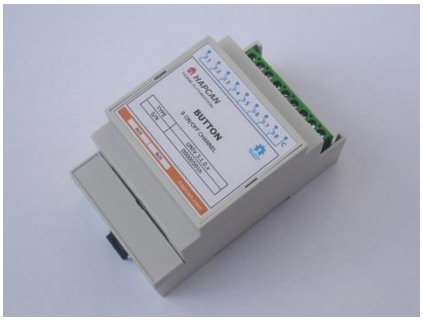
## 1. Features



- 8 channel button module.
- 7 types of button behaving is recognized: button pressed, released, pressed for 400ms, pressed for 4s, released within 400ms, released between 400ms and 4s, released after 4s
- There is a 20ms reaction time. Button has to be pressed for at least 20ms to activate module. It avoids contacts bouncing.
- Self-control feature – pressed button can control LEDs in the same module
- Allows writing notes in the processor memory
- Uptime counter
- Health check monitor
- Transmit (42 messages) and receive (42 messages) FIFO buffers

## 2. Compatibility

- Firmware for **UNIV 3.1.0.x** module
- Firmware can be uploaded into processor with bootloader version 3.1 or compatible.

## 3. Firmware version

UNIV 3 . 1 . 0 . 0

- 0 – firmware version
- 0 – application version (DIN rail button)
- 1 – application type (button)
- 3 – processor version
- UNIV – universal processor

## 4. Communication Frames (messages)

### 4.1. Button message

Module sends message to the bus, when status of input changes. Module is able to distinguish a few types of button behaving: pressed, released, pressed for 400ms, pressed for 4s, released within 400ms, released between 400ms and 4s , released after 4s. For each situation the unique message is sent to the bus. It is possible to choose for each button separately what massages should be sent.

Table 1. BUTTON frame (0x301)

| Frame type | Flags | | | | Module | Group | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0x301 | 3 | 2 | 1 | 0 | Node Nr | Group Nr | 0xFF | 0xFF | CHANNEL | BUTTON | 0xFF | 0xFF | 0xFF | 0xFF |

0x301 – universal module frame, button

- 3 - - not used flag, read as "0"
- 2 - - not used flag, read as "0"
- 1 - - not used flag, read as "0"
- 0 RE - response flag. Flag is equal "1" if node was requested. If flag is equal „0" it means that status of input has just changed.

Node Nr - message sender node number

Group Nr - message sender group number

CHANNEL - input channel 0x01 (button 1) – 0x0D (button 13)

BUTTON - actual input status
0x00 – open
0xFF – closed
0xFE – closed and held for 400ms
0xFD – closed and held for 4s
0xFC – closed and open within 400ms
0xFB – closed and open between 400ms and 4s
0xFA – closed and open after 4s

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### 4.2. Status request

Status of module can be checked by sending from computer STATUS REQUEST frame (0x109) (Table 2).

Table 2. STATUS REQUEST frame (0x109).

| Frame type | Flags | Module | Group | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0x109 | 0x0 | COMP ID1 | COMP ID2 | 0xXX | 0xXX | Node Nr | Group Nr | 0xXX | 0xXX | 0xXX | 0xXX |

0x1090 – STATUS REQUEST frame

COMP ID1 - computer identifier (must be unique on the network)
COMP ID2 - computer identifier (must be unique on the network)

Node Nr - node number of requested module

Group Nr - group number of requested module

0xXX - inessential data

As response the module will send 8 status frames (Table 3). Meaning of bytes is the same as in Table 1.

Table 3. Response to STATUS REQUEST.

| Frame type | Flags | Module | Group | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0x301 | 0x1 | Node Nr | Group Nr | 0xFF | 0xFF | 0x01 | BUTTON | 0xFF | 0xFF | 0xFF | 0xFF |
| 0x301 | 0x1 | Node Nr | Group Nr | 0xFF | 0xFF | 0x02 | BUTTON | 0xFF | 0xFF | 0xFF | 0xFF |
| ... | | | | | | | | | | | |
| 0x301 | 0x1 | Node Nr | Group Nr | 0xFF | 0xFF | 0x08 | BUTTON | 0xFF | 0xFF | 0xFF | 0xFF |

### 4.3. Uptime request

Table 4. UPTIME REQUEST (0x113).

| Frame type | Flags | Module | Group | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0x113 | 0x0 | COMP ID1 | COMP ID2 | 0xXX | 0xXX | Node Nr | Group Nr | 0xXX | 0xXX | 0xXX | 0xXX |

0x1130 – UPTIME REQUEST frame

COMP ID1 - computer identifier (must be unique on the network)
COMP ID2 - computer identifier (must be unique on the network)

Node Nr - node number of requested module

Group Nr - group number of requested module

0xXX - inessential data

Table 5. Response to UPTIME REQUEST (0x113).

| Frame type | Flags | Module | Group | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0x113 | 0x1 | Node Nr | Group Nr | 0xFF | 0xFF | 0xFF | 0xFF | UPTIME3 | UPTIME2 | UPTIME1 | UPTIME0 |

0x1131 – Response to UPTIME REQUEST frame

Node Nr - message sender node number
Group Nr - message sender group number

UPTIME - $(UPTIME3*256^3+UPTIME2*256^2+UPTIME1*256^1+UPTIME3*256^0)$ in seconds

### 4.4. Health check request

Table 6. HEALTH CHECK - STATUS REQUEST (0x115).

| Frame type | Flags | Module | Group | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0x115 | 0x0 | COMP ID1 | COMP ID2 | 0x01 | 0xXX | Node Nr | Group Nr | 0xXX | 0xXX | 0xXX | 0xXX |

0x1150 – HEALTH CHECK REQUEST frame

COMP ID1 - computer identifier (must be unique on the network)
COMP ID2 - computer identifier (must be unique on the network)

0x01 - status request

Node Nr - node number of requested module

Group Nr - group number of requested module

0xXX - inessential data

As response the module will send two frames (Table 7).

Table 7. Response to HEALTH CHECK - STATUS REQUEST (0x115).

| Frame type | Flags | Module | Group | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0x115 | 0x1 | Node Nr | Group Nr | 0x01 | RXCNT | TXCNT | RXCNTMX | TXCNTMX | CANINTCNT | RXERRCNT | TXERRCNT |

0x1151 – Response to HEALTH CHECK REQUEST frame

Node Nr - message sender node number
Group Nr - message sender group number

0x01 - frame 1 (current values)
RXCNT - current level of receive FIFO buffer
TXCNT - current level of transmit FIFO buffer
RXCNTMX - maximum level of receive FIFO buffer since power up
TXCNTMX - maximum level of transmit FIFO buffer since power up
CANINTCNT - number of CAN interface restarts since power up
RXERRCNT - current receive errors register
TXERRCNT - current transmit errors register

| Frame type | Flags | Module | Group | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0x115 | 0x1 | Node Nr | Group Nr | 0x02 | 0xFF | 0xFF | RXCNTMXE | TXCNTMXE | CANINTCNTE | RXERRCNTE | TXERRCNTE |

0x1151 – Response to HEALTH CHECK REQUEST frame

Node Nr - message sender node number
Group Nr - message sender group number

0x02 - frame 2 (maximum values saved in eeprom memory)
RXCNTMXE - maximum ever level of receive FIFO buffer
TXCNTMXE - maximum ever level of transmit FIFO buffer
CANINTCNTE - maximum ever number of CAN interface restarts
RXERRCNTE - maximum ever receive errors
TXERRCNTE - maximum ever transmit errors

To clear maximum values saved in eeprom memory the frame shown in Table 8 must be sent. There is no response to this message.

Table 8. HEALTH CHECK - CLEAR REQUEST (0x115).

| Frame type | Flags | Module | Group | D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0x115 | 0x0 | COMP ID1 | COMP ID2 | 0x02 | 0xXX | Node Nr | Group Nr | 0xXX | 0xXX | 0xXX | 0xXX |

0x1150 – HEALTH CHECK REQUEST frame

COMP ID1 - computer identifier (must be unique on the network)
COMP ID2 - computer identifier (must be unique on the network)

0x02 - clear request
Node Nr - node number of requested module
Group Nr - group number of requested module
0xXX - inessential data

## 5. Module control

There are no control instructions in this firmware.

## 6. Configuration

Parameters that can be configured with this firmware:

- Module identifier (module number and group number);
- Module description (16 chars);
- Button names
- Button settings
- Text notes;

Configuration process can be done using HAPCAN Programmer.

### 6.1. Module identifier
Every module on the network must have unique identifier. The identifier is made of two bytes, module number (1 byte) and group number (1 byte). Identifier of the Ethernet Interface can be changed in HAPCAN Programmer in software settings.

### 6.2. Module description
Every module can have 16 char description, which makes easier for user (programmer) to distinguish nodes.

### 6.3. Button names
Each button can be named with 32 chars.

### 6.4. Button settings
For each button it is possible to configure what type of button behaving is recognized by module. Module can recognize when:
- button is pressed,
- button is released,
- pressed and held for 400ms,
- pressed and held for 4s,
- pressed and released within 400ms (quick click),
- pressed and released between 400ms and 4s,
- pressed and released after 4s.

For each behaving a separate message will be sent on the bus.
WARNING: It is very important to choose only messages which will be used on the network to keep traffic on the bus as low as possible.

### 6.5. Text notes.
Up to 1024 characters can be written into processor's memory.

## 7. License

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## 8. Document version

| File | Note | Date |
|---|---|---|
| univ_3-1-0-0a.pdf | Original version | August 2013 |