Commissioning

FMS Firing Management System

TÜV type-approval

CE 0085 AS 0254

DIN DVGW Test mark NG-2510 AS 0324

Sensors and Systems
for Combustion Engineering

LAMTEC

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Validity of these instructions

These instructions apply to the FMS 4 and FMS 5 Combustion Management System in any configuration.

The software-related information relates to the software version V3.1 (recognisable from the sticker inscription on the program EPROM).

Standards

The units conform to the following standards and regulations:

FMS	EN 298	
	EN 230	
	EN 676	where applicable
	EN 267	where applicable
	EN 12 952-8 u.-11	where applicable
	EN 12 953-7 u.-9	where applicable
	EMC Directive, Low Voltage Directive	
	Gas Appliance Directive	

Integral leakage test:
EN 1643

Test mark
gas side DIN DVGW PÜZ NG-2510 AS 0324

CE-0085 AS 0254

Follow the legislation on safety of appliances

The legislation on safety of appliances states:
Follow the instructions !
Proceed only in accordance with this FMS commissioning supplement (booklet No. D LT 6079)

Use the appliance solely for the specified purpose.
It must be operated only by trained personnel. The appliance must be operated and serviced only by persons with the required knowledge and training. Follow the burner manufacturer's safety rules.

To be used only in a grounded power line network!

Associated automatic flame guard
The unit is approved for use only with an external automatic flame guard. The automatic flame guard type F 250 made by Hartmann & Braun is used for testing purposes.
However, any other automatic flame guard tested in accordance with DIN EN 298 and/or DIN EN 230 and approved for continuous operation may be used instead of this.

Electrical connection to appliances not mentioned in these instructions
Only after consultation with the manufacturers or a qualified expert.

If an automatic flame guard not approved for continuous operation is connected, approval of the system for continuous operation will lapse.

Liability for proper functioning of the appliance passes to the owner or operator.
Liability for correct functioning of the appliances in every case passes to the owner or operator, should the appliance be incorrectly operated, serviced or repaired by persons without the requisite knowledge, or if operation is inconsistent with the specified intended purpose.

In the event of modifications to the unit the type approval lapses. The unit's inputs and outputs and associated modules must only be wired according to the specifications in these instructions.

LAMTEC GmbH & Co KG will not be liable for damage or injury arising out of a failure to observe the instructions above. The warranty and liability provisions of the terms and conditions of sale and supply of LAMTEC GmbH & Co KG shall not be extended by virtue of the instructions above.

Where reference is made to legislation, government regulations and standards, these are based on the legal system of the Republic of Germany.

Intended purpose
FMS 4 / FMS 5

The FMS 4 / FMS 5 Combustion Management System is a control unit for combustion systems.

Brief description

The FMS 4 adjusts up to four control elements as a function of a control variable (generally the burner load) according to freely programmable curves.

The FMS 5 adjusts up to 5 control elements as a function of a control variable according to freely programmable curves).

2 sets of curves (e.g. for oil or gas) can be filed as standard, with the option for 4 or 8 sets of curves.

Examples of possible control elements:

- Combustion air damper
- Combustion air fan
- Fuel quantity
- Atomiser steam
- Re-circulation fan
- Flue gas damper
- Flue gas fan

Up to 20 points can be programmed for each channel. The display is relative between 0 and 999.

The FMS has two correction inputs for shifting the setting curves, allowing a feedback control (e.g. O_2 control unit) to be connected up.

Each output is freely configurable, either three-point step control element output for direct actuation of a motor or constant output (on the FMS 5 the 5^{th} channel is always constant). The constant output can be set to any of the following variables:

- Current signal 0 … 20 mA
- Current signal 4 … 20 mA
- Voltage signal 0 … 10 V

The FMS 4 also has a so-called monitor output. In addition an internal value (such as the load position of the burner or position of the gas control element) can be outputted by means of 4 … 20 mA signal).

The FMS has one serial interface for remote control/ display via PC (Windows software available separately) and for connection to other system components via BUS (e.g. fault message system, O_2 control). Connections for Interbus-S, Profibus, Modbus and CAN-BUS are available as options. Other BUS systems on request.

The FMS constantly monitors its own functioning and that of the control elements connected.

Each analog input (control variable and feedback or correction) is freely configurable via plug-in cards.

Alternatively:

- Potentiometer (1 5kΩ)
- Current signal 0/4 … 20 mA
- PT 100
- Step input (DPS)
- Namur transmitter as a two-wire system
- inductive sensor with switch terminals in three-wire system

The unit is of error-proof construction.

The FMS contains a burner control unit with process control program.

Outputs:

- actuation of gas valves
- actuation of oil valves
- actuation of the ignition valve and ignition transformer
- fan release
- oil pre-heating
- fault signal
- signal outputs for oil and gas operation
  (in the off condition, oil operation is always indicated)

The external signals to the control unit are via floating contacts or chains of contacts.

The following signals can be pre-set:

- 3 separate safety interlock circuits
- fault unlocking
- air pressure monitor
- gas pressure monitor (min.)
- flame signal (pilot flame monitor and ignition flame monitor)
- pre-ventilation and ignition release
- pre-ventilation suppression
- control release
- re-circulation release
- burner on
- fuel selection

Application - internal output regulator (optional)

This software option makes it possible to calculate the burner's required load setting continuously for a specified target value (referred e.g. to temperature or pressure), through comparison with the actual value. This load setting can be notified internally to the electronic compound as the specified value.

Application - internal O_2 regulator (optional)

This software function makes it possible to regulate one or several actuators independently of a switched-on O_2 actual value. By using a self-optimising regulator strategy, it is also possible to regulate burners with frequent load changes.

Purpose of these instructions

These instructions are concerned exclusively with commissioning and servicing.

Further information, for example design examples, possible uses, software settings etc., is given in separate booklets.

Special information dealing with optional equipment on this unit is explained in separate booklets.

Preliminary clarification

To make the best use of these instructions, proceed as follows:

Check whether the settings of your FMS meet the system requirements. You will find the settings on the sticker on the unit.

- Which physical quantities (current, resistance) and values does your FMS need on its inputs?
- Which physical quantities (current, voltage, relay signal) and values does the system expect on the outputs of the FMS ?
- Do the settings of the FMS match your requirements with regard to operating behaviour (pre-ventilation, feedback etc) ?

Should these matters not be clear, please read the section "Settings" (page 16-29)

Finding the appropriate section

Determine what operation you wish to perform on the FMS.

When initially putting into operating or tracing the cause of a fault, a function test is first recommended. You must then decide whether you wish to program with the burner stationary or running and whether or not an entire curve is to be programmed.

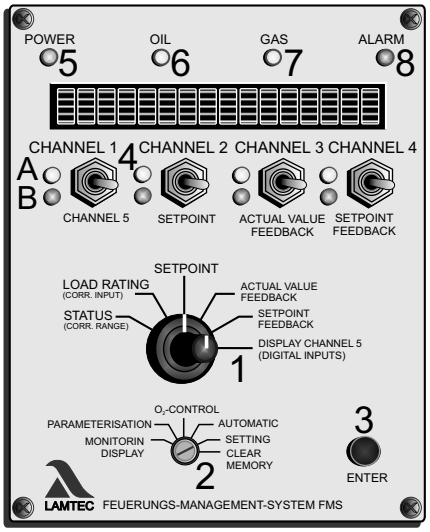
Identify your current requirement from the table of contents and turn to the appropriate page.

Conventions

Sub-headings
Serve as a guide if you can already handle the FMS and merely want to refer to certain information again.

Lines in italics after the sub-headings
describe what the current state of the system should be. If this is not the case, the subsequent operations will not show the desired result.

Lines in bold type
indicate an action which you are to perform.



The figures and letters in brackets (1), (2), (3), (4), (5), (6), (7), (8), (A) and (B) relate directly to the picture of the front panel. They identify the part on which the specified action is to be performed or on which a reaction can be seen.

The lines in ordinary typeface below the procedural instruction describe the reaction of the system or unit following the operation.

The figures at the right-hand margin denote a paragraph in the "Fault Correction" section of these instructions. If the reaction indicated does not occur, please refer to this. It describes the possible causes of faults and how to rectify them.

The word in italics between two lines and the [I] *sign*
are notes for a better understanding of the operation or notes on how to avoid incorrect operation.

The lines in bold italics between two lines and the triangle
draw attention to dangers. The instructions given there must be followed.

If you now follow the operations step by step, paying attention to the instructions, you will automatically be working correctly.
If any of the reactions indicated do not occur, there is a fault with the unit or the system. You should correct the fault first before proceeding.

Fault correction

Follow the instructions identified by the figures given after the fault codes and after the procedural instructions. You may find the solution to your problem there.

This section, however, makes no claim to completeness. Should the actions described there not have the desired effect, the unit or parts of the unit (e.g. front panel etc.) must be changed. If the fault still occurs you are dealing with a fault specific to the system.

Tip: You can download the up-to-date version of these instructions from http://www.lamtec.de as PDF File.
You will find the version from the letter of the booklet no. (see the backside of this document).
Example:

DLT 6066 cD

booklet No. version language

FMS Digital Inputs

For the FMS to function according to the requirements of a combustion system, the condition signals from the system must be relayed to the FMS.

These signals include:

Pre-ventilation suppression	Air pressure monitor
Gas safety interlock circuit	Gas pressure > min.
Oil safety interlock circuit	Ignition flame
Boiler safety interlock circuit	Burner on
Ignition position acknowledgement	Fault reset
High firing rate acknowledgement	Re-circulation On
Fuel selection	Control release
Flame signal	Set-point switch over (only with integral load control unit)

For use in burner control, the FMS emits 9 digital signals, which are converted by relay module (type 6 60 R 0016) into twelve output signals for 230 V:

Main gas 1	Ignition valve
Main gas 2	Ignition transformer
Oil	Release ignition gas line
Heated oil distribution	Fan
Oil operation signal	Pre-ventilation / post-ventilation
Gas operation signal	Fault signal

FMS operating sequence (for diagram of example, see appendix)

The operating sequence described relates to a usual configuration of the unit. The various parameter settings can result in a somewhat different sequence.

A signal is first sent to terminal 2 (burner ON), indicating when the burner is to start. The FMS then interrogates the safety interlock chain for the selected fuel and the air pressure monitor contact. If the fuel is selected via the fuel safety interlock circuits, the FMS performs a plausibility check. If it does not detect a satisfactory condition, a corresponding text message is emitted and the process control stops.
If all signals are OK, the fan output is activated and the ducts run to their bottom stop as a check. The "pre-ventilation/post-ventilation" output is activated. Once all ducts have reached their bottom stop, they open for aeration. Any leakage test configured runs in parallel.

In the case of control elements, aeration is used to enter and to check the range limits. The fuel control element, after reaching its top position, runs back into the ignition position. All other ducts remain in the open position. The FMS now interrogates the high firing rate acknowledgement and the air pressure monitor. If these signals are OK, the parameterised aeration time runs. If a duct is configured for re-circulation, this opens with a time delay. On reaching the parameterised re-circulation delay time, the pre-ventilation time stops. As soon as the re-circulation duct has reached the aeration position, the aeration time continues. Once this time has elapsed the ducts run into the programmed ignition position (re-circulation fully closed). Once all ducts have reached ignition position, the FMS interrogates the ignition position acknowledgement. In gas operation the gas pressure monitors must also be in a satisfactory condition prior to ignition.
The ignition transformer is now activated alone for the duration of the pre-ignition time (transformer start-up time).

Start without pilot burner:
The main valves open and remain activated together with the ignition transformer for the duration of the safety period. During this time the flame signal appears.

Start with pilot burner:
The ignition valve and main gas 1 are opened. The pilot flame forms and the flame signal appears. Once the 1st safety period has elapsed, the pilot burner burns on its own. The main gas 2 then opens and remains activated in parallel with the ignition valve for the duration of the 2nd safety period. When this period has elapsed the ignition valve closes again.

When ignition is completed the re-circulation duct and the flue gas damper run to the programmed point. Correction is activated. All ducts may run to the programmed base load point (depending on the setting selected).
The FMS remains in the base load position until control release (terminal 4) is given.

Following control release the FMS follows the prevailing external load.
A current signal proportional to the position of the compound is emitted as internal load (not on FMS 5).
Withdrawal of the signal/control release during operation allows the compound to run at base or ignition load (configurable).

Withdrawal of the terminal 2 signal is followed by shutting off. The main valves close. (In gas operation, main gas 1 first, followed by main gas 2 with an approx. 5-second delay, in order to allow the monitoring line between the solenoid valves to burn out. In the event of a fault shut-off, however, they both close immediately).
If configured for post-ventilation, the air ducts open again for this period. After the configured after-burning time the FMS again checks for a period of 5 seconds whether the flame has gone out. If not, a fault shut-off occurs.
The FMS then goes into "OFF" mode.

Pre-ventilation suppression through an external signal

The pre-ventilation range can be skipped by means of the pre-ventilation suppression signal (terminal 1). If the signal is present straight away at burner start-up (terminal 2 signal), the control elements run directly to the ignition position. In order to enter the range limits, however, pre-ventilation should be performed once after "Clear Memory".
Pre-ventilation suppression can only occur, however, if this function is activated via parameters.

Automatic pre-ventilation suppression

When activated by parameters, the FMS starts after regulator switch-off automatically without pre-ventilation. Pre-ventilation is only carried out now after fault switch-off or power failure. Using this function is subject to the regulations applicable to the facility.

Setting the pilot burner, servicing mode

A so-called servicing mode can be set via parameters. The control unit then runs until the stabilisation period. In this mode 5 successive starts are possible without the need for pre-ventilation and without a leakage test. The 5th start is automatically followed by pre-ventilation and/or a leakage test.

Program monitoring time

It can be determined by way of parameters how long the FMS may take after a start signal (terminal 2) until ignition occurs. If this length of time is exceeded, a fault shut-off occurs. If the content of the parameter is set to 0, no fault occurs (= program monitoring time = ∞).

Restarting

Automatic restart can be activated via parameters. The control unit attempts a one-off restart in the event of any fault marked with * after a factory-set period (standard: 10 sec). This restart can be prevented by setting the period to 0.

In the case of firing systems according to EN 676 the parameter must be set to "0".

The standard setting is without restart.

Leakage test (option)

The control unit may optionally also perform the leakage test on the gas valves. The leakage test can per performed before ignition and/or after shut-off

The leakage test is performed by way of the main valves. The use of filling and discharge valves is also possible by means of relay switching.

4 curve sets (option)

The FMS offers the facility for using two curve sets for each fuel (e.g. summer/winter operation) or a mode with and without speed.

Flying curve change (option)

When using Option 4: Curve sets, it is possible to switch **within one fuel selection** from one curve-set to the other (flying curve change). Fuel change can only be performed via "Off".

Automatic fuel change

When switching the fuel selection switch over (terminal 75), the FMS first moves automatically to the base load position. Then the system switches off. Only then are the fuel selection and thus the curve set changed over. If the "Burner on" signal is still present, the burner starts with the new fuel. (This function is not available with Option 4: Curve sets).

Range limits

In the 1st pre-ventilation after "Clear memory", the FMS determines the maximum range of travel for each control element and stores this automatically. If no ranges limits have yet been determined, the setting (in the case of constant outputs the feedback setting) in pre-ventilation stands at 0 and 999 points respectively. At all further starts a check is made to see that these range limits are correct. Should the limit switches be shifted or the frequency converter setting changed after programming, the range limits must be re-entered.

If the range limits cannot be determined automatically, they can also be entered manually by way of parameters. If the FMS has no existing range limits, it automatically takes the top and bottom point of the curve as the limit. It then does not go beyond this.

Internal load

The internal load is the load value at which the compound currently stands. It therefore corresponds indirectly to the output of the burner.
The internal load is displayed in addition to the external load signal.
In the "load value" position therefore both the external load (left-hand) and the internal load (right-hand) are displayed.

The value of the internal load can be outputted via the monitor output, in order to connect further units (e.g. O_2 control, only on FMS 4). When connecting other units, it must be remembered that the signal in itself is not error-proof.

Manual operation

When switching over to "Load value" with the burner running the burner load can be set via the FMS. The load value can then be adjusted with the channel 1 toggle switch.
The system follows this load value in the compound.
Operating a switch other than channel 1 causes the unit to exit manual mode again.

Parameterisation FMS

The person commissioning the unit can adjust various functions of the

by way of parameters (e.g. post-ventilation time). The parameters are classified into various safety levels. With the exception of the lowest safety level these are accessible only with a password. The parameterisation can be undertaken both on the unit itself and by means of a PC and Windows software.

Correction

The FMS has 2 correction inputs. An analog signal (0/4 … 20 mA) can be connected to these for shifting the set curves (e.g. for O_2 correction or air temperature correction). The assignment of the correction to the individual output channels and the mode of operation can be adjusted via parameters.

If the FMS cannot perform a correction because a control element stop has been reached, it adjusts the internal load and hence the compound until the correction can take effect as required.

Facility for direct connection of Namur transmitter (option)

An output for controlling the speed of a combustion air fan or a re-circulation fan etc. can be monitored by switching the pulse output of a Namur transmitter directly to the FMS.

Freedom from error of feedback signals

Continuous outputs and three-point step outputs have different feedback requirements. In the case of continuous outputs comparisons are made between output and feedback values in or to check the plausibility. The units therefore do not have to be intrinsically error-free in order to form the feedback signal. For availability reasons (minimisation of interference) the reproducibility of the values should be as good as possible.

For technical reasons this method cannot be used in the case of three-point step outputs. For this reason TÜV approved potentiometers must be connected directly as feedback to the FMS. These potentiometers must positively render the position of the damper.

Pre-ventilation limit

Normally during pre-ventilation each control element runs as far as ist uppermost stop. Now, by means of parameters, a limit can be set for each channel that is not exceeded during pre-ventilation.

Energy-saving mode for running text display

The brightness of the display can be adjusted to the ambient light conditions by means of parameters.
In addition the display can be set to automatically revert to the lowest brightness level if not operated within a given period of time.

Separate ignition point

In the standard version the ignition point is situated outside the accessible range in order to set a separate fuel/air ratio. By means of parameters, however, the ignition point can be adjusted so that it lies on the compound curve.

Integrated power control unit (option)

An integrated power control unit is also available as an option. Where this is used the actual temperature or the actual pressure is directly switched instead of the load signal. The control parameters are adjusted via parameters. It is also possible to change the setting (daytime/night time operation) and to control the atmospheric conditions by switching in the outside temperature.

The integral output regulator is a PID controller with special combustion technology functions. It can be used as a fixed-value regulator or as a weather-dependent regulator. The following signals can be set:

- Actual value (analogue)
- External temperature or some other analogue signal for target value shifting (only in weather-dependent regulators)
- Target value switching (via zero-potential contact)

Combustion enabling by the output regulator takes place internally in the FMS Boundary values that switch the burner on and off, need to be set via parameter setting. In this case, the startup signal is removed internally from the FMS via the output regulator module.
The operator is alerted by the display (running text) that the output regulator refuses to enable a startup.

Integrated O_2 regulation

- optimises combustion systems
- saves fuel
- minimises pollutants

The main purpose of O_2 regulation is to compensate for perturbations that affect combustion. In addition, the O_2 regulation system monitors the combustion's fuel/air ratio. A message is output at once if it strays outside the permitted limits.
The following are the main perturbing factors that affect combustion:

Air:	Temperature Pressure Humidity	Contamination:	Burner Boiler
Fuel:	Calorific value Temperature Viscosity Density Gas pressure fluctuations	Mechanical systems:	Mechanical hysteresis (free play)

The O_2 control unit is implemented as a free-standing software module. The unit compares the residual oxygen content in the exhaust gas of a combustion system measured by means of the LT1/LT2 Lambda transmitter (actual value) with the optimum residual oxygen content (target value). The target values are stored in the instrument in the form of an installation-specific curve. The control unit applies a correction until the actual value corresponds to the target. The calculated output value of the O_2 control module is transmitted to the compound module as a correction input signal.

Significance of ID number

The ID number comprises 8 characters, e.g. 664 V 0010
The two figures before the letter denote the unit, in this case a FMS 4.
The letter denotes whether the unit is a VMS or a FMS. The penultimate figure provides information on the unit hardware.
It also determines which connection diagram applies (see appendix).

Inputs

The inputs can be configured on the backplane by means of plug-in configuration cards. Any of the following can be connected up to each input:

- a potentiometer in the range from 1-5 kΩ
- a current signal 0 … 20 mA or 4 … 20 mA
- a step signal ("OPEN CLOSE" commands)
- a frequency signal (Namur transmitter), for details see appendix
- a PT 100 element
- flame sensor module (in preparation)
- a potentiometer module (in preparation)

There is a plug-in card for each configuration. This is inserted into the respective socket in order to configure the input.

Configuration sticker

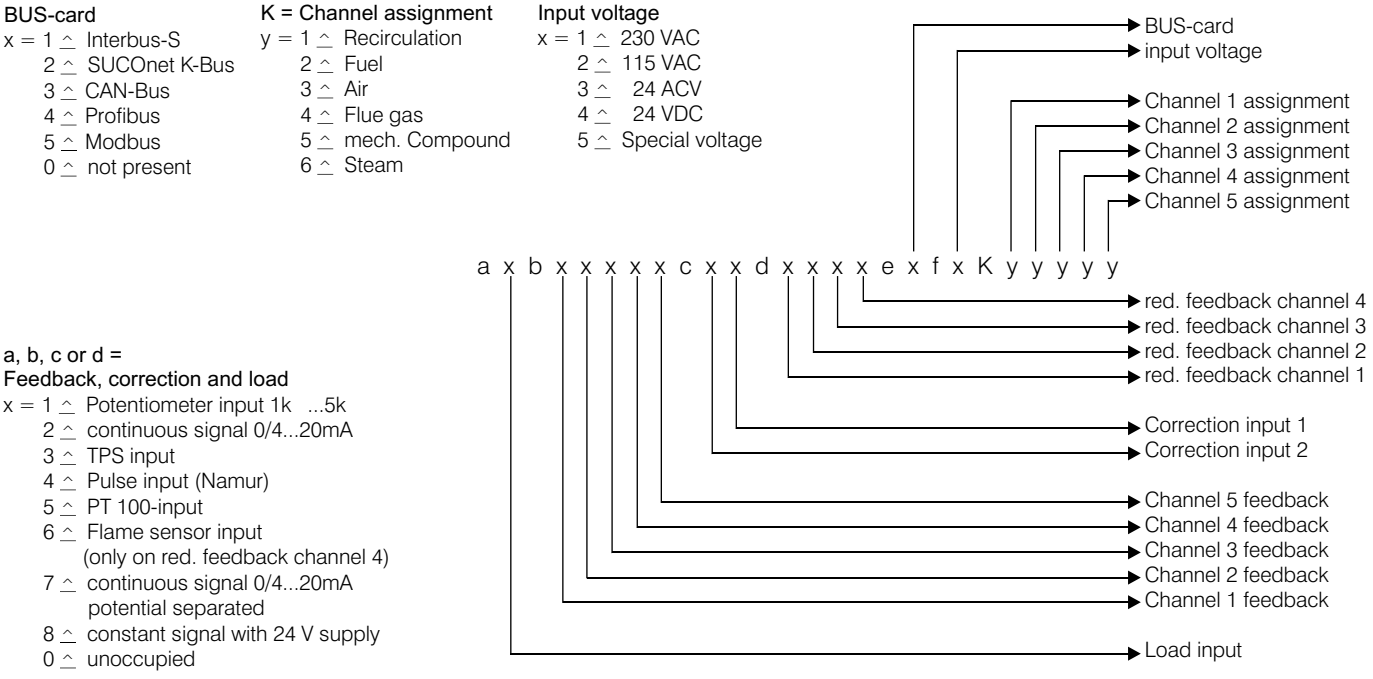
The factory setting is entered on a sticker on the side of the unit.

This corresponds either to the customer data or, if nothing was specified, the standard setting (see condition on delivery).

The EEPROM checksums and thereby the software version are also entered on this sticker, together with the configuration number and hence the hardware setting.

Configuration number

The configuration number is a 15-digit number, constructed according to a fixed code.



Condition on delivery

All units are set according to the order. Settings not evident from the ID number or configuration number must be indicated separately.
In particular:

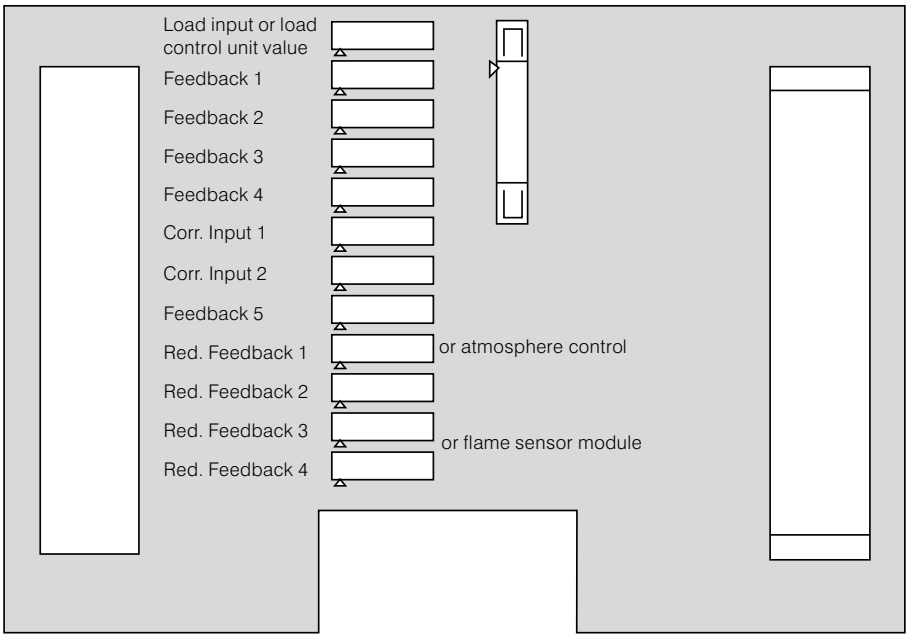
Outputs
- whether continuous or three-point step
- whether 0 … 10 V, 0/4 … 20 mA
- position of the outputs in the event of fault

Inputs, load, feedback
- Whether potentiometer or 0/4 … 20 mA or step
- Whether inputs are used doubled (redundant) and if so, which (possible only if the integrated power control unit is not used)
- Whether special plug-in configuration cards (PT 100, Namur transmitter) are used

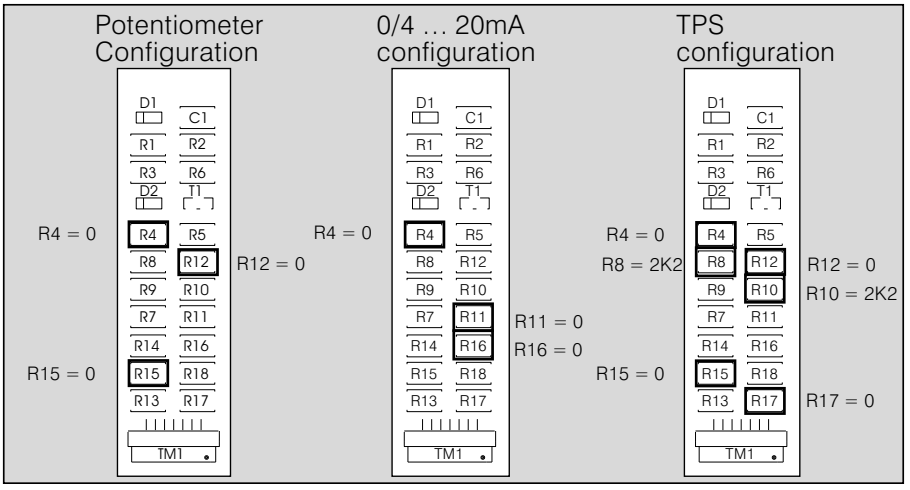
Correction input
- Whether 0 … 20 or 4 … 20 mA or direct temperature connection
- Mode of operation, on which channel, upward or downward shift (modifiable only via software)

Assignment of sockets to inputs

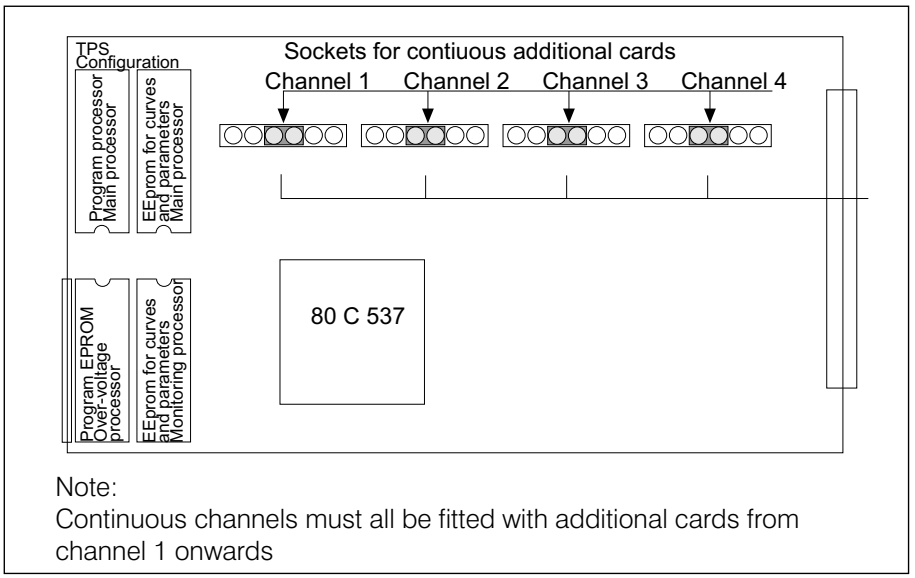
Backplane



Configuration cards (examples)

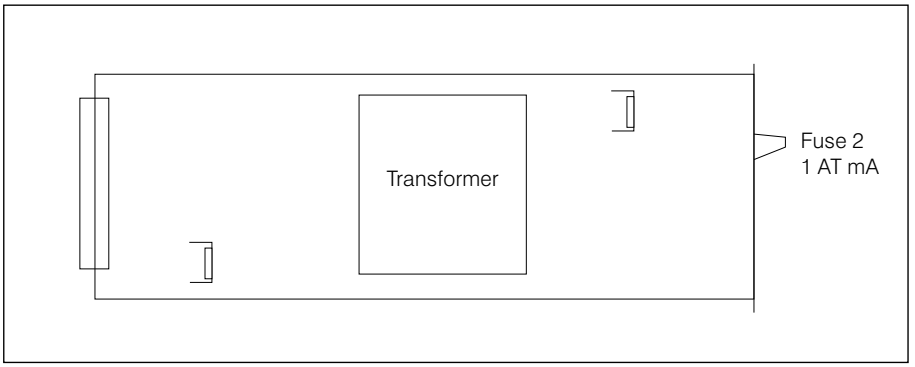


Processor card



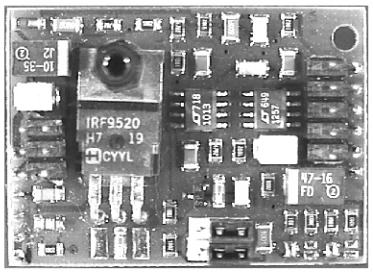
Note:
Continuous channels must all be fitted with additional cards from channel 1 onwards

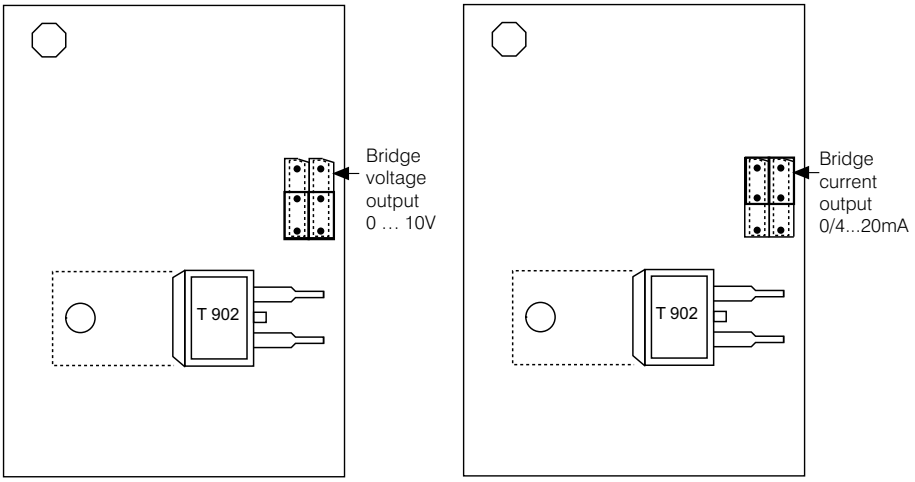
Power supply card



Plug-in p.c. card for
a continuous output

The standard control outputs are three-point step
(except for a possible 5-channel. This is always continuous).
Each TPS output can be reconfigured to make it continuous by plugging in an additional card.





The jumpers serve only for hardware switching between current output and voltage output.
The selection of 0 or 4 … 20 mA is done through the software by means of parameters.

Parameter setting

The parameter level can be accessed by turning to the "Parameter" selector switch position. When working on level 1-4, this works only with the burner stationary (i.e. no signal on the digital inputs). Only level 0 is accessible with the burner running.

As a rule, the factory parameter settings are precisely tuned for the installation for which the unit has been designed. Therefore, it is only necessary to change parameter settings in exceptional cases.

Access levels

The parameters are divided into four different access levels according to function and safety classification:

Operating level (Level 0)
- Accessible without password, non-critical parameters that may possibly have to be altered during operation.

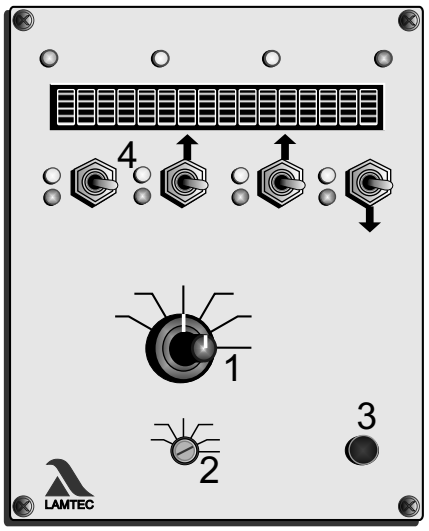
Customer level (Level 1)
- Accessible with modifiable password (on delivery set at "0000"), access to parameters, adjustment of which calls for technical knowledge, which are tailored to the system and which are not altered during operation.

Service level (Level 2)
- Accessible with a fixed password, but only to personnel specially trained in parameterisation. Access to all parameters that are not fixed on the basis of standards and technical regulations.

Production levels (Levels 3 and 4)
- Access to all parameters (only possible through LAMTEC)

Each parameter level is protected by its own checksum. This checksum serves to show that no changes have been made (see page 78).

Entering the password



Selector switch (1) to status

Push switch (4), channel 2 and 3, up

and at the same time

push switch, channel 4, down
- the input field for the password appears on the display.

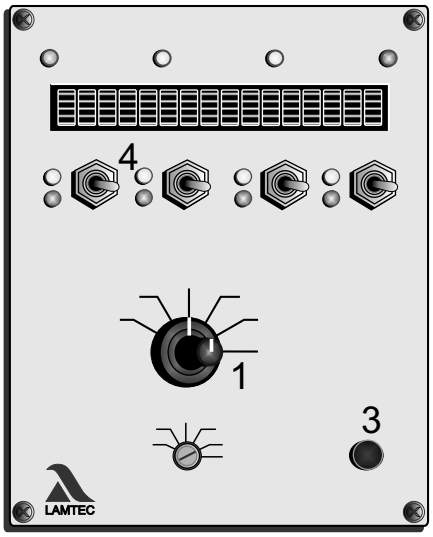
Set the appropriate password via the switch.

Acceptance key (3)
Parameters on the corresponding level are released.

Selector switch (2) to parameterisation

Changing the password

Only possible at customer level (level 1)



From level 1, once accessed:

Turn selector switch (1) to Status

Simultaneously push keys (4) channel 2 and 3 upwards

and channel 4 downwards

- the display shows the password input field

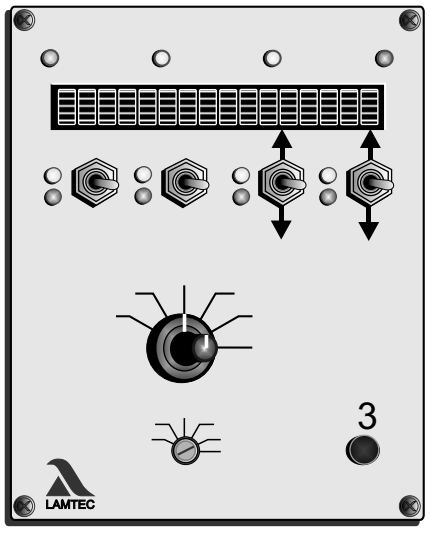
Set the new password for the level

Turn selector switch (1) to Digital inputs

Press the Acceptance key (3)

- new password is set

Changing parameters



Select the required parameter with Channel 3 key

Change its value with Channel 4 key

- The values are accepted immediately without further confirmation

An explanatory text for the parameters can be called up by pressing the Acceptance key (3)

For larger values, changes can be in x100 steps with Channel 1 key and in x10 steps with Channel 2 key.

When changing the parameters via interface (by means of optional PC software) a check must then be made on the spot to ensure that the changes have been properly accepted. This can be done by reading out the parameters on the unit or by comparing the unit's checksums. See page 78 .

Para-meter-No.	Short design-nation	Safety level	Lower limit	Upper limit	Description	Standard values	Aids
Pre-ventilation							
346	VO LimK1	1	0	999	Limit to which pre-ventilation can be terminated, Channel 1	999	P4
347	VO LimK2	1	0	999	Limit to which pre-ventilation can be terminated, Channel 2	999	P4
348	VO LimK3	1	0	999	Limit to which pre-ventilation can be terminated, Channel 3	999	P4
349	VO LimK4	1	0	999	Limit to which pre-ventilation can be terminated, Channel 4	999	P4
350	VO LimK5	1	0	999	Limit to which pre-ventilation can be terminated, Channel 5	999	P4
Running direction							
374	Laufr.K1	1	0	999	Channel 1 running direction in event or fault *0 = OFF (control element stops)* *1 = Control element runs OPEN* *2 = Control element runs CLOSED* *3 = Control element runs to the setting* *6 = Control element runs to its ignition point* *8 = Control element runs to base load*	2	P6
375	Laufr.K2	1	0	15	Channel 2 running direction in event or fault	2	P6
376	Laufr.K3	1	0	15	Channel 3 running direction in event or fault	2	P6
377	Laufr.K4	1	0	15	Channel 4 running direction in event or fault	2	P6
378	Laufr.K5	1	0	15	Channel 5 running direction in event or fault	2	P6
427	Vodel R	1	0	999	Re-circulation delay time (on FMS) No. of air duct points (VMS)	750	P71

Para-meter-No.	Short design-nation	Safety level	Lower limit	Upper limit	Description	Standard values	Aids
Correction							
433	K1 Spreiz	1	0	999	Spread factor for correction input (00.0 99.9) 01.0 = no expansion	10	P22
434	K2 Spreiz	1	0	999	Spread factor for correction input (00.0 99.9) 01.0 = no expansion	10	P22
517	KB11.1	0	0	999	Correction range, correction input 1	0	P7
597	KB21.1	1	0	999	Correction range, correction input 2	0	P7
Monitor output							
677	Moni.1	1	0	23	Definition of the monitor output with curve set 1	0	P8
					0= internal load *1= channel 1 setting* *2= channel 2 setting* *3= channel 3 setting* *4= channel 4 setting* *5= channel 5 setting* *11= channel 1 actual value* *12= channel 2 actual value* *13= channel 3 actual value* *14= channel 4 actual value* *15= channel 5 actual value* *21= external load* *22= correction input 1* *23= correction input 2* *24=O_2-actual value* *25=O_2-setpoint* *26=Flame intensity*		
678	Moni.2	1	0	25	Definition of the monitor output with curve set 2	0	P9
679	Moni.3	1	0	25	Definition of the monitor output with curve set 3	0	P9
680	Moni.4	1	0	25	Definition of the monitor output with curve set 4	0	P9
681	Moni.5	1	0	25	Definition of the monitor output with curve set 5	0	P9
682	Moni.6	1	0	25	Definition of the monitor output with curve set 6	0	P9
683	Moni.7	1	0	25	Definition of the monitor output with curve set 7	0	P9
684	Moni.8	1	0	25	Definition of the monitor output with curve set 8	0	P9
685	Unt.Mo1	1	0	999	Monitor output, curve set 1: 4 mA correspond to X points	0	P10
686	Unt.Mo2	1	0	999	Monitor output, curve set 2: 4 mA correspond to X points	0	P10
687	Unt.Mo3	1	0	999	Monitor output, curve set 3: 4 mA correspond to X points	0	P10
688	Unt.Mo4	1	0	999	Monitor output, curve set 4: 4 mA correspond to X points	0	P10

Para-meter-No.	Short design-nation	Safety level	Lower limit	Upper limit	Description	Standard values	Aids
689	Unt.Mo5	1	0	999	Monitor output, curve set 5: 4 mA correspond to X points	0	P10
690	Unt.Mo6	1	0	999	Monitor output, curve set 6: 4 mA correspond to X points	0	P10
691	Unt.Mo7	1	0	999	Monitor output, curve set 7: 4 mA correspond to X points	0	P10
692	Unt.Mo8	1	0	999	Monitor output, curve set 8: 4 mA correspond to X points	0	P10
693	Ob.Mo1	1	0	999	Monitor output, curve set 1: 20 mA correspond to X points	999.	P10
694	Ob.Mo2	1	0	999	Monitor output, curve set 2: 20 mA correspond to X points	999	P10
695	Ob.Mo3	1	0	999	Monitor output, curve set 3: 20 mA correspond to X points	999	P10
696	Ob.Mo4	1	0	999	Monitor output, curve set 4: 20 mA correspond to X points	999	P10
697	Ob.Mo5	1	0	999	Monitor output, curve set 5: 20 mA correspond to X points	999	P10
698	Ob.Mo6	1	0	999	Monitor output, curve set 6: 20 mA correspond to X points	999	P10
699	Ob.Mo7	1	0	999	Monitor output, curve set 7: 20 mA correspond to X points	999	P10
700	Ob.Mo8	1	0	999	Monitor output, curve set 8: 20 mA correspond to X points	999	P10
Flying curve change							
702	Luftvor	1	0	999	Air advance with flying curve change in points	0	P11
703	Dauer LV	1	0	999	Duration of air advance with flying curve change in seconds	0	P11
704	Wirku LV	1	0	999	Effect on air advance 0-Load / 1-Setting	1	P11
Band shift							
707	Wirk.Bve	1	0	1	Effect on band shift 0-Load / 1-Setting	0	P2
708	BandV K1	1	0	50	Band shift Channel 1	4	P3
709	BandV K2	1	0	50	Band shift Channel 2	4	P3
710	BandV K3	1	0	50	Band shift Channel 3	4	P3

Parameter-No.	Short designation	Safety level	Lower limit	Upper limit	Description	Standard values	Aids
711	BandV K4	1	0	50	Band shift Channel 4	4	P3
712	BandV K5	1	0	50	Band shift Channel 5	4	P3
Compound							
718	Laufz L	1	0	65535	Running time in pts./min for TPS Load input In the event of load via current or pot, the value must be 0	9999	P12
719	Laufz K1	1	0	65535	Running time in pts./min for continuous output channel 1	9999	P13
720	Laufz K2	1	0	65535	Running time in pts./min for continuous output channel 2	9999	P13
721	Laufz K3	1	0	65535	Running time in pts./min for continuous output channel 3	9999	P13
722	Laufz K4	1	0	65535	Running time in pts./min for continuous output channel 4	9999	P13
723	Laufz K5	1	0	65535	Running time in pts./min for continuous output channel 5	9999	P13
729	stopVERB	1	10	100	Minimum compound running time in seconds	10	P15
730	minTAKT1	1	1	100	Minimum cycle length for channel 1 in 20ths seconds per digit (50 ms)	1	P16
731	minTAKT2	1	1	100	Minimum cycle length for channel 2 in 20ths seconds per digit (50 ms)	1	P16
732	minTAKT3	1	1	100	Minimum cycle length for channel 3 in 20ths seconds per digit (50 ms)	1	P16
733	minTAKT4	1	1	100	Minimum cycle length for channel 4 in 20ths seconds per digit (50 ms)	1	P16
734	minTAKT5	1	1	100	Minimum cycle length for channel 5 in 20ths seconds per digit (50 ms)	1	P16
740	PauseT1	1	1	100	Minimum pause between channel 1 cycles in 20ths seconds per digit (50 ms)	2	P27
741	PauseT2	1	1	100	Minimum pause between channel 2 cycles in 20ths seconds per digit (50 ms)	2	P27
742	PauseT3	1	1	100	Minimum pause between channel 3 cycles in 20ths seconds per digit (50 ms)	2	P27
743	PauseT4	1	1	100	Minimum pause between channel 4 cycles in 20ths seconds per digit (50 ms)	2	P27
744	PauseT5	1	1	100	Minimum pause between channel 5 cycles in 20ths seconds per digit (50 ms)	2	P27

Para-meter-No.	Short design-nation	Safety level	Lower limit	Upper limit	Description	Standard values	Aids
754	ES aktiv	1	10	100	ES is activated when load falls by X points	40	P17
755	Verz. ZÜ	1	0	999	Delay time of ignition position relay	0	P19
756	Verz. GL	1	0	999	Delay time for base load with sep. ignition point	0	P20
757	Verz. RG	1	0	999	Delay time for control release	0	P21
758	ZEIT NA	1	0	999	Post-ventilation time	0	P18
759	Verz. ZÜ	1	0	30	Ignition delay when setting after actuation of the ignition point	0	P29
Control unit							
768	KuerznLE	1	0	15	Delay time for "Damper open" after fan on	5	P72
769	D.n.Abs	1	0	1	Leak test after switching off 0 = Off, 1 = On	0	P53
772	Dicht Zü	1	0	1	Leak test before starting 0 = Off, 1 = On	1	P53
777	Prgüzeit	1	0	9999	Program monitoring time With content 0 no monitoring occurs	4	P40
782	VorZüdel	1	2	40	Transformer pre-energise time (pre-ignition time)	3	P51
783	Stab.zei	1	3	100	Stabilisation time	3	P52
785	ZEIT VO	1	30	999	Pre-ventilation period	30	P54
787	Wartung	1	0	1	Service mode, control unit runs only until stabilisation time	0	P60
789	Nachbr.z.	1	0	30	Post-combustion time (flame signal irrelevant) in seconds	10	P62
Power control unit (option)							
790	Lasttyp	1	0	2	Load control type	0	P80
					0 = off *1 = Fixed value control unit* *2 = Atmosphere-controlled unit (possible only where there is hardware provision for this)*		
791	Anf.Temp.	0	0	999	Starting maximum temperature	0	P81
792	Anf.Leis	0	0	999	Starting power	0	P82
793	Anf.Zeit	0	0	32767	Starting time in minutes	0	P83
794	ext.Lgre	0	0	1000	External power limit	0	P84

Parameter-No.	Short designation	Safety level	Lower limit	Upper limit	Description	Standard values	Aids
795	SoftStop	0	0	100	Soft stop time D Burner after running	0	P85
796	Soll1min	0	0	1000	Control unit setting 1 minimum with atmosphere control/control unit setting 1		P86
797	Soll1max	0	0	1000	Control unit setting 1 maximum with atmosphere control		P86
798	Soll2min	0	0	1000	Control unit setting 2 minimum with atmosphere control/control unit setting 2		P86
799	Soll2max	0	0	1000	Control unit setting 2 maximum with atmosphere control		P86
800	Obergren	0	0	1000	Load regulator: upper limit with atmosphere control		P87
801	Untergren	0	0	1000	Load regulator: lower limit with atmosphere control		P87
802	Regelb.U	0	-999	+999	Control range, bottom		P88
803	Regelb.O	0	0	999	Control range, top		P89
804	Bren.AUS	0	0	200	Burner off		P90
805	P-Faktor	0	0	999	P-factor of control unit	3	P91
806	I-Faktor	0	0	999	I-factor of control unit	4	P91
807	D-Faktor	0	0	999	D-factor of control unit	50	P91
808	Nachst.z	0	0	60	Rest time	10	P92
809	L-Einheit	1	0	3	Load regulator actual value input and setting representation *0 = Display in digits* *1 = Display in °C* *2 = Display in bar (XX.X)*	0	P94
810	min.Einh.	1	0	999	Lower limit Pressure (4 mA) correspond to X bar	0	P95
811	max.Einh.	1	0	999	Upper limit Pressure (4 mA) correspond to X bar	0	P95

Parameter-No.	Short designation	Safety level	Lower limit	Upper limit	Description	Standard values	Aids
814	Leist. 1	1	0	1000	Power output of burner with curve set 1		P91
815	Leist. 2	1	0	1000	Power output of burner with curve set 2		P91
816	Leist. 3	1	0	1000	Power output of burner with curve set 3		P91
817	Leist. 4	1	0	1000	Power output of burner with curve set 4		P91
Interface							
822	BaudS 1	1	0	5	Baud rate of serial interface 1	4	P23
823	BaudS 2	1	0	5	Baud rate of serial interface 2	4	P23
					0 = 1200 3 = 9600 *1 = 2400 4 = 19200* *2 = 4800 5 = 38400*		
826	Adr.S 1	1	0	31	Network address VMS / FMS ser. 1	0	P24
827	Adr.S 2	1	0	31	Network address VMS / FMS ser. 2	0	P24
Display							
831	Helligkt	1	0	6	Brightness of display in steps 0 = 100 % … 6 = 13 %	5	P25
832	DispOFF	1	0	65535	Display switch-off time in minutes (0 = none) i.e., time after operation until switched back to lowest brightness level	15	P26
833	Sprache	1	0	6	Selection of language display	0	
					0 = German 4 = Swedish *1 = English 5 = not assigned* *2 = French 6 = Dutch* *3 = not assigned*		
838	Int.L.AU	1	0	999	Value of internal load in AU mode (for external power display)	200	
839	LastTotb	1	0	15	Dead band definition +/- this value does not alter load	10	P14
850	Einh. Kan.1	1	0	3	Represented unit channel 1 0 = digits 2 = pressure,steam, 1 = °C (temp.) rev speed, quantity 3 = mA	0	P55
851	Einh. Kan.2	1	0	3	Represented unit channel 2	0	P55

Para-meter-No.	Short design-nation	Safety level	Lower limit	Upper limit	Description	Standard values	Aids
852	Einh. Kan.3	1	0	3	Represented unit channel 3	0	P55
853	Einh. Kan.4	1	0	3	Represented unit channel 4	0	P55
854	Einh. Kan.5	1	0	3	Represented unit channel 5	0	P55
860	R4mA K1	1	0	999	4 mA feedback corresponds to x units channel 1	0	P55
861	R4mA K2	1	0	999	4 mA feedback corresponds to x units channel 2	0	P55
862	R4mA K3	1	0	999	4 mA feedback corresponds to x units channel 3	0	P55
863	R4mA K4	1	0	999	4 mA feedback corresponds to x units channel 4	0	P55
864	R4mA K5	1	0	999	4 mA feedback corresponds to x units channel 5	0	P55
870	R20 mA K1	1	0	999	20 mA feedback corresponds to x units channel 1	0	P55
871	R20 mA K2	1	0	999	20 mA feedback corresponds to x units channel 2	0	P55
872	R20 mA K3	1	0	999	20 mA feedback corresponds to x units channel 3	0	P55
873	R20 mA K4	1	0	999	20 mA feedback corresponds to x units channel 4	0	P55
874	R20 mA K5	1	0	999	20 mA feedback corresponds to x units channel 5	0	P55
880	Einh. K01	1	0	3	Represented unit correction input 1	0	P55
881	Einh. K02	1	0	3	Represented unit correction input 2	0	P55
882	4mA KOK 1	1	0	999	4 mA feedback correspond to X of correction input 1	0	P52
883	4mA KOK 2	1	0	999	4 mA feedback correspond to X of correction input 2	0	P52
884	20mA KOK 1	1	0	999	20 mA feedback correspond to X of correction input 1	0	P52
885	20mA KOK 2	1	0	999	20 mA feedback correspond to X of correction input 2	0	P52

Parameter-No.	Short designation	Safety level	Lower limit	Upper limit	Description	Standard values	Aids
Parameter for O_2 regulation							
896	O2Regler	0	0	9	O_2-Regulator 0 = O_2 regulator off 1 = Standard regulator 2 = Without lag time 3 = only display neutral value 8 = Only display, base value for deact. O_2 regulator 9 = Only display, base value for air shortage	1	P30
897	O2Stoer	1	0	2	Error shut-down by O_2 regulator permitted (0=No, 1=on air shortage)	0	P31
898	O2-TotZ	0	3	20	Lag time of the O_2 regulation section	15	P32
899	O2-P-Fak	0	1	50	O_2 P-factor	5	P32
900	O2 TZ -	0	0	5	Lag time shortening of the O_2 regulation section with full load	3	P32
901	O2Neutr1	1	0	1000	Correction value output on deactivated O_2 regulation. Fuel 1	300	P31
902	O2Neutr2	1	0	1000	Correction value output on deactivated O_2 regulation. Fuel 2	300	P31
903	O2FWZeit	1	0	9999	O_2 deactivated after fuel change in sec..	30	P33
904	O2WarteZ	1	0	9999	O_2 regulation active after ignition in sec.	90	P34
910	O2Totbnd	2	0	10	O_2 lag band in 0.1%	2	
914	O2Aktiv	0	0	999	Activate O_2 regulation from load position X (in pts)	0	P35
915	O2Deakti	0	0	999	Deactivate O_2 regulation from load position X (in pts)	999	P35
917	LftmKor1	1	0	999	Air shortage correction value, fuel 1	150	P31
918	LftmKor2	1	0	999	Air shortage correction value, fuel 2	150	P31
919	O2 4mA	1	0	999	O_2 value 4mA	0	P36
920	O2 20mA	1	0	999	O_2 value 20mA	250	P36
931	O22UBU1G	1	0	250	Lower 2nd monitoring band, fuel 1 in % of target value, base load	100	P37
932	O22UBU1V	1	0	250	Lower 2nd monitoring band, fuel 1 in % of target value, full load	100	P37
933	O22UBU2G	1	0	250	Lower 2nd monitoring band, fuel 2 in % of target value, base load	100	P37
934	O22UBU2V	1	0	250	Lower 2nd monitoring band, fuel 2 in % of target value, full load	100	P37
936	O2SOWert	0	0	65535	Probe dynamic test	2	P38

Integrated leakage test (option)

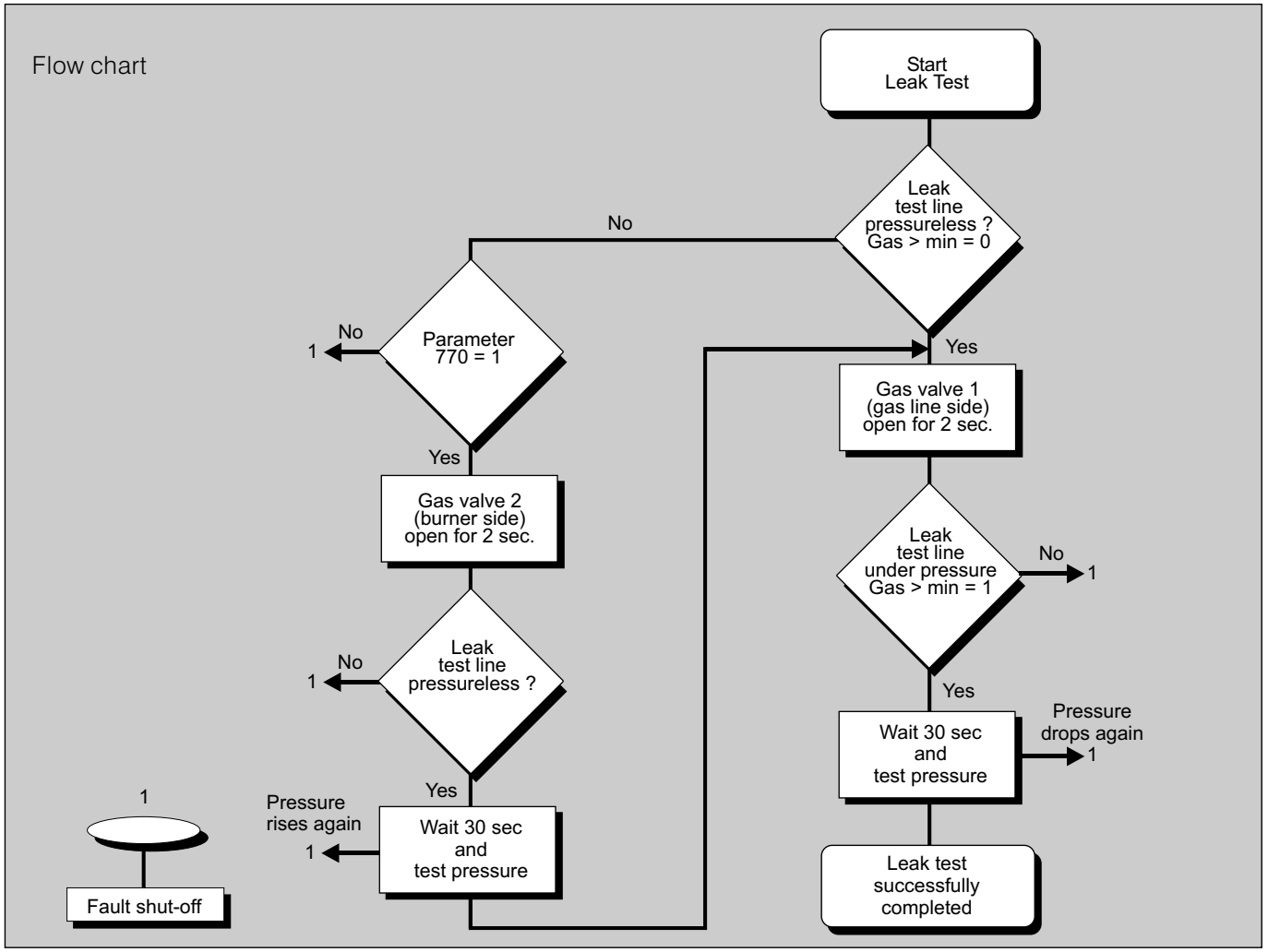
The leakage test checks whether the main gas valves are leak-tight.
The supply gas pressure is used for this purpose. Since the leakage test line (space between the two main valves) burns empty in the event of a shut-off, this part is normally pressureless when starting (gas pressure > min. = 0). The FMS checks this. Main gas 1 is then briefly opened and gas flows into the test line (gas pressure > min. changes from 0 to 1). This pressure must then subsist for 30 seconds. The leakage test is then deemed to be completed.
If the leakage test line is not empty at the start (e.g. as a result of a fault shut-off previously), main gas valve 2 is opened first. The leakage test line is thus vented (into the combustion chamber or over the roof, depending on the system, for suggested circuit see next page). A check is then conducted to see whether the line remains pressureless for 30 seconds. Otherwise the procedure is as described previously.

The leakage test can be performed before ignition and/or after shut-off. Selection via parameters.

The pressure monitor for the leakage test line must be connected to "Gas pressure >min" input (terminal 73). It also monitors the minimum pressure during operation. If another minimum pressure is to be monitored during operation, however, the pressure monitor is, for this purpose, to be looped into the gas safety interlock circuit.

The test line, however, must be designed so as to ensure that the test time of 30 sec. per valve is sufficient to reliably detect a leak of 0.1% of the fuel gas consumption at maximum firing heat output, but at least 50 dm^3/h.

Flow chart



Calculation formula

An (approximate) formula for calculating the leak test facility is compiled below:

Definitions:

GDW	gas pressure monitor
V1	gas-side safety shut-off device
V2	burner-side safety shut-off device
P_B	barometric air pressure » 1000 mbar
P_{SU}	lower switch point (falling) of GDW
P_{SO}	upper switching point (rising) of GDW
$D_P = P_{SO} - P_{SU}$	switch difference of GDW
P_G	gas flow pressure (supply pressure before V1)
V_P	volume of gas line tested
V_L	leakage quantity
V_{Lmax}	maximum admissible leakage quantity (limit)
t_P	testing time (30 seconds, fixed)

That is, for a maximum gas flow rate of 50 m^3/h the formula is:

$$\frac{V_P}{t_P} \cdot \frac{p}{P_B} \leq 50\ [dm^3/h]\ ; \quad \Rightarrow \frac{V_P}{30\ [s]} \cdot \frac{p}{1000\ [mbar]} \leq 50\ dm^3/h\ ;$$

$$\Rightarrow V_P \leq \frac{416}{p}\ [dm^3]\ ; \qquad (3);$$

inserting the numerical value for D_P in mbar.

For a gas rate of flow $\dot{Q}$ of >50 m3/h the formula is:

$$V_P \leq \frac{\dot{Q}}{0{,}12 \cdot p}\ [dm^3]\ ; \qquad (4);$$

inserting the numerical value for $\dot{Q}$ in m^3/h and for D_P in mbar.

Examples:

A. Assuming: $D_P = 20$ mbar, gas rate of flow < 50 m^3/h: i.e. the gas line to be tested must be no greater than 20.8 dm^3

$$\Rightarrow V_P \leq \frac{416}{20}\ [dm^3]; \Rightarrow V_P \leq 20{,}8\ [dm^3];$$

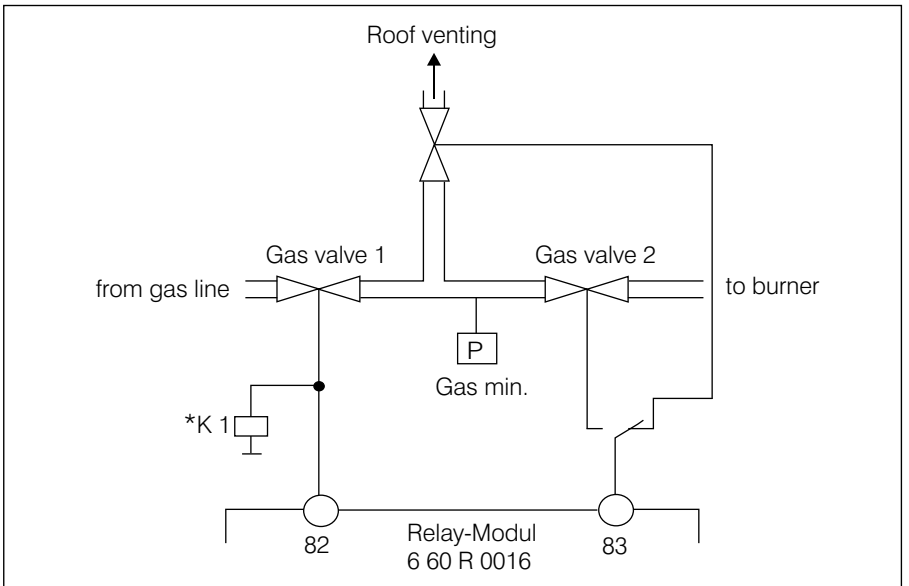
in order to be able to detect the leakage quantity demanded

B. Assuming: $D_P = 20$ mbar, gas rate of flow = 200 m^3/h; i.e. the gas line to be tested must be no greater than 83.3 dm^3

$$\Rightarrow V_P \leq \frac{200}{0{,}12\ \ 20}\ [dm^3]; \Rightarrow V_P \leq 83{,}3\ [dm^3];$$

in order to be able to detect the leakage quantity demanded of 200 dm^3/h.

Suggested circuit for venting the gas line over-roof in conjunction with the combustion management system



* If after shut-off the test line is not vented over-roof but is to be burned off into the combustion chamber, a timer relay with a delayed cut-out of 2 … 5 sec is to be used.

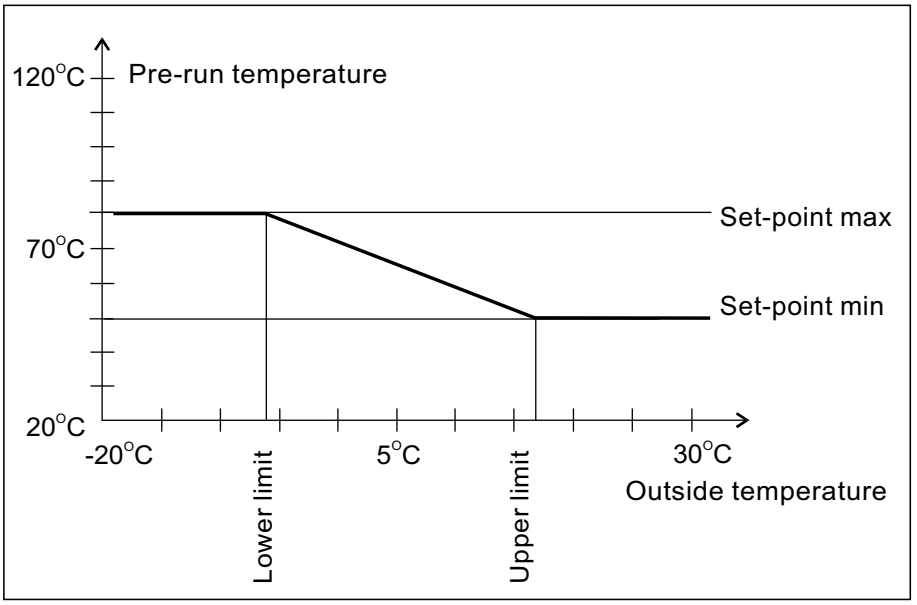
Procedure description

The burner's startup proceeds exactly as already described, except that an enabling command to start the burner must have been provided by the output regulator. In other words, the actual value must be smaller than the set-point by an appropriate amount.
The output regulator only operates once the burner has fired up and the signal "Enable regulation" (terminal 4) has been given. Load specification for the compound is then provided via the integral output regulator.
It depends on the difference between the actual value and the set-point, and on the control parameters set.
If the actual value exceeds the maximum value set, the output regulator shuts down the burner.

The load regulator is only active in "Automatic" mode.

Weather control

If the output regulator is configured as "weather controlled", the set-point can be shifted between the parameters SetpointMin and SetpointMax by altering the value at the redundant feedback channel 1.
When the regulator is weather-controlled, the outside temperature is taken into account when calculating the set-point. The operator can input a minimum and a maximum set-point, between which the outside temperature can determine the set-point (see diagram).



With the weather-controlled option activated, an external set-point specification can also be implemented.

Set-point switch-over

The set-point can be switched over via a digital input. In versions with a fixed set-point, this contact can be used to select between the two values entered in the parameters list.

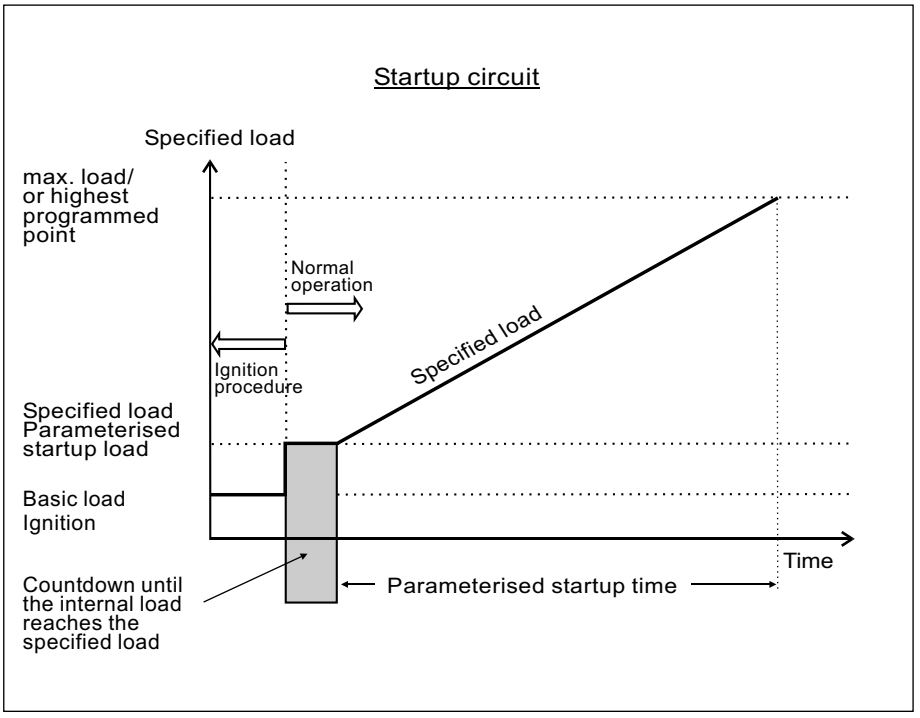
If, in addition, weather control is activated, a selection is made between two pairs of limiting values (see Weather control and Limiting ranges). The parameters for Set-point 1 (for set-point switch-over) and Set-point min. 1 (for weather control) are equal. Similarly for the parameters Set-point 2 and Set-point min. 2. The relevant content is assigned in accordance with the configuration.

Activating the "Weather control" option and adjusting the variable parameters can also be used to implement external set-point specification. In other words, the set-point can be altered manually or automatically via a potentiometer (or switched through resistors). Thus, by connecting a double-throw switch, night-time reduction could be implemented instead of weather control. Night-time reduction and weather control can be achieved simultaneously by combining the weather controller with the set-point switch-over. When the weather controller is active, the compound's feedback can no longer proceed completely redundantly.

Startup circuit

The load regulator has a startup circuit, in order to brake the burner's start load. The startup circuit is run during each new burner start. The internal load is held at a value adjustable by the user, for as long as the boiler is cold (actual value is below a user-adjustable limit). If the regulator's actual value is equal to or larger than the parameterised startup maximum temperature, this limit is overridden.

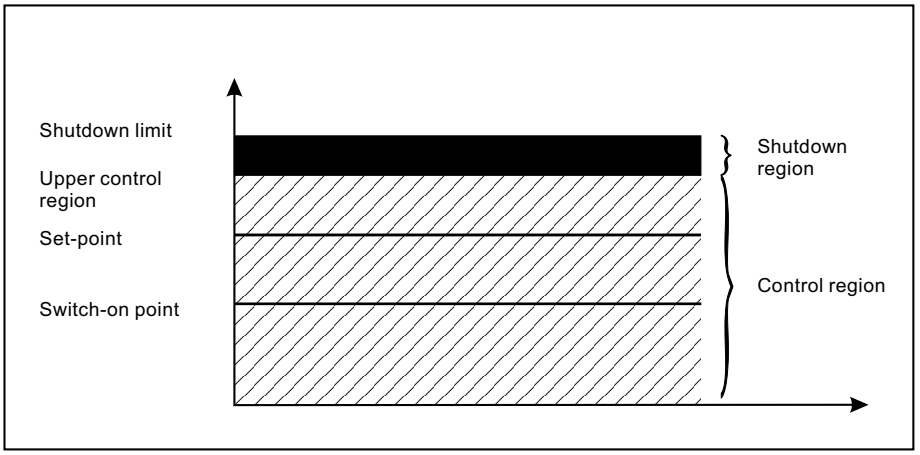
In order to prevent a situation where with an excessively large demand on system output, the boiler temperature necessary to override the startup circuit is not reached, a startup timer is also triggered in parallel (this timer can also be adjusted by the operator). Once the internal load's value reaches the parameterised startup load, the output limit is increased linearly step-wise up to the maximum load. The slope of this linear increase is calculated from the parameterised startup time.



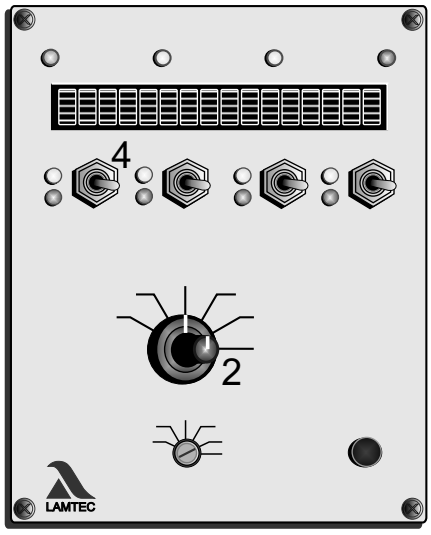
Thermostat and control region

The thermostat function switches the burner on or off, as a function of the temperature and/or pressure. However, this only happens if the burner has been enabled by the startup signal. The control region is formed by entering the regulator's set-point and the "Burner on" value (parameter). The shutdown hysteresis is divided into 3 regions. Generally speaking, the first section lies below the set-point. The second section lies above the set-point and bounds the control region, whilst the third section also lies above the set-point and forms the rundown region.
Thus, the control region can lie asymmetrically around the set-point.

Within the upper and the lower control region, the load regulator operates in accordance with its set parameters and specifications. If the regulator's actual value reaches the rundown region, a basic load demand is output to the compound. If the regulator's set-point exceeds the rundown region, the regulator is shut down. This takes place either through internal processing (if the controller is integral, i.e. FMS), or via a relay if the controller is an external device (VMS). A new startup can take place once the actual value falls below the switch-on point.
This function can replace the control thermostat required in the system.



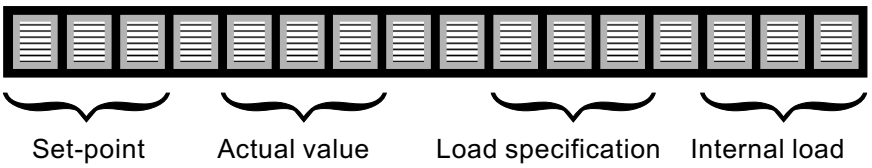
Manual control



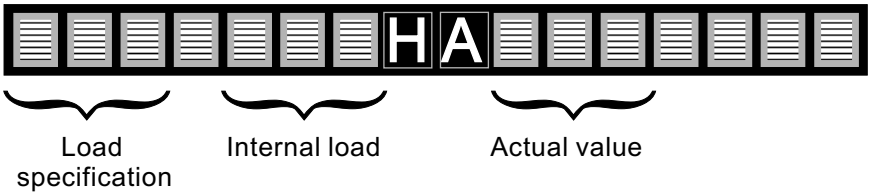
The output regulator's load specification can be overwritten by setting the selector switch (2) to "Load" and pressing the Channel 1 switch (4) upwards. This manual load control is cancelled by pressing the Channel 2 switch downwards.
The shutdown limit is non-operational in manual mode. Hence the manual mode can be used to test the safety limiter.

In manual mode, the load regulator's functions such as startup circuit and control thermostat are switched off
therefore
always monitor the system continuously when using manual control.

Interpreting the display The display when "Load" is selected



The display in manual operation



(via Channel 1 key)

Setting the output regulator

The output regulator is only adjusted via the parameters.

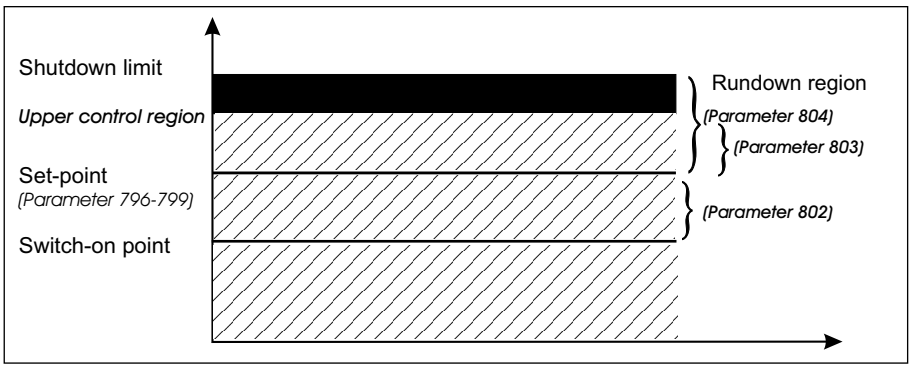
Control region

The regulator's set-point lies below the value "Upper control region" "Burner on" value (parameter 802).
The content of the parameter "Switch-on point" is subtracted from the set-point, giving the switch-on value. The value of the "Upper control region" (parameter 803) is added to the set-point and forms the control region's upper limit. Thus, the control region can lie asymmetrically around the set-point. The switch-on point can also be above the set-point; a negative value (<0) needs then to be input.

The rundown region is limited from above by the parameter "Burner off" (parameter 804). The parameter is added to the set-point. If this value is exceeded, the burner is shut down (either internally via the controller in FMS mode, or via a relay output in VMS mode).

The region between the "Upper control region" and the "Shutdown limit" is the rundown region. If the actual value reaches this region, the compound returns to base load.

It also follows from the above that in general, the value in "Burner off" is greater than the one in "Upper control region". Otherwise there is no rundown region, and the burner is shut down directly when reaching the limit.



Regulator behaviour

The load regulator attempts to adjust the actual value to the set-point.
A direct relationship between the internal load and the boiler's temperature is assumed. In other words, the higher the internal load, the faster the boiler's temperature rises.
The load regulator would not function if the curves were programmed otherwise.
Four parameters determine the regulator's behaviour:

Readjustment interval
The readjustment interval determines how often the deviation is monitored and a new adjustment calculated.
Example: a value of 10 in parameter 808 means that this procedure is carried out every ten seconds.
The value should correspond to the control section's lag time.

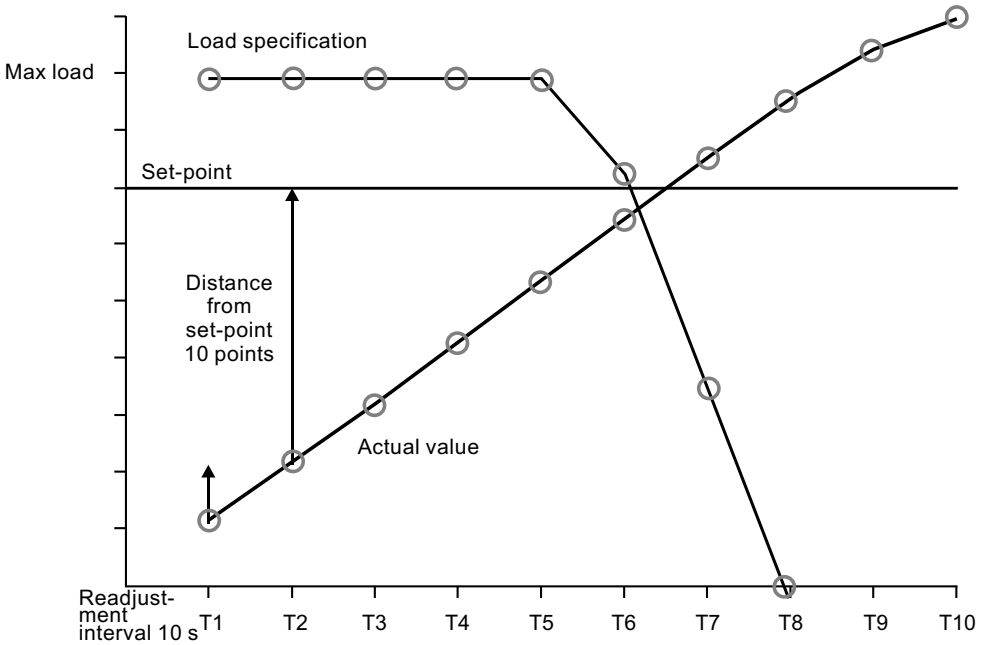
P-factor
The proportional factor acts directly on the deviation, i.e. the difference between the set-point and the actual value. The set factor is divided by 10 for the adjustment.
Example: with a set-point of 500, an actual value of 460 and a P-factor of 12, this results in a proportionality fraction of +48.

$$\frac{(500 - 460) \cdot 12}{10}$$

I-factor
The integral factor is calculated from the momentary deviation and the previous deviation from the set-point. The set factor is divided by 10 for the adjustment.
Example: with a set-point of 600 and a momentary actual value of 620, this results in an actual deviation of -20. Assume the actual value was 622 at the last calculation, i.e. before the set readjustment interval, giving a previous deviation of -22. With the factor set to 5, the adjustment would be -21 points (-42 x 0.5).

D-factor
The difference factor is calculated from the change in the actual value. It is also divided by 10.
Example: the previous actual value (before the readjustment interval) was 600. The current actual value is 605. With a D-factor of 50, this results in a D-fraction of -25 points (-5 x 5).

Example



Parameters set in this example:
P-factor 10
I-factor 5
D-factor 50

Time	T2	T3	T4	T5	T6	T7	T8	T9	T10
Deviation from set-point	-45	-35	-25	-15	-5	+5	+14	+22	+28
Change in actual value	+10	+10	+10	+10	+10	+10	+9	+8	+6
P-fraction	+45	+35	+25	+15	+5	-5	-14	-22	-28
I-fraction	+50	+40	+30	+20	+10	0	-9,5	-18	-25
D-fraction	-50	-50	-50	-50	-50	-50	-45	-40	-30
Load specification adjusted by	+45	+25	+5	-15	-35	-40	-63,5	-80	-83

Regulator behaviour

- All three fractions (P-fraction, I-fraction, D-fraction) are added together and act as an adjustment to the compound regulator's load specification. The value is added to the momentary internal load.
- As long as the actual value is below the set-point, the P-fraction and the I-fraction are positive, i.e. both these fractions act to increase the load specification.
- Only the D-fraction is still negative in such a case (assuming the boiler's temperature is rising).
- A sufficiently large D-factor should be selected, in order to avoid an excessively large overshoot during burner startup.
- The D-fraction can also be increased by increasing the readjustment interval, since the boiler has more time for a change in temperature.
- If, despite a large set-point deviation, the burner is not driven to full load or base load respectively, the P-factor should be increased.
- The larger the readjustment interval, the quieter the compound but also the larger the actual value's deviation from the set-point and the slower the adjustment.
- The overshoot effect can result in a failure of the control mechanism, hence the readjustment interval should be so selected that the compound (the internal load) settles down.

Examples

Parameter	Name	Hot water		Steam
805	P-factor	120	280	600
806	I-factor	60	360	300
807	D-factor	20	50	35
808	integral time	15	2	20

implicitly optimisation is provided by customer

Adjusting motor limit switch

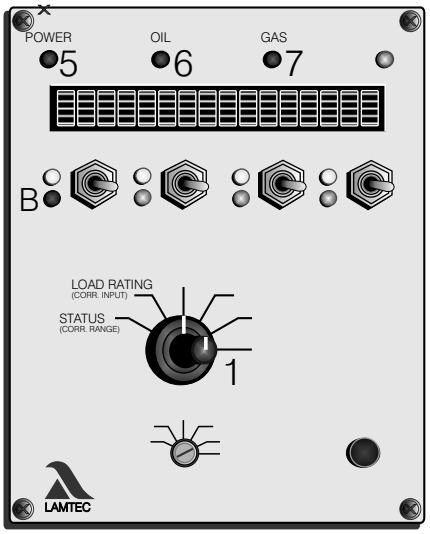
As soon as the FMS is supplied with voltage, it attempts to drive the actuator motors to the lower boundary of the factory curve. If the end-bearing's limit switches are not properly adjusted for this then the motor may hit the actuator's mechanical stop.

This can damage the motor or the valve.

Therefore:
Check the position of the end-bearing limit switches in the motors, taking into account the motor output shaft's travel.

If in doubt, set a shorter travel. It can be readjusted later.

Function test



Signal on terminal 2 = 0

Control quantity (load rating) is minimum.
Selector switch for mode (2) set to "Automatic"

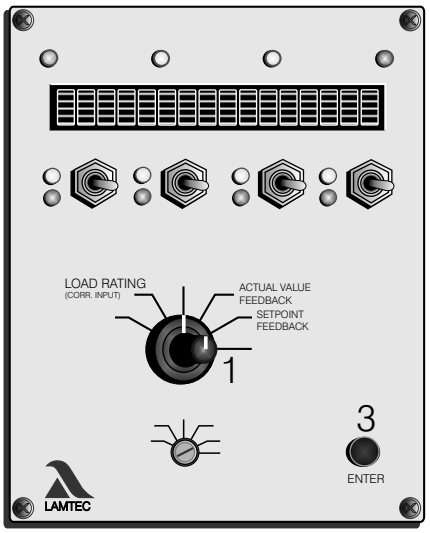
Apply voltage to unit:
Unit performs a self-test
FMS appears briefly on display
Software version No. appears on display

Compare software version No. with number on the sticker
- operating display (5) lights up
- fuel LED (6 or 7) lights up
- the four "CLOSED" LEDs (B) light up

Aids: A8

Selector switch (1) to "Status"
"OFF" appears on the display

Selector switch (1) to "Load rating"
The following appears:
- for external load default » 200
- for internal load control unit » 0



Set selector switch (1) to "Set-point feedback"

- the programmed value of the external feedback appears
  (120, if no curve has yet been programmed)

Set selector switch (1) to "Actual value feedback"
- the instantaneous value of the external feedback appears
  via 0 … 20 mA » 0
  via 4 … 20 mA » 200
  via potentiometer » 120

(normally, but not necessarily)

The values indicated only appear, however, if the control element is situated at the bottom stop.

Set selector switch (1) to "Load rating"

and

Press acceptance (3) (and keep pressed)
- The instantaneous value of the correction inputs is displayed
- KO appears between the channels
  the display is in %, irrespective of the input signal setting
  (0 … 20 mA or 4 … 20 mA)

Aids

Set selector switch (1) to "Status"

and

Press Acceptance (3) (and keep pressed)

- the instantaneously set correction range appears
- KB appears between the channels

On a 4-channel unit:
Selector switch (1) to "digital inputs"

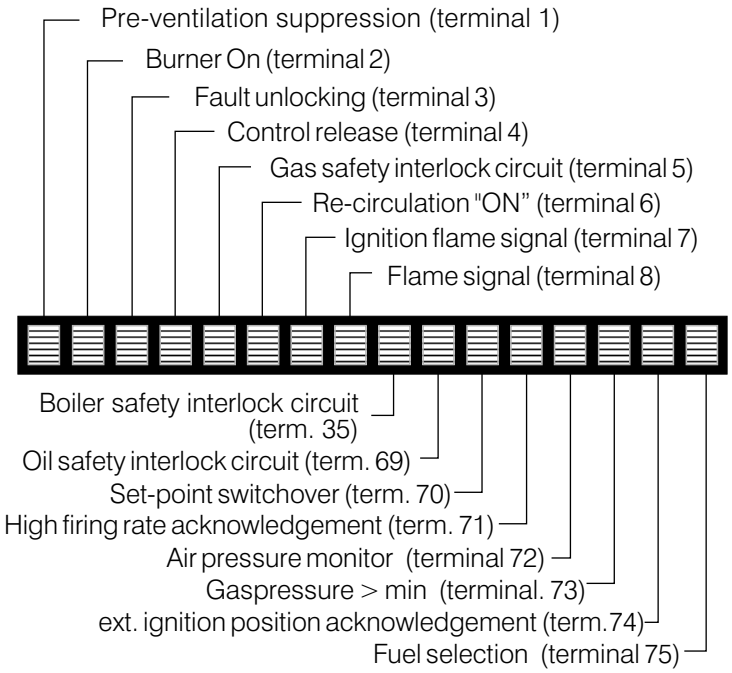
On a 5-channel unit:
Selector switch (1) to channel 5 display

and

Press Acceptance (3)

- the condition of the digital inputs appears
- "-" signifies input not activated
- "↑" signifies- input activated

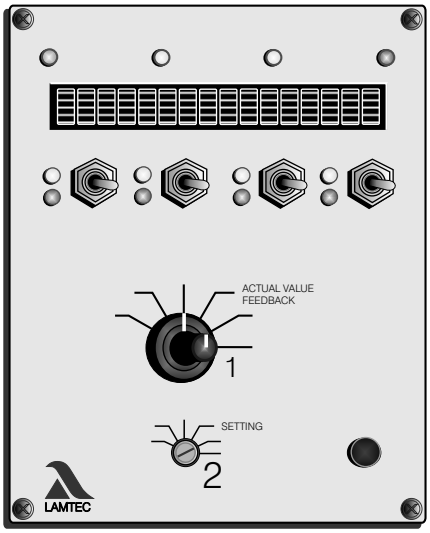
Significance of FMS digital input display



↑ = signal present

- = signal not present

Operation of control elements for potentiometer adjustment and limit switch settings

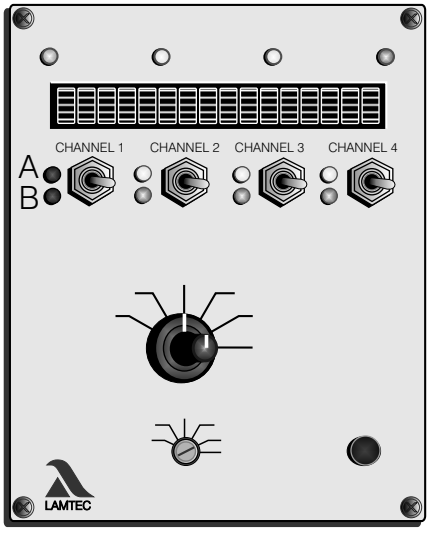


"Setting" mode permits direct access to the control elements. It is therefore essential to follow the safety rules laid down by the burner manufacturer!

Adjust the control elements only when the system is at rest.

Selector switch (1) to "Actual value feedback"

Selector switch (2) to "Setting"
- "EI" appears on the display



Set "Lower stop"
Set the channel's target value to "0" via key (4)
- Red LED (B) comes on
- Actuator responds
  - e.g. fan runs down or
  - motor moves in the "CLOSED" direction

Limit switch to "CLOSED". Adjust valve stop

Program the frequency converter to minimum rev. speed

Turn selector switch (1) to "Feedback actual value"

Adjust potentiometer to lower value
(see table below)

Set "Upper stop"
Turn selector switch (1) to "Target value"
Set target value = 999
Limit switch to "open" Adjust valve stop
Check frequency converter's maximum rev. speed
Turn selector switch to "Feedback actual value"
Check upper potentiometer value (see table)
Check rev. speed feedback value (see page 137)

Potentiometer adjustment values (approximate)

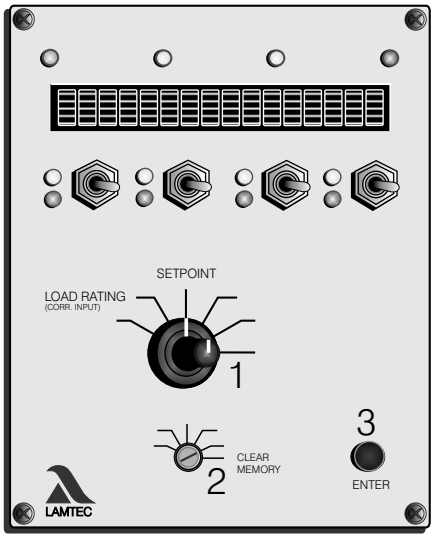
Pot	Lower stop*	Upper stop*
5kΩ	80	920
1kΩ	200	800

* assuming that full potentiometer rev. range is utilised

Aids

C1
B1
E2

Programming the compound



Final programming of the unit with the burner stationary can only be done when it is certain that all feedback signals are present in the same way as with the burner running (e.g. not temperature-dependent or active speed feedback). Otherwise program with burner running.

either with burner stationary
FMS
Signal on terminal 2 (burner on) *= 0 Display AU*

or with burner running
FMS:
Signal on terminal 2 (boiler thermostat) *= 1*
Wait until burner is on

Programming can be performed only with the signal combinations indicated. Otherwise the unit registers a fault and/or will accept no inputs. It may be necessary to wait for the automatic firing sequence control to release the control before programming with the burner running (via mode "EV", "EZ", "EG").

If burner drops out whilst programming in process
e.g. owing to control shut-off
- proceed to page 76 (continue programming)

If FMS skips to "ES" mode whilst programming is in progress
- see page 76

Entirely new curve,
Clear memory

Selector switch (1) to load rating
- set load rating to 200 via channel 1 switch

Selector switch (1) to set-point

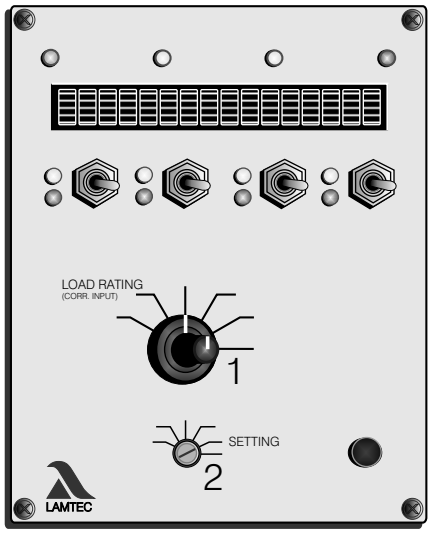
Mode selector switch (2) to "Clear memory"
- "SL" appears in centre of display

Press Acceptance (3):
- "cleared" appears on display

When programming the ignition load point for the first time, it is recommended that the FMS be initially started via the automatic firing sequence control. At the end of the pre-ventilation time all channels close. As soon as a switch is operated the "EI" mode is reactivated and the ignition point can be set

Aids

Programming 1st point
(separate ignition point)



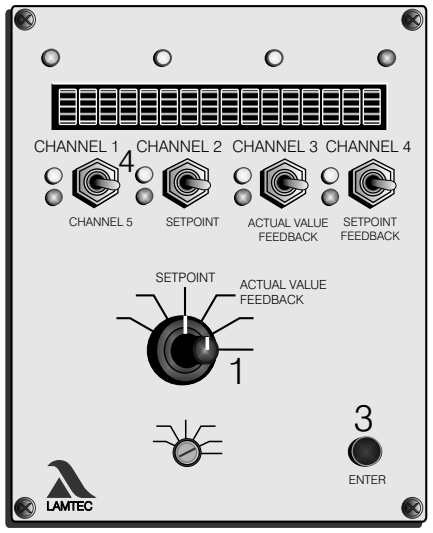
For safety reasons
"Setting" mode permits direct access to the control elements with the burner running. It is therefore essential to follow the safety rules laid down by the burner manufacturer!

"Setting mode" with the system running must only be undertaken by trained and experienced personnel, whilst keeping a constant watch on the system.

The first point entered after clearing the memory is always the ignition load point. This is fixed at a load rating that can no longer be run to whilst in operation (load rating 002)

Mode selector switch (2) to "Setting"
- "EI" appears in the middle of the display

Aids: A6



Selector switch (1) to "Set point"

Switch (4) up or down
until system is optimally adjusted at ignition load point
- control element reacts
- display changes

Aids: E2, B1,C1,E12

On FMS 5: Selector switch (1) to "Channel 5 display"
- set point and feedback actual value are displayed

Switch (4) (channel 2) up or down
until channel 5 is optimally adjusted

Selector switch (1) to "Actual value feedback"
- Value of the external feedback (with continuous output) is displayed
- with three-point step channel the same value as in "set point" position is displayed

Wait until feedback has stopped

Programming with burner running
(i.e. pre-ventilation has been carried out previously without programmed point)

Press Acceptance (3)
- "Really ignite?" appears on display

By operating the switch the ignition point setting can be corrected again

---

Aids

Press Acceptance (3) again
- burner ignites
- sep. ignition point appears on display

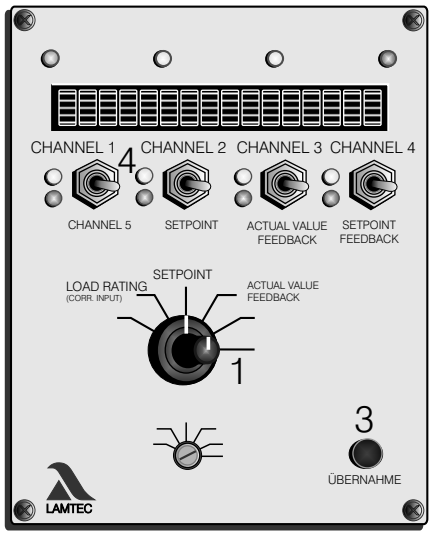
Programming
with burner stationary

Press Acceptance (3)
- ignition point 1 appears on display

Programming 2nd to 19th point

Selector switch (1) to "Load rating"

Run to desired load rating using channel 1 switch



Selector switch (1) to "set point"

Switch (4) up or down
until system is optimally adjusted at instantaneous load rating — E2,B1,C1

On FMS 5: Selector switch (1) to "Channel 5 display" — E12
- set point and actual value feedback are displayed.

Switch (4) (channel 2) up or down — E12
- until channel 5 is optimally adjusted

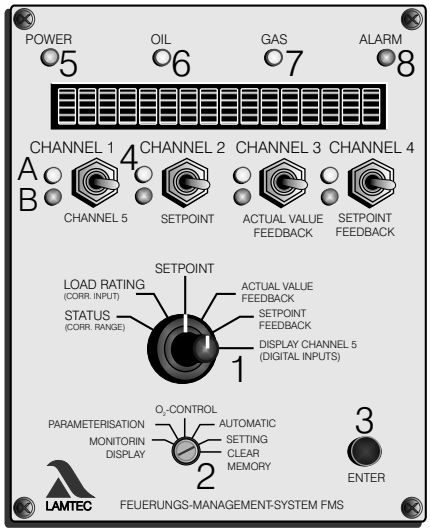
Selector switch (1) to "Actual value feedback"

Wait until feedback has stopped

Press Acceptance (3)
- Point X appears on the display (X is the number of the programmed point. That is, at the 4th press of the acceptance key, point 4) — A16

A load point on the curve must be the lowest possible load rating that can be pre-set by the load control unit in operation, otherwise the compound cannot completely follow the load control unit. The compound does not go below its lowest point even in the event of lower load requirements.

Programming
last top point



Selector switch (1) to "Load rating”

Run to top load rating
- 999 on the display (corresponds to 20 mA on the load input) D4, D6

It is essential to run to the highest load rating that can be pre-set by the load control unit in operation, otherwise the compound cannot completely follow the load control unit. The compound does not go above its highest point even in the event of higher load requirements

Selector switch (1) to "set point”

Switch (4) up or down
until system is optimally adjusted at instantaneous load rating

On FMS 5: Selector switch (1) to "Channel 5 display”
- set point and actual value feedback are displayed.

Switch (4) (channel 2) up or down
until channel 5 is optimally adjusted

Selector switch (1) to "Actual value feedback”

Wait until feedback has stopped

Press Acceptance (3)
- Point X appears on the display

Store curve

Switch mode selector switch (2) from "Setting” to "Automatic”
- "Memory” appears briefly on the display.
The curve has been transferred into the EEPROM A5, A10

Check monitoring values

Mode selector switch (2) to "Monitoring display”
- The display skips to the values of the monitoring section

Selector switch (1) to "Load rating”

Run to programmed load ratings

Selector switch to "Set-point” or "Actual value feedback”

For specimen report, see appendix page 149

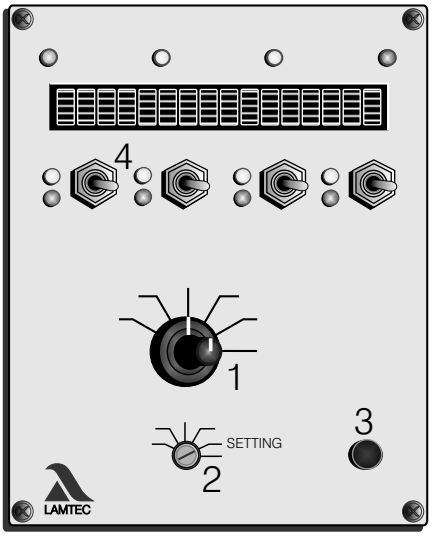
The monitoring values may clearly deviate from the values of the main processor, depending on the configuration (redundant signals or not). What is important is that the actual value and set-point value for the respective processor agree, not that there is agreement between the values of different processors.

Aids

Adding points

Aids

If a curve has previously been stored that does not contain twenty points, additional points may be added.



Mode selector switch (2) to "Setting"

Selector switch (1) to "Load rating

Run to desired load rating — D2

If a flashing number appears after the load rating, instead of adding a new point an old one is overwritten.

Selector switch (1) to "Set-point"

Switch (4) up or down
until system is optimally adjusted at the selected load rating — D1,C1,E2

On FMS 5: Selector switch (1) to "Channel 5 display"
- set point and actual value feedback are displayed.

Switch (4) (channel 2) up or down
until channel 5 is optimally adjusted

Selector switch (1) to "Actual value feedback"

Wait until feedback has stopped.

Press Acceptance (3)
- Point X (number of the new load rating appears on the display, if 6 points have previously been entered, "Point 7" appears, only then is it classified according to its value) — A16

if necessary

add further values

otherwise

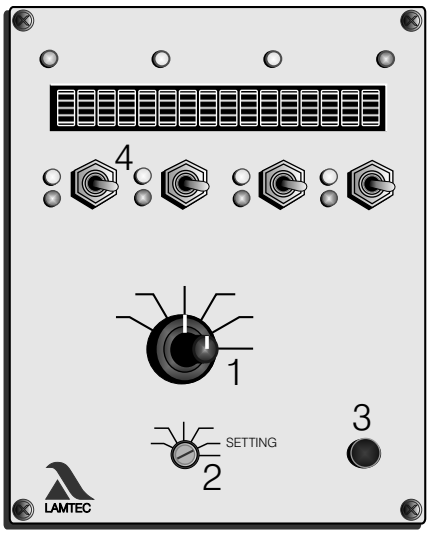
Store

Note monitoring values — A5,A10

Up to 20 points can be programmed. A high resolution should also be used, since this ensures precise firing control.
It is also possible, however, to store fewer than 20 points. This is advisable, for example when entering an initial, approximate curve.

A definitive curve for the FMS should always comprise at least 10 points.

Changing curve point



Mode selector switch (2) to "Setting"

Selector switch (1) to "Load rating"

Run to load rating with switch channel 1
the set-points of which are to be altered. Recognisable by the flashing digits after the load rating, e.g. 687 (8) — D2

A digit or "Z" must appear after the load rating, otherwise the VMS does not accept the change and a point may be accidentally added.

Selector switch (1) to "Set-point"

Switch (4) up or down
until system is optimally adjusted at the selected load rating — D1,C1,E2

On FMS 5: Selector switch (1) to "Channel 5 display"
- set point and actual value feedback are displayed.

Switch (4) (channel 2) up or down
until channel 5 is optimally adjusted

Selector switch (1) to "Actual value feedback"

Wait until feedback has stopped

Press Acceptance (3)
- Point X (number of the new load rating) appears on the display — A16

if necessary

change another curve point

otherwise

Store — A5, A10

Check monitoring values

The separate ignition point can also be started up and altered in this way.

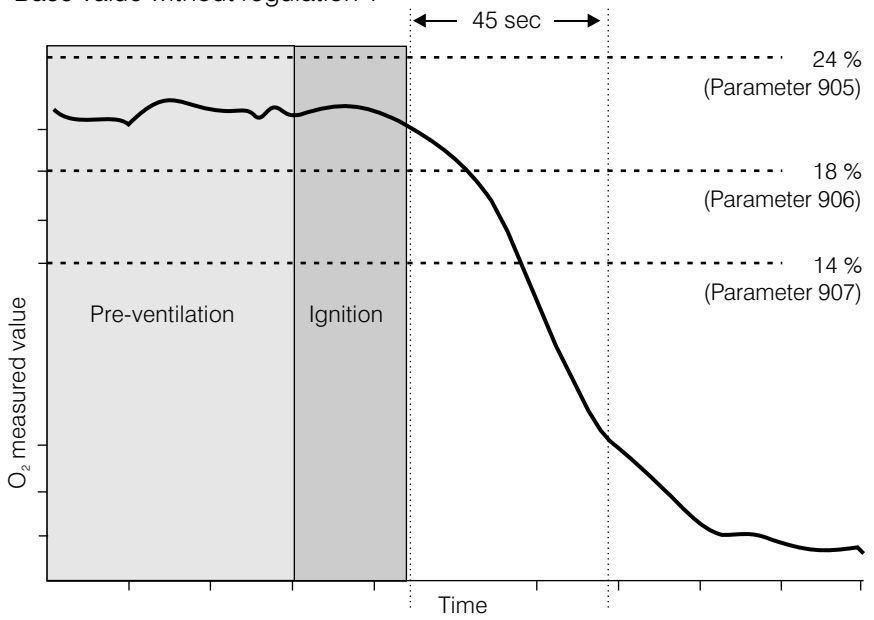
Aids

Adjusting the integrated O_2 regulator (optional)

This section explains only the operating steps needed to input the O_2 curve. Further information on O_2 regulation is contained in the publication DLT 5002.99cD Commissioning Supplement for the Optional "Integrated O_2 Regulator".

Checks during burner start-up

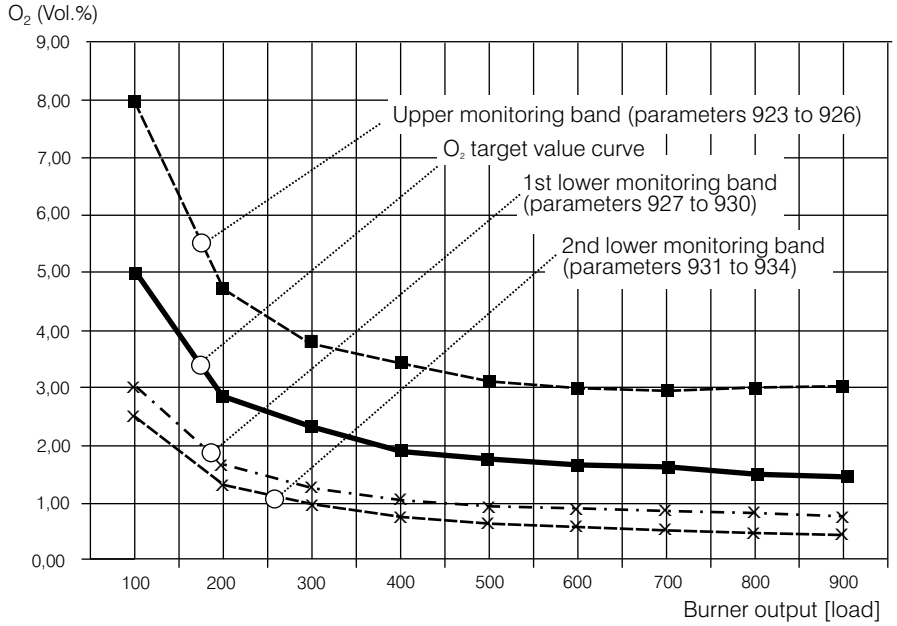
This tests whether during pre-ventilation, the O_2 actual value has complied with the air value (no smaller than 18 vol.% O_2 and smaller than 24 vol.% O_2). After ignition, the O_2 actual value should have reached a value of no less than 14% within 45 seconds. Reaching the threshold value is monitored. If one of the two values is not met, O_2 regulation is deactivated. The regulator outputs "Base value without regulation".



O_2 monitoring bands

The O_2 actual value is constantly checked during burner operation for one maximum and two minimum permitted values. These ranges are located around the O_2 target value as a function of the load.
If the actual values are outside these bands over a defined period of time, regulation is deactivated and the warning "Fault" is output. Thereafter, the regulator output (correction input) corresponds to "Base value without regulation" or "Base value for air shortage" as relevant.

O_2 boundary curves



The monitoring bands can be parameterised for 2 fuels, oil/gas, referenced to each fuel (parameters 923 to 934). In the case of more than 2 curve sets, these can be assigned to the individual curves via the parameters 912 and 913. The permitted deviation is calculated as a percentage of the target value. Two separate percentages can be specified for basic load and full load. The range between those is interpolated linearly.

Monitoring/shut-down times:

1st monitoring band 120 seconds; active after "Regulator on"

2nd monitoring band 30 seconds; active after "Burner on"

Factory settings:

1st monitoring band in the upper direction

Basic load	(parameters 923/925)	60%
Full load	(parameters 924/926)	100%

1st monitoring band in the lower direction

Basic load	(parameters 927/929)	40%
Full load	(parameters 928/930)	50%

2nd monitoring band in the lower direction

Basic load	(parameters 931/933)	50%
Full load	(parameters 932/934)	70%

Dynamic probe test

During active operation, the measured O_2 value is monitored by the main processor for any changes. If no greater fluctuation than 0.2 vol.% O_2 is detected over a period of 10 minutes, the fuel/air mixture is altered to force an air excess. If after 1 minute there is still no change in the actual O_2 value, the test is repeated with a higher air excess. If this does not cause a change in the actual value, this test is repeated yet again with an even higher air excess.
If even this does not force a change in the actual O_2 value, the regulator deactivates itself and displays a warning notice.
Thereafter the regulator output (correction input) corresponds to "Base value without regulation".

Probe blockage

Blockages in the probe can cause the measured value to increase slowly but steadily, in such a way that the dynamic probe test is not triggered. The main processor monitors whether the actual O_2 value drops by more than 0.2 vol.% O_2 at least once within 15 minutes. If this is not the case, then a dynamic test is triggered.

Note:
O_2 optimisation fault messages have no effect on the burner's function or that of the combustion system. They only notify that:
O_2 optimisation was deactivated.
Note error status and load value.
If desired, it is also possible to have the burner shut down on "Air shortage" faults via parameter 897.

Correction output monitoring

If the O_2 correction output is constantly greater than 98% [980 points] over 60 minutes, the O_2 regulator is deactivated for safety reasons. The base value for "Deactivated regulation" is output. If thereupon the O_2 value increases significantly, then the O_2 regulator is reactivated as soon as the O_2 value is (e.g.) at another load setting in the 1st monitoring band.

The regulation strategies employed were specially developed and optimised for the circumstances prevailing in combustion facilities:

- Frequent output changes,
- long lag times.

During burner start-up, the O_2 regulator remains on standby until it is ensured that plausible O_2 measured values are being displayed.
Factory setting 90 seconds after ignition -
this is adjustable via parameter 904.

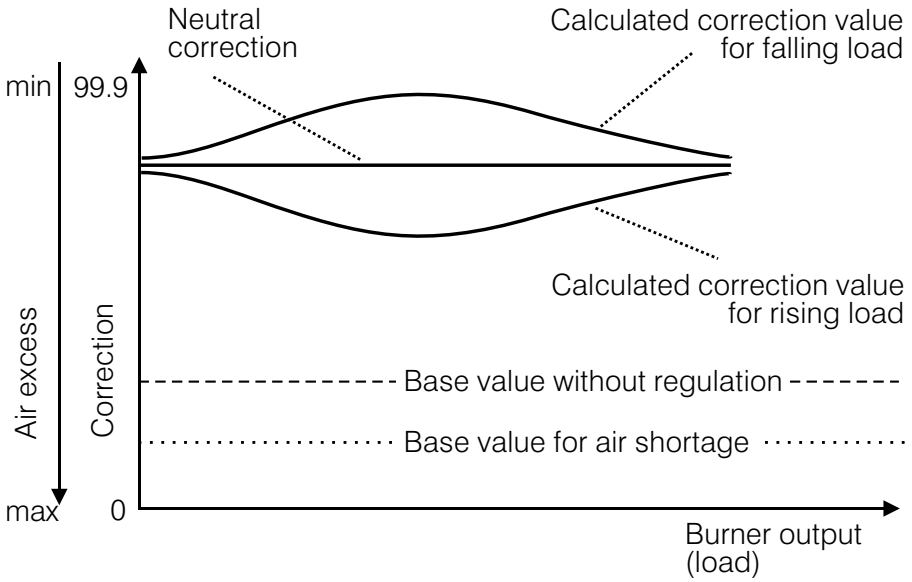
The "Neutral value" is output during standby.
It is calculated automatically from the range set.
Ignition takes place with the neutral value.
The neutral value depends on the selected correction mode;
e.g. at -50% to +50%, the output correction value (neutral value) is 500, whilst at -30% to +70% it is 300.

Note: *The neutral value corresponds to the basic setting of the VMS/FMS without regulation.*

In the case of fuel/curve switching during operation, the neutral value is output during the switch-over. An air advance can be set to the neutral value by means of parameters 702 to 704.
O_2 regulation is reactivated, with a time delay, once the switch-over is completed.
Factory setting 30 seconds, adjustable via parameter 903.

Various regulation strategies are available.

In the event of a fault, "O_2 regulation base value deactivated" or "Base value for air shortage" is output, depending on the cause.



With pre-setting for load changes (standard regulator)

O_2 regulation by means of a comparison between target and actual values is only performed if no output change (load change) takes place ("internal load" static). After a preceding load change, an target/actual value comparison is performed and an actuation step triggered only after expiry of the set lag time (parameters 898 and 900).

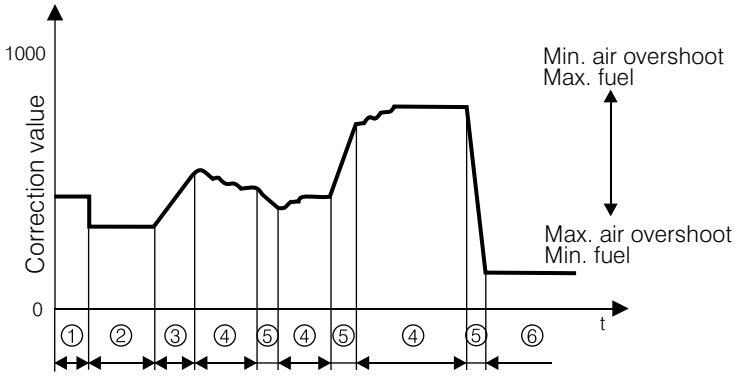
If the O_2 actual value corresponds to its target value, the current correction value, referenced to the load vale and the load direction, is stored in a table. The updated value is output at the next load change.

A pre-update is already carried out as from the 2nd target/actual value comparison, after a load change. As soon as the actual value gets close to the target value, the correction value is updated.

When the load changes, regulation is terminated immediately after target/actual value comparison and the neutral value, or if relevant the correction value obtained (updated) for this load point,
is output pre-setting!

Regulation after a target/actual value comparison is only performed again if the load is stationary and on expiry of the lag time.

In this type of regulation, the overshoot is automatically deactivated in the VMS/FMS. The actuators' hysteresis is compensated for by the load direction-dependent updating of the correction value.



Regulation strategy with pre-setting for load changes

(1) Pre-ventilation/ignition
The correction is switched off; i.e. the neutral correction value is output.

(2) O_2 regulation on standby
The "Correction value with deactivated regulator" specified in parameter 901/902 is output.

(3) Regulator takes over the neutral correction value,
or the updated correction value is output.

(4) On expiry of the set lag time, the residual deviation between target and actual value is corrected.

(5) Load change
O_2 regulation is suspended and pre-setting carried out - neutral correction value, or the updated correction value is output.

(6) Regulation is deactivated, e.g. by a fault
The correction value for deactivated regulator specified in parameter 901/902, or the one specified in parameter 917/918 for "Air shortage", is output.

Parameter 896 can be used to select whether the pre-setting is always (at each load change) to be activated (factory setting Standard 1), or not activated (content 2).

Furthermore, the updating too can be turned off. It is then possible to select whether, at load changes, the neutral correction value or the "Base value without regulator" is to be output (parameter 896).
The overshoot becomes active again when updating is turned off.

Extended regulation strategy (air shortage)

Regardless of the selected regulation strategy and the lag time set (parameter 898/900), immediate and extensive action is taken by the regulator to combat any air shortage occurring. The objective is to avoid air shortage and to correct any such shortage as quickly as possible.

Regulator overshooting and the resulting excess air are accepted as unavoidable.

Via analogue interface

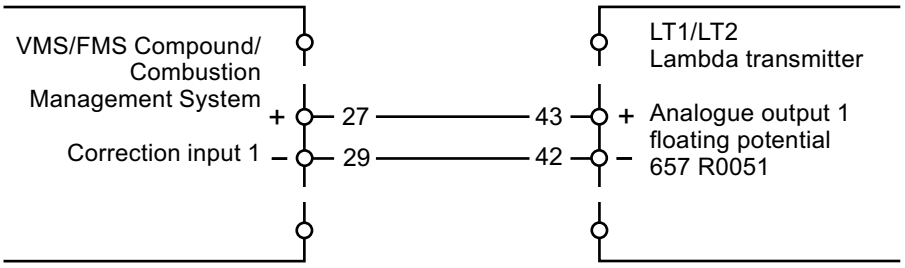
The default for the measured O_2 value is set via standard signal 0/4...20 mA to the VMS/FMS correction input 1.

ATTENTION:
Only O_2 meters whose t_{90} response time is < 15 sec may be connected.

Release of the analogue interface is only possible at the factory.
(Cat. no. 663 R0030).
In case of doubt, please contact LAMTEC.

Range compensation via parameters 919 and 920
Factory setting: 4...20 mA ≙ 0...25.0 vol. % O_2
0 mA when O_2 measurement is perturbed

Electric connection:

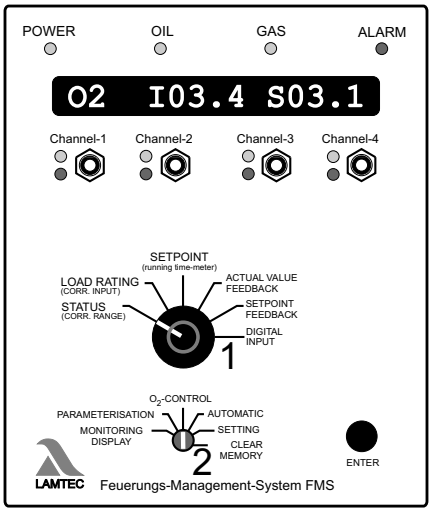


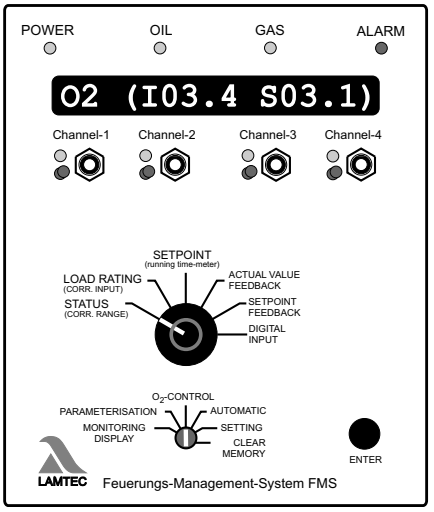
Mode switching

Selector switch (1) to status.
With channel key 3 in upward position, switch the display to O_2 regulation.

O_2 actual value and O_2 target value are displayed whilst the switch is in the Status position. If O_2 regulation is deactivated, the figures are shown in parentheses.

O_2 regulation activated





O_2 regulation deactivated

Push channel key 3 downward to return to VMS/FMS mode.

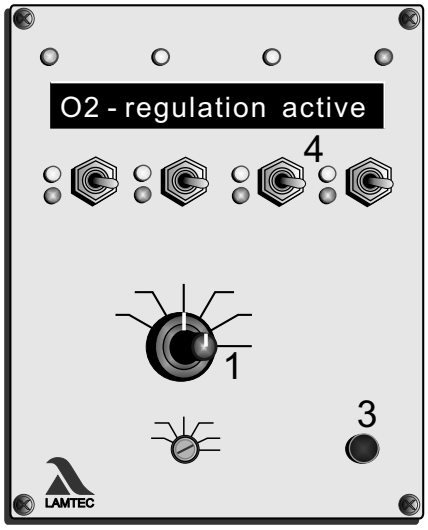
Note: O_2 actual and target values are only displayed if O_2 regulation or O_2 display are activated by means of parameter 896.

In automatic operation, the display switches during regular operation to the O_2 regulation mode. During burner start-up and with the basic load, VMS/FMS text mode is active - basic setting. However, switching the display by means of channel key 3 is always possible. Nevertheless, the manually preselected setting only remains in force until the next change-over into "Regular operation" or "Basic load regulation", and then returns automatically to the basic setting.

In "O_2 regulation" mode, and with the selector switch in the Status position, pressing the Acceptance key calls up commentary texts (running texts) relating to O_2 regulation.

The selector switch position (2) O_2 Regulation serves only for the input of O_2 target value curves.

Calling up O_2 regulation - text messages



Switch display to O_2 regulation.

Selector switch (1) to "Status".
Channel key 3 (4) upwards.

- Call up text messages by pressing the Acceptance key (3).

- Back → press the Acceptance key (3) again,
  or turn selector switch (1) to a different position.

First adjust the electronic compound completely.
The integrated O_2 regulator remains deactivated.
Set parameter 896 to 0 "No regulator"
or 3 "Only display".

Setting the correction range and correction mode

The integrated O_2 regulator is connected inline and upstream of the FMS, as a free-standing program block. It acts exclusively on correction input 1. The correction signal (actuation signal) transmitted to the FMS is 0...100% with a resolution of 0.1%.
0% corresponds to maximum excess air, 100% to minimum excess air.
The factory setting is a correction mode of +60 / -40 when correcting for air-valve / fan and -60 / +40 when correcting for fuel and a neutral value (base setting with the O_2 regulator switched off) of 50%.
This basic setting was selected on the assumption that over time, burner and boiler contamination during their operation would result in the installation's flow resistance increasing and thus a somewhat greater actuation range in the excess air direction could be of benefit.

If some other correction mode is selected by means of parameter 437 (expert level), the base setting also alters at the same time.

With correction mode	Base setting
+50 %___- 50%	50.0%
-50 %___+ 50%	50.0%
+70 %___- 30%	70.0%
-70 %___+ 30%	30.0%
0 %___-100%	0.0%
-100 %___ 0%	100.0%

The base setting can be called up when the O_2 regulator is switched off, e.g. when the burner is off, during burner start-up etc, by turning the selector switch to Load (correction input) whilst simultaneously pressing the Acceptance key.

Details and examples see "Correction input", page 63 - 64.

Inputting the
O_2 setpoint curve

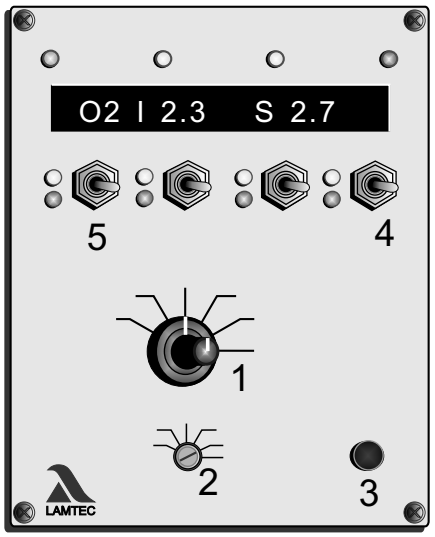
Calculation of O_2 target values as part of burner adjustment

Note: O_2-regulated operation is the normal operation. Unregulated operation should only be considered to be the emergency situation. Hence, the objective of burner adjustment should be to calculate the optimised operation and to store the corresponding curves in the VMS/FMS. The O_2 values calculated as part of burner adjustment are now input as target values for O_2 regulation.

The excess air required for unregulated operation is set via the base value without regulation (parameters 901/902). This is specified during Regulation off, Regulation in standby etc.

The O_2 values calculated during burner adjustment are input and stored as follows, regardless of whether the burner is off or in operation. The O_2 target values can be input arbitrarily. It is not necessary to observe any particular sequence.

Set selector switch (2) to O_2 regulation.

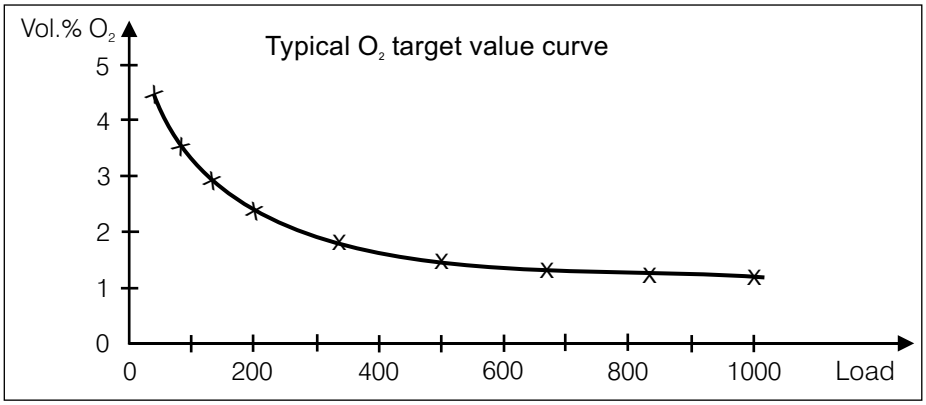


Delete the whole O_2 curve with
channel key 4 (4) upwards.

If only points need to be changed, push
channel key 4 (4) downwards.

Set selector switch (1) to Load.

Using channel key 1 (5), the composite curve's programmed load points can now be called up.



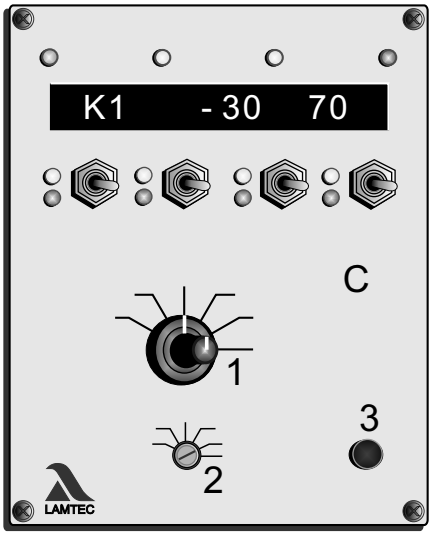
Note: The O_2 target values can only be stored in the programmed load points. If load points are skipped, the line in between is interpolated.

- Set selector switch (1) to target value.
- Channel key 4 (4) is used to set the required O_2 target value.
- Press the Acceptance key (3).

Note: Each stored O_2 target value can be changed as many times as necessary, including immediately after storing it.

Set selector switch (3) to Load and
use channel key 1 (5) to call up the next load point;
etc.
As soon as all required O_2 target values have been entered,
set selector switch (2) back to Automatic.
The O_2 target value curve is now stored.

Calling up the
correction range set



Turn selector switch (1) to Status

Press the Acceptance key (3)
The selected correction range appears on the display.

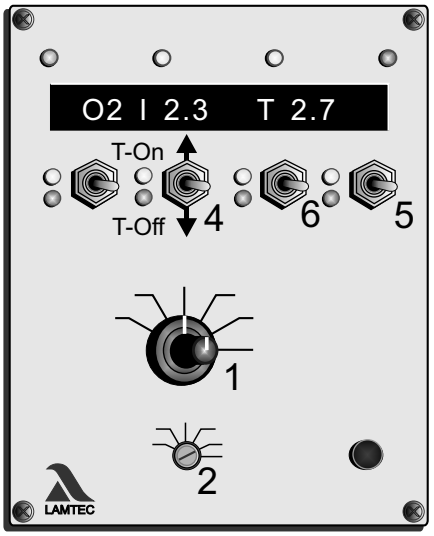
If both correction inputs act on one channel, the sums are shown.

Press the Acceptance key (3) again, or
turn selector switch back (1) → return to normal display.

The correction should be taken into account during later programming. The correction should be able to act without the FMS reaching the end of its travel (0 or 999 or end-switch values).

If the correction cannot drive the servo because a channel has reached the range limit obtained during pre-ventilation, burner output is increased or decreased until the correction can be effected. This function can be switched off via the parameter 0 - Release level 2. Content 0 Z off!

Calculation and setting
of control parameters
- Manual



Run burner on low load.

Set selector switch (2) to O_2 regulation

Text message appears

Push channel key 4 (5) downwards

Text message disappears

Set selector switch (1) to target value

Push channel key 2 (4) upwards
The O_2 regulator is activated when this is set.
The O_2 target value can now be adjusted using channel key 3 (6) within a range of +3 to -1 vol.% O_2 from the target value entered. The change in the actual O_2 value can be observed at the same time on the display.

Channel key 3 (6) upwards → more O_2
Channel key 3 (6) downwards → less O_2

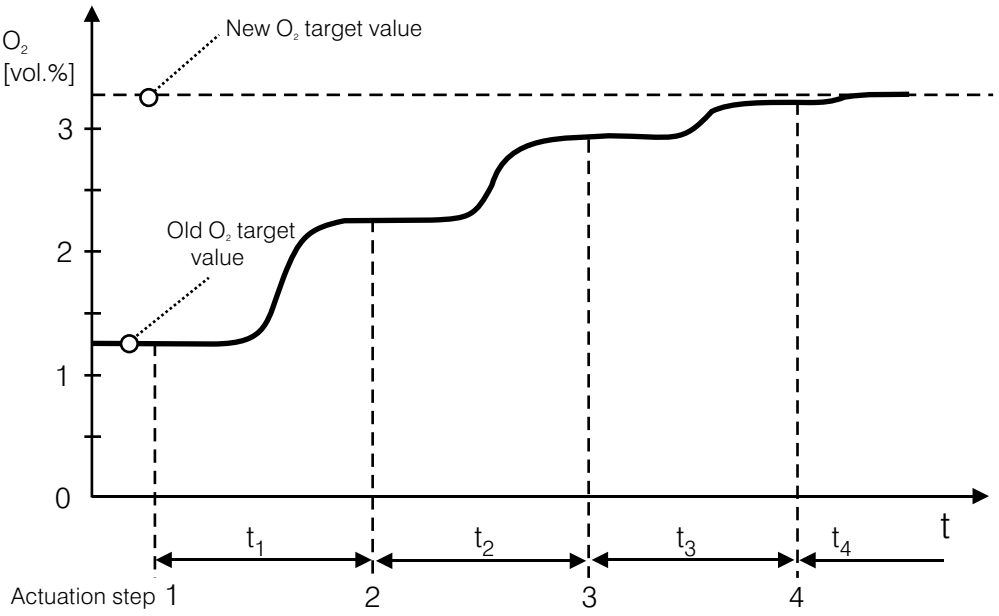
The setting of parameters 898/899 and 900 should be such that the next target/actual value comparison (actuation pulse) takes place only if the O_2 actual value has changed discernibly. A symbol +;-at the centre of the target value display indicates that a target/actual value comparison is being performed.

No change or change too small:
Increase P-factor parameter 899.
For details see page 60.

Note: The P-factor (proportionality factor, parameter 899) is specified by means of the parameter setting. The new correction is obtained from the two input quantities, deviation and P-factor. The former is then output to the FMS/VMS.
The procedure is repeated after the lag time's expiry. If the internal load has changed during this time, the O_2 regulator exits this routine. It must then be reactivated again as described above, via channel key 2 (4).

Deactivating test mode
Push channel key 2 (4) downwards

Lag time
Parameters 898 / 900



Regulation parameter setting
t_1 ___ t_4 = regulation section's lag time
Specified via parameters 898 and 900

The calculated value should be input by means of parameter 898.
Factory setting: 15 seconds.

The lag time can be adjusted to the load via parameter 900.
The lag time gets shorter at full load, due to the higher gas velocities.
Lag time shortening of 3 seconds is preset at the factory.

To calculate lag time at full load: proceed as described above.

Guideline for 2 or 3-draught boiler:
Parameter 898 → 12 seconds
Parameter 900 → 3 seconds

The P-factor should be so adjusted that a target/actual value deviation of 1...2 vol.% O_2 is corrected within 4...6 steps without overshooting.

P-factor
Parameter 899

Actuation pulse too short → increase P-factor parameter 899
Overshooting → reduce P-factor.

Repeat until the target value is corrected within ca. 4...6 steps.
Check regulator setting at intermediate and full load.

Note: It is possible to achieve optimisation by means of the P-factor (parameter 899) and the lag time (parameters 898 and 900), that inter alia also depends on the installation's properties; e.g. one may set a somewhat shorter lag time if the P-factor is reduced at the same time.

Recommendation:
Set a slightly longer regulation cycle and smaller P-factor → safer !!!

Setting a base value for "Deactivated regulator" and "Air shortage"

Perturbation of O_2 regulation causes it to deactivate, and the specified correction value for "Deactivated O_2 regulator" or "Air shortage" is output, depending on the cause. The burner is not shut down.

Parameters 901/902
917/918

Parameter 897 can be used by the customer to specify a burner shut-down if the perturbation is "Air shortage".

Calling up the base value for O_2 regulation deactivated / Air shortage

The base values for deactivated O_2 regulation and air shortage can be called up via parameter 896.

8 → Correction input _ base value for "Deactivated O_2 regulation"
Parameter 901/902

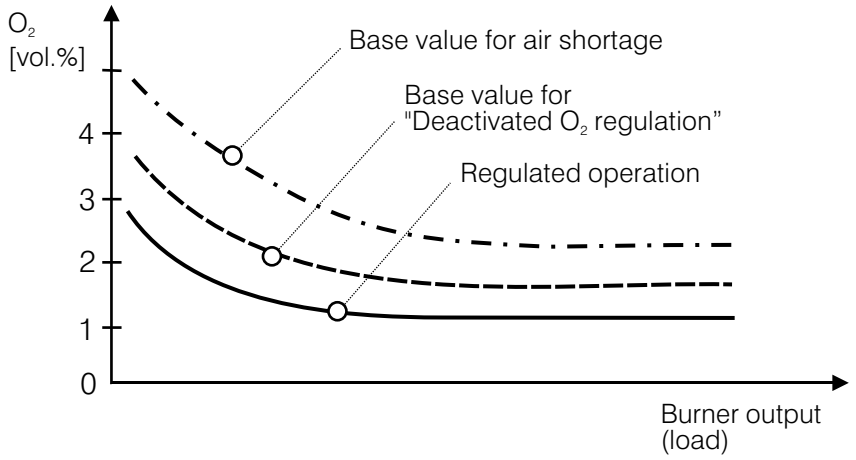
9 → Correction input _ base value for air shortage
Parameter 917/918

Recommended settings:
for parameters 901/902 and 917/918
Base value for deactivated O_2 regulation $\leq$ neutral value
Base value for air shortage $<$ base value for deactivated O_2 regulation

Note: The neutral value is obtained from the chosen correction mode:
Correction mode +50% / -50% → neutral value 500 $\triangleq$ 50%
Correction mode +60% / -40% → neutral value 600 $\triangleq$ 60%
See also the explanations on page 66.

Factory settings
Parameters 901/902 - base value for "Deactivated O_2 regulation" 300
Parameters 917/918 - base value for "Air shortage" 150

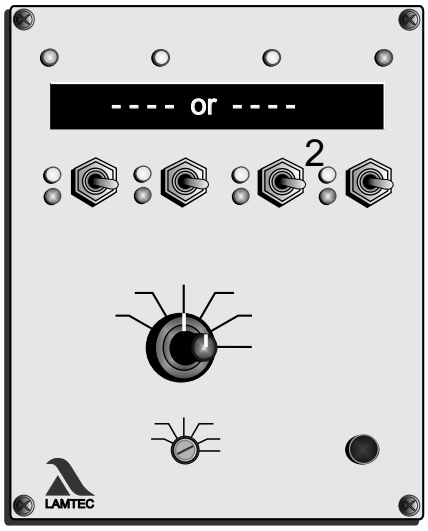
This results in the following approximate picture of burner output:



Automatic:

In preparation

The meaning of the additional modes



op O_2 regulation on standby (during burner start-up), or O_2 regulation temporarily switched off via parameters 914 and 915 as a function of load.

or O_2 regulation active.

ot O_2 regulation temporarily deactivated (air shortage, probe dynamics etc).

od O_2 regulation deactivated (perturbed), e.g. test routines failed during burner start-up, dynamic test negative, O_2 regulation temporarily deactivated for over 1 hour etc.

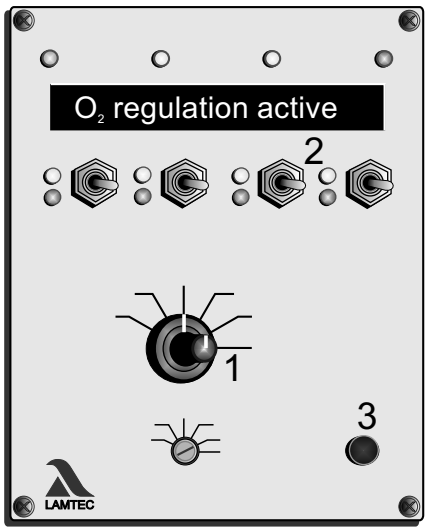
Resetting od:

Manually
Switch to "O_2 regulation" mode.
Press the Acceptance key and call up error text.
Push key 3 (2) upwards Z error deleted.

ATTENTION: If deleting an error, the error text must always first be called up by pressing the Acceptance key.

Automatic
During each new burner start-up.

Calling up O_2 regulation text messages



- Switch display to O_2 regulation mode.
  Selector switch (1) to "Status" and channel key 3 (2) upwards.
- Call up text messages by pressing the Acceptance key (3).
- Back Z press the Acceptance key (3) again,
  or turn selector switch (1) to a different position.

Aids

Set correction input

If corrective intervention is desired:
Make sure that correction input is set

Correction signal: terminals 27 and 29 (correction input 1) or
Correction signal: terminals 33 and 34 (correction input 2)

The correction is set via the parameter numbers 429-676, of which, however, only a fraction are generally released for use by the person commissioning.

The following settings are possible,
expert level only (level 2):

Current signal:

Correction input 1	0 … 20 or 4 … 20 mA	Parameter 431
Correction input 2	0 … 20 or 4 … 20 mA	Parameter 432

Correction mode:

Correction mode for correction input 1	Parameter 437
Correction mode for correction input 2	Parameter 441

Correction mode and input signal are quoted in the order and are set at the factory. Any change on site is possible only by parameter intervention at expert level.

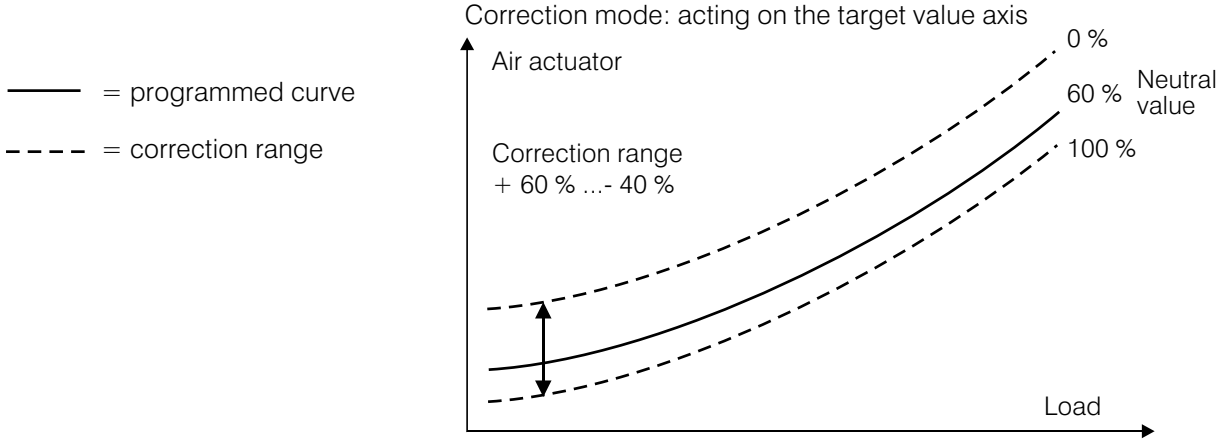
Available correction modes

The correction mode specifies how the correction should act. Manifold settings are possible. Diagrams 1 and 2 show two typical correction modes for O_2 correction.

Type 1: correction acting on the target value

Type 1 is used if the correction is applied to a linear actuator, e.g. a frequency converter shifting the combustion air blower's rotation speed. The correction is directly added to, or subtracted from, the target value.

Correction mode: acting on the target value axis

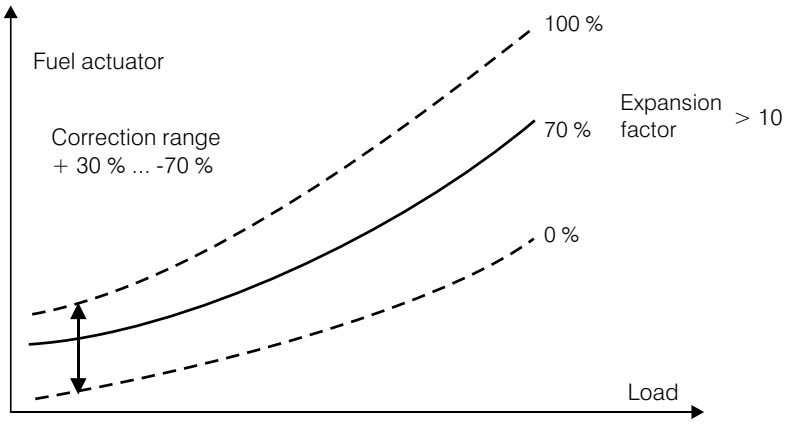


— = programmed curve

- - - - = correction range

If the correction is applied to a fuel actuator, the effect is reversed so that 0% corresponds to the smallest target value. By using the expansion factor held in parameter 433 - Commissioning level - the correction effect can also be weighted across the burner's output.

Factory setting:
Expansion factor 10; ≙ 1.0, i.e. no weighting
Expansion factor > 10; the correction increases with rising burner output;
Expansion factor < 10; the correction decreases with rising burner output.
For details see VMS Commissioning instructions, under Auxiliaries, p. 30.

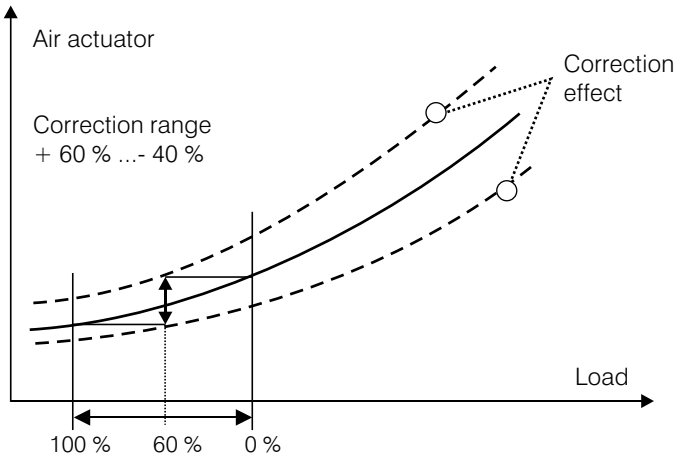


ATTENTION:
When applying O_2 corrections, make sure that the combustion limits are observed even with the maximum correction applied (100%). For details see page 67, "Checking the combustion engineering limits".

Type 2: correction acting on the load axis

Correction mode: applied to the load axis
This is used if correction is made via a non-linear actuator, e.g. air flap. The curve's slope is taken into account before calculating the correction. Thus, a flat curve results in a small correction range, whilst a steep curve results in a large one.

ATTENTION:
This is only meaningful if the curve rises monotonically.



ATTENTION:
When applying O_2 corrections, make sure that the combustion limits are observed even with the maximum correction applied (100%). For details see page 67, "Checking the combustion engineering limits".

Aids

The correction mode indicates how the correction is intended to act. A variety of settings are possible. Figure 1 and 2 show two typical correction modes for O_2 correction.

Type 1 is used where the correction is made on a linear control element, such as a fan frequency converter. The correction is directly added to or subtracted from the set-point value.

Type 2 is used where the correction is made on a non-linear control element such as an air damper. Before determining the correction, account is taken of the steepness of the curve. A flat curve results in a small correction range, whereas a steep curve give a large range.
If the correction is made to a fuel control element, the effect of the current is reversed, so that 0 mA corresponds to the smallest set-point.

Do not use if parts of the curve are horizontal.

Setting the correction range: The correction range can be set between 0 and 999 via parameter 517, commissioning level.

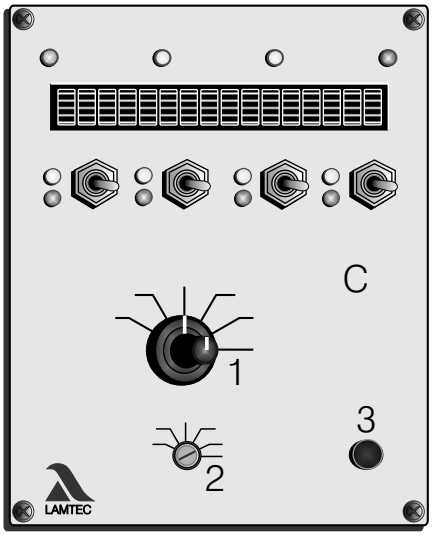
Example: A typical correction range for O_2 regulation is 200. This means:
With a correction mode of +40% ... -60% (factory setting) and correction for a target value of +80, the actuation range across which the correction can be applied is -120 points.

Recommendation: The correction mode and correction range should be so chosen that the effect on the O_2 value in the direction of excess air is -2 to 3 vol.% O_2, and the effect in the direction of air shortage is 1 to 1.5 vol.% O_2

Recall set correction range

Selector switch (2) to "Setting"

Selector switch (1) to "Status"



Press Acceptance key (3)
Set correction range appears on the display on the respective channel.
If two correction inputs act on one channel, the ranges are displayed alternately (e.g. 15 points)

If "OFF" appears
on the display, no correction is activated for this channel

Take account of correction in subsequent programming
The correction must be able to act without the FMS reaching the stop (0 or 999 or limit switch values).

If the correction cannot extend the adjustment travel because a channel does not reach the range limit determined for pre-ventilation, the burner output is increased or reduced until the correction can be extended.

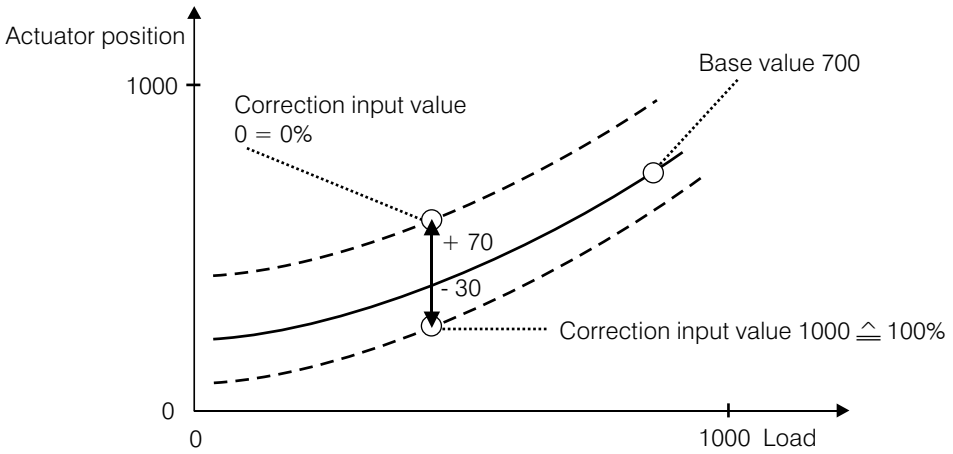
Altering the correction range

The parameters must be changed to allow the correction range to be altered. These parameters are accessible via Customer level (Level 1).

Proceed as described under Parameter setting.
The values associated with the correction range are stored in parameters 517 and 597.

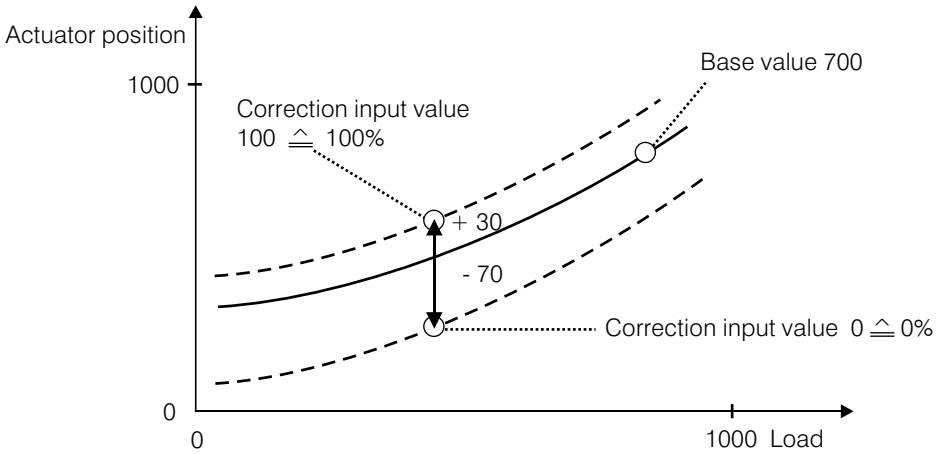
Examples and illustrations

Correction mode +70% ... -30% (recommended for air correction)



+70% corresponds to correction input value 0
- 30% corresponds to correction input value 1000
Base value 700 ≙ 70%

Correction mode -70% ... +30% (recommended for fuel correction)



- 30% corresponds to correction input value 0
+70% corresponds to correction input value 1000
Base value 300 ≙ 30%

Correction modes:

Correction for air actuator (valve/revs)			Correction for fuel actuator		
		Base setting			Base setting
+50%	- 50%	50%	- 50%	+50%	50%
+60%	- 40%	60%	- 60%	+40%	60%
+70%	- 30%	70%	- 70%	+30%	70%
+80%	- 20%	80%	- 80%	+20%	80%
+90%	- 10%	90%	- 90%	+10%	90%
+100%	- 0%	100%	-100%	0%	100%

Run to shut-off limits

As each monitoring system the FMS has tolerances, which affect the adjustment precision. With the FMS these tolerances can be affected by parameter settings.
If the firing system is adjusted, it has to be ensured that also the flame burns reliably and stably in consideration of these tolerances. In order to prove this it is necessary not only to prove the compound settings to the adjusted setpoint, but to the so-called shut-off limits, i.e. with the actuator values, that the FMS can take due to the permissible tolerances without shutting off just yet.
This inspection has to be performed for the whole load range and for every operating mode. This inspection can be abandoned if:

- the system is equiped with a failure-safe O_2- or CO-control, which causes the shut-off of the burner due to an uncomplete combustion.
  or
- the system is equipped wiht a failure-safe O_2/ CO- regulation, which compensates the tolerances of the combustion.
  or
- it is guaranteed that the relevant operating mode gets as much excess air over the full range, that the tolerances of the FMS do not have any effect.
  or
- the parameters of the FMS are set that way, that the tolerances to air deficiency are 0 digits, i.e. there are existing only tolerances to excess air.

If You abandon the inspection of the shut-off limits due to one of these measures, You have to check the effectiveness of this measures, i.e. the O_2/ CO- regulation respectively O_2/ CO- control the stability of the combustion at the adjusted shut-off limits value are to be checked.

Due to the evidence of conformity to public and inspection authoroties and quality management , liability reasons etc. we would therefore strongly recommend that You always document the run to shut-off limits. You will find an example protocol in the appendix page 158.

Checking the shut-off limits at three-point step output

Selector switch (1) to "Load rating"

Run to load point to be checked

Wait until the system has run to that point

Mode selector switch (2) to "Setting"

Adjust set-point value (4) of the three-point step channel in the air deficiency direction (for dead band setting, see parameters 62-76)
Check combustion

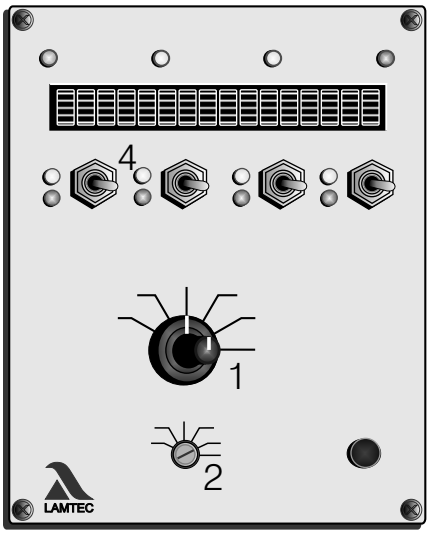
Reset set-point value (4) to original value

In this way run all channels in succession to the limit at the various load points -normally at low, medium and full load

Repeate this methode for all relevant operating modes (curve sets). As the case may be the above described inspection has to be executed in direction excess air instead of direction air deficiency if You cannot ensure that with the adjusted limits direction excess air, the flame burns reliably and stably and no CO arises from excess air.

Checking the shut-off limits at the continuous output of the FMS

This test is necessary with the use of continuous actuators and with r.p.m.regulation without the use of O_2/CO-regulation affecting these r.p.m. With using O_2 regulation it can be abandonned, if the excesse air at deactivated O2/regulation is higher than the setpoint



Selector switch (1) to "Load rating"

Run to load point to be checked

Wait until the system has run to that point

Mode selector switch (2) to "Setting"

Adjust set-point value (4) of the continuous channel in the air deficiency direction until the actual value feedback has changed by the set number the set number of points (1. monitoring band parameter 62-76)

Wait until the system has run to that point

Mode selector switch (2) to "Setting"

Check firing

Reset set-point value (4) to its origin value

Check firing

Reset set-point value (4) to the next continuous channel in air deficiency direction.

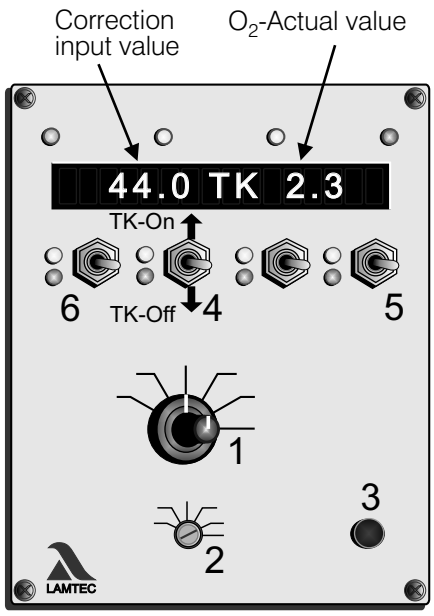
Check firing

Repeat, until all continuous channels are checked at their limits.

If a correction affects the continuous channel, the test can be omitted, if the correction range is bigger than the adjusted monitoring band (what is ordinarily the case). Instead the firing has to be checked at maximum correctional intervention. See section 2 "Checking the O_2 influence". The test can also be omitted if the monitoriing band is set to 0 at the air deficiency side.

As the case may be the above described inspection has to be examined in direction excess air than in direction air deficiency, if it cannot be ensured, that with the adjusted excess air limits, the flame burns reliably and stably and that there is no "excess air CO".

If the system is not equipped with an extra O2- or CO-monitor, it has to be ensured, that the combustion boundary values are kept at maximum adjacent correctional influence.



The correction value can be altered as follows in order to set the correction range and to check the combustion boundary values.

Burner on, regulator is enabled (terminal 4).

Turn selector switch (2) to O_2 regulator

Explanatory text is displayed

Press channel key 4 (5) downward

Explanatory text disappears

Turn selector switch (1) to load value (correction range)

Press Acceptance key (3)

With channel key 2 (4) upwards the manual correction is switched on, shown by the display "TK" in the middle of the display.

The correction value can now be changed at will with Channel key 1 (6), with burner on. The manually selected correction value is maintained until the selector switch (2) is turned to some other position, or normal correction is activated by pressing Channel key 2 (4) downward.
Adjustment of the correction range is possible via parameter 517 (with the burner operational). In the event of several fuels (curve-sets), the range can also be adjusted individually for each curve-set and channel via parameters 517 to 596 (expert level).
To ensure that with deactivated O2-control the tolerance to the air deficiency side is not growing, the Parameters 917, 918 and 901, 902 have to be set to the corresponding value. This value depends on the selected correctional mode.
Empirical formular (+correctional mode x 10.)-100
Example 1:

correctional mode +60/-40

→ the parameters have to be smaller than 500, i. e. every value between 0 and 500 creates an exceed air
(600 would correspond to the setpoint curve)

Example 2:

correctional mode +70/-30

→ the parameters have to be smaller than 600.

Tolerance limits direction air deficiency

The parameter values direction air deficiency have to be known to run the test. The factory settings of the relevant parameters are noticed on the configuration button.

If during the commissioning the factory settings of the dead band and the monitoring bands were changed, this has to be documented externally. The entries on the configuration button have to be set to status quo in non-blurable permanet manner. (par example with water proofed permanent marker)

Tolerances in direction air deficiency do not exist if the following parameter settings are kept :

→ For fuel channels and recirculation channels dead band in positive direction
parameters 42 - 46 = 0 digit

→ For air channels dead band in negative direction
parameters 32 - 36 = 0digits

Furthermore the "Band shift in the event of a change in power" (par. 709 - 712) must have the same value as the monitoring band of the respective channel in direction air deficiency (pa,r. 62 - 76) for there will be no tolerances in direction air deficiency in the case of changing power.

From delivery date 01.02.04it corresponds to the factory settings.
Changing this settings requires the documented inspection of the combustion limits like described before.

As the case may be the correctness of these parameter settings must be proven outwards. This can be done with reading the parameters directly on the device or with the remote software and another adequat tool for analysis respectively.
We recommend the documentation in the form of a protocol. This protocoll may be included in the setting protocols of the burner.

Indication for an example protocol (next page)

With help of the protocol it can be proven, that an inspection of the shut-off limits is not necessary due to the parameter settings. The values of the settings are entered to the table. The gray highlighted numbers identify the parameter numbers or numbers where the respective settings normally are stored. The statements 1-6 have to be confirmed by signature. Delete as applicable. A statemen has to be enlisted, why excess air doesn't have to be considered. Otherwise the inspection for excess air has to be confirmed.

Example protocol for the evidence of the parameter settings of the monitoring bands

Protocol Monitoring band, Dead band and correctional settings FMS

....

date serial no. system

.....

operational mode:

tolerances to air deficiency side

	Channel Functions	Dead Band	Monitoring Band	Band Shift
Channel 1	356	32 / 42	62 / 72	708
Channel 2	357	33 / 43	63 / 73	709
Channel 3	358	34 / 44	64 / 74	710
Channel 4	359	35 / 45	65 / 75	711
Channell 5	360	36 / 46	66 / 76	712
Correction				
adjustment direction air deficiency	adjustment direction excess air	correction range	correction value at deactivated O_2-control	correction value at air deficiency
		517	901 902	917 918

factory settings 40 : 60

(delete as applicable)

1. The dead band in direction air deficiency is always 0 digits
2. The band shift has at least the same size as the monitoring band in direction air deficiency.
3. With r.p.m control of the air for combustion fan the monitoring band in direction air deficiency is 0 digits.
4. If 1st und 2nd and as the case may be 3rd are fullfilled the following applies:
   A tolerance to air deficiency side does not exist, therefore no inspection of the shut-off limits in direction air deficiency has to be performed.
5. An Inspection at excess air is not performed because: .....[1)]
6. It is ensured that with deactivated O_2-regulation the burner is run with more excess air than with operation at the setpoint curves. (which correspond to protocol of the burner settings)

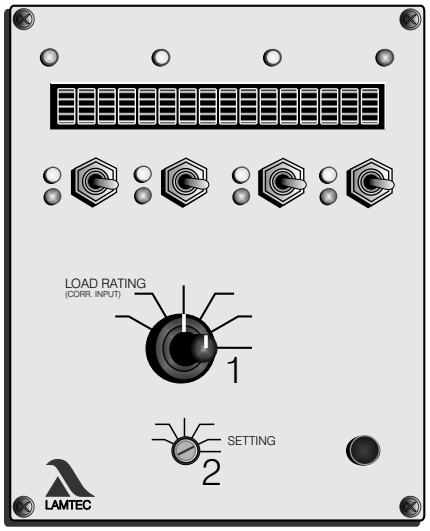
I have veryfied the circumstances above.

.....

name *company* *signature*

[1)] If this sentence is cancelled, a test protocol for the shut-off limits at excess air has to be provided.

Programming 1st point
(ignition load point)



If no separate fuel/air ratio is to be set for the ignition point (selectable via parameter 4= 0 or 2), proceed as described here.

For safety reasons
"Setting" mode permits direct access to the control elements with the burner running. It is therefore essential to follow the safety rules laid down by the burner manufacturer.

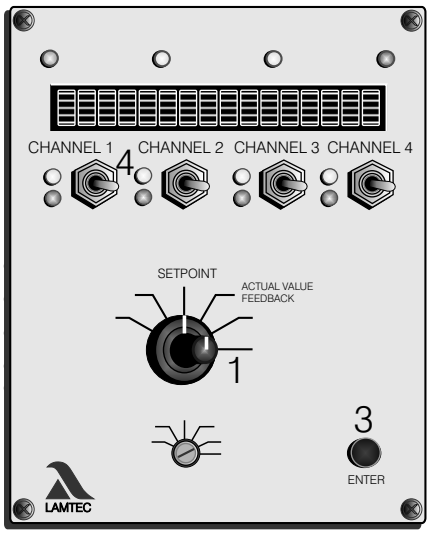
"Setting mode" with the system running must only be undertaken by trained and experienced personnel, whilst keeping a constant watch on the system.

The first point entered after clearing the memory is always the ignition load point. This need not be the lowest load point, it is possible to enter ones lower than this.
At least 1 point must be entered in order to form a new curve.
A subsequent addition up to 20 points is possible at any time, see "Adding points" on page 47.

Mode selector switch (2) to "Setting"
- "EI" appears in the middle of the display — A6

Selector switch (1) to "Load rating"

Run to ignition load point by means of channel 1 switch (4) — D1, D2, D5



Selector switch (1) to "Set point"

Switch (4) up or down
until system is optimally adjusted at ignition load point
- control element reacts
- display changes — E2

Selector switch (1) to "Actual value feedback"
- Value of the external feedback (with continuous output) is displayed
- with three-point step channel the same value as in "set point" position is displayed — B1, C1

On FMS 5: Selector switch (1) to "Channel 5 display"
- set point and actual value feedback are displayed.

Switch (4) (channel 2) up or down
until channel 5 is optimally adjusted

Wait until feedback has stopped

Programming with burner running
(i.e. pre-ventilation has been carried out previously without programmed point):

Press Acceptance (3)
- "Really ignite?" appears on display

By operating the switch the ignition point setting can be corrected again.

Aids

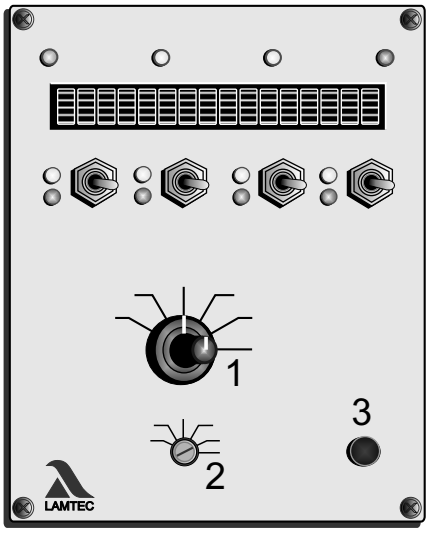
Press Acceptance (3) again
- ignition position relays pull up
  burner ignites
- ignition point 1 appears on display

Programming
with burner stationary

Press Acceptance (3)
- ignition point 1 appears on display

Reversing the programming

If you have started programming and do not want to save these values, but to re-activate the old curve instead.



Selector switch (2) to "Clear memory"

Selector switch (1) to "Set-point"

Press Acceptance (3)
- “cleared” appears on the display

Selector switch (2) to Automatic
- The old curve is valid again.

The unit recognises that the RAM does not contain a valid curve that could be transferred to the EEPROM. The last valid EEPROM curve is therefore re-activated.

Instrumentation
for commissioning

When commissioning systems with the FMS it is recommended that several 5K potentiometers with ready-made connections and at least 2 current transmitters be always carried, (particularly where the continuous outputs are used).

The current transmitter should be adjustable in the range 0 … 20 mA.
A voltage range of 0 … 10 V would also be advantageous in order to be able to simulate the continuous voltage output of the FMS.

In addition 2 multimeters (measuring ranges: current, voltage, resistance) should be to hand when commissioning.

Adjusting load ratings individually - when load points are to be adjusted without programming a complete curve

When adjusting individual points it is normally only possible to freely adjust the set-point values. This is done by running to the load value (figure appears after the value). The associated set-point can be adjusted. The figure, which shows that the change is admissible, appears not only right at the programmed load point but also in the range ± 3 points around this. When stored, however, the value actually displayed is adopted.

At each adjustment of individual points it is therefore possible to shift the load value by up to 6 points.

Procedure for shifting the load value:

Undertake operations as described under "Adjusting individual points" but shift the load rating as required,
Set set-point value

Store

If the desired load rating cannot be achieved in one operation:

Repeat procedure
- Output point is now the last curve entered

Entering an initial curve

Since, prior to initial programming, the set-point EEPROM contains a standard curve that very probably doe not correspond to the actual conditions of the system (ranges, set-point values), the following procedure is recommended for the initial curve:

Make sure that the signal wiring is correct
- see Function test and Manual

Clear memory

Leave FMS at "Setting"

Have system started up without control release (terminal 4)

After pre-ventilation, enter ignition load point

Ignition

Give control release (terminal 4)

Enter further points with burner running

Store

Approaching control elements from one side

During operation the compound approaches the control elements from one side in order to compensate for the mechanical hysteresis of the valves, approaching all set-points from above.

Exception: The top point is never overrun and therefore approached from below.

When setting, care should be taken to approach the valves in the same way. As a result the system values in automatic mode are reproduced in exactly the same way.

Entering settings

Selector switch (2) to "Setting"

Run to desired set-point from above

if accidentally running below this point

Run above set-point and re-approach from above

Entering top setting

Selector switch (2) to "Setting"

Run to desired set-point from below

if accidentally running above this point

Run below set-point and re-approach from below

Only in this way will you reach the same valve position and hence also the same combustion values in setting as later during automatic operation.

Ignition delay when setting

When the ignition point is entered for the first time the facility exists for observing the ignition process by entering a delay time. To do this, the time needed to run to the burner sight glass and to the boiler end respectively must be set in parameter 759.
As soon as the question "Really ignite?" is confirmed by pressing the acceptance key, this time expires. On expiry the ignition is released.
This time operates only if the FMS is on "Setting".

Pre-setting load automatically

Parameter 4 can be used not only to select the separate ignition point but also to determine whether the load default is to be automatically pre-set during setting. If this is the case the load points (in addition to the ignition point) are fixed at the values 200 (corresponding to 4 mA at the load input), 250, 300, 400, 500, 600, 700, 800, 900 and 999.

It is then possible to switch only between these points by means of the load rating switch position. You cannot run to intermediate values during setting.

Storing a point causes the load default to skip to the next value (unless this is already taken up). In this way a curve can be entered without shifting to load rating.

Entering the compound curves with the burner stationary

In order to be able to program the FMS without a flame, the fan must be in operation (at least where a speed-controlled fan is actuated by the FMS)

Apply 230-V signal to fan
- e.g. Bridge terminal 81 and terminal 89 on relay R 18
  (caution: as a result, terminal 92 also receives a voltage)

Disconnect "Burner On" signal (terminal 2)
so that burner does not start

Enter curve

Connect fan actuation again (e.g. remove bridge)

Keeping the re-circulation damper closed in pre-ventilation

The pre-ventilation behaviour of the re-circulation duct according to the technical regulations on steal boilers [TRD] is incorporated into the software of the FMS. That is, the re-circulation dampers always open with a delay.
If the system subsequently requires the re-circulation to remain closed during pre-ventilation, this can be achieved by means of the pre-ventilation limit parameters (parameter 346-350).

Clear range limits

Selector switch (2) to "Clear memory"

Press Acceptance
- Selector switch to Automatic

Select pre-ventilation limit parameter for the re-circulation duct

Enter CLOSE position of the re-circulation damper

Have range limits re-entered through pre-ventilation

Now the re-circulation damper does not open during pre-ventilation

Setting the pilot burner (servicing mode)

A special function is incorporated into the FMS in order to facilitate setting of the pilot burner. (The control unit runs only until the stabilisation time (main valves do not open).

By doing this, up to 5 ignition attempts can be performed without prior flushing or leakage test. Only after 5 starts does automatic flushing of the boiler occur according to the times set on the FMS.

Selector switch (2) to parameterisation

Select parameter 787

Set content to "1"
- Servicing modus is active

Selector switch (2) back to Automatic

Set pilot burner
(to do this allow the burner to start quite normally)

when setting is completed

Reset parameter 787 to "0"

If possible, only reset faults via short reset, otherwise the maintenance mode counter restarts, i.e. another pre-ventilation occurs.

Switching the burner on again via the target value

If the integral output regulator is used and a negative value is entered in parameter 802, it is possible to achieve a situation where the burner is switched on accordingly via the target value.

Significance of modes on the FMS

Abbreviation		Mode
ON	→	"Switch-on sequence"
BE	→	"Ready"
ZU	→	"Ignition position"
EZ	→	"Setting/Ignition position"
GL	→	"Base load"
EG	→	"Setting/Base load"
NA	→	"Post-ventilation"
AU	→	"Off"
EI	→	"Setting"
SL	→	"Clear memory"
EV	→	" Setting/Pre-ventilation"
ES	→	"Setting/Control"
ST	→	"Fault"
VO	→	"Pre-ventilation"
HA or HAND	→	"Manual mode"
LE	→	"Load extern"
(RG) keine Anzeige	→	"Control mode"

BE indicates that the signal is present on terminal 2, and all other signals = 0
If the FMS controls a flue gas damper, this opens. It is possible to switch to "Setting".

ZÜ indicates that pre-ventilation is finished and the ignition position relay
EZ pulls on. The FMS is in the ignition position, but the flame signal is absent. Switching to "Setting" merely causes the mode display to switch to EZ. Programming is not possible in this mode.

GL indicates that the burner is on (terminal 8=1), but the control release is
EG absent (terminal 4=0). The FMS therefore remains in base load position. Switching to "Setting" merely causes the mode display to switch to EG. Programming is not possible in this mode

NA indicates that the FMS is in post-ventilation mode.
All signals = 0
All air ducts open. When the configured time has elapsed, the FMS changes to "AU" mode.

AU indicates that the FMS is "OFF". All control elements closed.
Selector switch on "Automatic", all signals = 0.

EI indicates that the mode selector switch is on "Setting".
Single points can now be altered or new curves can be entered.

SL indicates that the mode selector switch is set to "Clear memory".
By pressing the acceptance key the existing curve is cleared and a new curve can be entered.

EV indicates that although the mode selector switch is on "Setting" it is nevertheless performing the pre-ventilation routine.
These is a signal on terminal 3.

If the selector switch is on "Setting" and there is a "signal on terminal 3", the FMS nevertheless maintains its control function.
The setting mode (display "EI") is only activated when the pre-ventilation is completed and there is a flame signal and control release. The FMS can therefore only be programmed when the signal combination corresponds either to the "AU" and/or "BE" modes, or when the signal combination corresponds to the "Automatic" mode.

ES indicates that although the mode selector switch is on "Setting". its control function is working according to a calculated curve in the RAM. The curve is calculated from a partial curve already entered. This mode is arrived at if the burner is switched off during a programming sequence and then restarts. The programming can be continued by operating a switch (change to "EI" mode"). Flame signal and control release are present.

ST indicates that the FMS has gone to "Fault". The fault code can be called up in "Status" switch position. In the "load rating" switch position" the load rating at the time of the fault is displayed.

VO indicates that the FMS is in "Pre-ventilation" mode. There is a signal on terminal 2 and a signal on terminal 3. Pre-ventilation routine active.

HAND or HA indicates that the FMS has been switched to manual mode whilst the burner is running. In the "Load rating" selector switch position the load can now be adjusted by means of the channel 1 switch. To quit manual mode, press a switch other than the channel 1 switch.

ext Hand indicates that the FMS was switched to manual operation, but the load was specified externally and not via the channel 1 key (that is, e.g. via remote software or bus).

LE indicates that the output regulator of the FMS is deactivated and the load is controled by an external signal.

Input terminals				Mode	
term.2	term.3	term.4	term.8		If also on "Setting"
0	0	0	0	AU or NA	EI or EZ
1	0	0	0	BE or ZÜ	EI or EZ
1	1	0	0	VO	EV
1	0	0	1	GL	EG
1	0	1	1	Automatic	EI

O_2 regulator modes

opO_2 regulator on standby (during burner startup), or O_2 regulator temporarily switched off as a function of load via parameters 914 and 915.

or O_2 regulator active

ot O_2 regulator temporarily deactivated (air shortage, probe dynamics, etc)

odO_2 regulator deactivated (during fault) e.g. test routines failed during burner startup, dynamic test negative, O_2 regulator temporarily deactivated for longer than 1 hour, etc.

"ES" Mode
(set - control)

Should the burner skip to "ES" mode whilst programming is in progress

This mode allows the electronic compound to run within curve sections already entered and thereby facilitates setting.
If the load drops by 40 points, the FMS skips to "ES" mode, thereby controlling the outputs automatically.

"ES" mode is also started if the selector switch 1 is set to load rating and the channel 2 switch is pushed up.

Back to normal programming:

touch a switch
- the FMS changes back to "EI" mode

Continue programming in the usual way

If the burner cuts-out whilst programming is in progress

Continue programming

Should the burner cut out due to control shutoff, proceed as follows:

Undertake no further action on the FMS

Wait until the boiler temperature falls

Allow burner to start quite normally

Pre-ventilation
- "EV" appears on the display
- FMS controls the outputs according to the pre-ventilation

The highest load point already entered is not exceeded.

For your safety:
"ES" mode should be run only by trained personnel with the system under constant supervision.

Run to next load rating to be programmed

Push switch up
- FMS switches back to "EI" mode

continue programming at the point where the burner cut-out previously occurred

Should the mains voltage to the unit have failed (display dark, operating LEDs out), before switching back to automatic, all curve points already entered will have been lost. Start programming from beginning again.

Interconnection with 4 curve sets option

The FMS offers the optional facility for using 4 curve sets.
In this case 2 curve sets are firmly assigned to oil operation and 2 curve sets to gas operation. The curve sets are then selected via terminal 75 (fuel selection) and additionally via the fuel safety interlock circuits.

Fuel selection terminal 75	Oil safety interlock circ. terminal 69	Gas safety Interlock circ. terminal 5	Curve set
0	1	0	Curve set 1 (oil op.)
0	0	1	Curve set 2 (gas op.)
1	1	0	Curve set 3 (oil op.)
1	0	1	Curve set 4 (gas op.)
X	0	0	FMS does not start or fault during operation
X	1	1	FMS does not start or fault during operation

Since the fuel safety interlock circuits now serve here for selection of the curve set, they are, contrary to the standard flowchart, monitored immediately after starting (or more precisely after the end of t1, see flow charts) and must remain on until burner-shut-off

Recalling the checksums and the safety times

Selector switch (1) to "Set-point feedback"

Press acceptance (3) and keep pressed
- the checksums and the safety times appear one after the other on the display

---

Each of the parameter levels is safeguarded by its own checksum.
The checksums for each level and the safety and pre-ventilation times are displayed here in succession

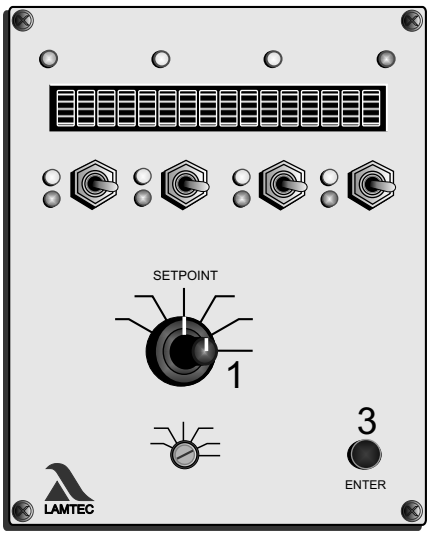
Order:

CRC 16 of level 0: adjustable without password
1: adjustable by person commissioning
2: adjustable by burner/boiler manufacturer
3: adjustable only by LAMTEC
4: adjustable only by LAMTEC

1st oil safety time in seconds
2nd oil safety time in seconds
1st gas safety time in seconds
2nd gas safety time in seconds
Pre-ventilation time in seconds
On the FMS without pilot burner the statement of the 2nd safety time contains safety time. The statement of the 1st safety time is then irrelevant.

If the parameter was changed, the checksum changes not before a complete reeboot of the device was made or after ca. 1h.

Calling up running time meter



Selector switch (1) to set-point

Press Acceptance (3) and keep pressed
- a moving text appears giving the following data:

  - total running hours
  - running hours on curve set 1
  - starts on curve set 1
  - running hours on curve set 2
  - starts on curve set 2

Where the 4 curve set or 8 curve set option is used the running hours and starts on the additional curve sets are also displayed.

The sum of the curve set 1 running hours and curve set 2 running hours does not necessarily give the running hours value displayed in total.
The total counter relates to the FMS running hours. It runs as soon as the unit is connected to a voltage (this also provides the basis for the fault history).

The single running time meters relate to the burner running hours.
These run as soon as the burner is in operation with the respective curve set (flame signal to the FMS)

What happens in the event of FMS fault

If the processor detects a fault, it runs the outputs in the programmed direction, e.g. air on, fuel off, re-circulation closed
The fuel solenoid valves close. The fault signal relay pulls on with a few seconds delay. Automatic restarting may be possible, depending on the nature of the fault.

Reading off a fault

Red fault LED lights up

Selector switch to "Status"
- Fault code is displayed

Note code

Press Acceptance
- Plain text message appears on display incl. running time meter reading up to the time of the fault

Selector switch on "Load rating"
- Load rating at the time of the fault is displayed (externally and internally)

Note load ratings

Resetting a fault

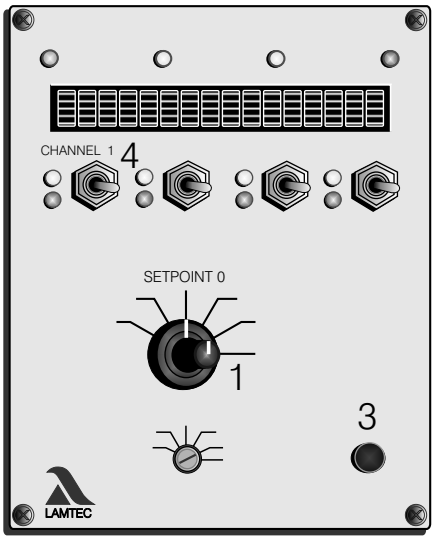
Selector switch to "Status"

Left-hand switch up
- the fault is cleared unless the cause is still directly present.

Alternative:
FMS: Emit terminal 3 signal briefly (min. 2 seconds) via external switch. Fault is cleared!

Calling up fault history

The FMS stores the last 10 faults with the associated running time meter reading.



Selector switch (1) to Status
- Instantaneous status appears on display

Channel 1 switch (4) up
- last fault code appears on display
- associated running time meter reading appears on display

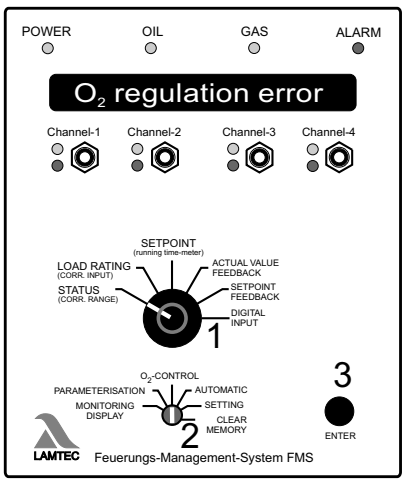
Press Acceptance (3)
- text and running time meter reading appears on display

Channel 1 switch (4) up again
- penultimate fault code appears on display
- associated running time meter reading appears on display

In this way the fault history can be browsed through by operating the channel 1 switch

If you are sure that there has been a voltage on the FMS at all times since the last fault, the time of the fault can be determined by means of the current running time meter reading and the current time.

O_2 regulation perturbed



In the event of perturbations, a warning message is displayed and the O_2 regulator is deactivated. The specified base value "Without regulation" or the one for "Air shortage" is set.
The display shows the running text "O_2 regulation perturbed".
The burner is not shut down as a rule.

The corresponding error code can be called up by setting the selector switch to Status. A plain text message about the cause of error appears after pressing the Acceptance key (3).

Air shortage perturbation

If the actual O_2 value is significantly smaller than the target value and corrective action by the FMS/VMS cannot rectify this error, the regulator is deactivated and the base value for air shortage errors is output. If desired, an air shortage burner shut-down can be triggered by the FMS/VMS. This is achieved by setting parameter 897 to 1.

The error code is H360, "Error shut-down by O_2 regulator".

Resetting O_2 errors

O_2 errors are automatically reset with each new burner start-up. This is permissible, since a 100% O_2 measurement test is performed at each start-up.

Manual resetting of O_2 errors is possible at any time, as follows:

Set selector switch (1) to Status
- FMS in O_2 regulation mode?
  If not, switch over to O_2 regulation mode
  by pushing channel key 3 (4) upwards.

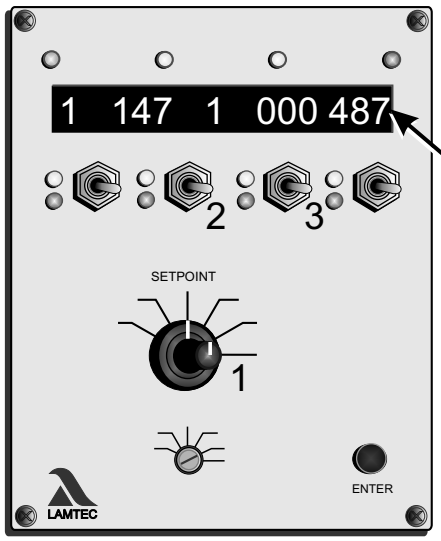
Press the Acceptance key (3) and
- call up the cause of error (mandatory!)

Push key 3 (4) upwards

Calling up O_2 regulation error history

Switch over to FMS/VMS mode (compound regulator)

Selector switch (1) to Status



Switch channel 3 down
- In this way the fault history can be browsed through by operating the switch channel 2

1	147	1	000 487
↑	↑	↑	↑
Current fault	Internal load	Curve-set	Operating hours

The display of O_2 history disappears automatically after 5 sec.
O_2 regulator faults lasting over 30 sec are stored. They are only stored in the EEPROM once the fault is cleared up or the FMS leaves the operating mode Regulation or Base load.

Fault codes

An "H" before the fault code indicates that the main processor has identified the cause of the defect. A preceding "Ü" indicates that the monitoring processor has triggered the fault.

*An * next to the fault code means that the control unit will attempt restarting after a few seconds.*
*** means that a repeat startup is attempted arbitrarily often. The time can be set at the factory or the restart deactivated.*
A flashing fault LED signals that a repeat startup is about to take place.

Fault code number

			Aids
H / Ü	1	Ignition flame fails to start	
H / Ü	2	Extraneous light fault	
H / Ü	3	Flame fault during ignition sequence	H2
H / Ü	4 **	Flame fault during operation	
H / Ü	5	Flame signal does not appear during 1st safety period	H2
H / Ü	6	Flame signal goes out during the stabilisation period	H2
H / Ü	7	Flame signal goes out during the 1st safety period	H2
H / Ü	8	Flame signal goes out during the 2nd safety period	H2
H / Ü	9	Flame signal does not appear during the safety period	H2
H / Ü	10	Flame signal goes out immediately after ignition	H2
H	102	Internal communication FIFO memory has overflowed	A7
H / Ü	103	Internal fault: EEPROM	A7,A9
H	104	D/A converter defective	A7
H / Ü	105 *	Curve data are defective! Curve set No.	A7,A13, A9
Ü	106	Unterschiedliche Parameter zwischen HP & UE, at parameter No.:	A7,A14, A9
H / Ü	107	Inadmissible configuration in the parameters	A7,A12
H	108	Different digital input signals on main and monitoring processor	A7,G8
H / Ü	110	CRC-16 test has discovered a fault	A7,A11
H / Ü	111	RAM test detects fault	A7
H / Ü	120 *	Different operating mode between main and monitoring processor	A24
Ü	121	The correction is outside its admissible range, channel 1	F1
Ü	122	The correction is outside its admissible range, channel 2	F1
Ü	123	The correction is outside its admissible range, channel 3	F1
Ü	124	The correction is outside its admissible range, channel 4	F1
Ü	125	The correction is outside its admissible range, channel 5	F1
H / Ü	139	Integrierter Flammenwächter: Störung bei Selbsttest	
H / Ü	140	The EEPROM is defective	A2,A7, A12,A15
H / Ü	141	Potentiometer defect, feedback varies too rapidly: channel 1	E13
H / Ü	142	Potentiometer defect, feedback varies too rapidly: channel 2	E13

Fault code number			Aids
H / Ü	143	Potentiometer defect, feedback varies too rapidly: channel 3	E13
H / Ü	144	Potentiometer defect, feedback varies too rapidly: channel 4	E13
H / Ü	145	Potentiometer defect, feedback varies too rapidly: channel 5	E13
H / Ü	151**	The deactivated re-circulation valve does not reach "CLOSED" position rapidly enough: channel 1	E2,B1,B3
H / Ü	152**	The deactivated re-circulation valve does not reach "CLOSED" position rapidly enough: channel 2	E2,B1,B3
H / Ü	153**	The deactivated re-circulation valve does not reach "CLOSED" position rapidly enough: channel 3	E2,B1,B3
H / Ü	154**	The deactivated re-circulation valve does not reach "CLOSED" position rapidly enough: channel 4	E2,B1,B3
H / Ü	155**	The deactivated re-circulation valve does not reach "CLOSED" position rapidly enough: channel 5	E2,B1,B3
H / Ü	161**	Running direction monitoring, channel 1	EE2,E17
H / Ü	162**	Running direction monitoring, channel 2	EE2,E17
H / Ü	163**	Running direction monitoring, channel 3	EE2,E17
H / Ü	164**	Running direction monitoring, channel 4	EE2,E17
H / Ü	165**	Running direction monitoring, channel 5	EE2,E17
H	171**	Dead band exceeded for too long: channel 1	B1,B4,E2 E4,E5
H	172**	Dead band exceeded for too long: channel 2	B1,B4,E2 E4,E5
H	173**	Dead band exceeded for too long: channel 3	B1,B4,E2 E4,E5
H	174**	Dead band exceeded for too long: channel 4	B1,B4,E2 E4,E5
H	175**	Dead band exceeded for too long: channel 5	B1,B4,E2 E4,E5
H	181**	Dead band not attained for too long: channel 1	B1,B4,E2 E4,E5
H	182**	Dead band not attained for too long: channel 2	B1,B4,E2 E4,E5
H	183**	Dead band not attained for too long: channel 3	B1,B4,E2 E4,E5
H	184**	Dead band not attained for too long: channel 4	B1,B4,E2 E4,E5
H	185**	Dead band not attained for too long: channel 5	B1,B4,E2 E4,E5

Fault code number			Aids
H / Ü	191*	1st monitoring band exceeded for too long: channel 1	B1,B3
H / Ü	192*	1st monitoring band exceeded for too long: channel 2	B1,B3
H / Ü	193*	1st monitoring band exceeded for too long: channel 3	B1,B3
H / Ü	194*	1st monitoring band exceeded for too long: channel 4	B1,B3
H / Ü	195*	1st monitoring band exceeded for too long: channel 5	B1,B3
H / Ü	201*	1st monitoring band not attained for too long: channel 1	B1,B3
H / Ü	202*	1st monitoring band not attained for too long: channel 2	B1,B3
H / Ü	203*	1st monitoring band not attained for too long: channel 3	B1,B3
H / Ü	204*	1st monitoring band not attained for too long: channel 4	B1,B3
H / Ü	205*	1st monitoring band not attained for too long: channel 5	B1,B3
H / Ü	211	2nd monitoring band exceeded for too long: channel 1	E11,B5
H / Ü	212	2nd monitoring band exceeded for too long: channel 2	E11,B5
H / Ü	213	2nd monitoring band exceeded for too long: channel 3	E11,B5
H / Ü	214	2nd monitoring band exceeded for too long: channel 4	E11,B5
H / Ü	215	2nd monitoring band exceeded for too long: channel 5	E11,B5
H / Ü	221	2nd monitoring band not attained for too long: channel 1	E11,B5
H / Ü	222	2nd monitoring band not attained for too long: channel 2	E11,B5
H / Ü	223	2nd monitoring band not attained for too long: channel 3	E11,B5
H / Ü	224	2nd monitoring band not attained for too long: channel 4	E11,B5
H / Ü	225	2nd monitoring band not attained for too long: channel 5	E11,B5
H	231**	Compound sticking: channel 1	E2,E4,E5 C1,B1,B3
H	232**	Compound sticking: channel 2	E2,E4,E5 C1,B1,B3
H	233**	Compound sticking: channel 3	E2,E4,E5 C1,B1,B3
H	234**	Compound sticking: channel 4	E2,E4,E5 C1,B1,B3
H	235**	Compound sticking: channel 5	E2,E4,E5 C1,B1,B3
H / Ü	301*	Wire break on correction input, channel 1	F2
H / Ü	302*	Wire break on correction input, channel 2	F2
H / Ü	320*	Wire break load input	D7

Fault code number			Aids
H / Ü	321*	Wire break feedback channel 1	E9
H / Ü	322*	Wire break feedback channel 2	E9
H / Ü	323*	Wire break feedback channel 3	E9
H / Ü	324*	Wire break feedback channel 4	E9
H / Ü	325*	Wire break feedback channel 5	E9
H / Ü	351*	Barred curve change with burner running	G3
H / Ü	352**	Inadmissible curve selection (no selection signals present)	G4
H / Ü	353**	Inadmissible curve selection (more than one selection signal present simultaneously)	G4
H	360	Fault switch-off through integral O_2 regulator	
H / Ü	361	Different status from ignition position relay	E6
H / Ü	370	Internal communication between processors defective	A20
H	371	Internal load output defective	C4
Ü	372	Load value difference between HP and UE too great	A7,D11
Ü	381	Difference between HP & UE too great Correction input 1	A7,F6
Ü	382	Difference between HP & UE too great Correction input 2	A7,F6
Ü	391	Fuel valves opened in ST operating mode	A7,A19
H	392	Remote no longer responds (time-out)	
H	393	Remote shut-off has been triggered (shut-off via interface)	
Ü	400	Different point number on acceptance	A23
H / Ü	451*	Ignition position was exited in ignition mode, channel 1	E18
H / Ü	452*	Ignition position was exited in ignition mode, channel 2	E18
H / Ü	453*	Ignition position was exited in ignition mode, channel 3	E18
H / Ü	454*	Ignition position was exited in ignition mode, channel 4	E18
H / Ü	455*	Ignition position was exited in ignition mode, channel 5	E18
H	500	Internal comparison: relay output terminal 67 does not pull on	A19, A7
H	501	Internal comparison: relay output terminal 43 does not pull on	A19, A7
H	502	Internal comparison: relay output terminal 16 does not pull on	A19, A7
H	503	Internal comparison: relay output terminal 11 does not pull on	A19, A7
H	504	Internal comparison: relay output terminal 45 does not pull on	A19, A7
H	505	Internal comparison: relay output terminal 68 does not pull on	A19, A7
H	506	Internal comparison: relay output terminal 36 does not pull on	A19, A7
H	507	Internal comparison: relay output terminal 41 does not pull on	A19, A7

Fault code number			Aids
H	508	Internal comparison: relay output terminal 76 does not pull on	A19, A7
H	520	Internal comparison: relay output terminal 67 does not drop out	A19, A7
H	521	Internal comparison: relay output terminal 43 does not drop out	A19, A7
H	522	Internal comparison: relay output terminal 16 does not drop out	A19, A7
H	523	Internal comparison: relay output terminal 11 does not drop out	A19, A7
H	524	Internal comparison: relay output terminal 45 does not drop out	A19, A7
H	525	Internal comparison: relay output terminal 68 does not drop out	A19, A7
H	526	Internal comparison: relay output terminal 36 does not drop out	A19, A7
H	527	Internal comparison: relay output terminal 41 does not drop out	A19, A7
H	528	Internal comparison: relay output terminal 76 does not drop out	A19, A7
H / Ü	600	Program monitoring time (FAT) elapsed cause	H1,H6
H / Ü	601	Leakage test fault: gas pressure still present Main gas 1 defective CAUTION! Follow safety instructions in the aids	I1,H6,I4
H / Ü	602	Leakage test fault: gas pressure still present Main gas 2 defective CAUTION! Follow safety instructions in the aids	I2,H6,I4
H / Ü	603	Vent gas line manually	I3
H / Ü	604	Flame signal does not promptly follow 1st safety period	H2
H	605**	Oil pressure >min!!!	H5
H	606*	Gas >min occurs in oil operating mode	H3
H	607*	Ignition position acknowledge drops out inadmissibly between ignition position and end of safety period 2	H4
H	608	Boiler safety interlock circuit drops out inadmissibly	
H	609*	Gas safety interlock circuit drops out inadmissibly	
H	610**	Oil safety interlock circuit drops out inadmissibly	
H / Ü	611**	Gas pressure too low. gas >min during operation	
H / Ü	612*	Gas pressure too high	
H	613	Air pressure signal absent	
H	700	Pre-ventilation signal present without signal on terminal 2	G2,G5
H	701	Flame signal present without signal on terminal 2	G2
H	702	Flame signal appears during pre-ventilation	G2,G5
H	703	Flame signal goes out, although terminal 2 signal still present	G2
H	711	Inadmissible operating mode change	H6

Fault code number		Aids
Ü 713	Incorrect signal combination in AU mode	H6
Ü 714	Incorrect signal combination in BE mode	H6
Ü 715	Incorrect signal combination in VO mode	H6
Ü 716	Incorrect signal combination in ZP mode	H6
Ü 717	Incorrect signal combination in ZÜ mode	H6
Ü 720	Ignition transformer switched on too long	H6
Ü 721	Ignition valve opened too long	H6
Ü 722	Fuel valves opened in servicing mode	H6
Ü 723	Ignition sequence lasts too long	H6
Ü 724	Gas valves opened in oil fuel mode	H6
Ü 725	Oil valves opened in gas fuel mode	H6
Ü 726	Main gas 1 opened without main gas 2	H6
Ü 727	Main gas 1 opened inadmissibly	H6
Ü 728	Main gas valves and ignition valve opened too long	H6
Ü 729	Ignition sequence lasts too long (without pilot burner)	H6
Ü 730	Servicing mode without pilot burner	H6
Ü 731	Ignition valve opened, although unit configured without pilot burner	H6
Ü 732	Incorrect signal combination during operation	H6
Ü 733	Incorrect signal combination after operation	H6
Ü 734	Pre-ventilation time not adhered to	H6, H8
Ü 735	Fuel safety interlock circuit missing	H6
Ü 736	Leakage test: Both gas valves opened	H6
Ü 737	Leakage test: Main gas 2 shut-off delayed too long	H6
Ü 738	Leakage test: Incorrect sequence	H6
Ü 739	Leakage test: Main gas 2 open too long	H6
Ü 741	Leakage test: Main gas 1 open too long	H6
Ü 743	Flame detection: flame after-burn too long	H7
Ü 744	Flame detection: flame back on	H6
Ü 745	Program monitoring time too long	

Fault code number		Aids
Ü 746	Solenoid valve cur-out defective	H6
Ü 747	Leakage test: venting into boiler not permitted	H6
Ü 750	Fault cut-out via the BUS	
Ü 751**	No data transfer via BUS (time-out)	
Ü 760	Fuel change not permitted during adjustment	G3
Ü 791**	BUS master is stopped	
Ü 792**	BUS data length is wrongly designed	
Ü 793**	BUS master is disconnected	
H / Ü 800	Error in the parameters, at parameter No.	A7,A9, A14
H / Ü 900	Fault in sequencer internal self-test	A7
H / Ü 901	Terminal 10 +24 volt cut-out defective	A7,A21,A22
H / Ü 902	Fault in over-voltage self-test	A7
H / Ü 903	Fault in optical coupler self-test	A7,G7
Ü 904*	Fault in the load reference	A7,A21
Ü 905*	Fault in the reference element of the main processor	A7,A21
H 906*	Fault in the reference element of the monitoring processor	A7,A21
Ü 911*	Fault in the reference, channel 1	A7,A21
Ü 912*	Fault in the reference, channel 2	A7,A21
Ü 913*	Fault in the reference, channel 3	A7,A21
Ü 914*	Fault in the reference, channel 4	A7,A21
Ü 915*	Fault in the reference, channel 5	A7,A21
H / Ü 921	Relay driver self test: terminal 11 output defective	A19,A7,A25
H / Ü 922	Relay driver self test: terminal 16 output defective	A19,A7
H / Ü 923	Relay driver self test: terminal 43 output defective	A19,A7
H / Ü 924	Relay driver self test: terminal 67 output defective	A19,A7
H / Ü 925	Relay driver self test: terminal 45 output defective	A19,A7,A25
H / Ü 926	Relay driver self test: terminal 68 output defective	A19,A7
H / Ü 927	Relay driver self test: terminal 36 output defective	A19,A7
H / Ü 928	Relay driver self test: terminal 41 output defective	A19,A7
H / Ü 929	Relay driver self test: terminal 76 output defective	A19,A7
H / Ü 998	Internal fault:	A7
H 999	Internal fault:	A7

A1

Display remains dark
all LEDs are off

Check whether there is a voltage present on the unit

Check "F1" fuse (back of the unit in cold unit case)

Check connectors for correct seating

A2

Display remains dark

or shows confused characters,
some or all LEDs light up

or fault 111, 140

After changing an EPROM or RAM

- take out processor card

Check modules for correct polarity
(all notches point in same direction)

Check that all modules are correctly seated in the bases
(any prongs bent over), if necessary push in again

Check correct seating of the processor card connection to backplane

Check correct seating of the power supply card connection to the backplane

A3

"AU" does not appear
between the channels

Cause: mode selector switch is not set to automatic
or signal on terminal 2 is not equal to zero

A5

"Store" does not appear on display
when switching from "Setting"
to Automatic

No curve point was modified or the modification was lost

Repeat programming

A7

Fault in an internal self-test

Reset fault, possibly turning mains voltage off and back on
Check all fuses in the unit

If fault message occurs repeatedly in succession change unit or
respective card

A9

Fault 105

When reading the redundant data in the EEPROM an error was discovered.

Rest fault, if fault still persists

EEPROM possibly defective

Re-enter curve

Enter parameters again or check

If fault persists:
Change EEPROM and read in curves and parameter again,
see A12

A10

Fault 211 221
212 222
213 223
214 224
215 225

After switching from "Setting" to "Automatic" with burner running

If switched from "Setting" to Automatic with the burner running, the FMS immediately assumes its monitored operation. The value of the internal load is set to the last known position of the compound in "Setting" and now follows the external load. If this last compound position cannot be properly determined, however, (because a control element was moved from the last accepted point by means of a switch before storing the curve, for example), the value of the internal elements are too far removed from the set-point values, load is equated to that of the external load. If the actual values of the control the fault "2nd monitoring band" is emitted.

The curve has nevertheless been properly stored.

Reset fault

A11

Fault 110

The program EPROM may be defective.

Request a new program EPROM from, LAMTEC, giving precise details of the order number and contract number at the time, the agent's order and all software checksums for the FMS. Please always return the defective EPROM (for address see back cover of this booklet).

A12

Fault 140, 107
EEPROM defective

The EEPROM of each processor contains important operating data, the parameters and the curves.

When replacing this module, a basic setting must be provided before it is possible to do anything else with the unit.

If the unit data are provided via PC interface it will be sufficient to feed these data into the new EEPROM.
For details, see remote control software documentation.

If this is not possible, a pre-programmed E^2 EPROM must be ordered from LAMTEC, quoting the unit number and the software checksums. This is essential in order to avoid any confusion.
For the address, see the back cover of the booklet.

A13

Fault 105

In checking the redundant curves an error was identified

If data were provided via PC interface:

Enter curve data again for the corresponding curve set

if this is not possible:

select appropriate curve set

Clear memory

Re-enter curve

A14

Fault 106

In checking the redundant parameters an error was identified

If data were provided via PC interface:

Read in parameter again

if this is not possible:

select said parameter

check value displayed and if necessary amend

In order to restore the parameter, a change must be made. If the correct value is displayed, adjust by one digit and change back again.

Should several parameters be defective, repeat as necessary.

If the parameter is not included in your release level, an EEPROM must be requested from LAMTEC.

A15

Fault 105
140

On attempting to store the curve in the EPROM an error was identified.

Repeat programming

if necessary, change EEPROM, see A12

A16

It was attempted to store or add a point, but there appear to be "> 20 points"

The curve already contains 20 points. It is not possible to add any more. Only individual load points can be altered (recognisable from the flashing figure after the load rating). Otherwise a new curve must be entered via "Clear memory".
or
if a fuel change occurred after "Clear memory" the old curve is reactivated.

Run load down and clear memory again.

Selector switch (2) to "Clear memory"

Press Acceptance (3)

A17

The software version number displayed does not match the number on the configuration sticker.

The unit supplied possibly did not correspond to the order.
Consult LAMTEC. (For address see back cover of this booklet) or since the time of delivery the program EPROM has been changed and the new checksums were not noted.

A18

The running text "Recessed selector switch defective! Automatic activated!" appears

Voltage off and back on

If fault appears again

Change front panel

Further fault-free operation is possible. In the event of a defective selector switch, however, it may be that the "Setting" mode can no longer be selected.

A19

Fault 500 520 921
501 521 922
502 522 923
503 523 924
504 524 925
505 525 926
506 526 927
507 527 928
508 528 929

The FMS checks the function of all connected relays on the external modules. The voltage present on the relay coils is read back.

Possible causes:
- Relay module not connected or connected wrongly
- Relay or relay module defective
- External voltage is fed into the corresponding terminal
- Terminal 9 and terminal 10 reversed
- 24V fuse F2 (front panel) defective

Check wiring

Check relay
- measure coil for continuity

With relay module V4:
- fuse F1-F4, F6 defective
- too less load at terminal 82-84
- at terminals 82-86 a testing current has to flow inboth directions. Otherwise the relay module switches all outputs off during the selftest and the FMS gets faulty.
- Impendance at a supply voltage of 230V ≤ 100 kOhm
  110V ≤ 22 kOhm

As the case may be adequate loads have to be connected (e. g. ohmic resistance or RC modue)
Outputs, which are not switched off by the FMS (e. g. ignitionv valve at start without pilot burner) doesn't need any load.

A20

Fault 370

The internal communication is not functioning.

Voltage off and back on
After changing EPROM
Check whether the monitoring program EPROM is correctly inserted

Otherwise:

Change processor card

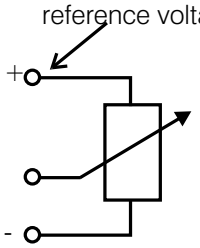
A21

Fault 901 911
904 912
905 913
906 914
915

After changing a potentiometer the reference must be inputted again.

Voltage levels are checked in the unit. These can give rise to false errors as a result of incorrect external wiring.

Check wiring
In the case of analog inputs the reference element serves for voltage supply to the potentiometers.



External contact at connector
loop possibly transposed,
see D4 and E4

in the case of fault 904, 911 915, in particular, check the corresponding reference, In the unloaded condition (terminal open) it is 2.4 V.
With potentiometer connected somewhat lower, depending on the resistance of the potentiometer.

Re-enter reference value with potentiometer connected.

Selector switch (2) to "Setting"

Back to "Automatic"
- new reference value is stored.

A22

Fault 901

Although terminal 9 and 10 both have +24V they are nevertheless monitored by internal tests at different times. They must not be connected to one another.

Use terminal 9 only for supplying digital input signals.
Use terminal 10 only for the supplying the relay modules.

Do not connect any other consumers unless expressly permitted.

A 23

Fault 116
400

The monitoring processor and the main processor may not have precisely the same load rating, so that in one an old point has been overwritten, whilst in the other a new one has been added. This is possible particularly where the load ratings of the individual points lie close together.

Selector switch (2) to "Clear memory"

Press Acceptance (3)

Re-enter curve

A24

Fault 120

Different operating modes on main and monitoring processors.
The digital input signals are detected at slightly different times on main and monitoring processor.

A signal change occurs only for such a brief instant that the main processor detects it but the monitoring processor does not.

Check signal sequence

A25

Fault 921
925

Relay modul 660 R 0016 old version:
see display text

Relay module 660 R 0016 since version V4.3:
One of the outputs, which are tested during burner start (teminal 82 - 84) has recognised a fault.
To diagnose the faults H 921 and H 925, you may change to the diagnosis mode.
The changing will be done with plugging or unplugging the jumper B on the relay module (see chapter "Diagnosis Mode" on p. 120).

B1

Motor does not move

Check whether "OPEN" and "CLOSE" relays pull on when the switch (4) is operated.

If not:

Make sure that there is not a fault (recognisable from the fault LED)

Check F2 fuse (on power supply front panel)

Check FMS relay-module connection

If so:

Check whether "OPEN" and "CLOSE" signals are present on motor

Check fuse on relay-module

Check voltage supply circuit of the motor

B3

Fault	151	201
	191	202
	192	203
	193	204
	194	205
	195	

The control element may not have reached its set-point value rapidly enough. Possible especially on control elements that are activated separately and then have to run their full travel (e.g. re-circulation damper or flue gas damper or in the case of flying curve switching).

Increase control speed on motor (if possible)

or

Limit control range by means of limit switch (in order to save running time)

otherwise

Increase parameters for monitoring bands (if admissible) (possible only for level 2)

B4

Fault	171	181
	172	182
	173	183
	174	184
	175	185

Although the control element is in the monitoring band it does not reach the dead band.

Increase pulse length for the channel (parameter 730 to parameter 734)
or
limit switch is too close the programmed top or bottom point.

Adjust limit switch

After adjusting the limit switch the FMS must read in the range limits again, see page 116.

B5

Fault	211	221	2nd monitoring band fault appears sporadically during operation.
	212	222	
	213	223	Cause:
	214	224	Motor is possibly running in wrong direction
	215	225	- this may happen on capacitor motors if:
			- the capacitor is defective
			- there is a broken wire in the motor or in the lead

C1

Control element does not react
Changes to continuous output of the FMS

Measure continuous output in order to make sure that the FMS is working correctly.

Check output circuit to the control element

It is recommended that the FMS output signal be simulated with current transmitter, making it very easy to locate the fault.

See also C2 and C4

C2

No current signal measurable on the continuous output, although a figure >0 appears on "continuous output value" display

Hardware probably defective

First change continuous additional cards

if fault persists, change processor card

if fault persists, change backplane

C4

Fault 371

The monitor output of the FMS constantly monitors the current flowing (terminals 47 and 49), (only if set to "Internal Load"). A current must flow at all times if the monitor output is configured to "Internal Load".
If the output is not used, the terminals must be short-circuited.

Check wiring

Measure current
(Maximum apparent ohmic resistance 600W)

Short-circuit terminals directly

Reset fault

If the current can no longer flow entirely via the negative input (terminal 49) because of an external earth connection, this fault will occur even though the output current is correct.

D1

Load signal does not show the minimum value

Cause: load transducer not on minimum

Run transducer down manually

D2

Load signal cannot be changed

Check whether fault present

if so

Rest fault
(selector switch on status switch up)

if not

Check load circuit
If only "000" is displayed
- current input poles reversed

D3

When changing a point, "Err" or >20 point appears on the display instead of "Point"

Load rating was not run precisely to the point previously programmed.

Repeat process

but this time

Run precisely to load rating

It is possible that the digital display shifts after the load rating, if
- the load rating is right at the edge of the adjustment range
- there are marked fluctuations on the connection leads

For this reason:
Run load rating to the middle of the adjustment range
(flashing number after the load rating)

D4

Load signal cannot be set higher than approx. 500, although the 5kΩ potentiometer runs over the full range

Load potentiometer wrongly connected (middle reversed with outer)
or
the internal wiring of the configuration cards causes the FMS to expect a current signal as load default

Check wiring

Check that the correct configuration jumpers are inserted,
if not, change them

–

D5

Load value does not attain the bottom value indicated

If the load transducer is in the basic position but does not emit the lowest possible value.

Make sure that this position of the load transducer is the lowest load rating position that occurs in operation

D6

Load rating does not attain the highest value indicated

If the load transducer is in the maximum position but does not emit the highest possible value.

Make sure that this position of the load transducer is the highest load rating position that occurs in operation.

D7

Fault 320

Load input is not correctly connected

In the case of load due to current default:
Current is less than 4 mA, poles possible reversed

Check wiring

Check input current

D11

Fault 372

The two load ratings for main and monitoring processor are compared with one another.

Change processor card.

E1

A minimum value is not displayed in "Actual value" position and "AU" display

On feedback via potentiometer:

Cause: potentiometer connections transposed

Check terminals
Cause: Potentiometer incorrectly fitted to the motor shaft

Turn potentiometer with control element connected until the desired value is displayed.
Cause: control element is not in "CLOSED" position

Check whether the "CLOSE" relay on the relay module has pulled on (recognisable from the LED on the relay module)

Check "F2" fuse (on the power supply front panel) of the VMS

Check lead to the control elements
(Is the "CLOSE" signal reaching the control element)
Cause: the FMS has read in an incorrect range limit.

Re-enter range limits

E2

Feedback does not move, although the control element moves

Check feedback connection to the FMS (See connection diagram)

In order to locate faults, it is recommended that the feedback be simulated at various points on the feedback circuit (using potentiometer or a current transmitter).

E3

The feedback of the continuous output does not display the values indicated

For feedback via potentiometer, see E4

For feedback via current, see E5

E4

The feedback displays much too high a value or goes only to approx. 500 points

Potentiometer leads are transposed

Check connections

In order to ensure that the FMS is working correctly a 5kΩ potentiometer may connected directly to the VMS feedback input in order to simulate the feedback manually.

E5

Feedback shows "000" and does not vary, even if the current is increased.

The poles of the feedback current signal are probably reversed.

Check connections

The feedback can be simulated by means of a current transmitter. This makes it easier to locate the fault on the feedback circuit.

E6

Fault 361
Main and monitoring processor do not show the same feedback value, although the same signal is fed to each of them

Check limit switch position

Check connections for transposition and reversal, see also E5, E4, E1

E7

The feedback values displayed do not correspond to the values indicated

If the feedback element in its normal position is not at the bottom stop, a higher feedback value may also be displayed.
(e.g. in feedback of the fan speed minimum speed

Make sure that the control element is in the normal position.

E8

The feedback potentiometers do not attain the upper value indicated

The potentiometer connections are possibly transposed (centre with outer)

Check wiring

E9

Fault 321
322
323
324
325

Broken wire in feedback lead or feedback is not properly connected.

Current feedback poles are possibly reversed or below a minimum value of 4 mA

Check wiring

Check input current

E10

"---" on the display instead of a figure

Selector switch (2) is on "Setting"

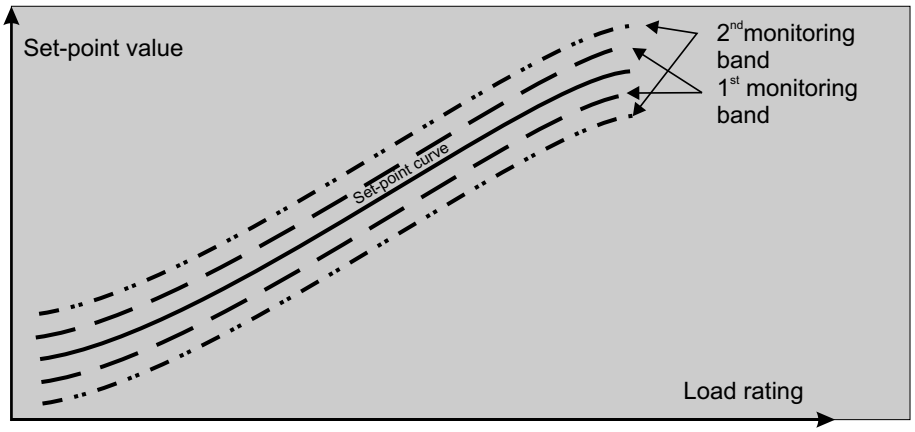
Set selector switch (2) to "Automatic"

E11

Fault 211
212
213
214
215
221
222
223
224
225

Control element is outside the 2nd monitoring band.

The 2nd monitoring band serves to switch off immediately in the even of an uncontrolled action of the control element.



If the actual value is outside the 1st monitoring band, the compound is stopped. After the parameterised time fault 231-235 occurs.
The 2nd monitoring band is standard 40 points above the 1st monitoring band.

E11 - Continued

If the actual value is outside the 2nd monitoring band, there is an immediate shutdown (3 sec.).

Check control element, actuation and feedback.

A relay may be "sticking", the system may not have been in the starting position when starting (all channels closed)

The motor is possibly defective (direction of rotation reversed)

E12

Integral rev. speed sensor

During motor startup, the display increases from ca. 0-7 digits until from a certain point it suddenly jumps back again to 0-7 digits.

The sensing pulses are too short, or the contact gap between Namur sensor and measured object is too small, to allow error-free measurement at higher rev. speeds.

Check the Namur sensor's attachment:
- The measuring point should be made of steel if at all possible
- Contact gap as small as possible
- The measuring point must be at least as large as the sensor element's area

E13

Fault 141
142
143
144
145

Only on three-point step control output
the feedback values vary more rapidly than the maximum specified in the parameter section

Check potentiometers for short-circuits
otherwise
Change potentiometers

E14

Text message Channel X does not reach aeration position rapidly enough and/or fault 600

The range monitoring during pre-ventilation resulted in too low a limit stop value of the feedback potentiometer. The upper and lower limit value were not reached during pre-ventilation.

Check potentiometer, check continuous feedback value

Compare range limits with feedback stop values

If necessary, re-enter range limits

If limit switches are adjusted after a curve has been programmed in, the range limits must be re-entered.

Actuation of the motor possibly defective
Check relay module
Check wiring

E17

Fault 161
162
163
164
165

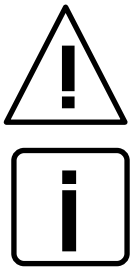
Only with "flying curve switching" option

With the flying curve switching option the 2nd monitoring band is replaced by running direction monitoring for up to 30 seconds after switching over. This tests whether the control element is moving towards the new set-point value.

Check feedback signal at the instant of switching, the value must change.

Possible reason:
→ The motor is sluggish
Remedy:
→ Arise puls length of the motor parameter 730 - 734

Possible reason:
→The motor has too much play
Remedy:
→extend parameter parameter 705



Parameter 705 is a safety parameter, the standard value is 3 sec.
With the extension you have to ensure, that a longer fault tolerance time is acceptable with the conditions of the system.
During that time no fault shut-down will be carried out, even if the actuator doesn't move in the right direction.

If no range limits exist, faults may occur, dependent on the load position during the "flying curve switching".

Change in a curve set without range limits, par example a curve set without pre-ventilation.

Remedy:
→ Enter shut-off limits manually or turn off the determination of range limits for this curve set. (contents 4 in parameter 106-108)

E18

Fault 451
452
453
454
455

A control element has left the ignition range after the VMS had detected the ignition position.

Possible causes
- control element oscillating
- wiring fault
- holding torque of motor too low

F1

Fault 121
122
123
124
125

The monitoring processor checks whether the present correction values lies within the range set.

Check correction range

Otherwise A7

F2

Fault 301
302

Correction input is configured for 4 … 20 mA, but the instantaneous value is < 4 mA, wire possibly broken or connection poles transposed

Check wiring

Check parameter 431, 432

F3

Selector switch on LR1 on "Measure" incorrectly
at output 0…20 mA but no 10 mA
at output 4…20 mA but no 12 mA

Centre position potentiometer P4 on power unit LPE 1/S possibly set

(see LR 1 operating instructions)

Turn potentiometer to 10 or 12 mA (on LPE 1/S)

F4

A value other than 200 or +/-100 is displayed

The maximum correction range according to the standard software setting is 200 points. Other range sizes are available for special cases, however.

F5

50% is not displayed

Either 10 or 12 mA are not being fed to the FMS

Measure current

Check wiring

Otherwise as for F2 or F3

or

Jumpers are incorrectly inserted on the back of the front panel.

Check

F6

Fault 381
382

The values of the correction input signals are compared between main and monitoring processor.

Change processor card

F8

Message
"Correction effect switched off, since over 97% for longer than 1 hour”

The correction signal is monitored in order to be able to detect an error function of the correction signal source (in O_2 regulation). If a correction signal >97% is present on the input for 1 hour a defect is assumed and the correction influence is disregarded.

Activate correction again
- Selector switch 1 to "Status”
- Channel 1 switch up
- Check correction effect

Selector switch (1) to "Load rating”

Press "acceptance”
- instantaneous correction input is displayed

If display >97%, check O_2 regulator

G3

Fault 351
760

The curve set was changed during operation

Check wiring

Especially the activation of terminal 75

Even if the "flying curve switching" software option is activated on the FMS, allowing the curve set to be changed during operation, it must be remembered that in "EI" mode (Setting) a flying change is not permitted.

G6

No signal defaults are accepted
(Status remains "Burner OFF")

24 V possibly defective (terminal 9 and 10)
Check fuse F2 (on power supply front panel)

G7

Fault 903

The optical couplers of the digital inputs are cyclically tested to see that they are functioning. This is done by briefly withdrawing the voltage from terminal 9 (+24 V supply). A check is then conducted to see whether the signals on the digital inputs also go to 0V.

A voltage remains on at least one of the digital inputs during the self-test.

Check wiring
- terminal 9 might not have been used to supply the inputs.

Disconnect terminal 9
and
Re-measure voltage level on all inputs
- an external voltage is possibly being fed in
- terminal 9 and 10 are possibly transposed

Otherwise A7

G8

Fault 108

The digital input signals for main and monitoring processor are compared

Change processor card

H1

Fault 600

The control unit has locked up
- call-up running text and follow instructions there

Check wiring and external signal transmitters e.g.
safety interlock chain boiler
safety interlock chain gas
air pressure monitor
safety interlock chain oil (special function)
fuel selectionl (special function)
external high firing rate acknowledgement
external ignition position acknowledgement

Check motor limit stops

otherwise

Extend program monitoring time
see parameterisation, parameter 777 (only with level 1 access)
See also E14

H2

Fault 001 009
003 010
005 604
006
007
008

The flame signal does not appear during the ignition process (terminal 8)
(or with separate ignition flame monitor terminal 7)
Check wiring

Check ignition transformer and, where necessary, pilot burner

Check flame sensor

The exact time after igniten is 3 sec., afterwards H004 appears.

H3

Fault 606

On the FMS the parameters can be set so that the gas >min monitor is also monitored in oil operation.

Check gas pressure monitor

Alter configuration (parameter 761)

H4

Fault 607

The ignition position acknowledgement signal drops out during the ignition sequence (terminal 74)

The ignition position acknowledgement signal must be present up to the end of the ignition sequence (to the end of the 2nd safety period).

H5

Fault 605

On the FMS the parameters can be set so that instead of the "Re-circulation On" signal (terminal 6), an oil pressure > min signal is monitored.

Check oil pressure monitor

Alter configuration (parameter 762)

H6

Fault 711 - 745

The monitoring processor checks the control unit cycle for plausibility. It has detected a fault in the cycle.

H7 Fault 743	If after the expiration of the duration, whichis set in P789 (after burner time) a flame signnal is recognized, these fault shut down occurs. You may set the monitoring time in P789.
I1 Fault 601	Despite pre-ventilation, gas pressure is still/again present in the leakage test line. Main gas valve 1 (gas line side) leaking - Check valve Pressure switch in leakage test line defective or incorrectly set - Check pressure switch - Set pressure switch In the case of venting into the combustion chamber or over-roof: Main gas valve 2 (burner side) does not open - Check valve - Check wiring - Check fuse on relay module 6 60 R 0016
I2 Fault 602	No pressure forms in the leakage test line or pressure is not maintained for long enough. Main gas valve 2 (burner side) leaking - Check valve Main gas valve 1 (gas line side) does not open (or vent valve) - Check valve - Check wiring - Check fuse on relay module 6 60 R 0016 Pressure switch in leakage test line defective - Check pressure switch - Set pressure switch
I3 Fault 603	At the start of the leak test the gas pressure monitor indicated that there is still gas present in the leakage test line. Automatic venting is deactivated via parameter 770. Vent the leakage test line manually.
I4 Fault 601, 602	Safety Instruction: In the event of leaks from a gas valve and venting of the leakage test line into the combustion chamber, repeated resetting of the fault and restarting can result in a dangerous situation, since small quantities of gas (volume of the leakage test line) repeatedly flow into the combustion chamber, especially where pre-ventilation is too short or inadequate (e.g. pre-ventilation suppression activated). Do not cancel the fault and reset without rectifying the cause of the fault.

P1
Parameter 4
(level 2)

This parameter determines whether or not the compound control unit works with separate ignition point and whether the load default is set automatically during setting. (See Tips & Tricks)

P2
Parameter 707

This determines whether the band shift in the event of a change in power output (in order to obtain excess air whilst running to a new load point) acts on the load axis or the set-point axis. If it acts on the set-point axis the points set are simply added to the existing set-points. If it acts on the load axis the points are rated at the steepness of the curve and only then added. In the case of continuous outputs and control elements with a linear characteristic the effect should be applied to the set-point axis. In the case of control elements with non-linear or exponential characteristic the parameter should be set to "1".

P3
Parameters 708 to 712

The band shift of the respective channel in the event of a change in power is entered in points here. The electronic compound control unit automatically assesses the directions in which the band shift is to act on the basis of the configuration of each control element (air up, fuel down). The band shift also acts only when the load varies in the direction that represents an air advance for the channel (in a load reduction the fuel is advanced, in a load increase the air). The size of the values that must be entered here depends on the effect of the control element on the lambda.

P4
Parameters 346 to 350

A number of points is entered here determining how wide the duct is to open in pre-ventilation. If 999 is entered (standard value) the duct runs as far as the stop. This parameter serves for setting pre-ventilation limits, e.g. on air dampers in order to curtail the pre-ventilation time (whilst nevertheless guaranteeing the exchange of air during pre-ventilation) or on the re-circulation damper in order to prevent overloading of the re-circulation frequency converter during pre-ventilation.

P5
Parameters 186 to 300

The range limits (upper and lower) for the respective control element are entered here. Generally these are determined automatically, i.e. the FMS / VMS fills in this parameter itself. The range limits determined form the limits of the unit's control range. Should motors be changed or limit switch settings be adjusted, the range limits must be re-determined.

P6
Parameters 374 to 378

These indicate how the control element is to behave in the event of a fault shut-off. The direction of running may be entered or the direction of running combined with an external condition.

NOTE:
Since the FMS is already in the "Fault" condition, the function of the control element can no longer be reliably monitored after this fault shut-off. If it is absolutely essential that the position entered by reliably attained, this must be guaranteed by way of a separate interrogation measure, e.g. limit switch
(may be possible with defined valve positions for turbine exhaust gas systems etc.)
With some internal faults, the FMS also switches off the +24 V supply to terminal 10. In this case, too, the servomotors will no longer run.

P7 Parameters 517 to 676	The correction range in points is entered here. Since the possible entries range from 0 999 it is possible to program a horizontal to a channel and to run it entirely via the correction input. If parameter 430 is set to "0", only parameters 517 and 597 will function.
P8 Parameter 677	This setting determines what value the monitor output (terminal 47 and 49) will emit as 4 … 20 mA signal. This function cannot be adjusted on FMS 5, since these terminals then serve for output of the channel 5 control signal. If the value of the output is set to "Internal Load" (parameter content "0" standard value), the internal monitoring for this signal is also active. This monitoring, however, can still be controlled via jumper. However, this monitoring is switched on as standard.
P9 Parameters 678 to 680	Same function as parameter 677, but for curve set 2 to 4. As a rule, however, the same contents are entered here as for parameter 677.
P10 Parameters 685 to 688	This indicates the number of points at which the monitor output will emit 4mA, i.e. depending on the selected source for the monitor output signal, a lower range is selected from which the monitor output is activated. If the signal is below the selected limit, 4 mA nevertheless continues to be emitted, i.e. a change below the limit is not displayed.
Parameters 693 to 696	This setting determines at what number of points the monitor output will display 20 mA. If the number of points of the source signal is higher than the value set here, 20 mA is nevertheless emitted, i.e. a change in the source signal above the value indicated is no longer displayed.
P11 Parameter 702	This setting can determine how many points the air ducts are to advance if the "Flying Change" is activated.
Parameter 703	This setting determines how long after a curve set change the air advance remains active.
Parameter 704	This can be used to select the channels on which the air advance will act (via Bit pattern).
P12 Parameter 718	This setting determines how rapidly the external load signal will vary if the load is set via a DPS signal. In the case of a DPS signal the external load is formed by a counter that counts up or down depending on the prevailing contact. The speed of the counter is therefore set via this parameter. The setting is in points per minute. If the load is not a DPS signal, the parameter must be set to "0".

P13
Parameters 719 to 723

If the respective channel is configured as continuous output, this setting can determine how rapidly this output must achieve the maximum adjustment. The time set here, however, is only a minimum running time. Due to the compound routine it may happen (for example, when using even slower damper drives on another channel) that this time is clearly exceeded. This parameter primarily serves to achieve an adjustment in the actuation frequency converters. The value set here should agree with the run-up time programmed on the frequency converter.

P14
Parameter 839

This defines the dead band of the load input. Load changes lying within this entered range are ignored and do not lead to any adjustment of the compound. If the load dead band selected is too small, the compound runs very erratically, since even the most minor load changes give rise to a correction. Due to the additional routines, such as air advance in the event of changes in power output and overshoot (approaching of control element from one side) this leads to unnecessary disturbance. With a slightly fluctuating or disturbed load signal the control elements are in constant movement. Selecting too large a load dead band means that power requirements are not run at full capacity by the load control unit, or that this is done only when the set-point/actual difference becomes even greater, the change then occurring in an abrupt surge.This can lead to excessive fluctuations in the actual value of the control equipment (steam pressure or supply temperature). The optimum for this parameter must be determined on the system. Only in exceptional cases should the parameter content should be set below three digits, however, so that at least the signal fluctuations on the load input do not lead to adjustment of the compound

P15
Parameter 729

This setting determines the minimum running time of the compound in seconds. This parameter serves to purposely retard the run-up time of the burner from low load to full load, or the run-down time in the opposite direction.

P16
Parameters 730 to 734

If the respective channel is configured for DPS these parameters can be used to enter the minimum cycle length that must be emitted in the actuation of the relay module. The electronic compound endeavours to set the necessary cycle length for adjustment of the control element as a function of its running time and of the steepness of the curve, so that all control elements run to the new value as synchronously as possible. To do this it makes maximum use of short timing pulses in order to achieve a large variance between the control elements. Where external factors (inertia of the contactors or of the motor, or use of mechanical relay modules) call for a minimum cycle length so as to produce any reaction at all, this must be entered here. Where electronic relay modules and responsive motors are used, the smallest possible cycle length should be selected in the interests of a smooth and evenly running compound. Where type 6 60 R 0011 mechanical relay modules are used, the minimum cycle length must be set to no lower than one $1/10^{th}$ of a second. With cycle lengths than $1/10^{th}$ of a second the relay may fail to transmit the clock pulses. The smallest value that can be emitted is 50 ms.

P17
Parameter 754

This parameter is used to set the number of points by which the internal load must fall for the compound, during setting, to skip automatically to the "Set/Control" mode.

P18
Parameter 758

This parameter is used to configure the burner for post-ventilation.
If the time is set to "0", no post-ventilation occurs.

P19
Parameter 755

This serves for entering how many seconds the ignition position relays are delayed after detection of the ignition position by the compound (or ignition on the FMS is released).

P20
Parameter 756

Here a delay time may be set so that the compound waits before leaving the programmed, separate ignition point after ignition, to run to the next base load point.
This parameter only has any effect if a separate ignition point is configured.

P21
Parameter 757

This serves for setting the delay time during which a given control release (signal on terminal 4) is ignored. During this time the burner remains in the ignition position or base load.

P22
Parameters 433, 434

Correction input spread factor
This can be used to set a situation where the correction has a smaller effect at weak loads or vice versa, in the range (00.0 - 99.9).
The standard setting is 10 (i.e. 01.0), then the correction has the same effect in all load ranges.

With values above 1.0, the selected correction range increases with rising load and reaches the times-X value at full load.

Example:
Parameter value 35 ≙ (3.5)
Correction range 150 points
With weak load the correction range is 150 points and at full load - 525 points.
There is linear interpolation between these values.

With values below 1.0, the selected correction range drops with increasing load.

Example:
Parameter value 5 ≙ (0.5)
Correction range 200 points
With weak load the correction range is 200 points and at full load - 100 points.

This can be used to increase or reduce previous weighting of the correction range via the correction mode on the load axis.

P23
Parameters 822, 823

These are used to set the baud rate of the serial interface. The standard value for the parameter content is "4" (19.200 baud). Should it be apparent from the system that problems are occurring with serial transmission (particularly with long serial connections), it may possibly help to reduce the baud rate. However, this must be done both on the FMS and on the operating unit, e.g. laptop.

P24
Parameters 826, 827

The network address for the respective serial interface is given here. The network address in the unit's delivered state is "0". The network address is to be altered only where several units are polled via a BUS. If a network address other than "0" is set, this must be noted on the unit sticker.

P25
Parameter 831

This may be used to set the brightness of the display. By means of this parameter the light intensity of the display can be adjusted to the ambient light conditions. Since the power consumption of the display is quite high, choosing a lower brightness level brings a not inconsiderable energy saving. This also reduces the amount of heat generated by the unit. When not being used, the unit after a time automatically switches to the lowest brightness level.

P26
Parameter 832

Here a time is configured in which the FMS, after the last operation (key press etc.) reverts to the lowest brightness level. As soon as a key is pressed or a fault appears, the unit automatically switches back to the brightness level set. If "0" is entered in this parameter the display does not dim down. In order to increase the life of the display, however, and to minimise the heat generated in the unit, we recommend that this parameter be used. The setting on delivery is 600 seconds, i.e. after 10 minutes without operation the unit switches its brightness level back.

P27
Parameters 740 744

This serves for setting the minimum time that must elapse after a control pulse from a DPS output until another one occurs. The smallest value is 50 msec. If a control element has a tendency to oscillate, stabilisation can be achieved not only by enlarging the dead band but also by increasing this parameter.

P29
Parameter 759

An ignition delay in seconds during setting can be entered here. This allows the person commissioning the unit to observe the 1st ignition attempt at the burner or boiler end. It runs from the 2nd operation of the acceptance key (after confirming the question "Really ignite?").
For details, see "Tips & Tricks page 69.

P40
Parameter 777

This is used to set the program monitoring time for the control unit. If, after starting, no ignition occurs within this period, a fault is emitted.
There is no monitoring if the parameter is set to "0".

P51
Parameter 782

Pre-ignition time. This indicates how many seconds the ignition transformer is activated before opening of the pilot gas solenoid valve (or main gas). Minimum value 2 seconds.

P52
Parameter 783

This parameter serves to set the stabilisation time. This parameter indicates how long between first and second safety periods the pilot burner burns on its own (without activation of the pilot burner and with the main gas valves still closed).

P53
Parameters 769 und 772

These parameters are only meaningful when leakage testing is integrated into the FMS.

This can be used to select whether a leakage test is to be performed before ignition, after switching off or in both cases. The leakage test can be switched off by setting both parameters to "0". If a leakage test after switching off is selected, it is also performed before the next startup in the event of fault switch-off or a power failure.

P54
Parameter 785

This is used to set the burner pre-ventilation time. This setting is undertaken by the person commissioning the unit.

P55
Parameters 850 to 885

This allows the display format to be configured.

P60
Parameter 787

The servicing mode can be set in this parameter. The servicing mode serves for setting the pilot burner. It allows 5 ignition attempts to be made in succession without having to go through pre-ventilation in order to start again. The control unit runs only until the stabilisation time. The main valves cannot be opened until this parameter has been reset.

ATTENTION:
Where a fault is reset with a long reset, the maintenance mode counter is also reset, i.e. the next startup takes place with pre-ventilation.

P62
Parameter 789

The FMS generally monitors again for a period of 5 seconds after shut-off to check whether the flame signal has really gone out. This parameter can be used to set the number of seconds for which this monitoring occurs after shut-off. Before setting this parameter it must be ensured that the system reliably waits at least for the after-burning time of the burner in order to avoid incorrect fault signals. If the parameter is set to "0", the flame signal is no longer monitored after shut-off.

P71
Parameter 427

This is used to set the re-circulation damper delay in seconds.
For details of the effect of this parameter, see Appendix.

This parameter has a double function:
If the unit is configured as VMS, a threshold value in points is given here (see VMS Commissioning Instructions)

P72
Parameter 768

In order to prevent excessively high current consumption by the fan during star-delta starting, this setting can be used to ensure that the dampers remain closed for a few seconds after the start command.

P 80
Parameter 790

This parameter activates the output regulator and selects the corresponding mode.
A value of 0 means load regulator is switched off.
A value of 1 means fixed target value regulator, switching between 2 target values is possible.
A value of 2 means weather control.

P 81
Parameter 791

As long as boiler temperature or steam pressure remain below this value, the startup circuit is operational (q.v.).

P 82
Parameter 792

This is the internal load output value for the startup circuit.

P 83
Parameter 793

The specified load is increased up to the maximum load over the time-interval indicated by this parameter, whilst the startup circuit is operational.
Input is in seconds.

P 84
Parameter 794

By entering a non-zero value, the internal load is limited to this maximum value, provided terminal 75 is set.

P 85
Parameter 795

Must be set to "0".

P 86
Parameter 796

This is where the target values are entered.
796 = target value 1 if weather control is activated 2
(switch-over to target value with signal terminal 4),
otherwise this parameter forms the lower target-value limit 1.

Parameter 797

797 = upper target-value limit 1 if weather control is activated, otherwise this parameter is unassigned.

Parameter 798

798 = target value 2 if no weather control is activated, otherwise this parameter forms the lower target-value limit 2.

Parameter 799

799 = upper target-value limit 1 if weather control is activated, other wise this parameter is unassigned.

P87
Parameter 800

This is where the weather control limits are entered, from which a floating target-value displacement is derived.

Parameter 801

The entered value refers to the external temperature.
In the case of external temperatures above the upper or below the lower limit, the maximum or the minimum target value is output as a fixed value.

P 88
Parameter 802

Control value for the thermostat function:
If the boiler temperature or the steam pressure is below the necessary target value less the bottom control region, the burner is switched on. If a negative value is entered here, the burner starts via the target value.

P 89
Parameter 803

If the boiler temperature or the steam pressure is above the necessary target value plus the top control region, burner load is set to base load.
Values between parameters 802 and 803 are the control region.

P 90
Parameter 804

If the boiler temperature or the steam pressure is above the necessary target value plus the value for Burner Off, the burner is switched off.
Values between parameters 803 and 804 are the shutdown region, i.e. base load is output as the demanded load.

If the load regulator is deactivated (e.g. via remote control software, manual operation or for adjustment), the "Burner Off limit" is not operational.

P 91

Example values:

The control parameters are adjusted here.

	Hot water facility	Steam facility
Parameter 805	4	10
Parameter 806	3	5
Parameter 807	250	100

P 92
Parameter 808

The time that elapses until a new calculation of load-value displacement is performed (should correspond to the control-path's dead time).
An extension of the readjustment time increases the regulator's D-component indirectly, and vice versa.

P 93
Parameter 814
Parameter 815
Parameter 816
Parameter 817
Parameter 818
Parameter 819
Parameter 820
Parameter 821

Burner output for the relevant curve-set in % in base load.
Serves only for conversion if a display in percent was selected.

Note: All load-regulator parameters (except for fuel output and load-regulator type) can be altered during current operation.

P30

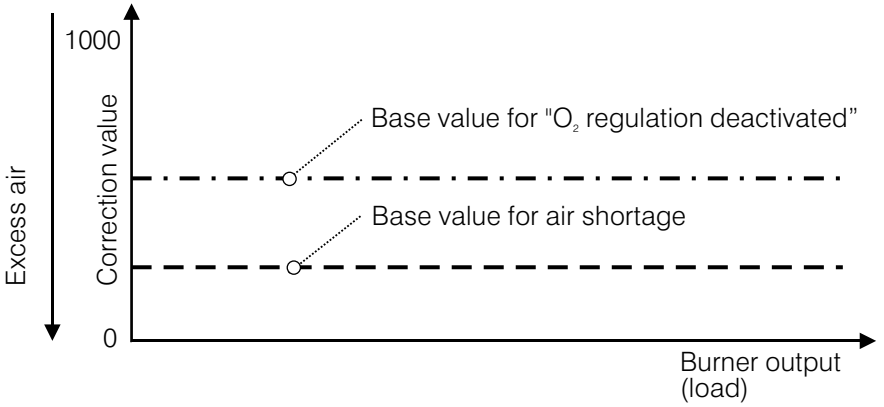
Parameter 896
Level 0

0 → O_2 regulation off
1 → Standard regulator
2 → Without lag time
} Selection of regulation strategy:
3 → Only display, neutral value is output
8 → Only display, base value for deactivated O_2 regulation is output
9 → Only display, base value for air shortage is output

P31

Parameters 897
901/902
917/918
Level 1

If O_2 regulation is perturbed, it is deactivated and the specified correction value for "Deactivated O_2 regulation" or "Air shortage" is output, depending on the cause. The burner is not shut down.
Parameter 897 is used to preselect whether the burner should be shut down in the event of "Air shortage" errors.



Note: The specified base value for air shortage must be smaller than or equal to the base value for deactivated O_2 regulation.

Recommended settings:
Base value for deactivated O_2 regulation $\leq$ neutral value
Base value for air shortage $<$ base value for deactivated O_2 regulation

Note: The neutral value is obtained from the chosen correction mode:
Correction mode +50% / -50% → neutral value 500 $\triangleq$ 50%
Correction mode +60% / -40% → neutral value 600 $\triangleq$ 60%
See also the explanations on page 57.

ATTENTION!
It is necessary to ensure that the burner's operation is still stable with the selected base values. These can be selected as follows in order to check the combustion:
Parameter 896 set to
8 → correction input $\triangleq$ base value for "Deactivated O_2 regulation"
$\triangleq$ parameter 901/902
9 → correction input $\triangleq$ base value "Air shortage"
$\triangleq$ parameter 917/918

P32

Parameters 898/899/900
Level 0

See page 59, "Calculation and setting of control parameters"

P33 Parameter 903 Level 1	Deactivation time for O_2 regulation in the case of curve switching during operation.Switching during burner operation. The time starts from when the actuators have reached the "new" position. The regulator is deactivated as soon as the switch-over starts, and the correction value for deactivated regulation is output (parameter 902).
P34 Parameter 904 Level 1	Delay time for activating the O_2 regulator after the flame appears.
P35 Parameters 914/915 Level 0	These parameters can be used to deactivate the O_2 regulator below and above a defined load value. The correction value for "Deactivated O_2 regulation" is output.
P36 Parameters 919/920 Level 1	These two parameters serve to equalise the O_2 regulator module with an O_2 meter coupled via an analogue signal (4...20 mA). Taking into account probe control during pre-ventilation, it is recommended to set a measurement range of 0...25 vol.% O_2.
P37 Parameters 923 to 930 Level 2 Parameters 931 to 934 Level 1	These parameters are used to set the O_2 monitoring bands for base and full load, referenced to the O2 target value in %. For details see page 49. Example: O_2 target value 3 vol.% O_2 50% below threshold specified Shut-down limit $<$ 1.5 vol.% O_2.
P38 Parameter 936 Level 1	This parameter can be used to set the demand threshold for the "Dynamic probe test" function control. Factory setting: 2 → 0.2 vol.% O_2 0 → means "Dynamic probe test" switched off.

Changing a data EPROM or a program EPROM

Pull out mains connector

Release and remove front panel

Pull out processor card (card fully to the left) and lay it down, remove any auxiliary card (on processor card).

Carefully remove modules and replace with new ones.

Make sure that
- the module points in the correct direction (notches of the upper module row and the lower module row are on opposite sides)
- all prongs are correctly inserted in the base
- the correct module is changed

Press in firmly again
plugging any auxiliary card back in

Push the card back into the unit

Push on front panel

Push cards right in

Screw down

Plug mains connector back in

If a new program EPROM has been inserted D proceed as described on page 118

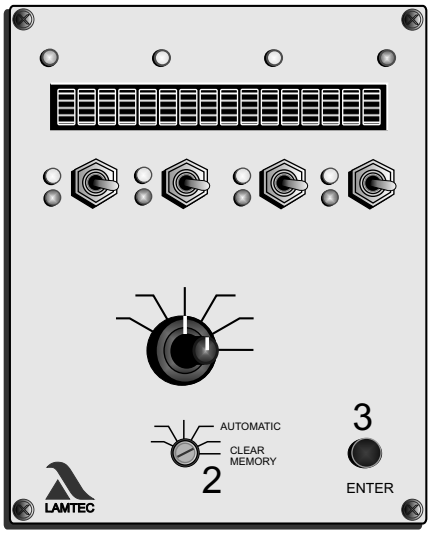
Mixing up the data EPROM and program EPROM can destroy the unit.

If a unit is changed and the previously programmed curves are to be inserted into the new unit, care must be taken to ensure that both the data EEPROM of the main processor and the EEPROM of the monitoring processor are transferred to the new unit.

Unless the data have been backed up on PC. Then it is sufficient to record them onto the new unit.

Re-entering range limits

When adjusting the limit stops after programming, the range limits must be redefined.



Selector switch (2) to "Clear memory"

Press Acceptance (3)
- the curve and the range limits are cleared

Selector switch (2) back to "Automatic"
- "restore previous curve" appears on the display
- Channel key 3 (5) upwards
- "Read old curve" appears on the display
- since no point has been entered, the old curve is reactivated, but the range limits remain cleared

Allow system to pre-ventilate
- new range limits are re-entered

This can be observed at "set-point" switch setting. Without limits, the set-point is 0 or 999. If the limit is defined the set-point skips to the actual value.

Procedure for installation of new software in the FMS

Insert EPROMs
Monitoring EPROM on card top left
Main processor EPROM on card bottom left

Power On
- Display: LAMTEC FMS 4/5
- Self tests

Please remember that the installation of modified software in a system that has already undergone acceptance will require a new acceptance or at least approval of the modification by the competent authorities. The new EPROM numbers (displayed during the start-up self-tests) are to be inserted accordingly.

Replacing the relais moduel 660 R 0016

The relais module for controlling yhe valves is subjected to abrasion
This abrasion depends upon the load of the contacts and the numbers of the working cycle.

For safet reasons the relais module 660 R 0016 is to be renewed after 250 000 starts.

The starts, the FMS has passed already, are shown under the function "Calling up running time meter" (q.v. page 78).
The starts, on all curve sets have to be added together.
When the sum reaches 250 000 the relais module has to be replaced.

Diagnoses mode

valid only for relay module type 660 R 0016 since version V4.3
One ofthe ouputs, which are tested during burner start, has recognised a fault.
To diagnose the faults H 921 and H 925, you may change to the diagnosis mode. The changing will be done with plugging or unplugging the jumper B on the relay module (see chapter "Diagnosis Mode" on p. 120).
The faults H 921 and 924 are shown in standard mode, the allocation of output and fault is still unclear.

Procedure to localise a fault:
- switch off the power supply and the FMS
- open the relay module
- plug in jumper B
- reactivate the power supply and the FMS
- watch the LEDs during the ignition process
- the LED which flashes at least before the fault and the shut down, is the one, the output recognises as faulty.
  Standard (B open) = indication is defined during ignition
  Diagnosis (B close) = indication undefined, directly

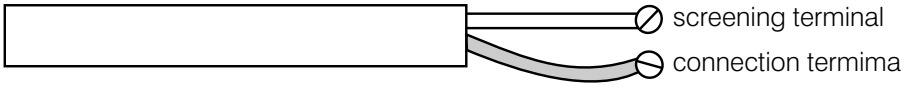
If a fault at R16 V4 occurs while the burner is running, a forced shut down follows. Different, undefined FMS fault shut downs may be generated.
This depends on how the process proceeds and which fault the FMS recognises first.
If the burner flame goes out rapidlyafter a valve cutt off, the FMS generates a fault of the flame.

Trouble shooting:
- check the wiring, is there a load conneted to the output
- check the fuse of the concerned output
- if the fault is still pending: exchange the relay module.

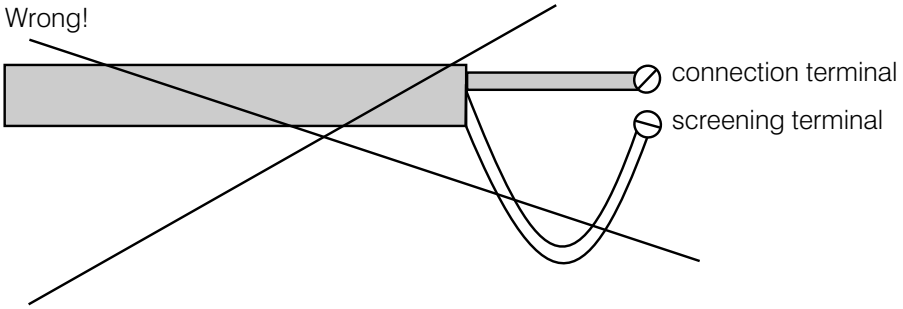
Connection of screening

All leads from the VMS and to the VMS are to be screened (exception: 230 V lead).
The screening must be laid to PE by the shortest possible route.

Correct:



Wrong!



PE bus bar

On the back of the unit two bars are fitted left and right parallel to the terminal strips. All screening is to be laid up to those bars. Although this bar already has a connection to PE via the housing, the fault leakage conduction is improved if a separate, low-impedance PE wire is laid to each of these in addition.

Switch cabinet wiring

The low-voltage lines from the FMS and to the FMS should not lie parallel to the feed and down conductors of the power electronics in a conduit. Frequency converter lines and switches/contactors that switch high inductive or capacitive loads are especially critical. Parallel laying with the drive lines of solenoid valves, ignition transformers or large servomotors and the like is therefore to be avoided.

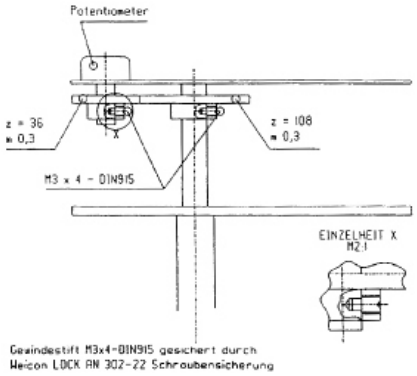
Although this unit to some extent far exceeds all applicable EMC standards, suitable wiring is essential in ensuring that the entire system functions trouble-free in all circumstances.

Screening of leads from the field

Screened leads from the field (e.g. potentiometer leads) are best laid directly to the FMS (without intermediate terminals).

Should intermediate terminals be necessary, the screening is also to be led immediately alongside via the terminal.
Long distances in the conduit without screening should be avoided.

Positive connection



Since the FMS, in the case of three-point step channels, adjusts the damper until the actual value is equal to the set-point value, the feedback potentiometer must always reliably correspond to the damper position.

The damper motor potentiometer connections must be positive interlock connections, i.e. not able to rotate.

In addition potentiometers with high quality standards must be used (see below).
If one of the two points is not given, two independent potentiometers (not dual-operated potentiometers) per channel must be used for the feedback.

Example of positive potentiometer connection

The motor damper connection must always be a positive interlock.

Error-proof feedback

In the case of single-channel feedback of TPS outputs, only authorised potentiometers may be used. These must be switched directly.

Examples of potentiometers

The following potentiometers are authorised for use as sole feedback in the case of FMS, on condition that they are positively connected to the damper:

1. Novotechnik	SP-Serie	Rating: 5kΩ*
2. Contelec	PL240	Rating: 1kΩ -5kΩ*
3. Contelec	PL310	Rating: 5kΩ*
4. Contelec	PL295	Rating: 5kΩ*
5. Bourns	6639S-095-..	Rating: 5kΩ*

Other potentiometers are admissible only after consultation with LAMTEC or the TÜV.

Examples of servomotors

Servomotors with approved potentiometer, fitted with a positive interlock connection:

Schimpf	All motors with feedback type R1*and type R2*
Landis & Geyer	SQM series with potentiometer PL 240
Haselhofer	HD 60 D 2 with Novotechnik potentiometer
Haselhofer	HD 60 D 10 with Novotechnik potentiometer
Aris	WAN1, WAN6
Regeltechnik	
Kornwestheim	ST 5102 and ST 5113
Regeltechnik	
Keller	CA03 and CA12
Auma	Address enquiries to the manufacturer
KFM Regelungstechnik	4d124B

Other motors are admissible only if the potentiometer connection forms a positive interlock or two independent potentiometers are used for feedback.

* also obtainable through LAMTEC

External switching of the
uel control element

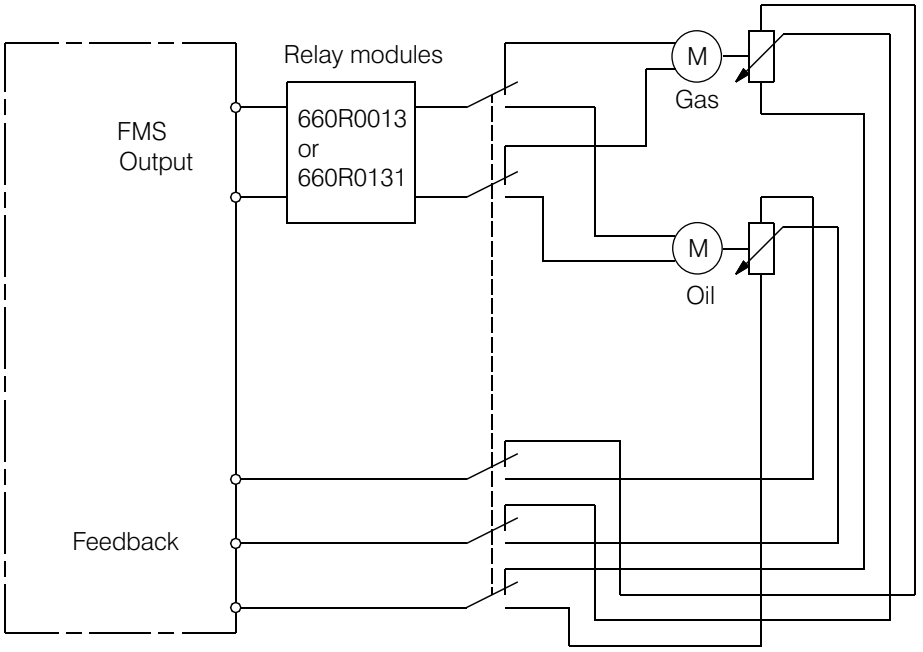
If the output channels of the device are insufficient, it is possible to switch the fuel control elements, which are not used in all curve sets (e.g. motor for oil control element and motor for gas control element).

When an external switching of the fuel control element is used you have to ensure, that the chosen motor matches the appropriate feedback e.g. compulsory guide or equal methods.

For switching of the potentiometer it is necessary to use only contacts with gold coating.

The cables between FMS and the relais modules may not exceed the length of 10m!

Switching oil/gasmotor FMS



Replacing a Servomotor with LAMTEC Precalibration

While replacing a servomotor with LAMTEC precalibration with another servomotor with LAMTEC precalibration, normally there are no further justifcations necessary.

A servomotor with precalibration is calibrated ex works, that the angular degrees 0° - 90° at every motor are equal to the potentiometer values. Therfore the replacement of these motors causes no deviation between the calibrated curve in FMS and the associated damper position.

You may not change any settings or tamper at a motor with LAMTEC precalibration. Especially you may not adjust a position switch or the adjustment of the potentiometer. The precalibration will be lost in this case. The firing has to be readjusted as the case may be.

Replacing the complete servomotor

While replacing a servomotor we can not ensure that the the adjusted curve in the FMS with the new motor results in the same damper position as before

Therefor after replacing a servomotor the settings of the firing has to be

checekd over the whole range and all operation modes.

If necessary the curves in the FMS have to be readjusted.

Replacing the Potentiometer iin a servomotor

Don't change the adjustment of the position switch

Determine and note the actual value feedback at the lower position switch block before replacing the potentiometer.

Dismantle the old potentiometer.

Install and adjust it, that the actual value feedback at the lower position switch block has the same value as that you noticed before.

Install the potentiometer with positive locking according to the specifications of the motor manufactor.

Control the settings of the firing and change as the case may be.

As the normally used potentiometers for the feedback may have different values, there may be a difference in the position of the dampers as before. Therefor after replacing a servomotor the settings of the firing has to be

checekd over the whole range and all operation modes.

If necessary the curves in the FMS have to be readjusted

Action	Switch Position top selector switch (1)	Switch Position bottom selector switch (2)	Buttons / Other
Recall correction ranges Status	Monitoring display	Acceptance Automatic Setting Clear memory	
Cold start (long reset)	Status		Fault / Switch 1 OPEN
Warm start (short reset) Status			Fault / Switch 1 OPEN and Switch 2 OPEN
Code entry for parameterisation	Status	Parameterisation	Switch 2 / 3 OPEN Switch 4 CLOSE
Scan fault history	Status	Monitoring display Automatic Setting Clear memory	Channel 1 switch OPEN or CLOSE (not in fault mode)
Recall correction input values	Load rating		Acceptance
Load adjustable via switch 1 (manual operation)	Load rating	Automatic	Channel 1 switch open/ close
Quit manual mode	Load rating	Automatic	operate a switch, channel 2,3 or 4
Load adjustable via switch 1 (internal load default)	Load rating	Setting	Channel 1 switch OPEN or CLOSE
EG / ES mode is activated	Load rating	Setting Clear memory	Channel 3 switch CLOSE Mode GL or RG (EI on display) Compound engaged (No "ES barred" message)
EG / ES mode is terminated		Setting Clear memory	Switch on front panel operated in EG or ES mode Exception Switch 1 at sep. ignition point or load default configured via switch
Display of running time meter / Starts counter	Set-point value	Monitoring display Automatic	Acceptance
Store point	Set-point value Actual value feedback	Setting	Acceptance
Clear present curve	Set-point value	Clear memory	Acceptance
Display of acceptance data CRCs for all levels Oil/gas safety times Pre-ventilation time	Set-point value feedback		Acceptance
Traverse channels	Set-point value Actual value feedback	Setting	Switch 1 - 4
Channel 5 set-point adjustable	Channel 5 display	Setting	Switch 2
Scanning of serial No.	Actual value feedback	Monitoring display Automatic	Acceptance
Call up flame intensity	Actual value feedback	Automatic	Channel 3 switch up

Action	Modus	Position of top switch (1)	Position of bottom switch (2)	Keys / other
Mode switch-over: O_2 regulation-VMS/FMS		Status	Automatic or O_2 regulation	Channel 3 key (5) Open → O_2 regulation Closed → VMS/FMS
O_2 error reset	O_2-regulation	Status	Automatic	O_2 regulation mode Press Acceptance key (3) and query cause of error Channel 3 switch (5)Z Open
Calling up text messages	O_2-regulation	Status	Automatic	Press Acceptance key (3) or O_2 regulation
Adjusting correction value	TK	Load	O_2 regulation	Channel key 1 Open → Excess air Closed → Air shortage
Changing O_2 target value to "Adjust"	T	Set-point	O_2 regulation	Channel key 4 Open → more O_2 Closed → less O_2
Calling up O_2 regulation error history	VMS/FMS	Status	Automatic	Channel key 2 upwards/downwards
Cahnge load regulator	load value	Operation		Cannel key 3 up, channel key 4 down. When display blinks, channel key 2 for c hanging setpoint, store with ENTER key

Interconnection of the air pressure monitor

The air pressure monitor is checked during starting to see whether it has dropped out. For this reason it must not be connected in series with other switching elements which, because they are themselves opened in the rest position, cause the FMS to incorrectly detect a drop-out air pressure monitor signal, although the air pressure monitor may actually be making contact (e.g. series connection with normally open contacts of the fan protection).

Parameterisation of the re-circulation pre-ventilation time

The pre-ventilation time of the re-circulation ducts, in proportion to the boiler pre-ventilation time must be set as a function of the ratio of the boiler volume to that of the re-circulation ducts and of the quantity of pre-ventilation air.
(For details, see the latest version of the Technical Regulations on Steam Boilers [TRD])

On the FMS this ratio can be set by means of parameter 785 (pre-ventilation time) and 427 (re-circulation release delay).

At the same time the total pre-ventilation time (i.e. boiler pre-ventilation time alone + boiler and flue gas duct pre-ventilation time) is entered in parameter 427.
The content of parameter 427 is therefore always $\leq$ content of parameter 785.

Example:

Parameter 785 (total pre-ventilation time) = 50 seconds
Parameter 427 (re-circulation delay time) = 15 seconds

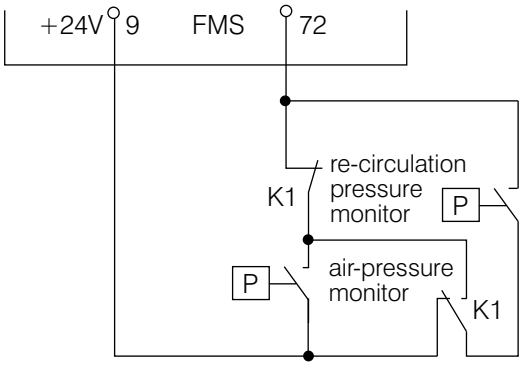
- Air control elements open. When all are open the pre-ventilation time starts to run.
- After 15 seconds the re-circulation ducts automatically receive a release and run open.
  The pre-ventilation time is stopped.
- Once the re-circulation ducts have reached their pre-ventilation position, the pre-ventilation time continues
- After 35 seconds (50_s 15_s) the pre-ventilation is terminated and all ducts close

Interconnection of monitors for the re-circulation ducts

If the re-circulation pressure monitor is connected in series with the air pressure monitor, it must be reliably bridged in the starting phase (to end of T_1, cf. flow chart) and in periods during which the re-circulation fan is not in operation.

Alternatively, it can also be switched in parallel to the air-pressure monitor during the startup phase. After the fan starts, it must be correctly switched in series.

Interconnection suggestion:



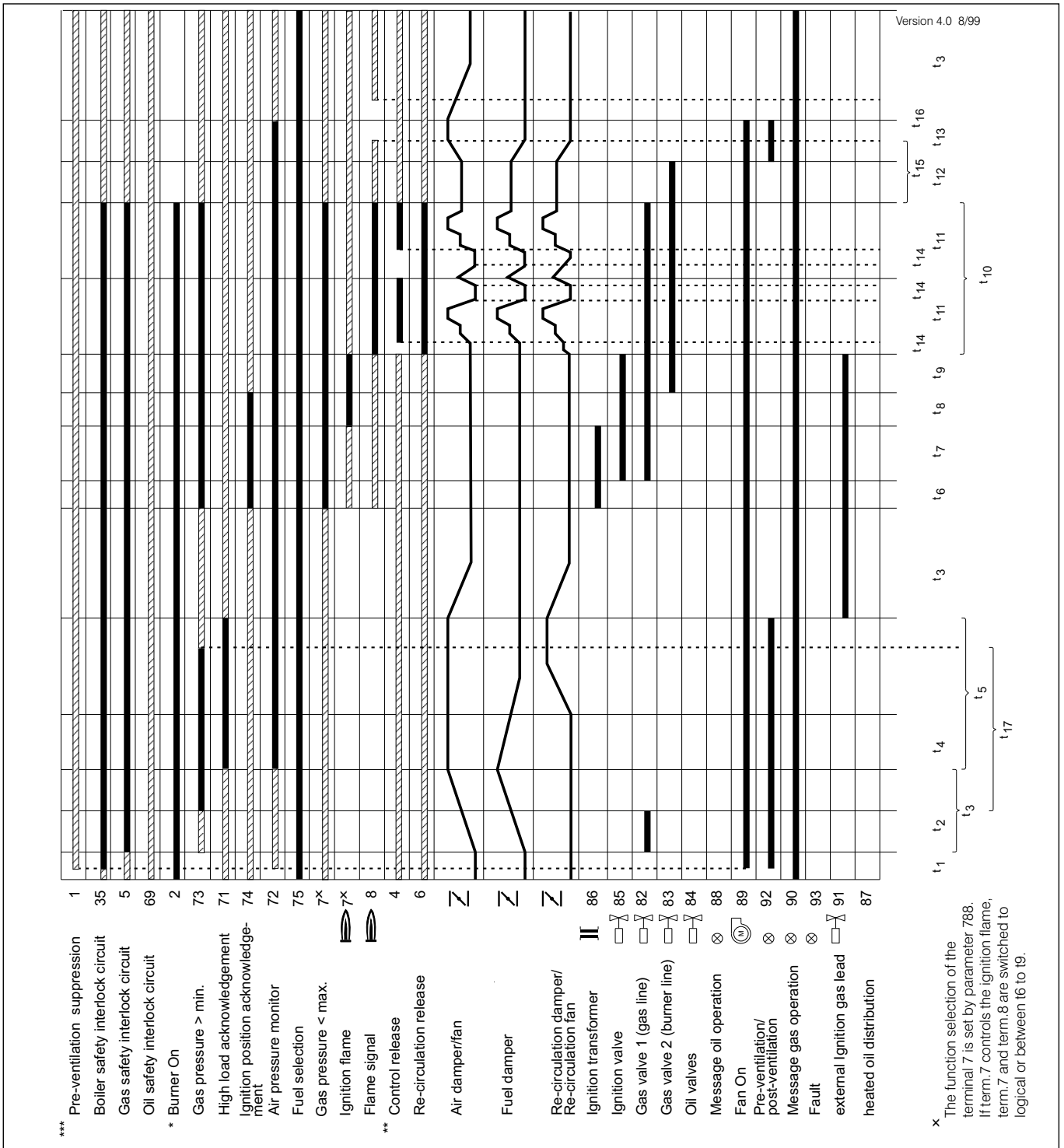
K1 are the contacts of the fan relay, which must be connected permanently to the power contacts.

Minimum time for outside light monitoring period of the flame monitoring device

While starting without pre-ventilation there have to be 5 seconds minimum idle time betweenthe start of the system (signal terminal 2) and the initiation of the ignition (activating the ignition transformer) to give the flame monitoring devioce enough time for "outside light monitoring". Unless otherwise ensured, please extend parameter 755 accordingly.

The flame monitoring device has to get minimum 5 seconds idle time for outside light monitoring before the ignition will be initiated.

Gas operation with pilot burner, leakage test and Ignition flame monitor



▨	Any condition	
t1	Wait for Gas safety interlock circuit air pressure monitor min. scan	any
t2	Time for pressure build-up in the gas test line (only with leakage test activated)	2 sec.
t3	Servo drive running time	
t4	Re-circulation damper delay	0-t5
t5	Aeration time	30-999 sec. adjustable
t6	Pre-ignition time	2-40 sec. adjustable
t7	1st safety period	4 sec.****
t8	Stabilisation period	3-10 sec. adjustable
t9	2nd safety period	3 sec.****
t10	Operating phase	any
t11	Control mode	any
t12	Time for pressure relief in the gas test line	3 sec.
t13	Post-ventilation time	0-999 sec. adjustable
t14	Control elements at base load	
t15	After-burning time	0-30 sec. adjustable
t16	Flame extinguishing check	5 sec.
t17	Leakage test, gas valve 2	30 sec.

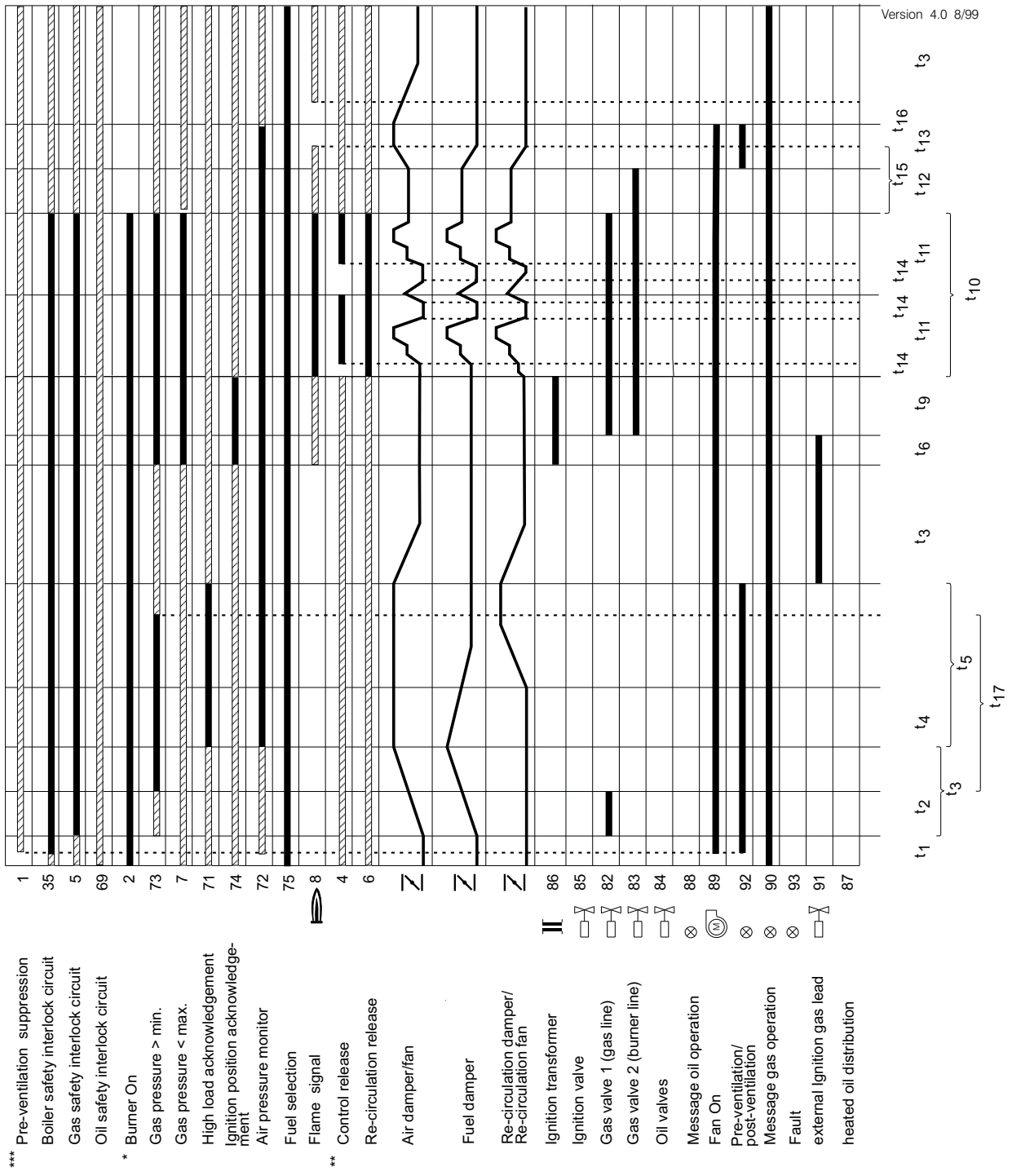
* If output regulator in the unit is activated, this signal is linked with the internal burner-start of this regulator

** If the re-circulation signal is absent, re-circulation valves remain closed or run closed. (except at pre-ventilation)..

*** Signal on terminal 1 clears the times t3, t4 and t5 at the end of t1 . The leakage test, if integrated, runs although

**** For determination of the total safety periods according to the standards, you have to add the reaction time of the flame monitor to the time settings of the FMS (typ.1sec.).

Gas operation without pilot burner with leakage test



▨	Any condition	
t1	Wait for Gas safety interlock circuit air pressure monitor min. scan	any
t2	Time for pressure build-up in the gas test line (only with leakage test activated)	2 sec.
t3	Servo drive running time	
t4	Re-circulation damper delay	0-t5
t5	Aeration time	30-999 sec. adjustable
t6	Pre-ignition time	2-40 sec. adjustable
t9	Safety period	3 sec.****
t10	Operating phase	any
t11	Control mode	any
t12	Time for pressure relief in the gas test line	3 sec.
t13	Post-ventilation time	0-999 sec. adjustable
t14	Control elements at base load	
t15	After-burning time	0-30 sec. adjustable
t16	Flame extinguishing check	5 sec.
t17	Leakage test, gas valve 2	30 sec.

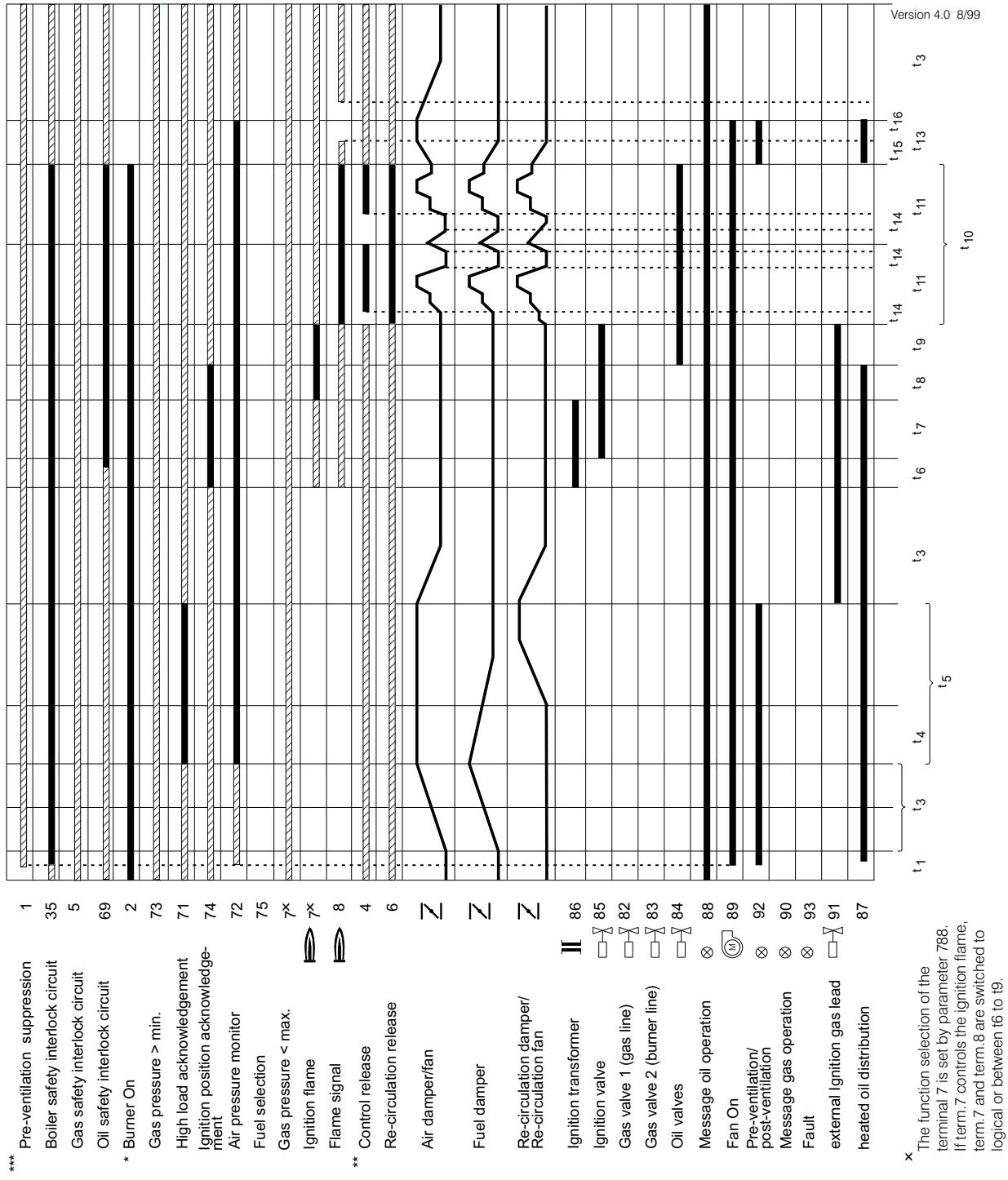
* If output regulator in the unit is activated, this signal is linked with the internal burner-start of this regulator

** If the re-circulation signal is absent, re-circulation valves remain closed or run closed. (except at pre-ventilation)..

*** Signal on terminal 1 clears the times t3, t4 and t5 at the end of t1 . The leakage test, if integrated, runs although

**** For determination of the total safety periods according to the standards, you have to add the reaction time of the flame monitor to the time settings of the FMS (typ.1sec.).

Oil operation with pilot burner and flame monitor



	Any condition	
t1	Wait for Gas safety interlock circuit air pressure monitor min. scan	any
t2	Time for pressure build-up in the gas test line (only with leakage test activated)	2 sec.
t3	Servo drive running time	
t4	Re-circulation damper delay	0-t5
t5	Aeration time	30-999 sec. adjustable
t6	Pre-ignition time	2-40 sec. adjustable
t7	1st safety period	4 sec.****
t8	Stabilisation period	3-10 sec. adjustable
t9	2nd safety period	4 sec.****
t10	Operating phase	any
t11	Control mode	any
t13	Post-ventilation time	0-999 sec. adjustable
t14	Control elements at base load	
t15	After-burning time	0-30 sec. adjustable
t16	Flame extinguishing check	5 sec.
t17	Leakage test, gas valve 2	30 sec.

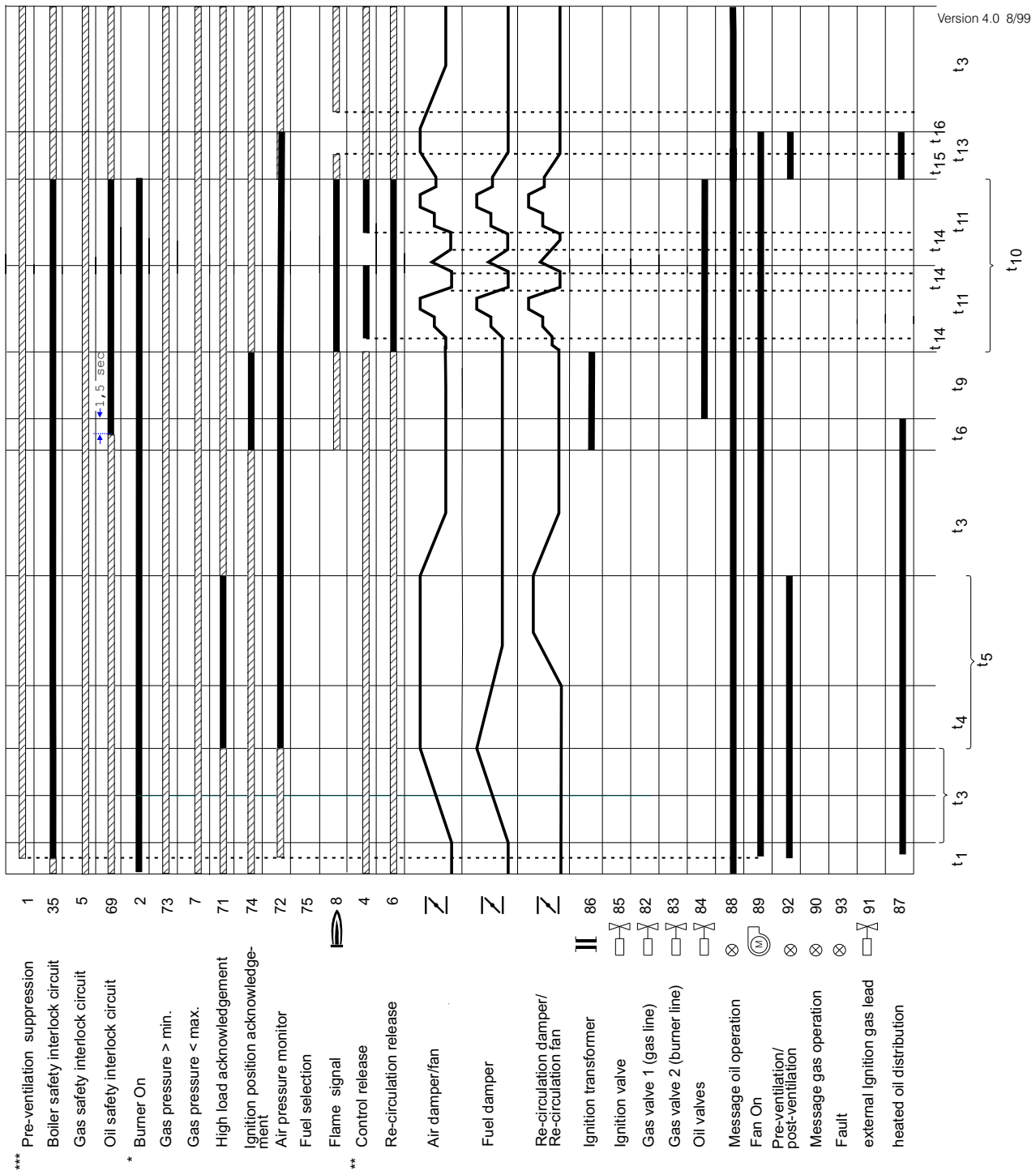
* If output regulator in the unit is activated, this signal is linked with the internal burner-start of this regulator

** If the re-circulation signal is absent, re-circulation valves remain closed or run closed. (except at pre-ventilation)..

*** Signal on terminal 1 clears the times t3, t4 and t5 at the end of t1 .

**** For determination of the total safety periods according to the standards, you have to add the reaction time of the flame monitor to the time settings of the FMS (typ.1sec.).

Oil operation without pilot burner



Any condition

t1	Wait for Gas safety interlock circuit air pressure monitor min. scan	any
t2	Time for pressure build-up in the gas test line (only with leakage test activated)	2 sec.
t3	Servo drive running time	
t4	Re-circulation damper delay	0-t5
t5	Aeration time	30-999 sec. adjustable
t6	Pre-ignition time	2-40 sec. adjustable
t9	Safety period	4 sec.****
t10	Operating phase	any
t11	Control mode	any
t13	Post-ventilation time	0-999 sec. adjustable
t14	Control elements at base load	
t15	After-burning time	0-30 sec. adjustable
t16	Flame extinguishing check	5 sec.
t17	Leakage test, gas valve 2	30 sec.

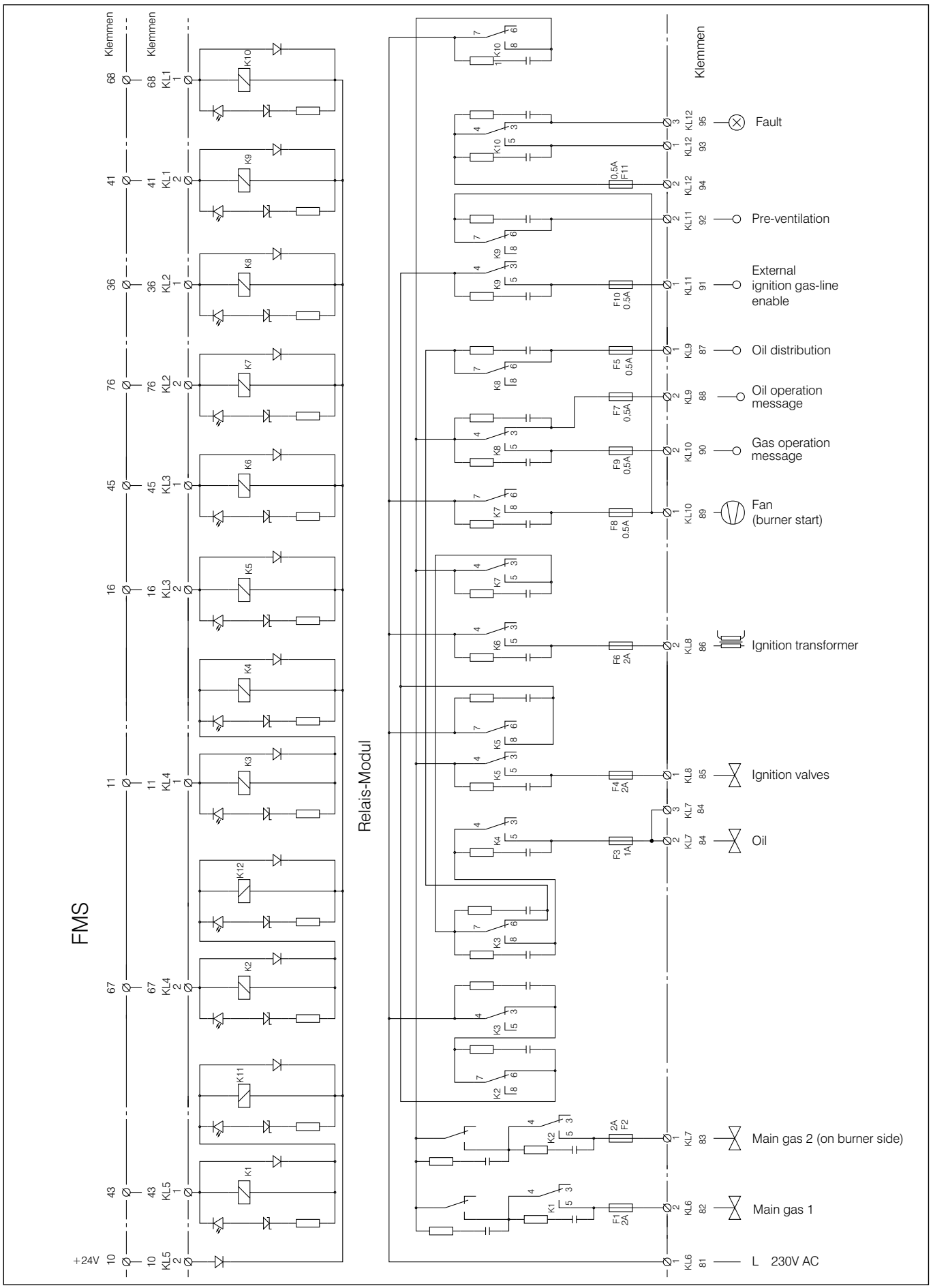
* If output regulator in the unit is activated, this signal is linked with the internal burner-start of this regulator

** If the re-circulation signal is absent, re-circulation valves remain closed or run closed. (except at pre-ventilation)..

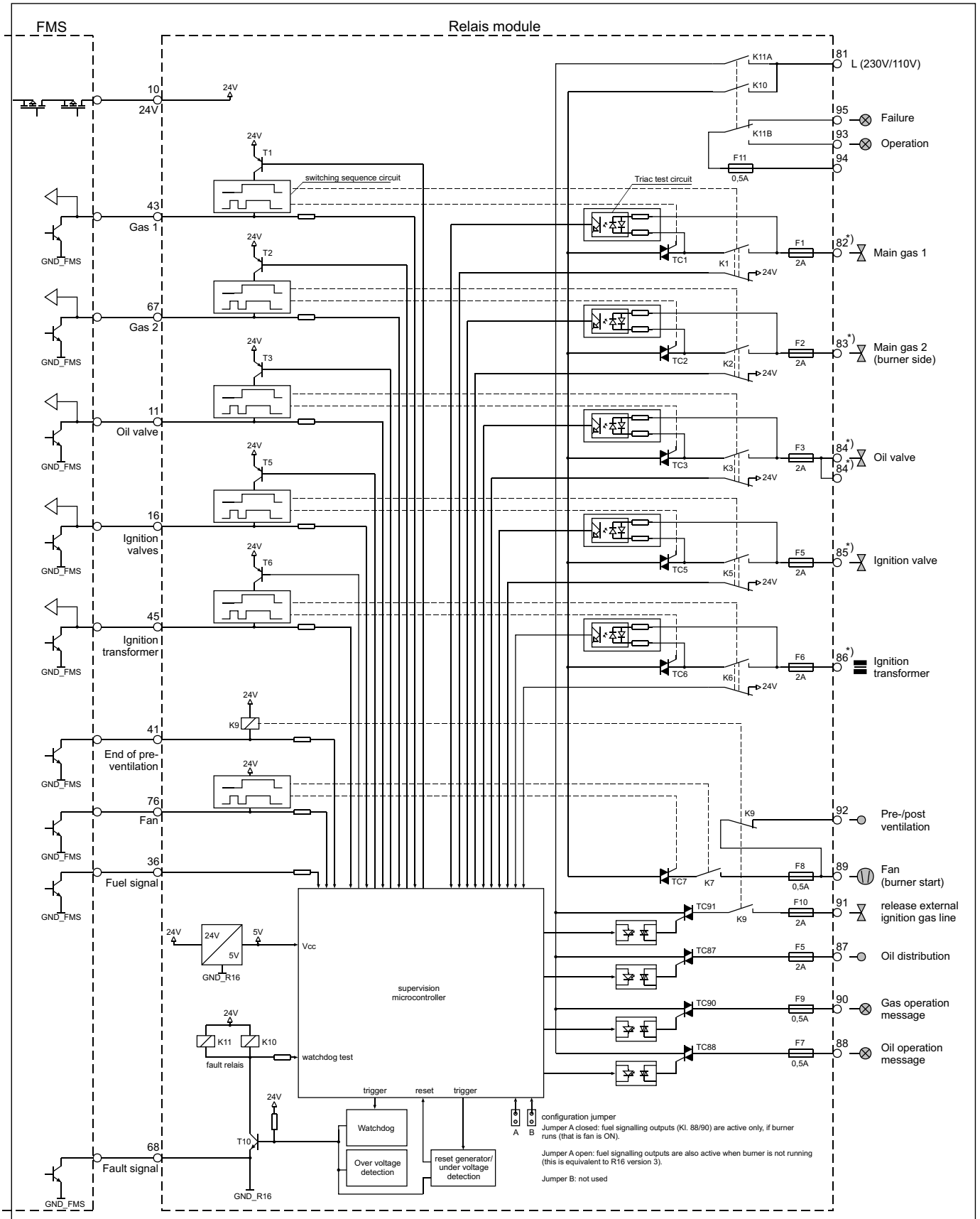
*** Signal on terminal 1 clears the times t3, t4 and t5 at the end of t1 . The leakage test, if integrated, runs although

**** For determination of the total safety periods according to the standards, you have to add the reaction time of the flame monitor to the time settings of the FMS (typ.1sec.).

Circuit diagram tzp 660 R 0016 valid until August 2006

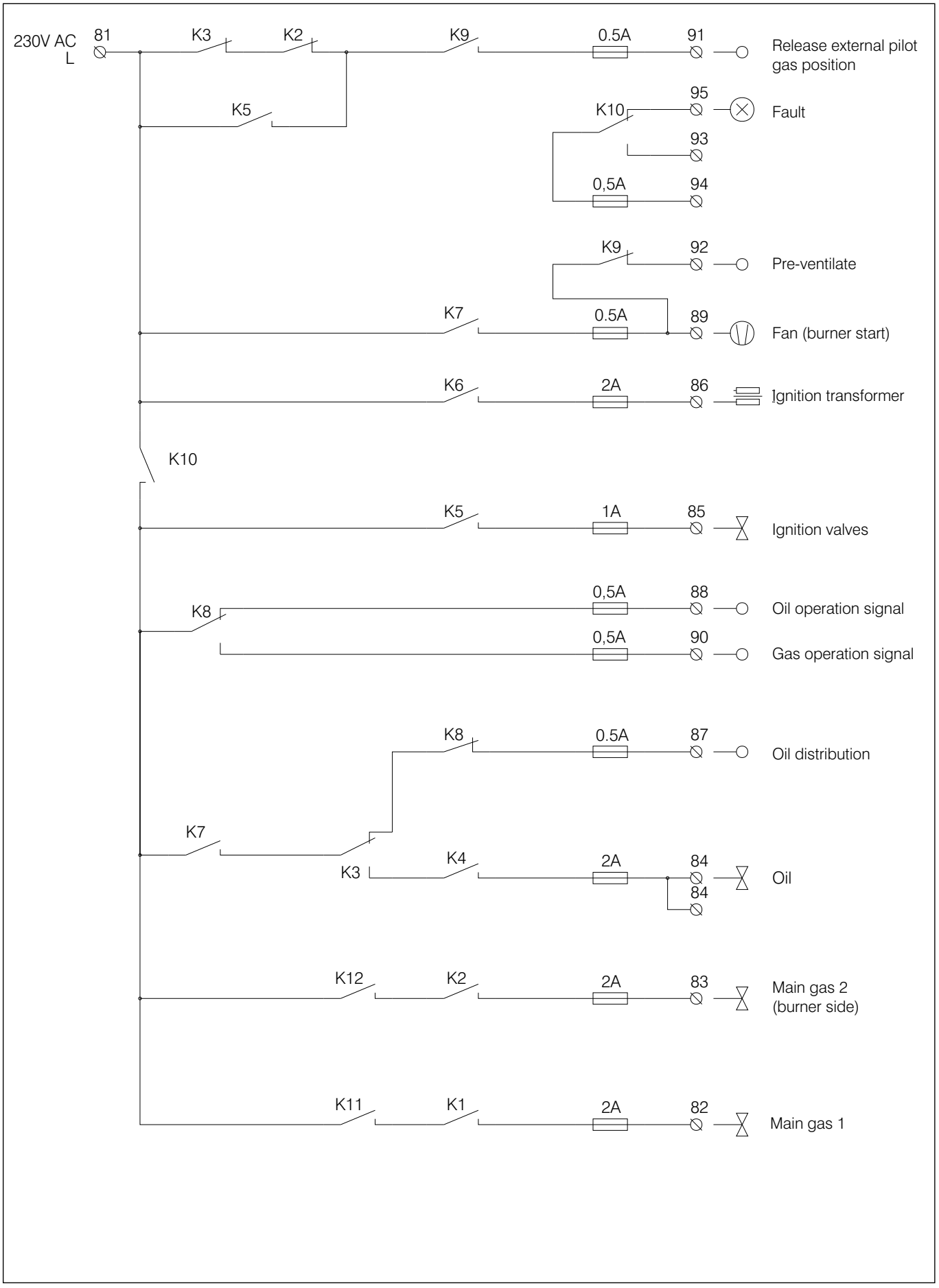


Circuit diagram tzp 660 R 0016 valid from August 2006

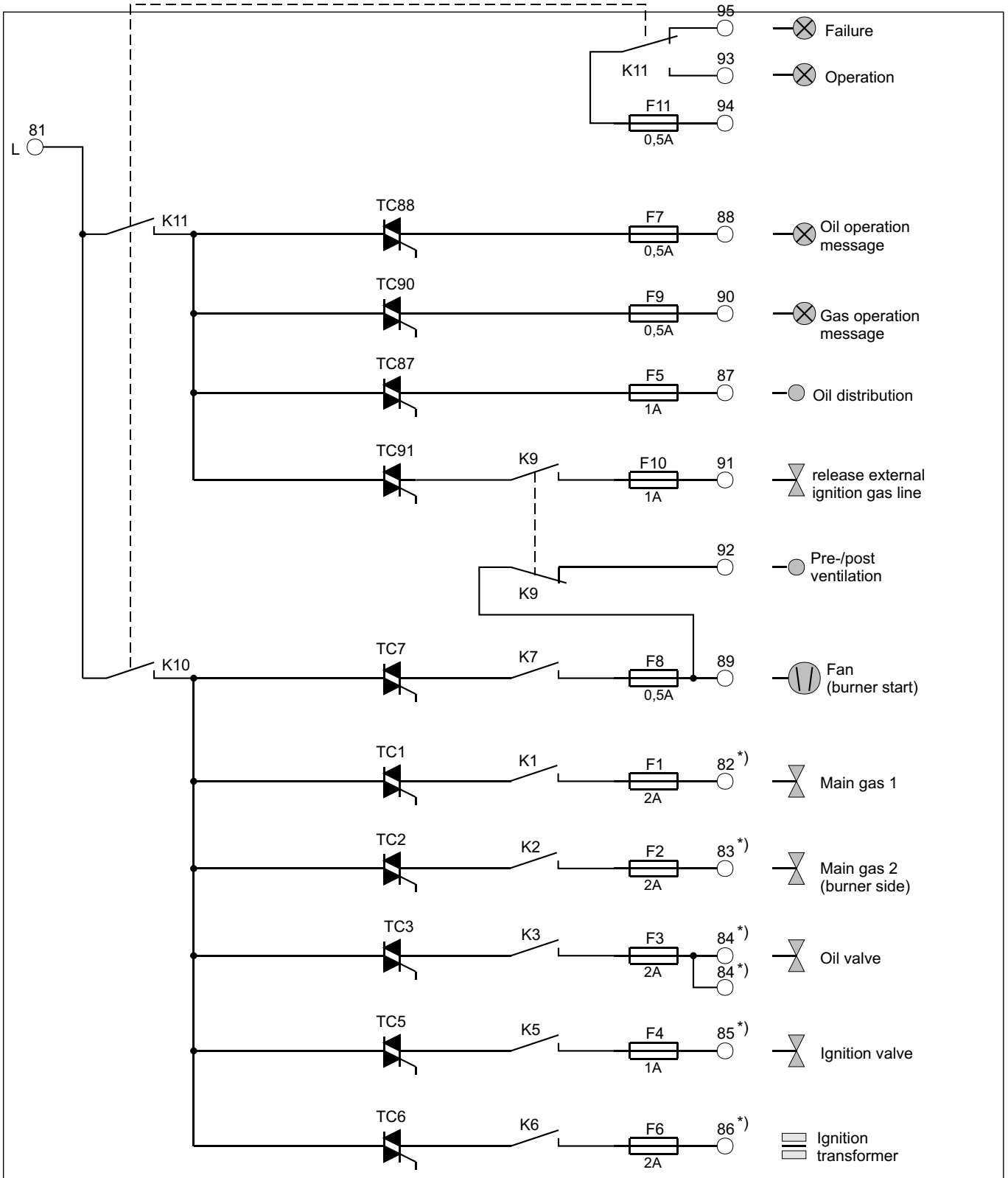


*) At terminals 82 through 86 an alternating testing current must flow. Otherwise the relais module will switch off all outputs during the self-test which forces the FMS to do a fault-shutdown. At a mains voltage of 230V an impedance of Z<=100k is required. At 110V Z must be 22k or less. If necessary connect an appropriate auxiliary load (as a resistor or RC element). Outputs which are not switched on by the FMS (e.g. ignition valve when starting without ignition burner) need no auxiliary load.

Contact plan, relay module type 6 60 R 0016 (since August 2006)

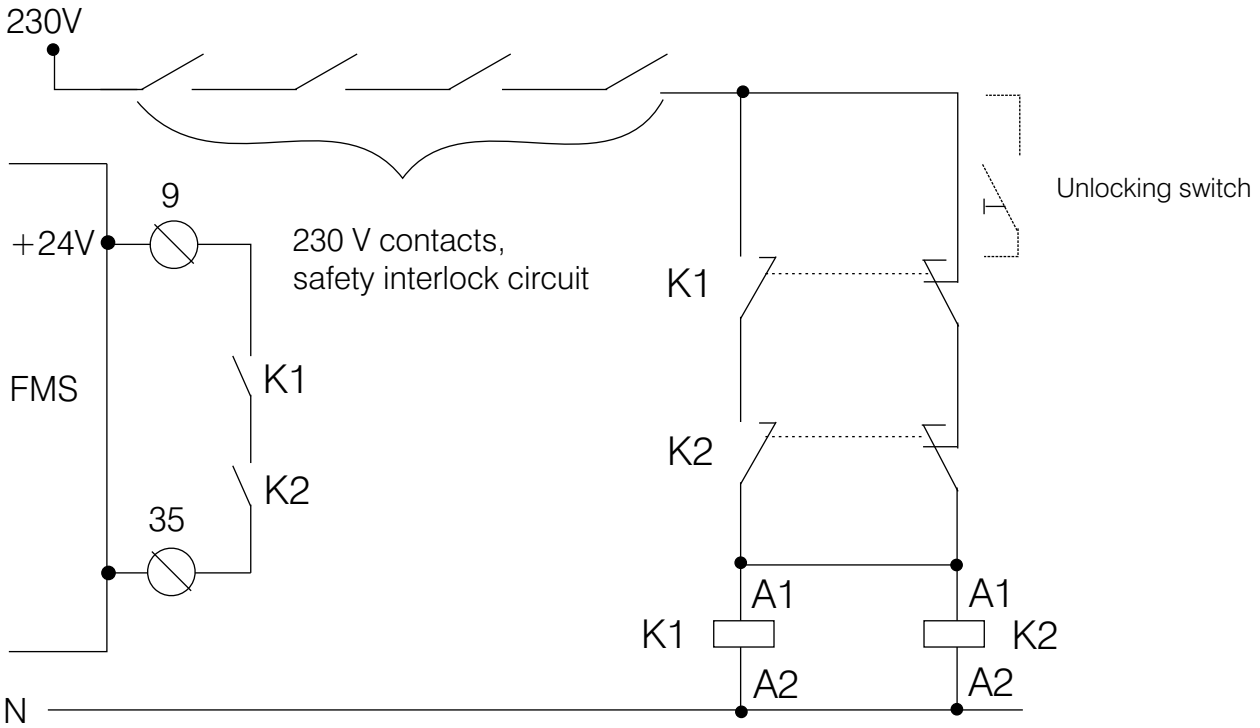


Contact plan, relay module type 6 60 R 0016 (since August 2006)



*) At terminals 82 through 86 an alternating testing current must flow. Otherwise the relais module will switch off all outputs during the self-test which forces the FMS to do a fault-shutdown. At a mains voltage of 230V an impedance of Z<=100k is required. At 110V Z must be 22k or less. If necessary connect an appropriate auxiliary load (as a resistor or RC element). Outputs which are not switched on by the FMS (e.g. ignition valve when starting without ignition burner) need no auxiliary load.

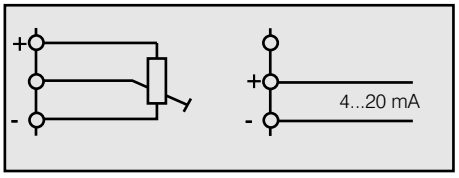
Example safetz interlock chain 230 V



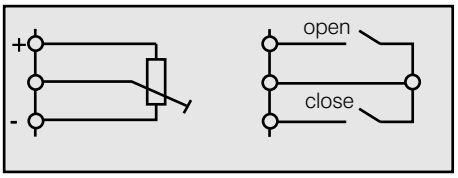
K1 and K2 must be diversitary, with overlapping contacts

The following circuit diagrams are universal. They do not go into the use of the respective channels.
In addition all analog inputs (except correction) are drawn for potentiometer connection. If current is used as input quantity on some channels, however, the respective inputs are to be wired as shown below.

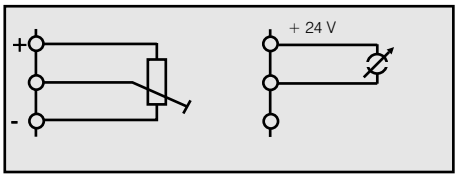
Where current is used as feedback signal in place of a potentiometer:



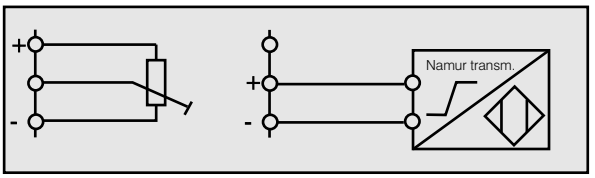
Where a three-point step signal from the load control unit is used as load input, the contacts are to be connected as follows in place of the load potentiometer:



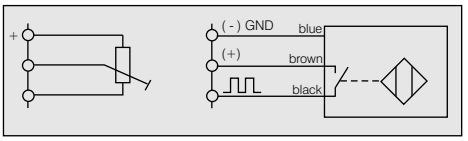
Where a 4-20 mA unit is to be supplied with 24 V.



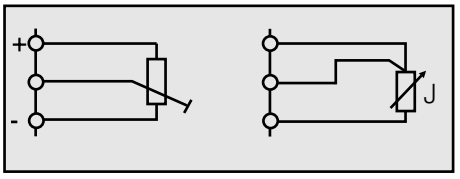
Where the speed feedback is not by way of 0/4 … 20 mA but through integral speed sensing (direct switching of a Namur transmitter)



Where the speed feedback is not by way of 0/4 … 20 mA but through integral speed sensing (iductive sensor with three wire system)



Where an input is configured as PT 100.

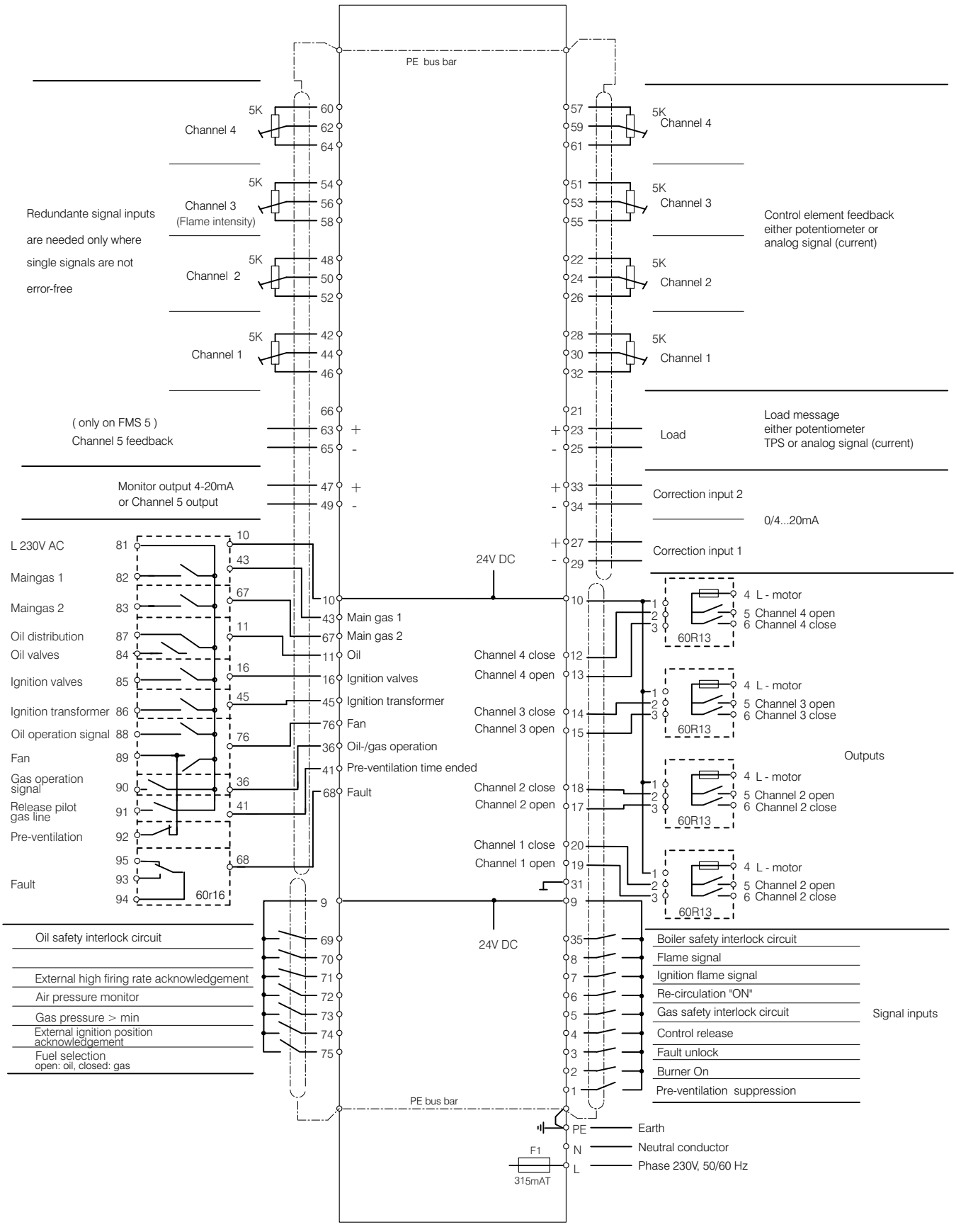


The pin-compatible 6 60 R 0131 relay module may also be used Instead of the 6 60 R 0013 relay module shown.

If the 6 60 R 0019 is used instead for the actuation of dc motors, terminal 4 of the relay module must also be connected to terminal 31 of the FMS.

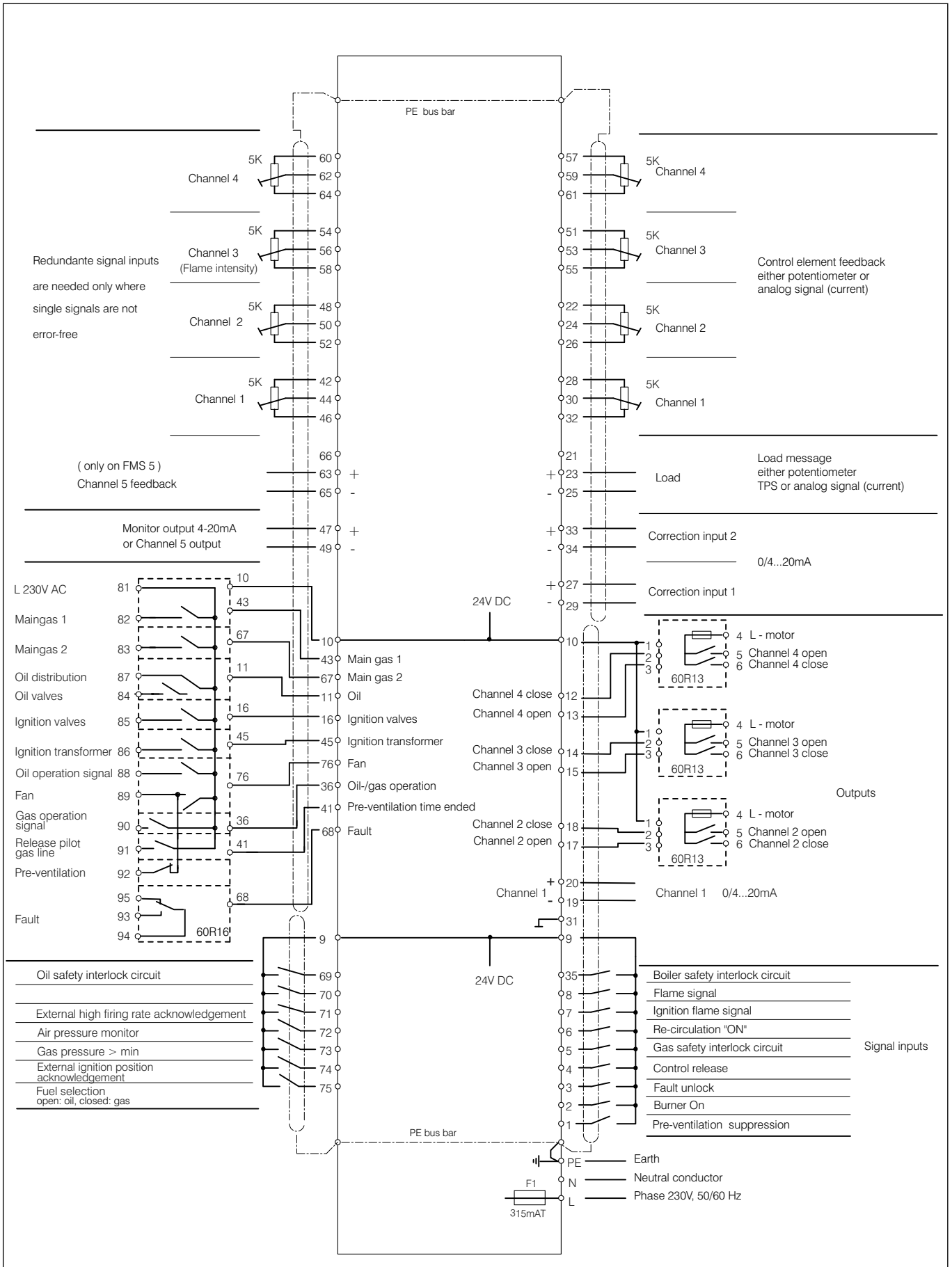
The digital signals can also be pre-set via the 230 V signal input module instead of via floating contacts (6 60 R 0018).

FMS 4 Type 6 64 F 0010 with 4 three-point step control outputs
FMS 5 Type 6 65 F 0010 with one continuous control and 4 three-point step control outputs



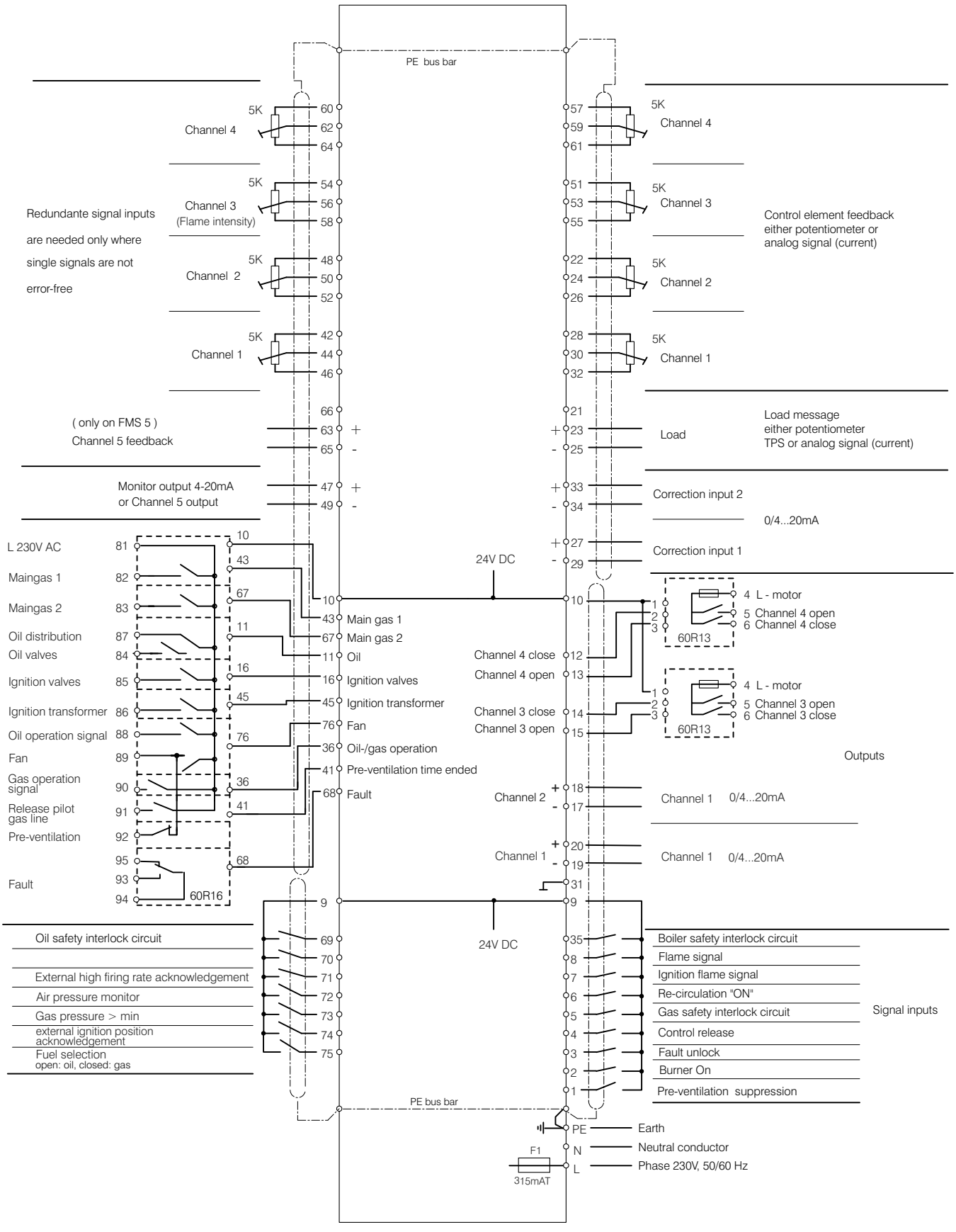
To be used only in a grounded power line network!

FMS 4 Type 6 64 F 0020 with one continuous control and 3 three-point step control outputs
FMS 5 Type 6 65 F 0020 with two continuous control and 3 three-point step control outputs



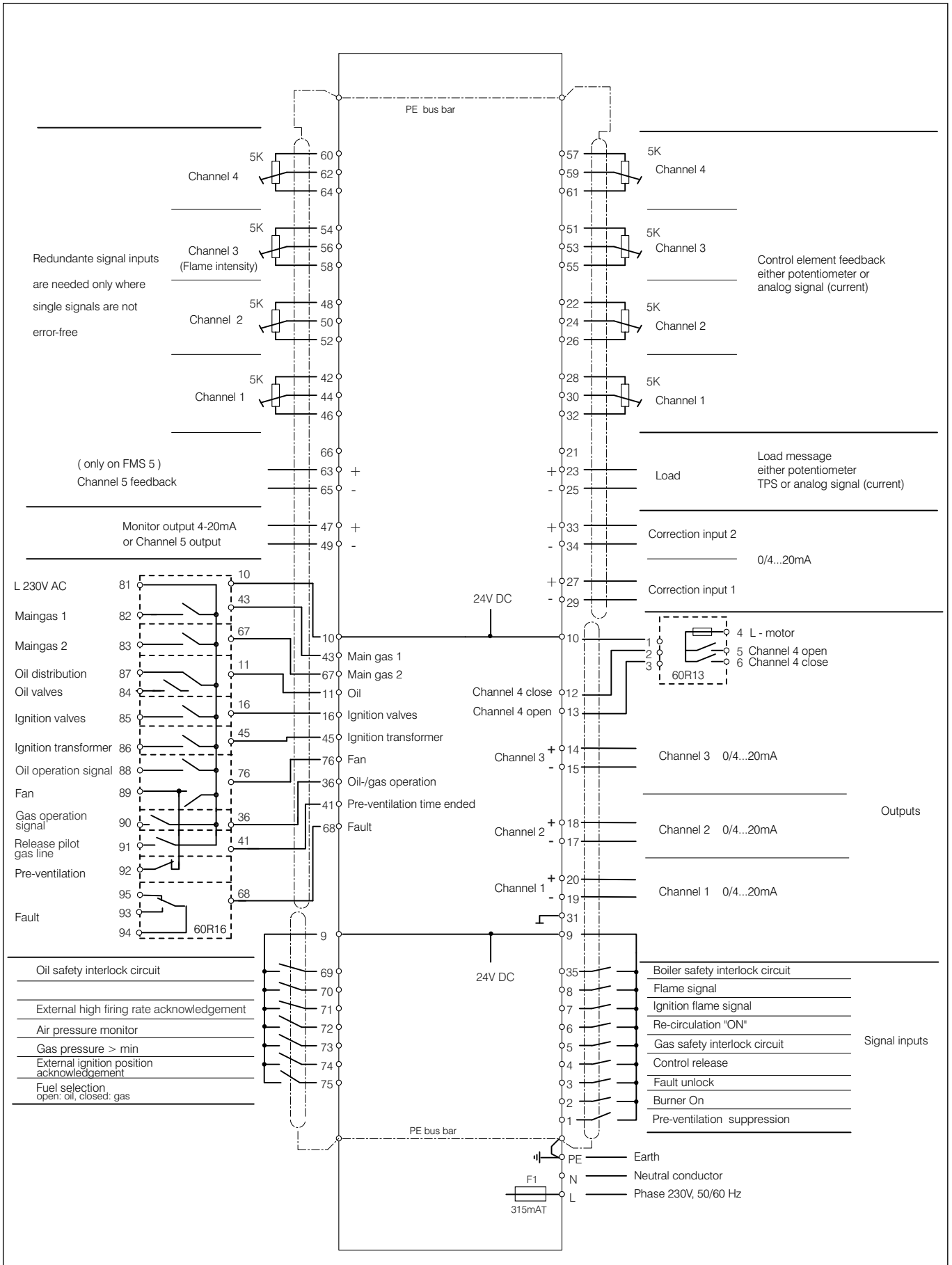
To be used only in a grounded power line network!

FMS 4 Type 6 64 F 0030 with two continuous control and 2 three-point step control outputs
FMS 5 Type 6 65 F 0030 with three continuous control and 2 three-point step control outputs



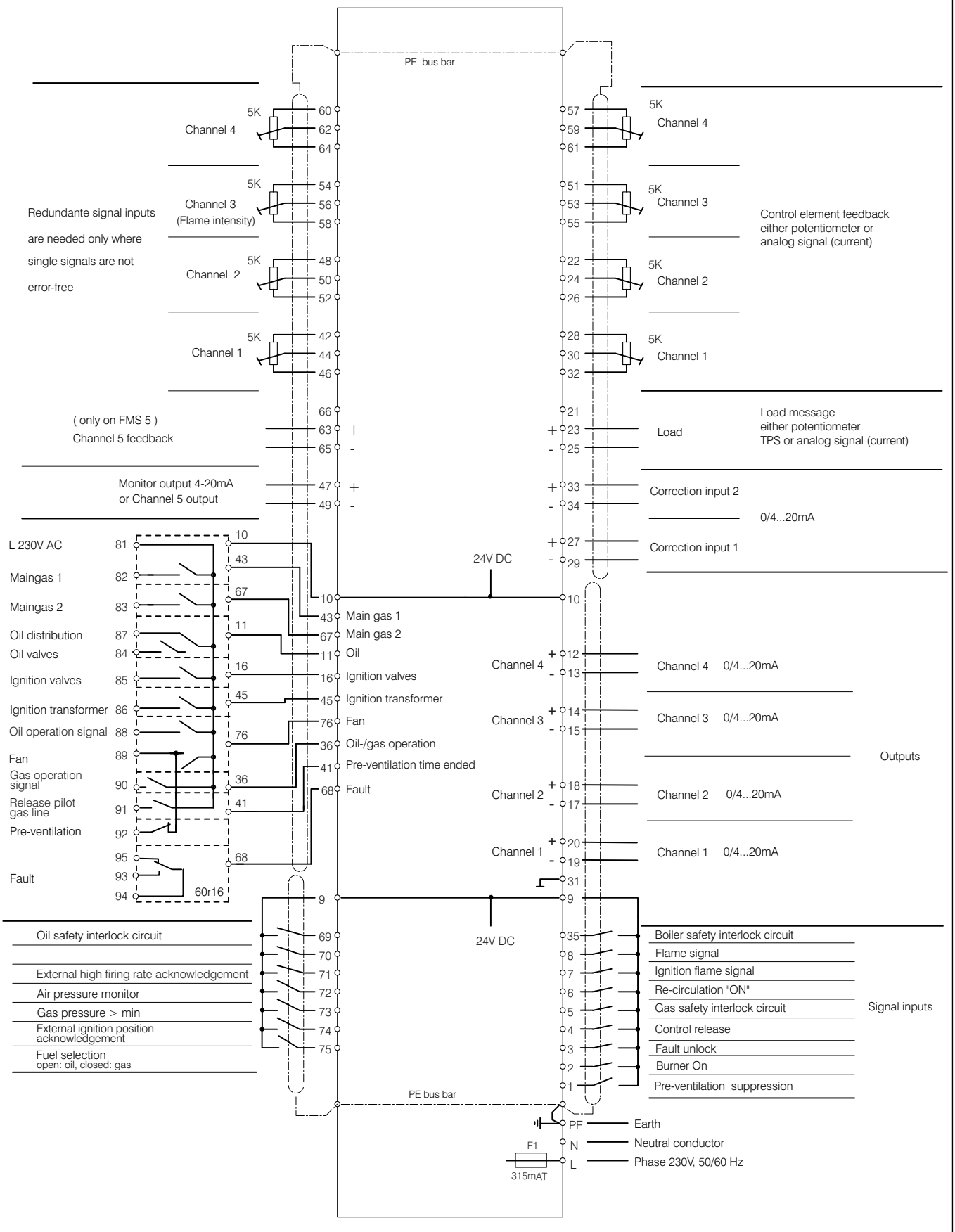
To be used only in a grounded power line network!

FMS 4 Type 6 64 F 0040 with 3 continuous control and one three-point step control outputs
FMS 5 Type 6 65 F 0040 with 4 continuous control and one three-point step control outputs



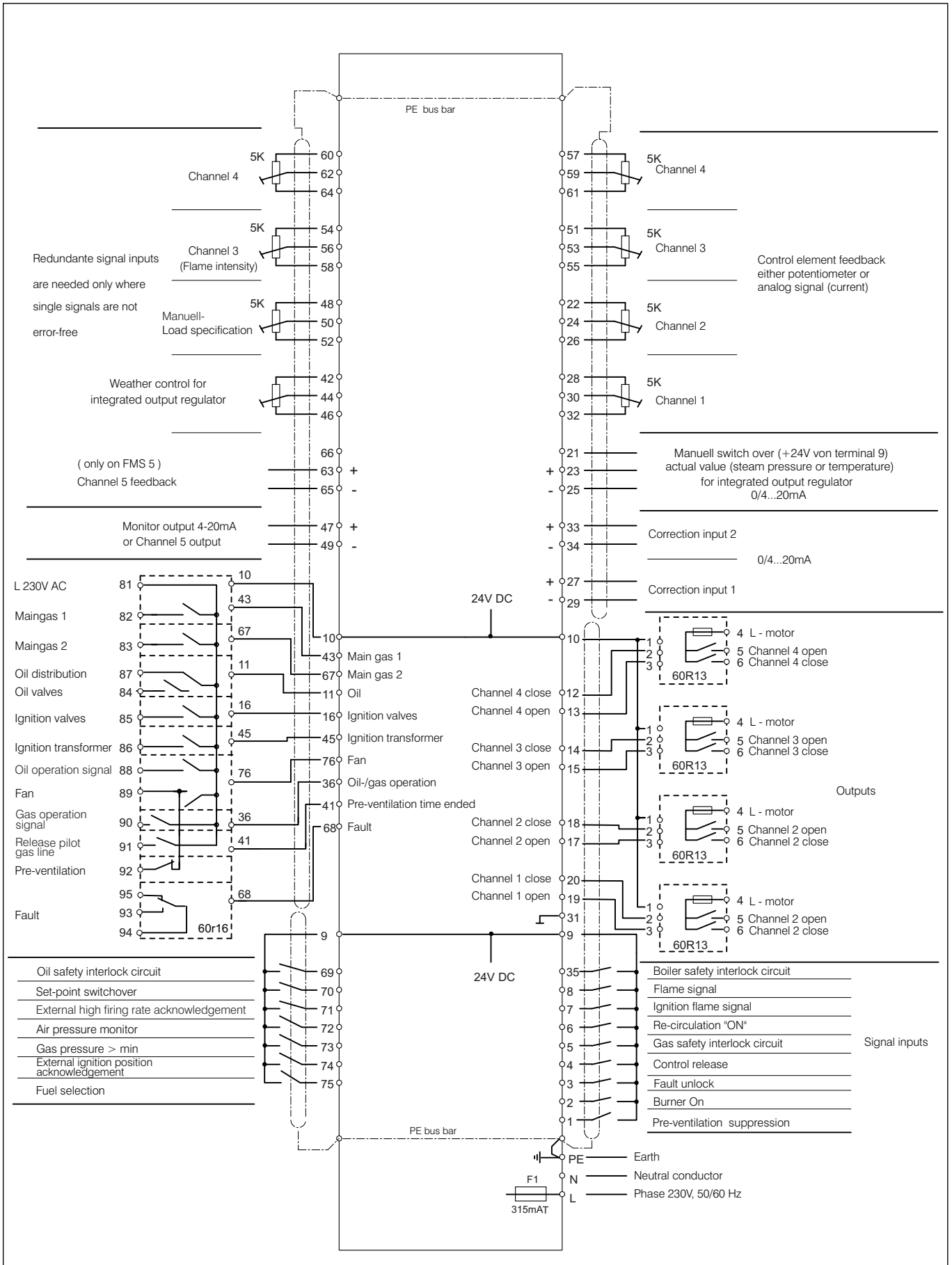
To be used only in a grounded power line network!

FMS 4 Type 6 64 F 0050 with 4 continuous control outputs
FMS 5 Type 6 65 F 0050 with 5 continuous control outputs



To be used only in a grounded power line network!

FMS 4 / FMS 5 Connection Diagram with Output regulator



To be used only in a grounded power line network!

Since July 2003
the configration card
has changed

A configuration card can be integrated into theFVMS that permits switching on a r.p.m. sensor as a two wire system or a company Turck inductive sensor with switch terminals as a three wire system for r.p.m. data feedback. There are 4 speed/pulse rages aviable (settings ex factory)

Normal range ≙ 164 to 819 points (+/-5)

I	30	300	pulses / min.
II	600	7200	pulses / min.
III	300	3600	pulses / min.
IV	30	300	pulses / min.

Upper limit - lower limit ≙ 152 to 991 points (+/-5)

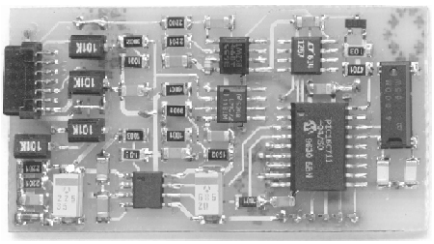
I	20	350	pulses / min.
II	355	8430	pulses / min.
III	175	4220	pulses / min.
IV	40	700	pulses / min.

If the set pulse range is exceeded the value remains at the upper end of the range (higher pulse numbers are ignored).
The standard setting is range III (i.e. on motors with 3000 rpm at 50 Hz, 1 pulse per revolution)

Make sure that the selected measuring range is not exceeded, otherwise speed changes in excess of this will no longer be detected

Below the measuring range the signal goes to approx. 0-7 digit, see Aids: E12.

Technical Data



Namur input:	U_0 = 8.2 V; I_k = 8.2 mA, +/- 5%
- make threshold:	max 1.98 mA (type 1.8 mA) +/- 5%
- break threshold:	max. 1.62 mA (type 1.4 mA) +/- 5%
- linearity error:	≤ 0.1 %
- temperature drift	≤ 75 ppm/K (type. 60ppm/K)
Measuring method:	period duration measurement over 5 periods
Input pulse width:	> 200 µs
Temperature range:	0 … 60°C
Useable Namur transmitter:	all Turck sensors, which contain Y0 or Y1 in their type designation

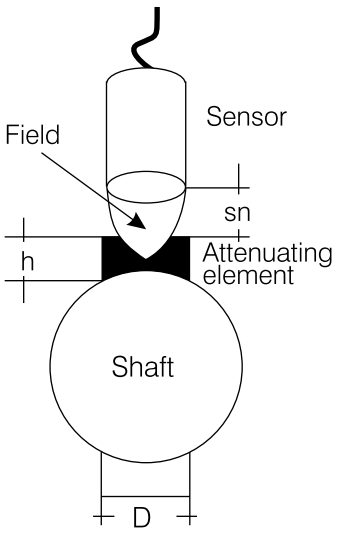
Owing to the large number of useable transducers LAMTEC has only one two wire element and ona three wire element in the range.
It is selected so as to cover a number of measuring tasks.
Other transducers only on enquiry or direct from company Turck.

663 R 8101	r.p.m. sensor as a two wire system d= 12mm, switch gab 2mm
663 R 8103	inductive sensor with switch terminals in three wire system d=12mm, switch gab 4mm

Selecting a suitable sensor for rev. speed monitoring

The correct sensor should always be selected, taking into account the structural features of the element to be measured.

Since this element is not always known, the following is an approximation procedure for dimensioning the attenuating elements and selecting a suitable sensor.



In most cases, a shaft is sensed directly. One or several attenuating elements (screw-heads or metal plates) are attached directly to the shaft. A symmetrical arrangement should be ensured, since many instruments work on the principle of measuring the period , and in the case of more than one attenuating element require 100% equal intervals between them. If this cannot be guaranteed, the signal can exhibit jumps (asymmetry can become particularly noticeable in analogue signals). This problem can be solved by installing only one attenuating element (this is the standard setting for rev. speed capture in the FMS).

The illustration (left) shows a typical arrangement of attenuating element, sensor and shaft.
How the system works:
Every inductive sensor forms an electric field at its active surface, from which the contact gap (nominal contact gap "Sn") can be derived as a function of sensor size. The table lists several typical sensors with their characteristics. The effective contact gap is 0.8 x nominal contact gap in the case of structural steel. An additional correction factor that depends on the material must be included for other materials. These factors are specified in the sensor manufacturer's data-sheets.

The installation distance between the sensor and the attenuating element's upper edge should be Sn/2 (half the nominal contact gap). The sensor's diameter depends on the required nominal contact gap and can be derived from the table. The attenuating element's diameter should be equal to or greater than the sensor's diameter (for frequencies < 20% of the sensor's maximum switching frequency). If the attenuating element is too small, this can cause problems at high rev. speeds since the element cannot be detected.

The attenuating element's height should be at least 3/4 of the nominal contact gap. If this value cannot be ensured, the sensor may detect the shaft or it is pre-attenuated by the shaft to such an extent that reliable rev. speed measurement cannot be guaranteed. This error too, may become noticeable only at higher rev. speeds.

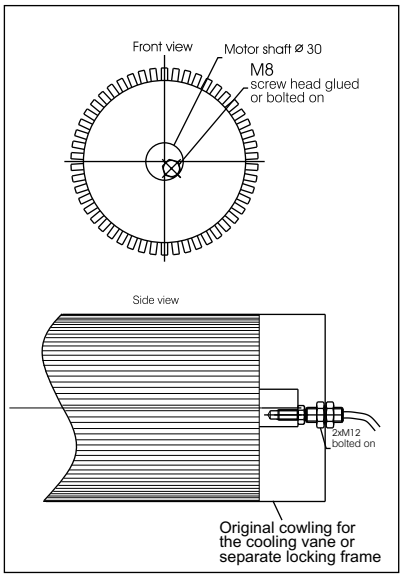
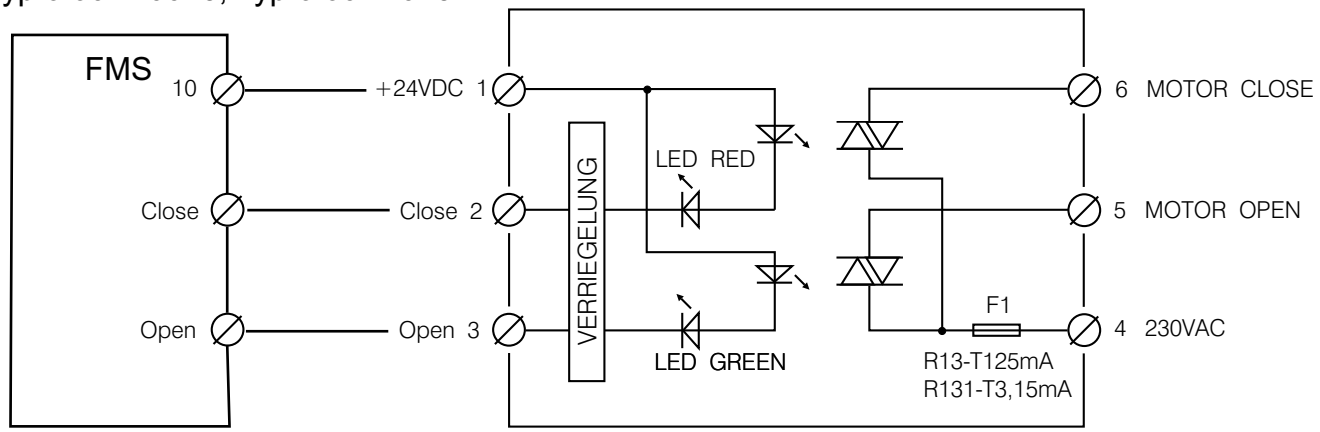


Illustration: Example of attaching an attenuating element (bolt M8) to the motor shaft's end-face

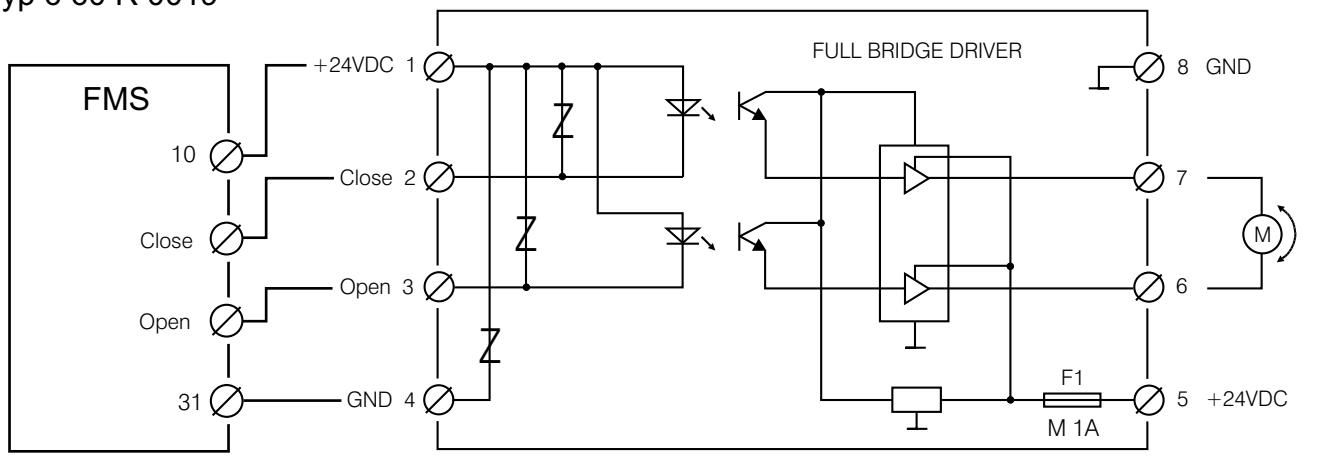
Selective list of Turck NAMUR sensors

Typ	sn [mm]	sn x 0,8 [mm]	D [mm]	f [Hz]	Installation
Bi1-EG05-Y1	1,0	0,8	5	5.000	flush
Bi1,5-EG08K-Y1	1,5	1,2	8	5.000	flush
Ni3-EG08K-Y1	3,0	2,4	8	5.000	non-flush
Bi2-G12-Y1	2,0	1,6	12	5.000	flush
Ni5-G12-Y1	5,0	4,0	12	2.000	non-flush
Bi5-G18-Y1	5,0	4,0	18	1.000	flush
Ni10-G18-Y1	10,0	8,0	18	500	non-flush
Bi10-G30-Y1	10,0	8,0	30	500	flush
Ni15-G30-Y11	15,0	12,0	30	200	non-flush

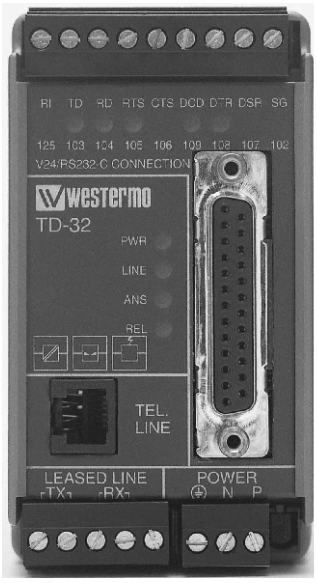
Typ 6 60 R 0013, Typ 6 60 R 0131

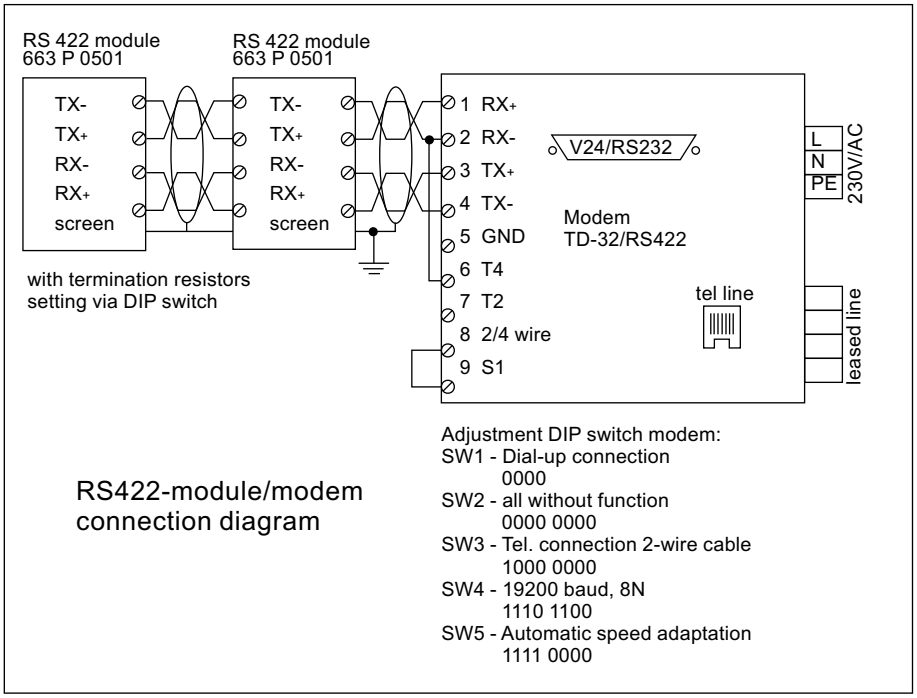


Typ 6 60 R 0019



Also possible is a connection between FMS via modem.
The industrial modem (optional) for mouting top hat rail makes possible to access to 31 units at the same time with the Windows PC software. This allows to realize a remote control of the operating mode of the units. The wiring between modem and RS422 module (interface adapter) provided by the customer. The cable should be 4-wire, twisted and screened.

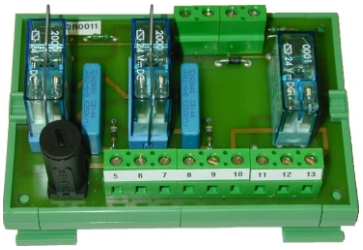




RS422-module/modem
connection diagram

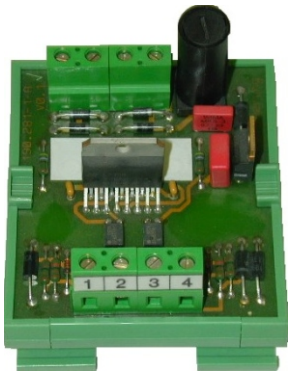
Adjustment DIP switch modem:
SW1 - Dial-up connection
0000
SW2 - all without function
0000 0000
SW3 - Tel. connection 2-wire cable
1000 0000
SW4 - 19200 baud, 8N
1110 1100
SW5 - Automatic speed adaptation
1111 0000

6 60 R 0013

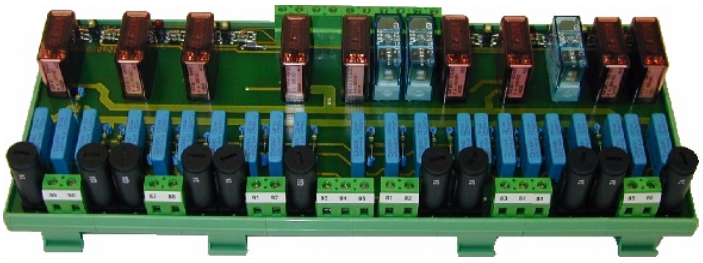


6 60 R 0011

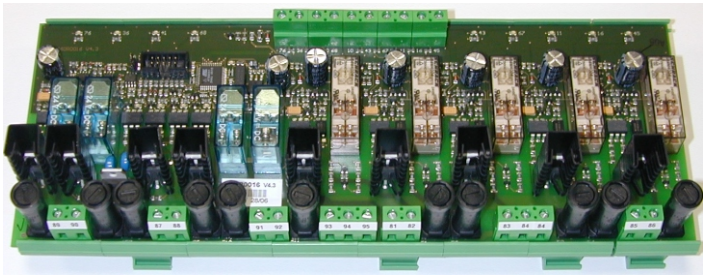
6 60 R 0131



6 60 R 0019



6 60 R 0016 bis August 2006



6 60 R 0016 V4.3 ab August 2006

Relay module Type 6 60 R 0011
For three-point-step control output
Mechanical relay
L112 x W 70 x D 70 mm
Characteristics:
Continuous current 3.15 A
Wear dependent on the
connected motor load

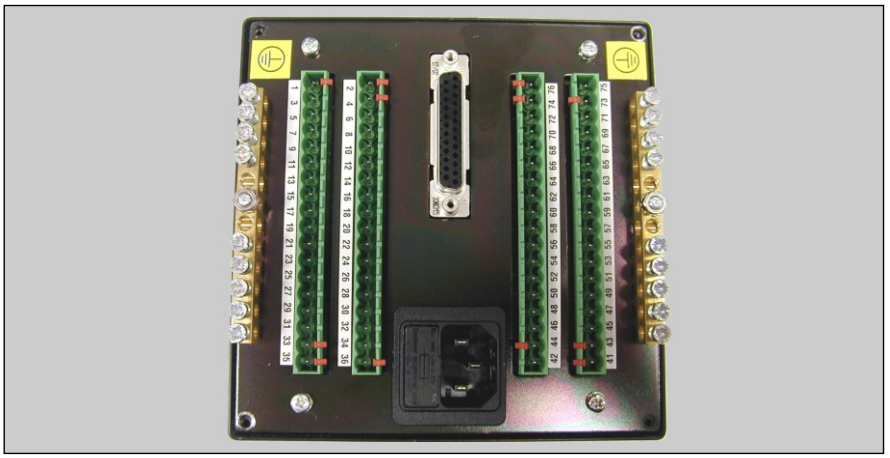
Relay module Type 6 60 R 0013
For three-point-step control output
For motors with a torque
less than/equal to 20 Nm
(but dependent on internal
motor construction)
Wear-free electronic relay
L77 x W 70 x D 60 mm
Characteristics:
Leakage current max. 5 μA
Continuous current max. 0.05A

Relay module Type 6 60 R 0131
For three-point-step control output
For motors with a torque
greater than 20 Nm
Wear-free electronic relay
L77 x W 70 x D 80 mm
Characteristics:
Leakage current max. 5 mA
Continuous current max. 5A

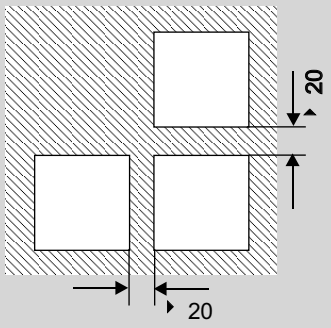
Relay module Type 6 60 R 0019
For three-point-step control output
For dc motors with 24 V voltage
Wear-free electronic relay
Characteristics:
L77 x W 70 x D 70 mm
Continuous current max. 0.8A

Relay module Type 6 60 R 0016 / 0016 V4.3
For actuation of the burner elements
Gas valve 1
Gas valve 2
Oil valves
Ignition valve
Ignition transformer
Oil operation signal
Gas operation signal
Fan
Heated oil distribution
External pilot gas line
Pre-ventilation/Post-ventilation
Fault message
Characteristics>
L111,5 x W 286 x D 57.5 mm
L 104 x B 165 x T 70 mm

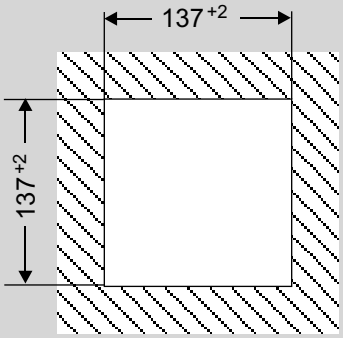
Dimensions (L x W x D) mm:		
FMS 4 / FMS 5 Combustion Management System		147 x 147 x 328
Mounting depth		295
Relay module 6 60 R 0011 (not shown)		77 x 112 x 70
Relay module 6 60 R 0013		77 x 70 x 60
Relay module 6 60 R 0131		77 x 70 x 80
Relay module 6 60 R 0019 (not shown)		77 x 70 x 60
Relay module 6 60 R 0016		110 x 289 x 60
Weight:		
FMS 4 / FMS 5 Combustion Management System		3.4 kg
Relay module 6 60 R 0013		0.1 kg
Relay module 6 60 R 0131		0.18 kg
Relay module 6 60 R 0016		0.75 kg
Protection class to		
DIN 40 050:	FMS 4 / FMS 5 Combustion Management System	IP 40
	Relay module	IP 00
Installation:	FMS 4 / FMS 5 Combustion Management System	Panel mounting
	Relay module	Cabinet mounting, mounting rail/top hat rail
	Position of use	any

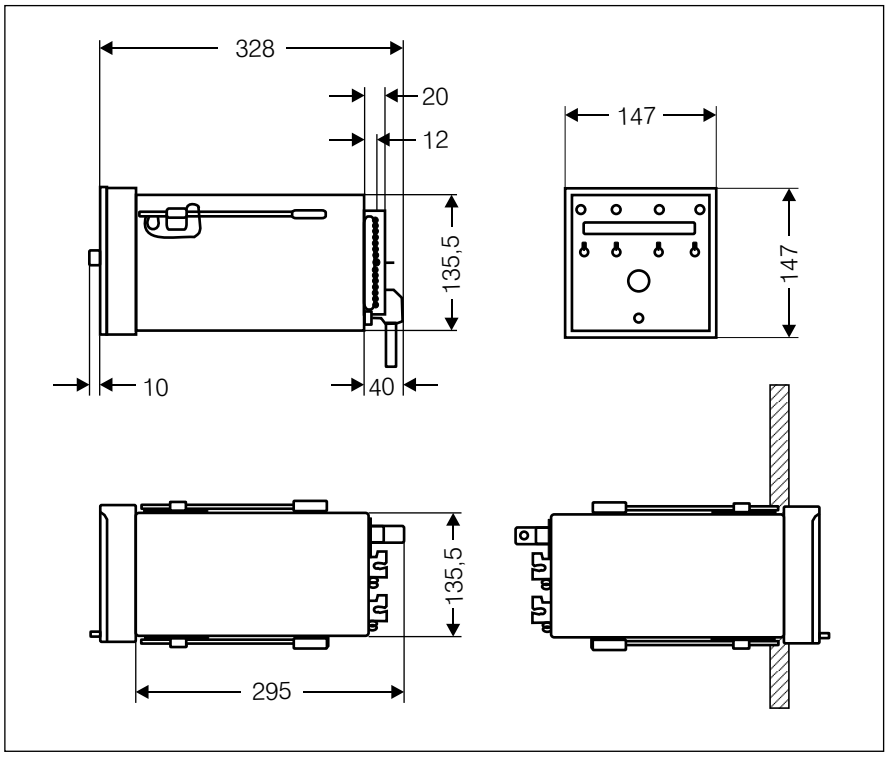


Minimum intervals
with more than one cut-outs



Single cut-out





Voltage supply:	230V + 10% - 15% 50/60 Hz To be used only in a grounded power line network!
Power input:	approx. 34 VA
Ambient temperature: Operation:	+ 0°C … +60°C
Transport and storage:	-25°C … +60°C
Display:	Alphanumeric display, 16-digit switchable to set-point, load rating, status, actual value feedback, set-point feedback, digital inputs, continuous control output value, correction input and correction range. Running text display
Admissible ambient humidity:	Class F, DIN 40 040
Inputs and outputs:	16 Digital inputs 8-16 Digital outputs 1-5 Analog outputs 12 Analog inputs all carrying a potential
Digital signal inputs:	16 via floating 24 V DC contact, or optionally via 230 V module, type 6 60 R 0018 The parasitic capacitance of the 2,2 μF line connected to the digital inputs must not be exceeded by the FMS self-tests. The line length should be limited to 100 m.
Load default:	Either potentiometer 1-5 kW, current signal (0/4 … 20 mA) or three-point step control output Optional: PT 100 direct switching
Feedback inputs:	Either potentiometer 1-5 kW, current signal (0/4 … 20 mA) Optional: Namur transmitter direct switching
Control outputs:	4 or 5 either continuous or three-point step, on FMS 5 channel 5 fixed continuous
Resolution: each analog input	999 points, 10 bit
Three-point step: Recommended running time of servo drives:	30 s … 60 s
Continuous control output: Apparent ohmic resistance:	0 … 10 V > 5 kΩ 0/4 … 20 mA < 600 Ω

Signal outputs

Monitor output:	4 … 20 mA signal, apparent ohmic resistance > 600 Ω
Correction inputs:	2, adjustable to 0 … 20 or 4 …20 mA channel and effect adjustable via parameters
Digital outputs via relay module R 16	(Contact material AgCdO, designed for 230 V AC switching voltage)

NOTE:
Only passive or non-reactive units may be connected to the outputs of the R 0016 relay module. Any infeed of 230 V into the unit via terminals 82 - 92 in the event of a fault must be prevented.

230 V supply terminal 81	All consumers connected to the R 16 relay module are supplied via this terminal. It is to have fuse protection provided by the customer in the form of a max. 16A delayed action fuse.
Main gas 1 terminal 82	Contact for actuation of the gas line-side main gas valve max. 2A, cos j ≥ max. 0.4
Main gas 2 terminal 83	Contact for actuation of the burner-side main gas valve max. 2A, cos j ≥ max. 0.4
Oil terminal 84	Contact for actuation of the two oil valves max. 2A, cos j ≥ max. 0.4
Ignition valves terminal 85	Contact for actuation of the ignition valve(s) max. 2A, cos j ≥ max. 0.4
Ignition transformer terminal 86	Contact for actuation of the ignition transformer max. 2A, cos j ≥ max. 0.2
Fan (burner start) terminal 89	Contact for actuation of the fan motor and all other components that have to be activated at the start max. 2A, cos j ≥ max. 0.8-1 (together with pre-ventilation signal)
Gas operation signal terminal 90	Contact for signalling of the fuel selection. Not active in the off-state max. 0.5A, cos j ≥ max. 0.8-1
Oil operation signal terminal 88	Contact for signalling of the fuel selection. Always active in the off-state max. 0.5A, cos j ≥ max. 0.8-1
Heated oil distribution terminal 87	Contact for actuation of oil pre-heating. Active in oil operation from the burner start to the main valve release max. 2A, cos j ≥ max. 0.8-1
External pilot gas line terminal 91	Contact for actuation of the shut-off valve of a more remote pilot gas supply. Active from end of pre-ventilation to main valve release max. 2A, cos j ≥ max. 0.4 If the contact is not needed for this purpose, the terminal must remain free (e.g. in systems without pilot burner)
Pre-ventilation / Post-ventilation terminal 92	Contact for signalling of the pre-ventilation or post-ventilation mode max. 0.5 A, cos j ≥ max. 0.8-1 (together with fan)

Fault terminal 93	Contact for signalling of a fault condition. Signalling follows only after closing of the main valves (normally open contact, floating) max. 0.5 A, cos j = 0.8-1
Fault terminal 95	Contact for signalling of a fault condition. Signalling follows only after closing of the main valves (normally closed contact, floating) max. 0.5 A, cos j = 0.8-1
Fault terminal 94	Supply input for fault contact 24 V DC or 230 V AC
Times:	Pre-ventilation time adjustable from 30 999 sec. (shorter times also available for special plant) 1st safety period: Oil 4 sec. * 1st safety period: Gas 4 sec. * 2nd safety period: Oil 4 sec. * (when starting without pilot burner = safety period) 2nd safety period: Gas 3 sec. * (when starting without pilot burner = safety period) other safety times also available for special plant)
Storage of set-point values and variable data:	In EEPROM up to 20 points per curve with linear interpolation
Number of curve sets:	2 per channel (e.g. for oil/gas combination burner) Optional 4 (2 for oil and 2 for gas)
Pre-setting the operating condition	By signals from control unit
Memory capacity:	Unlimited
Interface:	2 serial interfaces on 25-pole Sub-D connector accessible only via adapter RS 232 (standard setting 19200 baud, parity none, 8 databits, 1 stopbit) LAMTEC-SYSTEM-BUS

CAUTION!
Using the interface without adapter can damage the unit.

Plug adapter in or remove only with the voltage off.
Only connect units conforming to DIN EN 60950 / VDE 0805.

BUS connection:	Via 25-pole Sub-D connector BUS card optional for the following systems: Interbus-S (Phoenix) Profibus-DP Modbus CANopen Ethernet

* This period is exclusive of the external flame monitor's reaction time. I.e. the system's total safety period is equal to that given above + flame monitor's reaction time (usually 1 sec).

Connectable flame sensor:	Any tested flame sensor with reliable floating contact for flame signalling. If a flame sensor without approval for continuous operation is connected, the continuous operation approval for the entire system will lapse.

Accessories for FMS Combustion Management System	Novotechnik potentiometer, 5 kW, for VR, VMS/FMS TÜV-approved	6 60 P 7001
	Contelec potentiometer, 5 kW, for VR, VMS/FMS TÜV-approved	6 60 P 7003
	Contelec potentiometer, 5 kW, for VR, VMS/FMS TÜV-approved short axis for conversion of L & G motors	6 60 P 7002
	Contelec potentiometer, 5 kW, at 90° for conversion of Autoflame motors	6 60 P 7004
	Servomotor 12 Nm, running time 60 sec. at 90°, 2 limit switches, incl. TÜV-approved potentiometer	6 62 R 2110
	Servomotor 19 Nm, running time 60 sec. at 90°, 2 limit switches, incl. TÜV-approved potentiometer	6 62 R 2111
	Servomotor 30 Nm, running time 60 sec. at 90°, 3 limit switches, manual operation incl. TÜV-approved potentiometer	6 62 R 2112
	Isolation amplifier TUI21 (0…20 mA / 0…20 mA)	6 55 R 0100
	Isolation amplifier TUI21(input and output set at factory)	6 55 R 0101
	Module for 230V signal inputs	6 60 R 0018
	Module for connecting the PC remote-control software (RS 232 adapter for 25-pole Sub-D socket)	6 63 P 0600
	Remote-control software for VMS / FMS	6 63 R 9000
	Remote display software (end-user version)	6 63 R 9001
Spare parts for FMS Combustion Management System	Fuses 1A, T for VMS/FMS, 24V supply (pack of 10)	6 60 R 0110
	Fuses 3.15A, T for VMS/FMS, 230V (pack of 10)	6 60 R 0116
	Fuses 3.15A, T for relay module 6 60 R 0011/ R 0012 / R 0014 / R 0131(pack of 10)	6 60 R 0115
	Fuses 80 mA, T for relay module 6 60 R 0013 (pack of 10)	6 60 R 0113
	Fuses 2A, T for relay module 6 60 R 0016 (pack of 10)	6 60 R 0114
	Fuses 0.5A, T for relay module 6 60 R 0016 (pack of 10)	6 60 R 0117
	Spare relay for relay module 6 60 R 0011 (Open/Close)	6 60 P 0110
	Spare relay for relay module 6 60 R 0013	6 60 P 0126
	Spare relay for relay module 6 60 R 0131	6 60 P 0125
	VMS / FMS Program Up-Date	6 63 R 1100
	Edge connector, 18-pole for VMS / FMS	6 55 P 9211
	Installation fixing (pack of 2)	6 60 R 0080
	Set-point memory (EEPROM) for VMS / FMS	6 62 R 0111

Spare power supply electronics for VMS / FMS		6 63 P 0923
Spare computer electronics for VMS / FMS		6 63 P 0921
Continuous output electronics card for VMS / FMS		6 63 P 7000
Front electronics for VMS / FMS, complete		6 63 P 5000
Spare backplane for VMS / FMS		6 63 P 3000
Configuration module		
0...20mA / 4...20mA / 1-5 kW		6 63 P 6000
PT 100 module		6 57 P 0990
Speed module		6 63 P 8001
Universal module for analogue inputs:	Potentiometer 5 kW	6 63 P 6000
	0/4...20 mA	6 63 P 6001
	4...20 mA with 24 V supply for transducer	6 63 P 6002
Zero modem cable 10 m		6 63 R 0100
Extension 10 m		6 63 R 0101

EC Declaration of Conformity

Month/Year:	June / 2003
Manufacturer	LAMTEC Meß- und Regeltechnik für Feuerungen GmbH & Co KG
Address:	Impexstraße 5, D-69190 Walldorf
Product Designation:	FMS 4 / FMS 5 Combustion Management System
Type no.:	CE 0085 AS 0254

The designated product complies with the provisions of the following European Directives

Number	Subject
89/336/EEC	Electromagnetic compatibility
73/23/EEC	Electrical equipment within defined voltage limits
90/396/EEC	Gas Appliance Directive
97\23\EC	Pressure Equipment Directive

Appendix contains further information on compliance with this Directive

Affixing of CE Mark: No, since components

Plate, Date: Walldorf, 30. June 2003

Legally binding
Signature: .....

The appendices form an integral part of this Declaration
This declaration certifies compliance with the Directives quoted, but contains no assurance of the characteristics.
The safety instructions in the product documentation enclosed must be followed.
This declaration of conformity is only valid for the unit supplied, if the corresponding test numbers are affixed thereto.
Declaration of Conformity

Appendix
to the EC Declaration of Conformity
or EC Manufacturer's Declaration

Month/Year: .....06. /...03.....

Product Designation: FMS 4 / FMS 5 Combustion Management System

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The compliance of the designated product with the provisions of the above-mentioned Directives is verified by adherence to the following standards and regulations:

Harmonised European Standards:

Reference No.	
EN 298	
EN 230	
Integrated leakage test:	EN 1643

National Standards

Reference No.	
VDE 0110	
VDE 0100	
VDE 0116	
VDE 0801	AK 4 completely
	AK 5 partially
DIN VDE 160	
DIN 4788 Part 3	
Integrated output regulator: DIN 3440	

Application standards:

Reference No.	
EN 676	where applicable
EN 267	where applicable
EN 12 952-8 u.-11	where applicable
EN 12 953-7 u.-9	where applicable

Date: _____ Commissioned by: _____ Plant: _____

Location: _____ Fuel: _____

ID-No. Typ 6 _ _ _ _ _ R_ _ _ _ _ _ _ _ Correction range 1: _____

Unit-No. _____ Correction range 2: _____

Display
Main processor

Load point	Load Rating	Channel 1			Channel 2			Channel 3			Channel 4			Channel 5			O_2 value without regulation	O_2 value with regulation
		Set-point value	Feed-back		Set-point value	Feed-back		Set-point value	Feed-back		Set-point value	Feed-back		Set-point value	Feed-back			
lower range limits																		
1																		
2																		
3																		
4																		
5																		
6																		
7																		
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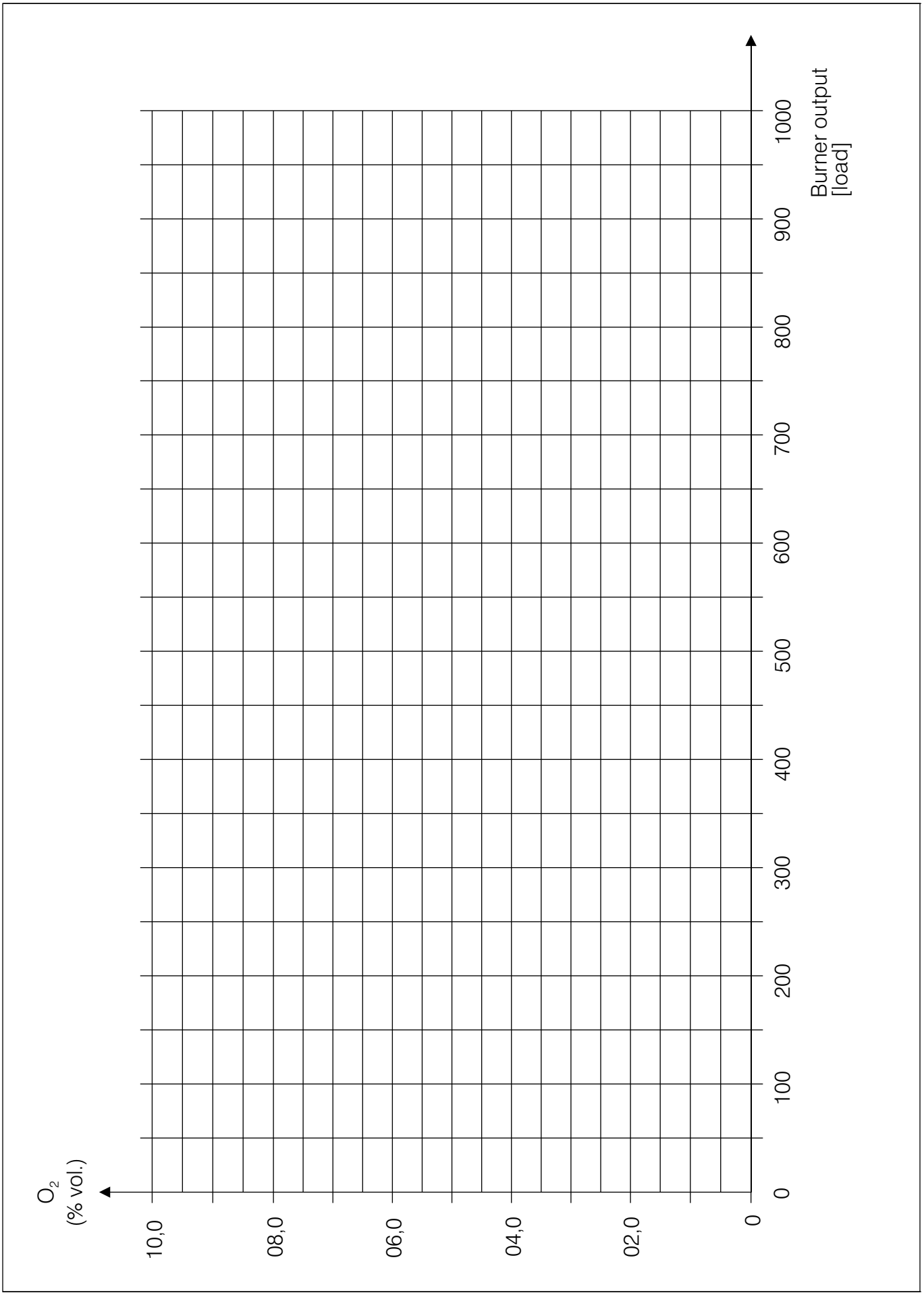
17																		
18																		
19																		
20																		
upper range limits																		


O_2
(% vol.)
10,0
08,0
06,0
04,0
02,0
0
0
100
200
300
400
500
600
700
800
900
1000
Burner output
[load]

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für Feuerungen GmbH & Co KG

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