# VMB4RYLD_10

**4 channel relay module with direct load connections for VELBUS system**

Binairy format:
<SOF-SID10...SID0-RTR-IDE-r0-DLC3...0-DATABYTE1...DATABYTEn-CRC14...CRC1-CRCDEL-ACK-ACKDEL-EOF7...EOF1-IFS3...IFS1>

| bits | Description |
|---|---|
| SOF | Start Of Frame (always 0) |
| SID10 & SID9 | Priority (00: highest … 11: lowest priority) |
| SID8…SID1 | Address |
| SID0 | Always 0 |
| RTR | Remote Transmit Request |
| IDE | Identifier Extension (always 0) |
| R0 | reserved (always 0) |
| DLC3…DLC0 | Data Length Code (0…8) |
| Databyte1 | Command |
| Databyte2 | Parameter |
| Databyte3 | Parameter |
| Databyte4 | Parameter |
| Databyte5 | Parameter |
| Databyte6 | Parameter |
| Databyte7 | Parameter |
| Databyte8 | Parameter |
| CRC14…CRC1 | Cyclic Redundancy Checksum |
| CRCDEL | CRC Delimiter (always 1) |
| ACK | Acknowledge slot (transmit 1 readback 0 if received correctly) |
| ACKDEL | Acknowledge Delimiter (always 1) |
| EOF7...EOF1 | End Of Frame (always 1111111) |
| IFS3...IFS1 | InterFrame Space (always 111) |

*The relay module can transmit the following commands:*
- Clears LEDs on a push button module
- Sets LEDs on a push button module
- Blinks LEDs slowly on a push button module
- Blinks LEDs fast on a push button module
- Blinks LEDs very fast on a push button module

*The relay module can transmit the following messages:*
- Relay status
- Relays switch status
- Module type
- Bus error counter status
- First, second and third part of the relay name
- Memory data
- Memory data block (4 bytes)

*The relay module can receive the following messages:*
- Push button status

*The relay module can receive the following commands:*
- Switch relay off
- Switch relay on
- Start relay timer
- Start relay blinking timer
- Forced off relay (Build 1105 or higher)
- Cancel forced off relay (Build 1105 or higher)
- Forced on relay (Build 1105 or higher)
- Cancel forced on relay (Build 1105 or higher)
- Inhibit relay (Build 1105 or higher)
- Cancel inhibit relay (Build 1105 or higher)
- Relay status request
- Clear Push button Led
- Module type request

- Bus error counter status request
- Relay name request
- Read memory data
- Read memory data block (4 bytes)
- Memory dump request
- Write memory data
- Write memory data block (4 bytes)
- Write module address and serial number

*Transmits the push button & relay switch status:*
    SID10-SID9 = 00 (highest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 4 databytes to send
    DATABYTE1 = COMMAND_PUSH_BUTTON_STATUS (H'00')
    DATABYTE2 = Local mode push buttons just pressed / relays just switched on (1 = just pressed / switched on)
    DATABYTE3 = Local mode push buttons just released / relays just switched off (1 = just released / switched off)
    DATABYTE4 = Local mode push buttons long pressed (1 = longer than 0.85s pressed)

|  | *Databyte2* | *Databyte3* | *Databyte4* |
|---|---|---|---|
| Relay channel 1 just switched on | B'xxxxxxx1' | B'xxxxxxx0' | B'xxxxxxx0' |
| Relay channel 1 just switched off | B'xxxxxxx0' | B'000x0001' | B'xxxxxxx0' |
| Relay channel 2 just switched on | B'xxxxxx1x' | B'xxxxxx0x' | B'xxxxxx0x' |
| Relay channel 2 just switched off | B'xxxxxx0x' | B'xxxxxx1x' | B'xxxxxx0x' |
| Relay channel 3 just switched on | B'xxxxx1xx' | B'xxxxx0xx' | B'xxxxx0xx' |
| Relay channel 3 just switched off | B'xxxxx0xx' | B'xxxxx1xx' | B'xxxxx0xx' |
| Relay channel 4 just switched on | B'xxxx1xxx' | B'xxxx0xxx' | B'xxxx0xxx' |
| Relay channel 4 just switched off | B'xxxx0xxx' | B'xxxx1xxx' | B'xxxx0xxx' |
| Virtual relay channel 5 just switched on | B'xxx1xxxx' | B'xxx0xxxx' | B'xxx0xxxx' |
| Virtual relay channel 5 just switched off | B'xxx0xxxx' | B'xxx1xxxx' | B'xxx0xxxx' |

*Transmit: Clears LEDs on a push button module:*
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Address of the push button module for clearing LEDs
    RTR = 0
    DLC3...DLC0 = 2 databytes to send
    DATABYTE1 = COMMAND_CLEAR_LED (H'F5')
    DATABYTE2 = LED bit numbers (1 = clear LED)

*Transmit: Sets LEDs on a push button module:*
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Address of the push button module for setting LEDs on
    RTR = 0
    DLC3...DLC0 = 2 databytes to send
    DATABYTE1 = COMMAND_SET_LED (H'F6')
    DATABYTE2 = LED bit numbers (1 = set LED)

*Transmit: Blinks LEDs slowly on a push button module:*
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Address of the push button module for slowly blinking LEDs
    RTR = 0
    DLC3...DLC0 = 2 databytes to send
    DATABYTE1 = COMMAND_SLOW_BLINKING_LED (H'F7')
    DATABYTE2 = LED bit numbers (1 = slow blink LED)

*Transmit: Blinks LEDs fast on a push button module:*
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Address of the push button module for fast blinking LEDs
    RTR = 0
    DLC3...DLC0 = 2 databytes to send
    DATABYTE1 = COMMAND_FAST_BLINKING_LED (H'F8')
    DATABYTE2 = LED bit numbers (1 = fast blink LED)

*Transmit: Blinks LEDs very fast on a push button module:*

    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Address of the push button module for very fast blinking LEDs
    RTR = 0
    DLC3...DLC0 = 2 databytes to send
    DATABYTE1 = COMMAND_VERYFAST_BLINKING_LED (H'F9')
    DATABYTE2 = LED bit numbers (1 = very fast blink LED)


*Transmit: Bus error counter status:*

    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 4 databytes to send
    DATABYTE1 = COMMAND_BUSERROR_COUNTER_STATUS (H'DA')
    DATABYTE2 = Transmit error counter
    DATABYTE3 = Receive error counter
    DATABYTE4 = Bus off counter

*Transmits the relay status:*

    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 8 databytes to send
    DATABYTE1 = COMMAND_RELAY_STATUS (H'FB')
    DATABYTE2 = Relay bit number

| Contents | Relay number |
|---|---|
| B'00000001' | Channel 1 |
| B'00000010' | Channel 2 |
| B'00000100' | Channel 3 |
| B'00001000' | Channel 4 |
| B'00010000' | Virtual Channel 5 |

DATABYTE3 = Disable/inhibit/Forced on setting

| Contents | Setting |
|---|---|
| B'xxxxxx00' | Channel normal |
| B'xxxxxx01' | Channel inhibited |
| B'xxxxxx10' | Channel forced on |
| B'xxxxxx11' | Channel disabled |

DATABYTE4 = Relay status

| Contents | Relay status |
|---|---|
| B'xxxxxx00' | Relay channel off |
| B'xxxxxx01' | Relay channel on |
| B'xxxxxx11' | Relay channel interval timer on |

DATABYTE5 = Led status

| Contents | Mode |
|---|---|
| B'00000000' | LED off |
| B'10000000' | LED on |
| B'01000000' | LED slow blinking |
| B'00100000' | LED fast blinking |
| B'00010000' | LED very fast blinking |

DATABYTE6 = high byte of current delay time
DATABYTE7 = mid byte of current delay time
DATABYTE8 = low byte of current delay time

Remark:
[DATABYTE6][DATABYTE7][DATABYTE8] contain a 24-bit time in seconds

*Transmits the module type:*
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 7 databytes to send
    DATABYTE1 = COMMAND_MODULE_TYPE (H'FF')
    DATABYTE2 = VMB4RYLD_10_TYPE (H'48')
    DATABYTE3 = High byte of serial number
    DATABYTE4 = Low byte of serial number
    DATABYTE5 = Memory map version
    DATABYTE6 = Build year
    DATABYTE7 = Build week
    DATABYTE8 = Terminator (0 = open / 1 = closed)

*Transmits the memory data:*
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 4 databytes to send
    DATABYTE1 = COMMAND_MEMORY_DATA (H'FE')
    DATABYTE2 = High memory address

| High address | Memory bank |
|---|---|
| H'00' | For channel 1 data |
| H'01' | For channel 2 data |
| H'02' | For channel 3 data |
| H'03' | For channel 4 data |
| H'04' | For virtual channel 5 data |

    DATABYTE3 = LOW memory address (H'00'...H'FF')
    DATABYTE4 = memory data

*Transmits memory data block (4 bytes):*
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 4 databytes to send
    DATABYTE1 = COMMAND_MEMORY_DATA_BLOCK (H'CC')
    DATABYTE2 = High start address of memory block
    DATABYTE3 = LOW start address of memory block
    DATABYTE4 = memory data1
    DATABYTE5 = memory data2
    DATABYTE6 = memory data3
    DATABYTE7 = memory data4

    Remark: address range: H'0000' to H'04FC'

*Transmits the first part of the relay name:*
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 8 databytes to send
    DATABYTE1 = COMMAND_RELAY_NAME_PART1 (H'F0')
    DATABYTE2 = Relay bit number

| Contents | Relay number |
|---|---|
| B'00000001' | Channel 1 |
| B'00000010' | Channel 2 |
| B'00000100' | Channel 3 |
| B'00001000' | Channel 4 |
| B'00010000' | Virtual channel 5 |

    DATABYTE3 = Character 1 of the relay name
    DATABYTE4 = Character 2 of the relay name
    DATABYTE5 = Character 3 of the relay name
    DATABYTE6 = Character 4 of the relay name
    DATABYTE7 = Character 5 of the relay name
    DATABYTE8 = Character 6 of the relay name

*Transmits the second part of the relay name:*

    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 8 databytes to send
    DATABYTE1 = COMMAND_RELAY_NAME_PART2 (H'F1')
    DATABYTE2 = Relay bit number

| Contents | Relay number |
|---|---|
| B'00000001' | Channel 1 |
| B'00000010' | Channel 2 |
| B'00000100' | Channel 3 |
| B'00001000' | Channel 4 |
| B'00010000' | Virtual channel 5 |

    DATABYTE3 = Character 7 of the relay name
    DATABYTE4 = Character 8 of the relay name
    DATABYTE5 = Character 9 of the relay name
    DATABYTE6 = Character 10 of the relay name
    DATABYTE7 = Character 11 of the relay name
    DATABYTE8 = Character 12 of the relay name

*Transmits the third part of the relay name:*

    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 6 databytes to send
    DATABYTE1 = COMMAND_RELAY_NAME_PART3 (H'F2')
    DATABYTE2 = Relay bit number

| Contents | Relay number |
|---|---|
| B'00000001' | Channel 1 |
| B'00000010' | Channel 2 |
| B'00000100' | Channel 3 |
| B'00001000' | Channel 4 |
| B'00010000' | Virtual channel 5 |

    DATABYTE3 = Character 13 of the relay name
    DATABYTE4 = Character 14 of the relay name
    DATABYTE5 = Character 14 of the relay name
    DATABYTE6 = Character 16 of the relay name

    Remarks:
    Unused characters contain H'FF'.

*'Push button status' received:*

    SID10-SID9 = 00 (highest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 4 databytes received
    DATABYTE1 = COMMAND_PUSH_BUTTON_STATUS (H'00')
    DATABYTE2 = Push buttons just pressed (1 = just pressed)
    DATABYTE3 = Push buttons just released (1 = just released)
    DATABYTE4 = Push buttons long pressed (1 = longer than 0.85s pressed)

*'Clear LED' command received:*

    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 2 databytes received
    DATABYTE1 = COMMAND_CLEAR_LED (H'F5')
    DATABYTE2 = LEDs to clear (a one clears the corresponding LED)

*'Switch relay off' command received:*

    SID10-SID9 = 00 (highest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 2 databytes received
    DATABYTE1 = COMMAND_SWITCH_RELAY_OFF (H'01')
    DATABYTE2 = Relay bit number

| Contents | Relay number |
|---|---|
| B'00000001' | Channel 1 |
| B'00000010' | Channel 2 |
| B'00000100' | Channel 3 |
| B'00001000' | Channel 4 |
| B'00010000' | Virtual channel 5 |

*'Switch relay on' command received:*

    SID10-SID9 = 00 (highest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 2 databytes received
    DATABYTE1 = COMMAND_SWITCH_RELAY_ON (H'02')
    DATABYTE2 = Relay bit number

| Contents | Relay number |
|---|---|
| B'00000001' | Channel 1 |
| B'00000010' | Channel 2 |
| B'00000100' | Channel 3 |
| B'00001000' | Channel 4 |
| B'00010000' | Virtual channel 5 |

*'Start relay timer' command received:*

    SID10-SID9 = 00 (highest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 5 databytes received
    DATABYTE1 = COMMAND_START_RELAY_TIMER (H'03')
    DATABYTE2 = Relay bit number

| Contents | Relay number |
|---|---|
| B'00000001' | Channel 1 |
| B'00000010' | Channel 2 |
| B'00000100' | Channel 3 |
| B'00001000' | Channel 4 |
| B'00010000' | Virtual channel 5 |

    DATABYTE3 = high byte of delay time
    DATABYTE4 = mid byte of delay time
    DATABYTE5 = low byte of delay time

Remark:

[DATABYTE3][DATABYTE4][DATABYTE5] contain a 24-bit time in seconds

The command will be skipped when the time parameter contains zero.

When the time parameter contains H'FFFFFF' then the relays are permanently switched on.

### 'Start relay blinking timer' command received:

SID10-SID9 = 00 (highest priority)

SID8...SID1 = Module address

RTR = 0

DLC3...DLC0 = 5 databytes received

DATABYTE1 = COMMAND_START_BLINK_RELAY_TIMER (H'0D')

DATABYTE2 = Relay bit number

| Contents | Relay number |
|---|---|
| B'00000001' | Channel 1 |
| B'00000010' | Channel 2 |
| B'00000100' | Channel 3 |
| B'00001000' | Channel 4 |
| B'00010000' | Virtual channel 5 |

DATABYTE3 = high byte of delay time

DATABYTE4 = mid byte of delay time

DATABYTE5 = low byte of delay time

Remark:

[DATABYTE3][DATABYTE4][DATABYTE5] contain a 24-bit time in seconds

The command will be skipped when the time parameter contains zero.

When the time parameter contains H'FFFFFF' then the relays are permanently blinking.

### 'Forced off' command received (Build 1105 or higher):

SID10-SID9 = 00 (highest priority)

SID8...SID1 = Module address

RTR = 0

DLC3...DLC0 = 5 databytes received

DATABYTE1 = COMMAND_FORCED_OFF (H'12')

DATABYTE2 = Relay bit number

| Contents | Relay number |
|---|---|
| B'00000001' | Channel 1 |
| B'00000010' | Channel 2 |
| B'00000100' | Channel 3 |
| B'00001000' | Channel 4 |
| B'00010000' | Virtual channel 5 |

DATABYTE3 = high byte of delay time

DATABYTE4 = mid byte of delay time

DATABYTE5 = low byte of delay time

Remark:

[DATABYTE3][DATABYTE4][DATABYTE5] contain a 24-bit time in seconds

The command will be skipped when the time parameter contains zero.

When the time parameter contains H'FFFFFF' then the relays are permanently forced off.

### 'Cancel forced off' command received (Build 1105 or higher):

SID10-SID9 = 00 (highest priority)

SID8...SID1 = Module address

RTR = 0

DLC3...DLC0 = 2 databytes received

DATABYTE1 = COMMAND_CANCEL_FORCED_OFF (H'13')

DATABYTE2 = Relay bit number

| Contents | Relay number |
|---|---|
| B'00000001' | Channel 1 |
| B'00000010' | Channel 2 |
| B'00000100' | Channel 3 |
| B'00001000' | Channel 4 |
| B'00010000' | Virtual channel 5 |

***'Forced on' command received (Build 1105 or higher):***
    SID10-SID9 = 00 (highest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 5 databytes received
    DATABYTE1 = COMMAND_FORCED_ON (H'14')
    DATABYTE2 = Relay bit number

| Contents | Relay number |
|---|---|
| B'00000001' | Channel 1 |
| B'00000010' | Channel 2 |
| B'00000100' | Channel 3 |
| B'00001000' | Channel 4 |
| B'00010000' | Virtual channel 5 |

DATABYTE3 = high byte of delay time
DATABYTE4 = mid byte of delay time
DATABYTE5 = low byte of delay time

    Remark:
    [DATABYTE3][DATABYTE4][DATABYTE5] contain a 24-bit time in seconds
    The command will be skipped when the time parameter contains zero or the channels are already forced off.
    When the time parameter contains H'FFFFFF' then the relays are permanently forced on.

***'Cancel forced on' command received (Build 1105 or higher):***
    SID10-SID9 = 00 (highest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 2 databytes received
    DATABYTE1 = COMMAND_CANCEL_FORCED_ON (H'15')
    DATABYTE2 = Relay bit number

| Contents | Relay number |
|---|---|
| B'00000001' | Channel 1 |
| B'00000010' | Channel 2 |
| B'00000100' | Channel 3 |
| B'00001000' | Channel 4 |
| B'00010000' | Virtual channel 5 |

***'Inhibit' command received (Build 1105 or higher):***
    SID10-SID9 = 00 (highest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 5 databytes received
    DATABYTE1 = COMMAND_INHIBIT (H'16')
    DATABYTE2 = Relay bit number

| Contents | Relay number |
|---|---|
| B'00000001' | Channel 1 |
| B'00000010' | Channel 2 |
| B'00000100' | Channel 3 |
| B'00001000' | Channel 4 |
| B'00010000' | Virtual channel 5 |

DATABYTE3 = high byte of delay time
DATABYTE4 = mid byte of delay time
DATABYTE5 = low byte of delay time

    Remark:
    [DATABYTE3][DATABYTE4][DATABYTE5] contain a 24-bit time in seconds
    The command will be skipped when the time parameter contains zero or the channels are already forced off/on.
    When the time parameter contains H'FFFFFF' then the relays are permanently inhibited.

**‘Cancel inhibit’ command received (Build 1105 or higher):**

    SID10-SID9 = 00 (highest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 2 databytes received
    DATABYTE1 = COMMAND_CANCEL_INHIBIT (H'17')
    DATABYTE2 = Relay bit number

| Contents | Relay number |
|---|---|
| B'00000001' | Channel 1 |
| B'00000010' | Channel 2 |
| B'00000100' | Channel 3 |
| B'00001000' | Channel 4 |
| B'00010000' | Virtual channel 5 |

**‘Relay status request’ command received:**

    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 2 databytes received
    DATABYTE1 = COMMAND_RELAY_STATUS_REQUEST (H'FA')
    DATABYTE2 = Relay bit number

| Contents | Relay number |
|---|---|
| B'00000001' | Channel 1 |
| B'00000010' | Channel 2 |
| B'00000100' | Channel 3 |
| B'00001000' | Channel 4 |
| B'00010000' | Virtual channel 5 |

**‘Module type request’ command received:**

    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 1
    DLC3...DLC0 = 0 databytes received

**‘Relay name request’ command received:**

    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 2 databytes received
    DATABYTE1 = COMMAND_RELAY_NAME_REQUEST (H'EF')
    DATABYTE2 = Relay bit number

| Contents | channel number |
|---|---|
| B'00000001' | Relay Channel 1 |
| B'00000010' | Relay Channel 2 |
| B'00000100' | Relay Channel 3 |
| B'00001000' | Relay Channel 4 |
| B'00010000' | Virtual relay channel 5 |

**‘Read data from memory’ command received:**

    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 3 databytes received
    DATABYTE1 = COMMAND_READ_DATA_FROM_MEMORY (H'FD')
    DATABYTE2 = High memory address

| High address | Memory bank |
|---|---|
| H'00' | For channel 1 data |
| H'01' | For channel 2 data |
| H'02' | For channel 3 data |
| H'03' | For channel 4 data |
| H'04' | For virtual channel 5 data |

    DATABYTE3 = LOW memory address (H'00'...H'FF')

**'Read data block from memory' command received:**
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 3 databytes received
    DATABYTE1 = COMMAND_READ_MEMORY_BLOCK (H'C9')
    DATABYTE2 = High memory address
    DATABYTE3 = LOW memory address

    Remark: Valid address range: H'0000' to H'04FC'

**'Memory dump request' command received:**
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 1 databytes received
    DATABYTE1 = COMMAND_MEMORY_DUMP_REQUEST (H'CB')

**'Write data to memory' command received:**
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 4 databytes received
    DATABYTE1 = COMMAND_WRITE_DATA_TO_MEMORY (H'FC')
    DATABYTE2 = High memory address

| High address | Memory bank |
|--------------|-------------|
| H'00' | For channel 1 data |
| H'01' | For channel 2 data |
| H'02' | For channel 3 data |
| H'03' | For channel 4 data |
| H'04' | For virtual channel 5 data |

    DATABYTE3 = LOW memory address (H'00'...H'FF')
    DATABYTE4 = memory data to write

    Remark: Wait at least 10ms for sending a next command on the velbus.

**'Write memory block' command received:**
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 7 databytes received
    DATABYTE1 = COMMAND_WRITE_MEMORY_BLOCK (H'CA')
    DATABYTE2 = High memory address
    DATABYTE3 = LOW memory address
    DATABYTE4 = memory databyte1 to write
    DATABYTE5 = memory databyte2 to write
    DATABYTE6 = memory databyte3 to write
    DATABYTE7 = memory databyte4 to write

    Remark:
    Valid address range: H'0000' to H'04FC'
    Wait for 'memory data block' feedback before sending a next command on the velbus.

**'Bus error counter status request' command received:** (Build 0647 or higher)
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 1 databytes to send
    DATABYTE1 = COMMAND_BUS_ERROR_CONTER_STATUS_REQUEST (H'D9')

*'Write module address & serial number' command received:*

    SID10-SID9 = 01 (firmware priority)
    SID8...SID1 = Current module address
    RTR = 0
    DLC3...DLC0 = 7 databytes received
    DATABYTE1 = COMMAND_WRITE_ADDR_SERIALNR (H'6A')
    DATABYTE2 = VMB4RYLD_MODULE_TYPE (H'10')
    DATABYTE3 = current high byte SERIAL NUMBER
    DATABYTE4 = current low byte SERIAL NUMBER
    DATABYTE5 = new module address
    DATABYTE6 = new high byte SERIAL NUMBER
    DATABYTE7 = new low byte SERIAL NUMBER

## Memory map version 1:

| Address | Contents | Address | Contents |
|---|---|---|---|
| H'0000' | Push button 1 module address | H'0001' | Push button 1 bit number |
| H'0002' | Push button 1 action for channel 1 | H'0003' | Push button 1 first time parameter |
| H'0004' | Push button 1 second time parameter | H'0005' | Push button 1 third time parameter |
| H'0006' | Push button 2 module address | H'0007' | Push button 2 bit number |
| H'0008' | Push button 2 action for channel 1 | H'0009' | Push button 2 first time parameter |
| H'000A' | Push button 2 second time parameter | H'000B' | Push button 2 third time parameter |
| ... | ... | ... | ... |
| H'00D2' | Push button 36 module address | H'00D3' | Push button 36 bit number |
| H'00D4' | Push button 36 action for virtual channel 1 | H'00D5' | Push button 36 first time parameter |
| H'00D6' | Push button 36 second time parameter | H'00D7' | Push button 36 third time parameter |
| H'00D8' | Normal open or normal closed contact CH1 | H'00D9' | CH1 location id low byte |
| H'00DA' | CH1 location id high byte | H'00DB' | CH1 group id low byte |
| H'00DC' | CH1 group id high byte | H'00DD' | CH1 circuit id low byte |
| H'00DE' | CH1 circuit id high byte | H'00DF' | CH1 load id low byte |
| H'00E0' | CH1 load id high byte | H'00E1' | Terminator |
| H'00E2' | Not used | H'00E3' | Module name character 1 |
| … | … | … | … |
| H'00EE' | Module name character 12 | H'00EF' | Module name character 13 |
| H'00F0' | Relay channel 1 name character 1 | H'00F1' | Relay channel 1 name character 2 |
| ... | ... | ... | ... |
| H'00FE' | Relay channel 1name character 15 | H'00FF' | Relay channel 1 name character 16 |

| Address | Contents | Address | Contents |
|---|---|---|---|
| H'0100' | Push button 1 module address | H'0101' | Push button 1 bit number |
| H'0102' | Push button 1 action for channel 2 | H'0103' | Push button 1 first time parameter |
| H'0104' | Push button 1 second time parameter | H'0105' | Push button 1 third time parameter |
| H'0106' | Push button 2 module address | H'0107' | Push button 2 bit number |
| H'0108' | Push button 2 action for channel 2 | H'0109' | Push button 2 first time parameter |
| H'010A' | Push button 2 second time parameter | H'010B' | Push button 2 third time parameter |
| ... | ... | ... | ... |
| H'01D2' | Push button 36 module address | H'01D3' | Push button 36 bit number |
| H'01D4' | Push button 36 action for virtual channel 2 | H'01D5' | Push button 36 first time parameter |
| H'01D6' | Push button 36 second time parameter | H'01D7' | Push button 36 third time parameter |
| H'01D8' | Normal open or normal closed contact CH2 | H'01D9' | CH2 location id low byte |
| H'01DA' | CH2 location id high byte | H'01DB' | CH2 group id low byte |
| H'01DC' | CH2 group id high byte | H'01DD' | CH2 circuit id low byte |
| H'01DE' | CH2 circuit id high byte | H'01DF' | CH2 load id low byte |
| H'01E0' | CH2 load id high byte | H'01E1' | Module location id low byte |
| H'01E2' | Module location id high byte | H'01E3' | Module name character 14 |
| … | … | … | … |
| H'01EE' | Module name character 25 | H'01EF' | Module name character 26 |
| H'01F0' | Relay channel 2 name character 1 | H'01F1' | Relay channel 2 name character 2 |
| ... | ... | ... | ... |
| H'01FE' | Relay channel 2name character 15 | H'01FF' | Relay channel 2 name character 16 |

| Address | Contents | Address | Contents |
|---|---|---|---|
| H'0200' | Push button 1 module address | H'0201' | Push button 1 bit number |
| H'0202' | Push button 1 action for channel 3 | H'0203' | Push button 1 first time parameter |
| H'0204' | Push button 1 second time parameter | H'0205' | Push button 1 third time parameter |
| H'0206' | Push button 2 module address | H'0207' | Push button 2 bit number |
| H'0208' | Push button 2 action for channel 3 | H'0209' | Push button 2 first time parameter |
| H'020A' | Push button 2 second time parameter | H'020B' | Push button 2 third time parameter |
| ... | ... | ... | ... |
| H'02D2' | Push button 36 module address | H'02D3' | Push button 36 bit number |
| H'02D4' | Push button 36 action for virtual channel 3 | H'02D5' | Push button 36 first time parameter |
| H'02D6' | Push button 36 second time parameter | H'02D7' | Push button 36 third time parameter |
| H'02D8' | Normal open or normal closed contact CH3 | H'02D9' | CH3 location id low byte |
| H'02DA' | CH3 location id high byte | H'02DB' | CH3 group id low byte |
| H'02DC' | CH3 group id high byte | H'02DD' | CH3 circuit id low byte |
| H'02DE' | CH3 circuit id high byte | H'02DF' | CH3 load id low byte |
| H'02E0' | CH3 load id high byte | H'02E1' | Module group id low byte |
| H'02E2' | Module group id high byte | H'02E3' | Module name character 27 |
| … | … | … | … |

| Address | Contents | Address | Contents |
|---|---|---|---|
| H'02EE' | Module name character 38 | H'02EF' | Module name character 39 |
| H'02F0' | Relay channel 3 name character 1 | H'02F1' | Relay channel 3 name character 2 |
| ... | ... | ... | ... |
| H'02FE' | Relay channel 3name character 15 | H'02FF' | Relay channel 3 name character 16 |

| Address | Contents | Address | Contents |
|---|---|---|---|
| H'0300' | Push button 1 module address | H'0301' | Push button 1 bit number |
| H'0302' | Push button 1 action for channel 4 | H'0303' | Push button 1 first time parameter |
| H'0304' | Push button 1 second time parameter | H'0305' | Push button 1 third time parameter |
| H'0306' | Push button 2 module address | H'0307' | Push button 2 bit number |
| H'0308' | Push button 2 action for channel 4 | H'0309' | Push button 2 first time parameter |
| H'030A' | Push button 2 second time parameter | H'030B' | Push button 2 third time parameter |
| ... | ... | ... | ... |
| H'03D2' | Push button 36 module address | H'03D3' | Push button 36 bit number |
| H'03D4' | Push button 36 action for virtual channel 4 | H'03D5' | Push button 36 first time parameter |
| H'03D6' | Push button 36 second time parameter | H'03D7' | Push button 36 third time parameter |
| H'03D8' | Normal open or normal closed contact CH4 | H'03D9' | CH4 location id low byte |
| H'03DA' | CH4 location id high byte | H'03DB' | CH4 group id low byte |
| H'03DC' | CH4 group id high byte | H'03DD' | CH4 circuit id low byte |
| H'03DE' | CH4 circuit id high byte | H'03DF' | CH4 load id low byte |
| H'03E0' | CH4 load id high byte | H'03E1' | Module circuit id low byte |
| H'03E2' | Module circuit id high byte | H'03E3' | Module name character 40 |
| … | … | … | … |
| H'03EE' | Module name character 51 | H'03EF' | Module name character 52 |
| H'03F0' | Relay channel 4 name character 1 | H'03F1' | Relay channel 4 name character 2 |
| ... | ... | ... | ... |
| H'03FE' | Relay channel 4name character 15 | H'03FF' | Relay channel 4 name character 16 |

| Address | Contents | Address | Contents |
|---|---|---|---|
| H'0400' | Push button 1 module address | H'0401' | Push button 1 bit number |
| H'0402' | Push button 1 action for virtual channel 5 | H'0403' | Push button 1 first time parameter |
| H'0404' | Push button 1 second time parameter | H'0405' | Push button 1 third time parameter |
| H'0406' | Push button 2 module address | H'0407' | Push button 2 bit number |
| H'0408' | Push button 2 action for virtual channel 5 | H'0409' | Push button 2 first time parameter |
| H'040A' | Push button 2 second time parameter | H'040B' | Push button 2 third time parameter |
| ... | ... | ... | ... |
| H'04D2' | Push button 36 module address | H'04D3' | Push button 36 bit number |
| H'04D4' | Push button 36 action for virtual channel 5 | H'04D5' | Push button 36 first time parameter |
| H'04D6' | Push button 36 second time parameter | H'04D7' | Push button 36 third time parameter |
| H'04D8' | Normal open or normal closed contact CH5 | H'04D9' | CH5 location id low byte |
| H'04DA' | CH5 location id high byte | H'04DB' | CH5 group id low byte |
| H'04DC' | CH5 group id high byte | H'04DD' | CH5 circuit id low byte |
| H'04DE' | CH5 circuit id high byte | H'04DF' | CH5 load id low byte |
| H'04E0' | CH5 load id high byte | H'04E1' | Module load id low byte |
| H'04E2' | Module load id high byte | H'04E3' | Module name character 53 |
| … | … | … | … |
| H'04EE' | Module name character 64 | H'04EF' | Not used |
| H'04F0' | Virtual relay channel 5 name character 1 | H'04F1' | Virtual relay channel 5 name character 2 |
| ... | ... | ... | ... |
| H'04FE' | Virtual relay channel 5name character 15 | H'04FF' | Virtual relay channel 5 name character 16 |

Remark:
Unused locations contain H'FF'

Normal open or normal closed contact:
- H'FF' : normal open relay contact
- H'00' : normal closed relay contact

| Action | Description | First time parameter | Second time parameter | Third time parameter |
|---|---|---|---|---|
| H'00' | Momentary | H'FF' | H'FF' | H'FF' |
| H'01' | Off | H'FF' | H'FF' | H'FF' |
| H'02' | 'Off' with timers disabled | H'FF' | H'FF' | H'FF' |
| H'03' | 'Off' with timers disabled at short press | H'FF' | H'FF' | H'FF' |
| H'04' | 'Off' with timers disabled at long press | H'FF' | H'FF' | H'FF' |
| H'05' | On | H'FF' | H'FF' | H'FF' |
| H'06' | 'On' with timers disabled | H'FF' | H'FF' | H'FF' |
| H'07' | 'On' with timers disabled at short press | H'FF' | H'FF' | H'FF' |
| H'08' | 'On' with timers disabled at long press | H'FF' | H'FF' | H'FF' |
| H'09' | Toggle | H'FF' | H'FF' | H'FF' |
| H'0A' | 'Toggle' with timers disabled | H'FF' | H'FF' | H'FF' |
| H'0B' | 'Toggle' with timers disabled at short press | H'FF' | H'FF' | H'FF' |
| H'0C' | 'Toggle' with timers disabled at long press | H'FF' | H'FF' | H'FF' |
| H'0D' | Start/stop timer | Time1 at short press | Time2 at long press | H'FF' |
| H'0E' | Restartable timer | Time1 at short press | Time2 at long press | H'FF' |
| H'0F' | Non retriggerable timer | Time | H'FF' | H'FF' |
| H'10' | Trigger on release timer | Time | H'FF' | H'FF' |
| H'11' | 'On' at press, delayed 'Off' at release | Delayed 'Off' time | H'FF' | H'FF' |
| H'12' | Delayed 'Off' only when relay is on | Delayed 'Off' time | H'FF' | H'FF' |
| H'13' | Start/stop delayed 'On' | Delayed 'On' time | Timeout | H'FF' |
| H'14' | Restartable delayed 'On' | Delayed 'On' time | Timeout | H'FF' |
| H'15' | Non restartable delayed 'On' | Delayed 'On' time | Timeout | H'FF' |
| H'16' | Start/Stop interval timer | Timeout | Pulse time | Pauze time |
| H'17' | Restartable interval timer | Timeout | Pulse time | Pauze time |
| H'18' | Non restartable interval timer | Timeout | Pulse time | Pauze time |
| H'19' | Disable at closed switch | H'FF' | H'FF' | H'FF' |
| H'1A' | Disable at opened switch | H'FF' | H'FF' | H'FF' |
| H'1B' | Disable at pressing push button | Timeout | H'FF' | H'FF' |
| H'1C' | Toggle disable at pressing push button | Timeout | H'FF' | H'FF' |
| H'1D' | Cancel disable at pressing push button | H'FF' | H'FF' | H'FF' |
| H'1E' | Forced 'On' at closed switch | H'FF' | H'FF' | H'FF' |
| H'1F' | Forced 'On' at opened switch | H'FF' | H'FF' | H'FF' |
| H'20' | Forced 'On' at pressing push button | Timeout | H'FF' | H'FF' |
| H'21' | Toggle forced 'On' at pressing push button | Timeout | H'FF' | H'FF' |
| H'22' | Cancel Forced 'On' at pressing push button | H'FF' | H'FF' | H'FF' |
| H'23' | Inhibit at closed switch | H'FF' | H'FF' | H'FF' |
| H'24' | Inhibit at opened switch | H'FF' | H'FF' | H'FF' |
| H'25' | Inhibit at pressing push button | Timeout | H'FF' | H'FF' |
| H'26' | Toggle inhibit at pressing push button | Timeout | H'FF' | H'FF' |
| H'27' | Cancel inhibit at pressing push button | H'FF' | H'FF' | H'FF' |

| Time parameter | Time |
| --- | --- |
| 0 | No timer |
| 1 | 1s |
| 2 | 2s |
| ... | |
| 119 | 1min59s |
| 120 | 2min |
| 121 | 2min15s |
| ... | |
| 131 | 4min45s |
| 132 | 5min |
| 133 | 5min30s |
| ... | |
| 181 | 29min30s |
| 182 | 30min |
| 183 | 31min |
| ... | |
| 211 | 59min |
| 212 | 1h |
| 213 | 1h15min |
| ... | |
| 227 | 4h45min |
| 228 | 5h |
| 229 | 5h30min |
| ... | |
| 237 | 9h30min |
| 238 | 10h |
| 239 | 11h |
| ... | |
| 251 | 23h |
| 252 | 1d |
| 253 | 2d |
| 254 | 3d |
| 255 | infinite |