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MODBUS/J-BUS PROTOCOL FOR SSI's - AC20

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TITLE: MODBUS/J-BUS Protocol for SSi's- AC20

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MODBUS/J-BUS PROTOCOL FOR SSi's - AC20

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INTRODUCTION

This half duplex protocol accepts one master and one or more slaves.
The physical interface should be of the RS-485 type.

A single multidrop link can take up to 128 devices having the same "High input impedance" as the transceiver used..

The computer should be programmed to serve as a master controlling which slave has access to the link. All other slaves are in waiting state. Each slave has a unique address ranging from 1 to 255.

Address "0" is a broadcast one. When the master sends a message with address 0, all slaves receive it and no one replies.

TRANSMISSION FORMAT

The protocol uses the RTU (Remote terminal unit) mode of transmission.
RTU is a binary method with byte format composed as follows:

1 start bit, 8 data bit, 1 parity bit (optional), 1 stop bit.

The communication speed is selectable among 600, 1200, 2400, 4800, 9600 and 19200 baud.

COMMUNICATION PROCEDURE

The communication can be initiated only by the master unit; the slave units can transmit only after a query has been received from the master.

The general format for the transmission from master to slave is the following:

RANGE	BYTE
Slave address	1
Function code	1
Data	n
Error check (CRC-16) (low byte)	1
Error check (CRC-16) (high byte)	1

The slave detects the start of a query frame when the delay time between two characters is greater than 3.5 T.U. (Time Unit = Time necessary to transmit one character).

ERROR CHECK(CRC-16 Cyclical Redundancy Check)

The CRC-16 value is calculated by the transmitting device. This value is appended to the message. The receiving device recalculates a CRC-16 and compares the calculated value to the received value. The two values must be equal.

The CRC-16 is started by first pre-loading a 16-bit register to all 1's. Then a process begins of applying successive the bytes of the message to the current contents of the register. Only the eight bits of data in each character are used for generating the CRC-16. Start and stop bits, and the parity bit if one is used, do not apply to the CRC-16.

During generation of the CRC-16, each byte is exclusive ORed with the register contents. Then the result is shifted to the right , with a zero filled into the most significant bit (MSB) position. If the LSB was a 1, the register is then exclusive ORed with a preset, fixed value. If the LSB was a 0, no exclusive OR takes place.

This process is repeated until eight shifts have been performed. After the last shift, the next byte is exclusive ORed with the register's current value, and the process repeats for eight more shifts as described above. The final contents of the register, after all the characters of the message have been applied, is the CRC-16 value.

A procedure for generating a CRC-16 is:

- 1) Load a 16-bit register (CRC-16 register) with FFFFh (all 1's).
- 2) Exclusive OR the first byte of the message with the low byte of the CRC-16 register. Put the result in the CRC-16 register.
- 3) Shift the CRC-16 register one bit to the right (toward the LSB), zero-filling the MSB. Extract and examine the LSB.
- 4) (If the LSB was 0): Repeat Step 3 (another shift).
(If the LSB was 1): Exclusive OR the CRC-16 register with the polynomial value A001h (1010 0000 0000 0001b).
- 5) Repeat Steps 3 and 4 until 8 shifts have been performed. When this is done, a complete byte will have been processed.
- 6) Repeat Steps 2 through 5 for the next byte of the message. Continue doing this until all bytes have been processed.
- 7) The final contents of the CRC-16 register is the CRC-16 value.

When the CRC-16 (16 bytes) is transmitted in the message, the low byte will be transmitted first, followed by the high byte

N.B. : the numerical value present in this text are expressed as:
binary value if they are followed by b
decimal value if they are not followed by any letter
hexadecimal value if they are followed by h

Function code 1 and 2: Bits reading

These function codes are used by the master unit to request the value of a consecutive group of bits (max 24) which are representing the status of the slave unit.

Request from master to slave	
Range	Byte
Slave address (1-255)	1
Function code (01-02)	1
Bit starting address (high byte)	1
Bit starting address (low byte)	1
Number of bits (high byte)	1
Number of bits (low byte)	1
Error check (CRC-16) (low byte)	1
Error check (CRC-16) (high byte)	1

Reply from slave to master	
Range	Byte
Slave address (1-255)	1
Function code (01-02)	1
Byte count (n)	1
Data	n
Error check (CRC-16) (low byte)	1
Error check (CRC-16) (high byte)	1

The "Data" field indicates the bits requested: the bit with lower address is in the bit 0 of the first byte, the next is in the bit 1, and so on.

The eventual don't care bits necessary to complete the last byte are equal to 0.

Example:

Ask to slave at address 100 (64h) the status of 14 (Eh) bits starting from bit 201 (C9h).

Request from master to slave	
Range	Byte
Slave address	64h
Function code	01h
Bit starting address (high byte)	00h
Bit starting address (low byte)	C9h
Number of bits (high byte)	00h
Number of bits (low byte)	0Eh
Error check (CRC-16) (low byte)	64h
Error check (CRC-16) (high byte)	05h

Reply from slave to master	
Range	Byte
Slave address	64h
Function code	01h
Byte count	02h
Data	A7h
Data	04h
Error check (CRC-16) (low byte)	8Eh
Error check (CRC-16) (high byte)	07h

The 2 bytes in "Data" field (A7h=10100111b, 04h=00000100b) mean:

bit 201 status = 1	bit 209 status = 0
bit 202 status = 1	bit 210 status = 0
bit 203 status = 1	bit 211 status = 1
bit 204 status = 0	bit 212 status = 0
bit 205 status = 0	bit 213 status = 0
bit 206 status = 1	bit 214 status = 0
bit 207 status = 0	Don't care = 0
bit 208 status = 1	Don't care = 0

Function code 3 and 4: Words reading

These function codes are used by the master unit to read a consecutive group of words (16 bit) which contain the value of the variable of the slave unit.

The master can require a maximum of 20 words at a time.

Request from master to slave	
Range	Byte
Slave address (1-255)	1
Function code (03-04)	1
Word starting address (high byte)	1
Word starting address (low byte)	1
Number of word (high byte)	1
Number of word (low byte)	1
Error check (CRC-16) (low byte)	1
Error check (CRC-16) (high byte)	1

Reply from slave to master	
Range	Byte
Slave address (1-255)	1
Function code (03-04)	1
Byte count (n)	1
Data	n
Error check (CRC-16) (low byte)	1
Error check (CRC-16) (high byte)	1

The "Data" field contains the requested words in the following format: high bytes of the first word, low byte of the first word, high byte of the second word, and so on.

The "data" field contains 8000h for not implemented addresses or for information not relevant in the actual device configuration.

Example:

Ask to slave at address 29 (1Dh) the value of 3 words (3h) starting from word 178 (B2h)

Request from master to slave	
Range	Byte
Slave address	1Dh
Function code	03h
Word starting address (high byte)	00h
Word starting address (low byte)	B2h
Number of words (high byte)	00h
Number of words (low byte)	03h
Error check (CRC-16) (low byte)	A7h
Error check (CRC-16) (high byte)	B0h

Reply from slave to master	
Range	Byte
Slave address	1Dh
Function code	03h
Byte count	06h
Data	FFh
Data	9Ch
Data	80h
Data	00h
Data	05h
Data	5Ah
Error check (CRC-16) (low byte)	D7h
Error check (CRC-16) (high byte)	0Dh

The 6 bytes in "Data" field (FFh, 9Ch, 80h, 00h, 05h, 5Ah) are 3 words whose meaning is:

word 178 value = -100 (FF9Ch)

word 179 value = not implemented or not relevant (8000h)

word 180 value = 1370 (55Ah)

Function code 5: Single bit writing

By using this command, the master unit can change the state of one bit of the slave unit.

Command from master to slave		Reply from slave to master	
Range	Byte	Range	Byte
Slave address (0*-255)	1	Slave address (1-255)	1
Function code (05)	1	Function code (05)	1
Bit address (high byte)	1	Bit address (high byte)	1
Bit address (low byte)	1	Bit address (low byte)	1
Data	2	Data	2
Error check (CRC-16) (low byte)	1	Error check (CRC-16) (low byte)	1
Error check (CRC-16) (high byte)	1	Error check (CRC-16) (high byte)	1

* To use the address 0, see note 1 at page 12: "Broadcast address".

"Data" field = 0h to reset the bit
 = FF00h to set the bit

Example:

Set bit 219 (DBh) of slave at address 35 (23h)

Command from master to slave		Reply from slave to master	
Range	Byte	Range	Byte
Slave address	23h	Slave address	23h
Function code	05h	Function code	05h
Bit address (high byte)	00h	Bit address (high byte)	00h
Bit address (low byte)	DBh	Bit address (low byte)	DBh
Data	FFh	Data	FFh
Data	00h	Data	00h
Error check (CRC-16) (low byte)	FAh	Error check (CRC-16) (low byte)	FAh
Error check (CRC-16) (high byte)	83h	Error check (CRC-16) (high byte)	83h

Function code 6: Single word writing

By using this command, the master unit can change the value of one word (16 bit) of the slave unit.

Command from master to slave		Reply from slave to master	
Range	Byte	Range	Byte
Slave address (0*-255)	1	Slave address (1-255)	1
Function code (06)	1	Function code (06)	1
Word address (high byte)	1	Word address (high byte)	1
Word address (low byte)	1	Word address (low byte)	n
Data	2	Data	2
Error check (CRC-16) (low byte)	1	Error check (CRC-16) (low byte)	1
Error check (CRC-16) (high byte)	1	Error check (CRC-16) (high byte)	1

* To use the address 0, see note 1 at page 12: "Broadcast address".

The 8000h value, present in the "data" field, should be considered as a don't care value, that is, the value present in the device at this address will not be modified.

Example:

Set word 2006 (7D6h) of slave at address 5 (5h) with value 1250 (4E2h)

Command from master to slave		Reply from slave to master	
Range	Byte	Range	Byte
Slave address	05h	Slave address	05h
Function code	06h	Function code	06h
Word address (high byte)	07h	Word address (high byte)	07h
Word address (low byte)	D6h	Word address (low byte)	D6h
Data	04h	Data	04h
Data	E2h	Data	E2h
Error check (CRC-16) (low byte)	EAh	Error check(CRC-16) (low byte)	EAh
Error check (CRC-16) (high byte)	4Bh	Error check (CRC-16) (high byte)	4Bh

Function code 15: Multiple bits writing

This function code is used by master unit to set/reset a consecutive group of bits (max 24).

Command from master to slave	
Range	Byte
Slave address (0*-255)	1
Function code (15)	1
Bit starting address (high byte)	1
Bit starting address (low byte)	1
Number of bits (high byte)	1
Number of bits (low byte)	1
Byte counter (n)	1
Data	n
Error check (CRC-16) (low byte)	1
Error check (CRC-16) (high byte)	1

Reply from slave to master	
Range	Byte
Slave address (1-255)	1
Function code (15)	1
Bit starting address (high byte)	1
Bit starting address (low byte)	1
Number of bits (high byte)	1
Number of bits (low byte)	1
Error check (CRC-16) (low byte)	1
Error check (CRC-16) (high byte)	1

* To use the address 0, see note 1 at page 12: "Broadcast address".

The desired status of each bit is packed in the DATA field (1 = ON, 0 = OFF).

The status imposed for read only bits will be ignored.

The command will be processed starting from the first bit and it will be executed or not executed depending on the actual device status.

At the first error found, the command will be aborted and the slave will answer with an error.

Example:

Send to slave, at address 2 (2h), the following set of 9 bits:

bit 224 status = 0 (bit 0)	bit 232 status = 1 (bit 0)
bit 225 status = 1 (bit 1)	Don't care = 0 (bit 1)
bit 226 status = 1 (bit 2)	Don't care = 0 (bit 2)
bit 227 status = 0 (bit 3)	Don't care = 0 (bit 3)
bit 228 status = 1 (bit 4)	Don't care = 0 (bit 4)
bit 229 status = 0 (bit 5)	Don't care = 0 (bit 5)
bit 230 status = 1 (bit 6)	Don't care = 0 (bit 6)
bit 231 status = 1 (bit 7)	Don't care = 0 (bit 7)

NOTE: 2 bytes with 9 bits and 7 don't care bits must be sent

Command from master to slave	
Range	Byte
Slave address	02h
Function code	0Fh
Bit starting address (high byte)	00h
Bit starting address (low byte)	E0h
Number of bits (high byte)	00h
Number of bits (low byte)	09h
Byte counter	02h
Data	D6h
Data	01h
Error check (CRC-16) (low byte)	78h
Error check (CRC-16) (high byte)	4Ch

Reply from slave to master	
Range	Byte
Slave address	02h
Function code	0Fh
Bit starting address (high byte)	00h
Bit starting address (low byte)	E0h
Number of bits (high byte)	00h
Number of bits (low byte)	09h
Error check (CRC-16) (low byte)	94h
Error check (CRC-16) (high byte)	08h

Function code 16: Multiple words writing

This function code is used by the master unit to write a consecutive group of words .
The master unit can change a maximum of 20 words at a time.

Command from master to slave	
Range	Byte
Slave address (0*-255)	1
Function code (16)	1
Word starting address (high byte)	1
Word starting address (low byte)	1
Number of words (high byte)	1
Number of words (low byte)	1
Byte counter (n)	1
Data	n
Error check (CRC-16) (low byte)	1
Error check (CRC-16) (high byte)	1

Reply from slave to master	
Range	Byte
Slave address (1-255)	1
Function code (16)	1
Word starting address (high byte)	1
Word starting address (low byte)	1
Number of words (high byte)	1
Number of words (low byte)	1
Error check (CRC-16) (low byte)	1
Error check (CRC-16) (high byte)	1

* To use the address 0, see note 1 at page 12: "Broadcast address".

The data imposed for read only words will be ignored.

The command will be processed starting from the first word and it will be executed or not executed depending on the actual device status.

At the first error found, the command will be aborted and the slave will answer with an error.

The 8000h value, present in the "data" field, should be considered as a don't care value, this is, the value present in the device at this address will not be modified.

Example:

Set words 139 (8Bh), 140 (8Ch), 141 (8Dh) of slave at address 10 (Ah) with 300 (12Ch), don't care (8000h) and 700 (2BCh) values.

Command from master to slave	
Range	Byte
Slave address	0Ah
Function code	10h
Word starting address (high byte)	00h
Word starting address (low byte)	8Bh
Number of words (high byte)	00h
Number of words (low byte)	03h
Byte counter	06h
Data	01h
Data	2Ch
Data	80h
Data	00h
Data	02h
Data	BCh
Error check (CRC-16) (low byte)	33h
Error check (CRC-16) (high byte)	00h

Reply from slave to master	
Range	Byte
Slave address	0Ah
Function code	10h
Word starting address (high byte)	00h
Word starting address (low byte)	8Bh
Number of words (high byte)	00h
Number of words (low byte)	03h
Error check (CRC-16) (low byte)	F1h
Error check (CRC-16) (high byte)	59h

NOTES:**1. "Broadcast" address**

When using the writing codes (5, 6, 15 and 16) the slave address 0 is permitted: in this case all the slaves connected accept the command but do not give any reply.

2. Words format

Every time the information transfer is performed by using 2 bytes (1 word of 16 bits), the first byte transmitted is the most significant one. For the negative numbers the "two complement" format is used.

3. Reply time

The slave will start to send a reply from 2 ms to 250 ms after the end of the request detected by counting the received bytes

4. Decimal digits

The decimal point that may be present in the value is ignored.

Example:

The value 204.6 is transmitted as 2046 (07FEh)

The value -12.50 is transmitted as -1250 (FB1Eh)

5. Local/remote status

At power up, the slave will be in local mode if it was in control mode at power off. In the other cases, it will maintain the condition it was at the power off.

In order to enable a slave to be controlled from the master, it is necessary to set the local/remote status bit (ModBus bit 218).

For a slave to remain in remote status, it is sufficient to detect line activity.

If there is no line activity for more than 3 sec. every slave will automatically return to local mode.

Local mode: the communication between master and slave is limited to transferring data from slave to master without possibility of modifying any parameter from the master itself (with the exception of the local/remote status bit). Therefore from the local keyboard, parameters can be displayed and modified.

Remote mode: the instrument parameters can be modified by the master. Therefore, from the local keyboard the parameters can be only displayed but not modified.

6. Control mode

“Control mode” indicates the normal functioning status of the device (indicator/controller).

In control mode they are parameters (menu groups), variables and status.

The parameters (Menu groups) are represented by words only.

Bits and words represent the variables and the status.

Reading:

The parameters (menu groups) are available only if they are meaningful in the present contest.

The variables and the status are available only if the device is in control mode and if they are meaningful in the present contest

Writing:

All the addresses are available only if the device is in control mode, in remote mode, in unlock condition (see note 9) and if they are meaningful in the present contest

7. Configuration mode

The configuration parameters (Menu conf.) are represented by words only.

They are available as read only if they are meaningful in the present contest

They are available as writing only if the device is in configuration mode, and they are meaningful in the present contest

At the end of the parameters programming of a configuration menu it is opportune to send the “end of configuration menu” command (ModBus words 3000 ÷ 3005). The congruence of the programmed data compared with the data of the other configuration menus is checked. In case of non compatibility, the reply will include a 1xx error message where xx represents the number of the menus whose closure has caused the error.

The end of the group programming is anyway automatically sent if data of a different menu are programmed or read and if the output of the configuration mode is imposed.

To modify the configuration parameters via serial link, it is necessary to set the slave in remote (ModBus bit 218). Then, set the slave in configuration mode (send the safety lock combination value for configuration mode to ModBus word 347 *).

The display will show:

SEr
COnF

To return in control mode condition, send 1 to Modbus word 3051. The slave will reset and restart in control mode condition.

8. Security code mode

The security code parameters are represented by words only.
They are always available as read.
They are available as writing only if the device is in security code mode.

To modify the security code parameters via serial link, it is necessary to set the slave in remote (ModBus bit 218). Then, set the slave in security code mode (send the safety lock combination value for configuration mode to ModBus word 348 *).
The display will show:

Scrt
COnF

To return in control mode condition, send 1 to ModBus word 3051. The slave will reset and restart in control mode condition.

* If the value of safety lock combination for configuration mode is 0, all values will be accepted. If the value is 1, no value will be accepted.
The safety lock combination is the value set at ModBus word 4000.

9. Software key for lock/unlock

Software keys can protect the modification of the parameters.
There is a key to protect the access to configuration mode and security code mode.
There is a second key to protect the modification of control mode parameters.
Once the control mode key is programmed, it is possible to decide which menus will be protected and which menus will not be protected.

Keys management via serial link

Set the slave in remote (ModBus bit 218).
Set the slave in security code mode (send the present safety lock combination value for configuration mode at ModBus word 348).
Set the new safety lock combination value for configuration mode at ModBus word 4000.
Set the new safety lock combination value for control mode at ModBus word 4001.

To protect control mode menus with the key, write 1 (key protected) in Modbus words 4002÷4011. Write 0 (free) if no key protection is needed.

N.B.:

Safety lock combination = 0: No security code (all parameters can always be modified)
If safety lock combination is for control mode, ModBus word 4002÷4011 are forced to 0.

Safety lock combination = 1: No security code (all parameters cannot be modified).
If safety lock combination is for control mode, ModBus word 4002÷4011 are forced to 1.

Safety lock combination=2÷250: Security code for parameter protection.
In order to remove the protection for the control mode parameters, it is necessary to write the safety lock combination value for control mode at ModBus word 349. It is sufficient to do this once only.
In order to protect the control mode parameters, it is necessary to write a value different from the safety lock combination value for control mode at ModBus word 349.

In order to modify the configuration parameters, it is necessary to set the configuration mode by writing the safety lock combination value for configuration mode at ModBus word 347.

In order to modify the security code parameters, it is necessary to set security code mode by writing the safety lock combination value for configuration mode at ModBus word 348.

ERROR REPLY

If the “error check” is wrong or the function code is not implemented or a buffer over flows has been received, the slave does not send any reply to the master.

If other errors are detected in the request or command frame, or the slave cannot reply with the requested values or it cannot accept the requested sets because it is in error condition, the slave replies by forcing at “1” the bit 7 of the “Function code” byte followed by an error code.

Error reply (from slave to master)

RANGE	BYTE
Slave address	1
Function code (+80h)	1
Error code	1
Error check (CRC-16)	2

List of error codes

ERROR Nr.	DESCRIPTION
2	Illegal data address
3	Illegal data value
9	Illegal number of data required
10	The bit or word indicated cannot be modified
50	The procedure cannot be initiated because another procedure is in progress
51	The procedure cannot be initiated because the first part of SMART algorithm (TUNE) is in progress
52	The procedure cannot be initiated because it is not elapsed 5 minutes from power on or from end of another procedure
53	The procedure cannot be initiated because the probe temperature is less than 1000°F/538°
54	The procedure cannot be initiated because the probe output is less than 1000 mV
55	The procedure cannot be initiated because the probe output is unstable (drift > 10 mV/minute)
101	Error on configuration group 1
102	Error on configuration group 2
103	Error on configuration group 3
104	Error on configuration group 4
105	Error on configuration group 5
106	Error on configuration group 6
151	Error on control mode group 1
152	Error on control mode group 2
153	Error on control mode group 3
154	Error on control mode group 4
155	Error on control mode group 5
156	Error on control mode group 6
157	Error on control mode group 7
158	Error on control mode group 8
159	Error on control mode group 9
160	Error on control mode group Hidden
200	Error on main probe input calibration (0÷1.5 V)
201	Error on main probe input calibration (1÷1.3 V)
202	Error on TC input calibration (0÷60 mV)
203	Error on CJ calibration
204	Error on auxiliary input current (0÷20 mA) calibration
205	Error on auxiliary input voltage (0÷5 V) calibration
206	Error on auxiliary input voltage (0÷10 V) calibration
207	Error on Out 6 (0÷20 mA output) calibration
208	Error on Out 7 (0÷20 mA output) calibration

On configuration error condition (101÷106), the device will replace the error message with the requested value in the following cases:

- request of configuration mode menu addresses
- request of control mode menu addresses
- request of security code mode addresses

It will accept the following sets:

- set in remote (ModBus bit 218)
- set in configuration mode (ModBus word 347)
- set in security code mode (ModBus word 348)
- set of all of configuration addresses
- set of all of security code mode addresses

On control mode error condition (151÷160), the device will replace the error message with the requested value in the following cases:

- request of configuration mode menu addresses
- request of control mode menu addresses
- request of security code mode addresses

It will accept the following sets:

- set in remote (ModBus bit 218)
- set in configuration mode (ModBus word 347)
- set in security code mode (ModBus word 348)
- set of all of configuration addresses
- set of all of control mode menu addresses
- load of control mode default parameters (ModBus bits 223÷232)
- set of all of security code mode addresses

On calibration error condition (200÷208), the device will replace the error message with the requested value in the following cases:

- request of configuration mode menu addresses
- request of control mode menu addresses
- request of security code mode menu addresses

It will accept the following sets:

- set in remote (ModBus bit 218)
- set in configuration mode (ModBus word 347)
- set in security code mode (ModBus word 348)
- set of all of configuration mode addresses
- set of all of security code mode addresses

If a configuration or control mode or calibration error occurs at start up and no action is taken, the device will reset after a 30 second time-out.
In configuration mode, the time-out will be disable.

WORDS FOR DEVICE IN CONTROL MODE - PARAMETERS**“St.Pn” - Menu group 1 - SET POINT VALUES**

ADDRESS (decimal)		DESCRIPTION	DEC. FIGU- RES	Display MNEM CODE	R E A D	W R I T E
JBus	Mod Bus					
139	138	Main set point	See Mbus Word 300	("SP")	X	X
140	139	Auxiliary set point 2	See Mbus Word 300	("SP2")	X	X
141	140	Auxiliary set point 3	See Mbus Word 300	("SP3")	X	X
142	141	Auxiliary set point 4	See Mbus Word 300	("SP4")	X	X
143	142	Carbon monoxide factor	0	("COF")	X	X
144	143	Hydrogen factor	0	("H2F")	X	X

“Alrñ” - Menu group 3 - ALARM THRESHOLD AND HYSTERESIS VALUE

ADDRESS (decimal)		DESCRIPTION	DEC. FIGU- RES	Display MNEM CODE	R E A D	W R I T E
JBus	Mod Bus					
178	177	Alarm 1 threshold	See Mbus Word 300	("AL1")	X	X
179	178	Alarm 2 threshold	See Mbus Word 300	("AL2")	X	X
180	179	Alarm 3 threshold	See Mbus Word 300	("AL3")	X	X
182	181	Band alarm 1 threshold low	See Mbus Word 300	("bA1.L")	X	X
183	182	Band alarm 1 threshold high	See Mbus Word 300	("bA1.h")	X	X
184	183	Band alarm 2 threshold low	See Mbus Word 300	("bA2.L")	X	X
185	184	Band alarm 2 threshold high	See Mbus Word 300	("bA2.h")	X	X
186	185	Band alarm 3 threshold low	See Mbus Word 300	("bA3.L")	X	X
187	186	Band alarm 3 threshold high	See Mbus Word 300	("bA3.h")	X	X
192	191	Alarm 1 hysteresis	See Mbus Word 300	("HSA1")	X	X
193	192	Alarm 2 hysteresis	See Mbus Word 300	("HSA2")	X	X
194	193	Alarm 3 hysteresis	See Mbus Word 300	("HSA3")	X	X

WORDS FOR DEVICE IN CONTROL MODE - PARAMETERS**“Cntr” - Menu group 4 - CONTROL PARAMETERS**

ADDRESS (decimal)		DESCRIPTION	DEC. FIGU- RES	Display MNEM CODE	R E A D	W R I T E
JBus	Mod Bus					
149	148	Proportional band	1	("Pb")	x	x
150	149	Hysteresis for on/off control mode	1	("HYS")	x	x
151	150	Integral time (in seconds) Note: The value 7FFFh means that the integral action is excluded	0	("ti")	x	x
152	151	Derivative time (in seconds)	0	("td")	x	x
153	152	Integral pre-load	1	("IP")	x	x
154	153	Relative secondary output gain	2	("r.Gn")	x	x
155	154	Dead band/overlap between main/second- ary output	0	("OLAP")	x	x

WORDS FOR DEVICE IN CONTROL MODE - PARAMETERS**“A.Ctr” - Menu group 5 - AUXILIARY CONTROL PARAMETERS**

ADDRESS (decimal)		DESCRIPTION	DEC. FIGU- RES	Display MNEM CODE	R E A D	W R I T E
JBus	Mod Bus					
1001	1000	Anti-reset windup	0	("ArU")	x	x
1004	1003	Main control output low limit	1	("ñ.OLL")	x	x
1005	1004	Main control output high limit	1	("ñ.OLH")	x	x
1006	1005	Main control output max rate of rise Note: The value 7FFFh means that no ramp limitation is imposed.	1	("ñ.rñP")	x	x
1007	1006	Proportional cycle time on main control output (in seconds)	0	("ñC.CY")	x	x
1008	1007	Secondary control output low limit	1	("S.OLL")	x	x
1009	1008	Secondary control output high limit	1	("S.OLH")	x	x
1010	1009	Secondary control output max rate of rise Note: The value 7FFFh means that no ramp limitation is imposed	1	("S.rñP")	x	x
1011	1010	Proportional cycle time on secondary control output (in seconds)	0	("SC.CY")	x	x
1012	1011	Set point low limit	See Mbus Word 300	("rL")	x	x
1013	1012	Set point high limit	See Mbus Word 300	("rH")	x	x
1014	1013	Rate of change for positive set point variation Note: The value 7FFFh means that the transfer is done as a step change.	See Mbus Word 300	("Grd1")	x	x
1015	1014	Rate of change for negative set point variation Note: The value 7FFFh means that the transfer is done as a step change	See Mbus Word 300	("Grd2")	x	x
1017	1016	External control of auto/man function Range: 0 = Off 1 = On	N.A.	("E.Añ")	x	x

WORDS FOR DEVICE IN CONTROL MODE - PARAMETERS**“A.SET” - Menu group 6 - ALARM SETTING**

ADDRESS (decimal)		DESCRIPTION	DEC. FIGU- RES	Display MNEM CODE	R E A D	W R I T E
JBus	Mod Bus					
1101	1100	Alarm 1 type Range: 0 = Alarm on process variable 1 = Band alarm on process variable 2 = Deviation alarm on process variable	N.A.	("A1.tP")	x	x
1102	1101	Alarm 1 configuration Range: 0 = High alarm with automatic reset 1 = Low alarm with automatic reset 2 = High alarm with automatic reset and acknowledge 3 = Low alarm with automatic reset and acknowledge 4 = High alarm with manual reset 5 = Low alarm with manual reset	N.A.	("A1.Cn")	x	x
1103	1102	Alarm 1 action Range: 0 = Rev 1 = Dir	N.A.	("A1.Ac")	x	x
1104	1103	Alarm 1 standby function Range: 0 = Off 1 = On	N.A.	("A1.St")	x	x
1105	1104	Alarm 2 type Note: See "Alarm 1 type"	N.A.	("A2.tP")	x	x
1106	1105	Alarm 2 configuration Note: See "Alarm 1 configuration"	N.A.	("A2.Cn")	x	x
1107	1106	Alarm 2 action Range: 0 = Rev 1 = Dir	N.A.	("A2.Ac")	x	x
1108	1107	Alarm 2 standby function Range: 0 = Off 1 = On	N.A.	("A2.St")	x	x

WORDS FOR DEVICE IN CONTROL MODE - PARAMETERS**“A.SET” - Menu group 6 - ALARM SETTING**

ADDRESS (decimal)		DESCRIPTION	DEC. FIGU- RES	Display MNEM CODE	R E A D	W R I T E
JBus	Mod Bus					
1109	1108	Alarm 3 type Note: See “Alarm 1 type”	N.A.	(“A3.tP”)	x	x
1110	1109	Alarm 3 configuration Note: See “Alarm 1 configuration”	N.A.	(“A3.Cn”)	x	x
1111	1110	Alarm 3 action Range: 0 = Rev 1 = Dir	N.A.	(“A3.Ac”)	x	x
1112	1111	Alarm 3 standby function Range: 0 = Off 1 = On	N.A.	(“A3.St”)	x	x

WORDS FOR DEVICE IN CONTROL MODE - PARAMETERS**“Sr.Ln” - Menu group 7 - SERIAL LINK PARAMETERS**

ADDRESS (decimal)		DESCRIPTION	DEC. FIGU- RES	Display MNEM CODE	R E A D	W R I T E
JBus	Mod Bus					
527	526	Serial interface protocol Range: 0 = No serial interface 1 = Modbus 2 = Jbus Note: The new data will be activated after the de-vice answer	N.A.	("S.L.Pr")	x	x
528	527	Serial link device address Note: The new data will be activated after the de-vice answer	N.A.	("S.L.Ad")	x	x
529	528	Baud rate for serial link Range: 0 = 600 Baud 1 = 1200 Baud 2 = 2400 Baud 3 = 4800 Baud 4 = 9600 Baud 5 = 19200 Baud Note: The new data will be activated after the de-vice answer	N.A.	("S.L.bd")	x	x
530	529	Byte format for serial link Range: 0 = 8 bits + even parity 1 = 8 bits + odd parity 2 = 8 bits without parity Note: The new data will be activated after the de-vice answer	N.A.	("S.L.bF")	x	x

WORDS FOR DEVICE IN CONTROL MODE - PARAMETERS**“tiñE” - Menu group 8 - TIMERS SETTING**

ADDRESS (decimal)		DESCRIPTION	DEC. FIGU- RES	Display MNEM CODE	R E A D	W R I T E
JBus	Mod Bus					
1301	1300	Timer for burn-off (in seconds)	0	("t.bOF")	x	x
1302	1301	Timer for purge (in seconds)	0	("t.PrG")	x	x
1303	1302	Timer for automatic burn-off interval (in minutes) Note: The value 7FFFh means that no time interval is imposed	0	("bF.tr")	x	x
1304	1303	Timer for probe test interval (in minutes) Note: The value 7FFFh means that no time interval is imposed	0	("Pb.tr")	x	x
1305	1304	Time lasting to beginning of burn-off procedure (in minutes) Note: The value 7FFFh means that no time interval is imposed	0	("bF.ñn")	x	
1306	1305	Time lasting to beginning of probe test procedure (in minutes) Note: The value 7FFFh means that no time interval is imposed	0	("Pb.ñn")	x	

WORDS FOR DEVICE IN CONTROL MODE - PARAMETERS**“Hidn” - Menu group hidden - SMART LIMIT VALUE**

ADDRESS (decimal)		DESCRIPTION	DEC. FIGU- RES	Display MNEM CODE	R E A D	W R I T E
JBus	Mod Bus					
1201	1200	Min value of proportional band calculated by the smart algorithm	1	("Pb.Lo")	x	x
1202	1201	Max value of proportional band calculated by the smart algorithm	1	("Pb.Hi")	x	x
1203	1202	Min value of integral time value calculated by the smart algorithm (in seconds)	0	("ti.Lo")	x	x
1204	1203	Max value of integral time value calculated by the smart algorithm (in seconds)	0	("ti.Hi")	x	x
1205	1204	Relative secondary output gain calculated by the smart algorithm Range: 0 = Off 1 = On	N.A.	("rG.CL")	x	x

WORDS FOR DEVICE IN CONTROL MODE - NON PARAMETERS

ADDRESS (decimal)		DESCRIPTION	DEC. FIGU- RES	Display MNEM CODE	R E A D	W R I T E
JBus	Mod Bus					
114	113	Status led alarm 1 Range: 0 = Off 1 = On 2 = Flashing (only for alarm)	N.A.		x	
115	114	Status led alarm 2 Range: 0 = Off 1 = On 2 = Flashing (only for alarm)	N.A.		x	
116	115	Status led alarm 3 Range: 0 = Off 1 = On 2 = Flashing (only for alarm)	N.A.		x	
120	119	Variation on alarm status Note: Alarm status information is on D8: (1 for entrance, 0 for exit) Number of alarm is on low byte (D2-D0)	N.A.		x	
121	120	Manufactured trade mark Value: 50 (32h)	N.A.		x	
122	121	Device identification code Note: Nr. of software revision x 100 + identifica- tion code (43)	N.A.		x	
123	122	Probe sensor mV value Note: When an error is detected on measure, the "Data field" contains one of these error codes: 30004 (7534h) = Under-range 30005 (7535h) = Over-range 30050 (7562h) = Error on internal auto- zero 30051 (7563h) = Error on internal zero- integrator	0		x	
124	123	Carbon potential value Note: When an error is detected on measure, the "Data field" contains one of these error codes: 30050 (7562h) = Error on internal auto- zero 30051 (7563h) = Error on internal zero- integrator	2		x	

WORDS FOR DEVICE IN CONTROL MODE - NON PARAMETERS

ADDRESS (decimal)		DESCRIPTION	DEC. FIGU- RES	Display MNEM CODE	R E A D	W R I T E
JBus	Mod Bus					
125	124	Dew point value (Value in Celsius or Fahrenheit as configured at Mbus word 2003) Note: When an error is detected on measure, the "Data field" contains one of these error codes: 30050 (7562h) = Error on internal auto-zero 30051 (7563h) = Error on internal zero-integrator	0		x	
126	125	Probe temperature value (Value in Celsius or Fahrenheit as configured at Mbus word 2003) Note: When an error is detected on measure, the "Data field" contains one of these error codes: 30002 (7532h) = Input open 30004 (7534h) = Under-range 30005 (7535h) = Over-range 30014 (753Eh) = Error on reference junction (t.a.<-25°C or t.a. >75°C) 30050 (7562h) = Error on internal auto-zero 30051 (7563h) = Error on internal zero-integrator	0		x	
127	126	Carbon monoxide measured value Note: When an error is detected on measure, the "Data field" contains one of these error codes: 30049 (7561h) = Out of range 30050 (7562h) = Error on internal auto-zero 30051 (7563h) = Error on internal zero-integrator	0		x	
128	127	Probe resistor value (in Kilo Ohm)	2		x	
129	128	Probe response time (in seconds)	1		x	
130	129	Probe temperature at last probe test (Value in Celsius or Fahrenheit as configured at Mbus word 2003)	0		x	

WORDS FOR DEVICE IN CONTROL MODE - NON PARAMETERS

ADDRESS (decimal)		DESCRIPTION	DEC. FIGU- RES	Display MNEM CODE	R E A D	W R I T E
JBus	Mod Bus					
131	130	Main control output value	1		x	x
132	131	Secondary control output value	1		x	x
133	132	Pid out value	1		x	x
134	133	Main control output display value	See Mbus word 301	(ñ.xxx)	x	
135	134	Secondary control output display value	See Mbus word 302	(S.xxx)	x	
136	135	Device status mode Range: 0 = Control mode 1 = Control mode with error E.130 2 = Control mode with error E.140 3 = Burn-off procedure in progress 4 = Purge procedure in progress 5 = Probe test procedure in progress 6 = Configuration mode 7 = Security code mode Note: For E.130/E.140 errors, see Technical specifications Eng. 247E The error is reset when read if device is in remote state	N.A.		x	
137	136	Type of operative set point Range: 0 = The set point utilized is a value set by serial link ("Operative Set Point Value") 1 = Main set point 2 = Auxiliary set point 2 3 = Auxiliary set point 3 4 = Auxiliary set point 4	N.A.		x	
138	137	Operative set point value Note: It is utilized by the device for the PID as well as for the SMART algorithms. Any change will not be influenced by the gradient mechanism. This set point value is not going to be stored in Earom and it will be lost at power down.	See Mbus word 300		x	x
301	300	Decimal number relative to primary control variable	N.A.		x	
302	301	Decimal number relative to main control output in engineering units	N.A.		x	
303	302	Decimal number relative to secondary control output in engineering units	N.A.		x	

WORDS FOR DEVICE IN CONTROL MODE - NON PARAMETERS

ADDRESS (decimal)		DESCRIPTION	DEC. FIGU- RES	Display MNEM CODE	R E A D	W R I T E
JBus	Mod Bus					
348	347	Code for enable configuration mode Range : Reading: 0 = Configuration mode unlocked 1 = Configuration mode always locked 2 = Configuration mode locked by software key Writing: 0-250 Note: See Note 7 at page 13	N.A.		x	x
349	348	Code for enable security code mode Range : Reading:0 = Security code mode unlocked 1 = Security code mode always locked 2 = Security code mode locked by software key Writing: 0-250 Note: See Note 8 at page 14	N.A.		x	x
350	349	Code for lock/unlock control parameters Range : Reading: 0 = Parameters always unlocked 1 = Parameters always locked 2 = Parameters can be locked by software key: Parameters locked 3 = Parameters can be locked by software key: Parameters unlocked. Writing: 0-250	N.A.		x	x
351	350	Lock/unlock status group hidden Note: See "Code For Lock/Unlock Control Para- meters"	N.A.		x	
352	351	Lock/unlock status group 1 Note: See "Code For Lock/Unlock Control Para- meters"	N.A.		x	
353	352	Lock/unlock status group 2 Note: See "Code For Lock/Unlock Control Para- meters"	N.A.		x	

WORDS FOR DEVICE IN CONTROL MODE - NON PARAMETERS

ADDRESS (decimal)		DESCRIPTION	DEC. FIGU- RES	Display MNEM CODE	R E A D	W R I T E
JBus	Mod Bus					
354	353	Lock/unlock status group 3 Note: See "Code For Lock/Unlock Control Parameters"	N.A.		x	
355	354	Lock/unlock status group 4 Note: See "Code For Lock/Unlock Control Parameters"	N.A.		x	
356	355	Lock/unlock status group 5 Note: See "Code For Lock/Unlock Control Parameters"	N.A.		x	
357	356	Lock/unlock status group 6 Note: See "Code For Lock/Unlock Control Parameters"	N.A.		x	
358	357	Lock/unlock status group 7 Note: See "Code For Lock/Unlock Control Parameters"	N.A.		x	
359	358	Lock/unlock status group 8 Note: See "Code For Lock/Unlock Control Parameters"	N.A.		x	
360	359	Lock/unlock status group 9 Note: See "Code For Lock/Unlock Control Parameters"	N.A.		x	

BITS FOR DEVICE IN CONTROL MODE

ADDRESS (decimal)		DESCRIPTION	Display MNEM CODE	R E A D	W R I T E
JBus	Mod Bus				
201	200	Logic level of external contact Dig1 Range: 0 = Logic level 0 1 = Logic level 1		x	
202	201	Logic level of external contact Dig2 Range: 0 = Logic level 0 1 = Logic level 1		x	
203	202	Logic level of external contact Dig3 Range: 0 = Logic level 0 1 = Logic level 1		x	
205	204	Status relay alarm 1 Range: 0 = Off 1 = On		x	
206	205	Status relay alarm 2 Range: 0 = Off 1 = On		x	
207	206	Status relay alarm 3 Range: 0 = Off 1 = On		x	
211	210	Unsolicited request flag general Range: 0 = No Parameters change is occurred 1 = Parameters change is occurred Note: The bit is set also to signal the start up. Changes produced by serial link will not be flagged The bit resets after reading		x	

BITS FOR DEVICE IN CONTROL MODE

ADDRESS (decimal)		DESCRIPTION	Display MNEM CODE	R E A D	W R I T E
JBus	Mod Bus				
212	211	Status tune Range: 0 = No tune 1 = Tune		x	
213	212	Status adaptive Range: 0 = No adaptive 1 = Adaptive		x	
214	213	Lock/unlock status Range: 0 = Unlock device 1 = Lock device Note: See also ModBus word 349		x	
217	216	Start probe test procedure			x
218	217	Start burn-off procedure			x
219	218	Local/remote device status Range: 0 = Device in local 1 = Device in remote		x	x
220	219	Auto/manual function Range: 0 = Auto 1 = Manual		x	x
222	221	Smart enable/disable Range: 0 = Disable 1 = Enable Note: Reading, this bit is logical OR between Tune (ModBus bit 211) and Adaptive status (ModBus bit 212)	("Sñrt")	x	x
223	222	Manual reset/acknowledge of an alarm condition Range: 0 = No operation 1 = Reset alarm	("ñ.Rst")		x
224	223	Load default control parameters value Range: 0 = No operation 1 = Load default Note: The command is accepted only if "Smart" (ModBus bit 221) is not active. The default value of group 7 (Serial link pa- rameters) are not loaded.			x

BITS FOR DEVICE IN CONTROL MODE

ADDRESS (decimal)		DESCRIPTION	Display MNEM CODE	R E A D	W R I T E
JBus	Mod Bus				
225	224	Load default data for group hidden Range: 0 = No operation 1 = Load default			x
226	225	Load default data for group 1 Range: 0 = No operation 1 = Load default			x
228	227	Load default data for group 3 Range: 0 = No operation 1 = Load default			x
229	228	Load default data for group 4 Range: 0 = No operation 1 = Load default Note: The command is accepted only if "Smart" (ModBus bit 221) is not active			x
230	229	Load default data for group 5 Range: 0 = No operation 1 = Load default			x
231	230	Load default data for group 6 Range: 0 = No operation 1 = Load default			x
232	231	Load default data for group 7 Range: 0 = No operation 1 = Load default Note: The new data will be activated after the device answer			x
233	232	Load default data for group 8 Range: 0 = No operation 1 = Load default			x
234	233	De-energized all 10 auxiliary outputs Range: 0 = No operation 1 = De-energized relays			x

BITS FOR DEVICE IN CONTROL MODE

ADDRESS (decimal)		DESCRIPTION	Display MNEM CODE	R E A D	W R I T E
JBus	Mod Bus				
250	249	Unsolicited request flag for probe test data Range: 0 = No change on probe test data 1 = The probe test is terminated and new data are available		x	
251	250	Unsolicited request flag group hidden Range: 0 = No Parameters change is occurred 1 = Parameters change is occurred Note: Changes produced by serial link will not be flagged. The bit resets after reading		x	
252	251	Unsolicited request flag group 1 Note: See "Unsolicited Request Flag Group Hidden"		x	
253	252	Unsolicited request flag group 2 Range: 0 = No status change is occurred 1 = Status change is occurred Note: The information of group 2 are on Modbus bits 211, 212, 221		x	
254	253	Unsolicited request flag group 3 Note: See "Unsolicited Request Flag Group Hidden"		x	
255	254	Unsolicited request flag group 4 Note: See "Unsolicited Request Flag Group Hidden"		x	
256	255	Unsolicited request flag group 5 Note: See "Unsolicited Request Flag Group Hidden"		x	
257	256	Unsolicited request flag group 6 Note: See "Unsolicited Request Flag Group Hidden"		x	
258	257	Unsolicited request flag group 7 Note: See "Unsolicited Request Flag Group Hidden"		x	
259	258	Unsolicited request flag group 8 Note: See "Unsolicited Request Flag Group Hidden"		x	
260	259	Unsolicited request flag group 9 Range: 0 = No change on status of auxiliary output 10÷19 1 = One or more auxiliary output is changed Note: See "Unsolicited Request Flag Group Hidden"		x	

BITS FOR DEVICE IN CONTROL MODE

ADDRESS (decimal)		DESCRIPTION	LED MNEM CODE	R E A D	W R I T E
JBus	Mod Bus				
301	300	Status auxiliary input 1 Range: 0 = Open 1 = Closed	("IN1")	x	
302	301	Status auxiliary input 2 Range: 0 = Open 1 = Closed	("IN2")	x	
303	302	Status auxiliary input 3 Range: 0 = Open 1 = Closed	("IN3")	x	
304	303	Status auxiliary input 4 Range: 0 = Open 1 = Closed	("IN4")	x	
305	304	Status auxiliary input 5 Range: 0 = Open 1 = Closed	("IN5")	x	
306	305	Status auxiliary input 6 Range: 0 = Open 1 = Closed	("IN6")	x	
307	306	Status auxiliary input 7 Range: 0 = Open 1 = Closed	("IN7")	x	
308	307	Status auxiliary input 8 Range: 0 = Open 1 = Closed	("IN8")	x	

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BITS FOR DEVICE IN CONTROL MODE

ADDRESS (decimal)		DESCRIPTION	Display MNEM CODE	R E A D	W R I T E
JBus	Mod Bus				
311	310	Status auxiliary output 10 Range: 0 = OFF 1 = ON	("OU.10")	x	x
312	311	Status auxiliary output 11 Range: 0 = OFF 1 = ON	("OU.11")	x	x
313	312	Status auxiliary output 12 Range: 0 = OFF 1 = ON	("OU.12")	x	x
314	313	Status auxiliary output 13 Range: 0 = OFF 1 = ON	("OU.13")	x	x
315	314	Status auxiliary output 14 Range: 0 = OFF 1 = ON	("OU.14")	x	x
316	315	Status auxiliary output 15 Range: 0 = OFF 1 = ON	("OU.15")	x	x
317	316	Status auxiliary output 16 Range: 0 = OFF 1 = ON	("OU.16")	x	x
318	317	Status auxiliary output 17 Range: 0 = OFF 1 = ON	("OU.17")	x	x
319	318	Status auxiliary output 18 Range: 0 = OFF 1 = ON	("OU.18")	x	x
320	319	Status auxiliary output 19 Range: 0 = OFF 1 = ON	("OU.19")	x	x

WORDS FOR DEVICE IN CONFIGURATION MODE - PARAMETERS**“Inpt.” - Menu Conf. 1 - MAIN/AUXILIARY INPUT CONFIGURATION**

ADDRESS (decimal)		DESCRIPTION	DEC. FIGU- RES	Display MNEM CODE	R E A D	W R I T E
JBus	Mod Bus					
2001	2000	Line frequency Range: 0 = 50 Hz 1 = 60 Hz	N.A.	("Ln.Fr")	x	x
2002	2001	Primary variable selection Range: 0 = Carbon potential as primary control variable (the span limits are 0.00 to 2.00) 1 = Dew point as primary control variable (the span limits are -100 to 100°F or -75 to 40°C) 2 = Sensor output in mV as primary control variable (the span limits are 0 to 1500 mV)	N.A.	("PV.SL")	x	x
2003	2002	Time constant for filter on probe sensor input (in seconds)	0	("Pb.FL")	x	x
2004	2003	Input type and range value for temperature input Range: 1 = TC K From -100 to 1370 °C 2 = TC S From - 50 to 1760 °C 3 = TC R From - 50 to 1760 °C 4 = TC K From -150 to 2500 °F 5 = TC S From - 60 to 3200 °F 6 = TC R From - 60 to 3200 °F	N.A.	("tP.In")	x	x
2005	2004	Temperature input offset adjustment (Value in Celsius or Fahrenheit as confi- gured at Mbus word 2003)	0	("OFSt")	x	x
2006	2005	Time constant for filter on temperature value (in seconds)	0	("tP.FL")	x	x
2007	2006	Auxiliary input function for carbon mono- oxide measurement Range: 0 = Input not used 1 = Input used for CO measurement	N.A.	("CO.In")	x	x
2008	2007	Auxiliary input type Range: 0 = 0÷20 mA 1 = 4÷20 mA 2 = 0÷5 V 3 = 1÷5 V 4 = 0÷10 V 5 = 2÷10 V	N.A.	("CO.tP")	x	x

WORDS FOR DEVICE IN CONFIGURATION MODE - PARAMETERS**"Out." - Menu Conf. 2 - OUTPUT CONFIGURATION**

ADDRESS (Decimal)		DESCRIPTION	DEC. FIGU- RES	Display MNEM CODE	R E A D	W R I T E
Jbus	Mod Bus					
2101	2100	Out 1 function Range: 0 = Output not used 1 = Time proportional main control output 2 = Time proportional secondary control output 3 = Output used as alarm 1 output	N.A.	("O1.Fn")	x	x
2102	2101	Out 2 function Range: 0 = Output not used 1 = Time proportional main control output 2 = Time proportional secondary control output 3 = Output used as alarm 2 output	N.A.	("O2.Fn")	x	x
2103	2102	Out 3 function Range: 0 = Output not used 1 = Time proportional main control output 2 = Time proportional secondary control output 3 = Output used as alarm 3 output	N.A.	("O3.Fn")	x	x
2107	2106	Out 6 function Range: 0 = Output not used 1 = Linear main control output 2 = Linear secondary control output 3 = Process variable retransmission 4 = Operative set point retransmission	N.A.	("O6.Fn")	x	x
2108	2107	Out 6 range Range: 0 = 0 ÷ 20 mA 1 = 4 ÷ 20 mA	N.A.	("O6.rm")	x	x
2109	2108	Retransmission low scale range value for Out 6	See Mbus word 300	("O6.Lr")	x	x
2110	2109	Retransmission high scale range value for Out 6	See Mbus word 300	("O6.Hr")	x	x
2111	2110	Time constant for filter on Out 6 analog retransmission value (in seconds)	0	("O6.FL")	x	x

WORDS FOR DEVICE IN CONFIGURATION MODE - PARAMETERS**“Out.” - Menu Conf. 2 - OUTPUT CONFIGURATION**

ADDRESS (Decimal)		DESCRIPTION	DEC. FIGU- RES	Display MNEM CODE	R E A D	W R I T E
Jbus	Mod Bus					
2112	2111	Out 7 function Range: 0 = Output not used 1 = Linear main control output 2 = Linear secondary control output 3 = Process variable retransmission 4 = Operative set point retransmission	N.A.	("O7.Fn")	x	x
2113	2112	Out 7 range Range: 0 = 0 ÷ 20 mA 1 = 4 ÷ 20 mA	N.A.	("O7.rm")	x	x
2114	2113	Retransmission low scale range value for Out 7	See Mbus word 300	("O7.Lr")	x	x
2115	2114	Retransmission high scale range value for Out 7	See Mbus word 300	("O7.Hr")	x	x
2116	2115	Time constant for filter on Out 7 analog retransmission value (in seconds)	0	("O7.FL")	x	x

WORDS FOR DEVICE IN CONFIGURATION MODE - PARAMETERS**"C.Cn." - Menu Conf. 3 - CONTROL OUTPUT CONFIGURATION**

ADDRESS (Decimal)		DESCRIPTION	DEC. FIGU- RES	Display MNEM CODE	R E A D	W R I T E
Jbus	Mod Bus					
2206	2205	Main control output conditioning Range 0 = The control output is calculated by the PID 1 = The control output is complemented (100-PID calculated value)	N.A.	("ñC.Cn")	x	x
2207	2206	Main control output scaleable for display in eng. unit Range: 0 = Scaleable is not required 1 = Scaleable is required	N.A.	("ñS.CL")	x	x
2208	2207	Decimal point position for main control output display in eng. unit Range: 0 = No decimal figure 1 = One decimal figure 2 = Two decimal figure	N.A.	("ñC.dP")	x	x
2209	2208	Low scale range value for main control output display in eng. unit	See Mbus word 301 or 2207	("ñC.E.L.")	x	x
2210	2209	High scale range value for main control output display in eng. unit	See Mbus word 301 or 2207	("ñC.E.H.")	x	x
2211	2210	Main control output auxiliary conditioning Range: 0 = The functions described in the note are applied "Before" of the "Main control output conditioning" stage 1 = The functions described in the note are applied "After" of the "Main control output conditioning" stage Note: a - Control output limiter b - Control output max rate of rise c - Control output display value	N.A.	("ñC.A.C.")	x	x
2212	2211	Secondary control output conditioning Note: See "Main control output conditioning"	N.A.	("SC.Cn.")	x	x
2213	2212	Secondary control output scaleable for display in eng. unit Range: 0 = Scaleable is not required 1 = Scaleable is required	N.A.	("S.SCL")	x	x

WORDS FOR DEVICE IN CONFIGURATION MODE – PARAMETERS**“C.Cn.” – Menu Conf. 3 – CONTROL OUTPUT CONFIGURATION**

ADDRESS (Decimal)		DESCRIPTION	DEC. FIG- RES	Display MNEM CODE	R E A D	W R I T E
Jbus	Mod Bus					
2214	2213	Decimal point position for secondary control output display in eng. Unit Range: 0 = No decimal figure 1 = One decimal figure 2 = Two decimal figure	N.A.	(“SC.dP”)	x	x
2215	2214	Low scale range value for secondary control output display in eng. unit	See Mbus word 302 or 2213	(“SC.E.L.”)	x	x
2216	2215	High scale range value for secondary control output display in eng. unit	See Mbus word 302 or 2213	(“SC.E.H”)	x	x
2217	2216	Secondary control output auxiliary conditioning 0 = The functions described in the note are applied “Before” of the “Secondary control output conditioning” stage 1 = The functions described in the note are applied “After” of the “Secondary control output conditioning” stage Note: a - Control output limiter b - Control output max rate of rise c - Control output display value	N.A.	(“SC.A.C”)	x	x

WORDS FOR DEVICE IN CONFIGURATION MODE - PARAMETERS**“AC.Cn.” - Menu conf. 4 - AUXILIARY CONTROL OUTPUT CONFIGURATION**

ADDRESS (decimal)		DESCRIPTION	DEC. FIGU- RES	Display MNEM CODE	R E A D	W R I T E
JBus	Mod Bus					
2301	2300	Smart function Range 0 = Smart function disable 1 = Smart function may be enabled	N.A.	(“Sñ.Fn”)	x	x
2302	2301	Control action type Range 0 = The process is controlled by PID actions 1 = The process is controlled by PI actions	N.A.	(“Cn.tP”)	x	x
2303	2302	Manual function Range 0 = Manual function disabled 1 = Manual function enabled	N.A.	(“ñAn.F”)	x	x
2304	2303	Output value for transfer from auto to manual Note: The value 7FFFh means that the transfer from auto to manual is bumpless	1	(“Añ.UL”)	x	x
2305	2304	Manual/auto transfer type Range 0 = Bumpless balance transfer 1 = Bumpless balanceless transfer	N.A.	(“ñ.A.t.t”)	x	x
2306	2305	Device status at start up Range 0 = It starts always in auto mode 1 = It starts always in manual mode with power output set to 0 2 = It starts in the same way it was left prior to power shut down (if in manual mode the power output is set to 0) 3 = It starts in the same way it was left prior to power shut down (if in manual mode the power output will be the last value prior to power shut down)	N.A.	(“St.Fn”)	x	x

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WORDS FOR DEVICE IN CONFIGURATION MODE - PARAMETERS**“In.Ot.” - Menu conf. 5 - DIGITAL INPUT/OUTPUT CONFIGURATION**

ADDRESS (decimal)		DESCRIPTION	DEC. FIGU- RES	Display MNEM CODE	R E A D	W R I T E
JBus	Mod Bus					
2401	2400	External contact “DIG1” function Range: 0 = Input contact not used 1 = Input contact used for SP/SP2 auxiliary set point selection 2 = Input contact used for SP3/SP4 auxiliary set point selection 3 = Input contact used for Auto/Manual selection 4 = Input contact used for output limiter activation 5 = Input contact used to reset (acknowledge) alarm	N.A.	(“d1.Fn”)	x	x
2402	2401	External contact “DIG1” logic level Range: 0 = The input is at logic level “1” when contact is open 1 = The input is at logic level “1” when contact is closed	N.A.	(“d1.St”)	x	x
2403	2402	External contact “DIG2” function Note: See “External contact “DIG1” function”	N.A.	(“d2.Fn”)	x	x
2404	2403	External contact “DIG2” logic level Note: See “External contact “DIG1” logic level“	N.A.	(“d2.St”)	x	x
2406	2405	External contact “DIG3” logic level Note: See “External contact “DIG1” logic level“	N.A.	(“d3.St”)	x	x

WORDS FOR DEVICE IN CONFIGURATION MODE - PARAMETERS**“Othr.” - Menu conf. 6 - OTHER CONFIGURATION PARAMETER**

ADDRESS (decimal)		DESCRIPTION	DEC. FIGU- RES	Display MNEM CODE	R E A D	W R I T E
JBus	Mod Bus					
2501	2500	Green bar-graph selection Range: 0 = On bar-graph the process variable value is shown 1 = On bar-graph the deviation error is shown	N.A.	("G.brG")	x	x
2502	2501	Orange bar-graph selection Range: 0 = On bar-graph the operative set-point value is shown 1 = On bar-graph the process output value is shown	N.A.	("O.brG")	x	x
2503	2502	Bar-graph low scale range value	See Mbus word 300	("brG.L")	x	x
2504	2503	Bar-graph high scale range value	See Mbus word 300	("brG.H")	x	x
2505	2504	Deviation bar-graph resolution Range: 0 = 1 digit per segment 1 = 2 digits per segment 2 = 5 digits per segment 3 = 10 digits per segment 4 = 20 digits per segment 5 = 50 digits per segment	N.A.	("brG.d")	x	x
2507	2506	Set point display type Range: 0 = the final set point will be shown 1 = the operative set point will be shown	N.A.	("SP.dS")	x	x
2508	2507	Temperature threshold activation Range: 0 = NO 1 = YES	N.A.	("t.t.Ac")	x	x
2510	2509	Time-out selection Range: 0 = 10 seconds time-out 1 = 30 seconds time-out	N.A.	("t.out")	x	x

WORDS FOR DEVICE IN CONFIGURATION MODE - NON PARAMETERS

ADDRESS (decimal)		DESCRIPTION	DEC. FIGU- RES	Display MNEM CODE	R E A D	W R I T E
JBus	Mod Bus					
3001	3000	The end of configuration menu 1 Range: 1 = end of configuration menu 1	N.A.			x
3002	3001	The end of configuration menu 2 Range: 1 = end of configuration menu 2	N.A.			x
3003	3002	The end of configuration menu 3 Range: 1 = end of configuration menu 3	N.A.			x
3004	3003	The end of configuration menu 4 Range: 1 = end of configuration menu 4	N.A.			x
3005	3004	The end of configuration menu 5 Range: 1 = end of configuration menu 5	N.A.			x
3006	3005	The end of configuration menu 6 Range: 1 = end of configuration menu 6	N.A.			x
3051	3050	Load default configuration value Range: 1 = Load default TB1=European table 2 = Load default TB2=American table	N.A.	(TB1/TB2)		x
3052	3051	Enable control mode Range: 1 = Enable control mode	N.A.			x

WORDS FOR DEVICE IN SECURITY CODE MODE

ADDRESS (decimal)		DESCRIPTION	DEC. FIGU- RES	Display MNEM CODE	R E A D	W R I T E
JBus	Mod Bus					
4001	4000	Safety lock combination for configuration mode Range : Reading: 0 = No parameters protection 1 = Parameters always protected 2 = Parameters protected by software key Writing: 0-250			X	X
4002	4001	Safety lock combination for control mode Range : Reading: 0 = No parameters protection 1 = Parameters always protected 2 = Parameters protected by software key Writing: 0-250			X	X
4003	4002	Group hidden protected Range : 0 = Group non protected 1 = Group protected			X	X
4004	4003	Group 1 protected Range : 0 = Group non protected 1 = Group protected			X	X
4005	4004	Group 2 protected Range : 0 = Group non protected 1 = Group protected			X	X
4006	4005	Group 3 protected Range : 0 = Group non protected 1 = Group protected			X	X
4007	4006	Group 4 protected Range : 0 = Group non protected 1 = Group protected			X	X
4008	4007	Group 5 protected Range : 0 = Group non protected 1 = Group protected			X	X
4009	4008	Group 6 protected Range : 0 = Group non protected 1 = Group protected			X	X
4010	4009	Group 7 protected Range : 0 = Group non protected 1 = Group protected			X	X

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ADDRESS (decimal)		DESCRIPTION	DEC. FIGU- RES	Display MNEM CODE	R E A D	W R I T E
JBus	Mod Bus					
4011	4010	Group 8 protected Range : 0 = Group non protected 1 = Group protected			x	x
4012	4011	Group 9 protected Range : 0 = Group non protected 1 = Group protected			x	x

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Additional and specialized technical notes

- Eng.247E Technical specifications for SSI's AC20 Atmosphere Controller