LMV51... / LMV52…

Trouble / Modbus

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Section 5 Troubleshooting

Common Problems 5-1

The most frequent source of problems concerning the LMV5 is wiring errors, followed closely by parameter setting errors.

This section details the most commonly seen problems, along with the most common solutions to these problems. Section 5-2 includes a list of error codes that have associated corrective actions.

CANBus Wiring

The majority of all wiring errors are related to the CANBus.

The CANBus system includes: the AGG5.210 transformer, the two 12VAC fuses in the LMV5, the AZL5, the special CANBus cable, the actuators, additional transformers (if required), and the O2 module (if equipped).

If an error occurs with any CANBus connected device, the following 5 items should be checked:

1) The wiring on the AGG5.210 transformer, specifically how the four pin connector X52 is wired to the LMV5. Most problems occur on Pins 3 and 4 of the transformer. Pin 3 on the transformer and terminal X52.4 on the LMV5 should be wired to PE (Protective Earth or Panel Ground). Pin 4 on the transformer should be wired to X52.3. (See Wiring, Section 3)

2) The connections of 12VAC1, 12VAC2, CANL, CANH and GND. Ensure that the heavier wires of the CANBus cable (16 AWG) are used for the 12VAC terminals and the lighter (24 AWG) twisted pair is used for CANL and CANH terminals. Make sure that the color convention used at the LMV5 CANBus Connection (X51 for actuators) is consistent throughout. Typically 12VAC1 = Red, 12VAC2 = Black, CANH = Blue, CANL = White, GND = Green. Ensure that no wire strands from adjacent pins on the CANBus plugs make contact. No conductors, only insulation should be visible when viewing a properly terminated CANBus green plug.

3) The shielding of the special CANBus cable. The shielding of this cable is immediately under the plastic sheathing of the cable and the shielding encircles all the conductors. All shielding, on all segments, of the CANBus cable must have continuity with terminals X51.1 (for the actuators, O2 module) or X50.1 (for the AZL). This can be checked with a multi-meter connecting one probe on the shielding clip attached to terminal X50.1, and one probe on the last device of the CANBus. Shielding clips (AGG5.110) are required (one for X51 and if not using a pre-made AZL cord, one for X50) to mount and terminate the shield of the CANBus cable on the LMV5 end. The continuity of the shield is maintained thru each of the actuators and / or O2 module by using the metal shielding clamps provided on each device.
(See wiring, Section 3)

4) CANBus fuses, FU2 and FU3, located on the right hand side of the LMV5. Check that these fuses are not blown. If any are blown, check the wiring for incorrect terminations. Also check the area of the cable where the sheathing was stripped. It is possible that a knife was used to cut the sheathing, and that the knife penetrated through the cable sheath, the shielding, and the insulation on 12VAC1 or 12VAC2. If the shield makes contact with either 12VAC1 or 12VAC2 a short will result. This will blow fuses, and can damage actuators or O2 module.

5) Electrical loading of the CANBus. The 12VAC1 and 12VAC2 power is supplied by the AGG5.110 transformer connected to the LMV5. The output of one transformer is sufficient for many applications, but some may require two transformers. CANBus loading can be determined useing of the CANBus loading table, found in Section 3-1.
Wiring of the second transformer can be found in Section 3-3.

CANBus Wiring "*AZL not on Bus*"

When the AZL5 displays "*AZL not on Bus*", or is stuck in "*System Test*", this is typically means that there is a voltage problem on the CANBus. This usually does not mean that the AZL5 needs to be replaced. Make sure that the neutral and chassis ground are bonded, meaning having no electrical potential (voltage) between them. The 5 points mentioned on the previous page should also be checked, especially points 1, 2 and 4.

It is possible that one or more actuators are being overloaded and are consuming too much power from the CANBus. Voltage should be checked by probing the CANBus terminals.

There should be 12 volts AC between 12VAC1 and GND.
There should also be 12 volts AC between 12VAC2 and GND.
Voltage between 12VAC1 and 12VAC2 should measure 24VAC.
If the voltage is significantly less than these values, the CANBus is overloaded, a short exists, a fuse is blown, or some part of the CANBus is improperly wired.

It is much easier to troubleshoot the CANBus in pieces rather than all devices at once.

When a CANBus problem is discovered, all actuators and the O2 module can be disconnected, so that ONLY the AZL5 is connected to the LMV5.
The actuators / O2 Module can then be connected one by one, to see when the CANBus fault appears. This method is easy to perform since the actuators / O2 Module have plugs that can be connected and disconnected with ease.

Grounding

The second largest category of wiring problems concerns the grounding and the shielding of LMV5 components.

The LMV5 has three different types of ground, each with a different function. The three types are:

1) **Protective earth or chassis ground (PE)**
2) **Functional Earth or Shield (FE)**
3) **Reference Ground (Labeled as 0, M, or GND, hereafter labeled as 0)**

All PE's that exist on the forward facing plugs (white plugs) of the LMV5 are bonded together.

All 0's that exist (green plugs) are internally bonded.

FE's are bonded to one another on the individual internal circuit boards of the LMV5, and are then bonded to the 0's with capacitors on each individual board.

At the 12VAC transformer's 4 pin SEK2 plug, Pins 2 and 3 are tied together, thus connecting 0 and FE directly on the circuit board that has the CANBus connectors. It is highly recommended that SEK2 Pin 3 on the transformer, and X52.4 are connected to chassis ground (PE), effectively connecting 0 to chassis ground (PE). This also connects 0 and PE directly to FE, on the CANBus board only. FE on other boards is isolated from 0 with capacitors.

In short, FE are exclusively for cable shields, 0 is the reference ground for all low voltage sensors, and PE should be connected to the main grounding lug (main chassis ground).

Note: The main step down (480VAC to 120 VAC) transformer must have the neutral and chassis ground bonded together on the low voltage (120VAC) side.

All other devices connected to the LMV5 (such as a VSD and blower motors) must also be grounded to chassis ground.

Load Controller Modes & Sensors

The LMV51.140 and LMV52 both have a load controller that can read press / temp directly.
The LMV51.040 must be used with a floating/bumping external load controller, such as a RWF40.

When the LMV5 load controller is configured, different inputs are expected on different terminals:

If an analog press/temp sensor is used, Input 2, Term X61.2 or X61.3 is required.
If remote setpoint / remote modulation is used, Input 3, Term X62.2 or X63.3 is required.
If RTD temp sensor(s) are used, Input 1, Term X60.1, or Input 4 Term X60.3 is required.

If an analog signal does not exist on the previously motioned terminals when the mode is selected (0 mA when 4-20mA is selected, for example) the LMV5 will fault. See section 3-3 for wiring.

If the incorrect mode of load controller is selected for the connected instrumentation or analog signal, the LMV5 will fault.

Figure 5-1.1 details which terminals should have sensors wired for the given load controller mode.

Figure 5-1.1 Required sensors for Load Controller mode

Mode	Label	Description	Expected Input Terminals (See Section 3-3)
1	ExtLC X5-03	External Load Control Floating / Bumping	X5-03.02 and X5-03.03
2	IntLC	Internal Load Control Temp. or Press. sensor connected to LMV5	Temperature X60.1, X60.2, X60.3, X60.4 **OR** Pressure X61.1, X61.2, X61.3, X61.4
3	Int LC bus	Internal Load Control Temp. or Press sensor connected to LMV5 remote setpoint via Modbus	Temperature X60.1, X60.2, X60.3, X60.4 **OR** Pressure X61.1, X61.2, X61.3, X61.4 **ALSO** Modbus Connection
4	Int LC X62	Internal Load Control Temperature or Pressure sensor connected to LMV5 remote setpoint via analog input	Temperature X60.1, X60.2, X60.3, X60.4 **OR** Pressure X61.1, X61.2, X61.3, X61.4 **ALSO** Analog input X62.2, X62.3, X62.4
5	ExtLC X62	External Load Control analog signal connected to X62	Analog input X62.2, X62.3, X62.4
6	ExtLC Bus	External Load Control via ModBus	Modbus Connection

On a steam boiler, a temperature sensor can be used in addition to the pressure sensor, for the cold start function.

In this case, an input is expected for both, a pressure sensor and a temperature sensor in modes 2 thru 4.

Load Controller General

If faults occur with the load controller, first consult Figure 5-1.1 to ensure that there are not mode sensor or signal conflicts.

1) Next, check to see that the wiring of the sensors is in accordance with Section 3-3.

2) If this fails to cure the problem, verify the analog signal to the LMV5.

3) Replace the sensors if necessary.

Note: On some older LMV5 units, if the load controller is in mode 5 or mode 6 (ExtLC modes), the load controller cannot be accessed by parameter path:
Params & Display > Load Controller > Controller > Configuration > LC_OptgMode

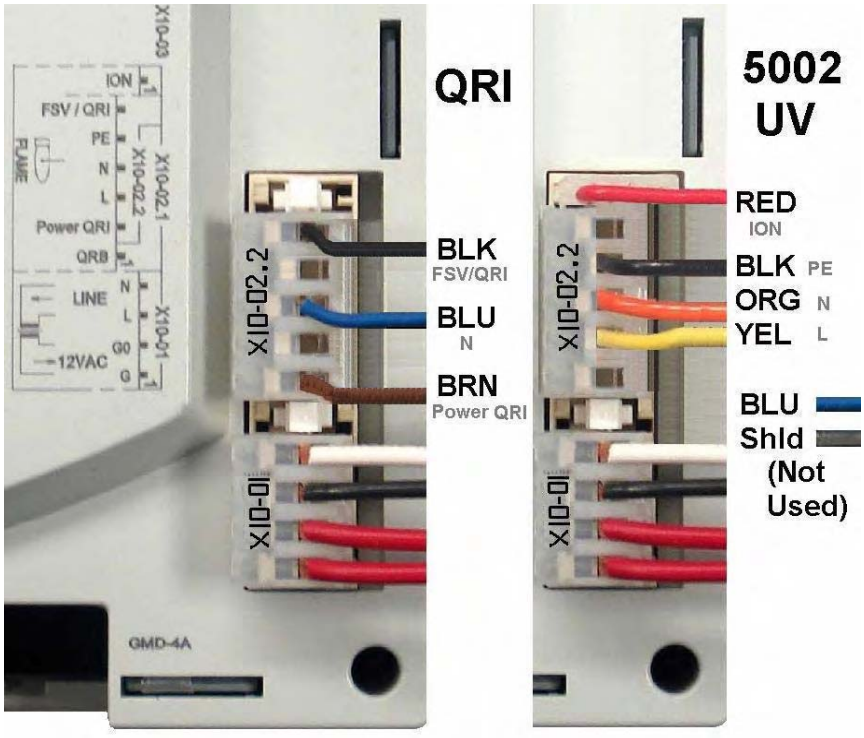
To change the load controller settings, the following path must be used:
Params & Display > System Config > LC_OptgMode

The load controller can then be accessed and put back into any of the IntLC modes.
If the load controller is in any of the IntLC modes use path:
Params & Display > Load Controller > Controller > Configuration > LC_OptgMode

Flame Detector

The flame detector wiring is typically another frequent source of wiring errors.
These errors are due a misunderstanding of the markings on plug X10-02.2, and the LMV5 terminals.
The plug that is typically furnished with the LMV5 only covers terms X10-02.2 to X10-02.6.
Terminal X10-02.1 and terminal X10-03.1 are not included in the X10-02.2 plug.

Figure 5-1.2 Plug X10-02.2 as it would be seen plugged into an LMV5



Notes:

For the QRI,
2 open terminals exist,
X10-02.1 and X10-03.1.

Never subject the
QRI flame scanner
to line voltage.

If Pin 6 QRI SIG, is
subjected to line voltage:
it will damage the QRI,
and the LMV5.

Also see Section 3-3.

Safety loop

The safety loop wired between terminals X3-04.2 and X3-04.1 is meant for safety limits only, such as auxiliary low water cut out and the high limit.

1) On occasion, operating (cycling) switches are wired into this loop - this is incorrect.
   If a cycling switch is placed in this loop, the LMV5 will lockout every time the burner cycles off.

2) If an external load controller (such as a RWF40) is used, or the LMV5 load controller is in any external load controller modes (ExtLC modes 1, 5, 6), then a cycling switch should be put in series with the burner on /off switch wired to X5-03.1.

3) If any of the internal load controller modes are used (IntLC modes 2, 3, 4) then a cycling switch wired to X5-03.1 is not necessary, since this is done automatically in the LMV5.

Note: The parameter *InputController* can activate or deactivate terminal X5-03.1.
See section 4-2
If this terminal is deactivated, no action will be taken, when terminal X5-03.1 is energized or de-energized.

Other Common Errors

1) If the LMV5 is not in alarm and will not start, (stays in phase 12) check the following:

   a. Terminal X5-03 Pin 1 has line voltage.
      The burner on / off switch is usually wired to this terminal.

   b. The LMV5 is set to "*automatic*" or "*burner on*" under manual operation.
      If set to automatic, make sure that the setpoint is higher than the actual value.
      Also check the setting on SDModOn, SDModOff.

   c. Ignition positions are defined for all activated actuators, including VSD on a LMV52.

2) If a low or high gas pressure fault occurs every time the gas valves attempt to open, it is possible that the commons to the high and low gas pressure switches are wired through the proof of closure switches on the gas valves. Thus, power will be removed from the high and low gas pressure switch commons when the gas valves open.

3) If a burner flange (oil drawer) switch is not used, a jumper must be placed between terminals X3-03.1 and X3-03.2. If this is not done, a fault will occur stating that the safety loop is open.

4) If terminal X4-01.4 (alarm) is energized when a fault does not exist on the LMV5, this will cause a manual lockout of the LMV5.

5) If indication of the gas and / or oil valve is desired, terminals X8.01.1 (gas) and X8.02.2 (oil) must be used for this function. Indicator lamps and other devices must not be wired directly to the gas valve and / or oil valve terminals.

6) If a single lamp is used such as "main burner on", a relay (or switch) must be used that changes state with the fuel selector switch, so that only X8.01.1 is connected to the indicator when firing gas and X8.01.2 is connected to the indicator when firing oil.

Oxygen Monitor / Trim / Efficiency Calculation

The LMV52 has the capability of integrated O2 trim and / or O2 monitoring. The O2 trim system includes the PLL52 module and the QGO20 O2 sensor as well as optional stack / ambient temperature sensors that can be used for an efficiency calculation. Common problems and the related solutions include:

O2 sensor is not reading

Displayed as “XXXX” on the AZL screen, or is reading incorrectly check the following:

1) Ensure that the QGO20 O2 sensor is activated.
   This can be done under:
   Params & Display > O2 Module > Configuration > O2 sensor.

2) If the QGO20 is activated, check the temperature of the QGO20 sensor.
   The sensor will not sense % O2 if the sensor is below 1202 °F.

   The PLL52 module controls the QGO20 sensor’s heater to achieve a sensor temperature of approximately 1292 °F.
   The temperature can be checked under:
   Params & Display > O2 Module > Displayed Values > QGO SensorTemp.
   The sensor heating load can also be viewed under the Displayed Values menu.

   Maximum heating load is 60%. If the heating load is at 60% and the QGO20 is not at least above 1202 °F after initial heat up, stack velocity may be too high, thus cooling the sensor. Maximum stack velocity is 33 ft / second.

   (See Section 2 for mounting restrictions on the QGO20 Sensor)

Note: The QGO20 sensor can take up to two hours to achieve operating temperature on the first start-up.
Anytime the LMV5 system / PLL52 has power and parameter O2 sensor is set to activated, the PLL52 will try to maintain the QGO20 at approximately 1292 °F.

O2 sensor reading grossly high or low

Check the following:

1) The milli-volt signal from the QGO20 to the PLL52 could have interference.
   Ensure that the high and low voltages wires that run from the PLL52 to the QGO20 are in separate conduits.

2) The wires for the QGO20 heating element are high voltage (120 VAC),
   and the wires for the O2 signal and thermocouples are very low voltage (200 mV max).
   Interference is almost sure to result if the high and low voltages are run in the same conduit.

Note: The QGO20 sensor reads %O2 wet.

Most combustion analyzers read %O2 dry, so the O2 number that appears on the AZL5 is typically at least 1% O2 lower than the combustion analyzer.

See table in Section 6 for approximate values.

O2 sensor reads but responds very slowly

Check the following:

1) Ensure that the QGO20 sensor is clean. This can be done by shutting off the power to the LMV52, and removing the QGO20 from the stack.

2) **Be Careful !!** The sensor is likely to be very hot.
   After the QGO20 is removed from the stack,
   let it cool for at least an hour (it will cool with power off to the LMV52).

   After this time, the sensor can be blown out using low pressure
   (less than 15 PSIG) compressed air.
   If this blowout is done when the QGO20 senor is hot,
   the ceramics inside the senor will most likely be cracked
   and the sensor will need to be replaced.

3) Check the orientation of the QGO20 sensor and the collector.
   The one notch on the collector's flange should be between the two notches
   on the sensor's flange.

   Also, ensure that the bevel of the collector is pointed into the flow.
   (See Section 2 for details on proper sensor / collector orientation)

4) Check the internal resistance of the QGO20 sensor.
   This can be read under:
   Params & Display > O2 Module > Displayed Values > QGO Resistance

   This value increases as the sensor ages. As the internal resistance increases, the response time of the sensor also increases. Absolute maximum resistance is 140 ohms.

Temperature sensor(s) reading incorrectly or not at all

If one or both of the temperature sensors wired into the PLL52 module for the ambient temperature and stack temperature are not reading,
(displayed as "XXXX" on the AZL screen) or the sensor are reading incorrectly.

Check the following:

1) Ensure that the sensors wired into the PLL52 module correctly,
   and are two wire 1000 ohm RTD.

   The Supply air temperature and the stack gas temperature sensor,
   are configurable for 1000 ohm platinum RTD and 1000 ohm Nickel RTD.

   Typically a platinum 1000 Ohm RTD is used in the stack,
   and a Nickel 1000 ohm RTD is used for the supply air.

2) Check to see that the sensors are activated and properly configured under:
   Params & Display > O2 Module > Configuration > SupAirTempSens or FlueGasTempSens

Note: The supply air temperature sensor and the stack gas temperature sensor are not necessary for O2 trim.

However, if one input or both inputs are configured for a sensor,
(set to Ni1000 or PT1000) and that sensor is not wired in or is not reading,
the O2 trim will not activate.

O2 Module not active or not Available

When attempting to go under:
Params & Display > O2 Module,
the following is displayed "*O2 Module not active or not Available*".

Check the CANBus wiring to the PLL52 Module.
If this wiring is not correct the LMV5 will not auto detect the PLL52 Module.

Point must lie 0.5 % O2 above O2 Monitor Curve

When setting the O2 Control Curve, messages are received that say "*Point must lie 0.5 % O2 above O2 Monitor Curve*" or "*Point must lie 1.0% O2 below Ratio Control Curve*".

Check the following:

1) Ensure that there is an absolute minimum of 1.6 % O2 between the O2 monitor curve and the O2 ratio control curve.

2) Also ensure that the %O2 that is to be set is at least 0.5% O2 above the O2 Monitor Curve and 1.0% O2 below the O2 ratio control curve.

3) In practice, it is much easier to make the %O2 gap between the curves larger than the absolute minimum.

   Depending on the burner characteristic, doing this may also lead to more trouble free operation.

4) If possible:

   It is preferable to have a 1 to 1.5% gap,
   between the O2 Monitor curve and the O2 Control Curve.

   It is also preferable to have a 1.5% gap,
   between the O2 Ratio control curve and the O2 Control Curve.

5) Please see Section 6 for more information in these curves.

Note: When setting up the three O2 curves,
these curves must be set using the %O2 values displayed on the AZL5.

These values are %O2 on a wet basis.

A separate combustion analyzer (which typically measures dry %O2)
is useful for reference and to monitor CO and NOx production,
but should not be used to set the three O2 curves.

Measurement of Delay time Unsuccessful

When setting Point 2 or the high fire point (typically Point 10) on the O2 control curve, messages are received that say words to the effect of:
"*Measurement of Delay time Unsuccessful*".

Check the following:

1) Make sure that parameter *OptgMode* is set to *man deact.*
   This setting can be found under :
   Params & Display > O2ControlGualrd > Gas / Oil Settings

2) This typically occurs at low fire when the velocity of the combustion gasses through the boiler is relatively slow. The delay time is defined as the length of time it takes a change in the air damper position to be detected by the O2 sensor. This time is longer at low fire and shorter at high fire due to gas velocity.

   When the points on the O2 control curve are set, the LMV5 will prompt at every point with "*press enter after the O2 value has stabilized*".

   Pressing enter then sets the %O2 for the O2 ratio control curve.

   This problem is typically cured by waiting at least 30 seconds after the LMV5 asks "*press enter after the O2 value has stabilized*", since the problem is typically caused by a non-representative %O2 value for the O2 ratio control curve.

   Please see Section 6 for additional information.

O2 trim automatically deactivated

The LMV5 gives warnings that the O2 trim has been automatically deactivated.
There are many different problems that can cause an auto deactivation of the O2 trim system.

The most common are:

1) Go into the fault history. If the LMV5 faulted on error code B5 diagnostic code 01, this states that the sensed % O2 value has gone below the O2 Monitor curve for more than 3 seconds and the trim deactivated.

   The most common solutions to this problem are increasing the % O2 gap between the O2 control curve and the O2 monitor curve at and around the point (can be determined by the load-stamp on the fault) where the fault occurred.

   Also, Parameters O2 Offset Gas or O2 offset Oil can be increased in 0.5% increments. Parameter LoadCtrlSuspend can also be decreased in 1% increments.

   See Section 4-2 for more information on these parameters

2) If the LMV5 faulted on error code AB diagnostic code 15 or 16, check the configuration of the ambient (supply air) sensor and the stack (flue) gas sensor.

   If these sensors are activated and are not wired in or are not functioning correctly, the O2 trim will automatically deactivate immediately after it is reactivated.

3) If the LMV5 faulted on error code AB, diagnostic code 20, check the temperature of the QGO20 sensor.
   This can be found under:
   Params & Display > O2 Module > Displayed Values > QGO SensorTemp.

   The temperature should be at least 1202 ^{o}F.

   If the temperature falls below this value during prepurge or anytime during operation, the QGO20 sensor may be mounted improperly, or gas velocity may be too high or too low. See Section 2 for proper QGO20 mounting

VSD Control

The LMV52 has the ability to control different types of VSD (variable speed drive).
The most common type of VSD used with the LMV52 is the VFD (variable frequency drive), and the most common type of motor used with the VFD is the so called “synchronous” AC induction motor.

For a more in depth overview of this application, please see the fist few pages of Section 7-1.
Common problems and the related solutions include:

VFD will not operate

If the VFD will not operate the blower (blower will not spin) when the LMV52 parameter standardize is activated. Consider the following:

1) Verify that the following:
   a. The 0 / 4-20mA signal from the LMV52 to the VFD is wired correctly (LMV52 terminals X73.4 and X73.2).
   b. The run / stop contact is wired to the VFD correctly (LMV52 terminals X73.1 and X73.2)
   c. The VFD parameters are set for the motor that it driving.
   d. The VFD is spanned so that 0 or 4mA equals 0Hz and 20mA = 63Hz (60 Hz grid frequency). The reason for this is explained in Section 7.
   e. VFD is in remote mode so that it looks for a 0 / 4-20mA signal, and run / stop contact. Closing the contact should cause the VFD to operate the motor.
   f. Verify that the three-phase wiring between the VFD and motor is correct.
2) Disconnect the analog signal and run / stop contact wires between the VFD and the LMV52. Use a handheld 0 / 4-20mA source and a toggle switch to verify that the VFD responds to a contact closure and a varying 0 / 4-20mA signal.

   If the VFD does not respond, check / correct the configuration of the VFD.

   If the VFD responds to the contact closure and the varying 0 / 4-20mA signal, then go to the next step.
3) With the wires between the LMV52 and VFD still disconnected, use a multi-meter to verify that the LMV52 outputs about 19.5mA during the standarization, (see note below) and that the run-stop contact (dry contact) in the LMV52 closes, and remains closed during the standardization.

   If the analog signal is not output and the contact does not close, verify that the VSD is set to activated under : *Params & Display* > *Ratio control* > *Gas* / *Oil settings VSD*.
   Also ensure that the safety loop (X3-04 Pin 1 and Pin 2), and the burner flange (X3-03 Pin 1 and 2) are closed.
   The LMV5 will not standardize if an alarm is present.

Note: When standarization is activated in the LMV52, the air actuator should drive to prepurge position before the run / stop contact closes and the LMV52 puts out 19.5mA. This is done so that the blower motor has a representative load (blower moves air) during standardization.

If this does not happen automatically, make sure that the air actuator is set to air influenced and the safety loop is closed.
Depending upon what air actuator is used and what parameter “*TimeNoFlame*” is set to, the actuator could take up to 120 seconds to reach prepurge position.

4) If the VFD responds to a contact closure and a 0 / 4-20mA source, the VFD should be configured correctly.
   If the LMV52 closes the run / stop contact and produces 19.5mA when put into standardize mode, then the LMV52 should be configured correctly.
   Thus, the LMV52 / VFD / motor combination should operate properly, and standardize when wired back together.

VSD Standardizing

A successful standarization can be done under:
Params & Display > VSD Module >Configuration > Standardized Sp

If a number is recorded under this parameter that is close to the full speed of the motor (typically 3585 RPM, +/- 100 RPM), the standarization is successful.

If the VFD operates the blower during standardization but does not standardize successfully, consider the following:

1) Verify the following:
   a. The speed wheel is installed on the blower motor correctly (see Section 2) and the gap between the inductive sensor and the speed wheel is correct.

   b. The inductive sensor is wired to the LMV52 correctly, on terminals (X70.1, X70.2 and X70.3)

   c. The yellow LED on the back of the inductive sensor should blink every time a speed wheel “finger” passes by the nose of the sensor. If it does not blink, the sensor is wired incorrectly or is defective.

   d. If everything is correct with the speed sensor, the real time RPM can be read under:
      Params & Display > VSD Module > Absolute Speed

      For troubleshooting purposes, the RPM can be read here during the standarization process.

2) Check to ensure that the air damper opens when the standardization is activated.
   If this does not happen automatically, make sure that the air actuator is set to air influenced, the safety loop is closed, and that the LMV52 is not in an alarm.

3) Check the ramp time on the LMV52 and the VFD.
   The ramp time on the VFD must be faster than the ramp rate on the LMV52.
   If the VFD ramp time is set at 30 seconds, the LMV52 ramp time should be set at least 40 seconds.
   The LMV52 ramp rates can be found under:
   Params & Display > Ratio Control > Times

   Both the *TimeNoFlame* parameter and the *OperatRampMod* parameter should be set to at least 40 seconds for a VFD ramp time of 30 seconds.

   In general, the VFD ramp time should be set about 25% faster than the LMV52 ramp time.

4) Monitor the RPM of the blower motor during the standarization process.
   After standardization is activated, the real time RPM can be read under:
   Params & Display > VSD Module > Absolute Speed

   During standarization, the indicated RPM should rise up to a peak value and hold steady at that value for a few seconds, and then drop back to zero or near zero.

   This peak value that is seen should be recorded automatically under:
   Params & Display > VSD Module >Configuration > Standardized Sp

If this doesn’t happen, it’s likely that there’s a problem with the VFD or the speed wheel.

Fan speed not reached or Control range limitation VSD Module

Typically, if the LMV52 / VFD / Motor standardize successfully this system will operate correctly. However, if the standarization is successful but problems are encountered during burner operation, consider the following:

1) Ramp times. Faster ramp times on both the VFD and the LMV52, create a more demanding application for the VFD. Simply put, a faster ramp time (20 seconds instead of 40 seconds) will cause the VFD to draw or absorb much more amperage for a given change in blower speed, since the change in speed occurs more quickly.

   Ramp times that are faster than the VFD can handle can lead to over current faults on the VFD as well as error messages on the LMV52 stating "*Fan speed not reached*" or "*Control range limitation VSD Module*".
   Increasing ramp times typically helps these problems.

   Please see the next point for details on these two most common LMV52 error messages.

2) If "*Fan speed not reached* " or "*Control range limitation VSD Module*" frequently appear on the AZL5, this indicates that the LMV52 has shifted the 0 / 4-20mA as far as possible from the standardized signal and the RPM of the blower motor as read by the speed wheel is still to low or too high.

   "*Fan speed not reached*" indicates that the blower speed is still to low, even though the LMV52 has increased the 0 / 4-20mA signal as far as possible.

   This shows up as a warning on the AZL5 for the first 2 seconds, and if it the blower speed does not increase in this time a lockout will occur.

   Conversely, "*control range limitation VSD Module*" indicates that the blower speed is too high even though the LMV52 has decreased the 0 / 4-20mA signal as far as possible.

   This also shows up as a warning on the AZL5 for about 5 seconds, and if the blower speed does not decrease in this time a lockout will occur.

   If *"Fan speed not reached*" occurs when the blower is ramping up, and *"control range limitation VSD Module*" occurs when the blower is ramping down, there is a good chance that the VFD is not able to accelerate or decelerate the blower wheel quickly enough for the given ramp times.

   As was previously mentioned, extending the ramp times will help this situation.

3) Inertia of the rotating assembly (blower motor wheel and motor armature).
   As the mass and inertia of the blower wheel and motor armature increase, the power needed to accelerate (increase RPM) and decelerate (decrease RPM) increases.

   Large blower motors connected to large heavy blower wheels, typically require longer ramp times and / or VFD with high over current capability, so that "*Fan speed not reached*" or "*Control range limitation VSD Module*" lockouts do not occur.

4) The alarm input into the LMV52 from the VFD.

   The LMV52 has an alarm input terminal from the VFD, so that if the VFD is having a problem, the LMV52 can sense this and shut the burner down.

   If an Error code A9 Diagnostic code 0C is encountered, then this means that the VFD caused the LMV52 to alarm by energizing terminal X73.3 on the LMV52 with 24 VDC.

   Typically, this happens due to an over current in the VFD itself.

VSD faults Phase 10

If VSD faults are occurring in Phase 10 (home position), check the setting of Parameter “ReleaseContctVSD”.

If this is set to open, the LMV52 will simply open the run / stop contact after postpurge is complete.

If this is set to closed, the LMV52 will keep the run / stop contact closed after postpurge is complete.

1) Depending on how the VFD is configured, opening the run / stop contact after postpurge could engage a DC brake in the VFD to slow down the blower rapidly.

   If the VFD does not have this capability, opening the run / stop contact will let the blower freewheel and coast down after postpurge is complete.

   If the run / stop contact is kept closed after postpurge is complete, the VFD should bring the bower RPM down to the home position in a controlled manner.

2) Whichever option is selected, the goal is to have the blower motor RPM correct at home position, which is phase 10. Typically, home position is set to 0% VSD. If this is the case, this means that the blower must be spinning at less than 8% of the standardized RPM by the end of Phase 10 (8% of 3585 RPM = 287 RPM). The LMV52 will wait approximately 20 seconds in Phase 10 for the proper speed (if set to a percent grater than 0 % VSD) or the less than 8% speed (if set to 0 % VSD) to be reached before locking out.

3) If this problem is occurring, verify that “ReleaseContctVSD” is set to closed.

   If this does not help, reducing the blower speed and / or opening the air damper further in postpurge will help slow the blower.
   If the problem is still encountered, setting “ReleaseContctVSD” to open and adding DC braking on the VFD typically cures the problem.

Random error codes or AZL not on bus

If random error codes occur or if “*AZL not on bus*” problems occur when operating the VFD, check the following:

1) Ensure that the LMV52, the VFD, and the three phase motor are grounded to chassis ground.

   Also ensure that Pin 3 of the AGG5.210 transformer, and Pin X52.4 of the LMV52, are grounded to chassis ground.

2) Ensure that the wires between the VFD and the blower motor are in some type of metal conduit (flex or hard conduit).

   This is important since these wires are a rich source of EMF (Electromagnetic Field) and can adversely affect the LMV52, causing many different error codes.

   Metal conduit will contain the vast majority of the EMF.

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
				Fault with Base Unit (LMV5)	
01	01	LMV5	Internal Fault Basic Unit	ROM error	**Electromagnetic compatibility (EMC)** Improving EMC is avoiding electrical interference effects Typically this means: 1) Check grounding (most often the cause) 2) Check shielding 3) Check for loose connections 4) Check for wiring that is too close to high voltage
02	Any #	LMV5	Internal Fault Basic Unit	RAM error	
	01			RAM error in register bank 0 (LMV51...)	
	02			RAM error in IDATA area (LMV51...)	
	03			RAM error in XDATA area (LMV51...)	
	04			RAM error of variables used	If fault occurs sporadically improve EMC. If fault occurs continously, replace LMV5
	05			RAM error variable consistency	
	06			RAM error reading back test pattern	
	07			Error RAM test code run	
03	Any #			Error in connection with data comparison (internal communication) between µC1 and µC2	
	01			TimeOut during program run synchronization prior to data transmission	
	02			TimeOut during data transmission	
	03			CRC error during data transmission	
	05			TimeOut during program run synchronization with initialization	
	10			Error counter "Flame intensity outside tolerance" has elapsed	Check flame detector signal. If ok, and fault re-occurs, replace LMV5
	11			Error counter "Target phase unequal" has elapsed	If fault occurs continously, replace LMV5
	12			Error counter "Reset-lockout input unequal" has elapsed	
	40			Fuel train unequal	
	41			Relay control word unequal	
	42			ROM-CRC signature unequal	
	43			Phase unequal	
	44			(Key + main loop counter) unequal	
04				Unsuccessful synchronization of the 2 µCs	

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
FAULT WITH FLAME SCANNER (QRI) OR BASE UNIT (LMV5)					
05	Any #	LMV5 / Flame Dect.	Fault Flame Detector Test	Fault during test of the flame signal amplifier	If fault occurs sporadically: Improve shielding / isolation of flame detector wires. High LMV5 temperatures can also cause this fault. If fault occurs constantly: Lower LMV5 temperature, replace flame detector or replace LMV5
	01			Fault during test of the flame signal amplifier	
	02			Crosstalk fault between test pin and flame signal amplifier channel (with LMV52 FSVchannel QRI... / QRB...)	
	03			Crosstalk fault between test pin and FSV channel ION (Only LMV52)	
FAULT WITH BASE UNIT (LMV5)					
06	Any #	LMV5	Internal Fault Basic Unit	Fault internal hardware tests	If fault occurs sporadically improve EMC. If fault occurs continously, replace LMV5
	01			Fault during test of the ignition relay	
	02			Fault during test of the safety relay	
	03			Fault during voltage supervision test	
	04			Relay voltage not switched off after reset	
FAULT WITH DEVICES OR WIRING CONNECTED TO THE BASE UNIT (LMV5)					
10	Any #	Devices conn. To LMV5	Internal Fault Basic Unit	Basic unit has detected an improper circuit at one of the outputs, a faulty diode, or a short-circuit in the power supply of the contact feedback network. The diagnostic codes indicates the input affected	1) Check connections of the neutrals to all of the connected switches, valves, etc... 2) Check for capacitive loads that cause voltage to be present on the terminal after the LMV deenergizes the terminal. If voltage exists on an output terminal, such as a fuel valve, after the LMV denergizes the terminal, this will cause a fault. Voltage must drop to zero on the terminal within about 10 ms after the terminal is de-energized.
	01			Load controller on / off	
	02			Fan contact	
	03			Selection of oil-firing	
	04			Selection of gas-firing	
	05			Reset	
	06			Pressure switch oil maximum	
	07			Pressure switch oil minimum	
	08			Pressure switch valve proving	
	09			Safety valve oil feedback	
	0A			Fuel valve 1 oil feedback	
	0B			Fuel valve 2 oil feedback	
	0C			Fuel valve 3 oil feedback	
	0D			Safety valve gas feedback	
	0E			Fuel valve 1 gas feedback	
	0F			Fuel valve 2 gas feedback	
	10			Fuel valve 3 gas feedback	
	11			Safety chain burner flange	
	12			Safety relay feedback	

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
FAULT WITH DEVICES OR WIRING CONNECTED TO THE BASE UNIT (LMV5)					
10	13			Pressure switch gas minimum	1) Check connections of the neutrals to all of the connected switches, valves, etc... 2) Check for capacitive loads that cause voltage to be present on the terminal after the LMV deenergizes the terminal. If voltage exists on an output terminal, such as a fuel valve, after the LMV denergizes the terminal, this will cause a fault. Voltage must drop to zero on the terminal within about 10 ms after the terminal is de-energized.
	14			Pressure switch gas maximum	
	15			Ignition transformer feedback	
	16			Fan pressure switch	
	17			Start release oil	
	18	Devices conn. To LMV5	Internal Fault Basic Unit	Heavy oil direct start	
	19			Load controller open	
	1A			Load controller closed	
	1B			Start release gas	
11	01			Basic unit has detected a short-circuit in the contact feedback network	
FAULT WITH CONNECTED ACTUATORS OR VSD					
15	Any #	Act. / VSD Control	Fault Positioning Actuator or Fan Speed not reached	LMV5 has detected a positioning error on one or several actuators. Could also be the VSD module if equipped	**If error occurs on one actuator only** : 1) Ensure torque requirements of dampers / valves is less than Actuator output. 2) Verify that no damper / valve is bound. 3) If 1 and 2 do not solve the problem: Replace actuator. **If error occurs on multiple actuators (01-3F) :** 1) Verify that the CanBus wiring is correct. 2) Verify that shields (screens) on CanBus cable are connected properly. **If error occurs on VSD :** 1) Check speed sensor on motor for correct installation, especially gap between sensor and wheel. 2) Check for filters, damping and or delays on the input signal to the VSD. The VSD should respond to the input signal in a linear fashion. Extend VSD and LMV5 ramp times.
	01-3F		Fault Positioning Actuator	The diagnostic value is made up of the following faults or their combinations (the individual diagnostic codes are added up in hexadecimal format) Indicated that more than one actuator / VSD has problems.	
	01	Air Act.		Positioning fault air actuator	
	02	Fuel Act.		Positioning fault fuel actuator	
	04	Aux1 Act.		Positioning fault auxiliary actuator 1	
	08	Aux2 Act.		Positioning fault auxiliary actuator 2	
	10	VSD module	Fan Speed Not Reached	The fan in combination with the VSD has not reached the required speed	
	20	Aux3 Act.	Fault Positioning Actuator	Positioning fault auxiliary actuator 3	

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
FAULT WITH BASE UNIT (LMV5) RATIO CONTROL, O2 TRIM, VSD					
16	Any #	LMV5	Internal Fault Basic Unit	Basic unit has detected a plausibility fault in the ratio control system.The diagnostic code describes the cause of the fault.	
	00			Ratio curve of the air actuator is not fully defined	Insure that actuators that are addressed and activated have their positions defined. Check curve points to see if correct values have been entered for the actuator or VSD. Readjust the ratio curve, if required
	01			Ratio curve of the fuel actuator is not fully defined	
	02			Ratio curve of auxiliary actuator 1 is not fully defined	
	03			Ratio curve of auxiliary actuator 2 is not fully defined	
	04			Ratio curve of auxiliary actuator 3 is not fullydefined	
	05			VSD curve is not fully defined	
	0A			Calculated P-part outside the permissible range	Check parameters (P Low-Fire, I Low-Fire, Tau Low Fire, P High-Fire, I High-Fire, Tau High-Fire) These values nomally self-set when the delay time is measured. Check the values of these parameters against the maximum and minimum ranges. Readjust O2 control curve if necessary.
	0B			Calculated I-part outside the permissible range	
	0C			Calculated system delay time outside the permissible range	
	0D			Calculated O2 setpoint outside the permissible range	The O2 control curve must be 1% O2 lower than the % O2 measured at the ratio control curve, and 0.5% above the O2 guard curve. Readjust curves.
	0E			Calculated O2 min. value outside the permissible range	
	0F			Calculated O2 ratio value outside the permissible range	
	03			The load / point number predefined by the AZL… lies outside the permissible range	If fault occurs sporadically improve EMC. If fault occurs continously, replace LMV5
	14			Calculated standardized value lies outside the permissible range	Check if the correct values have been entered for the standardized values. Readjust O2 trim control, if required, or repeat the settings
	20			With hysteresis compensation: Permissible target positioning range exceeded	If fault occurs sporadically improve EMC. If fault occurs continously, replace LMV5
	21			The load / point number predefined by the AZL… lies outside the permissible range	
	22			With a switch instruction, none of the defined cases was satisfied	
	23			With the switch instruction, no defined ratio control phase has been identified	
	40			Unplausible target positions	

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
FAULT WITH BASE UNIT (LMV5)					
17	Any #	LMV5	Internal Fault Basic Unit	(Internal) communication error of ELV	If fault occurs sporadically improve EMC. If fault occurs continously, replace LMV5
	3F			Detection of different data when making the data comparison	
	01			Timeout with program synchronization prior to data transmission	
	02			Timeout with data transmission	
	03			CRC fault during data transmission	
18	Any #		Invalid Curve Data	Corruption in the combustion curve data	Vaules on curve should be within 0.0 % - 100.0 % for load and VSD, 0.0° - 90.0° for actuators. If possible, adjust curve values back into the valid range. If this fault occurs on a unit that was functioning correctly after commisioning, replace LMV5
FAULT WITH ACTUATOR OR CANBUS CABLING					
19	Any #	Act.	Internal Fault Actuator	Basic unit (ratio control system) has detected a fault when comparing potentiometer channels A and B. Diagnostic code shows on which actuator the fault occurred. See diagnostic code	1) If fault occurs constantly: Replace actuator according to diagnostic code. After actuator(s) are replaced, make sure that the actuators do not "hunt" during operation. This can be done by adjusting Paramter "MinActuatorStep" and the PID loop.
	01..2F			The diagnostic value is made up of the following faults or their combinations (the individual diagnostic codes are added up in hexadecimal format)	
	01	Air Act.		Fault occurred on the indivudual actuator (see diagnostic code) when comparing potentiometer channels A and B	
	02	Active Fuel Act.			
	04	Aux 1 Act.			
	08	Aux 2 Act.			
	20	Aux 3 Act.			

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
FAULT WITH ACTUATOR (VSD) POSITIONING, ACTUATOR (VSD) RUN TIME					
1A	01	LMV5	Slope too steep	A section of actuator curve is too steep.	Check maximum slope sections of actuator curves. Maximum allowabe slopes are as follows: - 3.6° per 0.1 % Load (30 sec ramp) - 1.8° per 0.1 % Load (60 sec ramp) - 0.9° per 0.1 % Load (120 sec ramp) If these maximums are exceeded, adjust curve section below these maximum slopes.
1B	Any #		Operation in Parameter Setting Mode Quit	Curve Parameters (actuator curves) programming mode is still active in Phase 62 (drive to low fire and shutdown) and the target positions (normal operation) have not been reached.	When setting the curve parameters, the plant should be operated in manual mode with “Burner on“. This prevents the internal load controller from triggering the change to shutdown. Response of the internal Temperature Limiter can trigger this same fault. However, the curve point currently being set can still be stored in standby or lockout.
1C	Any #		Ignition Pos not defined	Ignition positions for activated actuators (or VSD) have not been set. See diagnostic code to indicate the faulted actuator.	Set the ignition position of the actuator(s). The ignition positions for each fuel are independent, and the positions are also independent of the low fire position.
	01..3F			The diagnostic value is made up of the following faults or their combinations (the individual diagnostic codes are added up in hexadecimal format)	
	01			Ignition position for air actuator not set.	
	02			Ignition position for active fuel actuator not set.	
	04			Ignition position for aux1 actuator not set.	
	08			Ignition position for aux2 actuator not set.	
	10			Ignition position for VSD not set.	
	20			Ignition position for aux3 actuator not set.	

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
Fault with Actuator (VSD) Positioning, Actuator (VSD) Run Time					
1D	Any #	LMV5/ Act./ VSD	Fault Running Time	Running time fault of actuators or VSD.	1) Check parameters (TimeNoFlame) and (OperatRampMod). These should be set to values greater than the ramping timeof the attached actuators or VSD. 2) Check connected actuators to determine if their torque rating is being exceed (stuck damper or valve etc...) 3) Check the two 12V fuses located under black covers on the right side of the LMV5 4) Check the CANBus power supply (blue or black transformer) Pin 1 and Pin 4 should have 12VAC to reference ground which is pin 2. Voltage betwen Pin 1 and Pin 4 should be 24VAC.
	01..3F			The diagnostic value is made up of the following faults or their combinations (the individual diagnostic codes are added up in hexadecimal format)	
	01	Act. / LMV5	Fault Running Time Air Actuator	Running time fault of air actuator	
	04		Fault Running Time Aux Actuator	Running time fault of auxiliary actuator 1	
	08		Fault Running Time Aux Actuator	Running time fault of auxiliary actuator 2	
	10	VSD / LMV5..	Fault Running Time VSD	Running time fault of VSD	
	20	Act. / LMV5	Fault Running Time Aux Actuator	Running time fault of auxiliary actuator 3	
1E	Any #	Act. / LMV5.. / VSD	Special Pos not reached	Basic unit has detected that 1 / several actuators (incl. VSD module) has / have not reached the special position pertaining to the Phase	1) Check connected actuators to determine if their torque rating is being exceed (stuck damper or valve etc...) 2) Check the two 12V fuses located under black covers on the right side of the LMV5 3) Check the CANBus power supply (blue or black transformer) Pin 1 and Pin 4 should have 12VAC to reference ground which is pin 2. Voltage betwen Pin 1 and Pin 4 should be 24VAC. 4) If a VSD is being used, check for filters, damping and or delays on the input signal to the VSD. The VSD should respond to the input signal in a linear fashion. See Error Code 15
	01..3F	Act.		The diagnostic value is made up of the following faults or their combinations (the individual diagnostic codes are added up in hexadecimal format)	
	01			Positioning fault of air actuator	
	02			Positioning fault of fuel actuator	
	04			Positioning fault of auxiliary actuator 1	
	08			Positioning fault of auxiliary actuator 2	
	10	VSD Sys.		VSD has not reached the speed	
	20	Act.		Positioning fault of auxiliary actuator 3	

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
				FAULT WITH VSD MODULE	
1F	Any #	VSD Sys.	Code for VSD Module Fault	Basic unit has detected a fault in connection with the VSD module	If fault occurs sporadically improve EMC. If fault occurs continously, replace LMV5
	01	VSD Module	Speed Acquisition faulty	Internal VSD module test was not successful	
	02	VSD Sys.	Wrong Direction of Rotation	Fan rotates in the wrong direction	1) Check to see if the motor's direction of rotation is correct. Reverse if necessary 2) Check to see if the arrow on the speed wheel points in the correct direction of rotation. Reverse if necessary.
	03		Speed Acquisition faulty	Pulse sequence and length at the speed input were different from those anticipated	1) Check and or adjust the gap between the speed wheel and the sensor. The gap shold be about 1/16" of an inch (2mm) or about two turns out. 2) Check the wiring of the speed sensor. Ensure reference ground is connected.
	04		Standardization canceled because of VSD	Fan was not able to keep the standardized speed at a constant level	
	05		Standardization canceled because of Air Actuator	Air actuator (or air influenced actuator) has not reached the prepurge position. For this reason, speed standardization is not possible	1) Check to see if all air-influencing actuators travel to the prepurge position and remain in that position for the VSD standardization. 2) Ensure torque requirements of air influencing dampers / valves is less than Actuator output. 3) Verify that no air influencing damper / valve is bound. 4) Check CanBus power suppy and CanBus fuses (FU 2 and FU3)
	06		Speed Test was not successfully completed	Internal VSD module speed test was not successful	If fault occurs sporadically improve EMC. If fault occurs continously, replace LMV5
				FAULT WITH DEVICES OR WIRING CONNECTED TO THE BASE UNIT (LMV5)	
21	Any #	Devices conn. To LMV5	Safety Loop open	Limit switches wired into the saftey loop have opened (such as low water or High Limit)	Check all switches wired into the saftey loop circuit. This also includes the burner flange circuit.
22	Any #		Internal Temp Limiter has responded	Internal TL has switched off because parameterized value has been exceeded	Check the burner / boiler temperature, sensor located on Input 1 and / or Input 4

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
Fault with devices or wiring connected to the Base Unit (LMV5)					
23	Any #	LMV5 / Flame Dect.	Extraneous Light on Startup	Basic unit has detected extraneous light during startup	1) Ensure that the source of extraneous light is not a flame. If it is a flame, take corrective action immediately. 2) If the QRI scanner is used, ambient light can cause an extraneous light error. Ensure sensor is viewing a dark area such as the inside of a boiler. 3) If the QRI scanner is used, check for glowing refractory. If glowing refractor is the cause, the afterburn time may need to be lengthened or a UV scanner may have to be used.
	00		Extraneous Light on Startup	Basic unit has detected extraneous light during startup	
	01… 03		Extraneous Light on Startup	(LMV52 only) Basic unit has detected extraneous light during startup 0 = QRI, 1 = ION or UV, 2 = Both	
24	Any #		Extraneous Light on Shutdown	Basic unit has detected extraneous light during shutdown	
	00		Extraneous Light on Shutdown	Basic unit has detected extraneous light during shutdown	
	01… 03		Extraneous Light on Shutdown	(LMV52 only) Basic unit has detected extraneous light during shutdown 0 = QRI, 1 = ION or UV, 2 = Both	
25	Any #	Devices conn. To LMV5/ Flame Detect.	No Flame at End of Safety Time	No flame detected at the end of safety time TSA1	1) With a piloted gas train, this means that the pliot did not light. Check wiring of ignition transformer and pilot valve. 2) Check manual shutoff valves for the pilot gas. 3) Check position of air damper. Close further if necessary. Pilot may be blowing out. 4) Check flame detector for signal in the presence of flame using a flame source. Replace if detector does not generate the anticipated signal.
	00		No Flame at End of Safety Time	No flame detected at the end of safety time TSA1	
	01… 03		No Flame at End of Safety Time	(LMV52 only) No flame detected at the end of the safety time. 0 = QRI, 1 = ION or UV, 2 = Both	
26	Any #		Loss of Flame	Loss of flame during normal operation (Phase 60-62)	1) Check flame detector for signal in the presence of flame using a flame source. Replace if detector does not generate the anticipated signal. 2) Check for flame signal "decay" as burner refractory heats up. If this happens a UV scanner may be needed.
	00			Loss of flame during normal operation (Phase 60-62)	
	01… 03			(LMV52 only) Loss of flame during operation detected. 0 = QRI, 1 = ION or UV, 2 = Both	
27	Any #	Devices conn. To LMV5 / LMV5	Air Pressure on	Air pressure = on, but should have been off	1) Make sure blower starts in Phase 22, Shuts off in Phase 78 or 83. (See sequence diagrams) 2) Check setpoint on air pressure switch. Raise setpoint if necessary. Swich should open after Postpurge. 3) If a FCC fault occurs in Phase 70, call a siemens representitive. A quecharc may be necessary.
28			Air Pressure off	Air pressure = off, but should have been on	
29			Fan Contactor Contact is on	FCC signal = on, but should have been off	
2A			Fan Contactor Contact is off	FCC signal = off, but should have been on	

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
Fault with devices or wiring connected to the Base Unit (LMV5)					
2B	Any #	Devices conn. To LMV5	Flue Gas Recirculation Pressure Switch on	FGR-PS = on, but should have been off	1) Check setpoint on FGR pressure switch. Adjust if necessary. 2) If a FGR-PS fault occurs in Phase 70, call a siemens representitve.
2C			Flue Gas Recirculation Pressure Switch off	FGR-PS = off, but should have been on	
2D	Any #		Valve not open	Closed Position Indicator (CPI) = on, but should have been off	1) Check wiring to the fuel valves. With manual shutoff valves closed, ensure that the fuel valves are opening in the proper phase (see sequence diagrams) 2) Ensure CPI (POC) switches are opening when the valve opens. If this does not happen check wiring, adjust switch, or replace fuel valve actuator.
	00				
	01			(Only LMV52) CPI via terminal StartRelease_Gas Closed Position Indicator (CPI) = on, but should have been off	
2E	Any #		Valve or Closed Position Indicator (CPI) open	Closed Position Indicator (CPI) = off, but should have been on	1) Check wiring to the fuel valves. Ensure fuel valves are wired to the correct terminal (see wiring diagram) With manual shutoff valves closed, ensure that the fuel valves are opening in the proper phase (see sequence diagrams). 2) Check wiring of the CPI (POC) switches. See wiring diagram.
	00				
	01			(Only LMV52) CPI via terminal StartRelease_Gas Closed Position Indicator (CPI) = off, but should have been on	
2F	Any #		Gas Pressure has dropped below minimum Limit	Low Gas Pressure switch is open	1) Check gas supply and / or manual shutoff valves. 2) Check setpoint and or wiring of Low Gas Presure Switch.
30			Gas Pressure has exceeded maximum Limit	High Gas Pressure switch is open	1) Check pressure regulators for ruptured diaphrams. 2) Check setpoint and / or wiring of High Gas Presure Switch.

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
Fault with devices or wiring connected to the Base Unit (LMV5)					
31	Any #	Devices conn. To LMV5	Gas Pressure w Valve proving: Valve on Gas Side leaking	PS(M)-VP (Pressure Switch Valve Proving) has detected pressure between the gas valves during the atmospheric test. Switch opened when should have been closed.	1) Bubble test gas valve to ensure that the upstream valve is not leaking. If leaking, replace. 2) Ensure that the setpoint of the PS(M)-VP is 50% of the pressure upstream of V1 (upstream valve)
32			No Gas Pressure Valve Proving: Valve on Burner Side leaking	PS(M)-VP (Pressure Switch Valve Proving) has detected the absence of pressure between the gas valves during the pressure test. Switch closed when should have been open.	1) Bubble test gas valve to ensure that the downstream valve is not leaking. If leaking replace. 2) Ensure that the setpoint of the PS(M)-VP is 50% of the pressure upstream of V1 (upstream valve)
33			Oil Pressure on although Oil Pump off	Low oil pressure switch is closed when oil pump is not running.	1) Configure oil train so that low oil pressure switch is off when the oil pump is not running. 2) Check to ensure switch is wire Normally Open.
34			Oil Pressure below Minimum	Low oil pressure switch is open when oil pump is running.	1) Ensure oil pressure exists at the switch when the oil pump is running. Adjust pressure reg. if needed. 2) Check to ensure switch is wired Normally Open. Check setpoint of switch.
35			Oil Pressure above Maximum	High Oil Pressure switch is open.	1) Ensure excess oil pressure is not present at the switch. Adjust pressure reg. if needed. 2) Check to ensure switch is wired Normally Closed. Check setpoint of switch.
36			No Start Release for Oil	Switches wired to the start release oil terminal (typically the atomizing media PS) are not closed when anticipated	1) Check setpoint of switches. 2) Ensure switches are closing and opening at the correct times (see sequence diagram)
37			No direct Heavy Oil Start	Switches wired to the direct start heavy oil terminal are not closed when anticipated	
38			Lack of Gas Program	Shortage-of-gas program in progress	1) If repition counter enabled (outside north america) the LMV is wating for gas pressure to return.
Fault with Base Unit (LMV5)					
39	Any #	LMV5	Internal Fault Basic Unit	Parameter of max. safety time faulty	If fault occurs continously, replace LMV5
	01			Fault with timer1	
	02			Fault with timer2	
	03			Fault with timer3	
3A	Any #		No Burner ID defined	No burner identification defined	Enter a unique burner Identification. Typically the burner SN.
3B	Any #		No Service Password defined	No service password defined	Enter a valid service password

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
				Fault with Base Unit (LMV5)	
40	Any #	LMV5	Internal Fault Basic Unit	Wrong contact position of SR relay	If fault occurs sporadically: Improve EMC
41	Any #			Wrong contact position of ignition	Check wiring on igniton transformer
42	Any #			Wrong contact position of BV relay	
	01..FF			The diagnostic value is made up of the following faults or their combinations (the individual diagnostic codes are added up in hexadecimal format)	1) Check to see if any source is feeding back voltage onto the input. If so eliminate the voltage source. 2)Check for switches in the saftey loop that are opening and closing again very quickly. This could be a pressure switch or a low water cut-out that is on the edge of opening and is "chattering". All outputs are powered through the saftey loop, so the microprocessor that monitors the outputs can detect this, resulting in a fault.
	01			Contact position fault SV-oil	
	02			Contact position fault V1-oil	
	04			Contact position fault V2-oil	
	08			Contact position fault V3-oil	
	10			Contact position fault SV-gas	
	20			Contact position fault V1-gas	
	40			Contact position fault V2-gas	
	80			Contact position fault V3-gas	
43	Any #	LMV5	Internal Fault Basic Unit	Fault in connection with plausibility check. For cause of fault, refer to diagnostic code	If fault occurs sporadically: Improve EMC
	01			No fuel selection	Select a fuel externally (by energizing or de-energizing terminals) or selct a fuel through the AZL.
	02			No defined fuel train parameterized or undefined type of fuel	Select the proper fuel trains for gas and or oil (see section 4)
	03			Variable "Train" not defined	Select a fuel externally (by energizing or de-energizing terminals) or selct a fuel through the AZL.
	04			Variable "Fuel" not defined	
	05			Operating mode with LC not defined	
	06			Prepurge time gas too short	The time defined by PrepurgeTmeGas(Oil) is less than the time defined by parameter MinT_PrepurgeGas(Oil). Change so that PrepurgeTmeGas(Oil) is longer than MinT_PrepurgeGas(Oil). See section on settings.
	07			Prepurge time oil too short	
	08			Safety time 1 gas too long	The time defined by Max SafteyTGas(Oil) is less than the time defined by parameter SafteyTmeGas(Oil). Parameter Max SafteyTGas(Oil) can only be changed by Siemens. Lengthen SafteyTmeGas(Oil).
	09			Safety time 1 oil too long	
	0A			Ignition off time > TSA1 gas	If fault occurs sporadically: Improve EMC
	0B			Ignition off time > TSA1 oil	

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
Fault with devices or wiring connected to the Base Unit (LMV5) / or Base Unit (LMV5)					
43	0C	LMV5	Internal Fault Basic Unit	Safety time 2 gas too long	The time defined by Max SafteyTGas(Oil) is less than the time defined by parameter SafteyTmeGas(Oil). Parameter Max SafteyTGas(Oil) can only be changed by Siemens. Lengthen SafteyTmeGas(Oil).
	0D			Safety time 2 gas too long	
44	Any #			Fault at deactivated inputs	Check inputs according to the diagnostic code. Disconnect wires or activate inputs for the specific application. Information concering the configuration of the terminals can be found in section 4.
	01		Controller connected but deactivated	Controller input (burner on / off switch) connected but deactivated, Terminal X5-03.01	
	02		Air Press Switch connected but deactivated	APS connected but deactivated, Terminal X3-02.01	
	03		FCC / FGR – APS connected but deactivated	FCC / FGR – PS connected but deactivated, Terminal X4-01.03	
	04		Gas Pressure min connected but deactivated	Low gas pressure switch connected but deactivated, Terminal X9-03.04	
	05		Gas Pressure max connected but deactivated	High gas pressure switch connected but deactivated, Terminal X9-03.03	
	06		Oil Pressure min connected but deactivated	Low oil pressure switch connected but deactivated, Terminal X5-01.02	
	07		Oil Pressure max connected but deactivated	High oil pressure switch connected but deactivated, Terminal X5-02.03	
	08		Start Signal Oil connectedbut deactivated	Start release oil connected but deactivated, Terminal X6-01.01	
	09		HO Start connected but deactivated	HO start connected but deactivated, Terminal X6-01.03	
	0A		Start Signal Gas connected but deactivated	Start signal gas connected but deactivated, Terminal X4-03.03	
45	Any #		Locked by SLT	Shutdown via SLT test	SLT was activated and safety shutdown was triggered (usually by the Saftey Loop Opening)

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
				Fault with Base Unit (LMV5)	
46	Any #	LMV5	Programstop active	Program stop was activated. System has stopped at the parameterized position	Deactivate the program stop if no longer required.
	01			Program stop in Phase 24 (driving to Prepurge position) active.	
	02			Program stop in Phase 32 (Prepurge) active	
	03			Program stop in Phase 36 (Ignition position) active	
	04			Program stop in Phase 44 (Interval 1) active	
	05			Program stop in Phase 52 (Interval 2) active	
	06			Program stop in Phase 72 (driving to Postpurge position) active	
	07			Program stopin Phase 76 (Pospurge) active	
47	Any #		No Start Release for Gas	Start release gas = off	Check the configuration of Terminal X7-03.02. Deactivate terminal if not used. See section 4 as a guide for configuration of the terminal.
48			2 Flame Signals with 1 Detector Operation	System parameterized for 1-detector operation but 2 flame signals present	Check flame detector wiring. If two detector operation is desired, configure the LMV52 for this type of operation. See section 4.
50			Internal Fault Basic Unit	Fault during key value check	If fault occurs sporadically improve EMC. If fault occurs continously, replace LMV5
	00..07			Number of time block in which the fault was detected	
51	Any #			Time block overflow	
	00..07			Number of time block in which the fault was detected	
52	Any #			Stack error	
	01			Stack overflow	
	02			Value dropped below preset minimum limit	
	03			Test values in stack range exceeded	
53	01			Faulty reset state has occurred	
58	Any #		Parameter Set damaged	Internal communication (µC1 <> µC2)	1) Reset the LMV5 2) If fault occurred after changing a parameter, check the parameters that were last changed. 3) If fault cannot be rectified by the reset: Restore parameters form the AZL to the LMV5 4) Replace the LMV5
59				After initialization, EEPROM page is on ABORT (last parameterization was possibly interrupted due to a power failure)	
59				Page number	
5A				CRC error of a parameter page	

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
Fault with Base Unit (LMV5)					
5A	Any #	LMV5	Parameter Set damaged	Page number	1) Reset the LMV5 2) If fault occurred after changing a parameter, check the parameters that were last changed. 3) If fault cannot be rectified by the reset: Restore parameters form the AZL to the LMV5 4) Replace the LMV5
5B				Page is on ABORT	
5B				Page number	
5C			Parameter Backup Restore	Page is on WR_RESTO. A backup restore was made	1) Reset the LMV5
				Page number	
5D			Internal Fault Basic Unit	Page open too long	1) Reset the LMV5 2) If fault occurred after changing a parameter, check the parameters that were last changed. 3) If fault cannot be rectified by the reset: Restore parameters form the AZL to the LMV5 4) Replace the LMV5
				Page number	
5E				Page has an undefined status	
				Page number	
5F			Parameter Set damaged	Last backup restore invalid (was interrupted)	Repeat parameter set download (from AZL to LMV5)
60			Internal Fault Basic Unit	Fault when copying a parameter page	1) Reset the LMV5 2) If fault occurred after changing a parameter, check the parameters that were last changed. 3) If fault cannot be rectified by the reset: Restore parameters form the AZL to the LMV5 4) Replace the LMV5
				Number of parameter page	
61				Fault in connection with EEPROM initialization	
	01			Fault during initialization of EEPROM	
	02			Number of write attempts exceeded	
	10			EEPROM was busy when accessed	
	11			Comparison of EEPROM and RAM area revealed dissimilarity	
	12			Page area of EEPROM exceeded during write process	
	13			Access conflict µC1 <> µC2 (aritation)	
	20			Fault when calling the "ParAccess()" function	
	21			Written EEPROM block unequal RAM block	
	22			CRC of page is faulty	
	23			Matching fault µC1, µC2 when saving the error page	
70	Any #			Fault during restoring of lockout information	If fault occurs sporadically improve EMC. If fault occurs continously, replace LMV5
	01			When reading from EEPROM (initialization)	
	02			When test writing in the initialization	
	03			No write access to error page in init.	
	04			Rep. counter "Internal fault" has elapsed	

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
				Fault with Base Unit (LMV5)	
71	Any #	LMV5	Manual Lockout	Lockout was made manually via contact	This lockout occurs when escape and enter on the AZL are pressed simutanously. This lockout also occurs when the remote reset X4-01.4 is energized when a alarm condition does not exist.
72	Any #		Internal Fault Basic Unit	Plausibility fault in connection with fault entry	If fault occurs sporadically improve EMC. If fault occurs continously, replace LMV5
	01			Fault in "seterr()"	
	02			Fault in "seterr()"	
	03			Fault in "error_manager()"	
	04			Fault in "storeerr()"	
				Fault with Connected actuators	
80	Any #	Aux 3 Act.	Fault Feedback Aux Actuator 3	Basic unit has detected wrong state of the Aux 3 actuator	1) This fault occurs when a un-addressed actuator is connected to the CANBus. It is normal to see this fault when a un-addressed actuator is connected to the CANBus. Addressing the actuator should eliminate the fault. 2) Check CANBus cabling. Ensure that all cable shields (screens) which are located in the cable sheath are terminated correctly at each actuator, O2 module, and at the LMV5x... 3) Check each CANBus Connector to ensure proper termination (no conductors exposed on the back of the plug) 4) If fault occurs sporadically: Improve EMC. 5) If fault occurs constantly: Replace actuator according to diagnostic code.
	01			CRC error	
	02			Key error main loop counter	
	03			No feedback for max. number	
81	Any #	Air Act.	Fault Feedback Air Actuator	Basic unit has detected wrong state of the air actuator	
	01			CRC error	
	02			Key error main loop counter	
	03			No feedback for max. number	
82	#	Gas / Oil Act.	Fault Feedback Gas (Oil) Actuator	Basic unit has detected wrong state of the gas actuator	
	01			CRC error	
	02			Key error main loop counter	
	03			No feedback for max. number	
83	Any #	Oil Act.	Fault Feedback Oil Actuator	Basic unit has detected wrong state of the oil actuator	
	01			CRC error	
	02			Key error main loop counter	
	03			No feedback for max. number	
84	Any #	Aux 1 Act.	Fault Feedback Aux Actuator 1	Basic unit has detected wrong state of the auxiliary actuator	
	01			CRC error	
	02			Key error main loop counter	
	03			No feedback for max. number	
85	Any #	Aux 2 Act.	Fault Feedback Aux Actuator 2	Basic unit has detected wrong state of the auxiliary actuator	
	01			CRC error	
	02			Key error main loop counter	
	03			No feedback for max. number	

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
FAULT WITH BASE UNIT (LMV5) OR AZL5					
86	Any #	LMV5	Fault Feedback Load Controller	Basic unit has detected wrong state of the internal load controller	If fault occurs sporadically improve EMC. If fault occurs continously, replace LMV5
	01			CRC error	
	02			Key error main loop counter	
	03			No feedback for max. number	
87	Any #	AZL5	Fault Feedback AZL	Basic unit has detected wrong state of the AZL…	1) Check CANBus cabling. Ensure that all cable shields (screens) which are located in the cable sheath are terminated correctly at each actuator, O2 module, and at the LMV5 2) Check each CANBus Connector to ensure proper termination (no conductors exposed on the back of the plug) 3) If fault occurs sporadically: Improve EMC. 4) Replace AZL5...
	01			CRC error	
	02			Key error main loop counter	
	03			No feedback for max. number	
88	Any #	All		Plausibility fault NMT	If fault occurs constantly: Replace defective AZL5…(see diagnostic code) or basic unit
	01	Air Act.	Fault Feedback Actuator	Undefined fault class of SA	
	02	LMV5	Fault Feedback Load Controller	Undefined fault class of LC	
	03	AZL5	Fault Feedback AZL	Undefined fault class of AZL	
	04	VSD module	Fault Feedback VSD Module	Undefined fault class of VSD module	
	05	O2 Mod.	Fault Feedback O2 Module	Undefined fault class of O2 module	
FAULT WITH CONNECTED ACTUATORS					
90	Any #	Aux 3 Act.	Fault Feedback Aux Actuator 3	Basic unit has detected a ROM-CRC error on the air actuator when checking its feedback signal	1) Check CANBus cabling. Ensure that all cable shields (screens) which are located in the cable sheath are terminated correctly at each actuator, O2 module, and at the LMV5x... 2) Check each CANBus Connector to ensure proper termination (no conductors exposed on the back of the plug) 3) If fault occurs sporadically: Improve EMC. 4) If fault occurs constantly: Replace actuator according to diagnostic code.
91		Air Act.	Fault Feedback Air Actuator	Basic unit has detected a ROM-CRC error on the air actuator when checking its feedback signal	
92		Gas / Oil Act.	Fault Feedback Gas (Oil) Actuator	Basic unit has detected a ROM-CRC error on the gas actuator when checking its feedback signal	
93		Oil Act.	Fault Feedback Oil Actuator	Basic unit has detected a ROM-CRC error on the oil actuator when checking its feedback signal	
94		Aux 3 Act.	Fault Feedback Aux Actuator 1	Basic unit has detected a ROM-CRC error on the auxiliary actuator when checking its feedback signal	

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
Fault with Connected actuators, Base Unit (LMV5), or AZL					
95	Any #	Aux 3 Act.	Fault Feedback Aux Actuator 3	Basic unit has detected a ROM-CRC error on the auxiliary actuator when checking its feedback signal	1) Check CANBus cabling. Ensure that all cable shields (screens) which are located in the cable sheath are terminated correctly at each actuator, O2 module, and at the LMV5x... 2) Check each CANBus Connector to ensure proper termination (no conductors exposed on the back of the plug) 3) If fault occurs sporadically: Improve EMC. 4) If fault occurs constantly: Replace actuator or AZL5. according to diagnostic code.
96		LMV5	Fault Feedback Load Controller	Basic unit has detected a ROM-CRC error on the load controller when checking its feedback signal	
97		AZL5	Fault Feedback AZL	Basic unit has detected a ROM-CRC error on the AZL… when checking its feedback signal	
98		All	Fault two equal Addresses	There are several components with the same address on the CAN bus (CAN overflow)	Check to see if two actuators are addressed identically. If so, erase the address on the incorrect actuator (hold red button down about 10 seconds) and re-address
99			Internal Fault Basic Unit	CAN is in bus off	1) Check CANBus cabling. Ensure that all cable shields (screens) which are located in the cable sheath are terminated correctly at each actuator, O2 module, and at the LMV5x... 2) Check each CANBus Connector to ensure proper termination (no conductors exposed on the back of the plug) 3) If fault occurs sporadically: Improve EMC. 4) If fault occurs constantly: Replace AZL5.., LMV5
9A	Any #			CAN warning level. Fault probably occurred when connecting or disconnecting a CAN bus user	
9B				CAN queue overrun	
	01			Overrun of RX queue	
	02			Overrun of TX queue	
A0	See A1				
A1	Any #	Air Act.	Internal Fault Air Actuator	Air actuator has detected own fault and reported it to the basic unit. Type of fault: See diagnostic code	1) Check CANBus cabling. Ensure that all cable shields (screens) which are located in the cable sheath are terminated correctly at each actuator, O2 module, and at the LMV5x... 2) Check each CANBus Connector to ensure proper termination (no conductors exposed on the back of the plug) 3) If fault occurs sporadically: Improve EMC. 4) If fault occurs constantly: Replace air actuator
	01			CRC fault during ROM test	
	02			CRC fault during RAM test	
	04			Fault during key value check	
	05			Error code for time block overflow	
	07			Sync fault or CRC fault	
	08			Error code for main loop counter	
	09			Fault during stack test	

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
			Fault with Connected actuators		
A1	0C	Air Act.	Overtemperature Air Actuator	Temperature warning and shutdown	Check the housing temperature of the Air actuator. Max housing temperature 140 F
	0D		Internal Fault Air Actuator	Actuator turns in the wrong direction	Verify that the air damper is not bound. A bound air damper will cause the actuator to trip on overcurrent. During this short trip the actuator can be momentarily pushed backwards by torsional effects.
	0E		Ramp time too short Air Actuator	Actuator operates with too short a ramp time, or with an angular rotation that is too long for the ramp time	1) Match ramp time to the slowest connected actuator (SQM48.4 30 sec, SQM48.6 60sec.) 2) Check the CanBus power supply. Verify fuses FU2 and FU3 are ok. Verify CanBus is not overloaded. (See Section 3)
	10		Internal Fault Air Actuator	Timeout during A/D conversion	1) If fault occurs sporadically: Improve EMC. 2) If fault occurs constantly: Replace Air Actuator.
	11			Fault during ADC test	
	12			Fault during A/D conversion	
	13		Position Fault Air Actuator	Actuator is outside the valid angular rotation (0-90°) or linearization data are faulty	Check to see if actuator is within the valid positioning range (0-90°) When the actuator is not powered, it could be moved out of the valid positioning range. Take power off the actuator and position shaft back within the valid positioning range.
	15		Internal Fault Air Actuator	CAN fault	1) Check CANBus cabling. Ensure that all cable shields (screens) which are located in the cable sheath are terminated correctly at each actuator, O2 module, and at the LMV5x... 2) Check each CANBus Connector to ensure proper termination (no conductors exposed on the back of the plug)
	16			CRC fault of a parameter page	
	17			Page too long open	1) Reset the LMV5 2) If fault occurred after changing a parameter, check the parameters that were last changed. 3) If fault cannot be rectified by the reset: Restore parameters form the AZL to the LMV5 4) Replace the LMV5
	18			Page disrupted	
	19			Invalid parameter access	
	1B			Fault during copying of parameter page	
	1E			External plausibility fault. This type of fault covers possible faults occurring due to invalid presettings in the drive commands. In response, the presettings will be ignored	1) Check the paramters related to special positions. The special positions of each activated actuator should be programmed between 0 to 90 degrees.
	1F			Internal plausibility fault. This type of fault covers possible faults that can occur due to strong EMC impact	1) If fault occurs sporadically: Improve EMC.

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
FAULT WITH CONNECTED ACTUATORS					
A2	See diagnostic codes for A1 error codes. These dianostic codes are identical, except they apply to the Gas / Oil Actuator.				
A3	See diagnostic codes for A1 error codes. These error codes are identical, except they apply to the Oil Actuator.				
A4	See diagnostic codes for A1 error codes. These error codes are identical, except they apply to the Aux 1 Actuator.				
A5	See diagnostic codes for A1 error codes. These error codes are identical, except they apply to the Aux 2 Actuator.				
FAULT WITH BASE UNIT (LMV5) INTERNAL LOAD CONTROLER					
A6	Any #	LMV5 Load Cont. Mod.		Internal load controller has detected a fault. Type of fault: See diagnostic code	
	10		No actual Value Slope at End of Identification		If fault occurs sporadically improve EMC. If fault occurs continously, replace LMV5
	12		Adaption invalid	Invalid XP identified	
	13			Invalid TN identified	
	14			TU longer than identification time	
	15			Invalid TN identified	
	16		Timeout with Adaption	Timeout during observation time	PV (Process Varible) is not changing in response to firing rate during the adaption time. Adaption times out due to lack of change in the measured PV. Check sensor and thermal system.
	17		Cold Start thermal Shock Protection active	A warning indicating that the Cold Start Thermal Shock Protection (CSTP) is activated	This can be deactivated, if desired. See parameters concerning the load controller in section 4.
	18		Timeout with Adaption	Timeout during delivery of adaption rate and while process is being watched	PV (Process Varible) is not changing in response to firing rate during the adaption time. Adaption times out due to lack of change in the measured PV. Check sensor and thermal system.
	22		Setpoint Temp Controller above maximum Limit	The current setpoint (W1, W2, W3) is above the value of the Internal temperature limiter.	Raise the value of the internal temperaure limiter or decrease current setpoint.
	30		Internal Fault Load Controller	EEPROM does not respond within the expected period of time	If fault occurs sporadically improve EMC. If fault occurs continously, replace LMV5
	31			Max. number of EEPROM attempts exceeded	
	32			Fault during opening of page	
	33			Invalid CRC when reading a page	Reset the unit. Restore parameters from AZL.
	34			Page cannot be set to FINISH	If fault occurs sporadically improve EMC. If fault occurs continously, replace LMV5
	35			No access to PID after identification	
	36			No access to PIDStandard after identification	
	37			No reading of EEPROM write access for PID possible	
	38			No EEPROM write access for PID possible	

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
FAULT WITH BASE UNIT (LMV5) INTERNAL LOAD CONTROLER					
A6	39	LMV5 Load Cont. Mod.	Internal Fault Load Controller	No EEPROM write access for PIDStandard possible	If fault occurs sporadically improve EMC. If fault occurs continously, replace LMV5
	3A			No access if reception via COM	
	3B			Invalid page access	
	40			Page too long open	1) Reset the LMV5 2) If fault occurred after changing a parameter, check the parameters that were last changed. 3) If fault cannot be rectified by the reset: Restore parameters form the AZL to the LMV5 4) Replace the LMV5
	41		Internal Fault Load Controller	Invalid phase during parameterization of the safety-related page P_TW	If fault occurs sporadically improve EMC. If fault occurs continously, replace LMV5
	42			Invalid phase during parameterization of the safety-related page P_STATUS	
	43			Invalid phase during parameterization of the safety-related page P_SYSTEM	
	44		Parameter Set damaged	Page has been set to ABORT	1) Reset the LMV5 2) If fault occurred after changing a parameter, check the parameters that were last changed. 3) If fault cannot be rectified by the reset: Download parameters form the AZL to the LMV5 4) Replace the LMV5
	45		Parameter Backup Restore	Page has been set to RESTO	
	46		Internal Fault Load Controller	Page has an invalid status	
	4A			CAN error	If fault occurs sporadically improve EMC. If fault occurs continously, replace LMV5
	4B			CAN error	
	4C			CAN error	
	4D			CAN error	
	4E			CAN error	
FAULT WITH SENSORS CONNECTED TO INTERNAL LOAD CONTROLLER, IN BASE UNIT (LMV5)					
A6	50	LMV5 Load Cont. Mod.	Short-circuit Pt100 Sensor	Short-circuit sensor PT100 Terminals X60.1, X60.4	Check temperature sensors connected to X60 terminals.Check wiring and sensor. Re-wire or replace sensors if necessary.
	51		Open-circuit Pt100 Sensor	Open-circuit sensor PT100 Terminals X60.1 X60.4	
	52		Open-circuit Pt 100 Sensor (Line Compens)	Open-circuit compensation line of sensor PT100 Terminals X60.2 X60.4	
	53		Short-circuit Pt1000 Sensor	Short-circuit sensor PT1000 Terminals X60.3, X60.4	

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
FAULT WITH SENSORS CONNECTED TO INTERNAL LOAD CONTROLLER, IN BASE UNIT (LMV5)					
A6	54	LMV5 Load Cont. Mod.	Open-circuit PT1000 Sensor	Open-circuit sensor PT1000 Terminals X60.3, X60.4	Check temperature sensors wired to X60, and pressure sensors wired to X61.Check wiring and sensor. Re-wire or replace sensors if necessary.
	55		Short-circuit Ni1000 Sensor	Short-circuit sensor Ni1000 Terminals X60.3, X60.4	
	56		Open-circuit Ni1000 Sensor	Open-circuit sensor Ni1000 Terminals X60.3, X60.4	
	57		Overvoltage at Input 2	Overvoltage at input 2 Terminals X61	
	58		Open-circuit / Short-circuit at Input 2	Open-circuit / short-circuit input 2 Terminals X61 Boiler sensor (7MF) could be seeing a vacuum	
	59		Overvoltage at Input 3	Overvoltage at input 3 Terminals X62	
	5A		Open-circuit / Short-circuit at Input 3	Open-circuit / short-circuit input 3 Terminals X62	
FAULT WITH BASE UNIT (LMV5) INTERNAL LOAD CONTROLER					
A6	60	LMV5 Load Cont. Mod.	Internal Fault Load Controller	Timeout during calibrate_ADC	If fault occurs sporadically improve EMC. If fault occurs continously, replace LMV5
	61			Timeout during read_conversion	
	62			Timeout during calibrate_ADC	
	63			Fault during RedInv reading from A/D converter	
	64			Fault internal A/D converter	
	65			Gain register has been changed	
	66			Offset register has been changed	
	67			Too great / small gain for self-calibration of A/D converter	
	68			Too great / small offset for self-calibration of A/D converter	
	69			Fault internal A/D converter	
	6A			Fault during PWM test	
	6B			Faulty reference voltage	
	6C			Fault transmitter power supply	
	6D			Fault analog output, voltage deviation too great	
	6E			Fault during resistance test PT100 input (X60)	
	6F			Fault during diode test PT100 input	

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
Fault with Sensors Connected to Internal Load Controller, in Base Unit (LMV5)					
A6	70	LMV5 Load Cont. Mod.	External Fault Load Controller	Measured value varies too much: PT100 sensor (Terminals X60)	1) Check wiring and sensor. Re-wire or replace sensors if necessary. 2) Use shielded cable on sensor wiring. 3) Make sure that sensor wiring is not run next to high voltage AC wiring. 4) If the diagnostic code indicates excsssive voltage, check input with meter. Trace voltage source.
	71			Measured value varies too much: PT100 line (Terminals X60)	
	72			Measured value varies too much: PT1000 (Terminals X60)	
	73			Measured value varies too much: PWM	
	74			Measured value varies too much: Voltage measurement input 2 (Terminals X61)	
	75			Measured value varies too much: Voltage measurement input 2 (Terminals X61)	
	76			Measured value varies too much: Voltage measurement input 3 (Terminals X62)	
	77			Measured value varies too much: Current measurement input 3 (Terminals X62)	
	78			Excessive voltage value or wrong polarity PT100 sensor (Terminals X60)	
	79			Excessive voltage value or wrong polarity PT100 line (Terminals X60)	
	7A			Excessive voltage value or wrong polarity PT1000 (Terminals X60)	
	7B			Excessive voltage value or wrong polarity PWM	
	7C			Excessive voltage value or wrong polarity voltage measurement input 2 (Terminals X61)	
	7D			Excessive voltage value or wrong polarity current measurement input 2 (Terminals X61)	
	7E			Excessive voltage value or wrong polarity voltage measurement input 3 (Terminals X62)	
	7F			Excessive voltage value or wrong polarity current measurement input 3 (Terminals X62)	
	80		Internal Fault Load Controller	Fault during internal muliplexer test PT100 sensor	If fault occurs sporadically improve EMC. If fault occurs continously, replace LMV5
	81			Fault during internal multiplexer test PT100 line	
	82			Fault during internal multiplexer test PT100	
	90			Number of maximum sync failures exceeded	
	91			Wrong CRC during SYNC message	
	92			Wrong CRC during PDO message	
	93			Main loop counter does not agree with basic unit	
	96			Fault during multiplexer test	
	97			Paraccess with FINISH unsuccessful	

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
FAULT WITH BASE UNIT (LMV5) INTERNAL LOAD CONTROLER					
A6	9B	LMV5 Load Cont. Mod.	Internal Fault Load Controller	Fault PageAccess, invalid access status	If fault occurs sporadically improve EMC. If fault occurs continously, replace LMV5
	9C			Fault voltage monitor test	
	9E			Fault during readout of PDO message	
	A0			XP smaller than min. value	
	A1			XP larger than max. value	
	A2			TN smaller than min. value	
	A3			TN larger than max. value	
	A4			TV smaller than min. value	
	A5			TV larger than max. value	
	A6			Parameter outside the permissible range	
	A7		Inadmissible Selection aux Sensor Cold Start	Inadmissible selection of the auxiliary sensor	When using the auxiliary temperature sensor for cold start, a temperature sensor must be selected at input 1 or 4
	B0		Internal Fault Load Controller	Red/Inv fault with float variables	If fault occurs sporadically improve EMC. If fault occurs continously, replace LMV5
	B1			Red/Inv fault of a Red/Inv variable	
	B2			Fault during key value check	
	B4			Fault in fault routine	
	B5			Step to invalid interrupt vector	
	B6			Time block too long: Time block 0	
	B7			Time block too long: Time block 1	
	B8			Time block too long: Time block 2	
	B9			Time block too long: Time block 3	
	BA			Time block too long: Time block 4	
	BB			Time block too long: Time block 5	
	BC			Time block too long: Time block 6	
	BD			Time block too long: Time block 7	
	C0			CRC fault in page	
	E0			Identpower	
	E1			Controller parameter KP	
	E2			Scanning time	
	EA			Invalid branch in eeprom module()	
	EB			Invalid branch in eeprom module()	
	EC			Invalid branch in eeprom module()	
	ED			Invalid branch in eeprom module()	

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
FAULT WITH BASE UNIT (LMV5) INTERNAL LOAD CONTROLLER					
A6	EE	LMV5 Load Cont. Mod.	Internal Fault Load Controller	Invalid branch in eeprom module()	If fault occurs sporadically improve EMC. If fault occurs continously, replace LMV5
	EF			Invalid branch in eeprom module()	
	F0			Fault during ROM test	
	F1			Fault during RAM test	
	F2			Fault during RAM test, register bank 0	
	F3			Fault during RAM test, IDATA range	
	F4			Fault during RAM test, XDATA range	
	F5			Stack pointer does not point at stack	
	F6			Stack overflow	
	FE			Fault messages in fault management	
	FF			Fault messages in fault management	
FAULT WITH AZL5...					
A7	Any #	AZL	Internal Fault AZL	AZL5…has detected a fault.	1) Check CANBus cabling. Ensure that all cable shields (screens) which are located in the cable sheath are terminated correctly at each actuator, O2 module, and at the LMV5x... 2) Check each CANBus Connector to ensure proper termination (no conductors exposed on the back of the plug) 3) If fault occurs sporadically: Improve EMC. 4) If fault occurs constantly: Replace AZL5...
	01			CRC fault during ROM test	
	02			CRC fault during RAM test	
	04			Fault during key value check	
	05			Time block overflow	
	07			Sync fault or CRC fault	
	08			Fault main loop counter	
	09		Manual Lockout AZL	Fault message for emergency off function via AZL…	This message is dispayed if escape and enter on the AZL are pressed simulaneously, causing a manual lockout. Can be reset normally.
	0A		Internal Fault AZL	Invalid AZL5… page	1) If fault occurs sporadically: Improve EMC. 2) If fault occurs constantly: Replace AZL5…
	0B		>250,000 startups, service required	250,000 Cycles have been exceeded. Internal parts in the LMV5.. Are close to the end of their life.	Replace LMV5
	0C		Internal Fault AZL	Save fault parameter	1) If fault occurs sporadically: Improve EMC. 2) If fault occurs constantly: Replace AZL5…

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
			FAULT WITH AZL5...		
A7	0D	AZL	Menu for Oil. Current Fuel is Gas	Fuel changeover from oil to gas when a "oil only" menu is being viewed.	Escape out of currnet menu, or change the fuel that is selected.
	0E		Menu for Gas. Current Fuel is Oil	Fuel changeover from gas to oil when a "gas only" menu is being viewed.	
	15		Internal Fault AZL	CAN queue fault	1) If fault occurs sporadically: Improve EMC. 2) If fault occurs constantly: Replace AZL5…
	16			CAN overflow fault	
	17			CAN busoff	1) Check CANBus cabling. Ensure that all cable shields (screens) which are located in the cable sheath are terminated correctly at each actuator, O2 module, and at the LMV5x... 2) Check each CANBus Connector to ensure proper termination (no conductors exposed on the back of the plug) 3) Check the wiring of the CANBus power supply (12 VAC Transformer). Ensure that Fuses FU2 and FU3 are not blown. Ensure that the CANBus power supply is not overloaded (too many actuators on CanBus)
	18			CAN warning level	1) If fault occurs sporadically: Improve EMC. 2) If fault occurs constantly: Replace AZL5…
	1A			EEPROM fault	
	1B		No valid Parameter Backup	Fault during copying of a parameter page	1) Back up LMV5 pararmeters to AZL. A prompt for this comes up when exiting the parameters & display menu.
	1C		Internal Fault AZL	Page in EEPROM was disrupted, has been restored	1) If fault occurs sporadically: Improve EMC. 2) If fault occurs constantly: Replace AZL5…
	20			Display fault	
	22			RTC is locked, permanently busy	
	24			Buffer for page copies too small	
	28			Time stamp could not be sent	
	30		Fault Communication eBUS	Fault in connection with eBUS communication	Check wiring on RJ45 connector, located on the underside of the AZL5..
	38		Internal Fault AZL	Interface mode could not be terminated	Reset the unit.

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
FAULT WITH AZL5...					
A7	40		Communication AZL with PC tool	Parameterization fault PC tool. Disclosed by key value check in AZL	Check cable between AZL and PC. A null modem adapter must be used on the 9 pin connector if the cable does not have this internally. A USB to serial adapter is OK to use when connecting the AZL to a laptop.
	88		Internal Fault AZL	RAM fault with redundant inverse variables	1) If fault occurs sporadically: Improve EMC. 2) If fault occurs constantly: Replace AZL5…
	89	AZL		Program run fault, execution of program code that will probably never be executed	
	8A	AZL		Unintentional watchdog reset	
FAULT WITH BASE UNIT (LMV5) VSD MODULE					
A9	Any #	LMV5 VSD module			
	01		Internal Fault VSD Module	CRC fault during ROM test	1) If fault occurs sporadically: Improve EMC. 2) If fault occurs constantly: Replace LMV5
	02			CRC fault during RAM test	
	04			Fault during key value check	
	05			Error code for time block overflow	
	07			Sync fault or CRC fault	
	08			Error code for main loop counter	
	09			Fault during stack test	
	0A			Max IRQ speed reached	1) Possibly interference on the line to the speed sensor, check cable routing, use shielded cable. 2) If fault occurs sporadically: Improve EMC. 3) If fault occurs constantly: Replace VSD Module.
	0C		Alarm from VSD	Fault has been triggered by the VSD.	1) This indicates that a fault has been relayed to the LMV5 from the VSD via the VSD alarm input terminal. This indicates a fault in the VSD, not the LMV5. Thus, check the VSD error codes and take action based on those codes. 2) Check VSD settings (ramps, motor settings), increase ramp time on VSD and basic unit, if necessary. 3) Check Motor and VSD for proper sizing.

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
FAULT WITH BASE UNIT (LMV5) VSD MODULE					
A9	0D	LMV5 VSD module	Control Range Limitation VSD Module	VSD module could not offset speed differential within its control limits	1) This indicates that that the LMV5 has decreased its signal to the VSD as much as possible and the motor RPM is still to high. Increase VSD / LMV52 ramp times. Also increase VSD braking if possible. 2) Re-standardize the speed. Ensure that the air damper is at purge position for the standardization (should do this automatically if the air damper is set to air-infulencing) 3) Be sure to check combustinon after the re-standardization.
	0E	VSD module	Internal Fault VSD Module	Fault during the speed calculation test	1) If fault occurs sporadically: Improve EMC. 2) If fault occurs constantly: Replace LMV5
	15			CAN bus fault, disturbed CAN bus transmissions	1) Check CANBus cabling. Ensure that all cable shields (screens) which are located in the cable sheath are terminated correctly at each actuator, O2 module, and at the LMV5x... 2) Check each CANBus Connector to ensure proper termination (no conductors exposed on the back of the plug) 3) Check terminating resistors for correct position.
	16			CRC fault of a parameter page	1) Reset the LMV5 2) If fault occurred after changing a parameter, check the parameters that were last changed. 3) If fault cannot be rectified by the reset: Restore parameters form the AZL to the LMV5 4) Replace the LMV5
	17			Page too long open	
	18			Page disrupted	
	19			Invalid access to parameters	
	1B			Fault when copying a parameter page	
	1E		Internal Fault VSD Module	External plausibility fault. This type of fault covers possible faults occurring due to invalid presettings in the drive commands. In response, the presettings will be ignored.	Check the special positions for valid value range (0-100 %)
	1F		Internal Fault VSD Module	Internal plausibility fault. This type of fault detects faults that cannot practically occur...	1) If fault occurs sporadically: Improve EMC. 2) If fault occurs constantly: Replace LMV5
FAULT WITH O2 MODULE (PLL5..)					
AB	Any #	PLL5..	Fault O2 Module	The PLL5… has detected a fault.	
	01		Internal Fault O2 Module	CRC fault during ROM test	1) If fault occurs sporadically: Improve EMC. 2) If fault occurs constantly: Replace PLL5..
	02			CRC fault during RAM test	
	04			Fault during key value check	
	05			Error code for time block overflow	

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
Fault with O2 Module (PLL5..) or Oxygen Sensor (QGO2..)					
AB	07	PLL5..	Internal Fault O2 Module	Sync fault or CRC fault	1) If fault occurs sporadically: Improve EMC. 2) If fault occurs constantly: Replace PLL5..
	08			Error code for main loop counter	
	09			Fault during stack test	
	0A			Feedback values invalid	
	10		Unplaus Value Nernst Voltage O2 Module	Nernst voltage outside the valid range	1) Check the wiring between the O2 Module and the O2 sensor. Ensure high and low voltage are in seperate conduits. 2) Check the power supply to the O2 Module 3) Check fuse in the O2 Module 4) Check the heating control on the O2 Sensor 5) Check the temperature inside the O2 Sensor terminal box. Should be between -13 and 248° F 5) If fault occurs constantly, Replace O2 Sensor and / or Module.
	12		Unplaus Value Thermocouple O2 Module	Thermocouple voltage outside the valid range	
	13		Unplaus Value Compensation Element	Compensation element voltage outside the valid range	
	15		Unplaus Value Flue Gas Temp O2 Module	Temperature of combustion air sensor outside the valid range (-20...+400 °C)	1) Check the wiring between the O2 Module and the O2 sensor. 2) Check the ambient / Flue gas temperature. Compare to valid range.
	16		Unplaus Value Flue Gas Temp O2 Module	Temperature of flue gas sensor outside the valid range (-20...+400 °C)	
	17		Internal Fault O2 Module	Fault during combustion air temperature sensor test	1) Check the wiring between the O2 Module and the O2 sensor. 2) If fault occurs constantly, Replace O2 Sensor and / or Module
	18			Fault during thermocouple test	
	19			Fault during compensation element test	
	1A			Fault during channel comparison of O2 signal	
	1B			Fault ADC test voltages	
	20		O2 Sensor Temp too low	Temperature of QGO measuring cell too low	1) Check the temperature of heated sensor (can be viewed on AZL) Minimum operating termperature is 1202 F, Maximum 1382 F. If the O2 sensor could take up to 20 minutes to reach temperature. 2) Ensure O2 sensor is installed properly (see section 2) and that stack gas velocity is correct. Min =3.2 ft / sec Max = 32 ft/ sec. 3) Check the power supply to the O2 Module 4) Check fuse in the O2 Module
	21		O2 Sensor Temp too high	Temperature of QGO measuring cell too high	
	22		Internal Fault O2 Module	Fault during calculation test	If fault occurs constantly, Replace O2 Sensor and / or Module

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
Fault with O2 Module (PLL5..) or Oxygen Sensor (QGO2..)					
AB	23	PLL5..	Unplaus Value Ri 02 Measuring Cell	Measured internal resistance of the QGO measuring cell is smaller than 5 Ohm or greater than 150 Ohm	1) Check the wiring between the O2 Module and the O2 sensor. 2) O2 Sensor may have reached the end of its service life (Check Resistance through AZL) If greater than 140 - 150 ohms, replace sensor.
	24		Response Time O2 Measuring Cell too long	Measured response time of the QGO measuring cell exceeds 5 s	1) Check mounting position / oirentation of O2 sensor. 2) Check to see if O2 sensor is dirty. Do Not blow out with compresed air when hot! Cool, then blow out with low pressure compressed air. 3) O2 Sensor may have reached the end of its service life (Check Resistance through AZL) If greater than 140 - 150 ohms, replace sensor.
	25		O2 Sensor Test aborted by O2 Module	Fault occurred during O2 sensor test	Check (through the AZL) to see if the measured O2 value is fluctuating.
	30		Internal Fault O2 Module	CAN fault	1) If fault occurs sporadically: Improve EMC. 2) If fault occurs constantly: Replace PLL5..
	31			CRC fault of a parameter page	1) Reset the LMV5 2) If fault occurred after changing a parameter, check the parameters that were last changed. 3) If fault cannot be rectified by the reset: Restore parameters form the AZL to the LMV5 4) Replace the LMV5
	32			Page too long open	
	33			Page disrupted	
	34			Invalid access to parameters	
	38			Fault during copying of a parameter page	
	3E			External plausibility fault. This type of fault covers possible faults occurring due to invalid presettings in the drive commands. In response, the presettings will be ignored.	
	3F			Internal plausibility fault. This type of fault detects faults that cannot practically occur...	
Fault with Base Unit (LMV5)					
B0	Any #	LMV5..	Internal Fault Basic Unit	Fault during test of port outputs	1) If fault occurs sporadically: Improve EMC. 2) If fault occurs constantly: Replace LMV5
	01			Fault when resetting the set outputs	
	02			Fault during ZR test	
B1	01			Fault during short-circuit test between inputs and outputs	

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
FAULT WITH BASE UNIT (LMV5) OR OXYGEN SENSOR (QGO2..)					
B5	Any #	LMV5..		O2 monitor	
	01		Below O2 Min Value	O2 value has dropped below O2 min. value	1) Check the %O2 between the O2 guard curve and the O2 setpoint curve. Increase the %O2 "gap" between these two curves at the load point where the the fault is occuring. 2) Check for mechanical lash (slop) between actuators and dampers / valves. Also check dampers for worn bearings. Change to zero lash flexible couplings if necessary. 3) If necessary, adjust parameters O2 OffsetGas(oil) and / or O2CtrlThreshold
	02		O2 Min Values undefined	Invalid O2 min. value	Set a point for the O2 min Value curve (or O2 Guard Curve) for each point set up on the ratio control curve (12 points on ratio control = 12 points on O2 min Value curve)
	03		O2 Setpoints undefined	Invalid O2 setpoint	Set a point for the O2 setpoints curve (or O2 Control Curve) for each point set up on the ratio control curve (12 points on ratio control = 12 points on O2 setpoints curve)
	04		O2 Delay Time undefined	Invalid O2 delay time	The dealy time has not been measured sucessfully at Point 2 or the highest curve point. See Section 5-1 under O2 trim for possible causes.
	05		Actual O2 Value invalid	No valid actual O2 value in operation for >= 3 s	1) Check the wiring between the O2 Module and the O2 sensor. 2) Check the power supply to the O2 Module
	06		O2 Value Prepurging not reached	During prepurging, the parameterized air oxygen content of +-2 % was not reached	1) Check the parameter "O2 content air". This %O2 must be reached within +/- 2% during prepurge. 2) Check prepurge time. The time that is set may not be long enough to completely purge the boiler. 3) Sensor may be dirty. Do Not blow out with compresed air when hot! Cool, then blow out with low pressure compressed air. 4) O2 Sensor may have reached the end of its service life (Check Resistance through AZL) If greater than 140 - 150 ohms, replace sensor.

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
FAULT WITH BASE UNIT (LMV5) OR OXYGEN SENSOR (QGO2..)					
B5	07	LMV5..	O2 Value in Operation too high	O2 value of 15 % in operation was exceeded	1) Check mounting of O2 sensor. Ensure no air in entering the stack upstream of the sensor. 2) Verivy that the O2 level in the stack is not 15% during operation.
BA	01		O2 Sensor Test aborted	O2 sensor test was not successful. E.g. reset of O2 module during probe test	If fault occurs constantly: Replace PLL5..
BF	Any #		O2 Control and Limiter automatic deactivated	Fault occurred in connection with O2 trim control or with the O2 monitor. It led to automatic deactivation of O2 trim control or the O2 monitor	See B5 Error codes. The will detail the reason for the automatic deactivation.
FAULT WITH BASE UNIT (LMV5) OR CONNECTED COMPONENTS					
C5	Any #	#	Version Conflict	When comparing the versions of the individual units, the AZL5... has detected old versions	Before replacing any units, start the system and wait about 1 minute (until, after entering the parameter level, the display “Parameters will be updated“ disappears). Then, reset. Replace the unit only if the fault message does not disappear. Replace the relevant units by new versions
	01..2F	#		The diagnostic value is made up of the following faults or their combinations (the individual diagnostic codes are added up in hexadecimal format)	
	01	LMV5..		Software of the basic unit too old	Replace the unit(s) called out in the diagnostic code. Be sure that the new unit has up to date software.
	02			Software of the load controller too old	
	04	AZL		Software of the AZL5... too old	
	08	Actuator		Software of 1 or several actuators too old	
	10	LMV5..		Software of VSD module too old	
	20	PLL5..		Software of O2 module too old	
D1	Any #	LMV5..	Fault Feedback VSD Module	Basic unit has detected a wrong state of the VSD module. Corresponds to the "8x"-faults with the other CAN users	1) If fault occurs sporadically: Improve EMC. 2) If fault occurs constantly: Replace LMV5 3)Check CANBus cabling. Ensure that all cable shields (screens) which are located in the cable sheath are terminated correctly at each actuator, O2 module, and at the LMV5x... 4) Check each CANBus Connector to ensure proper termination (no conductors exposed on the back of the plug)
	01			CRC error	
	02			Key error main loop counter	
	03			No feedback for max. number	
D3	Any #	PLL5..	Fault Feedback O2 Module	Basic unit has detected a wrong stage of the O2 module	
	01			CRC error	
	02			Key error main loop counter	
	03			No feedback for max. number	

Error code	Diag. code	Device	Display	Meaning for the LMV5x system	Corrective action
Fault with Base Unit (LMV5) or Connected Components					
E1	Any #	PLL5..	Fault Feedback O2 Module	Basic unit has detected a ROM-CRC fault in the VSD module when checking its feedback signal	1) If fault occurs sporadically: Improve EMC. 2) If fault occurs constantly: Replace LMV5
E3	---			Basic unit has detected a ROM-CRC fault in the O2 module when checking its feedback signal	
F0	---	LMV5..	Internal Fault Basic Unit	Plausibility fault during calculation of interpolation values	
F1	Any #			Internal fault during calculation of precontrol	1) Check to make sure that all curves (Ratio control, O2 Guard and O2 control) are defined at every point in the firing range. If the ratio control curve has 12 points, the O2 guard and the O2 trim must also have 12 points.
	01				
	02				
	03				
	04				
	05				
	06				
	07			Internal fault calculation of precontrol. Undefined value in the curves used for the calculation	
F2	Any #			Code for faulty temperature values from O2 module when calculating the air rate change	
	07			O2 module has delivered invalid value	If fault occurs constantly: Replace LMV5
	08		Flue Gas Temp too high	Flue gas temperature outside the permissible value range	Check flue gas temperature to ensure that it is in the permissible range. Range is 32 to 752 F
	0A		QGO in Heating-up Phase	QGO probe not yet sufficiently heated up	Check the termperature of the O2 Sensor (can be viewd through the AZL). The sensor needs to be a minumum of 1202 F to operate prooperly. Wait up to 20 minutes for sensor to reach operating termpeature.

Section 8 Modbus

Master-slave principle

Communication between Modbus users takes place according to the master-slave principle.
The AZL... always works as a slave.

Data transmission

Transmission mode (RTU)

– The transmission mode used is RTU (Remote Terminal Unit)
– Data are transmitted in binary format (hexadecimal) with 8 bits
– The LSB (least significant bit) is transmitted first
– ASCII operating mode is not supported

Structure of data blocks

All data blocks use the same structure:

Data structure

Slave address	Function code	Data field	Checksum CRC16
1 byte	1 byte	x byte	2 bytes

Every data block contains 4 fields:

Slave address Device address of a certain slave

Function code Function selection (reading / writing words)

Data field Contains the following information:
- Word address
- Number of words
- Word value

Checksum Identification of transmission errors

Checksum (CRC16)

The checksum (CRC16) is used to detect transmission errors. If, during evaluation, an error is detected, the relevant device will not respond.

Calculation scheme

CRC = 0xFFFF			
	CRC = CRC XOR ByteOfMessage		
	For (1 through 8)		
		CRC = SHR (CRC)	
		if (flag shifted at right = 1)	
		then CRC = CRC XOR 0xA001	else
while (not all ByteOfMessage handled)			

The low-byte of the checksum is transmitted first.

Example

Data query: Reading 2 words from address 6 (CRC16 = 0x24A0)

0B	03	00	06	00	02	A0	24
						CRC16	

Reply: (CRC16 = 0x0561)

0B	03	04	00	00	42	C8	61	05
			Word 1		Word 2		CRC16	

Mapping words

B0	B1	B2	B3	B4	B5	B6	B7
Byte High							

B8	B9	B10	B11	B12	B13	B14	B15
Byte Low							

Transmission mode: The LSB (least significant bit) is transmitted first.

Mapping long values

Byte High	Byte Low	Byte High	Byte Low
Word Low		Word High	

Communication process

Start and end of a data block are characterized by transmission pauses. The maximum permissible time between 2 successive characters is 3.5 times the time required for the transmission of once character.
The character transmission time is dependent on the Baud rate and the data format used.

Having a data format of 8 data bits, no parity bit and one stop, the character transmission time is calculated as follows:

Character transmission time [ms] = 1000 * 9 bits / Baud rate

And with other data formats:

Character transmission time [ms] = 1000 * 10 bits / Baud rate

Process

Data query from the master
Transmission time = n characters * 1000 * x bits / Baud rate

Marking for end of data query
3.5 characters * 1000 * x bits / Baud rate

Data query handling by the slave

Reply of slave
Transmission time = n characters * 1000 * x bits / Baud rate

Marking for end of reply
3.5 characters * 1000 * x bits / Baud rate

Example

Marking for data query or end of reply with data format 10 / 9 bits

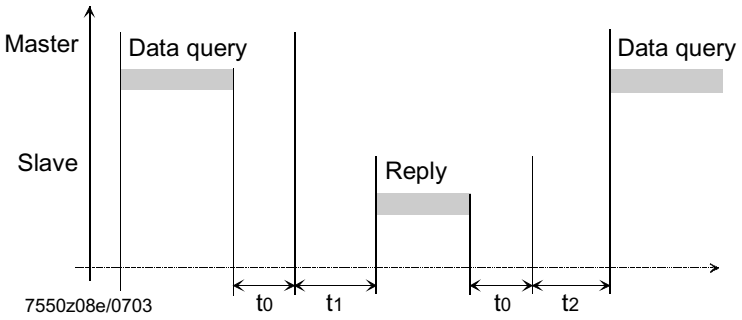
Waiting time = 3.5 characters * 1000 * x bits / Baud rate

Baud rate [Baud]	**Data format** [bit]	**Waiting time** [ms]
9600	10	3.125
	9	2.813

Data query process

Time diagram

A data query is made according to the following time diagram:



where:

t0 Marking for end = 3.5 characters (time is dependent on the Baud rate)

t1 This time is dependent on internal handling; the maximum handling time is dependent on the data type (internal and external data) and on the number of data; for more detailed information, see below!

t2 $t2 \geq 20$ ms
This time is required by the device to switch from transmitting back to receiving; this time must be observed by the master before a new data query is made; it must always be observed, even if a new data query to some other device is made

Communication during the slave's internal handling time

During the slave's internal handling time, the master is not allowed to make any data queries. The slave ignores data queries made during this period of time.

Communication during the slave's reply time

During the slave's reply time, the master is not allowed to make any data queries. Data queries made during this period of time cause all data on the bus at this instant to be deleted.

Number of messages

The number of addresses per message are limited:

- 20 addresses of the size of one word when reading
- 6 addresses of the size of one word when writing

Reply time of AZL... to a message from the master

1. Reading data from the LMV5... system:

1...3 addresses	25...75 ms
4...9 addresses	75...125 ms
10...15 addresses	125...175 ms
16...20 addresses	175...225 ms

Note

These periods of time are defined from the complete writing of the message from the master to sending the first byte by the AZL...

2. Writing data to the LMV5... system:

1 address	25...75 ms
2...3 addresses	75...125 ms
4...5 addresses	125...175 ms
6 addresses	175...225 ms

Modbus functions

The following Modbus functions are supported:

Function number	Function
03 / 04	Reading n words
06	Writing 1 word
16	Writing n words

For more information about the Modbus protocol, refer to www.modbus.org.

Table of addresses

Function	Address	Number of words	Data designation	Access	Data format	Data type / coding	Range	Updating rate
03/04	0	1	Phase	R	U16		0...255	Fast
03/04	1	1	Position of currently active fuel actuator	R	S16	PT_WINKEL	-3... 93°	Fast
03/04	2	1	Position of gas actuator	R	S16	PT_WINKEL	-3...93°	Fast
03/04	3	1	Position of oil actuator	R	S16	PT_WINKEL	-3...93°	Fast
03/04	4	1	Position of air actuator	R	S16	PT_WINKEL	-3...93°	Fast
03/04	5	1	Position of auxiliary actuator 1	R	S16	PT_WINKEL	-3...93°	Fast
03/04	6	1	Position of auxiliary actuator 2	R	S16	PT_WINKEL	-3...93°	Fast
03/04	7	1	Position of auxiliary actuator 3	R	S16	PT_WINKEL	-3...93°	Fast
03/04	8	1	Manipulated variable for variable speed drive	R	S16	PT_PROZENTFU	0…100 %	Fast
03/04	9	1	Current type of fuel	R	U16	0= Gas 1= Oil	0...1	Fast
03/04	10	1	Current output	R	U16	PT_LEISTUNG	0…100 %	Fast
03/04	11	1	Current setpoint / temperature / pressure	R	U16	PT_TEMP_ DRUCK		Medium
03/04	12	1	Actual value / temperature / pressure Unit: See address 18 / 19	R	U16	PT_TEMP_ DRUCK	0…2000 °C 0…100 bar	Medium
03/04	13	1	Flame signal	R	U16	PT_PROZENT01	0…100 %	Medium
03/04	14	1	Current fuel throughput	R	U16	0..65534		Fast
03/04	15	1	Current O2 value (LMV52...)	R	U16	PT_PROZENT01	0…100 %	Fast
03/04	16	1	Volume unit of gas	R	U16	0= m³ 1= ft³	0…1	Slow
03/04	17	1	Volume unit of oil	R	U16	0= l 1= gal	0…1	Slow
03/04	18	1	Unit of temperature	R	U16	0= °C 1= °F	0…1	Slow
03/04	19	1	Unit of pressure	R	U16	0= bar 1= psi	0…1	Slow
03/04	20	1	Sensor selection	R	U16	0=Pt100 1=Pt1000 2=Ni1000 3=temp. sensor 4=press. sensor 5=Pt100Pt1000 6=Pt100Ni1000 7=no sensor	0…7	Slow
03/04	21	2	Startup counter total	R	S32		0…999999	Slow
03/04	23	2	Hours run counter	R	S32		0…999999	Slow
03/04	25	1	Current error: Error code	R	U16		0...0x FF	Fast
03/04	26	1	Current error: Diagnostic code	R	U16		0…0x FF	Fast
03/04	27	1	Current error: Error class	R	U16		0...5	Fast
03/04	28	1	Current error: Error phase	R	U16		0...255	Fast
03/04	29	1	Temperature limiter OFF threshold, in degrees Celsius / Fahrenheit (in address 129: Temperature limiter switching differential ON)	R	U16		0…2000 °C 32…3632 °F	Slow
03/04	30	1	Supply air temperature, in degrees Celsius / Fahrenheit (LMV52...)	R	U16		-100…+923 °C -148..+1693 °F	Slow
03/04	31	1	Flue gas temperature, in degrees Celsius / Fahrenheit (LMV52...)	R	U16		-100...+923 °C -148...+1693 °F	Slow
03/04	32	1	Combustion efficiency (LMV52...)	R	U16	PT_Prozent01	0...200 %	Slow

Function	Address	Number of words	Data designation	Ac-cess	Data type / coding	Range	Updating rate
03/04	35	1	**Inputs**	R	U16	-	Medium

Coding: 0 → inactive 1 → active

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0

B8	Safety loop	B0	Controller ON/OFF
B9		B1	Fan contactor contact
B10	Pressure switch-min-gas	B2	Fuel selection oil
B11	Pressure switch-max-gas	B3	Fuel selection gas
B12		B4	
B13	LP	B5	Pressure switch-max-oil
B14	Start release oil	B6	Pressure switch-min-oil
B15	Heavy oil immediate start	B7	Pressure switch – valve proving

Function	Address	Number of words	Data designation	Ac-cess	Data type / coding	Range	Updating rate
03/04	37	1	**Outputs**	R	U16	-	Medium

Coding: 0 → inactive 1 → active

B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0

B8	Fuel valve SV oil	B0	Alarm
B9	Fuel valve V1 oil	B1	
B10	Fuel valve V2 oil	B2	
B11	Fuel valve V3 oil	B3	
B12	Fuel valve SV gas	B4	Ignition
B13	Fuel valve V1 gas	B5	Start signal / DW valve
B14	Fuel valve V2 gas	B6	Fan
B15	Fuel valve PV gas	B7	Oil pump / magnetic coupling

Function	Address	Number of words	Data designation	Access	Data format	Data type / coding	Range	Updating rate
R 03/04 W 06/16	38	1	Program stop	R/W*	U16	0=deactivated 1=24 PrePurgP 2=32 PrePFGR 3=36 IgnitPos 4=44 Interv 1 5=52 Interv 2 6=72 PostPPos 7=76 PostPFGR	0...7	Slow
R 03/04 W 06/16	39	1	Operating mode with load controller	R/W*	U16	0=ExtLR X5-03 1=IntLR 2=IntLR Bus 3=IntLR X62 4=ExtLR X62 5=ExtLR Bus	0…5	Slow
R 03/04	40	1	Selection of manual or automatic operation	R	U16	0=automatic 1=burner on 2=burner off	0…2	Fast
R 03/04 W 06/16	41	1	Modbus mode: Local / Remote	R/W	U16	0 = Local 1 = Remote	0…1	Slow

Function	Address	Number of words	Data designation	Access	Data format	Data type / coding	Range	Updating rate
R 03/04 W 06/16	42	1	Modbus downtime: Max. time with no communication. When this time has elapsed, automatic changeover from Remote to Local takes place	R/W*	U16		0…7200 s	Slow
R 03/04 W 06/16	43	1	Operating mode in Remote mode. Auto, Remote ON, Remote OFF	R/W	U16	0 = Auto 1 = ON 2 = OFF	0…2	Fast
R 03/04 W 06/16	44	1	External setpoint W3 Unit: See address 18 / 19	R/W	U16	PT_TEMP_ DRUCK	See ”Data types” on page 15	Fast
R 03/04 W 06/16	45	1	Predefined output mod. / multistage	R/W	U16	PT_LEISTUNG	See ”Data types” on page 15	Fast
R 03/04 W 06/16	46	1	Fuel selection AZL...	R/W*	U16	0 = Gas 1 = Oil	0…1	Slow
R 03/04 W 06/16	47	1	Setpoint W1	R/W	U16	PT_TEMP_ DRUCK	See ”Data types” on page 15	Slow
R 03/04 W 06/16	48	1	Setpoint W2	R/W	U16	PT_TEMP_ DRUCK	See ”Data types” on page 15	Slow
R 03/04 W 06/16	49	1	Weekday	R/W	U16	0 = Sunday 1 = Monday ...	0…6	Slow
R 03/04 W 16	50	3	Date	R/W	U16[3]	Data structure Date		Slow
R 03/04 W 16	53	3	Time of day	R/W	U16[3]	Data structure Time of day		Slow
R 03/04 W 16	56	2	Hours run gas (adjustable)	R/W*	S32		0...999999 h	Slow
R 03/04 W 16	58	2	Hours run oil stage 1 or modulating (adjustable)	R/W*	S32		0...999999 h	Slow
R 03/04 W 16	60	2	Hours run oil stage 2 or modulating (adjustable)	R/W*	S32		0...999999 h	Slow
R 03/04 W 16	62	2	Hours run oil stage 3 or modulating (adjustable)	R/W*	S32		0...999999 h	Slow
R 03/04 W 16	64	2	Hours run total (can be reset)	R/W*	S32		0...999999 h	Slow
03/04	66	2	Hours run total (read only)	R	S32		0...999999 h	Slow
03/04	68	2	Hours run device connected to power (read only	R	S32		0...999999 h	Slow
R 03/04 W 16	70	2	Startup counter gas (adjustable)	R/W*	S32		0...999999	Slow
R 03/04 W 16	72	2	Startup counter oil (adjustable)	R/W*	S32		0...999999	Slow
R 03/04 W 16	74	2	Startup counter total (can be reset)	R/W*	S32		0...999999	Slow
03/04	76	2	Startup counter total (read only)	R	S32		0...999999	Slow
03/04	78	2	Fuel volume gas (read only) (resettable from AZL5... version V4.10) 0…199999999.9 m^3 0…1999999999 ft^3	R/W*	S32		See ”Data types” on page 15	Slow

Function	Address	Number of words	Data designation	Access	Data format	Data type / coding	Range	Updating rate
03/04	80	2	Fuel volume oil (read only) (resettable from AZL5... version V4.10) 0…199999999.9 l 0…199999999.9 gal	R/W*	S32		See "Data types" on page 15	Slow
03/04	82	1	Number of lockouts	R	U16		0…65535	Slow
03/04	83	1	Extra temperature sensor (from AZL5... version V4.10)	R	U16	°C: *1 °F: *1	0..2000 °C 32..3632 °F	Slow
Parameters 84...137 are available from AZL5... version V4.20								
03/04	84	8	AZL5... ASN	R	U8[16]	String		Constant
03/04	92	1	AZL5... parameter set code	R	U16			Constant
03/04	93	1	AZL5... parameter set version	R	U16			Constant
03/04	94	3	AZL5... identification date	R	U16[3]	Date		Constant
03/04	97	1	AZL5... identification number	R	U16			Constant
03/04	98	8	Burner control ASN	R	U8[16]	String		Constant
03/04	106	1	Burner control parameter set code	R	U16			Constant
03/04	107	1	Burner control parameter set version	R	U16			Constant
03/04	108	3	Burner control identification date	R	U16[3]	Date		Constant
03/04	111	1	Burner control identification number	R	U16			Constant
03/04	112	1	Software version AZL5...	R	U16	Hexadecimal		Constant
03/04	113	1	Software version burner control	R	U16	Hexadecimal		Constant
03/04	114	1	Software version load controller	R	U16	Hexadecimal		Constant
03/04	115	8	Burner identification	R	U8[16]	String		Upon reset
03/04	123	1	Min-output gas	R	U16	PT_LEISTUNG	0...100 %	Slow
03/04	124	1	Max-output gas	R	U16	PT_LEISTUNG	0...100 %	Slow
03/04	125	1	Min-output oil	R	U16	PT_LEISTUNG	0...100 % 1001...1003	Slow
03/04	126	1	Max-output oil	R	U16	PT_LEISTUNG	0...100 % 1001...1003	Slow
R 03/04 W 16	127	1	Load limitation enduser (modulating)	R/W*	U16	PT_LEISTUNG	0...100 %	Slow
R 03/04 W 16	128	1	Load limitation enduser (multistage)	R/W*	U16	0: S1 1: S2 2: S3	0...2	Slow
03/04	129	1	Temperature limiter switching differential ON (in address 29: Temperature limiter OFF threshold, in degrees Celsius / Fahrenheit)	R	S16	PT_Prozent1	-50...0 %	Slow
03/04	130	1	Measuring range temperature sensor	R	U16	0: 150°C / 302°F 1: 400°C / 752°F 2: 850°C / 1562F	0...2	Slow
03/04	131	1	Adaption active / inactive	R	U16	0: Inactive 1: Active	0...1	Fast
03/04	132	1	Adaption state	R	U16	PT_ADAPTION	0...12	Slow
R 03/04 W 16	133	1	Start adaption	R/W	U16	0: Reset value 1: Start 2: Abort	0...2	Slow
R 03/04 W 16	134	1	Adaption output Permissible values: 40 %, 50 %, 60 %, 70 %, 80 %, 90 %, 100 %	R/W*	U16	PT_Prozent1	40...100 %	Slow
R 03/04 W 16	135	1	P-value	R/W*	U16	PT_Prozent01	2...500 %	Slow
R 03/04 W 16	136	1	I-value	R/W*	U16	Seconds	0...2000 s	Slow

Function	Address	Number of words	Data designation	Access	Data format	Data type / coding	Range	Updating rate
R 03/04 W 16	137	1	D-value	R/W*	U16	Seconds	0...1000 s	Slow
03/04	400	16	Lockout history (current lockout)	R	U16/U32 []			Fast
03/04	416	16	Lockout history (current lockout -1)	R	U16/U32 []			Fast
03/04	432	16	Lockout history (current lockout -2)	R	U16/U32 []			Fast
:	:	:	:	:	:			
03/04	528	16	Lockout history (current lockout -8)	R	U16/U32 []			Fast
03/04	544	8	Error history (current error)	R	U16/U32 []			Fast
03/04	552	8	Error history (current error -1)	R	U16/U32 []			Fast
:	:	:	:	:	:			
03/04	704	8	Error history (current error -20)	R	U16/U32 []			Fast

* These parameters need not be continually written since they are stored in EEPROM, which only permits a limited number of write accesses over its lifecycle (< 100,000)

Data structures

Date	U16	Year Month Day
Time of day	U16	Hour Minute Second
Lockout history	U16	Error code Error diagnostics Error class Error phase Fuel Output Date: Year Date: Month Date: Day Time of day: Hours Time of day: Minutes Time of day: Seconds
	U32	Startup counter total Hours run total
Error history	U16	Error code Error diagnostics Error class Error phase Fuel Dummy Output
	U32	Startup counter total

Legend to address table

Access	R	Value can only be read
	R / W	Value can be read and written
Data format	U16	16 bit integer, not subject to sign
	S32	32 bit integer, subject to sign Note: In the AZL..., this data type is also used to mark an invalid or non-available value by using the value of «-1»
[ ]		Data array

[1]) Refer to section «Data structures»

* These parameters need not be continually written since they are stored in EEPROM, which only permits a limited number of write accesses over its lifecycle (< 100,000)

Data types

TYPE	Phys.	Int. range	Resolution	Conversion int. / phys.
PT_PROZENT01	0...100 %	0...1000	0.1 %	/ 10
PT_PROZENTFU	0...110 %	0...1100	0.1 %	/ 10
PT_WINKEL	-3.0...93.0°	-30...930	0.1°	/ 10
PT_TEMP_ DRUCK	0...2000° 32...3632 °F 0...100 bar 0...1449 psi	0...2000 32...3632 0...1000 0...1449	1 °C 1 °F 0.1 bar 1 psi	1 1 / 10 1
PT_LEISTUNG	Modulating operation: 0...100 % Multistage operation: 1001 = stage 1 1002 = stage 2 1003 = stage 3	0...1003	Modulating operation: 0.1 % Multistage operation: 1	Modulating operation: / 10 Multistage operation: - 1000
PT_ADAPTION	0: Undefined 1: Identification completed, parameter determined 2: Undefined 3: Adaption aborted by user 4: Temperature differential too small, temperature will be lowered with low-fire 5: Monitoring time running 6: Delivery of identification load set 7: Error during identification (path) 8: Error during identification (internally) 9: Monitoring time running 10: Changeover from modulating to multistage during an identification 11: Timeout monitoring time 12: Timeout heating output on path with monitoring			

Starting adaption via Modbus

The routine used for identifying the path in the integrated load controller (termed “adaption“ here) of the LMV5... system can be controlled and monitored via Modbus.

In principle, the general conditions are the same as those used when making adaptions with the AZL52... (refer to subsection 6.4.2 *Self-setting of control parameters (adaption*)) in the Basic Documentation of the LMV5... system (P7550).

The terms *Start adaption*, *Adaption active* / *inactive* and *Adaption state* indicate the respective Modbus addresses (refer to ”Table of addresses”).

Start the adaption via *Start adaption* and change the value from ≠ 1 to = 1.
Starting the adaption has no impact on adaption processes already under way (*Adaption active* / *inactive* = 1).

If *Adaption active* / *inactive* = 1, the process can be monitored via *Adaption state* (refer to data type PT_ADAPTION).
When *Adaption active* / *inactive* = 0, the adaption process is completed.
On completion of the process, the result can be read out via *Adaption state*.

To complete the adaption process prematurely, the value at *Start adaption* must be changed from ≠ 2 to = 2.

Updating rate of AZL5

Fast	System data that have already been updated automatically by the system process are available on request, at a typical repetition rate of 200 ms.
Medium	These data are cyclically queried in the system by the AZL... The typical updating rate here is 5 seconds, depending on system load.
Slow	These data are cyclically queried in the system by the AZL... The typical updating rate that can be expected here is 25 seconds, depending on system load.
Constant	These data are updated in the system by the AZL5... upon each *Power On* or reset. When making a query, the updated data will be available after 25 seconds. Data that cannot be changed (e.g. the production date, etc.) – neither with the AZL5... nor via the ACS450 – can be identified by the value of *0* in the first Byte of the strings.
Upon reset	Same as constant data, but these data can be changed in the system.

Error handling

Error codes

When there are faulty telegrams (CRC errors, etc.), the AZL… does not send any exception code. It does not respond to this kind of message.

Reason: Usually, the commercially available Modbus drivers do not respond to exception codes.

Selection menus in the AZL5

Activation of Modbus operation

Activation takes place via menu
«Operation» → «OptgModeSelect» → «GatewayDDCon».

Having made the selection, the menu item can be quit via ESC. The setting is retained until «Operation» → «OptgModeSelect» → «GatewayDDCoff» is selected via the AZL… menu.

When «GatewayDDCon» is activated, plant operation and diagnostics via the AZL... are still possible.

Deactivation takes place via menu
«Operation» → «OptgModeSelect» → «GatewayDDCoff».

Slave address

Selection is made via menu
«Params & Display» → «AZL» → «Modbus» →«Address».

According to Modicon specifications, addresses between 1...247 can be selected. The slave address is filed in nonvolatile memory of the AZL...

Transmission parameters

Transmission rate

The setting is made via menu
«Params & Display» → «AZL» → «Modbus» → «Baud Rate»
There is a choice of 9600 bit/s or 19200 bit/s.

Parity

Using the AZL... menu
«Params & Display» → «AZL» → «Modbus» → «Parity», parity can be set to «none», «even» or «odd».

Timeout communication failure

When there is no Modbus communication, this timeout defines the period of time on completion of which the AZL… changes automatically from Remote to Local.

The setting is made via menu
«Params & Display» → «AZL» → «Modbus» → «Downtime».

Local «-» Remote mode

This setting defines whether the AZL… shall work in Local or Remote mode.

Remote mode

Display of «Remote Auto», «Remote On», «Remote Off» mode. A change can only be made via Modbus.

AZL5 interface

General

The AZL... serves the Modbus via its COM2 port (8-pole Western jack RJ45). The port is assigned to the functional low-voltage range.

Assignment of RJ45 pins:

PIN	
1	TXD (RS-232 level or V28)
2	Not used
3	RXD (RS-232 level or V28)
4	GND
5	U1 (typically +8.2V)
6	GND
7	U2 (typically -8.2V)
8	Not used

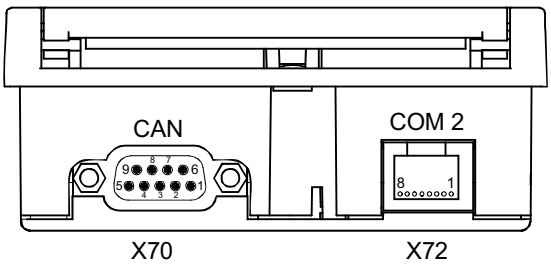
When preparing and fitting a connecting cable between the AZL... and a converter, it is to be noted that PIN 5 and PIN 7 can deliver a current of 5 mA each. Adequate insulation against other potentials must be ensured.

The maximum permissible data line length between COM2 and a converter is 3 m. In exceptional cases, this data line length can be exceeded, depending on environmental conditions (electrical interference) and the type of cable used – without Siemens assuming responsibility.

To ensure protection against electric shock hazard, it must be made certain that AC 230 V / AC 120 V lines are strictly separated from the functional low-voltage area.

CAN X70

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

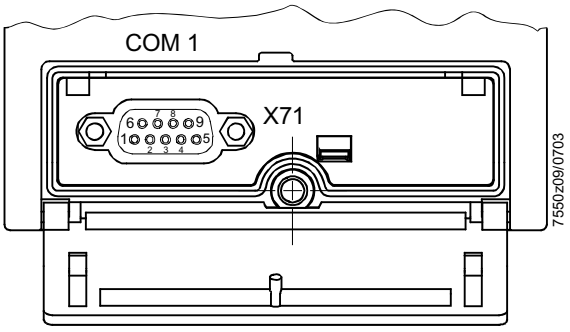


COM2 X72

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

COM1 X71

PIN	
2	RXD
3	TXD
5	GND



Note

COM1 (PC port) ad COM2 cannot be active at the same time!

Converter RS-232 – RS-485

This converter converts a V.24 / RS-232 port into an RS-485 port.

Technical requirements

– Code transparency, that is, data must remain unchanged
– When using the RS-485 interface as a bus, control of the transmitting section on the RS-485 side must be ensured by the transmitter power of the AZL...
– The interfaces must be galvanically separated to improve EMC

Commercially available converters

The technical specification provided by the suppliers of the converters must be observed when doing planning work. Some of them do not meet the specifications of the LMV5... system (e.g. operating temperatures). If required, technical measures must be taken (e.g. suitable location).
The following types of converters have been tested by us with respect to function and immunity (voltage surges):

- Supplier: Hedin Tex
  Type reference: H-4

  Contact address in Germany:
  Hedin Tex GmbH
  Am Herrkamp 14
  D-24226 Heikendorf
  www.hedintex.de

- Supplier: IPC CON
  Type reference: I-7520

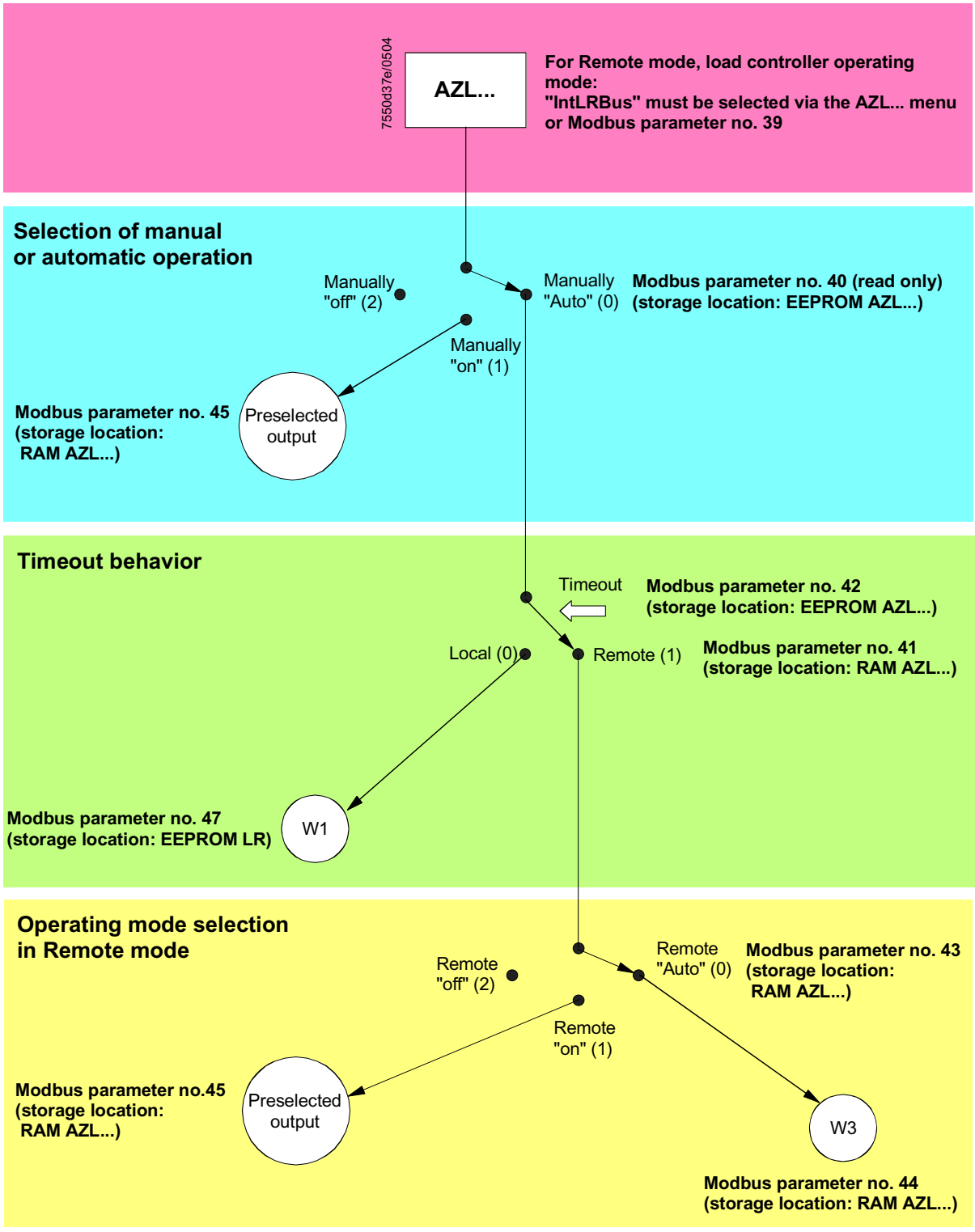
  Contact address in Germany:
  Spectra Computersysteme GmbH, Humboldtstraße 36
  D-70771 Leinfelden-Echterdingen
  *www.spectra.de

Connection example: Connecting cable for interface converter type Hedin Tex H4/M4

AZL COM2 8-pole Western		Cable	Hedin Tex interface converter X1 RS-232	
			H4	M4
1	TxD		21	2
2	––		––	––
3	RxD		22	3
4	GND		16	7
5	U1		(only for eBus adapter)	
6	GND		––	––
7	U2		(only for eBus adapter)	
8	––		––	––

7550t05e/0703

Overview of «Operating mode changeover of controller»



Notes on operating modes

Modbus downtime

When there is no more communication between DDC and AZL..., the Modbus downtime is used to switch over from Remote mode to the preselected setpoint in Local mode. The timer will be activated when changing from Local to Remote. With every permissible Modbus communication to this slave (AZL...), the timer will be reloaded.
Should the timer lapse, the DDC must again set the Remote mode, if required. The timer value will be retained in EEPROM and will also be retained after power off.

Note: When deactivating the «Gateway DDC» mode (menu item «OptgModeSelect» → «GatewayDDCoff»), automatic changeover to Local takes place, that is, preselected output «W1» will apply.

Changeover of operating mode via parameter 43

This changeover was introduced primarily because of the requirements of boiler sequence control.
In that case, the individual boiler can be operated at low output via manually «On». When switching to «Auto» via sequence control, preselected output «W3» will be used.

Default parameter settings

Parameter	Address	Storage location	Preselection	Choices for making changes
Setpoint W1	47	EEPROM	See Basic Documentation «Menu and parameter lists»	• On the AZL... (menu) • Preselection via Modbus
Setpoint W2	48	EEPROM	See Basic Documentation «Menu and parameter lists»	• On the AZL... (menu) • Preselection via Modbus
External setpoint W3	44	RAM	«0» will be reinitialized when resetting the AZL...	• On the AZL... (menu) • Preselection via Modbus
Set target load mod / multistage	45	RAM	«0» will be reinitialized when resetting the AZL...	• On the AZL... (menu) • Preselection via Modbus
Local / Remote	41	RAM	«Local»	• Via Modbus • On the AZL... (menu) • Via lapse of timer «Communication failure» from Remote to Local
Selection of manual or automatic operation	40	EEPROM	See Basic Documentation «Menu and parameter lists»	• On the AZL... (menu)
Operating mode: Remote ”off” / remote “on” / W3	43	RAM	«Auto» will be reinitialized when resetting the AZL...	• Preselection via Modbus
Operating mode with load controller	39	EEPROM	See Basic Documentation «Menu and parameter lists»	

Note: An AZL5 reset will be triggered when switching power on, or in the event of severe system errors.

Note

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