SIEMENS

7550

Burner Management System

LMV5...

LMV51... **Burner control with integrated fuel / air ratio control and load control for use with forced draft burners.**

LMV52... **Burner control with integrated fuel / air ratio control and load control for use with forced draft burners including oxygen trim control.**

The LMV5... and this Data Sheet are intended for use by OEMs which integrate the burner management systems in their products!

Use

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

- For gas burners with and without fan to EN 298: 2003
- For oil burners to EN 230: 2005

For additional safety notes, refer to the Basic Documentation of the LMV5... system (P7550)!

To avoid injury to persons, damage to property or the environment, the following warning notes must be observed!

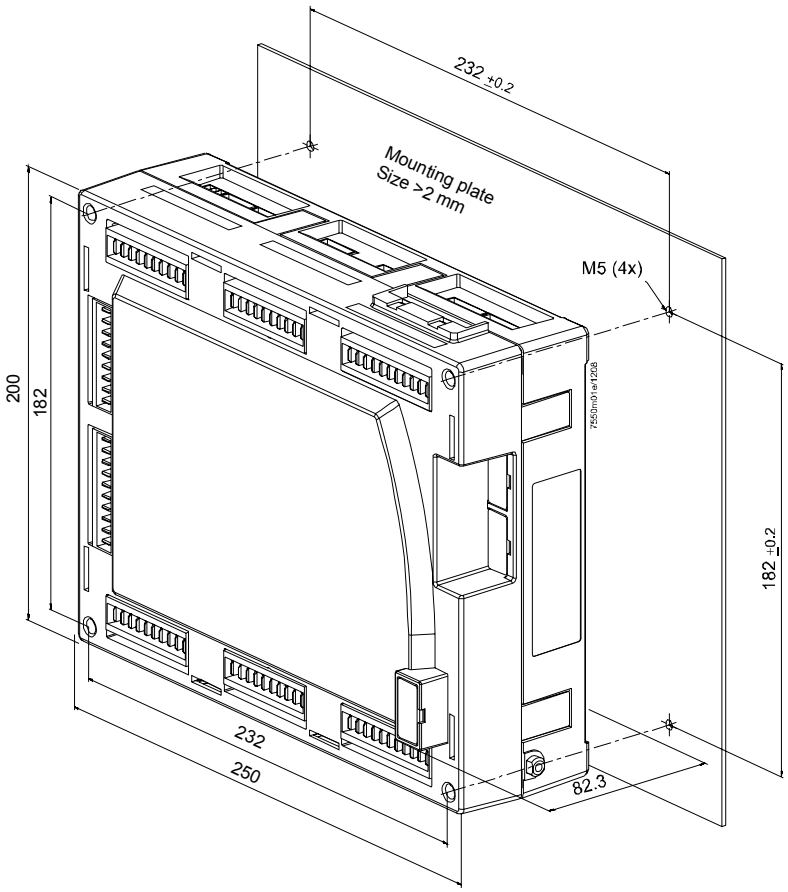
The LMV5... is a safety device! Do not open, interfere with or modify the unit. Siemens will not assume responsibility for any damage resulting from unauthorized interference!

- All activities (mounting, installation and service work, etc.) must be performed by qualified staff
- Before making any wiring changes in the connection area of the LMV5..., completely isolate the plant from mains supply (all-polar disconnection). Ensure that the plant cannot be inadvertently switched on again and that it is indeed dead. If not observed, there is a risk of electric shock hazard
- Ensure protection against electric shock hazard by providing adequate protection for the connection terminals and by securing the housing cover
- Each time work has been carried out (mounting, installation, service work, etc.), check to ensure that wiring and parameterization is in an orderly state and make the safety checks as described in «Commissioning notes»
- Fall or shock can adversely affect the safety functions. Such units must not be put into operation, even if they do not exhibit any damage

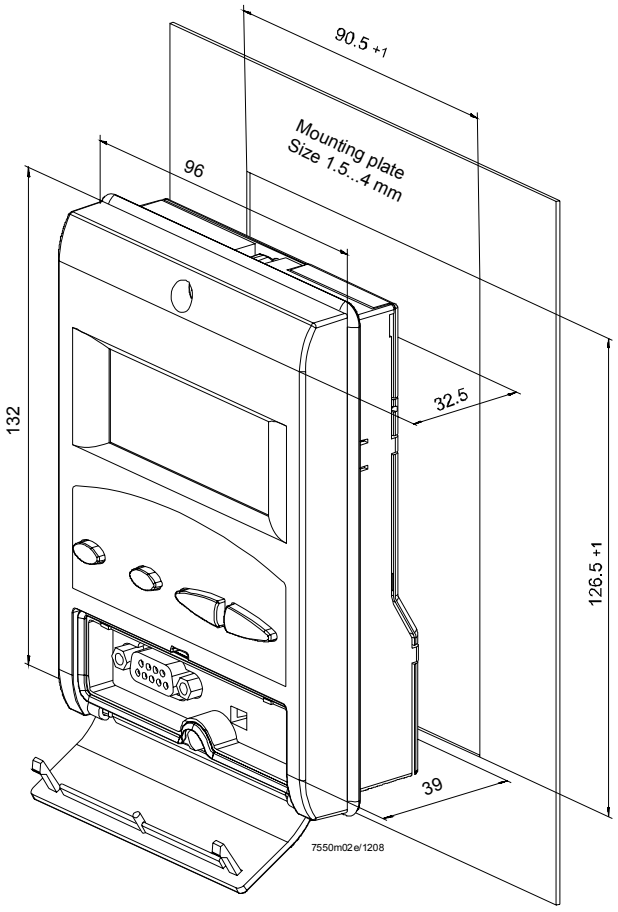
Mounting notes

- Ensure that the relevant national safety regulations are complied with

Notes for mounting LMV5...



Notes for mounting AZL5...



Installation notes

- Always run high-voltage ignition cables separately while observing the greatest possible distance to the unit and to other cables
- Do not mix up live and neutral conductors

Electrical connection of the flame detectors

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

- Never run the detector cable together with other cables
  – Line capacitance reduces the magnitude of the flame signal
  – Use a separate cable
- Observe the maximum permissible detector cable lengths
- The ionization probe is not protected against electric shock hazard. It is mains-powered and must be protected against accidental contact
- Locate the ignition electrode and the ionization probe such that the ignition spark cannot arc over to the ionization probe (risk of electrical overloads)

Standards and certificates

CE

Conformity to EEC directives

- Electromagnetic compatibility EMC (immunity)	2004/108/EC
- Directive for gas-fired appliances	2009/142/EC
- Low-voltage directive	2006/95/EC
- Directive for pressure devices	97/23/EEC
- Safety limit thermostats	to EN 14597

Safety and control devices for gas and/or oil burners and gas and/or oil appliances - Particular requirements -
Part 1: Fuel/air ratio controls, electronic type — ISO 23552-1:2007

ISO 9001: 2010
Cert. 00739

ISO 14001: 2010
Cert. 38233

Type	DIN Geprüft	DVGW	TÜV CERT	CSA	FM APPROVED	UL	Lloyd's Register		TÜV
LMV51.000C1	●	●	●	---	---	---	●	●	●
LMV51.000C2	●	●	●	---	---	---	●	●	●
LMV51.040C1	---	●	---	●	●	●	●	●	●
LMV51.040C2	---	●	---	---	---	---	●	●	●
LMV51.100C1	●	●	●	---	---	---	●	●	●
LMV51.100C2	●	●	●	---	---	---	●	●	●
LMV51.140C1	---	●	---	●	●	●	●	●	●
LMV51.140C2	---	●	---	---	---	---	●	●	●
LMV51.300B1	●	●	●	---	---	---	---	---	●
LMV51.300B2	●	●	●	---	---	---	---	---	●
LMV51.340B1	---	●	---	●	●	●	---	---	●
LMV52.200B1	●	●	●	---	---	---	---	●	●
LMV52.200B2	●	●	●	---	---	---	---	●	●
LMV52.240B1	---	●	---	●	●	●	---	●	●
LMV52.240B2	---	●	---	---	---	---	---	●	●
LMV52.400B2	●	●	●	---	---	---	---	---	●
LMV52.440B1	---	●	---	---	---	---	---	---	●

Supplementary documentation

User documentation AZL5… Modbus	A7550
User Documentation, basic diagram for LMV5... with 2 types of gas	A7550.1
User Documentation, basic diagram for LMV5... with 2 types of liquefied fuel	A7550.3
Operating Instructions ACS450 PC Software for LMV5...	J7550
Setting Lists	I7550
Fundamentals on Installation LMV5…	J7550.1
Basic Documentation LMV5…	P7550
Range Overview LMV5…	Q7550
Operating Instructions AZL5… (U7550.2) for heating engineer level	74 319 0306 0
Operating Instructions AZL5… (U7550.3) for user level	74 319 0307 0

Service notes

- If fuses are blown, the unit must be returned to Siemens

Life cycle

Burner controls has a designed lifetime* of 250,000 burner startup cycles which, under normal operating conditions in heating mode, correspond to approx. 10 years of usage (starting from the production date given on the type field). This lifetime is based on the endurance tests specified in standard EN 230/EN 298 and the table containing the relevant test documentation as published by the European Association of Component Manufacturers (Afecor) (www.afecor.org).

The designed lifetime is based on use of the burner controls according to the manufacturer's Data Sheet and Basic Documentation.

After reaching the designed lifetime in terms of the number of burner startup cycles, or the respective time of usage, the burner control is to be replaced by authorized personnel.

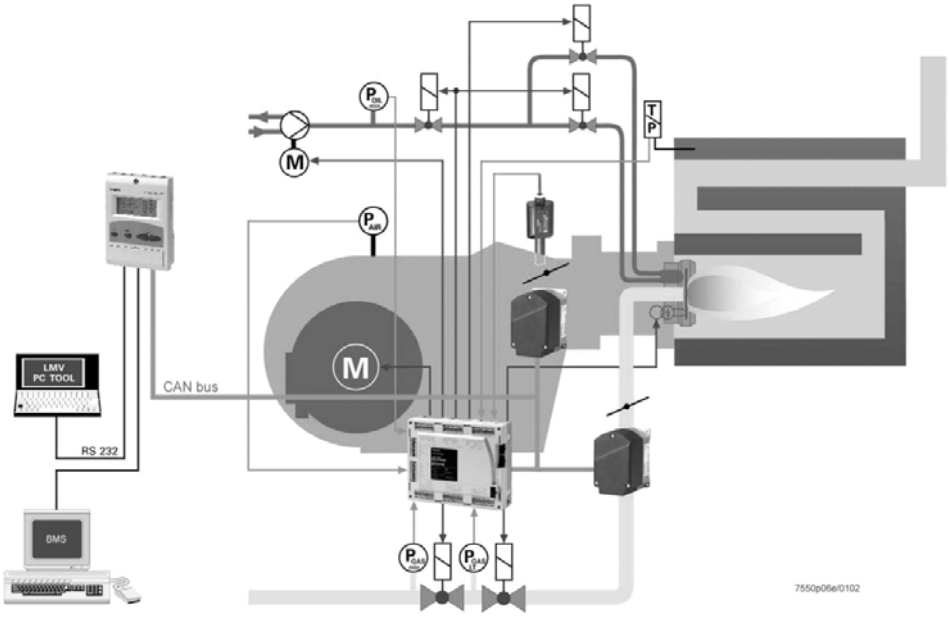
* The designed lifetime is not the warranty time specified in the Terms of Delivery

Disposal notes

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

The following system components are integrated in the basic unit of the LMV5…:

- Burner control with gas valve proving system
- Electronic fuel / air ratio control for use with a maximum of 4 (LMV51…) or 6 (LMV52…) actuators
- Optional PID temperature / pressure controller (load controller)
- Optional variable speed drive module (VSD module)



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

The system components (display and operating unit, actuators and O2 module) are interconnected via a CAN bus system. Communication between the bus users is ensured via a reliable, system-based data bus. For safety reasons, integration of the bus into external CAN bus systems is not allowed. All safety-related digital inputs and outputs of the system are constantly monitored by a contact feedback network (CFN). For flame supervision in connection with the LMV5... and continuous operation, the QRI... infrared flame detector, the QRA7... UV flame detector or an ionization probe can be used and, for intermittent operation, the optical flame detectors type QRB... or QRA2…, QRA4.U, QRA10… with AGQ1… (AC 230 V).

The burner management system is operated and programmed with the help of the display and operating unit (AZL5...) or a PC tool. The AZL5... features clear-text display and menu-driven operation, thus offering straightforward operation and targeted diagnostics. To simplify diagnostics, the display shows the operating states, the type of fault and the point in time the fault occurred. The different parameter setting levels for the burner / boiler manufacturer and the heating engineer are protected by passwords. Basic settings that the plant operator can make on site do not demand a password. Further, the display and operating unit serves as an interface to higher level systems such as building automation and control systems (BACS) or a PC which has the ACS450 software installed. Among other features, the unit affords convenient readout of settings and operating states, parameterization of the LMV5..., and trend logging.

Mechanical design (cont´d)

When replacing the LMV5... basic unit (BU), all parameters can be saved in a backup memory of the AZL5… to be downloaded again when the new unit is installed. Hence, manual reprogramming is not required.

To design specific fuel trains, the burner / boiler manufacturer can choose from a total of 7 valve families and – by making use of the large number of parameter setting choices (programming times, configuration of inputs and outputs, etc.) – fuel trains can be matched to individual needs.

The SQM4.../SQM9... actuators are driven by stepper motors and offer high-resolution positioning. The characteristics and settings of the actuators are defined by the LMV5... basic unit.

Type summary

Type reference	Mains voltage	Parameter set	Max. number of actuators	Automatic adaptation of controller's characteristics	Limit thermostat	Fuel meter input	Integrated gas valve proving	Integrated PID load controller	Control of VSD	Analog output	O2 trim control	Safety time TSAmax.	
												Gas	Oil
LMV51.000C1	AC 120 V	Europe	4	---	---	---	●	---	---	---	---	3 s	5 s
LMV51.000C2	AC 230 V	Europe	4	---	---	---	●	---	---	---	---	3 s	5 s
LMV51.040C1	AC 120 V	US / Canada	4	---	---	---	●	---	---	---	---	10 s	15 s
LMV51.040C2	AC 230 V	US / Canada	4	---	---	---	●	---	---	---	---	10 s	15 s
LMV51.100C1	AC 120 V	Europe	4	●	●	---	●	●	---	●	---	3 s	5 s
LMV51.100C2	AC 230 V	Europe	4	●	●	---	●	●	---	●	---	3 s	5 s
LMV51.140C1	AC 120 V	US / Canada	4	●	●	---	●	●	---	●	---	10 s	15 s
LMV51.140C2	AC 230 V	US / Canada	4	●	●	---	●	●	---	●	---	10 s	15 s
LMV51.300B1	AC 120 V	Europe	5 *)	●	●	●	●	●	●	●	---	3 s	5 s
LMV51.300B2	AC 230 V	Europe	5 *)	●	●	●	●	●	●	●	---	3 s	5 s
LMV51.340B1	AC 120 V	US / Canada	5 *)	●	●	●	●	●	●	●	---	10 s	15 s
LMV52.200B1	AC 120 V	Europe	6	●	●	●	●	●	●	●	●	3 s	5 s
LMV52.200B2	AC 230 V	Europe	6	●	●	●	●	●	●	●	●	3 s	5 s
LMV52.240B1	AC 120 V	US / Canada	6	●	●	●	●	●	●	●	●	10 s	15 s
LMV52.240B2	AC 230 V	US / Canada	6	●	●	●	●	●	●	●	●	10 s	15 s
LMV52.400B2	AC 230 V	Europe	6	●	●	●	●	●	●	●	●	3 s	5 s
LMV52.440B1	AC 120 V	US / Canada	6	●	●	●	●	●	●	●	●	10 s	15 s

*) When the VSD module is activated, only 4 SQM4.../SQM9... actuators can be controlled!

Technical data

LMV5... basic unit

Mains voltage	**AC 120 V** -15% / +10%	**AC 230 V** -15% / +10%
Transformer - Primary side - Secondary side 1 - Secondary side 2	AGG5.210 AC 120 V AC 12 V 2 x AC 12 V	AGG5.220 AC 230 V AC 12 V 2 x AC 12 V
Mains frequency	50 / 60 Hz ±6%	50 / 60 Hz ±6%
Power consumption	<30 W (typically)	<30 W (typically)
Safety class	I, with parts according to II and III to DIN EN 60730-1	
Terminal loading «Inputs»		
• Perm. mains primary fuse (externally)	Max. 16 AT	Max. 16 AT
• Unit fuse F1 (internally)	6.3 AT to DIN EN 60127 2/5	6.3 AT to DIN EN 60127 2/5
• Mains supply: Input current depending on operating state of the unit		
Undervoltage		
• Safety shutdown from operating position at mains voltage	<AC 96 V	<AC 186 V
• Restart on rise in mains voltage	>AC 100 V	>AC 188 V
Oil pump / magnetic clutch (nominal voltage)		
• Nominal current	1,6 A	2 A
• Power factor	Cosφ >0.4	Cosφ >0.4
LP test valve (nominal voltage)		
• Nominal current	0.5 A	0.5 A
• Power factor	Cosφ >0.4	Cosφ >0.4
Status inputs (KRN): Status inputs (with the exception of the safety loop) of the contact feedback network (CFN) are used for system supervision and require mains-related input voltage		
• Input safety loop	Refer to «Terminal loading outputs»	
• Input currents and input voltages		
- UeMax	UN +10%	UN +10%
- UeMin	UN -15%	UN -15%
- IeMax	1.5 mA peak	1.5 mA peak
- IeMin	0.7 mA peak	0.7 mA peak
• Contact material recommendation for external signal sources (LP, DWmin, DWmax, etc.)	Gold-plated silver contacts	
• Transition / settling behavior / bounce		
- Perm. bounce time of contacts when switching on / off	Max. 50 ms (after the bounce time, the contact must stay closed or open)	
• UN	AC 120 V	AC 230 V
• Voltage detection		
- On	AC 90...132 V	AC 180...253 V
- Off	<AC 40 V	<AC 80 V
Terminal loading «Outputs»		
Total contact loading:		
(nominal voltage)		
• Unit input current (safety loop) total contact current from: - Fan motor contactor - Ignition transformer - Valves - Oil pump / magnetic clutch	Max. 5 A	Max. 5 A

Individual contact loading:

Fan motor contactor		
• Nominal voltage	**AC 120 V**	**AC 230 V**
• Nominal current	1 A	1 A
• Power factor	Cosφ >0.4	Cosφ >0.4
Alarm output (nominal voltage)		
• Nominal current	1 A	1 A
• Power factor	Cosφ >0.4	Cosφ >0.4
Ignition transformer (nominal voltage)		
• Nominal current	1.6 A	2 A
• Power factor	Cosφ >0.2	Cosφ >0.2
Fuel valves-gas (nominal voltage)		
• Nominal current	1.6 A	2 A
• Power factor	Cosφ >0.4	Cosφ >0.4
Fuel valves-oil (nominal voltage)		
• Nominal current	1.6 A	1 A
• Power factor	Cosφ >0.4	Cosφ >0.4
Cable lengths		
• Mains line	Max. 100 m (100 pF/m)	Max. 100 m (100 pF/m)
• HCFN line	Max. 100 m (100 pF/m) [1)]	Max. 100 m (100 pF/m) [1)]
• Analog line	Max. 100 m (100 pF/m)	Max. 100 m (100 pF/m)
• Flame detector	Refer to chapter «Technical Data / Flame supervision»	
• CAN bus	Total lengths max. 100 m	

Note!
[1)] If the cable length exceeds 50 m, additional loads must not be connected to the status inputs (refer to «Power supply for the LMV5… system»)!

Above a certain cable length, the actuators must be powered by a separate transformer installed near the actuators.

Cross-sectional areas

The cross-sectional areas of the mains power lines (L, N, PE) and, if required, the safety loop (safety limit thermostat, water shortage, etc.) must be sized for nominal currents according to the selected external primary fuse. The cross-sectional areas of the other cables must be sized in accordance with the internal unit fuse (max. 6.3 AT).

Min. cross-sectional area	0.75 mm² (single- or multi-core to VDE 0100)

Cable insulation must meet the relevant temperature requirements and conform to the environmental conditions. The CAN (bus) cables have been specified by Siemens and can be ordered as accessory items. **Other cables must not be used. If this is not observed, the EMC characteristics of the LMV5... system will be unpredictable!**

Fuses used in the LMV5... basic unit		
- F1	6.3 AT DIN EN 60127 2/5	6.3 AT DIN EN 60127 2/5
- F2	4 AT GMD-4A	4 AT DIN EN 60127 2/5
- F3	4 AT GMD-4A	4 AT DIN EN 60127 2/5

AZL5... operating and display unit

Operating voltage	AC 24 V -15% / +10%
Power consumption	<5 W (typically)
Degree of protection of housing	
- Rear	IP00 to IEC 529
- Front	IP54 to IEC 529 when installed
Safety class	I, with parts according to II and III to DIN EN 60730-1

Battery:

Supplier	**Type reference**
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

PLL52...

Mains voltage «X89-01»	AC 120 V –15% / +10%	AC 230 V –15% / +10%
Safety class	I, with parts according to II to DIN EN 60730-1	
Mains frequency	50 / 60 Hz ±6%	50 / 60 Hz ±6%
Power consumption	Approx. 4 VA	Approx. 4 VA
Degree of protection	IP54, housing closed	

Cable lengths / cross-sectional areas:

• Electrical connection «X89»	Screw terminals up to 2.5 mm²
• Cable lengths	≤10 m to QGO20...
• Cross-sectional areas	Refer to QGO... description, twisted pairs

Analog inputs:

• Supply air temperature sensor	Pt1000 / LG-Ni1000
• Flue gas temperature sensor	Pt1000 / LG-Ni1000
• QGO20...	Refer to Data Sheet N7842
• Interface	Communication bus for LMV52...

AGG5.2…

Transformer AGG5.220	
- Primary side	AC 230 V
- Secondary side	AC 12 V (3x)
Transformer AGG5.210	
- Primary side	AC 120 V
- Secondary side	AC 12 V (3x)

CAN bus cable

Cable types:	
AGG5.641	8 mm dia. ±0.2 mm Bending radius ≥120 mm Ambient temperature -30...+70°C (no movements of cable) Cable is resistant to almost all types of mineral oil
AGG5.631	7.5 mm dia. ±0.2 mm Bending radius ≥113 mm Ambient temperature -30...+70°C (no movements of cable) Cable is resistant to almost all types of mineral oil

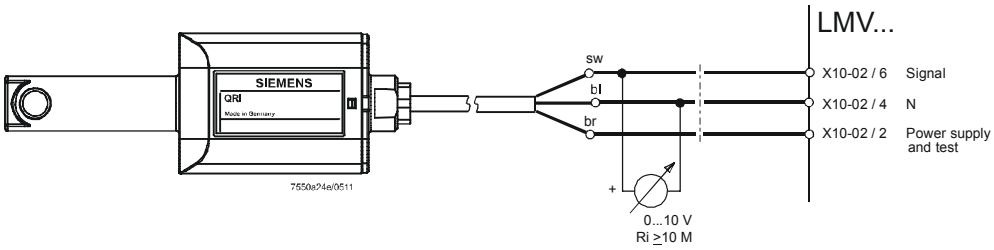
Flame supervision

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

QRI (suited for continuous operation)

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)	Min. DC 3,5 V Display flame approx. 50 %

Connection diagram



For detailed information, refer to Data Sheet N7719.

IONIZATION (suited for continuous operation)

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

Caution!
The ionization probe must be installed such that protection against electrical shock hazard is ensured!

Short-circuit current	Max. AC 0,5 mA
Required detector current	Min. DC 6 µA Display flame approx. 50 %
Possible detector current	Max. DC 85 µA Display flame approx. 100 %
Permissible length of detector cable (lay 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.

Flame supervision

QRA2… / QRA4.U / QRA10… with AGQ1…A27

For intermittent operation only.

Note!
AGQ1… is only available for AC 230 V mains voltage.

QRA…

Power supply in operation	DC 280…325 V
Power supply in test mode	DC 390…750 V

For more detailed information about QRA2… / QRA10…, refer to Data Sheet N7712.

For more detailed information about QRA4.U, refer to Data Sheet N7711.

Caution!
QRA2… (QRA4.U / QRA10... must not be used when extraneous light suppression is activated since detector tests will not be made in that case!

LMV5…

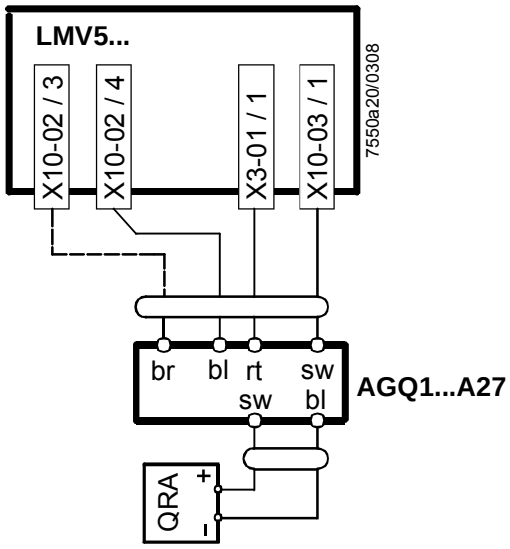
Possible ionization current	Max. 10 µA
Ionization current required	Min. 6 µA

AGQ1…A27

In connection with the LMV5…, ancillary unit AGQ1…A27 must be used.

Power supply	AC 230 V
Possible current	Max. 500 µA
Current required	Min. 200 µA

Connection diagram



Assignment of LMV5…terminals:

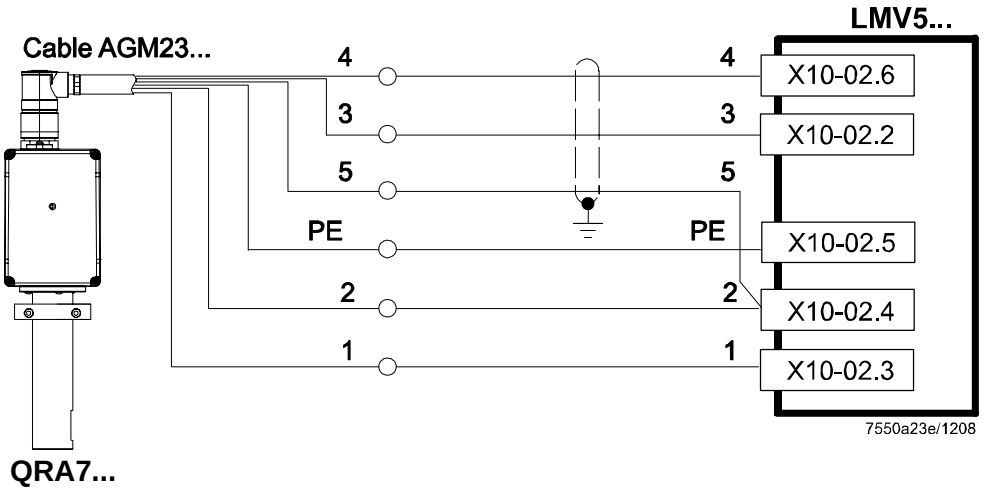
X10-02 / 3	L
X10-02 / 4	N
X10-03 / 1	Ionization
X3-01 / 1	Fan

When laid together with other cables (e.g. in a cable duct), the length of the 2-core cable between QRA… and AGQ… must not exceed 20 m. A maximum cable length of 100 m is permitted if the 2-core cable is run at a distance of at least 5 cm from other live cables. The length of the 4-core cable between AGQ… and LMV5… is limited to 20 m. A maximum cable length of 100 m is permitted if the signal line (ionization / black) is not run in the same cable but separately at a distance of at least 5 cm from other live cables.

Flame supervision

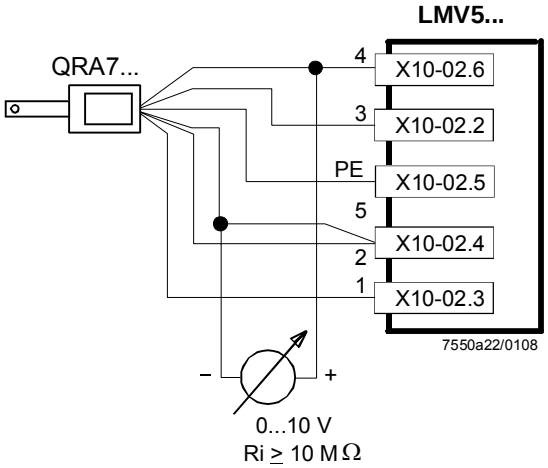
QRA7…
(suited for continuous operation)

Power supply for operation	
- QRA73A17 / QRA75A17	AC 120 V
- QRA73A27 / QRA75A27	AC 230 V
Power supply for test via increasing the power supply for QRI... (X10-02 terminal 2)	From DC 14 V up to DC 21 V
Required signal voltage (X10-02 terminal 6)	Min. DC 3.5 V
Perm. length of detector cable	
- 6 wire cable	Max. 10
- Signal cable no. 3, 4 and 5	Max. 100 m (lay separately from L, N and PE in shielded cable)



For more detailed information about QRA7…, refer to Data Sheet N7712.

Connection diagram



Assignment of LMV5… terminals:

X10-02 / 2	QRI... supply
X10-02 / 3	L
X10-02 / 4	N
X10-02 / 5	PE
X10-02 / 6	QRI... signal

Flame supervision

QRB... (for intermittent operation only)

No-load voltage at the QRB... terminal (X10–02, terminal 1)	Approx. DC 8 V
Detector current required (with flame)	Min. DC 30 µA Display flame 35 %
Permissible detector current (dark current with no flame)	Max. DC 5 µA
Permissible detector current	Max. DC 70 µA Display flame approx. 100 %
Permissible length of QRB... detector cable (lay separately)	100 m (wire-wire 100 pF/m)

Note!
A detector resistance value of RF <5 kΩ is identified as a short-circuit and, in operation, will lead 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, 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. Separate routing of detector cables as specified in Data Sheet 7714 must be observed.

Configuration
extraneous light
In the case of incinerator plant or other types of plant operating at combustion chamber temperatures of >650 °C, an extraneous light test must not be made.

Caution!
Observe the relevant standards and regulations (e.g. extra supervision of the combustion chamber temperature)!

Indication of flame AZL5…

Caution!
QRB… must not be used when extraneous light suppression is activated since detector tests will not be made in that case!

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 N7714.

Environmental conditions
(all LMV5... system components)

Storage	DIN EN 60721-3-1
Climatic conditions	Class 1K3
Mechanical conditions	Class 1M2
Temperature range	-20...+60°C
Humidity	<95% r.h.
Transport	DIN EN 60721-3-2
Climatic conditions	Class 2K2
Mechanical conditions	Class 2M2
Temperature range	-20...+60°C
Humidity	<95% r.h.
Operation	DIN EN 60721-3-3
Climatic conditions	Class 3K3
Mechanical conditions	Class 3M3
Temperature range	-20...+60°C
Humidity	<95% r.h.

Caution!
Condensation, formation of ice and ingress of water are not permitted!

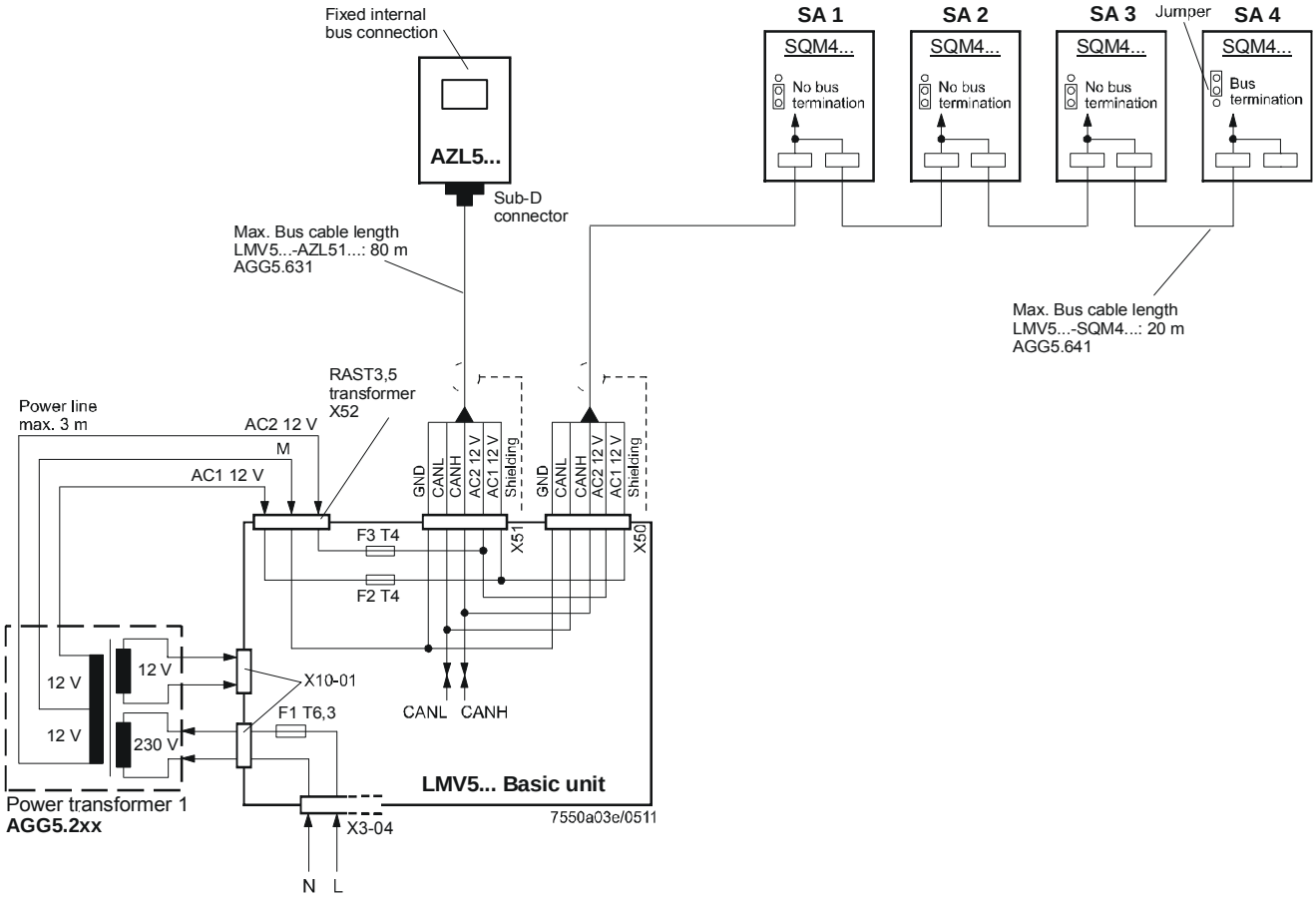
Power supply for the LMV5... system

General

The LMV5... system is powered via external transformer AGG5.2.... This transformer supplies power to certain electronics sections via terminal X10 – 01 and to internal modules, actuators and display and operating units via terminal X52. Run the power lines to the bus users together with the communication lines in a common cable. Since the transformer's power line is restricted, a second power transformer is required if the system uses more than 4 SQM45... actuators (or in the case of longer distances). The second power transformer is operated as shown in example 2. In principle, the bus topology must always have a line structure and, therefore, must have a start and an end node. The individual bus users must be connected in series, whereby the respective end nodes are to be terminated by bus terminating resistors. The basic unit is a component of the communication line and to be looped in between the AZL5... and the actuators. Within the system, the AZL5... always assumes the function of a bus end node. The required bus terminating resistor is already integrated in that case. With the actuators, the last user becomes the bus end node (here, the internal bus termination must be activated via a connecting plug). The other node users within the line structure are to be configured without using a terminating resistor.

Example 1

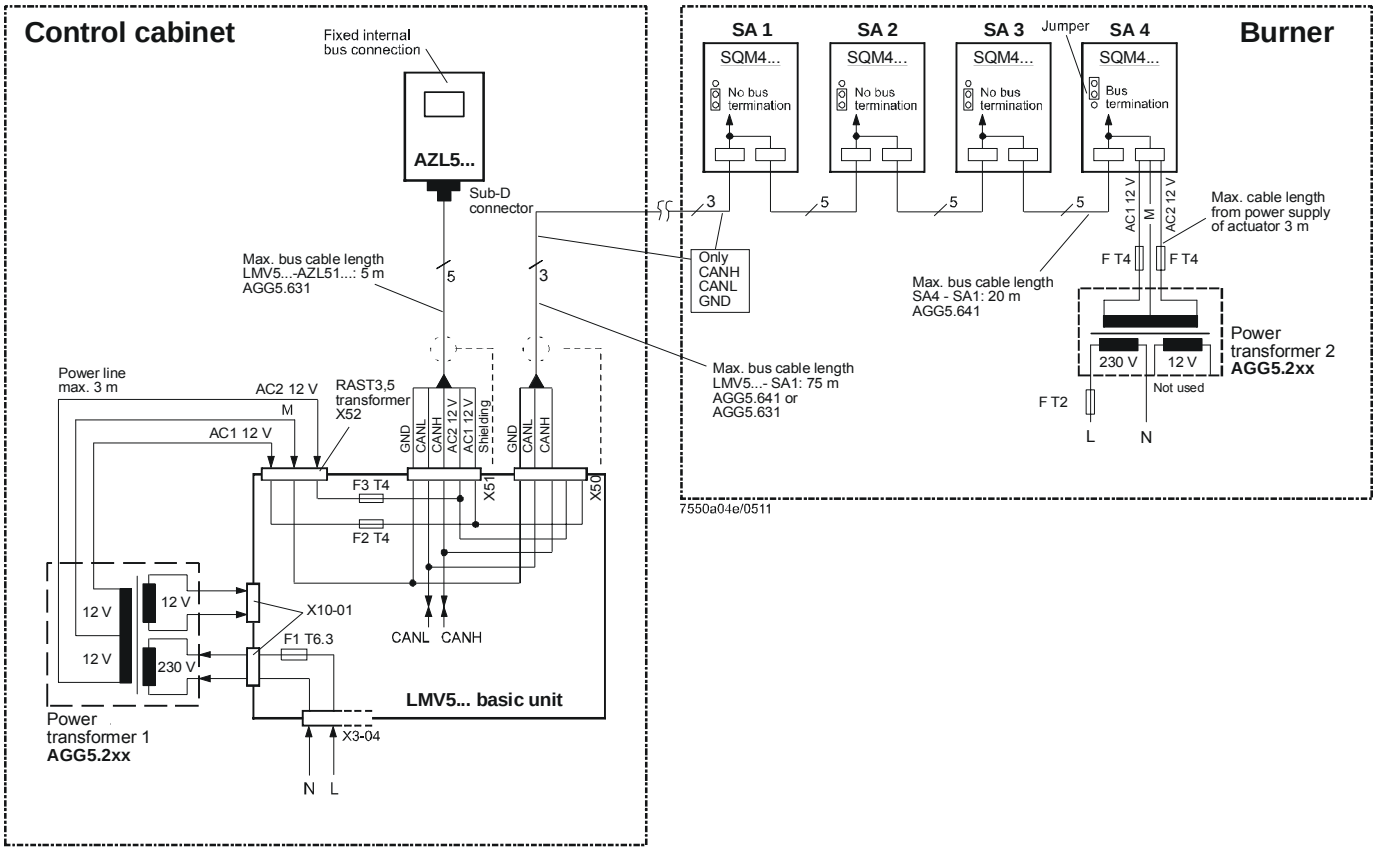
Installation of all components in the burner;
CAN bus cable ↔LMV5... →shielding last actuator ≈ 20 m



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... ↔ last actuator» >20 m



Note on example 2!
Total CAN bus cable length ≤100 m

If the distance between the LMV5... and the last actuator exceeds 20 m, or if more than 4 SQM45… are fitted to the burner (refer to «Determination of the maximum cable length»), a second transformer is required for powering the actuators. In that case, transformer 1 powers the LMV5... basic unit and the AZL5... display and operating unit (control panel). Transformer 2 powers the actuators (burner).

Note!
With the CAN bus cable connections from the LMV5... (control panel) to the first actuator (burner), the 2 voltages AC1 and AC2 on the LMV5... side must **not** be connected and only cables CANH, CANL and GND (+shielding) are to be connected to the first actuator (burner).
In that case, the actuators must be powered by a second transformer which to be located near the actuators.

The power from that transformer (lines AC1, AC2, M) must be fed to the actuator (ACT4 in the example above) and then connected through via bus cable AGG5.641 (cable type 1) to all the other actuators. The fuses required for transformer 1 are accommodated in the LMV5... basic unit.

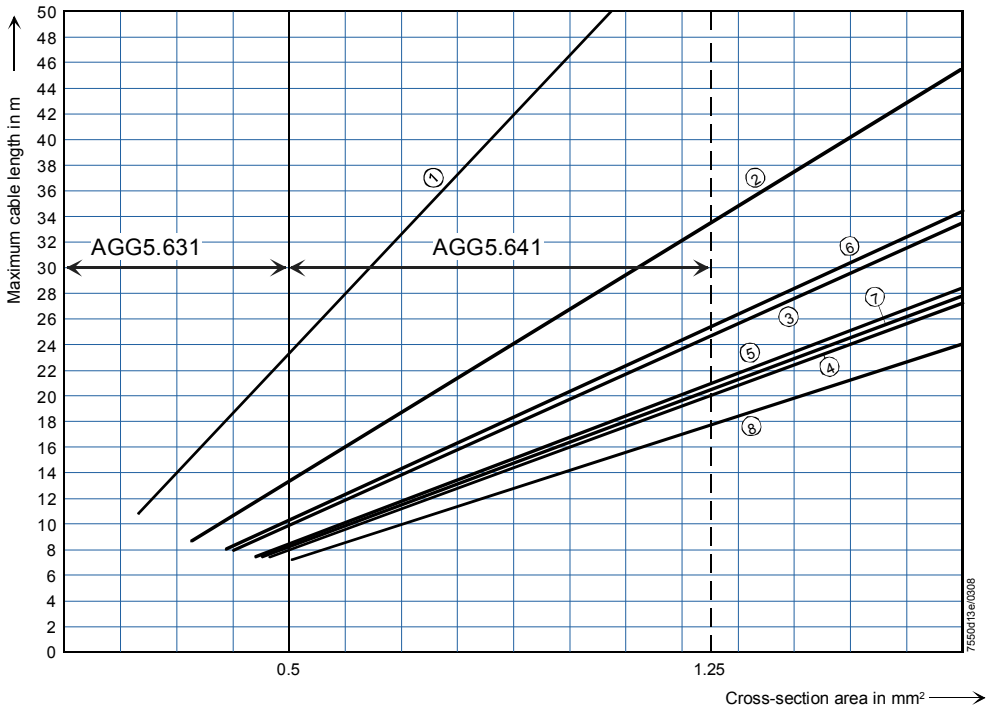
Note!
For transformer 2, the 3 fuses must be located close to the transformer (for type, refer to Basic Documentation P7550).

For additional examples, refer to Basic Documentation P7550!

Determination of the maximum cable length

The maximum cable length between power transformer and CAN bus users is dependent on the type of cable (cross-sectional area), the number of actuators and the type of actuator (supply current). The charts below can be used to determine the maximum CAN bus cable lengths between the transformer and the group of actuators or display and operating unit, depending on the influencing factors. The assumption is made here 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 length for the specified system cables AGG5.641 and AGG5.631 result from the points of intersection with the curves in the chart.

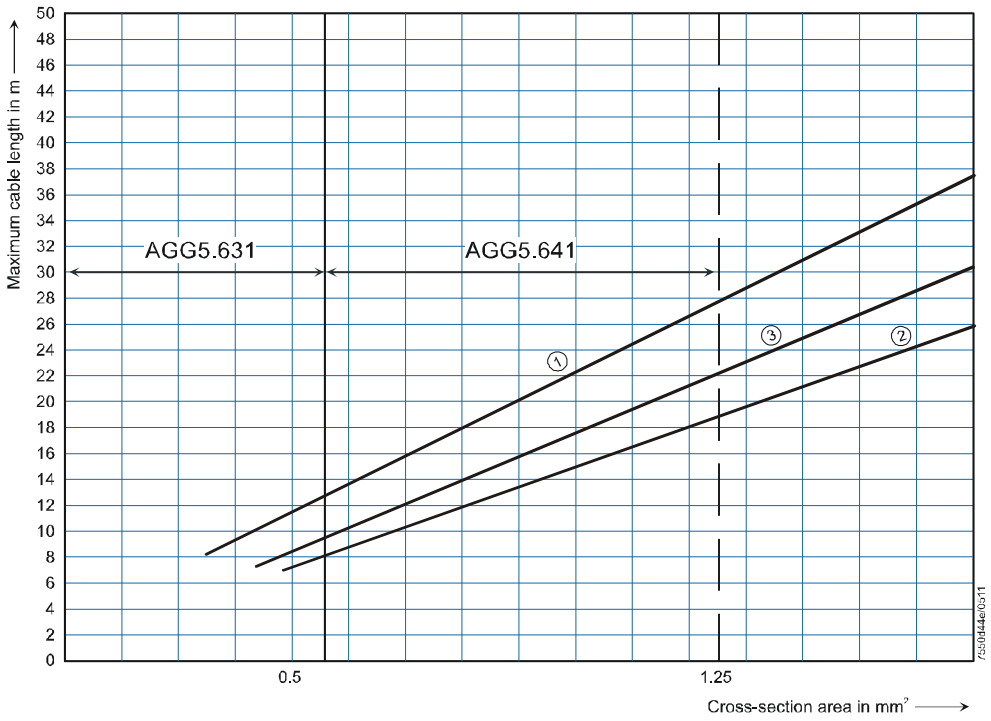
Diagram for cable length SQM45.../SQM48...



AGG5.631 (cable type 2)
AGG5.641 (cable type 1)

① 1 x SQM45...
② 2 x SQM45...
③ 3 x SQM45...
④ 4 x SQM45...
⑤ 2 x SQM48...
⑥ 1 x SQM45... + 1 x SQM48...
⑦ 2 x SQM45... + 1 x SQM48...
⑧ 3 x SQM45... + 1 x SQM48...

Diagram for cable length SQM45..., SQM48... and SQM9...



AGG5.631 (cable type 2)
AGG5.641 (cable type 1)

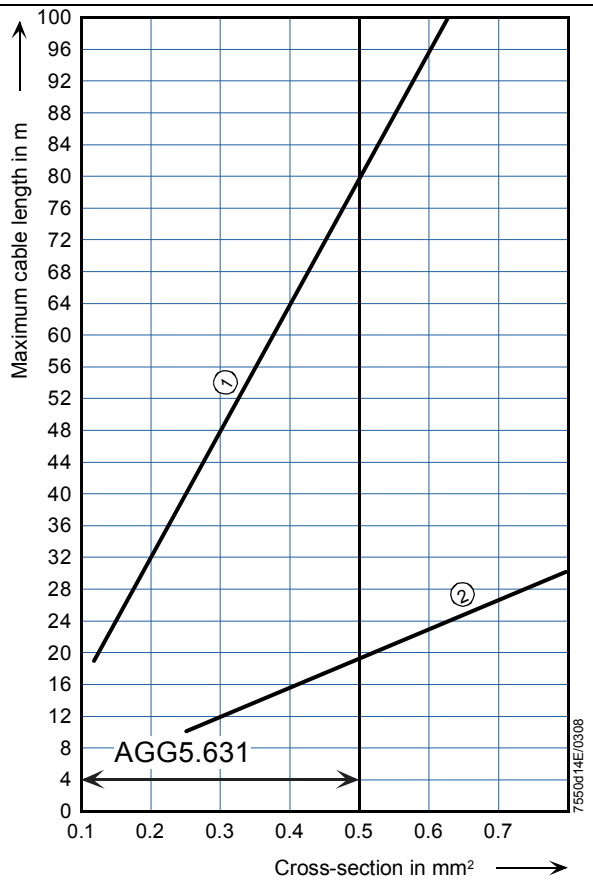
① 1 x SQM9...
② 1 x SQM48... + 1 x SQM9...
③ 1 x SQM45... + 1 x SQM9...

CAN bus connection between power transformer and actuator group

Note!
When using a PLL52..., the maximum permissible cable length is to be reduced by 2 m.

Example:
- System cable: AGG5.641 (connecting cable to the actuators)
- Actuators: 2 x SQM45...

The point of intersection of the vertical line for the AGG5.641 (1.25 mm^2) and curve ② (2 x SQM45...) gives a maximum cable length of 33.4 m between the power transformer and the group of actuators.

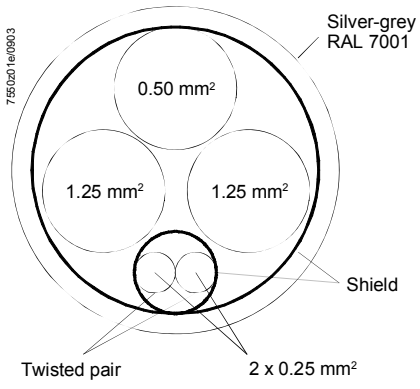


AGG5.631 (cable type 2)
① 1 x AZL5...
② 1 x AZL5... + 1 x SQM45...

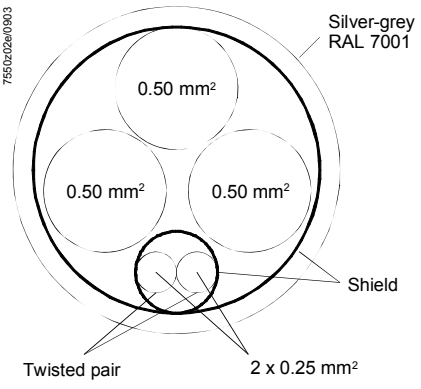
CAN bus connection between power transformer and AZL5... display and operating unit

Cable types

AGG5.641 (cable type 1) LMV5… ↔ SA



AGG5.631 (cable type 2) LMV5… ↔ AZL5...



Function of communication interfaces of AZL5...

The AZL5... is equipped with 3 different interfaces (connection facilities):

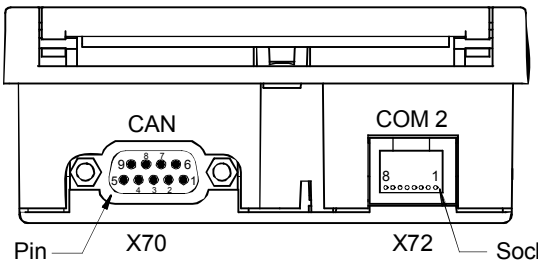
- Interface for LMV5... basic unit: CAN bus including power supply for AZL5...
  CAN X70 CAN bus connection for LMV5... basic unit, RJ45 (Sub-D connector X70)
- Interface for PC / laptop: RS-232 (Sub-D connector X71)
  COM1 port for PC, for parameterization and visualization by means of PC tool software, Sub-D, 9 pins
- Interface RS-232 for building automation (RJ45 connector X72)
  COM2 port for building automation via external bus interface (RS232)

Note!
COM1 and COM2 **cannot** simultaneously be active!

Assignment of terminals on AZL5…

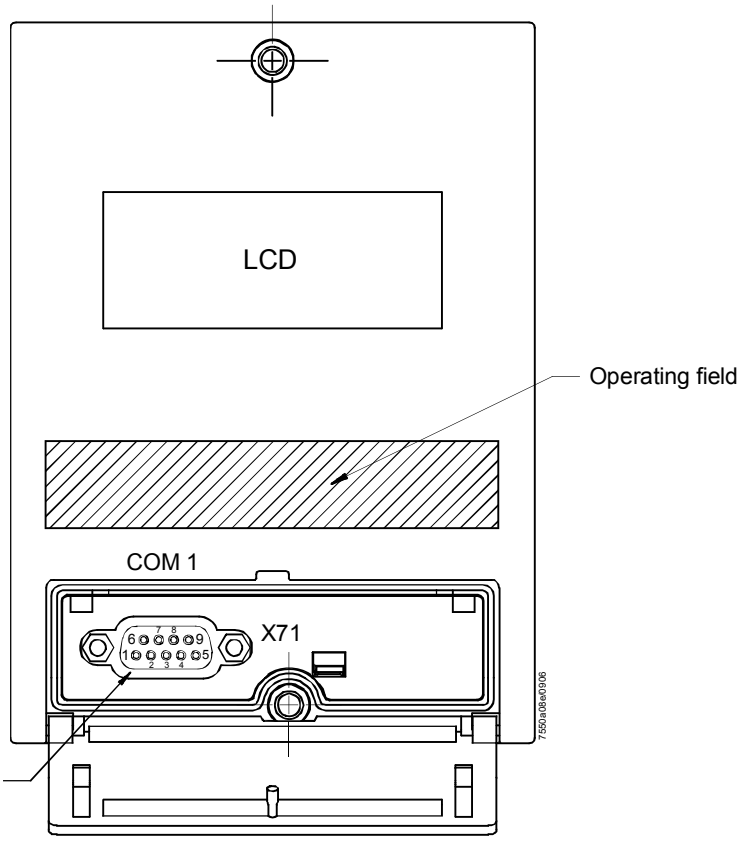
CAN X70

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

Pins without designation = not connected

Connection to higher level systems

Communication to a building automation and control system is effected via data connection through an external bus interface with galvanic separation connected to the COM2 port of the AZL5... Depending on the configuration of the AZL5..., this port can be used to serve either Modbus or eBus.

Modbus

When using this bus protocol, the AZL5... operates as a slave. The transmission mode employed is the RTU Modbus (Remote Terminal Unit). For detailed information, refer to document «AZL5... Modbus, A7550». Standardized coupling software is available on request.

Function of VSD (only LMV51.3... / LMV52.2... with AZL52… and LMV52.4...)

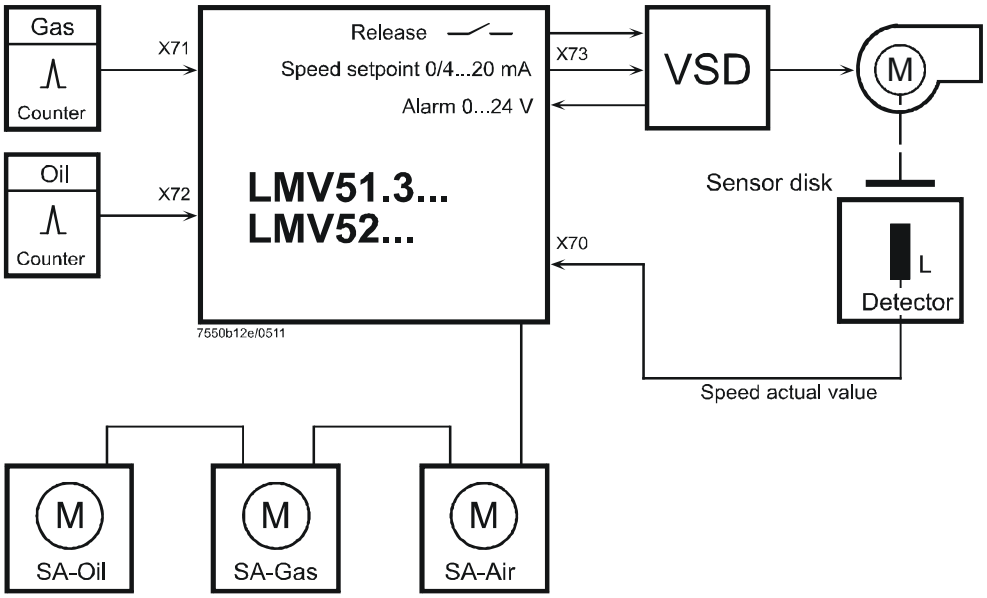
General

The VSD module is an extension to the LMV52.2... and is used for the control of a VSD that ensures safety-related supervision of the fan speed.
2 fuel meters (oil and gas) can be connected as an option.

A VSD can be connected to the VSD module integrated in the LMV52.2… 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 input. When activated, the LMV52.2... will enter the safety phase. Both motor speed and direction of rotation are acquired by an inductive sensor. In addition, the asymmetric speed signal is checked for direction of rotation and plausibility.

The VSD module generates the acceleration / deceleration ramps in accordance with the parameter settings made on the LMV52.2... The motor speed is adjusted the same way the speed of the actuators is adjusted. For this reason, the characteristic of the VSD must be linear. Remove filters, delay and damping elements. The VSD module of the LMV52.2... ensures that the motor's speed is controlled to the setpoint. The control range is limited to +15% / -10%. If control range limitation becomes active, the *AZL5...* will display it. If this is the case for a longer period of time (→ «Safety time ratio control»), the LMV52.2... will shut down, delivering the message «Special position not reached» or «Speed not reached». Speed control is only active with speeds ≥8%.

Basic diagram



The auxiliary actuator can be parameterized on the basic unit, depending on the type of fuel.

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 3 different lengths.

☞ Note!
Speed acquisition is safety-related!

We recommend using the AGG5.310 accessory kit.
To enable the acquired speed to be standardized to the range of 0...100%, the speed corresponding to 100% must be parameterized (→ «Standardization of speed»).

For more detailed information about the AGG5.310, refer to Basic Documentation P7550 or Mounting Instructions M7550!

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 the system 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 (pnp) with $U_{CE\text{-}sat}$ <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

Configuration of interface

The VSD is controlled via a current interface, which can be switched between 0...20 mA and 4...20 mA.

Note

If the VSD requires a DC 0...10 V input signal, a resistor of 500 Ω ±1% must be connected to its input in parallel.

Functional tests

LMV5... system → VSD

Both functional tests with the LMV5... system were conducted and successfully completed with the following types of VSDs:
Siemens: - Micromaster 440
Danfoss: - VT2807

EMC

In operation, VSDs produce electromagnetic interference.

For this reason – to ensure EMC of the entire system – the instructions given by the manufacturers must be observed:
Siemens: - Operating Instructions
→ EMC-compatible installation
Danfoss: - Technical Brochure → Radio Interference Suppression Filters
- Data Sheet of Danfoss EMC filter for long motor cables

☞ Note!
When using other types of VSDs, compliance with EMC regulations and correct functioning will not be ensured!

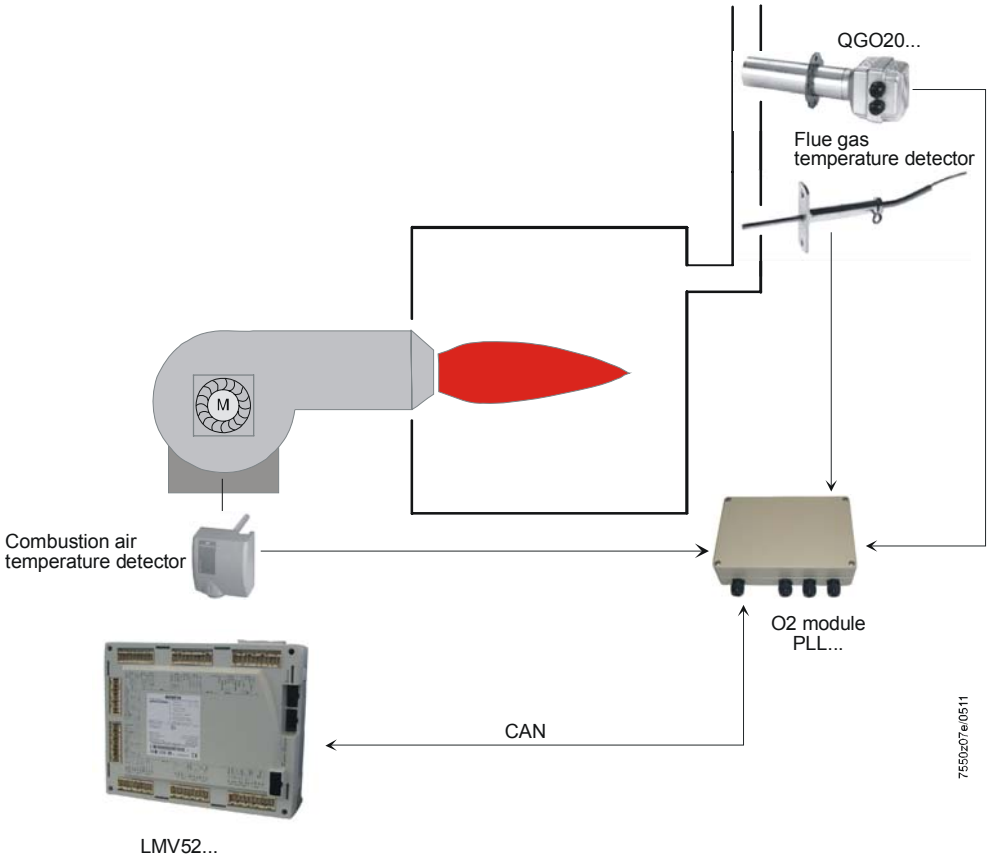
Function of LMV52... with O2 trim control

General

The LMV52... system is an extended LMV51... system. A special feature of the LMV52… is control of the residual oxygen content, aimed at increasing boiler efficiency.

In addition to the features of the LMV51..., the LMV52... provides O2 trim control, control of a maximum of 6 actuators, control of a VSD, and acquisition of cumulated fuel consumption and current fuel throughput. The LMV52... system uses an O2 sensor (QGO20...), an external O2 module, and the standard components of the LMV51... system.

The PLL... O2 module is a detached measuring module for use with the QGO20... sensor with a connection facility for 2 temperature sensors (Pt1000 / LG-Ni 1000). With the help of the temperature sensors (flue gas and combustion air temperature), the combustion performance can be determined, depending on the type of fuel. The module communicates via CAN bus with the LMV52... basic unit. The O2 module is to be located near the QGO... (<10 m) to keep the impact on sensitive sensor lines as low as possible. To power the sensor's heating element, the O2 module needs its own mains connection.



O2 trim control
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.

Warning!
The ratio curves must always be adjusted such that there are sufficient amounts of excess O2 available, irrespective of environmental conditions!

Parameter	*O2 Ctrl/Guard (man deact / O2-guard/ O2-control / conAutoDeac / auto deact)*

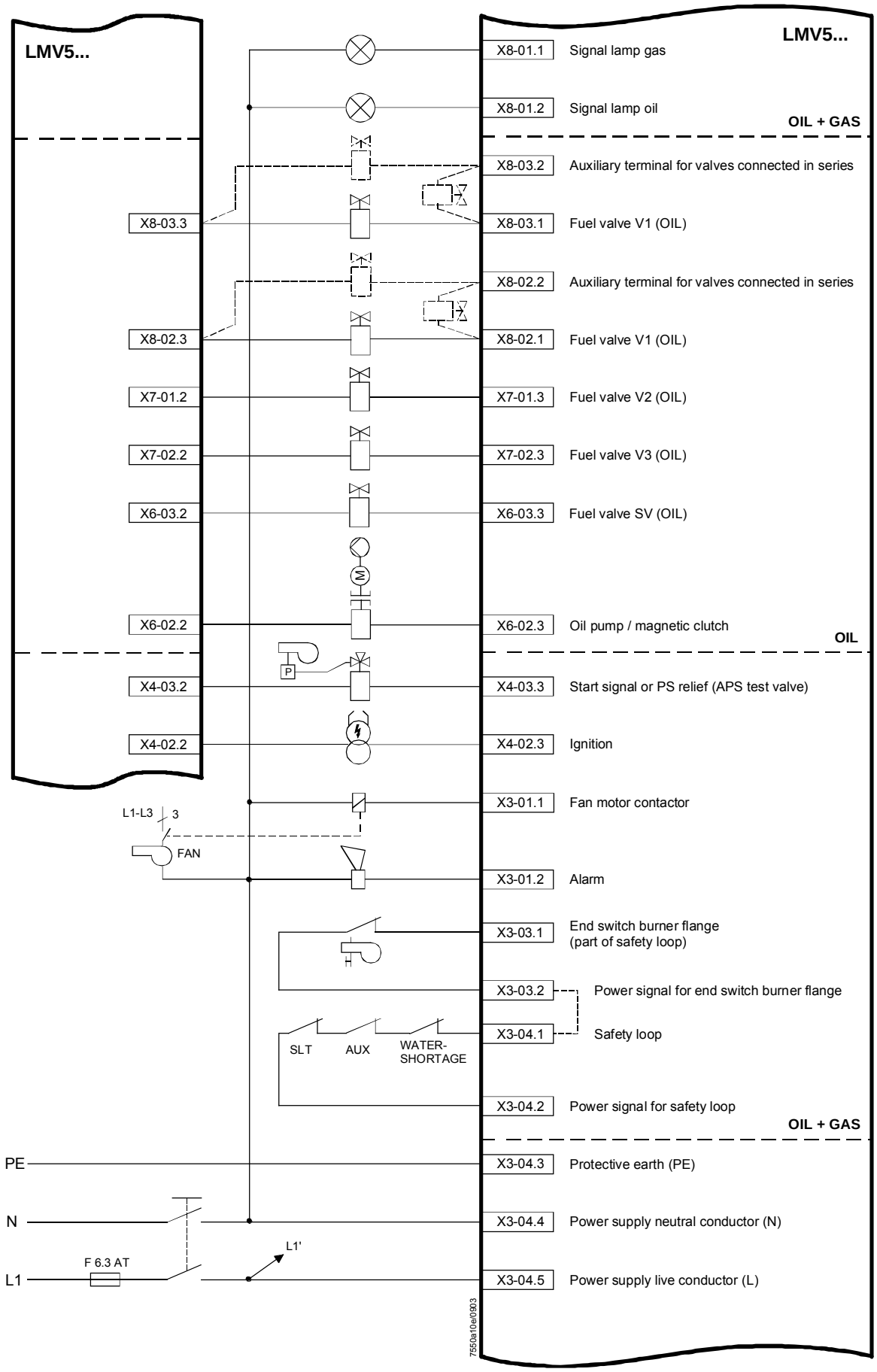
man deact	Both O2 trim controller and O2 monitor are deactivated. The system operates along the parameterized ratio curves.
O2-guard	Only the O2 monitor is active. Prior to startup, the O2 sensor must have reached its operating temperature. If not, startup will be prevented. If the O2 monitor responds, or if an error occurs in connection with O2 measurement, the O2 module or O2 sensor, safety shutdown will take place, followed by a repetition and followed by 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 O2 sensor, safety shutdown will take place, followed by a repetition and followed by 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 is 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».

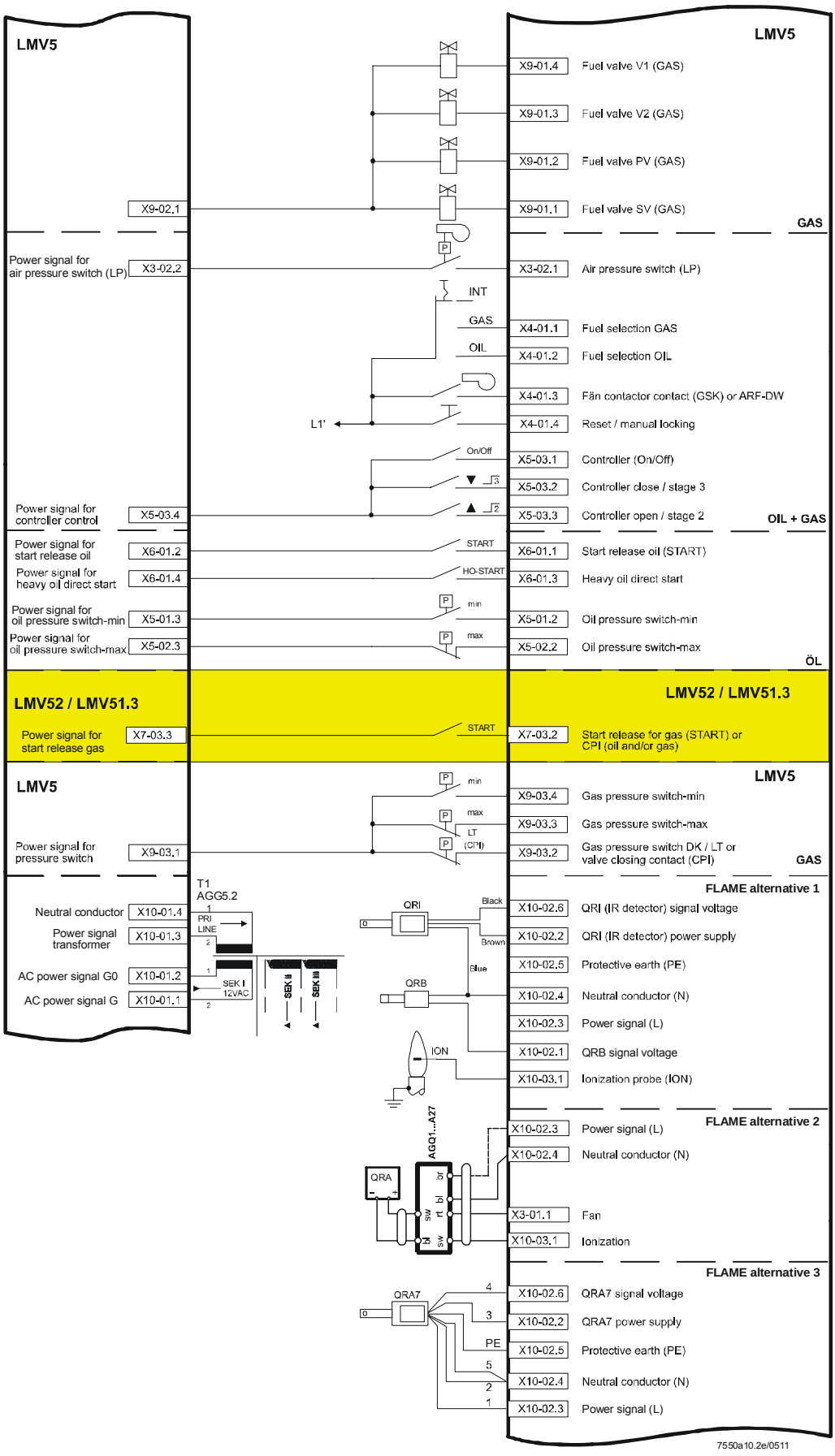
Auxiliary function

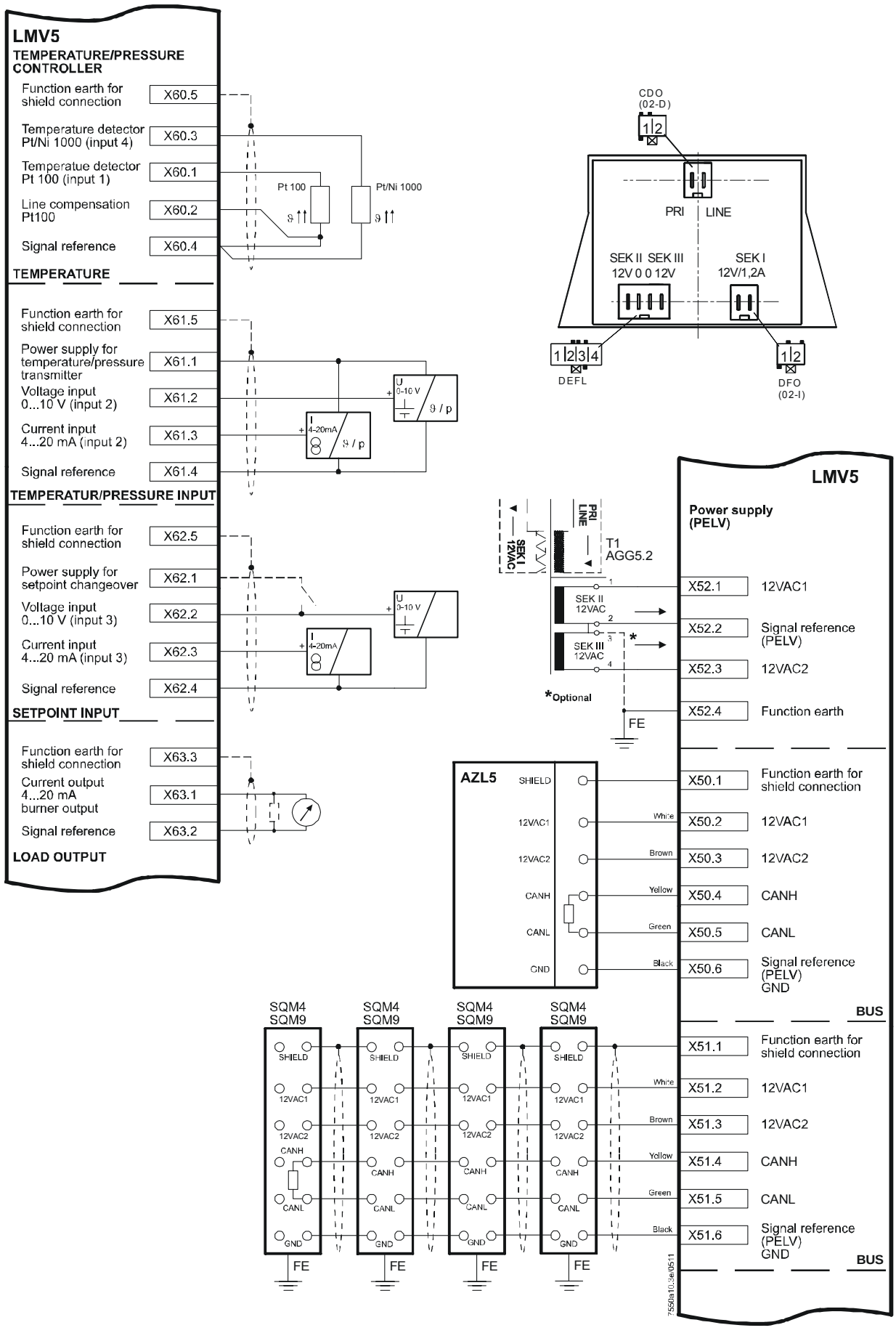
Warning when flue gas temperature exceeds a certain level.

If a flue gas temperature sensor is connected and activated, a warning signal will be delivered when a preset flue gas temperature is exceeded. High flue gas temperatures are an indication of higher boiler losses ⇒ Boiler should be cleaned. The warning threshold can be set separately for firing on gas and oil.

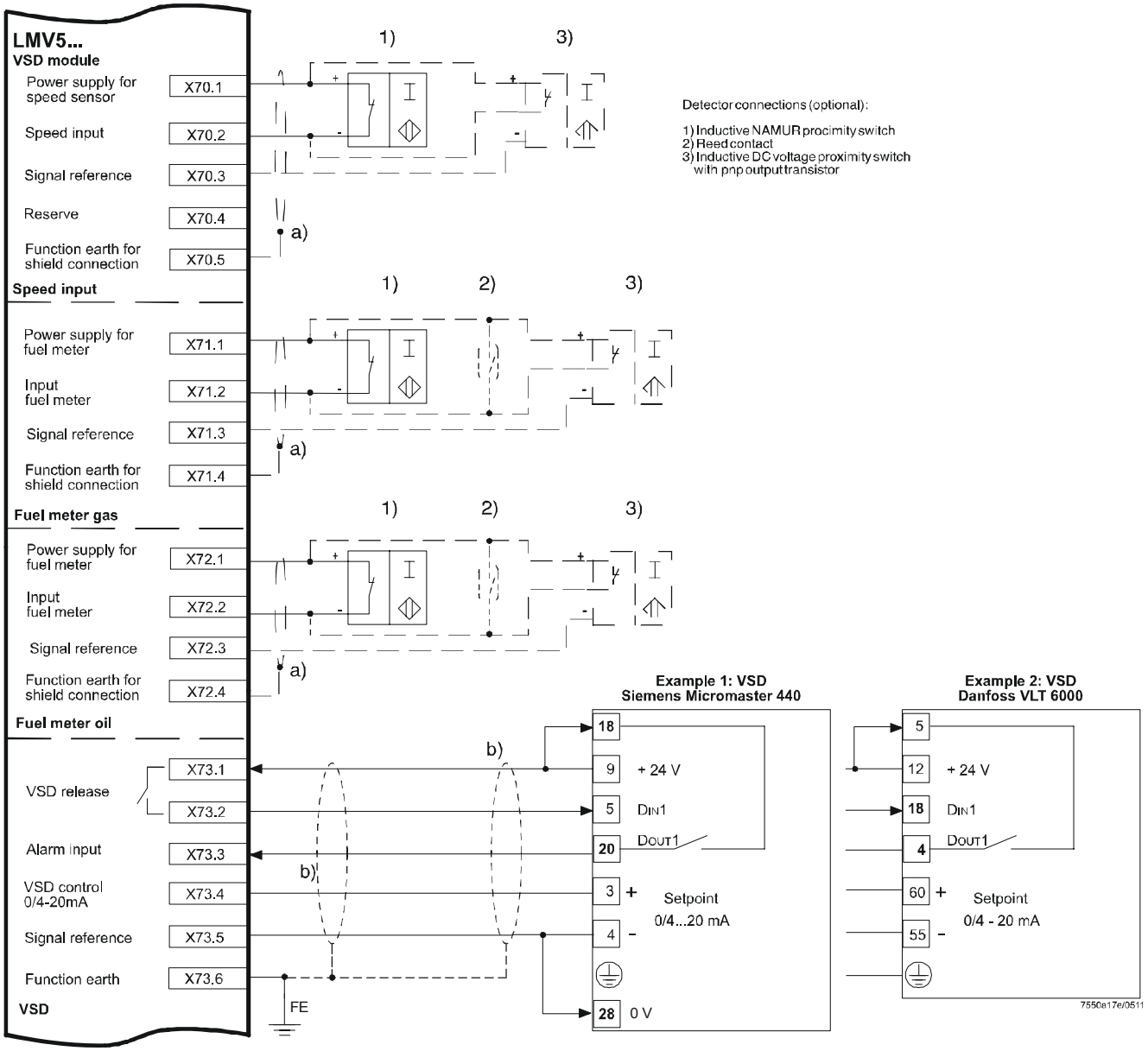
Block diagram inputs / outputs




LMV5
X9-02.1
Power signal for air pressure switch (LP)
X3-02.2
Power signal for controller control
X5-03.4
Power signal for start release oil
X6-01.2
Power signal for heavy oil direct start
X6-01.4
Power signal for oil pressure switch-min
X5-01.3
Power signal for oil pressure switch-max
X5-02.3
LMV52 / LMV51.3
Power signal for start release gas
X7-03.3
LMV5
Power signal for pressure switch
X9-03.1
Neutral conductor
X10-01.4
Power signal transformer
X10-01.3
AC power signal G0
X10-01.2
AC power signal G
X10-01.1
T1
AGG5.2
PRI
LINE
SEK I
12VAC
SEK II
SEK III
L1'
INT
GAS
OIL
On/Off
START
HO-START
min
max
LT
(CPI)
QRI
QRB
ION
AGQ1...A27
QRA
QRA7
PE
br
bl
rt
sw
gn
sw
Black
Brown
Blue
LMV5
X9-01.4 Fuel valve V1 (GAS)
X9-01.3 Fuel valve V2 (GAS)
X9-01.2 Fuel valve PV (GAS)
X9-01.1 Fuel valve SV (GAS)
GAS
X3-02.1 Air pressure switch (LP)
X4-01.1 Fuel selection GAS
X4-01.2 Fuel selection OIL
X4-01.3 Fän contactor contact (GSK) or ARF-DW
X4-01.4 Reset / manual locking
X5-03.1 Controller (On/Off)
X5-03.2 Controller close / stage 3
X5-03.3 Controller open / stage 2
OIL + GAS
X6-01.1 Start release oil (START)
X6-01.3 Heavy oil direct start
X5-01.2 Oil pressure switch-min
X5-02.2 Oil pressure switch-max
ÖL
LMV52 / LMV51.3
X7-03.2 Start release for gas (START) or CPI (oil and/or gas)
LMV5
X9-03.4 Gas pressure switch-min
X9-03.3 Gas pressure switch-max
X9-03.2 Gas pressure switch DK / LT or valve closing contact (CPI)
GAS
FLAME alternative 1
X10-02.6 QRI (IR detector) signal voltage
X10-02.2 QRI (IR detector) power supply
X10-02.5 Protective earth (PE)
X10-02.4 Neutral conductor (N)
X10-02.3 Power signal (L)
X10-02.1 QRB signal voltage
X10-03.1 Ionization probe (ION)
FLAME alternative 2
X10-02.3 Power signal (L)
X10-02.4 Neutral conductor (N)
X3-01.1 Fan
X10-03.1 Ionization
FLAME alternative 3
X10-02.6 QRA7 signal voltage
X10-02.2 QRA7 power supply
X10-02.5 Protective earth (PE)
X10-02.4 Neutral conductor (N)
X10-02.3 Power signal (L)
7550a10.2e/0511


LMV5
TEMPERATURE/PRESSURE CONTROLLER
Function earth for shield connection
X60.5
Temperature detector Pt/Ni 1000 (input 4)
X60.3
Temperatue detector Pt 100 (input 1)
X60.1
Line compensation Pt100
X60.2
Signal reference
X60.4
TEMPERATURE
Function earth for shield connection
X61.5
Power supply for temperature/pressure transmitter
X61.1
Voltage input 0...10 V (input 2)
X61.2
Current input 4...20 mA (input 2)
X61.3
Signal reference
X61.4
TEMPERATUR/PRESSURE INPUT
Function earth for shield connection
X62.5
Power supply for setpoint changeover
X62.1
Voltage input 0...10 V (input 3)
X62.2
Current input 4...20 mA (input 3)
X62.3
Signal reference
X62.4
SETPOINT INPUT
Function earth for shield connection
X63.3
Current output 4...20 mA burner output
X63.1
Signal reference
X63.2
LOAD OUTPUT
Pt 100
Pt/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 II 12VAC
SEK III 12VAC
*Optional
FE
LMV5
Power supply (PELV)
X52.1
12VAC1
X52.2
Signal reference (PELV)
X52.3
12VAC2
X52.4
Function earth
AZL5
SHIELD
12VAC1
12VAC2
CANH
CANL
GND
White
Brown
Yellow
Green
Black
X50.1
Function earth for shield connection
X50.2
12VAC1
X50.3
12VAC2
X50.4
CANH
X50.5
CANL
X50.6
Signal reference (PELV) GND
BUS
SQM4 SQM9
X51.1
Function earth for shield connection
X51.2
12VAC1
X51.3
12VAC2
X51.4
CANH
X51.5
CANL
X51.6
Signal reference (PELV) GND
BUS
7550a10de/0511

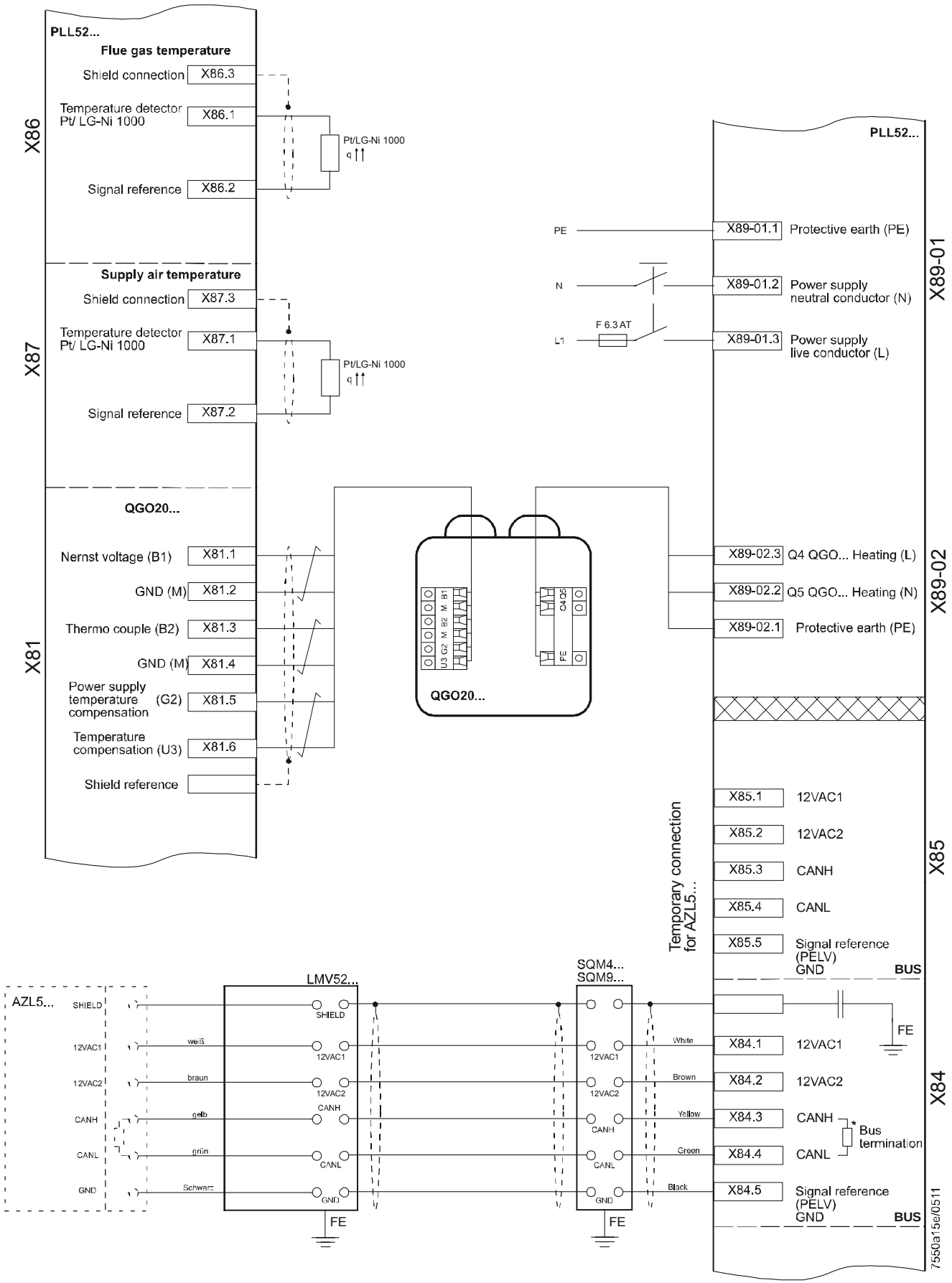
Connection terminals



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:~~ ~~• User Documentation A7550.2en~~ ~~Micromaster User Manual 6SE6400-5AW00-0BP0~~ ~~• Danfoss Operating Instructions VLT 6000 (MG60A703), chapter «Installation»~~
b)	• Alternative connection of VSD, refer to documentation of used VSD

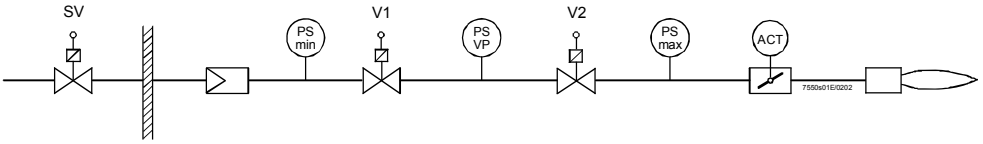
Terminal marking of LMV52... with PLL52... O2 module (cont'd)



Fuel train applications (examples)

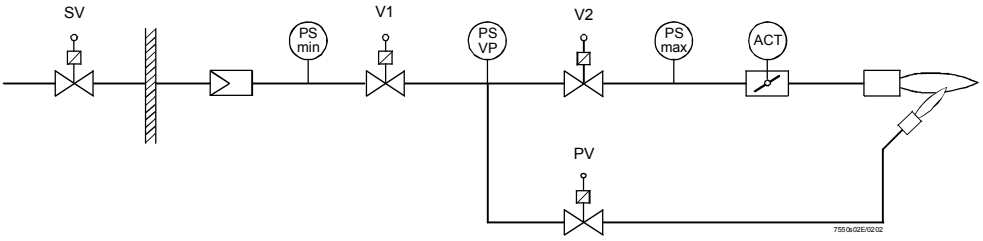
Direct gas ignition

Program **G** Direct ignition



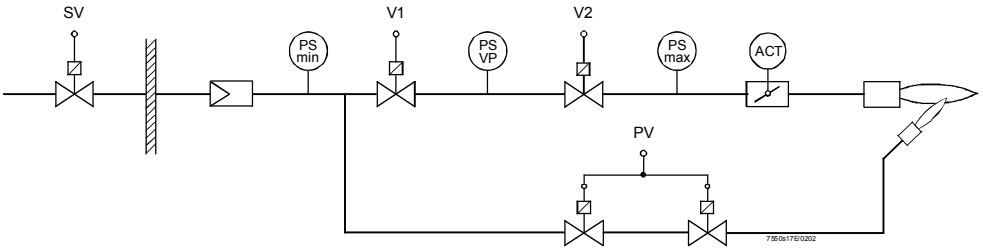
Gas pilot ignition 1

Program **Gp1** Gas pilot

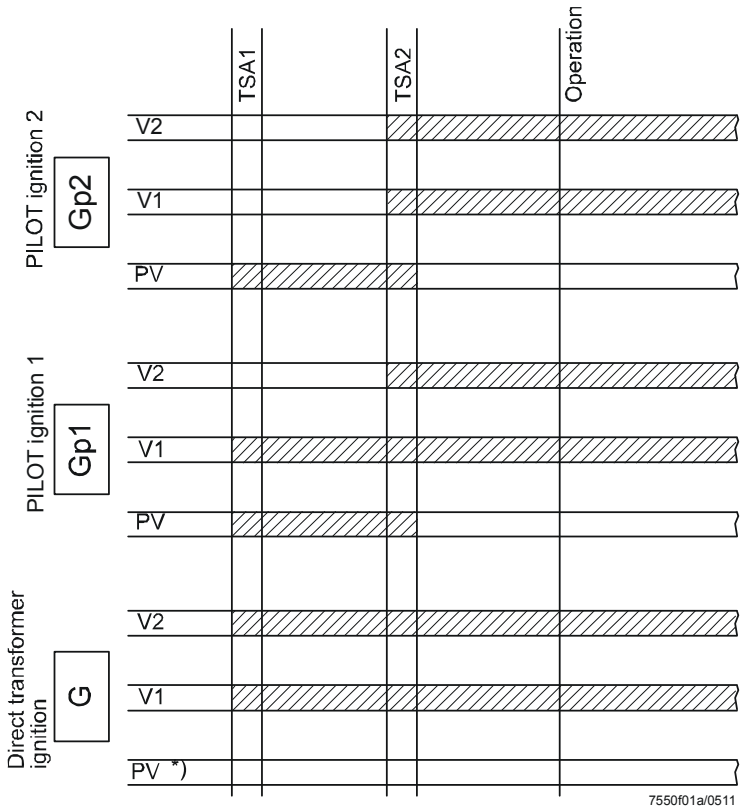


Gas pilot ignition 2

Program **Gp2** Gas-Pilot



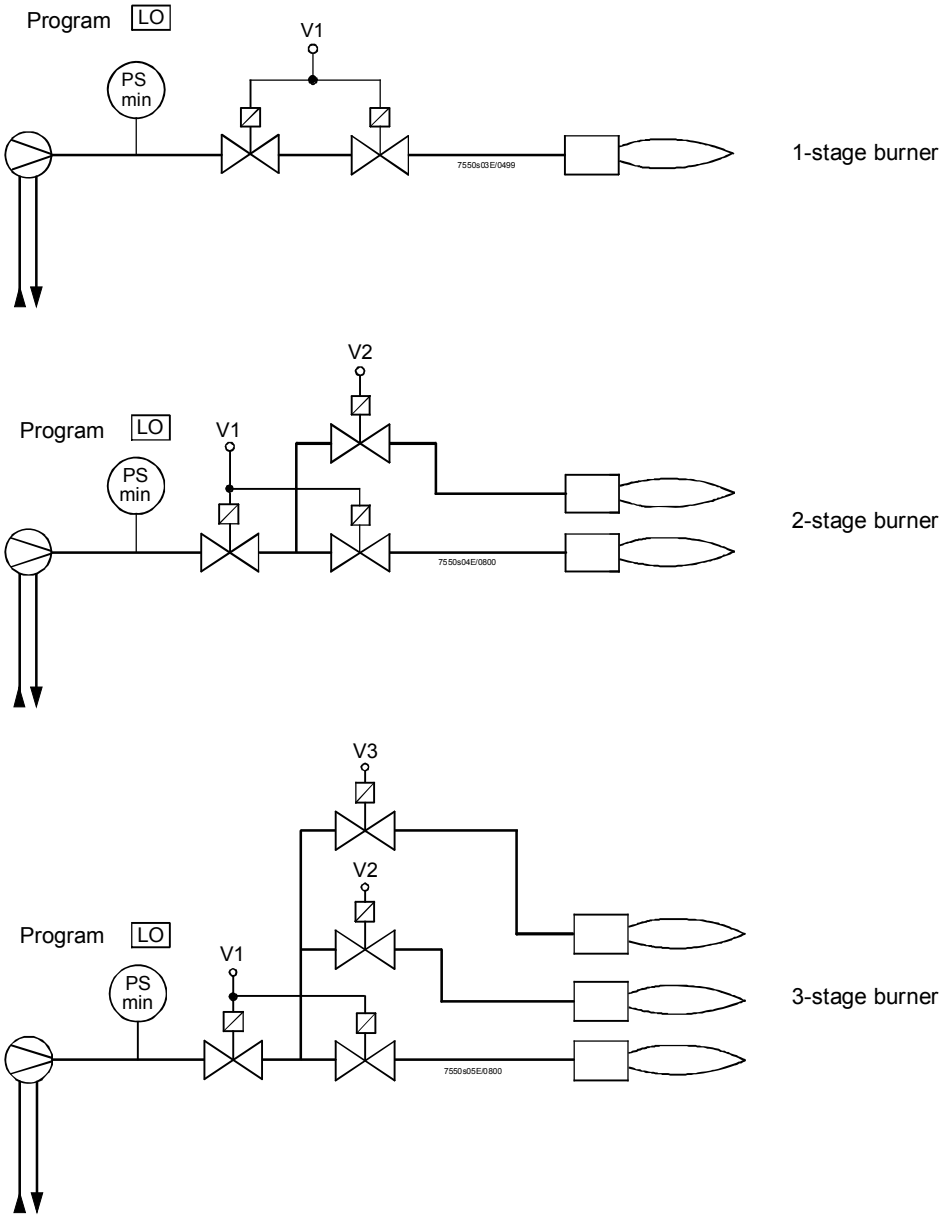
Fuel valve control Gas (always modulating)



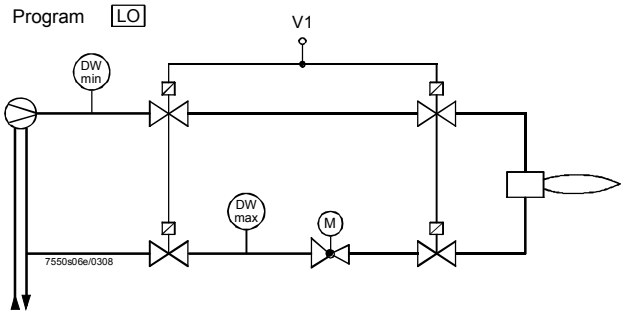
Legend (fuel trains):

*)	Not used
1)	Preheating device
V	Fuel valve
DK	Gas valve proving
DW	Pressure switch
HE	Heating element
HO	Heavy oil
LO	Light oil
SA	Actuator
No	**Normally Open**
SV	Shutoff valve (outside the building)
PV	Pilot valve

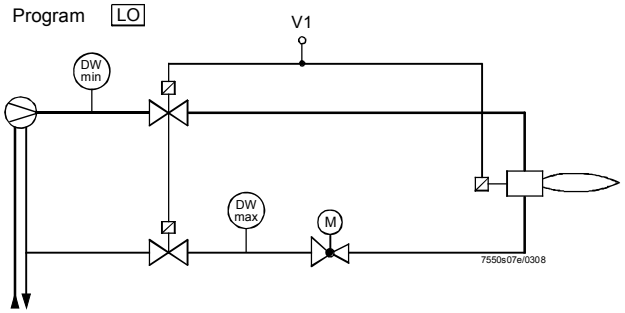
Direct ignition with light oil, multistage



Direct ignition with light oil, modulating



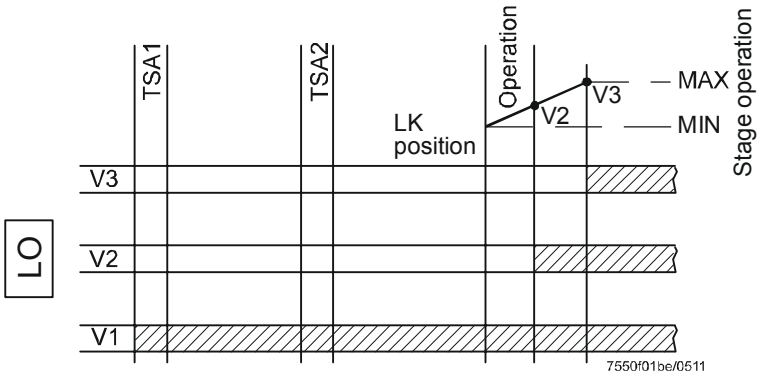
Modulating burner (without shutdown facility for adjustable head)



Modulating burner (with shutdown facility for adjustable head)

Fuel valve control

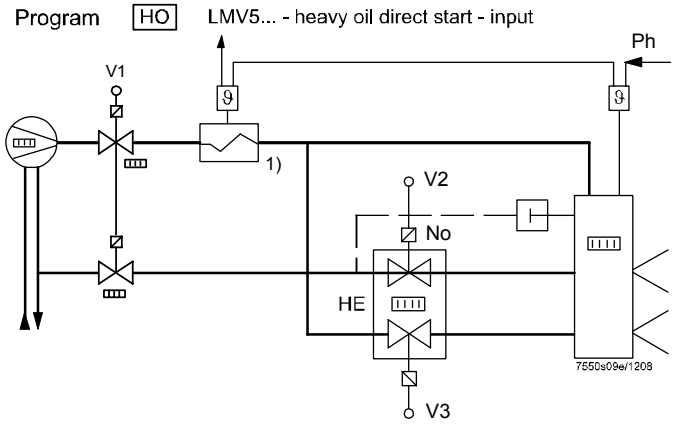
Light oil (direct transformer ignition)



Legend (fuel trains):

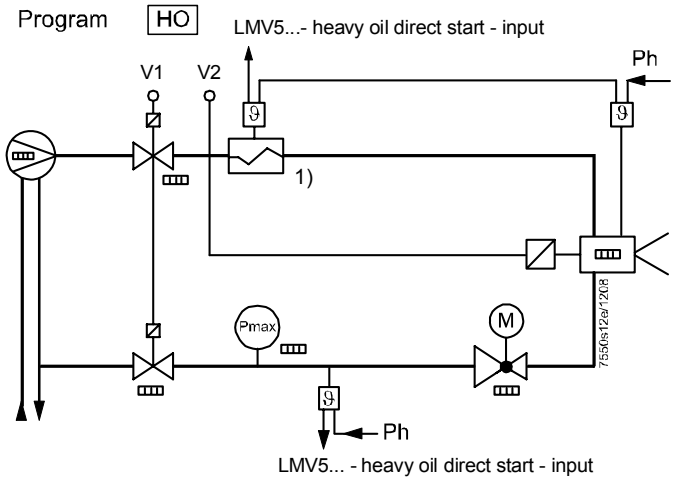
LK	Air damper
LO	Light oil
TSA	Safety time
V	Fuel valve

Direct ignition with heavy oil, multistage



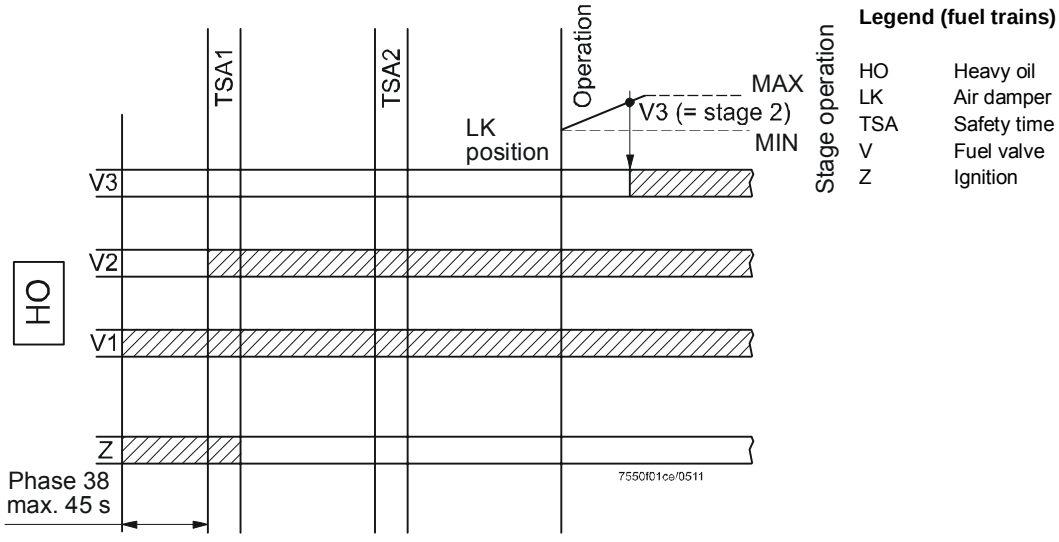
2-stage burner

Direct ignition with heavy oil, modulating



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)

Fuel valve control — Heavy oil (direct transformer ignition)



Legend (fuel trains)

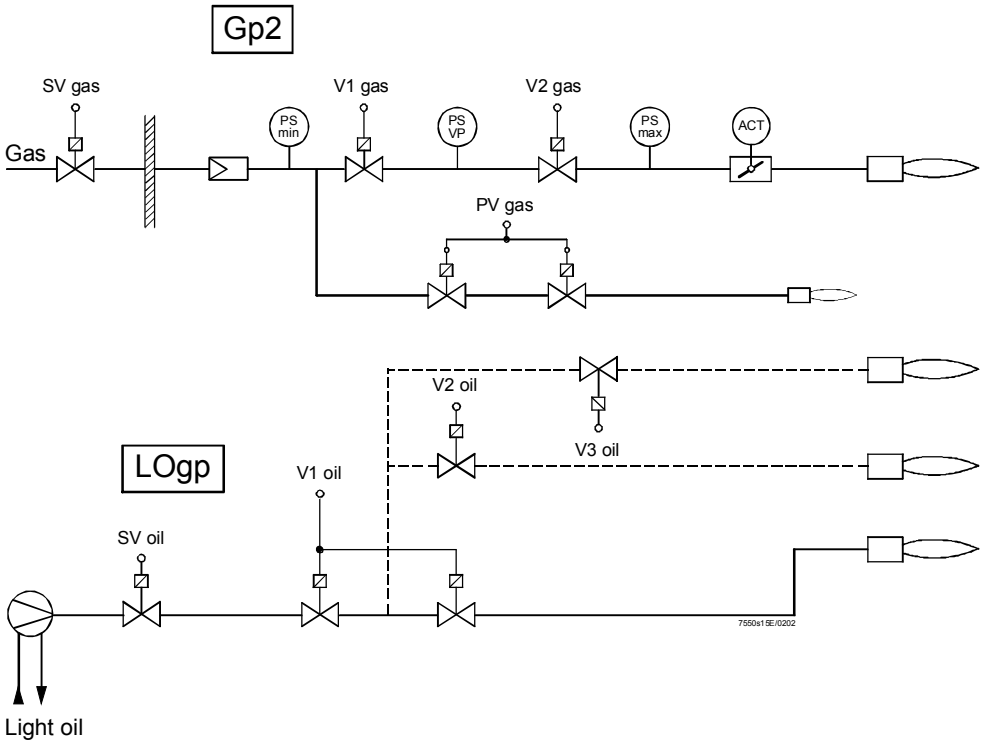
HO	Heavy oil
LK	Air damper
TSA	Safety time
V	Fuel valve
Z	Ignition

Note on dual-fuel burner!
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.

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

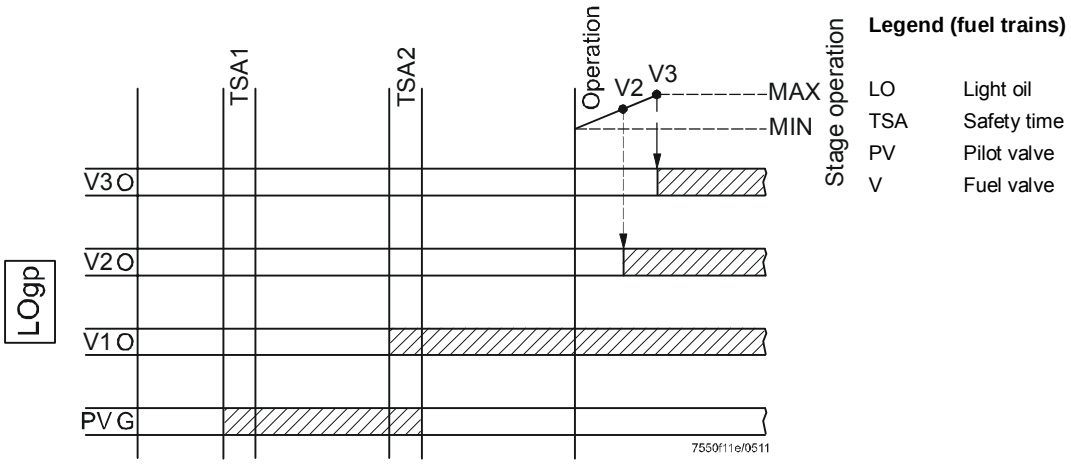
[1] With **Gp2** permitted with HW 01.C0, SW V01.40 or higher.

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

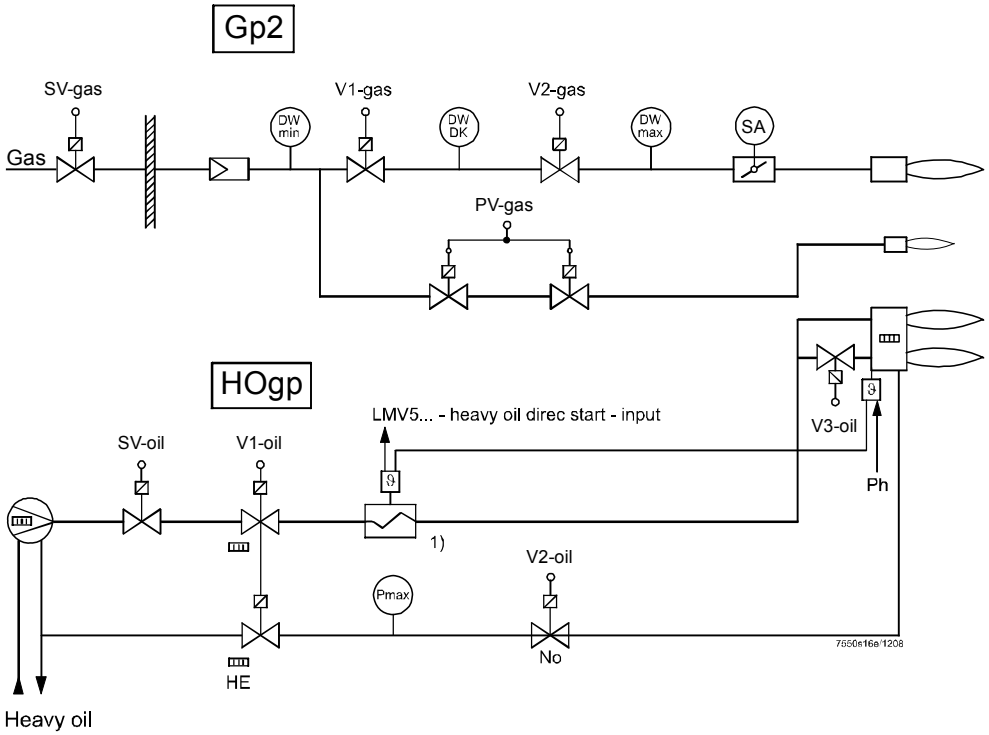


Fuel valve control

Light oil (with gas pilot ignition)

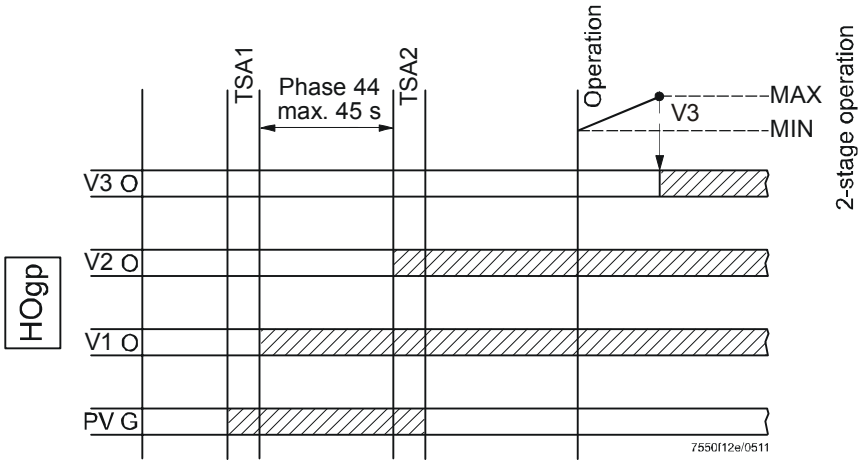


Dual-fuel burner gas / heavy oil with gas pilot ignition



Fuel valve control

Heavy oil (with gas pilot ignition)



Legend (fuel trains):

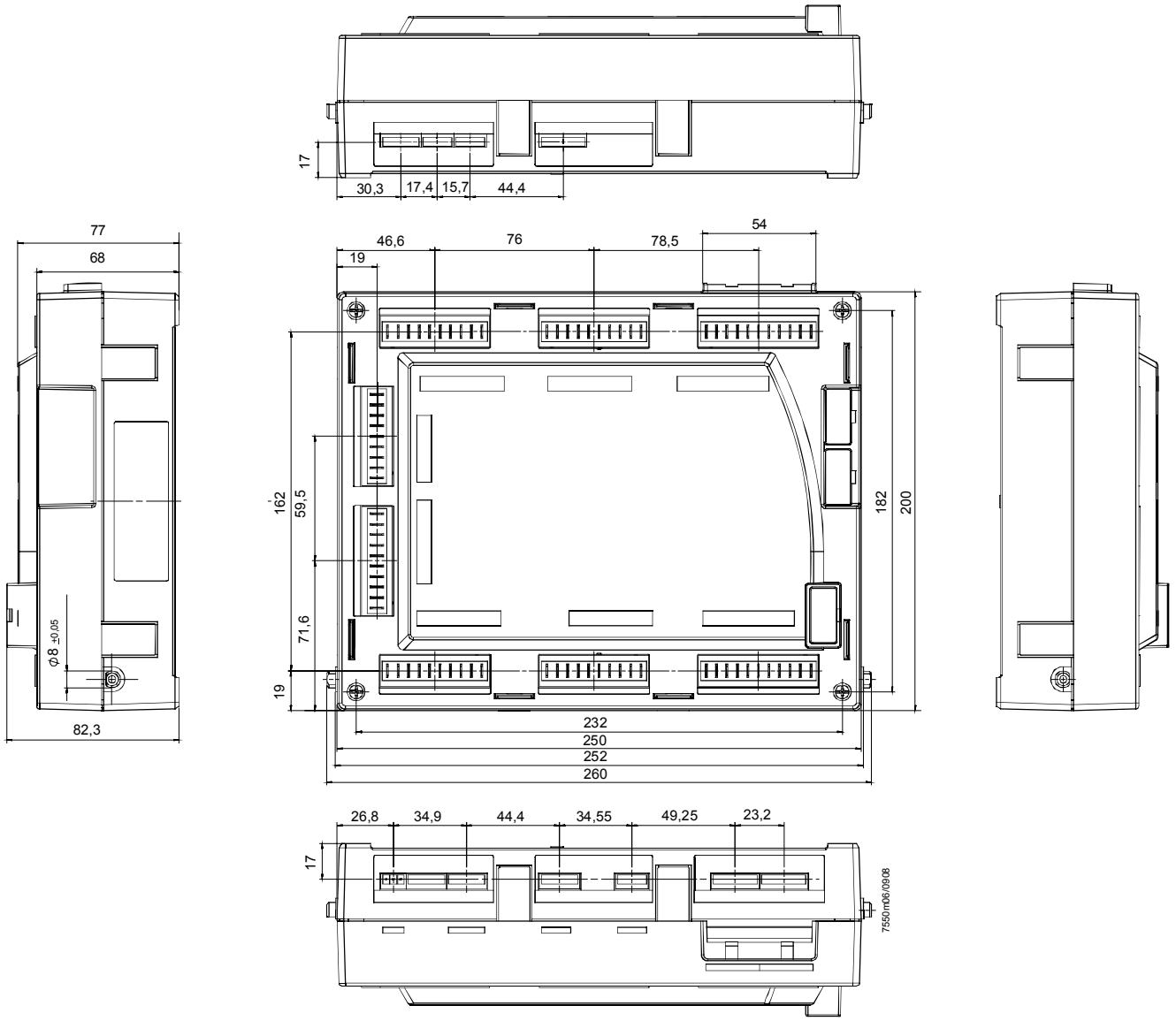
HO	Heavy oil
PV	Pilot valve
TSA	Safety time
V	Fuel valve

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)

Dimensions

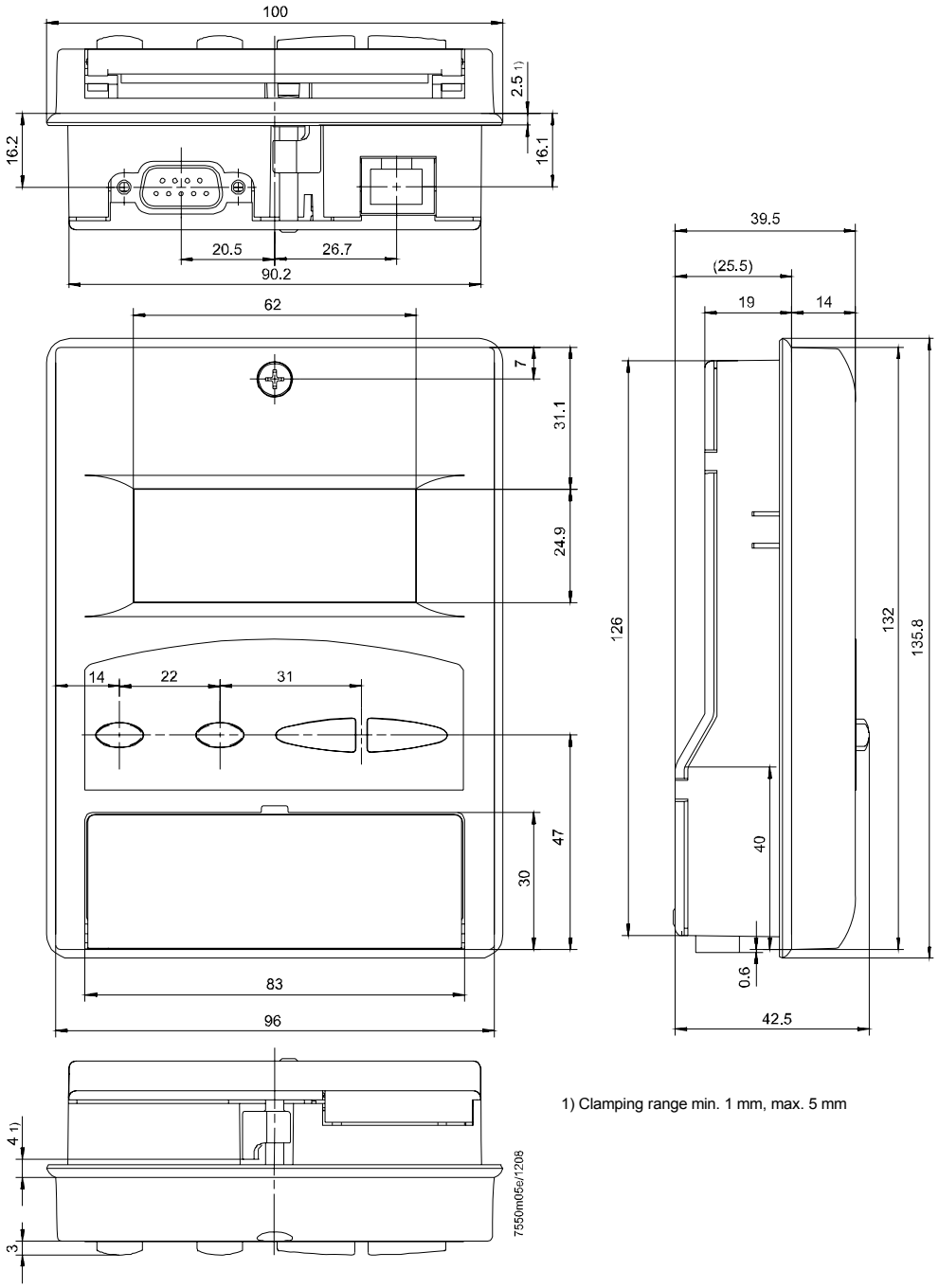
Dimensions in mm

LMV5...



Dimensions in mm

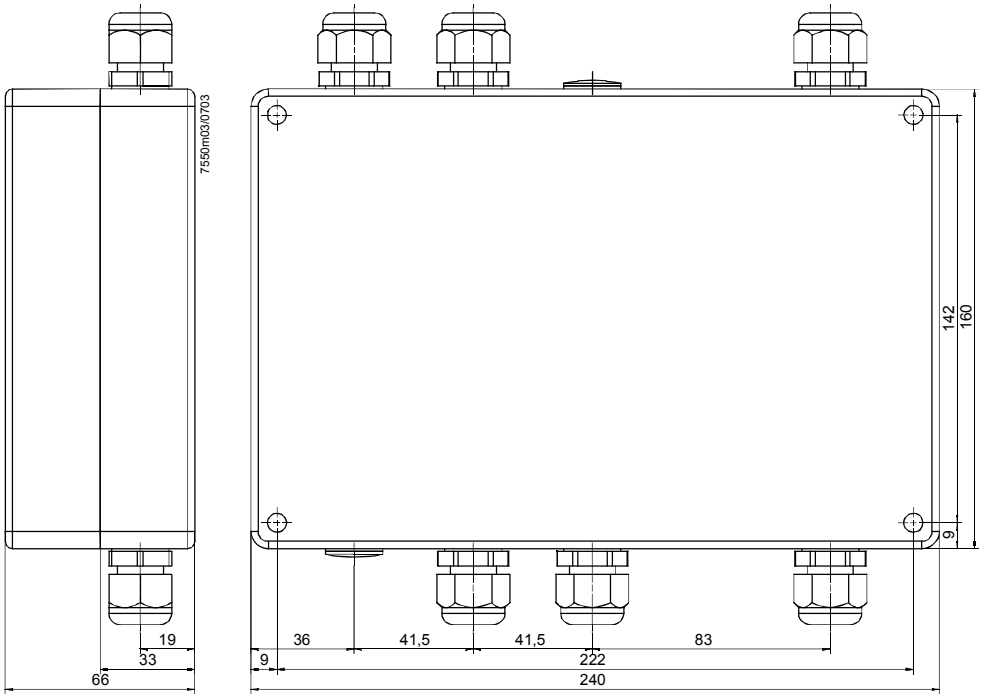
AZL5...



1) Clamping range min. 1 mm, max. 5 mm

Dimensions in mm

PLL52...



AGG5.210… /
AGG5.220…