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# Base module types

Currently there are several base modules that has the same principles of operation in register mapping and extension communication/support, but have different interfaces. Here is the list of base modules with their short description:

1) b01 - ModbusRTU slave with LCD screen and buttons. Has SD bootloader (press left two buttons during startup to activate) , needs file name B01\_FB.bin for update.

2) b02 - ModbusTCP slave with LCD screen and buttons. Has SD bootloader (press left two buttons during startup to activate) and Ethernet bootloader.

3) b03 - ModbusTCP slave with LCD screen and buttons. The same function as b02, but there are no DI (digital inputs) and SD card support. Include 5 ModbusRTU RS-485 ports for gateway function.

4) r01 - configurable regulator device. Similar to b02 (ModbusTCP slave with LCD screen and buttons.), but also provides ModbusTCP master and ModbusRTU master functions. Can be used for different regulation applications (temperature regulation, light control, jalousie control, fan coil regulator, etc). Device supports visual programming and includes different blocks: ANALOG/DIGITAL INPUT/OUTPUT, RS FLIP FLOP, AND, OR, INVERT, ON/OFF DELAY, ALARM, COMPARE and more complex blocks: PI-REGULATOR, 3 STEP CONTROL, 3 POINT ACTUATOR, JALOUSIE, DIMMER. Also available MATH block can be used for complex calculations (addition, subtraction, multiplication, division, exponentiation, ceil, cos, floor, log, pow, sin, tan, etc.). Device configuration is extremely simple and performed using web browser. User can select function blocks from device library, add them to active process (separate sheet with several blocks), connect blocks with each other in flowchart manner and configure blocks parameters. Dynamic editing and real time I/O values display supported. Each process can be saved to file and then loaded to another device or back to the same device (copy-paste part of configuration) using web browser. Entire configuration can be saved to file and then loaded to another device to create several devices with same configuration.

Has SD bootloader (press left two buttons during startup to activate) and Ethernet bootloader.

5) r02 - ModbusRTU (with UART physical layer) slave with fixed 115200 8N1, addr =1 interface. Has no UI controls or indicators, but contains auxiliary hardware (RTC, etc). Intended to be used as base for NanoPi linux single board PC (it adds Ethernet and USB ports). Has SD bootloader (starts always during startup if SD card is inserted), needs file name R02\_FB.bin for update. Leds on the board has following meaning:

Bootloader:

1 short red (0.2 sec) - bootloader start;

2 short (0.2sec)  red - bootloader restarting due to some problem (wrong bin file size, verify error, flash write error);

1 long (3sec) red - can't find R02\_FW.bin file;

red+greed on - flash erase;

red+greed simultaneously flashing - writing new firmware in flash;

red flashing fast continously - flashing is finished successfully, wait for the card removing.

App:

short(0.1sec) red flash + pause(0.9sec) + short greed flash(0.1sec) + pause(0.9sec)  - application start. After application start these leds are used to indicate communication with host linux PC (same as modbus communication for b01).

Normal start of the system will look like two red flashes (different lengs) and one greed.

# Base module menu.

**Buttons:**

there are 4 buttons that are placed in this order:



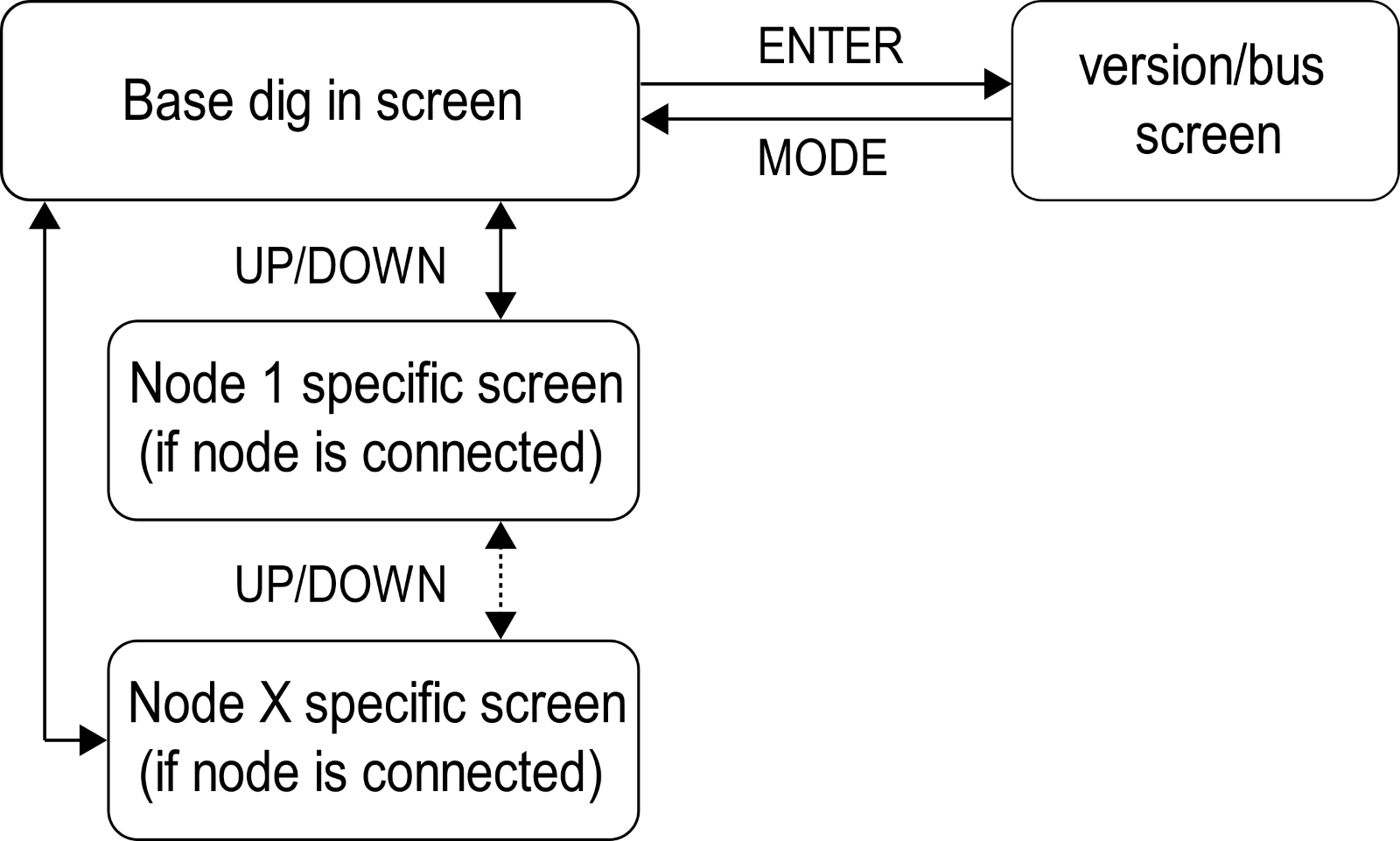
"UP" and "DOWN" are used to navigate through menu and change settings value when you are in a sub menu.

"ENTER" is used for enter in sub menu or to save new setting value.

"MODE " is used to exit from sub menu.

**Main menu screens:** **Sub menu screens:**

(can be scrolled by UP/DOWN buttons (can be scrolled by UP/DOWN buttons, press press ENTER to go into sub menu): MODE to exit from sub menu):



Node specific screen shows type and information from the node. It’s an entry point to node specific settings or additional information (if there are any). Currently nodes settings are not changeable through host module UI, you can only look at the values, but not change them. When node screen is selected on LCD its status led will become green. Last node on the bus that is detected by host module will blink with its green status led.

In system menu BusInfo shows following:  
"BusInfo: ok=xx"

(counter of complete packages with correct CRC, slave address, register address and valid instruction).  
"IA=yy FP=zz C=aa"

where IA - wrong instruction or wrong address range, FP - frame or parity error or other bit level error, C=CRC errors.

## Manual settings menu

To enter the menu keep DOWN button pressed for ~3sec. When you have entered the menu use UP/DOWN buttons to select device and press ENTER to select device's menu (keep in mind that not all extensions support these settings). When you are in device's menu use UP/DOWN buttons to select channel (selected channel is marked with '\_' sign), then press ENTER again to enter channel's menu (you will see '\_' sign before channel's name). In channels menu use UP/DOWN to select channel mode (A-automatic, 1-always on, 0-always off). For all submenus use MODE to go back and save changes.

## Special engineering menu for network settings

it can be entered from any screen of main menu by holding "UP" button pressed for ~3sec. In this menu use UP/DOWN buttons to modify values, ENTER to save new value and go to next parameter and MODE to exit from menu without latest changes saved.



# System modules register mapping.

NOTES:

1) node registers offset is 100, so every following node registers occupy

address = regAddress + nodeNumber\*100. Base module node number = 0.

2) if node is disconnected from running system content of registers stays unchanged, so if you disconnect from running system one node type and connect other node type it may lead to incorrect behavior. So it's better to reboot system after hardware configuration change.

3) for b02 or r01 TCP access address 230 should be used.

## B0x base module registers

**Input registers:**

IR0: Host HW Version.

IR1: Host FW Version.

IR2: Host DigIn (except b03).

IR3: Number of connected to ExtBus nodes.

IR4 - IR9: UID0 - UID5 (96bit unique device serial number).

IR10: digIns MONOFLOP bits\*\*(except b03).

IR11-IR18: digIns counters\*\* (except b03).

IR19: 16-bit life counter (1 second increment).

IR30: RTU port 1 - success requests number (only b02 and b03).

IR31: RTU port 1 - no response requests number (only b02 and b03).

IR32: RTU port 1 - exception response number (only b02 and b03).

IR33: RTU port 1 - success requests per second (only b02 and b03).

IR34: RTU port 2 - success requests number (only b03).

IR35: RTU port 2 - no response requests number (only b03).

IR36: RTU port 2 - exception response number (only b03).

IR37: RTU port 2 - success requests per second (only b03).

...

IR46: RTU port 5 - success requests number (only b03).

IR47: RTU port 5 - no response requests number (only b03).

IR48: RTU port 5 - exception response number (only b03).

IR49: RTU port 5 - success requests per second (only b03).

**Holding registers:**

HR1: H\_CONF\_DIGIN\_COUNTERS\*\*\*\* (only b01).

HR18: H\_REMOTE\_RESET\_REG\_FIRST\_VALUE.

HR19: H\_REMOTE\_RESET\_REG\_SECOND\_VALUE.

HR20: RTU port 1 baudrate (all except b01 and r02; 0 = 300, 1 = 600, 2 = 1200, 3 = 2400, 4 = 4800, 5 = 9600, 6 = 14400, 7 = 19200, 8 = 38400, 9 = 57600, 10 = 115200, 11 = 230400).

HR21: RTU port 1 parity (all except b01 and r02; 0 = none, 1 = odd, 2 = even).

HR22: RTU port 1 stopbits (all except b01 and r02; 1 = 1, 2 = 2, 3 = automatic).

HR23: RTU port 1 response timeout, ms (all except b01 and r02).

HR30: H\_CONF\_TOUT (1unit = 0.1sec)\*\*\*.

HR31: H\_CONF\_LOCK\_CONFIG (keyEnable=0x1234)\*

HR32: H\_CONF\_LOCK\_DEFAULT (keyEnable=0x1234)\*

HR33: MONOFLOP time [ms, min value 1ms] for base module and extensions\*\*.

HR34: RTU port 2 baudrate (only b03; possible values upper).

HR35: RTU port 2 parity (only b03; possible values upper).

HR36: RTU port 2 stopbits (only b03; possible values upper).

HR37: RTU port 2 response timeout, ms (only b03; possible values upper).

…

HR46: RTU port 5 baudrate (only b03; possible values upper).

HR47: RTU port 5 parity (only b03; possible values upper).

HR48: RTU port 5 stopbits (only b03; possible values upper).

HR49: RTU port 5 response timeout, ms (only b03; possible values upper).

\*-data in corresponding group of regs can be written only if value in the reg is equal to key value 0x1234. Attention! These two regs are not permanent!

\*\* - new functionality added for new firmware versions (starting 16.01.2016).

\*\*\* - timeout behavior is following:

1) Case 1. If (H\_CONF\_TOUT != 0) at startUp holding (H\_xxx) registers will be initialized with content of permanent registers (H\_PERM\_xxx). When there is no Modbus communication longer then specified in H\_CONF\_TOUT register then holding (H\_xxx) registers will be filled with content of permanent registers (H\_PERM\_xxx).

2) Case 2. If (H\_CONF\_TOUT = 0) at startUp holding (H\_xxx) registers will be initialized with "0"s. No actions will happen in case of absence Modbus communication.

\*\*\*\*-HR1: host DI pulse counters permanent configuration register (for b01 starting from v51), bits:

bit 0: 0=volatile counters, 1=permanent counters;

bit 1,2: 00 or 11 = count both edges, 10 only rising, 01 only falling;

bit 3: if change (0->1 or 1->0) = reset all counters to zero.

## Input register mapping table for extension nodes

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Input register | №: | e16di | e8r\_b | e6rw | e8oc | e16xi | e8xi4uo | e4ii4io | e16oc | e4di4xi2uo2r | e8uo | f32led | f16sw | f8pot | e16ntc | e8ocp | e8tr | e8di4r | e4r | e3pwr | e8hl |
|  |  | e16led | e8led, e8sw | e8led, e8sw | e8led, e8sw | e1led | e1led, e4pot | e1led, e4pot | e1led,  e16led | e1led(v1), e8led(v2),  e4led2pot2sw | e1led, e4pot |  |  |  | e1led | e8led, e8sw | e8led, e8sw | e12led, e8led4sw | e8led, e8sw | e1led | - |
| I\_HW | 0 | 10..19 | 20..29 | 50..59 | 60..69 | 30..39 | 40..49 | 70..79 | 80..89 | 90..99 | 100.. 109 | 110.. 119 | 120.. 129 | 130.. 139 | 140.. 149 | 150.. 159 | 160.. 169 | 170..179 | 180..  189 | 190..199 | 200-209 |
| I\_SW | 1 | SW | SW | SW | SW | SW | SW | SW | SW | SW | SW | SW | SW | SW | SW | SW | SW | SW | SW | SW | SW |
| I\_DIG\_IN | 2 | DIG\_IN |  |  |  |  |  |  |  | DIG\_IN |  |  |  |  |  |  |  | DIG\_IN |  |  |  |
| I\_DIG\_IN\_MONOFLOP I\_DIG\_IN\_TOGGLE\* | 3 | I\_DIG\_IN\_MONOFLOP DIG\_IN\_TOGGLE\* |  |  |  |  |  |  |  | I\_DIG\_IN\_MONOFLOP DIG\_IN\_TOGGLE\* |  |  |  |  |  |  |  | I\_DIG\_IN\_MONOFLOP DIG\_IN\_TOGGLE\* |  |  |  |
| I\_INPUT | 4 | A1 |  |  |  | A1 | A1 | A1 |  | A1(ch1-4 no xc8 ) |  |  |  |  | A1 |  |  | A1 |  | U1\_high (float, V) |  |
| analog in | 5 | A2 |  |  |  | A2 | A2 | A2 |  | … |  |  |  |  | A2 |  |  | A2 |  | U1\_low (float, V) |  |
|  | 6 | A3 |  |  |  | A3 | A3 | A3 |  |  |  |  |  |  | A3 |  |  | A3 |  | U2\_high (float, V) |  |
| value | 7 | A4 |  |  |  | A4 | A4 | A4 |  | … |  |  |  |  | A4 |  |  | A4 |  | U2\_low (float, V) |  |
|  | 8 | A5 |  |  |  | A5 | A5 |  |  |  |  |  |  |  | A5 |  |  | A5 |  | U3\_high (float,V) |  |
|  | 9 | A6 |  |  |  | A6 | A6 |  |  |  |  |  |  |  | A6 |  |  | A6 |  | U3\_low (float, V) |  |
|  | 10 | A7 |  |  |  | A7 | A7 |  |  |  |  |  |  |  | A7 |  |  | A7 |  | I1\_high (float, A) |  |
| group (1-16) | 11 | A8 |  |  |  | A8 | A8 |  |  | A8(ch5-8 only xc8 - mapped to DI1-4 pulse counters) |  |  |  |  | A8 |  |  | A8 |  | I1\_low (float, A) |  |
|  | 12 | A9 |  |  |  | A9 |  |  |  |  |  |  |  |  | A9 |  |  |  |  | I2\_high (float, A) |  |
|  | 13 | A10 |  |  |  | A10 |  |  |  |  |  |  |  |  | A10 |  |  |  |  | I2\_low (float, A) |  |
|  | 14 | A11 |  |  |  | A11 |  |  |  |  |  |  |  |  | A11 |  |  |  |  | I3\_high (float, A) |  |
|  | 15 | A12 |  |  |  | A12 |  |  |  |  |  |  |  |  | A12 |  |  |  |  | I3\_low (float, A) |  |
|  | 16 | A13 |  |  |  | A13 |  |  |  |  |  |  |  |  | A13 |  |  |  |  | P1\_high(float, W) |  |
|  | 17 | A14 |  |  |  | A14 |  |  |  |  |  |  |  |  | A14 |  |  |  |  | P1\_low(float, W) |  |
|  | 18 | A15 |  |  |  | A15 |  |  |  |  |  |  |  |  | A15 |  |  |  |  | P2\_high(float, W) |  |
|  | 19 | A16 |  |  |  | A16 |  |  |  |  |  |  |  |  | A16 |  |  |  |  | P2\_low(float, W) |  |
|  | 20 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | P3\_high(float, W) |  |
|  | 21 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | P3\_low(float, W) |  |
|  | 22 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Ptotal\_high(float, W) |  |
|  | 23 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Ptotal\_low(float, W) |  |
|  | 24 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | pEnrg1\_ high(float, kWh) |  |
|  | 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | pEnrg1\_ low(float, kWh) |  |
|  | 26 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | pEnrg2\_ high(float, kWh) |  |
|  | 27 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | pEnrg2\_ low(float, kWh) |  |
|  | 28 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | pEnrg3\_ high(float, kWh) |  |
|  | 29 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | pEnrg3\_ low(float, kWh) |  |
|  | 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | nEnrg1\_ high(float, kWh) |  |
|  | 31 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | nEnrg1\_ low(float, kWh) |  |
|  | 32 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | nEnrg2\_ high(float, kWh) |  |
|  | 33 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | nEnrg2\_ low(float, kWh) |  |
|  | 34 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | nEnrg3\_ high(float, kWh) |  |
|  | 35 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | nEnrg3\_ low(float, kWh) |  |
|  | 36 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | pEnrgT\_high(float, kWh) |  |
|  | 37 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | pEnrgT\_low(float, kWh) |  |
|  | 38 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | nEnrgT\_high(float, kWh) |  |
|  | 39 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | nEnrgT\_low(float, kWh) |  |
| … | … | … | … | … | … | … | … | … | … | … | … | … | … | … | … | … | … | … | … |  |  |
| I\_M | 50 |  | M | M | M |  | M | M |  | M(ch1-2 relay, ch3-4 UO) | M |  | M | M |  | M | M | M | M |  |  |
| I\_M\_ON | 51 |  | M\_ON | M\_ON | M\_ON |  | M\_ON | M\_ON |  | M\_ON(ch1-2 relay, ch3-4 UO) | M\_ON |  | M\_ON | M\_ON |  | M\_ON | M\_ON | M\_ON | M\_ON |  |  |
| Pot I\_POT | 52 |  |  |  |  |  | P1 | P1 |  | P1 | P1 |  |  | P1 |  |  |  |  |  |  |  |
|  | 53 |  |  |  |  |  | … | … |  | P2 | … |  |  | … |  |  |  |  |  |  |  |
| value | … |  |  |  |  |  | … | … |  |  | … |  |  | … |  |  |  |  |  |  |  |
| group (1-8) | 55 |  |  |  |  |  | P4 | P4 |  |  | P4 |  |  | … |  |  |  |  |  |  |  |
|  | … |  |  |  |  |  |  |  |  |  |  |  |  | … |  |  |  |  |  |  |  |
|  | 59 |  |  |  |  |  |  |  |  |  |  |  |  | P8 |  |  |  |  |  |  |  |

NOTE: Most of input registers are unsigned 16 bit values, except cases when opposite is explicitly stated.

HW..hardware type(if last digit is 5 or larger then extension module has UI control board connected).

SW..software version

DI..digital in

A..analog value depending on XC config (for temperature input this is a signed value, for others configurations - unsigned)

P.. Pot value [1unit = 0,01%/1mV/1uA]

M..sw manual mode status

M\_on..manual OnOff mode status.

Digital inputs have limited speed, max possible level detection speed is (the same for base module):  t\_low = 9ms, t\_high=9ms, Fmax = 55Hz.

XC=0: 0-10V [1mV] (0..10000) XC=10: KTY 1k [0,1°C] (-500..1500: -50,0 °C...+150,00 °C)

XC=1: 0-6553,5 Ohm [0,1 Ohm] (0..65535) XC=11: KTY 2k [0,1°C] (-500..1500: -50,0 °C...+150,00 °C)

XC=2: LM135 [0,1°C] (-500..1500: -50,0 °C...+150,00 °C) XC=12: 0-65535 Ohm, 1 Ohm unit

XC=3: PT1000 [0,1°C] (-2000..8000: -200,0 °C...+800,00 °C) XC=13: 0-655350 Ohm, 10 Ohm unit

XC=4: Ni1000 [0,1°C] (-2000..2800: -200,0 °C...+280,00 °C) XC=14: 0-6553500 Ohm, 100 Ohm unit

XC=5: Ni1000TK5000 [0,1°C] (-600..2500: -60,0 °C...+250,00 °C) XC=15: NTC 5K [0,1°C] (-500..1500: -50,0 °C...+150,00 °C)

XC=6: Siemens T1 [0,1°C] (-300..1300: -30,0 °C...+130,00 °C) XC=16: NTC 10K [0,1°C] (-500..1500: -50,0 °C...+150,00 °C)

XC=7: 0..20000uA [1uA] (0..20000) XC=17: NTC 20K [0,1°C] (-500..1500: -50,0 °C...+150,00 °C)

XC=8: 0..65535 [dig in counter value] XC=18: NTC 1K8 [0,1°C] (-500..1500: -50,0 °C...+150,00 °C)

XC=9: PT100 [0,1°C] (-2000..8000: -200,0 °C...+800,00 °C)

\* - outdated functionality, it's not supported in new devices/versions and replaced with new functionality (starting 16.01.2016).

## Holding register mapping table for extension nodes

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Holding register | № | e16di | e8r | e6rw | e8oc | e16xi | e8xi4uo | e4ii4io | e16oc | e4di4xi2uo2r | e8uo | f32led | f16sw | f8pot | e16ntc | e8ocp | e8tr | e8di4r | e4r | e3pwr | e8hl |
|  |  | e16led | e8led, e8sw | e8led, e8sw | e8led, e8sw | e1led | e1led, e4pot | e1led, e4pot | e1led, e16led | e1led(v1), e8led(v2)  e4led2pot2sw | e1led, e4pot |  |  | f8pot\_f | e1led | e8led, e8sw | e8led, e8sw | e12led, e8led4sw | e8led, e8sw | e1led |  |
| H\_DO | 0 |  | DO1-8 | DO1-6 | DO1-8 |  |  |  | DO1-16 | DO1-2 |  |  |  |  |  | DO1-8 | DO1-8 | DO1-4 | DO1-4 | EnergyReset  Request (0xdead) | DO1-8 |
| H\_OUTPUT | 1 |  |  |  | PWM1\* (real resolution 0.1us) |  | V1 | I1 | PWM1\*\*(real resolution 50us) | V1 | V1 | Ext LED RED 1-16 | Ext LED RED |  |  | PWM1\* (real resolution 0.1us) | PWM1\* (real resolution 1ms) |  |  |  |  |
|  | 2 |  |  |  | ... |  | ... | ... | ... | V2 | ... | Ext LED RED 17-32 | Ext LED GRN |  |  | ... | ... |  |  |  |  |
| Analog | 3 |  |  |  | … |  | … | … | … |  | … | Ext LED GRN 1-16 |  |  |  | … | ... |  |  |  |  |
| output value | 4 |  |  |  | … |  | V4 | I4 | … |  | … | Ext LED GRN 17-32 |  |  |  | … | ... |  |  |  |  |
| group | 8 |  |  |  | PWM8\*(real resolution 0.1us) |  |  |  | … |  | V8 |  |  |  |  | PWM8\*(real resolution 0.1us) | PWM8\*(real resolution 1ms) |  |  |  |  |
|  | 16 |  |  |  |  |  |  |  | PWM16\*\*(real resolution 50us) |  |  |  |  |  |  |  |  |  |  |  |  |
| H\_PULSE\_COUNTERS\_RESET | 17 | channels 1-16 |  |  |  |  |  |  |  | channels 1-4 |  |  |  |  |  |  |  | channels 1-8 |  |  |  |
| …. (reserved range) | … | … | … | … | … | … | … | … | … |  | … |  |  |  | … | … | ... | … | … |  |  |
| H\_CONF\_RED | 30 | RED | RED | RED | RED |  |  |  | RED | RED (ch1-4 - digInputs, ch5-6 - relays) |  | MAP1 |  |  |  | RED | RED | RED (ch1-8 - digInputs, ch9-12 - relays) | RED | pEnrg1\_ 48 (uint,mWh) |  |
| H\_ CONF\_GN | 31 | GRN | GRN | GRN | GRN |  |  |  | GRN | GRN (ch1-4 - digInputs, ch5-6 - relays) |  | … |  |  |  | GRN | GRN | GRN (ch1-8 - digInputs, ch9-12 - relays) | GRN | pEnrg1\_ 32  (uint,mWh) |  |
| H\_ CONF\_INV | 32 | INV | INV | INV | INV |  |  |  | INV | INV (ch1-4 - digInputs, ch5-6 - relays) |  | … |  |  |  | INV | INV | INV (ch1-8 - digInputs, ch9-12 - relays) | INV | pEnrg1\_ 16  (uint,mW) |  |
| H\_ CONF\_MANUAL | 33 |  |  |  |  |  |  |  |  |  |  | … | Extern LED control |  |  |  |  |  |  | pEnrg2\_ 48 (uint,mWh) |  |
| H\_CONF\_PWM\_SELECT | 34 |  |  |  | PWM \_SELECT |  |  |  | PWM \_SELECT |  |  | … |  |  |  | PWM \_SELECT | PWM \_SELECT |  |  | pEnrg2\_ 32  (uint,mW) |  |
| H\_ CONF\_PWM\_ PERIOD | 35 |  |  |  | PWM\_PERIOD  (range 1..48000) |  |  |  | PWM\_PERIOD  (range 4..48000) |  |  | … |  |  |  | PWM\_PERIOD  (range 1-48000) | PWM\_PERIOD (range 100-48000) |  |  | pEnrg2\_ 16  (uint,mWh) |  |
| Analog input | 36 | xc1  Supports  (xc=8\*\*\*) |  |  |  | xc1  Supports  (xc=0,1,3,4,5,6,9,  10,11) | xc1  Supports  (xc=0,1,3,  4,5,6,9,10,11) | xc1  Supports  (xc=7\*\*\*) |  | xc1  Supports  (channel 1-4 xc = 0,1,3,4,5,6,9,10,11) |  | … | MAP1 | MAP1 | xc1  Supports (xc=1,3,4, 5,6,9,10,11,12,13,14,15,16,17,18) |  |  |  |  | pEnrg3\_ 48 (uint,mWh) |  |
| H\_ CONF\_XC configuration | 37 | ... |  |  |  | … | … | … |  | … |  | … | … | … | … |  |  |  |  | pEnrg3\_ 32  (uint,mWh) |  |
|  | 38 | ... |  |  |  | … | … | … |  | … |  |  |  |  | … |  |  |  |  | pEnrg3\_ 16  (uint,mWh) |  |
| group (1-26) | 39 | ... |  |  |  | … | … | Xc4 |  | (channel 5-8 support xc=8) |  | … | … | … | … |  |  |  |  | nEnrg1\_ 48 (uint,mWh) |  |
|  | 40 | ... |  |  |  | … | … |  |  | … |  | … | … | … | … |  |  |  |  | nEnrg1\_ 32  (uint,mWh) |  |
|  | 41 | ... |  |  |  | … | … |  |  | … |  | … | … | … | … |  |  |  |  | nEnrg1\_ 16  (uint,mWh) |  |
|  | 42 | ... |  |  |  | … | … |  |  | … |  | … | … | … | … |  |  |  |  | nEnrg2\_ 48 (uint,mWh) |  |
|  | 43 | ... |  |  |  | … | xc8 |  |  | xc8 |  | … | … | MAP8 | … |  |  |  |  | nEnrg2\_ 32  (uint,mWh) |  |
|  | 44 | … |  |  |  | … |  |  |  |  |  | … | … |  | … |  |  |  |  | nEnrg2\_ 16  (uint,mWh) |  |
|  | 45 | … |  |  |  | … |  |  |  |  |  | … | … |  | … |  |  |  |  | nEnrg3\_ 48 (uint,mWh) |  |
|  | 46 | ... |  |  |  | ... |  |  |  |  |  | ... | ... |  | ... |  |  |  |  | nEnrg3\_ 32  (uint,mWh) |  |
|  | 47 | ... |  |  |  | ... |  |  |  |  |  | ... | ... |  | ... |  |  |  |  | nEnrg3\_ 16  (uint,mWh) |  |
|  | 48 | ... |  |  |  | ... |  |  |  |  |  | ... | ... |  | ... |  |  |  |  | pEnrgT\_ 48 (uint,mWh) |  |
|  | 49 | … |  |  |  | … |  |  |  |  |  | … | … |  | … |  |  |  |  | pEnrgT\_ 32  (uint,mWh) |  |
|  | 50 | … |  |  |  | … |  |  |  |  |  | … | … |  | … |  |  |  |  | pEnrgT\_ 16  (uint,mWh) |  |
|  | 51 | xc16 |  |  |  | xc16 |  |  |  |  |  | ... | MAP16 |  | xc16 |  |  |  |  | nEnrgT\_ 48 (uint,mWh) |  |
|  | 52 |  |  |  |  |  |  |  |  |  |  | … |  |  |  |  |  |  |  | nEnrgT\_ 32  (uint,mWh) |  |
|  | 53 |  |  |  |  |  |  |  |  |  |  | ... |  |  |  |  |  |  |  | nEnrgT\_ 16  (uint,mWh) |  |
|  | 54 |  |  |  |  |  |  |  |  |  |  | ,,,, |  |  |  |  |  |  |  | Current Transducer ratio  (unit = 0.01, range 0.01:1...655.35:1) |  |
|  | .... |  |  |  |  |  |  |  |  |  |  | ,,,, |  |  |  |  |  |  |  |  |  |
|  | 61 |  |  |  |  |  |  |  |  |  |  | MAP32 |  |  |  |  |  |  |  |  |  |
| …. (reserved range) | …. | …. | …. | …. | …. | …. | …. | …. | …. |  | …. |  |  |  | …. | …. | …. | …. | …. |  |  |
| H\_ PERM\_DO | 70 |  | DO1-8 | DO1-6 | DO1-8 |  |  |  | DO1-16 | DO1-2 |  |  |  |  |  | DO1-8 | DO1-8 | DO1-4 | DO1-4 |  |  |
|  | 71 |  |  |  | PWM1 |  | V1 | I1 | PWM1 | V1 | V1 |  |  |  |  | PWM1 | PWM1 |  |  |  |  |
|  | 72 |  |  |  | ... |  | ... | ... | ... | V2 | ... |  |  |  |  | ... | ... |  |  |  |  |
| Permanent analog | … |  |  |  | … |  | … | … | … |  | … |  |  |  |  | … | … |  |  |  |  |
| output value group | 74 |  |  |  | … |  | V4 | I4 | … |  | … |  |  |  |  | … | … |  |  |  |  |
| H\_PERM\_OUTPUT | 78 |  |  |  | PWM8 |  |  |  | … |  | V8 |  |  |  |  | PWM8 | PWM8 |  |  |  |  |
|  | 86 |  |  |  |  |  |  |  | PWM16 |  |  |  |  |  |  |  |  |  |  |  |  |

NOTE: All holding registers are unsigned 16 bit values.

RED..red led.

GRN..green led.

INV..inverted led.

H\_CONF\_MANUAL - if 1, manual control is blocked.

DO…digital out.

PWM - duty cycle (range 0-10000, 1unit=0,01%, but real resolution depends on device).

PWM\_PERIOD - depends on device (1unit = 1ms).

PWM \_SELECT - if bit set to 1 the outputs controlled as PWM, if set to 0 - as coils over DO register.

MONOFLOP\_TIME - defines pulse duration of monoflop pulse associated with dig input I\_DIG\_IN\_MONOFLOP bit state (1unit = 1ms).

V - 0-10000 (1unit=1mV).

I - 0-20000 (1unit=1uA).

MAP: 0xabcc: a=4bit (aktive (flag to activate mapping), red(led), green(led), inverted(led)), b= extension number(0-for base module, 1-15 for extensions 1-15 respectively), cc=channel(0-255 for channels 1-256 respectively).

**NOTE1:** explanation of RED,GN,INV usage. redLeds = (CHANNEL^LED\_INVERSION) & RED\_LED; greenLeds = (CHANNEL^LED\_INVERSION) & GREEN\_LED.

**NOTE2:** if module's H\_ CONF\_XC register is configured to unsupported XC mode then H\_INPUT will be set to special value 32767. Modules that support only one XC mode (e4ii4io, e16di) periodically set H\_ CONF\_XC register value to its only correct default state by themselves (XC=8 for e16di and XC=7 for e4ii4io).

\* - 0.1us max real resolution (setting resolution step 0,01%, so at max frequency real resolution 0,01%).

\*\* - 50us max real resolution (setting resolution step 0,01%, so at max frequency real resolution 1,25%).

\*\*\* - if there is only one supported mode for extension module, then it will be set by default to supported value.

# Firmware revisions history table

|  |  |
| --- | --- |
| HW type | Firmware revisions history |
| SD Bootloader(b01) | v1 - initial release.  v5 - added DCDC pin(PB9)initialization in low state to prevent its random opening. |
| BaseSystem (b01) | v1 - initial production release (reset development versions), add extModule MBus address functionality, improved extBus processing.  v2 - fixed extModule MBus address functionality when base address > 1, UI max MBus address is limited by 247. Fixed MBus Tout problem when extNode is addressed over MBus individually.  v2 - added FW version on b01 8di screen, but version ID wasn't incremented (because of minor change).  v2 - removed FW version on b01 8di screen, but version ID wasn't incremented (because of minor change).  v3 - release version with complete manual menu control menu (permanently saved).  v4 - reset manual registers nodes that doesn't support them. It's needed for correct red status led processing. Make pulling speed slower (45ms for fast packet, 300ms for slow).  v5 - fixed extModule MBus functionality. Now response to extModule device is sent from extModule's MBus address. Improved version screen to show current MBus addressing mode. Modified screen\_ConfBusExtAccess text. Fixed parity/frame error detection  v6 - add XC=9(PT100[0,1°C]),XC=10(KTY 1k [0,1°C]),XC=11(KTY 2k [0,1°C])  v7 - fixed bug with "DOWN" button nodes navigation in software manual mode menu. DigIn filtering set to 3ms. On B01\_DigInputs screen info about bus activity is added. BusInfo screen reworked (now wrong addressing, parity/frame error and CRC error are shown separately).  v8 - e4di4xi2uo2r module support added. Fixed bug with KTYx and PT100 sensors temperature indication on LCD.  v9 - fixed relay led problem with e4di4xi2uo2r.  v10- added e8uo support  v11- added f8pot, f16sw,f32led support. Large rework of extBus processing. Excluded remains of SAIA to get more free RAM. Fixed problem with Modbus reinitialization during host TIMEOUT change.  v12- added monoflop functionality for b01, e16di, e4di4xi2uo2r and digIn counters for b01.  v13- e16ntc support added. PT100/PT1000 precision improved.  v14- e16ntc sensors reworked(only ntc 5k,10k,20k sensors are supported).  v15 - fixed POT processing for non mapped analog pots  v16- fixed problem with digIn leds in inverted mode for e4di4xi2uo2r.  v17- changed channel number indication for f8pot+e4di4xi2uo2r. Analog channel 3-4 are shown as 1-2. Fixed influence of f16sw ch1-2 mapping on pot1-2 for e4di4xi2uo2r.  v18 - fixed "Even" parity configuration. Now during Tx it sends always 2 stop bits, during Rx only 1 is needed. Now output registers are initialized to PERM values during StartUp only if (permTout != 0). At startup now extension's config is checked and it's reset to allowed state if config is not ok.  v19- reworked 2 stop bits logic to prevent CRC problems  v20 - fixed switch to MBus multiaddress mode. Added IR0-1599 registers readOnly mirror as HR60000..61599.  v21- fixed problem with e8r/e6r output control.  v22- added new feature for f32led, f16sw: if channel is not assigned it can be controlled by PLC through ILED.  v23- timeBaseSource fix without IRQ on/off. Added e8ocp and e8tr support. Error handling reworked to allow increment of only one error counter per error. CRC errors will be shown only for our addr. Fixed upper PWM period limit for e8oc/e8ocp/e16oc nodes.  v24- added ignor of modbus frames with t1.5(frame) error. New error counters behavior. OK when addressed with correct CRC. Wrong when addressed with correct CRC but wrong register address or wrong function code; CRC Err if correctly addressed and CRC wrong (bus quality), FE\_FP if parity is wrong or if byte frame is wrong (wrong baud rate or wrong polarity). NO errors if block timing is wrong (1,5/3,5byte pause). Changed modbus timer period (was 4 times faster as needed). FePe not shown first 5 sec after power on and after good message.  v25- version change to fix version numbering (bad firmware was released instead of good under version 24).  v26- added e8di4r extension  v27 - added e4r support  v28- fixed e6r switches error introduced in previous version.  v29 - fixed H\_PERM\_XOUT\_1\_ext correction if more than 20000 for e4ii4io. Fixed e4ii4io manual pot range 0-20mA(was 0..10mA).  v30 - e3pwr support(attention, previous version hang if e3pwr is connected). 0xdead in e3pwr's HR0 will reset energyCounters in permanent memory.  v31- dcdc pwm frequency increased 2 times.  v32- calibration sending for special build with E3PWR\_CALIBRATION define.  v33- energy units in IRs are changed to Wh (instead of mWh).  v34- added current scaling configuration(current transducer ratio configuration  unit 0.01 -> 0.01:1 .... 655.35:1) and I value changed to float in Amps for e3pwr.  V35-added support of e8hl extension.  v36- prepared HW/FW id change from 8/8bit to 11/5bit. To activate - define EXT\_HW\_ID.  v37- added NTC 1k8 support, fixed RX failure of the first Modbus message.  v38- rework of e3pwr calibration functionality to implement PC controlled calibration(under E3PWR\_CALIBRATION define).  v39-fixed f16sw channel #16 mapping problem.  v40- special function for e8uo wit e4pot - manual control selection of any 4 channels, not only first 4. f16sw leds external control via HR regs. Fix e3pwr energy overflow. e3pwr energy units changed from Wh to kWh.  v41- Modbus SD card logging. Fix wrong invalid address exception errors count.  v42- EXT\_HW\_ID enabled. IR99 MANUFACTURER\_ID added. f32led - add HR1..HR4 which directly control red+green led if led is not assigned to a channel. e8di4r support for f32led.  v43- Fix f8pot assignment to e8uo (e8uo channels 5-8 can be controlled by f8pot now). Also if at least one e8uo channel controlled by f8pot, special function for e8uo with e4pot (see v40) is disabled.  v44- New HR (HR17) for reset DI counters for e16di, e4di4xi2uo2r and e8di4r.  v45- Add remote reset using modbus. To reset write 32481 to HR18 and 24237 to HR19. e3pwr energies LCD kWh instead of Wh. Ni1000 limit to -60/+400.  v46- Reworked extensions polling, speed improved. Extbus statistics LCD screen (long MODE press in host menu) and modbus regs. IR28: errors count, IR29: cycle time ms.  LCD I2C speed increased. LCD I2C redraw optimized.  v47- WRITE\_OUTPUTS\_CMD support for e8oc, e8ocp, e8tr, e16oc.  v48- Fix f32led host assigned channels clear after power on bug. Fix non working e8di4r output channels assignment to f32led. Fix hanging when work on 230400 speed. Fix host dig in averaging.Add dig\_in (UI module switches) filter for e8, e6rw, e4r if version <=6 and UI module connected (manual control switch is sometimes not read correct for old exx).  v49- Limit extbus min cycle time to 15 ms. Do not accept data from e3pwr if all values (U,I,P) for all phases are become simultaneously 0. Change dig\_in (UI module switches) filter depth from 3 to 30.  v50- Fix HR0(H\_DO) / HR1..16(H\_OUTPUT) regs (extensions outputs) random reset to defaults if Modbus communication absence timeout value (HR30:H\_CONF\_TOUT) is not 0.  v51- Host DI pulse counters can be configured as permanent with new config reg HR1 (permanent). Count type (rising, falling edge or both) can be configured. Also counters reset can be done. Fix wrong pulse count during power supply voltage changes (e.g. 24V -> 12V).  v52- v51 software ported to new hardware based on STM32G0B0CET6  v53- v51 software adapted to work with STM32F100VCT6 and GD32F103VC based hardware  v54(v52 based)- removed \_packed\_ attributes from certain structures bucause of memory align problems and as a result - some extensions which uses these structures cause b01 hardware fault |
| TcpBaseSystem (b02) | v1 - initial production release (reset development versions), add extModule MBus address functionality, improved extBus processing  v2 - fixed extModule MBus address functionality when base address > 1, UI max MBus address is limited by 247. Fixed MBus Tout problem when extNode is addressed over MBus individually.  v2 - added FW version on b01 8di screen, but version ID wasn't incremented (because of minor change)  v2 - removed FW version on b01 8di screen, but version ID wasn't incremented (because of minor change)  v3 - release version with complete manual menu control menu (permanently saved).  v4 - reset manual registers nodes that doesn't support them. It's needed for correct red status led processing.  v5 - B02 one bit access.  v6 - polling time increase 30->45ms, 200->300ms; digital averaging 50ms->10ms.  v7 - added PT100, KTY81/110, KTY81/210 temperature sensors support  v8 - fixed bug with "DOWN" button nodes navigation in software manual mode menu. DigIn filtering set to 3ms.  v9 - MODBUS\_SOCKETS\_0 define changed from 5 to 35  v10 - MJBC\_TEST5 (tcp.c) define to fix tcp  v11 - 4di4xi2uo2r.  v12 - added e8uo support. Fixed manual control for first node caused by mistake in e4di4xi2uo2r implementation. Embedded web pages.  v13 - added f8pot, f16sw,f32led support. Large rework of extBus processing.  v14- added monoflop functionality for b02, e16di, e4di4xi2uo2r and digIn counters for b02.  v15 - fixed problem with extra byte added in ModbusTCP response on "ReadDiscreteInputs\_0x02" message with requested length 8 bit.  v16 - e16ntc support added. PT100/PT1000 precision improved.  v17 - fixed timeout logic. Now writing to coil/register resets timeout counter.  v18 - e16ntc sensors reworked(only ntc 5k,10k,20k sensors are supported).  v19 - fixed POT processing for non mapped analog pots  v20 - fixed problem with digIn leds in inverted mode for e4di4xi2uo2r.  v21 - changed channel number indication for f8pot+e4di4xi2uo2r. Analog channel 3-4 are shown as 1-2. Fixed influence of f16sw ch1-2 mapping on pot1-2 for e4di4xi2uo2r.  v22 - Now output registers are initialized to PERM values during StartUp only if (permTout != 0). At startup now extension's config is checked and it's reset to allowed state if config is not ok.  v23 - Compatibility with B02 Ethernet loader (link address set to 0x08020000, max app size now 384KB). I2C EEPROM support for B02 Ethernet loader start via admin web page. Login / password editing on web page.  v24 - Input register 0-1599 mirrored to holding register 60000-61599.  v25 - fixed problem with e8r/e6r output control.  v26 - added new feature for f32led, f16sw: if channel is not assigned it can be controlled by PLC through ILED.  v27 - Local (LCD + keys) IP config.  v28 - Fix broadcast data tranfer bug: no broadcast timeout now.  v29 - Web config page (inlcuding "all" channels feature and set all LED green button).  v30 - Fixed e4di4xi2uo2r relay leds bug.  v31 - timeBaseSource fix without IRQ on/off. Added e8di4r, e8ocp and e8tr support. Fixed upper PWM period limit for e8oc/e8ocp/e16oc nodes.  v32 - e8di4r web config support. f16sw and f32led new extensions (e8r, e8tr, e8ocp, e8di4r) support.  v33 - e4r support. Soft I2C speed increased. Omit ES6 default arguments for IE11 support.  V34 - fixed H\_PERM\_XOUT\_1\_ext correction if more than 20000 for e4ii4io. Fixed e4ii4io manual pot range 0-20mA(was 0..10mA).  v35 - LCD\_SoftReInit state machine implementation (to avoid blocking delays while periodic lcd soft reinit).  v36 - E3pwr support (reset is missing).  v37 - with e3pwr counter reset.  v38 - added ntc 1k8, e8hl (added basic e3pwr calibration support, needs special build).  v39- rework of e3pwr calibration functionality to implement PC controlled calibration(under E3PWR\_CALIBRATION define).  v40-fixed f16sw channel #16 mapping problem.  v41 - special function for e8uo wit e4pot - manual control selection of any 4 channels, not only first 4. f16sw leds external control via HR regs. "Set all LED green" web interface button - fixed some browsers issue and works now for f32led and f16sw. Fix timeout web interface parameter issue. Fix f32led web interface leds bug.  v42 - e3pwr web interface correct display, current\_transducer\_ratio parameter added. Fix e3pwr energy overflow. Correct e3pwr energy reset from web interface. e3pwr web interface and IR energy units changed from Wh to kWh. Fix web interface parameters (PWM, PERIOD and similar inputs) old value display in some cases.  v43 - EXT\_HW\_ID enabled. IR99 MANUFACTURER\_ID added. f32led - add HR1..HR4 which directly control red+green led if led is not assigned to a channel.  f32led and f16sw - correctly display LEDs states(colors) on web when direct control active.  f16sw - new line "EXT LED CTRL" between MANUAL and RED.  e8di4r support for f32led.  v44 - f16sw "EXT LED CTRL" line is now editable via web interface. Fix outputs default not apply bug when change from web interface while modbus timeout active.  v45 - Fix f8pot assignment to e8uo (e8uo channels 5-8 can be controlled by f8pot now). Also if at least one e8uo channel controlled by f8pot, special function for e8uo with e4pot (see v41) is disabled.  New HR (HR17) for reset DI counters for e16di, e4di4xi2uo2r and e8di4r.  Fix e8uo web interface display.  v46 - Reworked extensions polling, speed improved. Extbus statistics LCD screen (long MODE press in host menu) and modbus regs. IR28: errors count, IR29: cycle time ms.  LCD I2C speed increased. LCD I2C redraw optimized. WRITE\_OUTPUTS\_CMD support for e8oc, e8ocp, e8tr, e16oc.  v47 - Fix f32led host assigned channels clear after power on bug. Fix non working e8di4r output channels assignment to f32led. Fix host dig in averaging. Add dig\_in (UI module switches) filter for e8, e6rw, e4r if version <=6 and UI module connected (manual control switch is sometimes not read correct for old exx).  v48 - Limit extbus min cycle time to 15 ms. Do not accept data from e3pwr if all values (U,I,P) for all phases are become simultaneously 0.  V49- Fix HR0(H\_DO) / HR1..16(H\_OUTPUT) regs (extensions outputs) random reset to defaults if Modbus communication absence timeout value (HR30:H\_CONF\_TOUT) is not 0.  v50 - Fix digital inputs. HWID 2610 instead of 2600.  v51  New features:  - Modbus gateway log HTML page.  Bug fixes:  - Fix uart reinit error.  v52  New features:  - Modbus log/debug page improved (counters, different log modes, scan, manual request, gateway disable checkbox, log pause/resume, clear log, messages improved).  - Modbus counters regs: IR30 - OK\_ANSWER\_REQUESTS\_CNT, IR31 - NO\_ANSWER\_REQUESTS\_CNT, IR32 – EXCEPTION\_ANSWER\_REQUESTS\_CNT.  v53  New features:  - Checking to which SPI MB85RS16 is connected ( board f revision have mixed SPI1 and SPI3).  v54  New features:  - Use one of two DI mapping sets depending from board revision (b02\_f DI assignment is different to b02\_e).  v55  New features:  - 16-bit life counter (1 second increment), IR19.  Changes:  - Partly board reinit (some pins, I2C, backlight, adc) before LCD init.  v56  Bug fixes:  - Fix LCD symbols missing (disable code optimization).  v57  Changes:  - Do not count READ\_POT\_SET\_OUTPUT\_CMD requests to any version of e16oc (v1 do not answer too).  Bug fixes:  - Add password protected registers write access check.  v58  Bug fixes:  - wrong reset settings (IP, other network settings, TCP port, web page login/pass) to defaults in case of power off while settings save after user change.  - RTU timeout wrong value in case of restore to defaults.  v59  Changes:  - Disable EMAC CRC offload (now CRC calc and check is done by software).  - Debug page with MCU ID.  v60  Changes:  - added single address mode that gateway function can also use slave address 230+ (only 255 is used for device itself)  v61  Bug fixes:  - added fix to avoid single address mode turned ON after software updating.  v62  Changes:  - use hardware emac CRC calculation if STM32 is used and software calculation in case GD32 is used  - added indormation if GD or STM uC is used(next to Software Version on a main webpage)  - gateway target device failed exception parameter (admin web page), if set - gateway will respond with 0x0B exception if there was no answer from RTU slave after timeout |
| TcpBaseSystem (b03) | v1 – test release  v2 - initial production release.  v3  Changes:  - default RTU timeout = 50 ms instead of 200 ms (for all ports);  - help text about TCP port's change only after reset added to serial web interface page.  v4  Changes:  - Do not count READ\_POT\_SET\_OUTPUT\_CMD requests to any version of e16oc (v1 do not answer too).  Bug fixes:  - add password protected registers write access check.  v5  Changes:  - added single address mode.  - Disable EMAC CRC offload (now CRC calc and check is done by software).(GD MCU hardware EMAC CRC calculation does not work properly).  v6  Changes:  - 15 TCP sockets for each modbus port (increased heap and used config for support more than 64 TCP sockets).  v7  New features:  - 16-bit life counter (1 second increment), IR19.  - Gateway target device failed exception parameter (admin web page), if set - gateway will respond with 0x0B exception if there was no answer from RTU slave after timeout  v8  Changes:  - use hardware emac CRC calculation if STM32 is used and software calculation in case GD32 is used  - added indormation if GD or STM uC is used(next to Software Version on a main webpage) |
| e16di\_a(e16led\_a) | v1 - initial production release (reset development versions), turn on O3 optimization.  v2 - DigIn filtering set to 3ms.  v3 - toggle functionality is replaced with monoflop functionality.  v4 - Enable counter reset function  v5 - Extbus byte buffering for exx -> host direction, instead of block buffering.  v6 - Removed checking of ExtbusHostSideUartBusy flag in EXTBUS\_EXTENSION\_SIDE\_UART\_IRQ() function to avoid bus errors |
| e8r\_a/e6rw /e4r (e8led,e8sw) | v1 - initial production release (reset development versions), turn on O3 optimization.  v2 - added PWM control for relays (19v - first 100ms, 13v - after). HW id increased. TimeBaseSource fix applied.  v3 - relays PWM reworked for 12v relay with full power output duty cycle 0,7 -> 14V -> 233mW and normal duty cycle 0,42 -> 8,4V -> 100mW. **(12V)**  v4 - added e4r support  v5 - relay ON pulse logic improved to prevent missed or delayed activation pulses in some conditions.  v6 - e8r build fixed(there was crash if output 5-8 was activated).  v7 - hand mode 30us delay (tested several devices with 200us = v200)  v8 - for 24V relays, e6r only! Change from 70%/42% to 100%/70%(100% = no PWM, just constantly ON).  v9 - Extbus byte buffering for exx -> host direction, instead of block buffering. Change PWM IRQ's priority to avoid extbus errors. Immediately answer on ext bus request (before delay could be 0..1 ms).  v10 (e8r only) - v9 ported to e8r\_d hardware(STM32G030)  v11 - Removed checking of ExtbusHostSideUartBusy flag in EXTBUS\_EXTENSION\_SIDE\_UART\_IRQ() function to avoid bus errors; improved relay PWM control to avoid relay noise  v12 (e8r only) - based on v10. Added optimizations to extension bus handler function to avoid rare bus errors. Removed checking of ExtbusHostSideUartBusy flag in EXTBUS\_EXTENSION\_SIDE\_UART\_IRQ() function to avoid bus errors; |
| e16xi\_a(e1led) | v1 - initial production release (reset development versions), turn on O3 optimization.  v2 - experimental, call EXTBUS\_ProcessExtensionCommunication every 100us to make extBus faster.  v3 - Extbus byte buffering for exx -> host direction, instead of block buffering.  v4 - Removed checking of ExtbusHostSideUartBusy flag in EXTBUS\_EXTENSION\_SIDE\_UART\_IRQ() function to avoid bus errors |
| e8xi4uo(e1led,e4pot) | v1 - initial production release (reset development versions), turn on O3 optimization.  v2 - extBus messages processing period lowered from 1ms to 0.1ms.  v3 - Extbus byte buffering for exx -> host direction, instead of block buffering. Remove process outputs delay.  v4 - Removed checking of ExtbusHostSideUartBusy flag in EXTBUS\_EXTENSION\_SIDE\_UART\_IRQ() function to avoid bus errors |
| e8oc\_a(e8led,e8sw) | v1 - initial production release (reset development versions), turn on O3 optimization.  v2 - delay for manual switch 30us instead of 2us; DCDC 5us on instead of 10us on  v3 - Process outputs immediately, instead of 100 ms wait. Also immediately answer on ext bus request (before delay could be 0..1 ms). Init PWM period on start-up. Do not response on READ\_POT\_SET\_OUTPUT\_CMD. Support WRITE\_OUTPUTS\_CMD for max speed in 0/1 mode. Remove direct control from e8sw. Extbus byte buffering for exx -> host direction, instead of block buffering.  v4 - Removed checking of ExtbusHostSideUartBusy flag in EXTBUS\_EXTENSION\_SIDE\_UART\_IRQ() function to avoid bus errors |
| e4ii4io(e1led,e4pot) | v1 - initial production release (reset development versions), output PWM scaling fixed, overcurrent protection fixed.  v2 - Extbus byte buffering for exx -> host direction, instead of block buffering. Decrease answer time on ext bus request to 0..100 us (before delay could be 0..1 ms). Remove process outputs delay.  v3 - Removed checking of ExtbusHostSideUartBusy flag in EXTBUS\_EXTENSION\_SIDE\_UART\_IRQ() function to avoid bus errors |
| e16oc(e1led,e16led\_a) | v1 - initial production release (reset development versions), set min PWM period = 4ms, change DCDC frequency and duty cycle to avoid acoustic noise  v2 - Process outputs immediately, instead of 100 ms wait. Also immediately answer on ext bus request (before delay could be 0..1 ms). Init PWM period on start-up. Support WRITE\_OUTPUTS\_CMD for max speed in 0/1 mode. Extbus byte buffering for exx -> host direction, instead of block buffering.  v3 - fix channels 9-16 bug in on/off mode (WRITE\_OUTPUTS\_CMD).  v4 - Removed checking of ExtbusHostSideUartBusy flag in EXTBUS\_EXTENSION\_SIDE\_UART\_IRQ() function to avoid bus errors |
| e4di4xi2uo2r(e8led, e4led2pot2sw) | v1 - initial release  v2 - e1led replaced with e8led.  v3 - toggle functionality is replaced with monoflop functionality  v4 - fix D9 orange led color problem (it was too red).  v5 - reworked to 12v relays support. **(12V)**  v6 - relay ON pulse logic improved to prevent missed or delayed activation pulses in some conditions. Adjusted systick handling for more precise time.  v7 - Enable counter reset function  v8 - Extbus byte buffering for exx -> host direction, instead of block buffering. Configuration->Link->Not use C library. Change PWM IRQ's priority to avoid extbus errors. Remove process outputs delay.  v9 - Removed checking of ExtbusHostSideUartBusy flag in EXTBUS\_EXTENSION\_SIDE\_UART\_IRQ() function to avoid bus errors; improved relay PWM control to avoid relay noise |
| e8uo | v1 - initial release.  v2 - Extbus byte buffering for exx -> host direction, instead of block buffering.  v3 - Removed checking of ExtbusHostSideUartBusy flag in EXTBUS\_EXTENSION\_SIDE\_UART\_IRQ() function to avoid bus errors |
| f32led | v1 - initial release  v2 - minor changes(version changed together with f16sw)  v3 - Extbus byte buffering for exx -> host direction, instead of block buffering.  v4 - Removed checking of ExtbusHostSideUartBusy flag in EXTBUS\_EXTENSION\_SIDE\_UART\_IRQ() function to avoid bus errors |
| f16sw | v1 - initial release(UI board needs HW rework).  v2 - f16sw\_b impemented instead f16sw\_a. Fixed 16th led for f16sw.  v3 - Extbus byte buffering for exx -> host direction, instead of block buffering.  v4 - Removed checking of ExtbusHostSideUartBusy flag in EXTBUS\_EXTENSION\_SIDE\_UART\_IRQ() function to avoid bus errors |
| f8pot | v1 - initial release  v2 - minor changes(version changed together with f16sw) 0  v3 - Extbus byte buffering for exx -> host direction, instead of block buffering.  v4 - Removed checking of ExtbusHostSideUartBusy flag in EXTBUS\_EXTENSION\_SIDE\_UART\_IRQ() function to avoid bus errors |
| e16ntc | v1 - initial release  v2 - Extbus byte buffering for exx -> host direction, instead of block buffering.  v3 - Removed checking of ExtbusHostSideUartBusy flag in EXTBUS\_EXTENSION\_SIDE\_UART\_IRQ() function to avoid bus errors |
| e8ocp | v1 - initial release  v2 - 30us intead of 2u delay at read of manual switch  v3 - Process outputs immediately, instead of 100 ms wait. Also immediately answer on ext bus request (before delay could be 0..1 ms). Init PWM period on start-up. Do not response on READ\_POT\_SET\_OUTPUT\_CMD. Support WRITE\_OUTPUTS\_CMD for max speed in 0/1 mode. Remove direct control from e8sw. Extbus byte buffering for exx -> host direction, instead of block buffering.  v4 - Removed checking of ExtbusHostSideUartBusy flag in EXTBUS\_EXTENSION\_SIDE\_UART\_IRQ() function to avoid bus errors |
| e8tr | v1 - initial release  v2 - time for manual switch read 30us instead of 2us  v3 - Process outputs immediately, instead of 100 ms wait. Also immediately answer on ext bus request (before delay could be 0..1 ms). Init PWM period on start-up. Do not response on READ\_POT\_SET\_OUTPUT\_CMD. Support WRITE\_OUTPUTS\_CMD for max speed in 0/1 mode. Remove direct control from e8sw. Extbus byte buffering for exx -> host direction, instead of block buffering.  v4 - Removed checking of ExtbusHostSideUartBusy flag in EXTBUS\_EXTENSION\_SIDE\_UART\_IRQ() function to avoid bus errors |
| e8di4r | v1 - initial release  v2 - reworked for 12v relay support. **(12V)**  v3 - relay ON pulse logic improved to prevent missed or delayed activation pulses in some conditions.  v4 - switch read wait time for pull up/down 30us instead of 2us  v5 - Enable counter reset function  v6 - Extbus byte buffering for exx -> host direction, instead of block buffering. Configuration->Link->Not use C library. Change PWM IRQ's priority to avoid extbus errors.  v7 - Removed checking of ExtbusHostSideUartBusy flag in EXTBUS\_EXTENSION\_SIDE\_UART\_IRQ() function to avoid bus errors; improved relay PWM control to avoid relay noise |
| e3pwr | 0v1 - initial release, based on e16xi project  0v2 - fixed energy scaling, improved energy accumulation precision (STPM34 uart speed set to 230400 bod)  0v3 - added P and I value sliding window averaging filters.  0v4 - added (U[3], I[3])calibration functionality.  0v5 - fixed STPM34 init problem at low power supply voltage (added waiting for an acceptable Vdd before chip init).  0v6 - added calibration sendout functionality when 0xFFs filled calibration request is received.  0v7 - change STPM34 uart communication -> fix energy jumps issue. Communication problems with STPM34 do not block extbus.  0v8 - change calibration: use only gains for calibration, no offsets used. Also add P and energy correction. To avoid wrong P or I values wait I,P filter buffers to be full after start or energy counters reset. Fix total energies calculation, because old implementation do not correct when phases have different energy flow direction at one time. Add STPM34 reinit in case of communication fail. Change STPM34 init (check both chips). Check written values on STPM init stage. Improve polling speed.Change CS handling: CS active during both STPM34\_writeCmdReadRsp calls.  0v9 - Extbus byte buffering for exx -> host direction, instead of block buffering. Change host side UART IRQ's priority to avoid extbus errors. Decrease answer time on ext bus request to 0..100 us (before delay could be 0..1 ms).  v10 - Removed checking of ExtbusHostSideUartBusy flag in EXTBUS\_EXTENSION\_SIDE\_UART\_IRQ() function to avoid bus errors |
| R01\_BaseSystem | V16  - mux2 block (Tools -> Multiplexer 2-way)  - global value input and output blocks (Values -> Global value input/output)  Changed bootloader to 0v4 (not compatible to previous 0v1); bootloader is started and version is displayed if left 2 buttons are pressed during power up  V17:  - modbus TCP blocks, like for RTU;  - Stop regulation buttons on web now stops modbus (TCP+RTU) too, e.g. device polling.  Please notice that this update at start up will reset device settings (IP, serial and so on) to defaults.  This is because settings change value from v1 to v2, so if in user hardware were stored some settings (v1) they will no apply, defaults will be loaded.  When user will change settings and save them, v2 version will be written and in future all be OK.  V18:  - math block;  Supported functions can be found here:  https://github.com/codeplea/tinyexpr  - dimmer one button;  - dimmer two buttons.  V19  New features:  - storing and loading program single page to/from file;  - web page close confirm if configuration not saved;  - update web page improvements;  - new firmware integrity check while upload via update web page.  Bug fixes:  - avoid hanging in case of configuration incompatibility.  V20  Bug fixes:  - fix delay\_on and delay\_off blocks issue when only short delay time was possible.  V21  New features:  For some blocks (delay on/off, long\_press, dimmers) time parameter is in seconds now. Decimal value supported, e.g.: 0.5 s = 500 ms.  V22  New features:  - modbus TCP and RTU read blocks format select (signed 16-bit / unsigned 16-bit);  - modbus TCP and RTU read blocks default format changed from unsigned 16-bit to signed 16-bit, this can affect existing configurations where more then 32767 values were used;  - limiter block (Tools->Limiter);  - configuration file optimization (remove unused fields).  Bug fixes:  - Alarm block incorrect parameter parsing fix. This fix will affect existing configurations with alarm blocks. Configurations should be recreated.  V23  New features:  - R01 TCP modbus slave holding reg value block (Values->R01 HR value), holding regs range: 40-69;  - R01 TCP modbus slave holding reg permanent value block (Values->R01 HR value, permanent), holding regs range: 70-99, values are stored in non-volatile memory.  v24  New features:  - Bits combiner 8/16 blocks (Tools folder);  - R01 TCP modbus HR value write block (Values->R01 HR value write), holding regs range: 40-69;  - R01 TCP modbus HR permanent value write block (Values->R01 HR perm. value write), holding regs range: 70-99, values are stored in non-volatile memory;  - Modbus RTU and TCP discrete input blocks;  - Modbus RTU and TCP coil write blocks.  Changes:  - "R01 HR value" block renamed to "R01 HR value read";  - "R01 HR value, permanent" block renamed to "R01 HR perm. value read".  Bug fixes:  - Firmware update using web browser works now (it was not working in V23 only, V23 users should use SD card for updating to V24);  - HTTP authentication works if enabled on administration page.  V25  New features:  - Jalousie one button block (Control folder);  - Multiplexer 4-way (Tools folder).  Changes:  - "Jalousie control" block renamed to "Jalousie, two buttons".  V26  New features:  - Min output value parameter for dimmer one button block;  - Min output value parameter for dimmer two buttons block.  Bug fixes:  - Set all LED green button Firefox issue.  V27  New features:  - Three point actuator block (Control folder).  Bug fixes:  - In case of power up RTC fail device will work without RTC.  V28  New features:  - Demultiplexer 2 and Demultiplexer 4 blocks (Tools folder)  - Update modular system support to actual state (support newest modular system extensions and sensors).  Changes:  - Three point actuator block rework (if input = 0, output direction off forever on, even if calculated position is already 0, if input = max\_value, output direction on forever on, even if calculated position is already max\_value, no reaction on input change which will take less time then current "Min move time" parameter);  - Jump from/to 0 to/from min value while increasing/decreasing for dimmer one button and dimmer two button blocks.  V29  Changes:  - Available processes number is 30 instead of 10.  Bug fixes:  - Check if memory available when create new operator.  V30  New features:  - Check and remove wrong i/o assignments while load new configuration from web interface (in case of errors, load log file can be downloaded).  Changes:  - Increased available RAM for configuration: more blocks can be created.  Bug fixes:  - Removed available RAM wrong checks while edit parameters and creating connections.  V31  Bug fixes:  - Wrong FlipFlopRS block output value when S = 1 and R change from 1 to 0.  V32  New features:  - 3 step control block (Control folder);  - PWM outputs support for R01 visual config as digital outputs blocks.  Changes:  - e3pwr units changed from Wh to kWh;  - e3pwr current\_transducer\_ratio parameter added to I/O configuration web inteface;  - for logic blocks (e.g. FlipFlop) input values less then zero is logic low, instead of logic high.  Bug fixes:  - e3pwr energy overflow;  - e3pwr support for R01 visual config;  - e3pwr I/O configuration web inteface display;  - e3pwr energy counters reset from I/O configuration web interface;  - I/O configuration web interface parameters (PWM, PERIOD and similar input fields) old value display in some cases.  V33  New features:  - New simulated position output for jalousie blocks.  Changes:  - XOR4 and XOR8 blocks output ON only if exactly one of connected inputs is ON.  v34  Changes:  - Priority for Modbus write requests is the same as for read requests.  Bug fixes:  - Various modbus TCP and RTU bugs.  v35  Changes:  - Reduced polling speed for modbus blocks (slow option).  v36  Changes:  - Modbus blocks poll speed options (slow, fast) changed to slowest, slow, medium, fast, fastest.  Bug fixes:  - Fix modbus TCP bug related to several simultaneously polled slaves.  V37  New features:  - New parameter (Slave identifier) for modbus TCP device status block. This can affect existing configurations with this block (required slave identifier should be entered).  Changes:  - Optimised modbus polling for unanswering devices (in case of several blocks using same device, only one block request will be performed while device unanswering).  - Optimised modbus write attempts for unanswering devices (while device unanswering, write attemps has lowest poll speed, to left time to read requests).  Bug fixes:  - Correct modbus TCP gateway support (different slave ID's).  - Fix modbus exceptions handling bug.  V38  Bug fixes:  - Wrong loading of single process containing alarm block with parameters.  V39  New features:  - f32led - add HR1..HR4 which directly control red+green led if led is not assigned to a channel;  - f16sw - new line "EXT LED CTRL" between MANUAL and RED;  - f32led and f16sw - correctly display LEDs states(colors) on web when direct control active;  - e8di4r support for f32led.  V40  Changes:  - "R01 HR perm. value write" block - performs write in case of "Reg. addr" parameter change;  - for all Modbus RTU/TCP write blocks - perform write in case of "IP", "slaveID" or "Reg. addr" parameter change.  Bug fixes:  - math block input I4 bug.  V41  Changes:  - Assigned in visual configuration output channels are not set to default when modbus timeout occurs;  - f16sw "EXT LED CTRL" line is now editable via web interface.  Bug fixes:  - Outputs default not apply bug when change from web interface while modbus timeout active.  v42  Update to B02 v45.  New features:  - New HR (HR17) for reset DI counters for e16di, e4di4xi2uo2r and e8di4r.  Bug fixes:  - Fix e8uo web interface display;  - Fix f8pot assignment to e8uo (e8uo channels 5-8 can be controlled by f8pot now). Also if at least one e8uo channel controlled by f8pot,  special function for e8uo with e4pot (see v40) is disabled.  v43  New features:  - Add remote reset using modbus. To reset write 32481 to HR18 and 24237 to HR19.  Bug fixes:  - e3pwr energies LCD kWh instead of Wh.  v44  New features:  - Extbus statistics LCD screen (long MODE press in host menu) and modbus regs, IR28: errors count, IR29: cycle time ms;  - WRITE\_OUTPUTS\_CMD support for e8oc, e8ocp, e8tr, e16oc.  Changes:  - reworked extensions polling, speed improved;  - LCD I2C redraw optimized;  - Ni1000 limit to -60/+400.  v45  Changes:  - Maximum 100 global value input blocks instead of 50.  v46  New features:  - jalousie angle block (Control folder).  Changes:  - regulation cycle time changed from 100 ms to 50 ms.  Bug fixes:  - one/two button dimmer blocks not working if min value equal to zero bug;  - Fix Modbus TCP blocks no write to slave error (occurs after 2 mins of idle after IP address change). Also because of this error all Modbus TCP slaves IP were damaged. Because of this there was no successfull reconnect in case of TCP connection lost. It was working only if first after power up connect try was successful. All of these errors were only actual if block slave ID was 255.  v47  New features:  - Angle correction parameter for jalousie angle block (value for angle correction on each activation), for example: T\_ANGLE = 1 sec., angle correction = 20, AI change from 0 to 100 will take 1.2 sec. (1.0 change itself + 0.2 correction), AI change from 0 to 30 will take 0.5 sec (0.3 change itself + 0.2 correction);  - For all jalousie blocks UP\_AND\_LOCK input (input for driving up completely and locking other control inputs).  Changes:  - regulation cycle time changed from 50 ms to 100 ms.  Bug fixes:  - f32led host assigned channels clear after power on bug;  - non working e8di4r output channels assignment to f32led;  - host digital inputs averaging bug;  - wrong char arrays sizes while parsing config.  v48  New features:  - limit extbus min cycle time to 15 ms;  - add dig\_in (UI module switches) filter for e8, e6rw, e4r if version <=6 and UI module connected (manual control switch is sometimes not read correct for old exx);  - do not accept data from e3pwr if all values (U,I,P) for all phases are become simultaneously 0.  v49  Bug fixes:  - HR0(H\_DO) / HR1..16(H\_OUTPUT) regs (extensions outputs) random reset to defaults if Modbus communication absence timeout value (HR30:H\_CONF\_TOUT) is not 0.  v50  New features:  - R01 reset and No data (? sign) detector blocks (Tools folder).  Bug fixes:  - RTU uart incorrect reinit;  - small Delay on bug fix.  v51  New features:  - Modbus RTU coil read block (Modbus RTU folder);  - Modbus TCP coil read block (Modbus TCP folder).  v52  New features:  - New input (Tr) for Modbus RTU holding write block (with Tr connected block will perform write ONLY on each Tr 0->1 transition, it will be NO write on input value change if Tr connected).  v53  New features:  - R01 HR set bit (Values folder);  - R01 HR clear bit (Values folder);  - Script Lua E8/A4 block (Script folder).  Changes:  - Disable web pages browser cache;  - "save config to device" button active after process rename.  v54  Changes:  - "R01 HR value write" block now actually perform write to R01 HR reg only if input value changed.  Bug fixes:  - Fixed error message when setting blocks params from web interface.  v55  New features:  - New parameter for TCP / RTU write coil blocks: write function code (FC05 - single coil or FC15 - multiple coils).  - New parameter for TCP / RTU write holding register blocks: write function code (FC06 - single register or FC16 - multiple registers).  - New parameter for TCP / RTU write holding register blocks and for TCP / RTU write coil blocks: Write period, seconds (0 -> periodic write deactivated).  v56  New features:  - Ethernet stats page.  Changes:  - ARP table size 32 instead of 8.  v57  New features:  - Modbus RTU 32-bit blocks (two 16-bit registers access per request): RTU input reg. 32-bit, RTU holding read 32-bit, RTU holding write 32-bit (Modbus RTU -> 32-bit folder).  - Modbus TCP 32-bit blocks (two 16-bit registers access per request): TCP input reg. 32-bit, TCP holding read 32-bit, TCP holding write 32-bit (Modbus TCP -> 32-bit folder).  v58  Changes:  -Do not count READ\_POT\_SET\_OUTPUT\_CMD requests to any version of e16oc (v1 do not answer too).  Bug fixes:  - Add password protected registers write access check.  - no months and years count (wrong date display on web page).  v59  New features:  - "Jalousie, one button" block new DN\_&\_LOCK input (same as UP\_AND\_LOCK, but for down direction).  Changes:  - "Jalousie, one button" for stopping in locking mode use time up/down counter instead of calculated position.  - "Jalousie, two buttons" for stopping in locking mode use time up/down counter instead of calculated position.  - "Jalousie, one button" UP\_AND\_LOCK input rename to UP\_&\_LOCK.  - "Jalousie, two buttons" UP\_AND\_LOCK input rename to UP\_&\_LOCK.  - "Jalousie, angle" UP\_AND\_LOCK input rename to UP\_&\_LOCK.  v60  Changes:  - Check only device type for SPI flash IC (no manufacturer ID check).  v61  Changes:  - SPI flash 4 KB sector erase command change to support ADESTO flash IC.  v62  Changes:  - Very fast autoincrement period changed from 1ms(..v61) to 10ms.  Bug fixes:  - fixed wrong up/down button direction for selecting extensions and for changing IP address  v63  Changes:  - four times more frequent retries requests send to no repsonse Modbus slaves.  Bug fixes:  - v60 running on HW with ADESTO possible settings change block issue auto fix.  - change poll speed of read coil block (RTU and TCP). |
| R01\_Bootloader | V0.1 SD R01 loader  V0.2 Works via SD with firmware file format.  V0.3. Works faster. Firmware file at the end of QSPI flash. Some comments.  V0.4 Delete new firmware from QSPI if CRC error while new app check to avoid endless cycle. Debug mode copy only first 120 KB.  v0.5 Check only device type for SPI flash IC (no manufacturer ID check). |
| R02\_BaseSystem | 0v1 - initial release based on B01v31. Modbus parameters: 230400 8N1. Addr=1.  0v2 - modbus reworked to 115200 8N1.  0v3 - sysled processing of extmodules fixed.  0v4 - addressing mode set to singleModbusAddr(no mbus addressess for extensions).  0v5 - added ntc 1k8, e8hl, e3pwr support.  0v6-fixed f16sw channel #16 mapping problem.  0v7 - update from B01 v40:  a) special function for e8uo with e4pot - manual control selection of any 4 channels, not only first 4.  b) f16sw leds external control via HR regs.  c) fix e3pwr energy overflow. e3pwr energy units changed from Wh to kWh.  0v8 - remove software manual control; at startup all software manual registers must be cleared  0v9 - EXT\_HW\_ID enabled. IR99 MANUFACTURER\_ID added.  0v10- f32led - add HR1..HR4 which directly control red+green led if led is not assigned to a channel. e8di4r support for f32led.  0v11- Fix f8pot assignment to e8uo (e8uo channels 5-8 can be controlled by f8pot now). Also if at least one e8uo channel controlled by f8pot, special function for e8uo with e4pot (see 0v7) is disabled.  New HR (HR17) for reset DI counters for e16di, e4di4xi2uo2r and e8di4r.  0v12- Reworked extensions polling, speed improved. Extbus statistics modbus regs, IR28: errors count, IR29: cycle time ms. Add remote reset using modbus. To reset write 32481 to HR18 and 24237 to HR19.  0v13- Add one more DI/DO read to extensions polling cycle.  0v14- Fix modbus uart re-init error.  0v15- WRITE\_OUTPUTS\_CMD support for e8oc, e8ocp, e8tr, e16oc  0v16- Limit extbus min cycle time to 15 ms. Do not accept data from e3pwr if all values (U,I,P) for all phases are become simultaneously 0. Remove unnecessary LCD buttons and digital inputs processing. Fix f32led host assigned channels clear after power on bug. Fix non working e8di4r output channels assignment to f32led. Add dig\_in (UI module switches) filter for e8, e6rw, e4r if version <=6 and UI module connected (manual control switch is sometimes not read correct for old exx).  V17- Fix HR0(H\_DO) / HR1..16(H\_OUTPUT) regs (extensions outputs) random reset to defaults if Modbus communication absence timeout value (HR30:H\_CONF\_TOUT) is not 0.  0v21 (G)  - fixed bug with not working extension modules contains XI inputs(wrong variable size apperared during porting)  - system clock changed from 24Mhz to 64Mhz |
| R02\_BootloaderSD | 0v1 - initial release based on b01 0v4 sd bootlader.  0v2 - If SD init fail or no bin file found run app instead of reset.  After FW update finish, SD card eject check via software approach (deinit/init try cycle).  All this needed to avoid wrong fw update try start when no SD card really inserted,  because of possible wrong state of SD presence contact (SD socket bad quality). |
| e8hl | v1 - initial release, based on e8ocp v1. Added timeBaseSource. Inverted output 1-4 order  v2 - HW/FW id reworked from 8/8bit representation to 11/5bit. PWM frequency changed from 24kHz to 48kHz.  v3 - manual control board support added(new hw rev.b).  v4 - added power supply voltage control (outputs off at 14v, back on at 16v). Switch detection charge time set to 30us.  v5 - new PWM\_ON value. Power supply control with hysteresis.  v6 - Extbus byte buffering for exx -> host direction, instead of block buffering. Immediately answer on ext bus request (before delay could be 0..1 ms).  v7 - Removed checking of ExtbusHostSideUartBusy flag in EXTBUS\_EXTENSION\_SIDE\_UART\_IRQ() function to avoid bus errors |

# Bootloader usage

The base module contains bootloader that can update its firmware using binary file from SD card. New binary should be stored in root directory of SD card in file named "**B01\_FW.BIN"**. To update firmware of the base module do following:

1) power off the device;

2) insert in the slot SD card with new firmware named B01\_FW.BIN;

3) press and keep pressed buttons "UP" and "DOWN" (2 left buttons);

4) power on the device;

5) wait a second and release the buttons;

6) the lcd will light up and will show information about bootloader version. Then it will show information about firmware update process. When the process is over new firmware will start automatically (you will see start up screen with new firmware version).

# B01 Modbus SD card logging function description

It is possible to log all B01 Modbus request to SD card. To activate log function, empty text file named “logconf.txt” should be present on SD card at power up. When active, “sd\_log” string is displaying at first line of LCD display. All requests are written to file “LOG.CSV” (delimiter: ‘;’).

Each request info:

* Request time
* Device address
* Function
* Register address
* Regs number
* Request data
* Error
* Response time
* Response data
* Request

Request / response times are in ms (time from B01 power up).

Error codes: blank - no error, 1 - illegal function, 2 - illegal data address, 3 - illegal data value, 4..11 - other Modbus exceptions, 12 - wrong frame length or CRC, 13 - frame parity error, 14 - response TX error.

B01 overwrite log file on each power up.

Supported SD card filesystem: FAT, FAT32.

To avoid possible log data loss, before SD card eject, safe file close should be done. To do this, “SD log active” parameter value should be changed from 1 to 0 in special engineering menu (see page 4 for special engineering menu info). Also it is possible to check how many requests were written to log file using “SD log OK/drop” screen in special engineering menu.