# VMBPIRO-20

## Outdoor PIR detector module for VELBUS system

Binairy format:

 <SOF-SID10...SID0-RTR-IDE-r0-DLC3...0-DATABYTE1...DATABYTEn-CRC15...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 |
| CRC15…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 module can transmit the following messages:*
- Channel status
- Module status
- Module type
- Bus error counter status
- Memory data
- Memory data block (4 bytes)
- Real-time clock status
- Date status
- Daylight savings status
- Real-time clock status request
- Clear linked push button led
- Set linked push button led
- Slow blink linked push button led
- Temperature sensor temperature
- Temperature sensor name
- Temperature sensor setting

*The module can receive the following commands:*
- Linked push button status
- Module type request
- Module status request
- Light value request
- Set or clear test mode
- Clear channel led
- Set channel led
- Slow blink channel led
- Fast blink channel led
- Very fast channel led
- Update channel leds
- Read memory data
- Read memory data block (4 bytes)
- Memory dump request

- Write memory data
- Write memory data block (4 bytes)
- Bus error counter status request
- Real-time clock status request
- Set real-time clock
- Set date
- Set daylight savings
- Enable/disable global sunrise/sunset related actions
- Enable/disable local sunrise/sunset related actions
- Set local alarm clock
- Set global alarm clock
- Lock channel
- Unlock channel
- Disable channel program
- Enable channel program
- Select program
- Temperature sensor name request
- Temperature sensor settings request
- Set temperature sensor zone number
- Set temperature calibration offset
- Set temperature calibration gain
- Set low temperature alarm
- Set high temperature alarm
- Reset minimum/maximum temperature

*Transmits power up message:*
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = 0x00
    RTR = 0
    DLC3...DLC0 = 2 data byte to send
    DATABYTE1 = COMMAND_POWER_UP (0xAB)
    DATABYTE2 = module address

*Transmits real time clock status request:*
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = 0x00
    RTR = 0
    DLC3...DLC0 = 1 data byte to send
    DATABYTE1 = COMMAND_REALTIME_CLOCK_STATUS_REQUEST (0xD7)

*Transmits the real time clock status:*
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 4 data bytes to send
    DATABYTE1 = COMMAND_REALTIME_CLOCK_STATUS (0xD8)
    DATABYTE2 = Day

| Contents | Day |
|----------|-----------|
| 0 | Monday |
| 1 | Tuesday |
| 2 | Wednesday |
| 3 | Thursday |
| 4 | Friday |
| 5 | Saturday |
| 6 | Sunday |

    DATABYTE3 = Hour (0…23)
    DATABYTE4 = Minute (0…59)

*Transmits the date status:*
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 5 data bytes to send
    DATABYTE1 = COMMAND_DATE_STATUS (0xB7)
    DATABYTE2 = Day (1…31)
    DATABYTE3 = Month (1…12)
    DATABYTE4 = High byte of Year
    DATABYTE5 = Low byte of Year

*Transmits the daylight savings status:*
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 2 data bytes to send
    DATABYTE1 = COMMAND_DAYLIGHT_SAVING_STATUS (0xAF)
    DATABYTE2 = 0 =disabled / 1 = enabled

*Transmits the channel switch status:*

    SID10-SID9 = 00 (highest priority)

    SID8...SID1 = Module address

    RTR = 0

    DLC3...DLC0 = 4 data bytes to send

    DATABYTE1 = COMMAND_PUSH_BUTTON_STATUS (0x00)

    DATABYTE2 = Channel just pressed

    DATABYTE3 = Channel just released

    DATABYTE4 = Channel long pressed

| Contents | Channel number |
|---|---|
| B'00000001' | Dark output |
| B'00000010' | Light output |
| B'00000100' | Motion 1 output |
| B'00001000' | Light depending motion 1 output |
| B'00010000' | Motion 2 output |
| B'00100000' | Light depending motion 2 output |
| B'01000000' | Low temperature alarm |
| B'10000000' | High temperature alarm |

*Transmits the module type:*

    SID10-SID9 = 11 (lowest priority)

    SID8...SID1 = Module address

    RTR = 0

    DLC3...DLC0 = 8 data bytes to send

    DATABYTE1 = COMMAND_MODULE_TYPE (0xFF)

    DATABYTE2 = VMBPIRO-20 type (0x59)

    DATABYTE3 = High byte of serial number

    DATABYTE4 = Low byte of serial number

    DATABYTE5 = Memory map version

    DATABYTE6 = Build year

    DATABYTE7 = Build week

    DATABYTE8 = Properties

| Contents | Output channel |
|---|---|
| B'xxxxxxx0' | Terminator open |
| B'xxxxxxx1' | Terminator closed |
| B'xxxx000x' | Hardware version number |
| B'xxx0xxxx' | Velbus connection type |
| B'xx0xxxxx' | Only standard CAN allowed |
| B'xx1xxxxx' | CAN FD support |

*Transmits the module status:*

    SID10-SID9 = 11 (lowest priority)

    SID8...SID1 = Module address

    RTR = 0

    DLC3...DLC0 = 8 data bytes to send

    DATABYTE1 = COMMAND_MODULE_STATUS (0xED)

    DATABYTE2 = channel status (1 = pressed / 0 = released)

| Contents | Channel status |
|---|---|
| B'xxxxxxx0' | Dark output off |
| B'xxxxxxx1' | Dark output on |
| B'xxxxxx0x' | Light output off |
| B'xxxxxx1x' | Light output on |
| B'xxxxx0xx' | Motion 1 output off |
| B'xxxxx1xx' | Motion 1 output on |
| B'xxxx0xxx' | Light depending motion 1 output off |
| B'xxxx1xxx' | Light depending motion 1 output on |
| B'xxx0xxxx' | Motion 2 output off |
| B'xxx1xxxx' | Motion 2 output on |
| B'xx0xxxxx' | Light depending motion 2 output off |
| B'xx1xxxxx' | Light depending motion 2 output on |
| B'x0xxxxxx' | Low temperature alarm off |
| B'x1xxxxxx' | Low temperature alarm on |
| B'0xxxxxxx' | High temperature alarm off |

| | | |
|---|---|---|
| | B'1xxxxxxx' | High temperature alarm on |

DATABYTE3 = light sensor value high byte
DATABYTE4 = light sensor value low byte
DATABYTE5 = test modus or locked channel status (0 = unlocked / 1 = locked)

| Contents | Test modus or locked status |
|---|---|
| B'00xxxxx0' | Dark output unlocked |
| B'00xxxxx1' | Dark output locked |
| B'00xxxx0x' | Light output unlocked |
| B'00xxxx1x' | Light output locked |
| B'00xxx0xx' | Motion 1 output unlocked |
| B'00xxx1xx' | Motion 1 output locked |
| B'00xx0xxx' | Light depending motion 1 output unlocked |
| B'00xx1xxx' | Light depending motion 1 output locked |
| B'00x0xxxx' | Motion 2 output unlocked |
| B'00x1xxxx' | Motion 2 output locked |
| B'000xxxxx' | Light depending motion 2 output unlocked |
| B'001xxxxx' | Light depending motion 2 output locked |
| B'10xxxxxx' | Test modus |

DATABYTE6 = disabled channel program status (0 = program enabled / 1 = program disabled)

| Contents | Program disabled status |
|---|---|
| B'00xxxxx0' | Dark output program enabled |
| B'00xxxxx1' | Dark output program disabled |
| B'00xxxx0x' | Light output program enabled |
| B'00xxxx1x' | Light output 1 program disabled |
| B'00xxx0xx' | Motion 1 output program enabled |
| B'00xxx1xx' | Motion 1 output program disabled |
| B'00xx0xxx' | Light depending motion 1 output program enabled |
| B'00xx1xxx' | Light depending motion 1 output program disabled |
| B'00x0xxxx' | Motion 2 output program enabled |
| B'00x1xxxx' | Motion 2 output 1 program disabled |
| B'000xxxxx' | Light depending motion 2 output program enabled |
| B'001xxxxx' | Light depending motion 2 output program disabled |

DATABYTE7 = alarm & program selection

| Contents | Selected programl |
|---|---|
| B'xxxxxx00' | None |
| B'xxxxxx01' | Summer |
| B'xxxxxx10' | Winter |
| B'xxxxxx11' | Holiday |
| B'xxxxx0xx' | Alarm 1 off |
| B'xxxxx1xx' | Alarm 1 on |
| B'xxxx0xxx' | Local alarm 1 |
| B'xxxx1xxx' | Global alarm 1 |
| B'xxx0xxxx' | Alarm 2 off |
| B'xxx1xxxx' | Alarm 2 on |
| B'xx0xxxxx' | Local alarm 2 |
| B'xx1xxxxx' | Global alarm 2 |
| B'x0xxxxxx' | Sunrise disabled |
| B'x1xxxxxx' | Sunrise enabled |
| B'0xxxxxxx' | Sunset disabled |
| B'1xxxxxxx' | Sunset enabled |

DATABYTE8 = light value auto send interval time
        (Valid range: 10…255s)
        (5…9 = auto send on light value change with min interval 5…9s)
        (<5 = auto send disabled)

*Transmit the light raw value:*
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 3 data bytes to send
    DATABYTE1 = COMMAND_SENSOR_RAW_DATA (0xA9)
    DATABYTE4 = High byte current light value
    DATABYTE5 = Low byte current light value

*Transmit: Bus error counter status*
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 4 data bytes to send
    DATABYTE1 = COMMAND_BUSERROR_COUNTER_STATUS (0xDA)
    DATABYTE2 = Transmit error counter
    DATABYTE3 = Receive error counter
    DATABYTE4 = Bus off counter

*Transmits the memory data:*
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 4 data bytes to send
    DATABYTE1 = COMMAND_MEMORY_DATA (0xFE)
    DATABYTE2 = High memory address
    DATABYTE3 = LOW memory address
    DATABYTE4 = memory data

    Remark: address range: 0x0000' to 0x03FF

*Transmits memory data block (4 bytes):*
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 7 data bytes to send
    DATABYTE1 = COMMAND_MEMORY_DATA_BLOCK (0xCC)
    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: 0x0000 to 0x03FC

***Transmits memory data block (5...60 bytes)(only allowed for CAN FD frames):***
SID10-SID9 = 11 (lowest priority)
SID8...SID1 = Module address
RTR = 0
DLC3...DLC0 = number of data bytes to send

| Contents | | | Number of data bytes |
|---|---|---|---|
| 0x09 | | | 12 data bytes |
| 0x0A | | | 16 data bytes |
| 0x0B | | | 20 data bytes |
| 0x0C | | | 24 data bytes |
| 0x0D | | | 32 data bytes |
| 0x0E | | | 48 data bytes |
| 0x0F | | | 64 data bytes |

DATABYTE1 = COMMAND_MEMORY_DATA_BLOCK (0xCC)
DATABYTE2 = High start address of memory block
DATABYTE3 = LOW start address of memory block
DATABYTE4 = memory block length (5…60)
DATABYTE5 = memory data 1
…
DATABYTE12 = memory data 8 (end of data for DLC3...DLC0 = 0x09)
…
DATABYTE16 = memory data 12 (end of data for DLC3...DLC0 = 0x0A)
…
DATABYTE20 = memory data 16 (end of data for DLC3...DLC0 = 0x0B)
…
DATABYTE24 = memory data 20 (end of data for DLC3...DLC0 = 0x0C)
…
DATABYTE32 = memory data 28 (end of data for DLC3...DLC0 = 0x0D)
…
DATABYTE48 = memory data 44 (end of data for DLC3...DLC0 = 0x0E)
…
DATABYTE64 = memory data 60 (end of data for DLC3...DLC0 = 0x0F)

Remark:
Contents of unused data bytes = 0x55
Address range: 0x0000 to (0x03FF – memory block length)

***Transmit: Clears LEDs on a linked push button module:***
SID10-SID9 = 11 (lowest priority)
SID8...SID1 = Address of the linked push button module for clearing LEDs
RTR = 0
DLC3...DLC0 = 2 data bytes to send
DATABYTE1 = COMMAND_CLEAR_LED (0xF5)
DATABYTE2 = LED bit numbers (1 = clear LED)

***Transmit: Sets LEDs on a linked push button module:***
SID10-SID9 = 11 (lowest priority)
SID8...SID1 = Address of the linked push button module for setting LEDs on
RTR = 0
DLC3...DLC0 = 2 data bytes to send
DATABYTE1 = COMMAND_SET_LED (0xF6)
DATABYTE2 = LED bit numbers (1 = set LED)

***Transmit: Blinks LEDs slowly on a linked push button module:***
SID10-SID9 = 11 (lowest priority)
SID8...SID1 = Address of the linked push button module for slowly blinking LEDs
RTR = 0
DLC3...DLC0 = 2 data bytes to send
DATABYTE1 = COMMAND_SLOW_BLINKING_LED (0xF7)
DATABYTE2 = LED bit numbers (1 = slow blink LED)

*Transmit the sensor temperature:*

SID10-SID9 = 11 (lowest priority)
SID8...SID1 = Module address
RTR = 0
DLC3...DLC0 = 7 data bytes to send
DATABYTE1 = COMMAND_SENSOR_TEMPERATURE (0xE6)
DATABYTE2 = High byte current sensor temperature
DATABYTE3 = Low byte current sensor temperature into two's complement format (resolution 0.0625°)
DATABYTE4 = High byte minimum sensor temperature
DATABYTE5 = Low byte minimum sensor temperature into two's complement format (resolution 0.0625°)
DATABYTE6 = High byte maximum sensor temperature
DATABYTE7 = Low byte maximum sensor temperature into two's complement format (resolution 0.0625°)

| High byte | Low byte | Current sensor temperature |
|---|---|---|
| 01111111 | 11100000 | 63.5°C |
| | | |
| 00000000 | 00100000 | 0.0625°C |
| 00000000 | 00000000 | 0°C |
| 11111111 | 11100000 | -0.0625°C |
| | | |
| 10010010 | 00000000 | -55°C |

*Transmits the first part of the temperature sensor name:*

SID10-SID9 = 11 (lowest priority)
SID8...SID1 = Module address
RTR = 0
DLC3...DLC0 = 8 data bytes to send
DATABYTE1 = COMMAND_SENSOR_NAME_PART1 (0xF0)
DATABYTE2 = Channel number (9 = Temperature Sensor)
DATABYTE3 = Character 1 of the sensor name
DATABYTE4 = Character 2 of the sensor name
DATABYTE5 = Character 3 of the sensor name
DATABYTE6 = Character 4 of the sensor name
DATABYTE7 = Character 5 of the sensor name
DATABYTE8 = Character 6 of the sensor name

*Transmits the second part of the temperature sensor name:*

SID10-SID9 = 11 (lowest priority)
SID8...SID1 = Module address
RTR = 0
DLC3...DLC0 = 8 data bytes to send
DATABYTE1 = COMMAND_SENSOR_NAME_PART2 (0xF1)
DATABYTE2 = Channel number (9 = Temperature Sensor)
DATABYTE3 = Character 7 of the sensor name
DATABYTE4 = Character 8 of the sensor name
DATABYTE5 = Character 9 of the sensor name
DATABYTE6 = Character 10 of the sensor name
DATABYTE7 = Character 11 of the sensor name
DATABYTE8 = Character 12 of the sensor name

*Transmits the third part of the temperature sensor name:*

SID10-SID9 = 11 (lowest priority)
SID8...SID1 = Module address
RTR = 0
DLC3...DLC0 = 6 data bytes to send
DATABYTE1 = COMMAND_SENSOR_NAME_PART3 (0xF2)
DATABYTE2 = Channel number (9 = Temperature Sensor)
DATABYTE3 = Character 13 of the sensor name
DATABYTE4 = Character 14 of the sensor name
DATABYTE5 = Character 15 of the sensor name
DATABYTE6 = Character 16 of the sensor name

Remarks:
Unused characters contain 0xFF.

***Transmit the first part of the sensor settings:***

SID10-SID9 = 11 (lowest priority)
SID8...SID1 = Module address
RTR = 0
DLC3...DLC0 = 8 data bytes to send
DATABYTE1 = COMMAND_TEMP_SENSOR_SETTINGS_PART1 (0xE8)
*DATABYTE2 = Current temperature set (resolution 0.5°)*
*DATABYTE3 = Comfort temperature set for heating mode (resolution 0.5°)*
*DATABYTE4 = Day temperature set for heating mode (resolution 0.5°)*
*DATABYTE5 = Night temperature set for heating mode (resolution 0.5°)*
*DATABYTE6 = Anti frost temperature set for heating mode (resolution 0.5°)*
*DATABYTE7 = Boost temperature difference set (resolution 0.5°)*
*DATABYTE8 = Hysteresis temperature set*

| Contents | Hysteresis |
|---|---|
| xxx11111 | 15.5°C |
| | |
| Xxx00001 | 0.5°C |
| Xxx00000 | 0°C |

***Transmit the second part of the sensor settings:***

SID10-SID9 = 11 (lowest priority)
SID8...SID1 = Module address
RTR = 0
DLC3...DLC0 = 8 data bytes to send
DATABYTE1 = COMMAND_TEMP_SENSOR_SETTINGS_PART2 (0xE9)
*DATABYTE2 = Comfort temperature set for cooling mode (resolution 0.5°)*
*DATABYTE3 = Day temperature set for cooling mode (resolution 0.5°)*
*DATABYTE4 = Night temperature set for cooling mode (resolution 0.5°)*
*DATABYTE5 = Safe temperature set for cooling mode (resolution 0.5°)*
*DATABYTE6 = High byte of the default sleep timer*
*DATABYTE7 = Low byte of the default sleep timer into minutes (1 to 65.279min)*
DATABYTE8 = Default auto send temperature time interval into seconds
       (Valid range: 10…255s)
       (5…9 = auto send on temperature change with min interval 5…9s)
       (<4 = auto send disabled)

***Transmit the third part of the sensor settings:***

SID10-SID9 = 11 (lowest priority)
SID8...SID1 = Module address
RTR = 0
DLC3...DLC0 = 8 data bytes to send
DATABYTE1 = COMMAND_TEMP_SENSOR_SETTINGS_PART3 (0xC6)
DATABYTE2 = Temperature alarm 1 setting (resolution 0.5°)
DATABYTE3 = Temperature alarm 4 setting (resolution 0.5°)
*DATABYTE4 = Lower temperature range cool mode (resolution 0.5°)*
*DATABYTE5 = Upper temperature range heat mode (resolution 0.5°)*
DATABYTE6 = Calibration offset factor (resolution 0.5°)

| Contents | Calibration factor |
|---|---|
| 00001111 | Calibration factor +7.5°C |
| | |
| 00000001 | Calibration factor +0.5°C |
| 00000000 | Calibration factor +0°C |
| 11111111 | Calibration factor -0.5°C |
| | |
| 11110000 | Calibration factor -8°C |

DATABYTE7 = Zone number
DATABYTE8 = Calibration gain factor

***Transmit the fourth part of the sensor settings:***

SID10-SID9 = 11 (lowest priority)
SID8...SID1 = Module address
RTR = 0
DLC3...DLC0 = 8 data bytes to send
DATABYTE1 = COMMAND_TEMP_SENSOR_SETTINGS_PART4 (0xB9)

*DATABYTE2 = Minimum switching time (0…255s)*
*DATABYTE3 = Pump delayed on time (0…255s)*
*DATABYTE4 = Pump delayed off time (0…255s)*
*DATABYTE5 = Temperature alarm 2 setting (resolution 0.5°)*
*DATABYTE6 = Temperature alarm 3 setting (resolution 0.5°)*
*DATABYTE7 = Lower temperature range heat mode (resolution 0.5°)*
*DATABYTE8 = Upper temperature range cool mode (resolution 0.5°)*

**Transmits program step info:**

SID10-SID9 = 11 (lowest priority)
SID8...SID1 = Module address
RTR = 0
DLC3...DLC0 = 8 data bytes to send
DATABYTE1 = COMMAND_PROGRAM_STEP_INFO (0xC1)
DATABYTE2 = Program step number (1…66 / 255 step not found)
DATABYTE3 = Program reference

| Contents | Description |
|---|---|
| 000xxxxx | Disable program step |
| 001xxxxx | Absolute time |
| 010xxxxx | Wake up time 1 + relative time |
| 011xxxxx | Go to bed time 1 + relative time |
| 100xxxxx | Wake up time 2 + relative time |
| 101xxxxx | Go to bed time 2 + relative time |
| 110xxxxx | Sunrise + relative time |
| 111xxxxx | Sunset + relative time |
| xxx01111 | Rel. time = 3h45min |
| … | |
| xxx00001 | Rel. time = 15min |
| xxx00000 | Rel. time = 0 |
| xxx11111 | Rel. time = -15min |
| … | |
| xxx10000 | Rel. time = -4h |

DATABYTE4 = Program step month & four least significant bits of day

| Contents | Description |
|---|---|
| xxxx0000 | Weekly program |
| xxxx0001 | January |
| xxxx0010 | February |
| xxxx0011 | March |
| xxxx0100 | April |
| xxxx0101 | May |
| xxxx0110 | June |
| xxxx0111 | July |
| xxxx1000 | August |
| xxxx1001 | September |
| xxxx1010 | October |
| xxxx1011 | November |
| xxxx1100 | December |
| xxxx1101 | Monthly program |
| xxxx1110 | Monthly program |
| xxxx1111 | Monthly program |

| Contents byte6 | Contents byte4 | Description |
|---|---|---|
| 00xxxxxx | 0000xxxx | Never |
| 00xxxxxx | 0001xxxx | Day 1of the month |
| 00xxxxxx | 0010xxxx | Day 2of the month |
| … | … | … |
| 01xxxxxx | 1111xxxx | Day 31of the month |
| 10xxxxxx | 0000xxxx | Never |
| 10xxxxxx | 0001xxxx | Every Monday |
| 10xxxxxx | 0010xxxx | Every Tuesday |
| … | … | … |

| | | |
|---|---|---|
| 10xxxxxx | 0111xxxx | Every Sunday |
| 10xxxxxx | 1000xxxx | Every weekend (sa & su) |
| 10xxxxxx | 1001xxxx | Every working day (mo…fr) |
| 10xxxxxx | 1010xxxx | Every day except Sunday |
| 10xxxxxx | 1011xxxx | Every day |
| 10xxxxxx | 1100xxxx | Never |
| … | … | … |
| 11xxxxxx | 1111xxxx | Never |

DATABYTE5 = Program step hour & group number

| Contents | Description |
|---|---|
| xxx00000 | 0h |
| xxx00001 | 1h |
| … | … |
| xxx10111 | 23h |
| xx1xxxxx | Program group 1 (Summer program) |
| x1xxxxxx | Program group 2 (Winter program) |
| 1xxxxxxx | Program group 3 (Holiday program) |

DATABYTE6 = Program step minute & every flag & msb of day

| Contents | Description |
|---|---|
| xx000000 | 0min |
| xx000001 | 1min |
| … | … |
| xx111011 | 59min |

| Contents byte6 | Contents byte4 | Description |
|---|---|---|
| 00xxxxxx | 0000xxxx | Never |
| 00xxxxxx | 0001xxxx | Day 1of the month |
| 00xxxxxx | 0010xxxx | Day 2of the month |
| … | … | … |
| 01xxxxxx | 1111xxxx | Day 31of the month |
| 10xxxxxx | 0000xxxx | Never |
| 10xxxxxx | 0001xxxx | Every Monday |
| 10xxxxxx | 0010xxxx | Every Tuesday |
| .. | | … |
| 10xxxxxx | 0111xxxx | Every Sunday |
| 10xxxxxx | 1000xxxx | Every weekend (sa & su) |
| 10xxxxxx | 1001xxxx | Every working day (mo…fr) |
| 10xxxxxx | 1010xxxx | Every day except Sunday |
| 10xxxxxx | 1011xxxx | Every day |
| 10xxxxxx | 1100xxxx | Never |
| … | … | … |
| 11xxxxxx | 1111xxxx | Never |

DATABYTE7 = Program step action

| Contents | Action |
|---|---|
| 0 | Lock |
| 1 | Unlock |

DATABYTE8 = Channel number

| Contents | Channel |
|---|---|
| 1 | Dark channel |
| 2 | Light channel |
| 3 | Motion 1 channel |
| 4 | Light depending motion 1 channel |
| 5 | Motion 2 channel |
| 6 | Light depending motion 2 channel |

**'Linked push button status' received:**
    SID10-SID9 = 00 (highest priority)
    SID8...SID1 = Address of the linked push button module
    RTR = 0
    DLC3...DLC0 = 4 data bytes received
    DATABYTE1 = COMMAND_PUSH_BUTTON_STATUS (0x00)
    DATABYTE2 = Linked push buttons just pressed (1 = just pressed)
    DATABYTE3 = Linked push buttons just released (1 = just released)
    DATABYTE4 = linked push buttons long pressed (1 = longer than 0.85s pressed)

**Power up message' received:**
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = 0x00
    RTR = 0
    DLC3...DLC0 = 2 data byte received
    DATABYTE1 = COMMAND_POWER_UP (0xAB)
    DATABYTE2 = module address

**'CAN FD enable command' received:**
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = 0x00
    RTR = 0
    DLC3...DLC0 = 2 data byte received
    DATABYTE1 = COMMAND_SET_CLR_LEARN_RF_CODE (0xB5)
    DATABYTE2 = enable/disable (0 = disable CAN FD / 1 = enable CAN FD)

**'Real time clock status request' command received:**
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 1 data byte to send
    DATABYTE1 = COMMAND_REALTIME_CLOCK_STATUS_REQUEST (H'D7')

**'Set real time clock' command received:**
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = 0x00
    RTR = 0
    DLC3...DLC0 = 4 data bytes to send
    DATABYTE1 = COMMAND_SET_REALTIME_CLOCK (0xD8)
    DATABYTE2 = Day of week

| Contents day of week' | Description |
|---|---|
| 0 | Monday |
| 1 | Tuesday |
| 2 | Wednesday |
| 3 | Thursday |
| 4 | Friday |
| 5 | Saterday |
| 6 | Sunday |

    DATABYTE3 = Hours (0…23)
    DATABYTE4 = Minutes (0…59)

**'Set date' command received:**
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = 0x00
    RTR = 0
    DLC3...DLC0 = 5 data bytes to send
    DATABYTE1 = COMMAND_SET_REALTIME_DATE (0xB7)
    DATABYTE2 = Day (1…31)
    DATABYTE3 = Month (1…12)
    DATABYTE4 = High byte of Year
    DATABYTE5 = Low byte of Year

**'Set daylight savings' command received:**
 SID10-SID9 = 11 (lowest priority)
 SID8...SID1 = 0x00
 RTR = 0
 DLC3...DLC0 = 2 data bytes to send
 DATABYTE1 = COMMAND_SET_DAYLIGHT_SAVING (0xAF)
 DATABYTE2 = 0 =disabled / 1 = enabled

**'Enable/disable global sunrise/sunset related actions' command received:**
 SID10-SID9 = 11 (lowest priority)
 SID8...SID1 = 0x00
 RTR = 0
 DLC3...DLC0 = 3 data bytes to send
 DATABYTE1 = COMMAND_ENA_DIS_SUNRISE_SUNSET (0xAE)
 DATABYTE2 = Channel (0xFF)
 DATABYTE3 = enable/disable flags

| Contents | Description |
|---|---|
| B'xxxxxxx0' | Disable sunrise related actions |
| B'xxxxxxx1' | Enable sunrise related actions |
| B'xxxxxx0x' | Disable sunset related actions |
| B'xxxxxx1x' | Enable sunset related actions |

**'Enable/disable local sunrise/sunset related actions' command received:**
 SID10-SID9 = 11 (lowest priority)
 SID8...SID1 = Module address
 RTR = 0
 DLC3...DLC0 = 3 data bytes to send
 DATABYTE1 = COMMAND_ENA_DIS_SUNRISE_SUNSET (0xAE)
 DATABYTE2 = Channel (0xFF)
 DATABYTE3 = enable/disable flags

| Contents | Description |
|---|---|
| B'xxxxxxx0' | Disable sunrise related actions |
| B'xxxxxxx1' | Enable sunrise related actions |
| B'xxxxxx0x' | Disable sunset related actions |
| B'xxxxxx1x' | Enable sunset related actions |

**'Set global clock alarm' command received:**
 SID10-SID9 = 11 (lowest priority)
 SID8...SID1 = 0x00
 RTR = 0
 DLC3...DLC0 = 7 data bytes to send
 DATABYTE1 = COMMAND_SET_ALARM_CLOCK (0xC3)
 DATABYTE2 = Alarm number (1 or 2)
 DATABYTE3 = Wake up hour (0…23)
 DATABYTE4 = Wake up minute (0…59)
 DATABYTE5 = Go to bed hour (0…23)
 DATABYTE6 = Go to bed minute (0…59)
 DATABYTE7 = Clock alarm enable flag (0 = disabled / 1 = enabled)

**'Set local clock alarm' command received:**
 SID10-SID9 = 11 (lowest priority)
 SID8...SID1 = Module address
 RTR = 0
 DLC3...DLC0 = 7 data bytes to send
 DATABYTE1 = COMMAND_SET_ALARM_CLOCK (0xC3)
 DATABYTE2 = Alarm number (1 or 2)
 DATABYTE3 = Wake up hour (0…23)
 DATABYTE4 = Wake up minute (0…59)
 DATABYTE5 = Go to bed hour (0…23)
 DATABYTE6 = Go to bed minute (0…59)
 DATABYTE7 = Clock alarm enable flag (0 = disabled / 1 = enabled)

***'Module type request' command received:***
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 1
    DLC3...DLC0 = 0 data bytes received

***'Module status request' command received:***
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 2 data bytes received
    DATABYTE1 = COMMAND_MODULE_STATUS_REQUEST (0xFA)
    DATABYTE2 = don't care

***'Light value request' command received:***
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 2 data bytes to send
    DATABYTE1 = COMMAND_LIGHT_VALUE_REQUEST (0xAA)
    DATABYTE2 = Auto send interval time into seconds
                     (valid range: 10…255s)
                      (5…9 = auto send on change)
                      (1…4 = auto send disabled)
                      (0 = no change on auto send interval time)

***'Set or Clear test mode' command received:***
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 2 data bytes received
    DATABYTE1 = COMMAND_SET_CLR_LEARN_MODE (0xB5)
    DATABYTE2 = Operating mode

| Contents | Operating mode |
|----------|----------------|
| 0 | Normal |
| 1 | Test mode |

Remark:
After changing the operating mode, the module sends his status.
There is a timeout of 30 minutes for the test mode.

***'Clear channel LED' command received:***
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 2 data bytes received
    DATABYTE1 = COMMAND_CLEAR_LED (0xF5)
    DATABYTE2 = LEDs to clear (a one clears the corresponding LED of channel 1 to 8)

***'Set channel LED' command received:***
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 2 data bytes received
    DATABYTE1 = COMMAND_SET_LED (0xF6)
    DATABYTE2 = LEDs to set (a one sets the corresponding LED of channel 1 to 8)

***'Slow blink channel LED' command received:***
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 2 data bytes received
    DATABYTE1 = COMMAND_SLOW_BLINK_LED (0xF7)
    DATABYTE2 = LEDs to blink slow (a one blinks slow the corresponding LED of channel 1 to 8)

**'Fast blink channel LED' command received:**
> SID10-SID9 = 11 (lowest priority)
> SID8...SID1 = Module address
> RTR = 0
> DLC3...DLC0 = 2 data bytes received
> DATABYTE1 = COMMAND_FAST_BLINK_LED (0xF8)
> DATABYTE2 = LEDs to blink fast  (a one blinks fast the corresponding LED of channel 1 to 8)

**'Very fast blink channel LED' command received:**
> SID10-SID9 = 11 (lowest priority)
> SID8...SID1 = Module address
> RTR = 0
> DLC3...DLC0 = 2 data bytes received
> DATABYTE1 = COMMAND_VERY_FAST_BLINK_LED (0xF9)
> DATABYTE2 = LEDs to blink very fast  (a one blinks very fast the corresponding LED of channel 1 to 8)

**'Update channel LEDs' command received:**
> SID10-SID9 = 11 (lowest priority)
> SID8...SID1 = Module address
> RTR = 0
> DLC3...DLC0 = 4 data bytes received
> DATABYTE1 = COMMAND_UPDATE_LED_STATUS (0xF4)
> DATABYTE2 = LEDs to set (a one sets the corresponding LED of channel 1 to 8)
> DATABYTE3 = LEDs to blink slow (a one blinks slow the corresponding LED of channel 1 to 8)
> DATABYTE4 = LEDs to blink fast  (a one blinks very fast the corresponding LED of channel 1 to 8)
>
> Remark:
> The 'LEDs to set' status overrides the blinking modes.
> Very fast blinking if slow & fast blinking are set.

**'Read data from memory' command received:**
> SID10-SID9 = 11 (lowest priority)
> SID8...SID1 = Module address
> RTR = 0
> DLC3...DLC0 = 3 data bytes received
> DATABYTE1 = COMMAND_READ_DATA_FROM_MEMORY (0xFD)
> DATABYTE2 = High memory address
> DATABYTE3 = LOW memory address
>
> Remark: address range: 0x0000 to 0x03FF

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

**'Read data block from memory' command received:**
> SID10-SID9 = 11 (lowest priority)
> SID8...SID1 = Module address
> RTR = 0
> DLC3...DLC0 = 3 data bytes received / 4 data bytes for CAN FD response
> DATABYTE1 = COMMAND_READ_MEMORY_BLOCK (0xC9)
> DATABYTE2 = High memory address
> DATABYTE3 = LOW memory address
>
> Remark:
> address range: 0x0000 to 0x03FC
> address range: 0x0000 to (0x03FF – memory block length) for CAN FD response

***'Write data to memory' command received:***

    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 4 data bytes received
    DATABYTE1 = COMMAND_WRITE_DATA_TO_MEMORY (0xFC)
    DATABYTE2 = High memory address
    DATABYTE3 = LOW memory address
    DATABYTE4 = memory data to write

    Remark:
    Wait at least 10ms for sending a next command on the velbus.
    Address range: 0x0000 to 0x03FF
    Terminate always with a write command at the last memory location.

***'Write memory block' command received:***

    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Address of the module
    RTR = 0
    DLC3...DLC0 = 7 data bytes received
    DATABYTE1 = COMMAND_WRITE_MEMORY_BLOCK (0xCA)
    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

Or

SID10-SID9 = 11 (lowest priority)
SID8...SID1 = Address of the module
RTR = 0
DLC3...DLC0 = number of data bytes to send

| Contents | Number of data bytes |
|----------|---------------------|
| 0x09 | 12 data bytes |
| 0x0A | 16 data bytes |
| 0x0B | 20 data bytes |
| 0x0C | 24 data bytes |
| 0x0D | 32 data bytes |
| 0x0E | 48 data bytes |
| 0x0F | 64 data bytes |

DATABYTE1 = COMMAND_WRITE_MEMORY_BLOCK (0xCA)
DATABYTE2 = High memory address
DATABYTE3 = LOW memory address
DATABYTE4 = memory block length (5…60)
DATABYTE5 = memory data 1 to write
…
DATABYTE12 = memory data 8 to write (end of data for DLC3...DLC0 = 0x09)
…
DATABYTE16 = memory data 12 to write (end of data for DLC3...DLC0 = 0x0A)
…
DATABYTE20 = memory data 16 to write (end of data for DLC3...DLC0 = 0x0B)
…
DATABYTE24 = memory data 20 to write (end of data for DLC3...DLC0 = 0x0C)
…
DATABYTE32 = memory data 28 to write (end of data for DLC3...DLC0 = 0x0D)
…
DATABYTE48 = memory data 44 to write (end of data for DLC3...DLC0 = 0x0E)
…
DATABYTE64 = memory data 60 to write (end of data for DLC3...DLC0 = 0x0F)

Remark:
Wait for 'memory data block' feedback before sending a next command on the velbus.
address range: 0x0000 to 0x03FC for standard CAN response

address range: 0x0000 to (0x03FF – memory block length) for CAN FD response
Contents of unused data bytes = 0x55
Terminate always with a write command at the last memory location.

**'Bus error counter status request' command received:**
SID10-SID9 = 11 (lowest priority)
SID8...SID1 = Module address
RTR = 0
DLC3...DLC0 = 1 data bytes to send
DATABYTE1 = COMMAND_BUS_ERROR_CONTER_STATUS_REQUEST (0xD9)

**'Unlock channel' command received:**
SID10-SID9 = 00 (highest priority)
SID8...SID1 = Module address
RTR = 0
DLC3...DLC0 = 2 data bytes received
DATABYTE1 = COMMAND_CANCEL_FORCED_OFF (0x13)
DATABYTE2 = Channel number 1…6

| Contents | | Channel |
|---|---|---|
| | 1 | Dark channel |
| | 2 | Light channel |
| | 3 | Motion 1 channel |
| | 4 | Light depending motion 1 channel |
| | 5 | Motion 2 channel |
| | 6 | Light depending motion 2 channel |

**'Lock channel' command received:**
SID10-SID9 = 00 (highest priority)
SID8...SID1 = Module address
RTR = 0
DLC3...DLC0 = 5 data bytes received
DATABYTE1 = COMMAND_FORCED_OFF (0x12)
DATABYTE2 = Channel number 1…7

| Contents | | Channel |
|---|---|---|
| | 1 | Dark channel |
| | 2 | Light channel |
| | 3 | Motion 1 channel |
| | 4 | Light depending motion 1 channel |
| | 5 | Motion 2 channel |
| | 6 | Light depending motion 2 channel |

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 0xFFFFFF then the channel will be permanently locked.

**'Enable Channel Program' command received:**
SID10-SID9 = 11 (lowest priority)
SID8...SID1 = Module address
RTR = 0
DLC3...DLC0 = 2 data bytes received
DATABYTE1 = COMMAND_ENABLE_PROGRAM (0xB2)
DATABYTE2 = Channel number 1…6

| Contents | | Channel |
|---|---|---|
| | 1 | Dark channel |
| | 2 | Light channel |
| | 3 | Motion 1 channel |
| | 4 | Light depending motion 1 channel |
| | 5 | Motion 2 channel |
| | 6 | Light depending motion 2 channel |

**'Disable Channel Program' command received:**
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 5 data bytes received
    DATABYTE1 = COMMAND_DISABLE_PROGRAM (0xB1)
    DATABYTE2 = channel

| Contents | Channel |
|---|---|
| 1 | Dark channel |
| 2 | Light channel |
| 3 | Motion 1 channel |
| 4 | Light depending motion 1 channel |
| 5 | Motion 2 channel |
| 6 | Light depending motion 2 channel |

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 channel program will be permanently disabled.

**'Select Program' command received:**
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 2 data bytes received
    DATABYTE1 = COMMAND_SELECT_PROGRAM (0xB3)
    DATABYTE2 = Program mode

| Contents | Selected program |
|---|---|
| 0 | None |
| 1 | Program group 1 (Summer) |
| 2 | Program group 2 (Winter) |
| 3 | Program group 3 (Holiday) |

**'Temperature sensor name request' command received:**
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 2 data bytes received
    DATABYTE1 = COMMAND_CHANNEL_NAME_REQUEST (0xEF)
    DATABYTE2 = channel 9 or 0xFF

**'Temperature request' command received:**
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 2 data bytes to send
    DATABYTE1 = COMMAND_SENSOR_TEMP_REQUEST (0xE5)
    DATABYTE2 = Auto send time interval into seconds
             (valid range: 10…255s)
             (5…9 = auto send on temperature change)
             (1…4 = auto send disabled)
             (0 = no change on auto send interval)

**'Temperature sensor settings request' command received:**
    SID10-SID9 = 11 (lowest priority)
    SID8...SID1 = Module address
    RTR = 0
    DLC3...DLC0 = 2 data bytes to send
    DATABYTE1 = COMMAND_TEMP_SENSOR_SETTINGS_REQUEST (0xE7)
    DATABYTE2 = don't care

*'Set temperature sensor zone number' command received:*
     SID10-SID9 = 11 (lowest priority)
     SID8...SID1 = Module address
     RTR = 0
     DLC3...DLC0 = 2 data bytes to send
     DATABYTE1 = COMMAND_SET_SENSOR_ZONE_NUMBER (0xC5)
     DATABYTE2 = Zone number  (0= no zone)

***'Set temperature' command received:***
SID10-SID9 = 11 (lowest priority)
SID8...SID1 = Module address
RTR = 0
DLC3...DLC0 = 3 data bytes received
DATABYTE1 = COMMAND_SET_TEMP (0xE4)
DATABYTE2 = Pointer to temperature variable (0…20)

| Contents | Temperature variable |
|---|---|
| 11 | Calibration offset (-8°…+7.5°C) |
| 12 | Reset minimum/maximum temperature |
| 15 | Low temperature alarm set |
| 16 | High temperature alarm set |
| 28 | Calibration gain factor |

DATABYTE3 = calibration offset (resolution 0.5°)

| Contents | Callibration offset |
|---|---|
| 00001111 | +7.5°C |
| | |
| 00000001 | +0.5°C |
| 00000000 | 0°C |
| 11111111 | -0.5°C |
| | |
| 11110000 | -8°C |

DATABYTE3 = Alarm temperature set (resolution 0.5°)

| Contents | Temperature set |
|---|---|
| 01111000 | 60°C |
| | |
| 00000010 | 1°C |
| 00000001 | 0.5°C |
| 00000000 | 0°C |
| 11111111 | -0.5°C |
| | |
| 11000000 | -32°C |

DATABYTE3 = Reset minimum/maximum temperature

| Contents | Reset temperature |
|---|---|
| 00000001 | Reset minimum temperature |
| 00000010 | Reset maximum temperature |

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

***'Read program step' command received:***
SID10-SID9 = 11 (lowest priority)
SID8...SID1 = Module address
RTR = 0
DLC3...DLC0 = 5 data bytes received
DATABYTE1 = COMMAND_READ_PROGRAM_STEP (0xC0)
DATABYTE2 = Start program step number (1…66)
DATABYTE3 = Program group number (1…3)
DATABYTE4 = Channel number

| Contents | Channel |
|---|---|
| 1 | Dark output |
| 2 | Light output |
| 3 | Motion 1 output |
| 4 | Light depending motion 1 output |
| 5 | Motion 2 output |
| 6 | Light depending motion 2 output |

DATABYTE5 = Search direction (1 = search for next matched step / 0 = search for previous matched program step)

***'Write program step' command received:***
SID10-SID9 = 11 (lowest priority)
SID8...SID1 = Module address
RTR = 0
DLC3...DLC0 = 8 data bytes received

DATABYTE1 = COMMAND_WRITE_PROGRAM_STEP (0xC2)
DATABYTE2 = Program step number (1…66)
DATABYTE3 = Program reference

| | Contents | | Description |
|---|---|---|---|
| | 000xxxxx | | Disable program step |
| | 001xxxxx | | Absolute time |
| | 010xxxxx | | Wake up time 1 + relative time |
| | 011xxxxx | | Go to bed time 1 + relative time |
| | 100xxxxx | | Wake up time 2 + relative time |
| | 101xxxxx | | Go to bed time 2 + relative time |
| | 110xxxxx | | Sunrise + relative time |
| | 111xxxxx | | Sunset + relative time |
| | xxx01111 | | Rel. time = 3h45min |
| | … | | |
| | xxx00001 | | Rel. time = 15min |
| | xxx00000 | | Rel. time = 0 |
| | xxx11111 | | Rel. time = -15min |
| | … | | |
| | xxx10000 | | Rel. time = -4h |

DATABYTE4 = Program step month & four least significant bits of day

| | Contents | | Description |
|---|---|---|---|
| | xxxx0000 | | Weekly program |
| | xxxx0001 | | January |
| | xxxx0010 | | February |
| | xxxx0011 | | March |
| | xxxx0100 | | April |
| | xxxx0101 | | May |
| | xxxx0110 | | June |
| | xxxx0111 | | July |
| | xxxx1000 | | August |
| | xxxx1001 | | September |
| | xxxx1010 | | October |
| | xxxx1011 | | November |
| | xxxx1100 | | December |
| | xxxx1101 | | Monthly program |
| | xxxx1110 | | Monthly program |
| | xxxx1111 | | Monthly program |

| | Contents byte6 | | Contents byte4 | | Description |
|---|---|---|---|---|---|
| | 00xxxxxx | | 0000xxxx | | Never |
| | 00xxxxxx | | 0001xxxx | | Day 1of the month |
| | 00xxxxxx | | 0010xxxx | | Day 2of the month |
| | … | | … | | … |
| | 01xxxxxx | | 1111xxxx | | Day 31of the month |
| | 10xxxxxx | | 0000xxxx | | Never |
| | 10xxxxxx | | 0001xxxx | | Every Monday |
| | 10xxxxxx | | 0010xxxx | | Every Tuesday |
| | … | | … | | … |
| | 10xxxxxx | | 0111xxxx | | Every Sunday |
| | 10xxxxxx | | 1000xxxx | | Every weekend (sa & su) |
| | 10xxxxxx | | 1001xxxx | | Every working day (mo…fr) |
| | 10xxxxxx | | 1010xxxx | | Every day except Sunday |
| | 10xxxxxx | | 1011xxxx | | Every day |
| | 10xxxxxx | | 1100xxxx | | Never |
| | … | | … | | … |
| | 11xxxxxx | | 1111xxxx | | Never |

DATABYTE5 = Program step hour & group number

| | Contents | | Description |
|---|---|---|---|
| | xxx00000 | | 0h |

| | Contents | Description | |
|---|---|---|---|
| | xxx00001 | 1h | |
| | … | … | |
| | xxx10111 | 23h | |
| | xx1xxxxx | Program group 1 (Summer program) | |
| | x1xxxxxx | Program group 2 (Winter program) | |
| | 1xxxxxxx | Program group 3 (Holiday program) | |

DATABYTE6 = Program step minute & msb of day & every flag

| | Contents | Description |
|---|---|---|
| | xx000000 | 0min |
| | xx000001 | 1min |
| | … | … |
| | xx111011 | 59min |

| Contents byte6 | Contents byte4 | Description |
|---|---|---|
| 00xxxxxx | 0000xxxx | Never |
| 00xxxxxx | 0001xxxx | Day 1of the month |
| 00xxxxxx | 0010xxxx | Day 2of the month |
| … | … | … |
| 01xxxxxx | 1111xxxx | Day 31of the month |
| 10xxxxxx | 0000xxxx | Never |
| 10xxxxxx | 0001xxxx | Every Monday |
| 10xxxxxx | 0010xxxx | Every Tuesday |
| … | … | … |
| 10xxxxxx | 0111xxxx | Every Sunday |
| 10xxxxxx | 1000xxxx | Every weekend (sa & su) |
| 10xxxxxx | 1001xxxx | Every working day (mo…fr) |
| 10xxxxxx | 1010xxxx | Every day except Sunday |
| 10xxxxxx | 1011xxxx | Every day |
| 10xxxxxx | 1100xxxx | Never |
| … | … | … |
| 11xxxxxx | 1111xxxx | Never |

DATABYTE7 = Program step action

| | Contents | Action |
|---|---|---|
| | 0 | Lock |
| | 1 | Unlock |

DATABYTE8 = Channel number 1…7

| | Contents | Channel | |
|---|---|---|---|
| | 1 | Dark channel | |
| | 2 | Light channel | |
| | 3 | Motion 1 channel | |
| | 4 | Light depending motion 1 channel | |
| | 5 | Motion 2 channel | |
| | 6 | Light depending motion 2 channel | |

Remark:
Erase program step if channel parameter is equal with zero.

## Memory map version 1:

| | | | |
|---|---|---|---|
| 0x0000 | Dark value low byte | 0x0001 | Dark value high byte |
| 0x0002 | Light value low byte | 0x0003 | Light value high byte |
| 0x0004 | Light to dark reaction time (default 1min) | 0x0005 | Dark timer mode = non restartable timer |
| 0x0006 | Dark timeout (default momentary) | 0x0007 | Dark flags (default cycling protect off & external overwrite off) |
| 0x0008 | Dark to light reaction time (default 1min) | 0x0009 | Light timer mode = non restartable timer |
| 0x000A | Light timeout (default momentary) | 0x000B | Light flags cycling protect = off (default external overwrite off) |
| 0x000C | Motion 1 reaction time = 0 sec (fixed) | 0x000D | Motion 1 timer mode = restartable timer (fixed) |
| 0x000E | Motion 1 timeout (default 2 min) | 0x000F | Motion 1 flags:<br>Bit 0: cycling protect<br>Bit 1: external overwrite restartable timer (default off) |
| 0x0010 | Dark value low byte for light depending motion 1 | 0x0011 | Dark value high byte for light depending motion 1 |
| 0x0012 | Light value low byte for light depending motion 1 (0.98*motion 1 dark value) | 0x0013 | light value high byte for light depending motion 1 |
| 0x0014 | Dark reaction time for light depending motion 1 = 0 sec (fixed) | 0x0015 | Dark timer mode for light depending motion 1 = non restartable timer (fixed) |
| 0x0016 | Dark timeout for light depending motion 1 = momentary (fixed) | 0x0017 | Dark flags for light depending motion 1:<br>Bit 0: cycling protect = off (fixed)<br>Bit 1: external overwrite off (fixed) |
| 0x0018 | Light depending motion 1 reaction time = 0 sec (fixed) | 0x0019 | Light depending motion 1 timer mode = restartable timer (fixed) |
| 0x001A | Light depending motion 1 timeout (default 2 min) | 0x001B | Light depending motion 1 flags:<br>Bit 0: cycling protect<br>Bit 1: external overwrite (default off) |
| 0x001C | Motion 2 reaction time = 0 sec (fixed) | 0x001D | Motion 2 timer mode = restartable timer (fixed) |
| 0x001E | Motion 2 timeout (default 2 min) | 0x001F | Motion 2 flags:<br>Bit 0: cycling protect<br>Bit 1: external overwrite restartable timer (default off) |
| 0x0020 | Dark value low byte for light depending motion 2 | 0x0021 | Dark value high byte for light depending motion 2 |
| 0x0022 | Light value low byte for light depending motion 2 (0.98*motion 1 dark value) | 0x0023 | light value high byte for light depending motion 2 |
| 0x0024 | Dark reaction time for light depending motion 2 = 0 sec (fixed) | 0x0025 | Dark timer mode for light depending motion 2 = non restartable timer (fixed) |
| 0x0026 | Dark timeout for light depending motion 2 = momentary (fixed) | 0x0027 | Dark flags for light depending motion 2:<br>Bit 0: cycling protect = off (fixed)<br>Bit 1: external overwrite off (fixed) |
| 0x0028 | Light depending motion 2 reaction time = 0 sec (fixed) | 0x0029 | Light depending motion 2 timer mode = restartable timer (fixed) |
| 0x002A | Light depending motion 2 timeout (default 2 min) | 0x002B | Light depending motion 2 flags:<br>Bit 0: cycling protect<br>Bit 1: external overwrite (default off) |
| 0x002C | *Absence timeout* | 0x002D | *Absence output mode* |
| 0x002E | Not used | 0x002F | Not used |
| 0x0030 | Not used | 0x0031 | Not used |
| 0x0032 | Not used | 0x0033 | Alarm clock configuration |
| 0x0034 | Wake up 1 hour (0…23) | 0x0035 | Wake up 1 minutes (0…59) |
| 0x0036 | Go to bed 1 hour (0…23) | 0x0037 | Go to bed 1 minutes (0…59) |
| 0x0038 | Wake up 2 hour (0…23) | 0x0039 | Wake up 2 minutes (0…59) |
| 0x003A | Go to bed 2 hour (0…23) | 0x003B | Go to bed 2 minutes (0…59) |
| 0x003C | Sunrise hour at 21 December (0…23) | 0x003D | Sunrise minutes at 21 December (0…59) |
| 0x003E | Sunrise 21 January – sunrise 5 January (-128'..127') | 0x003F | Sunrise 5 February – sunrise 21 January (-128'..127') |
| 0x0040 | Sunrise 21 February – sunrise 5 February (-128'..127') | 0x0041 | Sunrise 5 March – sunrise 21 February (-128'..127') |
| 0x0042 | Sunrise 21 March – sunrise 5 March (-128'..127') | 0x0043 | Sunrise 5 April – sunrise 21 March (-128'..127') |
| 0x0044 | Sunrise 21 April – sunrise 5 April (-128'..127') | 0x0045 | Sunrise 5 May – sunrise 21 April (-128'..127') |
| 0x0046 | Sunrise 21 May – sunrise 5 May (-128'..127') | 0x0047 | Sunrise 5 June – sunrise 21 May (-128'..127') |
| 0x0048 | Sunrise 21 June – sunrise 5 June (-128'..127') | 0x0049 | Sunrise 5 July – sunrise 21 June (-128'..127') |
| 0x004A | Sunrise 21 July – sunrise 5 July (-128'..127') | 0x004B | Sunrise 5 August – sunrise 21 July (-128'..127') |
| 0x004C | Sunrise 21 August – sunrise 5 August (-128'..127') | 0x004D | Sunrise 5 September – sunrise 21 August (-128'..127') |
| 0x004E | Sunrise 21 September – sunrise 5 September (-128..127') | 0x004F | Sunrise 5 October – sunrise 21 September (-128'..127') |
| 0x0050 | Sunrise 21 October – sunrise 5 October (-128'..127') | 0x0051 | Sunrise 5 November – sunrise 21 October (-128'..127') |
| 0x0052 | Sunrise 21 November – sunrise 5 November (-128'..127') | 0x0053 | Sunrise 5 December – sunrise 21 November (-128'..127') |
| 0x0054 | Sunrise 21 December – sunrise 5 December (-128'..127') | 0x0055 | Sunrise 5 January – sunrise 21 December (-128'..127') |
| 0x0056 | Not used | 0x0057 | Not used |
| 0x0058 | Sunset hour at 21 December (0…23) | 0x0059 | Sunset minutes at 21 December (0…59) |
| 0x005A | Sunset 21 January – sunrise 5 January (-128'..127') | 0x005B | Sunset 5 February – sunrise 21 January (-128'..127') |
| 0x005C | Sunset 21 February – sunrise 5 February (-128'..127') | 0x005D | Sunset 5 March – sunrise 21 February (-128'..127') |

| 0x005E | Sunset 21 March – sunrise 5 March (-128'..127') | 0x005F | Sunset 5 April – sunrise 21 March (-128'..127') |
|---|---|---|---|
| 0x0060 | Sunset 21 April – sunrise 5 April (-128'..127') | 0x0061 | Sunset 5 May – sunrise 21 April (-128'..127') |
| 0x0062 | Sunset 21 May – sunrise 5 May (-128'..127') | 0x0063 | Sunset 5 June – sunrise 21 May (-128'..127') |
| 0x0064 | Sunset 21 June – sunrise 5 June (-128'..127') | 0x0065 | Sunset 5 July – sunrise 21 June (-128'..127') |
| 0x0066 | Sunset 21 July – sunrise 5 July (-128'..127') | 0x0067 | Sunset 5 August – sunrise 21 July (-128'..127') |
| 0x0068 | Sunset 21 August – sunrise 5 August (-128'..127') | 0x0069 | Sunset 5 September – sunrise 21 August (-128'..127') |
| 0x006A | Sunset 21 September – sunrise 5 September (-128'..127') | 0x006B | Sunset 5 October – sunrise 21 September (-128'..127') |
| 0x006C | Sunset 21 October – sunrise 5 October (-128'..127') | 0x006D | Sunset 5 November – sunrise 21 October (-128'..127') |
| 0x006E | Sunset 21 November – sunrise 5 November (-128'..127') | 0x006F | Sunset 5 December – sunrise 21 November (-128'..127') |
| 0x0070 | Sunset 21 December – sunrise 5 December (-128'..127') | 0x0071 | Sunset 5 January – sunrise 21 December (-128'..127') |
| 0x0072 | Not used | 0x0073 | Not used |
| 0x0074 | Sensor name character 1 | 0x0075 | Sensor name character 2 |
| ... | ... | ... | ... |
| 0x0082 | Sensor name character 15 | 0x0083 | Sensor name character 16 |
| 0x0084 | Temp. sensor: zone | 0x0085 | Temp. sensor: calibration offset |
| 0x0086 | Temp. sensor: calibration gain | 0x0087 | *Temp. sensor: hysteresis* |
| 0x0088 | *Temp. sensor: boost difference* | 0x0089 | *Temp. sensor: Pump delayed on* |
| 0x008A | *Temp. sensor: pump delayed off* | 0x008B | *Temp. sensor: min switching time* |
| 0x008C | *Temp. sensor: default sleep time byte 0 (low)* | 0x008D | *Temp. sensor: default sleep time byte 1 (high)* |
| 0x008E | *Temp. sensor: default sleep time byte 2* | 0x008F | *Temp. sensor: default sleep time byte 3 (msb)* |
| 0x0090 | *Temp. sensor: heater lower temperature range low byte* | 0x0091 | *Temp. sensor: heater lower temperature range high byte* |
| 0x0092 | *Temp. sensor: heater upper temperature range low byte* | 0x0093 | *Temp. sensor: heater lower temperature range high byte* |
| 0x0094 | *Temp. sensor: heater safe temperature set* | 0x0095 | *Temp. sensor: heater night temperature set* |
| 0x0096 | *Temp. sensor: heater day temperature set* | 0x0097 | *Temp. sensor: heater comfort temperature set* |
| 0x0098 | *Temp. sensor: cooler lower temperature range low byte* | 0x0099 | *Temp. sensor: cooler upper temp. range high byte* |
| 0x009A | *Temp. sensor: cooler upper temperature range low byte* | 0x009B | *Temp. sensor: cooler upper temp. range high byte* |
| 0x009C | *Temp. sensor: cooler safe temperature set* | 0x009D | *Temp. sensor: cooler night temperature set* |
| 0x009E | *Temp. sensor: cooler day temperature set* | 0x009F | *Temp. sensor: cooler comfort temperature set* |
| 0x00A0 | Temp. sensor: alarm 1 temperature set (low alarm) | 0x00A1 | *Temp. sensor: alarm 2 temperature set* |
| 0x00A2 | *Temp. sensor: alarm 3 temperature set* | 0x00A3 | Temp. sensor: alarm 4 temperature set (high alarm) |
| 0x00A4 | Temp. sensor settings | 0x00A5 | Temp. sensor alarm 1 & 2 settings |
| 0x00A6 | Temp. sensor alarm 3 & 4 settings | 0x00A7 | Not used |

**Remark:**
Unused locations contain H'FF'

### Reaction time (light to dark, dark to light, motion & light depending motion)

| contents | Reaction time |
|---|---|
| 0 | 0s |
| 1 | 1s (factory default for motion & light depending motion) |
| 2 | 2s |
| ... | |
| 59 | 59s |
| 60 | 1min (factory default for light to dark & dark to light) |
| 61 | 1min1s |
| ... | |
| … | |
| 119 | 1min59s |
| 120 | 2min |
| 121 | 2min15s |
| ... | |
| 131 | 4min45s |
| 132 | 5min |
| 133 | 5min30s |
| ... | |
| 181 | 29min30s |
| 182 | 30min |
| 183 | 31min |
| ... | |
| 211 | 59min |
| 212 | 1h |

*Timer mode (dark, light, motion & light depending motion)*

| Contents | Timer mode |
|---|---|
| 0x00 | non restartable timer (for dark & light) |
| 0xFF | restartable timer (for motion & light depending motion) |

*Timeout (light to dark, dark to light, motion & light depending motion)*

| Contents | Timeout |
|---|---|
| 0 | 0 = momentary (factory default for dark, light & motion) |
| 1 | 1s |
| 2 | 2s |
| ... | |
| 119 | 1min59s |
| 120 | 2min (factory default for light depending motion) |
| 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 |

*Dark flags*

| Contents | Timer mode |
|---|---|
| B'xxxxxxx0' | Cycling protection disabled (default) |
| B'xxxxxxx1' | Cycling protection enabled |
| B'xxxxxx0x' | External overwrite disabled (default) |
| B'xxxxxx1x' | External overwrite enabled |

*Light flags*

| Contents | Timer mode |
|---|---|
| B'xxxxxxx0' | Cycling protection disabled (default) |
| B'xxxxxxx1' | Cycling protection enabled |
| B'xxxxxx0x' | External overwrite disabled (default) |
| B'xxxxxx1x' | External overwrite enabled |

*Motion flags*

| Contents | Timer mode |
|---|---|
| B'xxxxxxx0' | Cycling protection disabled -> time-out interruptable |
| B'xxxxxxx1' | Cycling protection enabled -> time-out not interruptable |
| B'xxxxxx0x' | External overwrite disabled (default) |
| B'xxxxxx1x' | External overwrite enabled |

*Light depending motion flags*

| Contents | Timer mode |
|---|---|
| B'xxxxxxx0' | Cycling protection disabled -> time-out interruptable |
| B'xxxxxxx1' | Cycling protection enabled -> time-out not interruptable |
| B'xxxxxx0x' | External overwrite disabled (default) |
| B'xxxxxx1x' | External overwrite enabled |

*Absence timeout*

| Time parameter | Timeout |
|---|---|
| 60 | 1min |
| 61 | 1min1s |
| 62 | 1min2s |
| ... | |
| 119 | 1min59s |
| 120 | 2min |
| 121 | 2min15s |
| ... | |
| 131 | 4min45s |
| 132 | 5min |
| 133 | 5min30s |
| ... | |
| 152 | 15min (default) |
| ... | |
| 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 |

*Absence output mode*

| Contents | Absence output mode |
|---|---|
| 0x00 | Momentary (default) |
| 0xFF | 1 second pulse |

*Alarm clock configuration*

| Contents | Channel locked/unlocked |
|---|---|
| B'xxxxxxx0' | Alarm 1 disabled |
| B'xxxxxxx1' | Alarm 1 enabled |
| B'0xxxxx0x' | Local alarm 1 |
| B'1xxxxx1x' | Global alarm 1 |
| B'xxxxx0xx' | Alarm 2 disabled |
| B'xxxxx1xx' | Alarm 2 enabled |
| B'xxxx0xxx' | Local alarm 2 |
| B'xxxx1xxx' | Global alarm 2 |
| B'xxx0xxxx' | Sunrise disabled |
| B'xxx1xxxx' | Sunrise enabled |
| B'xx0xxxxx' | Sunset disabled |
| B'xx1xxxxx' | Sunset enabled |
| B'x0xxxxxx' | Daylight savings disabled |
| B'x1xxxxxx' | Daylight savings enabled |

*Temp. sensor zone*

| Contents | Zone |
|----------|------|
| 0' | No zone |
| 1. | Zone 1... |
| ... | ... |
| 7 | Zone 7 |

*Temperature sensor flags*

| Contents | Description |
|----------|-------------|
| B'xxxxxxx0' | Pump unjamming disabled (default) |
| B'xxxxxxx1' | Pump unjamming enabled |
| B'xxxxxx0x' | Heater valve unjamming disabled (default) |
| B'xxxxxx1x' | Heater valve unjamming enabled |
| B'xxxxx0xx' | Independent temperature alarms (default) |
| B'xxxxx1xx' | Dependent temperature alarms |

*Temperature sensor calibration offset (resolution 0.5°):*

| Contents | Calibration offset |
|----------|--------------------|
| 00001111 | Calibration offset +7.5°C |
| … | … |
| 00000001 | Calibration offset +0.5°C |
| 00000000 | Calibration offset +0°C (default) |
| 11111111 | Calibration offset -0.5°C |
| … | … |
| 11110000 | Calibration offset -8°C |

*Temperature sensor calibration gain:*

| Contents | Calibration gain |
|----------|------------------|
| 0 | Calibration gain |
| … | … |
| 128 | Calibration gain (default) |
| … | … |
| 255 | Calibration gain |

Calibrated Temperature = (gain/128) * sensortemperature + offset

*Temperature sensor hysteresis (resolution 0.5°):*

| Contents | Hysteresis |
|----------|------------|
| 00011111 | 15.5°C |
| | |
| 00000001 | 0.5°C (default) |
| 00000000 | 0°C |

*Temperature sensor boost difference (resolution 0.5°):*

| Contents | Temperature difference |
|----------|------------------------|
| 00010100 | +10°C |
| | |
| 00000001 | +0.5°C |
| 00000000 | 0°C |
| 11111111 | -0.5°C |
| | |
| 11101100 | -10°C |

*Temperature sensor pump delayed on, pump delayed off & valve minimum switching time:*

| Contents | Time |
|----------|------|
| 00000000 | 0 (default) |
| 00000001 | 1 sec |
| 00000010 | 2 sec |
| … | … |
| 11111110 | 254 sec |
| 11111111 | 255 sec |

*Temperature sensor default sleep time into minutes*
  valid range 0x0001 to 0xFEFF or 1min to 65.279min


*Temperature sensor lower range, upper range, safe, night, day, comfort or alarm set (resolution 0.5°):*

| Contents | Temperature set |
|----------|-----------------|
| 01111000 | 60°C |
|          |                 |
| 00101000 | 20°C |
|          |                 |
| 00000010 | 1°C |
| 00000001 | 0.5°C |
| 00000000 | 0°C |
| 11111111 | -0.5°C |
|          |                 |
| 11000000 | -32°C |


*Temperature sensor Alarm1 & 2 modes*

| Contents | Description |
|----------|-------------|
| B'xxxxx000' | Low temperature alarm 1 (default) |
| B'xxxxx001' | High temperature alarm 1 |
| B'xxxxx010' | Anti-frost mode alarm 1 |
| B'xxxxx011' | Night mode alarm 1 |
| B'xxxxx100' | Day mode alarm 1 |
| B'xxxxx101' | Comfort mode alarm 1 |
| B'xxxxx110' | Night, Day or Comfort mode alarm 1 |
| B'xxxxx111' | Day or Comfort mode alarm 1 |
| B'xxxx0xxx' | Temperature alarms 1 absolute (default) |
| B'xxxx1xxx' | Temperature alarms 1 relative |
| B'x000xxxx' | Low temperature alarm 2 |
| B'x001xxxx' | High temperature alarm 2 (default) |
| B'x010xxxx' | Anti-frost mode alarm 2 |
| B'x011xxxx' | Night mode alarm 2 |
| B'x100xxxx' | Day mode alarm 2 |
| B'x101xxxx' | Comfort mode alarm 2 |
| B'x110xxxx' | Night, Day or Comfort mode alarm 2 |
| B'x111xxxx' | Day or Comfort mode alarm 2 |
| B'0xxxxxxx' | Temperature alarms 2 absolute (default) |
| B'1xxxxxxx' | Temperature alarms 2 relative |


*Temperature sensor Alarm3 & 4 modes*

| Contents | Description |
|----------|-------------|
| B'xxxxx000' | Low temperature alarm 3 |
| B'xxxxx001' | High temperature alarm 3 (default) |
| B'xxxxx010' | Anti-frost mode alarm 3 |
| B'xxxxx011' | Night mode alarm 3 |
| B'xxxxx100' | Day mode alarm 3 |
| B'xxxxx101' | Comfort mode alarm 3 |
| B'xxxxx110' | Night, Day or Comfort mode alarm 3 |
| B'xxxxx111' | Day or Comfort mode alarm 3 |
| B'xxxx0xxx' | Temperature alarms 3 absolute (default) |
| B'xxxx1xxx' | Temperature alarms 3 relative |
| B'x000xxxx' | Low temperature alarm 4 |
| B'x001xxxx' | High temperature alarm 4 (default) |
| B'x010xxxx' | Anti-frost mode alarm 4 |
| B'x011xxxx' | Night mode alarm 4 |
| B'x100xxxx' | Day mode alarm 4 |
| B'x101xxxx' | Comfort mode alarm 4 |
| B'x110xxxx' | Night, Day or Comfort mode alarm 4 |
| B'x111xxxx' | Day or Comfort mode alarm 4 |
| B'0xxxxxxx' | Temperature alarms 4 absolute (default) |