178 070 63-5 CR00505 2022-05-31

Installation and maintenance instruction

B 70i-3R FAME/RME J/K

LMV37

E6NC

Translation of the original instructions.

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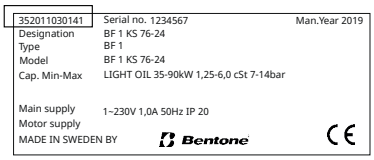
exempel example Beispiel



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1. General Information

The burner may only be used for its intended purpose in accordance with the product's technical data.

We reserve the right to make design changes and cannot be held liable for any misprints or typographical errors.

Modifying the design or using accessories or components that have not been approved by Enertech in writing is strictly prohibited.

This Installation and Maintenance manual:

- is to be regarded as part of the burner and must always be kept near the installation site.
- must be read prior to installation.
- is intended for use by authorised personnel.

1.1 Delivery inspection

- Make sure everything is delivered and the goods have not been damaged during transit.
  Transport damage must be reported to the shipping company.
- If something is wrong with a delivery, report it to the supplier.

1.2 Safety

- before installation:

- Installation and work on the burner and associated system components may only be carried out by persons who have undergone relevant training.
- The product is packaged to prevent damage from occurring when handled – Handle the product with care! Lifting equipment must be used to lift larger packages.
- The products must be transported/stored on a level surface in a dry environment, max. 80% relative humidity, no condensation. Temperature -20 to +60 °C.

- installation:

- The burner must be installed in accordance with local regulations for fire safety, electrical safety, and fuel distribution.
- The premises must comply with local regulations pertaining to use of the burner, and must have adequate air supply.
- The installation site must be free of chemicals.
- Fire extinguisher with Class BE recommended.
- Make sure when installing the burner that there is enough space to service the burner.
- The electrical installation must be professionally carried out in accordance with applicable high voltage regulations.
- Make sure that the burner is suitable for the application (see Technical Data).
- All components must be installed without being bent, twisted or subjected to mechanical or thermal forces that affect components.
- Care must be taken by the installer to ensure that no electrical cables or fuel lines are crushed or otherwise damaged during installation or service.
- Flame tubes, fan wheels and air dampers, for example, may contain sharp edges.

- before first start:

- The burner must not be put into operation without proper safety and protection devices.
- Permitted ambient temperature during operation -10 to +60 °C. Max. 80% relative humidity, no condensation.
- The surface temperature of the burner's components may exceed 60 °C.
- Handle with caution – the burner has moving parts, and there is risk of crushing injuries.
- Seal inspections must be performed during installation and servicing to prevent leakage.
- fitting and installation work has been completed and approved.
- electrical installation has been correctly performed.
- flue gas ducts and combustion air ducts are not blocked.
- all actuators and control and safety devices are in working order and correctly set.
- If the boiler is equipped with an access hatch, this must be equipped with a hatch opening switch connected to the burner's safety system.
- When in operation, the burner's noise level can exceed 85 dBA – use hearing protection!

- Operation:

- Carry out all stipulated settings, service and inspection work within the set time.
- If the oil burner control has a solid red light, contact your installer.

1.3 General requirements FAME/RME

- The fuel must meet the requirements of standard EN 14214 for FAME.
- The fuel must be stored and used according to the manufacturer's instructions. It should typically be used within 6 months of manufacture. Fuel that is allowed to age loses its oxidation stability and produces aggressive constituents. These may cause oxidation damage to components in the oil system. The fuel should be stored in a cool and dark area.
- The RME tank must be made of metal or dark coloured plastics approved for the fuel.
- Burners fuelled by FAME (RME) are – and must be – equipped with parts designed for this fuel. This applies to oil-related parts such as the pump, solenoid valve, oil filter and hoses.
- Oil hoses must be of high-quality fluoride rubber or PTFE intended for FAME/RME, and the hoses must be fitted with fire-retardant sleeves in order to satisfy requirements according to EN-ISO 6806.
- The installation should be performed as a single-pipe system. Copper should be avoided the fuel system since the fuel and copper have an oxidising effect on each other.
- Annual cleaning and checking for the presence of water in the tank should be done to avoid corrosion and microorganisms.

2. Technical data

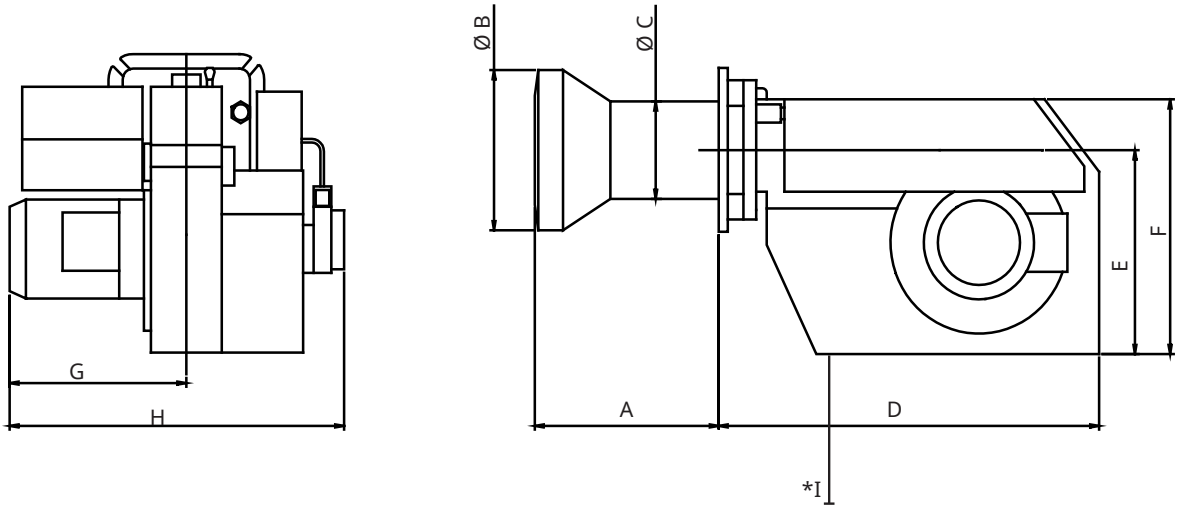
The burner is intended for:

- Light oil, B10 heating oil/biofuel mix, FAME, B-100 (RME) (as per the definition in DIN V51603-6)

and used for:

- Hot water boilers
- Steam boilers
- Industrial applications
- Warm air boilers

2.1 Dimensions B 70i-3R



**A	Ø B	Ø C	D	E	F	G	H	*I
324	220	205	730	408	504	420	830	200
624	220	205	730	408	504	420	830	200

*Minimum recommended floor dimensions.

2.2 Electrical Specifications

The burner corresponds to IP 54

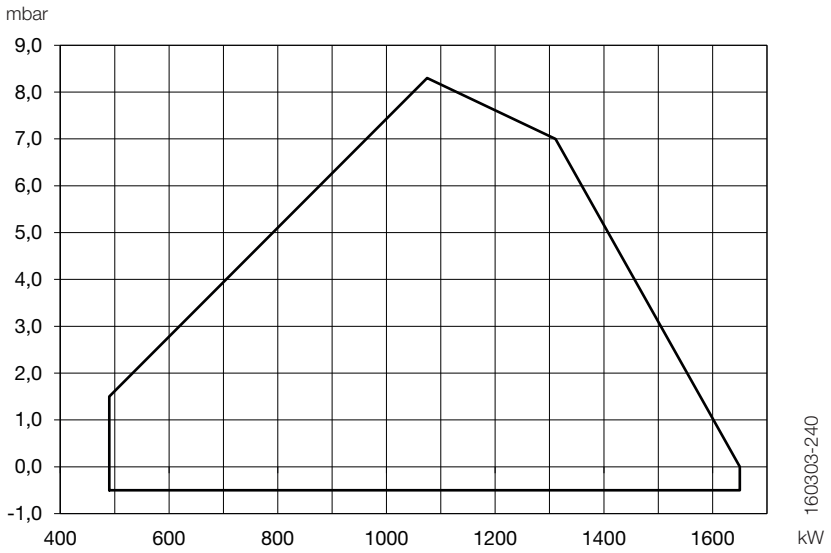
Type	Motor	Operating supply	Sound
B 70i-3R	230/400V, 10.4/6.0A	230V, 0.7A, 50Hz	89dBA ± 0.5dBA

Max operating current, see data plate.

165 105 79-2

2.3 Working field B 70i-3R

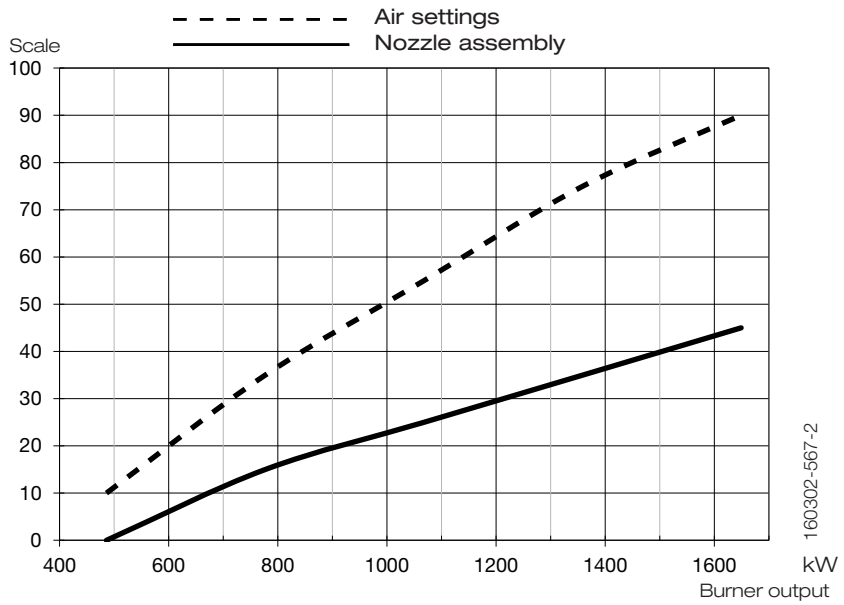
41-139 kg/h
490-1650 kW



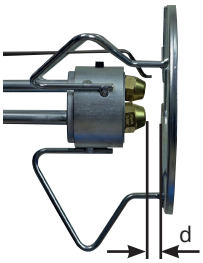
! Do not exceed working field.

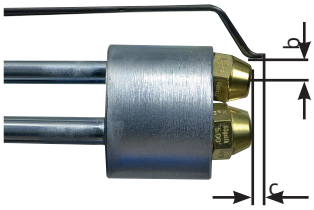
2.4 Setting for insert and air damper

Basic settings should only be seen as setting values to get burner to start. Once the burner has started and established flame, it is necessary to adjust the settings so that they are adapted to the installation and the fuel used.



2.5 Setting of ignition electrodes and brake plate





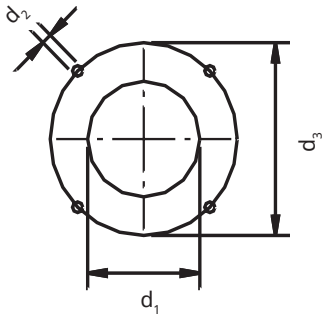
Burner, Type	a	b	c	d
B 70i-3R	3.5-4.0	8.0-10.0	2.0-3.0	10.0-13.0

! *NOTE! It is important that the spark does not strike against the brake plate or nozzle.

2.6 Burner installation

2.6.1 Hole pattern

Make sure the hole pattern on the boiler is adapted to the fixing flange.



Combustion device	d_1	d_2	d_3
B 70i-3R	(205) 225	14	(310) 324-390

d_1* If the flame tube is installed from inside the boiler.

d_3* The hole pattern can be moved down if the flame tube is installed from the front and the tabs in the flange are removed.

2.7 Nozzle and pressure

Due to different furnace geometries and capacities, it is not possible to recommend a nozzle model.

Nozzle:	45° Solid/semi-solid
	60° Solid/semi-solid
Pump pressure	14 bar (12-16 bar)

2.8 Nozzle table

Pump pressure bar

	10			11			12			13		
Gph	kg/h	kW	Mcal/h	kg/h	kW	Mcal/h	kg/h	kW	Mcal/h	kg/h	kW	Mcal/h
1,00	3,72	44	38	3,90	46	40	4,08	48	42	4,24	50	43
1,10	4,09	48	42	4,29	51	44	4,48	53	46	4,67	55	48
1,20	4,47	53	46	4,68	55	48	4,89	58	50	5,09	60	52
1,25	4,65	55	47	4,88	58	50	5,10	60	52	5,30	63	54
1,35	5,02	59	51	5,27	62	54	5,50	65	56	5,73	68	58
1,50	5,58	66	57	5,85	69	60	6,11	72	62	6,36	75	65
1,65	6,14	73	63	6,44	76	66	6,73	80	69	7,00	83	71
1,75	6,51	77	66	6,83	81	70	7,14	85	73	7,42	88	76
2,00	7,45	88	76	7,81	93	80	8,16	97	83	8,49	101	87
2,25	8,38	99	85	8,78	104	90	9,18	109	94	9,55	113	97
2,50	9,31	110	95	9,76	116	100	10,19	121	104	10,61	126	108
2,75	10,24	121	104	10,73	127	109	11,21	133	114	11,67	138	119
3,00	11,16	132	114	11,71	139	119	12,23	145	125	12,73	151	130
3,50	13,03	154	133	13,66	162	139	14,27	169	146	14,85	176	151
4,00	14,89	176	152	15,62	185	159	16,31	193	166	16,97	201	173
4,50	16,75	199	171	17,57	208	179	18,35	218	187	19,10	226	195
5,00	18,62	220	190	19,52	231	199	20,39	242	208	21,22	252	216
5,50	20,48	243	209	21,47	255	219	22,43	266	229	23,34	277	238
6,00	22,34	265	228	23,42	278	239	24,47	290	250	24,46	302	260
6,50	24,20	287	247	25,37	301	259	26,51	314	270	27,58	327	281
7,00	26,06	309	266	27,33	324	279	28,55	339	291	29,70	352	303
7,50	27,92	331	285	29,28	347	299	30,59	363	312	31,83	377	325
8,00	29,79	353	304	31,23	370	318	32,63	387	333	33,95	403	346
8,50	31,65	375	323	33,18	393	338	34,66	411	353	36,07	428	368
9,00	33,59	398	343	35,14	417	358	63,71	435	374	38,19	453	389
9,50	35,37	419	361	37,09	440	378	38,74	549	395	40,31	478	411
10,00	37,23	441	380	39,04	463	398	40,78	484	416	42,44	503	433
11,00	40,96	486	418	42,94	509	438	44,86	532	457	46,68	554	476
12,00	44,68	530	456	46,85	556	478	48,94	580	499	50,92	604	519
14,00	52,12	618	531	54,65	648	557	57,10	677	582	59,41	705	606
16,00	59,57	706	607	62,46	741	637	65,26	774	666	67,90	805	692
18,00	67,02	795	683	70,27	833	717	73,41	871	749	76,39	906	779
20,00	74,47	883	759	78,08	926	796	81,57	967	832	84,87	1007	865
22,00	81,91	971	835	85,89	1019	876	89,73	1064	915	93,36	1107	952
24,00	89,36	1060	911	93,70	1111	956	97,88	1161	998	101,85	1208	1039
26,00	96,81	1148	987	101,50	1204	1035	106,04	1258	1081	110,33	1308	1168

The table applies to oil with a viscosity of 4.4 mm^2/s (cSt) at a density of 830 kg/m^3.

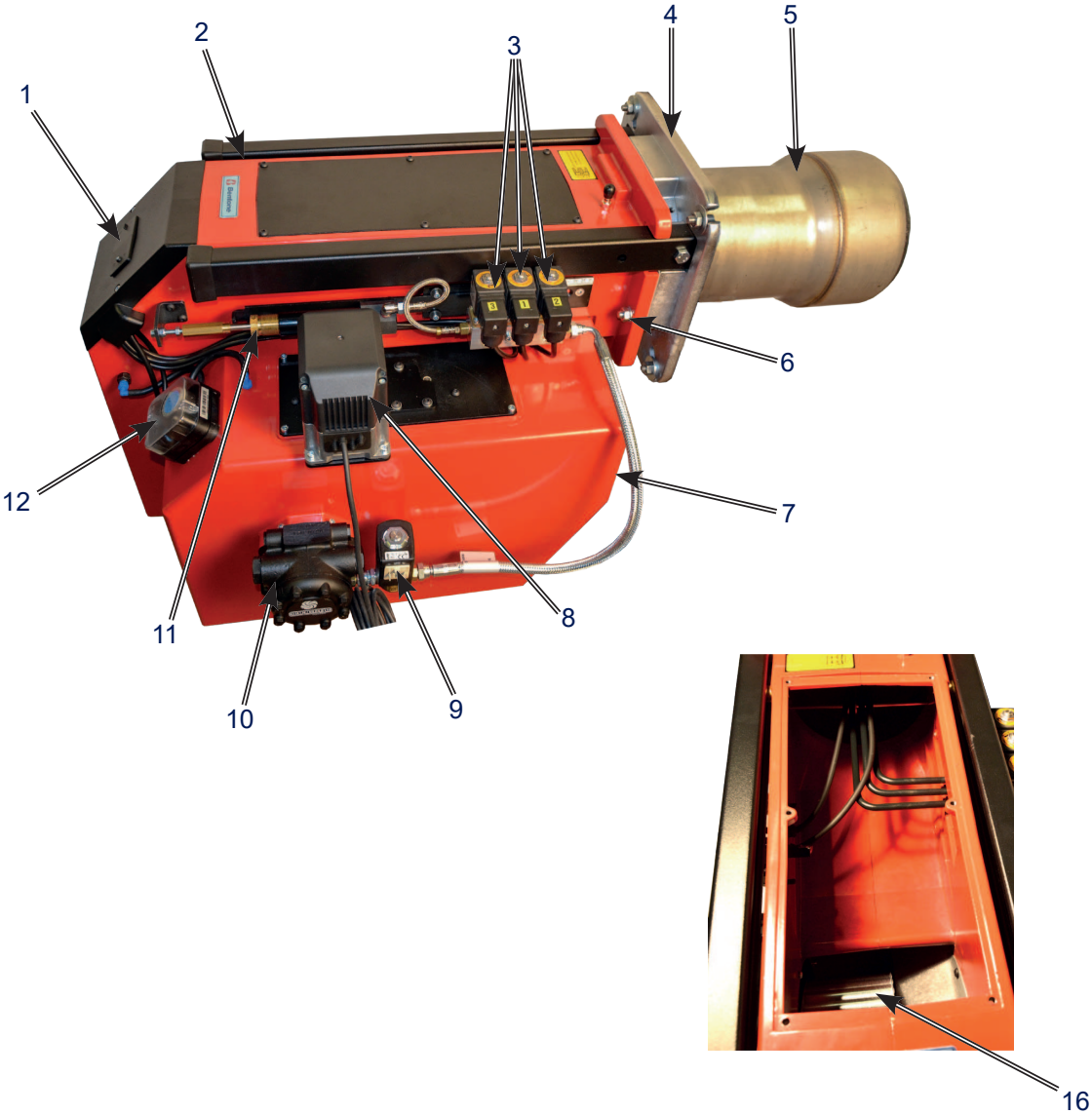
Nozzle table

Pump pressure bar

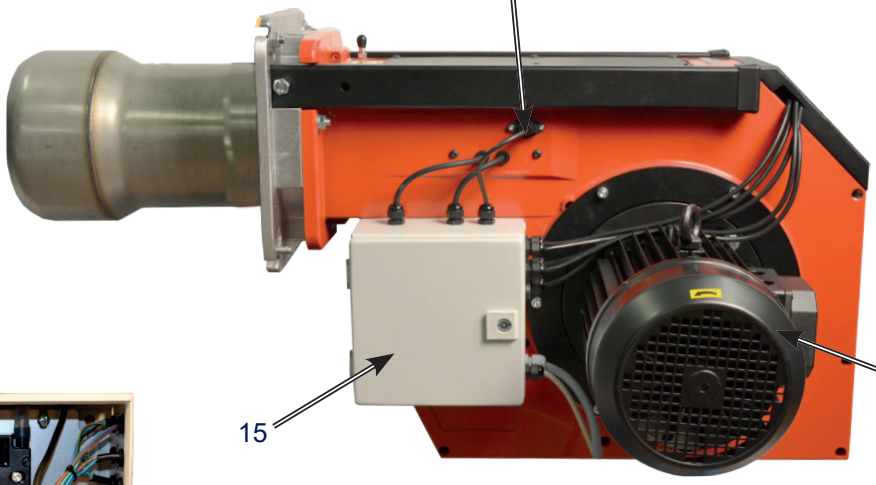
	14			15			16			17		
Gph	kg/h	kW	Mcal/h	kg/h	kW	Mcal/h	kg/h	kW	Mcal/h	kg/h	kW	Mcal/h
1,00	4,40	52	45	4,56	54	46	4,71	56	48	4,85	57	49
1,10	4,84	57	49	5,01	59	51	5,18	61	53	5,34	63	54
1,20	5,29	63	54	5,47	65	56	5,65	67	58	5,82	69	59
1,25	5,51	65	56	5,70	68	58	5,89	70	60	6,07	72	62
1,35	5,95	70	61	6,15	73	63	6,36	75	65	6,55	78	67
1,50	6,60	78	67	6,83	81	70	7,06	84	72	7,27	86	74
1,65	7,27	86	74	7,52	89	77	7,77	92	79	8,01	95	82
1,75	7,71	91	79	7,97	95	81	8,24	98	84	8,49	101	87
2,00	8,81	104	90	9,12	108	93	9,42	112	96	9,71	115	99
2,25	9,91	118	101	10,26	122	105	10,60	126	108	10,92	130	111
2,50	11,01	131	112	11,39	135	116	11,77	140	120	12,13	144	124
2,75	12,11	144	123	12,53	149	128	12,95	154	132	13,35	158	136
3,00	13,21	157	135	13,67	162	139	14,13	168	144	14,56	173	148
3,50	15,42	183	157	15,95	189	163	16,49	196	168	16,99	201	173
4,00	17,62	209	180	18,23	216	186	18,84	223	192	19,42	230	198
4,50	19,82	235	202	20,51	243	209	21,20	251	216	21,84	259	223
5,00	22,03	261	225	22,79	270	232	23,55	279	240	24,27	288	247
5,50	24,23	287	247	25,07	297	256	25,91	307	264	26,70	317	272
6,00	26,43	313	270	27,49	326	280	28,27	335	288	29,13	345	297
6,50	28,63	340	292	29,63	351	302	30,62	363	312	31,55	374	322
7,00	30,84	366	314	31,91	378	325	32,98	391	336	33,98	403	374
7,50	33,04	392	337	34,19	405	349	35,33	419	360	36,41	432	371
8,00	35,25	418	359	36,47	433	372	37,69	447	384	38,80	460	396
8,50	37,45	444	382	38,74	459	395	40,04	475	408	41,26	489	421
9,00	39,65	470	404	41,02	486	418	42,40	503	432	43,69	518	446
9,50	41,85	496	427	43,30	514	442	44,75	531	456	46,11	547	470
10,00	44,06	523	449	45,58	541	465	47,11	559	480	47,11	559	480
11,00	48,46	575	494	50,14	595	511	51,82	615	528	53,40	633	545
12,00	52,87	627	539	54,70	648	558	56,53	670	576	58,25	691	594
14,00	62,68	732	629	63,81	757	651	65,95	778	669	67,96	806	693
16,00	70,49	836	719	72,93	865	744	75,38	894	769	77,67	921	792
18,00	79,30	940	809	82,05	973	837	84,80	1006	865	87,38	1036	891
20,00	88,11	1045	899	91,17	1081	930	94,22	1117	961	97,09	1151	990
22,00	96,92	1149	988	100	1189	1023	104	1229	1057	107	1267	1089
24,00	106	1254	1078	109	1297	1116	113	1341	1153	116	1382	1188
26,00	115	1359	1168	119	1406	1209	122	1453	1249	126	1497	1287

The table applies to oil with a viscosity of 4.4 mm^2/s (cSt) at a density of 830 kg/m^3.

2.9 Components



1. Inspection glass
2. Guides
3. Solenoids with block
4. Fixing flange
5. Flame tube
6. Flange locking
7. Air intake
8. Damper motor
9. Solenoid valve
10. Pump
11. Insert control
12. Air pressure switch
13. Flame detector
14. Motor
15. Electrical cabinet (burner)
16. Fan wheel
17. Transformer
18. Main switch
19. LMV Automatic control unit
20. Fuse
21. Surge protection
22. Contactor
23. AZL Display for LMV Automatic control unit
24. Operating switch 0-I
25. Ignition electrodes
26. Brake plate
27. Nozzles
28. Insert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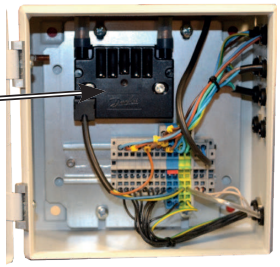
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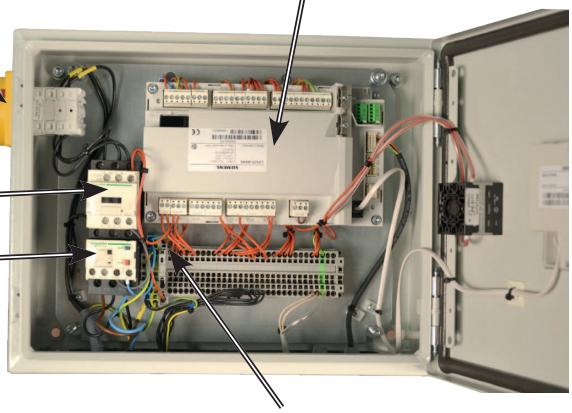
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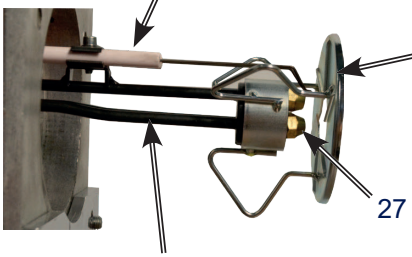
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3. General instructions

3.1 General rules

The installation of an oil burner should be carried out in accordance with local regulations. The installer of the burner must therefore be aware of all regulations relating to oil and combustion.

Only oil suitable for the burner should be used and then in combination with a suitable oil filter before the oil pump of the burner.

If the burner is replacing an existing burner make sure that the oil filter is replaced or cleaned. The installation must only be undertaken by experienced personnel. Care should be taken by the installer to ensure that no electrical cables or fuel/gas pipes are trapped or damaged during installation or service/maintenance.

3.1.1 Installation and maintenance instructions

The maintenance instructions supplied with the burner must be kept at an easily accessible location in the boiler room.

3.1.2 Instructions

It is the installer's responsibility to instruct the user in detail in the functions of the burner and the entire system.

3.1.3 Inspection and maintenance

Refer to servicing schedule

3.1.4 Before commissioning

A 3-stage thermostat must be installed before operation, contact Bentone for more information about the appropriate product.

3.1.5 Start up

In order to obtain the correct setting, a flue gas analysis and temperature measurement must be carried out. Otherwise, there is a risk of soot build up, poor efficiency or condensation precipitation in the chimney. The system must be fine-tuned at start-up. The temperature in the chimney must be at least 60 °C at 0.5 m down in the chimney to prevent condensation.

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4. Installation

4.1 Handling and lifting instruktion

The lifting aid are available as spare parts.

4.2 Acceptance inspection

Make sure everything is delivered and the goods have not been damaged during transit. If something is wrong with the delivery, report it to the supplier. Transport damage must be reported to the shipping company.

4.3 Preparations for installation

Check that the burner's dimensions and capacity range are suitable for the boiler in question. The power data on the type sign refers to the burner's min. and max. power.

4.4 Distribution of oil

In order to achieve good reliability, it is important that the oil distribution system is designed correctly.

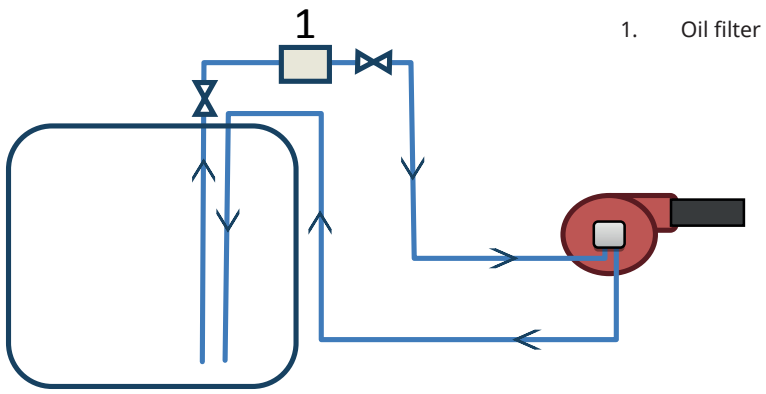
Take the following into account:

- Selection of pipe diameter, pipe length and height difference; see Pump instruction.
- Pipelines are to be laid with a minimal number of glands.
- The pipes are to be laid so that the oil supply hoses are not subjected to tensile stresses or are excessively bent when the burner is swung out or removed for service.
- The oil filter should be installed so that the filter cartridge can easily be replaced or cleaned. Self-cleaning filters are recommended for oils of a higher viscosity or oils that contain significant impurities.
- Oil-affected parts shall be selected in materials that are capable of withstanding the medium's physical properties.
- When installing oil hoses, check that the inlet and return hoses are fitted to the appropriate connection on the oil pump. The hoses shall be located so that they do not bend or become subject to tensile load.
- Bleed the oil system. The oil pump/oil preheater may be damaged if run dry. The vacuum should not fall below -0.3 bar in the suction line during start-up.

! Be sure to fill the burner oil system before starting it for the first time.

4.4.1 Proposed pipe routing for oil distribution systems without transport pump

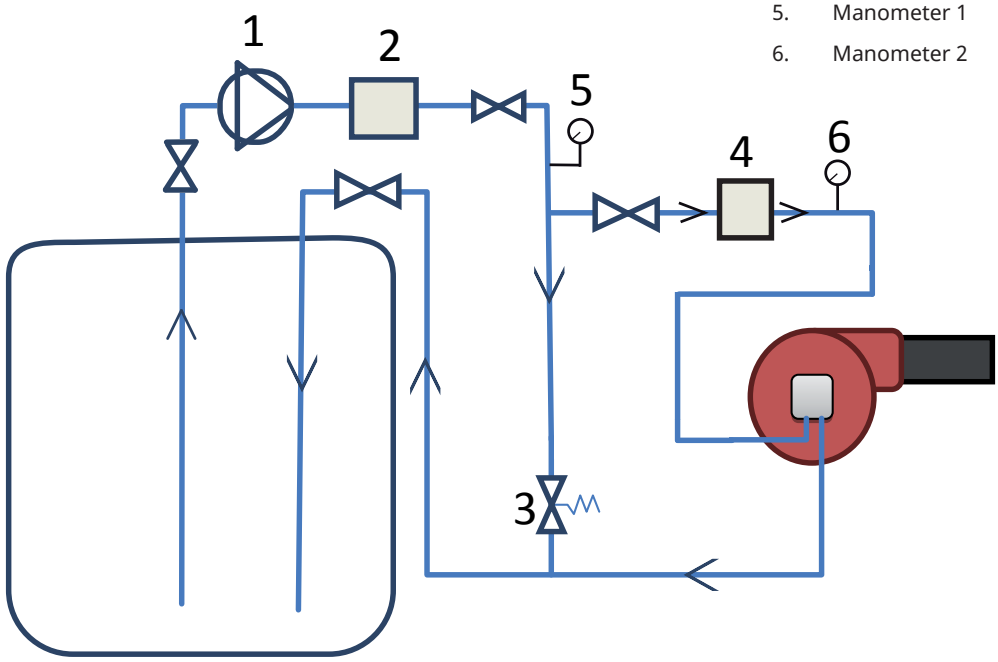
This type of connection should be used only when the oil has a viscosity less than 6 mm²/s.



1. Oil filter

4.4.2 Pipe routing suggestion for oil distribution systems with a transport pump, coarse filter and fine filter

1. Transport pump
2. Coarse filter
3. Bypass valve 0,5 - 2,0 bar
4. Fine filter
5. Manometer 1
6. Manometer 2

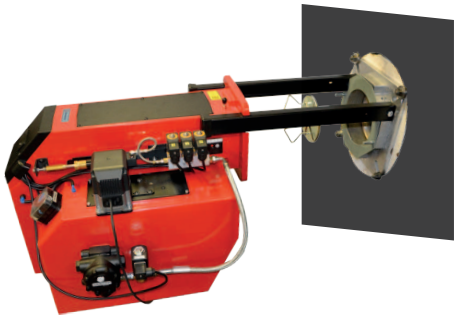


4.5 Electrical connection

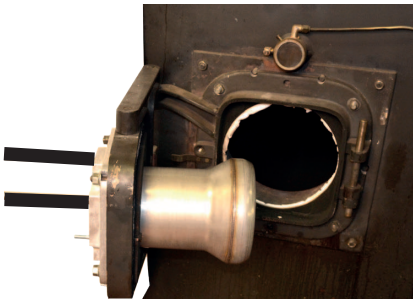
- Before work on the electrical connection, the current should be disconnected so that the installation is isolated.
- Electrical connection must be done in accordance with the applicable regulations.
- Burners should be connected to an isolator switch.
- The connection should be made in accordance with the wiring diagram.
- Fuse rating is as required.

! If any electrical connection is used other than that recommended by Bentone, there may be a danger of damage to property and personal injury.

4.6 Mounting the burner to the boiler



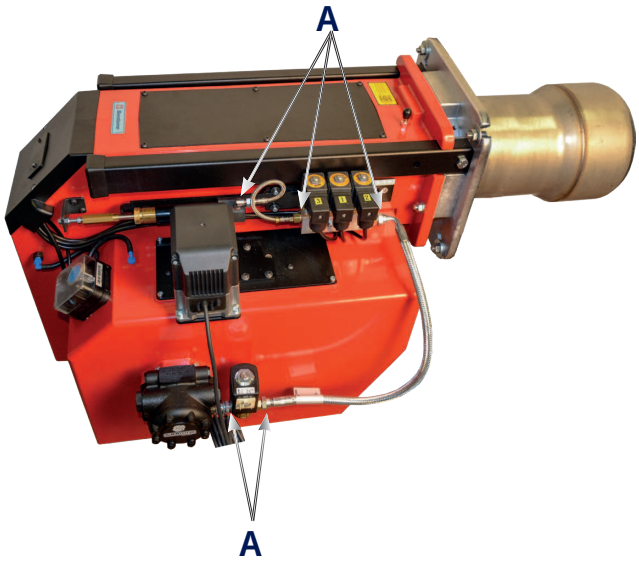
1. Remove fan housing from connection flange.
2. Remove brake plate from nozzle line.
3. Fit selected nozzles, (see Technical Data).
4. Fit brake plate to nozzle line.
5. Remove flame tube from flange.
6. Fit flange with gasket to the boiler.
7. Fit flame tube to flange. Make sure that the holes in the front edge of the flame tube are pointing down (not found on all flame tubes). This allows any drops of oil to run out.
8. Insulate between the burner and boiler door to reduce radiated heat.
9. Mount fan housing on flange.
10. Lock fan housing with nut(s).
11. Connect oil hoses to pump (see chapter Pump Instructions).
12. Connect burner electrically (see chapter Electrical Equipment).



! If the flame tube must be installed from the inside of the boiler, the boiler must be opened or have a hinged flange that allows it to be reconnected with the flame tube mounted.

4.7 Check oil line seals

Once the burner has been installed and commissioned, the seals of the various coupling elements should be checked (A). If there is any leakage, retighten the connections.



! Use Loctite 5188 on threaded oil lines.

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5. Burner settings

5.1 Calculate prepurge time, Industrial applications

Prepurge time can be set on control unit LMV with parameter 265.

Formula symbol	Description	Example values
V	Volume fire box [m^3]	13.07 m^3
Q	Burner output [kW]	1307 kW
T	Prepurge time [s] Industrial applications according to EN 746. The prepurge time must correspond to at least 5 complete air circulations in the fire box and adapted compartments.	

Calculate prepurge time using the following formula:

$$T = \frac{V \cdot 5}{Q \cdot 1.2 / 3600}$$

$$T = \frac{13.07\ m^3 \cdot 5}{1307\ kW \cdot 1.2 / 3600} = 150\ s$$

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5.2 Example of basic settings

Example - Nozzle selection B 70i-3R			
Burner output	1307 kW		
Pump pressure	14 bar		
Nozzle selection according to table, (see Technical data).			
Step 1	40%	523 kW	10.0 Gph
Step 2	30%	392 kW	7.5 Gph
Step 3	30%	392 kW	7.5 Gph

Example - Basic settings B 70i-3R		
Values can be determined from diagrams for air damper and insert setting values, (see Technical data). The different program steps are described in the LMV chapter.		
Insert setting	Step 1	20
	Step 2	20
	Step 3	34
Air damper mode What happens in the various stages is described in the LMV chapter.		
P0 Ignition air damper		=13°
P1 Low load air damper		=13°
P2 on MV2 open		=30°
P2 d preset air damper		=45°
P2 air damper step 2		=45°
P2 off, MV2 disconnection		=30°
P3 on, MV3 opens		=60°
P3 d preset air damper		=72°
P3 air damper step 3		=72°
P3 off, MV3 disconnection		=60°

This is an example of nozzle selection and air/insert setting.

Selection of output and connection between the different power stages must be selected and adjusted so that the system achieves good functionality.

5.3 Insert control, movable brake plate

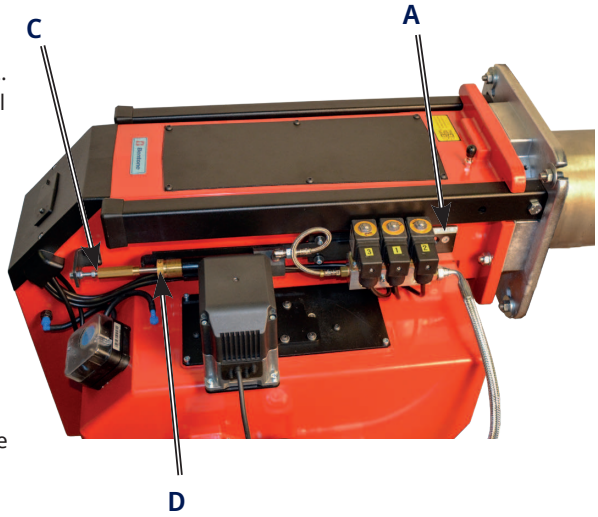
The insert control is used to achieve the most favourable possible pressure drop over the brake plate in the various power stages.

3 nozzles

The insert control sets the brake plate mode between Step 2 and 3 using a hydraulic piston. There are two adjustments to be made on the insert – low load and high load adjustment.

Low load

The low load adjustment is made by changing the guide rail's attachment to the hydraulic piston. This is done using a locking screw through an oval hole. For the basic setting, the value read from the table (XX) is used for the setting values for the selected power for step 2. During operation, the insert is adjusted in order to achieve optimal functionality.



- Loosen the locking screw (C).
- Set the desired position on the scale (A) by pushing the plate in the desired position.
- Tighten the screw (C).

High load

The high load setting is made by adjusting the hydraulic piston's stroke length using the set screw (D). Loosening the set screw increases the stroke length while tightening it decreases the stroke length.

- Set the desired position on the scale (A) using the set screw (D) (left turn reduces pressure drop, the brake plate moves outwards).
- If pulsation occurs, the changed pressure drop over the brake plate may stop the pulsation.

5.4 Air setting

When the burner's power stage has been selected, check the setting values for air dampers in the diagr§am. Read the damper angle for each of the power stages. This must then be used when the settings are made in the burner's control system.

Check the air settings by conducting a flue gas analysis.

Recommended excess air

Oil type	Excess air, flue gases		Max. % CO2
	% O2	% CO2 Lambda 1.2	
Light oil, B10 heating oil/ biofuel mix (as per the definition in DIN V51603-6). RME according to (EN 142 14 FAME)	3–5	≈12.5	15.4

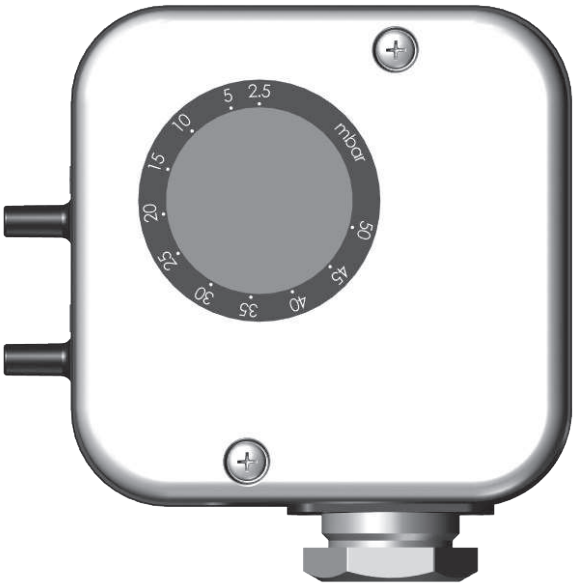
5.5 Setting the air pressure switch

The air pressure switch must block the burner if the amount of air for combustion becomes too low. The air pressure switch must be set so that in the event of a lack of air supply at the burner's max. or min. capacity reacts before the monitored pressure drops so much that poor combustion occurs.

1. Remove protective cover.

! **Be careful when adjusting the air pressure switch; it contains a live component.**

2. Start the burner.
3. Carefully turn the scale on the air pressure switch clockwise until the air pressure switch stops the burner.
4. Measure and note the lowest air pressure in the entire work area.
5. Set the air pressure switch to about 10-15% lower than the lowest noted pressure.
6. Test run the burner and check the function in the entire work area.
7. Refit protective cover.



6. Service

Service and maintenance work may only be performed by qualified personnel. Perform function control of all safety systems and components at each service. Only Enertech original parts should be used when replacing components.

! Use caution when operating the burner.
Surfaces may be hot!

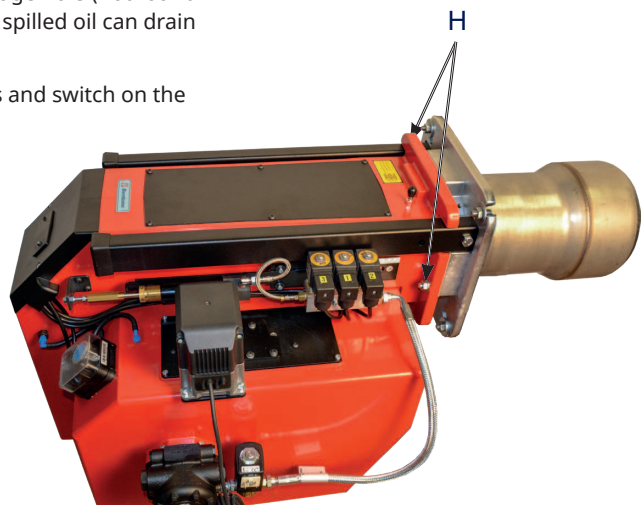
6.1 Combustion device

1. Switch off the main power supply and disconnect the Euro plugs from the burner.

! Before obtaining access to terminals,
all supply circuits must be disconnected.

2. Loosen the nuts (H) and pull out the fan housing on the guides from the burner flange.
3. Remove the brake plate from the oil pipe and clean.
4. Unscrew the nozzles and fit new ones.
5. Fit the brake plate and check the ignition electrodes (see Technical data). If necessary, replace the ignition electrodes.
6. Fit fan housing and burner flange, lock with the nuts (H).
7. Open the boiler/hinged flange to access the flame tube.
8. Remove and clean the flame tube.
9. Fit the flame tube, make sure you mount the drainage hole (not found on all burner pipes) facing downwards so that any spilled oil can drain out.
10. Close the boiler/hinged flange, refit the Euro plugs and switch on the main power supply.
11. Start burner and check/adjust combustion.

! NOTE!
When a nozzle becomes soiled, it must always be replaced.
Do not clean!



! When servicing/replacing components that affect combustion,
flue gas analysis and soot test must be carried out following installation.

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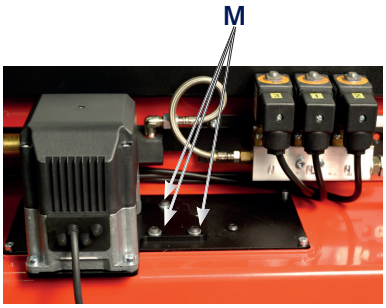
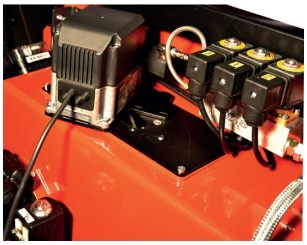
6.2 Air dampers

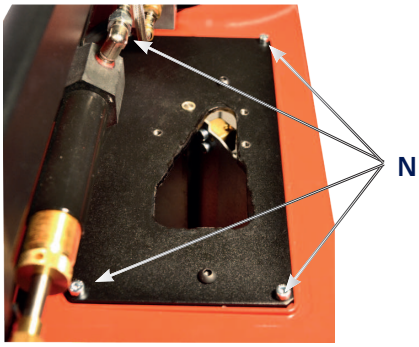
1. Switch off the main power supply and disconnect the Euro plugs from the burner.

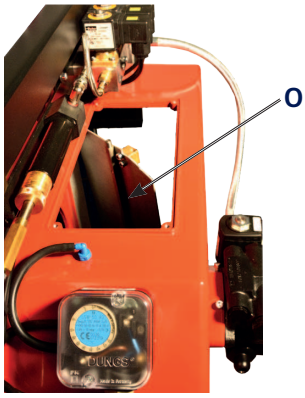
! Before obtaining access to terminals, all supply circuits must be disconnected.



2. Loosen the nuts (H) and pull out the fan housing on the guides from the burner flange.
3. Remove the air intake grid.
4. Loosen the screws (M) holding the damper motor and turn the damper motor so that the control arm comes loose from the damper.
5. Lift and remove the damper motor with fixing plate.
6. Loosen the screws (N) holding the fixing plate.
7. Lift out the air damper.
8. Clean air damper (O) and intake. Lubricate damper shaft, bushing and control arm if necessary.
9. Refit the air damper.
10. Refit the fixing plate screws (N).
11. Fit the damper motor with fixing plate and control arm.
12. Refit the damper motor's mounting screws (M) – but do not tighten them!
13. Adjust the neutral position by moving the damper motor back and forth in the adjustment groove. Lock the damper motor with the screws (M) in position where the damper is almost in place but with still a small gap against the fan housing.
14. Refit the air intake grille.
15. Slide in the burner and tighten the nuts (H).
16. Refit the Euro plugs and switch on the main power supply.
17. Start burner and check/adjust combustion.





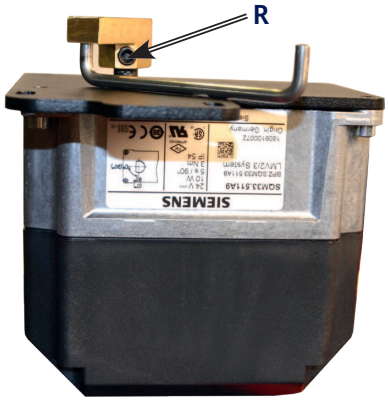


! When servicing/replacing components that affect combustion, flue gas analysis and soot test must be carried out following installation.

6.3 Damper motor, air

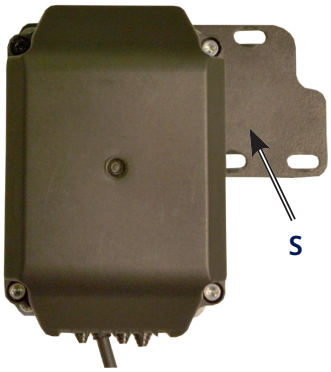
1. Switch off the main power supply and disconnect the Euro plugs from the burner.

Before obtaining access to terminals, all supply circuits must be disconnected.



2. Disconnect the damper motor cable from the automatic control unit.
3. Remove the damper motor (see Service/Air dampers).
4. Detach the control arm (R) from the motor shaft.
5. Fit the new damper motor on the fixing plate (S).
6. Connect the damper motor's cable to the automatic control unit and switch on power to the burner. This is in order to ensure the damper motor's shaft turns to the correct original position.

SQM must be connected and supplied with power before installation to ensure that the motor shaft and direction of rotation are set correctly.



7. Switch off the mains power.
8. Fir the control arm to the motor shaft. NOTE! It is important that the screw is screwed to the flat surface of the shaft.
9. Refit the damper motor and fixing plate to the air intake (see Service/ Air dampers). Ensure that the damper shaft and control arm are connected correctly.
10. Connect the damper motor cable to the automatic control unit.
11. Refit the damper motor's mounting screws (M) – but do not tighten them!
12. Adjust the neutral position by moving the damper motor back and forth in the adjustment groove. Lock the damper motor with the screws (M) in position where the damper has a small gap against the fan housing.

NOTE! When resetting and to prevent the automatic control from sounding an alarm, make sure the damper does not touch the end stop in the "Closed Damper" position.

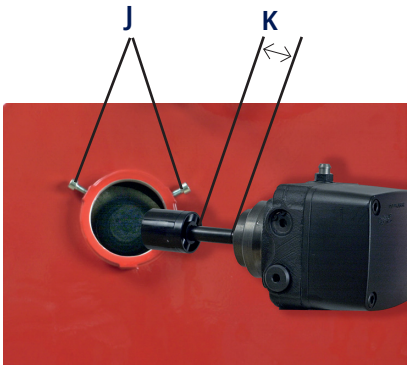
13. Refit the Euro plugs and switch on the main power supply.
14. Start burner and check/adjust combustion.

For B 70/B 80, which use SQM 33, the following parameters must be used to achieve the correct motor rotation direction. Parameters 601.00:0, 601.01:1, 602.00:0 and 602.01:1.

6.4 Oil pump

1. Switch off the main power supply and disconnect the Euro plugs from the burner.

Before obtaining access to terminals, all supply circuits must be disconnected.



2. Detach the oil hoses from the pump.
3. Loosen screws (J) and pull out the oil pump.
4. Measure the distance from the pump bracket to the pump connector (K).
5. Move the pump connector to the new pump and set the same distance as before (K).
6. Fit the oil pump to the burner and tighten the screws (J). (It is important that the pump shaft splines align correctly in the pump connector).
7. Fit the oil hoses.
8. Refit the Euro plugs and switch on the main power supply.
9. Bleed the pump, start the burner and set the correct oil pressure (see Technical data for correct output).
10. Start burner and check/adjust combustion.

When servicing oil-bearing components, check for oil leakage when the burner is commissioned after servicing.

When servicing/replacing components that affect combustion, flue gas analysis and soot test must be carried out following installation.

6.5 Electrical components

1. Switch off the main power supply and disconnect the Euro plugs from the burner.

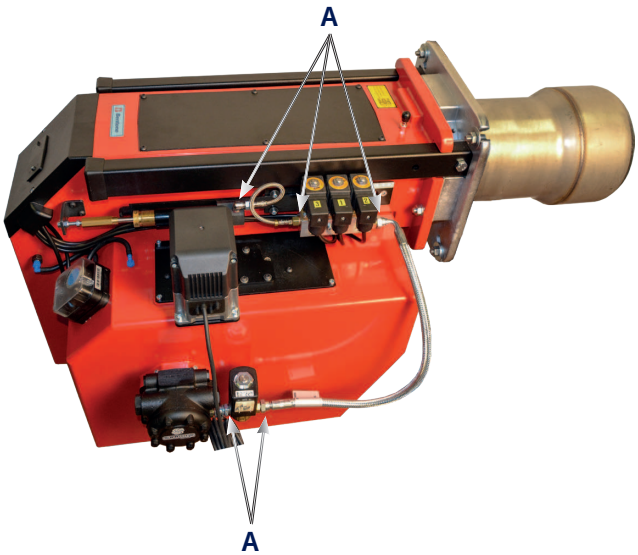
! Before obtaining access to terminals,
all supply circuits must be disconnected.

2. Note the connection of the existing component and then disconnect.
3. Install the new component using the same connection as the existing component or the specified alternative connection.
4. Refit the Euro plugs and switch on the main power supply.
5. Check the function of the new component.
6. Start burner and check/adjust combustion.

6.6 Check oil line seals

Once the burner has been installed and commissioned, the seals of the various coupling elements should be checked (A). If there is any leakage, retighten the connections.

! Use Loctite 5188 on threaded oil lines.



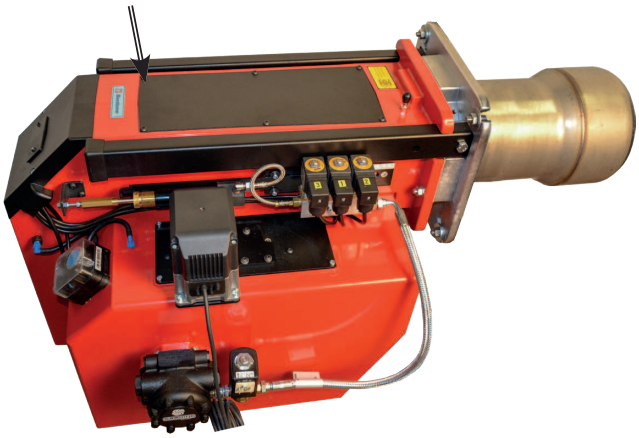
! When servicing/replacing components that affect combustion,
flue gas analysis and soot test must be carried out following installation.

6.7 Vibrations

Maximum permissible vibration level is 5.0 mm/s.

- Check that all screws are properly tightened.
- Check fan wheel for damage and dirt. Replace a damaged, soiled or unbalanced fan wheel.
- Check motor shaft and bearings. If they are worn, replace the motor or bearings.

Use the rear screw on the cover to attach the vibration sensor.



6.8 Burner Service Schedule, FAME/RME

Servicing must be carried out twice a year or after 3,000 hours of operation.

Burner	Twice a year	3,000 h
Filter	Twice yearly replacement	3,000 h replacement
Oil hose	Once yearly replacement	
Nozzle	Twice yearly replacement	3,000 h replacement
Electrodes	Replace/Clean twice a year	Replace/Clean 3,000 h
Brake disc	Replace/Clean twice a year	Replace/Clean 3,000 h
Motor	Twice a year	3,000 h
Drive shaft	Check/replace in the event of damage	Check/replace in the event of damage
Fan wheel	Twice a year Replace if need for cleaning/imbalance	3,000 h Replace if need for cleaning/imbalance
Tank	Check for water once a year Clean tank once a year	
Oil filter	Twice a year	3,000 h replacement
Oil valve	Tightness check twice a year	Replace if leaky

6.9 Component replacement intervals

Components	Service life – Recommended replacement	Service life – Recommended replacement Operating cycles
Control system	10 years	250,000 cycles
Pressure switch	10 years	250,000 cycles
Ignition system with flame guard	10 years	250,000 cycles
UV flame sensor	10,000 h	N/A
Damper motor		500,000 cycles
Contactor	10 years	500,000 cycles

The burner and its components must be recycled according to applicable regulations.

7. Pump instruction E6NC-1069

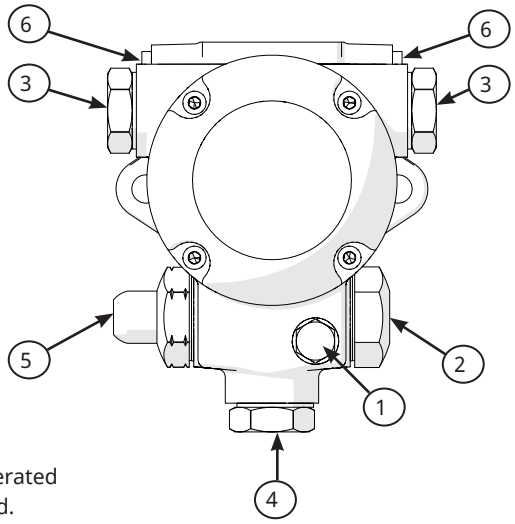
7.1 Technical data

Viscosity range: *	3.0 to 75.0 mm ^{2}/s
Pressure range:	14-30 bar
Oil temperature:	0 to+130°C
Max. pressure on the suction and return side:	3.5 bar

* Oils of higher viscosity may be used if it is pumped to the burner oil pump or if the oil viscosity is lowered to below 75 mm ^{2}/s by it being kept hot.

7.2 Components

1. Manometer connection G 1/8”
2. Connection for nozzle G 1/4”
3. Suction line G 1/2”
4. Return line G 1/2”, plug, by-pass (3/16 Allen key)
5. Pressure regulation with 4 mm Allen key
6. Holes Immersion heaters
7. Filter
8. Head gasket
9. Cover



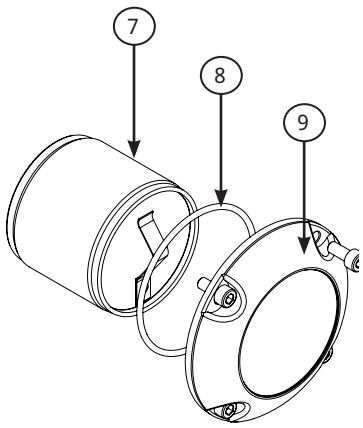
7.3 Oil connection

The pump should be connected using a two-pipe system when it is operated using oils with higher viscosity. A one-pipe system is not recommended.

7.4 Changing the filter

Change the oil pump oil filter in accordance with the following.

- Close the oil valves
- Unscrew the cover on the pump.
- Replace the oil filter.
- Replace head gasket.
- Mount the cover on the pump.
- Open the oil valves.

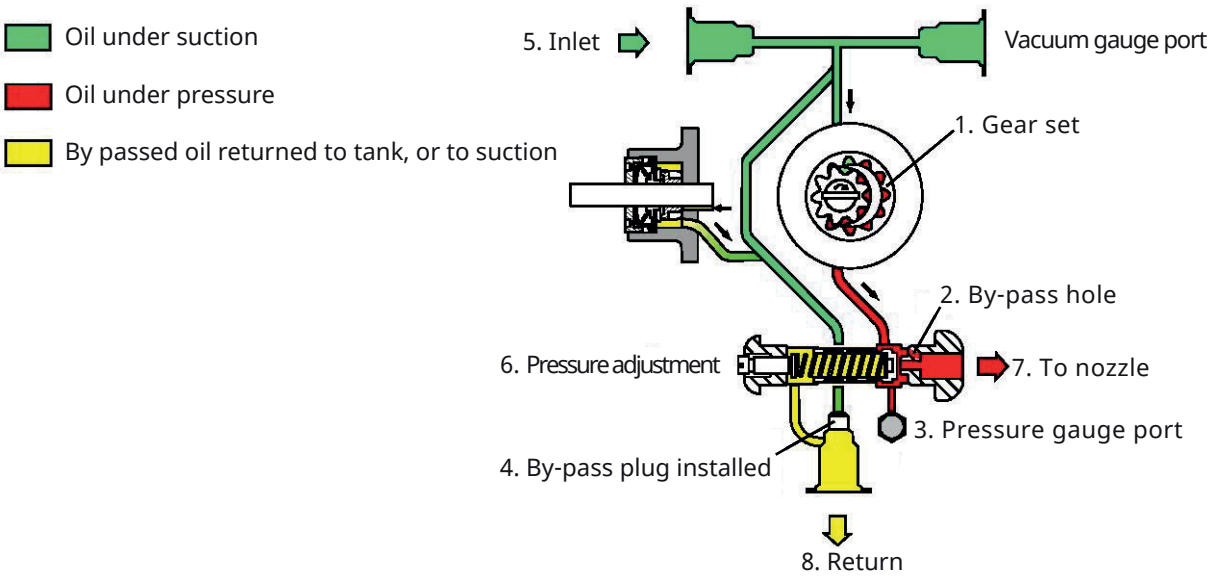


7.5 Function

The pump gear (1) draws oil through the pump suction port (5) from the tank through the filter in the pump and transports the oil to the valve (6) which controls the oil pressure to the nozzle. Oil that does not go through the outlet (7) to the nozzle will be bypassed (2) through the valve (6) back to the return port (8) on the pump.

7.6 Preheating pump

The pump has the facility to fit an immersion heater to providing preheating. The pump should be equipped with an immersion heater in order to facilitate cold starting and operation where oils of a higher viscosity are used. The burner is of a standard design and equipped with an immersion heater to preheat the pump.



8. Electric equipment

8.1 Safety system

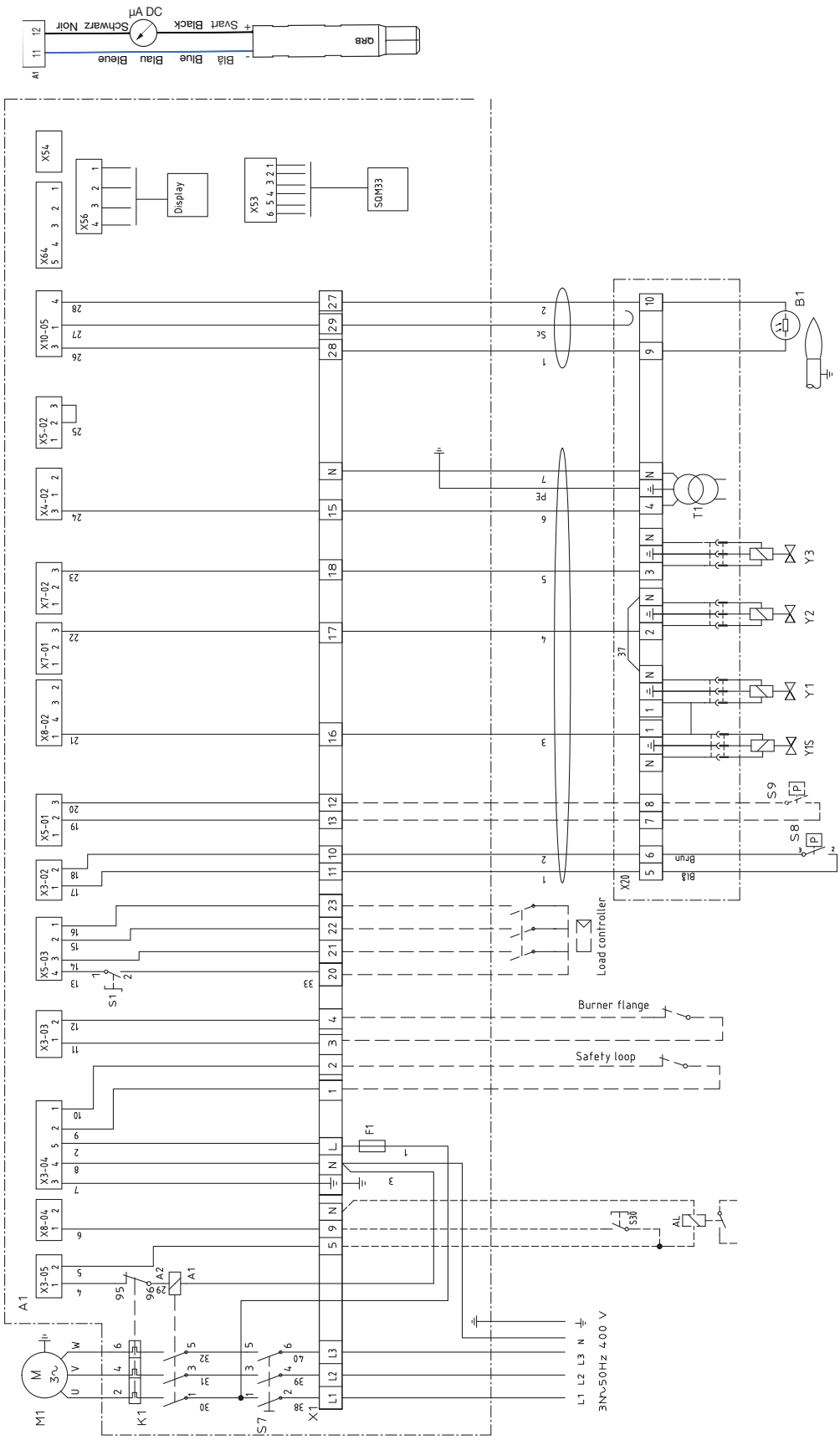
The safety system (safety switch for hatches, doors, water level, pressure, temperature and other safety devices) must be installed in the safety circuit in accordance with current regulations for the system. If these safety requirements are met by other means, safety circuits must be bypassed/jumpered. This can differ between different systems in which the burner is installed, see rules and regulations that apply.

The cables of the safety system must be separated so that the outgoing signal is not placed in the same cable as the incoming signal.

Manual reset with remote reset (optional)

The remote reset shall be installed with a cable connected from X8-04.1 to X3-05.2 and reset button installed in preferred place.

8.2 Wiring diagram



8.3 Component list LMV

A1 Gas burner control LMV37

B1 Flame detector

K1 Motor contactor with thermal overload protector

M1 Burner motor

S1 Operation switch

S7 Main switch

S8 Air pressure switch

S9 Oil pressure switch min (Accessories)

S30 External reset

T1 Ignition transformer

X1 Connection terminal board

X20 Connection terminal board

X53 Connection air damper

X56 Connection display

Y1 Solenoid valve 1

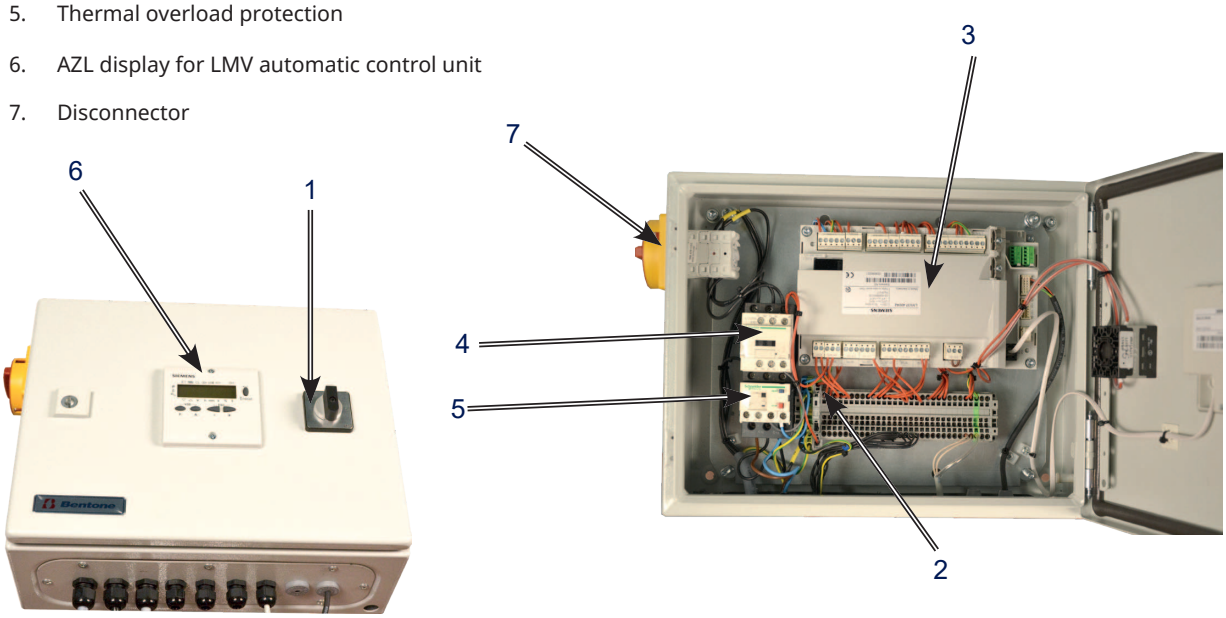
Y2 Solenoid valve 2

Y1S Safety solenoid valve

! Mains connection and fuse in accordance with local regulations.

8.4 Component electric box

1. Switch 0-1
2. Fuse
3. Automatic control unit LMV
4. Contactor
5. Thermal overload protection
6. AZL display for LMV automatic control unit
7. Disconnector



9. LMV37 Automatic control unit

The LMV37 automatic control unit is a piece of control equipment that can be used for many different types of burner.

In the following review of how this control equipment works and can be adjusted, the description will focus on the type of burner covered by this

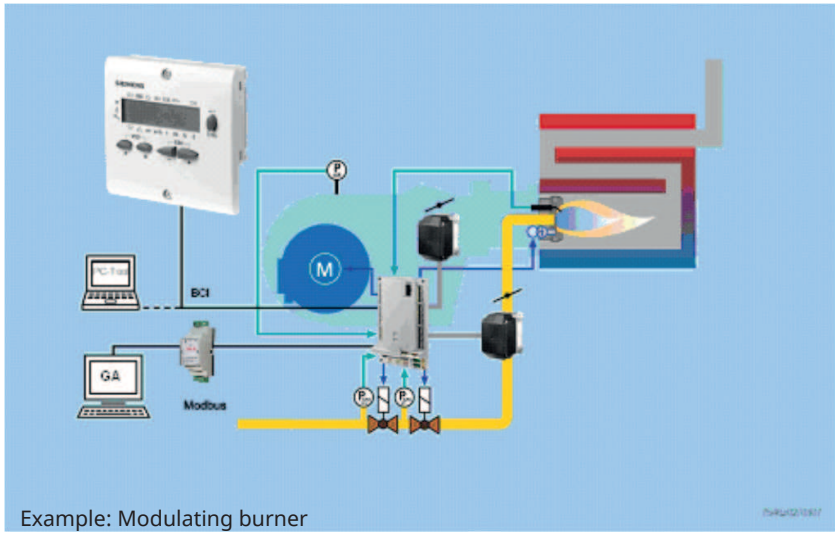
9.1 System structure/function description

The LMV37.4... 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.

Integrated in the basic unit of the LMV37.4... are:

- Burner management system complete with valve proving system
- Electronic air-fuel ratio control system for a maximum of 2 SQM3... or SQN1... actuators
- Control of VSD air fan
- Modbus interface

At the time of writing, of the parameters mentioned above, motor frequency control and communication via modbus are not available on the burner models described in this manual.



Example: Modulating burner

The system components (display and operating unit, actuators) are connected directly to the LMV37.4... basic unit. All safety-related digital inputs and outputs of the system are monitored by a contact feedback network.

165 405 09

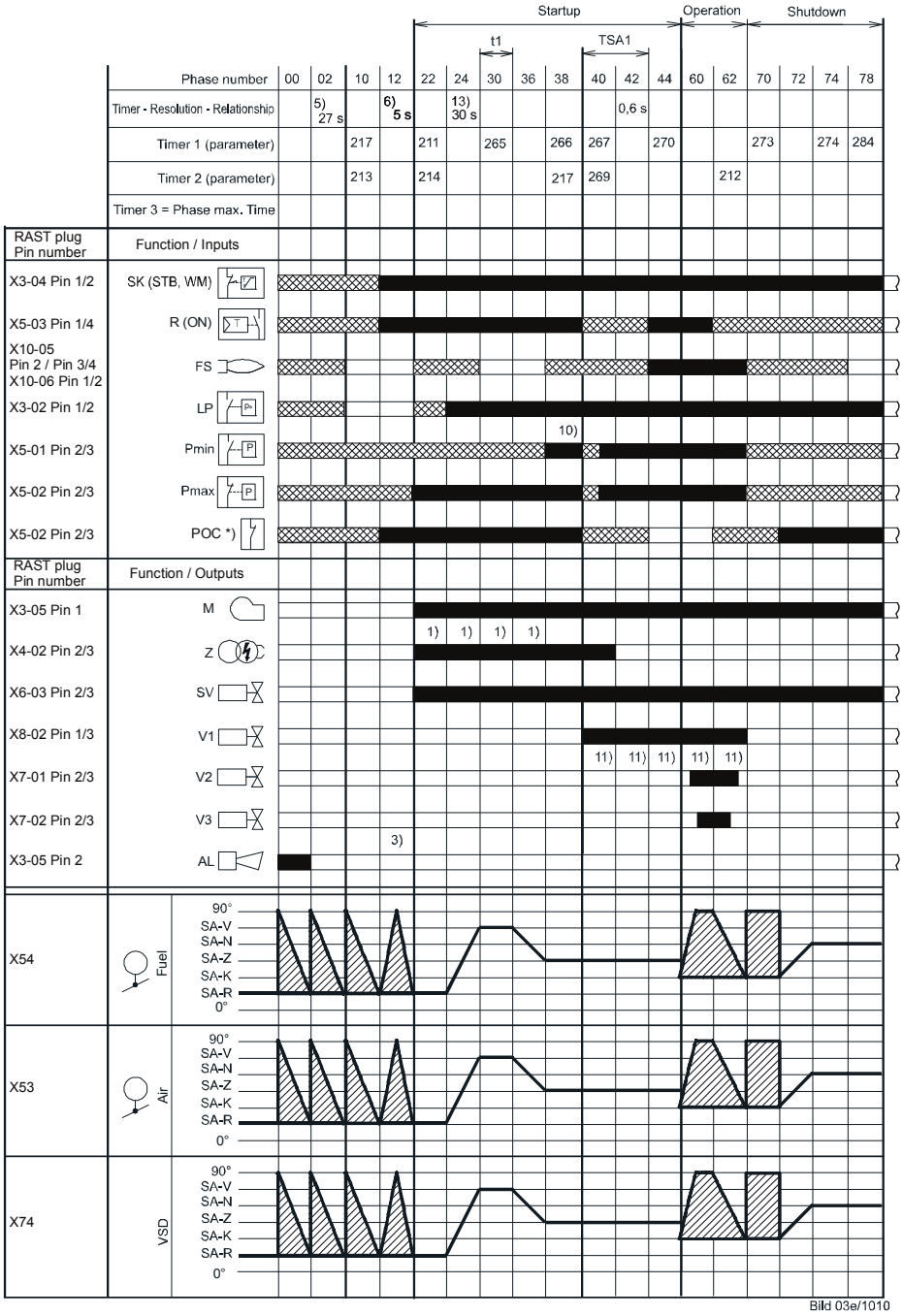
9.2 General information

The burner management system is operated and parameterized via the AZL2... display. The AZL2... with LCD and menu-driven operation facilitates straightforward use and targeted diagnostics. When making diagnostics, the display shows the operating states, the type of error and the point in time the error occurred. Passwords protect the different parameter levels of the burner against unauthorized access. It is possible to select from different types of fuel trains and make use of a wide choice of individual parameter settings (program times, configuration of inputs / outputs, etc.), enabling the installer to make optimum adaptations to the relevant application. A change of parameters varies in levels of authorization, this manual will give info on those that might be changed by the installer. The actuators are driven by stepper motors and can be positioned with high resolution. Specific features and actuator settings are defined by the LMV37.4... basic unit.

9.3 Technical Data Basic unit LMV37.4...

Mains voltage	
LMV37.400A2	AC 230 V -15 % / +10 %
Mains frequency	50 / 60 Hz ±6 %
Safety class	I, with parts according to II and III to DIN EN 60730-1
Perm. mains primary fuse (externally)	Max. 16 AT
Unit fuse F1 (internally)	6.3 AT (DIN EN 60127 2 / 5)
Mains supply: Input current depending on the operating state of the unit	
Under voltage	
Safety shutdown from operating position at mains voltage	
LMV37.400A2	Approx. AC 186 V
Restart on rise in mains voltage	
LMV37.400A2	Approx. AC 195 V

Oil direct ignition Eo1 «Lo», «Lo mod», «Lo 2-stage», «Lo 3-stage»



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Legend to the sequence diagrams

! Not all phases, times, indices, abbreviations and symbols appear in the individual sequence diagrams or are needed there!

Phase numbers

00	Lockout phase
02	Safety phase
10	Home run
12	Standby (stationary)
22	Fan motor (M) = ON, safety valve (SV) = ON
24	Air damper (LK) ⟹ fuel valve (V) – position
30	Prepurging
36	Air damper (LK) ⟹ ignition (Z) – position
38	Preignition ignition (Z) = ON
39	Test pressure switch-min (Pmin)
40	Fuel valve (V) = ON
42	Ignition (Z) = OFF
44	Interval 1 (t44)
50	Safety time 2 (TSA2)
52	Interval 2 (t52)
60	Operation 1 (stationary)
62	Operation 2 air damper (LK) ⟹ low-fire (KL) – position
70	Afterburn time (t13)
72	Air damper (LK) ⟹ Rated load (NL) – position
74	Postpurge time (t8)
78	Postpurge time (t3)
80	Evacuation of test space
81	Atmospheric pressure test
82	Filling of test space
83	Gas pressure test
90	Gas shortage waiting time

Valve proving is performed depending on the parameter settings:
Simultaneously with the prepurge time and/or the afterburn time.

Times

TSA1	1st safety time
TSA2	2nd safety time
t1	Prepurge time
t3	Postpurge time
t8	Postpurge time
t13	Afterburn time
t44	Interval 1
t52	Interval 2

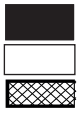
Indices

1)	Parameter:	Short/long prepurge time for oil only Short/long on time of oil pump – time
2)	Only with valve proving during startup	
3)	Parameter:	With/without alarm in the event of start prevention
4)	If signal is faulty in the startup phase, phase 10 is next, otherwise phase 70	
5)	Max. time safety phase, then lockout	
6)	Time from occurrence of start prevention to signaling	
7)	Only in case of valve proving during startup (valve proving via pressure switch-min)	
8)	Only in case of startup without valve proving (valve proving via pressure switch -min)	
9)	Inverse logic in case of valve proving via pressure switch-min	
10)	Parameter:	Oil pressure min-input 1 = active from phase 38 2 = active from safety time
11)	Only with fuel train Lo and 2 fuel valves	
12)	Parameter 223:	Repetition limit value gas pressure switch-min in connection with gas shortage program parameter 246 (phase 90)
13)	Max. drop-in/response time for air pressure switch	
14)	Alternative to valve proving	
15)	Alternative to pressure switch-max (Pmax) or POC	

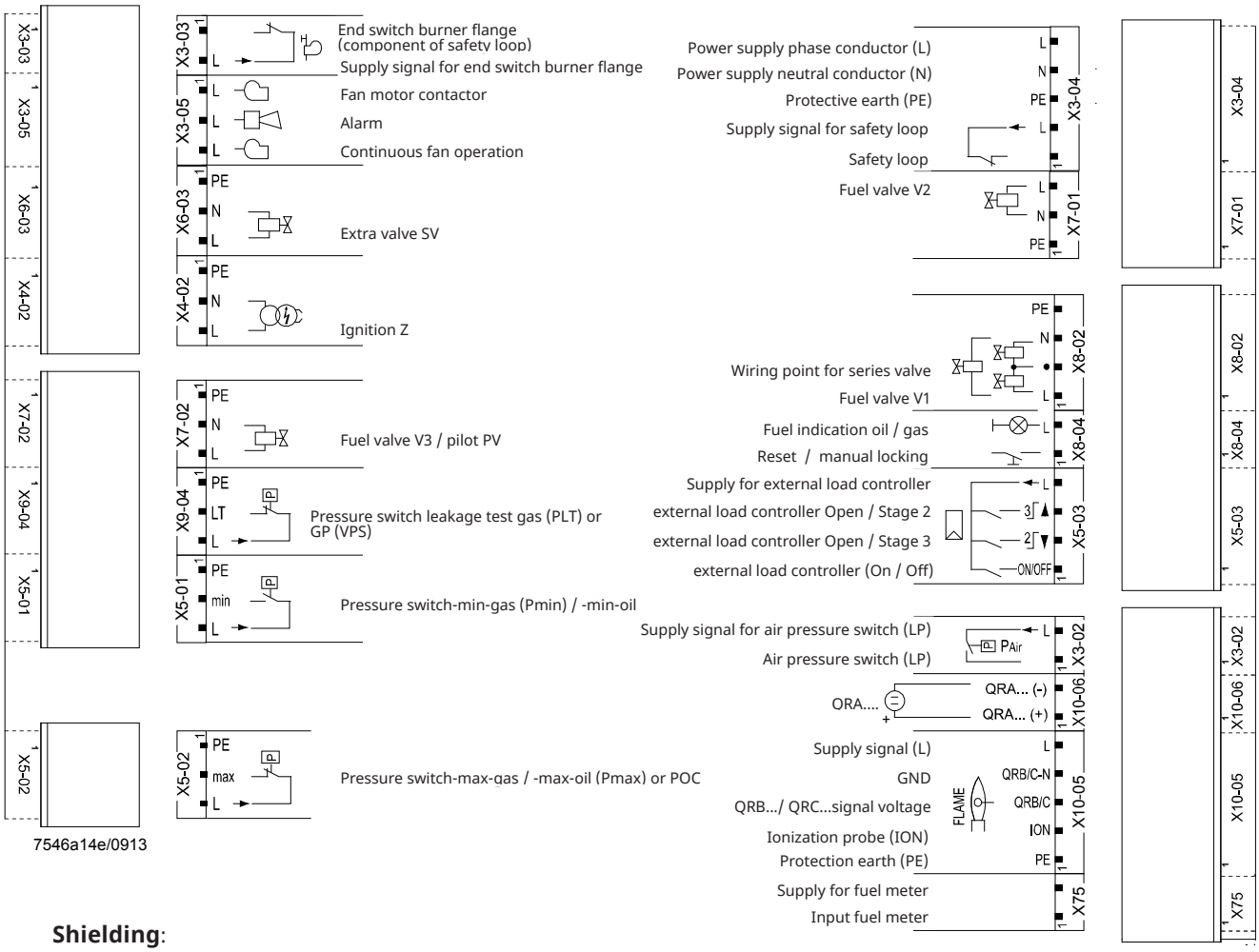
Abbreviations

AL	Alarm
FS	Flame signal
GM	Fan motor contactor
LP	Air pressure switch
M	Fan motor
P LT	Pressure switch for valve proving
Pmax	Pressure switch-max
Pmin	Pressure switch-min
POC	Proof of closure
PV	Pilot valve
R	Temperature or pressure controller
SB	Safety limiter
SK	Safety loop
STB	Safety limit thermostat
SV	Safety valve
WM	Water shortage
V1	Fuel valve 1
V2	Fuel valve 2
VP	Combustion pressure switch
Z	Ignition transformer
SA	Actuator
SA-K	Low-fire position of actuator
SA-N	Postpurge position of actuator
SA-R	Home position of actuator
SA-V	Rated load position of actuator
SA-Z	Ignition load position of actuator

Symbols

	Permissible position range	
	In Standby mode:	Actuator is allowed to travel within the permissible position range, but is always driven to the home position; must be in the home position for phase changes
0°/10% 90°/100%	Position as supplied (0°) Actuator fully open (90°)	
	Input/output signal 1 (ON) Input/output signal 0 (OFF) Input permissible signal 1 (ON) or 0 (OFF)	

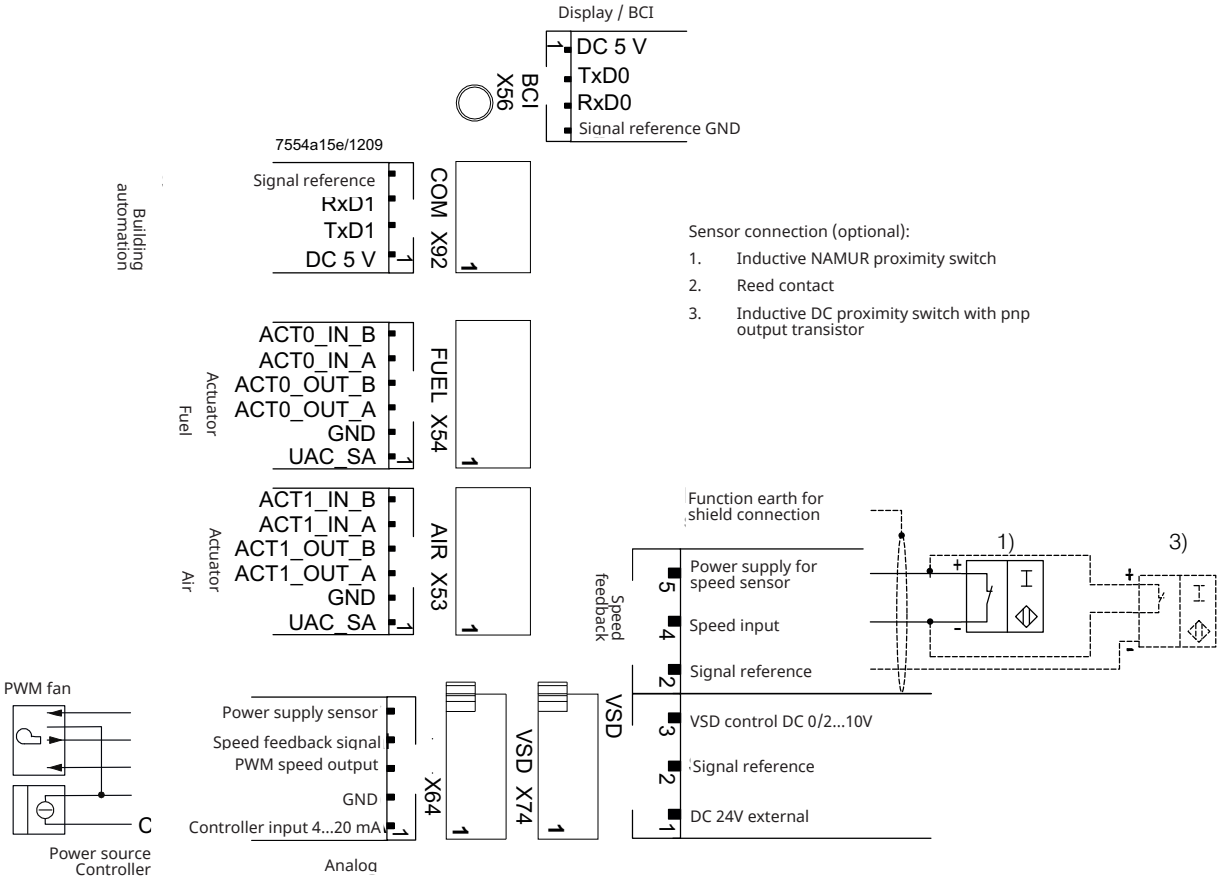
9.4 Connection and internal diagram



Shielding:

For shielding the cables on the VSD, refer to:

- Siemens SED2 VSD Commissioning Manual (G5192), chapters 4 and 7, or
- Danfoss Operation Manual VLT 6000 (MG60A703), chapter Installation


Display / BCI
BCI X56
DC 5 V
TxD0
RxD0
Signal reference GND
7554a15e/1209
Building automation
Signal reference
RxD1
TxD1
DC 5 V
COM X92
Sensor connection (optional):
1. Inductive NAMUR proximity switch
2. Reed contact
3. Inductive DC proximity switch with pnp output transistor
Actuator Fuel
ACT0_IN_B
ACT0_IN_A
ACT0_OUT_B
ACT0_OUT_A
GND
UAC_SA
FUEL X54
Actuator Air
ACT1_IN_B
ACT1_IN_A
ACT1_OUT_B
ACT1_OUT_A
GND
UAC_SA
AIR X53
Function earth for shield connection
Speed feedback
Power supply for speed sensor
Speed input
Signal reference
VSD control DC 0/2...10V
Signal reference
DC 24V external
VSD
VSD X74
1)
3)
PWM fan
Power supply sensor
Speed feedback signal
PWM speed output
GND
Controller input 4...20 mA
X64
Power source Controller
Analog

10. Operation

10.1 LMV37 automatic control unit

10.1.1 Explanation of display and buttons

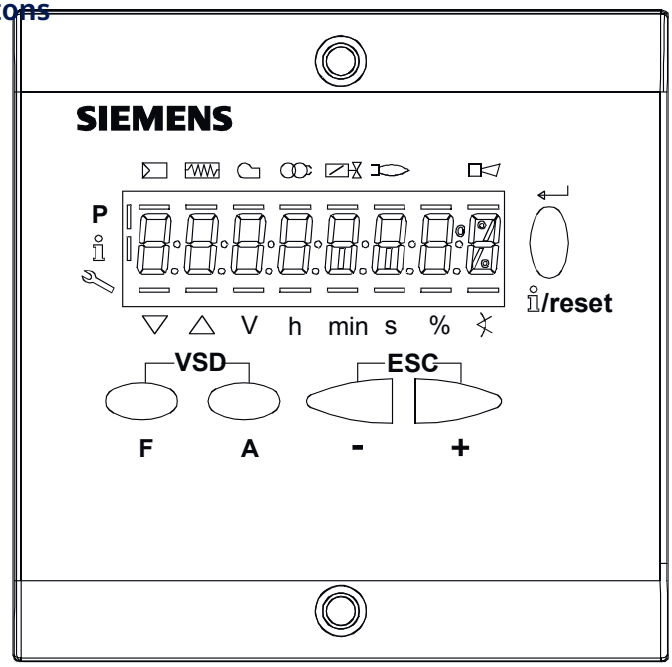
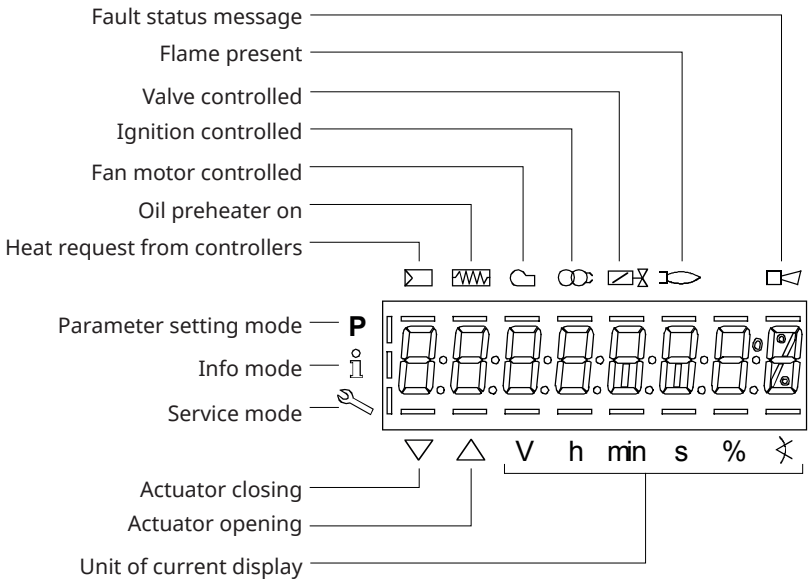


Figure 3: Description of unit/display and buttons

Button	Function
F	**Button F** - For adjusting the fuel actuator (keep F depressed and adjust the value by pressing - or +
A	**Button A** - For adjusting the air actuator (keep A depressed and adjust the value by pressing - or +
VSD F A	Buttons A and F: VSD function - For changing to parameter setting mode P (press simultaneously F and A
i/reset	**Info and Enter button** - For navigating in info or service mode • Selection (symbol flashing) (press button for <1 s) • For changing to a lower menu level (press button for 1...3 s) • For changing to a higher menu level (press button for 3...8 s) • For changing the operating mode (press button for >8 s) - Enter in parameter setting mode - Reset in the event of fault - One menu level down

Button	Function
-	**- button** - For decreasing the value - For navigating during curve adjustments in info or service mode
+	**+ button** - For increasing the value - For navigating during curve adjustments in info or service mode
ESC - +	**+ and - button: Escape function** (press - and + simultaneously) - No adoption of value - One menu level up

Figure 4: Meaning of display



10.2 List of phase displays

The display shows which phase the burner is in. The table below lists the codes and explains what these mean for the various phases. Not all the phases described in the table are shown or are suitable for the burners described in this manual.

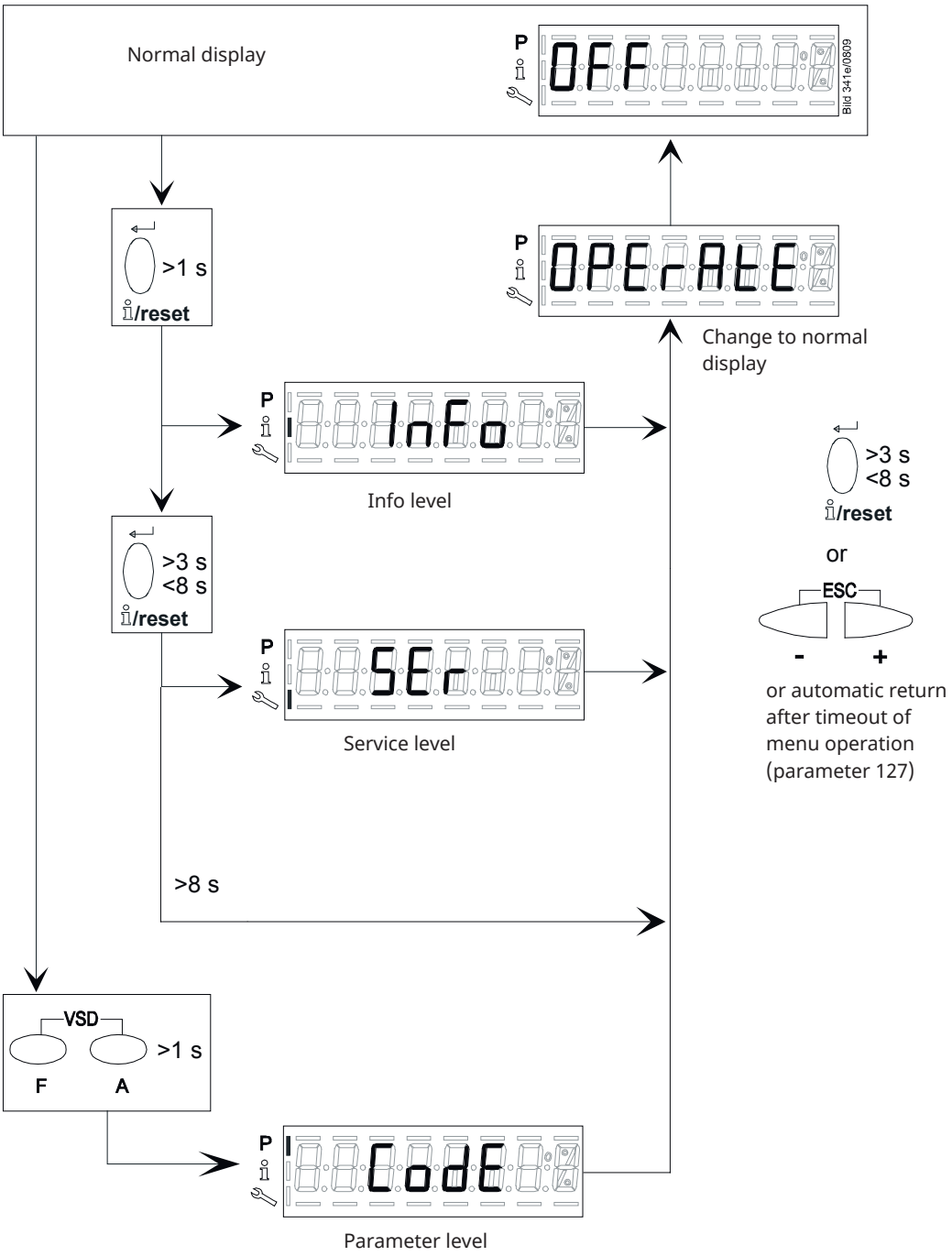
Phase	Function
Ph00	Lockout phase
Ph01	Safety phase
Ph10	Home run
Ph12	Standby (stationary)
Ph22	Fan ramp up time (fan motor = ON, safety valve = ON)
Ph24	Traveling to the prepurge position
Ph30	Prepurge time
Ph36	Traveling to the ignition position
Ph38	Preignition time
Ph39	Valve proving filling time (test of pressure switch-min when fitted between fuel valves V1 and V2)
Ph40	1st safety time (ignition transformer ON)
Ph42	1st safety time (ignition transformer OFF)
Ph44	Interval 1
Ph50	2nd safety time
Ph52	Interval 2
Ph60	Operation 1 (stationary)
Ph62	Max. time low-fire (operation 2, preparing for shutdown, traveling to low-fire)
Ph64	Switching back to pilot: Modulation to ignition load
Ph65	Switching back to pilot: Interval 2 waiting time
Ph66	Switching back to pilot: Reactivation of ignition + pilot
Ph67	Switching back to pilot: Shutdown of main valves
Ph68	Switching back to pilot: Pilot mode waiting phase
Ph69	Switching back to pilot: Pilot mode waiting phase for burner startup
Ph70	Afterburn time
Ph72	Traveling to the postpurge position
Ph74	Postpurge time (no extraneous light test)
Ph78	Postpurge time (t3) (abortion when load controller ON)
Ph80	Valve proving test evacuation time
Ph81	Valve proving test time atmospheric pressure, atmospheric test
Ph82	Valve proving filling test, filling
Ph83	Valve proving time gas pressure, pressure test
Ph90	Gas shortage waiting time

10.3 Automatic control unit levels

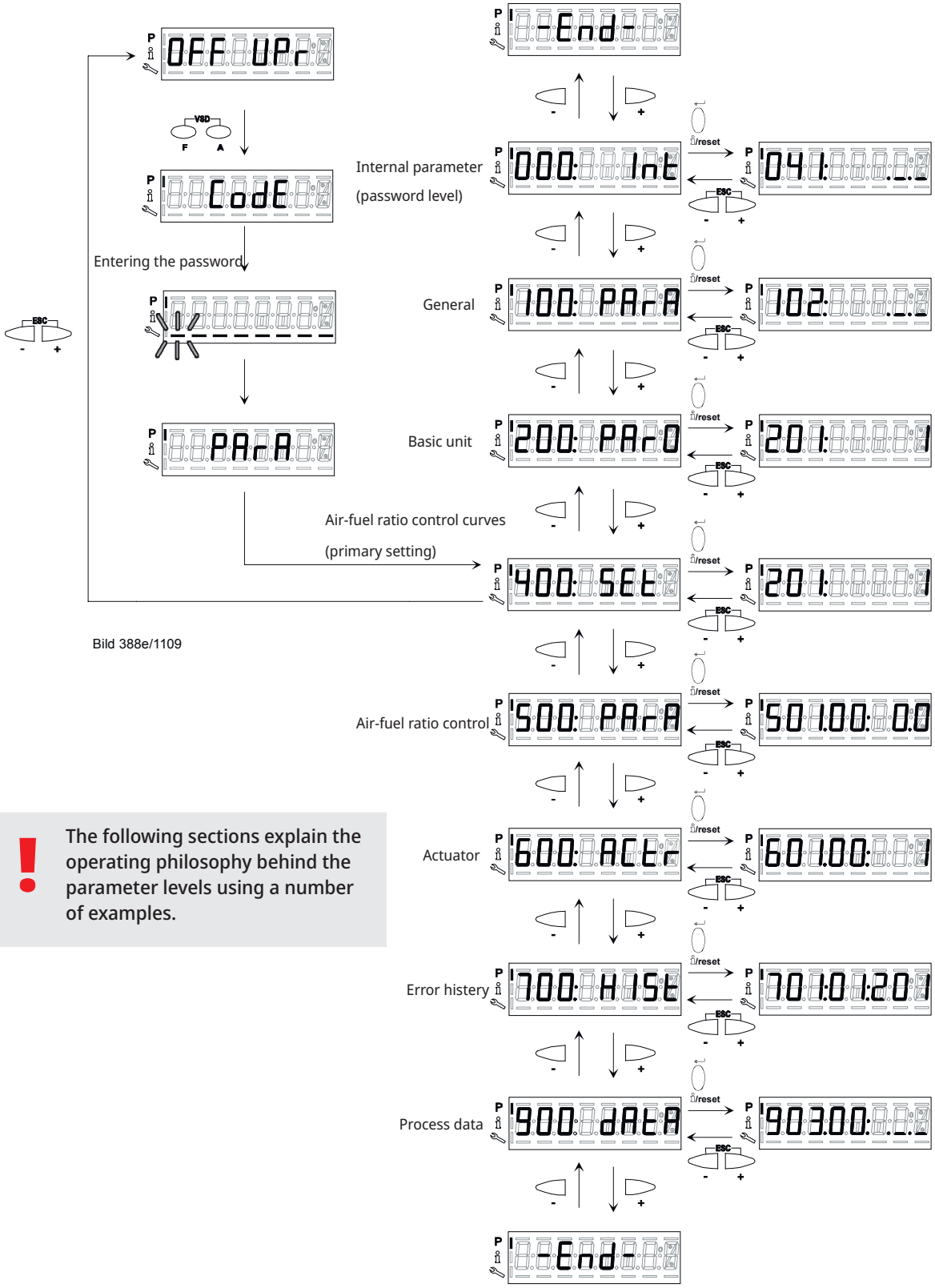
When working on burners there are different levels at which the automatic control unit can be accessed.

The info and service levels can be accessed without a password; error codes, error history and basic information about the burner can be viewed on these levels.

A code is required to enter settings for the burner.



10.3.1 Structure of parameter levels



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The following sections explain the operating philosophy behind the parameter levels using a number of examples.

10.3.2 Parameter of level info

No.	Parameter
167	Fuel volume resettable (m^3, l, ft^3, gal)
162	Operating hours resettable
164	Startups resettable
163	Operating hours when unit is live
166	Total number of startups
113	Burner identification
107	Software version
108	Software variant
102	Identification date
103	Identification number
104	Preselected parameter set: Customer code
105	Preselected parameter set: Version
143	Reserve
End	

10.3.3 Parameter of level service

No.	Parameter
954	Flame intensity
960	Actual flow rate (fuel throughput in m^3/h, l/h, ft^3/h, gal/h)
121	Manual output Undefined = automatic operation
922	Incremental position of actuators Index 0 = fuel Index 1 = air
936	Standardized speed
161	Number of faults
701 . . . 725	Error history: 701-725.01.Code ex. 701. 01. xxx chronological error list index value of index

Indexlist:

01 = error code

02 = diagnostic code

03 = error class

04 = error phase

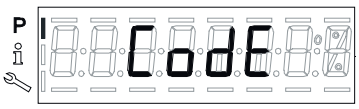
05 = startup counter

06 = output

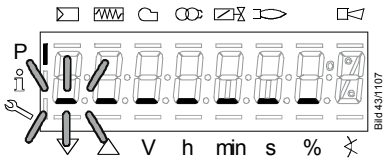
10.3.4 Access code for service engineer level

> **!** The code for logging into service level is found on the plate on the inside of the cover for the electrical connections box.

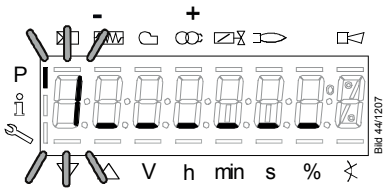
Press button combination VSD (F, A) to display **CodE**



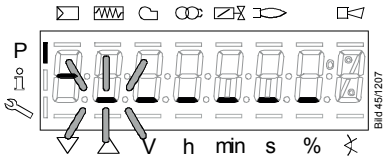
When releasing the buttons, 7 bars appear the first of whishes.



Press - or + to select a number or letter.

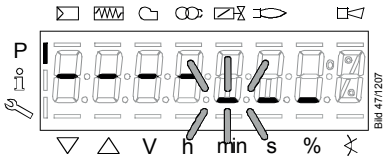


Press i/reset to confirm the value



The value entered changes to a minus sign (-)
The next bar starts flashing.

Complete the rest of the password according to the principle described.



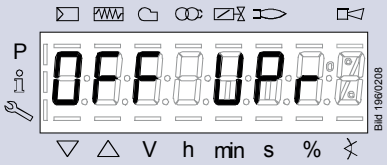
Example: Password consisting of 4 characters.

After entery of the last character the password must be confirmed by pressing **i/reset**

10.3.5 Manual

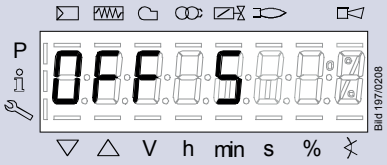
As long as the Manual OFF is active, **OFF** appears on the normal display flashing.
To deactivate and to change to automatic operation, press **ESC** **+** for 3 seconds. Then OFF appears without flashing in the display.

10.3.6 Start prevention



A non-programmed or not completely parameterized unit, or a unit whose operating mode was reset or changed, displays **OFF UPr.**

10.3.7 Safety loop



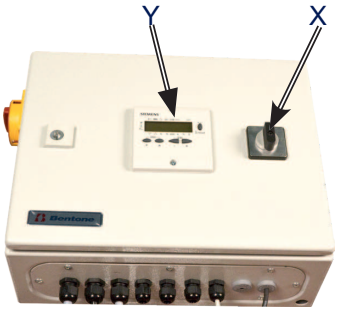
A unit whose safety loop and / or burner flange contact is open, and a controller ON signal is present, displays **OFF S**.

10.4 Setting the automatic control unit

To set the correct ratio between air and fuel, it is important to understand how this type of burner is controlled. This chapter will describe the procedure to follow when adjusting a burner with an LMV37 automatic control unit.

> **!** Note! When power is turned on for an unadjusted automatic control unit, "**OFF UPr**" is always shown in the display.

10.4.1 Setting an automatic control unit which has not previously been set or lost its settings

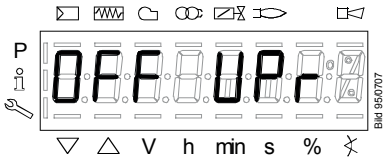


Check that the burner is receiving power and that oil is being supplied to the burner.

Move the switch (X) on the burner to the ON position.

The text "**OFF UPr**" is shown in the display.

Follow the procedure indicated below to set the automatic control unit.

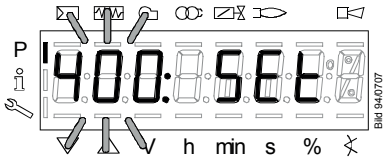


An unprogrammed unit or a unit whose operating mode has been reset or changed displays **OFF UPr.**

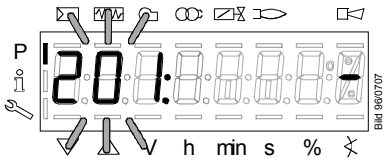
Press VSD (F, A) > 1 second to access login mode.

To continue with the setting work, you need to log into service engineer level. See 5.3.4.

After login is complete, continue with the setting work as shown below.



Press i/reset to select parameter **400** for initial commissioning and for setting air-fuel controll.



201: appears flashing.

Press i/reset to go to the settings for air-fuel ratio control and parameter **201** for selecting the operating mode.

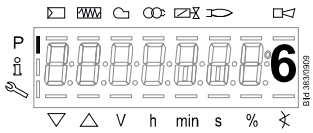
! Ensure that the fuel train is correctly set in compliance with the type of burner used.

No	Parameter	Actuator controlled	
201	Burner operating mode (fuel train, modulating / multistage, actuators, etc.)	Air	Fuel
	-- = undefined (delete curves)	●	●
	1 = gas modulating (G mod)	●	●
	2 = gas modulating with pilot valve (Gp1 mod)	●	●
	3 = gas modulating with pilot valve (Gp2 mod)	●	●
	4 = oil modulating (Lo mod)	●	●
	5 = oil 2-stage (Lo 2 stage)	●	–
	6 = oil 3-stage (Lo 3 stage)	●	–
	7 = gas modulating (G mod pneu)	●	–
	8 = gas modulating (Gp1 mod pneu)	●	–
	9 = gas modulating (Gp2 mod pneu)	●	–
	10 = oil modulating with gas pilot (LoGp mod)	●	●
	11 = oil 2-stage with gas pilot (LoGp 2-stage)	●	–
	12 = oil modulating with 2 fuel valves (Lo mod 2V)	●	●
	13 = oil modulating with gas pilot and 2 fuel valves (LoGp mod 2V)	●	●
	14 = gas modulating (G mod pneu, 0 active)	–	–
	15 = gas modulating with pilot (Gp1 mod pneu, 0 active)	–	–
	16 = gas modulating with pilot (Gp2 mod pneu, 0 active)	–	–
	17 = oil 2-stage (Lo 2-stage, 0 active)	–	–
	18 = oil 3-stage (Lo 3-stage, 0 active)	–	–
	19 = gas modulating only when firing on gas (G mod fuel active)	–	●
	20 = gas modulating with pilot only when firing on gas (Gp1 mod fuel active)	–	●
	21 = gas modulating with pilot only when firing on gas (Gp2 mod fuel active)	–	●
	22 = oil modulating only when firing on oil (Lo mod fuel active)	–	●
	23 = HO mod with circulation	●	●
	24 = HO 2-stage with circulation	●	–
	25 = HO mod without circulation control	●	●
	26 = HO 2-stage without circulation control	●	–
	27 = HO 3-stage without circulation control	●	–

This manual describes “6=oil 3-stage burners (Lo 3-stage).

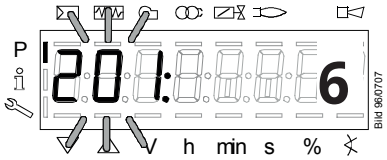
Press: ESC - + to return to parameter level.

2 stage oil parameter 5
3-stage oil parameter 6

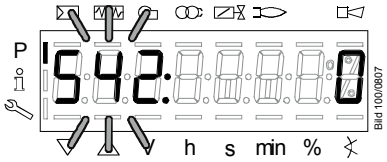


Press ℹ/reset to save selected setting.

Press: ESC - + to return to parameter level.



To the next parameter +



Parameter **542** to activate the VSD / PWM fan.
You can choose:
0 = VSD / PWM fan OFF
1 = VSD / PWM fan ON

If the parameter is set correctly, move directly to the next parameter with +

Press ℹ/reset to adjust parameter **542**.

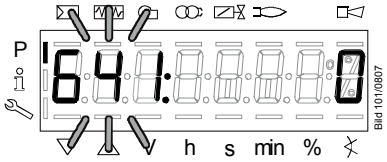
Select your setting by pressing one of the buttons - +

Press ℹ/reset to save the setting for parameter **542:** VSD

Press: ESC - + to return to parameter level.

This manual describes “0=VSD OFF” type burners.

To the next parameter + Back to the previous parameter -



Parameter **641** to control speed standardization of the VSD.

You can choose:

0 = speed standardization of VSD OFF

1 = speed standardization of VSD ON

After setting speed standardization to 1, standardization of the VSD commences. If successful, the parameter is reset to 0. Negative values indicate errors (refer to chapter Automatic speed standardization).

If the parameter is set correctly, move directly to the next parameter with +

Press: i/reset to adjust parameter **641**: speed standardization

Select your setting by pressing one of the buttons - +

Press: i/reset to save the setting for parameter **641:** VSD

Press: ESC - + to return to parameter level.

! This manual describes "0=speed standardization" type burners.

To the next parameter +

10.5 10.4 Multistage operation

This operating mode is only available when firing on oil. There is a choice of 2-stage and 3-stage operation. Hence, the burner's output can be modulated via 2 or 3 stages. Modulation is accomplished by adjustment of the air actuator or the VSD and by switching the fuel valves for adjusting the amount of fuel.

10.5.1 10.4.1 Definition of curves

Air-fuel ratio control is defined via the 2 or 3 static output points. To switch the valves on and off, switch-on and switch-off points must be defined.

The following assignments apply:

Curvepoint	Meaning	Valve
P0	Point of ignition (not approached in the operating position)	V1
P1	Stage 1	V1
P2on	Switch-on point stage 2. When the angle exceeds this point, the fuel valve for the second stage is switched on	V1
P2_d	Presetting of point P2 with no approach	V1
P2	Stage 2	V2
P2of	Switch-off point stage 2. When the angle falls below this point, the fuel valve for the second stage is switched off	V2
P3on	Switch-on point stage 3. When the angle exceeds this point, the fuel valve for the third stage is switched on	V2
P3_d	Presetting of point P3 with no approach	V2
P3	Stage 3	V3
P3of	Switch-off point stage 3. When the angle falls below this point, the fuel valve for the third stage is switched off	V3

The actuator positions can be set with a resolution of 0.1°, the speeds with a resolution of 0.1%.

10.5.2 Traveling speed

The air actuator or the VSD is operated like outside the operating position. The defined ramp speeds are used.
The speed of the VSD can be adjusted separately for speed increase or decrease.

No	Parameter	
522	Ramp up	
523	523 Ramp down	

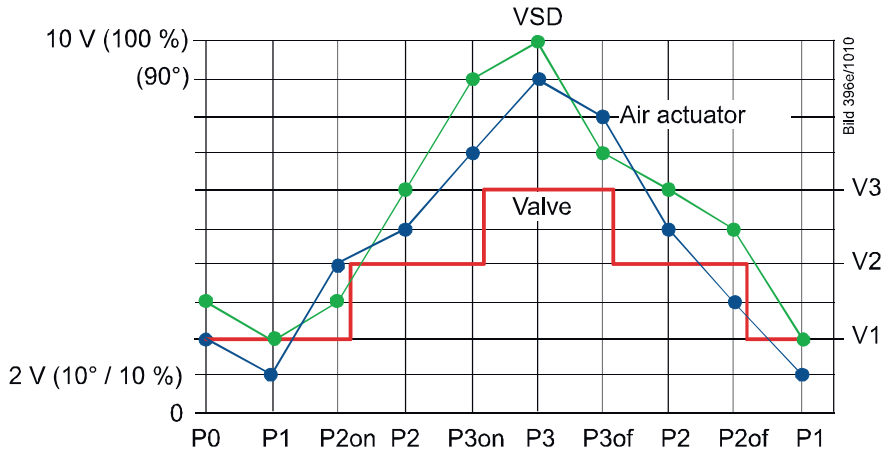
The setting also acts outside the operating position.

The running speed of the actuators is fixed at 5 seconds for a positioning angle of 90° for SQM33.4, SQM33.5, and SQN1.
The speed is 10 seconds for a positioning angle of 90° for SQM33.6.
The SQM33.7 requires 17 seconds for a positioning angle of 90°.

10.5.3 Adjustment of output

When the output increases, the system moves from the curvepoint of stage 1 (P1) to the switch-on point of stage 2 (P2on). If the switch-on point is exceeded, the valve for the second stage is switched on. Then, the system moves to the curvepoint for stage 2 (P2). When the output decreases, the system moves from the curvepoint of stage 2 (P2) to the switch-off point of stage 2 (P2of). If this point is crossed, the valve for the second stage is switched off. Then, the system moves to the curvepoint for stage 1 (P1).
In 3-stage operation, the output between stage 2 and stage 3 is adjusted analogously to 2-stage operation. As static outputs, only P1, P2 and P3 can be approached.
The switch-on and switch-off points are crossed only when changing between stages. The traveling speeds are fixed. Depending on the positioning angles to be covered, air actuator and VSD do not reach the operating or switch-on/ switch-off points at the same time. The valves are switched on/off only after both actuators have reached their correct positions.

When parameterizing the curves, the switch-on points can also be approached in a stationary manner. In addition, when setting the curve via P2_d (P3_d), curvepoint P2 (P3) can be readjusted without traveling to it. In that case, the system is at the respective switch-on point. This procedure is used to reduce the operating time if there is shortage of air.



Adjustment of output

10.5.4 Entering the operating position

The burner is ignited at ignition position P0. When entering operating phase 60, the actuators are driven from ignition position P0 to the operating point of stage 1 (P1) at the respective traveling speed.

10.5.5 Operating position

In the operating position, the burner's output can be adjusted between operating points P1 and P2 or P3 in accordance with the load controller's presetting, as described in chapter Adjustment of output. Ignition position P0 is not approached anymore. It can only be reached via curve adjustment.

10.5.6 Setting of curvepoints for multistage mode («Lo 2-stage», «Lo 3-stage»)

Example of «Lo 2-stage»

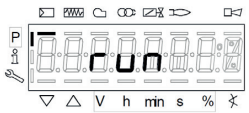
	P0:---:---	**P0** appears flashing. Curvepoint for ignition load.
A	P0 :A---	Keep A depressed. You are now at **P0** of air actuator **A**.
A and - or +	P0 :A20.0	Press simultaneously A and - or + to adjust ignition position P0 of the air actuator. Example: 20.0
F and A	P0:n---	Keep F and A depressed. You are now at **n0** of the VSD.
F and A and - or +	P0:n20.0	Press simultaneously F and A and - or + to adjust speed **n0** of the VSD. Example: **20.0**
	P0:20.0	Now, release A The selected value is adopted. Example: **20.0**
+		
	run	Identification of start for setting the curve parameters.

Note!
You are now given the choice of proceeding with the warm settings by

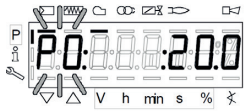
pressing i/**reset** (refer to chapter Warm settings for modulating mode «Lo2-steg"och "Lo3-steg", or settings

off mode by pressing ESC - +

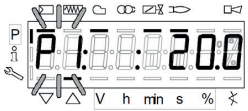
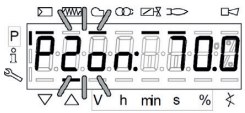
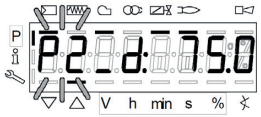
10.5.7 Warm settings for «Lo 2-stage», «Lo 3-stage»)

		Identification of start for setting the curve parameters.
		Provided the controller is enabled!
		Phase Standby (stationary)
		Phase Fan ramp up (fan motor = ON, safety valve = ON)
		Phase Traveling to prepurge position
		Phase Prepurging
		Phase Traveling to ignition position

Wait until the burner is operating and symbol ▲ or ▼ is no longer highlighted!
The startup sequence stops in phase 36 Traveling to ignition position.
The ignition position can be adjusted under cold conditions.

A and - or + as well as F and A **and** - + or		Ignition position **P0** can be set only when symbol ▲ or ▼ is no longer highlighted. Keep A depressed and, for VSD F and A Press - or + to adjust the value. When symbol ▲ or ▼ is no longer highlighted, the next curvepoint **P1** can be selected with +

		+
	Ph36:	Phase Traveling to ignition position
	Ph38:	Phase Preignition
	Ph40:	Phase 1st safety time (ignition transformer ON)
	Ph44:	Phase Interval 1
A and - + or as well as F and A **and** - + or	P0: :20.0	Ignition position **P0** can be set only when symbol ▲ or ▼ is no longer highlighted. Keep A depressed and, for VSD F and A Press - or + to adjust the value. When symbol ▲ or ▼ is no longer highlighted, the next curvepoint **P1** can be selected with +
		+

A and - or + as well as F and A **and** - or +		Low-fire position **P1** can be set only when symbol ▲ or ▼ is no longer highlighted. Set stage 1 **P1**. Fuel valve **V1** is switched on. Keep A depressed and, for VSD F and A . Press - or + to adjust the value. When symbol ▲ or ▼ is no longer highlighted, the next curvepoint **P2on** can be selected with +
To the next curvepoint	+	
A and - or + as well as F and A **and** - or +		Curvepoint **P2on** can be set only when symbol ▲ or ▼ is no longer highlighted. Set switch-on point stage 2 ↻↕. Fuel valve **V2** is still off. Keep A depressed and, for VSD F and A . Adjust the value with - or + . When symbol ▲ or ▼ is no longer highlighted, the next curvepoint P2_d can be selected with +
To the next curvepoint	- +	Back to the previous curvepoint
A and - or + as well as F and A **and** - or +		Curvepoint **P2_d** can be set only when symbol ▲ or ▼ is no longer highlighted. Fuel valve **V2** is still off and the system remains at curvepoint **P2on**. Presetting of operating stage **P2** with no travel, aimed at cutting the operating time if there is shortage of air. Keep A depressed and, for VSD F and A . Press - or + to adjust the value. When symbol ▲ or ▼ is no longer highlighted, the next curvepoint **P2** can be selected with -

To the next curvepoint	- +	Back to the previous curvepoint
A and - or + as well as F and A **and** - or +	P2: 80.0 V h min s %	Curvepoint **P2** can only be adjusted when symbol ▲ or ▼ is no longer highlighted. Fuel valve **V2** is switched on. Keep A depressed and, for VSD F and A. Press - or + to adjust the value. When symbol ▲ or ▼ is no longer highlighted, the next curvepoint **P2of** can be selected with -
	-	Back to the previous curvepoint
	P2oF: 70.0 V h min s %	Curvepoint **P2of** is now adjusted. The system remains at **P2**. Adjust the switch-off point with no travel. Now, the curvepoint is approached dynamically when traveling from **P2** to **P1**. When symbol ▲ or ▼ is no longer highlighted, the next curvepoint **P1** can be selected with -
To the next curvepoint	- +	Back to the previous curvepoint
	P1: 20.0 V h min s %	Automatic mode is released when, after reaching **P1**, the curve settings are quit with **ESC**. If the settings are aborted earlier (**ESC** or shutdown due to fault), start prevention **OFF UPr** is still active until all curvepoints are set.
	ESC - +	
	400: SEt V h min s %	When symbol ▲ or ▼ is no longer highlighted, **ESC** can be pressed a second time.
	ESC - +	
	oP: P1 V h min s %	

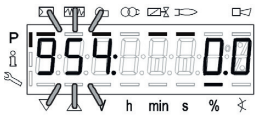
The warm settings for air-fuel ratio control of the LMV37.4... have now been configured.

10.5.8 Cold settings for multistage mode («Lo 2-stage», «Lo 3-stage»)

> **!** Refer to chapters Warm settings for «Lo 2-stage» and «Lo 3-stage»! But with no flame, no actuator travel and no automatic operation after the settings have been made.

10.5.9 Intensity of flame during curve settings

When setting the curve and the curvepoint is displayed, you can press /**reset** to show the intensity of flame. When pressing the button for >1 s, a change to parameter 954 is made; when releasing the button, you return to the curvepoint.

		Example: Curvepoint Low-flame position **P1**.
	/**reset** >1 s	Change to parameter **954**
		Parameter **954**: flashes. The intensity of flame in % is shown on the right. Example: **954: 0.0**
/**reset**		Release /**reset** to return to curvepoint Low-fire position **P1**.

10.5.10 The parameters below may need to be set according to the nature of the installation.

10.5.10.1 No-flame positions air actuator

502 No-flame positions air actuator

Index 0 = no-load position

Index 1 = pre purge position

Index 2 = post purge position

Factory settings marked with bald text.

This manual describes “2=valve proving via pressure switch-min (between fuel valves 1 and 2)” type burners.

Depending on the type of burner, the automatic control unit should be set to either “0=no valve proving” or “1=valve proving on startup”.

The automatic control unit should be set to “Index 0 = no-load position”.

The automatic control unit should be set to “Index 0 = no-load position”.

10.5.10.2 Active detector flame evaluation

261 Oil: Active detector flame evaluation

0 = QRB / QRC
1 = ION / QRA

Factory settings marked with bald text.
When replacing detector flame between ionisation and UV-cell (QRA), no change to the setting parameters is required; simply disconnect and connect ionisation and UV-cell (QRA) respectively..

10.5.10.3 Prepurging

262 Oil: Prepurging

Index 0 = deactivated
Index 1 = activated

Factory settings marked with bald text

When using valve proving and 2 fuel valves of class A, prepurging is not required (conforming to EN 676).

If not activated, it is nevertheless performed if one or several of the following conditions apply:

- Alterable lockout position
- After an off time of >24 hours
- In the event of a power failure (power-on)
- In the event of shutdown due to an interruption of oil supply (safety shutdown)

10.5.10.4 Prepurging time

265 Oil: Prepurging time
20 s – 60 min

10.5.10.5 Postpurge time

274 Oil: Postpurge time (no external light test)
0,2 s – 108 min

10.5.10.6 Postpurging in lockout position

190 Postpurging in lockout position

0 = deactivate (no-load position)
1 = active (postpurge position)

Factory settings marked with bald text.

! When the Purging in the lockout position function is used, the fan may only be powered via a contactor and must not be connected directly to LMV37.4 (X3-05 pin 1)!

When active, the Alarm in the event of start prevention function (parameter 210) is only possible to a limited extent!

The LMV37.4 system simply moves the actuators to the postpurge position. A fan release contact cannot be controlled, as the alarm relay of the LMV37.4 system cuts off the power supply to the outputs. With the Alarm in the event of start prevention function, an external circuit that may be present for controlling the fan release contact for purging in the lockout position is activated via start prevention in standby mode.

10.5.10.7 Continuous fan

A burner can be converted into a continuous fan using conversion kit 119 230 01. See the documentation provided with the kit for instructions on how to perform the conversion.

10.5.10.8 Continuous operation

The LMV37 automatic control unit permits continuous operation of the burner, provided that the burner's detector flame is an ionisation detector flame.

When forced intermittent operation is activated, the unit shuts down for a moment after 23 hours and 45 min of uninterrupted operation, followed by an automatic restart.

When forced intermittent operation is inactivated the burner will run continuously.

Forced intermittent operation is a standard feature.

279 Oil: Forced intermittent operation

0 = inactivate

1 = activated

Factory settings marked with bald text.

10.6 Backup and restore

When adjustments to the burner are complete, it is a good idea to make a backup of the settings.

The backup ensures that the adjusted values are also saved in the display memory. This can be useful, e.g. if there are any problems with the LMV. The LMV can then be replaced and previous settings for the burner restored from the display memory to the new LMV.

Backup: Means that the parameters set on the LMV control unit are saved in the display memory.

Restore: Means that the settings saved in the display memory are transferred to the LMV and these overwrite any settings already in the LMV. The transferred parameter settings then act as operating parameters for the burner.

10.6.1 Backup

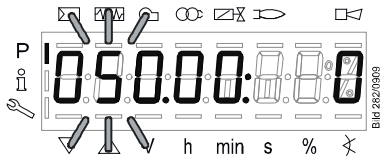
Press VSD F A > 1 second to access login mode.

To continue with the setting work, you need to log into service engineer level. See 5.3.4.

After login is complete, continue with the setting work as shown below.

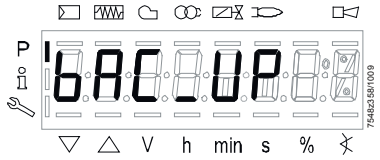
Press - or + for parameter level **000**.

Press i/reset



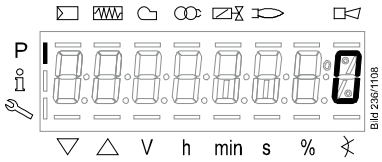
Display: Parameter **050**, flashes, index **00**, and value **0** do not.

i/reset



Display: Parameter **bAC_UP**

i/reset



Display: Value **0**

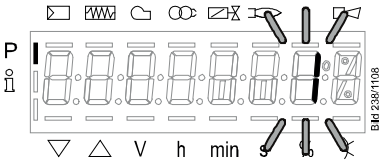
Press to backup process.

i/reset

Press to shift the value in change mode 1 position to the left.

+

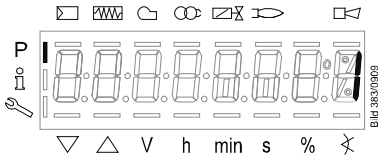
! Note! The value must be set to 1 if a backup is required, and to 0 if a backup is not required. The values higher than 1 which can be set must not be used.



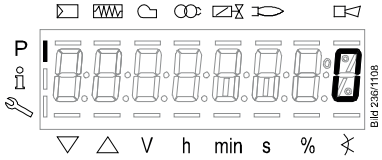
Display: Value **1** flashes

Press to activate the backup process.

i/reset



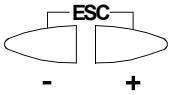
Display**: 1** appears



After about 5 seconds (depending on the duration of the program), **0** appears on the display, indicating the end of the backup process.

Display: **0**

! If an errror occurs during the backup process, a negativ value is displayed. For error diagnostics, the cause of the error can be determined from the diagnostic code of error message 137 (see Error code list)

Press  four times until the top menu is displayed.

ESC

- **+**

10.6.2 Restore

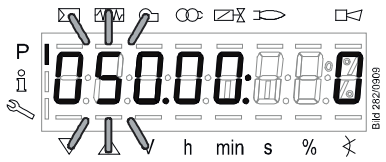
Press VSD F A > 1 second to access login mode.

To continue with the setting work, you need to log into service engineer level. See 5.3.4.

After login is complete, continue with the setting work as shown below.

Press - or + for parameter level **000**.

Press i/reset

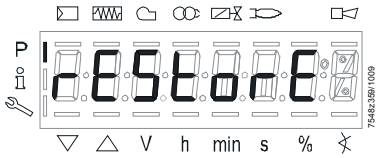


Display: Parameter **050**, flashes, index **00**, and value **0** do not.

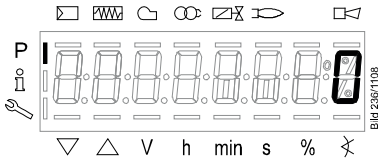
i/reset

Display: Parameter **bAC_UP**

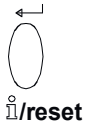
Press + to select parameter **rESstorE**



i/reset



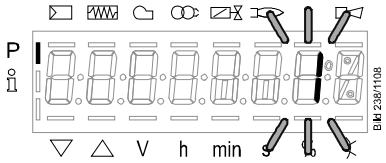
Dispalay: Value **0**

Press  to select the restore process.

i/reset

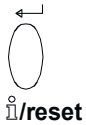
Press to shift the value in change mode 1 position to the left.

+

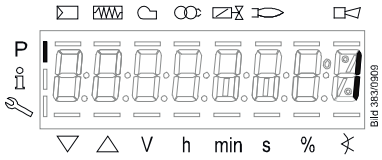


Display: Value **1** flashes

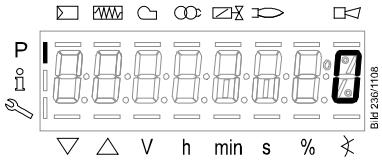
! To detect potential dispalay errors, the value is displayed 1 place shifted to the left

Press 

to activate the the restore process.

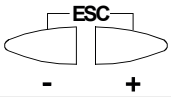


Dispalay**: 1** appears



After about 8 seconds (depending on the duration of the program), **0** appears on the display, indicating the end of the backup process.

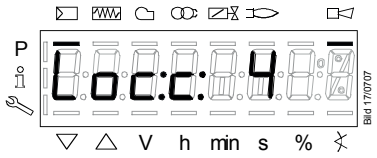
Display: **0**

Press 

four times until the top menu is displayed.

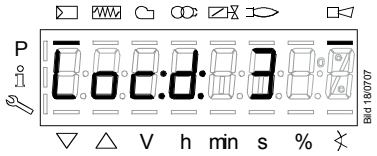
10.7 Fault status message, display of errors and info

10.7.1 Display of errors (faults) with lockout



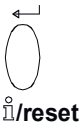
The display shows Loc:, the bar under the fault status message appears.

The unit is in the lockout position.

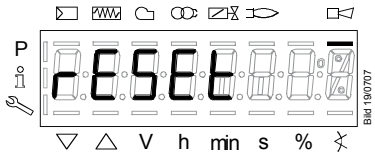


The display shows current error code c: alternating with diagnostic code d: (refer to Flash code list).

Example: Error code 4/diagnostic code 3

When pressing 

for 1...3 s, **rESEt** appears on the display.

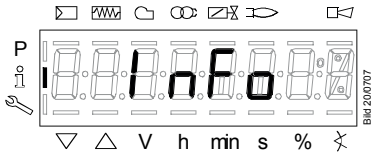


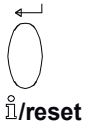
When the button is released, the basic unit is reset.

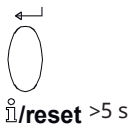
If the button is pressed for a time other than the time indicated above, a change to the previous menu is made.

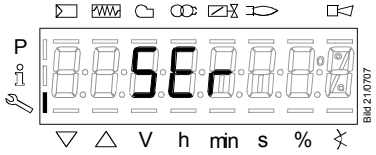
Exception
If an error occurred while setting the curve, a change back to the parameter setting level is made.

10.7.2 Activating info / service mode from lockout



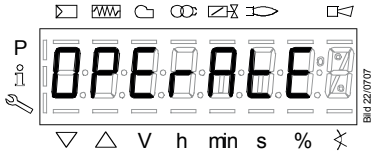
When pressing  for >3 s, the display shows InFo,





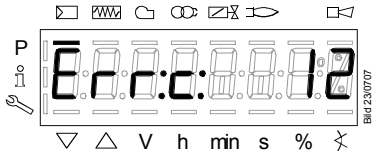
SEr and then **OPErAtE.**

For a list of parameters, see table 5.3.3.

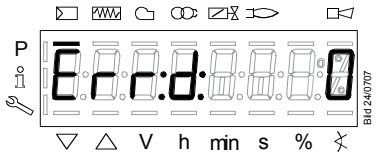


When the button is released, a change to info / service mode is made.

10.7.3 Error with safety shutdown



The display shows **Err:**.
The unit initiates safety shutdown.
The display shows current error code c:
alternating with diagnostic code d:.



Press 1...3 s, to return to the normal display.

i/reset

Example: Error code **12** / diagnostic code **0**

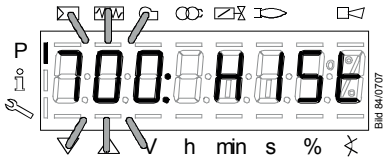
10.7.4 Error history

Press VSD F A > 1 second to access login mode.

To continue with the setting work, you need to log into service engineer level. See 5.3.4.

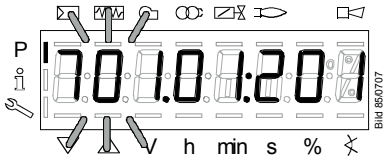
After login is complete, continue with the setting work as shown below.

Press - or + for parameter level **700**.



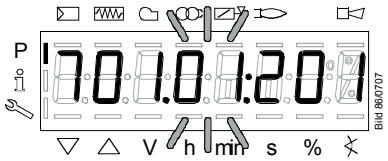
HISt 700: for error history

Press i/reset to go to the parameter level.



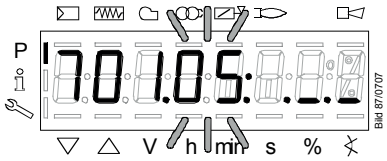
Display: Parameter **701**. flashes, index **01**: and example value **201** does not.

Press i/reset to go to index **01:**



Display: Parameter **701**. does not flash, index **01**: flashes, value **201** does not.

To the next index + Back to the previous index. -



Press + to select the index:

.01 = error code

.02 = diagnostic code

.03 = error class

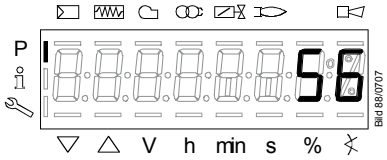
.04 = error phase

.05 = startup counter

.06 = output

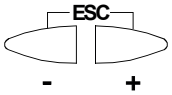
Example:

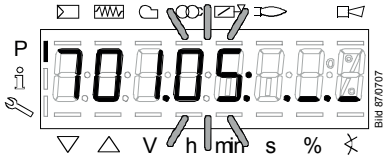
Parameter **701**., index **05**: for startup counter, diagnostic code ._._

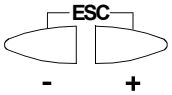


Press to go to display mode.

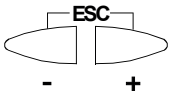
Display: Value **56** (number of startup)

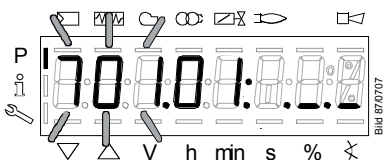




Press  to return to the index.

Display: Parameter **701**. does not flash, index **05**: flashes, characters ._._ do not.





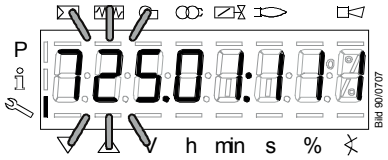
Press ESC - + to return to the parameter level.

Display: Parameter **701**. flashes index **01**: does not,

characters ._._ do not.

To the next old error +

Shows all saved error codes between 701 and 725.

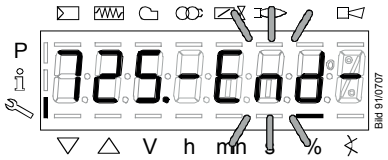


Parameters cover the period of time back to the last error since history was deleted (max. to parameter **725**.)

Example:

Parameter **725**., index **01**:, error code **111**

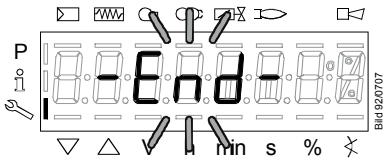
To the next parameter + Back to the previous parameter. -



When this display appears, you have reached the end of the error history index.

Display – **End** – appears flashing.

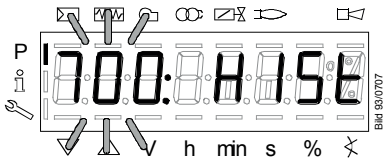
To the next index + Back to the previous index. -



When this display appears, you have reached the end of the error history.

Display – **End** – appears flashing.

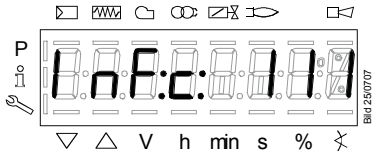
Press ESC - + twice.

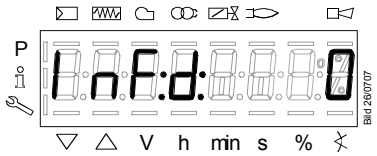


HISt 700: for error history

10.8 Dispaly message of info

10.8.1 General information





The unit displays an event which does not lead to shutdown.

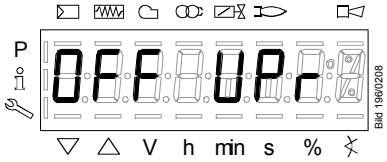
The display shows current error code c: alternating with diagnostic code d:.

Press to return to the display of phases.

Example: Error code **111** / diagnostic code **0**

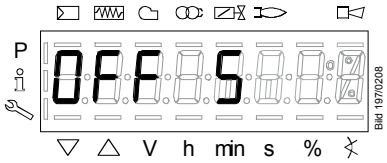
> **Note!**
> For meaning of the error and diagnostic codes, refer to chapter Error code list. When an error has been acknowledged, it can still be read out from the error history.

10.8.2 Start prevention



A non-programmed or not completely parameterized unit, or a unit whose operating mode was reset or changed, displays **OFF UPr.**

10.8.3 Safety loop

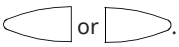


A unit whose safety loop and / or burner flange contact is open, and a controller ON signal is present, displays **OFF S**.

10.9 Resetting the automatic control unit

Press **F** **A** > 1 second to access login mode.

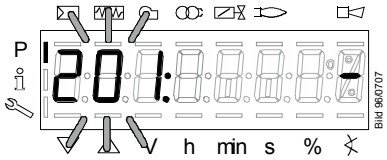
To continue with the setting work, you need to log into service engineer level. See 5.3.4.

After login is complete, move to parameter level **200** using  or .

- **+**

Press

i/reset

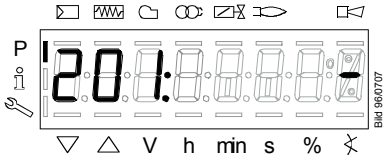


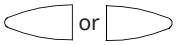
201: appears flashing

Press

i/reset

to go to the settings for air-fuel ratio control and parameter **201** for selecting the operating mode.

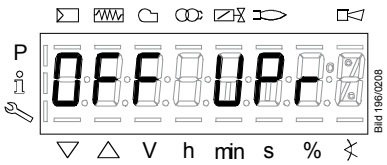


Select another burner type than the one already selected by pressing one of the buttons  or .

- **+**

Confirm this selection with The automatic control unit is now reset.

i/reset



Restart the setting process for the LMV automatic control unit as specified in 3.2.1.

10.10 Manual output

A manual output can be set with the «Normal display» of the display and operating unit.

10.10.1 Activation of Manually OFF in standby via the display and operating unit

When the burner is in OFF position it can be set to Manually OFF which means that the burner will not start.

Manual OFF can be activated by pressing F for at least 1 second then **LoAd 0.0** appears flashing.

LoAd 0.0 means Manually OFF.

As long as the Manual OFF is active, **OFF** appears on the normal display flashing.

To deactivate and to change to automatic operation, press ESC + for 3 seconds. Then OFF appears without flashing in the display.

10.10.2 Activation of Manually OFF in operation and adjustment of output via the display and operating unit

When the burner is in operation position it can be set to Manually OFF which means that the load of the burner can be manually set and will not start if the burner is shut down.

To activate Manually OFF, first run the system to the minimum output limit.

Manual OFF can be activated by pressing F for at least 1 second then **LoAd 0.0** appears flashing.

Adjustment of **LoAd** can now manually be done by pressing F and simultaneous pressing - or +.

The burner will now stay in set input if none of the safety regulators stops the burner.

To deactivate and to change to automatic operation, press ESC - + for 3 seconds.

> **!** If Manually OFF is activated, it is stored via mains OFF.
> On power return, the burner assumes the Manually OFF position (OFF flashing).

> **!** Please note that the automatic control unit will not exit manual mode by itself. Make sure that the automatic control unit is reset to automatic mode.

> **!** The unit can be changed to manual mode without login taking place. If the automatic control unit has been left in manual mode, no automatic burner control will take place, which in turn means that the installation is not operating satisfactorily. For this reason, make sure when servcing/ troubleshooting that the automatic control unit is not in manual mode.

> **!** Manually OFF must not be used just to put a burner out of operation when doing mounting work, or when the burner is not ready for operation. The safety notes contained in chapter Safety notes must be observed!

11. Parameter list

Par. no.	Parameter	Number of elements	Type	Edit	Value range Min	Value range Max	Resolution	Default setting		Password level
000	**Internal parameters**									
050	Start backup / restore via AZL2.../ PC software (set parameter to 1) Index 0: Create backup Index 1: Execute restore Error diagnostics via negative values (see error code 137)	2	Std_s8	edit	-99	50	1	0; 0		SO
055	Burner identification of AZL2... backup data set	1	Std_s32	read only	0	99999999	1	0		SO
056	ASN extraction of AZL2... backup data set	8	Std_u8	read only	0	127	1	0		SO
057	Software version when creating the AZL2... backup data set	1	Hex_16	read only	0x100	0xFFF9	1	0		SO
100	**General**									
102	Identification date	1	Date	read only	0	255	1			Info / Service
103	Identification number	1	Std_u16	read only	0	65535	1			Info / Service
104	Preselected parameter set: Customer code	1	Std_u8	read only	0	255	1	9		Info / Service
105	Preselected parameter set: Version	1	Hex_16	read only	0	0xFFFF	1	LMV37.400...: V 01.05 LMV37.420...: V 01.06		Info / Service
107	Software version	1	Hex_16	read only	0x100	0xFFF9	1	V 03.30		Info / Service
108	Software variant	1	Std_u8	read only	0	255	1	LMV37.400...: 1 LMV37.420...: 2		Info / Service
111	ASN extraction for verification with the AZL2... backup data set	8	Std_u8	read only	0	127	1	0		SO
113	Burner identification	1	Std_s32	edit	0	99999999	1	undefined		SO
121	Manual output Undefined = automatic mode	1	Output	edit / clear	0%	100%	0.1%	undefined		Info / Service
123	Minimum output positioning step Index 0: BACS output Index 1: Output of external load controller, analog Index 2: Output of external load controller contacts	3	Output	edit	0%	100%	0.1%	Index 0 1 2	Value 0% 1% 0%	SO
124	Start loss-of-flame test (TÜV test) (set parameter to 1) (shutdown of fuel valves ⟶ loss of flame) Error diagnostics via negative values (see error code 150)	1	Std_s8	edit	-6	1	1	0		SO
125	Mains frequency 0 = 50 Hz 1 = 60 Hz	1	Selection	edit	0	1	1	LMV37.400...: 0 LMV37.420...: 1		SO

Par. no.	Parameter	Number of elements	Type	Edit	Value range Min	Max	Resolution	Default setting	Password level
126	Display brightness	1	Std_u8	edit	0%	100%	1%	LMV37.400...: 75 % LMV37.420...: 100 %	SO
128	Fuel meter: Pulse valency [pulses / volume unit]	1	Std_u16	edit	0	400	0.01	0	SO
130	Delete display of error history To delete the display: Set parameter to 1, then to 2 Return value 0: Job successfully completed Return value -1: Timeout of 1_2 sequence	1	Std_s8	edit	-5	2	1	0	SO
133	Default output for TÜV test Invalid = TÜV test when output is active 2.000...10.000 = low-fire...high-fire or stage 1 / stage 2 / stage 3	1	Output	edit / clear	20 %	100 %	0.1 %	undefined	SO
141	Operating mode BACS 0 = off 1 = Modbus 2 = reserved	1	Selection	edit	0	2	1	0	SO
142	Setback time in the event of communication breakdown Setting values 0 = inactive 1....7200 s	1	Std_u16	edit	0 s	7200 s	1 s	120 s	SO (BA)
143	Reserved	1	Std_u8	edit	1	8	1	1	Info / Service
144	Reserved	1	Std_u16	edit	10 s	60 s	1 s	30 s	SO
145	Device address for Modbus of basic unit Setting values 1...247	1	Std_u8	edit	1	247	1	1	SO
146	Setting of Baud rate for Modbus communication Setting values 0 = 9600 1 = 19200	1	Selection	edit	0	1	1	1	SO
147	Parity for Modbus 0 = none 1 = odd 2 = even	1	Selection	edit	0	2	1	0	SO
148	Default output if communication with building automation is interrupted Setting values: For **modulation operation** the setting range is as follows: 0...19.9 = burner off 20...100 = 20...100% burner rating For **multistage operation** apply to setting range: 0 = burner OFF, P1, P2, P3 Invalid = no default output predefined by building automation Default setting: **Invalid**	1	Output	edit / clear	0%	100%	0.1%	undefined	SO (BA)

Par. no.	Parameter	Number of elements	Type	Edit	Value range Min	Max	Resolution	Default setting	Password level
161	Number of faults	1	Std_u16	read only	0	65535	1	0	Info / Service
162	Operating hours resettable	1	Std_s32	reset	0 h	9999999 h	1 h	0 h	Info / Service
163	Operating hours when unit is live	1	Std_s32	read only	0 h	9999999 h	1 h	0 h	Info / Service
164	Number of startups resettable	1	Std_s32	reset	0	9999999	1	0	Info / Service
166	Total number of startups	1	Std_s32	read only	0	9999999	1	0	Info / Service
167	Fuel volume resettable [m^3, l, ft^3, gal]	1	Std_s32	reset	0	99999999	1	0	Info / Service
176	**Switching back to pilot** switching cycles	1	Std_s32	read only	0	9999999	1	0	Info / Service
190	Postpurging in lockout position 0 = deactivate (no-load position) 1 = active (postpurge position) When active, the **Alarm in the event of start prevention** function is only possible to a limited extent!	1	Selection	edit	0	1	1	0	SO
191	Function **Switching back to pilot** 0 = deactivate 1 = active (low active) 2 = active (high active) Load controller contacts X5-03 are deactivated when function is active!	1	Std_u8	edit	0	2	1	0	SO
192	**Switching back to pilot** minimum time	1	Time	edit	5 s	120 s	0,2 s	30 s	SO
193	**Switching back to pilot** maximum time	1	Time	edit	30 s	108 min.	0,2 s	60 min.	SO
195	Repetition limit heavy oil direct start 1 = no repetition 2...15 = 1...14 number of repetitions 16 = constant repetition	1	Std_u8	edit	1	16	1	3	SO

Par. no.	Parameter	Number of elements	Type	Edit	Value range Min	Max	Resolution	Default setting	Password level
200	**Basic unit**								
201	Burner operating mode (fuel train, modulating / multistage, actuators, etc.) -- = undefined (delete curves) 1 = G mod 2 = Gp1 mod 3 = Gp2 mod 4 = Lo mod 5 = Lo 2-stage 6 = Lo 3-stage 7 = G mod pneu 8 = Gp1 mod pneu 9 = Gp2 mod pneu 10 = LoGp mod 11 = LoGp 2-stage 12 = Lo mod 2 fuel valves 13 = LoGp mod 2 fuel valves 14 = G mod pneu without actuator 15 = Gp1 mod pneu without actuator 16 = Gp2 mod pneu without actuator 17 = Lo 2-stage without actuator 18 = Lo 3-stage without actuator 19 = G mod only gas actuator 20 = Gp1 mod only gas actuator 21 = Gp2 mod only gas actuator 22 = Lo mod only oil actuator 23 = Ho mod. sep. circulation 24 = Ho 2-stage sep. circulation 25 = Ho mod. without circulation 26 = Ho 2-stage without circulation 27 = Ho 3-stage without circulation	1	Selection	edit / clear	1	27	1	undefined	SO
204	Analog output invalid (4...20 mA) 0 = default load low-fire 1 = safety shutdown + start prevention	1	Std_u8	edit	0	1	1	1	SO
208	Program stop 0 = inactive 1 = PrePurgP (Ph24) 2 = IgnitPos (Ph36) 3 = interval 1 (Ph44) 4 = interval 2 (Ph52)	1	Selection	edit	0	4	1	0	SO (BA)
210	Alarm in the event of start prevention 0 = deactivated 1 = activated	1	Selection	edit	0	1	1	LMV37.400...: 0 LMV37.420...: 1	SO

Par. no.	Parameter	Number of elements	Type	Edit	Value range Min	Max	Resolution	Default setting	Password level
211	Fan ramp up time	1	Time	edit	2 s	60 s	0.2 s	2 s	SO
212	Max. time down to low-fire	1	Time	edit	0.2 s	10 min	0.2 s	45 s	SO
215	Repetition limit safety loop 1 = no repetition 2...15 = 1...14 number of repetitions 16 = constant repetition	1	Std_u8	edit	1	16	1	LMV37.400...: 16 LMV37.420...: 1	SO
261	Oil: Active detector flame of evaluation 0 = QRB / QRC 1 = ION / QRA	1	Selection	edit	0	1	1	LMV37.400...: 0 LMV37.420...: 1	SO
262	Oil: Prepurging 0 = deactivated 1 = activated	1	Selection	edit	0	1	1	1	SO
265	Oil: Prepurge time	1	Time	edit	LMV37.400Ax: 15 s LMV37.420Ax: 5 s	60 min	0.2 s	LMV37.400...: 15 s LMV37.420...: 30 s	SO
266	Oil: Preignition time	1	Time	edit	0,6 s	60 min	0.2 s	2 s	SO
267	Oil: First safety time	1	Time	edit	1 s	15 s	0.2 s	5 s	SO
269	Oil: Time to respond to pressure faults within first and second safety time	1	Time	edit	0.4 s	14.6 s	0.2 s	1.8 s	SO
270	Oil: Interval 1	1	Time	edit	0,4 s	60 min	0,2 s	2 s	SO
271	Oil: Second safety time	1	Time	edit	1 s	15 s	0.2 s	LMV37.400...: 5 s LMV37.420...: 10 s	SO
272	Oil: Interval 2	1	Time	edit	0.4 s	60 s	0.2 s	2 s	SO
273	Oil: Afterburn time	1	Time	edit	0.2 s	60 s	0.2 s	8 s	SO
274	Oil: Postpurge time (no extraneous light test)	1	Time	edit	0.2 s	108 min	0.2 s	LMV37.400...: 0,2 s LMV37.420...: 15 s	SO
276	Oil: Input pressure switch-min 1 = active from phase 38 2 = active from safety time	1	Selection	edit	1	2	1	1	SO
277	Oil: Input pressure switch-max/POC 1 = pressure switch-max 2 = POC 3 = not used 4 = additional speed-dependent air pressure switch	1	Selection	edit	1	4	1	1	SO
279	Oil: Forced intermittent operation 0 = inactive 1 = activated	1	Selection	edit	0	1	1	1	SO

Par. no.	Parameter	Number of elements	Type	Edit	Value range Min	Value range Max	Resolution	Default setting		Password level
280	Repetition limit value loss of flame 1 = no repetition 2 = 1 repetition Recharging time: After the Operation phase	1	Std_u8	edit	1	2	1	LMV37.400...: 2 LMV37.420...: 1		SO
281	Oil: Point in time oil is ignited 0 = short preignition (phase 38) 1 = long preignition (with fan) (phase 22)	1	Selection	edit	0	1	1	LMV37.400...: 1 LMV37.420...: 0		SO
284	Oil: Postpurge time (abortion if load controller ON)	1	Time	edit	1 s	108 min	0.2 s	1 s		SO
286	Oil: Evaluation of heavy oil direct start 0 = only start signal in phase 38 1 = evaluation in phase 38...62	1	Selection	edit	0	1	1	1		SO
287	Oil: Maximum time heavy oil start signal	1	Time	edit	1 s	45 s	0.2 s	45 s		SO
400	**Ratio curves**									
401	Ratio control curve fuel actuator (only curve settings)	13	Std_s16	edit	0°	90°	0.1°	0°; 0°; 15°; undefined		SO
402	Ratio control curve air actuator (only curve settings)	13	Std_s16	edit	0°	90°	0.1°	0°; 90°; 45°; undefined		SO
403	Ratio control curve VSD (only curve settings)	13	Std_s16	edit	15 %	100%	0.1%	0%; 100%; 50%; undefined		SO
500	**Ratio control**									
501	No-flame positions fuel actuator Index 0 = home position Index 1 = prepurge position Index 2 = postpurge position	3	Std_s16	edit	0°	90°	0.1°	Index 0 1 2	Value 0° 0° 15°	SO
502	No-flame positions air actuator Index 0 = home position Index 1 = prepurge position Index 2 = postpurge position	3	Std_s16	edit	0°	90°	0.1°	Index 0 1 2	Value 0° 90° 45°	SO
503	No-flame speeds VSD Index 0 = no-load speed Index 1 = prepurge speed Index 2 = postpurge speed	3	Std_s16	edit	0%	100%	0.1%	Index 0 1 2	Value 0% 100% 50%	SO
522	Ramp up	1	Std_u8	edit	5 s	40 s	1 s	10 s		SO
523	Ramp down	1	Std_u8	edit	5 s	40 s	1 s	10 s		SO
542	Activation of VSD / PWM fan 0 = inactive 1 = active	1	Selection	edit	0	1	1	0		SO
544	Ramp modulating	1	Std_u8	edit	32 s	80 s	1 s	32 s		SO

Par. no.	Parameter	Number of elements	Type	Edit	Value range Min	Max	Resolution	Default setting		Password level
545	Lower output limit undefined = 20 %	1	Output	edit / clear	20%	100%	0.1%	undefined		SO (BA)
546	Upper output limit undefined = 100 %	1	Output	edit / clear	20%	100%	0.1%	undefined		SO (BA)
600	**Actuators**									
601	Selection of reference point Index 0 = fuel Index 1 = air 0 = close (<0°) 1 = open (>90°)	2	Selection	edit	0	1	1	Index 0 1	Value 0 1	SO
602	Actuator's direction of rotation Index 0 = fuel Index 1 = air 0 = counterclockwise 1 = clockwise (exclusively for SQM3...)	2	Selection	edit	0	1	1	Index 0 1	Value 0 1	SO
606	Tolerance limit of position monitoring [0.1°] Index 0 = fuel Index 1 = air Greatest position error where a fault is securely detected ⟶ error detection band: (parameter 606-0.6°) to parameter 606	2	Std_u8	edit	0.5°	4°	0.1°	Index 0 1	Value 1.7° 1.7°	SO
611	Type of referencing Index 0 = fuel Index 1 = air 0 = standard 1 = stop within usable range 2 = internal stop (SQN1...) 3 = both	2	Std_u8	edit	0	3	1	Index 0 1	Value 0 0	SO
613	Type of actuator Index 0 = fuel Index 1 = air 0 = 5 s / 90° (1 Nm, 1,2 Nm, 3 Nm) 1 = 10 s / 90° (6 Nm) 2 = 17 s / 90° (10 Nm)	2	Std_u8	edit	0	2	1	0; 0		SO
641	Control of speed standardization of VSD Error diagnostics of negative values (refer to error code 82) 0 = no speed standardization 1 = speed standardization active	1	Std_s8	edit	-25	1	1	0		SO
642	Standardized speed Index 0 = speed 1 Index 1 = speed 2 (internal supervision)	2	Std_u16	read only	650	6500	0.1	undefined		SO

Par. no.	Parameter	Number of elements	Type	Edit	Value range Min	Max	Resolution	Default setting	Password level
645	Configuration of analog output 0 = DC 0...10 V 1 = DC 2...10 V 2 = DC 0/2...10 V	1	Std_u8	edit	0	2	1	0	SO
652	VSD behavior when safety loop / burner flange is open 0 = no VSD control when safety loop / burner flange is open 1 = VSD control independent of safety loop / burner flange	1	Std_u8	edit	0	1	1	1	HF
653	VSD standstill supervision in standby mode 0 = deactivate 1 = active	1	Std_u8	edit	0	1	1	1	HF
700	**Error history**								
701	Error history: 701-725.01.Code	25	Std_u8	read only	0	255	1	0	Info / Service
•	Error history: 701-725.02.Diagnostic code	25	Std_u8	read only	0	255	1	0	Info / Service
•	Error history: 701-725.03.Error class	25	Std_u8	read only	0	6	1	0	Info / Service
•	Error history: 701-725.04.Phase	25	Std_u8	read only	0	255	1	0	Info / Service
•	Error history: 701-725.05.Startup counter	25	Std_s32	read only	0	99999999	1	0	Info / Service
725	Error history: 701-725.06.Output	25	Output	read only	0%	100 %	0.1%	0%	Info / Service
900	**Process data**								
903	Current output Index 0 = fuel Index 1 = air	2	Output	read only	0%	100%	0.1%	0%	Info / Service
922	Incremental position of actuators Index 0 = fuel Index 1 = air	2	Std_s16	read only	-50°	150°	0.01°	0°	Info / Service
935	Absolute speed	1	Std_u16	read only	0	6553.5	0.1	0	SO
936	Standardized speed	1	Std_s16	read only	-200%	200%	0.1%	0%	Info / Service
942	Active load source 1 = output during curve settings 2 = manual output 3 = default output via building automation 4 = default output via analog input 5 = external load controller via contacts	1	Selection	read only	0	255	1	0	SO

Par. no.	Parameter	Number of elements	Type	Edit	Value range Min	Max	Resolution	Default setting	Password level
947	Result of contact sensing (bit-coded) Bit 0.0 = 1: Pressure switch-min Bit 0.1 = 2: Pressure switch-max Bit 0.2 = 4: Pressure switch valve proving Bit 0.3 = 8: Pressure switch air pressure switch Bit 0.4 = 16: Load controller OPEN Bit 0.5 = 32: Load controller ON Bit 0.6 = 64: Load controller CLOSE Bit 0.7 = 128: Safety loop Bit 1.0 = 1: Safety valve Bit 1.1 = 2: Ignition Bit 1.2 = 4: Fuel valve 1 Bit 1.3 = 8: Fuel valve 2 Bit 1.4 = 16: Fuel valve 3 / pilot valve Bit 1.5 = 32: Reset	2	Std_u8	read only	0	255	1	0	Info / Service
948	Contact feedback network counter register	14	Std_u8	read only	0	255	1	0	SO
950	Required relay state (bit-coded) Bit 0 = 1: Alarm Bit 1 = 2: Safety valve Bit 2 = 4: Ignition Bit 3 = 8: Fuel valve 1 Bit 4 = 16: Fuel valve 2 Bit 5 = 32: Fuel valve 3 / pilot valve	1	Std_u8	read only	0	255	1	0	Info / Service
951	Mains voltage (normalized) AC 230 V: Voltage = value x 1.683 AC 120 V: Voltage = value x 0.843	1	Std_u8	read only	0 V	255 V	1 V	0 V	SO
954	Intensity of flame	1	Std_u8	read only	0%	100%	1%	0%	Info / Service
960	Actual flow rate (m^3/h, l/h, ft^3/h, gal/h)	1	Std_u16	read only	0	6553.5	0.1	0	Info / Service
961	Phase (state for external modules and display)	1	Std_u8	read only	0	255	1	0	Info / Service
981	Error memory: Code	1	Std_u8	read only	0	255	1	0	Info / Service
982	Error memory: Diagnostic code	1	Std_u8	read only	0	255	1	0	Info / Service
992	Error flags	10	Hex_32	reset	0	0xFFFFFFFF	1	0	SO

Std_**u8** 8 bit integer, **not** signed

Std_**u16** 16 bit integer, **not** signed

Std_**u32** 32 bit integer, **not** signed

Std_**s8** 8 bit integer, signed

Std_**s16** 16 Bit integer, signed

Std_**s32** 32 Bit integer, signed

! Note
This data type is also used to mark an invalid or non-signed value by using the value of -1!

12. Error code list

Error code	Diagnostic code	Meaning for the LMV37.4... system	Remedy
no Comm		**No communication between LMV37.4... basic unit and AZL2...**	Check wiring for line interruption/loose contact
2	**#**	**No flame at the end of the safety time (TSA)**	
	1	No flame at the end of safety time 1 (TSA1)	
	2	No flame at the end of safety time 2 (TSA2)	
	4	No flame at the end of safety time 1 (TSA1) (software version ≤ V02.00)	
3	**#**	**Air pressure failure**	
	0	Air pressure off	
	1	Air pressure on	
	2	Evaluation of air pressure	Correct the setting of parameter 235 or 335 (Deactivation of the air pressure check in operation only allowed in pneumatic operation!)
	4	Air pressure on – start prevention	
	20	Air pressure, combustion pressure – start prevention	
	68	Air pressure, POC – start prevention	
	84	Air pressure, combustion pressure, POC – start prevention	
4	**#**	**Extraneous light**	
	0	Extraneous light during startup	
	1	Extraneous light during shutdown	
	2	Extraneous light during startup – start prevention	
	6	Extraneous light during startup, air pressure – start prevention	
	18	Extraneous light during startup, combustion pressure – start prevention	
	24	Extraneous light during startup, air pressure, combustion pressure – start prevention	
	66	Extraneous light during startup, POC – start prevention	
	70	Extraneous light during startup, air pressure, POC – start prevention	
	82	Extraneous light during startup, combustion pressure, POC – start prevention	
	86	Extraneous light during startup, air pressure, combustion pressure, POC – start prevention	

Error code	Diagnostic code	Meaning for the LMV37.4... system	Remedy
7	**#**	**Loss of flame**	
	0	Loss of flame	
	3	Loss of flame (software version ≤ V02.00)	
	3...255	Loss of flame due to TÜV test (loss-of-flame test)	
12	**#**	**Valve proving**	
	0	Fuel valve 1 (V1) leaking (fuel valve 2 with valve proving via X5-01)	For valve proving via X5-01 (gas pressure switch-min) - Check to see if the valve on the burner side is leaking - Check to see if the pressure switch for the valve proving is closed when gas pressure is present - Check wiring to see if there is a short-circuit
	1	Fuel valve 2 (V2) leaking (fuel valve 1 with valve proving via X5-01)	For valve proving via X5-01 (gas pressure switch-min) - Check to see if the valve on the gas side is leaking - Check wiring to see if there is a short-circuit
	2	Valve proving not possible	Valve proving activated, but pressure switch-min selected as input function for X9-04 (check parameters 238 and 241)
	3	Valve proving not possible	Valve proving activated, but no input assigned (check parameters 236 and 237)
	4	Valve proving not possible	Valve proving activated, but 2 inputs assigned (set parameter 237 to pressure switch-max or POC)
	5	Valve proving not possible	Valve proving activated, but 2 inputs assigned (check parameters 236 and 237)
	81	V1 leaking	Check to see if the valve on the gas side is leaking Check wiring to see if there is an open-circuit
	83	V2 leaking	Check to see if the valve on the burner side is leaking Check to see if the pressure switch for the leakage test is closed when gas pressure is present Check wiring for short-circuit
14	**#**	**POC**	
	0	POC open	Check to see if the valve's closing contact is closed
	1	POC close	Check wiring Check to see if the valve's closing contact opens when valve is controlled
	64	POC open – prevention of startup	Check wiring to see if there is a line interruption. Check to see if the valve's closing contact is closed
19	**80**	**Combustion pressure, POC – start prevention**	**Check to see if pressure switch has closed with no combustion pressure present** **Check wiring for short-circuit**

Error code	Diagnostic code	Meaning for the LMV37.4... system	Remedy
20	**#**	**Pressure switch-min (Pmin)**	
	0	No minimum gas /oil pressure	Check wiring for line interruption
	1	Gas shortage – start prevention	Check wiring for line interruption
21	**#**	**Pressure switch-max (Pmax) / POC**	
	0	**Pressure switch-max (Pmax):** Max. gas / oil pressure exceeded **POC:** POC open (software version ≤ V02.00)	Check wiring to see if there is a line interruption. POC: Check to see if the valve's closing contact is closed.
	1	POC close (software version ≤ V02.00)	Check wiring. Check to see if the valve's closing contact opens when the valve is controlled
	64	POC open – start prevention (software version ≤ V02.00)	Check wiring. Check whether valve's make contact opens when valve is controlled
22 OFF S	**#**	**Safety loop / burner flange**	
	0	Safety loop / burner flange open	
	1	Safety loop / burner flange open – start prevention	
	3	Safety loop/burner flange, extraneous light – start prevention	
	5	Safety loop/burner flange, air pressure – start prevention	
	17	Safety loop/burner flange, combustion pressure – start prevention	
	19	Safety loop/burner flange, extraneous light, combustion pressure – start prevention	
	21	Safety loop/burner flange, air pressure, combustion pressure – start prevention	
	23	Safety loop/burner flange, extraneous light, air pressure, combustion pressure – start prevention	
	65	Safety loop/burner flange, POC – start prevention	
	67	Safety loop/burner flange, extraneous light, POC – start prevention	
	69	Safety loop/burner flange, air pressure, POC – start prevention	
	71	Safety loop/burner flange, extraneous light, air pressure, POC – start prevention	
	81	Safety loop/burner flange, combustion pressure, POC – start prevention	
	83	Safety loop/burner flange, extraneous light, combustion pressure, POC – start prevention	

Error code	Diagnostic code	Meaning for the LMV37.4... system	Remedy
	85	Safety loop/burner flange, air pressure, combustion pressure, POC – start prevention	
	87	Safety loop/burner flange, extraneous light, air pressure, combustion pressure, POC – start prevention	
23	**#**	**Gas pressure switch-min (Pmin) / heavy oil direct start**	
	0	No minimum gas pressure	Check wiring to see if there is an open-circuit (X5-01)
	1	Gas shortage – start prevention	Check wiring to see if there is an open-circuit (X5-01)
	2	Heavy oil direct start	Check wiring to see if there is an open-circuit (X9-04) Check that the oil is preheated correctly
51	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit
55	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit
56	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit
57	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit
58	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit
60	**0**	**Internal error: No valid output source**	Make a reset; if error occurs repeatedly, replace the unit
65	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit
66	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit
67	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit
70	**#**	**Error air-fuel ratio control: Position calculation modulating**	
	23	Output invalid	No valid output
	26	Curvepoints undefined	Adjust the curvepoints for all actuators
71	**#**	**Special position undefined**	
	0	Home position	Parameterize the home position for all actuators used
	1	Prepurge position	Parameterize the prepurge position for all actuators used
	2	Postpurge position	Parameterize the postpurge position for all actuators used
	3	Ignition position	Parameterize the ignition position for all actuators used
72	**#**	**Internal error air-fuel ratio control**	Make a reset; if error occurs repeatedly, replace the unit
73	**#**	**Internal error air-fuel control: Position calculation multistep**	
	23	Output invalid	No valid output

Error code	Diagnostic code	Meaning for the LMV37.4... system	Remedy
	26	Curvepoints undefined	Adjust the curvepoints for all actuators
75	**#**	**Internal error air-fuel ratio control: Data clocking check**	
	1	Current output different	
	2	Target output different	
	4	Target positions different	
	16	Different positions reached	Can be caused by different standardized speeds (e.g. after restore of data set) when the VSD is activated ⟶ standardize again and check adjustment of the air-fuel ratio control system
76	**#**	**Internal error air-fuel ratio control**	Make a reset; if error occurs repeatedly, replace the unit
80	**#**	**Control range limitation of VSD**	Basic unit could not correct the difference in speed and reached a control range limit. 1. Basic unit is not standardized for this motor ⟶ repeat standardization. ! **Caution!** **Settings of air-fuel ratio control must be checked!** 2. Ramp time settings of the VSD are not shorter than those of the basic unit (parameters 522, 523) or the setting for the modulating operating ramp is incorrect (parameter 544) 3. Characteristic of the VSD is not linear. Configuration of the voltage input at the VSD must accord with that of the basic unit (parameter 645). 4. VSD does not follow quickly enough the changes of the basic unit. Check settings of the VSD (input filter, slippage compensation, hiding different speeds
	1	Control range limitation at the bottom	VSD speed was too high
	2	Control range limitation at the top	VSD speed was too low
81	**1**	**Interrupt limitation speed input**	Too much electromagnetic interference on the sensor line ⟶ improve EMC
82	**#**	**Error during VSD's speed standardization**	
	1	Timeout of standardization (VSD ramp down time too long)	Timeout at the end of standardization during ramp down of the VSD ⟶ ramp time settings of the VSD are not shorter than those of the basic unit (parameter: 523)
	2	Storage of standardized speed not successful	Error during storage of the standardized speed ⟶ lock the basic unit, then reset it and repeat the standardization

Error code	Diagnostic code	Meaning for the LMV37.4... system	Remedy
	3	Line interruption speed sensor	Basic unit receives no pulses from the speed sensor: 1. Motor does not turn. 2. Speed sensor is not connected. 3. Speed sensor is not activated by the sensor disk (check distance)
	4	Speed variation / VSD ramp up time too long / speed below minimum limit for standardization	Motor has not reached a stable speed after ramp up. 1. Ramp time settings of the VSD are not shorter than those of the basic unit (parameters 522, 523). 2. Characteristic of the VSD is not linear. Configuration of the voltage input at the VSD must accord with that of the basic unit (parameter 645). 3. VSD does not follow quickly enough the changes of the basic unit. Check settings of the VSD (input filter, slippage compensation, hiding different speeds) 4. Speed of VSD lies below the minimum for standardization (650 1/min)
	5	Wrong direction of rotation	Motor's direction of rotation is wrong. 1. Motor turns indeed in the wrong direction ⟶ change parameterization of the direction of rotation or interchange 2 live conductors. 2. Sensor disk is fitted the wrong way ⟶ turn the sensor disk.
	6	Unplausible speed sensor signals	The required pulse pattern (60°, 120°, 180°) has not been correctly identified. 1. Speed sensor does not detect all tappets of the sensor disk ⟶ check distance 2. As the motor turns, other metal parts are detected also, in addition to the tappets ⟶ improve mounting. 3. Electromagnetic interference on the sensor lines ⟶ check cable routing, improve EMC
	7	Invalid standardized speed	The standardized speed measured does not lie in the permissible range ⟶ motor turns too slowly or too fast
	15	Speed deviation µC1 + µC2	The speeds of microcomputer 1 and 2 deviated too much. This can be caused by wrong standardized speeds (e.g. after restoring a data set to a new unit) ⟶ repeat standardization and check the air-fuel ratio
	20	Wrong phase of phase manager	Standardization was made in a wrong phase. Permitted are only phases ≤12 ⟶ controller OFF, start standardization again
	21	Safety loop / burner flange open	Safety loop or burner flange is open ⟶ repeat standardization with safety loop closed

Error code	Diagnostic code	Meaning for the LMV37.4... system	Remedy
	22	Air actuator not referenced	Air actuator has not been referenced or has lost its referencing. 1. Check if the reference position can be approached. 2. Check if actuators have been mixed up. 3. If error only occurs after the start of standardization, the actuator might be overloaded and cannot reach its destination.
	23	VSD deactivated	Standardization was started with VSD deactivated ⟶ activate the VSD and repeat standardization
	24	No valid operating mode	Standardization was started without valid operating mode ⟶ activate valid operating mode and repeat standardization
	25	Pneumatic air-fuel ratio control	Standardization was started with pneumatic air-fuel ratio control ⟶ standardization with pneumatic air-fuel ratio control not possible
	128	Running command with no preceding standardization	VSD is controlled but not standardized ⟶ make standardization
	255	No standardized speed available	Motor turns but is not standardized ⟶ make standardization
83	**#**	**Speed error VSD**	Required speed has not been reached
	Bit 0 Valency 1	Lower control range limitation	Speed has not been reached because control range limitation has become active ⟶ for measures, refer to error code 80
	Bit 1 Valency 2...3	Upper control range limitation	Speed has not been reached because control range limitation has become active ⟶ for measures, refer to error code 80
	Bit 2 Valency 4...7	Interrupt shutdown due to electromagnetic interference	Speed has not been reached due to too much electromagnetic interference on the sensor line ⟶ for measures, refer to error code 81

Error code	Diagnostic code	Meaning for the LMV37.4... system	Remedy
	Bit 3 Valency ≥ 8	Curve too steep in terms of ramp speed	Check speed differential between the curvepoints and the modulating operating ramp setting (parameter 544). 1. Modulating operating ramp 32 seconds Curve slope max. 10% for LMV37.4 ramp of 20 seconds (20% for 10 seconds or 40% for 5 seconds) 2. Modulating operating ramp 48 seconds Curve slope max. 10% for LMV37.4 ramp of 30 seconds (20% for 15 seconds or 30% for 10 seconds) 3. Modulating operating ramp 64 seconds Curve slope max. 10% for LMV37.4 ramp of 40 seconds (20% for 20 seconds or 40% for 10 seconds) ⟶ Between the ignition point (P0) and the low-fire point (P1), the speed change in modulating mode may be a maximum of 40%, independent of the LMV3... ramp. 2. The setting of the VSD ramp must be about 20% faster than the ramps in the basic unit (parameters 522, 523).
	Bit 4 Valency ≥ 16	Interruption of speed signal	No speed detected in spite of control. 1. Check if the motor turns. 2. Check if the speed sensor delivers a signal (LED / check distance from the sensor disk). 3. Check wiring of the VSD.
	Bit 5 Valency ≥ 32	Quick shutdown due to excessive speed deviation	Speed deviation was for about 1 s >10% outside the anticipated range. 1. Check ramp times of the LMV37.4... and VSD. 2. Check wiring of the VSD.
84	**Curve slope actuators**		
	Bit 0 Valency 1	VSD: Curve too steep in terms of ramp speed	Check speed differential between the curvepoints and the modulating operating ramp setting (parameter 544). 1. Modulating operating ramp 32 seconds Curve slope max. 10% for LMV37.4 ramp of 20 seconds (20% for 10 seconds or 40% for 5 seconds) 2. Modulating operating ramp 48 seconds Curve slope max. 10% for LMV37.4 ramp of 30 seconds (20% for 15 seconds or 30% for 10 seconds) 3. Modulating operating ramp 64 seconds Curve slope max. 10% for LMV37.4 ramp of 40 seconds (20% for 20 seconds or 40% for 10 seconds) ⟶ Between the ignition point (P0) and the low-fire point (P1), the speed change in modulating mode may be a maximum of 40%, independent of the LMV3... ramp. 2. Setting of the VSD ramp must be about 20% shorter than the ramps in the basic unit (parameters 522 and 523)

Error code	Diagnostic code	Meaning for the LMV37.4... system	Remedy
	Bit 1 Valency 2..3	Fuel actuator: Curve too steep in terms of ramp rate	Check position differential between the curvepoints and the modulating operating ramp setting (parameter 544). 1. Modulating operating ramp 32 seconds The slope of the curve may be a maximum position change of 31° (15° for SQM33.6 and 9° for SQM33.7) between 2 curve points in modulating mode. 2. Modulating operating ramp 64 seconds The slope of the curve may be a maximum position change of 62° (30° for SQM33.6 and 18° for SQM33.7) between 2 curve points in modulating mode.
	Bit 2 Valency 4..7	Air actuator: Curve too steep in terms of ramp rate	Check position differential between the curvepoints and the modulating operating ramp setting (parameter 544). 1. Modulating operating ramp 32 seconds The slope of the curve may be a maximum position change of 31° (15° for SQM33.6 and 9° for SQM33.7) between 2 curve points in modulating mode. 2. Modulating operating ramp 64 seconds The slope of the curve may be a maximum position change of 62° (30° for SQM33.6 and 18° for SQM33.7) between 2 curve points in modulating mode.
85	**#**	**Referencing error ones actuators**	
	0	Referencing error of fuel actuator	Referencing of fuel actuator not successful. Reference point could not be reached. 1. Check the setting of the actuator type (parameter 613.0 or 614) 2. Check to see if actuators have been mixed up 3. Check to see if actuator is locked or overloaded
	1	Referencing error of air actuator	Referencing of fuel actuator not successful Reference point could not be reached. 1. Check the setting of the actuator type (parameter 613.1) 2. Check to see if actuators have been mixed up 3. Check to see if actuator is locked or overloaded
	Bit 7 Valency ≥ 128	Referencing error due to parameter change	Parameterization of an actuator (e.g. the reference position) has been changed. To trigger new referencing, this error is set
86	**#**	**Error fuel actuator**	
	0	Position error	Target position could not be reached within the required tolerance band ⟶ check to see if actuator is locked or overloaded
	Bit 0 Valency 1	Line interruption	Line interruption detected at actuator's terminals ⟶ check wiring (voltage X54 across pin 5 or 6 and pin 2 >0.5 V)

Error code	Diagnostic code	Meaning for the LMV37.4... system	Remedy
	Bit 3 Valency ≥ 8	Curve too steep in terms of ramp rate	Check position differential between the curvepoints and the modulating operating ramp setting (parameter 544). 1. Modulating operating ramp 32 seconds The slope of the curve may be a maximum position change of 31° (15° for SQM33.6 and 9° for SQM33.7) between 2 curve points in modulating mode. 2. Modulating operating ramp 64 seconds The slope of the curve may be a maximum position change of 62° (30° for SQM33.6 and 18° for SQM33.7) between 2 curve points in modulating mode.
	Bit 4 Valency ≥ 16	Step deviation in comparison with last referencing	Actuator was overloaded or mechanically twisted. 1. Check the setting of the actuator type (parameter 613.0 or 614) 2. Check to see if the actuator is blocked somewhere along its working range. 3. Check to see if the torque is sufficient for the application.
87	**#**	**Error air actuator**	
	0	Position error	Target position could not be reached within the required tolerance band ⟶ check to see if actuator is locked or overloaded
	Bit 0 Valency 1	Line interruption	Line interruption detected at actuator's terminals ⟶ check wiring (voltage X53 across pin 5 or 6 and pin 2 >0.5 V)
	Bit 3 Valency ≥ 8	Curve too steep in terms of ramp rate	Check position differential between the curvepoints and the modulating operating ramp setting (parameter 544). 1. Modulating operating ramp 32 seconds The slope of the curve may be a maximum position change of 31° (15° for SQM33.6 and 9° for SQM33.7) between 2 curve points in modulating mode. 2. Modulating operating ramp 64 seconds The slope of the curve may be a maximum position change of 62° (30° for SQM33.6 and 18° for SQM33.7) between 2 curve points in modulating mode.
	Bit 4 Valency ≥ 16	Sectional deviation in comparison with last referencing	Actuator was overloaded or mechanically twisted. 1. Check the setting of the actuator type (parameter 613.1) 2. Check to see if the actuator is blocked somewhere along its working range. 3. Check to see if the torque is sufficient for the application
90	**#**	**Internal error basic unit**	
91	**#**	**Internal error basic unit**	
93	**#**	**Error flame signal acquisition**	
	3	Short-circuit of sensor	Short-circuit at QRB... 1. Check wiring. 2. Flame detector possibly fault

Error code	Diagnostic code	Meaning for the LMV37.4... system	Remedy
95	**#**	**Error relay supervision**	
	3 Ignition transformer 4 Fuel valve 1 5 Fuel valve 2 6 Fuel valve 3	External power supply active contact	Check wiring
96	**#**	**Error relay supervision**	
	3 Ignition transformer 4 Fuel valve 1 5 Fuel valve 2 6 Fuel valve 3	Relay contacts have welded	Test the contacts: 1. Unit connected to power: Fan output must be dead. 2. Disconnect power: Disconnect fan. No resistive connection between fan output and neutral conductor allowed. If one of the 2 tests fails, release the unit since contact have definitively welded and safety can no longer be ensured.
97	**#**	**Error relay supervision**	
	0	Safety relay contacts have welded or external power supply fed to safety relay	Test the contacts: 1. Unit connected to power: Fan output must be dead. 2. Disconnect power: Disconnect fan. No resistive connection between fan output and neutral conductor allowed. If one of the 2 tests fails, release the unit since contacts have definitively welded and safety can no longer be ensured.
98	**#**	**Error relay supervision**	
	2 Safety valve 3 Ignition transformer 4 Fuel valve 1 5 Fuel valve 2 6 Fuel valve 3	Relay does not pull in	Make a reset; if error occurs repeatedly, replace the unit
99	**#**	**Internal error relay control**	Make a reset; if error occurs repeatedly, replace the unit
	3	Internal error relay control	Make a reset. If error occurs repeatedly, replace the unit Software version V03.10: If error C:99 D:3 occurs during standardization of the VSD, deactivate temporarily function Alarm in case of start prevention (parameter 210 = 0, when using a release contact) or interrupt the controller-ON signal

Error code	Diagnostic code	Meaning for the LMV37.4... system	Remedy
100	**#**	**Internal error relay control**	Make a reset; if error occurs repeatedly, replace the unit
105	**#**	**Internal error contact sampling**	
	0 Pressure switch min 1 Pressure switch max / POC 2 Pressure switch valve proving 3 Air pressure 4 Load controller open 5 Load controller on / off 6 Load controller close 7 Safety loop / Burner flange 8 Safety valve 9 Ignition transformer 10 Fuel valve 1 11 Fuel valve 2 12 Fuel valve 3 13 Reset	Stuck-At failure	Can be caused by capacitive loads or supply of DC voltage to the mains voltage inputs. The diagnostic code indicates the input where the problem occurred
106	**#**	**Internal error contact request**	Make a reset; if error occurs repeatedly, replace the unit
107	**#**	**Internal error contact request**	Make a reset; if error occurs repeatedly, replace the unit
108	**#**	**Internal error contact request**	Make a reset; if error occurs repeatedly, replace the unit
110	**#**	**Internal error voltage monitor test**	Make a reset; if error occurs repeatedly, replace the unit
111	**#**	**Mains undervoltage**	Mains voltage to low Conversion factor diagnostic code ⟶ voltage value (AC 230 V: 1,683; AC 120 V: 0,843)

Error code	Diagnostic code	Meaning for the LMV37.4... system	Remedy
112	0	Mains voltage recovery	Error code for triggering a reset on power restoration (no error)
113	**#**	**Internal error mains voltage supervision**	Make a reset; if error occurs repeatedly, replace the unit
115	**#**	**Internal error system counter**	
116	**0**	Designed lifecycle exceeded (250,000 startups)	Warning threshold has been reached. The unit should be replaced
117	**0**	Life time exceeded Operation no longer allowed	Switch-off threshold has been reached
120	**0**	Interrupt limitation fuel counter input	Too many disturbance pulses at the fuel meters input ⟶ Improve EMC
121	**#**	**Internal error EEPROM access**	Make a reset, repeat last parameterization / check. Restore the parameter set, if error occurs repeatedly, replace the unit
122	**#**	**Internal error EEPROM access**	Make a reset, repeat last parameterization / check. Restore the parameter set, if error occurs repeatedly, replace the unit
123	**#**	**Internal error EEPROM access**	Make a reset, repeat last parameterization / check. Restore the parameter set, if error occurs repeatedly, replace the unit
124	**#**	**Internal error EEPROM access**	Make a reset, repeat last parameterization / check. Restore the parameter set, if error occurs repeatedly, replace the unit
125	**#**	**Internal error EEPROM read access**	Make a reset, repeat last parameterization / check. If error occurs repeatedly, replace the unit
126	**#**	**Internal error EEPROM write access**	Make a reset, repeat last parameterization / check. If error occurs repeatedly, replace the unit
127	**#**	**Internal error EEPROM access**	Make a reset, repeat last parameterization / check. Restore the parameter set, if error occurs repeatedly, replace the unit
128	**0**	Internal error EEPROM access - synchronization during initialization	Make a reset; if error occurs repeatedly, replace the unit
129	**#**	Internal error EEPROM access – command synchronization	Make a reset, repeat last parameterization / check. If error occurs repeatedly, replace the unit
130	**#**	Internal error EEPROM access - timeout	Make a reset, repeat last parameterization / check. If error occurs repeatedly, replace the unit
131	**#**	Internal error EEPROM access - page on abort	Make a reset, repeat last parameterization / check. If error occurs repeatedly, replace the unit
132	**#**	Internal error EEPROM register initialization	Make a reset; if error occurs repeatedly, replace the unit
133	**#**	Internal error EEPROM access – Request synchronization	Make a reset, repeat last parameterization / check. If error occurs repeatedly, replace the unit
134	**#**	Internal error EEPROM access – Request synchronization	Make a reset, repeat last parameterization / check. If error occurs repeatedly, replace the unit
135	**#**	Internal error EEPROM access – Request synchronization	Make a reset, repeat last parameterization / check. If error occurs repeatedly, replace the unit
136	**#**	Restore	
	1	Restore started	Restore of a backup has been started (no error) New devices require resetting following restore!
		for further diagnostic codes for error code 136, refer to error code 137	For measures, refer to error code 137

Error code	Diagnostic code	Meaning for the LMV37.4... system	Remedy
137	**#**	**Internal error – backup / restore**	
	157 (-99)	Restore – ok, but backup < data set of current system	Restore successful, but backup data set is smaller than in the current system
	239 (-17)	Backup – storage of backup in AZL2... faulty	Make reset and repeat backup
	240 (-16)	Restore – no backup in AZL2...	No backup in AZL2...
	241 (-15)	Restore – interruption concerning unpassable ASN	The Backup has a unpassable ASN and may not restore of the unit
	242 (-14)	Backup – backup made is inconsistent	Backup is faulty and cannot be transferred back
	243 (-13)	Backup – data comparison between µCs faulty	Repeat reset and backup
	244 (-12)	Backup data are incompatible	Backup data are incompatible with the current software version, restore not possible
	245 (-11)	Access error to parameter Restore_Complete	Repeat reset and backup
	246 (-10)	Restore – timeout when storing in EEPROM	Repeat reset and backup
	247 (-9)	Data received are inconsistent	Backup data set invalid, restore not possible
	248 (-8)	Restore cannot at present be made	Repeat reset and backup
	249 (-7)	Restore – abortion due to unsuitable burner identification	Backup has an unsuitable burner identification and must not be transferred to the unit
	250 (-6)	Backup – CRC of one page is not correct	Backup data set invalid, restore not possible
	251 (-5)	Backup – burner identification is not defined	Define burner identification and repeat backup
	252 (-4)	After restore, pages still on ABORT	Repeat reset and backup
	253 (-3)	Restore cannot at present be made	Repeat reset and backup
	254 (-2)	Abortion due to transmission error	Repeat reset and backup
	255 (-1)	Abortion due to timeout during restore	Make a reset, check the connections and repeat the backup
146	**#**	**Timeout building automation interface**	Refer to User Documentation Modbus (A7541)
	1	Modbus timeout	
150	**#**	**TÜV test**	
	1 (-1)	Invalid phase	TÜV test may only be started in phase 60 (operation)
	2 (-2)	TÜV test default output too low	TÜV test default output must be lower than the lower output limit
	3 (-3)	TÜV test default output too high	TÜV test default output must be higher than the upper output limit
	4 (-4)	Manual abortion	No error: Manual abortion of TÜV test by the user
	5 (-5)	TÜV test timeout	No loss of flame after fuel valves have been shut 1. Check for extraneous light 2. Check wiring for short-circuit 3. Check to see if one of the valves is leaking
165	**#**	**Internal error**	
166	**0**	Internal error watchdog reset	

Error code	Diagnostic code	Meaning for the LMV37.4... system	Remedy
167	**#**	**Manual locking**	Unit has been manually locked (no error)
	1	Manual locking by contact	
	2	Manual locking by AZL2...	
	3	Manual locking by PC software	
	8	Manual locking by the AZL2... Timeout / communication breakdown	During a curve adjustment via the AZL2..., the timeout for menu operation has elapsed (setting via parameter 127), or communication between the LMV37.4... and the AZL2... has broken down
	9	Manual locking by the PC software Communication breakdown	During a curve adjustment via the ACS410, communication between the LMV37.4... and the ACS410 was interrupted for more than 30 seconds
	33	Manual locking after PC software reset attempt	PC software made a reset attempt although the system worked correctly
168	**#**	**Internal error management**	Make a reset; if error occurs repeatedly, replace the unit
169	**#**	**Internal error management**	Make a reset; if error occurs repeatedly, replace the unit
170	**#**	**Internal error management**	Make a reset; if error occurs repeatedly, replace the unit
171	**#**	**Internal error management**	Make a reset; if error occurs repeatedly, replace the unit
200 OFF	**#**	**System error-free**	No error
201 **OFF UPr**	**#**	**Start prevention**	Start prevention due to unparameterized unit Go to error history, entry 702, for initial cause of the error with shutdown in connection with the first curve settings
	Bit 0 Valency 1	No operating mode selected	
	Bit 1 Valency 2..3	No fuel train defined	
	Bit 2 Valency 4..7	No curves defined	
	Bit 3 Valency 8..15	Standardized speed undefined	
	Bit 4 Valency 16..31	Backup / restore was not possible	
202	**#**	**Internal error operating mode selection**	Redefine the operating mode (parameter 201)
203	**#**	**Internal error**	Redefine the operating mode (parameter 201). Make a reset; if error occurs repeatedly, replace the unit

Error code	Diagnostic code	Meaning for the LMV37.4... system	Remedy
204	**Phase number**	**Program stop**	Program stop is active (no error)
205	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit
206	0	Inadmissible combination of units (basic unit - AZL2...)	
207	**#**	**Version compatibility basic unit - AZL2...**	
	0	Basic unit version too old	
	1	AZL2... version too old	
208	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit
209	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit
210	0	Selected operating mode is not released for the basic unit	
240	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit
245	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit
250	**#**	**Internal error**	Make a reset; if error occurs repeatedly, replace the unit

13. Fault Location

13.1 Burner will not start

Symptom	Causes	Remedies
Motor starts Burner pre-ventilates Flame formed Burner trips	Unstable flame Excess air Low oil pressure Incorrect combustion apparatus settings	Adjust the damper Check the oil pressure Check the nozzle in relation to the combustion apparatus dimensions and the ignition electrode position
Motor starts Burner pre-ventilates No flame formed Burner trips	Flame monitor does not register light Defective flame monitor Defective oil burner control	Check the flame monitor is clean and can register light Check with using new photocell Check using new oil burner control (Note: replacement of photocell recommended if oil burner control replaced)
	No oil	Check the oil supply to the burner and that there are no air bubbles in the pump
	False light	Check function of solenoid
	No spark	Check flame monitor does not register ambient light Check high voltage wiring and ignition electrodes
Motor does not start	Preheater does not get up to temperature.	Check preheater function

13.2 Burner will not start after normal use

Symptom	Causes	Remedies
Burner does not start	Fuse blown	Check and replace fuse as necessary. Investigate cause of fault
	Boiler thermostat has not reset	Adjust thermostat
	Preheater does not get up to temperature	Check preheater function
Burner pre-ventilates	Overheating protection has deployed	Reset the overheating protection. Investigate the cause of its deploying. Remedy fault
	Defective preheater	Check by replacing with new
	Defective oil burner control or flame monitor	
Burner stops	No oil supply	Check that tank, oil lines, solenoid valves, pump and nozzle are in good condition
	Too great a pressure drop at brake plate	Adjust the burner
	Too strong draught prevents flame forming	Correct the boiler draught
	No spark	Check the ignition transformer. Check the ignition electrode settings and ceramics
	Preheater temperature too low	Check preheater function
	New oil type	Adjust the preheater‘s set operating temperature Check that the oil used has the physical parameters that the burner is rated for. If not, change the oil.

13.3 Delayed ignition

Symptom	Causes	Remedies
Burner pulsates at start with hot flue gases	Excessively strong draught	Correct boiler draught
	Excessive pressure drop across the brake plate	Adjust the burner
	Preheater temperature too low	Check preheater function
	New oil type	Adjust the preheater's set operating temperature
		Ensure that the new oil's physical parameters are within the limits for which the burner is designed. If not, change the oil.
Burner pulsates at start	Nozzle partially blocked	Replace nozzle
	Oil pressure too low	Check and adjust
	Flue is blocked or damaged	Check and correct
	The fan wheel is slipping on the shaft	Check and tighten
	Pump coupling loose or worn	Replace
	Preheater blocked	Check the ignition electrode setting, (see technical data)
	Delayed ignition	Check that the ignition electrodes are not damaged
	Excessively strong draught	Check high voltage cables
		Check position of nozzle assembly setting
		Correct boiler draught
	Excessive pressure drop across the brake plate	Adjust the burner
	Preheater temperature too low	Check preheater function
	New oil type	Adjust the preheater's set operating temperature
		Ensure that the new oil's physical parameters are within the limits for which the burner is designed. If not, change the oil.

13.4 Noise in pump

Symptom	Causes	Remedies
The burner pump emits noise during start		Check the oil system in order to reduce pressure drop
The burner pump emits noise during operation	Insufficient negative pressure on the suction side pump	Rebuild the oil system to form a solution with a transport oil pump
		Check that the oil used has the physical parameters that the burner is rated for. If not, change the oil.
		Temperature of the oil from the tank is too low, increase the temperature of oil from tank
		Clean the pump filter

13.5 Pump pressure

Symptom	Causes	Remedies
The burner pump can not build up pressure	No oil	Check that there is oil and that it reaches the pump
	Oil viscosity too low	Check that the oil reaching the pump has the physical parameters that the pump can handle. Change the oil or the pump's oil parameters
	Pump worn	Replace the pump
	Pump run using impure oil that has worn the pump out prematurely	Replace pump and install self-cleaning filter in the oil system
	Blocked pump filter	Check, clean pump filter

14. Log of flue gas analysis

Owner	Adresss	Tel. no:
Installation		Tel. no:

Boiler

Type	Make	Power kW

Bentone Burner

Type	Model	Serial no.	Fuel

	Step 1	Step 2	Step 3
Draught in fireplace			
Fan Press mbar			
Filter smoke number			
CO_2			
O_2			
NOx			
CO			
Flue gas temp. °C			
Setting brake disc			
Setting Air damper			
Pump pressure bar			
Nozzle			

Test performed / 20	Address
Test performed by:	Postal address
Company name:	Tel. no:

EU Declaration of conformity

Bentone Oil Burners

Type

BF 1	**B 45**	**B 80**
ST 146	**B 55**	
B 30	**B 65**	
B 40	**B 70**	

This declaration of conformity is issued under the sole responsibility of the manufacturer.
The object of the declaration described above is in conformity with:

Machinery Directive 2006/42/EC
EMC 2014/30/EU
Restriction of the use of certain hazardous substances (RoHS) Directive 2011/65/EU

References to the relevant harmonised standards used or references
to the other technical specifications in relation to which conformity is declared:

EN 267:2009+A1:2011	Fullfiels the requirements of Annex J/K. Automatic forced draught burners for liquid fuels

Additional information can be downloaded at:

www.bentone.com

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