SIEMENS

LMV62…

Modbus

User Documentation

The LMV62 and this user documentation are intended for original equipment manufacturers (OEMs) and system integrators using the LMV62 in or on their products.

Firmware version V2.100 and higher

Smart Infrastructure

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Supplementary documentation

Product type	Designation	Documentation type	Documentation number
LMV6	Burner management system	Environmental declaration	E7560 *)
LMV6	Burner management system	Parameter list and error code list	I7560
LMV6	Burner management system	Basic documentation	P7560
LMV6	Burner management system	Product range overview	Q7560

*) On request only

Note
This document only refers to the *product type* – not the product designation. See the table below for details.

Product type	Product designation
ACS460	PC software
AZL66	Display and operating unit
LMV62	Burner management system
OCI460	Cloud gateway

Contents

1 Warning notes

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

Please note!
All the safety, warning, and technical notes given in the basic documentation for the LMV6 (P7560) also apply to this document in full.

- When connecting the OCI460 to the LMV62, the warning notes in the OCI460 data sheet (N7600) and in the LMV6 basic documentation (P7560) must be observed
- The Modbus in the LMV62 does not offer any special measures aimed at preventing or controlling errors. It is therefore essential to ensure that no inadequate combustion values can arise when using the Modbus, particularly in connection with multi-burner controls. Measures such as these are to be considered on an application-specific basis and should be verified and proven by checking the relevant standards and conducting adequate tests
- The Modbus terminals may only be connected to potentials with safe isolation (SELV). Failure to observe this information poses a risk of electric shock

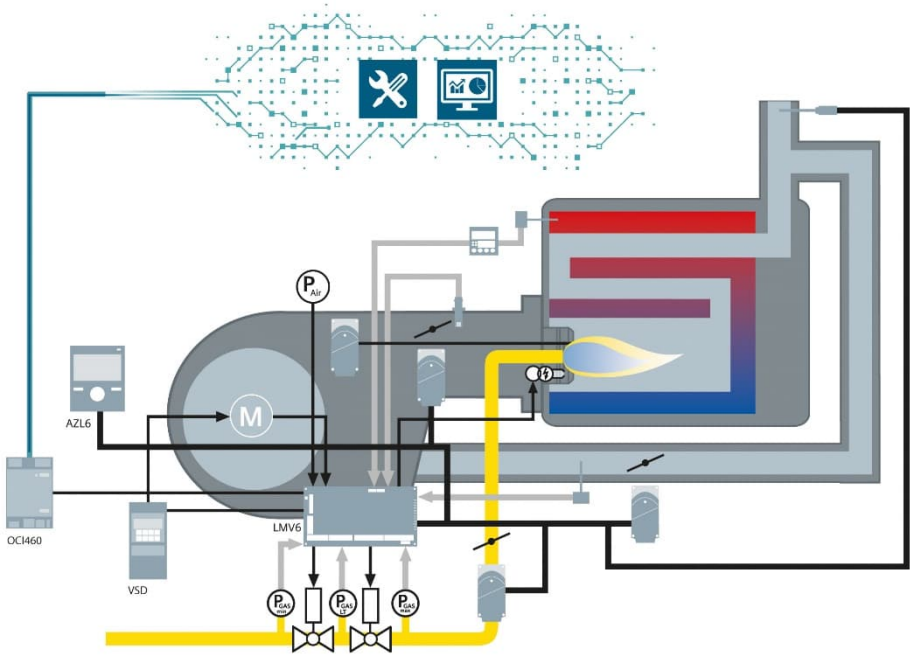
2 General

2.1 LMV62

The LMV62 is a microprocessor-based burner control with coordinated system components for controlling and monitoring forced draft burners of medium to large capacity. The LMV62 is operated and programmed via the AZL66 or ACS460. The LMV62 can be integrated into a data network with a Modbus system by means of the Modbus functionality in the LMV62.

This facilitates the implementation of the following applications:

- Visualization of plant states
- Plant control
- Logging
- Cloud connection



2.2 Master-slave principle

Communication between Modbus users takes place according to the master-slave principle,

whereby the LMV62 always operate as a slave.

Every LMV62 on the bus line must be assigned a different address.
For information on settings, refer to chapter 5.1 *Modbus interface settings*.

3 Plant configuration

Note
Please observe the guidelines provided by the master manufacturer regarding the configuration of a communication system!

3.1 Minimum configuration of a Modbus system

A Modbus plant comprises the following components as a minimum:

- A bus master that controls the data traffic
- One or several slaves that deliver data if requested by the master
- The transmission medium, comprising a bus cable and bus connector for connecting the individual users, and one or several bus segments that are linked via repeaters

3.2 Maximum configuration of Modbus system

A bus segment comprises a maximum of 32 field units with a standard RS-485 interface. The maximum number of slaves that can be operated with a Modbus master across several segments is determined by the internal memory structure of the master used. It is therefore essential to find out the capacity of the master when planning a system. The bus cable can be disconnected and a new user added at any point by adding a bus connector. At the end of a segment, the bus line can be extended to the specified segment lengths. The length of a bus segment depends on the transmission speed. The transmission rate is essentially determined by the plant constellation (segment length, distributed inputs/outputs) and the required query cycles of the individual users.

Note
Bus user in the Modbus system!
The same rate of transmission must be selected for all users on the bus! Modbus units must be connected in line!

Note
Terminating resistor on the Modbus cable!
The Modbus cable must be terminated at the 2 end nodes (typically with a terminating resistor of 120 ohms). The LMV62 does not include a terminating resistor on the Modbus cable.

4 Type summary

4.1 LMV62

Microprocessor-controlled burner control for single-fuel burners of any load, with electronic fuel-air ratio control, up to 4 actuators, and integrated gas valve proving.

4.2 OCI460

Interface between LMV62 and Modbus TCP/IP, refer to the OCI460 data sheet N7600 and LMV6 basic documentation P7560.

5 Data transfer

5.1 Modbus interface settings

In addition to the interface parameters that can be set on the LMV62 (refer to chapter 5.1 *Modbus interface settings*), the following parameters for the communication interface are already set:

Number	Bit type
8x	Data bits
1x	Start bit
1x	Stop bit
2x	Stop bits, if no parity bit (none) has been set (according to Modbus standard definition)

5.2 Transmission mode (RTU)

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

5.3 Structure of data blocks

All data blocks have the same structure:

5.3.1 Data structure

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

Each data block has 4 fields:

Slave address Unit 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 Detection of transmission errors

5.4 Checksum (CRC16)

Transmission errors are detected with the help of the checksum (CRC16). If an error is detected during evaluation, the respective LMV62 will not respond.

5.4.1 Calculation scheme

CRC = 0xFFFF		
CRC = CRC XOR ByteOfMessage		
For (1 to 8)		
CRC = SHR (CRC)		
if (flag shifted to the right = 1)		
then CRC = CRC XOR 0xA001	else	
while (not all ByteOfMessage edited)		

Note
The low-byte of the checksum is transmitted first.

5.4.2 Example

Data inquiry: 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	

5.5 Mapping long values

Byte high	Byte low	Byte high	Byte low
Word low		Word high	

5.6 Erroneous accesses to LMV62 parameters

5.6.1 Reading

If a parameter is accessed that is not defined in the LMV62 but was defined in the LMV5, a substitute value is sent. In the substitute value, each byte of the parameter is set to the value ‘0xFF’.

5.6.2 Writing

In case of write access to non-existent parameters or to parameters locked for the building automation mode, the response takes the form of a Modbus error code (Modbus exception code). The parameters are not changed.

5.7 Chronological sequence of communication

Both the beginning and end of a data block are characterized by transmission pauses. Between 2 successive characters, a maximum period of 3.5 times the character transmission time may elapse. The character transmission time is dependent on the baud rate and the data format used.

In the case of a data format of 8 data bits, no parity bit and one stop bit, for example, the transmission time is calculated as follows:

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

And with the other data formats:

Character transmission time [ms] = 1000 * 11 bits / baud rate

5.7.1 Procedure

Data inquiry from the master Transmission time = n characters * 1000 * x bits / baud rate
Identification code for end of data inquiry 3.5 characters * 1000 * x bits / baud rate
Handling of data inquiry by the slave
Reply from the slave Transmission time = n characters * 1000 * x bits / baud rate
Identification code for end of reply 3.5 characters * 1000 * x bits / baud rate

5.7.2 Example

Identification code for end of data inquiry or response in case of a data format of 11/ 10 bits.

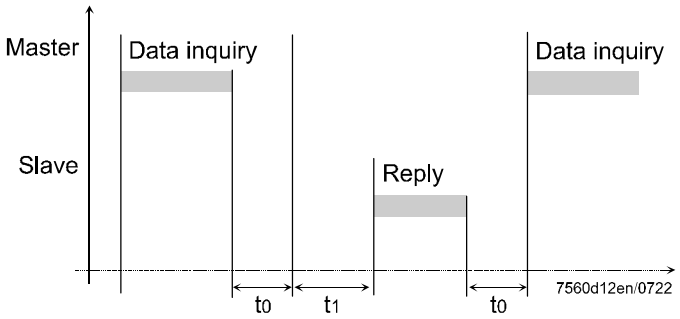
Waiting time = 3.5 characters * 1000 * x bits / baud rate

Baud rate [baud]	**Data format** [bit]	**Waiting time** [ms]
9600	11	4.01
	10	3.645

5.8 Chronological sequence of a data inquiry

5.8.1 Timing schedule

A data inquiry progresses according to the following timing schedule:



Key

t0 End identification code = 3.5 characters (time dependent on the baud rate)

t1 The handling time is dependent on the amount of data (typically 50 ms). In case of error (Modbus exception), this time can be up to 2 seconds

5.9 Communication during the internal slave handling time

The master must not make any data inquiries during the internal slave handling time. Any inquiries made during this period will be ignored by the slave.

5.10 Communication during the slave response time

The master must not make any data inquiries during the slave response time. If inquiries are made during this period, all data currently on the bus becomes invalid.

6 Modbus functions

The following Modbus functions are supported:

Function number	Function
0x03/0x04	Reading ‘n’ words
0x06	Writing a word
0x10	Writing ‘n’ words

7 Requirements for the Modbus master

The Modbus system with a connection based on RS-485 is a robust system.

In view of the possible cable lengths and the loads produced by various users and environmental conditions, the master software should meet the following criteria:

- In the case of write processes, correct writing must be checked through back-reading
- In the case of read processes, it is essential to check whether a reply from the slave is received. If there is no such reply, the inquiry must be repeated, or else checks on whether an error occurred (wiring, valid Modbus address, etc.) must be carried out

8 Modbus addresses

8.1 Overview table

Function	Address dec / hex	Number of words	Data designation	Access	Data format	Data type / coding	Range
03/04	0	1	Phase	R	U16	---	0…255
03/04	2	1	Position of the actuator for fuel 1 (e.g., gas)	R	S16	PT_WINKEL	-3…93°
03/04	3	1	Position of actuator for fuel 2 (e.g., oil) (preparation for MP1.3)	R	S16	PT_WINKEL	-3…93°
03/04	4	1	Position of the air actuator	R	S16	PT_WINKEL	-3…93°
03/04	5	1	Position of the auxiliary actuator 1	R	S16	PT_WINKEL	-3…93°
03/04	6	1	Position of the auxiliary actuator 2	R	S16	PT_WINKEL	-3…93°
03/04	7	1	Position of the auxiliary actuator 3/FGR	R	S16	PT_WINKEL	-3…93°
03/04	8	1	Current speed (VSD1)	R	S16	PT_PROZEN	0…100%
03/04	10	1	Current load	R	U16	PT_LEISTUNG	0…100%
03/04	13	1	Resulting flame signal on basic unit	R	U16	PT_PROZENT01	0…100%
03/04	15	1	Current O2 value 1	R	U16	PT_PROZENT01	0…30%
03/04	21	2	Total startup counter	R	S32	---	0…999999
03/04	23	2	Hours run counter	R	S32	---	0…999999
03/04	25	1	Current error: Error code	R	U16	---	0…0x270F or 0…999
03/04	27	1	Current error: Error class	R	U16	---	0…5
03/04	28	1	Current error: Error phase	R	U16	---	0…255
03/04	35	1	Base unit inputs	R	U16	---	---
03/04	37	1	Base unit outputs	R	U16	---	---
R 03/04	40	1	Selection of manual or automatic operation	R	U16	0 = Automatic 1 = Manual 2 = Burner OFF	0…2
R 03/04 W 06/16	41	1	Modbus mode: Local / remote	R/W	U16	0 = Local 1 = Remote	0…1
R 03/04 W 06/16	42	1	Modbus timeout: Max. time with no communication. Once this time has elapsed, the system automatically switches from remote to local.	R/W	U16	---	0…7200 s
R 03/04 W 06/16	43	1	Operating mode in remote mode	R/W	U16	0 = Automatic 1 = Manual 2 = Burner OFF	0…2
R 03/04	45	1	Predefined output modulating/multistage	R/W	U16	PT_LEISTUNG	---
03/04	98	8	Burner control type (ASN)	R	U16	---	---
03/04	123	1	MIN gas output – OEM	R	U16	---	0…100%
03/04	124	1	MAX gas output – end user	R/W	U16	---	0…100%

Function	Address dec / hex	Number of words	Data designation	Access	Data format	Data type / coding	Range
03/04	1305	1	Internal flame signal on base unit	R	U16	PT_PROZENT01	0…100%
03/04	1307	1	Flame signal flame module in base unit	R	U16	PT_PROZENT01	0…100%

Function	Address dec / hex	Number of words	Data designation	Access	Data type / coding	Range	Refresh 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	X93 pin 1 → Safety loop	B0	X73 pin 1 → Load controller ON/OFF
B9		B1	
B10	X61 pin 2 → Gas pressure switch-min	B2	
B11	X62 pin 2 → Gas pressure switch-max	B3	
B12		B4	
B13	X64 pin 1 → Air pressure switch	B5	
B14		B6	
B15		B7	X63 pin 1 → Pressure switch valve proving

Function	Address dec / hex	Number of words	Data designation	Access	Data type / coding	Range	Refresh 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		B0	X92 pin 2 → Alarm
B9		B1	
B10		B2	
B11		B3	
B12		B4	X82 pin 3 → Ignition
B13	X91 pin 4 → Fuel valve V1 gas	B5	
B14	X84 pin 3 → Fuel valve V2 gas	B6	X72 pin 1 → Fan motor
B15	X83 Pin 3 → Pilot valve PV gas	B7	

The above assignment of inputs/outputs is valid for the LMV62.

The inputs/outputs are different for other LMV6 types.

The default assignment applies for types not listed.

Note
Error code display.
The current error code (address 25) must be displayed in decimal format by the Modbus master, e.g., the building automation, so that it matches the display of the AZL66.

Note
The following displays are possible in read access mode to the Modbus register:

- If the Modbus register is supported in LMV62 and the corresponding component is configured, the value of the component is communicated in read access mode
- If the Modbus register is supported in the LMV62 and the corresponding component is not configured (e.g., no auxiliary actuator 2 activated), a maximum value (e.g., 0x7FFF) is communicated in read access mode
- If the Modbus register is not supported in the LMV62, a maximum value (e.g., 0x7FFF) is communicated in read access mode

8.2 Key to overview table

Access	R	Read only value
	R/W	Read and write value
Data format	U8	Character string
	U16	16-bit integer, not signed
	U32	32-bit integer, not signed
	S16	16-bit integer, signed
		Note This data type is also used to mark invalid or non-existent values using the value '-1'.
	S32	32-bit integer, signed
		Note This data type is also used to mark invalid or non-existent values using the value '-1'.
[ ]		Data array
[1])		Refer to chapter *Write restrictions*

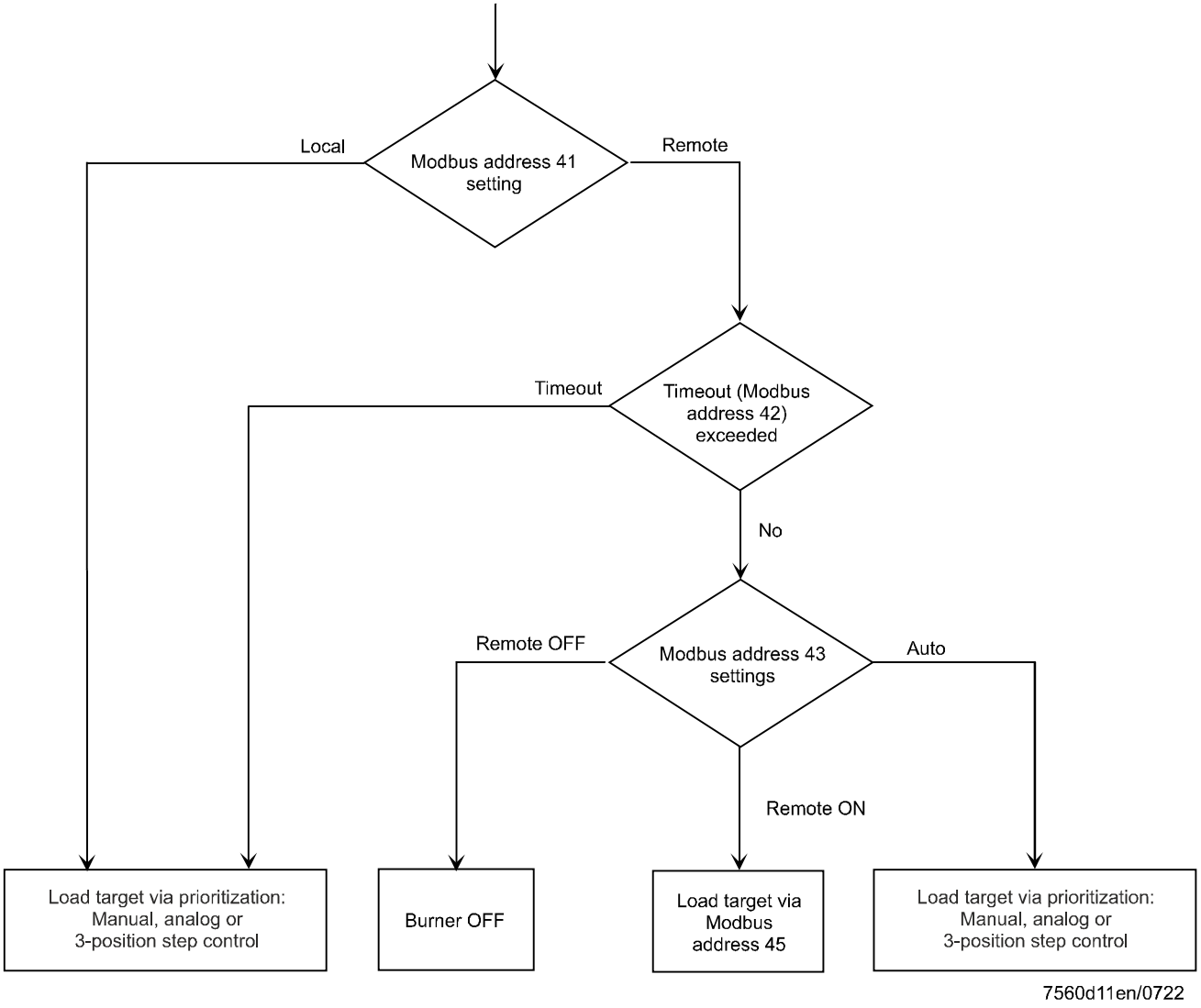
Data types

TYPE	Physical range	Internal range	Resolution	Conversion internally/physically
PT_PROZENT_01	0…100%	0…1000	0.1%	/ 10
PT_WINKEL	-50…150°	-500…1500	0.1°	/ 10
PT_LEISTUNG_BEGRENZT	Modulating operation: 20…100% 32767 = invalid	Modulating operation: 200…1000 32767 = invalid	Modulating operation: 0.1%	Modulating operation: / 10
PT_LEISTUNG	Modulating operation: 0…19.9% = burner OFF 20…100% = burner load 32767 = invalid	Modulating operation: 0…199 200…1000 32767 = invalid	Modulating operation: 0.1% 32767 = invalid	Modulating operation: / 10 32767 = invalid

8.3 Write restrictions

Note
The parameters marked with an asterisk in the overview table 8.1 ('Access' column) must not be continuously written since they are stored in EEPROM, and this memory only permits a limited number of write accesses (<100,000) over its lifetime.

9 Connection to the building automation system



9.1 Operating modes

9.1.1 Switching between ‘Local’ and ‘Remote’ mode

After activating Modbus communication, data can be exchanged between the LMV62 and the Modbus master via the Modbus interface. Preselection of the preset load target by the Modbus can only be made after the mode has been switched from ‘local’ to ‘remote’. This switch is made by writing the ‘Modbus mode’ parameter (refer to chapter 8 “Modbus addresses”).

Preset load targets that were made previously have no impact and are set to ‘invalid’ when switching to remote operation. The default setting after activation of Modbus communication is ‘local’. When the LMV62 is switched off, the mode is reset to the default setting.

9.1.2 Switching the Modbus operating mode between ‘AUTO’, ‘Remote ON’, and ‘Remote OFF’

This setting is used to determine the behavior of the LMV62 in remote mode. This setting is made by writing the ‘Operation in remote mode’ parameter (refer to chapter 8 “Modbus addresses”). With the ‘AUTO’ setting, the load to be delivered is determined by the LMV62. With the ‘Remote ON’ setting, the Modbus master determines the load approached by the LMV62 by presetting a load target With the ‘Remote OFF’ setting, the burner is switched off. A new startup only takes place when the operating mode switches to ‘Remote ON’ and a new preset load target is established, or after switching to local operation. To set a load target via the building automation system, the load controller ON contact on the LMV62 must be closed. The default setting after activating remote operation is ‘AUTO’. When the LMV62 is switched off, the operating mode is reset to the default setting.

9.1.3 Modbus timeout supervision

If communication between the Modbus and the LMV62 breaks down, the duration of the breakdown lasts is supervised (refer to section 8 “Modbus addresses”). Every permissible Modbus communication on this slave (LMV62) will restart monitoring. Monitoring only takes place in ‘Remote’ mode. If the parameterized time for communication breakdown is exceeded, a switch from remote to local operation will take place. In that case, the LMV62 travels to the parameterized load target in the event of a communication breakdown.

Note
After a timeout, remote operation must be reset by the Modbus master. This means that, on bus return, addresses ‘41’ and ‘43’, as well as the load target, must be written again. Only then can a new load adjustment be made. The timeout time is a Modbus parameter and is retained when the LMV62 is switched off.

9.2 Bus behavior in the event of a burner fault

If the LMV62 is locked due to an error, the setting of the operating mode in remote mode (Modbus address 41 and 43) is retained during the subsequent reset. To reach the desired load target, all that is required is to predefine the load target again via Modbus address 45.

10 Modbus settings on the LMV62

To be able to edit the Modbus parameters, at least the ‘Heating engineer (HF)’ level must be activated via the AZL66.

10.1 Slave address

The setting is made via parameter 0411.

Addresses can be set from 1…247. The slave address is stored in the non-volatile memory of the LMV62.

Changes can only be made via the LMV62 and not via the Modbus.

No.	Parameters	Settings	
		Unit	Resolution
0411	Modbus unit address of the LMV62 Setting values: 1…247 (Default setting: 1)	---	1

10.2 Baud rate of the Modbus interface

The setting is made via parameter 0412.

The parameter specifies the transmission rate for the interface used with the Modbus. The parameter is stored in the non-volatile memory of the LMV62.

Changes can only be made via the LMV62 and not via the Modbus.

No.	Parameters	Settings	
		Unit	Resolution
0412	Setting the baud rate for Modbus communication Setting values: • 9600 • 19200 • 38400 • 57600 • 115200 (Default setting: 1)	---	1

10.3 Parity of the Modbus interface

The setting is made via parameter 0413.

The parameter specifies the parity for the interface used with the Modbus. The parameter is stored in the non-volatile memory of the LMV62.

Changes can only be made via the LMV62 and not via the Modbus.

No.	Parameters	Settings	
		Unit	Resolution
0413	Parity for the Modbus 0 = none 1 = odd 2 = even (Default setting: 0)	---	1

10.4 Release time in the event of a communication breakdown

The setting is made via parameter 0414.

This parameter defines the maximum time during which communication between the Modbus and the LMV62 may break down. After this time, the Modbus operating mode is automatically switched from ‘Remote’ to ‘Local’ and the power last specified by the Modbus is approached (manual, analog or 3-position step control) The parameter is stored in the non-volatile memory of the LMV62.

Changes can only be made via the LMV62 and not via the Modbus.

No.	Parameters	Settings	
		Unit	Resolution
0414	Release time in the event of a communication breakdown (Default setting: 600 s = 10 min) Setting values: 0 = Deactivated 1…7200 s	s	1

10.5 Load target in the event of a communication breakdown

The setting is made via parameter 0414.

If a communication breakdown occurs in remote operation for longer than the time specified in parameter 0414, the power is specified by prioritization (manual, analog, or 3-position step control). The parameter is stored in the non-volatile memory of the LMV62.

Changes can only be made via the LMV62 and not via the Modbus.

No.	Parameters	Settings	
		Unit	Resolution
0414	Release time in the event of a communication breakdown (Default setting: 600 s = 10 min) Setting values: 0 = Deactivated 1…7200 s	s	1

10.6 Modbus activation

The Modbus is always activated.

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