BETRIEBSANLEITUNG
INSTRUCTION MANUAL

KEB COMBICOM **ModBus**

CM.F5.010-K000

KEB

12/2003

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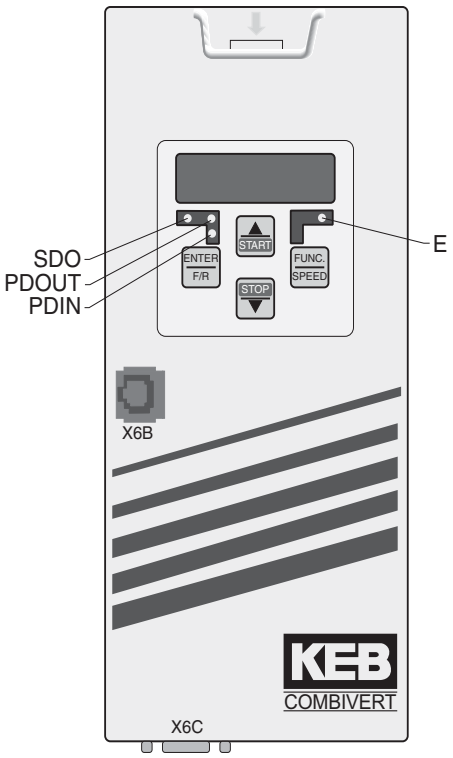
1. ModBus Interface

1.1 Ordering Information

F5 ModBus Operator:	00.F5.060-A000
Utilities for the diagnosis interface	
HSP5 cable between PC and adapter:	00.F5.0C0-0001
Adapter DSUB / Western:	00.F5.0C0-0002

Hardware Description



MDB: This green LED shines if a ModBus service is running.

ERROR: This red LED blinks if the frequency inverter control is in error state.
It shines constantly if the frequency inverter is ready for operation.
If this LED is constantly off then there is no power supply.

X6B: Diagnosis interface

X6C: ModBus interface connector (SUBD9 female).

SUBD9 (Female) connector is supplied for connecting to the ModBus. This connector supports the RS232 or alternatively the RS485 transmission standard. The assignment of the connector is as follows :

Pin	Name	Description
1	NC	Not used
2	RS232_TxD	RS232-Tx-Signal
3	RS232_RxD	RS232-Rx-Signal
4	RS485_RxD(A)	RS485-Rx-Signal-A
5	RS485_RxD(B)	RS485-Rx-Signal-B
6	VCC	Power supply of the serial interface
7	GND	Reference potential of the serial interface
8	RS485_TxD(A)	RS485-Tx-Signal-A
9	RS485_TxD(B)	RS485-Tx-Signal-B

1.2 ModBus Transmission Speed

The ModBus transmission speed is adjusted through parameter SY.07 in the frequency inverter control. During initialisation this value is read out by the ModBus operator together with the inverter address and the value is taken as ModBus bitrate.

Value	Meaning
0	1200 Bit/s
1	2400 Bit/s
2	4800 Bit/s
3	9600 Bit/s
4	19200 Bit/s
5	38400 Bit/s
6	55500 Bit/s[1]

1: No Default value of serial interfaces on Personal Computers

1.3 Diagnosis Interface

Attention !!! To prevent the damage of the serial interface on your Personal Computer be sure that you use the special HSP5 cable from KEB for connecting your PC to the diagnosis interface of the ModBus operator.

With an adapter the HSP5 cable is connected to the diagnosis interface (see ordering informations). When connected correctly access to all parameters of the frequency inverter is possible using the PC-software KEB Combivis. Also the operator internal parameters can be read out and partly adjusted or parameterized with Download.

2. Functions

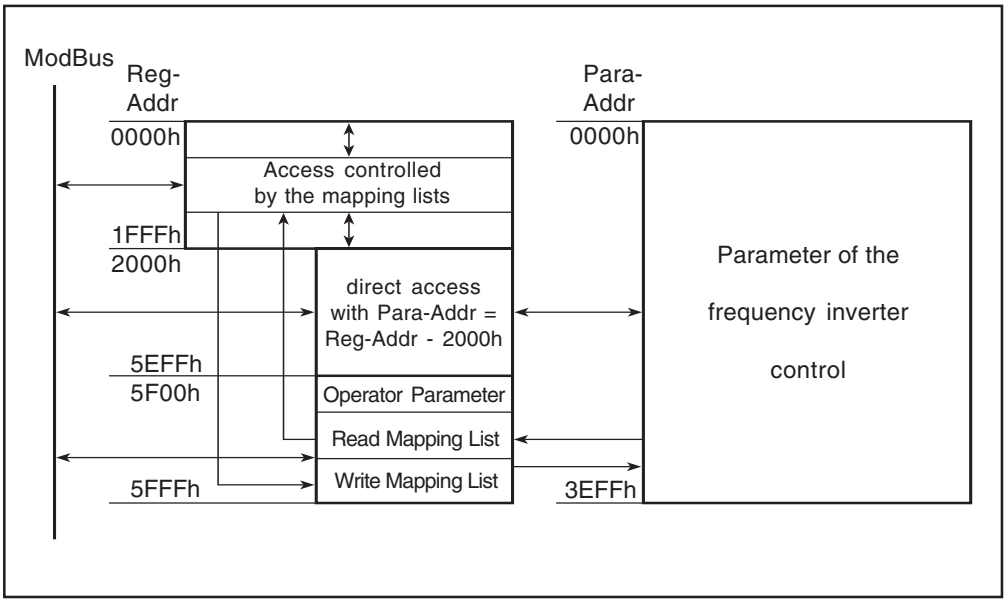
2.1 Slave Addressing

The KEB-ModBus operator is a slave interface. The required ModBus address for addressing is determined by the operator parameter **MDB_SlaveAddr_OP**. If the value of the operator parameter is equal to 255(decimal), the ModBus address is taken from the inverter address (SY.06). If SY.06 shall have the value zero which was reserved for broadcast at ModBus, the ModBus operator disable all ModBus activities. If the values are unequal 255(decimal) the ModBus address is directly taken from this value.

2.2 Parameter Addressing

The addresses of the parameters (register) are devided into different groups. Each of this group has its own accessing method:

- **0000(hex).....1FFF(hex)**: This group is build up by those parameters that are accessed through the mapping list. For a possible adaption of existing applications, the real start of the mapping parameters in this range can be adjusted by parameters MDB_MapStartAddr_Rd/Wr '. (see below).
- **2000(hex).....5EFF(hex)**: In this address area the parameters of the inverter control board are mapped by a fixed algorithm. Access is always made on:
  FI-Parameter Address = ModBus Register Address – 2000(hex). Please keep in mind that in this address area access is done with indirect set addressing (with FR.09). This means when writing/reading one parameter in different sets you have to set the set indicator (FR.09) previously before access.
- **5F00(hex)....5FFF(hex):** This block consists of the operator parameters.



2.3 ModBus Functions

The following predefined ModBus functions are supported by the KEB ModBus interface:

- 3 : ‚Read Holding Registers‘
- 4 : ‚Read Input Registers‘
- 6 : ‚Preset Single Register‘
- 16 : ‚Preset Multiple Registers‘

At KEB functions 3 and 4 are completely identical.

The predefined ModBus functions are designed for word (16 Bit) data access. Addressing of parameters is also done by 16 bit register address. Therefore this services can only operate to the inverter with indirect set addressing (FR.09).

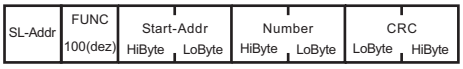
As some parameters of the KEB frequency inverter have 32 bit data length, additional definitions had to be made for accessing those parameters. This problem has been solved in two ways:

- First is that parameter access through functions 3, 4, 6, 16 in a certain register address area is controlled by two mapping lists. One list for reading and another for writing. With these lists it is possible to access as well as 16 bit or 32 bit parameters with the functions 3, 4, 16. Also the direct set addressing is supported here. The beginning of the register addresses of the mapping lists is programmable with parameters MDB_MapStartAddr_Rd/Wr in the operator. The real length of the mapping list is programmable with parameters MDB_MapNr_Rd/Wr in the operator. The maximum length is limited to 100 (dec) words (16-Bit).
- Second is that two additional ModBus functions have been defined by KEB. The ModBus specification [2] releases function codes for so called 'user defined function codes‘. In this function area the following functions have been created:
- 100: Read Registers32: Reading several 32 bit registers (indirect set addressing through FR.09))
- 101: Write Registers32: Writing several 32 bit registers (indirect set addressing through FR.09)

2.4 ModBus Functions Defined By KEB

2.4.1 Function 100: Read Registers32

By this function a number of 32 bit registers/parameters can be read.
Function 100 – Request:

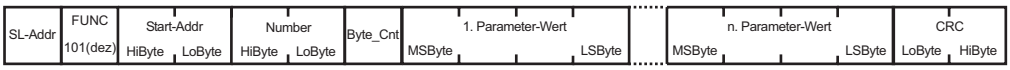


with Number: Number of registers/parameters to read
with Start-Addr: First read register address

Function 100 – Response:

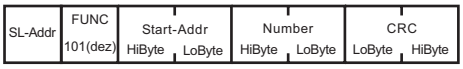
2.4.2 Function 101: Write Registers32

By this function a number of 32 bit registers can be written.
Function 101 – Request:



with Number: Number of registers/parameters to read
with Start-Addr: First read register address

Function 101 – Response:



2.5 Fieldbus Watchdog

The ModBus operator supports fieldbus supervising. Two operator parameters configure this function. **Watchdog_Inhibit** defines several events that reset the fieldbus watchdog. **Watchdog_Activation** serves for activating the watchdog functions with the first occurence of certain events. The effect of the timeout of the Watchdog timer is adjusted via parameter Pn.05. Parameter Pn.6 determines the Watchdog time. For more information see parameter description below and in the application manual of the used inverter control.

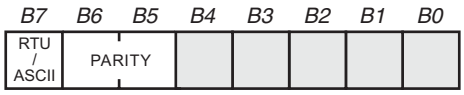
3. Operator Parameters

This parameters are localized in the ModBus interface and determine their behaviour. All operator parameters can be accessed as operator parameters via ModBus (mapping lists only for 32 bit services) as well as via diagnosis interface (HSP5).

Legend	**Parameter name**	Combivis Parameter address	**ModBus-Register address**

MDB_ProtCfg — 0280h (FB.00) — 5F00h

Meaning: Configures the ModBus interface protocol configuration.
Data Length: 1 Byte
Coding:



Bit7: = 1: ModBus RTU(binary) protocol
= 0: ModBus Ascii protocol (not yet adjustable)
Bit6, 5: = 00: 8 data bits, no parity bit, 2 stop bit
= 01: 8 data bits, odd parity bit, 1 stop bit
= 10: 8 data bits, even parity bit, 1 stop bit
Bit4, 3, 2, 1, 0 = reserved for further use

Default Setting: **C0h: ModBus RTU, 8 data bits, even parity bit, 1 stop bit**
Remarks: A changed value will immediately be active and non-volatile saved.

MDB_SlavAddr_OP — 0281h (FB.01) — 5F01h

Meaning: Defines the source for the ModBus slave address.
Data Length: 1 Byte
Coding: 255(dec): ModBus slave address = SY.06. No ModBus activity if SY.06 = 0!
1...247: ModBus slave address = MDB_SlaveAddr_OP
Default Setting: **255(dec): ModBus slave address = SY.06.**
Remarks: A changed value will immediately be active and non-volatile saved.

MDB_MapStartAddr_Rd — 0282h (FB.02) — 5F02h

Meaning: Configures the first parameter address whose read access is controlled by the read mapping list.
Data Length: 2 Byte
Coding: 1
Default Setting: **0**
Remarks: A changed value will immediately be active and non-volatile saved.

MDB_MapStartAddr_Wr — 0283h (FB.03) — 5F03h

Meaning: Configures the first parameter address whose write access is controlled by the write mapping list.
Data Length: 2 Byte
Coding: 1
Default Setting: **0**
Remarks: A changed value will immediately be active and non-volatile saved.

MDB_MapNr_Rd	0284h (FB.04)	5F04h

Meaning: Configures the number of parameters in the read mapping list.
Data Length: 1 Byte
Coding: 1
Default Setting: **2**
Remarks: Maximum 100 words(16 bit) can be mapped. A changed value will immediately be active and non-volatile saved.

MDB_MapNr_Wr	0285h (FB.05)	5F05h

Meaning: Configures the real number of parameters in the write mapping list.
Data Length: 1 Byte
Coding: 1
Default Setting: **2**
Remarks: Maximum 100 words(16 bit) can be mapped. A changed value will immediately be active and non-volatile saved.

Watchdog_Inhibit	0286h (FB.06)	5F06h

Meaning: Configures which events will reset the fieldbus watchdog.
Data Length: 1 Byte
Coding: Bit coded:
Bit0 = 1: Reset fieldbus watchdog by receive of each correct ModBus telegram
Bit1 = 1: Reset fieldbus watchdog by receive of each correct ModBus telegram to this slave (broadcast included)
Default Setting: **01h**
Remarks: A changed value will immediately be active and non-volatile saved.

Watchdog_Activation	0287h (FB.07)	5F07h

Meaning: Configures which events will activate the fieldbus watchdog.
Data Length: 1 Byte
Coding: Bit coded:
Bit0 = 1: Activate fieldbus watchdog by first receive of any ModBus telegram.
Bit1 = 1: Activate fieldbus watchdog by first receive of a correct ModBus telegram to this slave (broadcast included)
Default Setting: **01h**
Remarks: A changed value will immediately be active and non-volatile saved.

MDB_Command	0288h (FB.08)	5F31h

Meaning: Through writing to this parameter certain commands can be requested in the ModBus operator.
Data Length: 2 Byte
Coding: 0: No command
1: Set operator parameter to default values
Remarks: After completion of the requested command bit 15 of this value will be set by the ModBus operator.

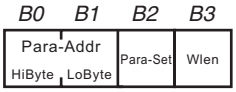
MDB_Mapping_Rd_N — see below — 5F32h+N

COMBIVIS Para. Addr.: COMBIVIS access through two parameters:
MDB_Read_MapIndex (0289h (FB.09)): = N
MDB_Read_Mapping (028Ah (FB.10)): The mapping itself

Meaning: Configures the nte mapping for read access mapping. N = 0 referes to the first mapping.

Data Length: 4 Byte

Coding:



Para. Address: Parameter address (see application manual of the FI control).
Para. Set: Parameter set bit coded
Bit0 = 1 --> Set 0 addressed
Bit7 = 1 --> Set 7 addressed.
Wlen: Data length = 16 bit words
Wlen = 1 --> Data length = 16 bit
Wlen = 2 --> Data length = 32 bit: In this case the first mapping for this parameter contains the used mapping. In the following mapping the values of Para. Addr., Para. Set and Wlen has to be set to zero. That means that a 32 bit mapping takes two entries in the mapping list.

Remarks: It is possible to address more than one set in one mapping. That means that the value of Para. Set can have more then one bit set. Please keep in mind that in this case the ModBus operator returns error code 3 (illegal value) if the values of the read parameter are not the same in all mapped sets.

MDB_Mapping_Wr_N — see below — 5F96h+N

COMBIVIS Para. Addr.: COMBIVIS access through two parameters:
MDB_Write_MapIndex (028Bh (FB.11)): = N
MDB_Write_Mapping (028Ch (FB.12)): The mapping itself

Meaning: Configures the nte mapping for write access mapping. N = 0 referes to the first mapping.

Data Length: 4 Byte

Coding: Para. Addr.: Parameter address (see application manual of the FI control).
Para. Set: Parameter set bit coded
Bit0 = 1 --> Set 0 addressed
Bit7 = 1 --> Set 7 addressed.
Wlen: Data length = 16 bit words
Wlen = 1 --> Data length = 16 bit
Wlen = 2 --> Data length = 32 bit: In this case the first mapping for this parameter contains the used mapping. In the following mapping the values of Para. Addr., Para. Set and Wlen has to be set to zero. That means that a 32 bit mapping takes two entries in the mapping list.

Remarks: It is possible to address more than one set in write mapping. That means that the value of Para. Set can have more then one bit set.

Operator Type — 0180h (OS.00) — not available

Meaning: Returns an identifier for the operator type.

Data Length: 2 Byte

Coding: Internal KEB Coding:
10310(dec) = ModBus operator and diagnosis interface

Remarks: Only for information

Software date

0182h (OS.02) **not available**

Meaning: Configures the software date.
Data Length: 2 Byte
Coding: The lowest decimal digit configures the year 2000.
The next two decimal digits configure the month.
The next two decimal digits configure the day.
Remarks: The representation is as follows: ddmm, year-2000

Diag Error Counter

0183h (OS.03) **not available**

Meaning: Counts errors on the diagnosis interface.
Data Length: 2 Byte
Coding: 1
Remarks: Only for information

DiagRsp.DelayTime

0184h (OS.04) **not available**

Meaning: Response delay time on the diagnosis interface.
Data Length: 1 Byte
Coding: 1 ms
Remarks: A changed value will immediately be active and non-volatile saved.

Diag Baudrate

0185h (OS.05) **not available**

Meaning: Configures the transmission speed on the diagnosis interface.
Data Length: 1 Byte
Coding: 0: 1200 Bit/s
1: 2400 Bit/s
2: 4800 Bit/s
3: 9600 Bit/s
4: 19200 Bit/s
5: 38400 Bit/s
Remarks: This Parameter can only read by the diagnosis interface.

HSP5_Max_InvBusy_Retries

0186h (OS.06) **not available**

Meaning: Configures how often the ModBus operator repeats a request to the frequency inverter control if this answers with error code ‚inverter busy‘.
Data Length: 1 Byte
Coding: 1
Remarks: A changed value will immediately be active and non-volatile saved.

HSP5 Tout Cnt

0187h (OS.07) **not available**

Meaning: Counts the occurrences of timeout on the interface between ModBus operator and frequency inverter control.
Data Length: 2 Byte
Coding: 1
Remarks: Only for information

4 Annex

4.1 Table of Operator Parameters

ModBus Address	COMBIVIS Para. Address	Name	Data length in Byte
———	0180h	Operator Type	2
———	0182h	Software date	2
———	0183h	Diag Error Counter	2
———	0184h	DiagRsp.DelayTime	1
———	0185h	Diag Baudrate	1
———	0186h	HSP5_Max_InvBusy_Retries	1
———	0187h	HSP5 Tout Cnt	2
5F00h	0280h	MDB_ProtCfg	1
5F01h	0281h	MDB_SlaveAddr_OP	1
5F02h	0282h	MDB_MapStartAddr_Rd	2
5F03h	0283h	MDB_MapStartAddr_Wr	2
5F04h	0284h	MDB_MapNr_Rd	1
5F05h	0285h	MDB_MapNr_Wr	1
5F06h	0286h	Watchdog_Inhibit	1
5F07h	0287h	Watchdog_Activation	1
5F31h	0288h	MDB_Command	2
5F32h	0289h + 028Ah	MDB_Mapping_Rd_0	4
:	:	:	:
5F95h	0289h + 028Ah	MDB_Mapping_Rd_99	4
5F96h	028Bh + 028Ch	MDB_Mapping_Wr_0	4
:	:	:	:
5FF9h	028Bh + 028Ch	MDB_Mapping_Wr_99	4

4.2 Error Codes of Exception Response

Error Code	Meaning
1	Illegal function
2	Illegal data address
3	Illegal data value
4	Slave device failure
5	Function accepted but not yet finished
6	Slave device busy
64	Internal buffer overflow
65	Timeout at transfer to frequency inverter control
66	Parameter is write protected
67	Invalid password

5. References

[1]: Modicon ModBus Protocol Reference Guide, PI-MBUS-300 Rev.J v. 06/1996
[2]: ModBus Application Protocol Specification V1.1 v. 12/06/02
[3]: ModBus over Serial Line Specification & Implementation Guide V1.0 v. 12/02/02

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