SIEMENS

LMV51...
Burner Control with integrated Fuel / Air Ratio Control

LMV52...
Burner Control with Load Control and Oxygen Trim Control for Forced-draft Burners

Basic Documentation

The LMV5... and this Basic Documentation are intended for OEMs which integrate the system in their products!

Gilt für Software-Versionen
LMV51... : V02.20
LMV52...: V01.00
Int. LR: V01.50
Int. FU-Modul: V1.20
AZL51...: V02.50
AZL52...: V03.20
PLL52...: V01.00
CC1P7550en
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Siemens Building Technologies
HVAC Products

Contents

1 Safety notes

1.1 Warnings

Observe the following warning notes to help prevent damage to persons, property or the environment!

The LMV5... is a safety device! Do not interfere with or modify the unit. Siemens Landis & Staefa will not assume responsibility for damage resulting from unauthorized interference!

The addendum to the LMV51.2... and LMV52... documentation contain additional warning notes which should also be observed when using these system variants.

After commissioning and after each service visit, check the flue gas values across the entire load range.

The present Basic Documentation describes a wide choice of applications and functions and serves as a guideline. The correct functioning is to be checked and proven with the help of functional tests on a test rig or on the plant itself!

- All activities (mounting, installation, service work, etc.) must be performed by qualified staff
- Degree of protection IP40 as per DIN EN 60 529 for burner controls must be ensured through adequate mounting by the burner or boiler manufacturer
- Before performing any work in the connection area of the LMV5…, disconnect the unit from mains supply (all-polar disconnection)
- Protection against electrical shock hazard on the LMV5... and on all connected electrical components must be ensured through appropriate mounting
- Check to ensure that wiring is in an orderly state
- Fall or shock can adversely affect the safety functions. Such units may not be put into operation even if they do not exhibit any damage
- In programming mode, the position check of the actuators and of the VSD (checking electronic fuel / air ratio control) is different from the check during automatic operation. Like in automatic operation, the actuators are still jointly driven to their required positions. If an actuator does not reach the required position, corrections are made until that position is reached. However, in contrast to automatic operation, there are no time limits for these corrective actions. The other actuators maintain their positions until all actuators have reached their currently required positions. This is essential for setting fuel /air ratio control. This means that during the time the ratio curves are programmed, the person making the plant settings must continuously monitor the quality of the combustion process (e.g. by means of a flue gas analyzer). Also, if combustion levels are poor, or in the event of dangerous situations, the commissioning engineer must take appropriate action (e.g. switching the system off manually)

To ensure the safety and reliability of the LMV5... system, the following points must also be observed:

- Condensation and ingress of humidity must be avoided. Should such conditions occur, make sure that the unit will be completely dry again before switching on!
- Static charges must be avoided since they can damage the unit's electronic components when touched.
  Recommendation: Use ESD equipment

1.2 Mounting notes

- Ensure that the relevant national safety regulations are complied with
- In the geographical areas where DIN regulations apply, the requirements of VDE must be satisfied, especially the standards DIN / VDE 0100, 0550 and DIN / VDE 0722

1.3 Installation notes

- Ensure that the electrical wiring inside the boiler is in compliance with national and local safety regulations
- Make certain that strain relief of the connected cables is in compliance with the relevant standards (e.g. as per DIN EN 60730 and DIN EN 60 335)
- Ensure that spliced wires cannot get into contact with neighboring terminals. Use adequate ferrules
- Lay the high voltage ignition cable completely separate from all other cables
- The burner manufacturer must protect unused AC 230 V terminals with a dummy plug (refer to 2.2 Product range overview and 11.2 Suppliers of other accessory items)
- When wiring the unit, ensure that AC 230 V mains voltage cables are run strictly separate from extra low-voltage cables to warrant protection against electrical shock hazard

1.4 Electrical connection of ionization probe and flame detector

It is important to achieve practically disturbance- and loss-free signal transmission:

- Never run the detector cables together with other cables
  – Line capacitance reduces the magnitude of the flame signal
  – Use a separate cable
- Observe the permissible cable lengths
- The ionization probe is not protected against electrical shock hazard. The mains-powered ionization probe must be protected against accidental contact

1.5 Commissioning notes

- Prior to commissioning, check to ensure that wiring is in an orderly state and that the parameter are correctly set
- When commissioning the unit, check all safety functions
- There is no absolute protection against incorrect use of the RAST5 connectors. For this reason, prior to commissioning the plant, check the correct assignment of all connectors
- Electromagnetic emissions must be checked on an application-specific basis

1.6 Setting and parameter setting notes

- When adjusting the electronic fuel / air ratio control system integrated in the LMV5…, allow for sufficient amounts of excess air since – over a period of time – the flue gas settings will be affected by a number of factors (e.g. density of air, wear of the actuating devices, etc.). For this reason, the flue gas values initially set must be checked at regular intervals
- To provide protection against inadvertent or unauthorized parameter transmission between the parameter backup memory of the AZL5... display and operating unit and the LMV5... basic unit, the OEM [1]) must enter an individual burner identification (ID) for each burner. Compliance with this regulation is mandatory to ensure that the LMV5… system will prevent parameter sets from other plant (with unsuited and possibly dangerous parameter values) to be transmitted to the LMV5… basic unit via the backup memory of the AZL5... (also refer to the description of burner identification in chapter 7 Display and operating unit AZL5...)

  [1]) OEM = burner or boiler manufacturer

- With the LMV5..., it is to be noted that the unit's characteristics are determined primarily by the specific parameter settings rather than by the type of unit. This means that, among other things, each time a plant is commissioned, the parameter settings must be checked and the LMV5... may not be transferred from one plant to another without adapting the parameter settings to the new plant
- In the case of dual-fuel burners and oil-firing, the short preignition (Phase 38) parameter *OnTmeOilIgnition* is to be selected and a magnetic clutch is to be used, thus ensuring that there will be no oil pressure until this phase is reached. Then, the long preignition (from Phase 22) must be parameterized
- When using the ACS450 PC software, the safety notes given in the relevant Operating Instructions (CC1J7550) must also be observed
- A password protects the parameter setting level against unauthorized access. The OEM allocates individual passwords to the setting levels he can access. The standard passwords used by Siemens Landis & Staefa must be changed by the OEM. These passwords are confidential and may only be passed on to persons authorized to access such setting levels
- The responsibility for setting the parameters lies with the person who – in accordance with his access rights – has made changes to the respective setting level

In particular, the OEM will assume responsibility for the correct parameter settings in compliance with the standards covering the specific applications (e.g. EN 676, EN 267, EN 1643, etc.).

1.7 Norms and standards

- Conformity with EEC directives
  - – Electromagnetic compatibility EMC (immunity) 89 / 336 EEC
  - – Directive for gas appliances 90 / 396 EEC
  - – Low-voltage directive 73 / 23 EEC

1.8 Service notes

- Each time a unit has been replaced, check to ensure that wiring is in an orderly state
- **If fuses are blown, return the complete unit to Siemens Landis & Staefa**

1.9 Disposal notes

The unit contains electrical and electronic components and may not be disposed of together with household waste. Legal and currently valid legislation must be observed.

2 General

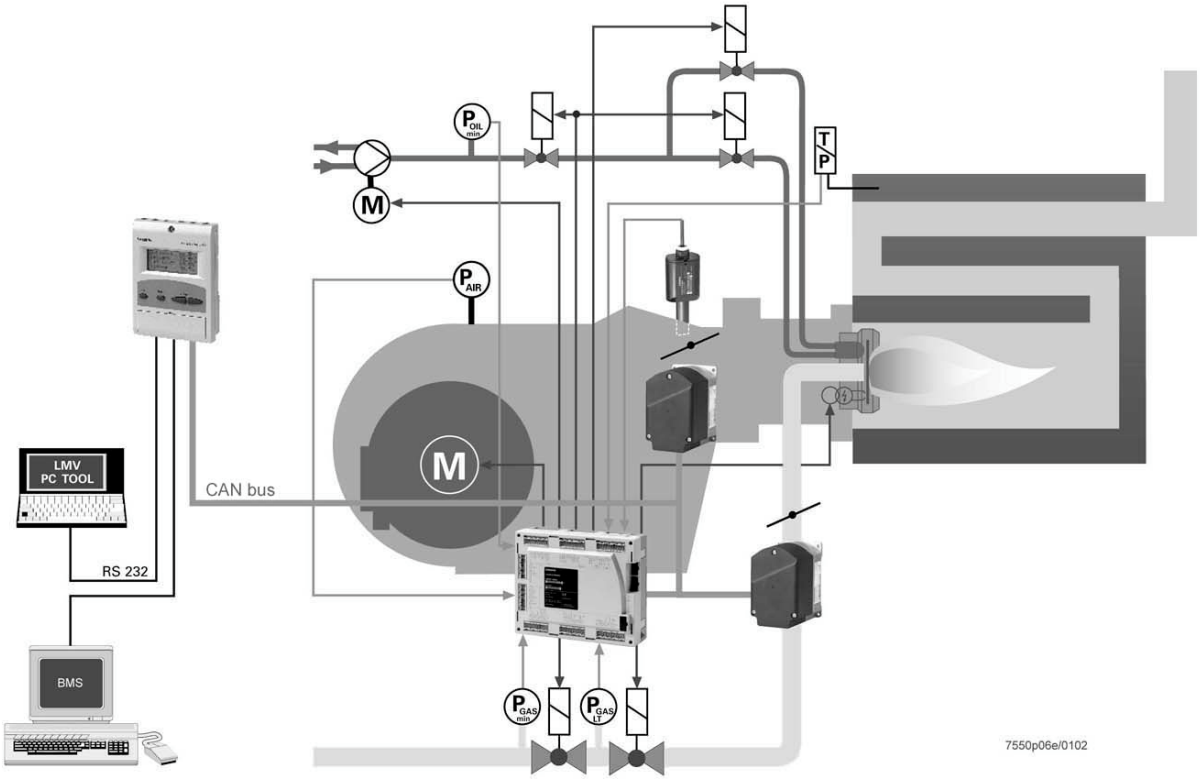
2.1 Brief description

The LMV5... is a microprocessor-based burner management system with matching system components for the control and supervision of forced draft burners of medium to large capacity.

The following components are integrated in the basic unit of the LMV5...:
- Burner control with gas valve proving system
- Electronic fuel / air ratio control system for a maximum of 4 actuators
- Optional PID temperature / pressure controller (load controller)
- VSD module

The system components (display and operating unit AZL5..., actuators, O2 module, etc.) are interconnected via a bus system. Communication between the individual CAN bus users takes place via a reliable, system-based data bus.
The safety concept makes use of 2 microprocessors for 2-channel signal processing. It offers a very high level of safety and reliability for monitoring the software and the program and control sequences.
All safety-related digital outputs of the system are permanently monitored via a contact feedback network.
For flame supervision in connection with the LMV5..., universal infrared flame detectors type QRI... or ionization probes can be used for continuous operation, and photoresistive flame detectors type QRB... for intermittent operation.

Basic diagram



Example: Dual-fuel burner
- Gas: Modulating
- Oil: 2-stage

The burner management system is operated and programmed with the help of the display and operating unit AZL5... or a PC tool.

The AZL5… with LCD cleartext and menu-driven operation affords straightforward operation and targeted diagnoses.

For making diagnoses, the LCD shows the operating states, the type of fault and the point in time the fault occurred.
The parameter setting levels for the burner / boiler manufacturer and heating engineer are password-protected to prevent unauthorized access.

Basic settings that the plant operator can make on site do not demand a password.

Also, the AZL5... is used as an interface for superposed systems such as a building management systems, or for a PC using the ACS450 software.
Among other things, the unit affords convenient readout of settings and operating states, parameterization of the LMV5..., and trend recording.

When replacing the LMV5... basic unit (BU), all parameters can be saved in a backup memory of the AZL5... to be loaded back into the basic unit.

This means that reprogramming is not required.

When designing the fuel trains, the burner / boiler manufacturer can choose from a total of 7 valve families. The large number of individual parameterization choices (program times, configuration of inputs / outputs, etc.) enable him to make optimum adaptations to the specific application.

The universal SQM4... actuators are driven by stepper motors and can be positioned with a high resolution. The characteristics and settings of the actuators are defined by the basic unit of the LMV5... .

2.2 Product range overview

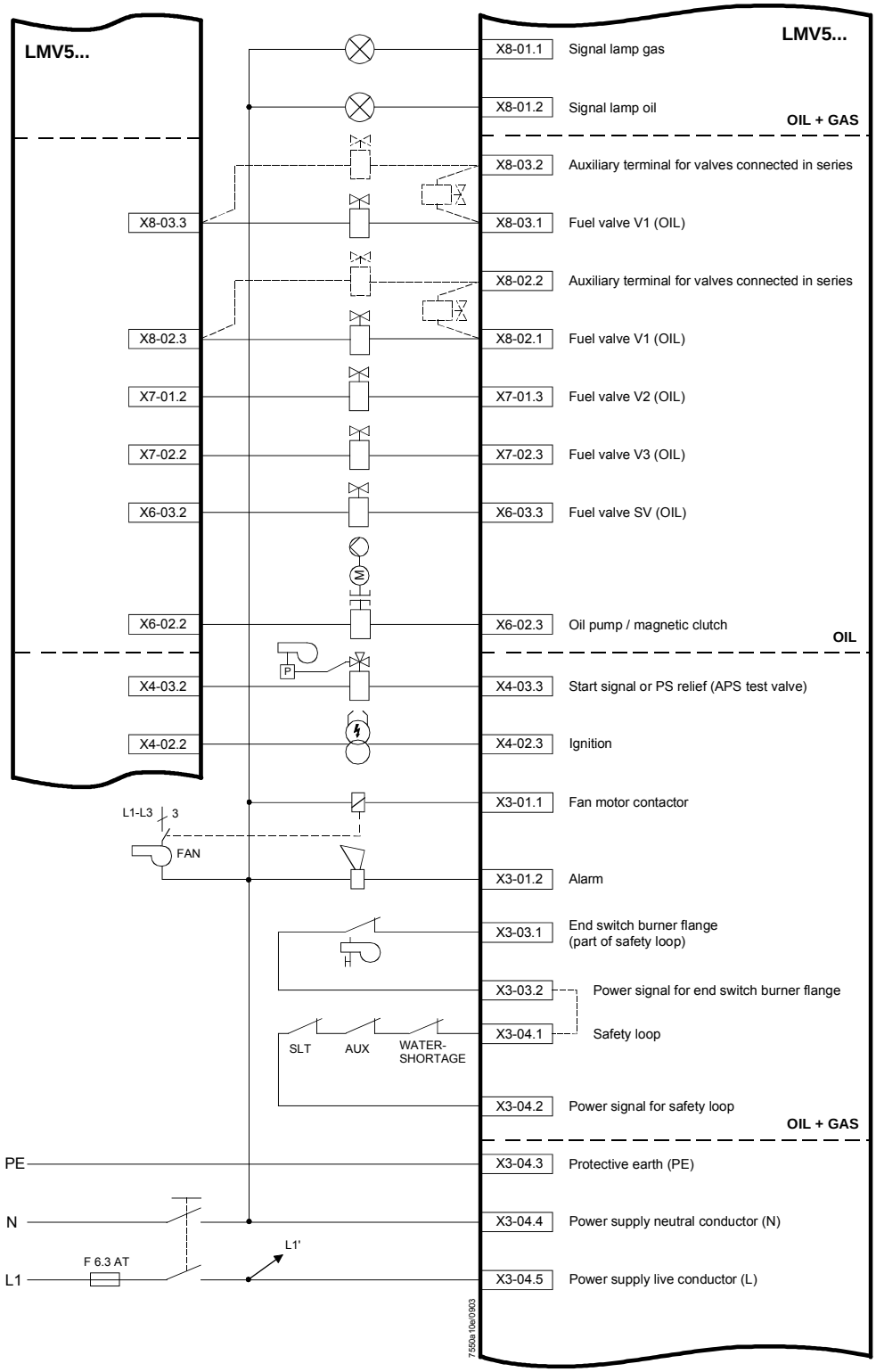
ACS450	PC tool for convenient programming and burner settings, process visualization, data recording, selection of AZL5... language, software update AZL5...
AGG5.110	CAN bracket for connecting the CAN bus to the basic unit
AGG5.220	Power transformer for CAN bus users with power characteristics matched to the requirements of the LMV5...
AGG5.310	Accessory set for acquisition of speed, for use with LMV51.2... and LMV52... systems, consisting of sensor disk (50 mm diameter), sensor and mounting set
AGG5.630	CAN bus connecting cable between basic unit and AZL5… and for short distances to the SQM4x. Shielded 5-core cable, 500 m
AGG5.631	CAN bus connecting cable between basic unit and AZL5… and for short distances to the SQM4x. Shielded 5-core cable, 100 m
AGG5.635	CAN bus connecting cable between basic unit and AZL5..., complete with connector type 3.5 and Sub-D, 3 m
AGG5.640	CAN bus connecting cable between basic unit and actuators or between actuators. Shielded 5-core cable, 500 m
AGG5.641	CAN bus connecting cable between basic unit and actuators or between actuators. Shielded 5-core cable, 100 m
AGG5.720	Standard connector
AGG5.721	Extension connector set
AGO20...	Flue gas collector. Accessory item for QGO20... oxygen sensor for use with LMV52... systems (refer to Data Sheet 7842)
AZL51...	Display and operating unit. Detached unit for front panel mounting with text display, 4 x 16 characters, 4 silicon buttons. Real time clock and e-bus interface for BACS
AZL52...	Display and operating unit. Detached unit for front panel mounting with text display, 4 x 16 characters, 4 buttons. Real time clock and bus interface for LMV52…systems
KF8893	Demo case including LMV51.100A2, AZL51.00A1, 2 x SQM45.295A9, and AGG5.220. Operating buttons for simulation. Electronic simulation of controlled system, burner graphics and LEDs (refer to Operating Instructions CC1B7988)
PLL52...	CAN bus module for LMV52..., with QGO20..., inputs for flue gas and combustion air temperature
QGO20...	Oxygen sensor for LMV52... systems
QRI2A2...	Infrared flame detector. Universal flame detector for oil or gas flames. Suited for intermittent or continuous operation, with integrated flame amplifier and prefabricated connecting cable 180 cm. **Front illumination**
QRI2B2...	Infrared flame detector. Universal flame detector for oil or gas flames. Suited for intermittent or continuous operation, with integrated flame amplifier and prefabricated connecting cable 180 cm. **Lateral illumination**

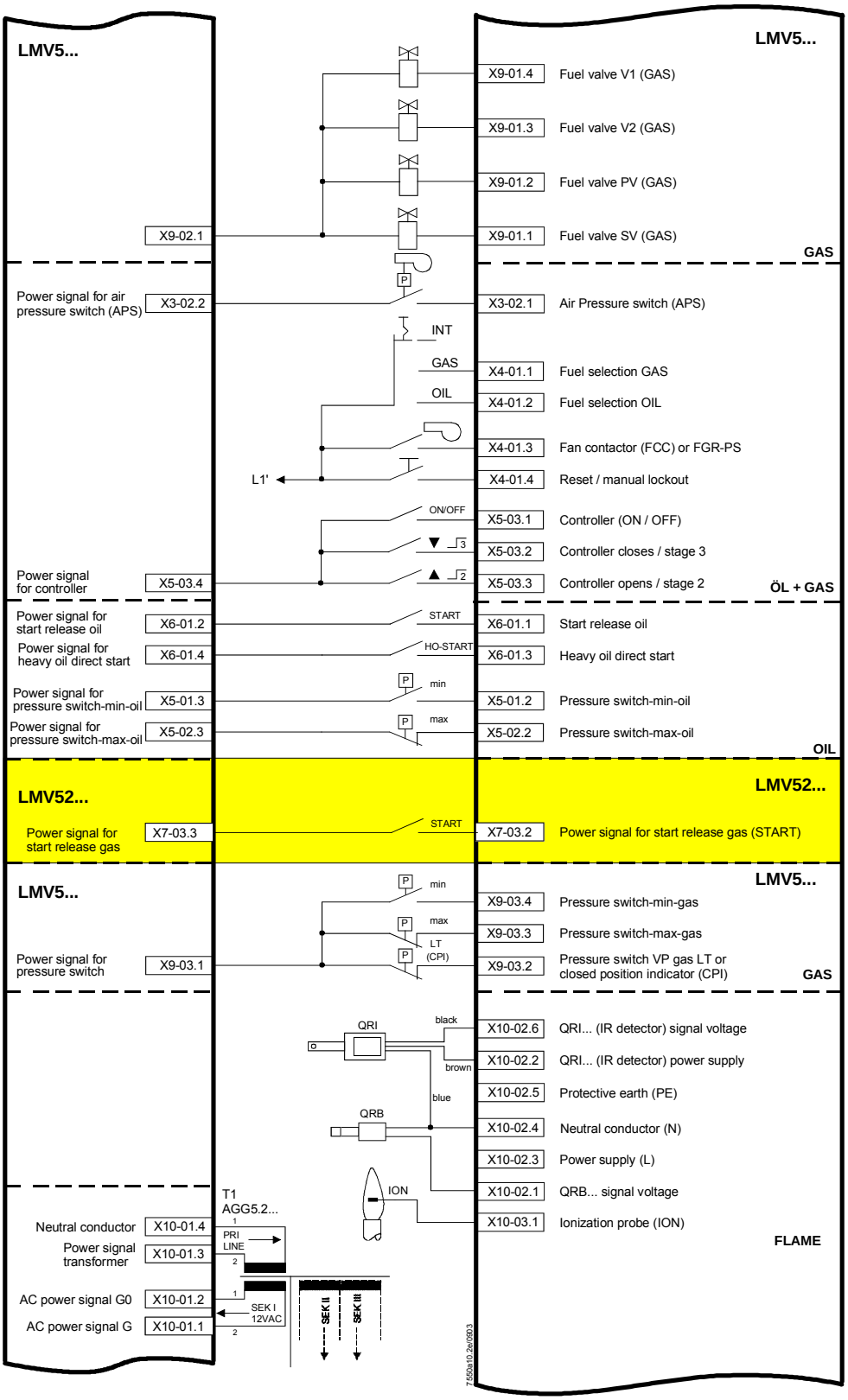
SQM45.291A9	Actuator. Nominal torque 3 Nm (reduced holding torque 1.5 Nm), running time 10…120 seconds. Control and feedback via CAN bus. Stepper motor, flush panel mounting, Woodruff key
SQM45.295A9	Actuator. Nominal torque 3 Nm (reduced holding torque 1.5 Nm), running time 10…120 seconds. Control and feedback via CAN bus. Stepper motor, flush panel mounting, D-shaft
SQM48.497A9	Actuator. Nominal torque 20 Nm, running time 30…120 seconds. Control and feedback via CAN bus. Stepper motor, flush panel mounting, parallel key
SQM48.697A9	Actuator. Nominal torque 35 Nm, running time 60…120 seconds. Control and feedback via CAN bus. Stepper motor, flush panel mounting, parallel key

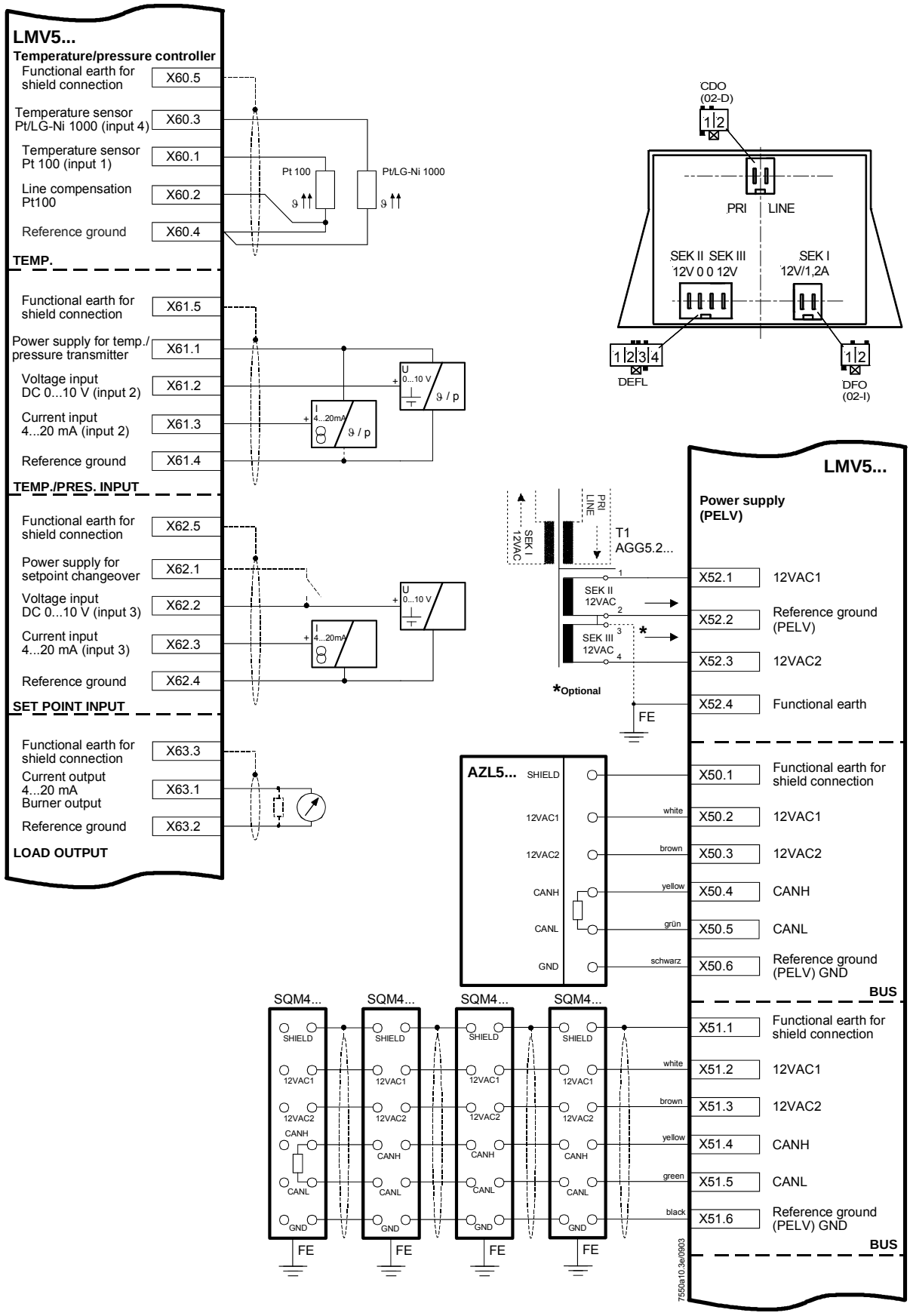
2.3 Type summary LMV5...

LMV51.000A1	Microprocessor-based burner control for single- or dual-fuel burners of any capacity, electronic fuel / air ratio control on CAN bus basis, up to 4 actuators, integrated gas valve proving, AC 120 V.
LMV51.000A2	Microprocessor-based burner control for single- or dual-fuel burners of any capacity, electronic fuel / air ratio control on CAN bus basis, up to 4 actuators, integrated gas valve proving, AC 230 V.
LMV51.100B1	Same as LMV51.000A2, plus load controller, integrated digital PID boiler temperature or pressure controller (LC), temperature limiter, automatic adaption of the controller's characteristic depending on modulating or multistage operating mode, AC 120 V.
LMV51.100B2	Same as LMV51.000A2, plus load controller, integrated digital PID boiler temperature or pressure controller (LC), temperature limiter, automatic adaption of the controller's characteristic depending on modulating or multistage operating mode, AC 230 V.
LMV51.200A1	Same as LMV51.1... basic unit, plus VSD control, AC 120 V.
LMV51.200A2	Same as LMV51.1... basic unit, plus VSD control, AC 230 V.
LMV52.200A2	Same as LMV51.2… basic unit, plus O_2 trim control and up to 6 actuators, AC 230 V.

2.4 Block diagram inputs / outputs

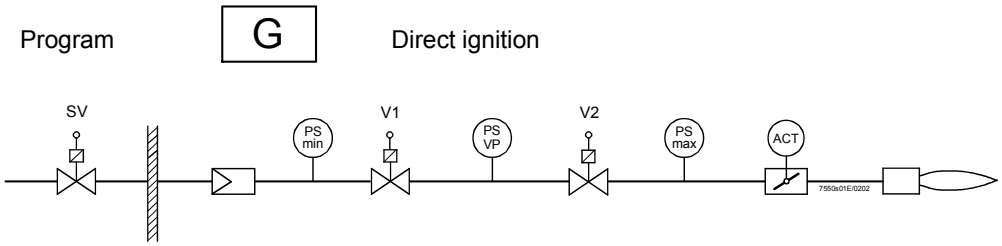



LMV5...
LMV5...
X9-01.4
Fuel valve V1 (GAS)
X9-01.3
Fuel valve V2 (GAS)
X9-01.2
Fuel valve PV (GAS)
X9-02.1
X9-01.1
Fuel valve SV (GAS)
GAS
P
Power signal for air pressure switch (APS)
X3-02.2
X3-02.1
Air Pressure switch (APS)
INT
GAS
X4-01.1
Fuel selection GAS
OIL
X4-01.2
Fuel selection OIL
X4-01.3
Fan contactor (FCC) or FGR-PS
L1'
X4-01.4
Reset / manual lockout
ON/OFF
X5-03.1
Controller (ON / OFF)
3
X5-03.2
Controller closes / stage 3
Power signal for controller
X5-03.4
2
X5-03.3
Controller opens / stage 2
ÖL + GAS
Power signal for start release oil
X6-01.2
START
X6-01.1
Start release oil
Power signal for heavy oil direct start
X6-01.4
HO-START
X6-01.3
Heavy oil direct start
Power signal for pressure switch-min-oil
X5-01.3
min
X5-01.2
Pressure switch-min-oil
Power signal for pressure switch-max-oil
X5-02.3
max
X5-02.2
Pressure switch-max-oil
OIL
LMV52...
LMV52...
Power signal for start release gas
X7-03.3
START
X7-03.2
Power signal for start release gas (START)
LMV5...
LMV5...
min
X9-03.4
Pressure switch-min-gas
max
X9-03.3
Pressure switch-max-gas
LT
(CPI)
Power signal for pressure switch
X9-03.1
X9-03.2
Pressure switch VP gas LT or closed position indicator (CPI)
GAS
QRI
black
X10-02.6
QRI... (IR detector) signal voltage
brown
X10-02.2
QRI... (IR detector) power supply
blue
X10-02.5
Protective earth (PE)
QRB
X10-02.4
Neutral conductor (N)
X10-02.3
Power supply (L)
ION
X10-02.1
QRB... signal voltage
X10-03.1
Ionization probe (ION)
FLAME
T1
AGG5.2...
Neutral conductor
X10-01.4
PRI
LINE
Power signal transformer
X10-01.3
AC power signal G0
X10-01.2
SEK I
12VAC
AC power signal G
X10-01.1
SEK II
SEK III
7550a10.2e/0903

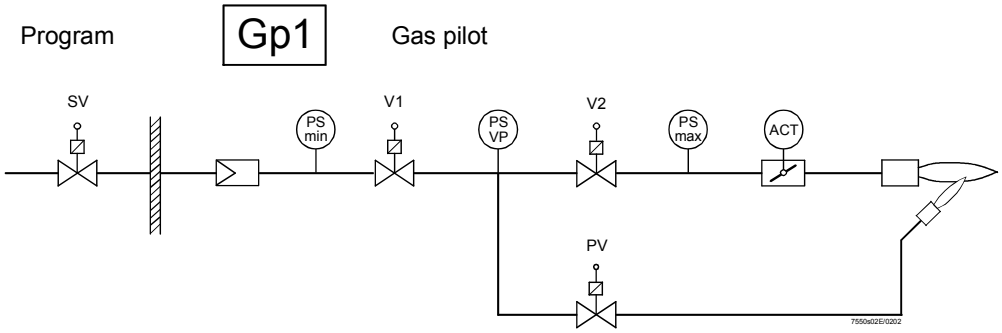

LMV5...
Temperature/pressure controller
Functional earth for shield connection
X60.5
Temperature sensor Pt/LG-Ni 1000 (input 4)
X60.3
Temperature sensor Pt 100 (input 1)
X60.1
Line compensation Pt100
X60.2
Reference ground
X60.4
TEMP.
Functional earth for shield connection
X61.5
Power supply for temp./ pressure transmitter
X61.1
Voltage input DC 0...10 V (input 2)
X61.2
Current input 4...20 mA (input 2)
X61.3
Reference ground
X61.4
TEMP./PRES. INPUT
Functional earth for shield connection
X62.5
Power supply for setpoint changeover
X62.1
Voltage input DC 0...10 V (input 3)
X62.2
Current input 4...20 mA (input 3)
X62.3
Reference ground
X62.4
SET POINT INPUT
Functional earth for shield connection
X63.3
Current output 4...20 mA Burner output
X63.1
Reference ground
X63.2
LOAD OUTPUT
Pt 100
Pt/LG-Ni 1000
CDO (02-D)
PRI
LINE
SEK II SEK III
12V 0 0 12V
SEK I
12V/1,2A
DEFL
DFO (02-I)
T1 AGG5.2...
SEK I 12VAC
PRI LINE
SEK II 12VAC
SEK III 12VAC
*Optional
FE
LMV5...
Power supply (PELV)
X52.1
12VAC1
X52.2
Reference ground (PELV)
X52.3
12VAC2
X52.4
Functional earth
AZL5...
SHIELD
12VAC1
12VAC2
CANH
CANL
GND
white
brown
yellow
grün
schwarz
X50.1
Functional earth for shield connection
X50.2
12VAC1
X50.3
12VAC2
X50.4
CANH
X50.5
CANL
X50.6
Reference ground (PELV) GND
BUS
SQM4...
X51.1
Functional earth for shield connection
X51.2
12VAC1
X51.3
12VAC2
X51.4
CANH
X51.5
CANL
X51.6
Reference ground (PELV) GND
BUS
green
black
7550a10.3e/0903

3 Fuel train applications (examples)

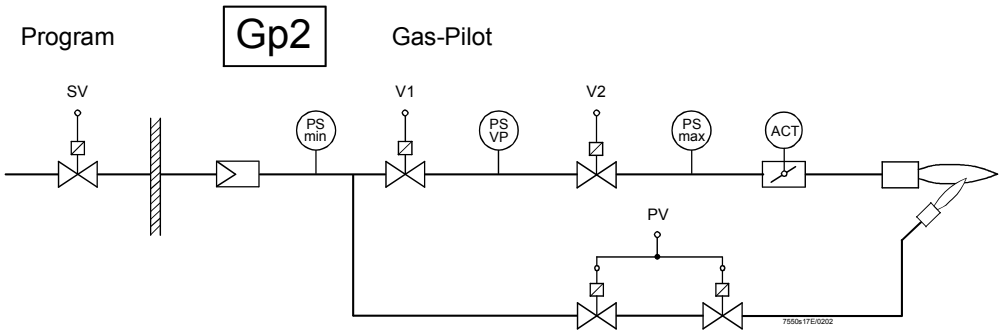
Direct gas ignition



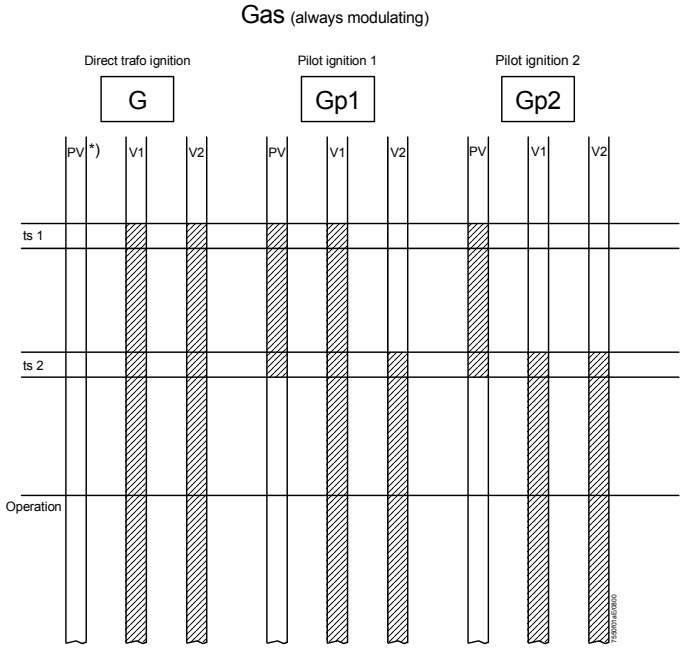
Gas pilot ignition 1



Gas pilot ignition 2



Fuel valve control program

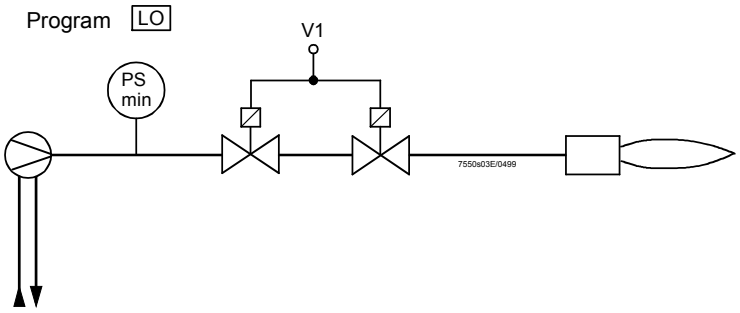


Legend to fuel trains:

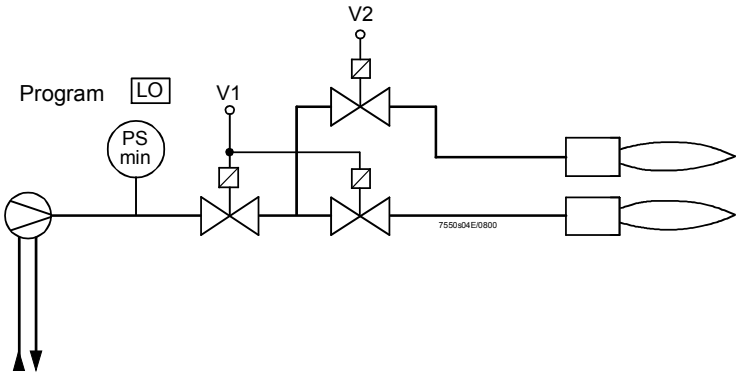
*)	Not used
1)	Series connection of two 115 V valves (each requiring approx. 25 VA control power)
2)	Preheating device
V	Fuel valve
VP	Gas valve proving
PS	Pressure switch
HE	Heating element
HO	Heavy oil
LO	Light oil
ACT	Actuator
NO	**N**ormally **O**pen
SV	Shutoff valve (outside the building)
PV	Pilot valve

Fuel train applications
(cont'd**)**

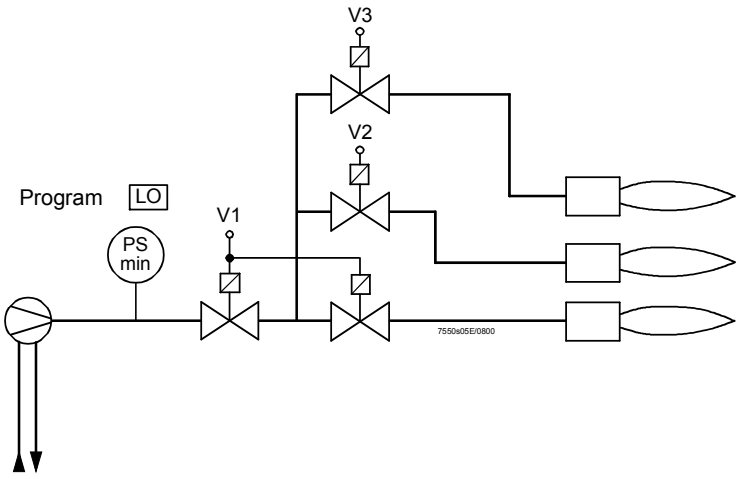
Direct ignition with light oil, multistage



Single-stage burner

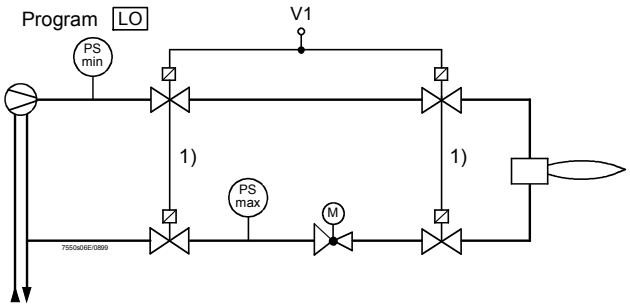


2-stage burner

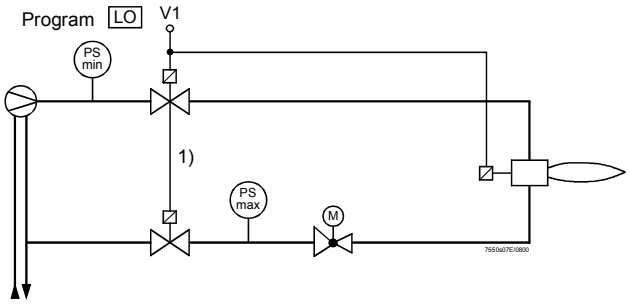


3-stage burner

Direct ignition with light oil, modulating



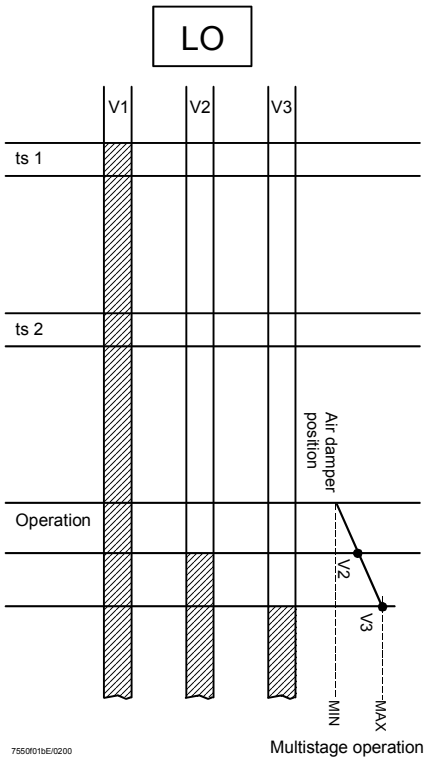
Modulating burner
(without shutdown facility for adjustable head)



Modulating burner
(with shutdown facility for adjustable head)

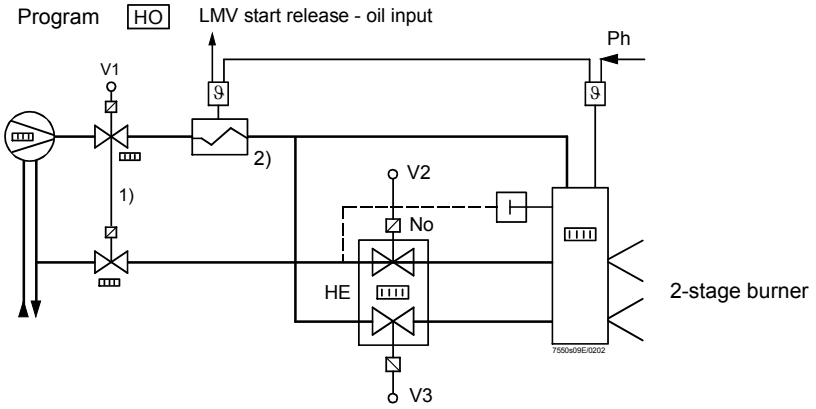
Fuel valve control program

Light oil (direct trafo ignition)

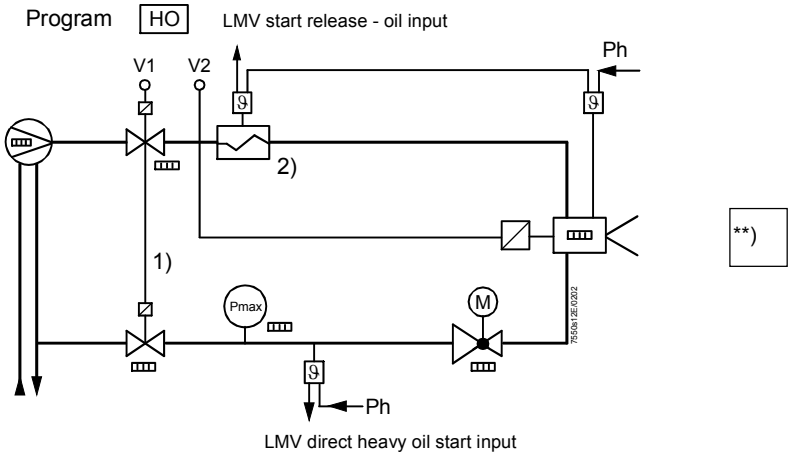


Multistage operation

Direct ignition with heavy oil, multistage

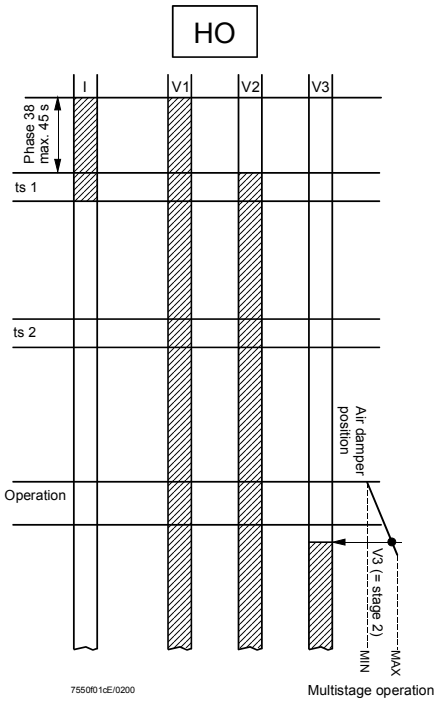


Direct ignition with heavy oil, modulating



Fuel valve control program

Heavy oil (direct trafo ignition)



) **Modulating burner

Circulation from Phase 38, max. 45 s as soon as direct heavy oil start = ON in Phase 38:

→ Phase change in Phase 40

Direct heavy oil start = OFF at the end of Phase 38

→ Repetition (max. 3 times in total)

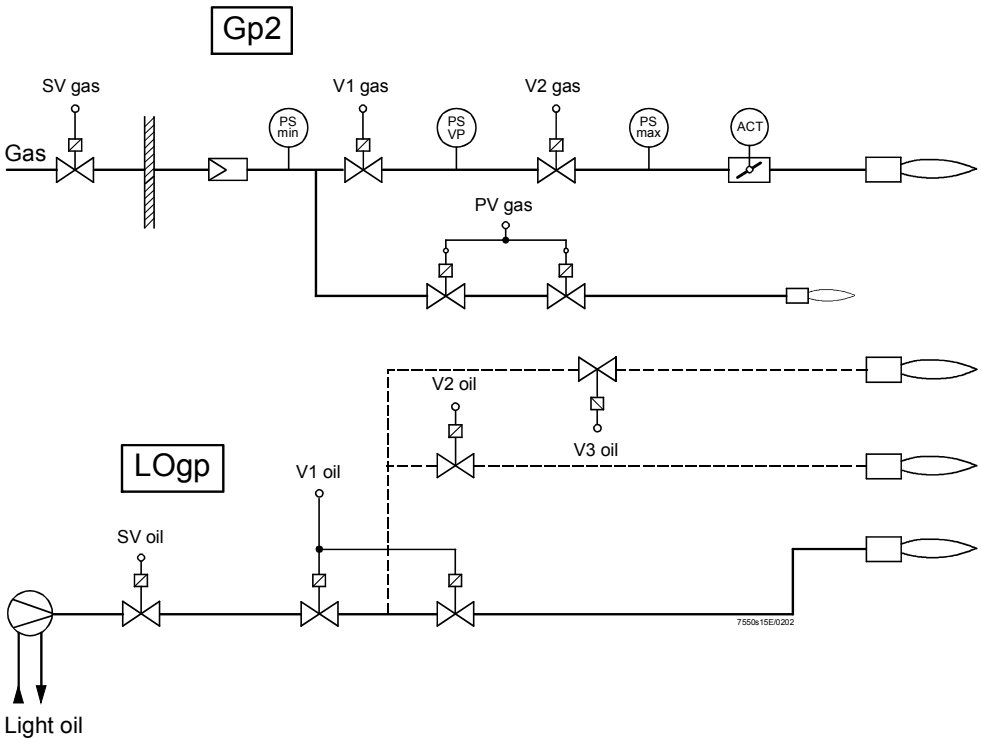
Note on dual-fuel burners

Gas trains **G**, **Gp1** and **Gp2** [1)] can be randomly combined with oil trains **LO** and **HO** for operation with dual-fuel burners since these fuel trains operate independently.

Oil trains **LOgp** and **HOgp** are designed for ignition with a gas pilot. They must **always** be combined with special gas train **Gp2** for operation with a dual-fuel burner.

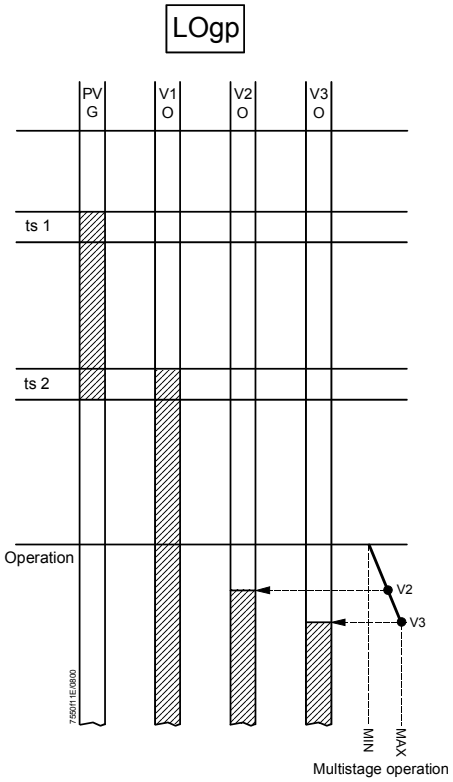
1) With **Gp2** permitted from
HW 01.C0 and SW V01.40

Dual-fuel burner gas / light oil with gas pilot ignition

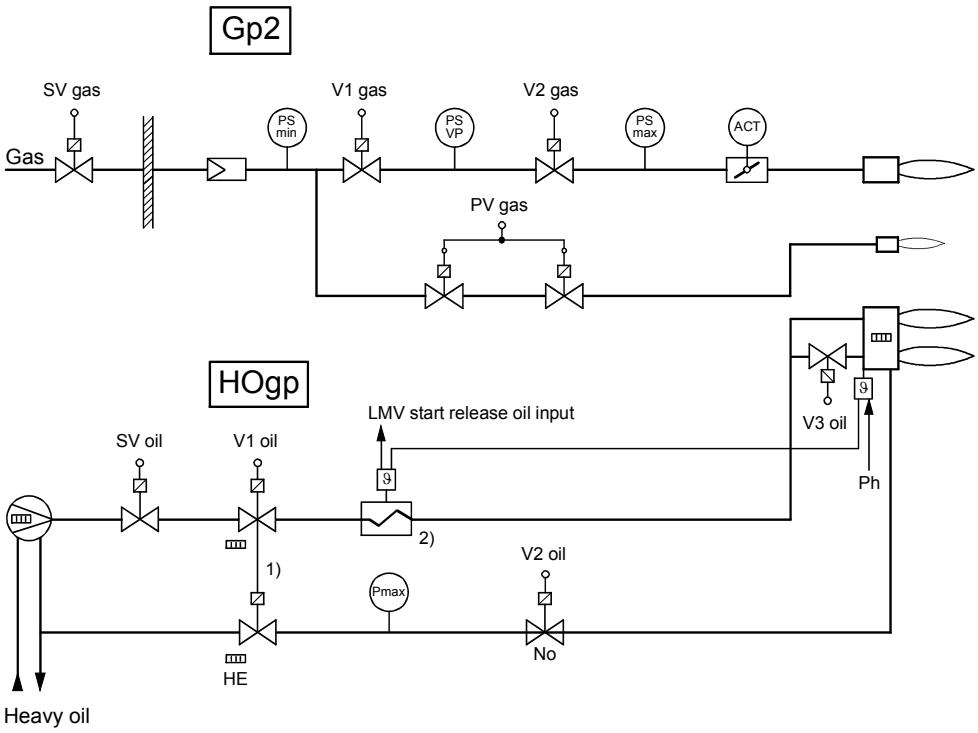


Fuel valve control program

Light oil (with gas pilot ignition)

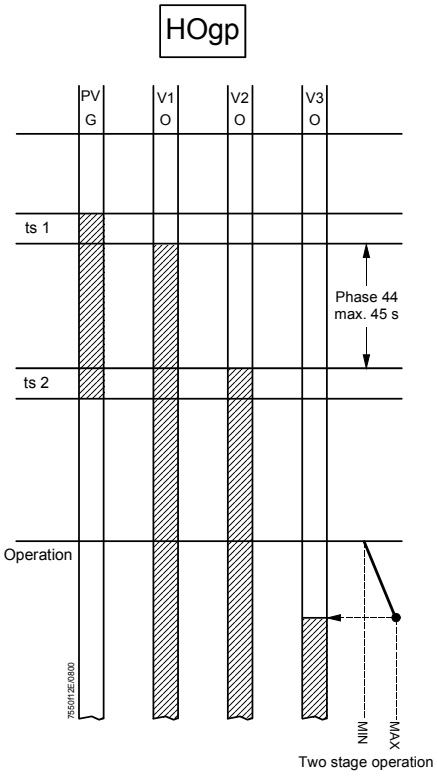


Dual-fuel burner gas / heavy oil with gas pilot ignition



Fuel valve control program

Heavy oil (with gas pilot ignition)



Circulation from Phase 44, max. 45 s as soon as direct heavy oil start = ON in Phase 44:
→ Phase change in Phase 40

Direct heavy oil start = OFF at the end of Phase 44
→ Repetition (max. 3 times in total)

4 Burner control

4.1 Description of inputs and outputs

This chapter describes the basic characteristics of the burner control's inputs and outputs. For the valuation of the inputs and activation of the outputs, refer to the «Sequence diagrams».

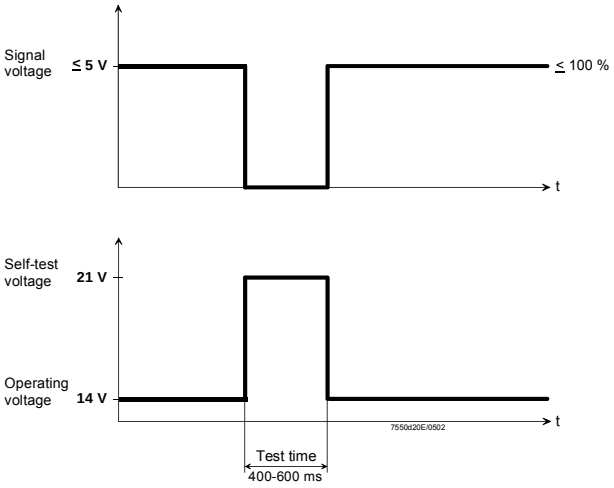
Flame signal input and flame detector X10–01 and X10–03

The following connection facilities are provided:

- QRI... (infrared flame detector) for continuous or intermittent operation
- Ionization probe for continuous or intermittent operation
- QRB... flame detector for intermittent operation only

When using the QRB..., continuous operation is **not** possible!

Self-test function LMV5... / QRI...



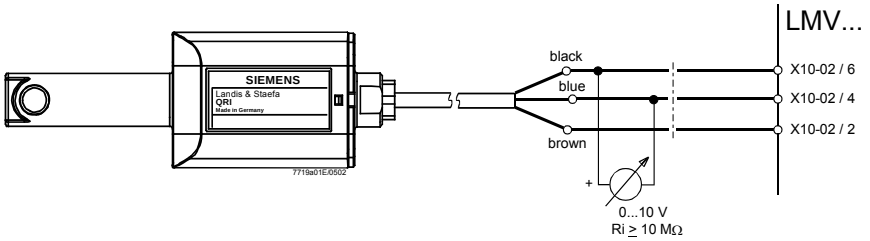
The self-test function of the QRI... is triggered by increasing the supply voltage to the level of self-test voltage.
During the following test time, the signal voltage at the output of the QRI... changes to zero so that the LMV5… will receive the anticipated flame OFF signal as a reply to the test.
If the behavior is correct, operation is continued until the next test cycle is reached.
The test cycle is dependent on the parameterization of the LMV5... .

Technical data flame supervision QRI (suited for continuous operation)

Note: All measured voltages refer to connection terminal N (X10–02, terminal 4).

Supply voltage operation / test at terminal POWER QRI... (X10–02, terminal 2)	approx. DC 14 / 21 V
Minimum signal voltage required at terminal FSV / QRI... (X10–02, terminal 6)	DC 3.5 V display flame approx. 50 %

Connection diagram



For detailed information, refer to Data Sheet 7719.

IONIZATION (suited for continuous operation)

No-load voltage at terminal ION (X10–03, terminal 1)	approx. U_{Mains}

Note: The ionization probe must be installed such that protection against electric shock hazard is ensured!

Short-circuit current	max. AC 0.5 mA
Minimum detector current required	DC 6 µA, display flame approx. 50 %
Maximum detector current	approx. DC 85 µA, display flame approx. 100 %
Permissible length of detector cable (laid separately)	100 m (wire-earth 100 pF / m)

Note

The greater the detector cable capacitance (cable length), the lower the voltage at the ionizations probe and, therefore, the lower the detector current. In the case of extensive cable lengths and high-resistance flames, it may be necessary to use low-capacitance cables (e.g. ignition cable).
The electronic circuit is designed such that impacts of the ignition spark on the ionization current will be largely eliminated. Nevertheless, it must be ensured that the minimum detector current required will already be reached during the ignition phase. If that is not the case, the connections of the ignition transformer on the primary side must be changed and / or the location of the electrodes also.

QRB... (for intermittent operation only)

No-load voltage at the QRB... terminal (X10–02, terminal 1)	approx. DC 8 V
Minimum detector current required (with flame)	DC 30 µA, display flame 35 %
Maximum permissible detector current (dark current with no flame)	DC 5 µA
Maximum detector current	approx. DC 70 µA, display flame approx. 100 %
Permissible length of QRB... detector cable (laid separately)	100 m (wire-wire 100 pF / m)

Notes

A detector resistance value of RF < approx. 5 kΩ is identified as a short-circuit and, in operation, leads to safety shutdown as if loss of flame had occurred.
Measurement of the voltage at terminal QRB... during burner operation gives a clear indication: If voltage drops below 1 V, safety shutdown will probably occur.
For that reason, before using a highly sensitive photoresistive flame detector (QRB1B or QRB3S), it should be checked whether such a detector is really required!
Increasing line capacitance between the QRB... terminal and mains live «L» adversely affects the sensitivity and increases the risk of damaged flame detectors due to mains overvoltages.
The separate laying of detector cables as specified in Data Sheet 7714 must be observed.

For **indication of flame** (on the AZL5...), observe the following general rules:
The above percentage values are obtained when, for parameter «Standardize» (standardization of flame signal), the default setting is used.
The accuracy of the display is a maximum of ± 10 %, depending on the tolerances of the components.
It should also be noted that, for physical reasons, there is no linear relationship between the display and the detector signal values. This is especially obvious with ionization current supervision.

For more detailed information, refer to Data Sheet 7714.

4.1.1 Digital inputs

SAFETY LOOP X3–04

This input serves for including the safety loop. The special feature of this input is that all signal source contacts connected in series here directly switch off the power supply to the fuel valves and the ignition.

Typically, the following contacts are included in the safety loop:
- External burner switch ON / OFF
- Safety limit thermostat / safety pressure limiter (SLT / SPL)
- External temperature limiter / pressure switch, if required
- Water shortage switch

FLANGE X3–03

- End switch burner flange (component of safety loop)

For the diagnosis, these signal source contacts are combined for delivering the «Safety loop» message. If no signal is received, the burner will at least be shut down. What follows is a number of repetitions that can be parameterized.

Parameter: *SafetyLoop*

Inputs for external controller (ON/OFF) X5–03

When the external control loop is closed, the signal from the integrated controller (if present) is used to deliver the internal «Heat demand» information to the input.

- There is a demand for heat when this external controller signal is present and – if present and configured – there is a demand for heat from the internal load controller or the building automation system

When there is no more demand for heat, the burner will be shut down. Depending on the parameterization, the fuel valves will either be shut the moment the period of time is completed by the timer, or after the MIN load is reached → Part load shutdown. In operation with the internal load controller or with load control, the input can be deactivated via a building management system. This means that a wire link at this controller input is not required. In operating mode 1 (ExtLR X5-03), the input is always active, deactivation is not active → Operating modes with load controller.

Parameter: *InputController (activated / deactivated)* [1)]

1) *(Parameter text) in Italics* = text displayed on the AZL5...

Note

The input is also valued with manual operation burner ON / OFF!

2 inputs (ON / OFF or STAGE2 / STAGE3)

(▲ ▼ ⌋2 ⌋3)

X5–03

This input serves for the connection of an external controller with contact outputs. The input is only active when configured as «External load controller».

Parameter: *LC_OptgMode (ExtLC X5-03)*

2 operating modes are possible. The one active depends on the parameterization of the fuel / air ratio control system.

a) Parameter: *Operation Mode (Two-stage / Three-stage)*

Multistage operation can be accomplished by using additional thermostats / pressure switches.
Input « ⌋2 » activates stage 2.
Input « ⌋3 » and input « ⌋2 » activate stage 3.

b) Parameter: *Operation Mode (Modulating)*

The burner's output can be increased or decreased by means of a 3-position step controller output with 2 relays.
« ▲ » increases the output
« ▼ » decreases the output
If none of the 2 inputs is active, the burner's output is maintained at a constant level.
The shortest permissible positioning step is about 100 ms.

Air pressure switch (APS)
X3–02

An air pressure switch can be connected to these terminals. Air pressure is anticipated after the fan has been switched on. If there is no pressure signal, at least safety shutdown will occur. The input can be deactivated.

Parameter: *AirPressureTest (activated / deactivated)*

Pressure switch-VP-gas / LT or closed position indicator (CPI)
X9–03

The input can be configured either as pressure switch - valve proving - input (PS-VP) **or** as a closed position indicator input (CPI).

a) Parameter: *Config_PS-VP/CPI (PS-VP)*

The input is only active when firing on gas and when valve proving is activated.
→ Valve proving

b) Parameter: *Config_PS-VP/CPI (CPI)*

CPI: The input is active in both gas- and oil-fired operation. It is used for checking the **gas** valves' fully closed position. For that purpose, the gas valves' contacts for the fully closed position are to be connected in series using this input.

Note on a) and b)

If the signal received at this input does not correspond to the anticipated value, at least safety shutdown will occur. The input can be deactivated by configuring the input as PS-VP and by switching off valve proving (no LT).

Parameter: *Config_PS-VP/CPI (PS-VP)*
Parameter: *ValveProvingType (No VP / VP startup / VP shutdown / VP stup/shd)*

Pressure switch-min-gas, start release gas (PSmin-gas)
X9–03

The input is used for connecting the gas pressure switch-min and the start signal, e.g. from the release contact of an external outside air damper. In that case, both signal sources are to be connected in series. With the LMV52..., only gas pressure switch-min is to be connected here; for start release, there is a specific input available (start release gas). The input is only active when firing on gas and in the LOgp and HOgp programs until the end of «TSA». It can be deactivated for oil programs LOgp and HOgp. The signal is anticipated in Phase 21. If there is no gas pressure, the → gas shortage program will be activated. Loss of gas pressure / start signal causes the burner to shut down. The input can be deactivated.

Parameter: *GasPressureMin (activated / deact x OGP / deactivated)* [2)]

[2)] *(activated / deactivated)* Active inputs are checked for signal input.

There is a delayed reaction to loss of gas pressure during «TSA1» and «TSA2» to prevent shutdown caused by pressure shocks when the valves open.

Parameter: *PressReacTme*

Start release gas
X7–03
(only LMV52...)

The input is used for connecting the start signal, e.g. from the release contact of an external outside air damper. The input is only active when firing on gas and in programs LOgp and HOgp until the end of TSA2. The signal is anticipated in Phase 21. Loss of the start signal causes the burner to shut down. The input can be deactivated.

Parameter: StartReleaseGas *(activated / deactivated)*

Pressure switch-max-gas, (PSmax-gas)
X9–03

The input is used for connecting the gas pressure switch-max. It is only active when firing on gas.

The signal is anticipated when «TSA1» starts.

If the gas pressure is exceeded, at least safety shutdown will occur.

The input can be deactivated.

Parameter: *GasPressureMax (activated / deactivated)*

There is a delayed reaction to loss of gas pressure during «TSA1» and «TSA2» to prevent shutdown caused by pressure shocks when the valves open.

Parameter: *PressReacTme*

Pressure switch-min-oil (PSmin-oil)
X5–01

The input is used for connecting an oil pressure switch-min. It is only active when firing on oil.

a) Parameter: *OilPressureMin (activated)*

It is anticipated that the pressure signal appears during preignition to be critically valued (with HOgp in Phase 44). If there is no oil pressure, or if the oil pressure drops, at least safety shutdown will occur. From The signal will be valued from TSA1. If there is no oil pressure, at least safety shutdown will occur.

b) Parameter: *OilPressureMin (act from ts)*

During preignition, there is no waiting for the oil pressure. The signal will be valued from TSA1. If there is no oil pressure, at least safety shutdown will occur.

Note: This kind of parameterization is only permitted in case of individual system approvals.

c) Parameter: *OilPressureMin (deactivated)*

The input can be deactivated.

There is a delayed reaction to loss of oil pressure during TSA1 and TSA2 to prevent shutdown caused by pressure shocks when the valves open.

Parameter: *PressReacTme*

Pressure switch-max-Oil (PSmax-Oil)
X5–02

The input is used for connecting an oil pressure switch-max. It is active only when firing on oil.

The maximum oil pressure may not be exceeded. If exceeded, at least one safety shutdown will occur.

The input can be deactivated.

Parameter: *OilPressureMax (activated / deactivated)*

There is a delayed reaction to loss of oil pressure during «TSA1» and «TSA2» to prevent shutdown caused by pressure shocks when the valves open.

Parameter: *PressReacTme*

Start release-oil (START)
X6–01

The input is used for connecting a start signal, e.g. from the release contact of an external outside air damper. It is only active when firing on oil.

The signal is anticipated in Phase 21. If the signal is not delivered, or if it is lost, shutdown will occur.

The input can be deactivated.

Parameter: *StartReleaseOil (activated / deactivated)*

Direct heavy oil start (HO-START)
X6–01

The input is used for connecting a heavy oil direct start signal with which circulation Phase 38 with HO or Phase 44 with HOgp can be shortened.

In the circulation phase, the waiting time for the signal is a maximum of 45 seconds. If the signal is not delivered, home run will take place, followed by → repetition. The input is only active when firing on heavy oil (HO or HOgp).

The input can be deactivated.

Parameter: *HeavyOilDirStart (activated / deactivated)*

2) *(activated / deactivated)* Active inputs are checked for signal inputs.

Fan contactor contact (FCC) or FGR-PS
X4–01

The input is used for connecting a fan contactor contact (FCC) or a flue gas recirculation pressure switch (FGR-PS).

a) Parameter: *Config_FGR-PS/FCC (FCC)*

The input is active when firing on oil **and** gas. It serves for checking the position of the fan contactor.

A signal is anticipated at this input after the fan has received a control command.

b) Parameter: *Config_FGR-PS/FCC (FGR-PS)*

The input has been designed for the connection of an air pressure switch for flue gas recirculation (only from LMV52...).

c) Parameter: *Config_FGR-PS/FCC (deactivated)*

The function of the input can be deactivated.

4.1.2 Digital outputs

Safety-related outputs, type SI

These contacts are read back by the microcomputers with the help of a contact feedback network (CFN) and then monitored for correct positions.

Non-safety-related outputs, type No-SI

These outputs are not monitored by CFN and, for this reason, can only be used for non-safety-related actuating devices are actuating devices that are secured in some other form (e.g. fans, oil pump / magnetic clutch, alarm).

Alarm output, type No-SI X3–01

A signal lamp or horn can be connected to this output.
The output will be activated when the unit is in the lockout position (Phase 00).

This output can also be used to signal start prevention
→ signaling of start preventions

An active alarm output can be manually deactivated. Deactivation remains active until a lockout reset or a system reset occurs, or up to the next startup. Then, the alarm will be activated again. Deactivation only applies to the alarm output, lockout or start prevention continue to be active.

Parameter: *Alarm act/deact (activated / deactivated)*

Output fan, type No-SI X3–01

This output is used for controlling a fan power contactor (200 VA). When changing to the lockout position, the fan continues to run for an adjustable period of time.

Parameter: *PostpurgeLockout*

When → continuous purging is activated, the fan runs in all phases. This mode functions only when using an APS relieve valve which, in Phase 21, ensures that the fan pressure switch does not sense any pressure, thus facilitating checking.

Parameter: *ContinuousPurge (activated / deactivated)*

Output ignition, type SI (IGNITION) X4–02

This output is used for connecting ignition transformers or electronic ignitors.

When firing on gas, ignition is switched on just prior to «TSA1» in Phase 38.

Parameter: *PreIgnitionTGas*

When firing on oil, there is choice of short preignition as with gas operation and long preignition. In the case of long preignition, ignition will be switched on when the fan starts to run in Phase 22.

Parameter: *PreIgnitionTOil*
Parameter: *IgnOilPumpStart (on in Ph38 / on in Ph22)*

Outputs valves-oil , type SI (V...) X8–02, X8–03, X7-01, X7-02

These outputs are used for connecting the oil valves in accordance with the selected fuel train. → Fuel trains, → sequence diagrams.

Parameter: *FuelTrainOil (LightOilLO / HeavyOilHO / LO w Gasp / HO w Gasp)*

(light oil with gas pilot and heavy oil with gas pilot may only be used in connection with Gp2)

Outputs valves -gas, type SI (V..., SV, PV) X9–01

These outputs are used for connecting the gas valves in accordance with the selected fuel train. → Fuel trains, → sequence diagrams.

Parameter: *FuelTrainGas (DirectIgniG / Pilot Gp1 / Pilot Gp2)*

Output oil pump / magnetic clutch, type No-SI X6–02

a) Applications with a separate oil pump or magnetic clutch

This output can be used for connecting an oil pump or a magnetic clutch for an oil pump.

The switch-on time can be parameterized together with preignition. In the case of dual-fuel burners, short preignition must be used (Phase 38). In the case of long preignition, the oil pump is switched on in Phase 22 together with ignition; in the case of short preignition, in Phase 38.

With the heavy oil programs (heavy oil HO, heavy oil with gas pilot), the oil pump with short preignition is already activated in Phase 36 to ensure oil pressure is available when circulation starts.

Parameter: *OilPumpCoupling (Magneticcoupl)*

Parameter: *IgnOilPumpStart (on in Ph38 / on in Ph22)*

b) Single-fuel applications with direct coupled oil pump

On applications where the oil pump is coupled directly to the fan motor, the safety oil valve (SV) can be connected to that output. The output is always activated when the fan operates, plus another 15 seconds after the fan has been switched off. If «Directcoupl» is selected, long preignition will automatically become active. Direct coupling is only permitted in the case of oil-firing only.

Parameter: *OilPumpCoupling (Directcoupl)*

Note:

With both variants, parameter *OnTmeOilIgnition* can be left on «On in Ph38». The short or long preignition will then automatically be correct, depending on the selection of *OilPumpCoupling.*

Output «Start signal» or «PS valve» (APS test valve) type No-SI (START) X4–03

Depending on parameterization, the output can be used for a start signal or for a PS relieve valve.

a) Parameter: *Start/PS-Valve (StartSignal)*

The start signal is used for controlling an outside air damper. When actuating the air damper's end switch, which is fed back to the start release inputs of the LMV5..., the startup sequence will be continued.

b) Parameter: *Start/PS-Valve (PS Relief)*

In this configuration, a 3-port valve for testing (no pressure) the air pressure switch (APS) can be connected. During the test, the valve is controlled.

c) Parameter: *Start/PS-Valvel (PS Relief_Inv*)

When using this configuration, a valve for testing (no pressure) the air pressure switch (APS) can be connected. The valve is controlled while the fan is running. During the test, the valve is deenergized.

This valve is required when parameterizing *NormDirectStart (NormalStart / DirectStart)* → direct start for testing the air pressure switch if *ContinuousPurge* is parameterized *(activated)* → continuous purging.

4.2 Program sequence

The sequence diagrams show the program sequence in detail (refer to «Sequence diagrams»).

4.2.1 Parameters

Time parameters

The most important time parameters for the program sequence are the following (for values, refer to the list of parameters):

- Prepurge time
- Preignition time / circulation time heavy oil
- Safety time 1 (TSA1)
- Safety time 2 (TSA2)
- Interval 1
- Interval 2
- Postpurge time 1 (t8-1) with FGR damper shut (this part of the postpurge time is always executed)
- Postpurge time 3 (t8-3) with FGR damper open (this part of the postpurge time will be interrupted when there is demand for heat)
- Postpurging in the lockout phase (if G = ON before lockout occurred)

All the times mentioned above - with the exception of «Postpurging in the lockout phase» - depend on the type of fuel, which means that different times can be set for oil and gas.

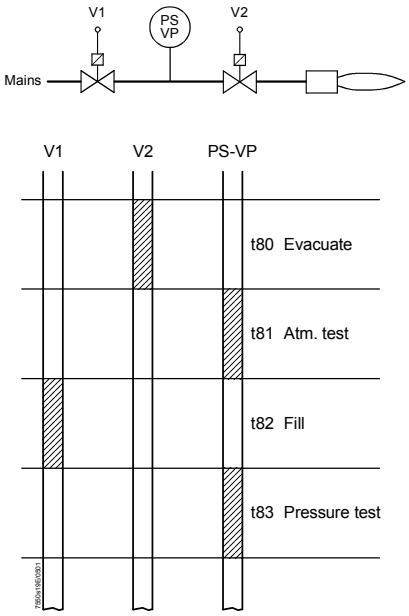
The prepurge time and the safety times are safety-related. This means that, using the AZL51…, the heating engineer can only readjust them in the «safe» direction (against internal maximum or minimum values).

In other words, «ts» times can only be shortened and «tv» times can only be extended.

4.2.2 Gas valve proving

Gas valve proving is only active when firing on gas.
When a leak is detected, the gas valve proving function ensures that the gas valves will not be opened and that ignition will not be switched on. Safety shutdown will take place.

Example



With gas valve proving, first the gas valve on the burner side is opened to bring the test space to atmospheric pressure.
After the valve has closed, the pressure in the test space may not exceed a certain level.
Then, the gas train is filled by opening the gas valve on the gas network side.
After shutting the gas valve, the gas pressure may not drop below a certain level.

It is possible to parameterize whether gas valve proving shall be performed. Also, the time can be set. Gas valve proving can be carried out during startup, shutdown, or in both phases.

Recommendation

Perform gas valve proving during shutdown.

Parameter: *ValveProvingType (No VP / VP startup / VP shutdown / VP stup/shd)*

The evacuation and filling times as well as the test times at atmospheric pressure or mains pressure must be set by the OEM, for each individual plant and in accordance with the requirements of EN 1643.

Parameter: *VP_EvacTme*
Parameter: *VP_TmeAtmPress*
Parameter: *VP_FillTme*
Parameter: *VP_Tme_GasPress*

In particular, it must be ensured that the 2 test times will be set correctly. It must also be checked whether - on the specific application - it is permitted to introduce into the combustion chamber the gas required for testing.
The test times are safety-related.
After a reset, or in the event gas valve proving has been aborted or prevented, the burner control will carry out gas valve proving during the next startup sequence (only if gas valve proving is activated).
Examples of aborted gas valve proving:
When the safety loop or the start prevention input for gas (containing Gpmin) opens during gas valve proving.

If gas valve proving is parameterized with «startup **and** shutdown», the gas valves must perform additional switching cycles. This means that wear and tear of the gas valves will increase.

Determination of VP leakage rate

$$Q_{Leakage} = \frac{(P_G - P_W) \cdot V \cdot 3600}{P_{atm} \cdot t_{Test}}$$

Legend

$Q_{Leakage}$	in l / h	Leakage rate in liters per hour
P_G	in mbar	**Overpressure** in the piping section between the valves to be tested, at the beginning of the test phase
P_W	in mbar	Overpessure adjusted on the pressure switch (normally set to 50 % of the gas inlet pressure)
P_{atm}	in mbar	**Absolute air pressure** (1,013 mbar normal pressure)
V	in l	Volume in the piping section between the valves to be tested, including the volume in the valves themselves, plus any pilot section (Gp1)
t_{Test}	in s	Test time

Examples

Refer to chapter «Commissioning instructions for LMV5... system» / gas valve proving / leakage test.

4.2.3 Special functions during the program sequence

Lockout phase (Phase 00)

The safety loop relays are deenergized, the alarm relay is activated and lockout will be initiated, that is, Phase 00 can only be quit via manual reset.

Phase 00 is unlimited in terms of time.

During the lockout phase, the fan motor remains switched off if it was already deactivated in the safety phase. Otherwise, postpurging takes place in the lockout phase for a period of time that can be parameterized.

Parameter: *PostpurgeLockout*

Safety phase (Phase 01)

The safety phase is an intermediate phase that is completed before lockout occurs. The safety loop relays are deenergized, but lockout will not yet occur. The alarm relay is not yet energized.

In the safety phase, the fan motor maintains the status of the previous phase, that is, it remains switched on if it was on before, and it remains switched off if it was off before.

If possible or permitted, safety checks or repetition counter checks will be made. Their results will decide on the transition to either «Lockout phase» or «Standby».

The duration of the safety phase varies (depending on the scope of testing), but lasts a maximum of 30 seconds.

This procedure serves primarily for suppressing undesired lockouts, caused by EMC effects, for instance.

Reset / manual lockout

There are 2 choices to reset the system:

1. Resetting on the AZL5…

Characteristics

If the burner control is in the lockout position, a reset produces the following reactions:

- The alarm relay will be deenergized and lockout indication switched off
- The lockout position will be cancelled

The function is only available when the unit is not in the lockout position.

The system can be manually locked by simultaneously pressing the **ENTER** and **ESC** buttons on the AZL5… .

This function enables the user to stop the system during programming should an emergency situation occur.

2. Resetting with the button on connection terminal «Reset» of the LMV5... basic unit

Characteristics

If the burner control is in the lockout position, a reset produces the following reactions:

- The alarm relay will be deenergized and lockout indication switched off
- The lockout position will be cancelled

If the burner control is **not** in the lockout position, a change to the lockout position will take place when pressing the reset button.

If this reaction is not desired, it is possible to feed power to the reset button from the alarm output, thus obtaining the same reaction as described in **1.** above.

Signaling start preventions

If start is prevented, it is always displayed on the AZL5… .

Start is prevented only when there is demand for heat **and** one of the start criteria is not satisfied.

The time from start prevention to display on the AZL5… can be set.

Parameter: *DelayStartPrev*

It is also possible to signal start preventions via the alarm output. This function can be activated and deactivated via

Parameter: *AlarmStartPrev (activated / deactivated)*

If «Signaling start preventions» is activated by means of the alarm relay, it is advisable to pick up power for the reset from the alarm output in order to prevent inadvertent manual lockouts.

The time from start prevention to signaling at the alarm contact can be set:

Parameter: *AlarmDelay*

Forced intermittent operation

No matter if the LMV5... is used for continuous operation or intermittent operation (e.g. when using a flame detector type QRB…), forced intermittent operation can be activated, this means short automatic shutdown after 23 hours and 50 minutes of uninterrupted operation.

As a general rule, it is recommended to activate forced intermittent operation or to leave it activated.

Forced intermittent operation should only be deactivated in plants where this function is not desired or is unacceptable.

Parameter: *ForcedIntermit (activated / deactivated)*

Program stop function

To simplify burner adjustments during commissioning or in connection with maintenance work, the program sequence of the LMV5... can be stopped at the following points:

	Phase
a) Air damper in the prepurge position	24
b) Traveling to the FGR position	32
c) Ignition position	36
d) Interval 1	44
e) Interval 2	52
f) Air damper in the postpurge position	72
g) Traveling to the FGR position	76

Activation takes place via the relevant menu items on the AZL5... .

Parameter: *ProgramStop (deactivated / 24 PrePurgP / 32 PreP FGR / 36 IgnitPos / 44 Interv 1 / 52 Interv 2 / 72 PostPPos / 76 PostPFGR)*

The program stop function is maintained until manual deactivation takes place. If the system stops at a program stop, a message will appear on the AZL5...

Gas shortage program

When gas pressure is insufficient (input PSmin-gas), the LMV5... ensures that a selectable number of start attempts will be made while observing a selectable waiting time.

The waiting time between the start attempts is automatically doubled (based on the value parameterized for the first waiting time).

The basic time is «DelayLackGas».

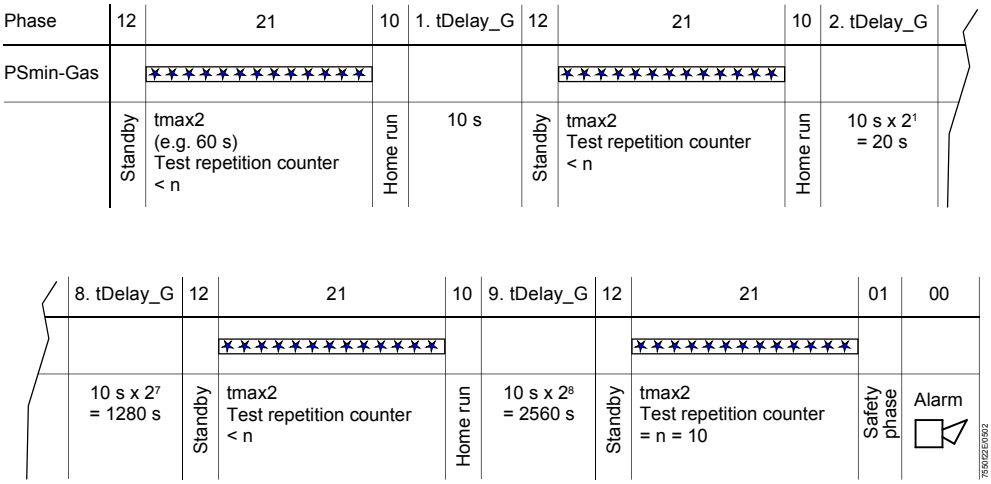
Parameter: *DelayLackGas*

If, with the last of the parameterized start attempts, there is still a shortage of gas, the burner control will initiate lockout.

Parameter: *StartPrev*

Sequence diagram

Start conditions must be satisfied.
n = Limitation of the number of start repetitions *(StartPrev)*. Example: 10
tDelay_G = Delay time gas shortage program *(DelayLackGas)*. Example: 10 s



- Repetition counter will be reset after controlled shutdown
- When phase 22 is reached for the first time, delay time will be reset to the selected parameter value

Part load shutdown

To prevent the boiler from shutting down when operating at high-fire, FARC will first change to low-fire when there is no more demand from the controller.

Only then will the valves be closed.

The maximum time «MaxTmeLowFire» for changing to low-fire operation can be parameterized.
If the time is set to 0.2 seconds, part load shutdown will be deactivated.

Parameter: *MaxTmeLowFire*

Normal / direct start

a) Normal start

With normal start, the fan will be deactivated also when there is a new demand for heat in Phase 78 or when changing the type of fuel.

b) Direct start

When there is demand for heat in Phase 78, there will be a direct change to startup via Phase 79 to Phase 24 without switching the fan off, so that the startup sequence will be accelerated.

But this would suppress checking the air pressure switch's OFF position in standby.

For this reason, the PS relieve valve is controlled in Phase 79. This valve ensures that the air pressure switch is relieved of the pressure produced by the fan so that it can signal «Air pressure OFF» although the fan motor is running, thus making possible a functional check of the air pressure switch.

Parameter: *NormDirectStart (NormalStart / DirectStart)*

For both variants, following applies:

If, during postpurging, there is another demand for heat, or if demand for heat is still present like in the case of type-of-fuel change, for example, that part of postpurging will be stopped in Phase 78 in order to accelerate the following startup sequence.

Continuous fan operation

In the case of burners that could be damaged by return heat (e.g. several burners operating on one combustion chamber), continuous purging can be activated. In that case, the fan runs in all phases.

To enable the air pressure switch to be tested, a PS relieve valve is required. This valve is controlled in Phase 21 on burner startup, causing the air pressure to fall, so that the «Air pressure OFF signal» can be delivered.

Parameter: *ContinuousPurge (activated / deactivated)*

Response to extraneous light in standby

As a response to extraneous light in the standby phase, it is possible to choose start prevention or lockout.

Parameter: *ReacExtranLight (Lockout / Startblock)*

4.2.4 Selection of fuel

Selection of fuel with the fuel selector on the LMV5...

The fuel selector is given priority and has 3 positions: INT, GAS and OIL. It is connected directly to the LMV5... basic unit.

It is possible to switch between oil and gas firing.

If the fuel selector is set to INT, either of the 2 sources can be selected: BACS **or** AZL5…

Selection of fuel on the AZL5...

The type of fuel is selected via the menu on the AZL51…

The selection is only possible when the fuel selector is set to INT (or when no selector is connected).

Fuel selection is continuously stored via power-Off, so that a valid fuel selection is present when power returns.

Selection of fuel via BACS (modbus /ebus

Selection of fuel via ebus (through BACS) is only possible when the fuel selector on the LMV51... basic unit is set to INT and, on the AZL5…, fuel selection via BACS has been selected.

Note: Fuel selection via BACS should be cyclically repeated.

There is no definition of priorities between fuel selection via ebus and fuel selection via the AZL5…, which means that the selection made last will be used.

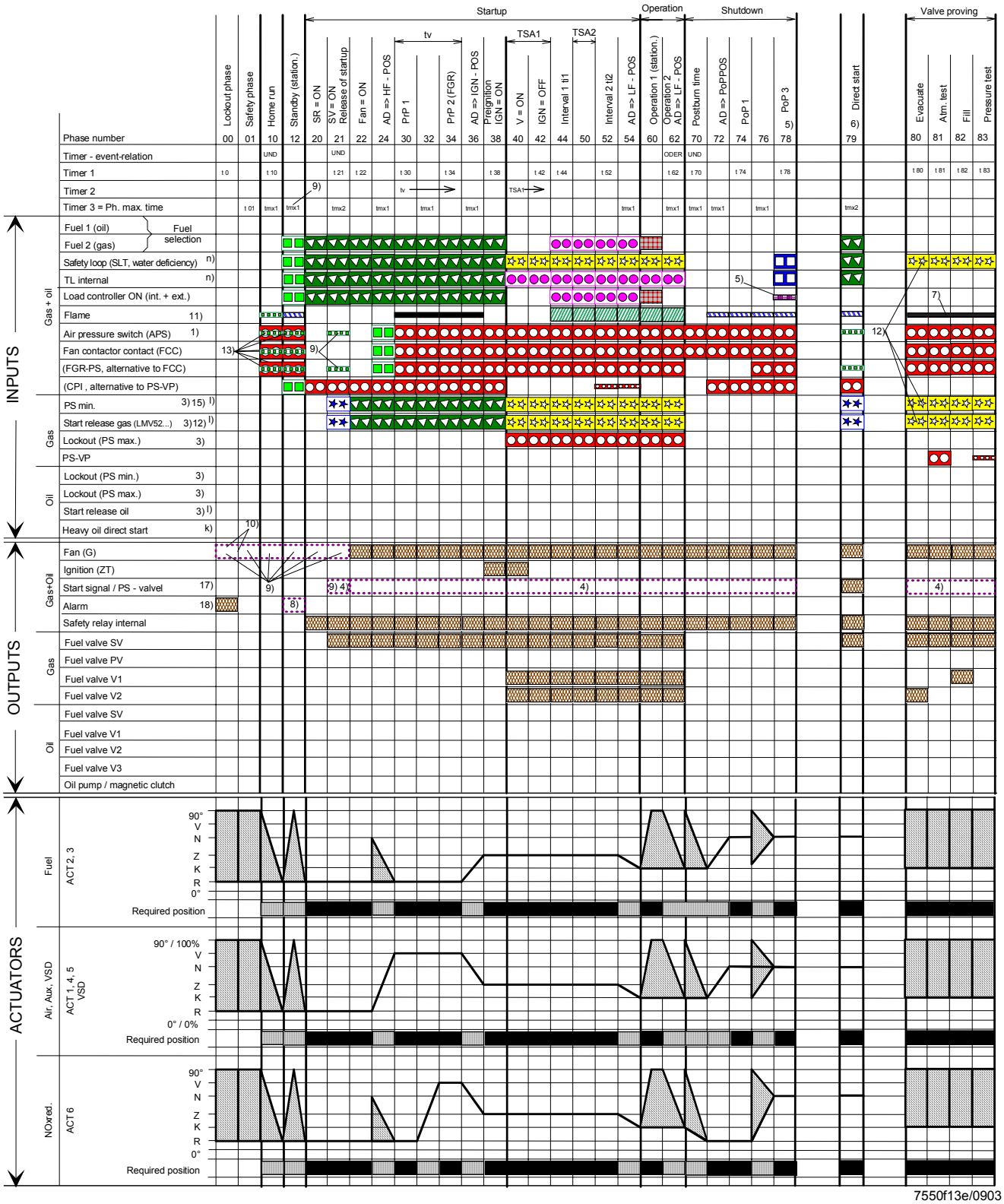
Fuel changeover

After fuel changeover, the burner control maintains or changes to standby (→ normal start). Now, a new start is made (provided there is demand for heat), firing on the selected type of fuel.

If → direct start has been parameterized, fuel changeover can also take place on shutdown in Phase 76. The fan will not be switched off.

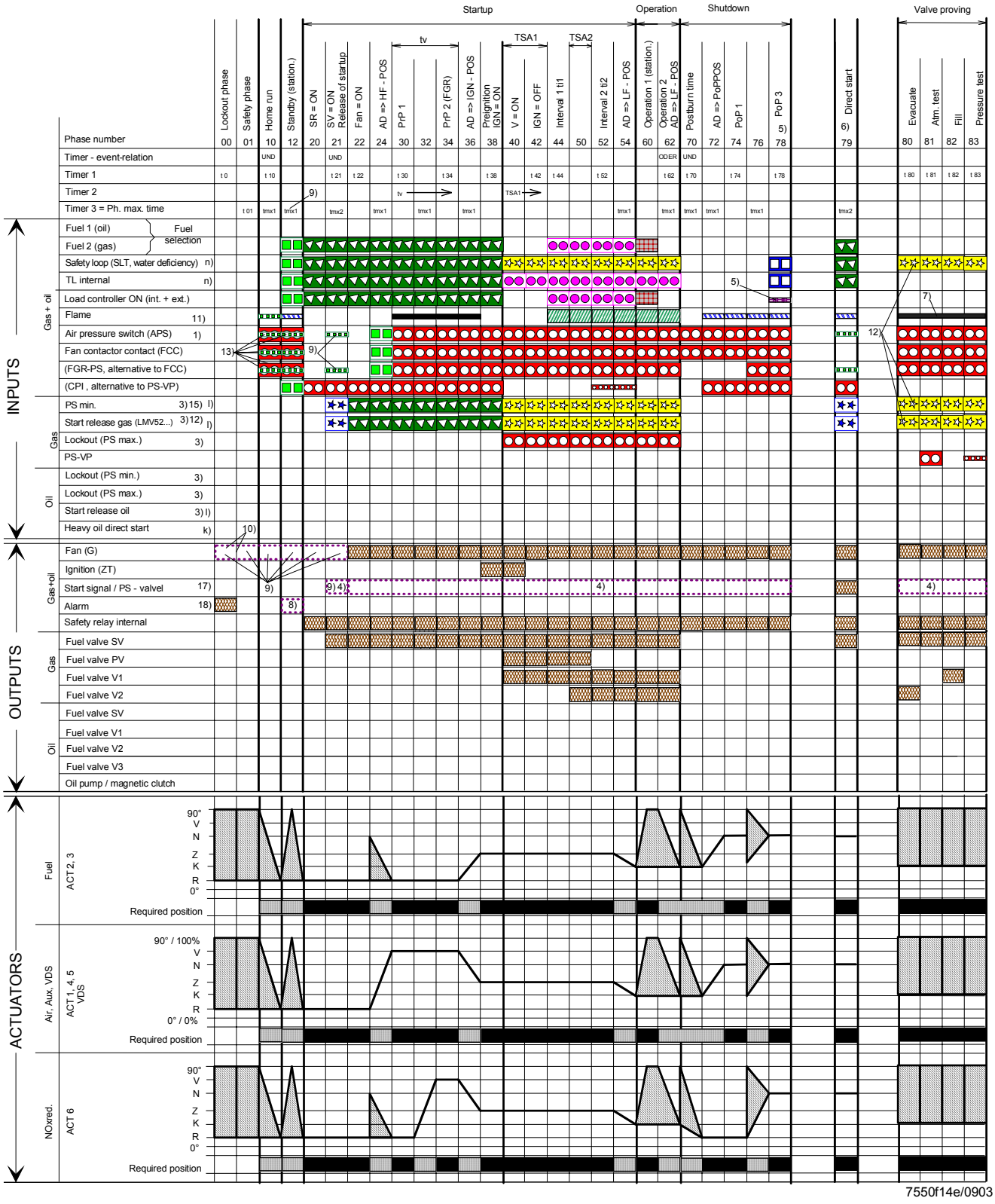
4.2.5 Sequence diagrams

Direct gas ignition **G**



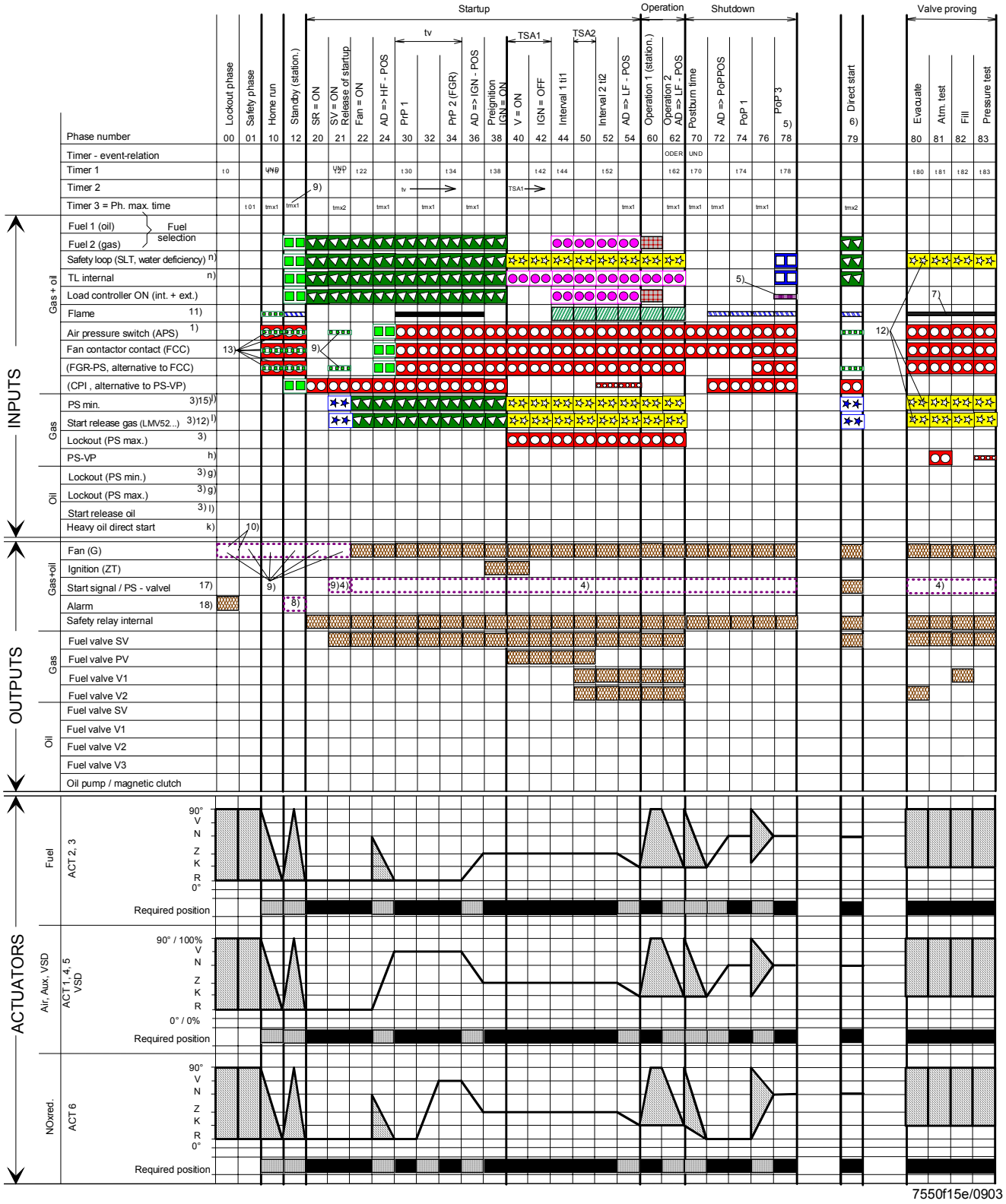
Program «Direct gas ignition» (also refer to «Fuel trains»)

Gas pilot ignition 1 | Gp1



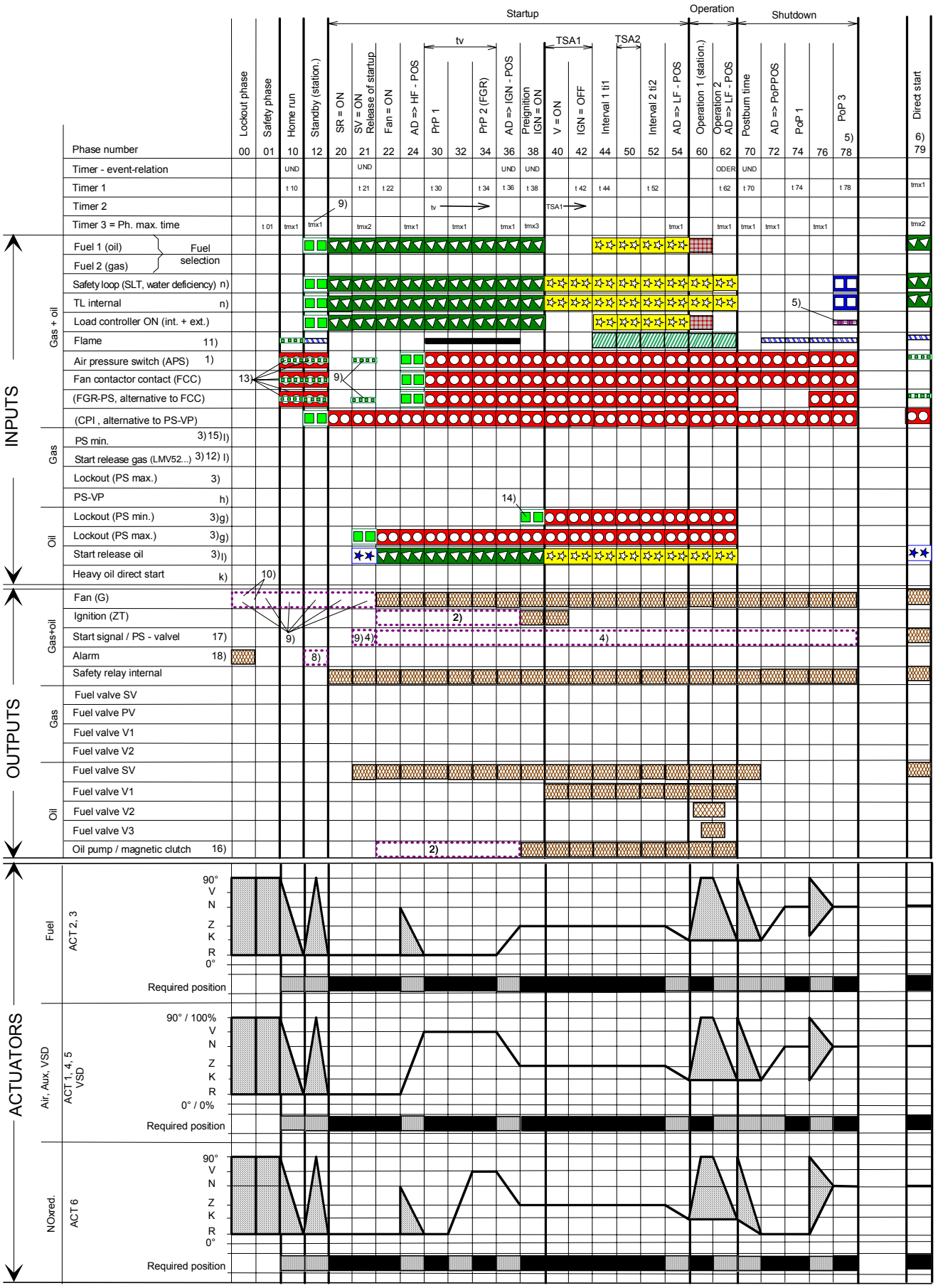
Program «Gas pilot ignition 1» (also refer to «Fuel trains»)

Gas pilot ignition 2 Gp2



Program «Gas pilot ignition 2» (also refer to «Fuel trains»)

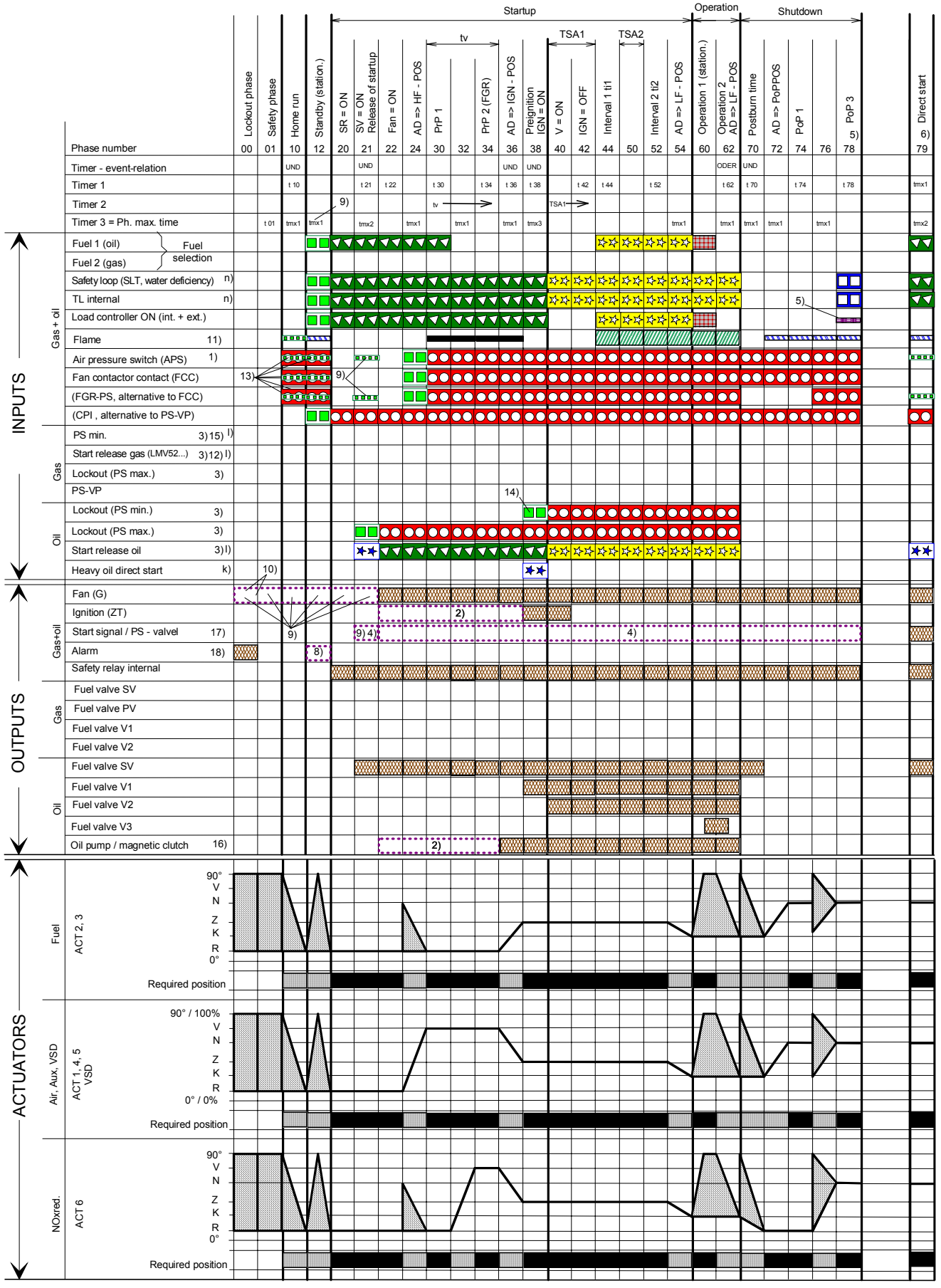
Light oil direct ignition LO



7550f16e/0903

Program «Light oil (LO) direct ignition» (also refer to «Fuel trains»)

Heavy oil direct ignition **HO**

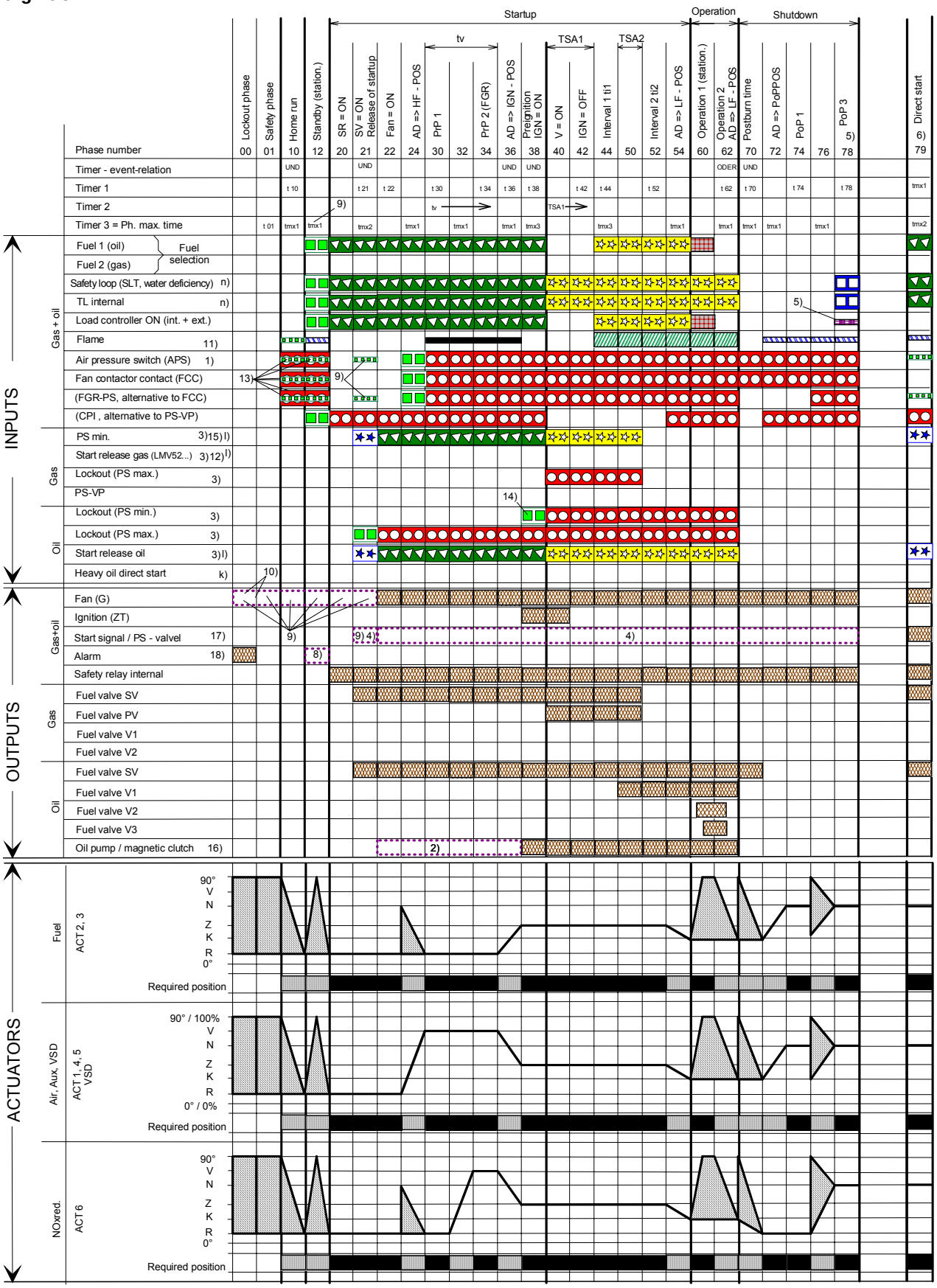


7550f17e/0903

Program «Heavy oil (HO) direct ignition» (also refer to «Fuel trains»)

Light oil with gas pilot ignition

LOgp

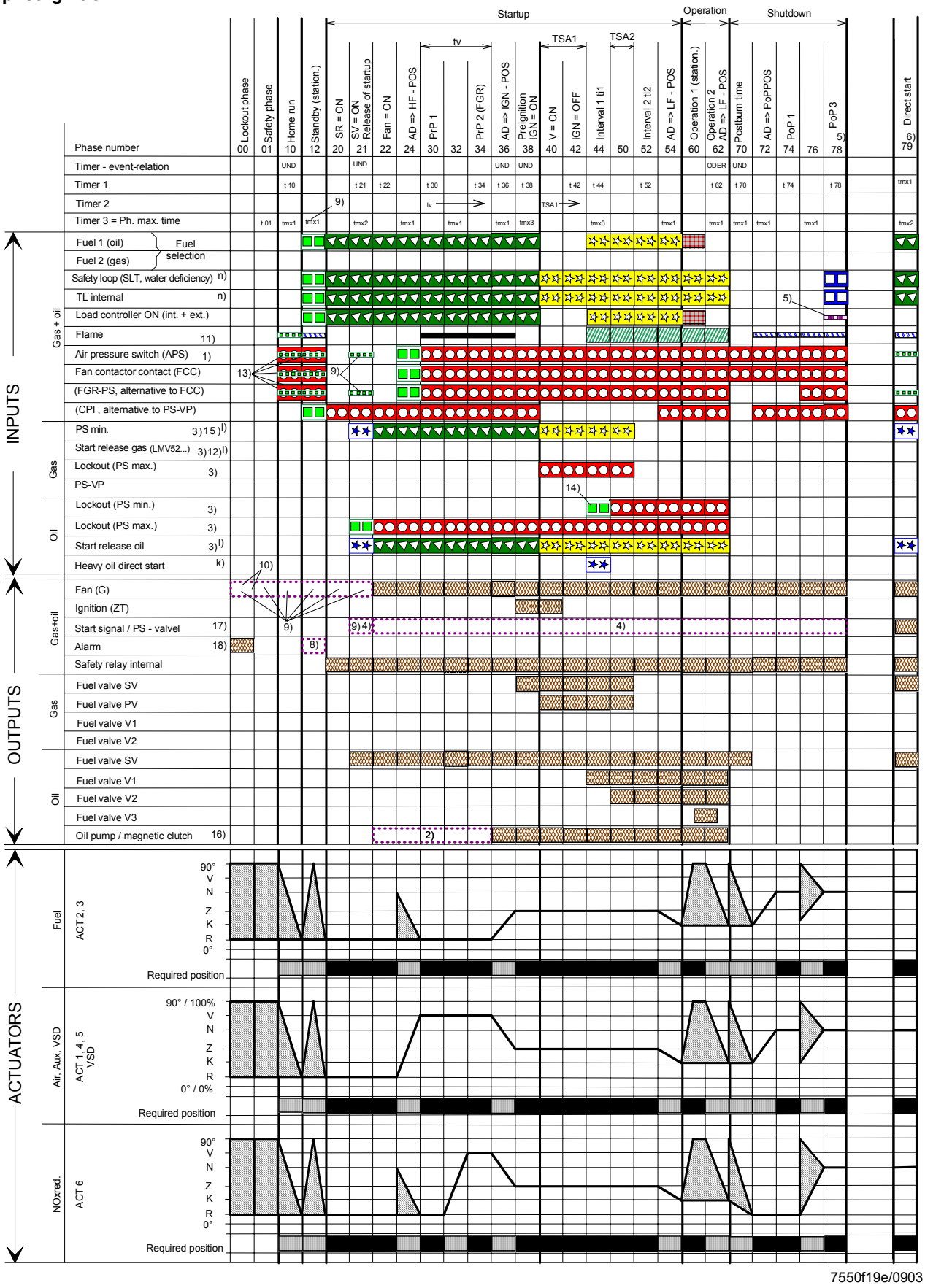


7550f18e/0903

Program «Light oil with gas pilot ignition (LOgp)» (also refer to «Fuel trains»)

Heavy oil with gas pilot ignition

HOgp



Program «Heavy oil with gas pilot ignition (HOgp)» (also refer to «Fuel trains»)

Legend to the sequence diagrams

Depending on the parameter, VP takes place:
between Ph62 and Ph70 or/and
between Ph30 and Ph32

Signal ON	Signal OFF	Next phase
		01 → 00, Rep = 0 12, Rep > 0
		Parameter direct start Checking with controller on Deviation → 10 No Rep. decrement
		10
		70
		Without VP70 with VP80
		62
		Stop, up to Ph – max. time → 01
		Stop, up to Ph – max. time → 10
	0 – 3 s	01 → 00, Rep = 0 12, Rep > 0
	0 – 30 s	01 → 00, Rep = 0 12, Rep > 0
0 – 3 s		01 → 00, Rep = 0 12, Rep > 0
		Param. → 79 10
		Input: don´t care Output: OFF
		Output: ON

1) Parameter: With / without PM
2) Parameter: Short / long preignition time for oil only
   Short / long oil pump – ON – time
3) Delayed shutdown within TSA1 + TSA2
4) Parameter: Output as startup signal / PM relief valve
5) Parameter: Normal / direct startup
   Normal startup → sequential phase = 10
   Direct startup → sequential phase = 79
   (when R = ON)
6) Sequential phase = 24
7) Only with valve proving during startup
8) Parameter: With / without alarm on prevention of startup
9) Parameter: With continuous purging
10) Fan controlled as before
    Running time when LOCK OUT = T_FanLockout
11) Parameter: With / without extraneous light test in STANDBY
12) With valve proving during startup in the event of a deviation
    Startup phase 10
13) Parameter: Normal / continuous purging
    Normal purging: Checking for off in 10, Stop to Ph-max time → 01
    Continuous purging: Checking for on in 10 and 12, Stop up to Ph-max time → 01
14) Parameter: "OilPressureMin", „akt_from_ts" → no check before
    TSA1 (LO, HO) or TSA2 (LOgp, HOgp)
15) Parameter: „GasPressureMin", „deakt_xOGP" → PSmin can be deactivated for oil programs with gas pilot
16) Parameter: „OilPumpCoupling", „direct_coupl" → SVoil has to be connected to output „Oil pump / magnetic clutch". Output is active when fan is on and for further 15 s after fan is switched off
17) Parameter: „Start / PSvalve", „PS_Reli_Inv"
    → Output PS valve will be logically inverted
18) Parameter: „Alarm act / deact", „deactivated"
    → The alarm output can temporarily be deactivated (only for the current error)

Assignment of times:

t0	Postpurge lockout position
t01	MaxT_SafetyPhase
t10	MinTimeHomeRun
t21	MinT_StartupRel
t22	FanRunupTime
t30	PrepurgePt1
t34	PrepurgePt3
t36	MinOnT_OilPump
t38	PreignitionT_Gas / Oil
t42	PreignitionT_Off
t44	Interval1 Gas / Oil
t52	Interval2 Gas / Oil
t62	MaxTimeLowFire
t70	AfterburnTime
t74	PostpurgeT1 Gas / Oil (tn1)
t78	PostpurgeT3 Gas / Oil (tn3)
t80	VP_EvacTime
t81	VP_TimeAtmPress
t82	VP_FillTime
t83	VP_TimeGasPress
tmx1	MaxDampRunTime
tmx2	MaxT_StartupRel
tmx3	MaxT_CircHOil
TSA1	SafetyTime1
TSA2	SafetyTime2
tv	PrepurgeTime_Gas / Oil

Permissible positioning range

In Standby: actuator can travel within the permissible positioning range, but is always driven to the home position. Must be in the home position before changing the phase

0°	Position as supplied (0°)
90°	Actuator fully open (90°)

FGR	Flue Gas Recirculation
CPI	Closed Position Indicator
AD	Air damper
PS-VP	Pressure Switch-Valve Proving
FCC	Fan Contactor Contact
LF	Low-fire position
APS	Air Pressure Switch
PS	Pressure switch
PoP	Post-Purge position
HP	Home position
SR	Safety Relay
SLT	Safety Limit Thermostat
TL	Temperature Limiter
HF	Pre-Purge position / pre-purge
IGN	Ignition position

Repetition counter:

k)	Heavy oil
l)	Restricted startup behavior
n)	Restricted safety chain

5 Fuel / air ratio control (FARC)

5.1 General

The electronic fuel / air ratio control system LMV51... can control up to 4 actuators, the LMV52... up to 6 actuators. The functions of the dampers are ready assigned to the addresses and are defined as follows:

	LMV51...	LMV52...
1	Air damper	Air damper [2)]
2	Fuel 1 (gas)	Fuel 1 (gas)
3	Fuel 2 (oil)	Fuel 2 (oil)
4	Auxiliary actuator 1 (mixing device) [1)]	Auxiliary actuator 1 (mixing device) [2)]
5		Auxiliary actuator 2 [2)]
6		Auxiliary actuator 3 (FGR) [2)]
7		VSD [2)]

[1)] VSD (LMV51.2...)

[2)] Actuators used in connection with air control (can be parameterized)

Actuators 1...6 are controlled with a resolution of 0.1°. They can be adjusted between 0° and 90°. The VSD is controlled with a resolution of 0.1 %. It can be adjusted between 0 % (off, prepurge / postpurge fan speed) or 10 % (ignition and operating speeds) and 100 %.

5.1.1 Program sequence

The program phases are controlled by the burner control. They advance in tune with the fuel / air ratio control system.

Standby

In standby, the actuators are driven to their home positions. A deviation from the required position does not lead to lockout, but only to start prevention. The home position is defined for all actuators and can be adjusted differently for oil and gas.

Parameters:	LMV51...	LMV52...
HomePosAir	x	x
HomePosGas	x	x
HomePosOil	x	x
HomePosAux	x	x
Aux2		x
Aux3		x
VSD		x

Preventilation

In Phase 24, the actuators used for the control of air (air actuator and auxiliary actuator) are driven to their postpurge positions. If the actuator does not reach the required position within the maximum time, safety shutdown will take place → position check. The prepurge time starts only when the actuators have reached their prepurge positions. The prepurge position is only defined for the actuators used for the control of air and can be parameterized depending on the type of fuel. The fuel actuators maintain their home positions.

Parameters:	LMV51...	LMV52...
PrepurgePosAir	x	x
PrepurgePosAux	x	x
Aux2		x
Aux3		x
VSD		x

Ignition

In Phase 36, all actuators are driven to their ignition positions. For that purpose - like in prepurging - a maximum time is available within which the ignition position must be reached → position check.

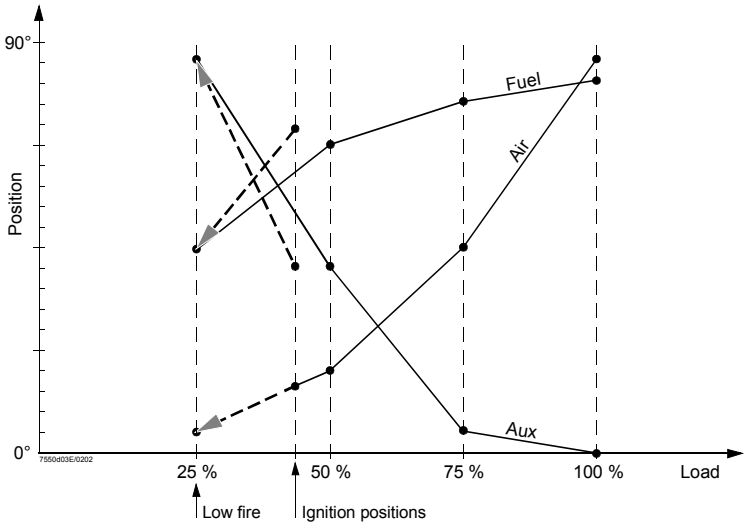
Ignition takes place only when the required position is reached. The ignition position can be adjusted for all actuators, depending on the type of fuel.

Parameters:	LMV51...	LMV52...
IgnitionPosAir	x	x
IgnitionPosGas	x	x
IgnitionPosOil	x	x
IgnitionPosAux	x	x
Aux2		x
Aux3		x
VSD		x

Traveling to the operating position

When ignition has taken place and the flame has stabilized, the actuators must be brought into line. For that purpose, the control unit drives the actuators to their basic part load position (low-fire) as defined by the curves.

The actuators which, for ignition, have assumed a special position, travel at individually calculated speeds to ensure that all of them will reach the part load position at the same time.



Traveling to the low-fire position after ignition

Note: The system also permits ignition positions that lie outside the range defined by fuel / air ratio control, that is, not between high-fire and low-fire.

Operation

In the operating position, the dampers are adjusted according to demand. The ratio curves are defined for gas and oil.

For modulating operation, the output can be adjusted in increments of 0.1°.
The actuators travel to the defined ratio curves.

In multistage operation, 2 or 3 load points can be approached.

For more detailed information, refer to section «Operating position».

End of operating position

After there is no more demand from the controller, the fuel / air ratio control system first changes to low-fire (Phase 62) before the fuel valve close. For that purpose, a maximum time is available which can be parameterized → part load shutdown.

Postpurging

When the burner is shut down, the actuators will be driven to their postpurge positions in Phase 72.

For that purpose, a maximum time is available → position check.

The postpurge position is defined for all actuators and can be adjusted depending on the type of fuel.

Parameters:	**LMV51...**	**LMV52...**
PostpurgePosAir	x	x
PostpurgePosGas	x	x
PostpurgePosOil	x	x
PostpurgePosAux	x	x
Aux2		x
Aux3		x
VSD		x

Actuator speed outside normal operation

The actuators' speed when traveling to the home, prepurge, ignition and postpurge positions can be parameterized.

Parameter: *TmeNoFlame*

Outside normal operation, all actuators travel at that speed.

Note

When parameterizing the operating ramp, the speed of the **slowest** actuator must be taken into consideration!

Operating position

Modulating operation is possible for both types of fuel, gas and oil.

Modulating

In the operating position, the dampers are driven to the defined fuel / air ratio curves in accordance with the required output. Up to 15 curvepoints can be defined. The spacing of the points (difference in output) can be freely selected.

The positions of the curvepoints are calculated by making linear interpolations.

To ensure correct fuel / air ratio control at any time, the actuators travel in steps of maximum 1.2 seconds. This traveling time corresponds to a positioning angle of 3.6° at an operating ramp of 30 seconds / 90 °.

For each of these steps, an individual speed is calculated for each actuator, so that all actuators reach the required positions at the same time.

The speed of the fastest actuator can be parameterized.

Parameter: *OperatRampMod*

The → position check is always made between the individual steps when the actuators do not move.

If there is a curvepoint on the way to the next target on the curve, it will always be approached.

Note

When parameterizing the operating ramp, the speed of the **slowest** actuator must be taken into consideration!

Multistage operation

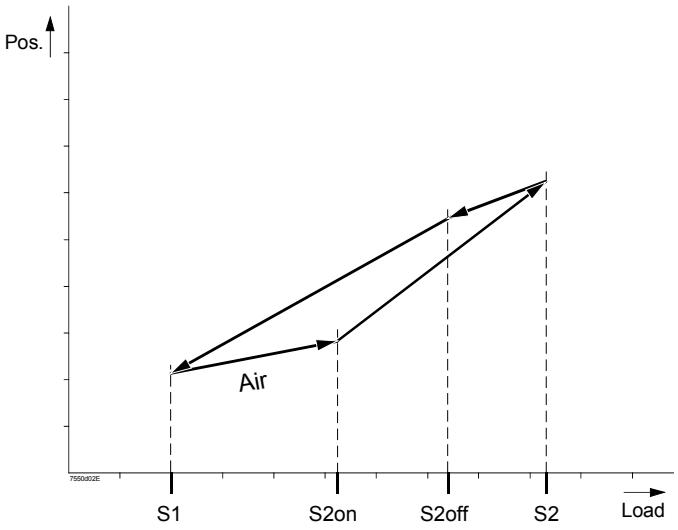
Multistage operation is only possible when firing on oil. It is possible to parameterize if multistage or modulating operation is used.

Electronic fuel / air ratio control can be configured for both 2-stage and 3-stage burners. In this operating mode, the oil actuator is not controlled.

Parameter: *Operation Mode (Two-stage / Three-stage / Modulating)*

Multistage fuel / air ratio control is defined via different load points. These are the stationary operating points and separately adjustable switch-on / off points.

Parameter: *SetPointStage1*
Parameter: *StartPointStage2*
Parameter: *OffPointStage2*
Parameter: *SetPointStage2*
Parameter: *StartPointStage3*
Parameter: *OffPointStage3*
Parameter: *SetPointStage3*



Multistage operation (here: 2-stage)

Between these points, the actuators are adjusted during their continuous travel. The speeds of the individual actuators will be calculated such that they reach their targets at the same time.

The speed of the fastest actuator can be parameterized.

Parameter: *OperatRampStage*

Note

When parameterizing the multistage operating ramp, the speed of the **slowest** actuator must be taken into consideration!

When changing from stage 1 to stage 2, first «switch-on point S2» is approached, starting from «operating point S1». Now, the second fuel valve is opened.

Then, the system travels to «operating point S2».

If the output shall be cut back to stage 1, first «switch-off point S2» will be approached.

If «switch-off point S2» has not yet been set, «switch-on point S2» will be approached and the fuel valve closed.

Then, the ratio position of «operating point S1» will be approached again.

The procedure is analogous when switching from stage 2 to stage 3 and back again.

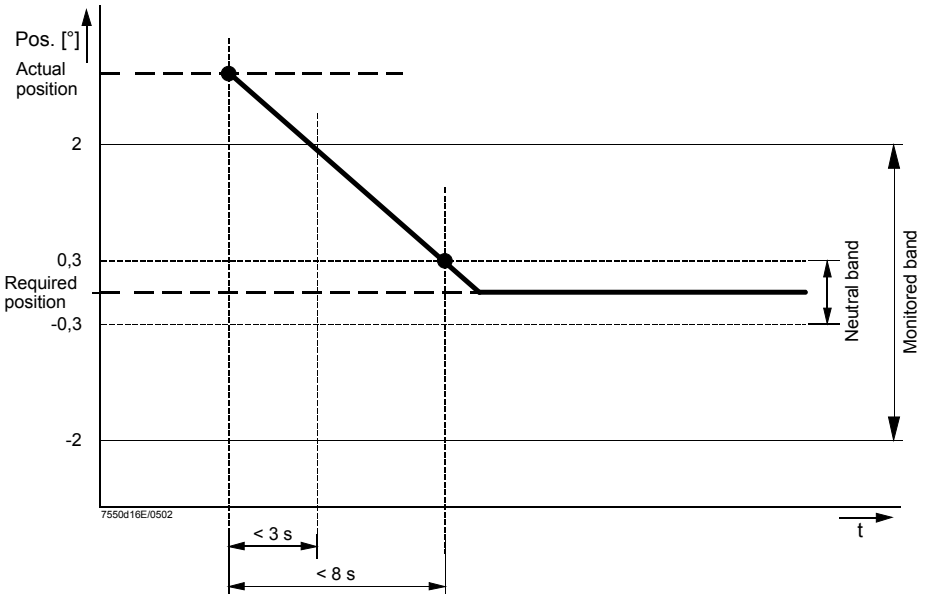
5.1.2 Position check

Dynamic safety time ratio control

Definition of «Safety time ratio control»:

- «Safety time ratio control» is the period of time during which deviations from the required position of one or several actuating devices are tolerated before the valves are shut down
- In contrast to the burner control's safety time, this safety time need not be fixed since the risk potential of a ratio control system increases in proportion to its deviation from the required state

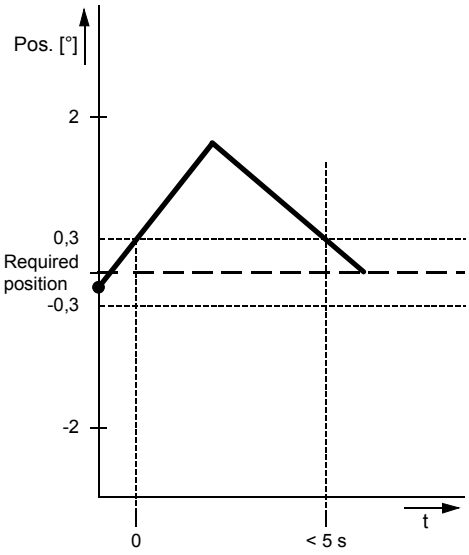
All safety-related supervision functions of the ratio control system, especially checking of the actuator positions with regard to the required positions, are based on this «Safety time ratio control».
The «Safety time ratio control» of 3 seconds considers the worst case. This describes the situation where the deviations from the actuators' required positions are such that loss of flame does just not yet occur, that is, the combustion process is as poor as it can possibly be.
In such a case, it is assumed that the amount of unburned or partly burnt gases produced within 3 seconds is not sufficient to cause deflagrations or explosions within the «Safety time ratio control» or just after that time (that is, after the valves are shut down).
As mentioned above, it should also be considered that the smaller the deviation from the required state, the smaller the proportion of unburned gases. This means that the closer the required positions, the smaller the risk of dangerous conditions.
For this reason and for reasons of availability, the LMV5... uses a «Dynamic safety time ratio control».
This safety time is accomplished as follows:



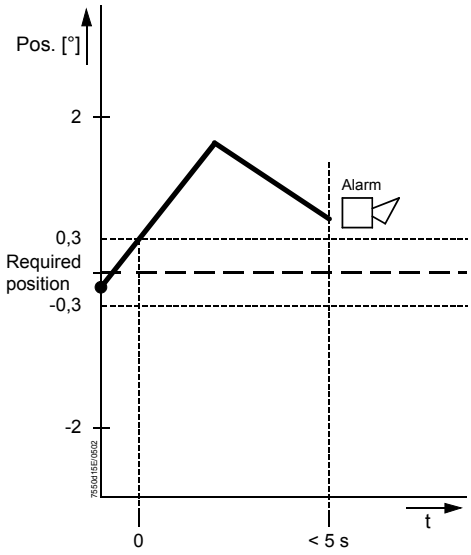
Successful change of position

In the case of a change of position, the current actuator position must have approached the required position to within 2° in no more than 3 seconds.
Otherwise, safety shutdown occurs.
Also, the neutral band must be reached within 8 seconds after starting the change in position.

If, due to external effects, an actuator moves from its required position by more than ± 0.3° (neutral band) for more than 8 seconds, the supply of fuel will be shut down.



Successful correction < 2°



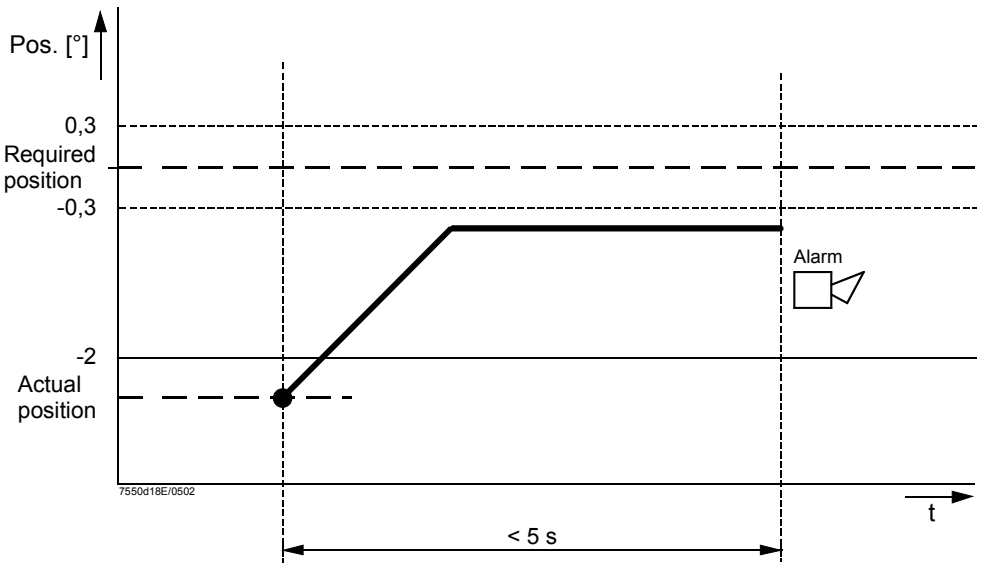
Fault < 2° (Stall point at constant output)

The required position is considered to be reached when it is within ± 0.3°.

When reaching a new position within ± 0.3°, the fuel / air ratio control system makes a fine adjustment on the actuators.

Readjustments of the position are made only if the current position deviates from the required position by more than 0.3°, followed by another fine adjustment.

If, during the load change, an actuator is mechanically blocked, the supply of fuel will be shut down within 3 or 8 seconds.



Locking on change of load (approach < 2° > 0.3°)

Outside the operating position

In the phases where the actuators are driven to one of the special positions (home, prepurge, ignition or postpurge position), there is no continuous position check. To make possible the change to the next phase, the required position must be reached. To travel to the required position, the maximum time available is 35 seconds or 20 % longer than *TmeNoFlame* parameterized. If the required position is not reached within this maximum period of time, safety shutdown will be initiated → actuator overload protection. In the phases where the damper does not move, the position is continuously checked. If there are deviations from the required position, adjustment attempts are made where the → «Dynamic safety time ratio control» is used.

Operating position modulating

The position checkback signal delivered by the actuators is evaluated only when the actuators do not travel, thus making possible precise position measurements.
To ensure that the actuators are not out of control of the basic unit for longer periods of time, longer movements are subdivided into traveling steps of 1.2 seconds. After each step, the required position must be reached. The required position is considered to be reached when the actuator has traveled to a band width of ± 0.3°.
If the actual position does not agree with the required position, readjustments will be made, whereby the → dynamic safety time of the fuel / air ratio control system will be applied.

Operating position multistage

In multistage operation, the actuators are monitored at stationary points. The actuators must reach these points within the calculated period of time, whereby the → dynamic safety time of the fuel / air ratio control system will be applied.
Additional position checks are made during the actuators' travel, in order to find out if the actuators do not move, or if they travel in the wrong direction.

5.1.3 Special features

Program stop

To facilitate burner startup, startup and shutdown can be stopped in several phases.
If a program stop is active, the special positions (prepurge, ignition and postpurge position) can be set in the respective phase.
If a program stop has been activated, it remains active until manual deactivation takes place (even after power-OFF).

Parameter: *ProgramStop (deactivated / 24 PrePurgP / 32 PreP FGR / 36 IgnitPos / 44 Interv 1 / 52 Interv 2 / 72 PostPPos / 76 PostPFGR)*

Direction of rotation of actuators

The actuators' direction of rotation can be reversed, so that the direction of rotation can be matched to the mounting. method. The direction of rotation must be selected before defining the ignition position and the curvepoints. If that is not observed, these points must be deleted before the direction of rotation is reversed. For that purpose, a special function called «Delete curves» is offered on the menu for selecting the direction of rotation.

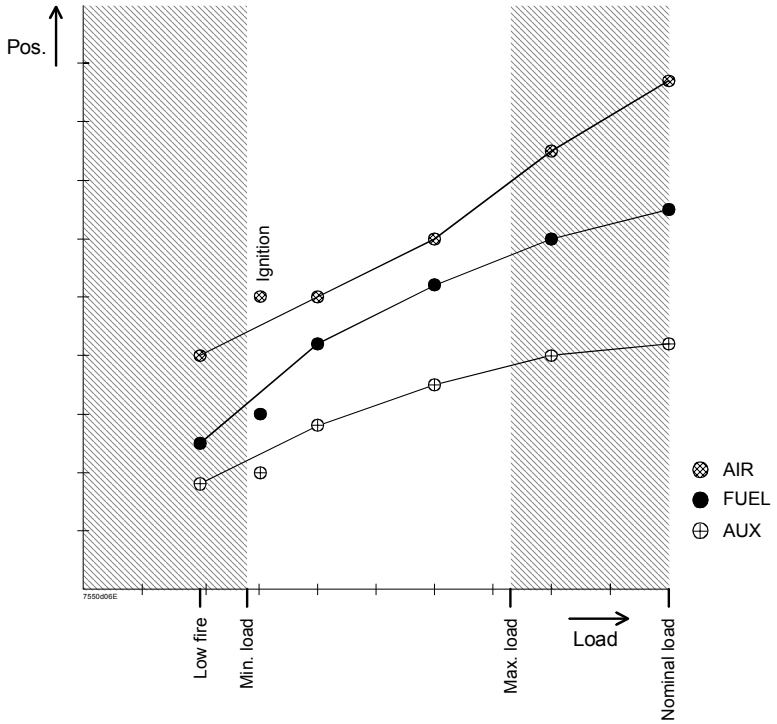
Parameters:	**LMV51...**	**LMV52...**
1 AirActuator (standard / inverted)	x	x
2 *GasActuator (oil) (standard / inverted)*	x	x
3 *OilActuator (standard / inverted)*	x	x
4 *AuxActuator (standard / inverted)*	x	x
5 AuxActuator 2		x
6 AuxActuator 3		x

Limitation of the load range

The curves are defined by the 2 limits «Low-fire» (part load) and «Nominal load» (maximum load).

In certain cases, it has proven practical to limit the burner's output, either temporarily or permanently.

This limitation of the burner's working range can make sense in both directions. The burner's working range then looks as follows:



Limited working range

The usable output range always lies within the defined curves. This means that if the minimum load is smaller than the low-fire load, loads below the low-fire load will be disregarded. And if the maximum load is greater than the high-fire load, loads above the high-fire load will be disregarded.

If the minimum load is greater than or equal to the low-fire load, the minimum load assumes the role of the low-fire load, that is, after ignition, the minimum load will be considered.

The 2 parameters «Minimum load» and «Maximum load» can be set depending on the type of fuel burnt, whereby:

Low-fire load ≤ minimum load ≤ maximum load ≤ nominal load

Parameter:	*MinLoadGas*
Parameter:	*MaxLoadGas*
Parameter:	*MinLoadOil*
Parameter:	*MaxLoadOil*

Activation of actuators / VSD

Parameters:	LMV51...	LMV52...
AuxActuator (deactivated / activated)	x	x
VSDOperation	LMV51.2...	
AirActuator (deactivated / activated) (air influen)		x
AuxActuator 1 (deactivated / activated) (air influen)		x
AuxActuator 2 (deactivated / activated) (air influen)		x
AuxActuator 3 (deactivated / activated) (air influen)		x
VSD (deactivated / activated)(air influen)		x

LMV51...

If the auxiliary actuator is not required, it must be deactivated. This can be selected separately for both types of fuel. Here, with the LMV51.2..., the VSD will be activated.

LMV52...

The required actuators must be activated. If O2 trim control is used, the actuators having an impact on the air volume must be parameterized to «air influen».

Number of fuel actuators

The standard LMV5... system uses 1 fuel actuator for gas and 1 fuel actuator for oil. But it is also possible to use one common actuator for the fuel damper and the oil pressure controller.
However, it is still possible to parameterize independent curves for both types of fuel.

Parameter: *NumFuelActuators (1 / 2)*

Note

If the above mentioned parameter was set to «1», the common fuel actuator must be addressed as a «gas actuator».

Traveling times

The traveling speed of the actuators can be adjusted for the different burner statuses. The time to be parameterized is the period of time the actuator requires to cover an angular rotation of 90°.
Traveling speed in the phases with no flame (e.g. traveling to prepurge):

Parameter: *TmeNoFlame*

Traveling speed in the operating position in modulating operation:

Parameter: *OperatRampMod*

Traveling speed in the operating position in multistage operation:

Parameter: *OperatRampStage*

When parameterizing the speeds, the running times of the connected actuators must be taken into consideration.

Shutdown behavior

The positions the actuators assume in the event of lockout can be adjusted. To facilitate fault diagnostics, the actuators can be stopped at their last position or can be driven to their home or postpurge position.

Parameter: *ShutdownBehav (Unchanged / PostpurgeP / HomePos)*

Overload protection of actuators

If the actuators block, lockout will be enforced.
However, if the actuators cannot reach the positions required by lockout, they would be damaged due to overtemperatures.
To prevent this, the actuators will be deactivated after a maximum time of 35 seconds, or at 20 % above the value for *TmeNoFlame* parameterized.

Curve adjustment

Refer to chapter «Displays and settings» / special function curve adjustment FARC.

6 Temperature or pressure controller (internal load controller LC)

6.1 General

The internal «load controller» is provided as an option to the LMV51... and is a standard component of the LMV52...

This is a digital PID controller for the control of temperature or pressure, featuring self-setting or manual setting of the control parameters.

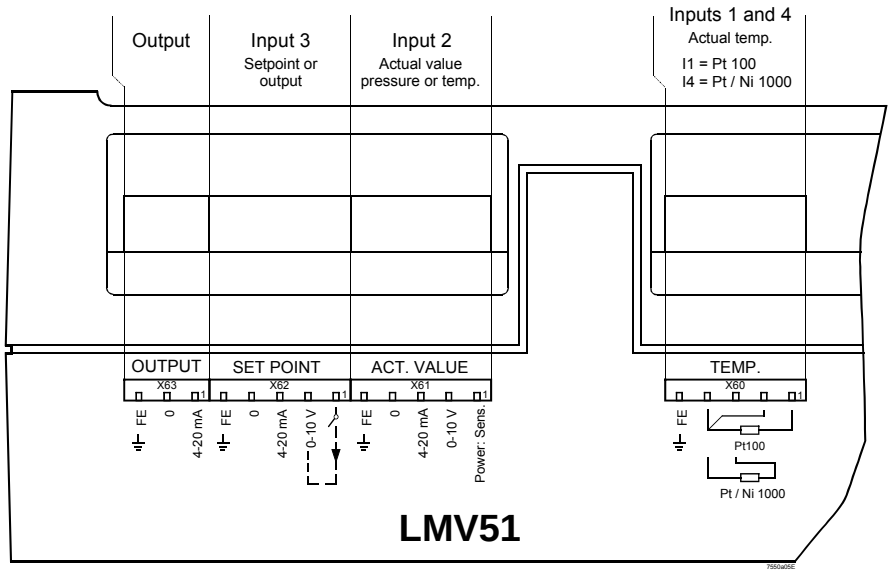
On fuel changeover, the control characteristics for modulating or multistage burners are automatically adapted if required.

Note

For operation and parameterization, refer to chapter «AZL5…»

6.2 Connection diagram

LR - connections



6.3 Operating modes with the load controller

For the connection of a load controller, the LMV5... can be operated in different configurations. In that case, the internal load controller, different external load controllers, or a load controller via a BMS can be used.

To ensure all involved bus users (BU, LC, AZL5…) are correctly configured, the global parameter «LC_OptgMode» will be defined.

This parameter is set on the AZL5… when selecting the operating mode and is delivered to all bus users involved. Then, each bus user makes the configurations required for the relevant operating modes.

Parameter: *LC_OptgMode (ExtLC X5-03/Int LC/Int LC Bus/Int LC X62/Ext LC X62/Ext LC Bus)*

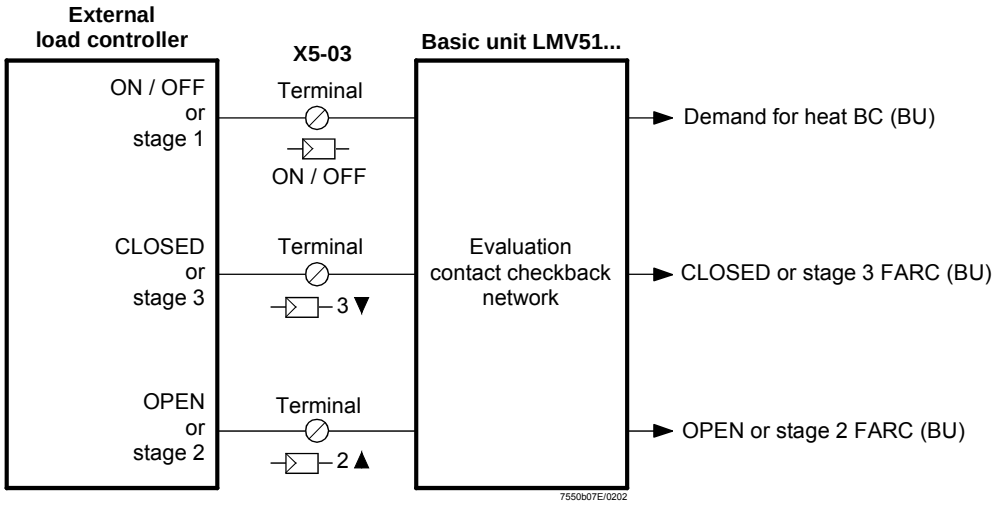
Operating mode 1 (ExtLC X5-03)

External load controller.

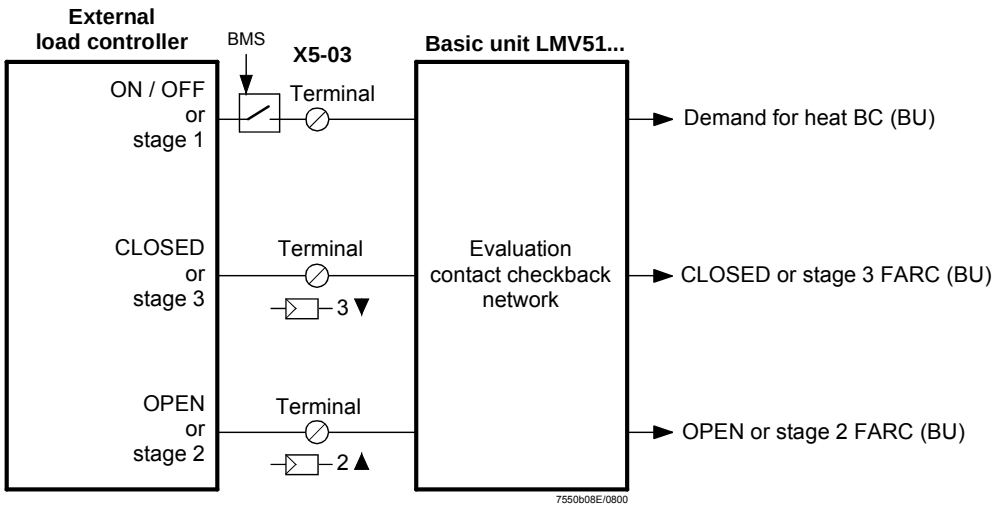
In this operating mode, an external load controller (e.g. RWF40...) is used. The internal control algorithm is not active.

The internal temperature limiter function can be activated.

The external load controller must have 3 contact outputs which - as shown below - must be connected to the LMV5... basic unit.

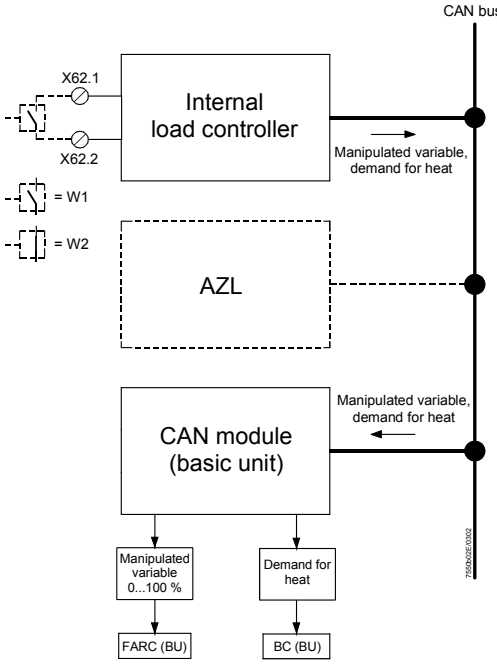


Special case: **BACS** as control via a contact



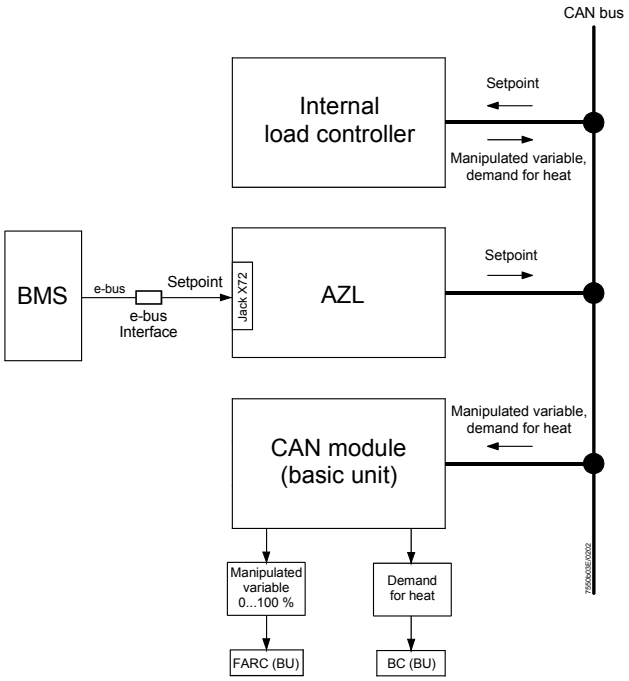
Operating mode 2 (intLC)

Internal load controller.
In this operating mode, the load controller inside the LMV5... is used (standard application).
The manipulated variable and the demand for heat are internally generated and handled.
Terminals X62.1 and X62.2 can be used to make an external changeover between the internal setpoints W1 and W2.



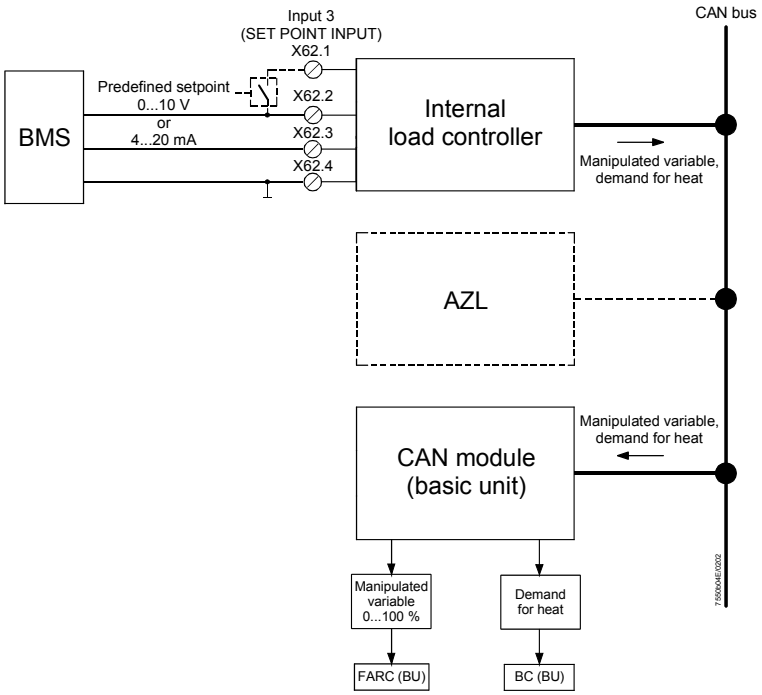
Operating mode 3 (int LC bus)

BACS as control via bus with the internal load controller.
The internal load controller is connected via the AZL5… and an external bus interface (Modbus) with a BACS. The BACS transmits “only“ predefined setpoints to the internal controller. This means that the actual control is provided by the internal load controller.
Terminals X62.1 and X62.2 can be used for changeover from the external predefined setpoint to the internal setpoint W1 (e.g. in the event the BACS fails), triggered via a potential-free contact (LC software version V01.40 or higher).



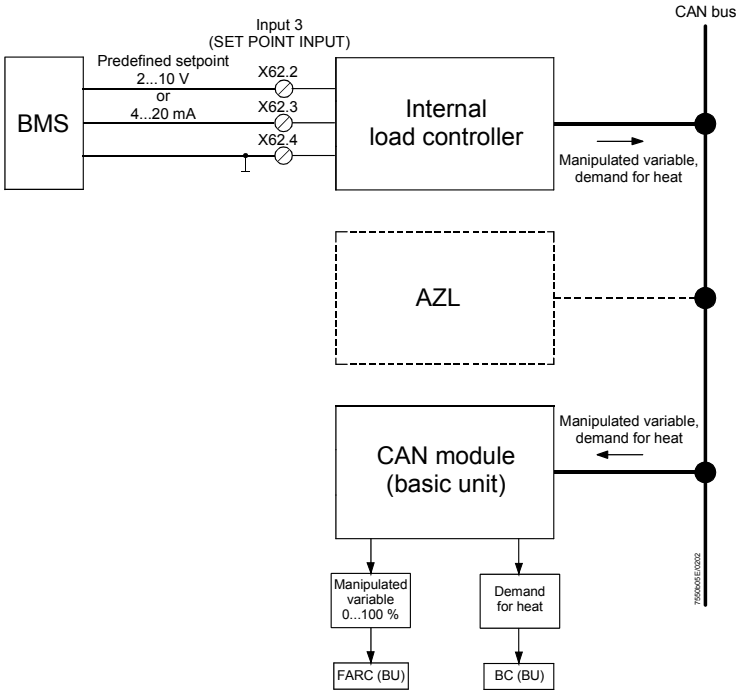
Operating mode 4 (int LC X62)

BACS as control via analog input with the internal load controller.
In principle, identical to operating mode 3, except that the BACS delivers the predefined setpoint via analog input 3 (SET POINT INPUT).
Terminals X62.1 and X62.2 can be used to make a changeover from externally (e.g. in the event the BACS fails) from the external predefined setpoints to the internal setpoint W1, using a potential-free contact (LC software version V01.40 or higher).
With a predefined setpoint via DC 0...10 V signal, voltage – in the case of changeover to the internal setpoint «W1» - must be separated from input X62.2.



Operating mode 5 (Ext LC X62)

The internal load controller is used for translating the analog load signal to the CAN bus protocol. BACS as control (or external controller) with analog predefined manipulated variable (load signal) to the controller inside the LMV5... .



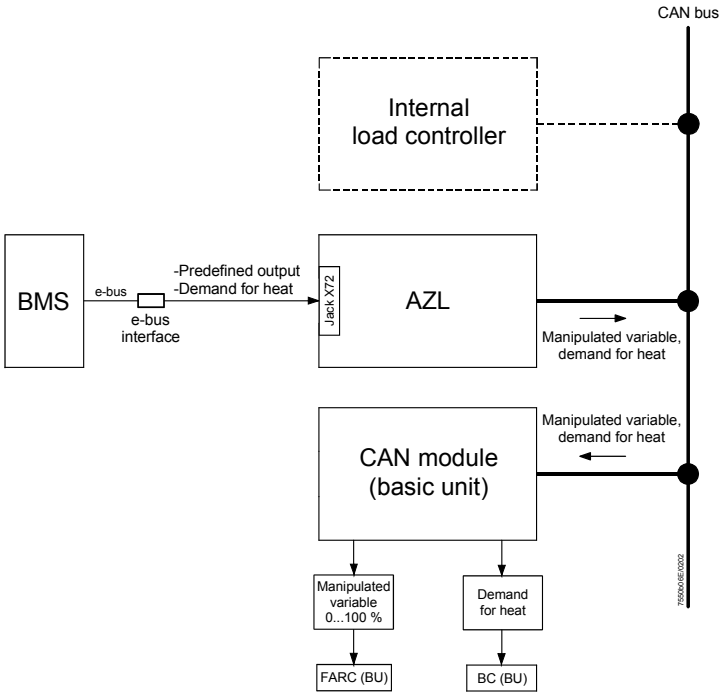
Operating mode 6 (Ext LC bus)

BACS as control with digital predefined load via bus.

The LMV5... system is connected to a BACS via the AZL5… and an external bus interface (e.g. eBus or Modbus).

The BACS contains the controller and transmits the load (manipulated variable) and the heat demand signal to the LMV5... system.

In this operating mode, the load controller inside the LMV5... is not required.



6.3.1 Operating mode changeover to internal load controller

To improve availability, a potential-free contact at inputs X62.1/ X62.2 can be used to switch from any of the other operating modes to the internal load controller. In that case, setpoint W1 applies.

Note:
When switching to operating mode 2 by means of an external contact, parameter «LC_OptgMode» set by the AZL5... will not be switched over. If one of the external operating modes was selected with the AZL5..., the internal LC parameter will no longer be offered for making settings. For this reason, to set the internal LC, parameter «LC_OptgMode» must first be set to «IntLC». Then, the LC operating mode must be set to the desired external operating mode.

To ensure that controller input X5-03 will not be valued when changing to operating mode 1 (ExtLC X5-03), the controller input at (ExtLC X5-03) should be deactivated. In operating mode 1 (ExtLC X5-03), the input is nevertheless active. Then, when changing to the internal load controller, the controller input is deactivated.

Parameter: *Input Controller (activated / deactivated)*

6.4 Control (characteristics)

Operating mode

The load controller can work in 2 different operating modes:

- Modulating, or
- Multistage

With electronic fuel / air ratio control, modulating or multistage mode must be selected, depending on the type of burner.

Parameter: *Operation Mode (Two-stage / Three-stage / Modulating)*

6.4.1 Integrated 2-position controller (C = ON / OFF)

General

The integrated 2-position controller transmits to the burner control section the internal information «Heat demand controller» (C = ON / OFF).

Switching differentials

Modulating mode:

C = ON when: Actual value ≤ (setpoint ± SD_ModOn)
C = OFF when: Actual value > (setpoint + SD_ModOff)

Multistage mode:

C = ON when: Actual value ≤ (setpoint ± SD_Stage1On)
C = OFF when: Actual value > (setpoint + SD_Stage1Off) or
C = OFF when: Actual value > (setpoint + SD_Stage3Off) = low-fire; always applies if none of the 2 thresholds Q2 or Q3 has been exceeded

Note: When «SD_*_On» is positive, the switching differential lies above the setpoint. When«SD_*_On» is negative, the switching differential lies below the setpoint (LC software version V01.40 or higher).

Parameters: *SD_ModOn*
SD_ModOff
SD_Stage1On
SD_Stage1Off
SD_Stage2Off
SD_Stage3Off

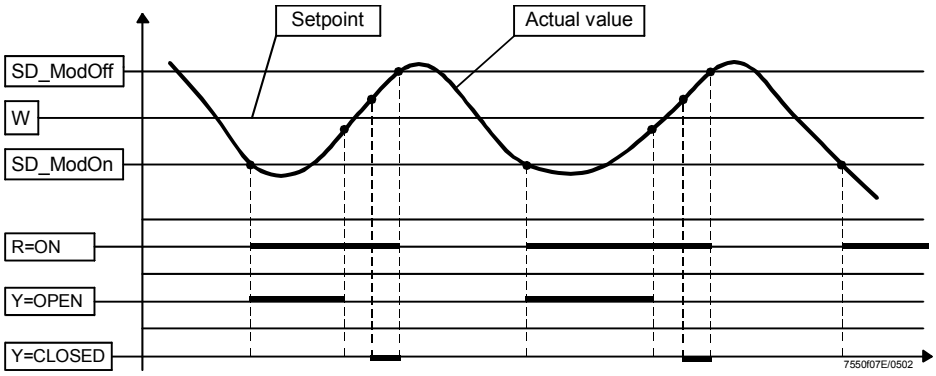
6.4.2 Modulating control

General

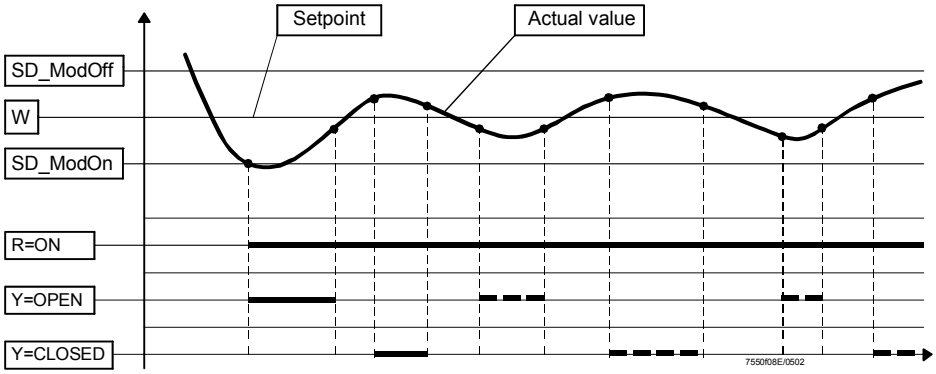
When selecting «Gas» as a fuel, the LMV5... will automatically operate in modulating mode. For that reason, no parameterization is required when firing on gas.
When selecting «Oil» as a fuel, the operating mode is to be set to «Modulating» - if required - using parameter «Operation Mode» of the electronic fuel / air ratio control system.
In this operating mode, the LC calculates the manipulated variable by means of a PID algorithm, depending on the control differential.

Function diagrams

Example 1: The load is so small that the controller must switch to ON / OFF mode.



Example 2: The load is greater than the amount of heat produced by the burner under part load conditions, thus enabling correct modulating operation.



Control parameters

Manual setting of the control parameters

Parameters:
Proportional band: *P-Part (Xp) (2...500 %)* of the parameterized measurement range
Integral action time: *I-Part (Tn) (0...2000 s)* 0 = no I-part
Derivative action time: *D-Part (Tv) (0...1000 s)* 0 = no D-part
The PID parameters can be manually set to any value of the above setting ranges, or a triple value from the standard values described below can be activated (and further edited it required).

Standard values:

The controller's memory contains 5 standard parameter sets.
If required, one of these 5 PID triple values can be copied to the storage locations for the current values so that it becomes active.
PID standard values for the following applications:
Parameter: *Standardparam (very fast / fast / normal / slow / very slow)*

Self-setting of control parameters (adaption)

Parameter: *AdaptionLoad*

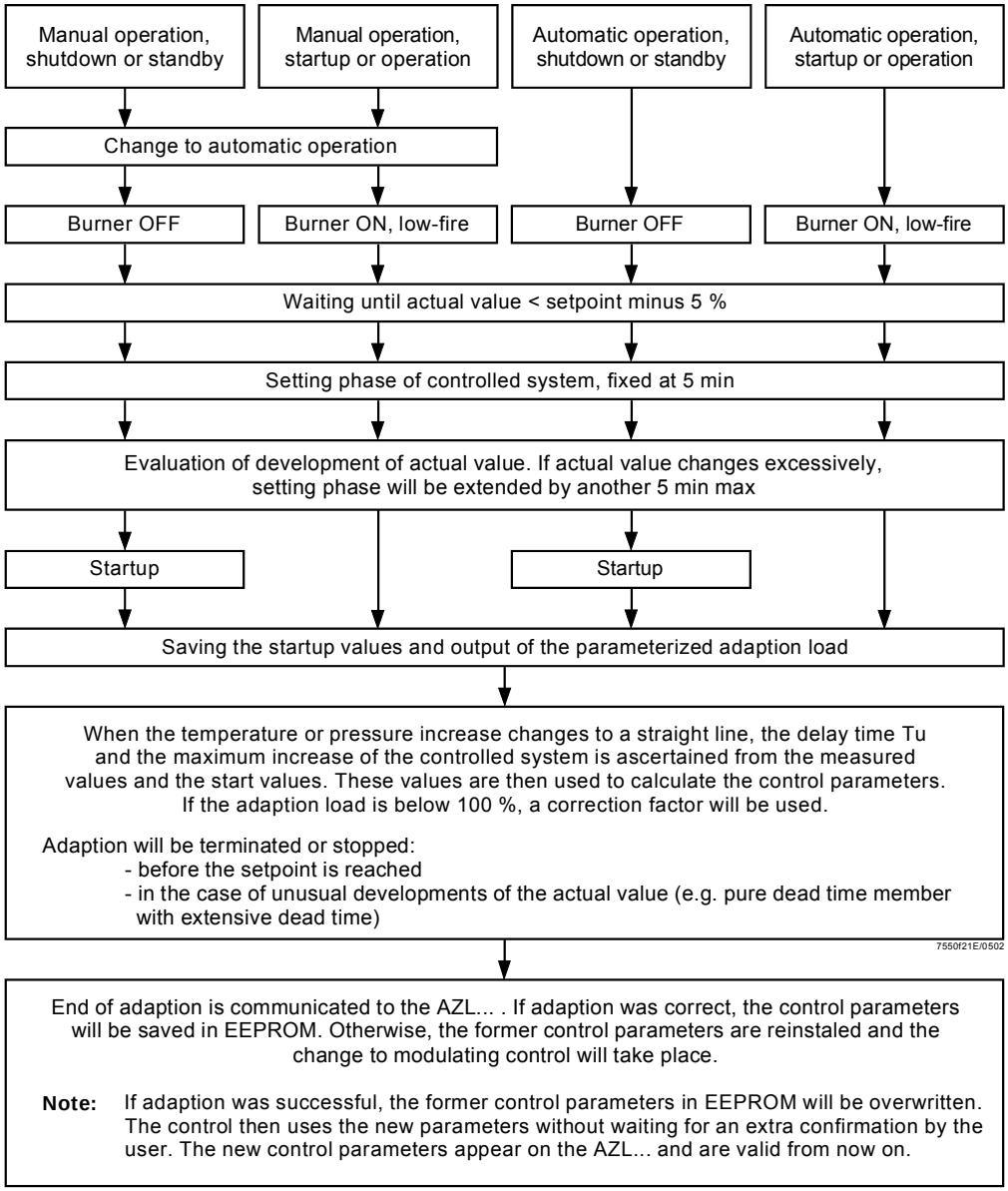
The load controller integrated in the LMV5... is capable of identifying the controlled system, of calculating its PID parameters based on the acquired characteristic data and of resetting the parameters. In modulating mode, the adaption function is available for both temperature and pressure control. In multistage mode, the PID controller is active, so that no adaption can be made there.

Adaption can be activated in a number of ways:

1. Adaption from manual operation
   a) Adaption from shutdown or standby «Burner OFF»
   b) Adaption from startup or operation «Burner ON»
2. Adaption from automatic operation
   a) Start of adaption from shutdown or standby
   b) Start of adaption from startup or operation

⚠ **During adaption of the LC, O2 trim control may not be active, since this can considerably distort the PID parameters ascertained!**

Adaption sequence



Note

Refer to chapter «Displays and settings» / special function adaption LC

Checking the control parameters

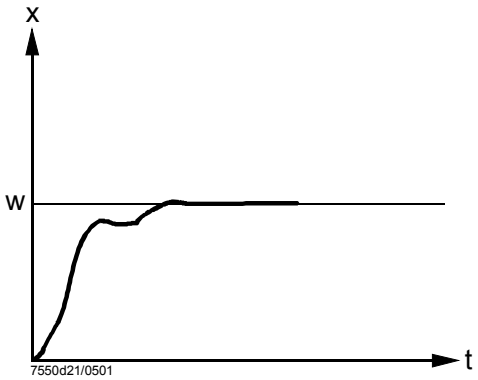
Optimum adaption of the controllers to the controlled system can be checked by recording the actual value during startup while the controlled system is working. The diagrams below reveal incorrect settings and give hints on remedy.

Example

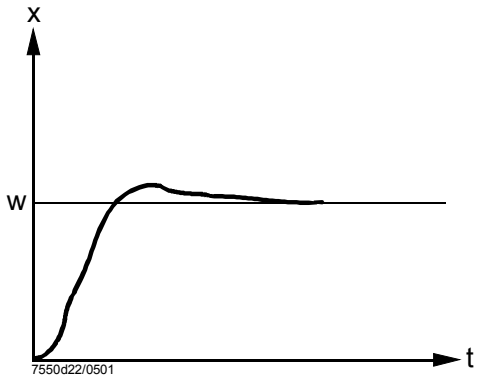
Here, the behavior of a controlled system of the 3rd order for a PID controller is shown. The procedure for setting the control parameters can also be applied to other types of controlled systems.

Practical value for «TN : TV» = 4...6.

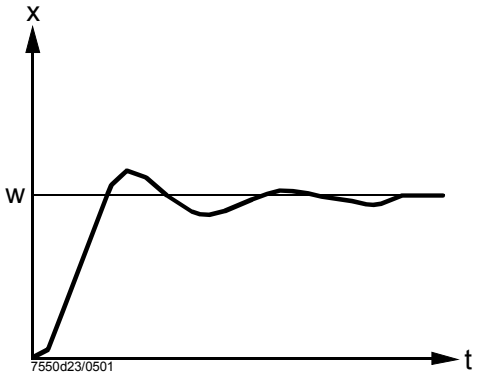
XP too small



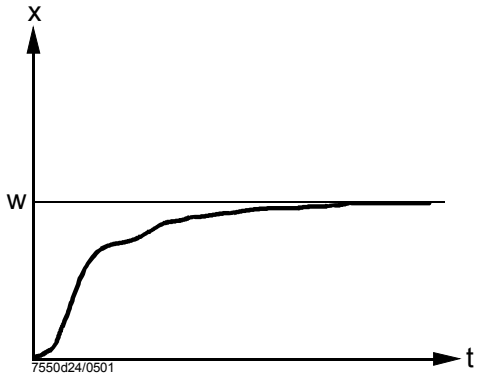
XP too great



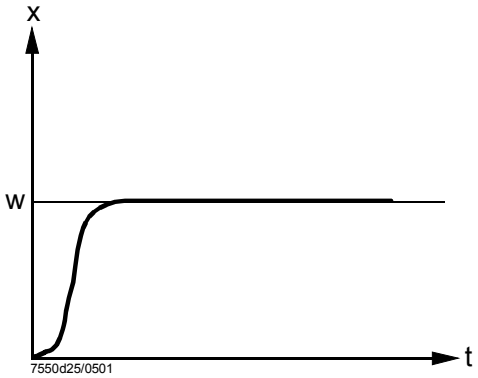
Tn and Tv too small



Tn and Tv too great



Optimum setting



Settling of the manipulated variable

Settling of the manipulated variable is used in modulating mode to avoid unnecessary drive pulses, thus extending the life of the controlling elements.
Settling of the manipulated variable is active across the entire working range so that a neutral zone is no longer required.

Principle

For setting the settling of the manipulated variable, a parameter is used that can be set by the user, it is called «Minimum possible step of the controlling element».

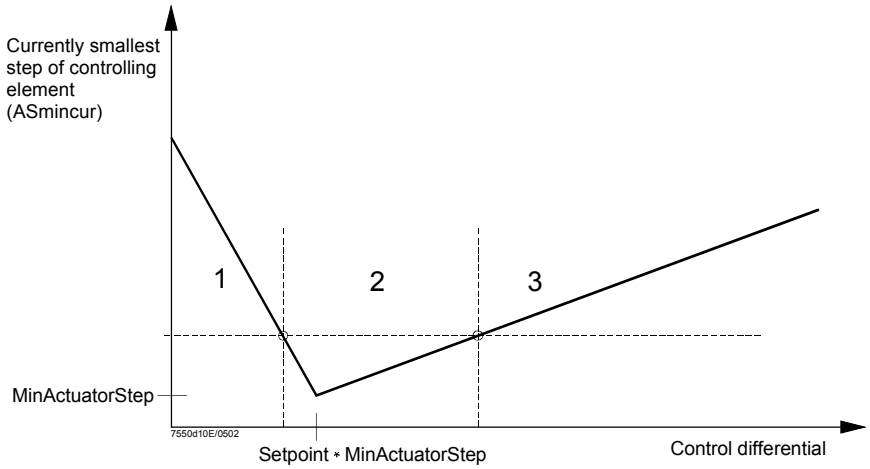
Parameter: *MinActuatorStep*

Based on this value, the «currently smallest step of the controlling element» (ASmincur) is calculated, depending on the control differential.

If the difference between the newly calculated manipulated variable and the manipulated variable delivered last is smaller than ASmincur, the last manipulated variable will be maintained and the newly calculated manipulated variable rejected.

Calculation of the «currently smallest possible step of the controlling element» (ASmincur) is made differently for the 2 ranges:

a) Value of control differential smaller than setpoint * MinActuatorStep
b) Value of control differential greater than setpoint * MinActuatorStep



Parameter: *MinActuatorStep: (0.5...10 %)*

Description (graph)

Settling of the manipulated variable is based on the following considerations:

Sector 1

- Actual value very close to the setpoint
- Range of a small number of large steps of the controlling element

In this range, the setpoint can be maintained with a small number of steps of the controlling element. If required, large changes of the controlling element are possible - in contrast to the classical neutral band.

Sector 2

- Actual value near the setpoint
- Range of a large number of small steps of the controlling element

In this range, to ensure control, the smallest steps of the controlling element are possible.

Sector 3

- Actual value far away from the setpoint
- Range of a small number of large steps of the controlling element

In this range, small steps of the controlling element are suppressed since they would not yet have any major impact.

6.4.3 Multistage control

General

When selecting «Oil» as a fuel, the LMV5... must be set to «2-stage» or «3-stage», depending on the type of burner used, using parameter «Operation Mode» (refer to section 5.4 → «Operating mode»).

In these 2 operating modes, the PID algorithm is not required and will not be calculated.

The 2 or 3 fuel stages are activated and deactivated depending on the actual values, the parameterized switching differentials_Stage1...3 (refer to subsection 5. 4. 1) and the parameterized reaction thresholds Q2 and Q3.

Load-dependent activation of the higher burner stages

This approach is used to reduce the switching frequency of the higher stages.

- The integral of the control deviation over time is generated
- Switching on of stage 2 will be locked until the temperature has dropped below the adjustable reaction threshold Q2
- Switching on of stage 3 will be locked until the temperature has dropped below the adjustable reaction threshold Q3

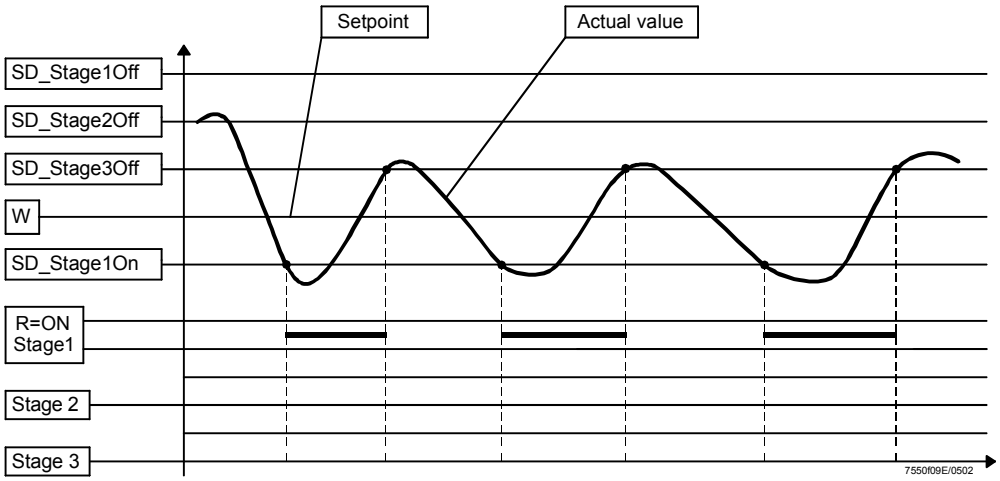
Parameter: *ThreshStage2On (Q2), ThreshStage3On (Q3)*
Reaction thresholds Q2 and Q3 (integral of control deviation (K) x time (s))

If the temperature often drops below the switching on thresholds, the integrals will be added up and the higher stage switched on when the associated Q-value is reached.

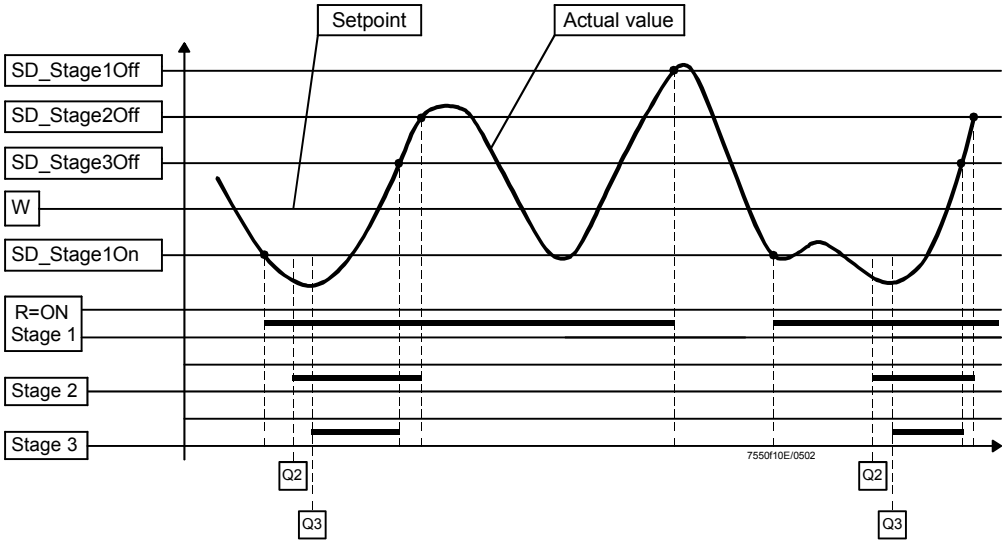
If, before that, the setpoint is reached with the lower stage, the counter will be reset.

Function diagrams

Example 1: Reaction thresholds Q2 and Q3 for switching on stages 2 and 3 are not reached. In that case, stage 1 will already be switched off when threshold W+SD_Stage3Off is reached (low-fire operation).



Example 2: Reaction thresholds Q2 and Q3 for switching on stages 2 and 3 are exceeded and the stages will be switched on.
In that case, stage 1 will be switched off when threshold W+ SD_Stage1Off is reached.



6.5 Actual values (X)

Measuring accuracy: Min. ± 1 % of the measuring range (excluding the sensor error).

Parameter: *UnitTemperature (Display °C / Display °F)*

Definition of sensors (incl. activation / deactivation of the TL function):
0 = input 1, Pt100, temperature (internal TL function = active)
1 = input 4, Pt1000, temperature, (internal TL function = active)
2 = input 4, LG-Ni 1000, temperature, (internal TL function = active)
3 = input 2, temperature, (internal TL function = not active)
4 = input 2, pressure, (internal TL function = not active)
5 = input 1 Pt100, for TC and TL function and input4, Pt1000, in addition for TL function
6 = input 1 Pt100, for TC and TL function and input4 LG-Ni 1000, in addition for TL function
7 = no sensor (e.g. in the case of external predefined loads and without internal TL function)

Parameter: *SensorSelection (Pt100 / Pt1000 / Ni1000 / Temp Sensor / PressureSensor / Pt100Pt1000 / Pt100Ni1000 / No Sensor)*

Input 1, TEMP, Pt100 sensor (DIN) X60

3-wire circuit (copper wires), line balancing is not required when the resistances of the measuring leads are identical.
The TL function is active.
Start of measuring range: 0 °C or 32 °F
End of measuring range: 150 °C or 302 °F
or (can be parameterized)
400 °C or 752 °F

Parameter: *MeasureRange PtNi*

Input 2: TEMP. / PRESS INPUT, DC 0...10 V / DC 2...10 V / 4...20 mA X61

This input can be parameterized as a pressure or temperature input.

Parameter: *Ext Inp X61 U/I:(4...20 mA/2...10 V/0...10 V)*

The TL function is **not** active.
Active power supply by the LMV5...; typically, a pressure or temperature sensor / transmitter is connected here (e.g. QBE620-P or QBE2000-P).
Power supply to the pressure sensor: DC 20 V / 25 mA (nominal rating).

Measuring range temperature (can be parameterized)

Start of measuring range: 0 °C or 32 °F

Parameter: *MeasureRange TempSensor*

End of measuring range: Continuously up to 2,000 °C or 3,632 °F

Measuring range pressure (can be parameterized)

Start of measuring range: 0 bar or 0 psi

Parameter: *MeasureRange PressSensor*

End of measuring range: Continuously up to 100 bar or 1,450 psi
Detection of sensor short-circuit and open-circuit is provided (distance from ends of the measuring range about 10 % of the measuring range).
In the case of DC 0...10 V signals, detection of short-circuits and open-circuits is not possible.
If a fault is detected, the burner will be shut down (changing to the safety phase). If the short-circuit or open-circuit disappears within the safety phase, a change to standby will take place. Otherwise, lockout will be triggered.

Input 4: TEMP, Pt1000 / LG-Ni 1000 X60

2-wire circuit. Line balancing is not required if the resistances of the measuring leads are small compared to the sensor's resistance.

The TL function is active.

The sensors to be used are QAE22.5A and QAE21.1.

Start of measuring range:	0 °C or 32 °F
End of measuring range:	150 °C or 302 °F
	or (can be parameterized)
	400 °C or 752 °F

Parameter: *MeasureRange PtNi*

6.6 Setpoints (W)

Internal setpoint

Using the AZL5…, 2 setpoints (W1 and W2) can be adjusted. It is not possible to adjust a temperature controller setpoint higher than the current limit value of the integrated TL function. The setting range automatically corresponds to the parameterized measuring range of the actual value. Changeover between W1 and W2 can be accomplished by means of an external (potentialfree) contact connected to input 3 (X62), «External predefinition of setpoint / load». W1 is active as standard (contact open).

Parameters: *SetpointW1*
SetpointW2

Input 3: SET POINT INPUT X62

Input for an external predefined setpoint, suited for a predefined load or setpoint changeover. The input is passive (not powered by the LMV5...). Typically, an active PC output is connected here (PC output requires galvanic separation for PELV).

Parameter: *Ext Inp X62 U/I: (4...20 mA / 0/2...10V)*
When setting is (0/2...10 V),
the setting ranges are as follows
- DC 2...10 V with external predefined load
- DC 0...10 V with external predefined setpoint

External predefined setpoint

If parameterized for «Int LC X62», the input signal is converted to pressure or temperature according to the parameterization of the measuring range and interpreted as the boiler's setpoint. The setting range automatically corresponds to the parameterized measuring range of the actual value and can also be limited.

Parameters: *Ext Setpoint min*
Ext Setpoint max

	Setpoint min. measuring range	Setpoint max. measuring range
I (mA)	4	20
U (V)	0	10

Detection of short-circuits and open-circuits of lines is ensured - similar to the sensor inputs (but not when configured for DC 0...10 V). The demand for heat results from the difference between actual value and setpoint.

External predefined load

If parameterized for «Ext LC X62», the input signal is interpreted as the predefined load. This will internally be transmitted to FARC where it is translated into the respective actuator driving signals. Since the internal controller is inactive in this operating mode, control must be performed externally. If, in addition, a temperature sensor Pt100 (and / or Pt1000, LG-Ni 1000 sensor) is connected, it is also possible to use the internal temperature limiter function with the external predefined load.

External predefined load, modulating

	Part load	Full load
I (mA)	4	20
U (V)	2	10

External predefined load, multistage

	Stage 1	Stage 2	Stage 3
I (mA)	5	10	15
U (V)	2.5	5	7.5

Detection of short-circuits and open-circuits of lines is ensured - similar to the sensor inputs.

External setpoint changeover

In operating mode 2 (intLC), changeover between the 2 internally defined setpoints W1 and W2 can be accomplished by means of an external (potentialfree) contact.

External setpoints or predefined load via digital e-bus interface

The settings described under «Input 3» can also be made from a BMS connected to the AZL5… via RS-232 and bus interface.

Parameter: *LC_OptgMode (intLC o.DDC / extLC o.DDC)*

An external predefined setpoint via e-bus exists with «Int LC bus».

An external predefined load via e-bus exists with «Ext LC bus».

6.7 Integrated temperature limiter function

The **temperature** limiter function is implemented as a «safety-related» function conforming to DIN 3440. This means that the function is single-error-proof, in other words, a single error cannot negate the protective function of controller and temperature limiter. The temperature limiter works similar to the 2-position controller but with a separate limit value that can only be changed after entry of a password.

Parameters: *TL_ThreshOff*
TL_SD_On

The TL function also ensures that controller setpoints > TL_Threshold_Off cannot become active.
The TL function is only active in connection with the Pt100, Pt1000 and LG-Ni 1000 sensors. These sensors are monitored for short-circuits and open-circuits.
Activation / deactivation of the TL function depends on the parameterization of the actual value input (parameter *SensorSelection*) (refer to section 5.5).
Short-circuits or open-circuits of the TL sensors lead to «C = OFF», «TL = OFF» and to the relevant error message.

TL within the scope of TRD

Within the scope of TRD (Technical Directives for Steam), 2 temperature sensors are required to ensure the internal TL function.

Parameter: *Inp1/2/4Sel (Pt100Pt1000)* or
Inp1/2/4Sel (Pt100Ni1000)

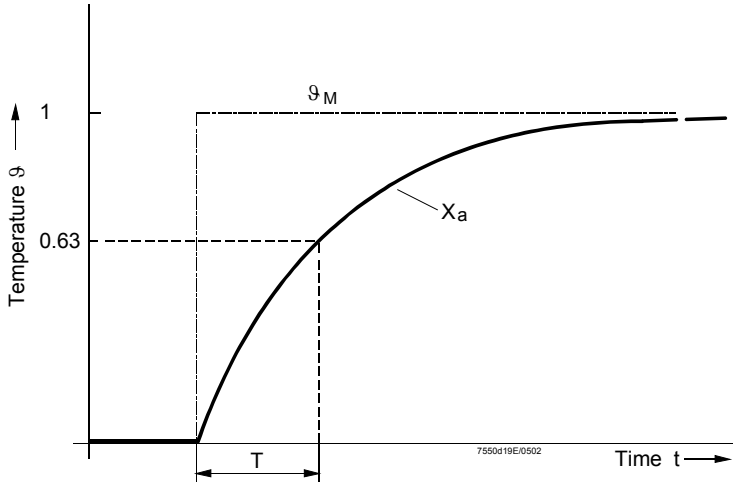
The Pt100 input is always assigned to the TC function. For the TL function, the Pt1000 or LG-Ni 1000 input is used for the second sensor.

TL with external predefined load

The internal TL function can be used in all operating modes, provided the appropriate actual value input parameterization is made and the associated temperature sensor is connected.

Requirements placed on sensor and protection pocket

If the internal TL function is used, the time constant T of the temperature sensor with protection pocket may not exceed 45 seconds.



Instant temperature change of test medium to determine the time constant

ϑ_M	Temperature of test medium
X_a	Output signal of temperature sensor
T	Time constant

6.8 Cold start thermal shock protection (CSTP)

Thermal shock protection can be activated and deactivated.

A differentiation is made between modulating and multistage control.

The cold start sequence is activated when, on startup, the actual value lies below the ON threshold).

If thermal shock protection is activated, the manipulated variable on cold start will be increased in a stepwise fashion using the set load step (or the next stage will be activated).

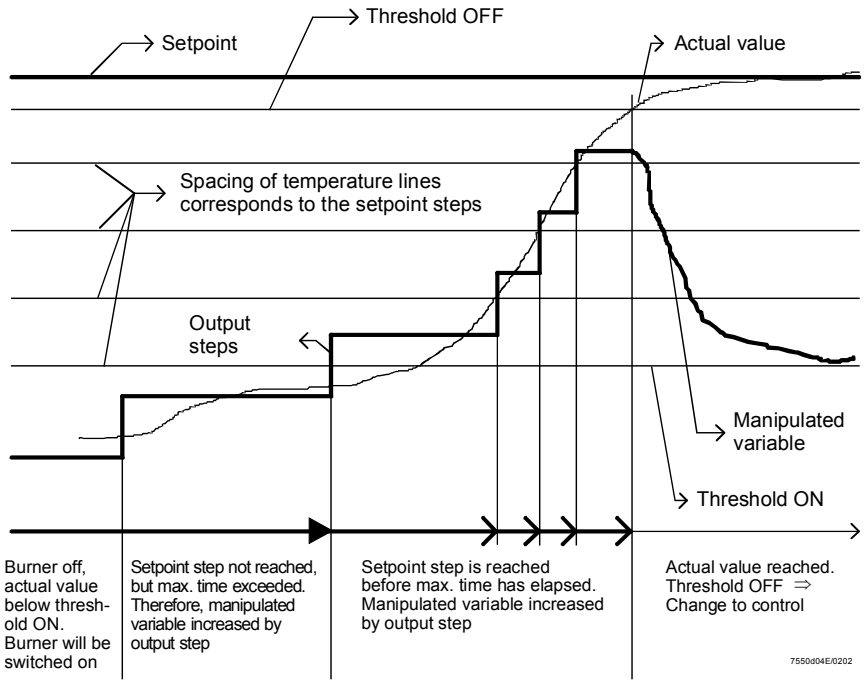
The output will be increased as soon as the actual value has exceeded the start value of the load stage by the setpoint step.

If this switching threshold is not reached within the adjustable maximum time, heating will automatically be ensured by the next output stage. When the OFF threshold is reached, the cold start sequence will be terminated in order to switch to normal control operation.

Parameters:	Thermal shock protection on / off	*ColdStartOn*
	Activation value for thermal shock protection	*ThresholdOn*
	Deactivation value for thermal shock protection	*ThresholdOff*
	Load step (only for modulating mode)	*StageLoad*
	Setpoint step, modulating	*StageStep_Mod*
	Setpoint step, multistage	*StageStep_Stage*
	Max. time, modulating per step	*MaxTmeMod*
	Max. time, multistage per step	*MaxTmeStage*

6.8.1 CSTP - modulating operation

For the output step, any output value in % can be predefined.
100 % divided by the output step gives the number of possible stages.



6.8.2 CSTP - multistage operation

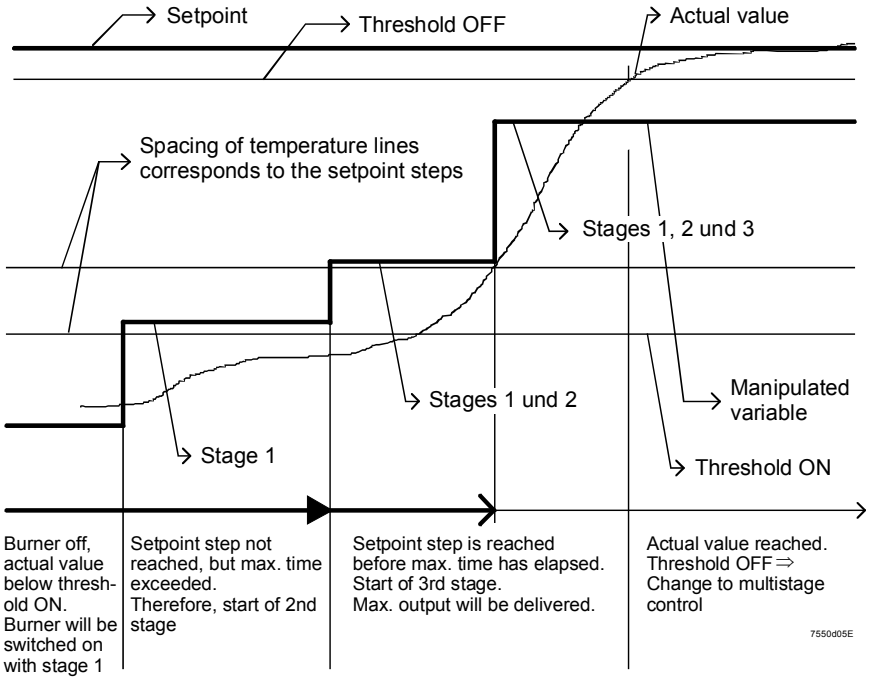
The difference between multistage and modulating control is that with multistage control the output steps are defined by the number of burner stages. With modulating control, any output value in % can be entered.

With multistage control, a maximum of 3 output stages are available:
1. Stage 1
2. Stage 1 and stage 2
3. Stage 1, stage 2 and stage 3

Use of the output stages 2 and 3 can be locked. In that case, the boiler is heated with stage 1 only.

Parameter: Release Stages (*release / no release)*

When stages 2 and 3 are locked, the system may stay in low-fire mode until the cold start function is terminated, if the output delivered by stage 1 is not sufficient to reach the switch-off threshold for thermal shock protection.



6.8.3 CSTP with temperature sensor in pressure plants

In pressure plants, thermal shock protection can also be accomplished with a temperature sensor (additional sensor), as an alternative to the pressure sensor.

Parameter: Additional Sensor (*deactivated / PT100 / PT1000 / NI1000)*

If an additional sensor is selected, the temperature setpoint for the additional sensor applies. «Threshold_Off» refers to that value.

Parameter: Setpoint AddSens
Parameter: Threshold_Off

Note: When using the pressure sensor, the temperature limiter is not active.

This function may only be used in combination with temperature or pressure sensors.

Parameter: SensorSelection *(Temp Sensor, Press Sensor)*

6.9 Output

6.9.1 Output 4...20 mA

This active output serves primarily for covering the current load, e.g. for boiler sequence control and for display by the BMS (if no bus interface is used).
If a voltage signal is required, it can be delivered by connecting a resistor (maximum 500 Ohm).

Output, modulating

	Burner OFF	0 %	100 %
I (mA)	4	4	20

Output, multistage

	Burner OFF	Stage 1	Stage 2	Stage 3
I (mA)	4	5	10	15

Tolerance ±5 %

6.10 Multiboiler plants

Boiler sequence control is accomplished with the help of external devices or control systems (e.g. BACS or PCs).
In principle, there are 2 choices available:

6.10.1 Multiboiler plants by means of an analog input

For that purpose, the LC of the LMV5… has an analog input (X62).

This means that the individual boilers can be
a) released / locked, and
b) operated at the required output
(or set to the required setpoint)

6.10.2 Multiboiler plants by means of a digital interface

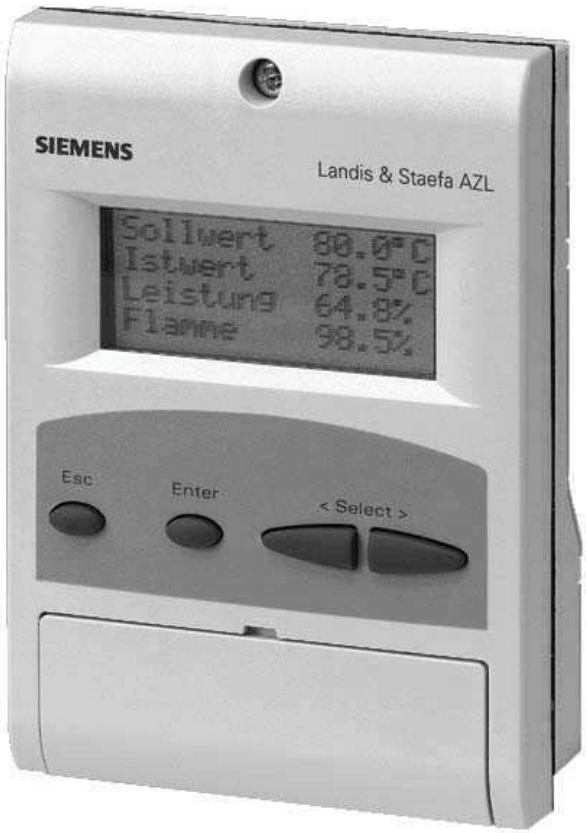
For that purpose, BACS terminal X72 on the AZL5… can be used with the help of the bus interface.

Inputs:
- Controller release / lock
- Predefined setpoint or predefined load

Outputs:
- Actual value
- Controller ON / OFF
- Manipulated variable multistage / modulating
- Error messages

For more detailed information, refer to → section 7.2.2 Connection to superposed systems.

7 Display and operating unit AZL5...

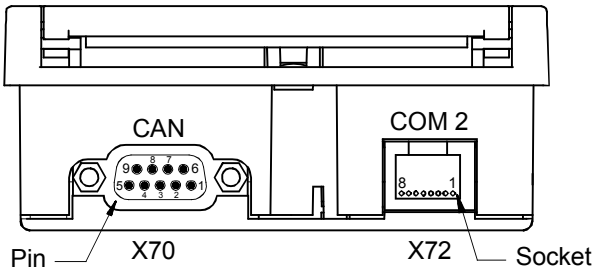


Display and operating unit AZL5...

7.1 Assignment of AZL5… terminals

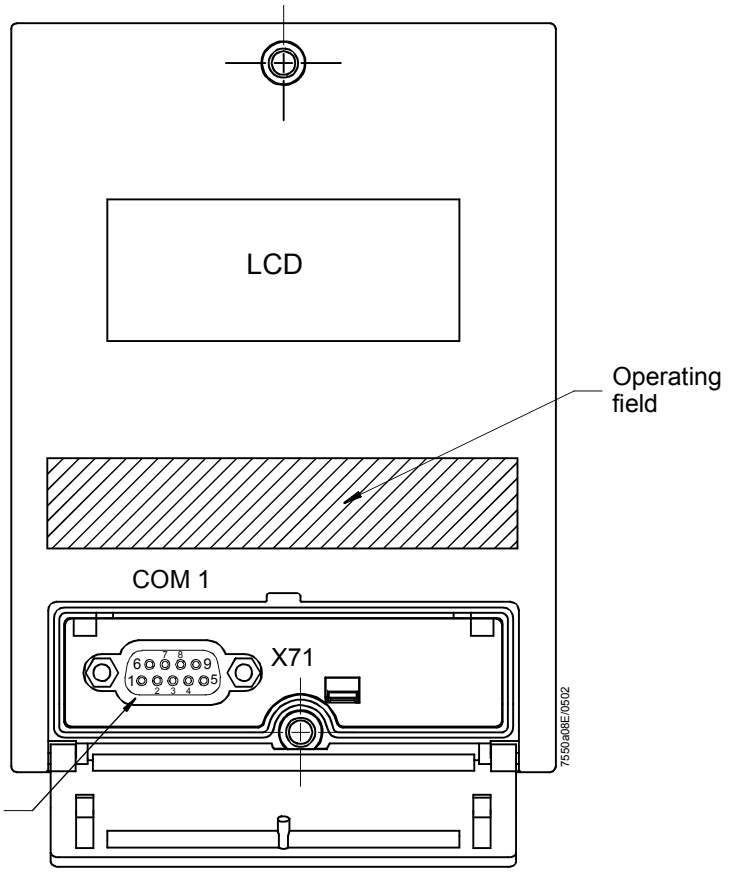
CAN X70

PIN
2 CAN L
3 GND
4 VAC 2
7 CAN H
8 VAC 1



COM2 X72

PIN
1 TXD
3 RXD
4, 6 GND
5 U 1
7 U 2



COM1 X71

PIN
2 RXD
3 TXD
5 GND

Unknown pins = not connected

COM1 Port for PC (RS-232); for parameterization and visualization with the help of the PC tool software

COM2 Port for BACS via external bus interface

CAN bus Port for the LMV5… basic unit

Note

COM1 and COM2 **cannot** be active at the same time!

Connecting cable to the e-bus adapter

AZL COM2 8-pin Western		Cable	e-bus PC adapter 25-pin SUB-D connector	
1	TxD			2
2	—		—	
3	RxD			3
4	GND			7
5	U1			20
6	GND		—	
7	U2			4
8	—		—	

7550t02E/0502

When making and fitting a connecting cable between the AZL5.. and a converter, it is to be noted that Pin 5 and Pin 7 can deliver a current of maximum 5 mA each. Adequate insulation against other potentials must be ensured.

Connecting cable to the PC

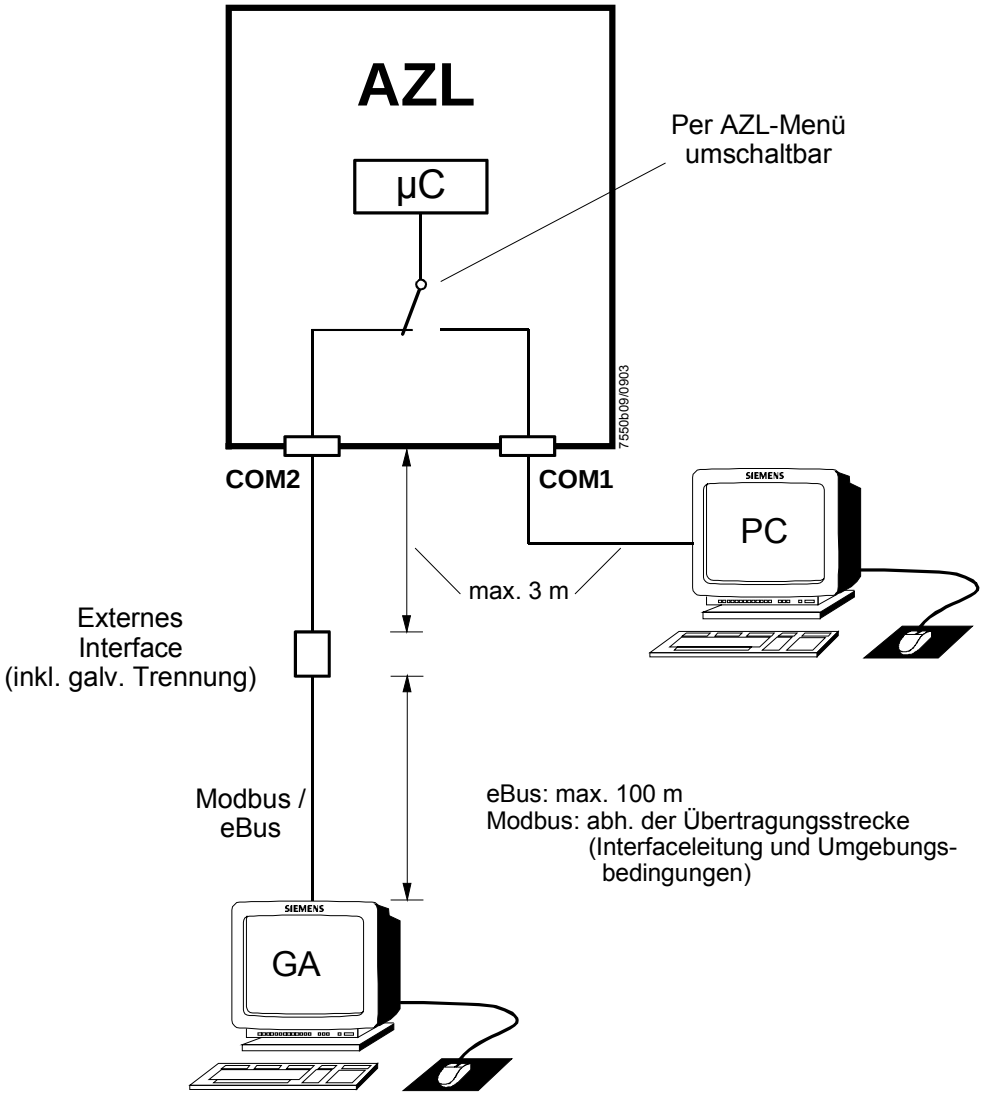
AZL COM1 9-pin connector		Cable	PC COM 9-pin socket	
1				1
2	RxD		RxD	2
3	TxD		TxD	3
4				4
5	GND		GND	5
6				6
7				7
8				8
9				9

7550t01E/0502

7.2 Ports of the AZL5…

The AZL5… has 3 ports:

- Port for the basic unit: CAN bus including power supply for the AZL5…
  (Sub-D connector on the underside of the AZL5…)
- Port for the PC / laptop: RS-232
  (Sub-D jack under the cover of the AZL5… front)
- Port for BACS
  including power supply for the external e-bus interface (RJ45 jack on the underside of the AZL5…)



The AZL5… menu («Operation» → «Select operating mode») offers the following choices:

- Interface PC
- Gateway BACS on
- Gateway BACS off

Note

The CAN bus connection to the basic unit can simultaneously be combined with only **one** of the 2 ports, either «Interface PC» or «Gateway BACS».

7.2.1 Port for the PC

Communication with the PC takes place via the COM1 port of the AZL5… .

The PC software ACS450 offers the following operating functions:

- Readout of settings, operating states, types of error, and points in time the errors occur (LMV5...)
- Graphic support for setting FARC
- Parameterization of the LMV5...
- Trend recording (write function)
- Printout functions for documenting the plant settings
- Program update of the AZL5…

For the standard operating functions, the following transmission parameters have been set:

- 19,200 bit / s
- 8 data bits
- No parity
- 1 stop bit

During the program update of the AZL5…, the transmission rate between PC tool and AZL5… is automatically increased to 38,400 bit / s.

7.2.2 Connection to superposed systems

(Refer to «Port for BACS»)

General information and BACS functions

Communication with a BACS takes place via a data link and an external bus interface with galvanic separation. That interface is connected to the COM2 port of the AZL5… . This interface can be used for eBus or Modbus, depending on the configuration of the AZL5...

Modbus

With this bus protocol, the AZL5... operates as a slave. The transmission mode used is the RTU mode (Remote Terminal Unit). For detailed information, refer to the document “Modbus AZL5...“.

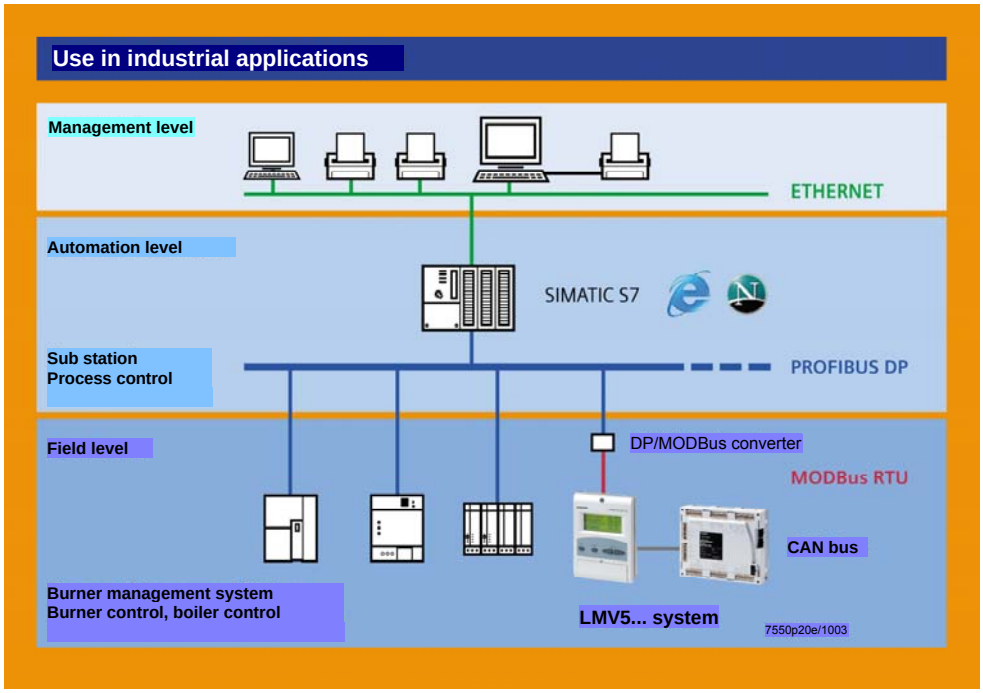
eBus

The following functions can be provided:

- Reading parameters and operating states
- Hours run
- Reading of start counter
- Fuel consumption (LMV51.2..., LMV52...)
- Operating display
- Current type of fuel
- Phase number
- Input states (if available)
- Output states including alarms (if available)
- Actual value of the temperature or pressure
- Temperature or pressure setpoint
- Current output
- Final temperature or pressure setpoint
- Contents of lockout and error storages

Reading eBus-specific data

- Identification (device identification, eBus software version)
- Existence inquiry
- Querying supported commands
- Fault status message



Writing parameters

- Boiler sequence control (maximum 8 boilers)

  Boiler sequence control with predefined setpoints:

  On the AZL5… menu «Params & Display» → «SystemConfig», set the «LC_OptgMode» parameter to «Int LC bus»,

  or

  boiler sequence control with predefined load:

  In this case, set the parameter to «Ext LC bus».

- Select the type of fuel
- Set the date and the time of day

Only **non**-safety-related data may be changed via BACS.

A reset via BACS is **not** possible.

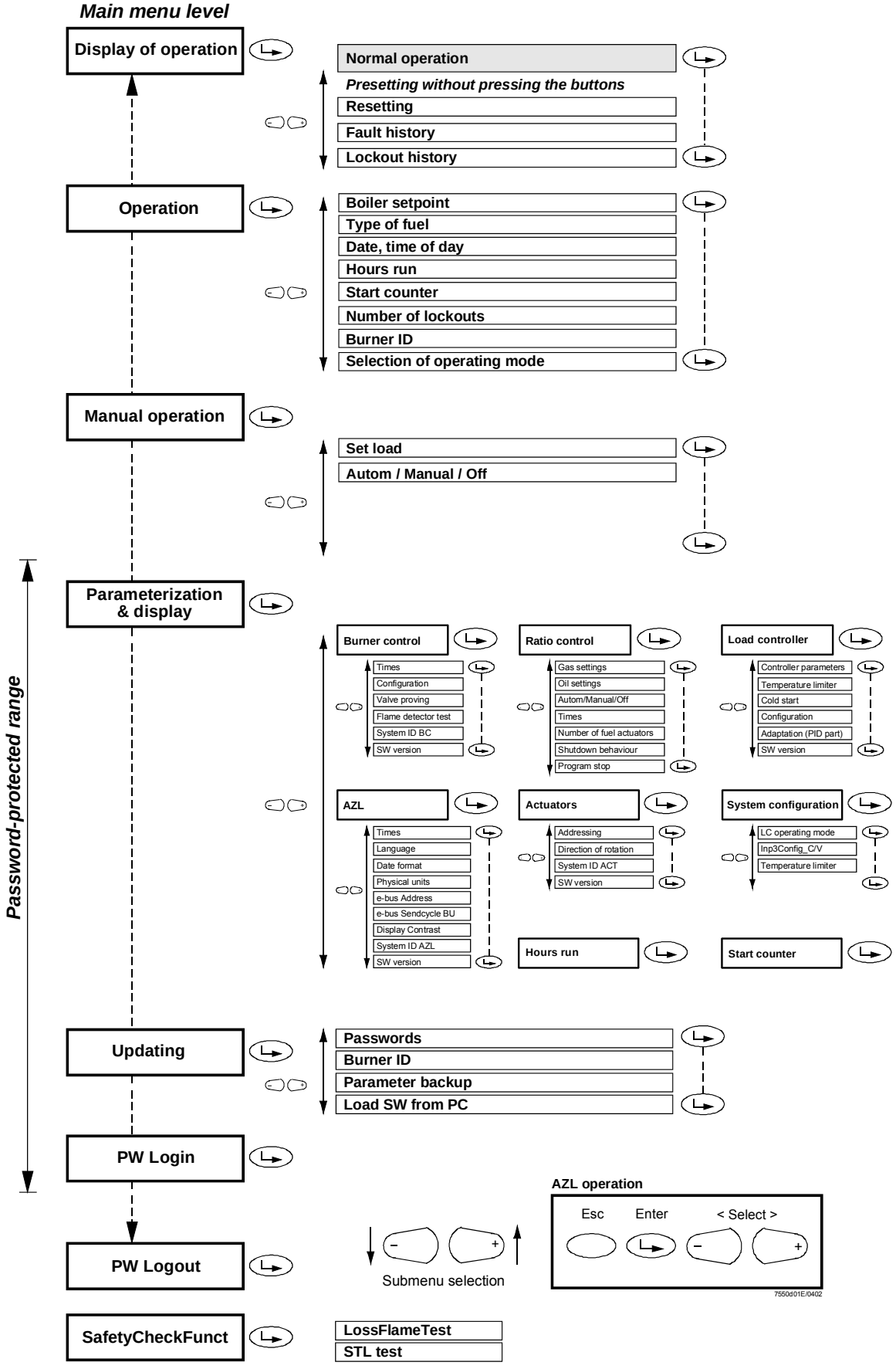
List of supported eBus commands

Primary command	Secondary command	Name
03h	10h	Meter readings
05h		
	07h	Operating data of the controller to the BC
	08h	Operating data request of the controller to the BC
	09h	Operating data of the BC to controller block 1+2 plus block 3 with the LMV52...
07h	01h	Set date / time of day
	04h	Identification
	05h	Query of the supported commands
	FEh	Existence inquiry
	FFh	Sign of life
15h	10h	Readout of LMV5... error storage (Siemens-specific)
15h	11h	Readout of LMV5... lockout storage (Siemens-specific)
FEh	01h	Error message

For details, refer to bus specification, Application Layer OSI7 of
User Club eBUS e. V.
www.eBUS.de

7.3 Display and settings

7.3.1 Menu structure



Displays

Below, the most important displays of «Normal operation» and examples of «Lockout and start prevention messages» and «Parameter settings» are defined.
In «Normal operation», the display shown is the default display which automatically appears and which is maintained as long as no settings are made and no unusual events like faults or start preventions occur.
The change from other displays to the normal display can be made by pressing the **Info** button.
If the commissioning procedure shall be watched, the display can be switched to «Normal operation» by simultaneously pressing the select buttons «<» and «>» or the «Info» button.

Normal operation (undisturbed, no manual entries)

HOME RUN (Phase 10)

L	M	V		5	x										
H	o	m	e											1	0
S	t	a	r	t		N	o			1	2	3	4	5	6
F	0	5	.	1		A	0	2	.	4		0	4	.	3

STANDBY (Phase 12)

S	e	t	p	o	i	n	t			1	2	5	°	C	
A	c	t		V	a	l	u	e		1	2	4	°	C	
F	u	e	l									O	i	l	
S	t	a	n	d	b	y								1	2

STARTUP I (Phases 20,21)

W	a	i	t	i	n	g		f	o	r					
S	t	a	r	t		R	e	a	l	a	s	e		2	1
F	0	5	.	1		A	0	2	.	4		0	4	.	3

STARTUP II (Phase 22)

S	t	a	r	t											
F	a	n		o	n									2	2
F	0	5	.	1		A	0	2	.	4		0	4	.	3

STARTUP III (Phase 24)

D	r	i	v	i	n	g		t	o						
P	r	e	-	p	u	r	g	i	n	g				2	4
F	0	5	.	1		L	4	4	.	6		3	0	.	3

STARTUP IV (Phases 30...34)

P	r	e	-	p	u	r	g	i	n	g				3	2
F	0	5	.	1		L	9	4	.	6		9	8	.	3

Display (cont'd)

STARTUP V (Phase 36)

D	r	i	v	i	n	g		t	o					
I	g	n	i	t	i	o	n		P	o	s			3	6
F	6	5	.	1		L	4	4	.	6		1	0	.	3

STARTUP VI (Phase 38)

I	g	n	i	t	i	o	n		P	o	s			3	8
F	3	2	.	1		L	4	2	.	3		2	2	.	3

STARTUP VII (Phases 40,42,44)

F	u	e	l												
R	e	l	e	a	s	e		1						4	0
F	l	a	m	e									8	0	%
F	3	2	.	1		L	4	2	.	3		2	2	.	3

STARTUP VIII (Phases 50,52)

F	u	e	l												
R	e	l	e	a	s	e		2						5	0
F	l	a	m	e									8	0	%
F	3	2	.	1		L	4	2	.	3		2	2	.	3

STARTUP IX (Phase 54)

D	r	i	v	i	n	g		t	o						
L	o	w	-	f	i	r	e							5	4
F	2	8	.	5		L	3	8	.	3		1	8	.	5

OPERATION I (Phase 60)

S	e	t	p	o	i	n	t			1	2	5	°	C	
A	c	t		V	a	l	u	e		1	2	4	°	C	
S	e	t		L	o	a	d		5	7	.	5	%		
F	l	a	m	e						1	0	0	%		

OPERATION II (Phase 62)

S	h	u	t	-	d	o	w	n							
L	o	w	-	f	i	r	e							6	2
F	2	8	.	5		L	1	7	.	6		1	2	.	5

SHUTDOWN (Phase 70)

S	h	u	t	d	o	w	n							
													7	0
F	2	8	.	5		L	1	7	.	6		1	2	.	5

SHUTDOWN (Phase 72)

D	r	i	v	i	n	g		t	o					
P	o	s	t	p	u	r	g	e					7	2
F	0	5	.	1		L	4	4	.	6		3	0	.	3

SHUTDOWN (Phases 74...78)

P	o	s	t	p	u	r	g	i	n	g			7	4
F	2	8	.	5		L	1	7	.	6		1	2	.	5

SHUTDOWN (Phase 79)

T	e	s	t		A	i	r		P	r	e	s	s	
S	w	i	t	c	h								7	9
F	2	8	.	5		L	1	7	.	6		1	2	.	5

VALVE PROVING (Phases 80...83)

V	a	l	v	e		P	r	o	v	i	n	g		
													8	0
E	v	a	c	u	a	t	i	n	g					

V	a	l	v	e		P	r	o	v	i	n	g		
													8	1
T	e	s	t		a	t	m	o	s		P	r	e	s	s

V	a	l	v	e		P	r	o	v	i	n	g		
													8	2
F	i	l	l	i	n	g								

V	a	l	v	e		P	r	o	v	i	n	g		
													8	3
T	e	s	t		G	a	s		P	r	e	s	s	

S A F E T Y P H A S E (P h a s e 0 1)

S	a	f	e	t	y		P	h	a	s	e				
														0	1

L O C K O U T (P h a s e 0 0)

L	o	c	k	o	u	t									
R	e	s	e	t		v	i	a							
O	p	e	r	a	t	i	o	n	a	l	S	t	a	t	
	S	t	a	t	u	s	/	U	n	l	o	c	k		

Example: Display of lockouts in the lockout history

In the event lockout occurs, the display alternates at 5-second intervals.
Press **ENTER** to choose one of the 2 display texts. In that case, the alternating cycle will be interrupted.

Example: Lockout due to a gas pressure signal in connection with gas valve proving.

1		1	8	.	0	6	.	9	9		1	0	:	3	5
C	:	3	1		D	:	0	0		P	:	8	1		
S	t	a	r	t		N	o		:	1	2	3	4	5	6
L	o	a	d	:			2	5	.	0			G	a	s

G	a	s		P	r	e	s	s	u	r	e		w		
V	a	l	v	e		P	r	o	v	i	n	g			
V	a	l	v	e		o	n		G	a	s				
S	i	d	e		l	e	a	k	i	n	g				

C = error code D = diagnosis
P = phase VP = gas valve proving

Example: Display of errors in the error history

In contrast to the lockout history, the error history contains the errors of all error classes and not only the lockouts.

If an error occurs, the display alternates at 5-second intervals.

1	2		C	l	a	s	s	:		0	3		G	A	S
C	o	d	e	:	2	1		P	h	a	s	e	:	2	4
D	i	a	g	:	0	0		L	o	d	:		0	.	0
S	t	a	r	t		N	o	:		1	2	3	4	5	6

Example: Safety loop open

S	a	f	e	t	y		L	o	o	p					
o	p	e	n	!											

Lockout and error messages (cont'd)

Example: Immediate display of lockouts

In the event lockout occurs, the display alternates at 5-second intervals.

L	**o**	**c**	**k**	**o**	**u**	**t**									

G	**a**	**s**		**P**	**r**	**e**	**s**	**s**	**u**	**r**	**e**		**w**		
V	**a**	**l**	**v**	**e**		**P**	**r**	**o**	**v**	**i**	**n**	**g**			
V	**a**	**l**	**v**	**e**		**o**	**n**		**G**	**a**	**s**				
S	**i**	**d**	**e**		**l**	**e**	**a**	**k**	**i**	**n**	**g**				

Example: Immediate display of safety shutdowns

In the event of safety shutdown, the display alternates at 5-second intervals.

S	**a**	**f**	**e**	**t**	**y**		**S**	**h**	**u**	**t**	**d**	**o**	**w**	**n**	

G	**a**	**s**		**P**	**r**	**e**	**s**	**s**	**u**	**r**	**e**		**h**	**a**	**s**
d	**r**	**o**	**p**	**p**	**e**	**d**		**b**	**e**	**l**	**o**	**w**			
m	**i**	**n**	**i**	**m**	**u**	**m**		**L**	**i**	**m**	**i**	**t**			

Example: Immediate display of warnings

In the event of warnings, the display alternates at 5-second intervals.

W	**a**	**r**	**n**	**i**	**n**	**g**									

C	**u**	**r**	**v**	**e**		**G**	**r**	**a**	**d**	**i**	**e**	**n**	**t**		
t	**o**	**o**		**h**	**i**	**g**	**h**								

Example: Immediate display of start preventions

In the event of start preventions, the display alternates at 5-second intervals.

S	**t**	**a**	**r**	**t**		**P**	**r**	**e**	**v**	**e**	**n**	**t**	**i**	**o**	**n**

A	**i**	**r**		**P**	**r**	**e**	**s**	**s**	**u**	**r**	**e**				
o	**n**														

Standard parameterizations (incl. entry of password)

For the complete parameter list, refer to section 6.5 «Menu and parameter lists».

Menu selection

A main menu item is selected as follows:

O	**p**	**e**	**r**	**a**	**t**	**i**	**o**	**n**	**a**	**l**	**S**	**t**	**a**	**t**
O	**p**	**e**	**r**	**a**	**t**	**i**	**o**	**n**						
M	**a**	**n**	**u**	**a**	**l**		**O**	**p**	**e**	**r**	**a**	**t**	**i**	**o**	**n**
P	**a**	**r**	**a**	**m**	**s**		**&**		**D**	**i**	**s**	**p**	**l**	**a**	**y**

Calling up and selection

To indicate a selection, the first letter of the menu item is shown with a flashing pointer. As long as the selection is made by pressing the **SELECT** buttons within the 4 menu items shown on the display, the selection scrolls.

If some other (presently not shown) menu item shall be selected, the menu display scrolls.

Press **ENTER** to make the final selection.

This calling up and selection procedure is similar on all other menu levels.

Example:

O	**p**	**e**	**r**	**a**	**t**	**i**	**o**	**n**						
M	**a**	**n**	**u**	**a**	**l**		**O**	**p**	**e**	**r**	**a**	**t**	**i**	**o**	**n**
P	**a**	**r**	**a**	**m**	**s**		**&**		**D**	**i**	**s**	**p**	**l**	**a**	**y**
U	**p**	**d**	**a**	**t**	**i**	**n**	**g**							

Changing the standard parameters

This action is shown using the example of setting the prepurge time of the burner control section.

Selection of the associated main menu item:

The main menu item «Parameterization & Display» is called up and selected as described above:

O	**p**	**e**	**r**	**a**	**t**	**i**	**o**	**n**	**a**	**l**	**S**	**t**	**a**	**t**
O	**p**	**e**	**r**	**a**	**t**	**i**	**o**	**n**						
M	**a**	**n**	**u**	**a**	**l**		**O**	**p**	**e**	**r**	**a**	**t**	**i**	**o**	**n**
P	**a**	**r**	**a**	**m**	**s**		**&**		**D**	**i**	**s**	**p**	**l**	**a**	**y**

P = flashing cursor

Entry of password (PW)

It is very important to study chapter «Safety notes on settings and parameterization»!

Before changing to the parameter settings range, a password must be entered. For that purpose, the display shown below appears.
First, the pointer points to the first character of the line «Access without PW». Access without PW is always available for access level «Enduser».

- If a valid password has been entered, there will be no more password prompt when accessing this parameter setting level until the end of the legitimation period is reached, or until legitimation is manually deactivated
- If required, access to the parameters can be deactivated on the bottom line of the main menu before the legitimation period expires

If a password shall be entered, line «Enter password» is selected by means of decrementing (pointer points to the first character of that line) and selected by pressing **ENTER**.

Then, the pointer jumps to the first position of the password entry line. Now, through incrementing or decrementing, a character (digit or letter) can be selected. A character is confirmed by pressing **ENTER**. If a wrong entry has been made, the last character can be edited again by pressing **ESC**.

The other password positions can be selected, edited and entered in a similar way. Hence, when making an entry, there is always only one character visible.

When the last character of the password is reached, the entry is to be confirmed by pressing **ENTER**.

- The passwords are linked to the access levels (Service, OEM, Siemens). This means that the parameters available for editing are only those associated with the access level
- When leaving the parameter setting level, a backup is offered

Start display

A	c	c	e	s	s		w	-	o	u	t		P	W	
A	c	c	e	s	s		S	e	r	v					
A	c	c	e	s	s		O	E	M						
A	c	c	e	s	s		L	S							

Display before the first password character is entered:

E	n	t	e	r		P	a	s	s	w	o	r	d		
:	*	*	*	*	*	*	*	*							

Display when entering the third password character:

E	n	t	e	r		P	a	s	s	w	o	r	d		
:	*	*	S	*	*	*	*	*							

If the check of the password entered is positive, the change to the next menu level will take place. Otherwise, the display will return to the main menu level.

First submenu level

Example: Calling up and selecting submenu «Burner control»

B	u	r	n	e	r	C	o	n	t	r	o	l		
R	a	t	i	o	C	o	n	t	r	o	l			
L	o	a	d		C	o	n	t	r	o	l	l	e	r
A	Z	L												

Second submenu level

Example: Calling up and selecting submenu «Times»

T	i	m	e	s										
C	o	n	f	i	g	u	r	a	t	i	o	n		
V	a	l	v	e		P	r	o	v	i	n	g		
F	l	a	m	e	F	a	i	l	T	e	s	t		

Third submenu level

Example: Calling up and selecting submenu «Times Startup»

T	i	m	e		S	t	a	r	t	u	p	1		
T	i	m	e		S	t	a	r	t	u	p	2		
T	i	m	e		S	h	u	t	d	o	w	n		
T	i	m	e		G	e	n	e	r	a	l			

Fourth submenu level

Example: Calling up and selecting parameter «Prepurge Time Gas»

M	i	n	T	i	m	e	S	t	a	r	t	R	e	l
F	a	n	R	u	n	u	p	T	i	m	e			
P	r	e	-	p	u	r	g	e	T	i	m	e	G	a	s
P	r	e	-	p	u	r	g	e	T	i	m	e	O	i	l

Setting the parameter:

a) After the required parameter has been called up and selected, the display shown below will appear. Lines «Curr» and «New» show identical values at first, namely the current parameter value.

The pointer automatically points to the colon on line «New». Here, the required new value can be entered, whereby the AZL5… automatically displays the 4 possible line setting ranges with the associated resolutions:

- 0...12.6 s resolution 0.2 s
- 13...63 s resolution 1 s
- 70...630 s resolution 10 s
- 11...63 min resolution 1 min

P	r	e	-	p	u	r	g	e	T	i	m	e	G	a	s
C	u	r	r	:	1	2	.	6	s						
N	e	w		:	1	2	.	6	s						

Setting the new value

P	r	e	-	p	u	r	g	e	T	i	m	e	G	a	s
C	u	r	r	:	1	2	.	6	s						
N	e	w		:			3	0	s						

b) As soon as the basic unit has handled the parameter settings, the new value appears on line «Curr». The user has to make certain that the 2 values are identical (safety test of display).

P	r	e	-	p	u	r	g	e	T	i	m	e	G	a	s
C	u	r	r	:			3	0	s						
N	e	w		:			3	0	s						

The user can return to the next higher menu level by pressing **ESC**.

Addressing the actuators (function assignment)

To make the addressing, the actuator must be opened. A button and an LED are located behind the actuator's removable plastic cover.

In connection with addressing with the help of the AZL5…, the button is used to define the address of an actuator.

When commissioning the plant, the actuators are in their addressing mode.
To indicate this, the LED is steady on. If the LED is **not** steady on, refer to «Reset» below.

To make the addressing, the following menu is required on the AZL5…:

«Params & Display» → «Actuators» → «Addressing»

This menu contains the choice of actuators to be addressed (e.g. the air actuator). By appropriately positioning the pointer and then pressing **ENTER**, the user can select the required actuator function.

Address assignment is started by pressing **ENTER**. After a short period of time, the user will be prompted to press the button on the actuator to be addressed.

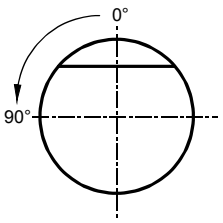
The AZL5… confirms the successful address assignment. To be sure, the address of the actuator can be checked against the blink code which now appears.

This procedure can be repeated for other actuators used by the system, but the AZL5… does not allow double assignments. In that case, a display tells the user that an appropriate actuator is already used by the system.

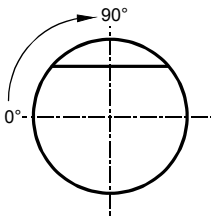
Direction of rotation

To select the direction of rotation, choose the following menu on the AZL5…:
«Params & Display» → **«Actuators»** → **«DirectionRot»**
You are given the choice of «Standard» and «Reversed»:

Standard (counterclockwise)



Reversed (clockwise)



7550d29/0903

Facing the end of the drive shaft (**not** mounted)

To check the direction of rotation, every actuator can be moved in the home position in fault-free standby mode.
The parameter is filed in the basic unit so that the direction of rotation need not be reentered when replacing the actuator.

Note: After setting the ignition positions or curves, the direction of rotation can only be changed after deleting the curves and ignition positions on setting menu «*Delete Curves*».

Reset

This facility makes it possible to reset an already addressed actuator in the case of a replacement, repair, or if addressing is wrong (wrong address assignment by the user). For that purpose, the user must press the actuator's addressing button for at least 10 seconds when the actuator is in normal operation. The actuator will then reset its address which is indicated by the LED when steady on.

Operational status indication by LED on the actuator

Power is fed to unaddressed actuator

LED steady ON

Button for addressing is pressed (display during addressing procedure)

Addressing completed, normal operation of actuator

The actuator gives the addressing number via the LED. The blink interval is 200 ms:

1 pulse	⇒	air actuator
2 pulses	⇒	gas actuator
3 pulses	⇒	oil actuator
4 pulses	⇒	auxiliary actuator
5 pulses	⇒	auxiliary actuator 2
6 pulses	⇒	auxiliary actuator 3

After each blink cycle, there is a pause of 1.2 seconds.

Example of an actuator for gas

Special function curve settings FARC

The following section covers the parameter settings of the curves used by the basic unit module «Fuel / air ratio control».

Selection menu «Ratio control»

The selection menu looks as follows:

S	**e**	**t**	**t**	**i**	**n**	**g**	**s**		**G**	**a**	**s**					**1)**
S	**e**	**t**	**t**	**i**	**n**	**g**	**s**		**O**	**i**	**l**					**2)**
A	**u**	**t**	**o**	**m**	**/**	**M**	**a**	**n**	**u**	**a**	**l**	**/**	**O**	**f**	**f**	**3)**
T	**i**	**m**	**e**	**s**												**4)**
N	**u**	**m**	**F**	**u**	**e**	**l**	**A**	**c**	**t**	**u**	**a**	**t**	**o**	**r**	**s**	**5)**
S	**h**	**u**	**t**	**d**	**o**	**w**	**n**	**B**	**e**	**h**	**a**	**v**				**6)**
P	**r**	**o**	**g**	**r**	**a**	**m**		**S**	**t**	**o**	**p**					**7)**

Selection of 3) through 6) leads to standard parameter settings of the parameters specified.

Selection of 1) leads to:

Selection menu «Settings gas»

Only the data associated with the currently active type of fuel can be parameterized.

S	**p**	**e**	**c**	**i**	**a**	**l**	**P**	**o**	**s**	**i**	**t**	**i**	**o**	**n**	**s**	**1)**
C	**u**	**r**	**v**	**e**		**P**	**a**	**r**	**a**	**m**						**2)**
L	**o**	**a**	**d**		**L**	**i**	**m**	**i**	**t**	**s**						**3)**
A	**u**	**x**	**A**	**c**	**t**	**u**	**a**	**t**	**o**	**r**						**4)**

Calling up 1) (*HomePositions, PrepurgePositions*...), 3) and 4) leads to standard parameter settings of the parameters specified.

Selection of 2) leads to:

Selection menu «Curve Param»(modulating)

P	**o**	**i**	**n**	**t**	**|**	**L**	**o**	**a**	**d**		**:**	**2**	**3**	**.**	**2**	
		:		**1**	**|**	**F**	**u**	**e**	**l**		**:**	**2**	**3**	**.**	**2**	
M	**a**	**n**			**|**	**A**	**i**	**r**			**:**	**4**	**1**	**.**	**6**	
					|	**A**	**u**	**x**			**:**	**3**	**3**	**.**	**3**	
					l	**H**	**i**	**l**	**f**	**2**	**:**	**2**	**9**	**.**	**2**	**only LMV52...**
					l	**H**	**i**	**l**	**f**	**3**	**:**	**1**	**3**	**.**	**8**	**only LMV52...**
					l	**F**	**U**				**:**	**4**	**5**	**.**	**0**	**only LMV52...**

In this example, the ignition positions are copied to the first point of the curve.
This is always made automatically when the ignition positions are defined but no point on the curve has as yet been entered. The preliminary load value entered is the position value of the fuel actuator.
This point is also automatically approached as the low-fire point.
If the installer attempts to reach submenu «Curve parameter settings» before the ignition positions are defined, point number «1» appears. But the position fields display «XXXX», indicating that the data are **invalid**.
When making the parameter settings, the installer is guided, starting with entry of the ignition positions and coarse adjustment of the low- and high-fire positions to fine adjustment of the curve settings with up to 15 curvepoints.

This setting of the curve can be made in 2 different ways:

1. Individual points are specifically entered.
2. Ratio control is operated manually until the value reached shall be stored as a new point.

A more detailed description of both approaches is given below:

Editing or introducing an individual point

In this setting mode, an individual point of curve is edited by acknowledging the pointer on «Point» with **ENTER**, so that the pointer jumps to the curvepoint number.

By scrolling the (available) curvepoints, the point to be edited or a new point can be selected. After acknowledgement, the pointer jumps to the right field of the display, thus releasing the individual actuator positions and the associated load value for change or adjustment. Below, the procedure is shown in graphic form:

When accessing this menu, the pointer is positioned on «Point». To edit the curvepoint, the pointer must be positioned on «Point».

- Pointer positioned on «Point»:

P	o	i	n	t	|	L	o	a	d		:	2	3	.	5
					|	F	u	e	l		:	2	3	.	2
M	a	n			|	A	i	r			:	4	1	.	6
					|	A	u	x			:	3	3	.	3

- Continue with **ENTER**

⇓

P	o	i	n	t	|	L	o	a	d		:	2	3	.	5
		:		3	|	F	u	e	l		:	2	3	.	2
	O	2			|	A	i	r			:	4	1	.	6
		4	.	5	|	A	u	x			:	3	3	.	3

After selecting the curvepoint number, the associated point data will always be displayed in the right column (see above). Below that, the currently acquired O2 value will now be shown if a PLL52.110A200 O2 module and an O2 sensor are connected to the system.

The first unused point always has the highest number. If, for instance, 3 points are used, a new point is given number 4 prior to sorting. The new point is also characterized by the display of «XXXX» for the point‘s data.

Note: When introducing a new point, the following display will be skipped!

- For changing the parameter data:
  Select the required curvepoint, then continue with **ENTER**

⇓

P	o	i	n	t	|	P	o	i	n	t				
		:		3	|	c	h	a	n	g	e	?		
M	a	n			|	d	e	l	e	t	e	?		
					|									

Here, the pointer position can change between «change?» and «delete?».
To edit the point, «change?» must be selected here.

- Continue with **ENTER**

⇓

P	o	I	n	t	|	L	o	a	d		:	2	3	.	5
		:		3	|	F	u	e	l		:	2	3	.	2
	O	2			|	A	i	r			:	4	1	.	6
		4	.	5	|	A	u	x			:	3	3	.	3

It is to be noted that with these settings, which can be made in standby and normal operation, the actuators will travel to the displayed or changed positions.
Traveling to the load that is assigned to the curvepoint can be stopped by pressing **ESC**.
During the time the actuators approach the positions, the display shows « **>** » in place of « **:** ».

Note: If a new point is introduced, the point's data to be entered are the actual values.

The parameter that shall be changed (e.g. the fuel position) can be selected by changing the pointer position.

P	o	I	n	t	|	L	o	a	d		:	2	3	.	5
		:		3	|	F	u	e	l		:	2	3	.	2
	O	2			|	A	i	r			:	4	1	.	6
		4	.	5	|	A	u	x			:	3	3	.	3

After the selected point of curve has been reached by the system:
- Continue with **ENTER**

⇓

P	o	I	n	t	|	L	o	a	d		:	2	3	.	5
		:		3	|	F	u	e	l		:	2	3	.	2
	O	2			|	A	i	r			:	4	1	.	6
		4	.	5	|	A	u	x			:	3	3	.	3

Now, the selected parameter can be changed online. This means that the system follows the changes at the rate of the selected ramp speed. Press **ENTER** to save the changed values.

Now, additional parameters for change can be selected.

If **ESC** is pressed before **ENTER**, changes made to the selected parameter (e.g. fuel position) will be rejected and the value last saved will be restored.

When leaving this level with **ESC**, the following query appears:

P	u	n	k	t										
s	p	e	i	c	h	e	r	n	-	>	E	N	T	E	R
v	e	r	w	e	r	f	e	n	-	>	E	S	C		

ENTER saves the changes or the new point and adds them to the already existing points in the correct order (during the storage process, no buttons will be evaluated. To indicate this, a symbol appears on the display).

The changes can be rejected by pressing **ESC**.

Canceling a curvepoint

When accessing this menu, the pointer is positioned on «Point». To cancel a curvepoint, the pointer must be positioned on «Point».

- Pointer positioned on «Point»:

P	o	i	n	t	|	L	o	a	d		:	2	3	.	5
					|	F	u	e	l		:	2	3	.	2
M	a	n			|	A	i	r			:	4	1	.	6
					|	A	u	x			:	3	3	.	3

- Continue with **ENTER**

⇓

Point of curve number

P	o	i	n	t	|	L	o	a	d		:	2	3	.	5
		:		3	|	F	u	e	l		:	2	3	.	2
	O	2			|	A	i	r			:	4	1	.	6
		4	.	5	|	A	u	x			:	3	3	.	3

By calling up the curvepoint number the respective point is selected.
The data associated with the point number are always displayed in the column on the right (see above).

- For canceling the parameter data:
  Select the required curvepoint, then continue with **ENTER**

⇓

P	o	i	n	t	|	P	o	i	n	t					
		:		3	|	c	h	a	n	g	e	?			
M	a	n			|	d	e	l	e	t	e	?			
					|										

Here, the pointer position can change between «change?» and «delete?».
To cancel the point of curve, «delete?» must be selected here.
Confirm by pressing **ENTER**.
The selected point has been canceled and the actuators travel to the positions determined by the remaining curvepoints, in other words, the system's output will be maintained.

Setting the curve via manual control

In addition to curve settings by means of individual point entry, it is also possible to adjust the burner in manual operation with optional point storage. The procedure is the following:
After leaving menu item «CurveParams», position the pointer on «Man» when reaching the menu.

- Pointer positioned on «Man»:

P	o	i	n	t	|	L	o	a	d		:	2	3	.	5
					|	F	u	e	l		:	2	3	.	2
M	a	n			|	A	i	r			:	4	1	.	6
					|	A	u	x			:	3	3	.	3

After pressing **ENTER**, the following display appears:

	O	2			|	L	o	a	d		:	2	3	.	5
		4	.	5	|	F	u	e	l		:	2	3	.	2
M	a	n			|	A	i	r			:	4	1		6
:	2	3	.	5	|	A	u	x			:	3	3	.	3

This menu enables the installer to manually change the output by using incrementing or decrementing commands, letting the actuators operate on interpolated straight lines (outside the parameterized curvepoints: Extrapolation). Above that, the currently acquired O2 value will now be shown if a PLL52.110A200 O2 module and an O2 sensor are connected to the system.

Traveling to the output preset here can be stopped by pressing **ESC**.

The actual curve settings are made by adjusting the entire ratio control system based on the roughly predefined curvepoints and outside the already defined points. After pressing **ENTER** again, new points can be introduced at the required positions. Then, the values can be changed:

P	o	i	n	t	|	L	o	a	d		:	2	8	.	5
		:		3	|	F	u	e	l		:	2	8	.	4
	O	2			|	A	i	r			:	4	5	.	2
		4	.	5	|	A	u	x			:	3	1	.	3

The further setting procedure is the same as that used with «Edit individual point».

Example: Adjustment of the ratio control system via manual control

Prerequisite: No curvepoints are parameterized.

1. Activating program stop

On menu: «Params & Display» → «Ratio Control» → «Program Stop» → parameterize from «deactivated» to «Stop_Ph24»

2. Starting the system

On menu: «Params &. Display» → «Ratio Control» → «Settings Gas / Oil» → «Special Positions» → «Autom / Manual / Off»

or on: «Manual Operation» → «Autom / Manual / Off» to «Burner on» and confirm.

3. Setting the prepurge positions

The system commences the startup sequence and stops in phase «Driving to Prepurge 24». Now, the prepurge positions can be set on menu «SpecialPositions». Then, on «ProgramStop», change to «Stop_Ph36.

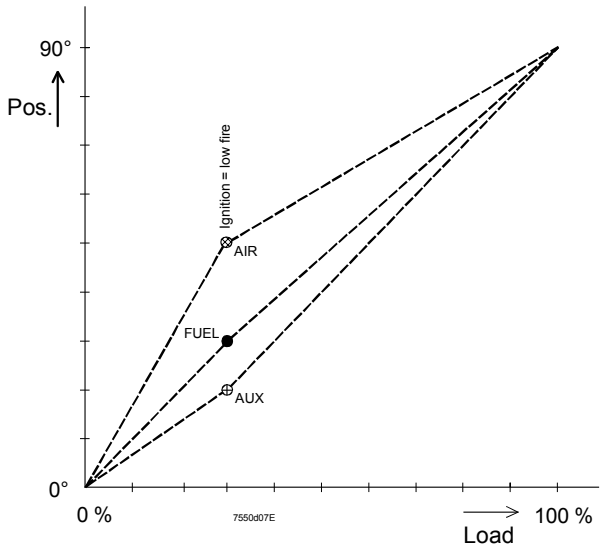
4. Setting the ignition positions

The system continues the startup sequence and stops in phase «Driving to ignition position 36». Now, the ignition positions can be set on menu «SpecialPositions». Then, on «ProgramStop», set to «Stop_Ph72», if operation shall immediately follow.

To readjust the ignition positions after the burner has ignited: «ProgramStop» to «Stop_Ph44», or «Stop_Ph52» for pilot ignition after the pilot flame has been shut down. Then, on «ProgramStop», set to «Stop_Ph72».

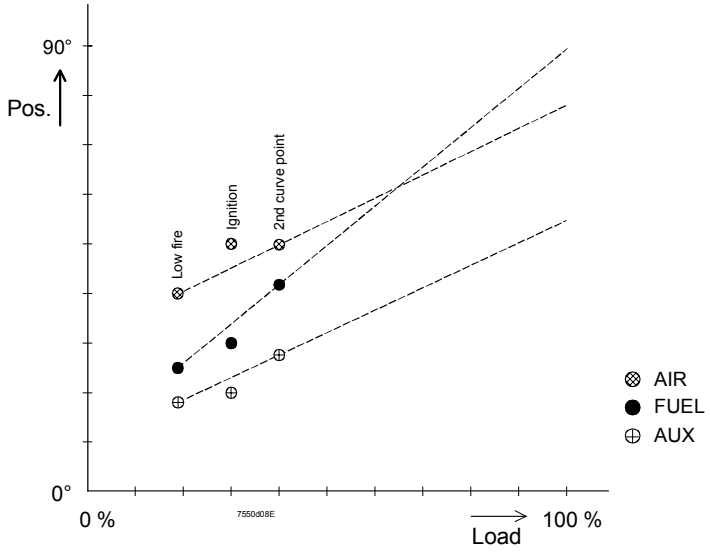
5. Curve settings via manual control

The system continues the startup sequence and assumes normal operation. The first curvepoint entered are the ignition positions and the load entered is the number of degrees (angular rotation) of the fuel actuator.

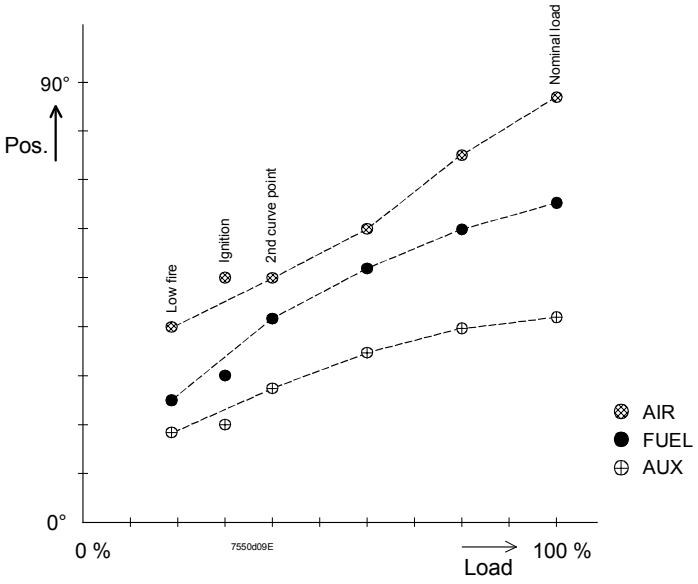


Change of load / position resulting from an automatically entered point

Choose «Man» from the menu «Params & Display» → «Ratio Control» → «Settings Gas / Oil» → «Curve Param». It is now possible to follow the above curves by changing the load. A point can be saved at every intermediate point. Then, the load / position graph will look as follows:



Change of load / position with two points



Change of load / position with several points

Using this method, up to 15 points can be defined.

6. Shutdown

On the menu: «Params & Display» → «Ratio Control» → «Settings Gas / Oil» → «Special Positions» → «Autom / Manual / Off»

or on: «Manual Operation» → «Autom / Manual / Off» to «Burner off» and confirm

7. Setting the postpurge positions

The system shuts down and stops in phase «Driving to postpurge 72».
Now, the postpurge positions on menu «Special positions» can be set.

Then, on «Program Stop», set to «deactivated».
The system continues the shutdown sequence and stops in phase «Standby 12».

Selection menu «Settings Oil»

Only the data associated with the currently active type of fuel can be parameterized.

SpecialPositions														**1)**
Curve Parameter														**2)**
Load Limits														**3)**
AuxActuator														**4)**

Selection of 1) (*HomePositions, PrepurgePositions*), 3) and 4) leads to standard parameter settings of the parameters specified.

Selection of 2) leads to:

Curve Settings														**1)**
OperationMode														**2)**

Selection of 2) leads to standard parameter settings of the operating mode (modulating or multistage).

Selection of 1) leads to curve setting, modulating (refer to gas) or curve setting, multistage, depending on the parameterized operating mode.

Setting modulating ratio control

Refer to selection menu «Settings Gas»

Setting multistage ratio control

With multistage ratio control, the position values can be changed in 2 different ways:

1. Presetting the positions with no response by the actuators in order to fine-adjust the points later using «Followed».
2. Setting the switching and operating positions from «below» using «Followed». This means that stage 1 must be adjusted first, followed by the next switching on point, etc.

A	c	t	u	a	t	o	r							
P	o	s	i	t	i	o	n	s						
	f	o	l	l	o	w	e	d						
	n	o	t		f	o	l	l	o	w	e	d		

When the switch on / off and operating positions have been parameterized with «Not followed», the values can be changed. The system maintains its current load stage. The menu offers the choice of «Followed» or «Not followed». The display is maintained while the settings are made.

When accessing the menu, the operating positions «Stage 1» appear.
By pressing the **SELECTION** buttons the entered positions of all switching and operating points can be viewed. This has no impact on the system, even if «Followed» has been selected.

Example: **Not** followed.

P	u	n	k	t	l	L	u	f	t		:	2	8	.	5
:	B	S	1		l	H	i	l	f	1	:	2	8	.	4
	O	2			l						:				
		4	.	3	l						:				

Setting multistage ratio control «Followed»

The startup is made similar to modulating operation, including automatic entry of the ignition positions in the operating positions «Stage 1», if these still display invalid values (showing: XXX.X as a value).

P	u	n	k	t	l	L	u	f	t		:	2	8	.	5
:	B	S	1		l	H	i	l	f	1	:	2	8	.	4
	O	2			l						:				
		4	.	3	l						:				

For the fine adjustment of that point, confirm by pressing **ENTER**.

P	u	n	k	t	l	L	u	f	t		:	2	8	.	5
:	B	S	1		l	H	i	l	f	1	:	2	8	.	4
	O	2			l						:				
		4	.	3	l						:				

This causes output stage 1 to be approached. Here, the actuator to be adjusted can be selected. Again, confirm by pressing **ENTER**.

P	u	n	k	t	l	L	u	f	t		:	2	8	.	5
:	B	S	1		l	H	i	l	f	1	:	2	8	.	4
	O	2			l						:				
		4	.	3	l						:				

Now, the value can be changed and the respective actuator follows at the rate of the set ramp speed.

ENTER saves the value and **ESC** rejects it.

In this way, all stages can be set one by one.
The following table shows the response of the system when a point is selected. However, the relevant valve is switched on only when at least the switching on point is definitely used (≠ XXXX).

Selected point	Response	Remark
Operating point stage 1	Approach of stage 1	Fine adjustment of stage 1
Switch-on point stage 1	Approach of stage 1	Setting from stage 1
Switch-off point stage 2	--	Setting from both stage 1 and stage 2
Operating point stage 2	Approach of stage 2	Fine adjustment of stage 2
Switch-on point stage 3	Approach of stage 2	Setting from stage 2
Switch-off point stage 3	--	Setting from both stage 2 and stage 3
Operating point stage 3	Approach of stage 3	Fine adjustment of stage 3

System response when a point is selected

Special function adaption LC

Sequence steps of adaption (self-setting):

1) Starting the adaption

Using the AZL5… menu, the heating engineer manually activates the adaption function of the LC.
After selecting menu item «Adaption» (within the parameter settings of the LC), the following display will appear:

- The pointer is positioned on «Start adaption». Adaption is activated by pressing **ENTER**

S	**t**	**a**	**r**	**t**		**A**	**d**	**a**	**p**	**t**	**i**	**o**	**n**		
w	**i**	**t**	**h**		**E**	**N**	**T**	**E**	**R**					**6**	**0**
S	**e**	**t**	**p**	**o**	**i**	**n**	**t**	**:**	**7**	**0**	**.**	**0**	**°**	**C**	
A	**c**	**t**		**V**	**a**	**l**		**:**	**6**	**0**	**.**	**0**	**°**	**C**	

Adaption starts after pressing **ENTER** whereupon the following text appears:

A	**d**	**a**	**p**	**t**		**a**	**c**	**t**	**i**	**v**	**e**				
L	**o**	**a**	**d**					**:**	**5**	**2**	**.**	**0**	**%**		
A	**c**	**t**		**V**	**a**	**l**		**:**	**6**	**0**	**.**	**0**	**°**	**C**	
C	**a**	**n**	**c**	**e**	**l**		**w**	**i**	**t**	**h**		**E**	**S**	**C**	

Depending on the adaption step, the following displays appears, alternating with the display shown above:

A	**d**	**a**	**p**	**t**		**a**	**c**	**t**	**i**	**v**	**e**				
S	**e**	**t**	**t**	**i**	**n**	**g**		**P**	**h**	**a**	**s**	**e**			
m	**a**	**x**	**.**		**1**	**0**		**m**	**i**	**n**					
C	**a**	**n**	**c**	**e**	**l**		**w**	**i**	**t**	**h**		**E**	**S**	**C**	

A	**d**	**a**	**p**	**t**		**a**	**c**	**t**	**i**	**v**	**e**				
T	**e**	**m**	**p**		**S**	**e**	**t**	**b**	**a**	**c**	**k**				
A	**c**	**t**		**V**	**a**	**l**		**:**	**6**	**0**	**.**	**0**	**°**	**C**	
C	**a**	**n**	**c**	**e**	**l**		**w**	**i**	**t**	**h**		**E**	**S**	**C**	

A	**d**	**a**	**p**	**t**		**a**	**c**	**t**	**i**	**v**	**e**				
H	**e**	**a**	**t**	**i**	**n**	**g**									
m	**a**	**x**	**.**		**1**	**0**		**m**	**i**	**n**					
C	**a**	**n**	**c**	**e**	**l**		**w**	**i**	**t**	**h**		**E**	**S**	**C**	

2) End of a successful adaption

After the adaption, the relevant characteristics will be displayed.

By pressing the **SELECTION** buttons, the P-, I- and D-parts as well as the acquired loop delay time Tu will be displayed:

A	d	a	p	t	i	o	n		o	k				
P	-	P	a	r	t		(	X	p	)				
										X	2	5	.	0	%
C	o	n	t	i	n	u	e		w	i	t	h		<	>

A	d	a	p	t	i	o	n		o	k				
I	-	P	a	r	t		(	T	n	)				
												4	0	0	s
C	o	n	t	i	n	u	e		w	i	t	h		<	>

A	d	a	p	t	i	o	n		o	k				
D	-	P	a	r	t		(	T	v	)				
													3	5	s
C	o	n	t	i	n	u	e		w	i	t	h		<	>

A	d	a	p	t	i	o	n		o	k				
D	e	l	a	y		T	i	m	e		(	T	u	)	
													1	0	s
C	o	n	t	i	n	u	e		w	i	t	h		<	>

3) Canceling the adaption

If the LC was not able to select a suitable loop, it will stop the adaption and display the following text.

If a running adaption is manually canceled by pressing **ESC**, the following text will also appear:

A	d	a	p	t	i	o	n								
c	a	n	c	e	l	e	d								
C	o	n	t	i	n	u	e		w		E	S	C		

The system changes to «Normal operation». In that case, the previous PID parameters will be maintained.

Burner identification
(burner ID)

Burner ID offers the OEM the opportunity - which may also be the OEM's duty - to store an **individual** burner ID in each LMV5... system by means of the OEM password, prior to delivery.

Burner ID is then used to enable or disable the data transfer between the basic unit and the AZL5… backup storage. Parameters can be loaded to the AZL5… at any time, if the burner ID in the basic unit is not in the «as supplied» status.

The burner ID itself is part of the data transfer in both directions (if that is possible). In addition, for the burner, the burner ID represents one of a number of start prerequisites. In other words, the burner cannot be started up as long as the burner ID is in the «as supplied» status. So, it is possible to have data transmission between the basic unit and the AZL5… of **one** plant (burner IDs are identical) and between an AZL5… and a **new** basic unit (burner ID «as supplied» by Siemens). Data transmission between AZL5… and basic units of different plants (burner IDs not identical) is not possible (no «cloning»!).

Makeup of burner ID

Invalid characters for the burner ID are all vowels (ä, ö, ü and ß).
Minimum length of burner ID = 4 characters
Maximum length of burner ID = 15 characters

Languages

The AZL5… can output the display texts in different languages.
Changeover to another language takes place via menu «Params & Display» → «AZL5…» → «Language».
In addition to English as the basic language, the AZL5… provides another 5 languages. This means that a language group can comprise a maximum of 6 languages.
Using the program update function of the PC tool, additional language groups can be loaded to the AZL5… together with the relevant program version.
Hence, direct exchange of the language without loading a new program version is not possible.

Real time clock and calendar

The LMV5... system is equipped with a real time clock with a calendar and backup, which is accommodated in the AZL5... .
The clock features automatic **s**ummer- / **w**intertime changeover.

S / W changeover

The following parameter setting choices are available:

Parameter1	summer- / wintertime changeover:	on / off
Parameter2	summer- / wintertime changeover:	EU version / US version
EU version	start:	last Sunday in March
	end:	last Sunday in October
US version	start:	first Sunday in April
	end:	like EU version

Changeover takes place on the dates given above in the night between 02:00 and 03:00 hrs. The time shift is always 1 hour.
Changeover takes place only if the AZL5… receives power at that moment in time.

Backup

Backup is about 10 years.
The backup battery is a replaceable lithium battery.

Type of battery

Refer to «Technical data».
When changing batteries, ensure ESD protection!
If the AZL5… uses the associated interface to communicate with a building management center, the latter can act as the clock master by transmitting cyclically a preset time of day and date to the AZL5... .
This information is given priority over all other time of day / date sources.

Adjustment of contrast (display)

In «Normal operation» of the AZL5…, the contrast of the display can be adjusted.

To do this, keep the **ENTER** button depressed and, **at the same time,** press the **SELECTION** buttons (+ or -).

The contrast of the display can also be adjusted on the parameter setting level of the AZL5… menu.

Shutdown function

Lockout of the basic unit can be triggered by **simultaneously** pressing **ENTER** and **ESC**.

Lockout will be stored in the AZL5... .

7.4 Safety check function

The safety check function may only be performed by authorized staff.
It is possible to activate
- the floss-of-flame test, and
- the SLT test

Loss-of-flame test

The loss-of-flame test is triggered manually with the AZL5… and produces an interruption of the flame signal.
Using safety shutdown «Loss of flame», the LMV5... must shut the burner down.

SLT test

Activation of the SLT test negates the internal controller and temperature limiter function.
The setpoint and the temperature limiter switch-off threshold will be ignored.
The burner will be switched on and the output automatically increased to 100 %.
After safety shutdown by STL lockout or manual selection, the SLT test can be deactivated again.

7.5 Menu and parameter lists

AZL5… menu structure with parameter definitions

For each line, a parameter for the AZL5… menu is defined.

Name of column	Description
Menu level	This parameter name or this submenu level corresponds to the name on the menu
Description	Brief explanation of the parameter or of the submenu level
Value range	Definition of setting limits within which the parameter can be changed
Access rights	Definition of access rights. Parameters can be set by: **User**: Plant operator **Service**: Heating engineer **OEM**: Boiler / burner manufacturer
Basic parameter setting	Factory-set parameter
LMV51...	Line marked with an “x“: Line will be displayed with the LMV51... system
LMV52...	Line marked with an “x“: Line will be displayed with the LMV52... system

The parameter list shown on the next pages represents the preselection for the following type of system:
- LMV52.200A2
- SQM45...

The basic parameter settings made in the factory can vary, depending on customer- or country-specific requirements.

The preselected values listed are valid for the following parameter set:
- Parameter set code: 20
- Parameter set version: 400

If required, the code or version of the parameter set can be displayed on the AZL5...
In that case, select menu item «Factory ID» from the menu of the relevant device.

Parameterdarstellung auf Basis der Menüstruktur AZL - Ebene «OEM» - Auslieferstand Siemens Landis&Staefa

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6	Description	Value range	Access rights	Default parameter setting	LMV51	LMV52
OperationalStat						Menu level for displaying normal operation		User		x	x
	NormalOperation					Display of actual values, setpoints, load a. flame signal		User		x	x
	Status/Reset					Shows the current error (or no fault), lockout reset function		User		x	x
	FaultHistory					Last 21 error messages		User		x	x
	LockoutHistory					Storing the last 6 lockout indications with date and time of day		User		x	x
	Alarm act/deact					Activation / deactivation of horn in the event of an alarm	activated deactivated	User	-	x	x
Operation						Menu level for operating the key functions		User		x	x
	BoilerSetpoint							User		x	x
		SetpointW1				Internal setpoint W1, in °C Internal setpoint W1, in bar	0..2000 °C 0..100bar	User	-	x	x
		SetpointW2				Internal setpoint W2, in °C Internal setpoint W2, in bar	0..2000 °C 0..100bar	User	-	x	x
	Fuel					Displaying and selecting the type of fuel		User		x	x
		CurrentFuel				Information about the type of fuel currently burnt (read only)	Gas Oil	User	-	x	x
		FuelSelect				Fuel selection via DOU when fuel selector is set to "Internal"	Gas Oil	User	Gas	x	x
	Date/TimeOfDay					Displaying and setting the time of day and the date		User		x	x
		DisplayClock						User		x	x
			Date			Display of date (Day.Month.Year or Month-Day-Year)	01.01.00..31.12.99 01-01-00..12-31-99	User	-	x	x
			TimeOfDay			Display of time of day (Hour:Minute)	00:00..23:59	User	-	x	x
			Weekday			Display of day of week	Sunday Monday Tuesday Wednesday Thursday Friday Saturday	User	-	x	x
		SetClock						User		x	x

Parameterdarstellung auf Basis der Menüstruktur AZL - Ebene «OEM» - Auslieferstand Siemens Landis&Staefa

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6	Description	Value range	Access rights	Default parameter setting	LMV51	LMV52
			Date			Setting the display of date (Day.Month.Year or Month-Day-Year)	01.01.00..31.12.99 01-01-00..12-31-99	User	-	x	x
			TimeOfDay			Setting the time of day (Hour:Minute)	00:00..23:59	User	-	x	x
			Weekday			Setting the display of day of week	Sunday Monday Tuesday Wednesday Thursday Friday Saturday	User	-	x	x
	HoursRun					Displaying the current hours run readings		User		x	x
		GasFiring				Hours run gas (selectable)	0..999999 h	User	0	x	x
		OilStage1/Mod				Hours run oil stage 1 or modulating (selectable)	0..999999 h	User	0	x	x
		OilStage2				Hours run oil stage 2 (selectable)	0..999999 h	User	0	x	x
		OilStage3				Hours run oil stage 3 (selectable)	0..999999 h	User	0	x	x
		TotalHoursReset				Hours run total (can be reset)	0..999999 h	User	0	x	x
		TotalHours				Hours run total (read only)	0..999999 h	User	0	x	x
		SystemOnPower				Hours run device under voltage (read only)	0..999999 h	User	0	x	x
	StartCounter					Displaying the start counter readings		User		x	x
		GasStartCount				Number of startups gas, start counter (selectable)	0..999999	User	0	x	x
		OilStartCount				Number of startups oil, start counter (selectable)	0..999999	User	0	x	x
		TotalStartCount R				Total number of startups, start counter (can be reset)	0..999999	User	0	x	x
		TotalStartCount				Total number of startups, start counter (read only)	0..999999	User	0	x	x
	Fuel Meter							User		x	x
		Curr Flow Rate				Current fuel throughput	0..6553,4	User	-	x	x
		Volume Gas				Fuel volume gas (read only)	0..199999999,9 m³ 0..1999999999 ft³	User	0	x	x
		Volume Oil				Fuel volume oil (read only)	0..199999999,9 l 0..199999999,9 gal	User	0	x	x
		Volume Gas R				Fuel volume gas (resettable)	0..199999999,9 m³ 0..1999999999 ft³	User	0	x	x

Parameterdarstellung auf Basis der Menüstruktur AZL - Ebene «OEM» - Auslieferstand Siemens Landis&Staefa

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6	Description	Value range	Access rights	Default parameter setting	LMV51	LMV52
		Volume Oil R				Fuel volume oil (resettable)	0..199999999,9 l 0..199999999,9 gal	User	0	x	x
		Reset Date Gas				Reset date fuel volume gas	01.01.00..31.12.99 01-01-00..12-31-99	User	0	x	x
		Reset Date Oil				Reset date fuel volume oil	01.01.00..31.12.99 01-01-00..12-31-99	User	0	x	x
	LockoutCounter					Total number of lockouts that occurred (read only)	0..65535	User	0	x	x
	CombEfficiency						0..200%	User	-		x
	BurnerID					Identification of burner	4..15 characters	User	invalid	x	x
	OptgModeSelect					Operating mode selection of AZL for serial port and eBus		User		x	x
		InterfacePC				Setting the serial port (RS-232) of the AZL to interface operation for PC tool		User		x	x
		GatewayBASon				Activating the eBus port on the AZL for BAS		User		x	x
		GatewayBASoff				Deactivating the eBus port on the AZL		User		x	x
ManualOperation						Menu level for activating manual operation with the preselected load		User		x	x
	SetLoad					Set target load	0..100%, S1, S2, S3	User	-	x	x
	Autom/Manual/Off					Selection of manual or automatic operation	Automatic Burner on Burner off	User	Automatic	x	x
Params & Display						Menu level for making the parameter settings		User		x	x
	BurnerControl					Setting the burner control parameters		User		x	x
		Times						Service		x	x
			TimesStartup1			Burner control startup times 1		Service		x	x
				MinTmeStartRel		Minimum time for start release	0.2..63 s	OEM	1s	x	x
				FanRunupTme		Fan runup time	0.2..63 s	OEM	2s	x	x
				PrepurgeTmeGas		Prepurge time gas	MinT_PrepurgeGas..63 min	Service	20s	x	x
				PrepurgeTmeOil		Prepurge time oil	MinT_PrepurgeOil..63 min	Service	15s	x	x
				MinT_PrepurgeGas		Minimum prepurge time gas	0.2..63 min	OEM	20s	x	x

Parameterdarstellung auf Basis der Menüstruktur AZL - Ebene «OEM» - Auslieferstand Siemens Landis&Staefa											
Menu level 1	**Menu level 2**	**Menu level 3**	**Menu level 4**	**Menu level 5**	**Menu level 6**	**Description**	**Value range**	**Access rights**	**Default parameter setting**	**LMV51**	**LMV52**
				MinT_PrepurgeOil		Minimum prepurge time oil	0.2..63 min	OEM	15s	x	x
				PrepurgeSafeGas		Prepurge time after safety shutdown gas	MinT_PrepurgeGas..63 min	OEM	20s	x	x
				PrepurgeSafeOil		Prepurge time after safety shutdown oil	MinT_PrepurgeOil..63 min	OEM	15s	x	x
				PreIgnitionTGas		Preignition time gas	0.2..63 s	OEM	2s	x	x
				PreIgnitionTOil		Preignition time oil	0.2..44 s	OEM	2s	x	x
				MinOnTmeOilPump		Minimum on time of oil pump	0.2..63 s	OEM	1s	x	x
			TimesStartup2			Burner control startup times 2		Service		x	x
				SafetyTme1Gas		Safety time 1 gas	1 s..MaxSafetyTGas	OEM	2s	x	x
				SafetyTme1Oil		Safety time 1 oil	1 s..MaxSafetyTOil	OEM	2s	x	x
				Interval1Gas		Interval 1 (ts1-ts2) gas	0.2..63 s	Service	2s	x	x
				Interval1Oil		Interval 1 (ts1-ts2) oil	0.2..63 s	Service	2s	x	x
				SafetyTme2Gas		Safety time 2 gas	1 s..MaxSafetyTGas	OEM	2s	x	x
				SafetyTme2Oil		Safety time 2 oil	1 s..MaxSafetyTOil	OEM	2s	x	x
				Interval2Gas		Interval 2 (ts2 operation) gas	0.2..63 s	Service	2s	x	x
				Interval2Oil		Interval 2 (ts2 operation) oil	0.2..63 s	Service	2s	x	x
				PressReacTme		Reaction time to lack of pressure in ts1 and ts2	0.2s..MaxSafetyTGas	OEM	1s	x	x
			TimesShutdown			Burner control shutdown times		Service		x	x
				MaxTmeLowFire		Maximum time to low-fire in operation 2	0.2..630 s	Service	45s	x	x
				AfterburnTme		Afterburn time	0.2..63 s	OEM	8s	x	x
				PostpurgeT1Gas		Postpurge time 1 gas	0.2..63 min	OEM	0.2s	x	x
				PostpurgeT1Oil		Postpurge time 1 oil	0.2..63 min	OEM	0.2s	x	x
				PostpurgeT3Gas		Postpurge time 3 gas	0.2..63 min	Service	5s	x	x
				PostpurgeT3Oil		Postpurge time 3 oil	0.2..63 min	Service	5s	x	x
				MinTmeHomeRun		Minimum time in home run phase	0.2..63 s	OEM	1s	x	x
				DelayLackGas		Basic waiting time in the event of lack of gas	MinTmeHomeRun ..63s	OEM	10s	x	x
			TimesGeneral			General times of burner control		Service		x	x
				AlarmDelay		Time to alarm in the event of start prevention and heat demand	0.4..630 s	Service	35s	x	x

Parameterdarstellung auf Basis der Menüstruktur AZL - Ebene «OEM» - Auslieferstand Siemens Landis&Staefa											
Menu level 1	**Menu level 2**	**Menu level 3**	**Menu level 4**	**Menu level 5**	**Menu level 6**	**Description**	**Value range**	**Access rights**	**Default parameter setting**	**LMV51**	**LMV52**
				DelayStartPrev		Time until message on start prevention and heat demand is delivered	0.4..630 s	Service	35s	x	x
				PostpurgeLockout		Postpurge in lockout position	0.2..63 min	OEM	0.2s	x	x
				MaxTmeStartRel		Maximum phase time start release (timeout)	0.2..630 s	OEM	120s	x	x
		Configuration						Service		x	x
			ConfigGeneral			General parameters of burner control		Service		x	x
				AlarmStartPrev		With/without alarm in the event of start prevention and heat demand	deactivated activated	Service	deactivated	x	x
				NormDirectStart		Normal/direct start in the event of heat demand in phase 78	NormalStart DirectStart	OEM	NormalStart	x	x
				OilPumpCoupling		Configuration for coupling the oil pump	Magnetcoupl Directcoupl	OEM	Magnetcoupl	x	x
				IgnOilPumpStart		Switch-on time of ignition and oil pump	on in Ph38 on in Ph22	OEM	on in Ph38	x	x
				ForcedIntermit		With / without forced intermittent operation	deactivated activated	Service	activated	x	x
				ContinuousPurge		Configuration for normal or continuous fan operation	deactivated activated	OEM	deactivated	x	x
				FuelTrainGas		Fuel train when firing on gas	DirectIgniG Pilot Gp1 Pilot Gp2	OEM	invalid	x	x
				FuelTrainOil		Fuel train when firing on oil	LightOilLO HeavyOilHO LO w Gasp HO w Gasp	OEM	invalid	x	x
				FuelTrainReset		Resetting the fuel train to invalid value		OEM		x	x
					FuelTrainGas			OEM		x	x
					FuelTrainOil			OEM		x	x
				MainsFrequency		Selection of mains frequency 50 Hz/60 Hz	50 Hz 60 Hz	OEM	50 Hz	x	x
			ConfigIn/Output			Configuring the inputs and outputs		OEM		x	x

Parameterdarstellung auf Basis der Menüstruktur AZL - Ebene «OEM» - Auslieferstand Siemens Landis&Staefa											
Menu level 1	**Menu level 2**	**Menu level 3**	**Menu level 4**	**Menu level 5**	**Menu level 6**	**Description**	**Value range**	**Access rights**	**Default parameter setting**	**LMV51**	**LMV52**
				StartReleaseGas		Input start release oil active	deactivated activated	OEM	activated		x
				StartReleaseOil		Input start release oil active	deactivated activated	OEM	activated	x	x
				AirPressureTest		Assess/ignore air pressure signal	deactivated activated	OEM	activated	x	x
				PS-VP/CPI		Configuration of input on PM-VP or CPI	PS-VP CPI	OEM	PS-VP	x	x
				FGR-PS/FCC		Configuration of input for FCC or FGR-PS	FCC FGR-PS deactivated	OEM	FCC	x	x
				InputController		Input controller active	deactivated activated	OEM	activated	x	x
				GasPressureMin		Input minimum gas pressure (+start release gas) active	deactivated activated deact xOGP	OEM	activated	x	x
				GasPressureMax		Input maximum gas pressure active	deactivated activated	OEM	activated	x	x
				OilPressureMin		Input minimum oil pressure active	deactivated activated act from ts	OEM	activated	x	x
				OilPressureMax		Input oil pressure max. active	deactivated activated	OEM	activated	x	x
				HeavyOilDirStart		Input immediate heavy oil start active	deactivated activated	OEM	activated	x	x
				Start/PS-Valve		Configuration of output for start signal or PS relief valve	StartSignal PS Relief PS Reli_Inv	OEM	StartSignal	x	x
			ConfigFlameDet			Configuring the flame detector		OEM		x	x
				ReacExtranLight		Reaction in the event of extraneous light in standby	Lockout Startblock	OEM	Startblock	x	x
				FlameSignal		Configuration the flame signal		OEM		x	x

Parameterdarstellung auf Basis der Menüstruktur AZL - Ebene «OEM» - Auslieferstand Siemens Landis&Staefa

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6	Description	Value range	Access rights	Default parameter setting	LMV51	LMV52
					Standardize	Standardizing the flame signal		OEM		x	x
					StandardFactor	Reading/reseting the standard factor		OEM		x	x
			RepetitCounter			Displaying the repetition counters		OEM		x	x
				HeavyOil		Rep. counter: immediate start heavy oil	1..16	OEM	3	x	x
				StartRelease		Rep. limit value: start prevention	1..16	OEM	10	x	x
				SafetyLoop		Rep. limit value: safety loop	1..16	OEM	16	x	x
		ValveProving				Settings for valve proving		OEM		x	x
			ValveProvingType			Type and time of proving test	No VP VP startup VP shutdown VP stup/shd	OEM	VP shutdown	x	x
			Config_PM-VP/CPI			Configuration of input on PM-VP or CPI	PS-VP CPI	OEM	PS-VP	x	x
			VP_EvacTme			Proving test evacuation time	0.2..3 s	OEM	3s	x	x
			VP_TmeAtmPress			Proving test test time atmospheric pressure	MinT_VP_AtmPress..63 s	OEM	10s	x	x
			VP_FillTme			Proving test filling time	0.2..3 s	OEM	3s	x	x
			VP_Tme_GasPress			Proving test test time gas pressure	MinT_VP_GasPress..63 s	OEM	10s	x	x
		ProductID				Displaying the burner control's HW version		User		x	x
			ASN			Type reference	1..15 characters	User	"LMV52.200 A2"	x	x
			ProductionDate			Production date	01.01.00..31.12.99 01-01-00..12-31-99	User	-	x	x
			SerialNumber			Serial number	0..65535	User	-	x	x
			ParamSet Code			Preselected parameter set: customer code	0..255	User	20	x	x
			ParamSet Vers			Preselected parameter set: version	0..65535	User	400	x	x
		SW Version				SW version of burner control	0..65535	User	-	x	
		SW Version					0..65535	User	-		x
	RatioControl					Parameter settings for ratio control		User		x	x
		GasSettings				Parameter settings for firing on gas		Service		x	x
			SpecialPositions			Setting the special actuator positions for firing on gas		Service		x	x

Parameterdarstellung auf Basis der Menüstruktur AZL - Ebene «OEM» - Auslieferstand Siemens Landis&Staefa

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6	Description	Value range	Access rights	Default parameter setting	LMV51	LMV52
				HomePos		Setting the home positions for firing on gas		Service		x	x
					HomePosGas	Home position of fuel damper (gas)	0..90°	Service	0°	x	x
					HomePosAir	Home position of air damper (gas)	0..90°	Service	0°	x	x
					HomePosAux	Home position of auxiliary damper (gas)	0..90° 0..100%	Service	0°	x	x
					HomePosAux2	Home position of auxiliary damper 2	0..90°	Service	0°		x
					HomePosAux3	Home position of auxiliary damper 3	0..90°	Service	0°		x
					HomePosVSD	Home position of VSD	0..100%	Service	0°		x
				PrepurgePos		Setting the prepurge positions for firing on gas		Service		x	x
					PrepurgePosAir	Prepurge position of air damper (gas)	0..90°	Service	90°	x	x
					PrepurgePosAux	Prepurge position of auxiliary damper (gas)	0..90° 0..100%	Service	90°	x	x
					PrepurgePosAux2	Prepurge position of auxiliary damper 2	0..90°	Service	90°		x
					PrepurgePosAux3	Prepurge position of auxiliary damper 3	0..90°	Service	90°		x
					PrepurgePosVSD	Prepurge position of VSD	0..100%	Service	100%		x
				IgnitionPos		Setting the ignition positions for firing on gas		Service		x	x
					IgnitionPosGas	Ignition position of fuel damper (gas)	0..90°	Service	invalid	x	x
					IgnitionPosAir	Ignition position of air damper (gas)	0..90°	Service	invalid	x	x
					IgnitionPosAux	Ignition position of auxiliary damper (gas)	0..90° 0..100%	Service	invalid	x	x
					IgnitionPosAux2	Ignition position of auxiliary damper 2	0..90°	Service	invalid		x
					IgnitionPosAux3	Ignition position of auxiliary damper 3	0..90°	Service	invalid		x
					IgnitionPosVSD	Ignition position of VSD	10..100%	Service	invalid		x
				PostpurgePos		Setting the postpurge positions for firing on gas		Service		x	x
					PostpurgePosGas	Postpurge position of fuel damper (gas)	0..90°	Service	15°	x	x
					PostpurgePosAir	Postpurge position of air damper (gas)	0..90°	Service	15°	x	x
					PostpurgePosAux	Postpurge position of auxiliary damper (gas)	0..90° 0..100%	Service	25°	x	x

Parameterdarstellung auf Basis der Menüstruktur AZL - Ebene «OEM» - Auslieferstand Siemens Landis&Staefa											
Menu level 1	**Menu level 2**	**Menu level 3**	**Menu level 4**	**Menu level 5**	**Menu level 6**	**Description**	**Value range**	**Access rights**	**Default parameter setting**	**LMV51**	**LMV52**
					PostpurgePosAux2	Postpurge position of auxiliary damper 2	0..90°	Service	25°		x
					PostpurgePosAux3	Postpurge position of auxiliary damper 3	0..90°	Service	25°		x
					PostpurgePosVSD	Postpurge position of VSD	0..100%	Service	50%		x
				ProgramStop		Program stop	deactivated 24 PrePurgP 32 PreP FGR 36 IgnitPos 44 Interv 1 52 Interv 2 72 PostPPos 76 PostPFGR	Service	deactivated	x	x
				ResetIgnitPos		Resetting the ignition positions to invalid value		Service		x	x
					IgnitionPosGas			Service		x	x
					IgnitionPosAir			Service		x	x
					IgnitionPosAux			Service		x	x
					IgnitionPosAux2			Service			x
					IgnitionPosAux3			Service			x
					IgnitionPosVSD			Service			x
			CurveParams					Service		x	x
			LoadLimits			Setting the minimum and maximum load limits		Service		x	x
				MinLoadGas		Minimum load "Low fire" (gas)	0..MaxLoadGas	Service	0%	x	x
				MaxLoadGas		Maximum load "High fire" (gas)	MinLoadGas..100 %	Service	100%	x	x
			AuxActuator			Auxiliary actuator for firing on gas: Deactivate / activate / VSD operation	deactivated Damper act VSD activat	OEM	deactivated	x	
			AirActuator			Air actuator for firing on gas: Deactivate / activate / air-regulating	deactivated activated air influen	OEM	air influen		x

Parameterdarstellung auf Basis der Menüstruktur AZL - Ebene «OEM» - Auslieferstand Siemens Landis&Staefa											
Menu level 1	**Menu level 2**	**Menu level 3**	**Menu level 4**	**Menu level 5**	**Menu level 6**	**Description**	**Value range**	**Access rights**	**Default parameter setting**	**LMV51**	**LMV52**
			AuxActuator 1			Auxiliary actuator 1 for firing on gas: Deactivate / activate / air-regulating	deactivated activated air influen	OEM	deactivated		x
			AuxActuator 2			Auxiliary actuator 2 for firing on gas: Deactivate / activate / air-regulating	deactivated activated air influen	OEM	deactivated		x
			AuxActuator 3			Auxiliary actuator 3 for firing on gas: Deactivate / activate / air-regulating	deactivated activated air influen	OEM	deactivated		x
			VSD			VSD for firing on gas: Deactivate / activate / air-regulating	deactivated activated air influen	OEM	deactivated		x
		OilSettings				Parameter settings for firing on oil		Service		x	x
			SpecialPositions			Setting the special actuator positions for firing on oil		Service		x	x
				HomePos		Setting the home positions for firing on oil		Service		x	x
					HomePosOil	Home position of fuel damper (oil)	0..90°	Service	0°	x	x
					HomePosAir	Home position of air damper (oil)	0..90°	Service	0°	x	x
					HomePosAux	Home position of auxiliary damper (oil)	0..90° 0..100%	Service	0°	x	x
					HomePosAux2	Home position of auxiliary damper 2	0..90°	Service	0°		x
					HomePosAux3	Home position of auxiliary damper 3	0..90°	Service	0°		x
					HomePosVSD	Home position of VSD	0..100%	Service	0°		x
				PrepurgePos		Setting the prepurge positions for firing on oil		Service		x	x
					PrepurgePosAir	Prepurge position of air damper (oil)	0..90°	Service	90°	x	x
					PrepurgePosAux	Prepurge position of auxiliary damper (oil)	0..90° 0..100%	Service	90°	x	x
					PrepurgePosAux2	Prepurge position of auxiliary damper 2	0..90°	Service	90°		x
					PrepurgePosAux3	Prepurge position of auxiliary damper 3	0..90°	Service	90°		x

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Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6	Description	Value range	Access rights	Default parameter setting	LMV51	LMV52
					PrepurgePosVSD	Prepurge position of VSD	0..100%	Service	100%		x
				IgnitionPos		Setting the ignition positions for firing on oil		Service		x	x
					IgnitionPosOil	Ignition position of fuel damper (oil)	0..90°	Service	invalid	x	x
					IgnitionPosAir	Ignition position of air damper (oil)	0..90°	Service	invalid	x	x
					IgnitionPosAux	Ignition position of auxiliary damper (gas)	0..90° 0..100%	Service	invalid	x	x
					IgnitionPosAux2	Ignition position of auxiliary damper 2	0..90°	Service	invalid		x
					IgnitionPosAux3	Ignition position of auxiliary damper 3	0..90°	Service	invalid		x
					IgnitionPosVSD	Ignition position of VSD	10..100%	Service	invalid		x
				PostpurgePos		Setting the postpurge positions for firing on oil		Service		x	x
					PostpurgePosOil	Postpurge position of fuel damper (oil)	0..90°	Service	0°	x	x
					PostpurgePosAir	Postpurge position of air damper (oil)	0..90°	Service	15°	x	x
					PostpurgePosAux	Postpurge position of auxiliary damper (oil)	0..90° 0..100%	Service	25°	x	x
					PostpurgePosAux2	Postpurge position of auxiliary damper 2	0..90°	Service	25°		x
					PostpurgePosAux3	Postpurge position of auxiliary damper 3	0..90°	Service	25°		x
					PostpurgePosVSD	Postpurge position of VSD	0..100%	Service	50%		x
				ProgramStop		Program stop	deactivated 24 PrePurgP 32 PreP FGR 36 IgnitPos 44 Interv 1 52 Interv 2 72 PostPPos 76 PostPFGR	Service	deactivated	x	x
				ResetIgnitPos		Resetting the ignition positions to invalid value		Service		x	x
					IgnitionPosOil			Service		x	x
					IgnitionPosAir			Service		x	x

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Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6	Description	Value range	Access rights	Default parameter setting	LMV51	LMV52
					IgnitionPosAux			Service		x	x
					IgnitionPosAux2			Service			x
					IgnitionPosAux3			Service			x
					IgnitionPosVSD			Service			x
			CurveParams			Setting the curve parameters of ratio control for firing on oil		Service		x	x
				Curve Settings				Service		x	x
				Operation Mode		Selection of burner operating mode (multistage or modulating) for oil	Two-stage Three-stage Modulating	OEM	Modulating	x	x
			LoadLimits			Setting the minimum and maximum load limits		Service		x	x
				MinLoadOil		Minimum load "Low fire" (oil)	0..MaxLoadOil	Service	0%	x	x
				MaxLoadOil		Maximum load "High fire" (oil)	MinLoadOil..100%	Service	100%	x	x
			AuxActuator			Auxiliary actuator for firing on oil: Deactivate / activate / VSD operation	deactivated Damper act VSD activat	OEM	deactivated	x	
			AirActuator			Air actuator for firing on oil: Deactivate / activate / air-regulating	deactivated activated air influen	OEM	air influen		x
			AuxActuator 1			Auxiliary actuator 1 for firing on oil: Deactivate / activate / air-regulating	deactivated activated air influen	OEM	deactivated		x
			AuxActuator 2			Auxiliary actuator 2 for firing on oil: Deactivate / activate / air-regulating	deactivated activated air influen	OEM	deactivated		x
			AuxActuator 3			Auxiliary actuator 3 for firing on oil: Deactivate / activate / air-regulating	deactivated activated air influen	OEM	deactivated		x
			VSD			VSD for firing on oil: Deactivate / activate / air-regulating	deactivated activated air influen	OEM	deactivated		x
		Autom/Manual/Off				Selection of manual or automatic operation	Automatic Burner on Burner off	User	Automatic	x	x

Parameterdarstellung auf Basis der Menüstruktur AZL - Ebene «OEM» - Auslieferstand Siemens Landis&Staefa											
Menu level 1	**Menu level 2**	**Menu level 3**	**Menu level 4**	**Menu level 5**	**Menu level 6**	**Description**	**Value range**	**Access rights**	**Default parameter setting**	**LMV51**	**LMV52**
		Times						Service		x	x
			OperatRampMod			Duration operating ramp ratio control modulating operation	30..120s	Service	30s	x	x
			OperatRampStage			Duration operating ramp ratio control multistage operation	10..60s	Service	10s	x	x
			TimeNoFlame			Duration ramp in prepurge and ignition position	10..120s	Service	10s	x	x
		NumFuelActuators				Number of fuel actuators	1..2	OEM	2	x	x
		ShutdownBehav				This parameter determines the way the ratio control system behaves in the lockout phase	Unchanged PostpurgeP HomePos	Service	HomePos	x	x
		ProgramStop				Program stop	deactivated 24 PrePurgP 32 PreP FGR 36 IgnitPos 44 Interv 1 52 Interv 2 72 PostPPos 76 PostPFGR	Service	deactivated	x	x
	O2Ctrl/Limiter					Parameter settings for O2 control and monitor function		User			x
		GasSettings				Parameter settings for firing on gas		Service			x
			OptgMode			Operating mode of O2 controller / monitor when firing on gas	auto deact man deact O2 Limiter O2 Control conAutoDeac	Service	man deact		x
			O2 Control					Service			x
			O2 Limiter					Service			x
			Control Param					Service			x
				P Low-Fire		P-part of O2 controller with low-fire	3..500 %	Service	invalid		x
				I Low-Fire		I-part of O2 controller with low-fire	0..500s	Service	invalid		x
				Tau Low-Fire		Time constant Tau of O2 controller's controlled system with low-fire	1..27s	OEM	invalid		x
				P High-Fire		P-part of O2 controller with high-fire	3..500 %	Service	invalid		x

Parameterdarstellung auf Basis der Menüstruktur AZL - Ebene «OEM» - Auslieferstand Siemens Landis&Staefa

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6	Description	Value range	Access rights	Default parameter setting	LMV51	LMV52
				I High-Fire		I-part of O2 controller with high-fire	0..500s	Service	invalid		x
				Tau High-Fire		Time constant Tau of O2 controller's controlled system with high-fire	1..27s	OEM	invalid		x
			O2 CtrlThreshold			Minimum load O2 control (gas)	0..100 %	Service	0%		x
			Type of Fuel			Selection of type of gas	user def naturalGasH naturalGasL propane butane	Service	naturalGasH		x
			Fuel user def			User-defined setting of the fuel parameters		Service			x
				V_LNmin		Air volume under standard conditions and lambda = 1	0,00..40,00	Service	9.90		x
				V_afNmin		Flue gas volume wet under standard conditions and lambda = 1	0,00..40,00	Service	10.93		x
				V_atrNmin		Flue gas volume dry under standard conditions and lambda = 1	0,00..40,00	Service	8.89		x
				A2		Adjustable constant for calculating the combustion efficiency (gas)	0.40..0.80	Service	0.65		x
				B / 1000		Adjustable constant for calculating the combustion efficiency (gas)	1..20	Service	9		x
			O2 Content Air			Oxygen content of air	0..30%	OEM	20.9%		x
			Type ofAirChange			Impact of air density change on O2 value	like theory like P air	OEM	like theory		x
		OilSettings				Parameter settings for firing on oil		Service			x
			OptgMode			Operating mode of O2 controller / monitor when firing on oil	auto deact man deact O2 Limiter O2 Control conAutoDeac	Service	man deact		x
			O2 Control					Service			x
			O2 Limiter					Service			x
			Control Param					Service			x
				P Kleinlast		P-part of O2 controller with low-fire	3..500 %	Service	invalid		x
				I Kleinlast		I-part of O2 controller with low-fire	0..500s	Service	invalid		x

Parameterdarstellung auf Basis der Menüstruktur AZL - Ebene «OEM» - Auslieferstand Siemens Landis&Staefa

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6	Description	Value range	Access rights	Default parameter setting	LMV51	LMV52
				Tau Kleinlast		Time constant Tau of O2 controller's controlled system with low-fire	1..27s	OEM	invalid		x
				P Volllast		P-part of O2 controller with high-fire	3..500 %	Service	invalid		x
				I Volllast		I-part of O2 controller with high-fire	0..500s	Service	invalid		x
				Tau Volllast		Time constant Tau of O2 controller's controlled system with high-fire	1..27s	OEM	invalid		x
			O2 CtrlThreshold			Minimum load O2 control (oil)	0..100 %	Service	0%		x
			Type of Fuel			Selection of type of oil	user def oil EL oil H	Service	oil EL		x
			Fuel user def					Service			x
				V_LNmin		Air volume under standard conditions and lambda = 1	0,00..40,00	Service	11.2		x
				V_afNmin		Flue gas volume wet under standard conditions and lambda = 1	0,00..40,00	Service	12.02		x
				V_atrNmin		Flue gas volume dry under standard conditions and lambda = 1	0,00..40,00	Service	10.53		x
				A2		Adjustable constant for calculating the combustion efficiency (oil)	0.40..0.80	Service	0.65		x
				B / 1000		Adjustable constant for calculating the combustion efficiency (oil)	1..20	Service	9		x
			O2 Content Air			Oxygen content of air	0..30%	OEM	20.9%		x
			Type Air Change			Impact of air density change on O2 value	like theory like P air	OEM	like theory		x
		Process Data						User			x
			CombEfficiency				0..200%	User	-		x
			ManVar O2 Ctrl				-35..35%	User	-		x
			Release O2 Ctrl				deactivated activated	User	-		x
			Air-related Load				0..100%, S1, S2, S3	User	-		x
	LoadController					Settings for the internal load controller		User		x	x
		ControllerParam				Setting the controller parameters		User		x	x

Parameterdarstellung auf Basis der Menüstruktur AZL - Ebene «OEM» - Auslieferstand Siemens Landis&Staefa											
Menu level 1	**Menu level 2**	**Menu level 3**	**Menu level 4**	**Menu level 5**	**Menu level 6**	**Description**	**Value range**	**Access rights**	**Default parameter setting**	**LMV51**	**LMV52**
			ContrlParamList			PID control parameters		User		x	x
				StandardParam		Selection of standard parameter sets for the load controller	Adaption very fast fast normal slow very slow	User	-	x	x
				P-Part (Xp)		Controller parameter proportional band	2..500 %	User	15%	x	x
				I-Part (Tn)		Controller parameter integral part	0..2000s	User	320s	x	x
				D-Part (Tv)		Controller parameter differential part	0..1000s	User	40s	x	x
			MinActuatorStep			Minimum actuator step possible	0,5..10 %	User	1%	x	x
			SW_FilterTmeCon			Software filter time constant	1..10 s	User	3s	x	x
			SetpointW1			Internal setpoint W1, in °C Internal setpoint W1, in bar	0..2000 °C 0..100bar	User	-	x	x
			SetpointW2			Internal setpoint W2, in °C Internal setpoint W2, in bar	0..2000 °C 0..100bar	User	-	x	x
			SD_ModOn			Two-position controller switching differential burner ON modulating referred to the current setpoint (Wcurrent)	-50..+50 % Wcurrent	User	1.0%	x	x
			SD_ModOff			Two-position controller switching differential burner OFF modulating referred to the current setpoint (Wcurrent)	0..+50 % Wcurrent	User	10%	x	x
			SD_Stage1On			Two-position controller switching differential burner ON multistage referred to the current setpoint (Wcurrent)	-50..+50 % Wcurrent	User	-2%	x	x
			SD_Stage1Off			Two-position controller switching differential stage 1 OFF referred to the current setpoint (Wcurrent)	0..+50 % Wcurrent	User	10%	x	x
			SD_Stage2Off			Two-position controller switching differential stage 2 OFF referred to the current setpoint (Wcurrent)	0..+50 % Wcurrent	User	8%	x	x
			SD_Stage3Off			Two-position controller switching differential stage 3_1 OFF referred to the current setpoint (Wcurrent)	0..+50 % Wcurrent	User	6%	x	x
			ThreshStage2On			Reaction threshold Q2 for switching on stage 2 (integral control deviation * time)	0..1000	User	300	x	x

Parameterdarstellung auf Basis der Menüstruktur AZL - Ebene «OEM» - Auslieferstand Siemens Landis&Staefa											
Menu level 1	**Menu level 2**	**Menu level 3**	**Menu level 4**	**Menu level 5**	**Menu level 6**	**Description**	**Value range**	**Access rights**	**Default parameter setting**	**LMV51**	**LMV52**
			ThreshStage3On			Reaction threshold Q3 for switching on stage 3 (integral control deviation * time)	0..1000	User	600	x	x
		TempLimiter				Settings for the temperature limiter function		Service		x	x
			TL_ThreshOff			Temperature limiter OFF threshold, in °C	0..2000 °C	Service	95°C	x	x
			TL_SD_On			Temperature limiter switching differential ON	-50..0 % TL_Thresh_Off	Service	-5%	x	x
		ColdStart				Settings for the cold start (thermal shock protection)		Service		x	x
			ColdStartOn			Cold start thermal shock protection, activate/deactivate	deactivated activated	Service	deactivated	x	x
			ThresholdOn			Cold start thermal shock protection activation level referred to the current setpoint (Wcurrent)	0..100 % Wcurrent	Service	20%	x	x
			StageLoad			Cold start thermal shock protection load step	0..100 %	Service	15%	x	x
			StageSetp_Mod			Cold start thermal shock protection setpoint step (modulating) referred to the current setpoint (Wcurrent)	1..100 % Wcurrent	Service	5%	x	x
			StageSetp_Stage			Cold start thermal shock protection setpoint step (multistage) referred to the current setpoint (Wcurrent)	1..100 % Wcurrent	Service	5%	x	x
			MaxTmeMod			Cold start thermal shock protection, max. time per step (modulating)	1..63 min	Service	3min	x	x
			MaxTmeStage			Cold start thermal shock protection, maximum time per step (multistage)	1..63 min	Service	3min	x	x
			ThresholdOff			Cold start thermal shock protection deactivation level referred to the current setpoint (Wcurrent)	0..100 % Wcurrent	Service	80%	x	x
			AdditionalSens			Selection for additional sensor (cold start thermal shock protection)	deactivated Pt100 Pt1000 Ni1000	Service	deactivated	x	x
			Setp AddSensor			Setpoint for additional sensor (cold start thermal shock protection)	0..450°C	Service	60°C	x	x
			Release Stages			Cold start thermal shock protection load step stage mode	no release release	Service	release	x	x
		Configuration				General configuration of the load controller		User		x	x

Parameterdarstellung auf Basis der Menüstruktur AZL - Ebene «OEM» - Auslieferstand Siemens Landis&Staefa											
Menu level 1	**Menu level 2**	**Menu level 3**	**Menu level 4**	**Menu level 5**	**Menu level 6**	**Description**	**Value range**	**Access rights**	**Default parameter setting**	**LMV51**	**LMV52**
			LC_OptgMode			Operating mode with load controller	ExtLC X5-03 IntLC IntLC Bus IntLC X62 ExtLC X62 ExtLC Bus	User	IntLC	x	x
			Sensor Select			Select actual value input E1-> Pt100, TL act. E4-> Pt1000, TL act. E4-> Ni1000, TL act. E2-> Temp, TL inact. E2-> Pressure, TL inact. E1-> Pt100 for controller + TL and E4-> Pt1000 for TL E1-> Pt100 for controller + TL and E4-> Ni1000 for TL No input	 Pt100 Pt1000 Ni1000 TempSensor PressSensor Pt100Pt1000 Pt100Ni1000 NoSensor	Service	Pt100	x	x
			MeasureRangePtNi			End of measurement range for sensor at input X60	150°C/302°F 400°C/752°F	Service	150°C/302°F	x	x
			Ext Inp X61 U/I			Configuration of external input X61	4..20 mA 2..10 V 0..10 V	Service	0..10 V	x	x
			MRange TempSens			End of temperature measurement range for input X61	0..2000 °C	Service	90°C	x	x
			MRange PressSens			End of pressure measurement range for input X61	0..99,9 bar	Service	2bar	x	x
			Ext Inp X62 U/I			Configuration of external input X62	4..20 mA 0/2..10 V	Service	4..20 mA	x	x
			Ext MinSetpoint			Accepted preselected minimum external setpoint for X62 / bus	0..100 % ScaleHIcurrent	Service	0%	x	x
			Ext MaxSetpoint			Accepted preselected maximum external setpoint for X62 / bus	0..100 % ScaleHIcurrent	Service	60%	x	x
		Adaption				Adapting the controlled system		User		x	x
			StartAdaption					User		x	x
			AdaptionLoad			Adaption load	40..100 %	User	100%	x	x
		SW Version				SW version of internal load controller	0..65535	User	-	x	x

Parameterdarstellung auf Basis der Menüstruktur AZL - Ebene «OEM» - Auslieferstand Siemens Landis&Staefa

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6	Description	Value range	Access rights	Default parameter setting	LMV51	LMV52
	AZL					Settings for the display and operating unit		User		x	x
		Times				AZL-specific time settings		User		x	x
			PasswordTime			Validity of password	10..480 min	OEM	120min	x	x
			Sum/WinterTime			Setting the summer-/wintertime	Manual Automatic	User	Automatic	x	x
			Time EU/US			Setting the summer-/wintertime US/EU	S/W time EU S/W time US	User	S/W time EU	x	x
		Language				Selection of language	Deutsch English Français	User	Deutsch	x	x
		DateFormat				Selection of date format (Day.Month.Year or Month-Day-Year)	DD.MM.YY MM-DD-YY	User	DD.MM.YY	x	x
		PhysicalUnits						User		x	x
			UnitTemperature			Selection of display format °C or F	Display °C Display °F	User	Display °C	x	x
			UnitPressure			Selection of display format bar or psi	Display bar Display psi	User	Display bar	x	x
		eBUS						User		x	x
			Address			E-bus address of LMV	1..8	User	1	x	x
			SendCycleBU			Cycle time for sending the burner control's operating data to BAS	10..60s	User	30s	x	x
		Modbus						User		x	x
			Address			Modbus address of LMV	1..247	User	1	x	x
			Baudrate				19200 bit/s 9600 bit/s	User	19200 bit/s	x	x
			Parity			Modbus-Parität for LMV	no even odd	User	no	x	x
			Timeout			Maximum time with no communication. When this period of time has elapsed, "Remote" changes to "Local"	0..7200s	User	30s	x	x
			Lokal / Remote			Change of operating mode local / remote	local remote	User	-	x	x

Parameterdarstellung auf Basis der Menüstruktur AZL - Ebene «OEM» - Auslieferstand Siemens Landis&Staefa

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6	Description	Value range	Access rights	Default parameter setting	LMV51	LMV52
			Remote Mode			Operating mode: Remote "off" / remote "on" / W3	Automatic Burner on Burner off	User	-	x	x
			W3			External setpoint W3, in °C External setpoint W3, in bar	0..2000 °C 0..100bar	User	-	x	x
		Display Contrast						User		x	x
		ProductID				Displaying the HW version of the AZL		User		x	x
			ASN			Type reference	1..15 characters	User	"AZL52.00A 1WH"	x	x
			ProductionDate			Production date	01.01.00..31.12.99 01-01-00..12-31-99	User	-	x	x
			SerialNumber			Serial number	0..65535	User	-	x	x
			ParamSet Code			Preselected parameter set: customer code	0..255	User	20	x	x
			ParamSet Vers			Preselected parameter set: version	0..65535	User	400	x	x
		SW Version				SW version of AZL	0..65535	User	-	x	x
	Actuators					Settings for the actuators		User		x	x
		Addressing				Addressing unaddressed actuators		Service		x	x
			1 AirActuator			Actuator to be addressed becomes the air actuator		Service		x	x
			2 GasActuat(Oil)			Actuator to be addressed becomes the gas actuator, or the fuel actuator for dual fuel burners with one fuel actuator		Service		x	x
			3 OilActuator			Actuator to be addressed becomes the oil actuator		Service		x	x
			4 AuxActuator			Actuator to be addressed becomes the auxiliary actuator		Service		x	x
			5 AuxActuator2			Actuator to be addressed becomes the auxiliary actuator		Service			x
			6 AuxActuator3			Actuator to be addressed becomes the auxiliary actuator		Service			x
		DirectionRot						Service		x	x
			DeleteCurves					Service		x	x
			1 AirActuator			direction of rotation of the respective actuator	standard reversed	OEM	standard	x	x
			2 GasActuat(Oil)			direction of rotation of the respective actuator	standard reversed	OEM	standard	x	x
			3 OilActuator			direction of rotation of the respective actuator	standard reversed	OEM	standard	x	x

Parameterdarstellung auf Basis der Menüstruktur AZL - Ebene «OEM» - Auslieferstand Siemens Landis&Staefa

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6	Description	Value range	Access rights	Default parameter setting	LMV51	LMV52
			4 AuxActuator			direction of rotation of the respective actuator	standard reversed	OEM	standard	x	x
			5 AuxActuator2			direction of rotation of the respective actuator	standard reversed	OEM	standard		x
			6 AuxActuator3			direction of rotation of the respective actuator	standard reversed	OEM	standard		x
		ProductID				Displaying the actuators' HW version		User		x	x
			1 AirActuator					User		x	x
				ASN		Type reference	1..15 characters	User	"SQM45.29"	x	x
				ProductionDate		Date of production	01.01.00..31.12.99 01-01-00..12-31-99	User	-	x	x
				SerialNumber		Serial number	0..65535	User	-	x	x
				ParamSet Code		Preselected parameter set: customer code	0..255	User	20	x	x
				ParamSet Vers		Preselected parameter set: version	0..65535	User	400	x	x
			2 GasActuat(Oil)					User		x	x
				ASN		Type reference	1..15 characters	User	"SQM45.29"	x	x
				ProductionDate		Date of production	01.01.00..31.12.99 01-01-00..12-31-99	User	-	x	x
				SerialNumber		Serial number	0..65535	User	-	x	x
				ParamSet Code		Preselected parameter set: customer code	0..255	User	20	x	x
				ParamSet Vers		Preselected parameter set: version	0..65535	User	400	x	x
			3 OilActuator					User		x	x
				ASN		Type reference	1..15 characters	User	"SQM45.29"	x	x
				ProductionDate		Date of production	01.01.00..31.12.99 01-01-00..12-31-99	User	-	x	x
				SerialNumber		Serial number	0..65535	User	-	x	x
				ParamSet Code		Preselected parameter set: customer code	0..255	User	20	x	x
				ParamSet Vers		Preselected parameter set: version	0..65535	User	400	x	x
			4 AuxActuator					User		x	x
				ASN		Type reference	1..15 characters	User	"SQM45.29"	x	x
				ProductionDate		Date of production	01.01.00..31.12.99 01-01-00..12-31-99	User	-	x	x

Parameterdarstellung auf Basis der Menüstruktur AZL - Ebene «OEM» - Auslieferstand Siemens Landis&Staefa

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6	Description	Value range	Access rights	Default parameter setting	LMV51	LMV52
				SerialNumber		Serial number	0..65535	User	-	x	x
				ParamSet Code		Preselected parameter set: customer code	0..255	User	20	x	x
				ParamSet Vers		Preselected parameter set: version	0..65535	User	400	x	x
			5 AuxActuator2					User			x
				ASN		Type reference	1..15 characters	User	"SQM45.29"		x
				ProductionDate		Date of production	01.01.00..31.12.99 01-01-00..12-31-99	User	-		x
				SerialNumber		Serial number	0..65535	User	-		x
				ParamSet Code		Preselected parameter set: customer code	0..255	User	20		x
				ParamSet Vers		Preselected parameter set: version	0..65535	User	400		x
			6 AuxActuator3					User			x
				ASN		Type reference	1..15 characters	User	"SQM45.29"		x
				ProductionDate		Date of production	01.01.00..31.12.99 01-01-00..12-31-99	User	-		x
				SerialNumber		Serial number	0..65535	User	-		x
				ParamSet Code		Preselected parameter set: customer code	0..255	User	20		x
				ParamSet Vers		Preselected parameter set: version	0..65535	User	400		x
		SW Version						User		x	x
			1 AirActuator			SW version of actuator	0..65535	User	-	x	x
			2 GasActuat(Oil)			SW version of actuator	0..65535	User	-	x	x
			3 OilActuator			SW version of actuator	0..65535	User	-	x	x
			4 AuxActuator			SW version of actuator	0..65535	User	-	x	x
			5 AuxActuator2			SW version of actuator	0..65535	User	-		x
			6 AuxActuator3			SW version of actuator	0..65535	User	-		x
	VSD Module					Settings for the VSD module		User		x	x
		Configuration						Service		x	x
			Speed					Service		x	x
				Num Puls per R		Number of pulses per revolution	3..6	Service	3	x	x
				Standardization		Standardization process for fan speed	deactivated activated	Service	-	x	x
				StandardizedSp		Standardized speed: Speed corresponding to 100 %	1..6300	Service	1	x	x

Parameterdarstellung auf Basis der Menüstruktur AZL - Ebene «OEM» - Auslieferstand Siemens Landis&Staefa

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6	Description	Value range	Access rights	Default parameter setting	LMV51	LMV52
				Setpoint Output		Configuration of analog interface	0..20 mA 4..20 mA	Service	4..20 mA	x	x
				Setteling Time		Time between speed readjustment and speed acquisition for long run commands	(8..200) * 25 ms	OEM	16	x	x
			Fuel Meter					Service		x	x
				PulseValueGas		Number of pulses per volume unit gas	0,0000..9999,9999 Imp/m³ 0,00000..999,99999 Imp/ft³	Service	1	x	x
				PulseValueOil		Number of pulses per volume unit oil	0,0000..9999,9999 Imp/l 0,0000..9999,9999 Imp/gal	Service	1	x	x
		Process Data						User		x	x
			Max Stat Dev			Maximum speed deviation at the end of a run command	0..100%	User	-	x	x
			Max Dyn Dev			Maximum speed deviation when accelerating	0..100%	User	-	x	x
			Num Dev >0.3%			Number of speed deviations >0.3 % at the end of a run command	0..255	User	-	x	x
			Num Dev >0.5%			Number of speed deviations >0.5 % at the end of a run command	0..255	User	-	x	x
			Absolute Speed			Absolute speed	0..6553,5	User	-	x	x
		ProductID						User		x	x
			ASN			Type reference	1..15 characters	User	-	x	x
			ProductionDate			Date of production	01.01.00..31.12.99 01-01-00..12-31-99	User	-	x	x
			SerialNumber			Serial number	0..65535	User	-	x	x
			ParamSet Code			Preselected parameter set: customer code	0..255	User	20	x	x
			ParamSet Vers			Preselected parameter set: version	0..65535	User	400	x	x
		SW Version				SW version of VSD	0..65535	User	-	x	x
	O2 Module					Settings for the O2 module		User			x
		Configuration						Service			x

Parameterdarstellung auf Basis der Menüstruktur AZL - Ebene «OEM» - Auslieferstand Siemens Landis&Staefa

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6	Description	Value range	Access rights	Default parameter setting	LMV51	LMV52
			O2 Sensor			Configuration of oxygen sensor	no sensor QGO20	Service	no sensor		x
			SupAirTempSens			Configuration of supply air temperature input	no sensor Pt1000 Ni1000	Service	no sensor		x
			FlueGasTempSens			Configuration of flue gas temperature input	no sensor Pt1000 Ni1000	Service	no sensor		x
			MaxTempFlGasGas			Switch-off limit of flue gas temperature	0..400°C	Service	400°C		x
			MaxTempFlGasOil			Switch-off limit of flue gas temperature	0..400°C	Service	400°C		x
		Displayed Values						User			x
			Current O2 Value			Current O2 value	0..100%	User	-		x
			SupplyAirTemp			Supply air temperature in °C	-100..923 °C	User	-		x
			FlueGasTemp			Flue gas temperature in °C	-100..923 °C	User	-		x
			QGO SensorTemp			Sensor temperature of QGO in °C	-100..923 °C	User	-		x
			QGO HeatingLoad			Control value of QGO heating in 0.1%	0..100%	User	-		x
			QGO Resistance			Internal resistance of QGO's Nernst cell	0..1000 Ohm	User	-		x
		ProductID						User			x
			ASN			Type reference	1..15 characters	User	"PLL52.110 A200"		x
			ProductionDate			Date of production	01.01.00..31.12.99 01-01-00..12-31-99	User	-		x
			SerialNumber			Serial number	0..65535	User	-		x
			ParamSet Code			Preselected parameter set: customer code	0..255	User	20		x
			ParamSet Vers			Preselected parameter set: version	0..65535	User	400		x
		SW Version				SW version of O2M	0..65535	User	-		x

Parameterdarstellung auf Basis der Menüstruktur AZL - Ebene «OEM» - Auslieferstand Siemens Landis&Staefa

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6	Description	Value range	Access rights	Default parameter setting	LMV51	LMV52
	SystemConfig					Settings for LMV5x system configuration		User		x	x
		LC_OptgMode				Operating mode with load controller	ExtLC X5-03 IntLC IntLC Bus IntLC X62 ExtLC X62 ExtLC Bus	User	IntLC	x	x
		Ext Inp X62 U/I				Configuration of external input X62	4..20 mA 0/2..10 V	Service	4..20 mA	x	x
		TempLimiter						Service		x	x
			TL_Thresh_Off			Temperature limiter OFF threshold, in °C	0..2000 °C	Service	95°C	x	x
			TL_SD_On			Temperature limiter switching differential ON	-50..0 % TL_Thresh_Off	Service	-5%	x	x
			Sensor Select			Select actual value input E1-> Pt100, TL act. E4-> Pt1000, TL act. E4-> Ni1000, TL act. E2-> Temp, TL inact. E2-> Pressure, TL inact. E1-> Pt100 for controller + TL and E4-> Pt1000 for TL E1-> Pt100 for controller + TL and E4-> Ni1000 for TL No input	 Pt100 Pt1000 Ni1000 TempSensor PressSensor Pt100Pt1000 Pt100Ni1000 NoSensor	Service	Pt100	x	x
			MeasureRangePtNi			End of measurement range for sensor at input X60	150°C/302°F 400°C/752°F	Service	150°C/302°F	x	x
		O2Ctrl/LimitrGas				Operating mode of O2 controller / limiter when firing on gas	auto deact man deact O2 guard O2 control conAutoDeac	Service	man deact		x
		O2Ctrl/LimitrGas				Operating mode of O2 controller / limiter when firing on oil	auto deact man deact O2 guard O2 control conAutoDeac	Service	man deact		x

Parameterdarstellung auf Basis der Menüstruktur AZL - Ebene «OEM» - Auslieferstand Siemens Landis&Staefa

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6	Description	Value range	Access rights	Default parameter setting	LMV51	LMV52
	HoursRun							User		x	x
		GasFiring				Hours run gas (selectable)	0..999999 h	User	0	x	x
		OilStage1/Mod				Hours run oil stage 1 or modulating (selectable)	0..999999 h	User	0	x	x
		OilStage2				Hours run oil stage 2 (selectable)	0..999999 h	User	0	x	x
		OilStage3				Hours run oil stage 3 (selectable)	0..999999 h	User	0	x	x
		TotalHoursReset				Hours run total (can be reset)	0..999999 h	User	0	x	x
		TotalHours				Hours run total (read only)	0..999999 h	User	0	x	x
		SystemOnPower				Hours run device under voltage (read only)	0..999999 h	User	0	x	x
		Reset				Resetting the hours run counters		User		x	x
			GasFiring			Hours run gas (selectable)	0..999999 h	User	0	x	x
			OilStage1/Mod			Hours run oil stage 1 or modulating (selectable)	0..999999 h	User	0	x	x
			OilStage2			Hours run oil stage 2 (selectable)	0..999999 h	User	0	x	x
			OilStage3			Hours run oil stage 3 (selectable)	0..999999 h	User	0	x	x
			TotalHoursReset			Hours run total (can be reset)	0..999999 h	User	0	x	x
	StartCounter							User		x	x
		GasStartCount				Number of startups gas, start counter (selectable)	0..999999	User	0	x	x
		OilStartCount				Number of startups oil, start counter (selectable)	0..999999	User	0	x	x
		TotalStartCount R				Total number of startups, start counter (can be reset)	0..999999	User	0	x	x
		TotalStartCount				Total number of startups, start counter (read only)	0..999999	User	0	x	x
		Reset				Resetting the start counters		User		x	x
			GasStartCount			Number of startups gas, start counter (selectable)	0..999999	User	0	x	x
			OilStartCount			Number of startups oil, start counter (selectable)	0..999999	User	0	x	x
			TotalStartCount R			Total number of startups, start counter (can be reset)	0..999999	User	0	x	x
	Fuel Meter							User		x	x
		Curr Flow Rate				Current fuel throughput	0..6553,4	User	-	x	x
		Volume Gas				Fuel volume gas (read only)	0..199999999,9 m³ 0..1999999999 ft³	User	0	x	x
		Volume Oil				Fuel volume oil (read only)	0..199999999,9 l 0..199999999,9 gal	User	0	x	x

Parameterdarstellung auf Basis der Menüstruktur AZL - Ebene «OEM» - Auslieferstand Siemens Landis&Staefa											
Menu level 1	**Menu level 2**	**Menu level 3**	**Menu level 4**	**Menu level 5**	**Menu level 6**	**Description**	**Value range**	**Access rights**	**Default parameter setting**	**LMV51**	**LMV52**
		Volume Gas R				Fuel volume gas (resettable)	0..199999999,9 m³ 0..1999999999 ft³	User	0	x	x
		Volume Oil R				Fuel volume oil (resettable)	0..199999999,9 l 0..199999999,9 gal	User	0	x	x
		Reset DateGas				Reset date fuel volume gas	01.01.00..31.12.99 01-01-00..12-31-99	User	0	x	x
		Reset DateOil				Reset date fuel volume oil	01.01.00..31.12.99 01-01-00..12-31-99	User	0	x	x
Updating								User		x	x
	Passwords					Changing the passwords		OEM		x	x
		ServicePassword				Service password (not included in parameter backup)	3..8 characters	OEM	-	x	x
		OEM Password				OEM password (not included in parameter backup)	4..8 characters	OEM	-	x	x
	BurnerID					Identification of burner	4..15 characters	OEM	invalid	x	x
	ParamBackup							User		x	x
		BackupInfo						User		x	x
			Date			Date of backup	01.01.00..31.12.99 01-01-00..12-31-99	User	0	x	x
			TimeOfDay			Time of day of backup	00:00..23:59	User	0	x	x
			BU included?			Information: BU included in last backup YES/NO	No Yes	User	No	x	x
			AZL included?			Information: DOU included in last backup YES/NO	No Yes	User	No	x	x
			LC included?			Information: LC included in last backup YES/NO	No Yes	User	No	x	x
			ACT1 included?			Information: ACT1 included in last backup YES/NO	No Yes	User	No	x	x
			ACT2 included?			Information: ACT2 included in last backup YES/NO	No Yes	User	No	x	x
			ACT3 included?			Information: ACT3 included in last backup YES/NO	No Yes	User	No	x	x

Parameterdarstellung auf Basis der Menüstruktur AZL - Ebene «OEM» - Auslieferstand Siemens Landis&Staefa											
Menu level 1	**Menu level 2**	**Menu level 3**	**Menu level 4**	**Menu level 5**	**Menu level 6**	**Description**	**Value range**	**Access rights**	**Default parameter setting**	**LMV51**	**LMV52**
			ACT4 included?			Information: ACT4 included in last backup YES/NO	No Yes	User	No	x	x
			ACT5 included?			Information: ACT5 included in last backup YES/NO	No Yes	User	No		x
			ACT6 included?			Information: ACT6 included in last backup YES/NO	No Yes	User	No		x
			VSD included?			Information: ACT1 included in last backup YES/NO	No Yes	User	No	x	x
			O2 included?			Information: O2 included in last backup YES/NO	No Yes	User	No		x
		LMV5x -> AZL				Saving the parameters of the system on the AZL		Service		x	x
		AZL -> LMV5x				Transferring the parameters saved on the AZL to the system		Service		x	x
	Load_SW_from_PC					Updating the AZL software via the serial port with the PC tool		Service		x	x
PW Login						Obtaining access right via the password (access times can be parameterized)		User		x	x
PW Logout						Canceling the last access right obtained via password		Service		x	x
SafetyCheckFunct						TÜV test		User		x	x
	LossFlameTest					Loss of flame test		Service		x	x
	SLT Test					Safety limit thermostat test	deactivated activated	User	-	x	x

8 Commissioning instructions for the LMV5... system

8.1 Practice-oriented setting instructions for the system configuration, the burner control, and the electronic fuel / air ratio control system

These settings instructions serve for commissioning the LMV5… system.
To access the parameter setting levels, a password must be entered.
After having entered the correct password, the data will appear on the AZL5… (backup for emergencies). Then, the unit can be parameterized.
After leaving the parameter setting level, we recommend to make a backup.

8.1.1 Basic configuration

1. Parameterizing the burner identification (burner ID)

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Updating					
	BurnerID				

Burner identification: E.g. OEM13-10-02-003 (name of OEM = burner manufacturer; date 13-10-2002, production number 003); minimum 4 characters

2. Selecting the fuel trains

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	BurnerControl				
		Configuration			
			ConfigGeneral		
				FuelTrainGas	
				FuelTrainOil	

FuelTrainGas from *DirectIgniG* to *Pilot Gp2*
FuelTrainOil from *LightOilLO* to *HO w Gasp*

3. Checking the inputs / outputs while taking into account the burner and plant conditions. For details, refer to subsection 4.1.1 Digital inputs

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Parameter					
	BurnerControl				
		Configuration			
			ConfigInput/Output		

4. Setting gas valve proving

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	BurnerControl				
		ValveProving			
			ValveProvingType		

Selection of gas valve proving: No VP, VP startup, VP shutdown or VP stup/shd
(→ «Gas valve proving system»)

5. Addressing the actuators

Prior to programming the actuators, the connector for the bus connection at the last CAN bus element must be plugged in.

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	Actuators				
		Addressing			
			1. AirActuator *2. GasActuat(Oil)* *3. OilActuator* *4. AuxActuator* *5. AuxActuator 2* *6. AuxActuator 3*		

For addressing an actuator, select the respective type of actuator:

1. Air actuator
2. Gas actuator (oil) [for dual-fuel burners with only one fuel actuator]
3. Oil actuator
4. Auxiliary actuator
5. Auxiliary actuator 2
6. Auxiliary actuator 3

Confirm by pressing **ENTER** (→ «Display and operating unit AZL5…»).

The AZL5… prompts you to operate the addressing switch on the actuator.

6. Selecting the actuator's direction of rotation

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	Actuators				
		DirectionRot			
			DeleteCurves *1. AirActuator* *2. GasActuat.(Oil)* *3. OilActuator* *4. AuxActuator* *5. AuxActuator 2* *6. AuxActuator 3*		

Select the direction of rotation with *Standard* or *Reversed*.

The standard direction of rotation is anticlockwise when facing the end of the drive shaft (→ «Display and operating unit AZL5…»).

Note: To check the direction of rotation, every actuator can be rotated when in the home position (see item 11). After setting the ignition positions / curves, the direction of rotation can only be changed after canceling the curves and the ignition positions on the setting menu «*DeleteCurves*».

7. LMV51... Activating and deactivating the actuator

Depending on the application and the type of fuel (with or without auxiliary actuator), the auxiliary actuator can be activated or deactivated, or used as a VSD (only LMV51.2...).

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	RatioControl				
		GasSettings			
			Actuator		
		OilSettings			
			Actuator		

LMV52... activating and deactivating the actuators

In accordance with the application and the type of fuel, the actuators can be activated or deactivated. Here, it is also defined whether the relevant actuator influences the air volume.

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	RatioControl				
		GasSettings			
			AirActuator		
			AuxActuator 1		
			AuxActuator 2		
			AuxActuator 3		
			VSD		
		OilSettings			
			AirActuator		
			AuxActuator 1		
			AuxActuator 2		
			AuxActuator 3		
			VSD		

8. Setting the load controller (option)

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	LoadController				
		Configuration			
			LC_OptgMode		

Select a load controller operating mode in accordance with the examples given in chapter «Operating modes with load controller».

9. Selecting a temperature or pressure sensor

If the internal load controller of the LMV5… is used, a temperature or pressure sensor must be connected to input 1, 2 or 4.

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	LoadController				
		Configuration			
			SensorSelection *MeasureRange* *PtNi* *Ext Input X61 U/I* *MeasureRange* *TempSensor* *MeasureRange* *PressSens* *Ext Setpoint minExt Setpoint max*		

On the configuration level of the LC, select the required type of sensor.
Then, define the sensor's measuring range.

8.1.2 Settings for gas-fired operation

The next steps explain how the fuel / air ratio control system is to be set.
Specific curves are required for each type of fuel.

10. Activating program stops in different program phases

Activate a program stop when startup shall be stopped to set the special positions.

Prepurging	Phases 24 - 34
Ignition position	Phase 36
Interval 1	Phase 44
Interval 2	Phase 52
Postpurging	Phases 72 - 78

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	RatioControl				
		ProgramStop			
			deactivated *24PrePurgP* *32PreP FGR* *36IgnitPos* *44Interv1* *52Interv2* *72PostPPos* *76PostPFGR*		

Activate a program stop in Phase 24.

11. Checking and presetting the actuators positions for gas ignition

The unit is supplied with presettings for the parameters «home position, prepurge and postpurge position». These positions should be checked and adapted if required, either now or during the following program stops.
The ignition positions are not predefined. In this section, a valid setting must be made or, otherwise, burner startup is **not** possible.

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6	
Params & Display						
	RatioControl					
		GasSettings				
			SpecialPositions			
				IgnitionPos		
					IgnitionPosGas *IgnitionPosAir* *IgnitionPosAux*	
					IgnitionPosAux2 *IgnitionPosAux3* *IgnitionPosVSD*	***Only LMV52...***

Example: Gas actuator: 32.5° Air actuator: 25.6°

12. Manual startup

To start the burner, select *«Autom/Manual/Off»* and *«BurnerOn»*.

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
ManualOperation					
	Autom/Manual/Off				

If startup shall be watched, press simultaneously selection buttons «<» and «>» to switch the display to «Normal operation».

13. Actuator positions during the prepurge time

The burner control stops startup during the prepurge phase (Phase 24).
The positions of the actuators for prepurging can thus be set very straightforwardly.

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6	
Params & Display						
	RatioControl					
		GasSettings				
			SpecialPositions			
				PrepurgePos		
					PrepurgePosAir *PrepurgePosAux*	
					PrepurgeAux2 *PrepurgeAux3* *PrepurgeVSD*	**Only LMV52...**

Note:

The prepurge position of auxiliary actuator 3 is approached in Phase 32 (FGR).

After the settings have been made, the program stop in the prepurge position should be replaced by the program stop of the ignition position in Phase 36.

14. Ignition positions

The burner control continues the startup sequence until the ignition position (Phase 36) is reached. Then, it stops again so that the actuator's ignition positions can be set.

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6	
Params & Display						
	RatioControl					
		GasSettings				
			SpecialPositions			
				IgnitionPos		
					IgnitionPosGas *IgnitionPosAir* *IgnitionPosAux*	
					Aux2 *Aux3* *VSD*	***Only LMV52...***

To verify the ignition positions again, the program sequence can be stopped in interval phase 44 or 52 (interval with ignited flame on completion of the relevant safety time).

On deactivation of the program stop, the burner continues its program until the operating phase (Phase 60) is reached.

If no point for the fuel / air ratio control system has as yet been predefined, the first curvepoint «P1» to be adopted on a preliminary basis are the ignition positions of the actuators.

15. Setting the curve

First setting

The burner travels to the ignition load. The burner's output should now be increased manually and in steps of the curve setting until the nominal capacity (100 %) is reached. During the manual procedure, the actuators travel on the interpolated straight line to the maximum position of 90° at 100 % output. The flue gas values and the stability of the flame must be constantly checked. It may be necessary to define provisional curvepoints, which can be canceled again later. As soon as the nominal capacity is reached, the burner should be optimized with regard to flue gas values.

Note

It is recommended to measure the gas throughput at **each curvepoint** in order to reflect the real burner output on the display in relation to the maximum gas throughput.

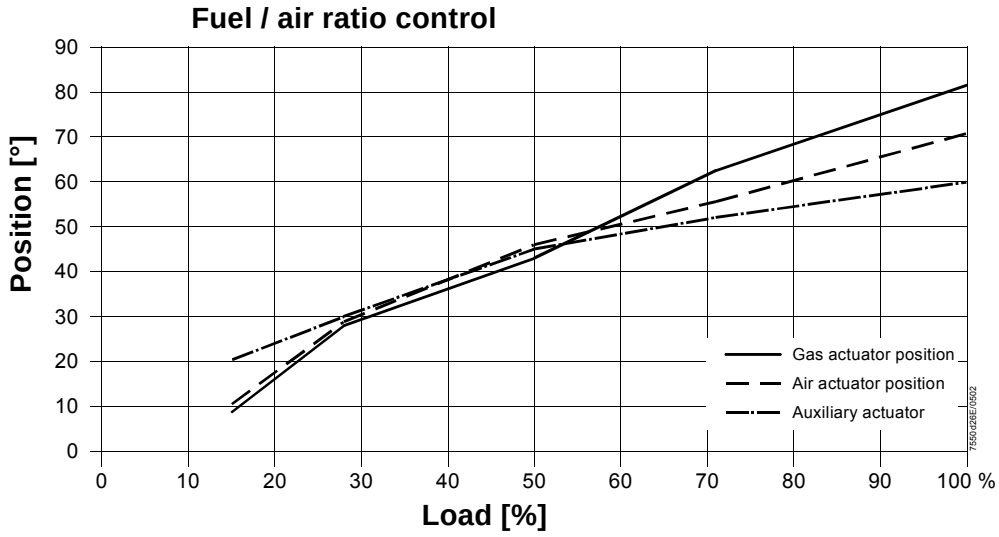
- Press the **ESC** button to leave the curvepoint setting
- Store the point by pressing **ENTER**
- Now, select the second curvepoint. The settings of the previous curvepoint will be adopted on a preliminary basis
- Store the second curvepoint like the first one

During storage, the LMV5... sorts the curvepoints based on rising output. This means that you can enter the curvepoints in any order you like as long as the output was correctly set. Proceed in this way point by point until the minimum output is reached. After storage of the minimum output point, leave the curve setting.

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	RatioControl				
		GasSettings			
			CurveParams		
				Point	
				Manual	

Example:

Point	1	2	3	4	5
Order of setting	5	4	3	2	1
Output	15 %	28 %	50 %	71 %	100 %
Gas	8.6°	28.0°	43.0°	62.5°	81.5°
Air	10.5°	28.8°	46.0°	55.7°	70.8°
Aux	20.3°	30.0°	45.0°	52.0°	60.0°



Changing an existing curve

The curvepoints can be changed during burner off periods (Phase 12) or during burner operation (Phase 60).

To change an existing curve, select the curvepoint in «Point» mode. You are now able to change the point, or to cancel it.

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	RatioControl				
		GasSettings			
			CurveParams		
				Point	
				Manual	

Creating a new curvepoint

To create a new curvepoint, select «Manual». Set the output of the new point and acknowledge by pressing **ENTER**.

During the manual procedure, the actuators travel on the interpolated straight lines between the curvepoints.

After pressing **ENTER**, each individual actuating device can be selected to optimize the position.

To leave the curvepoint setting, press the **ESC** button and store the point by pressing **ENTER**.

16. Load limits

Finally, you can limit the burner output to a minimum and maximum in accordance with the boiler's requirements.

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	RatioControl				
		GasSettings			
			LoadLimits		
				MinLoadGas *MaxLoadGas*	

17. Shutdown

Choose *«Autom/Manual/Off»* to select *«BurnerOff»*.

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
ManualOperation					
	Autom/Manual/Off				

8.1.3 Settings for multistage firing on oil

18. Fuel changeover for firing on oil

Fuel changeover on the AZL5… is possible only if input «FuelSelect» is set to «internal».

Set fuel selection to «Oil» or set the external fuel selector to «Oil».

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Operation					
	Fuel				
		FuelSelect			

19. Changing the burner operating mode from modulating to multistage (only when firing on oil)

Here, the burner operating mode can be set to «2-stage» or «3-stage».

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	RatioControl				
		OilSettings			
			CurveParams		
				Operation Mode	

20. Activating the program stops in the different program phases

Activate the program stop if startup shall be interrupted to continue setting the special positions.

Prepurge	Phases 24 - 34
Ignition position	Phase 36
Interval 1	Phase 44
Interval 2	Phase 52
Postpurge	Phases 72 - 78

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	RatioControl				
		ProgramStop			
			deactivated *24PrePurgP* *32PreP FGR* *36IgnitPos* *44Interv1* *52Interv2* *72PostPPos* *76PostPFGR*		

Activate a program stop in Phase 24.

21. Checking and presetting the ignition positions for firing on oil

For the parameters «home, prepurge and postpurge position», the parameter set as supplied contains presettings. These should be checked and, if necessary, adapted, either now or during the following program stops.

There is **no** presetting for the ignition position. In this section, a valid setting must be made because otherwise, the burner cannot be started up.

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6	
Params & Display						
	RatioControl					
		OilSettings				
			SpecialPositions			
				IgnitionPos		
					IgnitionPosOil *IgnitionPosAir* *IgnitionPosAux*	
					Aux2 *Aux3* *VSD*	***Only LMV52...***

Example: Gas actuator: 22.5° Air actuator: 37.6°

These values are also transferred to operating point S1 even if it has not yet been set.

22. Manual startup

To start the burner, select *«Autom/Manual/Off»* to choose *«BurnerOn»*.

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
ManualOperation					
	Autom/Manual/Off				

If startup shall be watched, the display can be changed to «Normal operation» by pressing simultaneously selection buttons «<» and «>».

23. Actuator positions during the prepurge time

The burner control stops startup in the prepurge phase (Phase 24), so that the positions of the actuators for prepurging can be straightforwardly set.

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6	
Params & Display						
	RatioControl					
		OilSettings				
			SpecialPositions			
				PrepurgePos		
					PrepurgePosAir *PrepurgePosAux*	
					Aux2 *Aux3* *VSD*	***Only LMV52...***

Note:

The prepurge position of auxiliary actuator 3 is approached in Phase 32 (FGR).

After the settings are made, the program stop in the prepurge position should be replaced by the program stop of the ignition position in Phase 36.

24. Ignition positions

The burner control proceeds with the startup sequence until the ignition position (Phase 36) is reached. There, the burner control stops again for setting the ignition positions of the actuators.

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6	
Params & Display						
	RatioControl					
		OilSettings				
			SpecialPositions			
				IgnitionPos		
					IgnitionPosOil *IgnitionPosAir* *IgnitionPosAux*	
					Aux2 *Aux3* *VSD*	***Only LMV52...***

To repeatedly verify the ignition positions, the program sequence can be stopped in interval phase 44 or 52 (interval with ignited flame on completion of the respective safety time).

When the program stop is deactivated, the burner proceeds with its program until normal operation is reached (Phase 60).

If the switching points of the burner stages have not yet been defined, the ignition positions of the actuators will be used as the first stage for the moment.

25. Setting the burner stages

The burner runs at ignition load or at the first burner stage. The positions of the actuators can now be changed.

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	RatioControl				
		OilSettings			
			CurveParams		
				Curve Settings	
					Actuator Positions followed not followed

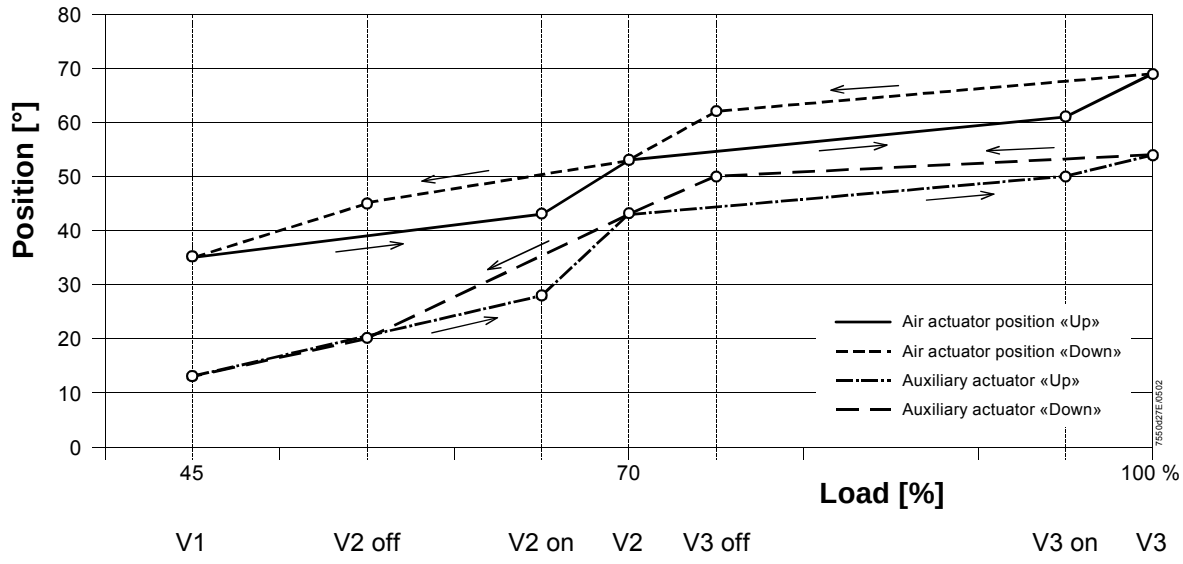
It is recommended to use the function «*Actuator positions followed*» to set the switching points and operating points of the second and third stage.

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	RatioControl				
		OilSettings			
			CurveParams		
				Curve Settings	
					Actuator Positions followed not followed ——— *SetPointStage1* *StartPointStage2* *OffPointStage2* *SetPointStage2* *StartPointStage3* *OffPointStage3* *SetPointStage3*

Example:

Stage	S1	S2 on	S2 off	S2	S3 on	S3 off	S3
Air	35.0°	43.0°	45.0°	53.0°	61.0°	62.0°	69.0°
Aux	13.0°	28.0°	20.0°	43.0°	50.0°	50.0°	54.0°

Fuel / air ratio contol (multistage operation)



26. Shutdown

Select «*Autom/Manual/Off*» and choose «*BurnerOff*».

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
ManualOperation					
	Autom/Manual/Off				

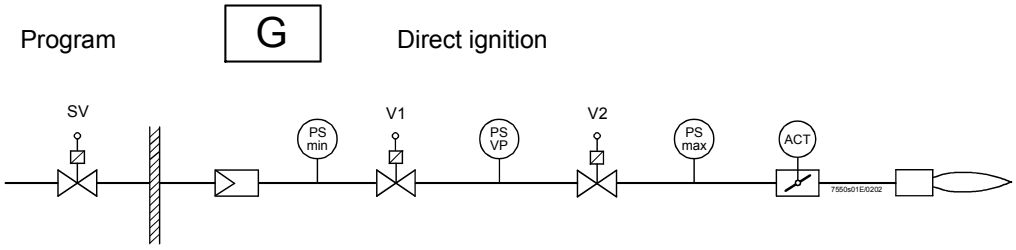
8.1.4 Extra functions of the LMV5...

27. Valve proving (leakage test LT)

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	BurnerControl				
		ValveProving			
			ValveProvingType		
			Config_PM-VP/CPI		
			VP_EvacTme		
			VP_TmeAtmPress		
			VP_FillTme		
			VP_Tme_GasPress		

The gas volume contained in the piping between the valves (including the valve volume) must be calculated in accordance with the gas train.

Example of fuel train



Determination of the test time with predefined leakage rate to be detected during valve proving:

$$t_{Test} = \frac{(P_G - P_W) \cdot V \cdot 3600}{P_{atm} \cdot Q_{Leck}}$$

Determination of the detected leakage rate during valve proving:

$$Q_{Leck} = \frac{(P_G - P_W) \cdot V \cdot 3600}{P_{atm} \cdot t_{Test}}$$

Legend

Q_{Leck}	in l / h	Leakage rate in liters per hour
P_G	in mbar	**Overpressure** between the valves at the beginning of the test phase
P_W	in mbar	Overpressure set on the pressure switch (normally 50 % of the gas inlet pressure)
P_{atm}	in mbar	**Absolute air pressure** (1,013 mbar normal pressure)
V	in l	Volume between the valves (test volume) including valve volume and pilot path (Gp1) if present
t_{Test}	in s	Test time

Example 1 (calculation of test time)

P_G = 30 mbar
P_W = 15 mbar
P_{atm} = 1013 mbar
V = 3 l
Q_{Leck} = 50 l / h

$$t_{Test} = \frac{(30 - 15)\ \text{mbar} \cdot 3\ \text{l} \cdot 3600\ \text{s / h}}{1013\ \text{mbar} \cdot 50\ \text{l / h}} = \mathbf{3.2\ s}$$

Result: The test time to be set is 4 seconds

Example 2 (determination of the detectable leakage rate)

P_G = 30 mbar
P_W = 15 mbar
P_{atm} = 1013 mbar
V = 3 l
t_{Test} = 4 s

$$Q_{Leck} = \frac{(30 - 15)\ \text{mbar} \cdot 3\ \text{l} \cdot 3600\ \text{s / h}}{1013\ \text{mbar} \cdot 4\ \text{s}} = \mathbf{40.0\ l / h}$$

Result: The detected leakage rate is 40 l / h

8.1.5 Configuration of the load controller

Selection of operating mode

→ «Operating modes with the load controller»
Example: Internal load controller with Pt1000 sensor.

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	SystemConfig				
		LC_OptgMode			
			ExtLC X5-03		
			Int LC		
			Int LC Bus		
			Int LC X62		
			Ext LC X62		
			Ext LC Bus		

Or, alternatively:

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	LoadController				
		Configuration			
			LC_OptgMode		
				ExtLC X5-03	
				Int LC	
				Int LC Bus	
				Int LC X62	
				Ext LC X62	
				Ext LC Bus	

After the internal load controller has been activated, the sensor input must be selected and configured.

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	LoadController				
		Configuration			
			SensorSelection		
				Pt100	
				Pt1000	
				Ni1000	
				TempSensor	
				PressSensor	
				Pt100Pt1000	
				Pt100Ni1000	
				NoSensor	

Then, the temperature measuring range must be defined.

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	LoadController				
		Configuration			
			MeasureRange PtNi		
				150°C/302°F	
				400°C/752°F	

8.1.6 Control parameters of the load controller

The control parameters can be defined in 3 different ways.

1. Selection of the standard parameter set

The memory of the load controller contains 5 standard parameter sets.
Depending on the characteristics of the controlled system, a PID triple value can be selected and activated.

The following standard parameter sets can be chosen:

	P [%]	I [s]	D [s]
Very fast	40	55	15
Fast	4	35	17
Normal	7	90	50
Slow	15	320	40
Very slow	30	400	10

2. Individual setting of the PID parameters

Alternatively, the PID parameters can be directly selected and set within the predefined value range.

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	LoadController				
		ControllerParam			
			ContrlParamList		
				StandardParam	
					Adaption *very fast* *fast* *normal* *slow* *very slow*

Or

				P-Part (Xp) *I_Part (Tn)* *D-Part (Tv)*	

3. Automatic adaption

With the method of adapting the control parameters, the characteristic data of the controlled system are acquired with an adaption procedure whereupon matching PID parameters will be calculated.

If possible, the adaption load should be 100 %.

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	LoadController				
		Adaption			
			StartAdaption		
			AdaptionLoad		

Temperature limiter function

The integrated temperature limiter observes a separate temperature limit.
(for details → «Integrated temperature limiter function»).

After the switch-off point in °C for the temperature limiter has been entered, the relative switch-on point in % will be given.

Example: TW_Threshold_Off: 80 °C
TW_SwiDiff_On -10 % (= 8 K)
Temperature limitation on at 72 °C

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	LoadController				
		TempLimiter			
			TL_Thresh_Off		
			TL_SD_On		

Or

	SystemConfig				
		TempLimiter			
			TL_Thresh_Off		
			TL_SD_On		

Boiler setpoints W1 and W2

2 boiler setpoints can be adjusted which, however, may not lie above the current limit value of the temperature limiter function (→ «Setpoints»).

Changeover from setpoint W1 to setpoint W2 is accomplished by means of an external, potential-free contact at input 3.

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	LoadController				
		ControllerParam			
			Setpoint W1		
			Setpoint W2		

Or

Operation					
	BoilerSetpoint				
		Setpoint W1			
		Setpoint W2			

2-position controller (C = ON / OFF)

Example: Modulating control

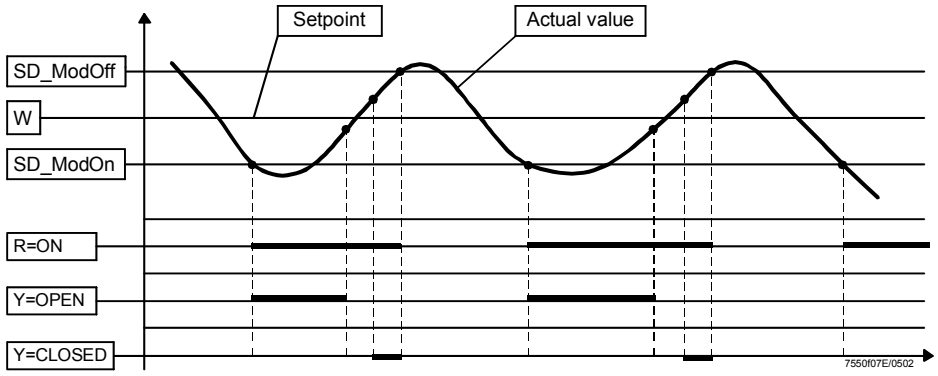
After the boiler setpoint in °C has been entered, the switch-on and switch-off point of the 2-position controller in % will be given.

The switching points will be calculated in relation to the current setpoint.

Example:	Setpoint:	70 °C
	SD_ModOn	+5 % (= 3.5 K)
	SD_ModOff	+10 % (= 7 K)
	Controller loop open (Off)	70 + 3.5 = 73.5 °C
	Controller loop closed (On)	70 - 7 = 63 °C

Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	LoadController				
		ControllerParam			
			SD_ModOn		
			SD_ModOff		

Diagram



Cold start thermal shock protection (CSTP)

When the cold start thermal protection has been activated, a boiler - after having dropped below a predefined switch-on threshold - will be heated up in multistage operation.

This approach ensures that when cold, the boiler does not have to satisfy the maximum demand for heat within a very short period of time. Thermal strain on the boiler will thus be prevented.

Description

The cold start sequence will be activated when, on startup, the actual value lies below the switch-on threshold. When cold start thermal shock protection is activated, the manipulated variable - on cold start - will be increased in a stepwise fashion using the adjusted output step (or the next stage will be switched on).

Start output for the cold start is the minimum load. The increase of the output by the output step depends on 2 criteria:

1. If the predefined change of the actual value is not reached with the current output (setpoint step modulating or setpoint step multistage), the output will be increased by this step (output step) when the maximum time has elapsed.
2. If the predefined change of the actual value is reached with the current output within the maximum time, the output will be increased by one output step.

When the switch-off threshold is reached, the cold start sequence will be terminated and normal control operation started.

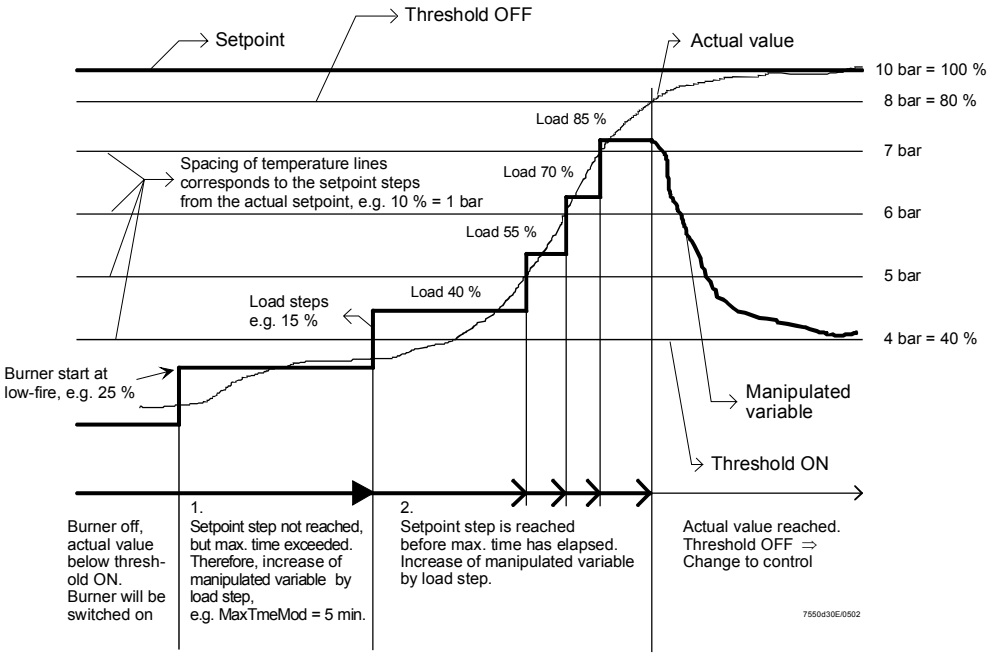
Example

Modulating burner with pressure control

For the output step, any output value in % can be predefined. 100 % divided by the output step gives the number of possible steps.

Parameters:	Shock protection on / off	*ColdStartOn*	activated
	Shock protection activation level	*ThresholdOn*	40 % of setpoint
	Output step (only for modulating operation)	*StageLoad*	10 % of burner output
	Setpoint step modulating	*StageStep_Mod*	10 % of setpoint
	Max. time modulating per step	*MaxTmeMod*	5 minutes
	Shock protection deactivation level	*ThresholdOff*	80 % of setpoint

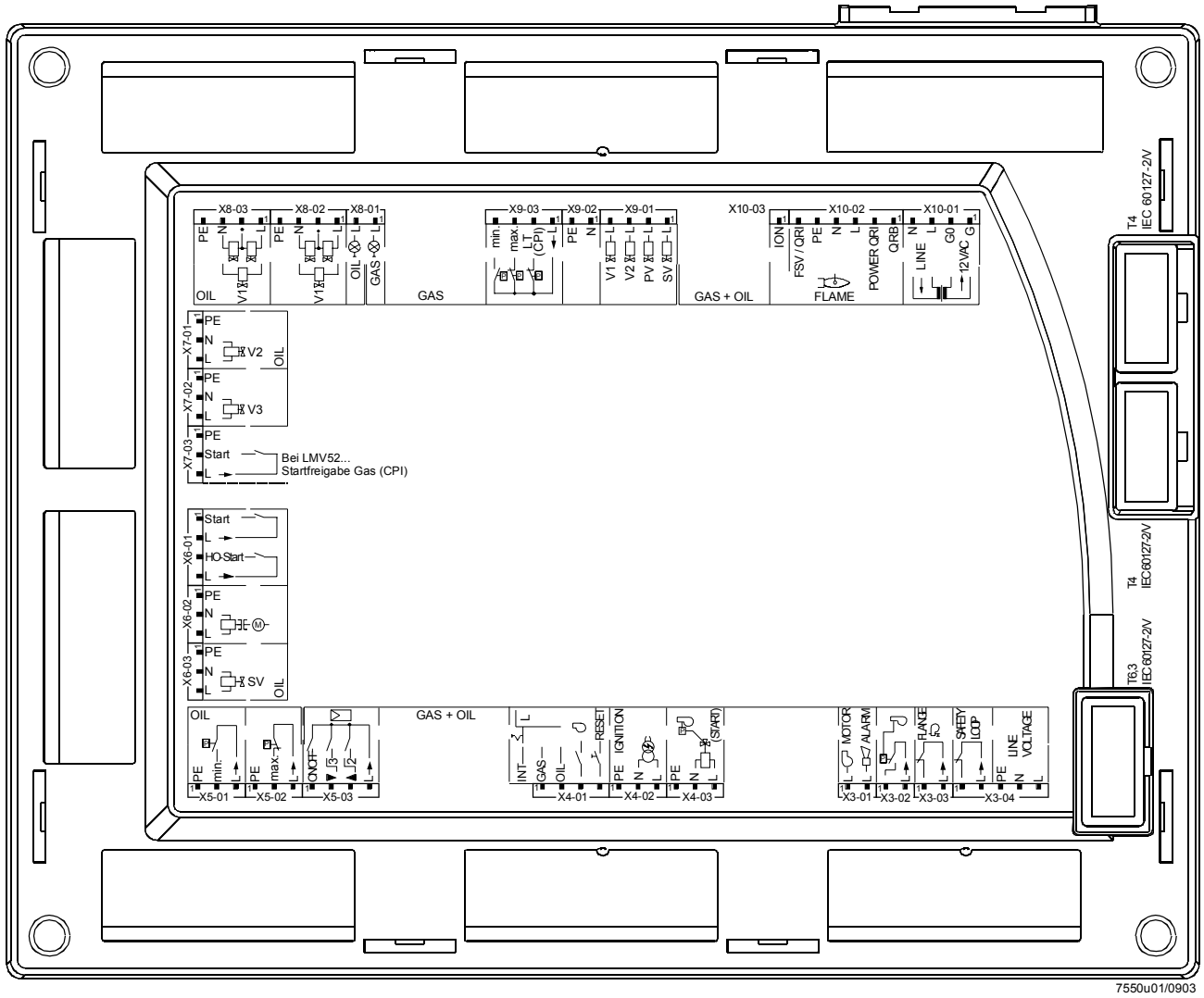
Example (cont'd)

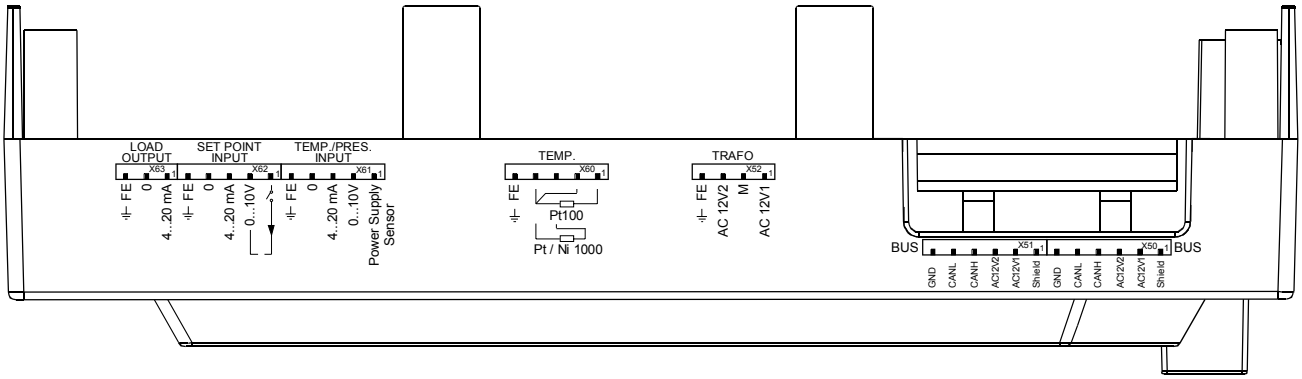


Menu level 1	Menu level 2	Menu level 3	Menu level 4	Menu level 5	Menu level 6
Params & Display					
	LoadController				
		ColdStart			
			ColdStartOn *ThresholdOn* *StageLoad* *StageStep_Mod* *StageStep_Stage* *MaxTmeMod* *MaxTmeStage* *ThresholdOff*		

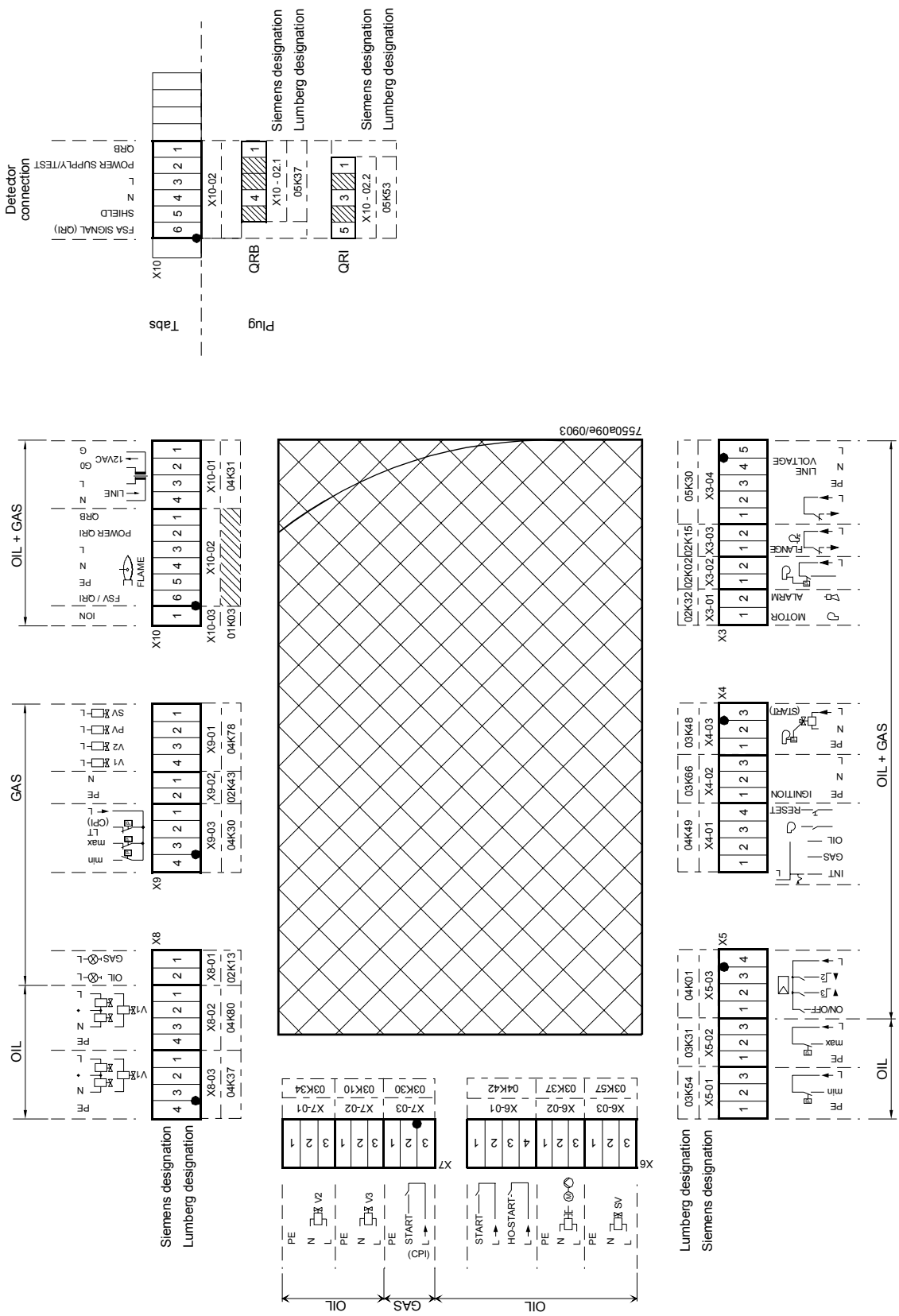
9 Connection terminals / coding of connectors

9.1 Connection terminals of the LMV5...





9.2 Coding of connectors



AGG5.720

Standard connector set LMV51... for gas / oil applications with up to 3 actuators.
Standard connector set LMV52... for gas / oil applications with up to 5 actuators.

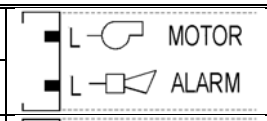
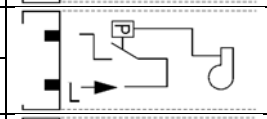
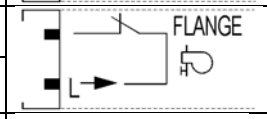
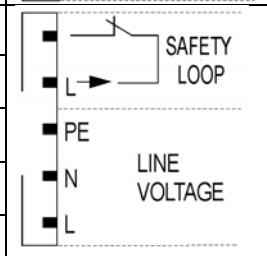
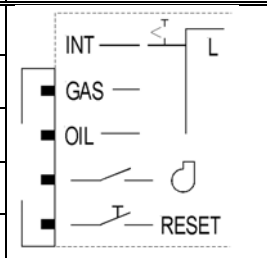
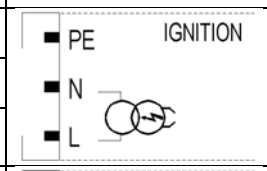
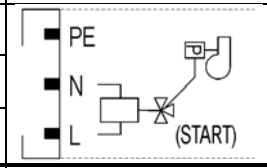
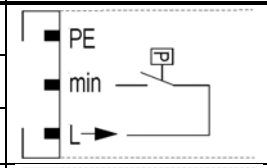
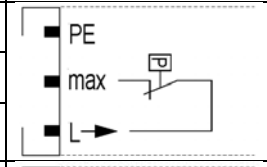
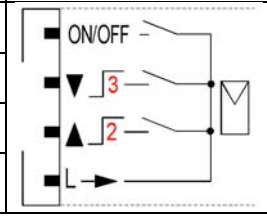
LMV5...	Terminal designation	Description
		RAST 5
1	X3-01	Alarm, fan
1	X3-02	Air pressure switch (APS)
1	X3-03	Burner flange
1	X3-04	Power supply safety loop
1	X4-01	Fuel selection, lockout reset
1	X4-02	Ignition
1	X4-03	Start signal / PS relieve valve
1	X5-01	Oil pressure switch min.
1	X5-02	Oil pressure switch max.
1	X5-03	Load controller external
1	X6-01	Direct heavy oil start
1	X6-02	Magnetic clutch / oil pump
1	X6-03	Safety valve SV (oil)
1	X7-01	Oil valve V2
1	X7-02	Oil valve V3
1	X7-03	Not used
1	X8-01	Firing on gas / oil
1	X8-02	Oil valve V1
1	X8-03	Oil valve V1
1	X9-01	Gas valves
1	X9-02	Protective earth, neutral conductor
1	X9-03	Gas pressure switch min., max.
1	X10-01	Power transformer (prim I, sec I)
1	X10-02.2	Infrared flame detector QRI...
5	[/]	Plug
1	X10-03	Ionization probe ION
		Transformer
1	prim I	CDO
1	sec I	DFO
1	sec II	DEFL
		Type 3.5
2	X50, X51	CAN bus (6-pole)
1	X52	Transformer, secondary side (4-pole, low-voltage)
1	X60	Inputs 1 and 4 - temperature sensor (5 pins), TEMP.
1	X61	Input 2 - pressure input - temperature limiter (5 pins) TEMP. / PRESS. INPUT
1	X62	Input 3, analog input (5 pins), SET POINT INPUT
1	X63	Load output (3 pins), LOAD OUTPUT
6	[/]	Actuator (5 pins)

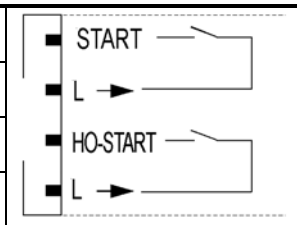
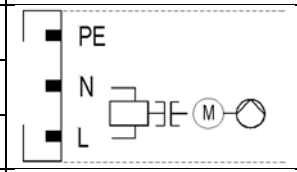
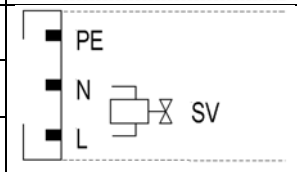
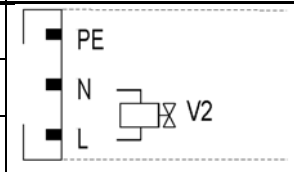
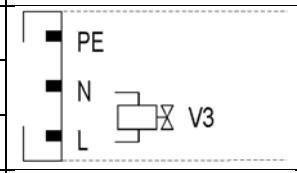
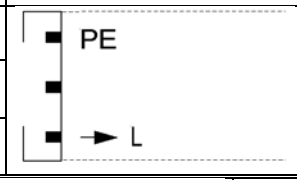
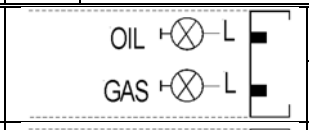
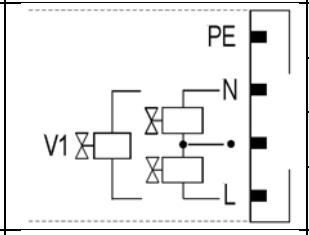
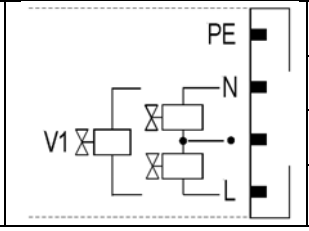
AGG5.721

Extension connector set LMV5... (in addition to AGG5.720, covering all connector variants).

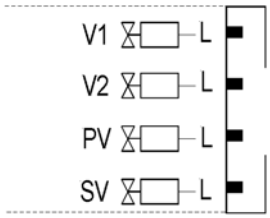
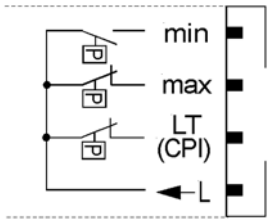
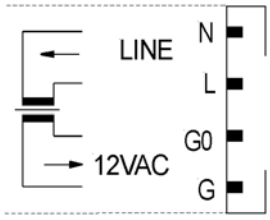
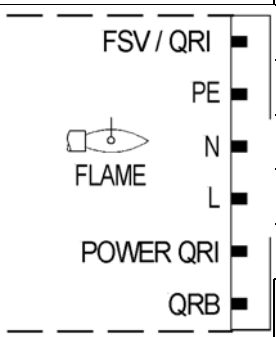
LMV5...	Terminal designation	Description
		Type 3.5
2	[/]	Actuator (5 pins)
		VSD
2	[/]	4-pin connector 2 x
1	[/]	5-pin connector 1 x
1	[/]	6-pin connector 1 x
		RAST 5
		Transformer
1	prim I	CDO
1	sec II	DEFL
1	X10-02.1	Photoresistive detector QRB...

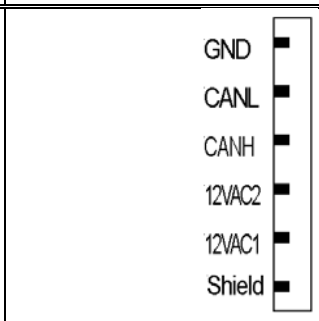
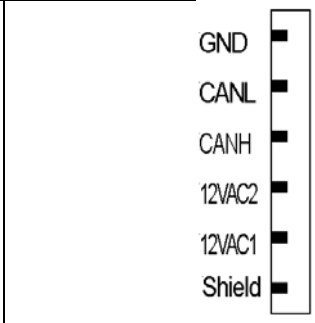
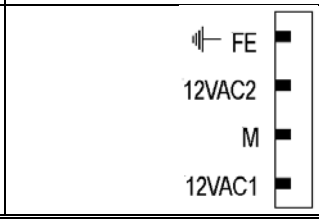
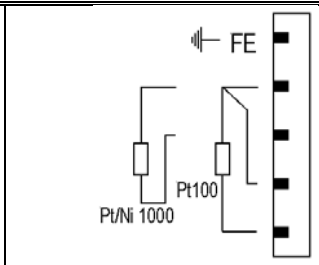
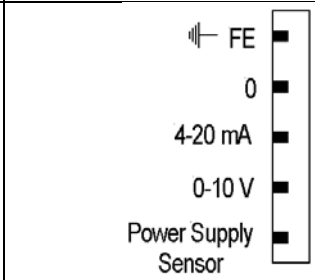
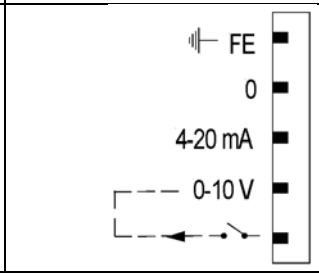
10 Description of the connection terminals

Terminal designation	Connection symbol		Input	Output	Description	Electrical rating
X3-01	PIN1			x	Fan motor contactor	AC 230 V +10 % / -15 %, 50...60 Hz, 1 A, cosφ 0.4
	PIN2			x	Alarm	AC 230 V +10 % / -15 %, 50...60 Hz, 1 A, cosφ 0.4
X3-02	PIN1		x		Air pressure switch (LP)	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 1.5 mA
	PIN2			x	Power signal for air pressure switch (LP)	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 500 mA
X3-03	PIN1		x		End switch burner flange	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 5 A
	PIN2			x	Power signal for end switch burner flange	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 5 A
X3-04	PIN1		x		Safety loop	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 5 A
	PIN2			x	Power signal for safety loop	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 5 A
	PIN3		x		Protective earth (PE)	
	PIN4		x		Neutral conductor (N)	
	PIN5		x		Live conductor (L)	AC 230 V +10 % / -15 %, 50...60 Hz, fuse 6.3 AT (DIN EN 60 127 2 / 5)
X4-01					Fuel selection “internal” if pin 1-2 is not used	
	PIN1		x		Fuel selection gas	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 1.5 mA
	PIN2		x		Fuel selection oil	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 1.5 mA
	PIN3		x		Fan contactor contact (FCC) or FGR-PS	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 1.5 mA
	PIN4		x		Reset / manual lockout	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 1.5 mA
X4-02	PIN1			x	Protective earth (PE)	
	PIN2			x	Neutral conductor (N)	
	PIN3			x	Ignition	AC 230 V +10 % / -15 %, 50...60 Hz, 2 A, cosφ 0.2
X4-03	PIN1			x	Protective earth (PE)	
	PIN2			x	Neutral conductor (N)	
	PIN3			x	Start signal or PS relief (APS test valve)	AC 230 V +10 % / -15 %, 50...60 Hz, 0.5 A, cosφ 0.4
X5-01	PIN1			x	Protective earth (PE)	
	PIN2		x		Pressure switch min-oil (DWmin-oil)	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 1.5 mA
	PIN3			x	Power signal for pressure switch-min-oil (DWmin-oil)	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 500 mA
X5-02	PIN1			x	Protective earth (PE)	
	PIN2		x		Pressure switch-max-oil (DWmax-oil)	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 1.5 mA
	PIN3			x	Power signal for pressure switch-max-oil (DWmax-oil)	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 500 mA
X5-03	PIN1		x		Controller (ON / OFF)	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 1.5 mA
	PIN2		x		Controller closes / stage 3	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 1.5 mA
	PIN3		x		Controller opens / stage 3	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 1.5 mA
	PIN4			x	Power signal for control of controller	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 500 mA

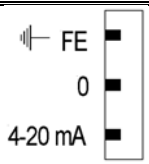
Terminal designation	Connection symbol		Input	Output	Description	Electrical rating
X6-01	PIN1		x		Start release oil	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 1.5 mA
	PIN2			x	Power signal start release oil	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 500 mA
	PIN3		x		Direct heavy oil start	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 1.5 mA
	PIN4			x	Power signal direct heavy oil start	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 500 mA
X6-02	PIN1			x	Protective earth (PE)	
	PIN2			x	Neutral conductor (N)	
	PIN3			x	Oil pump / magnetic coupling	AC 230 V +10 % / -15 %, 50...60 Hz, 2 A, cosφ 0.4
X6-03	PIN1			x	Protective earth (PE)	
	PIN2			x	Neutral conductor (N)	
	PIN3				Fuel valve SV (oil)	AC 230 V +10 % / -15 %, 50...60 Hz, 1 A, cosφ 0.4
X7-01	PIN1			x	Protective earth (PE)	
	PIN2			x	Neutral conductor (N)	
	PIN3				Fuel valve V2 (oil)	AC 230 V +10 % / -15 %, 50...60 Hz, 1 A, cosφ 0.4
X7-02	PIN1			x	Protective earth (PE)	
	PIN2			x	Neutral conductor (N)	
	PIN3				Fuel valve V2 (oil)	AC 230 V +10 % / -15 %, 50...60 Hz, 1 A, cosφ 0.4
X7-03	PIN1			x	Protective earth (PE)	
	PIN2					
	PIN3			x	Power signal (reserve)	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 500 mA
X8-01			PIN2		x	Firing on oil	AC 230 V +10 % / -15 %, 50...60 Hz, 1 A, cosφ 0.4
			PIN1		x	Firing on gas	AC 230 V +10 % / -15 %, 50...60 Hz, 1 A, cosφ 0.4
X8-02			PIN4		x	Protective earth (PE)	
			PIN3		x	Neutral conductor (N)	
			PIN2		x	Wiring point for valves connected in series	
			PIN1		x	Fuel valve V1 (oil)	AC 230 V +10 % / -15 %, 50...60 Hz, 1 A, cosφ 0.4
X8-03			PIN4		x	Protective earth (PE)	
			PIN3		x	Neutral conductor (N)	
			PIN2		x	Wiring point for valves connected in series	
			PIN1		x	Fuel valve V1 (oil)	AC 230 V +10 % / -15 %, 50...60 Hz, 1 A, cosφ 0.4

Description of the connection terminals (cont'd)

Terminal designation	Connection symbol		Input	Output	Description	Electrical rating
X9-01		PIN4		x	Fuel valve V1 (gas)	AC 230 V +10 % / -15 %, 50...60 Hz, 2 A, cosφ 0.4
		PIN3		x	Fuel valve V2 (gas)	AC 230 V +10 % / -15 %, 50...60 Hz, 2 A, cosφ 0.4
		PIN2		x	Fuel valve PV (gas)	AC 230 V +10 % / -15 %, 50...60 Hz, 2 A, cosφ 0.4
		PIN1		x	Fuel valve SV (gas)	AC 230 V +10 % / -15 %, 50...60 Hz, 2 A, cosφ 0.4
X9-02		PIN2		x	Protective earth (PE)	
		PIN1		x	Neutral conductor (N)	
X9-03		PIN4	x		Pressure switch-min-gas, start release gas	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 1.5 mA
		PIN3	x		Pressure switch-max-gas (DWmax-gas)	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 1.5 mA
		PIN2	x		Pressure switch-VP-gas / LT or valve closing contact (CPI)	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 1.5 mA
		PIN1		x	Power signal for pressure switch	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 500 mA
X10-01		PIN4		x	Neutral conductor (N)	AC 230 V +10 % / -15 %, 50...60 Hz, max 1 mA
		PIN3		x	Power signal transformer	
		PIN2	x		AC power signal GO	AC 12 V +10 % / -15 %, 50...60 Hz, max 1.2 mA
		PIN1	x		AC power signal G	
X10-02		PIN6	x		QRI... (IR detector) signal voltage	Umax DC 5 V
		PIN5		x	Protective earth (PE)	
		PIN4		x	Neutral conductor (N)	
		PIN3		x	Power signal	AC 230 V +10 % / -15 %, 50...60 Hz, Imax 500 mA
		PIN2		x	QRI... (IR detector) power supply	DC 14 / 21 VC Imax 100 mA
		PIN1	x		QRB... signal voltage	max. DC 8 V
X10-03		PIN1		x	Ionization probe	Umax (X3-04-PINS) Imax. 0.5 mA

Terminal designation	Connection symbol		Input	Output	Description	Electrical rating
X50		PIN6		x	Reference ground (PELV)	
		PIN5		x	Communication signal (CANL)	DC U ← 5 V, Rw = 120 Ω, level to ISO-DIS 11898
		PIN4		x	Communication signal (CANH)	
		PIN3		x	AC power supply for actuators / display and operating unit AZL...	AC 12 V +10 % / -15 %, 50...60 Hz, fuse max. 4 A
		PIN2		x		
		PIN1		x	Shield connection (functional earth)	
X51		PIN6		x	Reference ground (PELV)	
		PIN5		x	Communication signal (CANL)	DC U ← 5 V, Rw = 120 Ω, level to ISO-DIS 11898
		PIN4		x	Communication signal (CANH)	
		PIN3		x	AC power supply for actuators / display and operating unit AZL...	AC 12 V +10 % / -15 %, 50...60 Hz, fuse max. 4 A
		PIN2		x		
		PIN1		x	Shield connection (functional earth)	
X52		PIN4	x		Functional earth	
		PIN3	x		AC power supply from transformer to LMV51... system	AC 12 V +10 % / -15 %, 50...60 Hz
		PIN2	x		Reference ground (PELV)	
		PIN1	x		AC power supply from transformer to LMV51... system	AC 12 V +10 % / -15 %, 50...60 Hz
Temperature / pressure controller						
X60		PIN5	x		Functional earth for shield connection	
		PIN4	x		Reference ground	
		PIN3	x		Temperature sensor input Pt / LG-Ni 1000 (Input 4, TEMP)	
		PIN2	x		Line compensation temperature sensor PT100	
		PIN1	x		Temperature sensor input PT100 (input 1, TEMP)	
X61		PIN5	x		Functional earth for shield connection	
		PIN4	x		Reference ground	
		PIN3	x		Current input for temperature / pressure signal (input 2, TEMP / PRESS INPUT 4...40 mA)	DC 0...20 mA
		PIN2	x		Voltage input for temperature / pressure signal (input 2, TEMP / PRESS INPUT DC 0...10 V	DC 0...10 V
		PIN1		x	Power supply for temperature / pressure transmitter	approx. DC 20 V max. 25 mA
X62		PIN5	x		Functional earth for shield connection	
		PIN4	x		Reference ground	
		PIN3	x		Current input for setpoint or load (input 3, SETPOINT INPUT)	DC 0...20 mA
		PIN2	x		Voltage input for setpoint or load (input 3, SETPOINT INPUT)	DC 0...10 V
		PIN1		x	Power supply for setpoint changeover	approx. DC 24 V max. 2 mA

Description of the connection terminals (cont'd)

Terminal designation	Connection symbol		Input	Output	Description	Electrical rating
Temperature / pressure controller						
X63		PIN3	x		Functional earth for shield connection	
		PIN2		x	Reference ground	
		PIN3		x	Current output for burner load (LOAD OUTPUT)	DC 4...20 mA, RLmax = 500 Ω

11 Mounting, electrical installation and service

Installation

- **The burner / boiler manufacturer must ensure degree of protection IP 40 through appropriate mounting**
- **Depending on the field of use, external requirements may impose more stringent degrees of protection, which must then be observed**
- **When fitted, the maximum permissible ambient temperature may not be exceeded!**
- **The unit is designed for mounting inside the burner casing or in a control panel**
- **The display and operating unit (AZL5…) has its own housing and can be mounted in a suitable location (detached from the basic unit), e.g. away from the burner or in the control panel door**
- **Condensation water may not drip on the unit, neither in operation nor while service work is carried out!**
- **The power transformer is not integrated in the LMV5... and must be fitted by the burner / boiler manufacturer in a suitable location**
  (Only the AGG5.2XX transformers specified by Siemens may be used!)

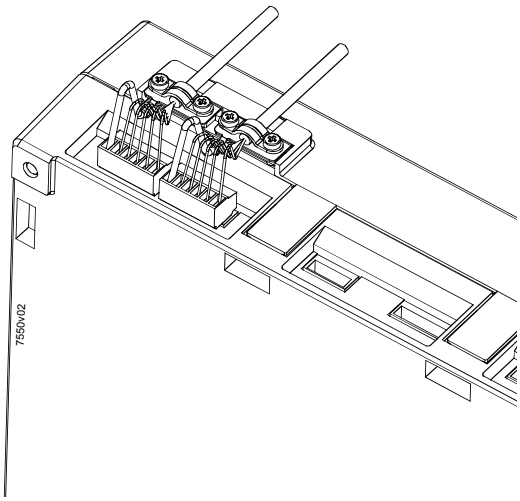
Electrical connections and wiring

The entire RAST 5 connection area **does not** feature functional low voltage.

The RAST 3.5 connection area on the unit's small side offers functional low voltage.

- **When making the wiring, the functional low voltage section must be strictly separated from the other sections to ensure protection against electric shock hazard!**
- **Adequate protection against electric shock hazard on unused AC 230 V terminals (RAST 5) must be provided by fitting dummy plugs!**
- **To isolate the unit from the mains supply, a multipolar switch must be used.**
- **For wiring the bus users, only the cables specified by Siemens may be used!**
- **The electrical contacts used by the external signal sources (DWmin, max, LC, etc.) must be gold-plated silver contacts!**
- **The ignition cable must be run to the ignition electrode as directly as possible, with no loops**
  It may never be laid parallel with or very close to other electrical cables.

Connection of LMV5... CAN bus



11.1 Power supply to the LMV5... system

In principle, the CAN bus topology always has a line structure and, therefore, has a start and an end node.

The individual CAN bus users are connected in series, whereby the respective end nodes are terminated by CAN bus terminating resistors.

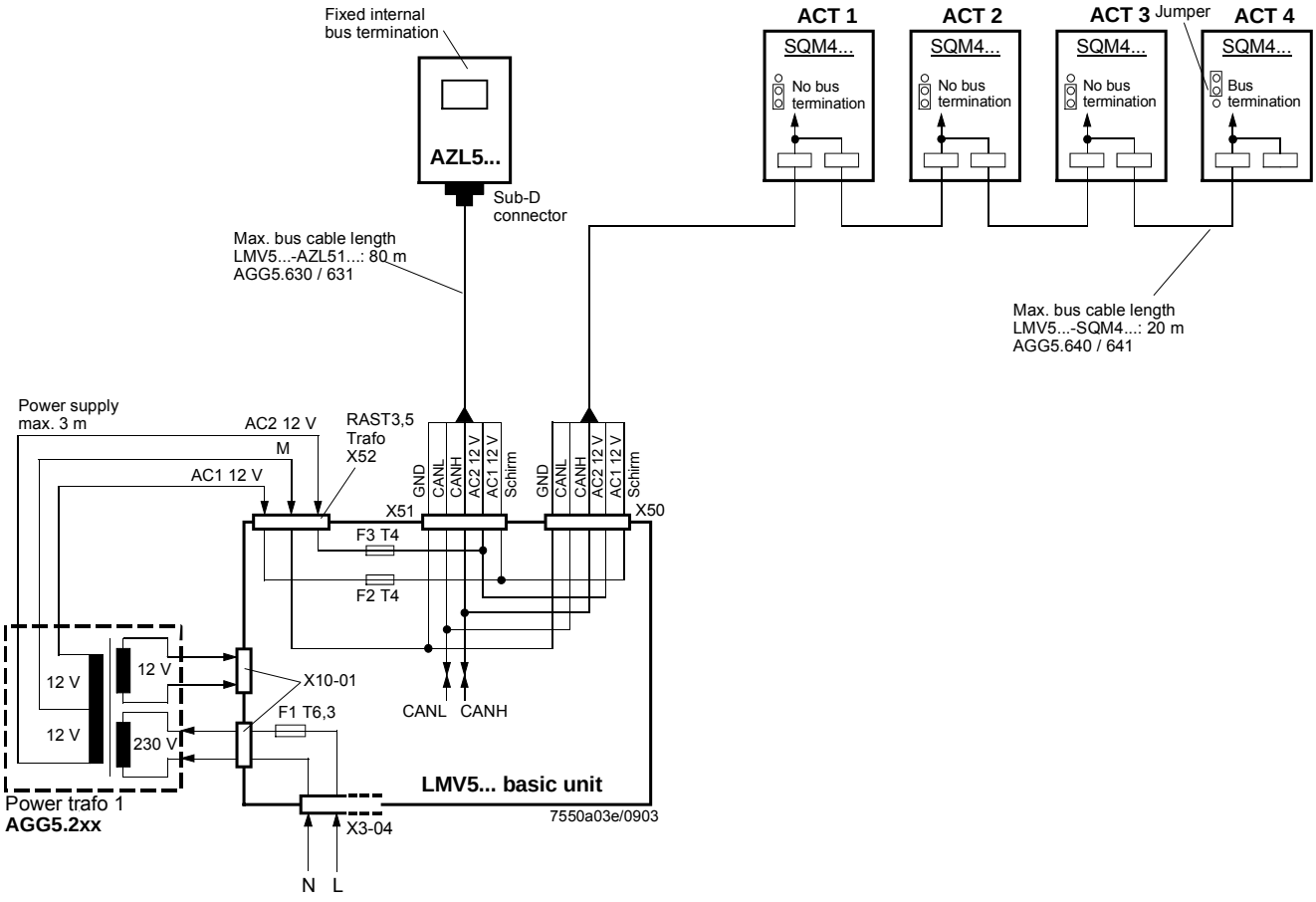
The basic unit is a component of the communication line and is looped in between the AZL5… and the actuators.

In the system, the AZL5… always assumes the function of a CAN bus end node. The required CAN bus terminating resistor is already integrated in that case.

With the actuators, the last user becomes the CAN bus end node (here, the internal CAN bus termination must be activated via a connecting plug).
The other node users within the line structure are configured without terminating resistor.

Example 1

Installation of all components in the burner;
CAN bus cable «LMV5... ↔ ACT» < 20 m

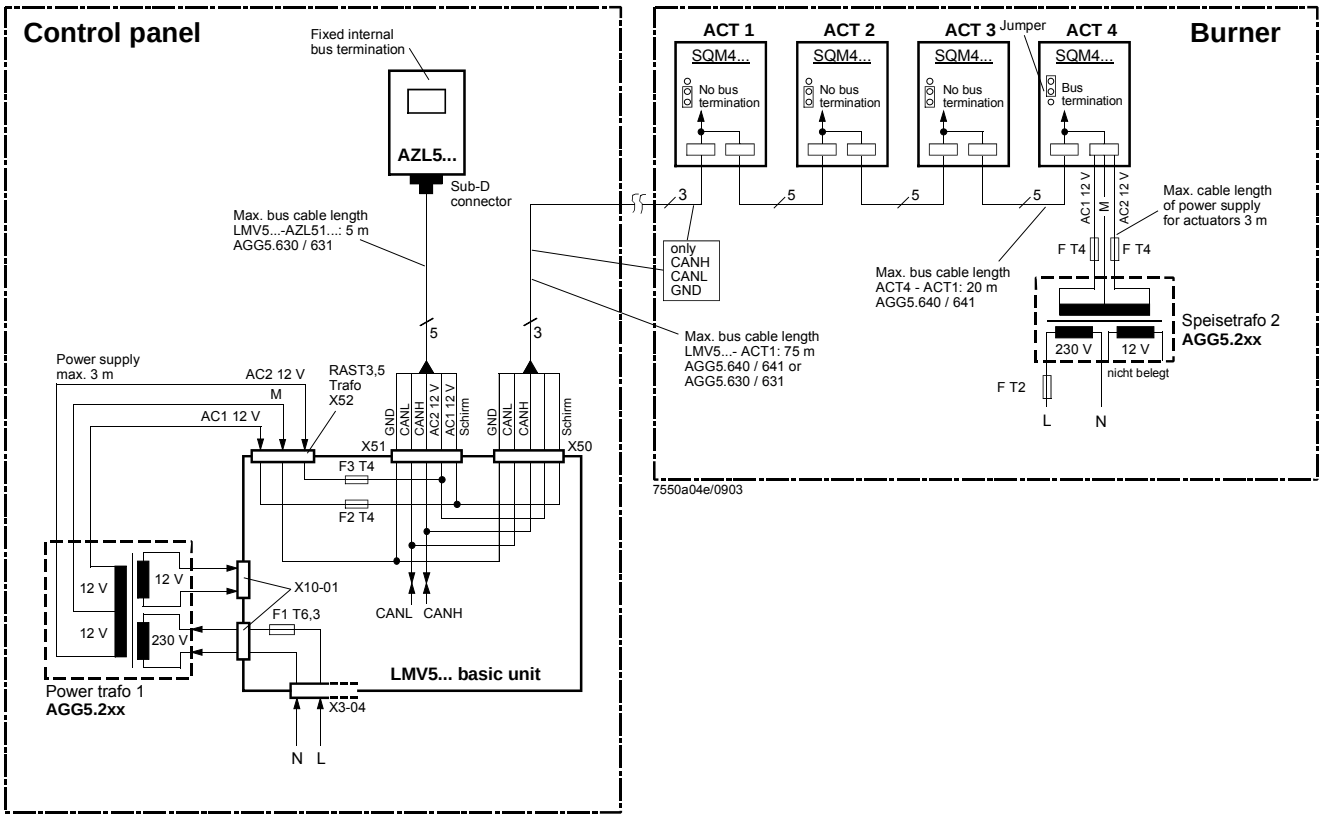


Note on example 1

Total length of CAN bus cable ≤ 100 m

Example 2

Basic unit LMV5... in the control panel, actuator on the burner; CAN bus cable «LMV5... ↔ SA» > 20 m



Notes on example 2

Total length of CAN bus cable ≤ 100 m

Whenever the distance between the LMV5... and the last actuator exceeds 20 m, a second transformer is required for powering the actuators.

In that case, transformer 1 supplies power to the basic unit of the LMV5... and the **AZL5...**

With the CAN bus cable connections from the LMV5... to the first actuator, the 2 voltages AC1 and AC2 on the LMV5... side will **not be** connected and only the cables CANH, CANL and M (+shield) will be connected to the first actuator.

In that case, the actuators are powered by a second transformer which must be located near the actuators.

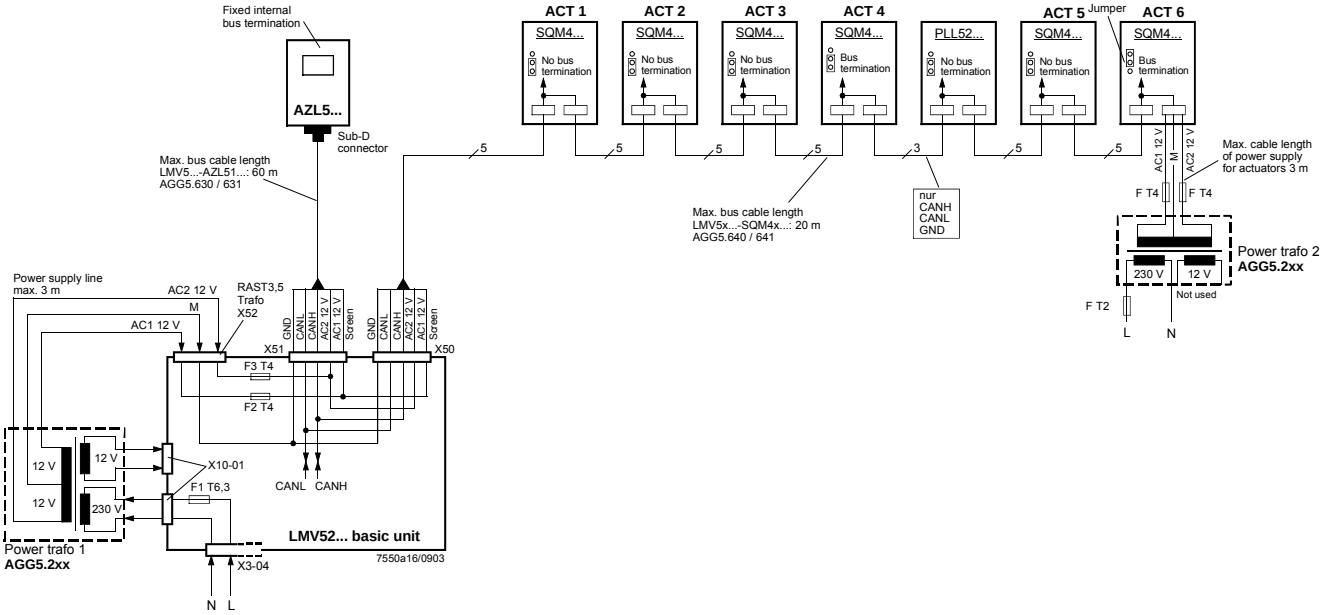
The power from that transformer (cables AC1, AC2 and GND) is fed to the actuator (ACT4 in the example above) and then connected through via bus cable AGG5.640 (Type1) to all the other actuators.

The fuses required for transformer 1 are accommodated in the LMV5... basic unit.

For transformer 2, these 3 fuses must be located close to the transformer.

Example 3

Installation of all components in the burner;
CAN bus cable «LMV52... ↔ ACT» < 20 m with 6 actuators and O2 module



Notes on example 3

CAN bus cable with LMV52... and more than 4 actuators and O2 module PLL52...

On LMV52... applications using more than 4 actuators, a second transformer is required for powering the extra actuators.

In that case, transformer 1 powers the LMV52... basic unit, the **AZL5...**, and the first 4 actuators.

With the CAN bus cable connection from the fourth actuator to the O2 module, the 2 voltages AC1 and AC2 will **not** be connected on the «actuator 4» side, but only lines «CANH, CANL and M» (+shielding) will be connected to the O2 module.

In that case, the actuators (SA5 and SA6) and the O2 module are to be powered by a second transformer which must physically be located near the actuators and the O2 module.

The supply line from that transformer will be connected to the actuator (SA6 in the example above) (lines AC1, AC2, and M), to be run from there via the AGG5.640 (cable type 1) to all the other actuators (SA5) and the O2 module.

The fuses required for transformer 1 are accommodated in the LMV52... basic unit.

For transformer 2, the OEM must fit the 3 fuses in the vicinity of the transformer.

Determination of the maximum cable length

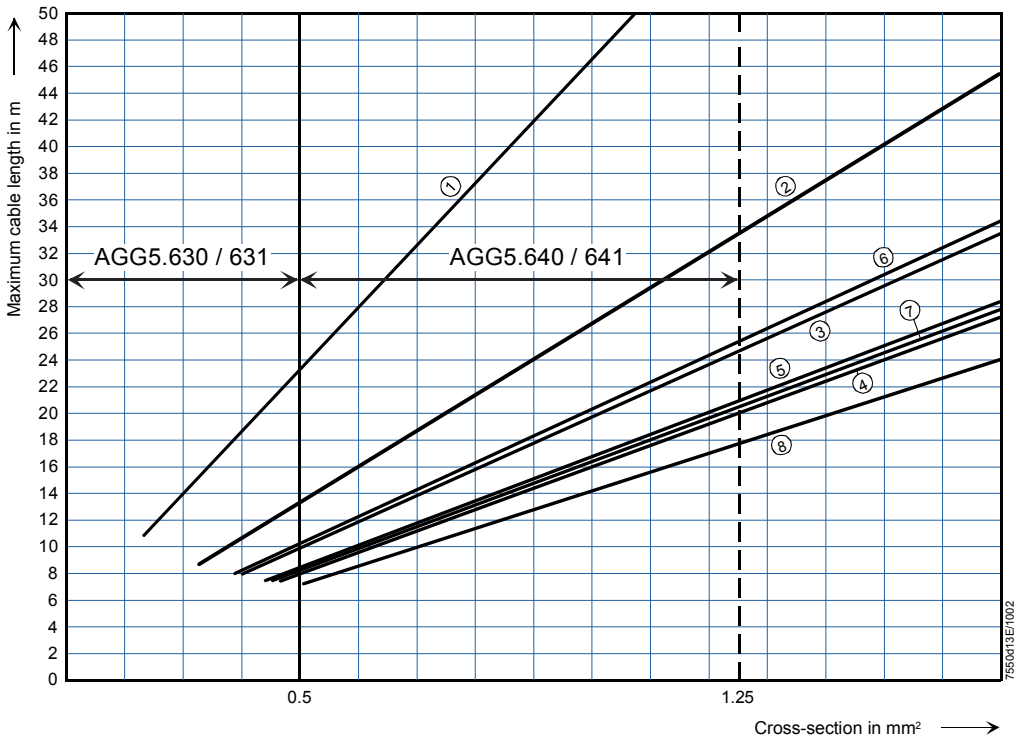
The maximum cable length between transformer and CAN bus users is dependent on the type of cable (cross-sectional area), the number of actuators and the type of actuator used (current).

The following graphs can be used to determine the maximum CAN bus cable lengths between the transformer and group of actuators or the AZL5…, depending on the relevant influencing factors.

The assumption was made that the actuators within the group are close to one another.

The **minimum** cross-sectional area for the system examples shown results from the start of the curve.

The **maximum** cable lengths for the defined system cables AGG5.640 and AGG5.630 result from the points of intersection in the graph.



AGG5.630 / 631 (cable type 2)
AGG5.640 / 641 (cable type 1)

①	1 x SQM45	⑤	2 x SQM48
②	2 x SQM45	⑥	1 x SQM45 + 1 x SQM48
③	3 x SQM45	⑦	2 x SQM45 + 1 x SQM48
④	4 x SQM45	⑧	3 x SQM45 + 1 x SQM48

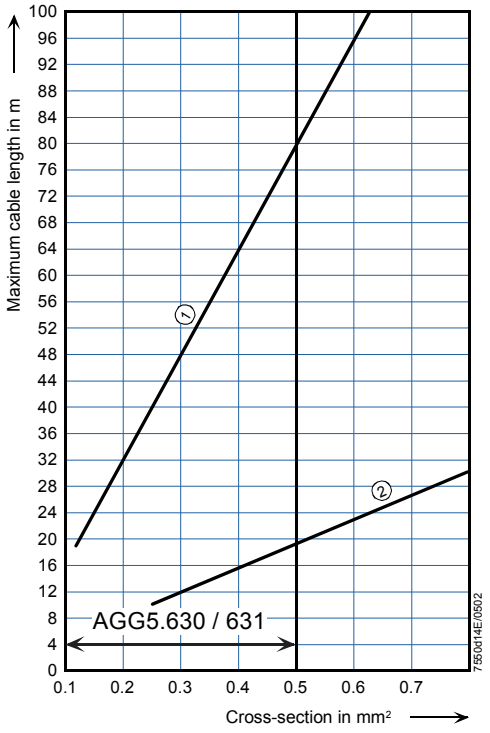
CAN bus connection between transformer and actuator group

⚠ When connecting a PLL52... O2 module, the maximum permissible cable length of a network is to be reduced by 2 m.

Example: - System cable: AGG5.640 (connecting cable to the actuators)
- Actuators: 2 x SQM45...

The point of intersection of the vertical line for the AGG5.640 (1.25 mm^2) and curve ② (2 x SQM45.xxx) gives a maximum cable length of 33.4 m between the transformer and the group of actuators.

The minimum cross-sectional area is 0.33 mm^2.

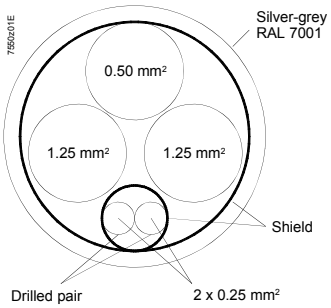


AGG5.630 / 631 (cable type 2)
① 1 x AZL
② 1 x AZL + 1 x SQM45

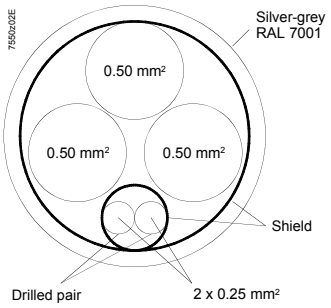
CAN bus connection between transformer and AZL5...

Types of cable

AGG5.640 / 641 (cable type 1) LMV5... ↔ SA



AGG5.630 / 631 (cable type 2) LMV5... ↔ AZL5…



11.2 Suppliers of other accessory items

Mounting rail adapter type: USA 10 / 4,6

Fa. Phoenix
Flachsmarktstr. 8-28
D-32825 Blomberg
Tel.: 05235 / 300
Fax: 0561 / 505-1787
www.phoenixcontact.com

e-bus / PC adapter part no. 230 437

Fa. Karl Dungs GmbH & Co.
Steuer- und Regeltechnik
Postfach 1229
D-73602 Schorndorf

or

User Club eBUS e.V.
www.eBUS.de

12 Duties of the authorized inspector

Prior to approval, the manufacturer must state the assigned DIN registration number and product ID number confirming that the LMV5... burner management system complies with the type-tested system.

Also, only the components specified for use with the LMV5… system (AZL5…, actuating devices, flame detectors, transformer and CAN bus cable) may be used and, in addition with the LMV52..., the O2 module and the O2 sensor. In the case of VSD operation, we recommend to use the AGG5.310 accessory set for acquiring the fan speed.

LMV51... systems	Flame detectors QRB...	refer to Data Sheet CC1N7714
	Flame detectors...	refer to Data Sheet CC1N7719
	Actuators SQM4...	refer to Data Sheet CC1N7814
	Operating and display unit AZL5...	refer to User Documentation CC1A7550
	Transformer AGG5...	refer to Basic Documentation CC1P7550
	CAN bus connecting cable AGG5.63X	refer to Basic Documentation CC1P7550
	Accessory set AGG5.310 for acquiring the fan speed (recommended, if required)	refer to Basic Documentation CC1P7550
In addition with LMV52... systems	Residual oxygen measuring module PLL52...	refer to Basic Documentation CC1P7550
	Oxygen sensor QGO20...	refer to Data Sheet CC1N7842
	Flue gas collector AGO20...	refer to Data Sheet CC1N7842
	Accessory set AGG5.310 for acquiring the fan speed (recommended)	refer to Basic Documentation CC1P7550

The mechanical links between the actuators and the fuel and air actuating devices and any other actuating devices used must be rigid.

In addition, following must be checked:

Correct parameterization of the system

The parameterized values and setting values (e.g. curve characteristics) that define the fuel / air ratio control system and, if used O2 trim control must be **documented** by the individual responsible for plant / the heating engineer after the plant is installed and commissioned. These data can be printed out with the help of the ACS450 PC software, for example, or they must be put down in writing. These documents must be kept in a safe place and are to be checked by the inspector.

⚠

On the OEM access level of the LMV5... system, it is possible to make parameter settings that differ from application standards. For this reason, it is to be checked whether parameterization is in compliance with the relevant application standards (e.g. EN 298, EN 230, EN 676, EN 267, etc.) or whether the respective plant can be approved on an “individual basis“.

The following parameters are of particular importance:

Fuel / air ratio control system

The setting values (curve parameters) for the actuating devices, the types of fuel and the combustion air across the burner's load range must be stored in adequate numbers.
While considering the combustion chamber pressure, fuel pressure as well as temperature and pressure of the combustion air, assignment of the selected setting values of fuel and combustion air must be made such that correct operation with sufficient amounts of excess air is ensured across the entire burner load range.
Proof of this must be delivered by the burner / boiler manufacturer by measuring the combustion characteristics. When using a VSD, the fan will be run to the steady-state condition. Hence, the burner's nominal load refers to the fan speed acquired with speed standardization.

Burner control section

Fuel train parameterization (G, Gp1, Gp2, LO, HO, LOgp, HOgp, refer to chapter «Fuel trains») must be checked prior to commissioning to ensure it agrees with the fuel trains implemented on the burner and to make certain the valves are correctly assigned to the valve outputs on the LMV5... .

The correct setting of the time parameters, especially the safety and prepurge times (separately for oil and gas), must be checked.
It must also be checked if, in the case of plants with continuous operation, flame detector type QRI... (or the ionization probe) is used, because only these are suited for continuous operation.
Further, the function of the flame detector in the event of loss of flame during operation and with extraneous light during the prepurge time, or in the case there is no establishment of flame at the end of the safety time, must be checked.
(With the QRI... flame detector, generation of an extraneous light signal is achieved by simulating a flickering flame with an artificial light source).
The functions of all available or required input messages must be checked, for example:

- Air pressure
- Minimum gas pressure
- Maximum gas pressure
- Gas valve proving or CPI
- Minimum oil pressure
- Maximum oil pressure
- Safety loop (e.g. SLT)
- Fan contactor contact in at least 2 phases (e.g. prepurge and operation)

It is to be checked whether gas valve proving is activated if required by the application. If yes, the correct leakage rate is to be checked. For details, refer to chapter «Gas valve proving».
In the case of dual-fuel burners, short preignition_Oil (from Phase 38) must be parameterized when firing on oil, and the oil pump must be equipped with a magnetic clutch, for example, ensuring that the oil pressure will be increased in Phase 38 before ignition takes place. In addition, parameter «OilPumpCoupling» must be set to «Magnetcoupl».
Pure oil burners do not require a magnetic clutch, in which case long preignition_Oil (from Phase 22) is to be parameterized, or parameter «OilPumpCoupling» is to be set to «Directcoupl».

O2 trim control (only with LMV52... system)

The O2 trim control system of the LMV52... offers a number of operating modes. In operating mode «CtrlAutodeact», O2 trim control is automatically deactivated by the LMV52... if the O2 limit switch responds or if a fault in connection with actual value acquisition of O2 occurs (O2 sensor, O2 module, O2 sensor test, etc.). Also, O2 trim control can be deactivated manually, «mandeact». For this reason, the fuel / air ratio curves with the LMV52... must always be set such that there are sufficient amounts of excess air irrespective of environmental conditions (e.g. combustion chamber and fuel pressure, and temperature and pressure of the combustion air) across the whole load range – same as with a system without O2 trim control (LMV5…). Also, the fuel / air ratio curves must be proven. The actual O2 value should not fall below the O2 setpoint of O2 trim control.

A sufficient number of curvepoints (for actuator positions, O2 setpoints, etc.) should be stored to ensure that there is a linear progression of the O2 value across the entire load range. The second curvepoint must correspond to the low-fire position (or be set to a lower value). The first curvepoint must lie sufficiently below curvepoint 2 (at about 50 % load) so that the curves are defined for reducing the air rate by O2 trim control below the low-fire position also.

The O2 min. value represents the switch-off threshold of the O2 monitoring function and must be set and proven such that – across the entire load range and while taking into account the combustion chamber and fuel pressure as well as the temperature and pressure of the combustion air – there will be no dangerous increase of the CO and/or soot values.
On the other hand, the safety distance from the dangerous area should be selected as small as possible in order to prevent inadvertent or undesired shutdowns (guide values: CO < 2000 ppm Vol % or soot number < 3 according to Bacharach).

The O2 setpoint must have an adequate distance from the above mentioned O2 min. value (guide value: O2 setpoint = O2 min. value + 1 % O2).

General

It must be made certain that all safety notes and the notes on mounting., electrical installation and service according to the above mentioned chapter and Data Sheets are complied with.

13 Technical data

13.1 LMV5... and AZL5...

Basic unit LMV5...

Mains voltage	AC 230 V -15 % / +10 %
Transformer AGG5.220 - Primary side - Secondary side	AC 230 V AC 12 V 2 x AC 12 V
Mains frequency	50...60 Hz ±6 %
Power consumption (typically)	< 30 W
Safety class	I with parts according to II and III as per DIN EN 60 730-1

Environmental conditions LMV5...

Transport	DIN EN 60 721-3-2
Climatic conditions	class 2K2
Mechanical conditions	class 2M2
Temperature range	-20...+70 °C
Humidity	< 95 % r.F.
Operation	DIN EN 60 721-3-3
Climatic conditions	class 3K5
Mechanical conditions	class 3M2
Temperature range (incl. mounting. plate)	-20...+60 °C
Humidity	< 95 % r.h.

⚠ **Condensation, formation of ice and ingress of water are not permitted!**

AZL...

Operating voltage	AC 24 V -15 % / +10 %
Power consumption (typically)	< 5 W
Degree of protection of housing – Rear – Front	 IP00, IEC 529 IP54, IEC 529 (when built in)
Safety class	I with parts according to II and III as per DIN EN 60 730-1

Environmental conditions AZL5...

Transport	DIN EN 60 721-3-2
Climatic conditions	Class 2K3
Mechanical conditions	Class 2M2
Temperature range	-20...+60 °C
Humidity	< 95 % r.F.
Operation	DIN EN 60 721-3-3
Climatic conditions	Class 3K3
Mechanical conditions	Class 3M2
Temperature range (incl. mounting plate)	-20...+60 °C
Humidity	< 95 % r.F.

⚠ **Condensation, formation of ice and ingress of water are not permitted!**

Battery:

Manufacturer	Type
VARTA	CR 2430 (LF-1 / 2 W)
DURACELL	DL 2430
SANYO ELECTRIC, Osaka / Japan	CR 2430 (LF-1 / 2 W)
RENATA AG, Itingen / CH	CR 2430

Types of cable

AGG5.640 / 641	8 mm dia. ±0.2 mm bending radius: 120 mm ambient temperature: -30...+70 °C (cable not moving) cable jacket resistant to almost all types of mineral oil
AGG5.630 / 631	7.5 mm dia. ±0.2 mm bending radius: 113 mm ambient temperature: -30...+70 °C (cable not moving) cable jacket resistant to almost all types of mineral oil

13.2 Loads on terminals, cable lengths and cross-sectional areas

Loads on terminals

General data
- Max. perm. mains primary fuse (external): 16 AT
- Unit fuse F1 (internal): 6.3 AT (DIN EN 60 127 2 / 5)

Mains supply
- The mains input current depends on the status of the unit

Undervoltage
- Safety shutdown from operating position at mains voltage: < AC 186 V
- Restart on increase of mains voltage: > AC 188 V

Oil pump / magnetic clutch
- Nominal voltage: AC 230 V +10 % / -15 %, 50-60 Hz
- Nominal current: 2 A
- Power factor: cosφ > 0.4

APS test valve
- Nominal voltage: AC 230 V +10 % / -15 %, 50-60 Hz
- Nominal current: 0.5 A
- Power factor: cosφ > 0.4

Status inputs (CFN)

Status inputs (with the exception of the safety loop) of the contact feedback network (CFN) are used for system supervision and require a mains-related input voltage.
- Input safety loop: refer to «Loads on terminals, outputs»
- Input currents and input voltages
  - UeMax: UN +10 %
  - UeMin: UN -15 %
  - IeMax: 1.5 mA peak
  - IeMin: 0.7 mA peak

- Recommended contact material for external signal sources (APS, PSmin, PSmax, etc.): gold-plated silver contacts

- Transition / transient behavior / bouncing
  - Max. perm. bounce time of contacts when switching on / off: 50 ms
    (after the bounce time, the contact must be permanently closed or open)

- UN: AC 230 V

- Voltage detection
  - ON: AC 180...253 V
  - OFF: < AC 80 V

Load on terminals «outputs»

Total load on contacts
- Nominal voltage: AC 230 V +10 % / -15 %, 50-60 Hz
- Unit input current* (safety loop): max. 5 A

* Total contact current resulting from:
- Fan motor contactor
- Ignition transformer
- Valves
- Oil pump / magnetic clutch

Load on individual contacts

Fan motor contactor	• Nominal voltage	AC 230 V +10 % / -15 %, 50-60 Hz
	• Nominal current	1 A
	• Power factor	cosφ > 0.4
Alarm output	• Nominal voltage	AC 230 V +10 % / -15 %, 50-60 Hz
	• Nominal current	1 A
	• Power factor	cosφ > 0.4
Ignition transformer	• Nominal voltage	AC 230 V +10 % / -15 %, 50-60 Hz
	• Nominal current	2 A
	• Power factor	cosφ > 0.2
Fuel valves (gas)	• Nominal voltage	AC 230 V +10 % / -15 %, 50-60 Hz
	• Nominal current	2 A
	• Power factor	cosφ > 0.4
Fuel valves (oil)	• Nominal voltage	AC 230 V +10 % / -15 %, 50-60 Hz
	• Nominal current	1 A
	• Power factor	cosφ > 0.4

Cable lengths

Mains cable	max. 100 m (100 pF / m)
CFN cable	max. 100 m (100 pF / m) [1)]
Analog cable	max. 100 m (100 pF / m)
Flame detectors	refer to data sheets CC1N7714 CC1N7719
CAN bus	total length max. 100 m

When a certain cable length is exceeded, the actuators must be powered by a transformer located near the actuators.
For details, refer to «Power supply for LMV5... system».

Cross-sectional areas

The cross-sectional areas of the mains supply lines (L, N, PE) and, if applicable, the safety loop (SLT, shortage of water, etc.) must be sized for nominal currents in agreement with the selected external primary fuse.
The cross-sectional areas of the other cables must be sized in agreement with the internal unit fuse (max. 6.3 AT).
Min. cross-sectional area 0.75 mm^2
(single- or multi-core to VDE 0100)
Cable insulation must satisfy the requirements of the relevant temperature and environmental conditions.
The CAN (bus) cables have been specified by Siemens and can be ordered as accessory items.
Other types of cables may not be used. Otherwise, the EMC characteristics of the LMV5... system will become unpredictable!

Fuses used in the LMV5... basic unit

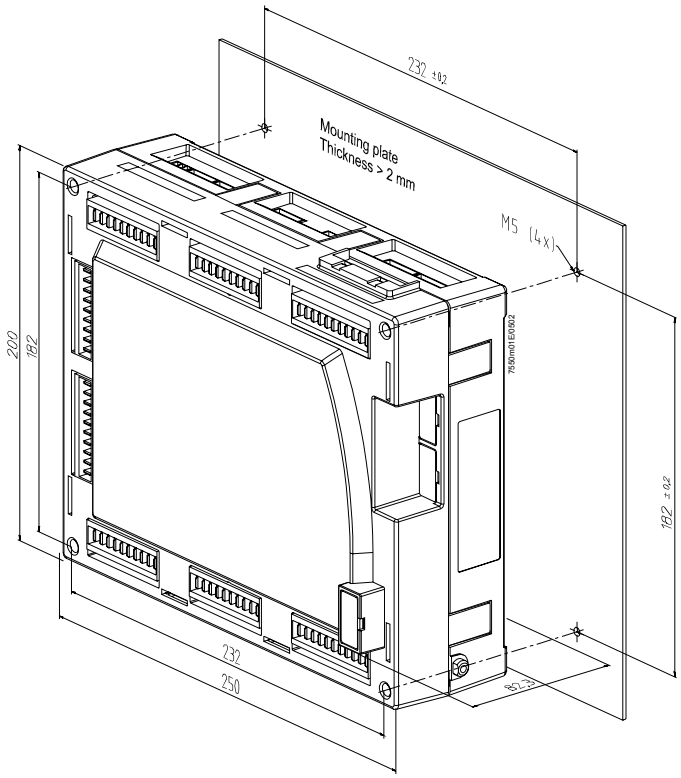
F1	6.3 AT DIN EN 60 127 2 / 5
F2	4 AT DIN EN 60 127 2 / 5
F3	4 AT DIN EN 60 127 2 / 5

1) If the cable length exceeds 50 m, no additional loads may be connected to the status inputs

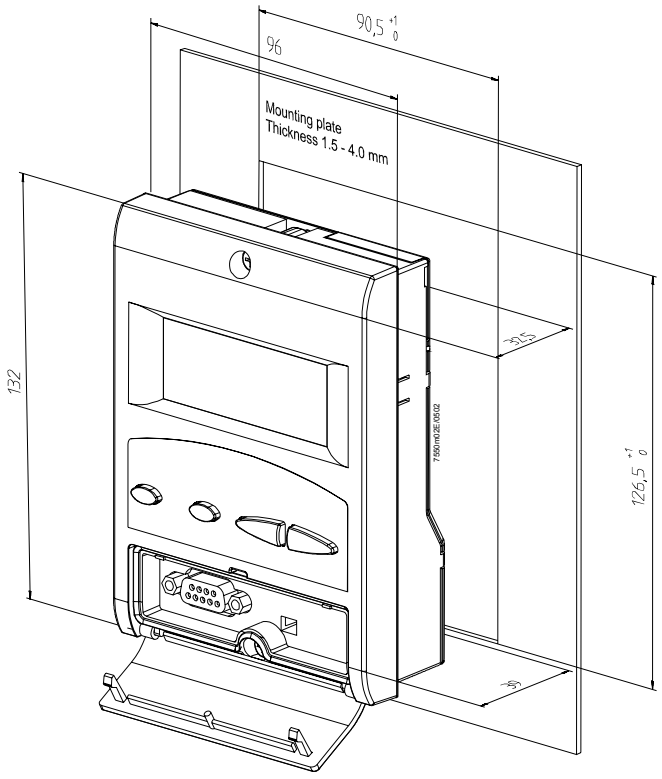
14 Dimensions

Dimensions in mm

LMV5...



AZL5...



15 Addendum 1: List of fault status messages of LMV51... system

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
01	01	BU	Internal Fault Basic Unit	ROM error	*1)
02	#	BU	Internal Fault Basic Unit	RAM error	*1)
02	*01*	*BU*	*Internal Fault Basic Unit*	*RAM error in register bank 0 (LMV51...)*	
02	*02*	*BU*	*Internal Fault Basic Unit*	*RAM error in IDATA area (LMV51...)*	
02	*03*	*BU*	*Internal Fault Basic Unit*	*RAM error in XDATA area (LMV51...)*	
02	*04*	*BU*	*Internal Fault Basic Unit*	*RAM error of variables used*	
02	*05*	*BU*	*Internal Fault Basic Unit*	*RAM error variable consistency*	
02	*06*	*BU*	*Internal Fault Basic Unit*	*RAM error reading back test pattern*	
02	*07*	*BU*	*Internal Fault Basic Unit*	*Error RAM test code run*	
03	#	BU	Internal Fault Basic Unit	Error in connection with data comparison (internal communication) between uC1 and uC2	*1)
03	*01*	*BU*	*Internal Fault Basic Unit*	*TimeOut during program run synchronization prior to data transmission*	
03	*02*	*BU*	*Internal Fault Basic Unit*	*TimeOut during data transmission*	
03	*03*	*BU*	*Internal Fault Basic Unit*	*CRC error during data transmission*	
03	*05*	*BU*	*Internal Fault Basic Unit*	*TimeOut during program run synchronization with initialization*	
03	*10*	*BU*	*Internal Fault Basic Unit*	*Error counter "Flame intensity outside tolerance" has elapsed*	
03	*11*	*BU*	*Internal Fault Basic Unit*	*Error counter "Target phase unequal" has elapsed*	
03	*12*	*BU*	*Internal Fault Basic Unit*	*Error counter "Reset-lockout input unequal" has elapsed*	
03	*40*	*BU*	*Internal Fault Basic Unit*	*Fuel train unequal*	
03	*41*	*BU*	*Internal Fault Basic Unit*	*Relay control word unequal*	
03	*42*	*BU*	*Internal Fault Basic Unit*	*ROM-CRC signature unequal*	
03	*43*	*BU*	*Internal Fault Basic Unit*	*Phase unequal*	
03	*44*	*BU*	*Internal Fault Basic Unit*	*(Key + main loop counter) unequal*	
04	-	BU	Internal Fault Basic Unit	Unsuccessful synchronization of the 2 µCs	*1)

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
05	#	BU	Fault Flame Detector Test	Fault during test of the flame signal amplifier	If fault occurs sporadically: Improve EMC If fault occurs constantly: Replace flame detector or replace defective basic unit
05	*01*	*BU*	*Fault Flame Detector Test*	*Fault during test of the flame signal amplifier*	
05	*02*	*BU*	*Fault Flame Detector Test*	*Crosstalk fault between test pin and flame signal amplifier channel*	
06	#	BU	Internal Fault Basic Unit	Fault internal hardware tests	*1)
06	*01*	*BU*	*Internal Fault Basic Unit*	*Fault during test of the ignition relay*	
06	*02*	*BU*	*Internal Fault Basic Unit*	*Fault during test of the safety relay*	
06	*03*	*BU*	*Internal Fault Basic Unit*	*Fault during voltage supervision test*	
06	*04*	*BU*	*Internal Fault Basic Unit*	*Relay voltage not switched off after reset*	
10	#	BU	Internal Fault Basic Unit	Basic unit has detected an inadmissible circuit at one of the outputs, a faulty diode, or a short-circuit in the power supply of the contact feedback network. The diagnostic codes indicates the input affected	Check wiring of outputs, check connection of the neutral conductor to the devices used. The fault may be caused by capacitive loads which, with the relay deenergized, are the reason the voltage takes more than about 10 ms to drop to zero. Check wiring to the load *1)
10	*01*	*BU*	*Internal Fault Basic Unit*	*Load controller on / off*	
10	*02*	*BU*	*Internal Fault Basic Unit*	*Fan contact*	
10	*03*	*BU*	*Internal Fault Basic Unit*	*Selection of oil-firing*	
10	*04*	*BU*	*Internal Fault Basic Unit*	*Selection of gas-firing*	
10	*05*	*BU*	*Internal Fault Basic Unit*	*Reset*	
10	*06*	*BU*	*Internal Fault Basic Unit*	*Pressure switch oil maximum*	
10	*07*	*BU*	*Internal Fault Basic Unit*	*Pressure switch oil minimum*	
10	*08*	*BU*	*Internal Fault Basic Unit*	*Pressure switch valve proving*	
10	*09*	*BU*	*Internal Fault Basic Unit*	*Safety valve oil feedback*	
10	*0A*	*BU*	*Internal Fault Basic Unit*	*Fuel valve 1 oil feedback*	
10	*0B*	*BU*	*Internal Fault Basic Unit*	*Fuel valve 2 oil feedback*	

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
10	*0C*	*BU*	*Internal Fault Basic Unit*	*Fuel valve 3 oil feedback*	
10	*0D*	*BU*	*Internal Fault Basic Unit*	*Safety valve gas feedback*	
10	*0E*	*BU*	*Internal Fault Basic Unit*	*Fuel valve 1 gas feedback*	
10	*0F*	*BU*	*Internal Fault Basic Unit*	*Fuel valve 2 gas feedback*	
10	*10*	*BU*	*Internal Fault Basic Unit*	*Fuel valve 3 gas feedback*	
10	*11*	*BU*	*Internal Fault Basic Unit*	*Safety chain burner flange*	
10	*12*	*BU*	*Internal Fault Basic Unit*	*Safety relay feedback*	
10	*13*	*BU*	*Internal Fault Basic Unit*	*Pressure switch gas minimum*	
10	*14*	*BU*	*Internal Fault Basic Unit*	*Pressure switch gas maximum*	
10	*15*	*BU*	*Internal Fault Basic Unit*	*Ignition transformer feedback*	
10	*16*	*BU*	*Internal Fault Basic Unit*	*Fan pressure switch*	
10	*17*	*BU*	*Internal Fault Basic Unit*	*Start release oil*	
10	*18*	*BU*	*Internal Fault Basic Unit*	*Heavy oil direct start*	
10	*19*	*BU*	*Internal Fault Basic Unit*	*Load controller open*	
10	*1A*	*BU*	*Internal Fault Basic Unit*	*Load controller closed*	
10	*1B*	*BU*	*Internal Fault Basic Unit*	*Start release gas*	
11	01	BU	Internal Fault Basic Unit	Basic unit has detected a short-circuit in the contact feedback network	*1)
15	#	SA FuM	Fault Positioning Actuator or Fan Speed not reached	Basic unit has detected a positioning error on 1 / several actuators (incl. the VSD module)	If fault occurs sporadically: Improve EMC. If fault occurs constantly: Replace the relevant actuators (refer to diagnostic code). Check if actuator is overloaded
15	*01..3F*	*SA*	*Fault Positioning Actuator*	*The diagnostic value is made up of the following faults or their combinations (the individual diagnostic codes are added up in hexadecimal format)*	
15	*01*	*SA*	*Fault Positioning Actuator*	*Positioning fault air actuator*	
15	*02*	*SA*	*Fault Positioning Actuator*	*Positioning fault fuel actuator*	

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
15	*04*	*SA*	*Fault Positioning Actuator*	*Positioning fault auxiliary actuator 1*	
15	*08*	*SA*	*Fault Positioning Actuator*	*Positioning fault auxiliary actuator 2*	
15	*10*	*FuM*	*Fan Speed not reached*	*The fan in combination with the VSD has not reached the required speed*	
15	*20*	*SA*	*Fault Positioning Actuator*	*Positioning fault auxiliary actuator 3*	
16	#	BU	Internal Fault Basic Unit	Basic unit has detected a plausibility fault in the ratio control system. The diagnostic code describes the cause of the fault.	
16	*00*	*BU*	*Internal Fault Basic Unit*	*Ratio curve of the air actuator is not fully defined*	*Check the curve to see if correct values have been entered for the air actuator. Readjust the ratio curve, if required*
16	*01*	*BU*	*Internal Fault Basic Unit*	*Ratio curve of the fuel actuator is not fully defined*	*Check the curve to see if correct values have been entered for the fuel actuator. Readjust the ratio curve, if required*
16	*02*	*BU*	*Internal Fault Basic Unit*	*Ratio curve of auxiliary actuator 1 is not fully defined*	*Check the curve to see if correct values have been entered for auxiliary actuator 1. Readjust the ratio curve, if required*
16	*03*	*BU*	*Internal Fault Basic Unit*	*Ratio curve of auxiliary actuator 2 is not fully defined*	*Check the curve to see if correct values have been entered for auxiliary actuator 2. Readjust the ratio curve, if required*
16	*04*	*BU*	*Internal Fault Basic Unit*	*Ratio curve of auxiliary actuator 3 is not fullydefined*	*Check the curve to see if correct values have been entered for auxiliary actuator 3. Readjust the ratio curve, if required*
16	*05*	*BU*	*Internal Fault Basic Unit*	*VSD curve is not fully defined*	*Check the curve to see if correct values have been entered for the VSD. Readjust the ratio curve, if required*
16	*0A*	*BU*	*Internal Fault Basic Unit*	*Calculated P-part outside the permissible range*	*Check to see if correct values have been entered for the controller parameters. Readjust O2 trim control, if required, or repeat the settings*

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
16	*0B*	*BU*	*Internal Fault Basic Unit*	*Calculated I-part outside the permissible range*	*Check to see if correct values have been entered for the controller parameters. Readjust O2 trim control, if required, or repeat the settings*
16	*0C*	*BU*	*Internal Fault Basic Unit*	*Calculated system delay time outside the permissible range*	*Check to see if correct values have been entered for the controller parameters. Readjust O2 trim control, if required, or repeat the settings*
16	*0D*	*BU*	*Internal Fault Basic Unit*	*Calculated O2 setpoint outside the permissible range*	*Check to see if correct values have been entered for the O2 setpoints. Readjust O2 trim control, if required, or repeat the settings*
16	*0E*	*BU*	*Internal Fault Basic Unit*	*Calculated O2 min. value outside the permissible range*	*Check to see if correct values have been entered for the O2 min. values. Readjust O2 trim control, if required, or repeat the settings*
16	*0F*	*BU*	*Internal Fault Basic Unit*	*Calculated O2 ratio value outside the permissible range*	*Check to see if the correct values have been entered for the O2 ratio values. Readjust O2 trim control, if required, or repeat the settings*
16	*03*	*BU*	*Internal Fault Basic Unit*	*The load / point number predefined by the AZL… lies outside the permissible range*	**1)*
16	*14*	*BU*	*Internal Fault Basic Unit*	*Calculated standardized value lies outside the permissible range*	*Check if the correct values have been entered for the standardized values. Readjust O2 trim control, if required, or repeat the settings*
16	*20*	*BU*	*Internal Fault Basic Unit*	*With hysteresis compensation: Permissible target positioning range exceeded*	**1)*
16	*21*	*BU*	*Internal Fault Basic Unit*	*The load / point number predefined by the AZL… lies outside the permissible range*	**1)*
16	*22*	*BU*	*Internal Fault Basic Unit*	*With a switch instruction, none of the defined cases was satisfied*	**1)*
16	*23*	*BU*	*Internal Fault Basic Unit*	*With the switch instruction, no defined ratio control phase has been identified*	**1)*

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
17	-	BU	Internal Fault Basic Unit	(Internal) communication error of ELV	*1)
17	*3F*	*BU*	*Internal Fault Basic Unit*	*Detection of different data when making the data comparison*	
17	*01*	*BU*	*Internal Fault Basic Unit*	*Timeout with program synchronization prior to data transmission*	
17	*02*	*BU*	*Internal Fault Basic Unit*	*Timeout with data transmission*	
17	*03*	*BU*	*Internal Fault Basic Unit*	*CRC fault during data transmission*	
18	-	BU	Invalid Curve Data	Invalid curve data	Checking the curve data for invalid entries: Valid load range: 0.0 % - 100.0 % Valid positioning range: 0.0° - 90.0° Valid speed range: 0.0 % - 100 % In the case of a deviation from the valid range when commissioning the unit: Readjustment to the valid value range. If fault occurs after the unit has previously worked correctly: Replace defective basic unit
19	#	SA	Internal Fault Actuator	Basic unit (ratio control system) has detected a fault when comparing potentiometer channels A and B. Diagnostic code shows on which actuator the fault occurred. See diagnostic code	If fault occurs sporadically: Improve EMC. If fault occurs constantly: Replace actuator (see diagnostic code)
19	*01..2F*	*SA*	*Internal Fault Actuator*	*The diagnostic value is made up of the following faults or their combinations (the individual diagnostic codes are added up in hexadecimal format)*	
19	*01*	*SA*	*Internal Fault Actuator*	*Fault occurred on the air actuator when comparing potentiometer channels A and B*	
19	*02*	*SA*	*Internal Fault Actuator*	*Fault occurred on the active fuel actuator when comparing potentiometer channels A and B*	

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
19	*04*	*SA*	*Internal Fault Actuator*	*Fault occurred on auxiliary actuator 1 when comparing potentiometer channels A and B*	
19	*08*	*SA*	*Internal Fault Actuator*	*Fault occurred on auxiliary actuator 2 when comparing potentiometer channels A and B*	
19	*20*	*SA*	*Internal Fault Actuator*	*Fault occurred on auxiliary actuator 3 when comparing potentiometer channels A and B*	
1A	1	BU	Slope too steep	Slope of curve section is too steep	Check curve data. If there is a slope greater than - 3.6° per 0.1 % (30 s ramp) - 1.8° per 0.1 % (60 s ramp) - 0.9° per 0.1 % (120 s ramp) load change between 2 curvepoints -> change load assignment of the curvepoints such that above condition will be satisfied
1B	#	BU	Operation in Parameter Setting Mode quit	Programming mode is still active in Phase 62 and the target positions (normal operation) have not been reached	When parameterizing the curve, the plant should be operated in manual mode with “Burner on“. This prevents the load controller from triggering the change to shutdown. Response of the TL can trigger the same action, however, but the value (curvepoint) currently handled can still be stored in standby or lockout
1C	#	BU	Ignition Pos not defined	The relevant ignition positions have not been parameterized	Set the ignition positions
1C	*01..3F*	*BU*	*Ignition Pos not defined*	*The diagnostic value is made up of the following faults or their combinations (the individual diagnostic codes are added up in hexadecimal format)*	
1C	*01*	*BU*	*Ignition Pos not defined*	*Ignition position of the air actuator*	
1C	*02*	*BU*	*Ignition Pos not defined*	*Ignition position of the active fuel actuator has not been parameterized*	
1C	*04*	*BU*	*Ignition Pos not defined*	*Ignition position of auxiliary actuator 1 has not been parameterized*	

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
1C	*08*	*BU*	*Ignition Pos not defined*	*Ignition position of auxiliary actuator 2 has not been parameterized*	
1C	*10*	*BU*	*Ignition Pos not defined*	*Ignition position of VSD has not been parameterized*	
1C	*20*	*BU*	*Ignition Pos not defined*	*Ignition position of auxiliary actuator 3 has not been parameterized*	
1D	#	BU		Running time fault of actuators / VSD.	Check the relevant actuators to see if they are mechanically overloaded. Check power supply to the actuators and their fuses. The actuator's ramp must be smaller to or equal to the ramp parameterized in the basic unit. The parameterized ramp of the VSD must be smaller than the ramp parameterized in the basic unit (recommendation: 20 %)
1D	*01..3F*	*BU*	*Fault Running Time*	*The diagnostic value is made up of the following faults or their combinations (the individual diagnostic codes are added up in hexadecimal format)*	
1D	*01*	*BU*	*Fault Running Time Air Actuator*	*Running time fault of air actuator*	
1D	*04*	*BU*	*Fault Running Time Aux Actuator*	*Running time fault of auxiliary actuator 1*	
1D	*08*	*BU*	*Fault Running Time Aux Actuator*	*Running time fault of auxiliary actuator 2*	
1D	*10*	*BU*	*Fault Running Time VSD*	*Running time fault of VSD*	
1D	*20*	*BU*	*Fault Running Time Aux Actuator*	*Running time fault of auxiliary actuator 3*	
1E	#	SA FuM	Special Pos not reached	Basic unit has detected that 1 / several actuators (incl. VSD module) has / have not reached the special position pertaining to the Phase	Check the relevant actuators to see if they are mechanically overloaded Check power supply to the actuators and their fuses
1E	*01..3F*	*SA*	*Special Pos not reached*	*The diagnostic value is made up of the following faults or their combinations (the individual diagnostic codes are added up in hexadecimal format)*	

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
1E	*01*	*SA*	*Special Pos not reached*	*Positioning fault of air actuator*	
1E	*02*	*SA*	*Special Pos not reached*	*Positioning fault of fuel actuator*	
1E	*04*	*SA*	*Special Pos not reached*	*Positioning fault of auxiliary actuator 1*	
1E	*08*	*SA*	*Special Pos not reached*	*Positioning fault of auxiliary actuator 2*	
1E	*10*	*FuM*	*Special Pos not reached*	*VSD has not reached the speed*	
1E	*20*	*SA*	*Special Pos not reached*	*Positioning fault of auxiliary actuator 3*	
1F	#	FuM	Code for VSD Module Fault	Basic unit has detected a fault in connection with the VSD module	If fault occurs sporadically: Check CAN bus wiring. Improve EMC. If fault occurs constantly: Replace the defective basic unit
1F	*01*	*FuM*	*Speed Acquisition faulty*	*Internal VSD module test was not successful*	
1F	*02*	*FuM*	*Wrong Direction of Rotation*	*Fan rotates in the wrong direction*	*Check to see if the motor's direction of rotation is correct.* *Check to see if the sensor disk on the motor is mounted the correct way.* *Change live conductor on the fan motor or check parameterized direction of rotation on the VSD and correct, if necessary*
1F	*03*	*FuM*	*Speed Acquisition faulty*	*Pulse sequence and length at the speed input were different from those anticipated*	*Check to see if sensor disk and speed sensor are correctly mounted.* *Check if the distance of the inductive sensor is correct.* *Check if the inductive sensor is correctly connected*
1F	*04*	*FuM*	*Standardization canceled because of VSD*	*Fan was not able to keep the standardized speed at a constant level*	*Check if motor runs.* *Check if the inductive sensor is correctly connected.* *Check if distance of inductive sensor is correct*
1F	*05*	*FuM*	*Standardization canceled because of Air Actuator*	*Air actuator has not reached the prepurge position. For this reason, speed standardization is not possible*	*Check to see if all air-influencing actuators travel to the prepurge position.* *Check to see if the relevant actuators are mechanically overloaded or replace defective actuator, if necessary.* *Check power supply to the actuators*
1F	*06*	*FuM*	*Speed Test was not successfully completed*	*Internal VSD module speed test was not successful*	

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
21	-	BU	Safety Loop open	Safety chain open	
22	-	BU	Internal Temp Limiter has responded	Internal TL has switched off because parameterized value has been exceeded	
23	-	BU	Extraneous Light on Startup	Basic unit has detected extraneous light during startup	
24	-	BU	Extraneous Light on Shutdown	Basic unit has detected extraneous light during shutdown	
25	-	BU	No Flame at End of Safety Time	No flame detected at the end of safety time ts1	
26	-	BU	Loss of Flame	Detection of loss of flame during operation	
27	-	BU	Air Pressure on	Air pressure = on, but should have been off	
28	-	BU	Air Pressure off	Air pressure = off, but should have been on	
29	-	BU	Fan Contactor Contact is on	FCC signal = on, but should have been off	
2A	-	BU	Fan Contactor Contact is off	FCC signal = off, but should have been on	
2B	-	BU	Flue Gas Recirculation Pressure Switch on	FGR-PS = on, but should have been on	
2C	-	BU	Flue Gas Recirculation Pressure Switch off	FGR-PS = off, but should have been on	
2D	-	BU	Valve not open	Closed Position Indicator (CPI) = on, but should have been off	
2D	*00*	*BU*	*Valve not open*	*Closed Position Indicator (CPI) = on, but should have been off*	
2D	*01*	*BU*	*Valve not open*	*(Only LMV52...) CPI via terminal StartRelease_Gas* *Closed Position Indicator (CPI) = on, but should have been off*	*Check the parameters or signal: DW-DK/CPI and StartRelease_Gas*
2E	-	BU	Valve or Closed Position Indicator (CPI) open	Closed Position Indicator (CPI) = on, but should have been off	

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
2E	*00*	*BU*	*Valve or Closed Position Indicator (CPI) open*	*Closed Position Indicator (CPI) = on, but should have been off*	
2E	*01*	*BU*	*Valve or Closed Position Indicator (CPI) open*	*(Only LMV52...) CPI via terminal StartRelease_Gas* *Closed Position Indicator (CPI) = on, but should have been off*	*Check the parameters or signal: DW-DK/CPI and StartRelease_Gas*
2F	-	BU	Gas Pressure has dropped below minimum Limit	Gas pressure < Min	
30	-	BU	Gas Pressure has exceeded maximum Limit	Gas pressure > Max	
31	-	BU	Gas Pressure w Valve proving: Valve on Gas Side leaking	Gas pressure VP = high	
32	-	BU	No Gas Pressure Valve Proving: Valve on Burner Side leaking	Gas pressure VP = low	
33	-	BU	Oil Pressure on although Oil Pump off	Oil pressure > Min	
34	-	BU	Oil Pressure below Minimum	Oil pressure < Min	
35	-	BU	Oil Pressure above Maximum	Oil pressure > Max	
36	-	BU	No Start Release for Oil	Start release oil = off	
37	-	BU	No direct Heavy Oil Start	Heavy oil direct start	
38	-	BU	Lack of Gas Program	Shortage-of-gas program in progress	
39	#	BU	Internal Fault Basic Unit	Parameter of max. safety time faulty	
39	*01*	*BU*	*Internal Fault Basic Unit*	*Fault with timer1*	
39	*02*	*BU*	*Internal Fault Basic Unit*	*Fault with timer2*	
39	*03*	*BU*	*Internal Fault Basic Unit*	*Fault with timer3*	
3A	-	BU	No Burner ID defined	No burner identification defined	Parameterize burner identification
3B	-	BU	No Service Password defined	No service password defined	Enter service password
40	-	BU	Internal Fault Basic Unit	Wrong contact position of SR relay	*1)
41	-	BU	Internal Fault Basic Unit	Wrong contact position of ignition	Check output wiring
42	#	BU	Internal Fault Basic Unit	Wrong contact position of BV relay	Check output wiring

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
42	*01..FF*	*BU*	*Internal Fault Basic Unit*	*The diagnostic value is made up of the following faults or their combinations (the individual diagnostic codes are added up in hexadecimal format)*	
42	*01*	*BU*	*Internal Fault Basic Unit*	*Contact position fault SV-oil*	
42	*02*	*BU*	*Internal Fault Basic Unit*	*Contact position fault V1-oil*	
42	*04*	*BU*	*Internal Fault Basic Unit*	*Contact position fault V2-oil*	
42	*08*	*BU*	*Internal Fault Basic Unit*	*Contact position fault V3-oil*	
42	*10*	*BU*	*Internal Fault Basic Unit*	*Contact position fault SV-gas*	
42	*20*	*BU*	*Internal Fault Basic Unit*	*Contact position fault V1-gas*	
42	*40*	*BU*	*Internal Fault Basic Unit*	*Contact position fault V2-gas*	
42	*80*	*BU*	*Internal Fault Basic Unit*	*Contact position fault V3-gas*	
43	#	BU		Fault in connection with plausibility check. For cause of fault, refer to diagnostic code	*1)
43	*01*	*BU*	*Internal Fault Basic Unit*	*No fuel selection*	
43	*02*	*BU*	*No Fuel Train defined*	*No defined fuel train parameterized*	
43	*03*	*BU*	*Internal Fault Basic Unit*	*Variable "Train" not defined*	
43	*04*	*BU*	*Internal Fault Basic Unit*	*Variable "Fuel" not defined*	
43	*05*	*BU*	*Internal Fault Basic Unit*	*Operating mode with LC not defined*	
43	*06*	*BU*	*Internal Fault Basic Unit*	*Prepurge time gas too short*	
43	*07*	*BU*	*Internal Fault Basic Unit*	*Prepurge time oil too short*	
43	*08*	*BU*	*Internal Fault Basic Unit*	*Safety time 1 gas too long*	
43	*09*	*BU*	*Internal Fault Basic Unit*	*Safety time 1 oil too long*	
43	*0A*	*BU*	*Internal Fault Basic Unit*	*Ignition off time > ts1 gas*	
43	*0B*	*BU*	*Internal Fault Basic Unit*	*Ignition off time > ts1 oil*	
43	*0C*	*BU*	*Internal Fault Basic Unit*	*Safety time 2 gas too long*	
43	*0D*	*BU*	*Internal Fault Basic Unit*	*Safety time 2 gas too long*	
44	#	BU		Fault at deactivated inputs	Deactivate input or do not connect
44	*01*	*BU*	*Controller connected but deactivated*	*Controller input connected but deactivated*	

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
44	*02*	*BU*	*Air Press Switch connected but deactivated*	*APS connected but deactivated*	
44	*03*	*BU*	*FCC / FGR – APS connected but deactivated*	*FCC / FGR – APS connected but deactivated*	
44	*04*	*BU*	*Gas Pressure min connected but deactivated*	*GP-Min connected but deactivated*	
44	*05*	*BU*	*Gas Pressure max connected but deactivated*	*GP-Max connected but deactivated*	
44	*06*	*BU*	*Oil Pressure min connected but deactivated*	*OP-Min connected but deactivated*	
44	*07*	*BU*	*Oil Pressure max connected but deactivated*	*OP-Max connected but deactivated*	
44	*08*	*BU*	*Start Signal Oil connected but deactivated*	*Start signal oil connected but deactivated*	
44	*09*	*BU*	*HO Start connected but deactivated*	*HO start connected but deactivated*	
44	*0A*	*BU*	*Start Signal Gas connected but deactivated*	*Start signal gas connected but deactivated*	
45	-	BU	Locked by SLT	Shutdown via SLT test	SLT was activated and safety shutdown was triggered (usually via the SLT)
46	#	BU	Programstop active	Program stop was activated. System has stopped at the parameterized position	Deactivate the program stop if no longer required
46	*01*	*BU*	*Programstop active*	*Program stop "STOP_DR_PREP" in Phase 24 active*	
46	*02*	*BU*	*Programstop active*	*Program stop "STOP_PREP2" in Phase 32 active*	
46	*03*	*BU*	*Programstop active*	*Program stop "STOP_DR_IGN" in Phase 36 active*	
46	*04*	*BU*	*Programstop active*	*Program stop "STOP_INTERV1" in Phase 44 active*	
46	*05*	*BU*	*Programstop active*	*Program stop "STOP_INTERV2" in Phase 52 active*	

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
46	*06*	*BU*	*Programstop active*	*Program stop "STOP_DR_POSTP" in Phase 72 active*	
46	*07*	*BU*	*Programstop active*	*Program stop "STOP_PREP2" in Phase 76 active*	
47	-	BU	No Start Release for Gas	Start release gas = off	
48	-	BU	2 Flame Signals with 1 Detector Operation	System parameterized for 1-detector operation but 2 flame signals present	
50	#	BU	Internal Fault Basic Unit	Fault during key value check	*1)
50	*00..07*	*BU*	*Internal Fault Basic Unit*	*Number of time block in which the fault was detected*	
51	#	BU	Internal Fault Basic Unit	Time block overflow	*1)
51	*00..07*	*BU*	*Internal Fault Basic Unit*	*Number of time block in which the fault was detected*	
52	#	BU	Internal Fault Basic Unit	Stack error	*1)
52	*01*	*BU*	*Internal Fault Basic Unit*	*Stack overflow*	
52	*02*	*BU*	*Internal Fault Basic Unit*	*Value dropped below preset minimum limit*	
52	*03*	*BU*	*Internal Fault Basic Unit*	*Test values in stack range exceeded*	
53	01	BU	Internal Fault Basic Unit	Faulty reset state has occurred	*1)
58	-	BU	Parameter Set damaged	Internal communication (uC1 <> uC2)	Reset the unit. ! Caution ! If fault occurred during parameterization: Check the parameters changed last. If fault cannot be rectified by the reset: Restore AZL… parameters. Otherwise, replace defective basic unit

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
59	#	BU	Parameter Set damaged	After initialization, EEPROM page is on ABORT (last parameterization was possibly interrupted due to a power failure)	Reset the unit. ! Caution ! If fault occurred during parameterization: Check the parameters changed last. If fault cannot be rectified by the reset: Restore AZL… parameters. Otherwise, replace defective basic unit.
59	#	*BU*	*Parameter Set damaged*	*Page number*	
5A	#	BU	Parameter Set damaged	CRC error of a parameter page	Reset the unit. ! Caution ! If fault occurred during parameterization: Check the parameters changed last. If fault cannot be rectified by the reset: Restore AZL… parameters. Otherwise, replace defective basic unit
5A	#	*BU*	*Parameter Set damaged*	*Page number*	
5B	#	BU	Parameter Set damaged	Page is on ABORT	Reset the unit. ! Caution ! If fault occurred during parameterization: Check the parameters changed last. If fault cannot be rectified by the reset: Restore AZL… parameters. Otherwise, replace defective basic unit
5B	#	*BU*	*Parameter Set damaged*	*Page number*	
5C	#	BU	Parameter Backup Restore	Page is on WR_RESTO A backup restore was made	Reset the unit.
5C	#	*BU*	*Parameter Backup Restore*	*Page number*	

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
5D	#	BU	Internal Fault Basic Unit	Page too long open	Reset the unit. ! Caution ! If fault occurred during parameterization: Check the parameters changed last. If fault cannot be rectified by the reset: Restore AZL… parameters. Otherwise, replace defective basic unit
5D	#	BU	*Internal Fault Basic Unit*	Page number	
5E	#	BU	Internal Fault Basic Unit	Page has an undefined status	Reset the unit. ! Caution ! If fault occurred during parameterization: Check the parameters changed last. If fault cannot be rectified by the reset: Restore AZL… parameters. Otherwise, replace defective basic unit
5E	#	*BU*	*Internal Fault Basic Unit*	*Page number*	
5F	-	BU	Parameter Set damaged	Last backup restore invalid (was interrupted)	Repeat backup restore
60	#	BU	Internal Fault Basic Unit	Fault when copying a parameter page	Reset the unit. ! Caution ! If fault occurred during parameterization: Check the parameters changed last. If fault cannot be rectified by the reset: Restore AZL… parameters. Otherwise, replace defective basic unit
60	#	*BU*	*Internal Fault Basic Unit*	*Number of parameter page*	
61	#	BU	Internal Fault Basic Unit	Fault in connection with EEPROM initialization	Reset the unit. ! Caution ! If fault occurred during parameterization: Check the parameters changed last. If fault cannot be rectified by the reset: Restore AZL… parameters. Otherwise, replace defective basic unit

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
61	*01*	*BU*	*Internal Fault Basic Unit*	*Fault during initialization of EEPROM*	
61	*02*	*BU*	*Internal Fault Basic Unit*	*Number of write attempts exceeded*	
61	*10*	*BU*	*Internal Fault Basic Unit*	*EEPROM was busy when accessed*	
61	*11*	*BU*	*Internal Fault Basic Unit*	*Comparison of EEPROM and RAM area revealed dissimilarity*	
61	*12*	*BU*	*Internal Fault Basic Unit*	*Page area of EEPROM exceeded during write process*	
61	*13*	*BU*	*Internal Fault Basic Unit*	*Access conflict µC1 <> µC2 (aritration)*	
61	*20*	*BU*	*Internal Fault Basic Unit*	*Fault when calling the "ParAccess()" function*	
61	*21*	*BU*	*Internal Fault Basic Unit*	*Written EEPROM block unequal RAM block*	
61	*22*	*BU*	*Internal Fault Basic Unit*	*CRC of page is faulty*	
61	*23*	*BU*	*Internal Fault Basic Unit*	*Matching fault µC1, µC2 when saving the error page*	
70	#	BU	Internal Fault Basic Unit	Fault during restoring of lockout information	*1)
70	*01*	*BU*	*Internal Fault Basic Unit*	*When reading from EEPROM (initialization)*	
70	*02*	*BU*	*Internal Fault Basic Unit*	*When test writing in the initialization*	
70	*03*	*BU*	*Internal Fault Basic Unit*	*No write access to error page in init.*	
70	*04*	*BU*	*Internal Fault Basic Unit*	*Rep. counter "Internal fault" has elapsed*	
71	-	BU	Manual Lockout	Lockout was made manually via contact	Lockout via the external reset / lockout contact is negated by new actuation
72	#	BU	Internal Fault Basic Unit	Plausibility fault in connection with fault entry	*1)
72	*01*	*BU*	*Internal Fault Basic Unit*	*Fault in "seterr()"*	
72	*02*	*BU*	*Internal Fault Basic Unit*	*Fault in "seterr()"*	
72	*03*	*BU*	*Internal Fault Basic Unit*	*Fault in "error_manager()"*	

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
72	*04*	*BU*	*Internal Fault Basic Unit*	*Fault in "storeerr()"*	
80	#	SA	Fault Feedback Aux Actuator 3	Basic unit has detected wrong state of the air actuator	If fault occurs sporadically: Improve EMC. If fault occurs constantly: Replace defective actuator
80	*01*	*SA*	*Fault Feedback Aux Actuator 3*	*CRC error*	
80	*02*	*SA*	*Fault Feedback Aux Actuator 3*	*Key error main loop counter*	
80	*03*	*SA*	*Fault Feedback Aux Actuator 3*	*No feedback for max. number*	
81	#	SA	Fault Feedback Air Actuator	Basic unit has detected wrong state of the air actuator	If fault occurs sporadically: Improve EMC. If fault occurs constantly: Replace defective actuator
81	01	SA	Fault Feedback Air Actuator	CRC error	
81	02	SA	Fault Feedback Air Actuator	*Key error main loop counter*	
81	03	SA	Fault Feedback Air Actuator	*No feedback for max. number*	
82	#	SA	Fault Feedback Gas (Oil) Actuator	Basic unit has detected wrong state of the gas actuator	If fault occurs sporadically: Improve EMC. If fault occurs constantly: Replace defective actuator
82	01	*SA*	*Fault Feedback Gas (Oil) Actuator*	*CRC error*	
82	02	*SA*	*Fault Feedback Gas (Oil) Actuator*	*Key error main loop counter*	
82	03	*SA*	*Fault Feedback Gas (Oil) Actuator*	*No feedback for max. number*	

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
83	#	SA	Fault Feedback Oil Actuator	Basic unit has detected wrong state of the oil actuator	If fault occurs sporadically: Improve EMC. If fault occurs constantly: Replace defective actuator
83	01	*SA*	*Fault Feedback Oil Actuator*	*CRC error*	
83	02	*SA*	*Fault Feedback Oil Actuator*	*Key error main loop counter*	
83	03	*SA*	*Fault Feedback Oil Actuator*	*No feedback for max. number*	
84	#	SA	Fault Feedback Aux Actuator 1	Basic unit has detected wrong state of the auxiliary actuator	If fault occurs sporadically: Improve EMC. If fault occurs constantly: Replace defective actuator
84	01	*SA*	*Fault Feedback Aux Actuator 1*	*CRC error*	
84	02	*SA*	*Fault Feedback Aux Actuator 1*	*Key error main loop counter*	
84	03	*SA*	*Fault Feedback Aux Actuator 1*	*No feedback for max. number*	
85	#	SA	Fault Feedback Aux Actuator 2	Basic unit has detected wrong state of the auxiliary actuator	If fault occurs sporadically: Improve EMC. If fault occurs constantly: Replace defective actuator
85	01	*SA*	*Fault Feedback Aux Actuator 2*	*CRC error*	
85	02	*SA*	*Fault Feedback Aux Actuator 2*	*Key error main loop counter*	
85	03	*SA*	*Fault Feedback Aux Actuator 2*	*No feedback for max. number*	
86	#	LC	Fault Feedback Load Controller	Basic unit has detected wrong state of the internal load controller	*1)

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
86	01	*LC*	*Fault Feedback Load Controller*	*CRC error*	
86	02	*LC*	*Fault Feedback Load Controller*	*Key error main loop counter*	
86	03	*LC*	*Fault Feedback Load Controller*	*No feedback for max. number*	
87	#	ABE	Fault Feedback AZL	Basic unit has detected wrong state of the AZL…	If fault occurs sporadically: Improve EMC. If fault occurs constantly: Replace the faulty ABE
87	01	*ABE*	*Fault Feedback AZL5...*	*CRC error*	
87	02	*ABE*	*Fault Feedback AZL5...*	*Key error main loop counter*	
87	03	*ABE*	*Fault Feedback AZL5...*	*No feedback for max. number*	
88	#	All		Plausibility fault NMT	If fault occurs sporadically: Improve EMC. If fault occurs constantly: Replace defective AZL…(see diagnostic code) or basic unit
88	01	*SA*	*Fault Feedback Actuator*	*Undefined fault class of SA*	
88	02	*LC*	*Fault Feedback Load Controller*	*Undefined fault class of LC*	
88	03	*ABE*	*Fault Feedback AZL*	*Undefined fault class of AZL*	
88	04	*FuM*	*Fault Feedback VSD Module*	*Undefined fault class of VSD module*	
88	05	*O2M*	*Fault Feedback O2 Module*	*Undefined fault class of O2 module*	
90	-	SA	Fault Feedback Aux Actuator 3	Basic unit has detected a ROM-CRC error on the air actuator when checking its feedback signal	If fault occurs sporadically: Improve EMC If fault occurs constantly: Replace defective actuator

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
91	-	SA	Fault Feedback Air Actuator	Basic unit has detected a ROM-CRC error on the air actuator when checking its feedback signal	If fault occurs sporadically: Improve EMC If fault occurs constantly: Replace defective actuator
92	-	SA	Fault Feedback Gas (Oil) Actuator	Basic unit has detected a ROM-CRC error on the gas actuator when checking its feedback signal	If fault occurs sporadically: Improve EMC If fault occurs constantly: Replace defective actuator
93	-	SA	Fault Feedback Oil Actuator	Basic unit has detected a ROM-CRC error on the oil actuator when checking its feedback signal	If fault occurs sporadically: Improve EMC If fault occurs constantly: Replace defective actuator
94	-	SA	Fault Feedback Aux Actuator 1	Basic unit has detected a ROM-CRC error on the auxiliary actuator when checking its feedback signal	If fault occurs sporadically: Improve EMC If fault occurs constantly: Replace defective actuator
95	-	SA	Fault Feedback Aux Actuator 3	Basic unit has detected a ROM-CRC error on the auxiliary actuator when checking its feedback signal	If fault occurs sporadically: Improve EMC If fault occurs constantly: Replace defective actuator
96	-	LC	Fault Feedback Load Controller	Basic unit has detected a ROM-CRC error on the load controller when checking its feedback signal	If fault occurs sporadically: Improve EMC If fault occurs constantly: Replace defective basic unit
97	-	ABE	Fault Feedback AZL	Basic unit has detected a ROM-CRC error on the AZL… when checking its feedback signal	If fault occurs sporadically: Improve EMC If fault occurs constantly: Replace defective AZL…
98	-	All	Fault two equal Addresses	There are several components with the same address on the CAN bus (CAN overflow)	Check to see if several users (e.g. actuators) with the same address are connected to the CAN bus and rectify (e.g. readdressing the actuators)

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
99	-	All	Internal Fault Basic Unit	CAN is in bus off	Check CAN cabling *1)
9A	-	All	Internal Fault Basic Unit	CAN warning level. Fault probably occurred when connecting or disconnecting a CAN bus user	Check CAN cabling *1)
9B	#	All	Internal Fault Basic Unit	CAN queue overrun	Check CAN cabling *1)
9B	*01*	*All*	*Internal Fault Basic Unit*	*Overrun of RX queue*	
9B	*02*	*All*	*Internal Fault Basic Unit*	*Overrun of TX queue*	
A0	#	SA		Auxiliary actuator 3 has detected a fault and reported it to the basic unit. Type of fault: See diagnostic code	If fault occurs sporadically: Improve EMC If fault occurs constantly: Replace defective actuator
A0	*See A1*	*See A1*	*See A1*	*See A1*	*See A1*
A1	#	SA		Air actuator has detected own fault and reported it to the basic unit. Type of fault: See diagnostic code	If fault occurs sporadically: Improve EMC If fault occurs constantly: Replace defective actuator
A1	*01*	*SA*	*Internal Fault Air Actuator*	*CRC fault during ROM test*	
A1	*02*	*SA*	*Internal Fault Air Actuator*	*CRC fault during RAM test*	
A1	*04*	*SA*	*Internal Fault Air Actuator*	*Fault during key value check*	
A1	*05*	*SA*	*Internal Fault Air Actuator*	*Error code for time block overflow*	
A1	*07*	*SA*	*Internal Fault Air Actuator*	*Sync fault or CRC fault*	
A1	*08*	*SA*	*Internal Fault Air Actuator*	*Error code for main loop counter*	
A1	*09*	*SA*	*Internal Fault Air Actuator*	*Fault during stack test*	
A1	*0C*	*SA*	*Overtemperature Air Actuator*	*Temperature warning and shutdown*	*Check housing temperature (max. 60 °C)*
A1	*0D*	*SA*	*Internal Fault Air Actuator*	*Actuator turns in the wrong direction*	

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
A1	*0E*	*SA*	*Ramp time too short Air Actuator*	*Actuator operates with too short a ramp time, or with an angular rotation that is too long for the ramp time*	*Recommendation:* *1. Match ramp time to the slowest actuator in the system (SQM48.4/6), OR* *2. Reduce the actuator's angular rotation between special positions (load stages with multistage operation) based on angular rotation* *= 90° * ramp time / (90°running time of SA)*
A1	*10*	*SA*	*Internal Fault Air Actuator*	*Timeout during A/D conversion*	
A1	*11*	*SA*	*Internal Fault Air Actuator*	*Fault during ADC test*	
A1	*12*	*SA*	*Internal Fault Air Actuator*	*Fault during A/D conversion*	
A1	*13*	*SA*	*Position Fault Air Actuator*	*Actuator is outside the valid angular rotation (0-90°) or linearization data are faulty*	*Check to see if actuator is within the valid positioning range (0-90°)*
A1	*15*	*SA*	*Internal Fault Air Actuator*	*CAN fault*	*Check CAN wiring*
A1	*16*	*SA*	*Internal Fault Air Actuator*	*CRC fault of a parameter page*	Check CAN wiring
A1	*17*	*SA*	*Internal Fault Air Actuator*	*Page too long open*	Reset the unit. ! Caution ! If fault occurred during parameterization: Check the parameters changed last. If fault cannot be rectified by the reset: Restore AZL… parameters. Otherwise, replace defective basic unit
A1	*18*	*SA*	*Internal Fault Air Actuator*	*Page disrupted*	*Reset the unit.* *! Caution ! If fault occurred during parameterization: Check the parameters changed last.* *If fault cannot be rectified by the reset: Restore AZL… parameters.* *Otherwise, replace defective basic unit*

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
A1	*19*	*SA*	*Internal Fault Air Actuator*	*Invalid parameter access*	*Reset the unit.* *! Caution ! If fault occurred during parameterization: Check the parameters changed last.* *If fault cannot be rectified by the reset: Restore AZL… parameters* *Otherwise, replace defective basic unit*
A1	*1B*	*SA*	*Internal Fault Air Actuator*	*Fault during copying of parameter page*	*Reset the unit.* *! Caution ! If fault occurred during parameterization: Check the parameters changed last.* *If fault cannot be rectified by the reset: Restore AZL… parameters.* *Otherwise, replace defective basic unit*
A1	*1E*	*SA*	*Internal Fault Air Actuator*	*External plausibility fault. This type of fault covers possible faults occurring due to invalid presettings in the drive commands. In response, the presettings will be ignored*	*Check the special positions to see if value range is valid (0-90°)*
A1	*1F*	*SA*	*Internal Fault Air Actuator*	*Internal plausibility fault. This type of fault covers possible faults that can occur due to strong EMC impact*	
A2	#	SA		Gas actuator has detected own fault and reported it to the basic unit. Type of fault: See diagnostic code	If fault occurs sporadically: Improve EMC. If fault occurs constantly: Replace defective actuator
A2	See A1	See A1	See A1	See A1	See A1
A3	#	SA		Oil actuator has detected own fault and reported it to the basic unit. Type of fault: See diagnostic code	If fault occurs sporadically: Improve EMC. If fault occurs constantly: Replace defective actuator
A3	See A1	See A1	See A1	See A1	See A1

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
A4	#	SA		Auxiliary actuator 1 has detected own fault and reported it to the basic unit. Type of fault: See diagnostic code	If fault occurs sporadically: Improve EMC. If fault occurs constantly: Replace defective actuator
A4	See A1	See A1	See A1	See A1	See A1
A5	#	SA		Auxiliary actuator 2 has detected own fault and reported it to the basic unit. Type of fault: See diagnostic code	If fault occurs sporadically: Improve EMC. If fault occurs constantly: Replace defective actuator
A5	See A1	See A1	See A1	See A1	See A1
A6	#	LC		Internal load controller has detected own fault and reported it to the basic unit. Type of fault: See diagnostic code	
A6	*10*	*LC*	*No actual Value Slope at End of Identification*		**1)*
A6	*12*	*LC*	*Adaption invalid*	*Invalid XP identified*	**1)*
A6	*13*	*LC*	*Adaption invalid*	*Invalid TN identified*	**1)*
A6	*14*	*LC*	*Adaption invalid*	*TU longer than identification time*	**1)*
A6	*15*	*LC*	*Adaption invalid*	*Invalid TN identified*	**1)*
A6	*16*	*LC*	*Timeout with Adaption*	*Timeout during observation time*	**1)*
A6	*17*	*LC*	*Cold Start thermal Shock Protection active*		**1)*
A6	*18*	*LC*	*Timeout with Adaption*	*Timeout during delivery of adaption rate and while process is being watched*	**1)*
A6	*22*	*LC*	*Setpoint Temp Controller above maximum Limit*		**1)*
A6	*30*	*LC*	*Internal Fault Load Controller*	*EEPROM does not respond within the expected period of time*	**1)*
A6	*31*	*LC*	Internal Fault Load Controller	*Max. number of EEPROM attempts exceeded*	**1)*
A6	*32*	*LC*	*Internal Fault Load Controller*	*Fault during opening of page*	**1)*

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
A6	*33*	*LC*	*Parameter Set damaged*	*Invalid CRC when reading a page*	*Reset the unit, repeat backup restore if necessary*
A6	*34*	*LC*	*Internal Fault Load Controller*	*Page cannot be set to FINISH*	**1)*
A6	*35*	*LC*	*Internal Fault Load Controller*	*No access to PID after identification*	**1)*
A6	*36*	*LC*	*Internal Fault Load Controller*	*No access to PIDStandard after identification*	**1)*
A6	*37*	*LC*	*Internal Fault Load Controller*	*No reading of EEPROM write access for PID possible*	**1)*
A6	*38*	*LC*	*Internal Fault Load Controller*	*No EEPROM write access for PID possible*	**1)*
A6	*39*	*LC*	*Internal Fault Load Controller*	*No EEPROM write access for PIDStandard possible*	**1)*
A6	*3A*	*LC*	*Internal Fault Load Controller*	*No access if reception via COM*	**1)*
A6	*3B*	*LC*	*Internal Fault Load Controller*	*Invalid page access*	**1)*
A6	*40*	*LC*	*Internal Fault Load Controller*	*Page too long open*	*Reset the unit.* *! Caution ! If fault occurred during parameterization: Check the parameters changed last.* *If fault cannot be rectified by the reset: Restore AZL… parameters.* *Otherwise, replace defective basic unit*
A6	*41*	*LC*	*Internal Fault Load Controller*	*Invalid phase during parameterization of the safety-related page P_TW*	**1)*
A6	*42*	*LC*	*Internal Fault Load Controller*	*Invalid phase during parameterization of the safety-related page P_STATUS*	**1)*
A6	*43*	*LC*	*Internal Fault Load Controller*	*Invalid phase during parameterization of the safety-related page P_SYSTEM*	**1)*

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
A6	*44*	*LC*	*Parameter Set damaged*	*Page has been set to ABORT*	*Reset the unit.* *! Caution ! If fault occurred during parameterization: Check the parameters changed last.* *If fault cannot be rectified by the reset: Restore AZL… parameters.* *Otherwise, replace defective basic unit*
A6	*45*	*LC*	*Parameter Backup Restore*	*Page has been set to RESTO*	*Reset the unit.* *! Caution ! If fault occurred during parameterization: Check the parameters changed last.* *If fault cannot be rectified by the reset: Restore AZL… parameters* *Otherwise, replace defective basic unit*
A6	*46*	*LC*	*Internal Fault Load Controller*	*Page has an invalid status*	*Reset the unit.* *! Caution ! If fault occurred during parameterization: Check the parameters changed last.* *If fault cannot be rectified by the reset: Restore AZL… parameters.* *Otherwise, replace defective basic unit*
A6	*4A*	*LC*	*Internal Fault Load Controller*	*CAN error*	**1)*
A6	*4B*	*LC*	*Internal Fault Load Controller*	*CAN error*	**1)*
A6	*4C*	*LC*	*Internal Fault Load Controller*	*CAN error*	**1)*
A6	*4D*	*LC*	*Internal Fault Load Controller*	*CAN error*	**1)*
A6	*4E*	*LC*	*Internal Fault Load Controller*	*CAN error*	**1)*
A6	*50*	*LC*	*Short-circuit Pt100 Sensor*	*Short-circuit sensor PT100 (X60.1 X60.4)*	*Check wiring and sensor*
A6	*51*	*LC*	*Open-circuit Pt100 Sensor*	*Open-circuit sensor PT100 (X60.1 X60.4)*	*Check wiring and sensor*
A6	*52*	*LC*	*Open-circuit Pt 100 Sensor (Line Compens)*	*Open-circuit compensation line of sensor PT100 (X60.2 X60.4)*	*Check wiring and sensor*

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
A6	*53*	*LC*	*Short-circuit Pt1000 Sensor*	*Short-circuit sensor PT1000 (X60.3 X60.4)*	*Check wiring and sensor*
A6	*54*	*LC*	*Open-circuit PT1000 Sensor*	*Open-circuit sensor PT1000 (X60.3 X60.4)*	*Check wiring and sensor*
A6	*55*	*LC*	*Short-circuit Ni1000 Sensor*	*Short-circuit sensor Ni1000 (X60.3 X60.4)*	*Check wiring and sensor*
A6	*56*	*LC*	*Open-circuit Ni1000 Sensor*	*Open-circuit sensor Ni1000 (X60.3 X60.4)*	*Check wiring and sensor*
A6	*57*	*LC*	*Overvoltage at Input 2*	*Overvoltage at input 2 (X61)*	*Check wiring and sensor*
A6	*58*	*LC*	*Open-circuit / Short-circuit at Input 2*	*Open-circuit / short-circuit input 2 (X61)*	*Check wiring and sensor*
A6	*59*	*LC*	*Overvoltage at Input 3*	*Overvoltage at input 3 (X62)*	*Check wiring and sensor*
A6	*5A*	*LC*	*Open-circuit / Short-circuit at Input 3*	*Open-circuit / short-circuit input 3 (X62)*	*Check wiring and sensor*
A6	*60*	*LC*	*Internal Fault Load Controller*	*Timeout during calibrate_ADC*	**1)*
A6	*61*	*LC*	*Internal Fault Load Controller*	*Timeout during read_conversion*	**1)*
A6	*62*	*LC*	*Internal Fault Load Controller*	*Timeout during calibrate_ADC*	**1)*
A6	*63*	*LC*	*Internal Fault Load Controller*	*Fault during RedInv reading from A/D converter*	**1)*
A6	*64*	*LC*	*Internal Fault Load Controller*	*Fault internal A/D converter*	**1)*
A6	*65*	*LC*	*Internal Fault Load Controller*	*Gain register has been changed*	**1)*
A6	*66*	*LC*	*Internal Fault Load Controller*	*Offset register has been changed*	**1)*
A6	*67*	*LC*	*Internal Fault Load Controller*	*Too great / small gain for self-calibration of A/D converter*	**1)*
A6	*68*	*LC*	*Internal Fault Load Controller*	*Too great / small offset for self-calibration of A/D converter*	**1)*
A6	*69*	*LC*	*Internal Fault Load Controller*	*Fault internal A/D converter*	**1)*
A6	*6A*	*LC*	*Internal Fault Load Controller*	*Fault during PWM test*	**1)*
A6	*6B*	*LC*	*Internal Fault Load Controller*	*Faulty reference voltage*	**1)*
A6	*6C*	*LC*	*Internal Fault Load Controller*	*Fault transmitter power supply*	**1)*
A6	*6D*	*LC*	*Internal Fault Load Controller*	*Fault analog output, voltage deviation too great*	**1)*
A6	*6E*	*LC*	*Internal Fault Load Controller*	*Fault during resistance test PT100 input (X60)*	**1)*

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
A6	*6F*	*LC*	*Internal Fault Load Controller*	*Fault during diode test PT100 input*	**1)*
A6	*70*	*LC*	*Internal Fault Load Controller*	*Measured value varies too much: PT100 sensor (X60)*	*Check wiring of input.*
A6	*71*	*LC*	*Internal Fault Load Controller*	*Measured value varies too much: PT100 line (X60)*	*Check wiring of input.*
A6	*72*	*LC*	*Internal Fault Load Controller*	*Measured value varies too much: PT1000 (X60)*	*Check wiring of input.*
A6	*73*	*LC*	*Internal Fault Load Controller*	*Measured value varies too much: PWM*	**1)*
A6	*74*	*LC*	*Internal Fault Load Controller*	*Measured value varies too much: Voltage measurement input 2 (X61)*	*Check wiring of input. Check input voltage value for humming voltages*
A6	*75*	*LC*	*Internal Fault Load Controller*	*Measured value varies too much: Current measurement input 2 (X61)*	*Check wiring of input. Check input voltage value for humming voltages*
A6	*76*	*LC*	*Internal Fault Load Controller*	*Measured value varies too much: Voltage measurement input 3 (X62)*	*Check wiring of input. Check input voltage value for humming voltages*
A6	*77*	*LC*	*Internal Fault Load Controller*	*Measured value varies too much: Current measurement input 3 (X62)*	*Check wiring of input. Check input voltage value for humming voltages*
A6	*78*	*LC*	*Internal Fault Load Controller*	*Excessive voltage value or wrong polarity PT100 sensor (X60)*	*Check wiring of input*
A6	*79*	*LC*	*Internal Fault Load Controller*	*Excessive voltage value or wrong polarity PT100 line (X60)*	*Check wiring of input*
A6	*7A*	*LC*	*Internal Fault Load Controller*	*Excessive voltage value or wrong polarity PT1000 (X60)*	*Check wiring of input*
A6	*7B*	*LC*	*Internal Fault Load Controller*	*Excessive voltage value or wrong polarity PWM*	**1)*
A6	*7C*	*LC*	Internal Fault Load Controller	*Excessive voltage value or wrong polarity voltage measurement input 2 (X61)*	*Check wiring of input. Check input voltage value*

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
A6	*7D*	*LC*	*Internal Fault Load Controller*	*Excessive voltage value or wrong polarity current measurement input 2 (X61)*	*Check wiring of input. Check input current value*
A6	*7E*	*LC*	*Internal Fault Load Controller*	*Excessive voltage value or wrong polarity voltage measurement input 3 (X62)*	*Check wiring of input. Check input voltage value*
A6	*7F*	*LC*	*Internal Fault Load Controller*	*Excessive voltage value or wrong polarity current measurement input 3 (X62)*	*Check wiring of input. Check input current value*
A6	*80*	*LC*	*Internal Fault Load Controller*	*Fault during internal muliplexer test PT100 sensor*	**1)*
A6	*81*	*LC*	*Internal Fault Load Controller*	*Fault during internal multiplexer test PT100 line*	**1)*
A6	*82*	*LC*	*Internal Fault Load Controller*	*Fault during internal multiplexer test PT100*	**1)*
A6	*90*	*LC*	*Internal Fault Load Controller*	*Number of maximum sync failures exceeded*	**1)*
A6	*91*	*LC*	*Internal Fault Load Controller*	*Wrong CRC during SYNC message*	**1)*
A6	*92*	*LC*	*Internal Fault Load Controller*	*Wrong CRC during PDO message*	**1)*
A6	*93*	*LC*	*Internal Fault Load Controller*	*Main loop counter does not agree with basic unit*	**1)*
A6	*96*	*LC*	*Internal Fault Load Controller*	*Fault during multiplexer test*	**1)*
A6	*97*	*LC*	*Internal Fault Load Controller*	*Paraccess with FINISH unsuccessful*	**1)*
A6	*9B*	*LC*	*Internal Fault Load Controller*	*Fault PageAccess, invalid access status*	**1)*
A6	*9C*	*LC*	*Internal Fault Load Controller*	*Fault voltage monitor test*	**1)*
A6	*9E*	*LC*	*Internal Fault Load Controller*	*Fault during readout of PDO message*	**1)*
A6	*A0*	*LC*	*Internal Fault Load Controller*	*XP smaller than min. value*	**1)*
A6	*A1*	*LC*	*Internal Fault Load Controller*	*XP larger than max. value*	**1)*
A6	*A2*	*LC*	*Internal Fault Load Controller*	*TN smaller than min. value*	**1)*
A6	*A3*	*LC*	*Internal Fault Load Controller*	*TN larger than max. value*	**1)*
A6	*A4*	*LC*	*Internal Fault Load Controller*	*TV smaller than min. value*	**1)*
A6	*A5*	*LC*	*Internal Fault Load Controller*	*TV larger than max. value*	**1)*

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
A6	*A6*	*LC*	*Internal Fault Load Controller*	*Parameter outside the permissible range*	**1)*
A6	*A7*	*LC*	*Inadmissible Selection aux Sensor Cold Start*	*Inadmissible selection of the auxiliary sensor*	*When using the auxiliary sensor for the cold start, a temperature or pressure sensor must be selected at input 2. Parameter: Sensor Selection (TempSensor, PressSensor)*
A6	*B0*	*LC*	*Internal Fault Load Controller*	*Red/Inv fault with float variables*	**1)*
A6	*B1*	*LC*	*Internal Fault Load Controller*	*Red/Inv fault of a Red/Inv variable*	**1)*
A6	*B2*	*LC*	*Internal Fault Load Controller*	*Fault during key value check*	**1)*
A6	*B4*	*LC*	*Internal Fault Load Controller*	*Fault in fault routine*	**1)*
A6	*B5*	*LC*	*Internal Fault Load Controller*	*Step to invalid interrupt vector*	**1)*
A6	*B6*	*LC*	*Internal Fault Load Controller*	*Time block too long: Time block 0*	**1)*
A6	*B7*	*LC*	*Internal Fault Load Controller*	*Time block too long: Time block 1*	**1)*
A6	*B8*	*LC*	*Internal Fault Load Controller*	*Time block too long: Time block 2*	**1)*
A6	*B9*	*LC*	*Internal Fault Load Controller*	*Time block too long: Time block 3*	**1)*
A6	*BA*	*LC*	*Internal Fault Load Controller*	*Time block too long: Time block 4*	**1)*
A6	*BB*	*LC*	*Internal Fault Load Controller*	*Time block too long: Time block 5*	**1)*
A6	*BC*	*LC*	*Internal Fault Load Controller*	*Time block too long: Time block 6*	**1)*
A6	*BD*	*LC*	*Internal Fault Load Controller*	*Time block too long: Time block 7*	**1)*
A6	*C0*	*LC*	*Internal Fault Load Controller*	*CRC fault in page*	**1)*
A6	*E0*	*LC*	*Internal Fault Load Controller*	*Identpower*	**1)*
A6	*E1*	*LC*	*Internal Fault Load Controller*	*Controller parameter KP*	**1)*
A6	*E2*	*LC*	*Internal Fault Load Controller*	*Scanning time*	**1)*
A6	*EA*	*LC*	*Internal Fault Load Controller*	*Invalid branch in eeprom module()*	**1)*
A6	*EB*	*LC*	*Internal Fault Load Controller*	*Invalid branch in eeprom module()*	**1)*
A6	*EC*	*LC*	*Internal Fault Load Controller*	*Invalid branch in eeprom module()*	**1)*
A6	*ED*	*LC*	*Internal Fault Load Controller*	*Invalid branch in eeprom module()*	**1)*
A6	*EE*	*LC*	*Internal Fault Load Controller*	*Invalid branch in eeprom module()*	**1)*

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
A6	*EF*	*LC*	*Internal Fault Load Controller*	*Invalid branch in eeprom module()*	**1)*
A6	*F0*	*LC*	*Internal Fault Load Controller*	*Fault during ROM test*	**1)*
A6	*F1*	*LC*	*Internal Fault Load Controller*	*Fault during RAM test*	**1)*
A6	*F2*	*LC*	*Internal Fault Load Controller*	*Fault during RAM test, register bank 0*	**1)*
A6	*F3*	*LC*	*Internal Fault Load Controller*	*Fault during RAM test, IDATA range*	**1)*
A6	*F4*	*LC*	*Internal Fault Load Controller*	*Fault during RAM test, XDATA range*	**1)*
A6	*F5*	*LC*	*Internal Fault Load Controller*	*Stack pointer does not point at stack*	**1)*
A6	*F6*	*LC*	*Internal Fault Load Controller*	*Stack overflow*	**1)*
A6	*FE*	*LC*	*Internal Fault Load Controller*	*Fault messages in fault management*	**1)*
A6	*FF*	*LC*	*Internal Fault Load Controller*	*Fault messages in fault management*	**1)*
A7	#	AZL		AZL5…has detected own fault and reported it to the basic unit. Type of fault: See diagnostic code	Observe instructions given below, and: If fault occurs sporadically: Improve EMC. If fault occurs constantly: Replace defective AZL…
A7	*01*	*AZL*	*Internal Fault AZL*	*CRC fault during ROM test*	
A7	*02*	*AZL*	*Internal Fault AZL*	*CRC fault during RAM test*	
A7	*04*	*AZL*	*Internal Fault AZL*	*Fault during key value check*	
A7	*05*	*AZL*	*Internal Fault AZL*	*Time block overflow*	
A7	*07*	*AZL*	*Internal Fault AZL*	*Sync fault or CRC fault*	
A7	*08*	*AZL*	*Internal Fault AZL*	*Fault main loop counter*	
A7	*09*	*AZL*	*Manual Lockout AZL*	*Fault message for emergency off function via AZL…*	
A7	*0A*	*AZL*	*Internal Fault AZL*	*Invalid AZL5… page*	
A7	*0B*	*AZL*	*>250,000 startups, service required*		
A7	*0C*	*AZL*	*Internal Fault AZL*	*Save fault parameter*	
A7	*0D*	*AZL*	*Menu for Oil. Current Fuel is Gas*	*Fuel changeover from oil to gas*	*Change to menu "GasSettings"*
A7	*0E*	*AZL*	*Menu for Gas. Current Fuel is Oil*	*Fuel changeover from gas to oil*	*Change to menu "OilSettings"*
A7	*15*	*AZL*	*Internal Fault AZL*	*CAN queue fault*	
A7	*16*	*AZL*	*Internal Fault AZL*	*CAN overflow fault*	
A7	*17*	*AZL*	*Internal Fault AZL*	*CAN busoff*	

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
A7	*18*	*AZL*	*Internal Fault AZL*	*CAN warning level*	
A7	*1A*	*AZL*	*Internal Fault AZL*	*EEPROM fault*	
A7	*1B*	*AZL*	*No valid Parameter Backup*	*Fault during copying of a parameter page*	*Reset the unit, repeat backup restore if necessary*
A7	*1C*	*AZL*	*Internal Fault AZL*	*Page in EEPROM was disrupted, has been restored*	
A7	*20*	*AZL*	*Internal Fault AZL*	*Display fault*	
A7	*22*	*AZL*	*Internal Fault AZL*	*RTC is locked, permanently busy*	
A7	*24*	*AZL*	*Internal Fault AZL*	*Buffer for page copies too small*	
A7	*28*	*AZL*	*Internal Fault AZL*	*Time stamp could not be sent*	
A7	*30*	*AZL*	*Fault Communication eBUS*	*Fault in connection with eBUS communication*	
A7	*38*	*AZL*	*Internal Fault AZL*	*Interface mode could not be terminated*	
A7	*40*	*AZL*	*Communication AZL with PC tool*	*Parameterization fault PC tool. Disclosed by key value check in AZL*	
A7	*88*	*AZL*	*Internal Fault AZL*	*RAM fault with redundant inverse variables*	
A7	*89*	*AZL*	*Internal Fault AZL*	*Program run fault, execution of program code that will probably never be executed*	
A7	*8A*	*AZL*	*Internal Fault AZL*	*Unintentional watchdog reset*	
A9	#	FuM	Fault VSD Module	VSD module has detected own fault and reported it to the basic unit. Type of fault: See diagnostic code	
A9	*01*	*FuM*	*Internal Fault VSD Module*	*CRC fault during ROM test*	**1)*
A9	*02*	*FuM*	*Internal Fault VSD Module*	*CRC fault during RAM test*	**1)*
A9	*04*	*FuM*	*Internal Fault VSD Module*	*Fault during key value check*	**1)*
A9	*05*	*FuM*	*Internal Fault VSD Module*	*Error code for time block overflow*	**1)*
A9	*07*	*FuM*	*Internal Fault VSD Module*	*Sync fault or CRC fault*	**1)*
A9	*08*	*FuM*	*Internal Fault VSD Module*	*Error code for main loop counter*	**1)*

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
A9	*09*	*FuM*	*Internal Fault VSD Module*	*Fault during stack test*	**1)*
A9	*0A*	*FuM*	*Internal Fault VSD Module*	*Max IRQ speed reached*	*Possibly interference on the line to the speed sensor, check cable routing, use shielding* **1)*
A9	*0C*	*FuM*	*Alarm from VSD*	*VSD reports a fault to the VSD module*	*Fault has been triggered by the VSD.* *Read VSDs error code.* *Check VSD settings (ramps, motor settings), increase ramp time on VSD and basic unit, if necessary.* *Check combination VSD / motor size*
A9	*0D*	*FuM*	*Control Range Limitation VSD Module*	*VSD module could not offset speed differential within its control limits*	*Check to see if the current interfaces of VSD and VSD module use the same setting (0/4...20 mA).* *Standardize the speed.* *!! Note !!* *After standardizing the speed -> check setting of combustion mixture !*
A9	*0E*	*FuM*	*Internal Fault VSD Module*	*Fault during the speed calculation test*	**1)*
A9	*15*	*FuM*	*Internal Fault VSD Module*	*CAN bus fault, disturbed CAN bus transmissions*	*If fault occurs sporadically: Check CAN bus wiring.* *Improve EMC.* *Check terminating resistors and correct, if necessary*
A9	*16*	*FuM*	*Internal Fault VSD Module*	*CRC fault of a parameter page*	*Reset the unit.* *! Caution ! If fault occurred during parameterization: Check the parameters changed last.* *If fault cannot be rectified by the reset: Restore AZL… parameters.* *Otherwise, replace defective basic unit*

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
A9	*17*	*FuM*	*Internal Fault VSD Module*	*Page too long open*	*Reset the unit.* *! Caution ! If fault occurred during parameterization: Check the parameters changed last.* *If fault cannot be rectified by the reset: Restore AZL… parameters.* *Otherwise, replace defective basic unit*
A9	*18*	*FuM*	*Internal Fault VSD Module*	*Page disrupted*	*Reset the unit.* *! Caution ! If fault occurred during parameterization: Check the parameters changed last.* *If fault cannot be rectified by the reset: Restore AZL… parameters.* *Otherwise, replace defective basic unit.*
A9	*19*	*FuM*	*Internal Fault VSD Module*	*Invalid access to parameters*	*Reset the unit.* *! Caution ! If fault occurred during parameterization: Check the parameters changed last.* *If fault cannot be rectified by the reset: Restore AZL… parameters.* *Otherwise, replace defective basic unit*
A9	*1B*	*FuM*	*Internal Fault VSD Module*	*Fault when copying a parameter page*	*Reset the unit.* *! Caution ! If fault occurred during parameterization: Check the parameters changed last.* *If fault cannot be rectified by the reset: Restore AZL… parameters.* *Otherwise, replace defective basic unit*
A9	*1E*	*FuM*	*Internal Fault VSD Module*	*External plausibility fault. This type of fault covers possible faults occurring due to invalid presettings in the drive commands. In response, the presettings will be ignored*	*Check the special positions for valid value range (0-100 %)*

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
A9	*1F*	*FuM*	*Internal Fault VSD Module*	*Internal plausibility fault. This type of fault detects faults that cannot practically occur...*	**1)*
AB	#	O2M	Fault O2 Module	The O2 module has detected own fault and reported it to the basic unit	
AB	*01*	*O2M*	*Internal Fault O2 Module*	*CRC fault during ROM test*	**2)*
AB	*02*	*O2M*	*Internal Fault O2 Module*	*CRC fault during RAM test*	**2)*
AB	*04*	*O2M*	*Internal Fault O2 Module*	*Fault during key value check*	**2)*
AB	*05*	*O2M*	*Internal Fault O2 Module*	*Error code for time block overflow*	**2)*
AB	*07*	*O2M*	*Internal Fault O2 Module*	*Sync fault or CRC fault*	**2)*
AB	*08*	*O2M*	*Internal Fault O2 Module*	*Error code for main loop counter*	**2)*
AB	*09*	*O2M*	*Internal Fault O2 Module*	*Fault during stack test*	**2)*
AB	*0A*	*O2M*	*Internal Fault O2 Module*	*Feedback values invalid*	**2)*
AB	*10*	*O2M*	*Unplaus Value Nernst Voltage O2 Module*	*Nernst voltage outside the valid range*	*Check the connection (correct polarity, short-circuit)*
AB	*12*	*O2M*	*Unplaus Value Thermocouple O2 Module*	*Thermocouple voltage outside the valid range*	*Check connections (polarity, short-circuit, open-circuit).* *Check power supply to the O2 module.* *Check fuse F2 on the O2 module.* *Check heating control on the QGO.*
AB	*13*	*O2M*	*Unplaus Value Compensation Element*	*Compensation element voltage outside the valid range*	*Check connections (polarity, short-circuit, open-circuit).* *Check housing temperature of the QGO (temperature inside -25°C..120°C)*
AB	*15*	*O2M*	*Unplaus Value Flue Gas Temp O2 Module*	*Temperature of combustion air sensor outside the valid range (-20...+400 °C)*	*Check connections (short-circuit, open-circuit).* *Check ambient temperature*
AB	*16*	*O2M*	*Unplaus Value Flue Gas Temp O2 Module*	*Temperature of flue gas sensor outside the valid range (-20...+400 °C)*	*Check connections (short-circuit, open-circuit).* *Check ambient temperature*
AB	*17*	*O2M*	*Internal Fault O2 Module*	*Fault during combustion air temperature sensor test*	**2)*
AB	*18*	*O2M*	*Internal Fault O2 Module*	*Fault during thermocouple test*	**2)*
AB	*19*	*O2M*	*Internal Fault O2 Module*	*Fault during compensation element test*	**2)*
AB	*1A*	*O2M*	*Internal Fault O2 Module*	*Fault during channel comparison of O2 signal*	**2)*

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
AB	*1B*	*O2M*	*Internal Fault O2 Module*	*Fault ADC test voltages*	**2)*
AB	*20*	*O2M*	*O2 Sensor Temp too low*	*Temperature of QGO measuring cell too low*	*Check mains power supply on O2 module.* *Check fuse F2 on O2 module.* *Check connection between O2 module and QGO heating*
AB	*21*	*O2M*	*O2 Sensor Temp too high*	*Temperature of QGO measuring cell too high*	*Check QGO temperature*
AB	*22*	*O2M*	*Internal Fault O2 Module*	*Fault during calculation test*	**2)*
AB	*23*	*O2M*	*Unplaus Value Ri 02 Measuring Cell*	*Measured internal resistance of the QGO measuring cell is smaller than 5 Ohm or greater than 150 Ohm*	*Check electrical connection (polarity, short-circuit).* *If fault occurs after more than 1 year, QGO may have reached the end of its service life -> replace*
AB	*24*	*O2M*	*Response Time O2 Measuring Cell too long*	*Measured response time of the QGO measuring cell exceeds 5 s*	*Check mounting position of QGO.* *Check to see if QGO is dirty.* *If error occurs after more than 1 year, QGO may have reached end of its service life -> replace*
AB	*25*	*O2M*	*O2 Sensor Test aborted by O2 Module*	*Fault occurred during O2 sensor test*	*Check fluctuations of the O2 value*
AB	*30*	*O2M*	*Internal Fault O2 Module*	*CAN fault*	**2)*
AB	*31*	*O2M*	*Internal Fault O2 Module*	*CRC fault of a parameter page*	*Reset the unit.* *! Caution ! If fault occurred during parameterization: Check the parameters changed last.* *If fault cannot be rectified by the reset: Restore AZL5... parameters.* *Otherwise, replace defective O2 module*
AB	*32*	*O2M*	*Internal Fault O2 Module*	*Page too long open*	*Reset the unit.* *! Caution ! If fault occurred during parameterization: Check the parameters changed last.* *If fault cannot be rectified by the reset: Restore AZL5... parameters.* *Otherwise, replace defective O2 module*

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
AB	*33*	*O2M*	*Internal Fault O2 Module*	*Page disrupted*	*Reset the unit.* *! Caution ! If fault occurred during parameterization: Check the parameters changed last.* *If fault cannot be rectified by the reset: Restore AZL5... parameters.* *Otherwise, replace defective O2 module*
AB	*34*	*O2M*	*Internal Fault O2 Module*	*Invalid access to parameters*	*Reset the unit.* *! Caution ! If fault occurred during parameterization: Check the parameters changed last.* *If fault cannot be rectified by the reset: Restore AZL5... parameters.* *Otherwise, replace defective O2 module*
AB	*38*	*O2M*	*Internal Fault O2 Module*	*Fault during copying of a parameter page*	*Reset the unit.* *! Caution ! If fault occurred during parameterization: Check the parameters changed last.* *If fault cannot be rectified by the reset: Restore AZL5... parameters.* *Otherwise, replace defective O2 module*
AB	*3E*	*O2M*	*Internal Fault O2 Module*	*External plausibility fault.* *This type of fault covers possible faults occurring due to invalid presettings in the drive commands. In response, the presettings will be ignored*	*Reset the unit.* *! Caution ! If this fault occurred during parameterization: Check the parameters changed last.* *If fault cannot be rectified by the reset: Restore AZL5... parameters.* *Otherwise, replace defective O2 module*
AB	*3F*	*O2M*	*Internal Fault O2 Module*	*Internal plausibility fault.* *This type of fault covers possible errors that cannot practically occur*	**2)*
B0	#	BU		Fault during test of port outputs	*1)
B0	*01*	*BU*	*Internal Fault Basic Unit*	*Fault when resetting the set outputs*	

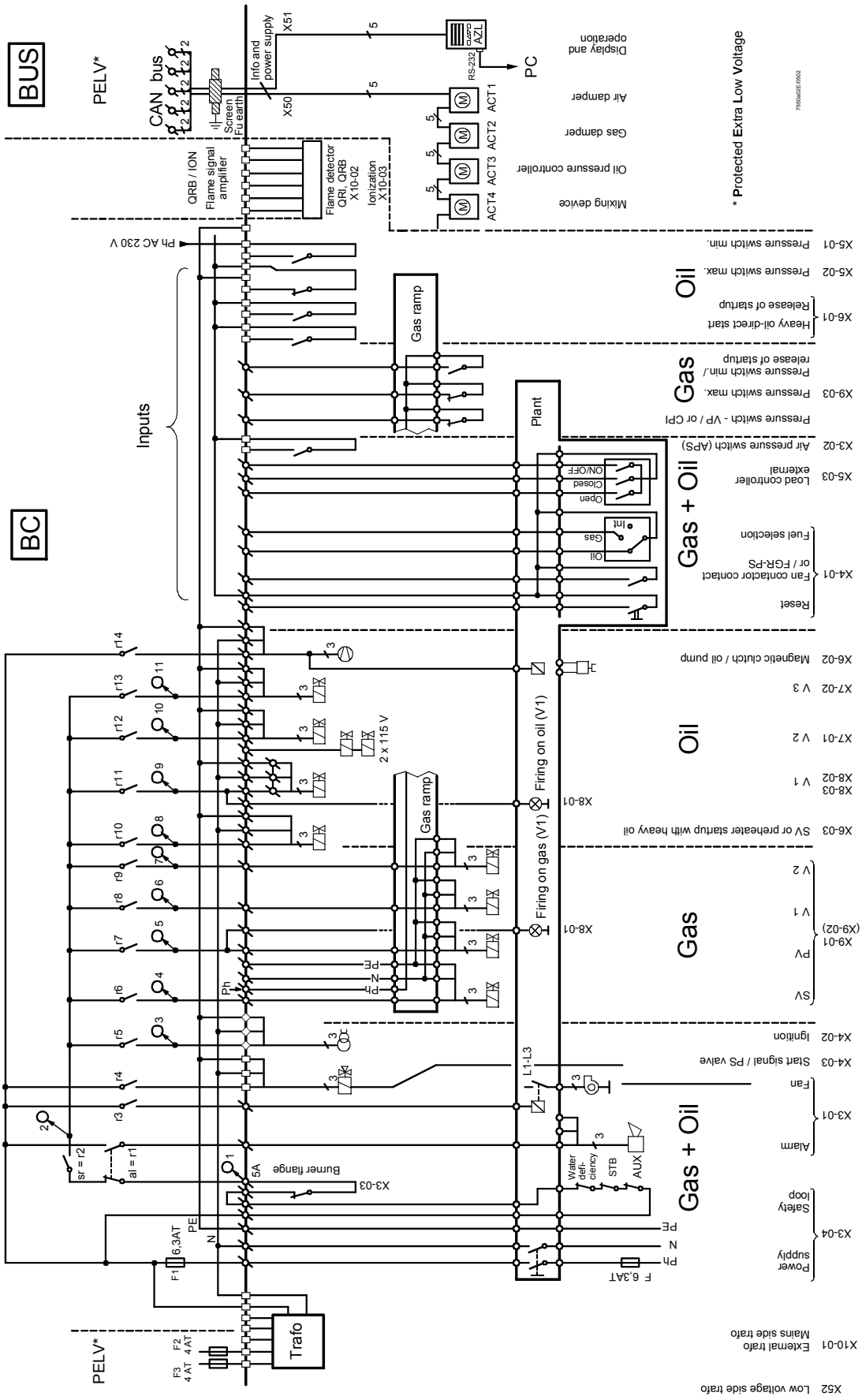
Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
B0	*02*	*BU*	*Internal Fault Basic Unit*	*Fault during ZR test*	
B1	01	BU	Internal Fault Basic Unit	Fault during short-circuit test between inputs and outputs	*1)
B5	#	BU		O2 monitor	*1)
B5	*01*	*BU*	*Below O2 Min Value*	*O2 value has dropped below O2 min. value*	*Check setting of the ratio curve.* *Increase interval between O2 setpoint and O2 min. value*
B5	*02*	*BU*	*O2 Min Values undefined*	*Invalid O2 min. value*	*Define all O2 min. values*
B5	*03*	*BU*	*O2 Setpoints undefined*	*Invalid O2 setpoint*	*Define all O2 setpoints*
B5	*04*	*BU*	*O2 Delay Time undefined*	*Invalid O2 delay time*	*Adaption at curvepoint 2 or at the highest curvepoint has not been made. Set these curvepoints*
B5	*05*	*BU*	*Actual O2 Value invalid*	*No valid actual O2 value in operation for >= 3 s*	*O2 module and O2 sensor must be correctly connected.* *Mains power supply to the QGO must be connected*
B5	*06*	*BU*	*O2 Value Prepurging not reached*	*During prepurging, the parameterized air oxygen content of +-2 % was not reached*	*At the end of prepurging, the parameterized "O2 content air" must be reached.* *Prepurging may not be sufficiently long for the air to reach the O2 content in the flueways.* *The value must have been parameterized at an air oxygen content of 20.9 %.* *If fault occurs after more than 1 year, QGO may have reached the end of its service life -> replace*
B5	*07*	*BU*	*O2 Value in Operation too high*	*O2 value of 15 % in operation was exceeded*	*Check mechanical and electrical mounting of the QGO sensor*
BA	01	BU	O2 Sensor Test aborted	O2 sensor test was not successful. E.g. reset of O2 module during probe test	*2)
BF			O2 Control and Limiter automate deactivated	Fault occurred in connection with O2 trim control or with the O2 monitor. It led to automatic deactivation of O2 trim control or the O2 monitor	The fault history shows the reason for switching off just before the "BF" fault

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
C5	#	#	Version Conflict	When comparing the versions of the individual units, the AZL5... has detected old versions	Before replacing any units, start the system and wait about 1 minute (until, after entering the parameter level, the display “Parameters will be updated“ disappears). Then, make a reset. Replace the unit only if the fault message does not disappear. Replace the relevant units by new versions
C5	*01..2F*	*#*	*Version Conflict*	*The diagnostic value is made up of the following faults or their combinations (the individual diagnostic codes are added up in hexadecimal format)*	
C5	*01*	*BU*	*Version Conflict*	*Software of the basic unit too old*	*Replace basic unit*
C5	*02*	*LC*	*Version Conflict*	*Software of the load controller too old*	*Replace basic unit*
C5	*04*	*ABE*	*Version Conflict*	*Software of the AZL5... too old*	*Replace AZL5... or update its software*
C5	*08*	*SA*	*Version Conflict*	*Software of 1 or several actuators too old*	*Replace actuator*
C5	*10*	*FuM*	*Version Conflict*	*Software of VSD module too old*	*Replace basic unit*
C5	*20*	*O2*	*Version Conflict*	*Software of O2 module too old*	*Replace O2 module*
D1	#	FuM	Fault Feedback VSD Module	Basic unit has detected a wrong state of the VSD module. Corresponds to the "8x"-faults with the other CAN users	If fault occurs sporadically: Improve EMC. If fault occurs constantly: Replace defective module
D1	01	FuM	Fault Feedback VSD Module	*CRC error*	
D1	02	FuM	Fault Feedback VSD Module	*Key error main loop counter*	
D1	03	FuM	Fault Feedback VSD Module	*No feedback for max. number*	

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
D3	#	O2	Fault Feedback O2 Module	Basic unit has detected a wrong stage of the O2 module	If fault occurs sporadically: Improve EMC. If fault occurs constantly: Replace defective module
D3	01	*O2*	*Fault Feedback O2 Module*	*CRC error*	
D3	02	*O2*	*Fault Feedback O2 Module*	*Key error main loop counter*	
D3	03	*O2*	*Fault Feedback O2 Module*	*No feedback for max. number*	
E1	-	FuM	Fault Feedback VSD Module	Basic unit has detected a ROM-CRC fault in the VSD module when checking its feedback signal	If fault occurs sporadically: Improve EMC. If fault occurs constantly: Replace defective module
E3	-	O2	Fault Feedback O2 Module	Basic unit has detected a ROM-CRC fault in the O2 module when checking its feedback signal	If fault occurs sporadically: Improve EMC. If fault occurs constantly: Replace defective module
F0	-	BU	Internal Fault Basic Unit	Plausibility fault during calculation of interpolation values	*1)
F1	#	BU	Internal Fault Basic Unit	Internal fault during calculation of precontrol	Check curve setting, check fuel parameters depending on the selected type of fuel
F1	01	*BU*	*Internal Fault Basic Unit*		
F1	02	*BU*	*Internal Fault Basic Unit*		
F1	03	*BU*	*Internal Fault Basic Unit*		
F1	04	*BU*	*Internal Fault Basic Unit*		
F1	05	*BU*	*Internal Fault Basic Unit*		
F1	06	*BU*	*Internal Fault Basic Unit*	*Internal fault calculation of precontrol. Undefined value in the curves used for the calculation*	

Error code	Diagnostic code	Device	Display	Meaning for the LMV5x system	Troubleshooting
F1	07	*BU*	*Internal Fault Basic Unit*	*Internal fault calculation of precontrol. Undefined value for a type of fuel parameter*	
F2	#	BU		Code for faulty temperature values from O2 module when calculating the air rate change	
F2	*07*	*BU*	*Internal Fault Basic Unit*	*O2 module has delivered invalid value*	
F2	*08*	*BU*	*Flue Gas Temp too high*	*Flue gas temperature outside the permissible value range*	*Set permissible flue gas temperature to a higher level*
F2	*0A*	*BU*	*QGO in Heating-up Phase*	*QGO probe not yet sufficiently heated up*	*Wait until probe has reached its operating temperature*
F3	01	BU	Missing or faulty Control Parameters	PID parameter for controller algorithm missing	Check controller parameters
					*1) If fault occurs sporadically: Improve EMC. If fault occurs constantly: Replace defective module
					*2) If fault occurs sporadically: Improve EMC. If fault occurs constantly: Replace defective module

16 Addendum 2: Connection diagram



17 Addendum 3: Variable speed drive (VSD) module

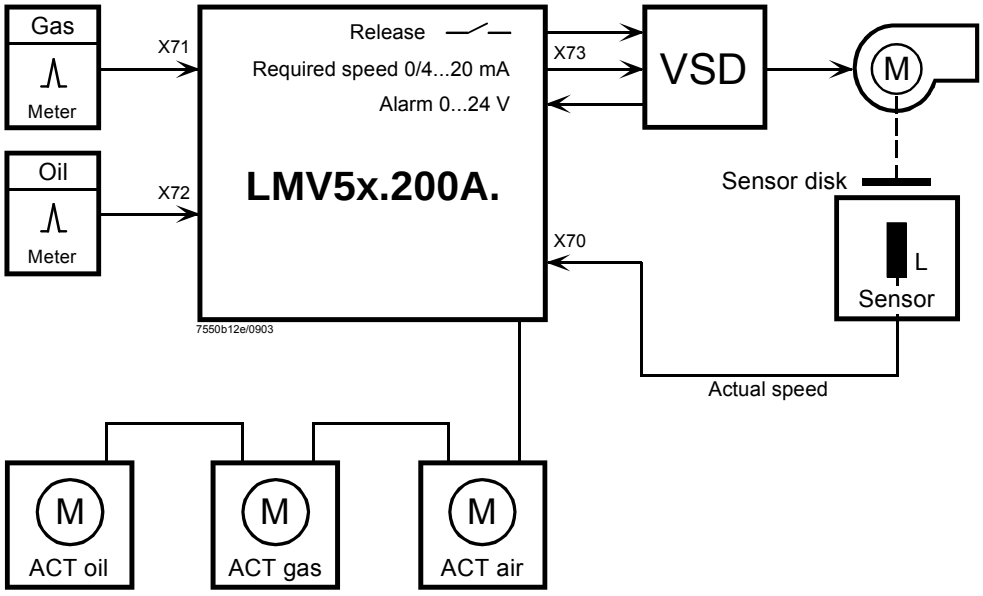
(Only for use with the LMV5x.200 and AZL51.XXB)

General

The VSD module is an extension to the LMV5... burner control system and is used for the control of VSD that ensure safety-related supervision of the fan speed.

2 fuel meters (oil and gas) can be connected as an option.

Basic diagram



LMV51... Configuration of the basic unit (BU)

The auxiliary actuator can be parameterized on the basic unit, depending on the type of fuel burnt. The function offers 2 choices: Air damper or VSD.

Parameter: *Aux Actuator (deactivated / activeDamper / active VSD)*

The «Damper» configuration corresponds to the previous function of the LMV51.000A2 and LMV51.100A2.

If «VSD active» is configured, it is used in place of the auxiliary actuator. This means that with all curve and position settings, «Auxiliary» refers to the VSD.

Owing to the system characteristics of the LMV51.2..., VSD operation always demands an air damper.

This means that an LMV51.2... system must be equipped with at least one fuel actuator, one air actuator and one VSD («VSD active»).

LMV52... configuration of the basic unit (BU)

On the LMV52.200..., the VSD option can be selected in addition to the actuators.

Parameter: *VSD (deactivate / activate / air influen)*

Here, it is also selected whether the VSD shall be used in connection with O2 trim control.

17.1 VSD module (VSD-M)

General

A VSD can be connected to the VSD module integrated in the LMV5x.2...

The VSD is controlled via an analog current output and a potential-free release contact.

Evaluation of the alarm feedback signal from the VSD is accomplished with a 0...24 V output. When activated, the LMV5x.2... will enter the safety phase.

Both motor speed and direction of rotation are acquired by an inductive sensor. The asymmetric speed signal is checked for direction of rotation and plausibility.

The VSD module generates acceleration and deceleration ramps in accordance with the parameters settings made on the LMV5x.2...

The motor speed is adjusted according to the same principle as that used with actuator adjustments.

The VSD module of the LMV5x.2... controls the motor speed to the setpoint. The control range is limited to +15 % / -10 %.

If control range limitation becomes active, an appropriate display appears on the AZL5...

If that is the case over a longer period of time (→ «Safety Time Ratio Control»), the LMV5x.2... will be shut down and the message «Special Position not reached» or «Speed not reached» will appear.

Speed control is active for speeds ≥ 8 %.

17.1.1 Inputs / outputs

Connection diagram

MOTOR SPEED INPUT FUEL COUNTER INPUT FREQUENCY CONVERTER

Release contact X73-1 / -2

The LMV5x.2... has a potential-free release contact for the VSD. This contact will be activated when a motor speed other than zero is required.

Voltage:	≤ AC / DC 24 V (protective extra low-voltage)
Current:	5 mA to 2 A

Alarm input X73-3

The alarm input of the LMV5x.2... will be connected to the alarm output of the VSD. In the event of an alarm, safety shutdown will be triggered as a minimum requirement.

Voltage active:	DC 12...24 V	(alarm ON)
Voltage inactive:	< DC 4 V	(alarm OFF)

Analog output to the VSD X73-4

This output is used for delivering the preselected speed setpoint to the VSD.

Current:	0 / 4...20 mA ≈ 0...105 % (→ «Standardization of Speed»)
Output load:	max. 750 Ω (burden), short-circuit-proof
Resolution:	0,1 %
Cross-sectional area of wire:	≥ 0,1 mm^2

Speed feedback signal

The motor's speed can be acquired with different types of sensors. To detect the motor's direction of rotation with a sensor, a sensor disk with angular steps of 60°, 120° and 180° is used. The sensor disk generates pulse intervals of different length.

Note

Acquisition of speed is safety-related!

We recommend to use the accessory set AGG5.310.

To enable the acquired speed to be standardized to the range of 0...100 %, the speed that corresponds to 100 % must be parameterized (→ «Standardization of speed»).

Speed input X70

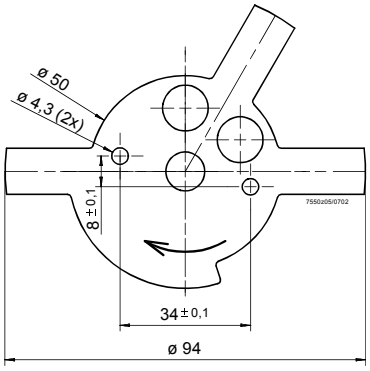
Motor speed:	300...6300 1 / min
100 % speed:	1350...6300 1/ min
Sensor:	Inductive sensor to DIN 19234 or open collector (pnp)
	U_{CEsat} < 4 V, U_{CEmin} > DC 15 V
Power supply:	DC 10 V, max.15 mA
Switching current:	> 10 mA
Cable length:	max. 100 m (sensor line must be run **separately**!)

Safe segregation between mains voltage and protective extra low-voltage

All inputs and outputs of the VSD module comply with the requirements for protective extra low-voltage. Hence, the mains voltage section must strictly be segregated!

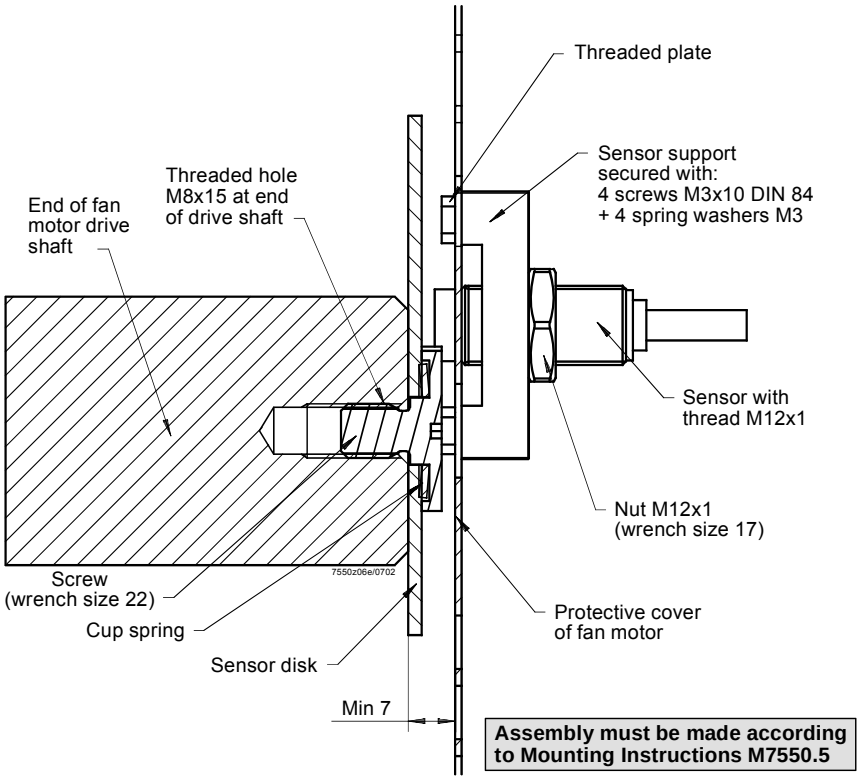
Sensor disk

Sensor disk and speed sensor can be ordered in the form of accessory set AGG5.310.



Number of protrusions:	3
Angular steps:	60°, 120°, 180°
Accuracy:	± 2°

Speed sensor



Selection of fan motor

1. Motor supplier: Version **with** threaded hole M8x15
2. Standard motor plus extra machining (drilling hole and cutting thread M8x15)

Fuel meter

To acquire the amount of fuel consumed, up to 2 fuel meters can be connected. Assignment to the type of fuel is fixed.

To adapt to different types of fuel meters, assignment of the number of pulses and the resulting fuel throughput must be parameterized.

Fuel meter input X71 / X72

Type of sensor:	inductive sensor to DIN 19234 (Namur) or open collector (pn) with U_{CEsat} < 4 V, U_{CEmin} > DC 15 V or Reed contact
Frequency:	≤ 300 Hz
Pulses / l or gal, m^3:	≤ 9999.9999 (to be parameterized)
Pulses / ft^3:	≤ 999.99999 (to be parameterized)
Power supply:	DC 10 V, max. 15 mA
Switching current:	> 10 mA

17.1.2 Configuration of VSD

The VSD must be configured in accordance with the type of motor connected.

The times set for the acceleration and deceleration ramps must be shorter than the times of the ramps parameterized for the LMV5x.2... with electronic fuel / air ratio control.

Example: Ramp of 10 seconds ⇒ VSD ramps to be set to 7 seconds.

The motor must be able to follow the parameterized VSD ramp.

If this is not observed, the predefined speeds will not be reached within the respective periods of time.

The configuration of the current / voltage interfaces of the VSD must be in accordance with the configuration of the LMV5x.2... VSD module.

17.1.3 Configuration of speed acquisition

The speed sensor to be used must be an inductive sensor (Namur or open collector (pnp) (refer to subsection 15.1.1). The motor speed is acquired with an asymmetric sensor disk having 3 protrusions spaced at 60°, 120° and 180° respectively. The number of protrusions must be appropriately parameterized. The sensor disk is to be fitted such that the pulse intervals are generated in the direction of rotation as described.

Parameter: *Num Puls per R*

Since the different types of motors have different maximum speeds, the VSD module must know the speed that corresponds to 100 %.

Standardization

Since the standardized speed is difficult to adjust – but the correct adjustment has a great impact on the control performance of the VSD module – an automatic measurement function has been implemented.

Parameter: *Standard (deactivated / activated)*

When this function is activated, the air actuator will be driven to the prepurge position first. The air actuator's prepurge position should be adjusted such that the air damper is fully open.
This action can be watched on the menu «Ratio Control» → «Settings» → «Gas / Oil» → «Curve Parameters»
Then, the VSD will be controlled at 95 %. A reserve of 5 % is left, enabling the VSD module to safely reach the 100 % speed in situations where environmental conditions may change. Once the motor speed has stabilized, that speed will then be standardized. In other words, that speed will represent 100 %. That speed can be read using parameter «StandardizedSp».

Parameter: *StandardizedSp*

«StandardizedSp» should not be parameterized manually.

Note

If, based on the steps described above, the burner's rated output cannot be reached (the fan is controlled at 47.5 Hz), proceed as follows:

- Set the maximum frequency to 105.2 % of the motor's nominal speed
  This means that at a motor frequency of 50 Hz:
  Parameterize the maximum frequency of the VSD to 50 Hz • 1.052 = 52.6 Hz (on the VSD)
- Then, standardize

This standardization cannot lead to motor overloads since only 95 % of the maximum control signal is delivered during standardization and the actual speed will be controlled later in operation and monitored with «Safety time ratio control». Frequencies between 50 and 52.6 Hz are delivered only if this is necessary to reach the required speed due to increased load.

If automatic speed standardization is activated, or if the standardized speed is changed, the burner must be readjusted! Any change to the standardized speed changes the assignment between the parameterized percentages on the curves and the speed.

Settling time

If oscillations occur during extensive running times, the settling time between acceleration ramp and speed measurement can be extended to overcome the problem.

Parameter: *Settling Time (in x • 25 ms)* → Value of 16 means 16 • 25 ms = 400 ms (0.4 s)

17.1.4 Configuration of current interface

The VSD is controlled via a current interface which can be switched from 0...20 mA to 4...20 mA, or vice versa.

Parameter: *Analog Output (0...20 mA / 4...20 mA)*

Note

If the VSD requires an input signal of DC 0...10 V, a resistor of 500 Ω ±1 % must be connected parallel to its input.

17.1.5 Configuration of fuel meter

The module can be used with fuel meters having a Namur or Reed output or open collector (pnp).

To be able to adapt the module to different types of meters, the number of pulses corresponding to a volume unit must be parameterized in the system.

The setting requires 4 or 5 decimal points. If one of these values shall be changed, the following setting procedure is required on the following menu:

«Params & Display» → «VSD Module» → «Configuration» → «Fuel Meter» → «Pulse Value **Gas**» or

«Params & Display» → «VSD Module» → «Configuration» → «Fuel Meter» → «Pulse Value **Oil**»

The pointer indicates the unit to be selected (1 m^3 / 1ft^3)

Pulse value gas

P	**u**	**l**	**s**	**e**	**V**	**a**	**l**	**u**	**e**	**G**	**a**	**s**			
C	**u**	**r**	**r**	**:**				**3**	**.**	**0**	**0**	**0**	**0**		
1	**m**	**3**		**=**				**3**	**.**	**0**	**0**	**0**	**0**		

The proposed unit can be changed with **SELECT**.

When pressing **ENTER**, the pointer jumps to the first position of the display section with the numbers.

P	**u**	**l**	**s**	**e**	**V**	**a**	**l**	**u**	**e**	**G**	**a**	**s**			
C	**u**	**r**	**r**	**:**				**3**	**.**	**0**	**0**	**0**	**0**		
1	**m**	**3**		**=**				**3**	**.**	**0**	**0**	**0**	**0**		

SELECT can be used to change the digit with the highest value of the numerical number, or **ENTER** can be pressed to switch to the next digit.

After selecting the last decimal place and pressing **ENTER**, the value will be adopted.

After selecting the last decimal place and pressing **ENTER**, the value will be adopted.

Pulse value oil

The setting procedure for «Pulse Value Oil» is the same as that for «Pulse Value Gas», the selectable units being 1 l or 1 gal.

17.1.6 Fuel meter readings

The VSD module ascertains the cumulated gas or oil throughout. For each type of fuel, there is one resettable and one nonresettable meter available.

Parameter: *Volume Gas*
Parameter: *Volume Oil*
Parameter: *Volume Gas R*
Parameter: *Volume Oil R*

When resetting the fuel meters, the reset date will be stored.

Parameter: *Reset DateGas*
Parameter: *Reset DateOil*

The system continuously calculates the throughput of the selected type of fuel. The calculation time is dynamic and reaches from 1 to 10 seconds.

If the meter delivers no pulse for 10 seconds, the throughput displayed will be «0». This means that with minimum throughput, the sensor's pulse frequency should be a minimum of 0.1 Hz.

The display is smoothed.

The maximum frequency is 300 Hz when fuel throughput is at its maximum.

Parameter: *Curr Flow Rate*

17.1.7 Process data

In its operating position, the VSD module records data that show how well the system components work together (LMV5x.2..., VSD module, VSD, motor and BU).

These data can only be read.

The «Maximum static deviation» indicates the greatest speed deviation that occurred during a drive command in modulating operation.

Parameter: *Max Stat Dev*

The «Maximum dynamic deviation» indicates the greatest speed deviation between the ramp predefined by the VSD module and the measured speed. This information is only relevant in multistage operation.

Parameter: *Max Dyn Dev*

In addition, the number of «static deviations» > 0.3 % or > 0.5 % will be counted. This gives the number of speed deviations above 0.3 % or 0.5 % that occurred during a drive command.

The number of deviations > 0.5 % also corresponds to the number of correcting cycles.

Parameter: *Num Dev >0.3%*
Parameter: *Num Dev >0.5%*

The process data will only be stored in RAM, which means that they will be reset via reset or lockout reset.

17.2 Differences to LMV51.200... and LMV51.000 / LMV51.100

6.3.1 Menu structure

Special functions
Curve settings for electronic ratio control

Selection of 1) will take you to:
Selection menu «GasSettings»

Only the data associated with the currently active type of fuel can be parameterized.

SpecialPositions	1)
CurveParam	2)
LoadLimits	3)
AuxActuator	4)

Selection of 1) (*Home Pos, Prepurge Pos*...), 3) and 4) will take you to the standard parameterizations of the specified parameters.

Selection of 4) will take you to:
Standard parameterization «Auxiliary Actuator»

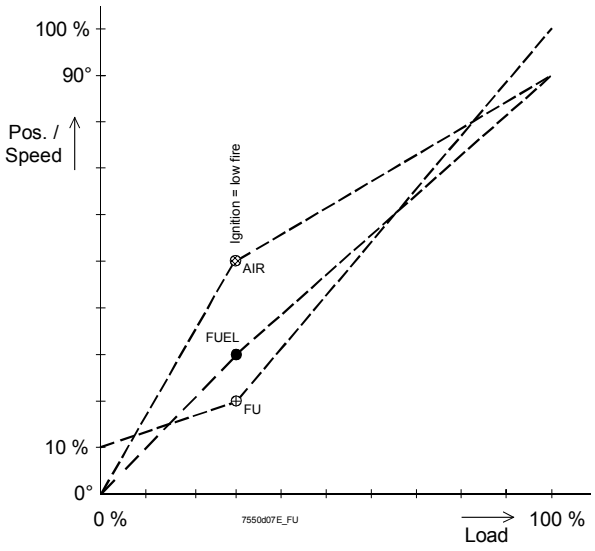
Here, the function of the auxiliary actuator can be separately selected for each type of fuel: deactivated / activeDamper / VSD active.

AuxActuator
Curr:deactivated
New:[ ]VSD activat

With «VSD active», the VSD takes the place of the auxiliary actuator (menus «Aux Actuator», «Auxiliary»). The available setting values reach from 0 to 100 %.

6.3.2 Changes when setting ratio control via manual control

The system extrapolates the VSD to a minimum speed of **10 %** and a maximum speed of 100 %.



Change of load / position resulting from an automatically entered point

17.3 EMC: LMV5... system – VSD

The functional and EMC tests of the LMV5... system were conducted and successfully completed with the following types of VSD:

Siemens Landis & Staefa: - SED2-1.5 / 35 B

Danfoss: - VT2807

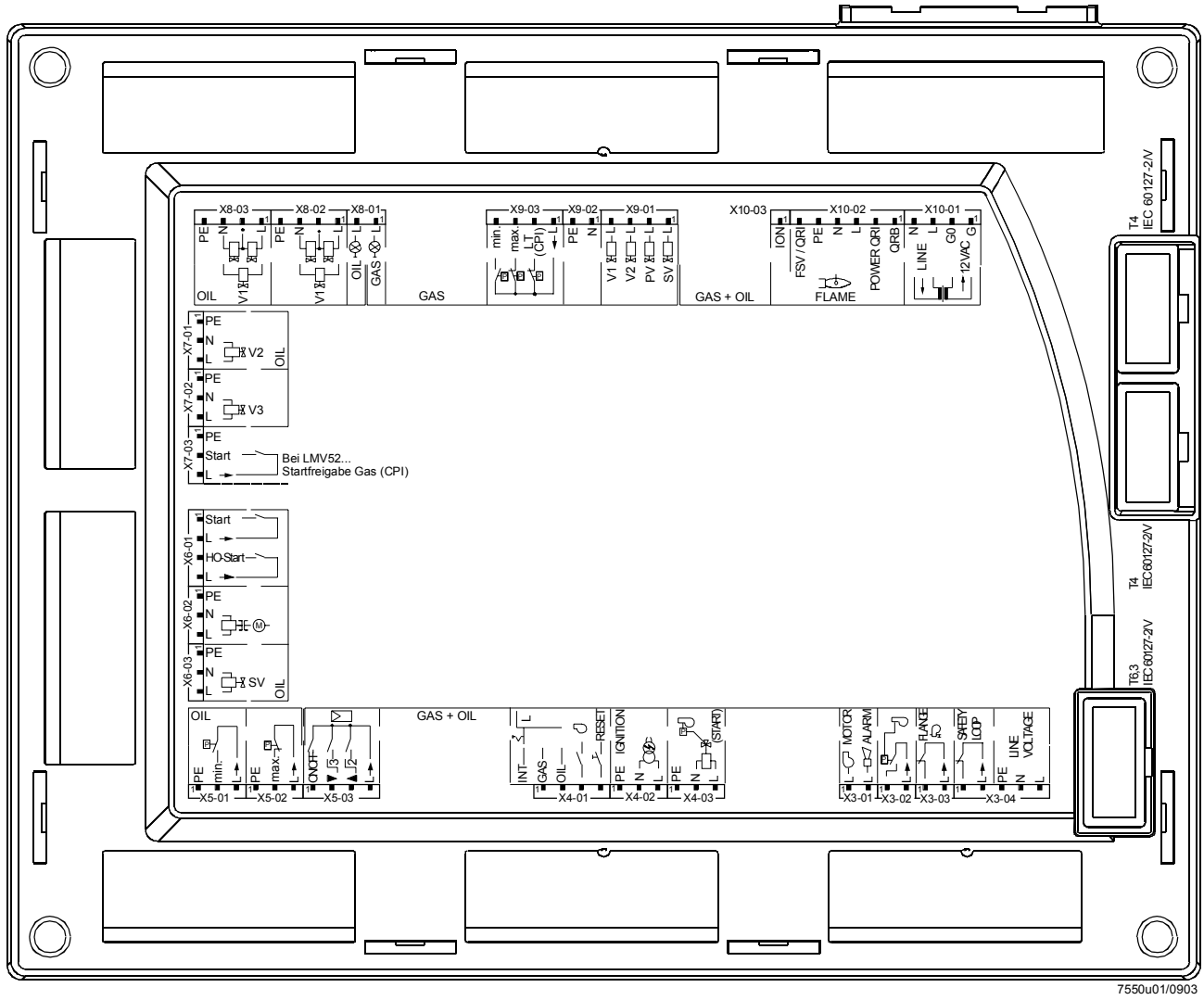
In operation, VSDs produce electromagnetic interference. For this reason - to ensure EMC of the entire system - the instructions provided by the manufacturers must be observed:

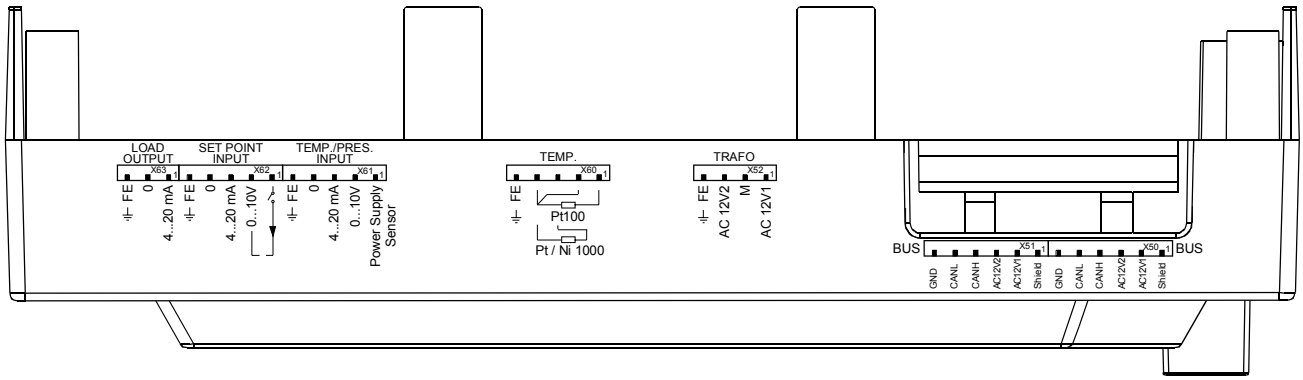
Siemens Landis & Staefa: - Operating Instructions
→ EMC-compatible installation

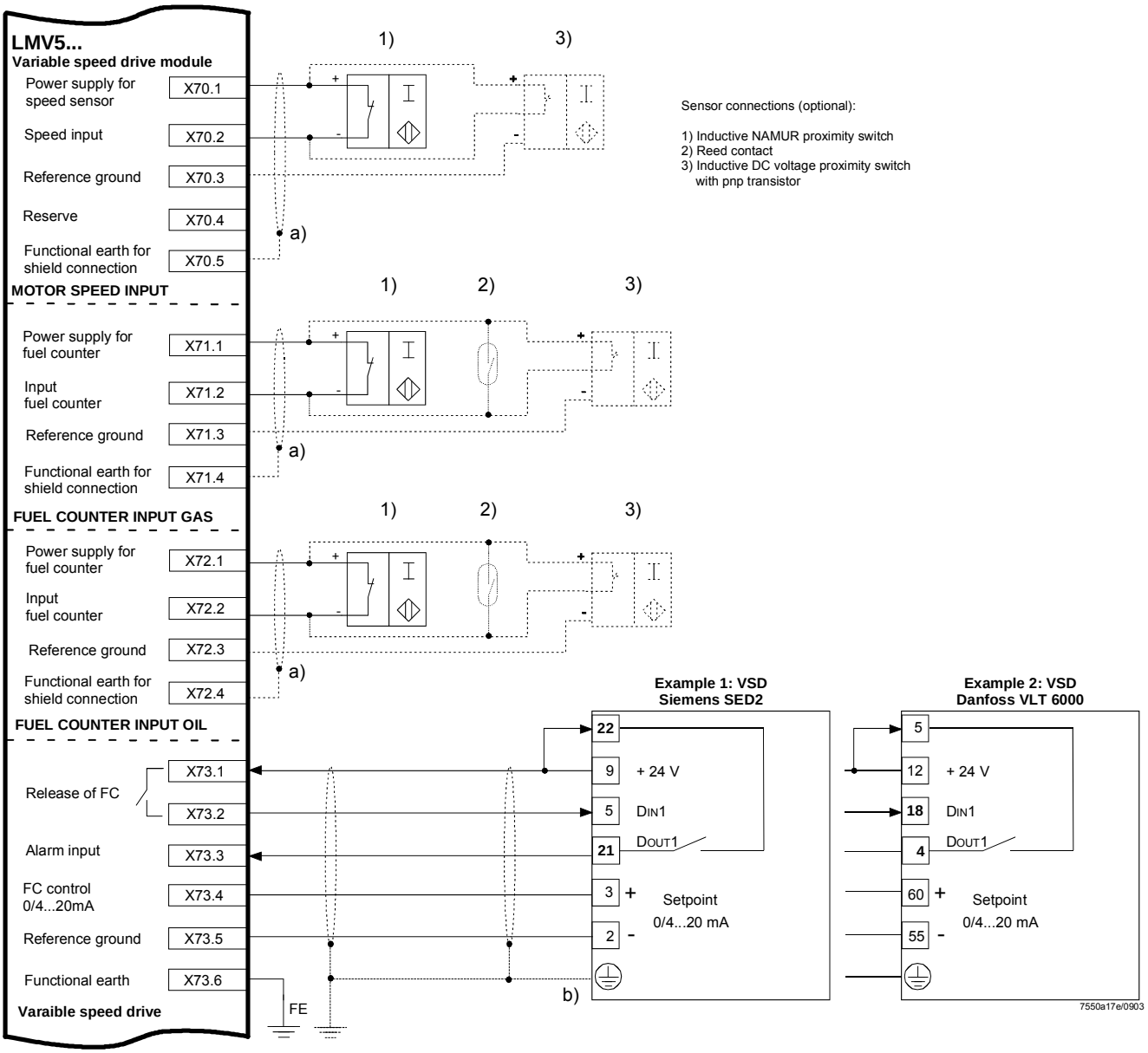
Danfoss:
- Technical Brochure → Radio Interference Suppression Filters
- Data Sheet of Danfoss EMC filter for long motor cables

When using other types of VSD, compliance with EMC regulations and correct functioning are not ensured!

17.4 Connection terminals



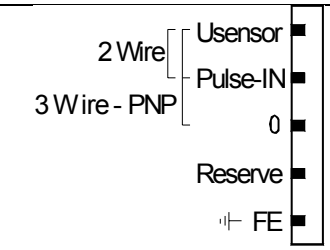
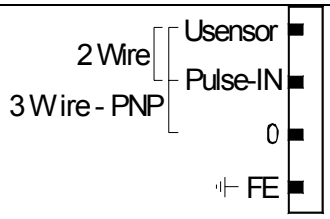
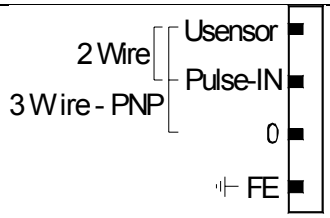
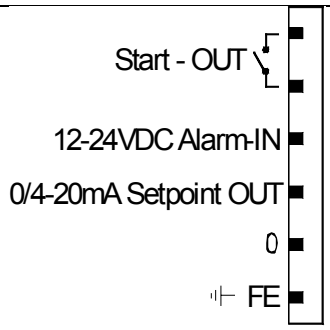




Shielding:

a) + b)	Optional shield connection for rough environmental conditions
b)	For shielding the cables on the VSD, refer to the following pieces of documentation: • Siemens SED2 VSD Commissioning Instructions (CM1G5192en), chapters 4 and 7, or • Danfoss Operating Instructions VLT 6000 (MG60A703), chapter «Installation»

17.5 Description of the connection terminals for the variable speed drive module

Terminal designation	Connection symbol		Input	Output	Description	Electrical rating
X70		PIN1		x	Power supply for speed sensor	approx. DC 10 V max. 45 mA
		PIN2	x		Speed input	
		PIN3		x	Reference ground	
		PIN4			Reserve	
		PIN5	x		Functional earth for shield connection	
X71		PIN1		x	Power supply for fuel meter	approx. DC 10 V max. 45 mA
		PIN2	x		Fuel meter input gas	
		PIN3		x	Reference ground	
		PIN4	x		Functional earth for shield connection	
X72		PIN1		x	Power supply for fuel meter	approx. DC 10 V max. 45 mA
		PIN2	x		Fuel meter input oil	
		PIN3		x	Reference ground	
		PIN4	x		Functional earth for shield connection	
X73		PIN1		x	Reference contact	max. AC / DC 24 V max. 2 A
		PIN2		x	Release contact	
		PIN3	x		Alarm input	DC 0...24 V
		PIN4		x	0 / 4...20 mA control of variable speed drive	0...20 mA RLmax = 750 Ω
		PIN5		x	Reference ground	
		PIN6	x		Functional earth	

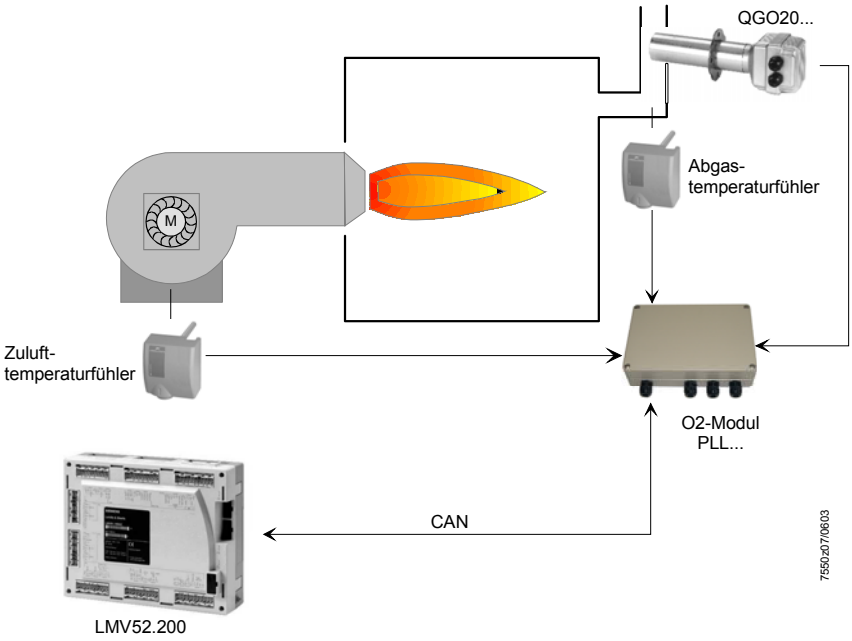
18 Addendum 4: LMV52... with O2 trim control and O2 module

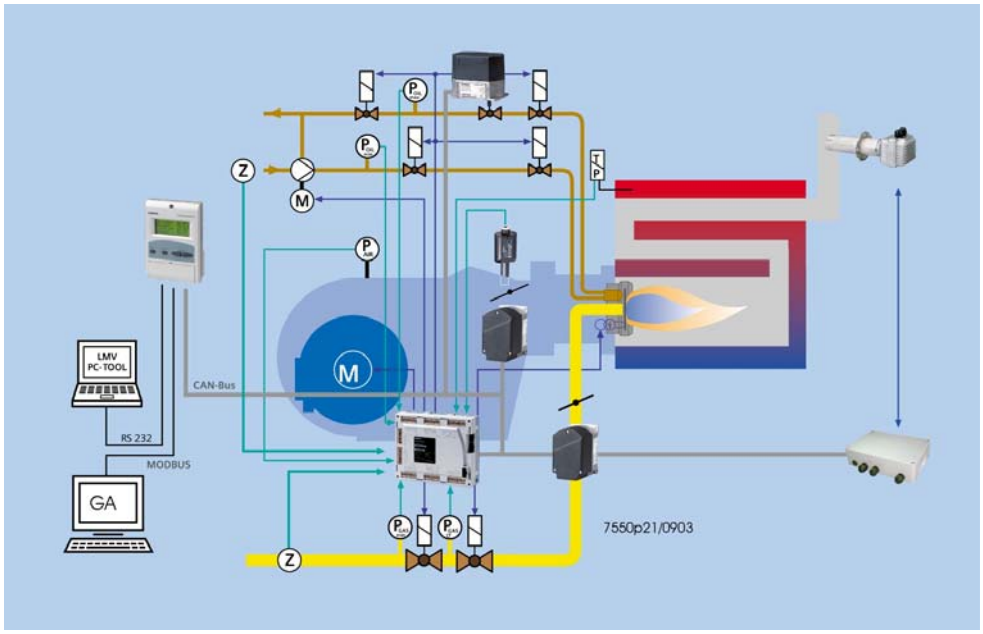
18.1 General

The LMV52... system is an extended LMV51... system. A special feature of the LMV52… is improved boiler efficiency owing to control of the residual oxygen content.

In addition to the features of the LMV51..., the LMV52... offers O2 trim control, control of a maximum of 6 actuators and of a VSD. The LMV52... system uses an O2 sensor (QGO20...), an external O2 module, and the standard components of the LMV51... system.

The O2 module type PLL… is a measuring module for use with the O2 sensor type QGO20... and 2 temperature sensors (Pt1000 / LG-Ni 1000). It communicates with the LMV52... via CAN bus.



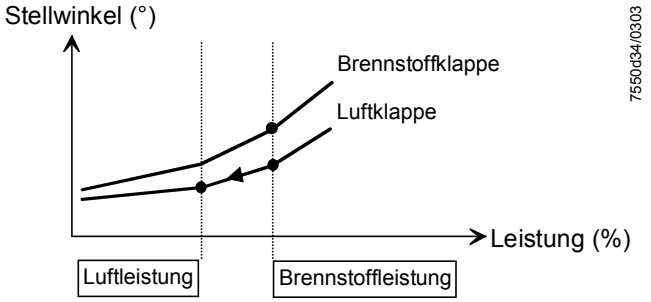


18.2 Functioning principle of O2 trim control

The residual oxygen control system reduces the amount of combustion air depending on the control differential (O2 setpoint minus actual O2 value). The amount of combustion air is normally influenced by several actuators and, if used, by a VSD. Reduction of the amount of combustion air is achieved by lowering the air rate via the air-influencing actuators. For that purpose, the damper positions of the air-influencing actuators are calculated from some other load point on the ratio curves. Hence, due to the parameterized ratio curves, the air-influencing actuators are in a fixed relation to one another.

O2 trim control is supported by precontrol, which calculates the air rate reduction such that the controller requires the same manipulated variable for the period of time environmental conditions do not change, irrespective of burner loads. Consideration is given to a number of measured values that are ascertained when the burner is set. This means that the controller must only become active when environmental conditions (temperature, pressure) change, and not when the burner load changes.

18.2.1 Air rate reduction



Due to the air rate reduction, the O2 trim controller reduces the amount of air. For that purpose, the air-influencing actuators will travel to a smaller load (air rate) on the ratio curve. On the ratio curve, fuel rate and air rate are the same.

Example: If the air rate is 50 % of the fuel rate, half the amount of air is delivered to the burner (if λ is the same at all curvepoints) compared to the ratio curve.

18.2.2 Definition of O2 setpoint

Using the ratio curve as a basis, the O2 setpoint is set by manually lowering the air rate.

⇒ The system stores the O2 ratio value, the O2 setpoint and the relative air rate reduction (standardized value required to attain the O2 setpoint).

> *Example:*
> With a relative air rate reduction of 10 %, the air rate must be changed by 6 percentage points from 60 % to 54 %.

By measuring both O2 values and by having the relative air rate reduction required for the readjustment, the system identifies the burner's behavior. Effects such as the fan pressure's impact on the amount of gas are taken into consideration.

18.2.3 Lambda factor

The system calculates the lambda factor from the O2 ratio value, the O2 setpoint and the required air rate reduction (standardized value to attain the O2 setpoint). The lambda factor reflects the ratio of the actual lambda change and the theoretical lambda change, in relation to a change of the air rate.

With an ideal burner, a relative air rate reduction of 10 % produces a lambda change of $\lambda Theorie = \frac{\lambda neu}{\lambda alt} = 0,9$

corresponding to a lambda factor of 1.

Example:

If the amount of gas is influenced by the fan pressure, a reduction of the air volume can simultaneously lead to an increase in the amount of gas. In practice, this results in a more pronounced change of the lambda value. If the change of lambda value is twice the theoretical value, an air rate change of 10 % produces

a value of $\lambda Praxis = \frac{\lambda neu}{\lambda alt} = 0,8$, corresponding to a lambda factor of 2.

From the lambda values of the ratio curve, the setpoint curve and the standardized value (required air ratio reduction), the lambda factor is calculated as follows:

$$Lambdafaktor = \frac{\lambda Soll - \lambda Verbund}{Normierwert} \bullet 100$$

The system should be adjusted such that the lambda factor across the load range will be as flat as possible. In the future, this can be checked with the ACS450 PC tool. Without the tool, the lambda factors can be calculated according to the above formula to be entered in a graph.

18.3 Precontrol

With the measurements made in connection with O2 setpoint adjustment, the characteristics and behavior of the burner will be acquired. Based on the type of fuel, the O2 ratio value, the O2 setpoint and the standardized value, precontrol calculates the air rate such that the O2 setpoint will be reached as long as environmental conditions do not change, irrespective of burner load.
Calculation of the air rate from the manipulated variable is made such that a manipulated variable of +10 % offsets an air density change of –10 %.

18.3.1 Calculation of precontrol

Based on the settings for O2 trim control, the system becomes familiar with the characteristics and behavior of the burner. The lambda factor, which is taken into consideration when calculating the air rate reduction, reflects these values which are gained from practical experience.

Precontrol can be calculated in 2 different ways:

Parameter: *Type Air Change (like P air, like theory)*

like P air The measured lambda factor is also considered when air density (temperature pressure) changes. Air pressure and air density have an impact on the fuel throughput.

like theory The measured lambda factor is not considered when air density (temperature pressure) changes. Air pressure and air density have no impact on the fuel throughput.

Recommendation:

With gas: *like P air*

With oil: *like theory*

18.4 O2 trim control

18.4.1 Operating modes of O2 trim controller / O2 monitor

The O2 trim controller or O2 monitor can be deactivated or activated in various operating modes by setting a parameter.

Parameter:	*O2 Ctrl/Guard (man deact / O2-guard / O2-control / conAutoDeac / auto deact)*

man deact — Both the O2 trim controller and O2 monitor are deactivated. The system operates along the parameterized ratio curves.

⚠ **The ratio curves must always be adjusted such that there are sufficient amounts of excess O2 available, irrespective of environmental conditions!**

O2-guard — Only the O2 monitor is active. Prior to startup, the O2 sensor must have reached its operating temperature. If not, startup will be prevented. If the O2 monitor responds, or if an error occurs in connection with O2 measurement, the O2 module or the O2 sensor, safety shutdown will take place, followed by a repetition if possible, otherwise lockout.

O2-control — Both the O2 trim controller and the O2 monitor are active. Prior to startup, the O2 sensor must have reached its operating temperature. If not, startup will be prevented. If the O2 monitor responds, or if an error occurs in connection with O2 measurement, the O2 module or the O2 sensor, safety shutdown will take place, followed by a repetition if possible, otherwise lockout.

conAutoDeac — Both the O2 trim controller and the O2 monitor are active (option «automatic deactivation»). Startup takes place before the O2 sensor has reached its operating temperature. O2 trim control in operation is activated only when the operating temperature has been reached and the sensor test has been successfully completed. If the O2 monitor responds, or if an error occurs in connection with O2 measurement, the O2 module, the O2 sensor or the sensor test, both the O2 trim controller and the O2 monitor will automatically be deactivated.

The system operates along the parameterized ratio curves and this parameter will be set to *auto deact*. The AZL5... indicates automatic deactivation. The error code is maintained until O2 trim control is manually deactivated or activated.

auto deact — O2 trim control has automatically been deactivated and the system operates along the parameterized ratio curves (do not select this system parameter). To deactivate the O2 trim controller / O2 monitor, use parameter setting «man deact».

Also refer to subsection 18.4.4, Heating up the O2 sensor after «PowerOn».

18.4.2 Load limitation with O2 trim control

O2 trim control can be deactivated below an adjustable load limit. This can be selected separately for gas- and oil-firing.

Parameter: *O2CtrlThreshold*

If the load drops below this limit, O2 trim control will be deactivated and the system operates along the parameterized ratio curves. If the load increases and exceeds the O2 trim control threshold by 5 percentage points, the O2 trim controller will be reinitialized.

18.4.3 Startup

With the parameter setting
Parameter: *O2Ctrl/Guard (O2-guard / O2-control)*
startup will be prevented until the O2 sensor has reached its operating temperature.

With the parameter setting
Parameter: *O2Ctrl/Guard (conAutoDeac)*
starts the burner directly, O2 trim control will be activated only when the operating temperature has been reached and sensor test has been successful.

Also refer to subsection 18.4.4, Heating up the O2 sensor after «PowerOn».

18.4.4 Heating up the O2 sensor after «PowerOn»

When the system or the O2 module is switched on for the first time, the cold O2 sensor is slowly heated up until its operating temperature is reached. When this temperature is attained, the sensor requires another 10 minutes for fully assuming that temperature.

With the parameter setting
Parameter: *O2Ctrl/Guard (O2-guard / O2-control)*start prevention will take place until the O2 sensor has fully assumed its operating temperature, followed by burner startup. O2 trim control in the operating position will be activated the moment the controller locking time has elapsed.

With parameter setting
Parameter: O2Ctrl/Guard (conAutoDeac)
the burner will immediately be started up. O2 trim control in the operating position will only take place when the sensor has fully assumed its operating temperature and after the sensor test has been successfully completed.

18.4.5 Initialization of O2 trim controller

The system starts operating with the O2 trim controller locked (safe ratio curve). The locking time will start as soon as the system operates at constant load. The locking time is determined based on the boiler plant delay times acquired during adaption. On completion of the locking time, the O2 trim controller will be initialized. To reach the O2 setpoint as quickly as possible, the theoretically required manipulated variable is calculated from the currently measured O2 ratio value, the O2 ratio value determined at the time of setting, the O2 setpoint, and the standardized value. The manipulated variable will be increased by 3.7 % so that the value will lie slightly above the O2 setpoint. With this 3.7 % increase, the O2 value reached will be about 0.7 % above the O2 setpoint. The PI controller will then ensure fine-tuning until the O2 setpoint is reached.

18.4.6 Behavior in the event of load changes

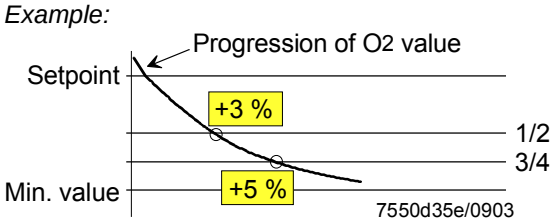
As soon as the load changes, the O2 trim controller will be locked, that is, the last manipulated variable will be maintained. If the O2 setpoint was reached before the load change took place, precontrol will calculate the air rate such that the O2 setpoint will also be reached with all other loads. If the system stays at a stationary load for a period of time longer than the controller locking time, the controller will be released again.

18.4.7 Control interventions by the O2 trim controller

To prevent the burner from getting insufficient amounts of air when the load changes, the O2 trim controller has additional means for counteracting. These become active if the O2 trim controller or precontrol is not optimally adjusted, or if the burner's behavior cannot be adequately mapped by the measured values. The control interventions are also active during the controller locking time.

If the O2 value drops below the setpoint in the direction of the O2 min. value, the manipulated variable will be abruptly increased if predefined thresholds are exceeded ⇒ more air supply:

Example:



a) O2 value exceeds ½ of the differential between setpoint and min. value → manipulated variable is increased by 3 %
b) O2 value exceeds ¾ of the differential between setpoint and min. value → manipulated variable is increased by 5 %

For the control interventions – using a software timing element PT1 – the setpoints and O2 min. values will be delayed by the time constant Tau acquired during adaption. This allows the actual O2 value (corresponding to a combustion value from the past as a result of the boiler running time) to be compared with the associated setpoints and min. values.
Also refer to subsection 18.5.1, Delayed O2 min. value.

18.5 O2 monitor

The O2 monitor can be used with or without O2 trim control. When O2 trim control is activated, the O2 monitor will automatically become active.

18.5.1 Delayed O2 min. value

Due to the long time it takes the flue gases to pass through the boiler's flueways, the O2 value currently acquired is delayed compared to the residual oxygen content occurring the same moment in the combustion chamber. To prevent O2 min. values from being compared with "old" O2 values, the O2 min. values used by the O2 monitor are delayed by Tau as acquired during adaption, using a software timing element PT1.

18.5.2 Switch-off criteria

If
a) the actual O2 value falls for > 3 seconds below the O2 min. value delayed via the PT1 timing element, or
b) the actual O2 value falls for > 3 seconds below the smallest parameterized O2 min. value,

one of the following reactions takes place, depending on the operating mode:

Parameter: *O2Ctrl/Guard (O2-guard / O2-control)*

Safety shutdown will take place, followed by a repetition if possible, otherwise lockout.

Parameter: *O2Ctrl/Guard (conAutoDeac)*

O2 trim control will automatically be deactivated and the system operates along the parameterized ratio curves. O2 trim control must be manually reactivated.

18.6 Self-test

During the startup phase and during operation, the system performs a number of self-tests to ensure that the O2 sensor is working correctly.

18.6.1 Sensor test

To detect aging O2 sensors, a sensor test is made. An aged measuring cell can be identified by its increased internal resistance. The cell is considered too old when the internal resistance measured is Ri < 5 Ω or Ri > 150 Ω.

The test is made at 23-hour intervals. To perform the test, a constant O2 value is essential. This requirement is satisfied after prepurging or when a stationary load point is reached. The system performs the test after 23 hours as soon as such stationary values are available. If this is not the case after 24 hours, the load will be “frozen“ in operation so that the test can be made. If the system is in standby mode, the test will be performed during the next startup phase (maximum 3 repetitions).

If the test is negative, the system’s response will be one of the following, depending on the parameter setting of «O2Ctrl/Guard»:

Parameter:	*O2Ctrl/Guard (auto deact / man deact / O2-guard/ O2-control / conAutoDeact)*
man deact (auto deact):	O2 trim controller and O2 monitor are deactivated. No sensor test will be made.
O2-guard / O2-control:	O2 trim controller / O2 monitor is / are activated. If the test is negative, safety shutdown will take place, followed by a repetition if possible, otherwise lockout.
conAutoDeact:	Both the O2 trim controller and the O2 monitor are activated. If the test is negative, O2 trim control will be deactivated and the burner will be started up without O2 trim control.

18.6.2 Checking the O2 content (20.9 %)

Every time the burner is started up, the measured residual oxygen content is compared with the O2 content of the ambient air at the end of prepurging.

⚠ **For that purpose, the prepurging time of the LMV52... must be parameterized such that the combustion chamber and the flueways will be completely purged.**

Normally, this value reads 20.9 %, but it can be parameterized in the case of plants that operate with enriched air. This test detects offset errors of the measuring cell. For this reason, the correct setting of the air's O2 content is safety-related.

Parameter: *O2 Content Air*

If the O2 content lies outside the tolerance band of ±2 %, one of the following reactions will take place, depending on the parameterization of «O2Ctrl/Guard»:

Parameter: *O2Ctrl/Guard (auto deact / man deact / O2-guard / O2-control / conAutoDeac)*

man deact (auto deact):	O2 trim controller and O2 monitor are deactivated. No O2 test will be made.
O2-guard / O2-control:	O2 trim controller / O2 monitor is / are activated. If the test is negative, safety shutdown will take place, followed by a repetition if possible, otherwise lockout.
conAutoDeac:	O2 trim controller and O2 monitor are activated. Option is «automatic deactivation». If the test is negative, both the O2 trim controller and the O2 monitor will be deactivated. The burner will be started up without O2 trim control.

18.7 Auxiliary functions

18.7.1 Warning when flue gas temperature is too high

If a flue gas temperature sensor is connected and activated, a warning is delivered in case the adjusted flue gas temperature is exceeded. Excessive flue gas temperatures are an indicator of increased boiler losses ⇒ boiler should be cleaned. The warning threshold for gas- and oil-firing can be set separately.

Parameter:	*MaxTempFlueGas Gas*
Parameter:	*MaxTempFlueGas Oil*

18.7.2 Combustion efficiency

If an O2 sensor, a combustion air and flue gas temperature sensor is connected and activated, the combustion efficiency will be calculated and displayed.

Parameter:	*Combustion air temperature sensor (NoSensor, Pt1000, LG-Ni1000)*
Parameter:	*Flue gas temperature sensor (NoSensor, Pt1000, LG-Ni1000)*

To ensure that the calculation will be made correctly, the fuel parameters must be selected and set in accordance with the type of fuel burnt.
Also refer to subsection 18.10.2, Parameterization .

The calculation is made according to the following formula (1. BimSchV = 1. Bundes-Imissionsschutzverordnung = First Federal Imission Protection Decree):

Flue gas volume ratio:

$$AVft = \frac{V\_afNmin}{V\_atrNmin}$$

O2 value dry:

$$O2\_tr = \frac{AVft \bullet O2GehaltLuft}{\frac{O2GehaltLuft}{O2Wert\_feucht} + AVft - 1}$$

Flue gas losses:

$$qa = \left(\frac{A2}{O2GehaltLuft - O2\_tr} + B \right) \bullet \left(\vartheta_{Abgas} - \vartheta_{Zuluft} \right)$$

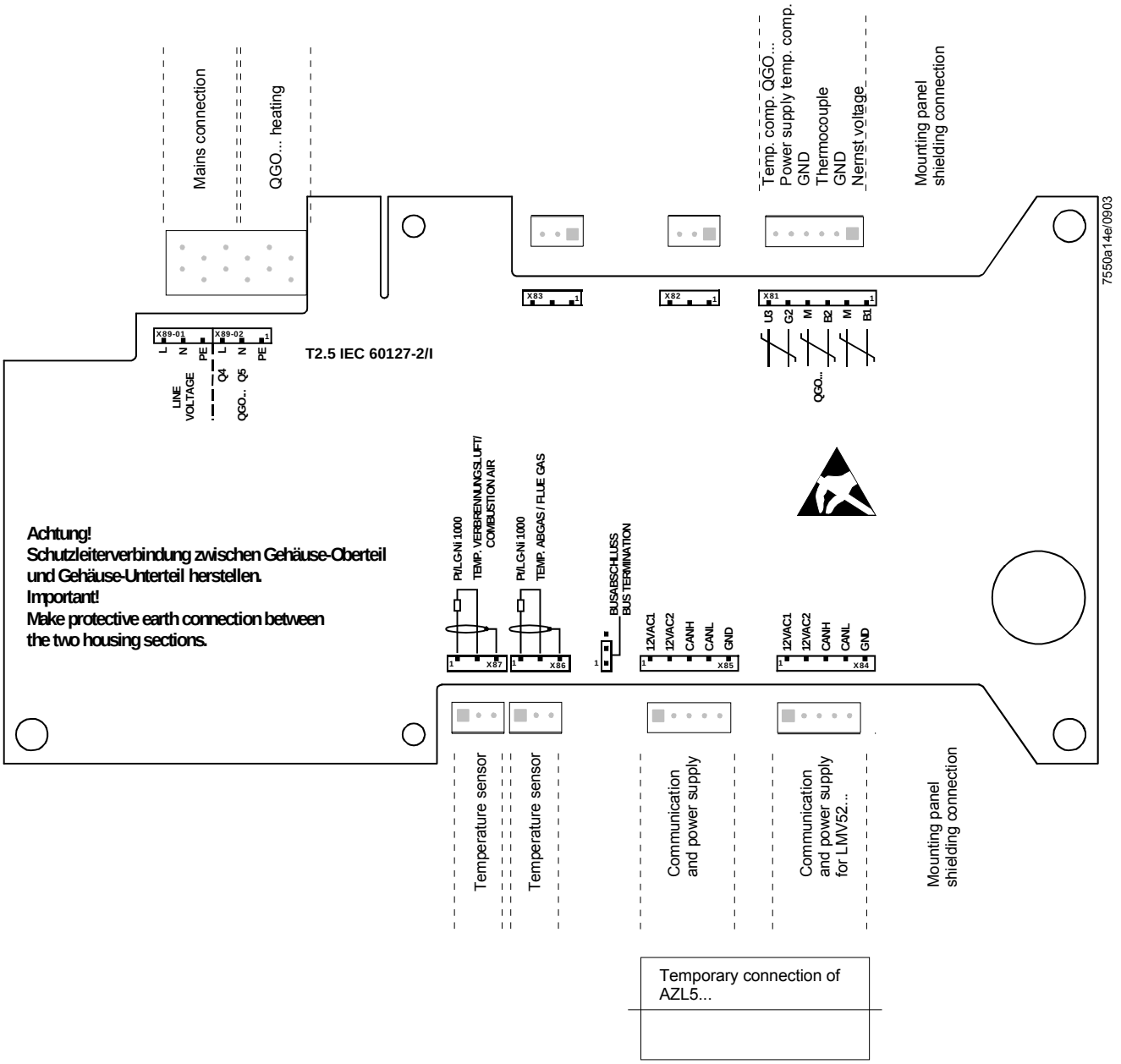
Efficiency:

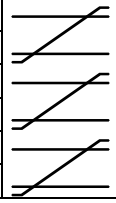
$$\eta_F = 100\% - qa$$

18.8 O2 module

In comparison with the LMV51... system, the extra components to be connected with the LMV52… system are the O2 module and the O2 sensor QGO... and, optionally, the combustion air and flue gas temperature sensors. The O2 module is to be connected to the basic unit via the CAN bus. The O2 module must be located in the vicinity of the QGO... (< 10 m), aimed at keeping interference on the sensitive detector lines as low as possible. For sensor heating, the O2 module requires a separate mains connection facility.

18.8.1 Inputs and outputs

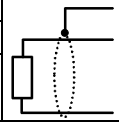


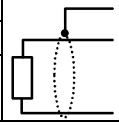
Terminal marking	Connection symbol		Eingang	Ausgang	Description of connection	Electrical limit values
X81	PIN 6		x		Temperature compensation QGO... (U3)	DC [0...2 V], Ri > 100 kΩ
	PIN 5			x	Power supply temperature compensation (G2)	DC [12...18 V], Ra = 20 Ω
	PIN 4		x	x	GND (M)	
	PIN 3		x		Thermocouple (B2)	DC [0...33 mV], Ri > 100 kΩ
	PIN 2		x	x	GND (M)	
	PIN 1		x		Nernst voltage (B1)	DC [-25...1 mV], Ri > 100 kΩ

X84	PIN 5	GND	x		Signal reference	
	PIN 4	CANL	x		Communication signal	DC U <= 5 V, Rw = 120 Ω, Level to ISO-DIS 11898
	PIN 3	CANH	x		Communication signal	
	PIN 2	12VAC2	x		AC supply for O2 module	AC12V +10%/-15%, 50...60 Hz, Fuse max. 4 A
	PIN 1	12VAC1	x		AC supply for O2 module	

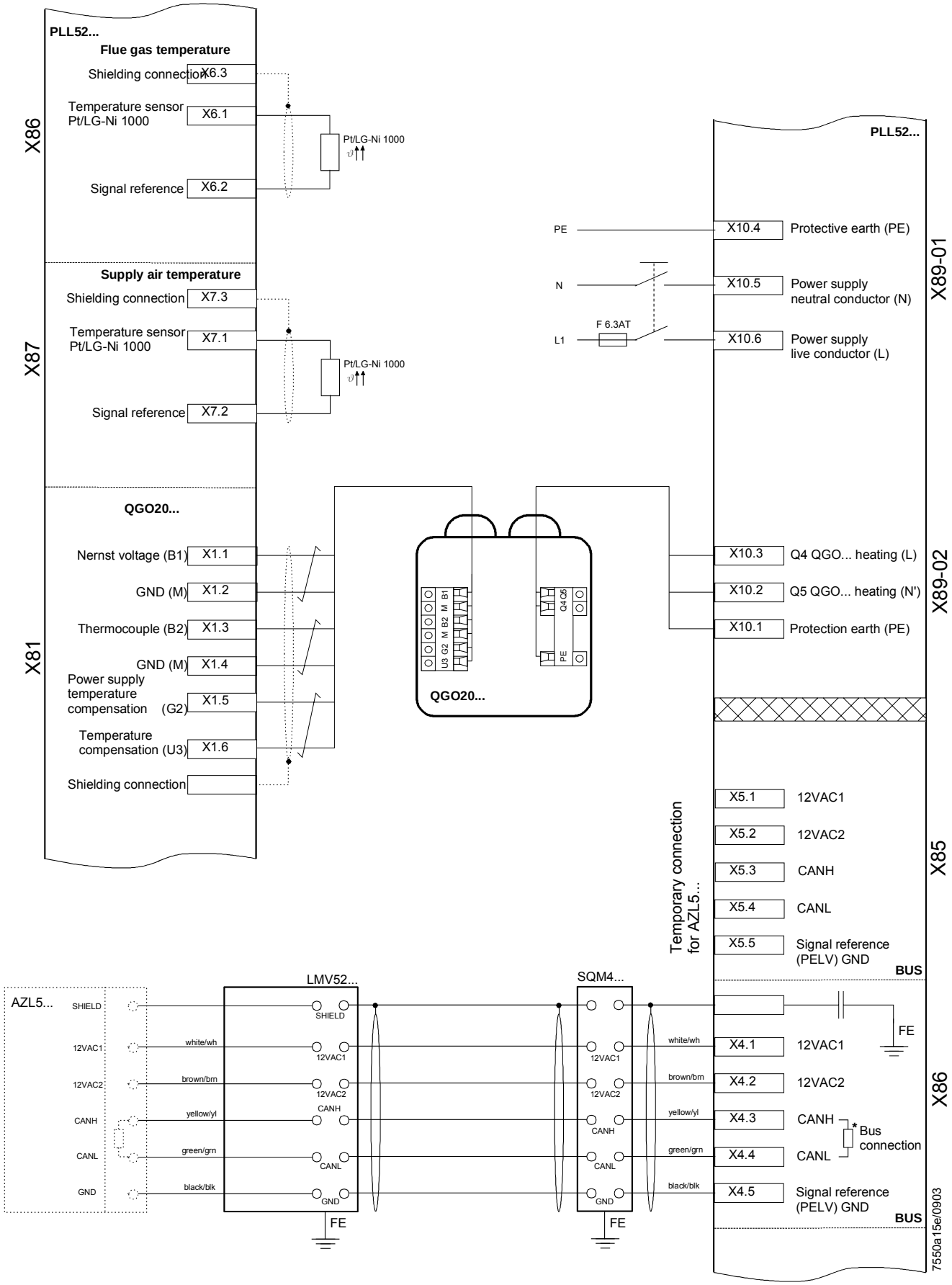
X85	PIN 5	GND	x		Signal reference	
	PIN 4	CANL	x		Communication signal	DC U <= 5 V, Rw = 120 Ω, Level to ISO-DIS 11898
	PIN 3	CANH	x		Communication signal	
	PIN 2	12VAC2	x		AC supply for O2 module	AC12V +10%/-15%, 50...60 Hz, Fuse max. 4 A
	PIN 1	12VAC1	x		AC supply for O2 module	

Combustion air / flue gas temperature sensor

X86	PIN 3		x		Shield connection	
	PIN 2		x		Signal reference	
	PIN 1		x		Flue gas temperature sensor input Pt1000 / LG-Ni 1000	

X87	PIN 3		x		Shield connection	
	PIN 2		x		Signal reference	
	PIN 1		x		Combustion air temperature input Pt1000 / LG-Ni 1000	

X89-02	PIN 1	PE		x	Protective earth (PE)	
	PIN 2	Q5 N		x	QGO... heating N (Q5)	
	PIN 3	Q4 L		x	QGO... heating L (Q4)	AC230V +10%/-15%, 50...60Hz, Imax. 2.5 A
X89-01	PIN 4	PE	x		Protective earth (PE)	
	PIN 5	N	x		Power supply neutral conductors (N)	
	PIN 6	L	x		Power supply live conductor (L)	AC230V +10%/-15%, 50...60Hz, Imax. 2.5 A


PLL52...
Flue gas temperature
Shielding connection
X6.3
Temperature sensor Pt/LG-Ni 1000
X6.1
Signal reference
X6.2
Pt/LG-Ni 1000
X86
Supply air temperature
Shielding connection
X7.3
Temperature sensor Pt/LG-Ni 1000
X7.1
Signal reference
X7.2
Pt/LG-Ni 1000
X87
QGO20...
Nernst voltage (B1)
X1.1
GND (M)
X1.2
Thermocouple (B2)
X1.3
GND (M)
X1.4
Power supply temperature compensation (G2)
X1.5
Temperature compensation (U3)
X1.6
Shielding connection
X81
QGO20...
PLL52...
PE
X10.4
Protective earth (PE)
N
X10.5
Power supply neutral conductor (N)
F 6.3AT
L1
X10.6
Power supply live conductor (L)
X89-01
X10.3
Q4 QGO... heating (L)
X10.2
Q5 QGO... heating (N')
X10.1
Protection earth (PE)
X89-02
X5.1
12VAC1
X5.2
12VAC2
X5.3
CANH
X5.4
CANL
X5.5
Signal reference (PELV) GND
BUS
X85
Temporary connection for AZL5...
AZL5...
SHIELD
12VAC1
12VAC2
CANH
CANL
GND
white/wh
brown/brn
yellow/yl
green/grn
black/blk
LMV52...
SQM4...
FE
X4.1
12VAC1
X4.2
12VAC2
X4.3
CANH
X4.4
CANL
* Bus connection
X4.5
Signal reference (PELV) GND
BUS
X86
7550a15e/0903

18.8.2 CAN bus X84, X85

The O2 module is to be connected to the basic unit via CAN bus. There are 2 terminals for the CAN bus, X84 for the supply and X85 for the connection of the AZL5... If the O2 module is located at the end of the bus line, the CAN bus termination must be activated.

18.9 Configuration of O2 module

The connected sensors are to be configured via the AZL5...

The O2 sensor connected to terminals X81 / X89-02 must be parameterized.

Parameter: *O2 Sensor (NoSensor, QGO20)*

The combustion air temperature sensor connected to terminal X87 must be parameterized.

Parameter: *Combustion air temperature sensor (NoSensor, Pt1000, LG-Ni1000)*

The flue gas temperature sensor connected to terminal X86 must be parameterized.

Parameter: *Flue gas temperature sensor (NoSensor, Pt1000, LG-Ni1000)*

18.10 Configuration of the system

(Description of the plant-dependent basic configuration)

First, make all configurations as described in detail with the LMV51... system.

18.10.1 Actuators / VSDs

When activating the actuators / VSDs in menu section «RatioControl», parameterization comprises «Activation» and «Deactivation» and, in addition, «air influencing». Air-influencing actuators have an impact on the amount of air. The actuators defined as air-influencing actuators are used for O2 trim control. Basically, all actuators having an impact on the air volume are to be parameterized as «air-influencing». In exceptional cases, a truly air-influencing actuator can be excluded from O2 trim control by setting it to «activated».

⚠ **If the parameterization is changed, O2 trim control must be readjusted.**

Parameter: *Air actuator (deactivated, activated, air influen)*
Parameter: *Auxiliary actuator 1 (deactivated, activated, air influen)*
Parameter: *Auxiliary actuator 2 (deactivated, activated, air influen)*
Parameter: *Auxiliary actuator 3 (deactivated, activated, air influen)*
Parameter: *VSD (deactivated, activated, air influen)*

deactivated: Actuator is not active.

activated: Actuator is active but has no impact on the air volume. Actuator is not used for O2 trim control.

air infuen: Actuator is active and has an impact on the air volume. Actuator is used for O2 trim control.

18.10.2 Parameterization of the type of fuel

For calculating precontrol and combustion efficiency, the type of fuel burnt must be selected.
Also refer to section 18.3 Precontrol.

For firing on gas, there are 4 preprogrammed fuel types available, plus 1 type of fuel that can be defined by the user.

Parameter: *Type of Fuel (user def, naturalGasH, naturalGasL, propane, butane)*

For firing on oil, there are 2 preprogrammed types of fuel available, plus 1 type that can be defined by the user.

Parameter: *Type of Fuel (user def, LightOilLO, LightOilHO)*

18.10.3 Setting the user-defined type of fuel

If, when firing on gas or oil, the user-defined fuel type is selected, the relevant fuel parameters must be manually set.

Parameter: *V_LNmin*

Amount of air required for stoichiometric combustion (λ = 1) [m³ air per m³ gas] or [m³ air per kg oil]. This value is used for calculating O2 trim control / precontrol.

Parameter: *V_afNmin*

Flue gas volume «wet» with stoichiometric combustion (λ = 1) in [m³ flue gas «wet» per m³ gas] or in [m³ flue gas «wet» per kg oil]. This value is used for calculating O2 trim control / precontrol or the combustion efficiency.

Parameter: *VatrNmin*

Flue gas volume «dry» with stoichiometric combustion (λ = 1) in [m³ flue gas «dry» per m³ gas] or in [m³ flue gas «dry» per kg oil]. This value is used for calculating O2 trim control / precontrol or the combustion efficiency.

Parameter: *A2*

This value is used for calculating the combustion efficiency. It is in compliance with the definition given in the first BimScHV.

Parameter: *B/1000*

This value is used for calculating the combustion efficiency. It is in compliance with the definition given in the first BimScHV. The parameters are set using a resolution of 1/1000. This means that a parameterized value of 8 corresponds to 0.008.

Preset fuel parameters

	Natural gas H	Natural gas L	Propane	Butane	Fuel oil EL	Fuel oil S
V_Lnmin	9.90	8.41	23.80	30.94	11.20	10.73
V_afNmin	10.93	9.43	25.80	33.44	12.02	11.39
VatrNmin	8.89	7.69	21.80	28.44	10.53	10.08
A2	0.66	0.66	0.63	0.63	0.68	0.68
B/1000	9 ≈ 0.009	9 ≈ 0.009	8 ≈ 0.008	8 ≈ 0.008	7 ≈ 0.007	7 ≈ 0.007

18.11 Commissioning the O2 trim control system

18.11.1 Setting ratio control

⚠ **First, adjust the ratio curves as with the LMV51... system. The excess O2 rate must be selected high enough, ensuring that, irrespective of ambient conditions** (combustion chamber and fuel pressure, temperature and pressure of the combustion air), **the O2 level will not fall below the O2 setpoint of O2 trim control.**

Parameterize the loads at the curvepoints proportional to the effective fuel rate (amount of fuel). For that purpose, ascertain the load with the help of the fuel counter.
The curvepoint identifies the smallest load where O2 trim control is still possible. In normal situations, this is the low-fire position. Point 1 defines the curve for reducing the air rate below point 2. If, in the low-fire position, no further air reduction is possible (e.g. because the air damper has already fully closed), curvepoint 1 must be selected as the low-fire point. In that case, O2 trim control will only be performed up to curvepoint 2.
The O2 ratio value between the curvepoints should be linear. When O2 trim control is activated, precontrol will transfer any nonlinearity to the actual O2 value. When adjusting the load, the actual O2 value fluctuates about the O2 setpoint. Check the linearity of the O2 progression by approaching the loads between the curvepoints. If the O2 ratio value has such nonlinearities, they can be corrected by setting intermediate curvepoints.
The more thoroughly the ratio curve is set, the easier the subsequent adjustment of O2 trim control, and the more accurate O2 trim control will be.

⚠ **If the ratio curves are changed later, the O2 trim controller must also be readjusted.**

18.11.2 Setting the O2 monitor

Next, the O2 monitor must be adjusted. When making the adjustment for the first time, the O2 monitor should remain deactivated to avoid undesired responses. When changing settings later, it can stay activated.

Set the O2 min. value as low as possible to ensure a high level of availability. The O2 min. value marks the boundary between the permanently non-harzardous range and the potentially hazardous range.

⚠ **Above or at the O2 min. value, hazardous conditions must not permanently occur.**

Guide values: CO = 2,000 ppm, soot number 3.
The values can vary, depending on the type of plant.

After setting all O2 min. values, the O2 monitor can be activated.
The setting can be made in 2 different ways.

18.11.3 Direct entry of O2 min. values

If the limit values of a plant are known, and if the CO limit need not be remeasured, the O2 min. values can be entered directly.

P	u	n	k	t	:			2							
O	2	-	M	i	n	w	e	r	t		:		1	.	2
P	-	L	u	f	t		H	a	n	d	:		0	.	0

On the first line, «Point», select the point number to be changed and confirm with ENTER (point 1 can be adjusted). With the second line, «O2 Min Value», the O2 min. value can be directly parameterized. The points will only be approached if, previously, setting choice «P Air Man» has been used.

18.11.4 Measuring the O2 min. values by lowering the air rate

On the first line, select the point number and confirm with ENTER. Now, select line «P-Air Man» and confirm. After confirmation with ENTER, the ratio control system approaches this point on the parameterized ratio curve, that is, air rate reduction «P-Air Man» will be set to «0». The display on the second line changes to «Actual O2 Value», which will then be displayed.

P	u	n	k	t	:			3							
O	2	-	I	s	t	w	e	r	t		:		1	.	4
P	-	L	u	f	t		H	a	n	d	:	2	1	.	3

By readjusting the air rate «P-Air Man», the amount of combustion air and thus the O2 value can be reduced. «P-Air Man» corresponds to the relative air rate reduction. During the readjustment, all actuators on the curve parameterized as air-influencing will travel to the relevant positions. When the O2 min. value is found, the measured «Actual O2 Value» will be entered as the «O2 Min Value» by pressing ENTER.

18.11.5 Setting O2 trim control

Since with O2 trim control activated, the O2 monitor is always active also, the O2 monitor should already be set. For the initial setting, O2 trim control should remain deactivated, and the O2 monitor can be activated. Prior to setting the O2 trim controller, both ratio control and the loads of the curvepoints should be correctly set. This facilitates correct functioning of precontrol.
Also refer to subsection 18.11.1 Setting ratio control .

⚠ **If the ratio curves are changed later, O2 trim control must also be readjusted.**

It is important to make all settings of the O2 trim controller when environmental conditions do not change. For this reason, when making corrections later, all points must be set again. When setting O2 trim control, the user is guided through the necessary setting steps.

First, select the desired curvepoint and confirm with ENTER (point 1 cannot be set since O2 trim control does not approach any load below point 2). The system approaches the selected point on the ratio curve.

P	u	n	k	t	:			2							
O	2	-	V	e	r	b	u	n	d		:	x	x	x	x
O	2	-	S	o	l	l	w	e	r	t	:	x	x	x	x
N	o	r	m	i	e	r	w	e	r	t	:	x	x	x	x

The display will change. During this step, the system acquires the O2 value on the ratio curve. The actual O2 value is displayed and the operator is prompted to confirm when a stable O2 value has been reached. This is important since the value is used for calculating precontrol. In the future, the PC tool will be useful for making checks.

P	u	n	k	t	:			2							
O	2	-	V	e	r	b	u	n	d		:		5	.	4
W	e	n	n		W	e	r	t		s	t	a	b	i	l
w	e	i	t	e	r		m	i	t		E	N	T	E	R

Then, the measured O2 ratio value will be displayed. The cursor now indicates the standardized value. By changing this value, the relative amount of air will be reduced, whereby the standardized value corresponds to the relative air rate reduction. The standardized value is only changed until the actual O2 value reaches the required O2 setpoint, which is then displayed. The setting may only be confirmed after a constant O2 value has been attained. The PC tool will be useful for making checks.

P	u	n	k	t	:			2							
O	2	-	V	e	r	b	u	n	d		:		5	.	2
O	2	-	I	s	t	w	e	r	t		:		2	.	0
N	o	r	m	i	e	r	w	e	r	t	:	1	5	.	3

Now, the operator must decide whether he wants to adopt or reject the settings.

P	u	n	k	t										
s	p	e	i	c	h	e	r	n	-	>	E	N	T	E	R
v	e	r	w	e	r	f	e	n	-	>	E	S	C		

At curvepoint 2 and at the highest curvepoint, the system adapts itself when storing. This is accomplished by measuring the delay time (τ) of the boiler plant. Based on these values, the PI control parameters, the controller locking time after load readjustment and the min. value delay for the O2 monitor will be calculated. To measure the time constant (τ), the burner will be driven back to the ratio curve. With the other curvepoints, the system returns to the ratio curve without adaption after setting the O2 setpoint. After setting all points, O2 trim control can be activated.

18.11.6 Checking and changing the controller parameters

The adapted controller parameters and the measured time constant (τ) of the boiler can be viewed on the «Controller parameters» menu, and changed, if required.
The O2 setpoint must lie at least 0.5 % above the O2 min. value and 1 % below the O2 ratio value.

18.12 Setting notes

(Summary of the most important rules for setting O2 trim control)

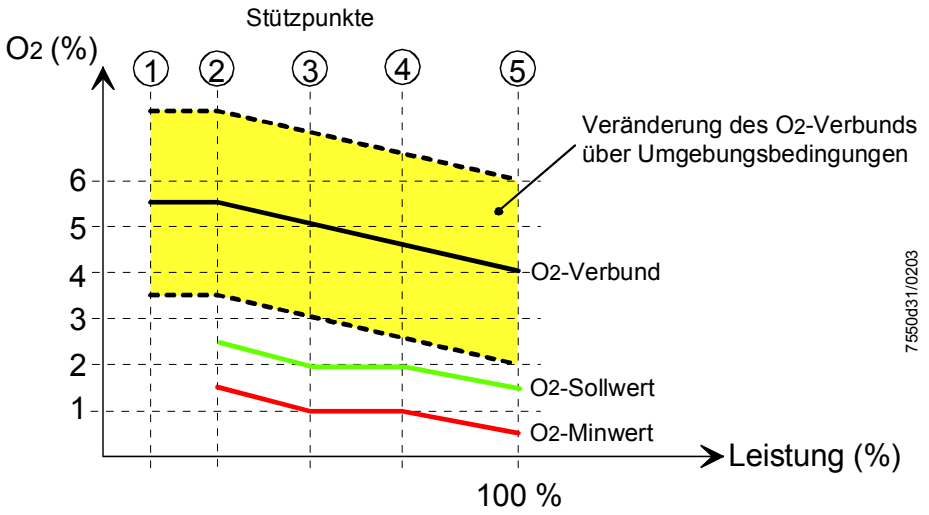
18.12.1 Parameter settings

- **Parameterize all truly air-influencing actuators as air-influencing actuators**
  If changing the parameter settings, O2 trim control must be readjusted.

18.12.2 Setting O2 ratio control

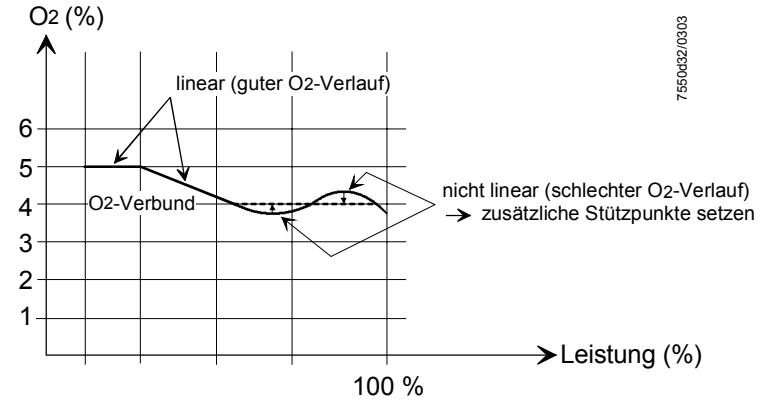
- **Set sufficient excess O2**
  Set the amount of excess air of the ratio curve such that, whatever the environmental conditions (combustion chamber and fuel pressure, temperature and pressure of the combustion air), the set residual oxygen content will lie above the O2 setpoints required by O2 trim control.

  Example:

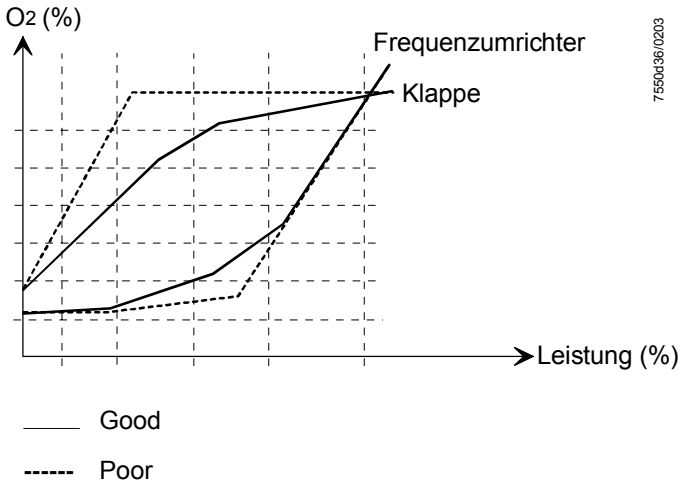


- **Parameterized load proportional to the fuel rate**
  The burner load parameterized at the curvepoints must be proportional to the actual burner load. To make the setting, determine the burner load with the help of the fuel counter.
- **Curvepoint 1**
  The first curvepoint should have an adequate distance below curvepoint ②. This means that the curve for reducing the air rate is also defined below point ②. As a guide value, point ① should lie at about half the load of point ②. Point ② should be smaller than or equal to the low-fire load.
  If, in the low-fire position, no further air reduction is possible (e.g. because the air damper has already fully closed), curvepoint 1 must be selected as the low-fire point. In that case, O2 trim control will only be performed up to curvepoint 2.

- **Linear progression of O2 value between the curvepoints**
  The O2 value between the curvepoints should progress in a linear fashion. To make checks, approach load positions between the curvepoints and check the O2 value. If the progression is not linear, additional curvepoints should be set and the O2 progression should be appropriately corrected.



- **Checking the transfer range between damper and VSD**
  When using several air-influencing actuators (e.g. air damper or VSD), it should be made certain that the curves are as smooth as possible. Irregularities should be avoided.



18.12.3 Setting the O2 trim controller

- **Selecting the O2 min. value**
  The O2 min. value should be set as low as possible to ensure a high level of availability.

⚠ **Above or at the O2 min. value, hazardous conditions may not permanently occur.**

Guide values: CO = 2,000 ppm, soot number 3.
The values can vary, depending on the type of plant.

- **Adequate distance between O2 setpoint and O2 min. value**
  The distance should be a minimum of 1...1.5 % O2. If a smaller distance is used, the ratio curve must be set as accurately as possible, in accordance with subsection 18.12 Setting notes - «Setting O2 ratio control».

- **All O2 setpoints must be adjusted under the same environmental conditions**
  It is important to adjust the O2 setpoints at the same ambient temperatures. If, later, individual setpoints are changed, all setpoints of the curvepoints must be readjusted since environmental conditions will probably be different from those at the time the initial settings were made.

18.12.4 Other notes

When firing on oil and using a VSD, the oil pump must be driven separately.
If this is not observed, the fan speed has an impact on the amount of oil delivered. This can cause problems in connection with precontrol or O2 trim control.

18.13 Technical data

Basic unit LMV52...

Refer to section 13 Technical data!

PLL52.x

Mains voltage «X89-01»	AC 230 V –15 % / +10 %
Safety class	I with parts according to II as per DIN EN 60 730-1
Transformer AGG5.220	
- Primary side	AC 230 V
- Secondary side	AC 12 V (2x)
Mains frequency	50...60 Hz ±6 %
Power consumption	4 VA
Degree of protection	IP 54, housing closed

Environmental conditions

Transport	DIN EN 60 721-3-2
Climatic conditions	class 2K2
Mechanical conditions	class 2M2
Temperature range	-30...+70 °C
Humidity	< 95 % r.h.
Operation	DIN EN 60 721-3-3
Climatic conditions	class 3K5
Mechanical conditions	class 3M2
Temperature range	-20...+60 °C
Humidity	< 95 % r.h.

⚠ **Condensation, formation of ice or ingress of water are not permitted!**

18.14 Terminal ratings, line lengths and cross-sectional areas

Basic unit LMV52...

Refer to section 13.2 Loads on terminals, cable lengths and cross-sectional areas!

PLL52...

Electrical connections «X89»	screw terminals up to 2.5 mm²
Line lengths	≤ 10 m to QGO20...
Cross-sectional areas	refer to description of RPO.../QGO.., twisted pairs

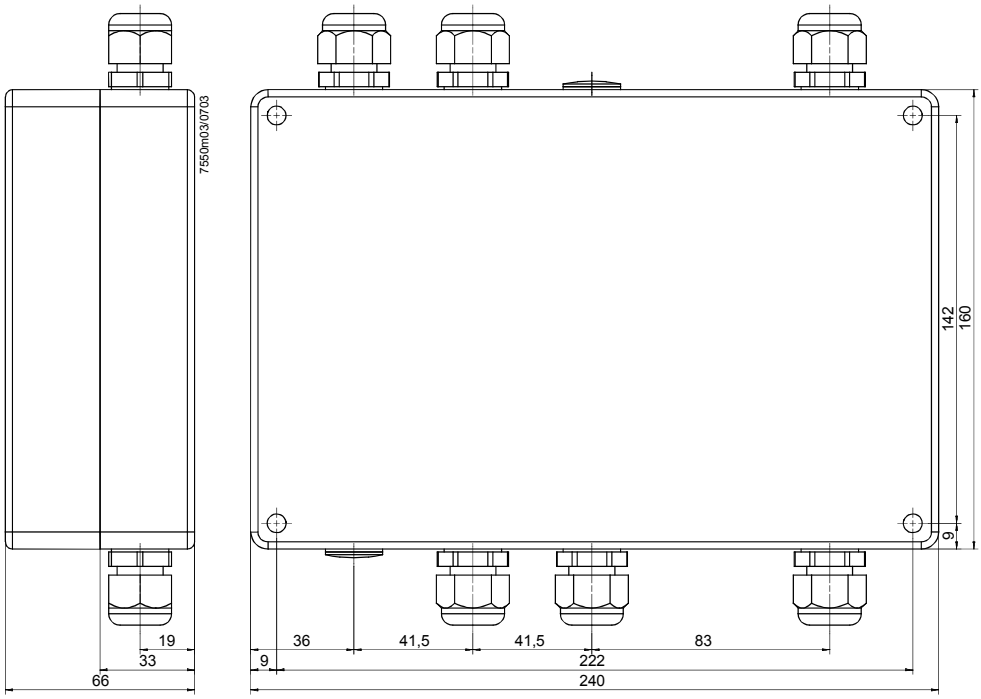
Analog inputs

Combustion air temperature sensor	Pt1000 / LG-Ni 1000
Flue gas temperature sensor	Pt1000 / LG-Ni 1000
QGO20...	refer to Data Sheet N7842
Interface	communication bus for LMV52...

19 Dimensions

Dimensions in mm

PLL52...



20 Revision history

The new release of the basic unit is identified by the series letter B in the type reference (LMV51.XXX**B**XXX).

Notes on compatibility

- When changing from A-series to B-series units, the parameter sets can be copied
- The added parameters are preset in a way that they correspond to the former functioning mode
- An update to a new unit, which is no longer in the state supplied, should not be made since it is only the parameters from the A-series that can be stored back
- The compatibility of the load controller must be set manually, with the sign reversed
- Due to the change to the external analog predefined load and to the analog load output (LR V01.50), it may be necessary to make adaptations on the associated external controllers or BACS (building automation and control system)

20.1 Basic unit

Software changes

The software of the basic card has been changed from V02.10 to V02.20.

The following changes have been made:

20.1.1 Program stop

When the unit reaches the «Program stop» position, the AZL5... will display «Programstop active».

20.1.2 Deactivating the alarm

The alarm relay can be deactivated via the menu of the AZL5…, which means that the actual lockout or start prevention will be maintained.
Deactivation remains active until the next lockout reset, system reset or startup occurs. Then, normal alarming will be resumed, that is, deactivation of the alarm applies to the current alarm.

20.1.3 «GPmin» in the oil program

«GPmin» can also be activated for the oil program only.

20.1.4 «SV» oil, switch-off time

In the case of oil-firing, the external «SV» valve closes on completion of the permissible afterburn time (end of Phase 70).
The burner motor operates until Phase 79 is reached.
Using the relevant parameter, it is now possible to choose between the present function (when using the magnetic clutch) and direct coupling of the oil pump.
In that case, the «SV» oil must be connected to the output for the oil pump (X6-02).
This output is not safety-related and is not used in the case of direct oil pump coupling.
The «SV» oil (X6-02) is always controlled when the fan runs, plus another 15 seconds.

20.1.5 «DWminOil» in program «Heavy oil with gas pilot»

Valuation of input «DWminOil» in program «Heavy oil with gas pilot» has been moved from Phase 38 to Phase 44.

20.1.6 «DWminOil» is only valued during the safety time after a delay time has elapsed

20.1.7 Air pressure switch test valve, inverted control

The signal can be inverted via the relevant parameter.
The output is only active when the fan operates.

20.1.8 External controller contact with «Manually on»

If the burner is in operation with «Manually on», the external controller on contact (X5-03 Pin1) acts as a shutoff device should overtemperatures occur.
With the exception of operating mode 1 (extLC), the controller contact can be deactivated if not used as a switch-off device.

20.1.9 Prepurge time after safety shutdown

After safety shutdown, the longer prepurge time «PrepurgeSafeGas/Oil» becomes active.

20.1.10 Changes to the supplied parameter set

The parameter set has been changed from V20.02.00 to V20.03.00.

20.2 Load controller card

Software changes of «LC»

The software of the load controller has been changed from V01.40 to V01.50.

The following changes have been made:

20.2.1 Auxiliary sensor for cold start thermal shock protection

20.2.2 Straightforward changeover of operation to internal load controller

Using a potential-free contact at terminals X62.1 and X62.2, it is possible to switch from external load controllers to the internal load controller of the LMV51.100...

The following operating modes can be switched over:

Operating mode 4	→ 2	= Int LC X62	→ intLC
Operating mode 5	→ 2	= Ext LC X62	→ intLC
Operating mode 3	→ 2	= Int LC Bus	→ intLC
Operating mode 6	→ 2	= Ext LC Bus	→ intLC
Operating mode 1	→ 2	= Ext LC X5-03	→ intLC

20.2.3 With software version V01.50 or higher, Pt100 sensors in operating mode 6 are permitted

20.2.4 New load controller function for manipulated variable input and load output

Modulating burners

Manipulated variable input, modulating:

< 3 mA	open-circuit	
4 mA	or 2 V	low-fire (min. load)
20 mA	or 10 V	high-fire (max. load)

Burner shutdown at < 5 mA not used.

Load output, modulating:

< 3 mA	open-circuit
4 mA	0 % load
xx mA	low-fire (min. load)
xx mA	high-fire (max. load)
20 mA	100 % load

Shutting the burner down = no impact on signal.

Multistage burners

Manipulated variable input, multistage burner:

Stage 1:	5 mA	or 2.5 V
Stage 2:	10 mA	or 5 V
Stage 3:	15 mA	or 7.5 V

Switching thresholds at:

7.5 mA	and 12 mA	with 0.5 Ma	hysteresis
3.75 V	and 6.25 V	with 0.25 V	hysteresis

Burner shutdown at < 5 mA not used.

< 3 mA: Open-circuit

Load output, multistage:

Burner off:	4 mA
Stage 1:	5 mA
Stage 2:	10 mA
Stage 3:	15 mA

20.3 Display and operating unit AZL51...

In connection with the new B-series of the basic unit (LMV51.XXX**B**XXX), the type reference of the AZL5... has been changed to include C-series (AZL51.XX**C**XXX). Hence, the type references indicate the state of release and show the unit versions that work together.

20.3.1 Software changes to the flash memory

The software version of the flash memory has been changed from V02.20 to V02.50.

20.3.2 New designations of load controller inputs

For the load controller inputs 1 / 2 / 4 and the associated parameters, the following new names have been assigned:

Eing1/2/4Auswahl	→ Sensor selection
Eing1/4BerEnde	→ Measuring range PtNi
Eing2TempBerEnde	→ Measuring TempSensor
Eing2DruckBerEnde	→ Measuring PressSensor
Eing3Konfig_I/U	→ External input X62 U/I
Eing3MinSollwert	→ External setpoint min.
Eing3MaxSollwert	→ External setpoint max.

20.3.3 Fuel counter with reading in liters

A blank has been introduced between the value and the unit.

20.3.4 Preventing the transfer of parameter copies from new basic units to the backup memory of the AZL5...

Copying is not possible and a message will be delivered.

20.3.5 Various parameter changes

The default settings of the following parameters have been changed:

Prepurging time oil:	15 s
Maximum time low-fire:	45 s
Postpurging position air (gas-firing):	15 °
Postpurging position air (oil-firing):	15 °
Postpurging position Aux/Fu (gas-firing):	25 °
Postpurging position Aux/Fu (oil-firing):	25 °
LC: Sd_Step1_On:	- 2 %

20.3.6 Name changes of load controller operating modes

extLR	→ ExtLR X5-03
intLR	→ IntLR
intLR via BACS	→ IntLR Bus
intLR BACS to	→ IntLR X62
extLRanalg	→ ExtLR X62
extLR via BACS	→ ExtLR Bus

20.3.7 New display text for actuator faults

The AZL5… indicates a new fault carrying code 0x0E (too short ramp time):

Text message
- Too short ramp time, air actuator
- Too short ramp time, gas actuator (oil)
- Too short ramp time, oil actuator
- Too short ramp time, auxiliary actuator 1
- Too short ramp time, auxiliary actuator 2 only LMV52...
- Too short ramp time, auxiliary actuator 3 only LMV52...

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