas burner control system can be installed in any position.

Electrical connection

The equipment shall be connected and earthed in accordance with the prevailing local regulations and terminal diagram. The mains cable can be of any length. The cable of the temperature controller and output controller must not exceed a length of 3 m. All other lengths of cable must not exceed 1 m.

Fuses

The MPA is fused externally with a 6.3 A medium time-lag fuse or 10 A quick-acting backup fuse.

The max. permissible switching capacities shall be observed!

⚠ If a fuse blows, the automatic burner control system must be tested for safe functioning. Otherwise, there is a danger of contact welding due to short-circuiting.

Commissioning

All plug-in connections must be checked for correctness before commissioning the equipment. The system can then be put into operation. During the commissioning procedure, at least the following safety functions must be checked:

1. Temperature controller and temperature detector or limiter
2. Gas pressure switch
3. Fault shutdown if flame signal is interrupted by disconnecting the ionization probe or short-circuiting the ionization probe to earth.

Measurement of the supervision current

The current intensity should not drop below 6 μ A during operation.

The max. achievable ionization current is approx. 15 μ A.

MPA51 S02 enters fault state if the ionization current drops below 1.4 μ A during operation. It detects a flame after the safety period expires if the ionization current exceeds 1.2 μ A. During the flame supervision check at startup, the ionization current must not exceed 0.8 μ A.

Response to faults

Flame failure:

Restart or fault shutdown with lock-out, restarting by fault unlock.

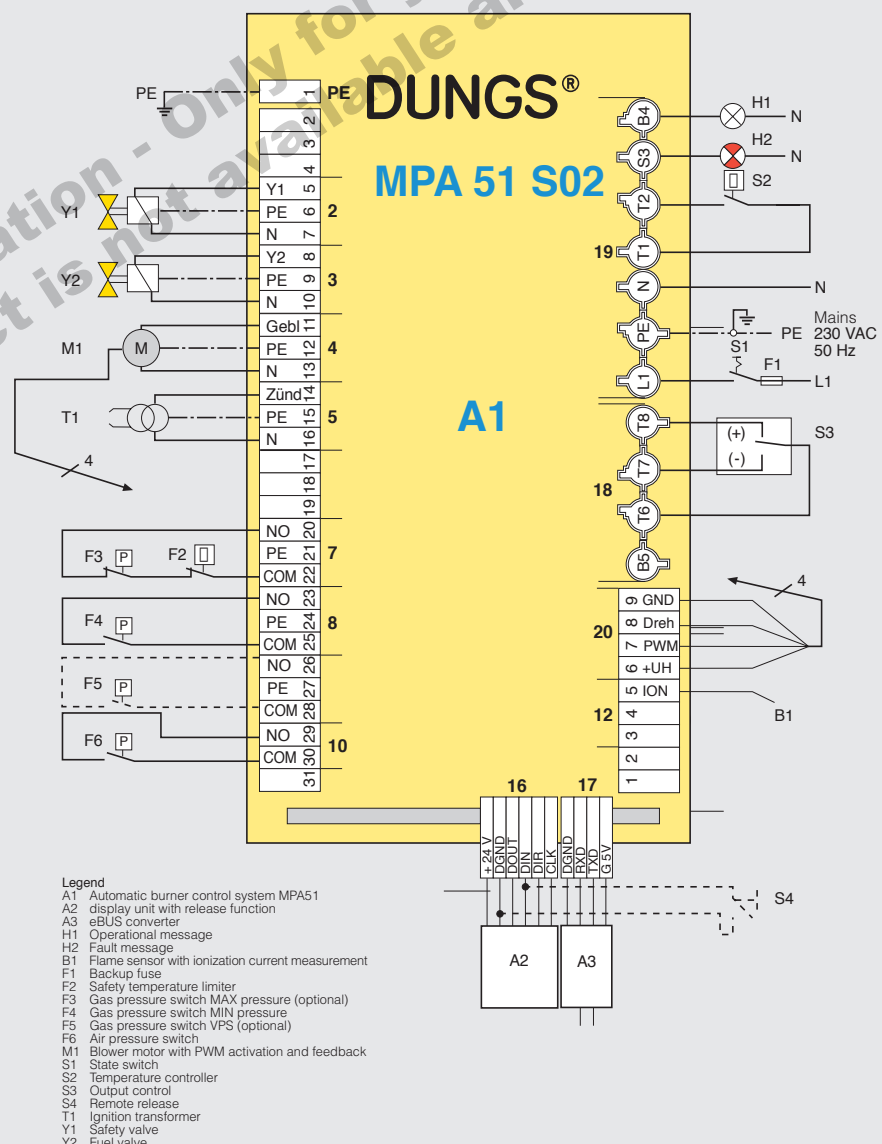
If a fault occurs, valves and the blower motor are switched off.

Air pressure switch:

Fault shutdown with lock-out, restarting by fault unlock.

⚠ Failure to follow these operation and assembly instructions can result in personal injury or damage to property. For this reason, it is essential to follow the instructions. Tampering with the electronics voids the warranty covering the control system.

Terminal diagram MPA51 S02



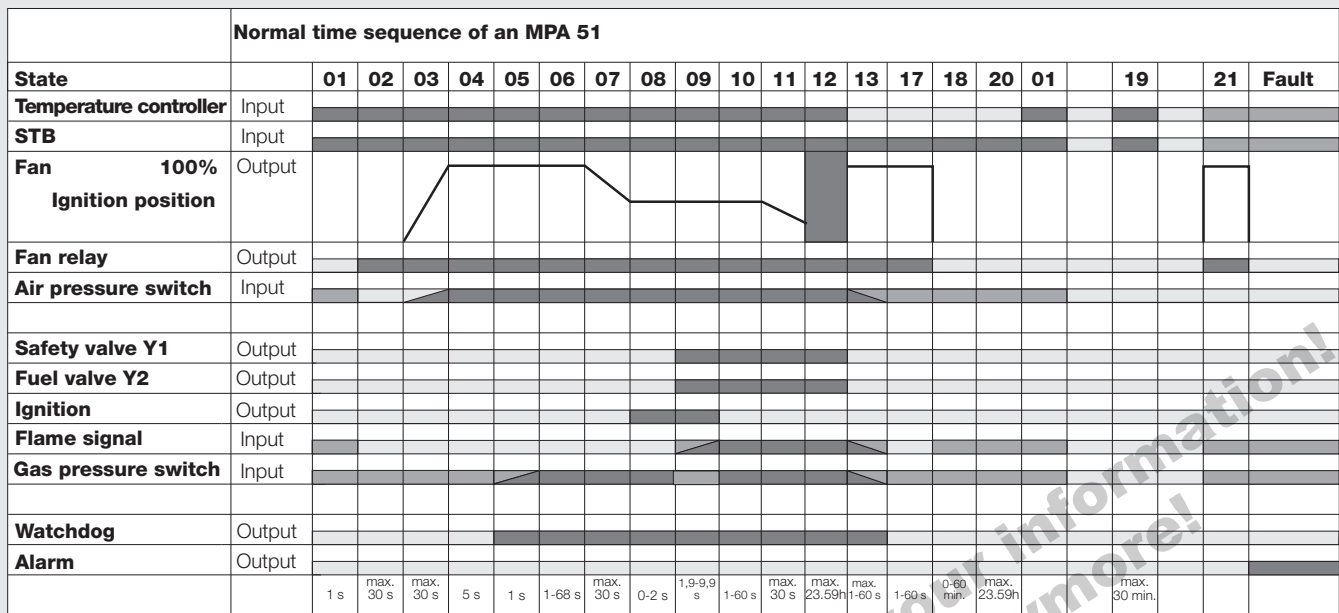
Operational sequence and program flow.

Operational sequence and program flow.

After the controller issues a heating request, the following program is run:

State Duration		State Duration	
01 Test for heating request	1 s	10 Flame stabilization, settable in the EEPROM in ignition position	1...60 s
02 Idle state check of air pressure switch and fan	1...30 s	11 Transition to controlled operation	1...30 s
03 Fan startup	1...30 s	System ramps up to setpoint speed defined by controller.	
If the air pressure switch does not indicate „in range“ or if fan speed does not reach the setpoint within this period, then a fault shutdown is triggered.		12 Operation	max. 23:59 h
04 Preventilation cycle I	5 s	The system is restarted on expiration of this period.	
Preparation of the watchdog		13 After-burn period	1...60 s
05 Preventilation cycle II	1 s	settable in the EEPROM	
Activation of the watchdog		17 Post-ventilation	1...60 s
06 Preventilation cycle III	1...68 s	settable in the EEPROM	
settable in the EEPROM		18 Restart inhibit	0...60 s
States 04+05+06 result in a settable prevention period of	7...74 s	settable in the EEPROM	
07 Ignition position	1...30 s	19 Gas failure state	max. 30 Min.
If the fan speed does not reach the setpoint, the MPA enters fault state.		20 Standby	max. 23:59 h
08 Pre-ignition	0...2 s	If a heating request is issued, a restart is triggered. When this period expires, the system restarts.	
09 Startup safety period (SZA)	1.9...9.9 s	After fault shutdown: from Stat 09:	
settable in the EEPROM		21 Fan run-on	5 s
Enable Y1/Y2 on commencement of SZA. (SZB is <1 s)		prior to lock-out	
Gas pressure switch is not monitored			

MPA51 S02 –Program flow



Legend

- ON
- OFF
- ON or OFF

- State 01

Heating request test
- State 02

Idle state check
- State 03

Fan startup
- State 04

Prepare preventilation / watchdog
- State 05

Activate preventilation / watchdog
- State 06

Preventilation
- State 07

Ignition position
- State 08

Pre-ignition
- State 09

Startup safety period
- State 10

Flame stabilization
- State 11

Transition to controlled operation
- State 12

Operation
- State 13

After-burn period
- State 17

Post-ventilation
- State 18

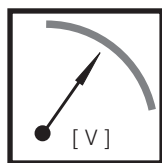
Restart inhibit period
- State 19

Wait for gas pressure
- State 20

Standby
- State 21

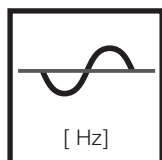
Fan run-on prior to lock-out

Technical data



Rated voltage

~(AC) 230 V – 15 % ... + 10 %



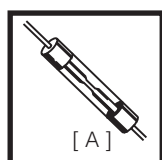
Frequency

50 Hz



Power consumption

~ 10 VA



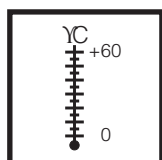
Fuse

Backup fuse: 6.3 A medium time-lag or 10 A quick-acting
Keep to the permissible breaking capacities



Degree of protection

Housing: IP40, connector: IP20



Ambient - temperature

0 °C ... + 60 °C



Air humidity

DIN 60730-1



Electrical connection

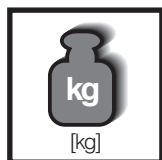
Boiler side: with 7- and 4-pin connectors to DIN
Burner side: encoded RAST5 connector system
Direct PCB connectors for display and eBUS
The wiring shall be configured in compliance with the prevailing local regulations and the terminal diagram of the burner manufacturer.
Extra-low voltage is not safety-separated. Pay attention to correct polarity!



PE terminal

Protective conductor is integrated in the device

The PE terminal for the burner is connected via the PE terminal on the automatic burner control system.



Weight

approx. 0,7 kg

Technical data

Switching capacities:

Fuel valves Y1	230 VAC, 2 A
Fuel valves Y2	230 VAC, 2 A
DC fan,	speed-controlled
- Line-side supply	230 VAC, 4 A
- Supply of PWM connection	24 VDC - 31 VDC
- Activation	PWM 4KHz
- Speed measurement:	by F/t digital Hall sensor with 32 rpm resolution
Temperature controller	230 VAC
Input +	230 VAC
Input -	230 VAC
Fault output	230 VAC, 1 A
Operating hours counter	230 VAC, 1 A
Safety circuit	230 VAC, max. 8 A The safety circuit is connected upstream of the secondary switch-off circuit (hardware watchdog).
Air pressure switch	24 VDC, 10 mA, 2-wire
Gas pressure switch	24 VDC, 10 mA, 2-wire and PE

Flame detector:

Ionization	
Flame simulation detection	> 0.8 μ A
Switch-on sensitivity after SZA	> 1.2 μ A
Switch-off sensitivity during operation	< 1.4 μ A

Ignition:

Ignition output	230 VAC, 2A
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Fault unlock:

Remote release with button on separate display and control module

Kommunikation:

	In accordance with eBUS specification:
	Layer 1/2: V1.2
	Layer 7: V1.2

Controller communication Connection for external eBUS controller

PC service program MPA-Vision for Windows 95
Connection via eBUS PC interface

Communication:

approx. 200 x 105 x 60 mm

Dimensions:

any



Open- and closed-loop control functions

Operational sequence

Operational sequence and program flow.

The previous flowchart shows the program flow.

Switch-on decision

Query to determine whether a heating request has been issued. If a heating request is not issued within 1 second, the system enters Standby state (State 20). If a heating request is present, the startup procedure is performed.

Startup

tr Idle state check of air pressure switch

Firstly, an idle state check is performed on the air pressure switch and fan. If the air pressure switch contact is not opened within 30 seconds or if the measured speed is greater than 300 rpm, a restart is initiated (anti-cycling function). If the idle state check is still unsuccessful after 5 attempts, the system enters fault state.

thl fan startup

The blower ramps up to the defined setpoint speed for „Preventilation“ with the PI parameters for preventilation. If the setpoint speed is not reached, the preventilation cycle commences. If the set speed is not reached after 30 seconds, up to 5 additional startups are performed (anti-cycling), and then the system enters fault state.

tv Preventilation

The combustion chamber is purged. The fan is set to the set setpoint speed for „Preventilation“. During this period, the air pressure switch and speed are monitored via a tolerance window. If a fault is detected, a fault shutdown is initiated via the anti-cycling function. The gas pressure is monitored as of State 6. If the gas pressure fails, the system enters gas failure state (State 19) after 5 failed startup attempts (anti-cycling function) and remains in this state for 30 minutes. Following this, the entire cycle is repeated.

tbr Deceleration time for the ignition position

The fan speed is changed to the defined setpoint speed for „Ignition position“. If the setpoint speed is reached, the pre-ignition cycle is performed. If the set speed is not reached after 30 seconds, up to 5 additional startup attempts are performed (anti-cycling), and then the system enters fault state.

tvz Pre-ignition period

During the pre-ignition phase, the output for the external ignition module is activated.

ts Startup safety period SZA

Fuel valves Y1/Y2 are opened on commencement of the startup safety period. The ignition output remains activated for the safety period. The ignition can be deactivated up to 0.3 seconds before the safety period expires through the parameter „Ignition time reduction“. At the end of the safety period, the presence of a flame signal must be indicated. If this signal is not present, the following actions are executed:

1. Fault shutdown, or
2. Restart (1x), provided that the parameter „Max. restart factor“ was set to 1.

If ignition is successful and a flame signal is present, the following actions are executed:

tst Stabilisation period

The programmable period can be used to stabilize the burn process with ignition speed.

Burner operation

Open- and closed-loop control functions Operational sequence

tü Transition to operation

The fan speed is changed to the programmed setpoint speed for „Starting output, operation“ with the PI parameters for operation. The set speed must be reached after 30 seconds, otherwise a safety shutdown is performed.

tb Operation

The actual operation phase begins now. During this phase, the burner can be set to between minimum and maximum output in modulating mode via an external output control. Failure of the air pressure switch, gas pressure switch or flame detector triggers a safety shutdown. These inputs are actively tested cyclically and trigger a fault shutdown if a fault is detected in the MPA. In addition to the air pressure switch, the speed is checked for conformity with a permissible window when the closed-loop fan control is switched on. A safety shutdown is likewise performed if a fault occurs.

A forced shutdown (intermittent operation) takes place after max. 23:59 hours.

If a flame fails during operation, the following actions are executed:

1. Fault shutdown, or
2. Restart (1x), provided that the parameter „Max. restart factor“ was set to 1.

Shutdown

tnb After-burn period

During the tolerated after-burn period, the presence of a flame signal is tolerated. As soon as the flame goes out, the system enters blower run-on mode.

tn Post-ventilation

The fan is set to the previous setpoint speed during operation. The post-ventilation cycle is interrupted when another heating request is issued, and a new startup is performed.

tw Restart inhibit period

At the end of the post-ventilation cycle, the MPA commences the anti-cycling-period, provided this is parameterized. In this case, a heating request is ignored for the set period. The restart inhibit period prevents continuous reciprocation if heating demand is too low.

Standby / start position

This is the idle state of the MPA51. The MPA waits for a heating request.

The burner is out of service, the valves are closed.

The system performs a restart if it has been continuously idle for 23:59 hours.

Gas failure state

The system is in the gas failure state (State 19) if the gas pressure switch does not signal the presence of gas pressure. This phase lasts max. 30 minutes, after which a new startup attempt is performed.

Valve proving system

The MPA is optionally prepared for an integrated valve proving system in combination with MB-VEF.

The valve proving system operates in combination with the GW-VPS gas pressure switch, which must be connected on the pressure side between safety valve Y1 and fuel valve Y2. Following a controlled shutdown, safety valve Y1 is closed first followed by fuel valve Y2 on expiration of the after-burn period if the valve proving system is active. Neither a flame nor gas pressure may be present any longer. During valve proving period Y1 (State 14), the system monitors the switching contact of GW-VPS to ensure that it does not re-close. Safety gas valve Y1 is then opened for 1 second (State 15) and a check is performed to determine whether the gas pressure is building up again. During valve proving period Y2 (State 16), the switching contact of GW-VPS must not reopen. If a leakage is detected, the system enters fault lock-out state.

After a power fail and fault unlock, the valve test is also performed at startup.

Causes of faults

The system performs complete tests on safety-relevant functional parts within the switching sequence. All internal faults trigger an immediate fault shutdown.

Lockout

The system is locked out during each fault shutdown. It is not possible to start up the system by re-enabling the mains.

Reset

To reset the device, the „Enter“ button on the operator panel must be pressed.

Anti-cycling function

The cycling function prevents the immediate shutdown in the fault state if the air pressure switch, gas pressure switch or other switch functions are activated during the startup procedure. This function increases system availability. If one of the above faults occurs, 5 startup attempts will be performed. The system only enters fault state if the last of these tests fails.

Application and setting instructions

Limiting the heating output

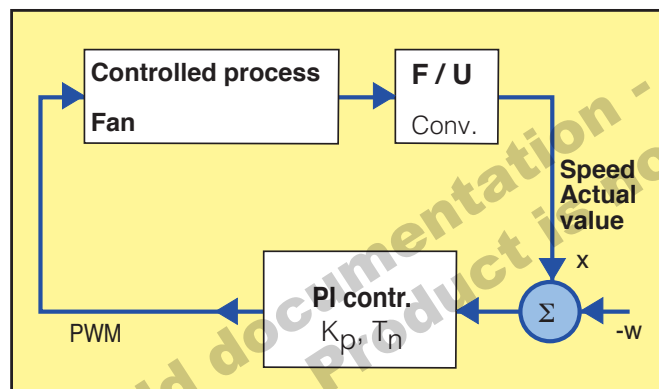
The minimum or maximum heating output is limited by the lower or upper limit of the fan. The limits for fan speed are defined by the EEPROM parameters „Setpoint speed at min. output“ and „Setpoint speed at 100% output“. If the close-loop fan control is deactivated, blower speed is set by means of the EEPROM parameters „PWM min value“ and „PWM max value“. The settable output range is burner dependent.

Closed-loop fan control

MPA51 controls the blower by means of a PWM signal and evaluates a Hall sensor signal supplied by the blower in the form of a rotational speed. Resolution is 32 rpm. The number of pulses per revolution supplied by the Hall sensor must be specified in the EEPROM parameter „Number of pulses per rev.“. If an false value is specified, the wrong speed will be calculated.

MPA51 sets the fan to the setpoint defined in the EEPROM by means of a PI controller; this setpoint must be specified separately for preventilation, ignition position and operation. The K_p and T_n factors can be set separately for each of these states in the EEPROM.

The following figure shows the controller structure:



The influence of the **proportional coefficient** K_p is directly proportional to the controller deviation e_k . The manipulated variable Y_p is calculated as follows:

$$Y_p = e_k \cdot K_p / 4$$

e_k Control difference speed setpoint - actual value

The **integral-action time** T_n is the period during which a constant deviation produces the same manipulated variable Y as would the P component. The sampling interval T is 0.25 s.

The manipulated variable Y_i is calculated during every sampling operation as follows:

$$Y_i = Y_{i-1} + e_k$$

In contrast to purely mathematical controllers, this procedure ensures that the manipulated variable will be changed no matter how small the deviation.

Fan control

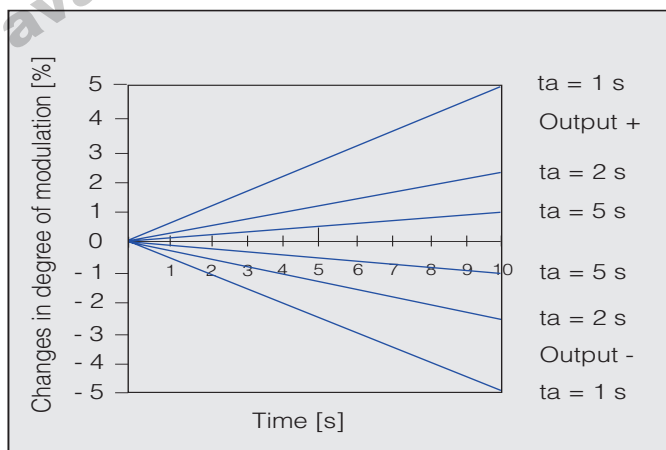
The close-loop fan control can be deactivated. In this case, the fan is controlled with a PWM signal. Fan feedback is not required. To avoid PWM step changes at startup, a PWM ramp can be set. This ramp specifies the inverse value of the maximum PWM change, i.e. 0 = steep PWM ramp and 8 = flat PWM ramp.

Selection of speeds for preventilation, ignition position and operation

The EEPROM parameters „Output, preventilation“, „Output, ignition control“ and „Starting output, operation“ are freely selectable, but must lie within the limits for maximum and minimum speed. These parameters are specified in percent. 100% corresponds to the maximum speed.

Output control

For modulating operation, MPA51 acts as an output control. For this purpose, the MPA converts a so-called degree of modulation into a corresponding speed or a corresponding PWM signal between minimum and maximum boiler capacity. The degree of modulation can be varied between 0 - 100% with a resolution of 0.5%. This degree of modulation is increased or decreased as appropriate by means of the „Output +“ / „Output -“ inputs in dependence on a sampling rate t_a , which can be set in the EEPROM. The following diagram illustrates this relationship:



The sampling rate can be set to between 0.032 s and 7.968 s

Setting the air pressure switch

The air pressure switch is compulsory! It must be set such that it switches before minimum output is set.

Exceptions: in some cases, it is only necessary to monitor startup of the air pressure switch; this can also be defined by means of an EEPROM parameter.

The function of the air pressure switch can also be programmed such that air pressure supervision is only performed during operation if the speed is greater than the speed for the starting load „Operation“. In this mode, startup of the air pressure switch is monitored completely (idle state check, monitoring of pre-purge period).

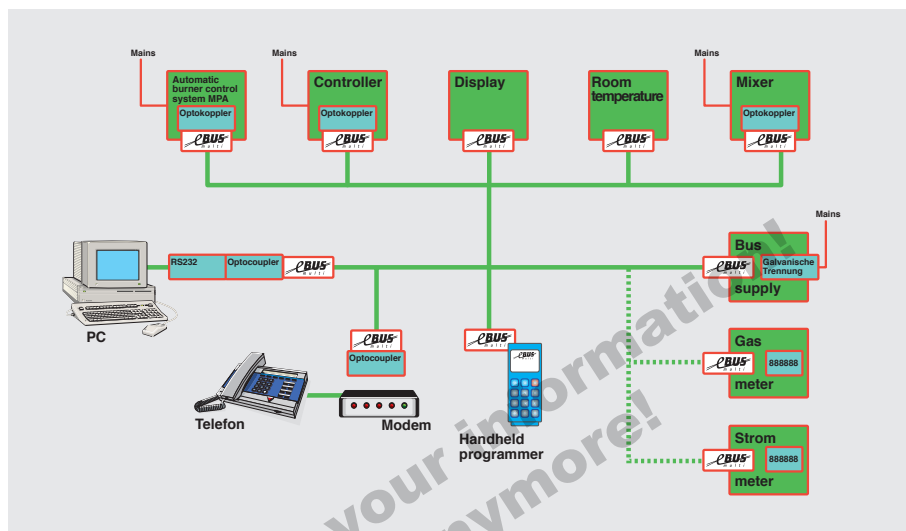
Application and setting instructions



-connection

Communications interface

MPA51 is equipped with a „four-wire“ eBUS interface (RxD, TxD, 5V, GND). MPA51 can be integrated in an eBUS system by connecting an MPA/eBUS adapter. Direct connection to a PC is possible using an MPA/PC adapter. The MPA51 software supports the eBUS protocol in accordance with the eBUS specification.



The eBUS is a bus system for heating applications. Only 2 wires are required to transfer information between the bus nodes. The wiring can be configured by anyone because safety extra-low voltage is used.

Up to 25 masters - control devices which access the bus automatically, i.e. without prior request, e.g. MPA or heating controller, can be operated on the eBUS. Up to 203 slaves, usually actuators or sensors which do not access the bus until a request is issued, e.g. recirculation pumps or intelligent room sensors, can also be operated.

Configuration and servicing by PC

A PC can also be used to set the MPA parameter values and to display operating status and fault information. MPA data can also be visualized via the PC.

Service package MPA Vision MV2000-9x/NT

An MPA/PC interface and the MPAVision for Windows 95 software is required for communication. For this purpose, DUNGS supplies an service package containing all the required components. The system is connected to the PC via a serial port (e.g. COM 2).

Communication with intelligent heating controllers

MPA51 support communication with intelligent eBUS heating controllers. The communication commands for FA controller communication (primary command 5) are fully implemented.

User Club eBUS e.V.

To obtain further information on the eBUS and the User Club eBUS e.V., visit the following website:

<http://www.ebus.de>

Application and setting instructions

Access levels, setting, service and factory parameters

Access levels

The following parameters can be changed within the specified limits; a distinction is made between several setting levels.

Level 4	Access for system operators and all others.	Level 2	Access for boiler manufacturer after activating programming mode.
Level 3	Access for service after activating programming mode on the display.		Access via serial port only.
		Level 1	Access for system manufacturer.
			Access condition similar to level 3.



Parameters may only be changed by authorized specialist personnel !

Setting values

Service and OEM parameters

Time factors:

	Level	Range of values	Units
Pre-purge period	2	7 - 74	s
Pre-ignition period	2	0 - 2	s
Startup safety period	2	20 - 106	x 93,75 ms
Stabilization period	2	1 - 60	s
After-burn period	2	1 - 60	s
Post-ventilation	2	1 - 60	s
Restart inhibit	3	0 - 60	Min.
Sampling rate of power inputs	3	0...255	x 0,032 s
Ignition time reduction	2	0...10	x 0,032 s
Switch functions:			
Air pressure switch test	3	0 - 255	0 = test active 85 = no idle state check 170 = startup supervision only 255 = speed dependent

Parameters of the fan control unit (PI):

Setpoint speed at 100 % output	3	0 - 255	x 32 U/min
Setpoint speed at min. output	3	0 - 255	x 32 U/min
Preventilation capacity	3	0 -100	%
Ignition capacity	3	0 -100	%
Starting output, operation	3	0 -100	%
K _p -factor preventilation	3	0 - 255	x 0,25
Integral-action time T _n -factor pre-ventilation	3	0 - 255	x 0,25 s
K _p -factor ignition position	3	0 - 255	x 0,25
Integral-action time T _n -factor ignition position	3	0 - 255	x 0,25 s
K _p -factor operation	3	0 - 255	x 0,25
Integral-action time T _n -factor operation	3	0 - 255	x 0,25 s
Fan controller switch	3	0 - 255	85=closed-loop blower control ON 170=closed-loop blower control-OFF

PWM min value	3	0 - 100	%
PWM max value	3	0 - 100	%
PWM ramp	2	0 - 8	x 0,032 s
No. of pulses per rev. of motor	2	1 - 6	

Miscellaneous parameters:

eBUS address of MPA	3	0 - 255	03h, 13h, 33h, 73h, F3h
eBUS controller address	3	0 - 255	
SnapShot pointer 1..4	3	44 - 207	
Fault memory 16 Byte	2	0 - 255	
Customer parameter 20..29	2	0 - 255	
Customer parameter 30..39	3	0 - 255	
Restarts	2	0 - 1	

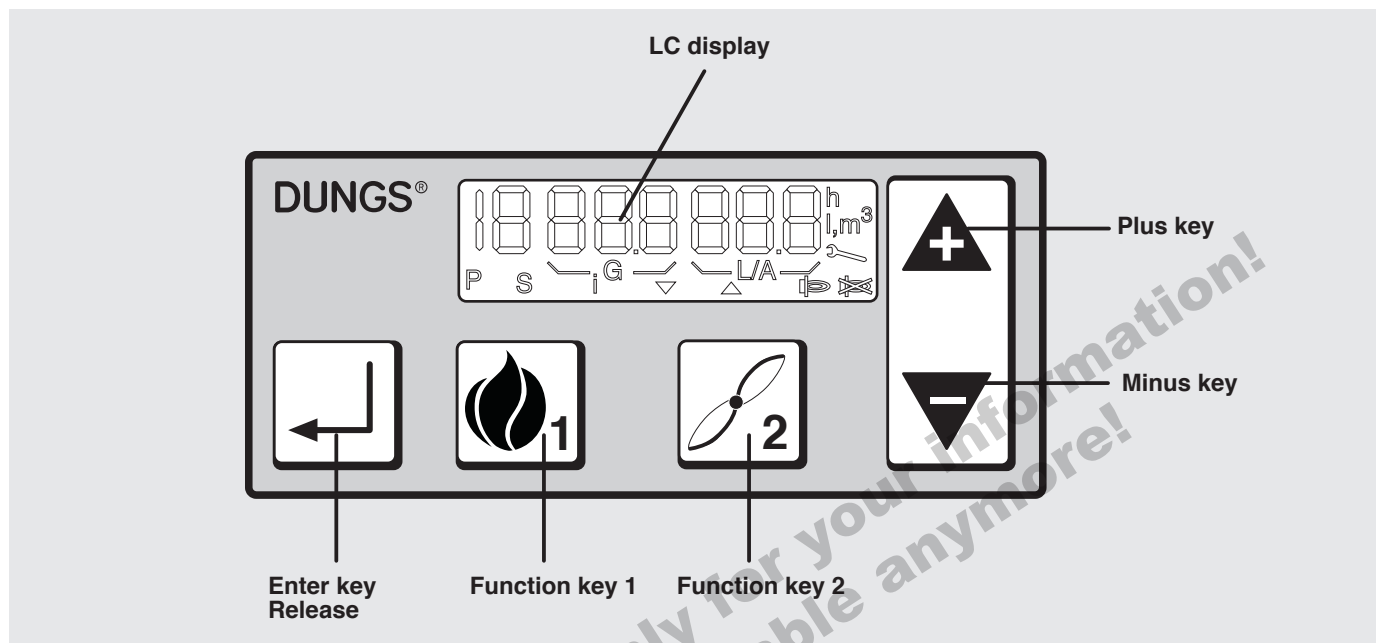
Manufacturer parameters (DUNGS):

Startup counter	1	0 - 999999	
Operating hours counter	1	0 - 999999:59	hours
Device serial number	1	0 - 999999	
Date of production	1	TTMMJJ	

Display and operating unit

Display operation

The display and operating unit of the MPA51 S02 consists of an LCD display with a total of 64 individual segments for displaying operating states, service and parameter states and fault codes, and five buttons for operation in the various operator levels and canceling interlocks.



Display modes

The display offers the following display modes, which are described in the the following:

- Operating status display
- Service mode
- Info mode
- Parameterization mode
- Fault display

If the system is in operation, the operating status display is active. In this case, the momentary operating states of the system are shown on the display.

Info and Service modes

Info mode and Service mode can be activated by pressing the „Enter“ key for a defined period of time . The individual display values can be retrieved in Service mode or Info mode by further keystrokes with the „Enter“ key. In Service mode or Info mode, a timeout function is active and can be restarted by pressing the „Enter“ key. When the timeout expires, the system returns to the operating status display.

Parameterization mode

Parameterization mode can only be accessed in Standby by pressing the key combination „Enter“ and „Plus“ for approx. 2s and is also limited in time by a timeout. As long as Parameterization mode is active, no heating request is accepted.

Fault code display

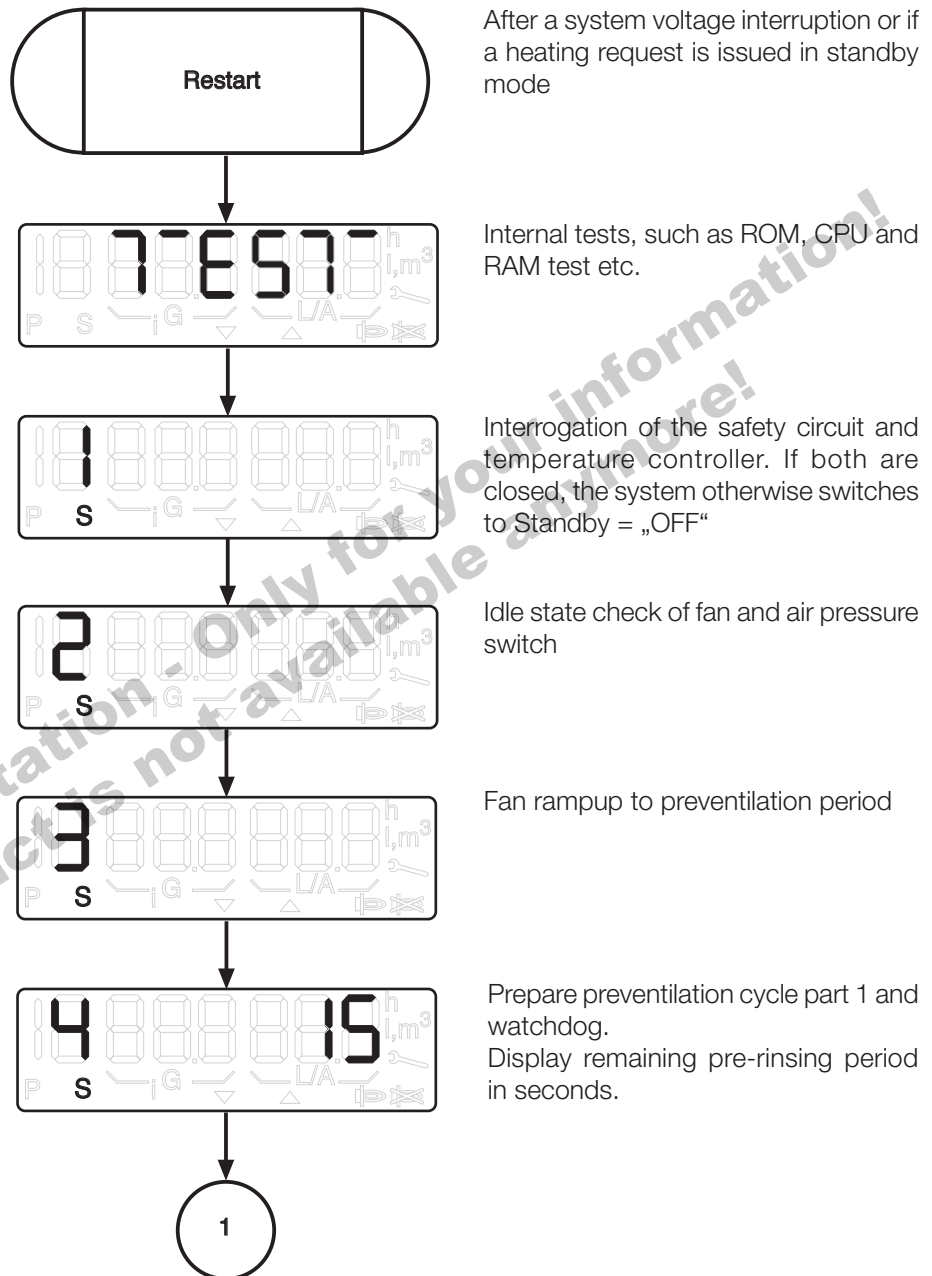
In the fault state, the corresponding fault code is shown on the LC display. The display flashes when the system is in the fault state. The fault code is displayed in hexadecimal notation. The individual fault codes are described later in these instructions.

Display and operating unit

Operating status display

Operating status display

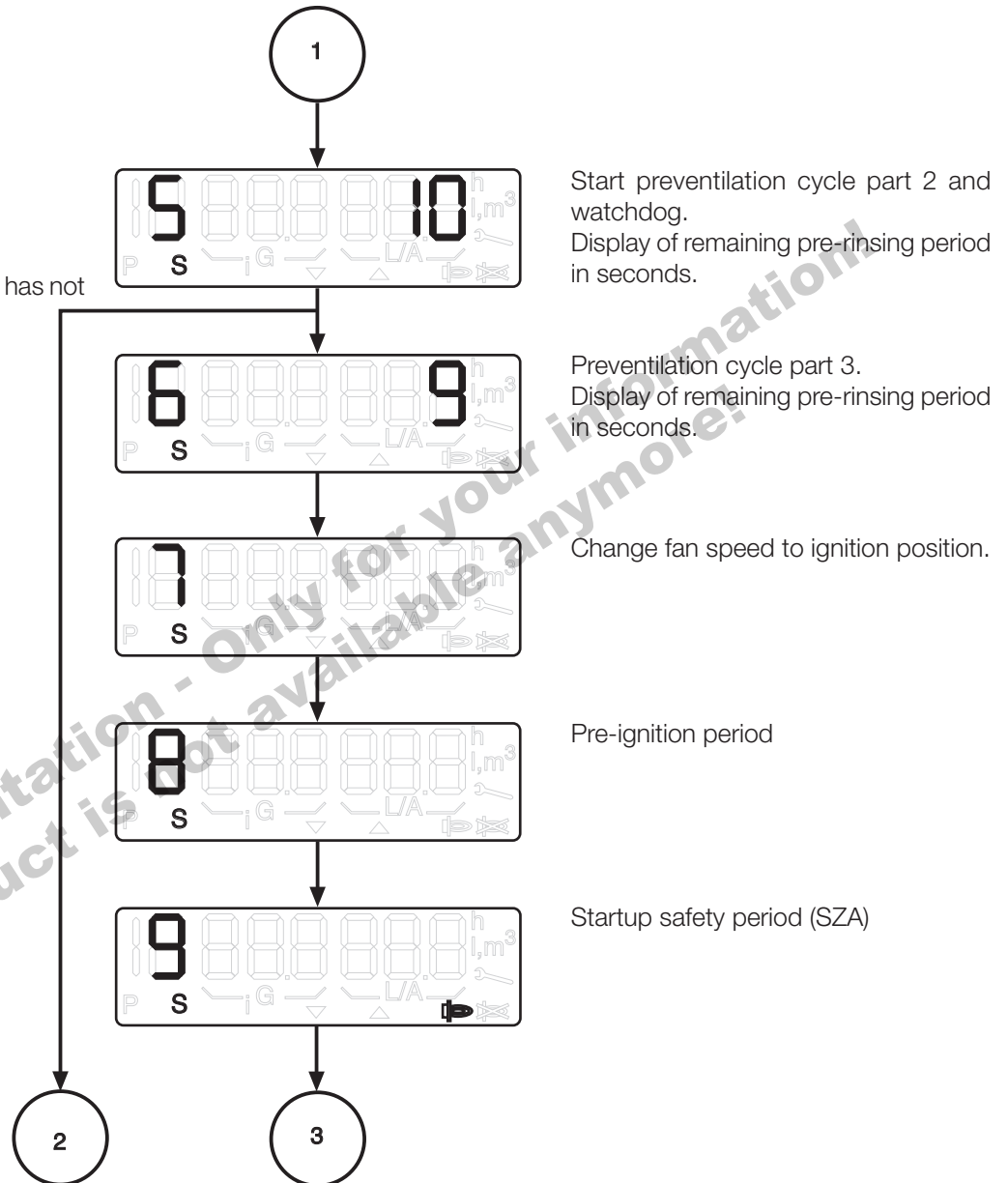
During normal operation, the operating state is shown on the LC display. If a flame is present, the flame symbol is lit. During the start phase, the „S“ symbol is displayed.



Display and operating unit

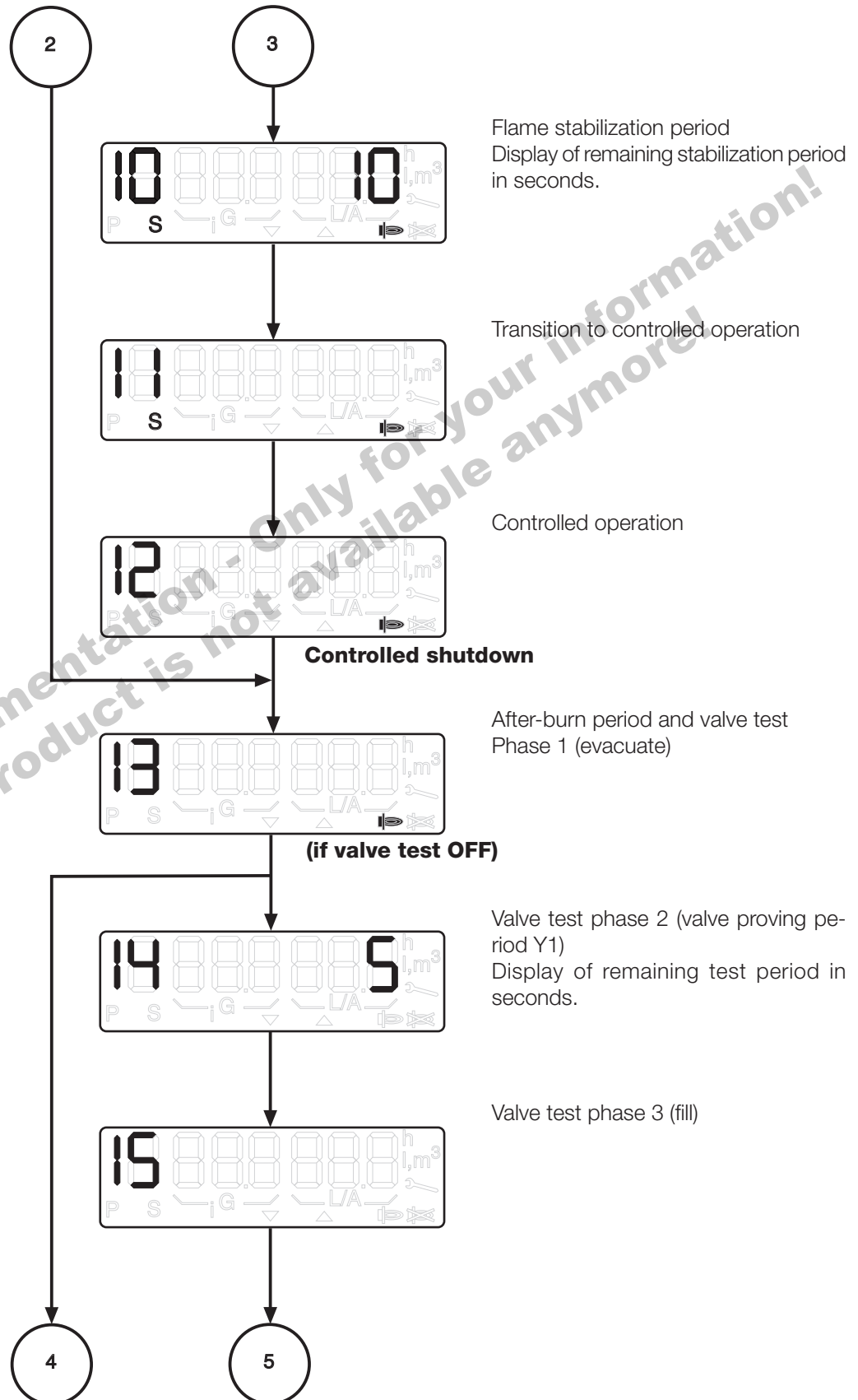
Operating status display

If the valve test is activated and has not been performed yet



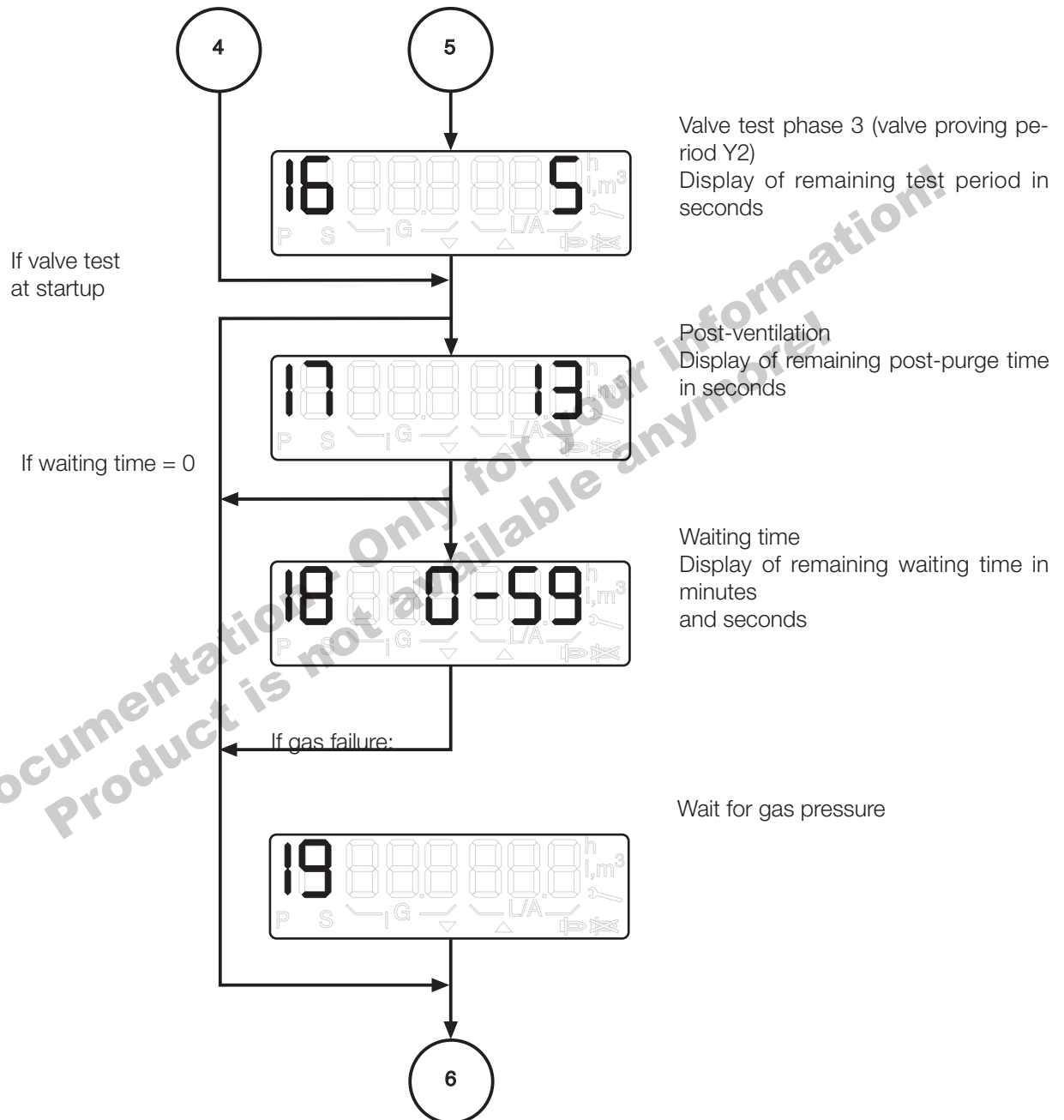
Display and operating unit

Operating status display



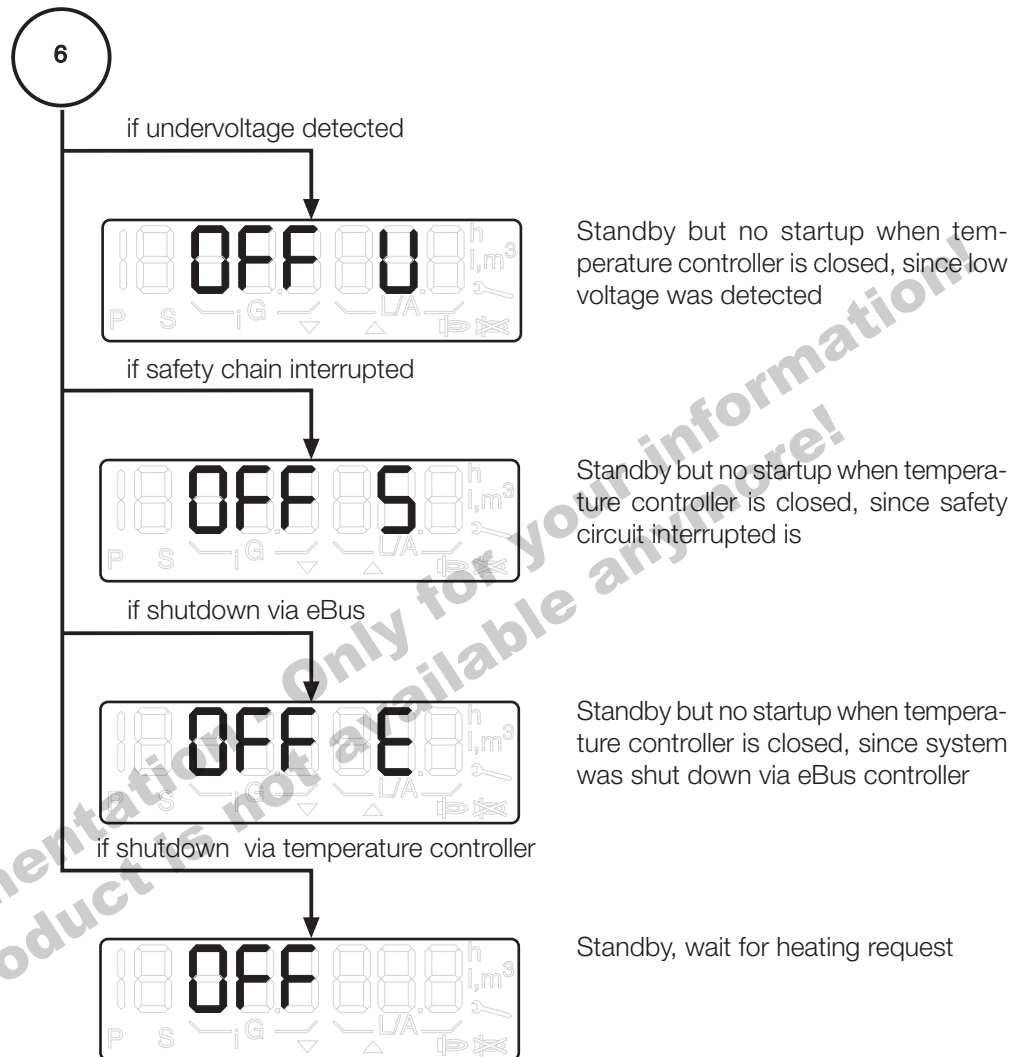
Display and operating unit

Operating status dis-



Display and operating unit

Operating status display

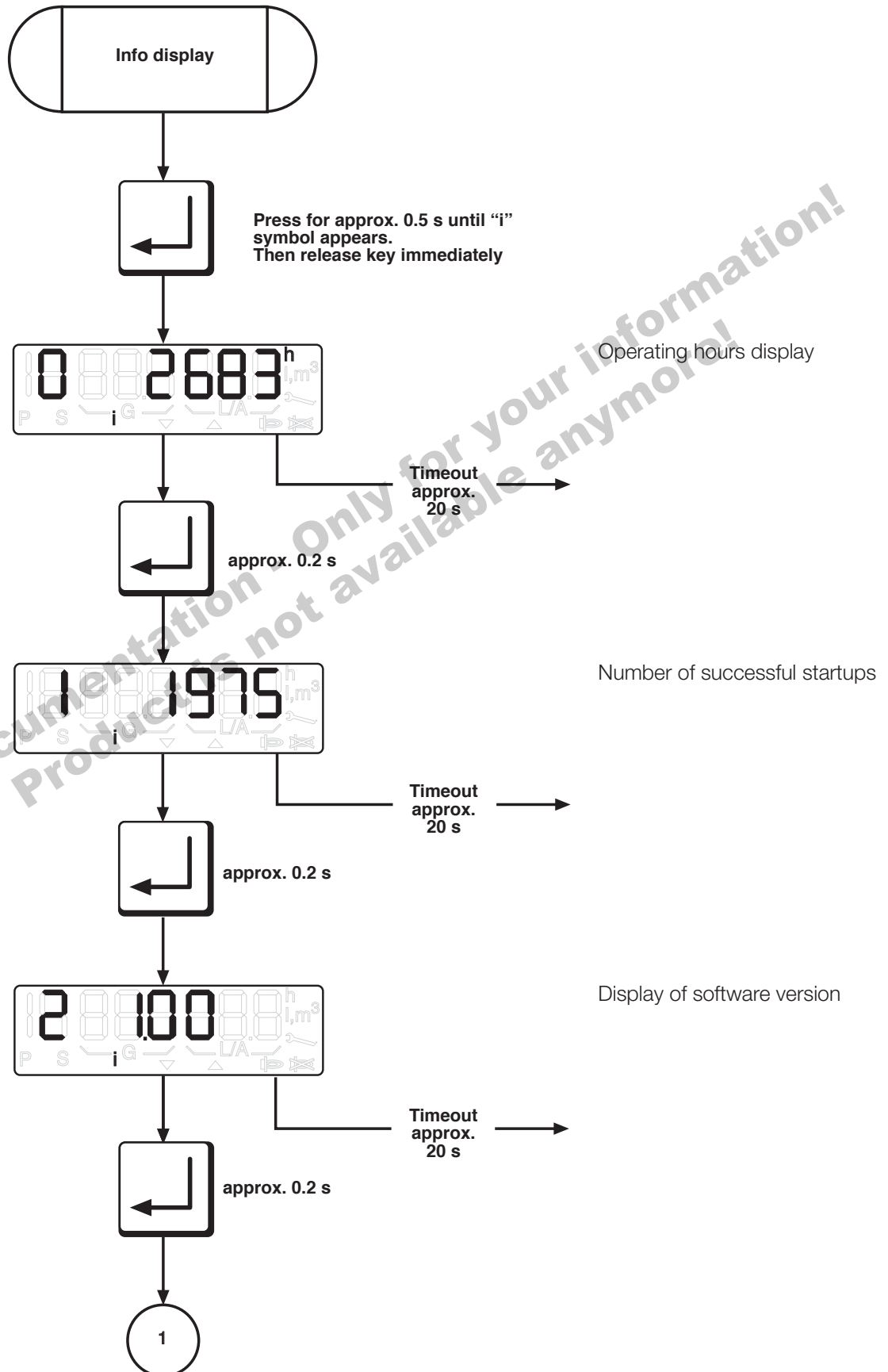


Display and operating unit

Info mode

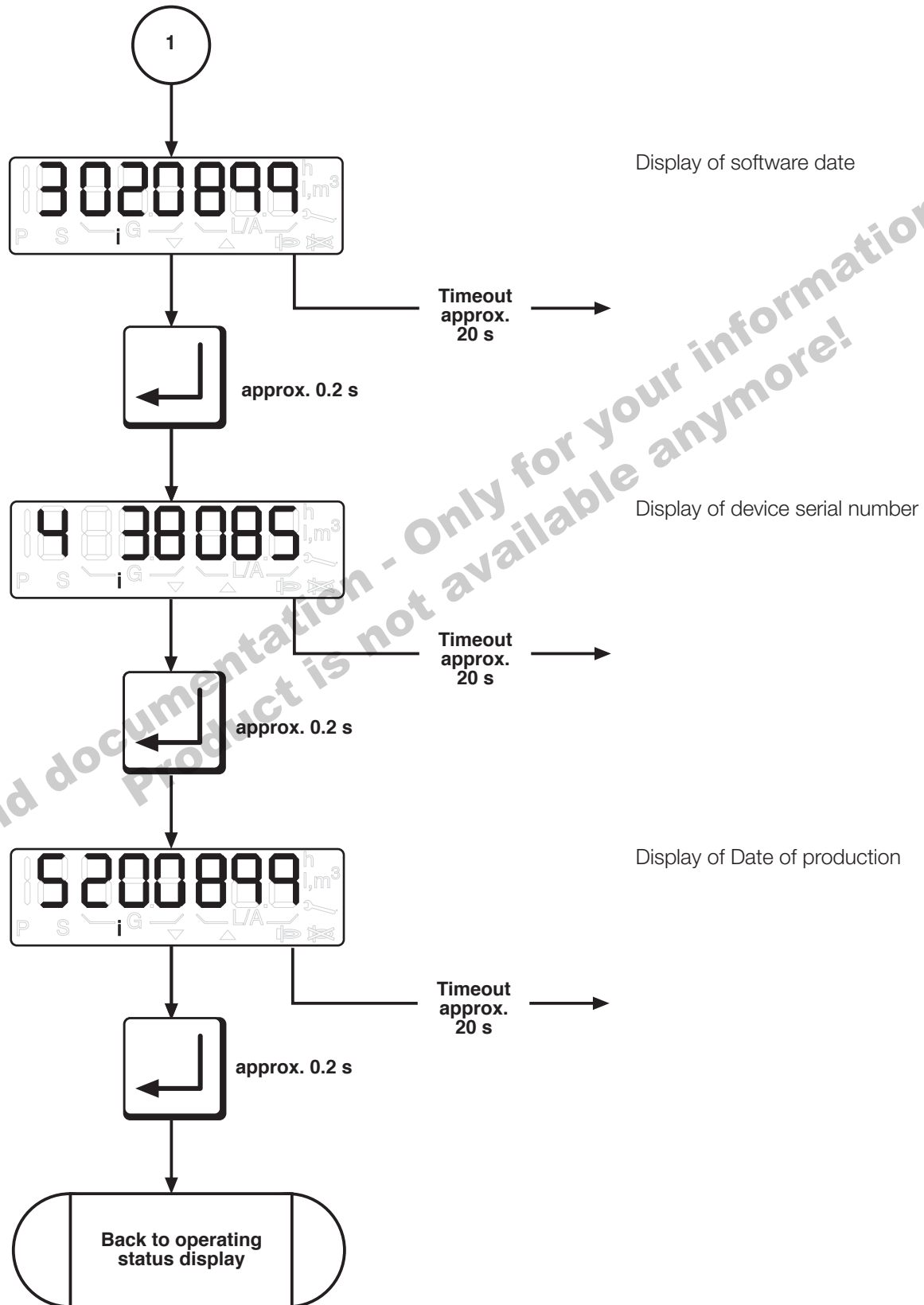
Info mode

The information display can only be accessed from the operating status display. It can be called up in every burner state and provides information on the current counts for fuel quantities, operating hours and startups, as well as software status and date of production. The system exits this display mode after 20 seconds via the timeout or by advancing after the last display.



Display and operating unit

Info mode

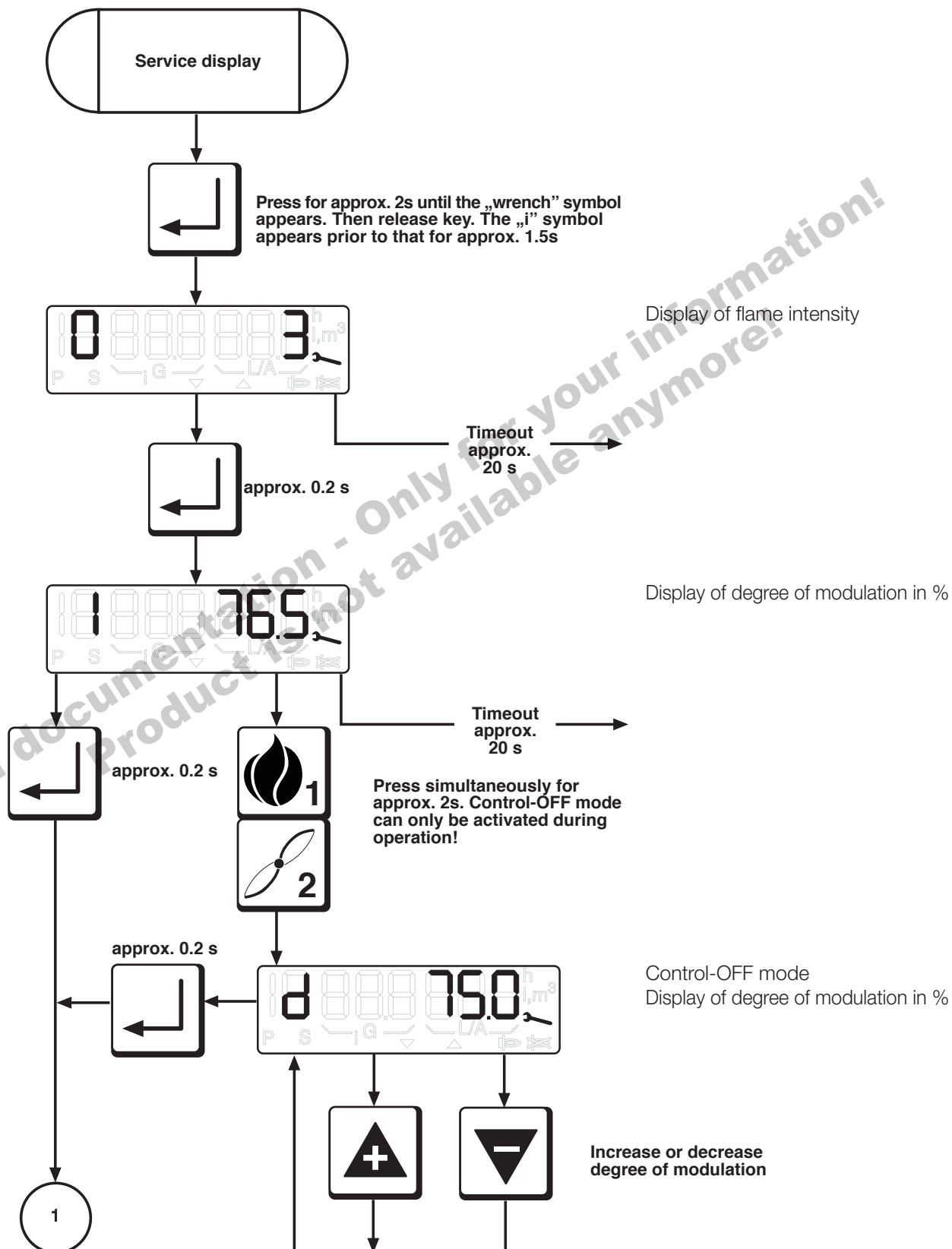


Display and operating unit

Service mode

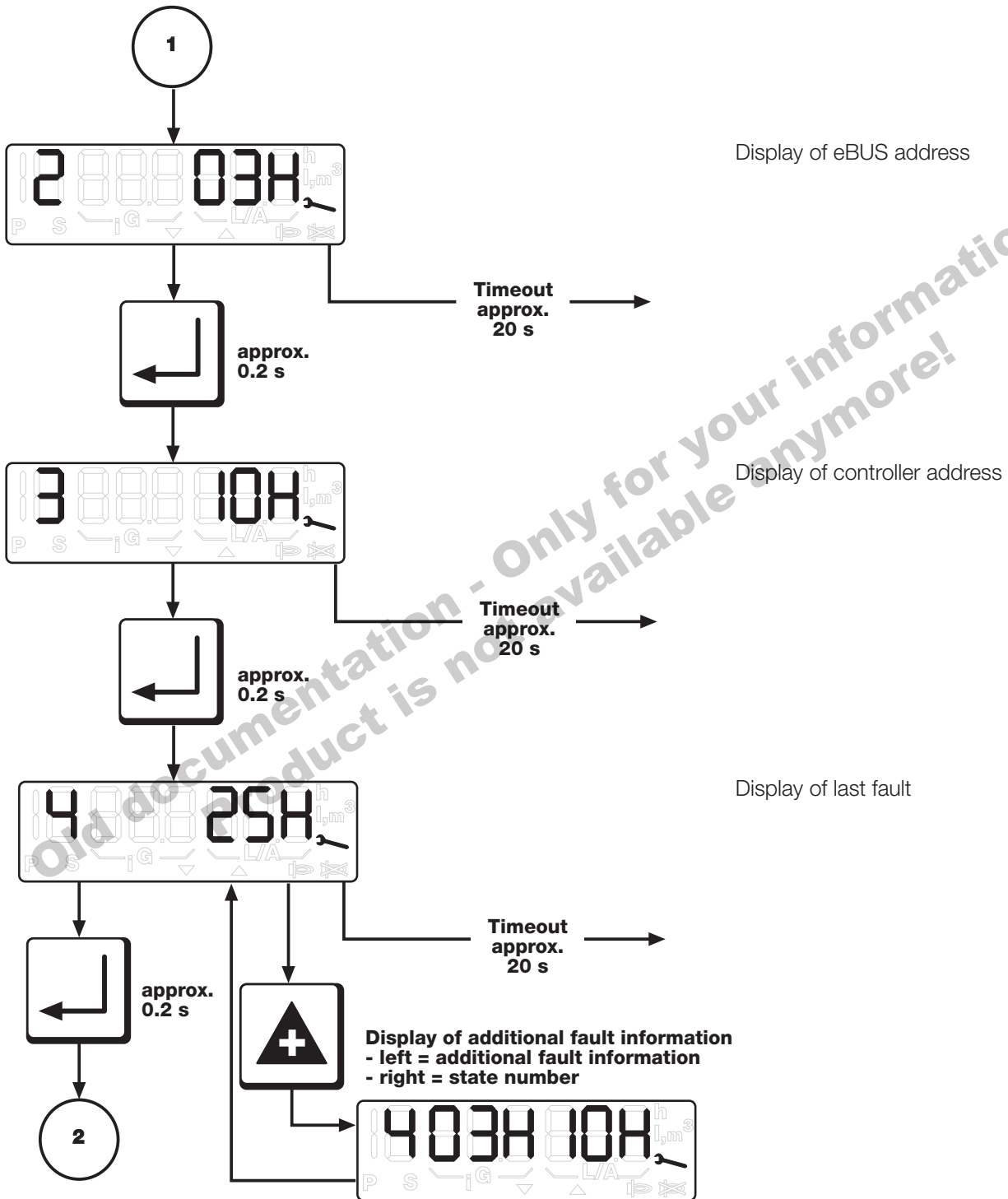
Service mode

The service display can only be accessed from the operating status display. The service display can be called up in every burner state and provides information on the parameters stored in the EEPROM, ionization quality and degree of modulation. Control-OFF mode can also be activated via the degree of modulation display. The system exits this display mode after 20 seconds via the timeout or by advancing after the last display. In control-OFF mode, the system does not exit display mode via the timeout.



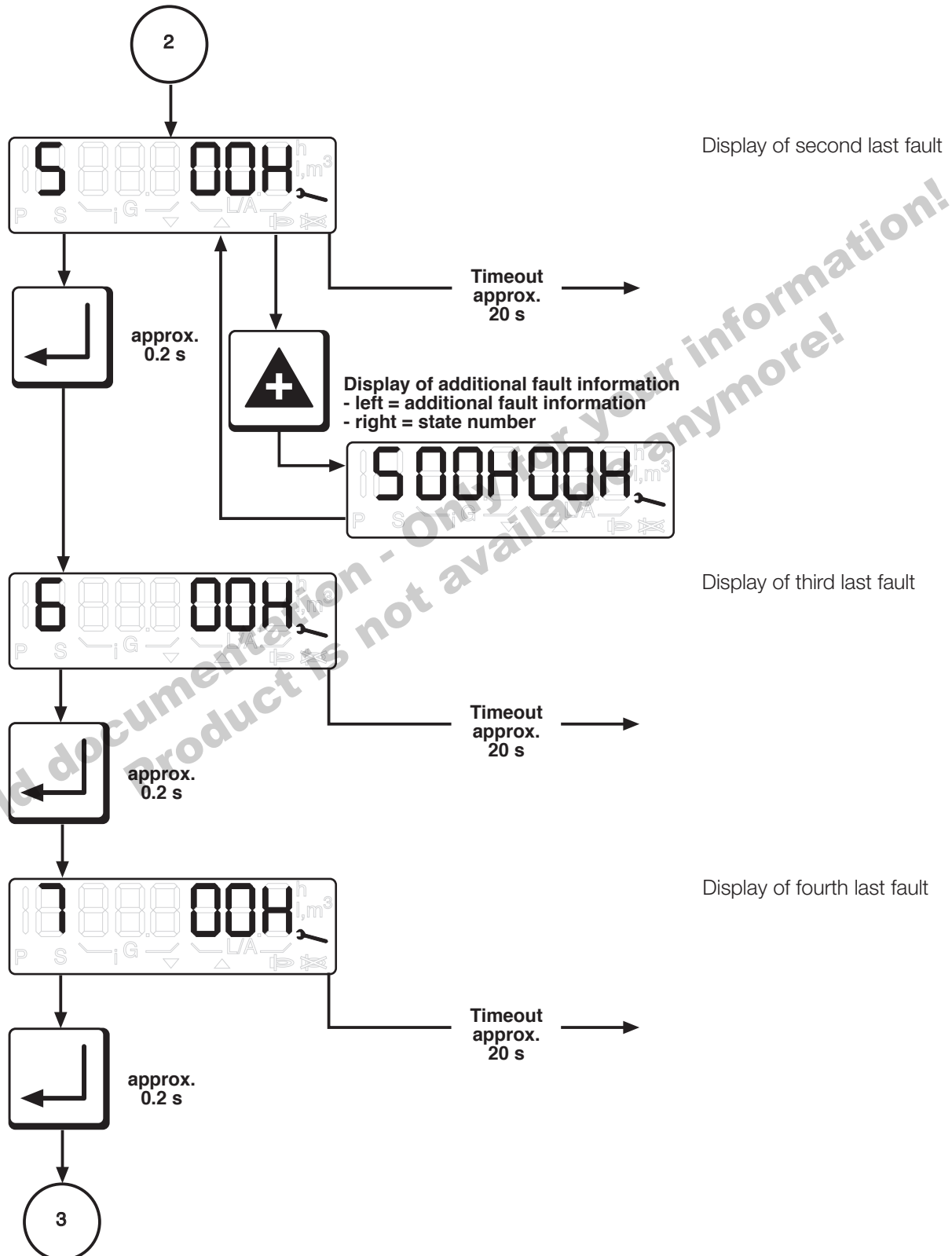
Display and operating unit

Service mode



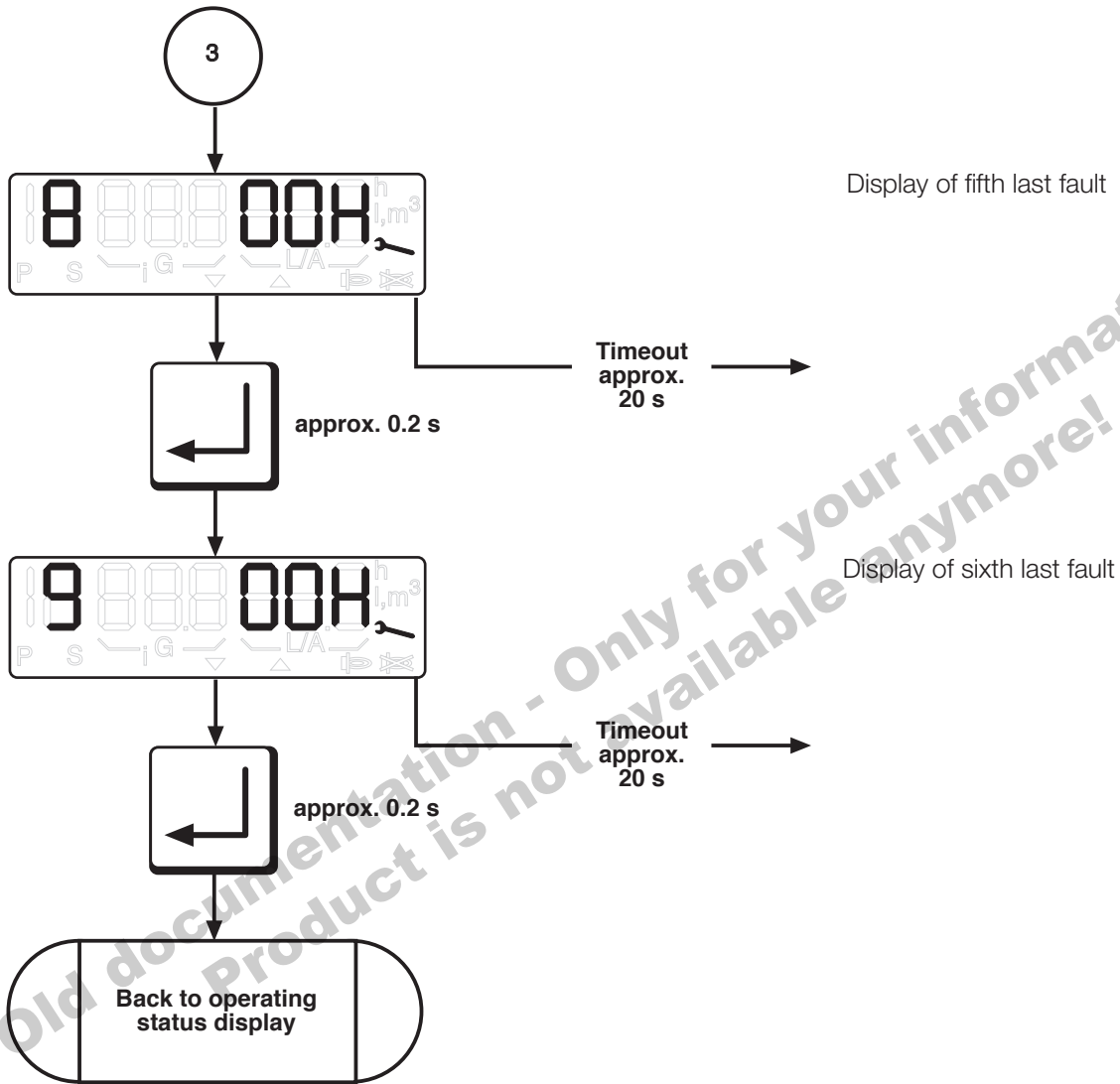
Display and operating unit

Service mode



Display and operating unit

Service mode

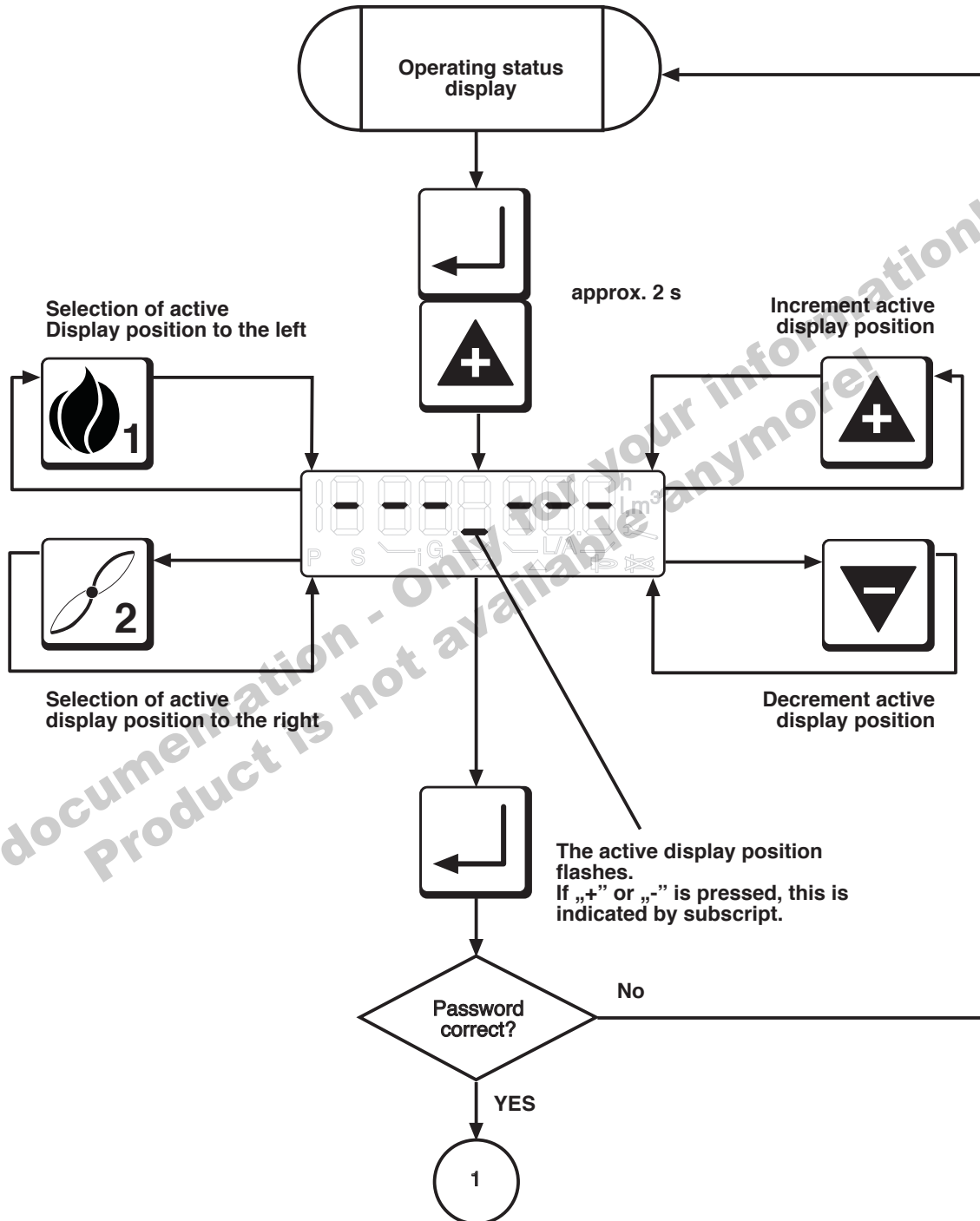


Display and operating unit

Parameterization mode

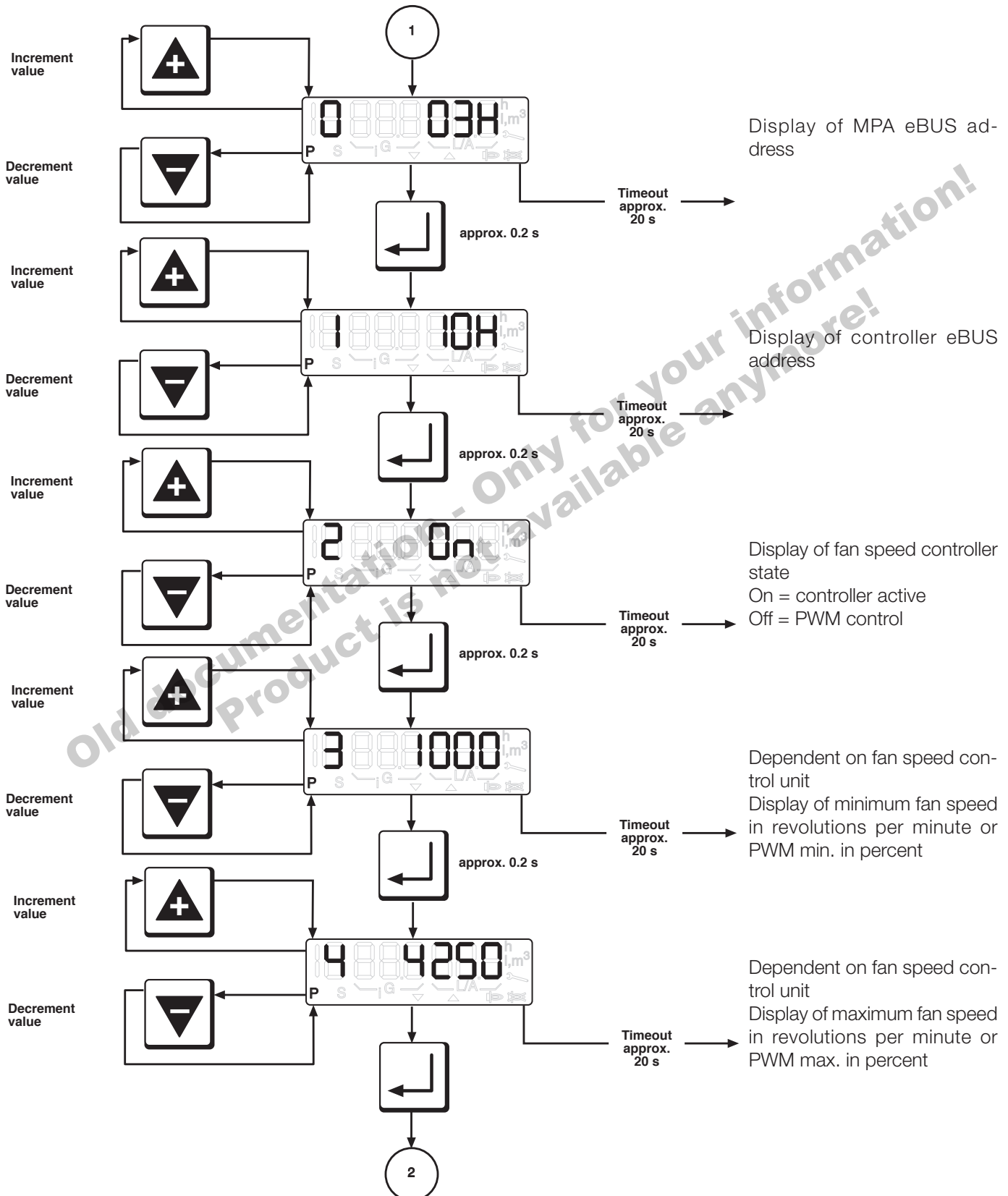
Parameterization mode

Parameterization mode can only be accessed from the operating status display and during standby („OFF“). In this mode, key operating parameters can be displayed and set via the display keyboard. Parameterization mode sets the access level such that all service level parameters can be configured with MPA-Vision. The system exits this display mode after 20 seconds via the timeout or by advancing after the last display.



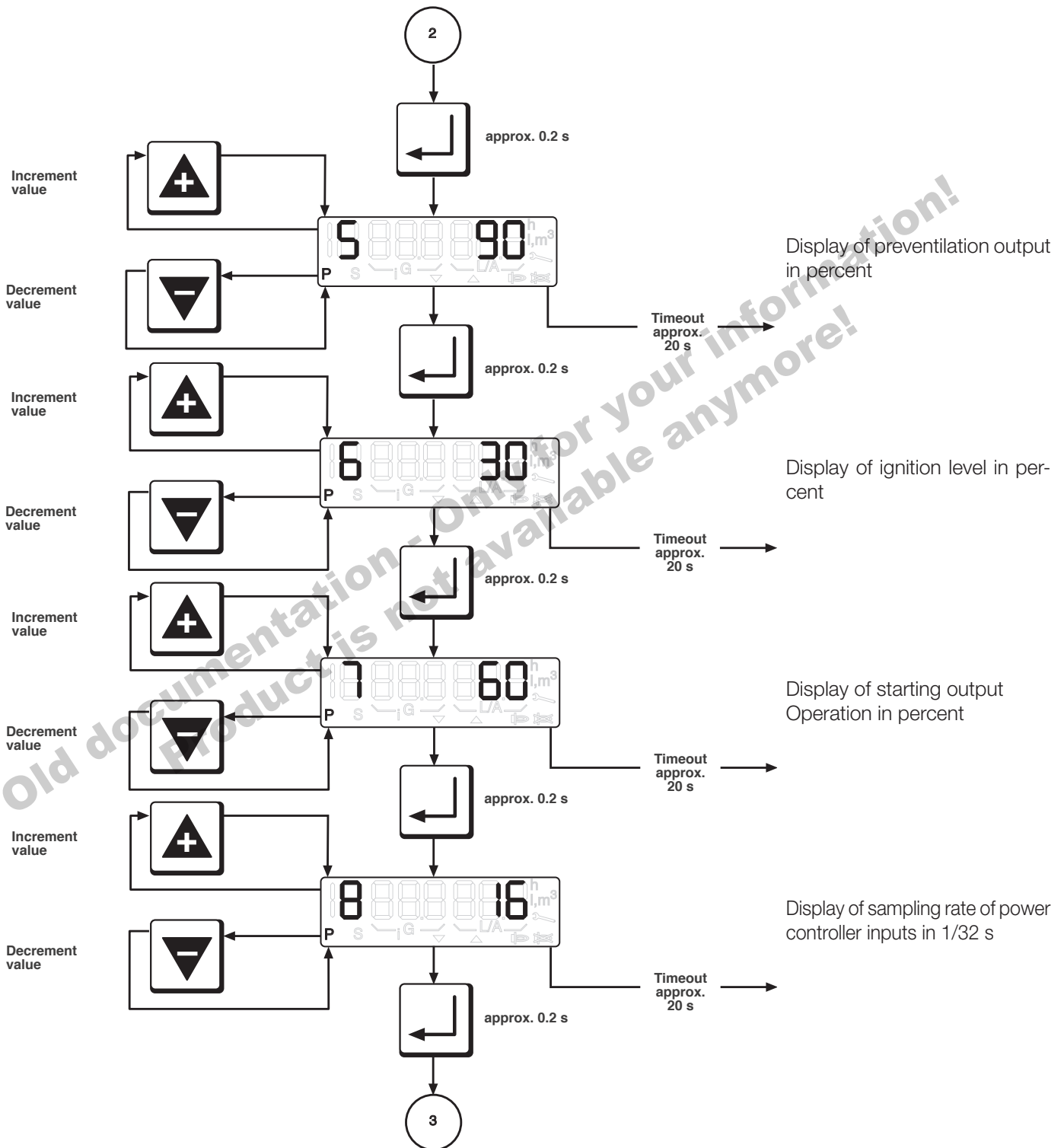
Display and operating unit

Parameterization mode

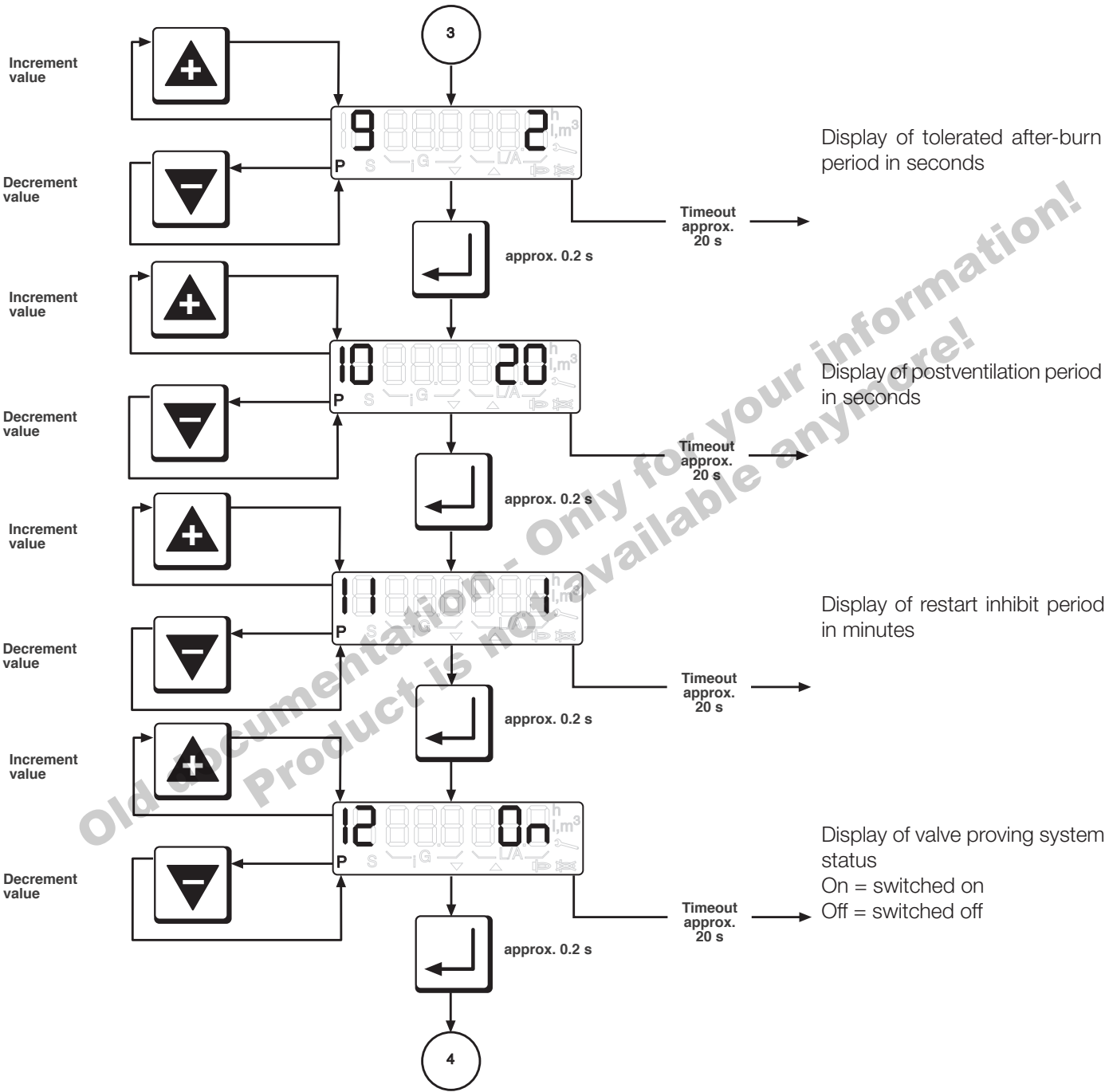


Display and operating unit

Parameterization mode

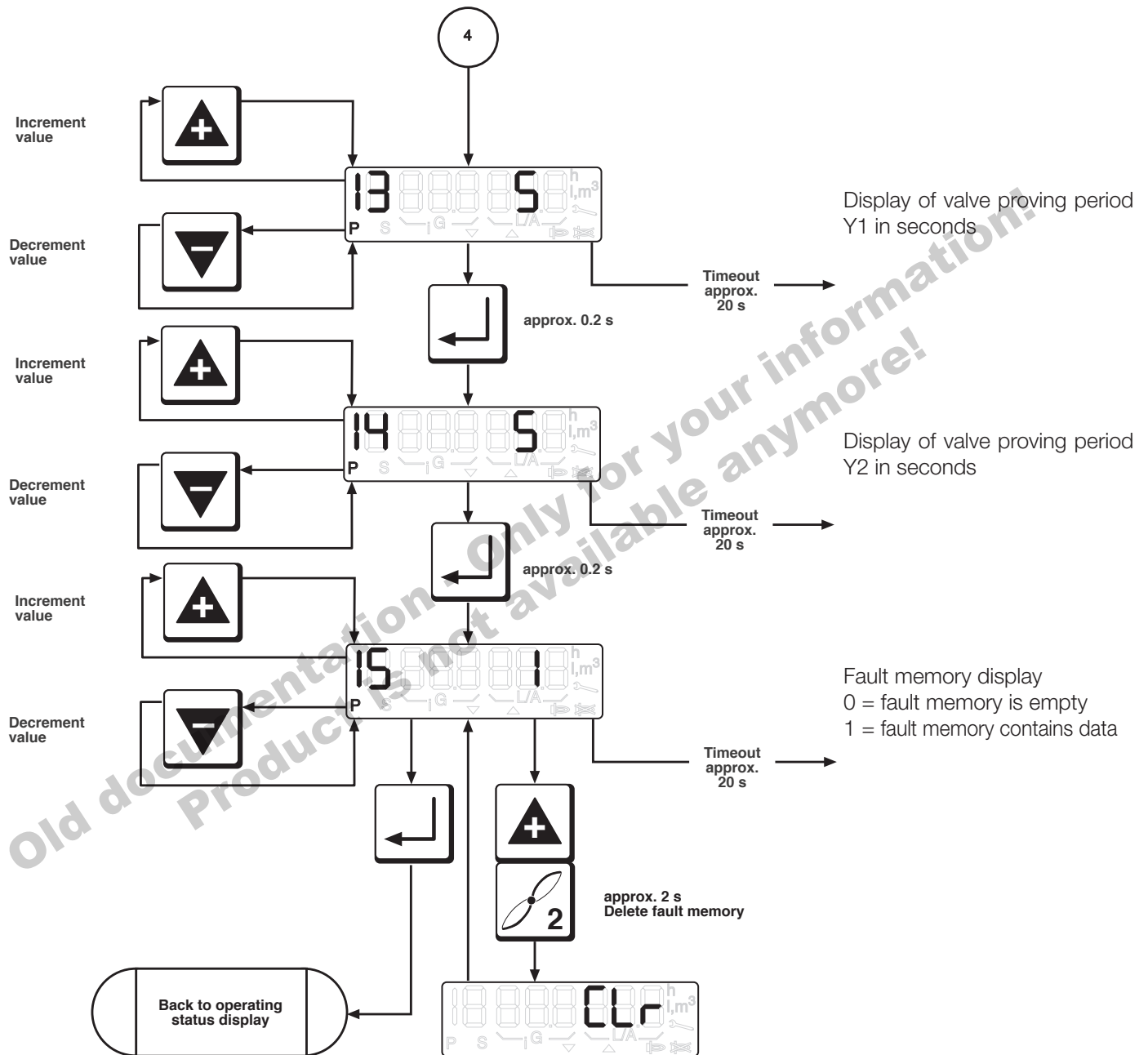


Display and operating unit
Parameterization mode



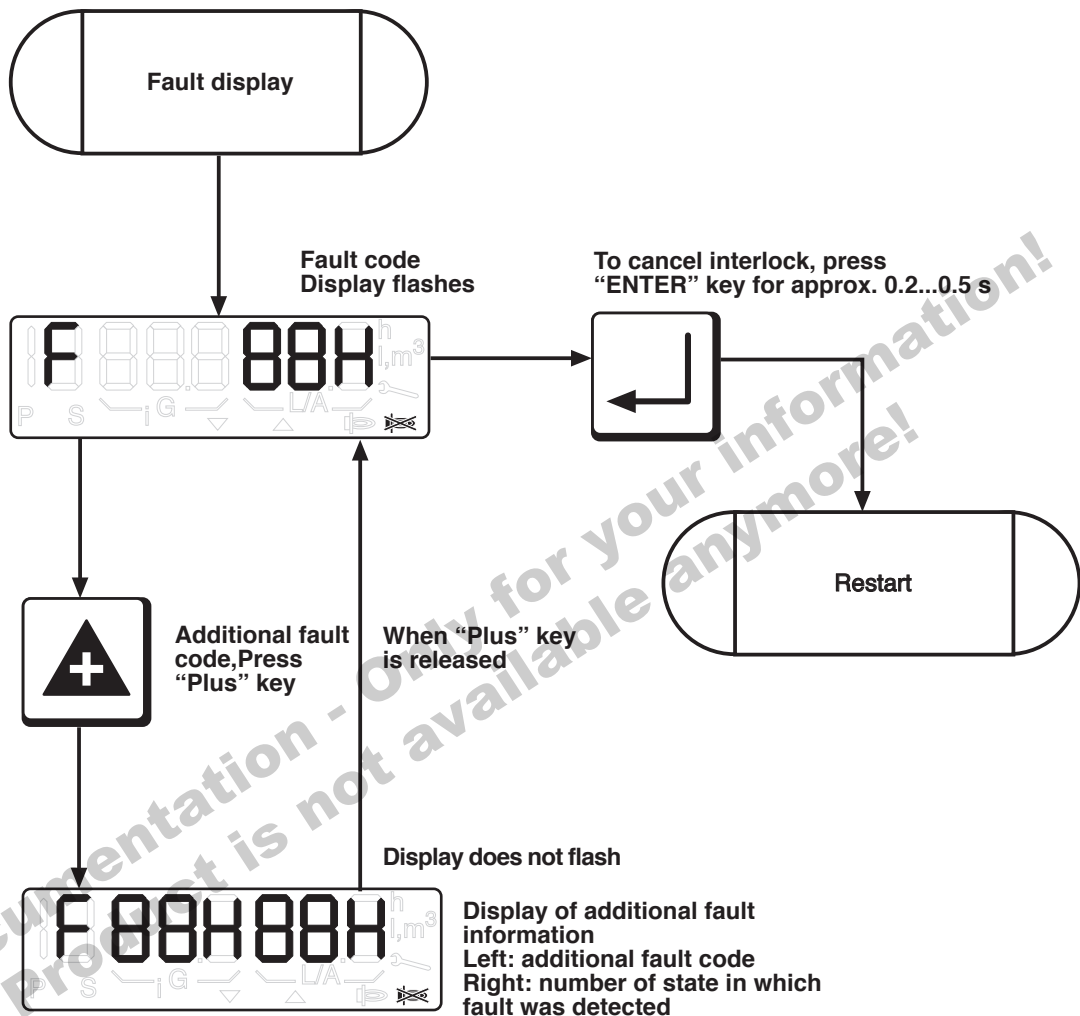
Display and operating unit

Parameterization mode



Display and operating unit

Fault mode



Fault messages

General process faults

Fault code	Description
20H	Fault during air pressure switch idle state check A fault has occurred during the idle state check of the air pressure switch. This fault only occurs if the fan does not enter the idle state during the idle state check and the air pressure switch contact does not open.
21H	Air pressure switch indicates ,no air pressure' This fault is indicated if the fan is not running or the air pressure switch does not switch.
22H	Gas pressure switch indicates no gas pressure Possible causes of this fault are the absence of gas pressure or a defective gas pressure switch.
25H	No flame present after safety period The ionization flame detector issues a flame signal after the safety period expires. Possible cause of this fault are a faulty ignition or an incorrectly set gas mixture.
26H	Fault - Flame simulation The ionization flame detector indicates flame simulation during the startup procedure or after the after-burn period
27H	Fault - Flame failure during operation This fault only occurs during operation. The ionization flame detector indicates a flame failure during operation.
29H	Internal fault of the gas pressure switch input
2AH	Internal fault of the air pressure switch input
2BH	Internal fault of the flame detector
2CH	Fault during test of safety-relevant inputs A hardware fault was detected while testing safety-relevant inputs.
2DH	Internal fault of low voltage detector
2EH	Internal fault of voltage failure detector
2FH	Internal fault of heating request
31H	Fault in feedback of fuel valve Y1 The feedback of the safety relevant output for the fuel valve indicates a fault. This fault occurs if the output relay cannot be switched.
32H	Fault in feedback of the fuel valve Y2 The feedback of the safety-relevant output for the fuel valve indicates the presence of a fault. This fault occurs if the output relay cannot be switched.
33H	Gas pressure switch of the valve proving system indicates ,no gas pressure present'
34H	Internal fault of the gas pressure switch of the valve proving system
35H	Fault in feedback of ignition The feedback of the safety-relevant output for the ignition indicates the presence of a fault. This fault occurs if the output relay cannot be switched.
36H	Fault during speed supervision This fault occurs if the fan speed is outside the designated bandwidth of the setpoint during the startup procedure or during operation for longer than 5 seconds, or if the speed for ignition position or starting output is not reached during operation.
37H	Fault during fan startup A fault has occurred during the fan startup procedure. The specified speed setpoint was not reached. This fault occurs frequently in connection with incorrectly set PI parameters for the preventilation cycle. Possible causes of this fault are a faulty speed signal or a defective fan.
42H	Safety chain is interrupted
43H	Valve proving system indicates a leakage in safety valve Y1
44H	Valve proving system indicates a leakage in fuel valve Y2 This fault generally does not occur, as the system enters the start position if the safety circuit is interrupted.
4EH	Internal Fault while waiting for EEPROM access

Internal system faults

Internal system faults occur if the correct program flow can no longer be assured. Possible causes include short circuits or interruptions in data transmission paths within the processor or on the PCB, defective components or program flow errors.

Fault code	Description
01H	System enters lock-out state but does not write the lock-out to EPROM.
02H	Fault detected while unlocking of the system.
04H	CPU is defective
05H	EPROM is defective
06H	Internal RAM is defective
07H	Internal timer 0, 1 or 2 defective
08H	A/D converter is defective
09H	Fault while synchronizing with clock of first time base
10H	General subroutine fault in state frame
11H	Fault while defaulting state time
12H	Incorrect software watchdog count when entering a state
13H	Incorrect software watchdog count during state interim test
14H	Fault during state time monitoring
15H	Incorrect software watchdog count when exiting a state
70H	Hardware watchdog „OFF“ test faulty
71H	Hardware watchdog „ON“ test faulty
72H	Fault while initializing the device-specific RAM variables
73H	Fault in normal and inverted state counter
74H	Fault in normal and inverted state factor
75H	Fault detected in voltage supervision circuit of watchdog
76H	Fault detected in watchdogs during startup procedure
77H	Fault: internal short circuit
78H	Fault in restart counter
79H	Fault while writing to EEPROM
7AH	General system fault