

Description of MODBUS-Interface

Compound-Management-System

VMS

and

Firings-Management-System

FMS

and

ETAMATIC

Revised:

Released:

Date: 11.09.2001

Date: _____

Version	Date	KP-Version	Modifications / Extensions
2.00	11.09.02	K2u001	Cause and motive for changes
2.10	25.02.03	#	Developed for Communication Processor Software Version up from KPR2u001 and FMS/VMS/ETAMATIC Software up from A3z104
2.20	06.07.04	M4y001 06.07.04	- RelayStatus in Register 8279 replaced by KPR_uiDigitalOut (identically up to bit 9 of RelayStatus) - Detailed description of Interface Parameter and of the Modbus-Transmission-Mode
2.30	16.07.04	keine	New: Serial Modbus-Line-Configuration via parameter 893
2.40	01.11.04	M4f002 01.11.04	- Write-Command-Register expanded with all GESTRA-Values - Example added: How to read the Oil-Safety-Chain from register 8280 - Description of bit patterns of registers 8279, 8280, 8281, 8285. - HP-Register write not allowed any more (Register-Nr. 9487) - With VMS now 13. Bit in the DigitalenEingängen Register-No. 9488 and Bit-Commands is transmitted as „VMS Continuous ventilating“ with KPW_FAT_Dauerlüften 16. - With VMS now 16. Bit in the DigitalenEingängen Register-No. 9488 and Bit-Commands is transmitted as „ETAMATIC-V Curve Set-1“. - Systembus-Parameter added. - Table of contents added
2.41	31.05.05	M4m002 31.05.05	- New Modbus-Registers 8201...8205 with Actual Values in %
2.42	08.06.05	M4p002 08.06.05	Register 9489 extended with Curve-Setting for FMS with modbus-function 6 or 16 and also the bit-commands with modbus-function 5
2.50	28.09.05	M5b001 28.09.05	- Version-history added - Description of Reg. 8264 moved to register table - Extensions of Read-Registers: *1) 8340: O2 actual value (from LSB) *1) 8341: O2 actual value status (from LSB) *1) 8342: COe value (from LSB)

			<ul style="list-style-type: none"> *1) 8343: COe value status (from LSB) *1) 8344: Flue gas temperature (from LSB) *1) 8345: Flue gas temperature status (from LSB) *1) 8346: Induction air (from LSB) *1) 8347: Induction air status (from LSB) *1) 8348: Efficiency (from LSB) *1) 8349: Efficiency status (from LSB) *1) 8360-8374: All values from LT1/LT2-1 (Device-09) *1) 8375-8389: All values from LT1/LT2-2 (Device-10) - Chapter 7.2.1...7.2.9 added: Description of all LT1/LT2-values
2.51	13.10.05	#	Warning added concerning the actualisation of the range values of the actual values
(2.60)	12.10.05	-	Preliminary definition only
(3.00)	16.06.04	-	Preliminary definition only
3.10	21.10.05	M5e001 21.10.05	<ul style="list-style-type: none"> - Warning: From this version upwards bit-commands function-05: Bit-register addressing now with 0...31, instead before 1...32 - Warning: From this version upwards Write-registers: Gestra-values at 9476-9485 now moved to 9492-9501 - Modbus-register 8256 description of bits added - Chapter „Bit-commands (function 05)” moved to Chapter “Write-commands” <p><u>Extensions of write-registers:</u></p> <ul style="list-style-type: none"> *2) 9476: mixing-signal for mixed-firing *2) 9489.8-.15: O2/CO-controller, oil-pump, FAT-values, curve setting VMS *2) 9504 – 9512: LSB-modules *2) 9514 – 9518: PID-Controller *2) 9520 – 9524: NEMS-devices - Chapter 7.1.1 – 7.1.6 added <p><u>Extensions of read-registers:</u></p> <ul style="list-style-type: none"> *2) 8259: KPR_uiZustandInfoLeistungsregler *2) 8261: KPR_uiTextnummer *2) 8265: KPR_uiRelaisstatus *2) 8266: KPR_uiMischKorrWert *2) 8267: KPR_O2Impuls *2) 8268: KPR_uiO2CO_Betriebszustand *2) 8269: KPR_uiKSWechselInfo *2) 8270: KPR_uiMonitorausgang *2) 8271: KPR_uiFAT_State *2) 8272: KPR_uiBrennstoffMengenaezähler *2) 8273: KPR_uiLSBOutAusblasen *2) 8400 – 8415: LSB-modules *2) 8416 – 8447: NEMS-devices - Chapter 7.3.10 – 7.3.16 added
3.20	08.11.05	M5f001 08.11.05	<ul style="list-style-type: none"> - Bit-registers extended with 32...255 for all bit-oriented write-values - Read-register 8416 extended with Bit 8...15 for NEMS-input-status-valid-bits - All new values since M5e001 completely tested
3.21	10.11.05	#	Description of new KPRs added
3.22	07.12.05	M5h001 06.12.05	- Chapter „4. Modbus-Parameters in the FMS/VMS“ completely revised and default value of parameter 889 corrected to „100“
3.30	29.01.06	M5i001 29.01.06	<ul style="list-style-type: none"> - New LSB-Adr. for Read-Registers 8201...8205 - New Read-Register 8239 with %-Value of internal load
3.31	22.02.06	#	register 8284 (5302.1): description of high-byte contents added
3.32	05.04.06	#	registers 8265 and 8279 bit descriptions extended
3.33	18.04.06	M5n001 18.04.06	- New Parameter 894 with minimal Query-Response-Time
3.34	28.06.06	M5t001 28.06.06	registers 8252, 8253 now not used (before 272.0, 272.1)
3.35	01.09.09	M7q002 21.08.09	<ul style="list-style-type: none"> Fix: NEMS message handshake fixed in KP. NEMS status documentation fixed (bit 0 and 2 were swapped). Doc. for Reg. 8278 and 8281 updated.

Impexstraße 5, 69190 Walldorf (Baden)

1. Table of Contents

2. Version History

- *1) From communications-processor-version M5b001 28.09.05
- *2) From communications-processor-version M5e001 21.10.05
- *3) From communications-processor-version M5f001 08.11.05
- *4) From communications-processor-version M5i001 29.01.06
- *5) From communications-processor-version M5n001 18.04.06
- *6) From communications-processor-version M5t001 28.06.06
- **) Future extensions, realization open yet

3. Systembus-Parameters in FMS/VMS/ETAMATIC

With these parameters in the FMS/VMS the behaviour of the communications-processor on the LSB-Systembus can be configured.

FMS-Parameter	LSB-Parameter	Bezeichnung	Standard-Werte	Wertebereich
845	1	Systembus-Family	1	
846	2	LSB-Modules-Occupancy-Configuration	6	With versions *1) and before, here costumer specific value 0 ... 5 With versions *2) and higher this value must be = 6
847	3	LSB-Device-Number	1	
848	4	LSB-Analog-Modules-Input-Output-Range-Configuration	0	see separate description
849	5	various special configurations	0	

4. Modbus-Parameters in the FMS/VMS

With these parameters in the FMS/VMS the Modbus-Interface can be configured.

FMS-Parameter	Bus-Parameter	Description	Standard-Value	Value-Range
886	1	reserved		
887	2	<u>Modbus-Slave-Address</u>	2	1 ... 247
888	3	<p><u>FMS-Timeout</u> Defines the behaviour of FMS/VMS/ETAMATIC after a disconnection of the MODBUS communication or after disconnecting the Communication Processor. In the case of stop receiving queries from the Modbus-Master after the timeout time set in Bus-Parameter-7, this Parameter can be used to shut off the burner by defined time and fault condition.</p> <p>The same reaction occurs if the communication between the Communication Processor and FMS/VMS/ETAMATIC is interrupted.</p> <p><u>Remark:</u> This Parameter 888 is only used for FMS/VMS/ETAMATIC internal. The Communication Processor does not use this parameter.</p>	0	0 ... 255 0 – The input data will be cleared after 5 sec. It results in no fault condition and does not shut OFF the burner. 1 – After 5 sec. the burner shuts OFF due to fault condition. 2 – No reaction. The input data remains at the last values. >2 = Timeout-value [sec] till one of the following reactions occur: - for even numbers the input data will be cleared, it results in no fault condition and does not shut OFF the burner. - for odd numbers it results in a fault condition and the burner shuts OFF.
889	4	<p><u>KP-Timeout</u> Timeout value for the Com.-Processor in units of 25 ms (after that time the data for the Modbus-Master are set invalid if the communication to the FMS/VMS/ETAMATIC is disconnected, and the Com.-Processor rejects any Modbus-response to the received Modbus-queries. A zero value (0) disables the timeout, so always Modbus-responses are transmitted with the last valid data.</p>	100 (100*25 ms = 2,5 sec.)	0..65500 (* 25 ms)
890	5	<u>Baudrate for Modbus</u>	3 (= 9600 Bit/s)	0 => 1200, 1 => 2400, 2 => 4800 3 => 9600 , 4 => 19200 Bit/s
891	6	<p><u>Message-Timeout for Modbus</u> When a started message transmission to the Modbus-Master is sending no more characters and exceeds the timeout value, the Com.-Processor finishes the transmission and starts the evaluation.</p>	5 (5 * 1 ms = 5 ms)	3..20 ms
892	7	<p><u>Data-Reset-Time for Modbus</u> If no more queries are received from the Modbus-Master, then the received Modbus-data will be cleared for the FMS/VMS/ETAMATIC after this Data-Reset-Time. A zero value (0) disables the timeout, it means the received Modbus-data are valid for ever.</p>	30 (30 * 1 s = 30 sec.)	0..999 s
893	8	<u>Parity und Stop-bits for Modbus</u>	0	0: 8N1 (no parity, 1 stop-bit) 1: 8E1 (even parity, 1 stop-bit) 2: 8O1 (odd parity, 1 stop-bit) 3: 8N2 (no parity, 2 stop-bits) 4: 8E2 (even parity, 2 stop-bits) 5: 8O2 (odd parity, 2 stop-bits)
894	9	<u>*5) Minimal Query-Response-Time</u>	0	*5) 0...999 ms
895	10	reserved		

5. Line-Parameters

The Baudrate is adjustable between 1200 Baud and 19200 Baud (Parameter no. 890). The data are sent and received by default with **1 start bit, 8 data bits, No Parity and 1 stop bit**. But these serial-line-parameters can be configurated in **FMS-Parameter no. 893**.

For the Modbus Transmission-Mode the **RTU** (Remote Terminal Unit) is used with the standard-16-Bit-**CRC** check sum at the end of each telegram.

For **16-Bit-Values** (ie. **Register-No**) always are transmitted first the **high-byte** and then the **low-byte**.

6. Modbus-Commands

From all possible Modbus-commands these are implemented:

Function	Command
03	read one or more registers
05	write one bit
06	write one register
08	LOOPBACK Test
16	write several registers

7. Register-Numbers

7.1 Write-Commands (Function 06 or 16)

Reg.-No. (dec)	LSB- adr. .value No0..2	FMS/VMS/Etamac destination	Description	Value- Range
9472	5110.0 5110.1	KPW_Lastvorgabe KPW_Lastvorgabe_Status	Given load value	0 ... 999
9473	5111.0 5111.1	KPW_Aussentemperaturvorgabe KPW_Aussentemperaturvorgabe_Status	Given outside temperature (only for weather guided load controller)	0 ... 999
9474	5125.0 5125.1	KPW_Korrekturwert_1 KPW_Korrekturwert_1_Status	Input value of correction channel 1	0 ... 999
9475	5126.0 5126.1	KPW_Korrekturwert_2 KPW_Korrekturwert_2_Status	Input value of correction channel 2	0 ... 999
*2) 9476	5127.0 5127.1	KPW_Mischsignal KPW_Mischsignal_Status	Mixing signal for mixed-firing	0 ... 999
9477		not used		
9478		not used		
9479		not used		
9480		not used		
9481		not used		
9482		not used		
9483		not used		
9484		not used		
9485		not used		
9486	5210.0	RegisterNr	Main Processor register number	0...65535
9487		reserved for register-value		
9488	5100.x 5101.x 5102.x	DigitalIn	Bit pattern for digital input signals (see 7.2 Bit-commands bits 0...15)	0...65535 see bit pattern
9489	5101.x 5102.x 5103.x	DigitalIn_2	Bit pattern for digital input signals 2 (see 7.2 Bit-commands bits 16...31)	0...65535 see bit pattern
9490		not used		
9491		not used		
9492	5220.0	KPW_ucNRS_140_Flags_Niedrigwasser	<u>Gestra-Tank-Value-Flags</u> Bit 0...5: reserved Bit 6: Low-water cut off probe2 (NRG16-40) Bit 7: Low-water cut off probe1 (NRG16-40) Bit 8...15: reserved	
9493	5221.0	KPW_uiNRG1642_Wasserstand_digital	<u>Water level digital</u> Bit 0 ... 3: Water level digital (Bit 0: longest probe ... Bit 3: shortest probe) Bit 4...7: reserved Bit 8 ... 11: Level in % (20, 40, 60, 80 %) Bit 12...15: reserved	
9494	5222.0	KPW_uiNRG2640_Wasserstand_analog	Water level analog (0 ... 100 %)	0 ... 100
9495	5223.0	KPW_ucNRR_240_Speisewasserventil	Feed water valve position in % (0...100 %)	0 ... 100
9496	5224.0	KPW_uiLRG1640_kompens_Leitfaehig	Compensated conductivity (0 ... 12000 µS)	0...12000
9497	5224.1	KPW_uiLRG1640_Medientemperatur	Medium temperature in 1/10 °C	
9498	5225.0	KPW_ucLRR_140_Flag_Handbetrieb	Flag for manual operation	0x0055 o.

			(0x55=active, 0xAA=passive)	0x00AA
9499	5226.0	KPW_ucNRS_141_Flags_Hochwasser	Bit 0..6: reserved Bit 7: High-water cut off probe (NRG16-41) Bit 8...15: reserved	
9500	5230.0	KPW_uIstwert_Druck	Current pressure value	
9501	5230.1	KPW_uIstwert_Temperatur	Current temperature value	
9502		not used		
9503		not used		
*2) 9504	4213.1	LSB-Analog-Output-Module-11.1	LSB-Analog-Output-Module-11 Output 1	
*2) 9505	4213.2	LSB-Analog-Output-Module-11.2	LSB-Analog-Output-Module-11 Output 2	
*2) 9506	4214.0	LSB-Analog-Output-Module-11.3	LSB-Analog-Output-Module-11 Output 3	
*2) 9507	4214.1	LSB-Analog-Output-Module-11.4	LSB-Analog-Output-Module-11 Output 4	
*2) 9508	4214.2	LSB-Analog-Output-Module-12.1	LSB-Analog-Output-Module-12 Output 1	
*2) 9509	4215.0	LSB-Analog-Output-Module-12.2	LSB-Analog-Output-Module-12 Output 2	
*2) 9510	4215.1	LSB-Analog-Output-Module-12.3	LSB-Analog-Output-Module-12 Output 3	
*2) 9511	4215.2	LSB-Analog-Output-Module-12.4	LSB-Analog-Output-Module-12 Output 4	
*2) 9512	4222.2	LSB-Digital-Output-Modules-6 and -7	Bit 0 ... 3: reserved Bit 4 ... 7: LSB-Digital-Output-Module-6 Bit 8 ... 11: LSB-Digital-Output-Module-7 Bit 12...15: reserved	
*2) 9513		not used		
*2) 9514		**) PID-Controller-Digital-Outputs		
*2) 9515		**) PID-Controller-Analog-Output-1		
*2) 9516		**) PID-Controller-Analog-Output-2		
*2) 9517		**) PID-Controller-Analog-Output-3		
*2) 9518		**) PID-Controller-Analog-Output-4		
*2) 9519		not used		
*2) 9520	- 6120.0	NEMS-Handshake-Out and NEMS-Key-Functions	<u>NEMS-Handshake-Out:</u> Bit 0: DataRead (new Message reading) Bit 1, 2, 3: not used <u>NEMS-Key-Functions:</u> Bit 4 (0=>1):LP Lamp-Test Bit 5 (0=>1):HQ Signal-Horn-Quit Bit 6 (0=>1):EQ First-Event-Confirm Bit 7 (0=>1):NQ New-Event-Confirm Bit 8...15: not used	
*2) 9521	6010.1 6010.0	NEMS-Relais 1 ... 16	Bit 0: Relais 1 Device 1 Family 1 Bit 1: Relais 2 Device 1 Family 1 Bit 2: Relais 1 Device 2 Family 1 Bit 3: Relais 2 Device 2 Family 1 Bit 4: Relais 1 Device 3 Family 1 Bit 5: Relais 2 Device 3 Family 1 Bit 6: Relais 1 Device 4 Family 1 Bit 7: Relais 2 Device 4 Family 1 Bit 8: Relais 1 Device 5 Family 1	

			Bit 9: Relais 2 Device 5 Family 1 Bit 10: Relais 1 Device 6 Family 1 Bit 11: Relais 2 Device 6 Family 1 Bit 12: Relais 1 Device 7 Family 1 Bit 13: Relais 2 Device 7 Family 1 Bit 14: Relais 1 Device 8 Family 1 Bit 15: Relais 2 Device 8 Family 1	
*2) 9522	257.0	NEMS-Time set	NEMS-Day (High-Byte) in BCD, NEMS-Month (Low-Byte) in BCD, see description below	
*2) 9523	257.1	NEMS-Time set	NEMS-Year (High-Byte) in BCD, NEMS-Hour (Low-Byte) in BCD, see description below	
*2) 9524	257.2	NEMS-Time set	NEMS-Minute (High-Byte) in BCD, NEMS-Second (Low-Byte) in BCD, see description below	

7.1.1 LSB-Analog-Output-Module-11

(Register-Nr. 9504 ... 9507)

These values are sent to LSB-Analog-Output-Module-11 (LSB-Module-address 43). Value 0 corresponds to 0 V output voltage, the value 999 (0x03E7) corresponds to 9,99 V output voltage.

7.1.2 LSB-Analog-Output-Module-12

(Register-Nr. 9508 ... 9511)

These values are sent to LSB-Analog-Output-Module-12 (LSB-Module-address 47). Value 0 corresponds to 0 V output voltage, the value 999 (0x03E7) corresponds to 9,99 V output voltage.

7.1.3 LSB-Digital-Output-Modules-6 and 7

(Register-Nr. 9512)

Bits 4 ... 7 of this value are sent to LSB-Digital-Output-Module-6 (LSB-Module-address 23) and Bits 8 ... 11 are sent to LSB-Digital-Output-Module-7 (LSB-Module-address 27).

7.1.4 NEMS-Handshake-Out

(Register-Nr. 9520, Bit 0)

See description under „NEMS-Read-Registers“

7.1.5 NEMS-Key-Functions

(Register-Nr. 9520, Bit 4...7)

Same functionality as the keys on the NEMS-Devices
(only the edge 0 =>1 of the bits causes the respective action):

- Bit 4 (0=>1): LP: Lamp-Test
- Bit 5 (0=>1): HQ: Signal-Horn-Quit
- Bit 6 (0=>1): EQ: First-Event-Confirm
- Bit 7 (0=>1): NQ: New-Event-Confirm

7.1.6 NEMS-Relais 1 ... 16

(Register-Nr. 9521)

Bit 0 is sent to Relais 1 of NEMS-Device 1 Family 1.
Bit 1 is sent to Relais 2 of NEMS-Device 1 Family 1.
Bit 2 is sent to Relais 1 of NEMS-Device 2 Family 1.
Bit 3 is sent to Relais 2 of NEMS-Device 2 Family 1.
Bit 4 is sent to Relais 1 of NEMS-Device 3 Family 1.
Bit 5 is sent to Relais 2 of NEMS-Device 3 Family 1.
Bit 6 is sent to Relais 1 of NEMS-Device 4 Family 1.
Bit 7 is sent to Relais 2 of NEMS-Device 4 Family 1.
Bit 8 is sent to Relais 1 of NEMS-Device 5 Family 1.
Bit 9 is sent to Relais 2 of NEMS-Device 5 Family 1.
Bit 10 is sent to Relais 1 of NEMS-Device 6 Family 1.
Bit 11 is sent to Relais 2 of NEMS-Device 6 Family 1.
Bit 12 is sent to Relais 1 of NEMS-Device 7 Family 1.
Bit 13 is sent to Relais 2 of NEMS-Device 7 Family 1.
Bit 14 is sent to Relais 1 of NEMS-Device 8 Family 1.
Bit 15 is sent to Relais 2 of NEMS-Device 8 Family 1.

7.1.7 NEMS-Time set

(Register-Nr. 9522 ... 9524)

The NEMS-Time is set with the values of the registers 9522-9524 for the NEMS-devices, always, and only when register 9524 is written.

Setting the LSB-Time has to be done by writing the registers 9522-9524 with one write-command using Modbus-Function-16, or with 3 write-commands with Modbus-Function-6 writing the registers 9522, 9523, 9524 in this sequence.

Warning:

During run-time the register 9524 should not always been written, because every time when the NEMS-Time is set, the NEMS-devices are running a system-reset operation automatically.

To consider:

After setting the NEMS-Time the NEMS-Devices are running a system-reset operation automatically !!!

If a remote clock is connected to the NEMS-Devices, the setting of the NEMS-Time via Modbus is ignored !!!

7.2 Bit-Commands (Function 05)

The grey marked cells for the **FMS** will not be copied and neither stored for safety reasons.

With **VMS** the curve setting can be done via Reg. 9488 or 9489. The bit-values of the curve setting of these two registers are being OR-ed. Only one of the 8 curve sets should be selected at one time. If no curve set is selected (all bits = 0) or if more than one curve set are selected (more than one bit = 1), a fault state of the burner will be caused (if the burner was in on-state).

Bit-Register no.	Write-Register no., bit no.	Terminal Input no.	Function with FMS	Function with VMS
0	9488.0	1	Pre-ventilation rejection	Curve set no. 6
1	9488.1	2	Burner "ON"	Burner start up
2	9488.2	3	Fault reset (only edge 0→1)	Pre ventilation
3	9488.3	4	Control release	Control release
4	9488.4	5	Gas safety interlock circuit	Curve set no. 3
5	9488.5	6	Flue gas recirculation "ON"	Recirculation „ON“
6	9488.6	7	Gas pressure < max	Curve set no. 1
7	9488.7	8	Flame signal	Flame signal
8	9488.8	35	Boiler safety interlock circuit	Curve set no. 2
9	9488.9	69	Oil safety interlock circuit	Curve set no. 4
10	9488.10	70	Setpoint switching	Setpoint switching
11	9488.11	71	Extern. high fire posit. prove true	Curve set no. 5
12	9488.12	72	Air fan pressure switch	VMS Continuous ventilating
13	9488.13	73	Gas pressure < min	Curve set no. 7
14	9488.14	74	Extern. ignition posit. prove true	Curve set no. 8
15	9488.15	75	Fuel selection	ETAMATIC-V Curve set no. 1
16	9489.0	-	Curve set no. 1	*2) Curve set no. 1
17	9489.1	-	Curve set no. 2	*2) Curve set no. 2
18	9489.2	-	Curve set no. 3	*2) Curve set no. 3
19	9489.3	-	Curve set no. 4	*2) Curve set no. 4
20	9489.4	-	Curve set no. 5	*2) Curve set no. 5
21	9489.5	-	Curve set no. 6	*2) Curve set no. 6
22	9489.6	-	Curve set no. 7	*2) Curve set no. 7
23	9489.7	-	Curve set no. 8	*2) Curve set no. 8
24	9489.8	-	*2) O2 Controller on/off	*2) O2 Control on/off
25	9489.9	-	*2) CO Controller on/off	*2) CO Control on/off
26	9489.10	-	*2) Oil pump on/off	reserved
27	9489.11	-	reserved	reserved
28	9489.12	-	*2) FAT Standby	reserved
29	9489.13	-	*2) FAT Continuous ventilating	*2) VMS Continuous ventilating
30	9489.14	-	reserved	reserved
31	9489.15	-	reserved	reserved
32...47	9490.0...15	-	***) reserved for 9490	***) reserved for 9490
48...63	9491.0...15	-	***) reserved for 9491	***) reserved for 9491
All the following have the same functionality with FMS and VMS				
64...69	9492.0...5		***) reserved for 9492	
70	9492.6		Low-water cut off probe 2 (NRG16-40)	
71	9492.7		Low-water cut off probe 1 (NRG16-40)	
72...79	9492.8...15		***) reserved for 9492	
80	9493.0		Water level digital Bit 0: longest probe	
81	9493.1		Water level digital Bit 1: second longest probe	
82	9493.2		Water level digital Bit 2: second shortest probe	
83	9493.3		Water level digital Bit 3: shortest probe	
84...87	9493.4...7		***) reserved for 9493	

88	9493.8		Level in %, Bit 8: 20 %
89	9493.9		Level in %, Bit 9: 40 %
90	9493.10		Level in %, Bit 10: 60 %
91	9493.11		Level in %, Bit 11: 80 %
92...95	9493.12...15		**) reserved for 9493
96...111	9498.0...15		**) reserved for 9498
112...118	9499.0...6		**) reserved for 9499
119	9499.7		High-water cut off probe (NRG16-41)
120...127	9499.8...15		**) reserved for 9499
128...143	9502.0...15		**) reserved for 9502
144...159	9503.0...15		**) reserved for 9503
160...163	9512.0...3		**) reserved for 9512
164	9512.4		LSB-digital-output-module-6 output 1
165	9512.5		LSB-digital-output-module-6 output 2
166	9512.6		LSB-digital-output-module-6 output 3
167	9512.7		LSB-digital-output-module-6 output 4
168	9512.8		LSB-digital-output-module-7 output 1
169	9512.9		LSB-digital-output-module-7 output 2
170	9512.10		LSB-digital-output-module-7 output 3
171	9512.11		LSB-digital-output-module-7 output 4
172...175	9512.12...15		**) reserved for 9512
176...191	9513.0...15		**) reserved for 9513
192...207	9514.0...15		**) reserved for 9514 (PID-controller-digital-outputs)
208...223	9519.0...15		**) reserved for 9519
224	9520.0		DataRead (new Message reading) NEMS-Handshake-Out Bit 0
225...227	9520.1...3		**) reserved for 9520
228	9520.4		LP Lamp-Test NEMS-Key-Functions Bit 4 (0=>1)
229	9520.5		HQ Signal-Horn-Quit NEMS-Key-Functions Bit 5 (0=>1)
230	9520.6		EQ First-Event-Confirm NEMS-Key-Functions Bit 6 (0=>1)
231	9520.7		NQ New-Event-Confirm NEMS-Key-Functions Bit 7 (0=>1)
232...239	9520.8...15		**) reserved for 9520
240	9521.0		NEMS-Relais 1 Device 1 Family 1
241	9521.1		NEMS-Relais 2 Device 1 Family 1
242	9521.2		NEMS-Relais 1 Device 2 Family 1
243	9521.3		NEMS-Relais 2 Device 2 Family 1
244	9521.4		NEMS-Relais 1 Device 3 Family 1
245	9521.5		NEMS-Relais 2 Device 3 Family 1
246	9521.6		NEMS-Relais 1 Device 4 Family 1
247	9521.7		NEMS-Relais 2 Device 4 Family 1
248	9521.8		NEMS-Relais 1 Device 5 Family 1
249	9521.9		NEMS-Relais 2 Device 5 Family 1
250	9521.10		NEMS-Relais 1 Device 6 Family 1
251	9521.11		NEMS-Relais 2 Device 6 Family 1
252	9521.12		NEMS-Relais 1 Device 7 Family 1
253	9521.13		NEMS-Relais 2 Device 7 Family 1
254	9521.14		NEMS-Relais 1 Device 8 Family 1
255	9521.15		NEMS-Relais 2 Device 8 Family 1

Example for function-05 byte contents:

Byte-No.	1	2	3	4	5	6	7	8
Meaning	Addr	Function	HighByte Register	LowByte Register	On/Off Value	Null	CRC	CRC
Value	04	05	00	01 (for Burner on)	0xFF => (switch on) 0x00 => (switch off)	00	0x2D	0xAF

7.3 Read-Commands (Function 03)

With one read-command the maximal number of 125 Read-Registers can be read.

Register-No. (decimal)	LSB-Adr .ValueNo .0..2	FMS/VMS/Etamatic Source	Description	Value- Range
8192	5303.0	KPR_uiInterneLast	Internal load value	0..999
8193	5303.1	KPR_uiLastMin	Lowest load point	0..999
8194	5303.2	KPR_uiLastMax	Highest load point	0..999
8195	5310.0	KPR_uiKesselTemp	Actual value of load controller (if available)	0..999
8196	5401.0	KPR_uiIstwert_Kanal_1	Actual value of channel 1 (absolute value)	0..999
8197	5402.0	KPR_uiIstwert_Kanal_2	Actual value of channel 2 (absolute value)	0..999
8198	5403.0	KPR_uiIstwert_Kanal_3	Actual value of channel 3 (absolute value)	0..999
8199	5404.0	KPR_uiIstwert_Kanal_4	Actual value of channel 4 (absolute value)	0..999
8200	5405.0	KPR_uiIstwert_Kanal_5	Actual value of channel 5 (absolute value)	0..999
8201	5406.2 (5406.0) (5406.1)	KPR_uiIstwert_Kanal_1 (KPR_uiMinWert_Kanal_1) (KPR_uiMaxWert_Kanal_1)	Actual value of channel 1 in % 0% = Actuator pos. at low level of value range 100% = Act. pos. at high level of value range	0..100
8202	5407.2 (5407.0) (5407.1)	KPR_uiIstwert_Kanal_2 (KPR_uiMinWert_Kanal_2) (KPR_uiMaxWert_Kanal_2)	Actual value of channel 2 in % 0% = Actuator pos. at low level of value range 100% = Act. pos. at high level of value range	0..100
8203	5408.2 (5408.0) (5408.1)	KPR_uiIstwert_Kanal_3 (KPR_uiMinWert_Kanal_3) (KPR_uiMaxWert_Kanal_3)	Actual value of channel 3 in % 0% = Actuator pos. at low level of value range 100% = Act. pos. at high level of value range	0..100
8204	5409.2 (5409.0) (5409.1)	KPR_uiIstwert_Kanal_4 (KPR_uiMinWert_Kanal_4) (KPR_uiMaxWert_Kanal_4)	Actual value of channel 4 in % 0% = Actuator pos. at low level of value range 100% = Act. pos. at high level of value range	0..100
8205	5410.2 (5410.0) (5410.1)	KPR_uiIstwert_Kanal_5 (KPR_uiMinWert_Kanal_5) (KPR_uiMaxWert_Kanal_5)	Actual value of channel 5 in % 0% = Actuator pos. at low level of value range 100% = Act. pos. at high level of value range	0..100
8206	5401.1	KPR_uiKorrSollwert_Kanal_1	Setpoint, Main Processor, channel 1	0..999
8207	5402.1	KPR_uiKorrSollwert_Kanal_2	Setpoint, Main Processor, channel 2	0..999
8208	5403.1	KPR_uiKorrSollwert_Kanal_3	Setpoint, Main Processor, channel 3	0..999
8209	5404.1	KPR_uiKorrSollwert_Kanal_4	Setpoint, Main Processor, channel 4	0..999
8210	5405.1	KPR_uiKorrSollwert_Kanal_5	Setpoint, Main Processor, channel 5	0..999
8211		not used		
8212		not used		
8213		not used		
8214		not used		
8215		not used		
8216	5406.0	KPR_uiMinWert_Kanal_1	Lower actuator stop, Main Processor, channel 1	0..999
8217	5407.0	KPR_uiMinWert_Kanal_2	Lower actuator stop, Main Processor, channel 2	0..999

			text (ie. channel no.)	
*2) 8259	5350.0	KPR_uiZustandInfoLeistungsregler	<u>Additional information for load controller</u> Actual value of load controller is above the switch-on point Bit 0: Def_LR_UEBER_EIN 1	
8260	5330.0	KPR_FMS_Brennstoff	ÖL oder GAS aktiv beim FMS	
*2) 8261	5304.2	KPR_uiTextnummer	Information text number	
8262	5422.0	KPR_uiSynchron	0x0001 Ignition position Main Processor 0x0002 Ignition position Monitoring Processor 0x0004 High fire Main Processor 0x0008 High fire Monitoring Processor Bit 4...15 reserved	
8263	5422.1	KPR_uiAcHandmodus	Manual Mode: 0x0001 Comp. regulator adjustment via front panel 0x0002 O ₂ adjustment via front plate 0x0004 Given load under control mode operation via front plate 0x0100 Given load for comp. regulator adjustment by Remote Software 0x0200 Given load for O ₂ adjustment by Remote Software 0x0400 External manual given load 0x0800 External manual given load 0x1000 Manual given load under control mode operation via Remote Software 0x2000 Given load via Systembus / Fieldbus	
8264	5422.2	Bit-combination of: KPR_uiSynchron and KPR_uiAcHandmodus	0x0200 → Ignition position reached Set bit only when following both bits of KPR_uiSynchron simultaneous are 1 PQ_ZP_HP 0x0001 // Ignition position Main Proc. reached PQ_ZP_UE 0x0002 // Ignition position Monitoring Processor reached 0x0400 → High fire position reached Set bit only when following both bits of KPR_uiSynchron simultaneous are 1 PQ_GL_HP 0x0004 // High fire position Main Processor reached PQ_GL_UE 0x0008 // High fire position Monitoring Processor reached 0x0800 → Manual operation Following bits of KPR_uiAcHandmodus are WIRED OR. 0x0001 Compound regulator adjustment via front panel 0x0002 O ₂ adjustment via front panel 0x0004 Manual given burner load under released control via front panel 0x0100 Burner load given for compound regulator adjustment by Remote-	

			<p>Software</p> <p>0x0200 Burner load given for O₂ adjustment by Remote-Software</p> <p>0x0400 Manual given external burner load</p> <p>0x0800 Manual given external burner load</p> <p>0x1000 Manual given burner load under released control via Remote-Software</p> <p>--- therefore KPR_uiAcHandmodus & 0x1fff</p>	
*2) 8265	5304.0	KPR_uiRelaisstatus	<p><u>Relaisstatus:</u></p> <p>FMS</p> <p>0x0001: oil valve 0x0002: ignition valve 0x0004: oil / gas 0x0008: ventilation time end 0x0010: gas1 0x0020: ignition transformer 0x0040: gas2 0x0080: fault relais 0x0100: ventilator ON</p> <p>(up to bit 9 identical with KPR_uiDigitalOut 149)</p> <p>ETAMATIC</p> <p>0x0001: oil valve 0x0002: ignition valve 0x0004: oil / gas 0x0008: oilpump 0x0010: gas1 0x0020: ignition transformer 0x0040: gas2 0x0080: fault relais 0x0100: ventilator ON</p> <p>(up to bit 9 identical with KPR_uiDigitalOut 149)</p> <p>VMS</p> <p>0x0001: ignition point main processor 0x0002: fault main processor 0x0004: mixed firing fuel A Fr. 0x0008: mixed firing gas release 0x0010: fault monitoring processor 0x0020: Großlast erreicht 0x0040: ignition point monitoring proc. 0x0080: mixed firing oil release 0x0100: burner on</p> <p>(up to bit 9 identical with KPR_uiDigitalOut 149)</p>	
*2) 8266	5306.2	KPR_uiMischKorrWert	Correction value for mixed firing	
*2) 8267	5321.2	KPR_O2Impuls	=, +, -, ! => sO2Data.ucImpuls	
*2) 8268	5322.0	KPR_uiO2CO_Betriebszustand	<p><u>O2/CO-Status (values are in decimal):</u></p> <p>1 O2 measured value too low 2 O2 measured value too high during pre-ventilation</p>	

			<p>3 O2 measured value too high after pre-ventilation</p> <p>4 no probe-dynamics: O2-control is deactivated</p> <p>5 O2 measured value 1 high range passed over</p> <p>6 O2 measured value 2 high range passed over</p> <p>7 O2 measured value 1 low range passed over</p> <p>8 O2 measured value 2 low range passed over</p> <p>9 medium air shortage reached</p> <p>10 O2 measured value trouble</p> <p>11 O2 measured value trouble (LSB)</p> <p>12 O2 control trouble, internal error</p> <p>13 air shortage: O2 control deactivated</p> <p>14 air shortage: O2 control deactivated</p> <p>15 no probe-dynamics: high air supply</p> <p>16 correction limited: O2 control deactivated</p> <p>17 O2 control trouble</p> <p>18 O2 set point curve not correct</p> <p>19 undefined</p> <p>20 O2 control trouble</p> <p>21 O2 control trouble</p> <p>22 undefined</p> <p>23 undefined</p> <p>24 O2 control ready</p> <p>25 O2 control off: load value out of range</p> <p>26 O2 control off</p> <p>27 O2 control trouble</p> <p>28 O2 control trouble</p> <p>29 O2 control trouble</p> <p>30 O2 control trouble temporary</p> <p>31 O2 control switched off via LSB</p> <p>32 correction value controlled manually</p> <p>33 O2 control ready</p> <p>34 O2 control active</p> <p>35 effective CO probe voltage UCOe faulty</p> <p>40 no valid edge information on LSB</p> <p>41 probe voltage not inside the supervision window</p> <p>42 probe offset voltage not inside the supervision window</p> <p>43 cell resistance not inside the supervision window</p> <p>44 cell temperature not inside the supervision window</p> <p>45 dynamics of probe voltage not recognizable</p> <p>46 interal load is outside of the configured load window</p> <p>47 CO controller is going to be deactivated by the monitoring processor</p> <p>48 CO controller is going to be deactivated by the LSB</p>	
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			<p>49 CO controller is going to be deactivated by the O2-Monitoring</p> <p>50 effective CO probe voltage UCOe is outside of the configured load window</p> <p>51 CO controller is active</p> <p>Other values are undefined After the text, put out always the codenumber !</p>	
*2) 8269	5330.2	KPR_uiKSWechselInfo	Information about curve set change	
*2) 8270	5331.1	KPR_uiMonitorausgang	Monitoring output	
*2) 8271	5331.2	KPR_uiFAT_State	Status of FAT	
*2) 8272	5351.1	KPR_uiBrennstoffMengenzaehler	Fuel amount counter	
*2) 8273	5352.0	KPR_uiLSBOutAusblasen Bit 0: Def_AusblasenVentil Bit 1: Def_ZerstaeuberVentil Bit 2: Def_FMSOelpumpe	<u>Blow out LSB output</u> Bit 0: blow out valve Bit 1: sprayer valve Bit 2: FMS oil pump	
8274		not used		
8275		not used		
8276	5306.0	KPR_uiKoval_1	Correction value of correction-channel 1	0..999
8277	5306.1	KPR_uiKoval_2	Correction value of correction-channel 2	0..999
8278	5300.1	KPR_uiStoerung	Last fault code message Offset 10.000 for Monitoring-Processor Offset (0-4) if channel-dependant fault	0..999
8279	5302.2 (5422.2)	KPR_uiDigitalOut & 0xF1FF (RelaisStatus) 5422.2 & 0x0E00	<p>Status of relay outputs:</p> <p>0x0001 Relais 11 0x0002 Relais 16 0x0004 Relais 36 0x0008 Relais 41 0x0010 Relais 43 0x0020 Relais 45 0x0040 Relais 67 0x0080 Relais 68 0x0100 Relais 76 *0x0200 Ignition-Position reached *0x0400 High-Fire-Position reached *0x0800 Manual-Load active 0x1000 Curve-Set changing 0x2000 Mixed-Firing-Relais</p> <p>FMS</p> <p>0x0001: Oil valve 0x0002: Ignition valve 0x0004: OIL / GAS 0x0008: Pre ventilation finished 0x0010: Gas valve 1 0x0020: Ignition transformer 0x0040: Gas valve 2 0x0080: Fault relay 0x0100: Combustion air fan ON *0x0200: Ignition position reached *0x0400: High fire position reached *0x0800: Manual given load 0x1000: Curve set changing 0x2000: Mixed-firing relais</p> <p>ETAMATIC</p> <p>0x0001: Oil valve 0x0002: Ignition valve</p>	0..65535

			<p>0x0004: OIL / GAS 0x0008: Oilpump 0x0010: Gas valve 1 0x0020: Ignition transformer 0x0040: Gas valve 2 0x0080: Fault relay 0x0100: Combustion air fan ON *0x0200: Ignition position reached *0x0400: High fire position reached *0x0800: Manual given load 0x1000: Curve set changing 0x2000: reserved</p> <p style="text-align: center;">VMS</p> <p>0x0001: Ignition position HP 0x0002: Fault detected by HP 0x0004: Mixed-firing fuel A release 0x0008: Mixed-firing Gas release 0x0010: Fault detected by UP 0x0020: High fire position reached 0x0040: Ignition position UP 0x0080: Mixed-firing Oil release 0x0100: Burner ON *0x0200: Ignition position reached *0x0400: High fire position reached *0x0800: Manual given load 0x1000: Curve set changing 0x2000: Mixed-firing relais</p> <p>* The Bits 0x0200, 0x0400, 0x0800 are a logical composition of KPR_uiSynchron and KPR_uiAcHandmodus (see also register 8264)</p>	
8280	5302.0	<p>KPR_uiDigitalIn</p> <p>Example: Reading the Oil-Safety-Chain via register 8280. Use for example the outputbytes 30,31.</p> <p>Course: Put the number 8280 (decimal !) into the inputbytes 16,17 and do not change this no further. Then read out the 16 input clamps from the outputbytes 30,31.</p> <p>The Oil-Safety-Chain can be read out from Bit-6 (0x0040)</p>	<p>Digital input signals:</p> <p style="text-align: center;">FMS</p> <p>0x8000 Pre-Ventilation-Supressing 0x4000 Burner on 0x2000 Fault-Reset 0x1000 Control-Release 0x0800 Gas-Safety-Chain 0x0400 REZI on 0x0200 Gas-Pressure < Max / Ignition-Flame 0x0100 Main-Flame 0x0080 Tank-Safety-Chain 0x0040 Oil-Safety-Chain 0x0020 Set-Point-Switch-Over 0x0010 High-Fire-Position reached 0x0008 Air-Pressure-Watchdog 0x0004 Gas-Pressure > Min 0x0002 Ignition-Position-Confirmation 0x0001 Fuel-Change</p> <p style="text-align: center;">VMS</p> <p>0x8000 Curveset-6 0x4000 Burner on 0x2000 Pre-Ventilation 0x1000 Control-Release</p>	0..65535

			0x0800 Curveset-3 0x0400 REZI on 0x0200 Curveset-1 0x0100 Flame-Signal 0x0080 Curveset-2 0x0040 Curveset-4 0x0020 Set-Point-Switch-Over 0x0010 Curveset-5 0x0008 Permanent-Ventilation 0x0004 Curveset-7 0x0002 Curveset-8 0x0001 External-Power-Limit	
8281	5300.0	KPR_uiBetrModus	Operating mode of FMS: 0x0001 PowerOn 0x0002 Burner off 0x0004 Burner ready 0x0008 Pre-Ventilation 0x0010 go to Ignition-Point 0x0020 Igniting 0x0040 Base-Load 0x0080 Control-Operation 0x0100 Post-Ventilation 0x0200 Fault-State 0x1000 O2 adjustment 0x2000 Parameterization 0x4000 Setting 0x8000 Clear Memory	0...512
8282	5510.0	Register Number	Main Processor Register Number	0..65535
8283	5510.1	Register Value	Main Processor Register Value	0..65535
8284	5302.1	KPR_ucAktBrennstoff	currently selected curve set value = 0: curve set 1 value = 1: curve set 2 ... value = 7. curve set 8 Attention: from version M4o002: high-byte contains additionally the bit-values of the currently selected curve set: Bit 8: curve set 1 Bit 9: curve set 2 Bit 10: curve set 3 Bit 11: curve set 4 Bit 12: curve set 5 Bit 13: curve set 6 Bit 14: curve set 7 Bit 15: curve set 8	<u>values:</u> 0x0000, 0x0001 ... 0x0007 <u>new values:</u> 0x0100 0x0201 0x0402 0x0803 0x1004 0x2005 0x4006 0x8007
8285	5421.0	KPR_ucSchalter_S5	Setting of switch S5: 0x0001 Display-Supervision 0x0002 Parameter-Setup 0x0004 Manual-Operation 0x0008 Automatic-Operation 0x0010 Setting 0x0020 Memory-Clear	0..65535
8286		not used	Remark: The thermostat-bit is (Modbus operation: this register is supplied by internal Bus card) available on register 8263 bit-1	
8287		not used		
8288		not used		
8289		not used		

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8290		not used		
8291		not used		
8292		not used		
8293		not used		
8294		not used		
8295		not used		
8296		not used		
8297		not used		
8298		not used		
8299		not used		
8300	5520.0	KPR_BetrStd_Gesamt_Hi	Total operating hours	
8301	5520.1	KPR_BetrStd_Gesamt_Lo	Total operating hours	
8302	5521.0	KPR_BetrStd_Kurvensatz_1_Hi	Operating hours curve set -1	
8303	5521.1	KPR_BetrStd_Kurvensatz_1_Lo	Operating hours curve set -1	
8304	5522.0	KPR_BetrStd_Kurvensatz_2_Hi	Operating hours curve set -2	
8305	5522.1	KPR_BetrStd_Kurvensatz_2_Lo	Operating hours curve set -2	
8306	5523.0	KPR_BetrStd_Kurvensatz_3_Hi	Operating hours curve set -3	
8307	5523.1	KPR_BetrStd_Kurvensatz_3_Lo	Operating hours curve set -3	
8308	5524.0	KPR_BetrStd_Kurvensatz_4_Hi	Operating hours curve set -4	
8309	5524.1	KPR_BetrStd_Kurvensatz_4_Lo	Operating hours curve set -4	
8310	5525.0	KPR_BetrStd_Kurvensatz_5_Hi	Operating hours curve set -5	
8311	5525.1	KPR_BetrStd_Kurvensatz_5_Lo	Operating hours curve set -5	
8312	5526.0	KPR_BetrStd_Kurvensatz_6_Hi	Operating hours curve set -6	
8313	5526.1	KPR_BetrStd_Kurvensatz_6_Lo	Operating hours curve set -6	
8314	5527.0	KPR_BetrStd_Kurvensatz_7_Hi	Operating hours curve set -7	
8315	5527.1	KPR_BetrStd_Kurvensatz_7_Lo	Operating hours curve set -7	
8316	5528.0	KPR_BetrStd_Kurvensatz_8_Hi	Operating hours curve set -8	
8317	5528.1	KPR_BetrStd_Kurvensatz_8_Lo	Operating hours curve set -8	
8318	5531.0	KPR_AnIzaehl_Kurvensatz_1_Hi	Start up counter curve set -1	
8319	5531.1	KPR_AnIzaehl_Kurvensatz_1_Lo	Start up counter curve set -1	
8320	5532.0	KPR_AnIzaehl_Kurvensatz_2_Hi	Start up counter curve set -2	
8321	5532.1	KPR_AnIzaehl_Kurvensatz_2_Lo	Start up counter curve set -2	
8322	5533.0	KPR_AnIzaehl_Kurvensatz_3_Hi	Start up counter curve set -3	
8323	5533.1	KPR_AnIzaehl_Kurvensatz_3_Lo	Start up counter curve set -3	
8324	5534.0	KPR_AnIzaehl_Kurvensatz_4_Hi	Start up counter curve set -4	
8325	5534.1	KPR_AnIzaehl_Kurvensatz_4_Lo	Start up counter curve set -4	
8326	5535.0	KPR_AnIzaehl_Kurvensatz_5_Hi	Start up counter curve set -5	
8327	5535.1	KPR_AnIzaehl_Kurvensatz_5_Lo	Start up counter curve set -5	
8328	5536.0	KPR_AnIzaehl_Kurvensatz_6_Hi	Start up counter curve set -6	
8329	5536.1	KPR_AnIzaehl_Kurvensatz_6_Lo	Start up counter curve set -6	
8330	5537.0	KPR_AnIzaehl_Kurvensatz_7_Hi	Start up counter curve set -7	
8331	5537.1	KPR_AnIzaehl_Kurvensatz_7_Lo	Start up counter curve set -7	
8332	5538.0	KPR_AnIzaehl_Kurvensatz_8_Hi	Start up counter curve set -8	
8333	5538.1	KPR_AnIzaehl_Kurvensatz_8_Lo	Start up counter curve set -8	
*1) 8334		not used		
*1) 8335		not used		
*1) 8336		not used		
*1) 8337		not used		
*1) 8338		not used		
*1) 8339		not used		
*1) 8340	5120.0	O2 actual value (from LSB)	O2 actual value (= Register 8244)	
*1) 8341	5120.1	O2 actual value status (from LSB)	O2 actual value status (= Register 8245)	
*1) 8342	5122.0	COe value (from LSB)	COe value	
*1) 8343	5122.1	COe value (from LSB)	COe value status	
*1) 8344	5123.0	Flue gas temperature (from LSB)	Flue gas temperature 1/10 K (signed int)	
*1) 8345	5123.1	Flue gas temperature status (from LSB)	Flue gas temperature status	
*1) 8346	5124.0	Induction air (from LSB)	Induction air 1/10 K (signed int)	
*1) 8347	5124.1	Induction air status (from LSB)	Induction air status	
*1) 8348	5121.0	Efficiency (from LSB)	Efficiency 1/10 %	

*1) 8349	5121.1	Efficiency status (from LSB)	Efficiency status	
*1) 8350		not used		
*1) 8351		not used		
*1) 8352		not used		
*1) 8353		not used		
*1) 8354		not used		
*1) 8355		not used		
*1) 8356		not used		
*1) 8357		not used		
*1) 8358		not used		
*1) 8359		not used		
		<u>Following values from LT1/LT2-1 (Device-09)</u>		
*1) 8360	7310.0	O2-Value LT1 or LT2	O2-value in units of 1/10 %	
*1) 8361	7310.1	Operating mode of LT1 or LT2	Bit-coded value of operating mode of LT1 or LT2, see table below	
*1) 8362	7310.2	Faults states of LT1 or LT2	Bit-coded value of fault states of LT1 or LT2, see table below	
*1) 8363	7311.0	Warnings 1 of LT1 or LT2	Bit-coded value of warning-word 1 of LT1 or LT2, see table below	
*1) 8364	7311.1	Warnings 2 of LT1 or LT2	Bit-coded value of warning-word 2 of LT1 or LT2, see table below	
*1) 8365	7311.2	Absolute pressure value of LT1 or internal resistance of probe LT2	Absolute pressure value of LT1 in mbar or internal resistance of probe LT2 in units of 0,1 Ohm, the meaning of this LT-value can be selected by parameter 1302 in the LT	
*1) 8366	7312.0	LT1/LT2: Application specific measured value 1	Application specific measured value 1. The meaning of this LT-value can be selected by parameter 1303 in the LT	
*1) 8367	7312.1	LT1/LT2: Application specific measured value 2	Application specific measured value 2. The meaning of this LT-value can be selected by parameter 1304 in the LT	
*1) 8368	7312.2	LT1/LT2: Application specific measured value 3	Application specific measured value 3. The meaning of this LT-value can be selected by parameter 1305 in the LT	
*1) 8369	7313.0	LT1/LT2: Application specific measured value 4	Application specific measured value 4. The meaning of this LT-value can be selected by parameter 1306 in the LT	
*1) 8370	7313.1	LT1/LT2: reserved	reserved for future expansions	
*1) 8371	7313.2	LT1/LT2: reserved	reserved for future expansions	
*1) 8372	7314.0	LT1/LT2: reserved	reserved for future expansions	
*1) 8373	7314.1	LT1/LT2: reserved	reserved for future expansions	
*1) 8374	(7314.2)	reserved		
		<u>Following values from LT1/LT2-2 (Device-10)</u>		
*1) 8375	7320.0	O2-Value LT1 or LT2	O2-value in units of 1/10 %	
*1) 8376	7320.1	Operating mode of LT1 or LT2	Bit-coded value of operating mode of LT1 or LT2, see table below	
*1) 8377	7320.2	Faults states of LT1 or LT2	Bit-coded value of fault states of LT1 or LT2, see table below	
*1) 8378	7321.0	Warnings 1 of LT1 or LT2	Bit-coded value of warning-word 1 of LT1 or LT2, see table below	
*1) 8379	7321.1	Warnings 2 of LT1 or LT2	bit-coded value of warning-word 2 of LT1 or LT2, see table below	
*1) 8380	7321.2	Absolute pressure value of LT1 or internal resistance of probe LT2	Absolute pressure value of LT1 in mbar or internal resistance of probe LT2 in units of 0,1 Ohm, the meaning of this LT-	

			value can be selected by parameter 1302 in the LT	
*1) 8381	7322.0	LT1/LT2: Application specific measured value 1	Application specific measured value 1. The meaning of this LT-value can be selected by parameter 1303 in the LT	
*1) 8382	7322.1	LT1/LT2: Application specific measured value 2	Application specific measured value 2. The meaning of this LT-value can be selected by parameter 1304 in the LT	
*1) 8383	7322.2	LT1/LT2: Application specific measured value 3	Application specific measured value 3. The meaning of this LT-value can be selected by parameter 1305 in the LT	
*1) 8384	7323.0	LT1/LT2: Application specific measured value 4	Application specific measured value 4. The meaning of this LT-value can be selected by parameter 1306 in the LT	
*1) 8385	7323.1	LT1/LT2: reserved	reserved for future expansions	
*1) 8386	7323.2	LT1/LT2: reserved	reserved for future expansions	
*1) 8387	7324.0	LT1/LT2: reserved	reserved for future expansions	
*1) 8388	7324.1	LT1/LT2: reserved	reserved for future expansions	
*1) 8389	(7324.2)	reserved		
*2) 8390		not used		
*2) 8391		not used		
*2) 8392		not used		
*2) 8393		not used		
*2) 8394		not used		
*2) 8395		not used		
*2) 8396		not used		
*2) 8397		not used		
*2) 8398		not used		
*2) 8399		not used		
*2) 8400		Status LSB-Output-Modules and **) PID-Regulator-Analog-Outputs Stat. **) PID-Regulator-Digital-Outputs Stat.	Status-Bits (0 => Offline, 1 => Online): Bit 0: LSB-Analog-Output-Module-11 Bit 1: LSB-Analog-Output-Module-12 Bit 2: LSB-Digital-Output-Module-6 Bit 3: LSB-Digital-Output-Module-7 Bit 4 ... 7: PID-Reg.-Analog-Outp. **) Bit 8 ... 14: PID-Reg.-Digital-Outp. **)	
*2) 8401		Status LSB-Analog-Input-Modules and Status LSB-Digital-Output-Modules	Status-Bits (0 => Offline, 1 => Online): Bit 0: reserved Bit 1: LSB-Analog-Input-Module-14 Bit 2: LSB-Analog-Input-Module-15 Bit 3: LSB-Analog-Input-Module-16 Bit 4: LSB-Digital-Input-Module-1 Bit 5: LSB-Digital-Input-Module-3 Bit 6: LSB-Digital-Input-Module-13 Bit 7: LSB-Digital-Input-Module-14	
*2) 8402		LSB-Analog-Input-Module-14.1	LSB-Analog-Input-Module-14 Input-Value 1	
*2) 8403		LSB-Analog-Input-Module-14.2	LSB-Analog-Input-Module-14 Input-Value 2	
*2) 8404		LSB-Analog-Input-Module-14.3	LSB-Analog-Input-Module-14 Input-Value 3	
*2) 8405		LSB-Analog-Input-Module-14.4	LSB-Analog-Input-Module-14 Input-Value 4	
*2) 8406		LSB-Analog-Input-Module-15.1	LSB-Analog-Input-Module-15 Input-Value 1	
*2) 8407		LSB-Analog-Input-Module-15.2	LSB-Analog-Input-Module-15 Input-Value 2	
*2) 8408		LSB-Analog-Input-Module-15.3	LSB-Analog-Input-Module-15 Input-Value 3	
*2) 8409		LSB-Analog-Input-Module-15.4	LSB-Analog-Input-Module-15	

			Input-Value 4	
*2) 8410		LSB-Analog-Input-Module-16.1	LSB-Analog-Input-Module-16 Input-Value 1	
*2) 8411		LSB-Analog-Input-Module-16.2	LSB-Analog-Input-Module-16 Input-Value 2	
*2) 8412		LSB-Analog-Input-Module-16.3	LSB-Analog-Input-Module-16 Input-Value 3	
*2) 8413		LSB-Analog-Input-Module-16.4	LSB-Analog-Input-Module-16 Input-Value 4	
*2) 8414		LSB-Digital-Input-Modules-1-3-13-14	Bit 0 ... 3: LSB-Digital-Input-Module-1 Bit 4 ... 7: LSB-Digital-Input-Module-3 Bit 8 ...11: LSB-Digital-Input-Module-13 Bit 12...15: LSB-Digital-Input-Module-14	
*2) 8415		not used		
*2) 8416		NEMS-Device-Status and NEMS-Input-Status-Valid	<u>NEMS-Device-Status:</u> Bit 0: Device 1 (0 => Offline, 1 => On) ... Bit 7: Device 8 (0 => Offline, 1 => On) <u>NEMS-Input-Status-Valid:</u> Bit 8: Input-Status-Valid-Device-No. 1 (0 => Input-Status is not valid, 1 => Input-Status is valid) ... Bit 15: Input-Status-Valid-Device-No. 8 (0 => Input-Status is not valid, 1 => Input-Status is valid)	
*2) 8417		NEMS-Handshake-IN	<u>NEMS-Handshake-IN:</u> Bit 0: NewData (new Message arrived)	
*2) 8418		NEMS-MessageInfo	<u>NEMS-MessageInfo-Bits:</u> Bit 0: reserved Bit 1: TimeStamp valid = 1 / not valid = 0 Bit 2: Input unstable = 1 / stable = 0 Bit 3: Not confirmed = 1 / confirmed = 0 Bit 4: Link-Input = 1 / Not a Link-Input = 0 Bit 5: FirstValue = 1 / NewValue = 0 Bit 6: Arrived = 1 / Gone = 0 Bit 7: Process signal = 1 / Fault signal = 0	
*2) 8419		NEMS-Message-Number	Message-Number 1...1024	
*2) 8420		NEMS-Day in BCD (High-Byte) NEMS-Month in BCD (Low-Byte)	Message-Timestamp Day in BCD Message-Timestamp Month in BCD	
*2) 8421		NEMS-Year in BCD (High-Byte) NEMS-Hour in BCD (Low-Byte)	Message-Timestamp Year in BCD Message-Timestamp Hour in BCD	
*2) 8422		NEMS-Minute in BCD (High-Byte) NEMS-Second in BCD (Low-Byte)	Message-Timestamp Minute in BCD Message-Timestamp Second in BCD	
*2) 8423		NEMS-Millisecond in Hex.	Message-Timestamp Millisecond in Hex.	
*2) 8424		NEMS-Input-Status-0 von NEMS-Device-Nr. 1	Status-0 of inputs 1-16 Device-Nr. 1 (Bit 0: Input1 ... Bit 15: Input16)	
*2) 8425		NEMS-Input-Status-1 von NEMS-Device-Nr. 1	Status-1 of inputs 1-16 Device-Nr. 1 (Bit 0: Input1 ... Bit 15: Input16)	
*2) 8426		NEMS-Input-Status-2 von NEMS-Device-Nr. 1	Status-2 of inputs 1-16 Device-Nr. 1 (Bit 0: Input1 ... Bit 15: Input16)	
*2) 8427		NEMS-Input-Status-0 von NEMS-Device-Nr. 2	Status-0 of inputs 1-16 Device-Nr. 2 (Bit 0: Input1 ... Bit 15: Input16)	
*2) 8428		NEMS-Input-Status-1 von NEMS-Device-Nr. 2	Status-1 of inputs 1-16 Device-Nr. 2 (Bit 0: Input1 ... Bit 15: Input16)	
*2) 8429		NEMS-Input-Status-2 von NEMS-Device-Nr. 2	Status-2 of inputs 1-16 Device-Nr. 2 (Bit 0: Input1 ... Bit 15: Input16)	
*2) 8430		NEMS-Input-Status-0 von	Status-0 of inputs 1-16 Device-Nr. 3	

		NEMS-Device-Nr. 3	(Bit 0: Input1 ... Bit 15: Input16)	
*2)	8431	NEMS-Input-Status-1 von NEMS-Device-Nr. 3	Status-1 of inputs 1-16 Device-Nr. 3 (Bit 0: Input1 ... Bit 15: Input16)	
*2)	8432	NEMS-Input-Status-2 von NEMS-Device-Nr. 3	Status-2 of inputs 1-16 Device-Nr. 3 (Bit 0: Input1 ... Bit 15: Input16)	
*2)	8433	NEMS-Input-Status-0 von NEMS-Device-Nr. 4	Status-0 of inputs 1-16 Device-Nr. 4 (Bit 0: Input1 ... Bit 15: Input16)	
*2)	8434	NEMS-Input-Status-1 von NEMS-Device-Nr. 4	Status-1 of inputs 1-16 Device-Nr. 4 (Bit 0: Input1 ... Bit 15: Input16)	
*2)	8435	NEMS-Input-Status-2 von NEMS-Device-Nr. 4	Status-2 of inputs 1-16 Device-Nr. 4 (Bit 0: Input1 ... Bit 15: Input16)	
*2)	8436	NEMS-Input-Status-0 von NEMS-Device-Nr. 5	Status-0 of inputs 1-16 Device-Nr. 5 (Bit 0: Input1 ... Bit 15: Input16)	
*2)	8437	NEMS-Input-Status-1 von NEMS-Device-Nr. 5	Status-1 of inputs 1-16 Device-Nr. 5 (Bit 0: Input1 ... Bit 15: Input16)	
*2)	8438	NEMS-Input-Status-2 von NEMS-Device-Nr. 5	Status-2 of inputs 1-16 Device-Nr. 5 (Bit 0: Input1 ... Bit 15: Input16)	
*2)	8439	NEMS-Input-Status-0 von NEMS-Device-Nr. 6	Status-0 of inputs 1-16 Device-Nr. 6 (Bit 0: Input1 ... Bit 15: Input16)	
*2)	8440	NEMS-Input-Status-1 von NEMS-Device-Nr. 6	Status-1 of inputs 1-16 Device-Nr. 6 (Bit 0: Input1 ... Bit 15: Input16)	
*2)	8441	NEMS-Input-Status-2 von NEMS-Device-Nr. 6	Status-2 of inputs 1-16 Device-Nr. 6 (Bit 0: Input1 ... Bit 15: Input16)	
*2)	8442	NEMS-Input-Status-0 von NEMS-Device-Nr. 7	Status-0 of inputs 1-16 Device-Nr. 7 (Bit 0: Input1 ... Bit 15: Input16)	
*2)	8443	NEMS-Input-Status-1 von NEMS-Device-Nr. 7	Status-1 of inputs 1-16 Device-Nr. 7 (Bit 0: Input1 ... Bit 15: Input16)	
*2)	8444	NEMS-Input-Status-2 von NEMS-Device-Nr. 7	Status-2 of inputs 1-16 Device-Nr. 7 (Bit 0: Input1 ... Bit 15: Input16)	
*2)	8445	NEMS-Input-Status-0 von NEMS-Device-Nr. 8	Status-0 of inputs 1-16 Device-Nr. 8 (Bit 0: Input1 ... Bit 15: Input16)	
*2)	8446	NEMS-Input-Status-1 von NEMS-Device-Nr. 8	Status-1 of inputs 1-16 Device-Nr. 8 (Bit 0: Input1 ... Bit 15: Input16)	
*2)	8447	NEMS-Input-Status-2 von NEMS-Device-Nr. 8	Status-2 of inputs 1-16 Device-Nr. 8 (Bit 0: Input1 ... Bit 15: Input16)	

7.3.1 LT1/LT2-Values

(Register-Nr. 8360...8389)

These values are only available if an O2 analyser (LT1 or LT2) is connected via the Lamtec system bus. The meaning of some values is different according to whether an LT1 or LT2 is connected.

7.3.2 Operating mode LT1

(Register-Nr. 8361, 8376)

The operating mode is bit-coded, combinations of several set bits are possible.

0x0001 = Measurement

0x0002 = Calibration

0x0004 = Maintenance

0x0008 = Heating active

0x0010 = Cold start

0x0020 = Standby

0x0040 = At least one warning active

0x0080 = At least one fault active

0x0100 = Manual calibration active

0x0200 to 0x0800 = not yet in use
0x1000 = Limit value 1 active
0x2000 = Limit value 2 active
0x4000 = Limit value 3 active
0x8000 = Limit value 4 active

7.3.3 Operating mode LT2

(Register-Nr. 8361, 8376)

The operating mode is bit-coded, combinations of several set bits are possible.

0x0001 = Measurement
0x0002 = Calibration
0x0004 = Maintenance
0x0008 = not used
0x0010 = Cold start
0x0020 = Standby
0x0040 = At least one warning active
0x0080 = At least one fault active
0x0100 to 0x0800 = not yet in use
0x1000 = Limit value 1 active
0x2000 = Limit value 2 active
0x4000 = Limit value 3 active
0x8000 = Limit value 4 active

7.3.4 Fault states LT1

(Register-Nr. 8362, 8377)

The faults are bit-coded, combinations of several set bits are possible.

0x0000 = No warning / fault active
0x0001 = Probe defective LS 1
0x0002 = Flow throughput to low $I_s < 200 \text{ mA}$ ⁽¹⁾
0x0004 = Vacuum pressure (flue gas pump)
0x0008 = LS 1 defective probe heater
0x0010 = LS 1 broken wire
0x0020 = Current input of pump too high
0x0040 = LS 1 Probe: no constant current (dI/dT is not small enough)
0x0080 = Fault test gas (check with test gas failed)
0x0100 = Dynamic LS 1 is missing
0x0200 = Dirty pre-filter (sintered metal preliminary filter dirty)
0x0400 = Error analog output
0x0800 = Error parameters
0x1000 = Error analog inputs
0x2000 = Error O₂-controller (look at Par. 4002)
0x4000 to 0xffff provided for expansions

⁽¹⁾ Parameter 51 can be used to read-out the probe current at the last calibration.

7.3.5 Fault states LT2

(Register-Nr. 8362, 8377)

The faults are bit-coded, combinations of several set bits are possible.

0x0001 = Probe voltage $< - 20 \text{ mV}$
0x0002 = Probe heating defective (heating current $< 200 \text{ mA}$)
0x0010 = Wire break in probe/probe defective (Ri too high)
0x0100 = Probe dynamics missing
0x0400 = Fault in analogue outputs

7.3.6 Warnings LT1 section 1

(Register-Nr. 8363, 8378)

The warnings are bit-coded, combinations of several set bits are possible.

- 0x0000 = No warning
- 0x0001 = Warning 1: LS 1 defective heating control (Probe heating control defective, heating with fixed voltage)
- 0x0002 = Warning 2: Dirty pre-filter-heating (filter SEA blocked)
- 0x0004 = Warning 3: Flow throughput too low, $I_s < 260 \text{ mA}$ ⁽¹⁾ (par. 51)
- 0x0008 = Warning 4: LS 1 O2-sensor well-worn -> must be replaced
- 0x0010 = Warning 5: Leakage of flue gas piping
- 0x0020 = Warning 6: Defective MEV-heating
- 0x0040 = Warning 7: Defective pre-filter-heating
- 0x0080 = Warning 8: Cal. Gas flow throughput too low, increase!
- 0x0100 = Warning 9: Pressure at measuring point outside the permissible range (too high / too low)
- 0x0200 = Warning 10: LS1 temperature at measuring point outside the permissible range (too high / too low)
- 0x0400 = Warning 11: Don't draw stack gas through a cold LS 1
- 0x0800 = Warning 12: Defective LS 1 temperature- measuring
- 0x1000 = Warning 13: Defective MEV temperature- measuring ⁽²⁾
- 0x2000 = Warning 14: Defective pre-filter temperature measuring (SEA filter defective)
- 0x4000 = Warning 15: LS 1 probe current limit active
- 0x8000 = Warning 16: Line voltage too high or too low

⁽¹⁾ at the probe current, at the last calibration

⁽²⁾ Option in course of preparation

7.3.7 Warnings LT1 section 2

(Register-Nr. 8364, 8379)

The warnings are bit-coded, combinations of several set bits are possible.

- 0x0001 = Warning 17: Running time definition of flue gas pump active (determination of operating time for measuring gas pump active, measuring value deviations possible)
- 0x0002 = Warning 18: No constant probe current while calibration
- 0x0004 = Warning 19: Value of analogue input 1 too high/low
- 0x0008 = Warning 20: Value of analogue input 2 too high/low
- 0x0010 = Warning 21: Value of analogue input 3 too high/low
- 0x0020 = Warning 22: Value of analogue input 4 too high/low
- 0x0040 = Warning 23: Configuration error analogue outputs
- 0x0080 = Warning 24: Service warning 1
- 0x0100 = Warning 25: Service warning 2
- 0x0200 = Warning 26: Dynamic LS 1 is missing
- 0x0400 = Warning 27: Dynamic test LS 1 activated
- 0x0800 = Warning 28: Probe exchange? If yes, activate Par. 104
- 0x1000 = Warning 29: (not assigned yet)
- 0x2000 = Warning 30: (not assigned yet)
- 0x4000 = Warning 31: (not assigned yet)
- 0x8000 = Warning 32: (not assigned yet)

7.3.8 Warnings LT2 section 1

(Register-Nr. 8363, 8378)

The warnings are bit-coded, combinations of several set bits are possible.

- 0x0001 = Warning 1: Internal resistance LS2 too high
- 0x0002 = Warning 2: LS2 offset voltage air defective
- 0x0100 = Warning 9: Pressure at measuring point outside the permissible range

0x0200 = Warning 10: Temperature at measuring point outside the permissible range
0x0800 = Warning 12: Temperature sensor probe defective

7.3.9 Warnings LT2 section 2

(Register-Nr. 8364, 8379)

The warnings are bit-coded, combinations of several set bits are possible.

0x0004 = Warning 19: Value of analogue input 1 too high/low
0x0008 = Warning 20: Value of analogue input 2 too high/low
0x0010 = Warning 21: Value of analogue input 3 too high/low
0x0020 = Warning 22: Value of analogue input 4 too high/low
0x0080 = Warning 24: Service warning 1
0x0100 = Warning 25: Service warning 2
0x0200 = Warning 26: Probe dynamics missing
0x0400 = Warning 28: Dynamic test triggered

7.3.10 Status-LSB-Output-Modules-and-PID-Controller-Output

(Register-Nr. 8400)

Status-Bits (0 => LSB-Module is Offline, 1 => LSB-Module is Online):

Bit 0: LSB-Analog-Output-Module-11 (LSB-Module-address 43)
Bit 1: LSB-Analog-Output-Module-12 (LSB-Module-address 47)
Bit 2: LSB-Digital-Output-Module-6 (LSB-Module-address 23)
Bit 3: LSB-Digital-Output-Module-7 (LSB-Module-address 27)
Bit 4 ... 7: PID-Controller-Analog-Outputs (**)
Bit 8 ... 14: PID-Controller-Digital-Outputs (**)

7.3.11 Status-LSB-Input-Modules

(Register-Nr. 8401)

Status-Bits (0 => LSB-Module is Offline, 1 => LSB-Module is Online):

Bit 0: reserved
Bit 1: LSB-Analog-Input-Module-14 (LSB-Module-address 55)
Bit 2: LSB-Analog-Input-Module-15 (LSB-Module-address 59)
Bit 3: LSB-Analog-Input-Module-16 (LSB-Module-address 63)
Bit 4: LSB-Digital-Input-Module-1 (LSB-Module-address 3)
Bit 5: LSB-Digital-Input-Module-3 (LSB-Module-address 11)
Bit 6: LSB-Digital-Input-Module-13 (LSB-Module-address 51)
Bit 7: LSB-Digital-Input-Module-14 (LSB-Module-address 55)

7.3.12 LSB-Analog-Input-Module-14

(Register-Nr. 8402...8405)

These are the Analog-Input-Values of LSB-Analog-Input-Module-14 (LSB-Module-address 55).
Value 0 corresponds to 0 V input voltage, the value 999 (0x03E7) corresponds to 9,99 V input voltage.

7.3.13 LSB-Analog-Input-Module-15

(Register-Nr. 8406...8409)

These are the Analog-Input-Values of LSB-Analog-Input-Module-15 (LSB-Module-address 59).
Value 0 corresponds to 0 V input voltage, the value 999 (0x03E7) corresponds to 9,99 V input voltage.

7.3.14 LSB-Analog-Input-Module-16

(Register-Nr. 8410...8413)

These are the Analog-Input-Values of LSB-Analog-Input-Module-16 (LSB-Module-address 63). Value 0 corresponds to 0 V input voltage, the value 999 (0x03E7) corresponds to 9,99 V input voltage.

7.3.15 LSB-Digital-Input-Modules-1-3-13-14

(Register-Nr. 8414)

The four Input-Bits of LSB-Digital-Input-Module-1 (LSB-Module-address 3) are sent to the Bits 0 ... 3 of this value.

The four Input-Bits of LSB-Digital-Input-Module-3 (LSB-Module-address 11) are sent to the Bits 4 ... 7 of this value.

The four Input-Bits of LSB-Digital-Input-Module-13 (LSB-Module-address 51) are sent to the Bits 8 ... 11 of this value.

The four Input-Bits of LSB-Digital-Input-Module-14 (LSB-Module-address 55) are sent to the Bits 12 ... 15 of this value.

7.3.16 NEMS-read-register

(Register-Nr. 8416...8447)

There are 5 areas of NEMS-Read-Data:

1. Register-Nr. 8416 Bit 0...7: NEMS-Device-Status

The Device-Status is continuously updated and reflects which NEMS-Devices are online.

2. Register-Nr. 8416 Bit 8...15: NEMS-Input-Status-Valid

These bits indicate whether the input-status in register-No. 8424...8447: NEMS-Input-Status-Area of the corresponding NEMS-device is valid or not.

(see also following the description under „5. Register-No. 8424...8447: NEMS-Input-Status-Area“)

3. Register-Nr. 8417: NEMS-Handshake-Bit for new Messages

(see Handshaking-Procedure for Message-Window)

4. Register-Nr. 8418...8423: NEMS-Message-Window

It shows all specified data of a new message and is updated via a handshaking-procedure from the Communications-Processor.

Handshaking-Procedure between
Communications-Processor (CP) and Modbus-Master (MM)
for the Message-Window:

HandshakeBit: „NewData“ Source: CP Reg.-Nr. 8417 Bit 0	HandshakeBit: „DataRead“ Source: MM Reg.-Nr. 9520 Bit 0	
0	0	Normal state (CP can write a new message into the Message-Window (Reg.-Nr. 8418...8423))
1	0	CP has written a new Message into the Message-Window (Reg.-Nr. 8418...8423) and sets then NewData = 1

1	1	MM sets DataRead = 1
0	1	MM reads the new message from the Message-Window (Reg.-Nr. 8418...8423); CP sets NewData = 0
0	0	When MM has read the complete message, then MM checks if NewData = 0 and if yes it sets DataRead = 0

Timeout for new messages: A new message (NewData = 1) in the Message-Window must be fetched by the Modbus-Master (MM) during the configured timeout time (configured in NEMS-Config). Otherwise the probably following messages are being cleared by the NEMS-Devices, they are only putted out on to the NEMS-printer (if connected) and are not sent any more to the modbus-interface, until the Modbus-Master (MM) fetches again the messages in the message-buffer via the above described handshaking-procedure.

5. Register-Nr. 8424...8447: NEMS-Input-Status-Area

This area shows the current states of the 16 NEMS-Inputs of all 8 NEMS-Devices with the following coding and the values are updated continuously

Coding of NEMS-Input-Status0...2 (Bit 0: NEMS-Input 1... Bit 15: NEMS-Input 16):

<u>Status0</u> <u>Bit x</u>	<u>Status1</u> <u>Bit x</u>	<u>Status2</u> <u>Bit x</u>	<u>Status of the related NEMS-Input x</u>
0	0	0	Process-State-/Fault-State-Input is not active
0	0	1	Fault-State-Input is active
0	1	0	Input bypassed and Input is not active
0	1	1	Input bypassed and Input is active
1	0	0	Input unstable
1	0	1	Process-State-Input is active
1	1	0	reserved
1	1	1	reserved

Example: NEMS-Input-Status0 = 0x0002,
NEMS-Input-Status1 = 0x0000,
NEMS-Input-Status2 = 0x0003:
=> NEMS-Input1: Fault-State-Input is active and NEMS-Input2: Process-State-Input is active

To consider:

If new messages of an NEMS-Device are present in the Message-Window (NewData = 1), then the Input-Status is being hold at the previous state until the new messages are being fetched completely by the Modbus-Master. After that the Input-Status is continuously updated again.

The validity of the Input-Status-Data of each NEMS-Device is signaled in register 8416. (see also the description above „2. Register-Nr. 8416 Bit 8...15: NEMS-Input-Status-Valid“)

8. Fault Conditions

The Modbus protocol has no possibilities to transmit data marked with 'none valid', so there is no answer on the Modbus in a fault condition.

Some of these fault conditions are:

- no “new” data from the FMS
- a write command exceeds the max. no. of the registers
- a read command exceeds the max. no. of the registers
- an unknown command was received
- a wrong slave-address was received
- several messages were received without waiting for the response
- a too long message was received
- wrong Baudrate
- wrong COM-Parameter

9. Examples for Write- and Read-Commands

In these examples only the command, the register-no. and the register-content are listed.

Command-byte	Direction	Register-no.	Register-Value	Comment
03	Bus->FMS	8281		Recall the operating status of the FMS
03	FMS->Bus	8281	512 (hex:0x0200)	The FMS is in fault condition
03	Bus->FMS	8278		Recall the fault code
03	FMS->Bus	8278	0002	Flame signal-fault
06	Bus->FMS	9488	0004	Perform fault reset
06	FMS->Bus	9488	0004	Echo the command
06	Bus->FMS	9488	0010	Burner ON & Control Release via Bus
06	FMS->Bus	9488	0010	Echo of the command
06	Bus->FMS	9473	0500	Preset the outside temperature input to 10mA (moving the setpoint for weather guided load controller)
06	FMS->Bus	9473	0500	Echo of the command
03	Bus->FMS	8192		Recall the internal load
03	FMS->Bus	8192	609	The internal load is 609
03	Bus->FMS	8279		Recall the relay outputs
03	FMS->Bus	8279	476 (hex:0x1DC)	Relay Terminal 36, 41, 43, 67, 68, 76 - are activated

10. Example for a Modbus-Read-Query

Modbus-Read-Query:

Byte-No.	Value in hex.	Description
1. Byte	0x04	modbus-slave adress (parameter no: 887)
2. Byte	0x03	function-code (3 means reading several registers)
3. Byte	0x20	high-byte of first register
4. Byte	0x56	low-byte of first register
5. Byte	0x00	high-byte number of registers to read
6. Byte	0x04	low-byte number of registers to read
7. Byte	0xaf	CRC16-Checksum
8. Byte	0x8c	CRC16-Checksum

Modbus-Read-Response:

Byte-No.	Value in hex.	Description
1. Byte	0x04	modbus-slave adress
2. Byte	0x03	function code
3. Byte	0x08	number of bytes in the answer
4. Byte	0x02	high-byte first value (fault code)
5. Byte	0x58	low-byte first value (fault code)
6. Byte	0x00	high-byte first value (relay status)
7. Byte	0x04	low-byte first value (relay status)
8. Byte	0xbb	high-byte first value (digital input)
9. Byte	0xdb	low-byte first value (digital input)
10. Byte	0x02	high-byte first value (operating mode)
11. Byte	0x00	low-byte first value (operating mode)
12. Byte	0x78	CRC16-Checksum
13. Byte	0x78	CRC16-Checksum

In this example the telegram message means:

Fault code: 0x0258 is 600 in decimal, which means „Timeout FMS (burner sequence control)“

Relay status: 0x0004 , which means „Fuel indication“ etc.