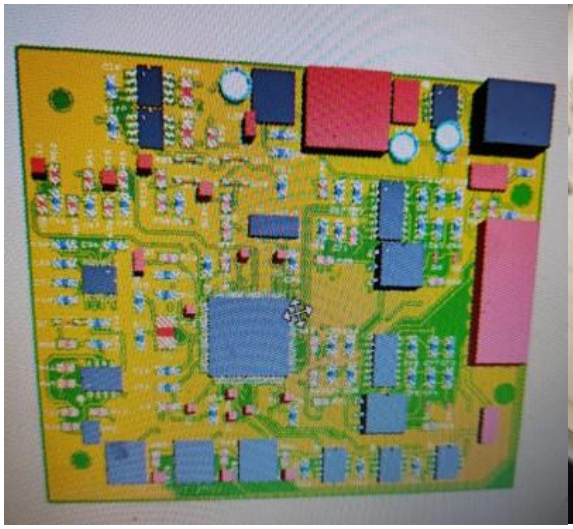
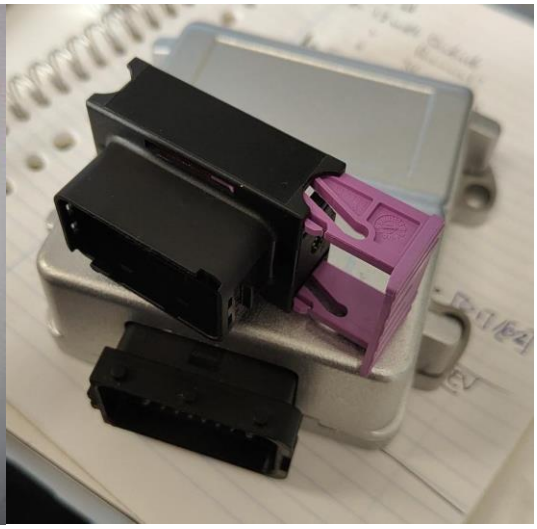
# Programmers Manual

**(with latest stm_xxx firmware loaded)**

**Battery Gateway / Blue BMS / ESS Firmware**

**(for board V3.1)**





**By** : **EV-Builder**

**Forum** : **OpenInverter.org**

**Version** : **v3.5 (09-01-2023)**

# Inhoud

# History Notes

## Change Log:

| Change # | Ver. | Description |
|---|---|---|
| 1 | 2.2 | Added Mux to signal 0x603 to decrease bus load; |
| 2 | 2.3 | Added Cell Balance commands and status readout. |
| 3 | 2.4 | Added BMS status to CANID 0x600; |
| 4 | 2.5 | Added Module Count to CANID 0x600; |
| 5 | 2.6 | Changed/Fixed Cell Balance commands; |
| 6 | 2.7 | Changed strategy to upload balance config and added activate command; |
| 7 | 2.8 | Clarified module count during config and during discovery; |
| 8 | 2.9 | Added parameters & commands to change BMS Port en Canbus speed of EXT1 |
| 9 | 3.0 | Needed more cell voltage space so moved the messages around; Check Interfaces section! |
| 10 | 3.1 | Added sections for separate firmware's behaviour |
| 11 | 3.2 | Change pre-relais output from 4 to 1; |
| | | |

## Known Issues:

| Issue # | HW Ver. | Description |
|---|---|---|
| 1 | 2.0 | By default only 3GP_INPUTS are connected to CPU. |
| 2 | 2.0 | PWM2 needs two CPU pins connected, shorted. (check for shorted pins) |
| 3 | Manual | Missing bit definition; |
| 4 | Manual | Parameter list not filled in yet; |
| 5 | | |
| 6 | | |
| 7 | | |

# Foreword

This manual tries to be as complete as possible but please just mail and ask if certain wordings or explanations aren't clear enough.

The device can come with 3 types of firmware. It's important to untherstand the three types.

- BGTW ; Battery Gateway; Often used within systems of integrators;
- BlueBMS ; Vehicle BMS mode; The firmware will do typical BMS tasks on its own;
- ESSBMS ; Energy Storage Systems; The firmware will communicate with hybrid inverters.

In the manual we use 

to indicate firmware appliance.

To indicate on which part the sections applies too.

The hardware variations are indicated like this:


## Bootloader

The bootloader used is a CAN bootloader.

The CAN bootloader listens only on the **EXT2** interface @ 500K.

In order to use the CAN bootloader the matching GUI application is needed (see PEAK BMS Studio / PEAK Bootloader).

Select an interface, at the time of writing only the PEAK adapters and the BUSMUST adapter are supported.

Select a HEX file, upon succesfull reading some properties of the file will be shown;

After a reboot the device should pop-up in the list or if you know the device select it from the list with a double click.

Next reboot the device will receive the hex file, see the log tab for user friendly details and messages.

CAN ID **0x7DE** is used by the nodes and **0x7DD** is used by the bootloader application.

Identification of the Node by the GUI application is done by its unique chip ID. All devices will be kept in “wait_state” until a choice is made in the GUI application.

# Configuration

The configuration consists of a hardware part, mainly on the PCB with jumpers and or optional population of components.

In the table below can be seen what would be added / sacrificed with each choice.
(actions might be needed like removal or placement of components and or closing / opening of solder jumpers).

## HW Configurations HWv3.1:

| HW Configuration Matrix CMC | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Default** | | | | | | | |
| CanBus 1 | | | | | | | |
| Canbus 2 | | | | | | | |
| TPL 1 port | | | | | | | |
| 3 Dig Inputs | | | | | | | |
| 4 Dig Outputs | | | | | | | |
| **Exclusive / OR Configuration options** | +1 Dig Inputs | Analog 1 Input | Analog 2 Input | Analog 3 Input | Analog 4 Input | PWM GP-OUT1 | PWM GP-OUT2 |
| LIN Interface | X | | | | | | |
| PWM1_Out | | X | | | | | |
| PWM2_Out | | | X | | | | |
| TPL 2 port | | | | X | X | | |
| RS232 Interface | | | | X | X | | |
| PWM1 Driver | | | | | | X | |
| PWM2 Driver | | | | | | | X |

**[Config. Table: When an X is read in the junction it means that a choice has to be made between those 2 functions.] (Contact us for latest updates of this table).**

## SW Configuration & Commands

Configuration of the device is done over CANBus. The settings only have to be sended once per reset cycle (no saving of settings currently supported). The device will listen on both CANBus ports for the configuration.

CAN ID **0x598** is the ID used for sending over the settings on the **EXT2 or EXT1** interface.

All bytes are unsigned (dec. 0-255);

| Description | Default | Byte0(CMD) | Setting parameters | Remarks |
|---|---|---|---|---|
| PORT (Enable/Disable) | Disabled | 0x1 | Byte1=Port#, Byte2=0/1 | Please delay 1000ms between switching. (modules need to time-out) |
| Nr of Modules | 1 | 0x2 | Byte1=PORT#; Byte2=Number of modules | Byte1 = 1 or 2;<br>Byte2 = 1-15; |
| Change BMSport and EXTSpeed | | 0x5 | Byte1=BMSPort;Byte2=EXT1Speed; | Byte1=1 for EXT2 (default) or 2 for EXT;<br>Byte2=0 for 250K, 1 for 500K and 2 for 800K; |
| | | | | |
| Write Sink Outputs | Disabled | 0x10 | Byte1=3Bits LSB are on / off | |
| | | | | |
| Enable/Disable Global Balancing for module(s) | | 0x20 | Byte1=Port#,<br>Byte2=Enable/Disable<br>Byte3=MOD# | Byte1 = 1 or 2;<br>Byte2 = 0 or 1;<br>Byte3 = 0 (all); 1 to 15; |
| Enable 2Min. Timer Balancing for a cell(s); (re-write means restart of timer) | | 0x21 | Byte1=Port#,<br>Byte2=CELL MASK<br>Byte3=MOD#<br>byte4=Activate Config | Byte1 = 1 or 2;<br>Byte2 = 0 all off; 1 to 63;<br>Byte3 = 0 (all mod.); 1 to 15;<br>Byte4 = 0 or 1 |

### Cell Balancing

Cell balancing can be activated on cell level. The bleed resistors on the internal PCB will be enabled by command. This will bleed energy out of certain cells. In that way we try to get as many cells as possible at a high charge level.

Step 1) Wait for BMS Status == Running;
Step 2) Enable / Disable Global Balancing;
Step 3) Wait for BMS Status == Running;
Step 4) Upload Cell balance config per module;
Step 5) Set Activate bit in last Cell level balancing config

Now the whole config will be distributed to the pack at once.
In this way we interrupt the measurements the least possible and we minimize the risk of tail trailing our own changes.

MOD#: 0= All modules; 1-15 --> one module command;
CELL#: 0= All Cells off; 1 = cell ON; 3= 1 & 2 On etc. (bit pos. 1 = Cell 1 etc.)

BGTW BMS ESS

## Main Connections

(Default HW configuration)

| TPL | | TPL | | MAX | |
|---|---|---|---|---|---|
| +12Vin | A1 1 | +12Vin | A1 1 | +12Vin | A1 1 |
| GND | B1 2 | GND | B1 2 | GND | B1 2 |
| GND | C1 3 | GND | C1 3 | GND | C1 3 |
| CCM1_P | A2 4 | CCM1_P | A2 4 | CCMRX_P | A2 4 |
| CCM0_P | B2 5 | CCM0_P | B2 5 | CCMTX_P | B2 5 |
| LIN_BUS | C2 6 | LIN_BUS | C2 6 | LIN_BUS | C2 6 |
| CCM1_N | A3 7 | CCM1_N | A3 7 | CCMRX_N | A3 7 |
| CCM0_N | B3 8 | CCM0_N | B3 8 | CCMTX_N | B3 8 |
| CAN_EXT2H | C3 9 | CAN_EXT2H | C3 9 | CAN_EXT2H | C3 9 |
| CAN_EXT2L | A4 10 | CAN_EXT2L | A4 10 | CAN_EXT2L | A4 10 |
| CAN_EXTH | B4 11 | CAN_EXTH | B4 11 | CAN_EXTH | B4 11 |
| CAN_EXTL | C4 12 | CAN_EXTL | C4 12 | CAN_EXTL | C4 12 |
| GP_OUT1 | A5 13 | GP_OUT1 | A5 13 | GP_OUT1 | A5 13 |
| GP_OUT2 | B5 14 | GP_OUT2 | B5 14 | GP_OUT2 | B5 14 |
| GP_INP_2 | C5 15 | GP_INP_2 | C5 15 | GP_INP_2 | C5 15 |
| GP_INP_0 | A6 16 | GP_INP_0 | A6 16 | GP_INP_0 | A6 16 |
| GP_INP_1 | B6 17 | GP_INP_1 | B6 17 | GP_INP_1 | B6 17 |
| PWM1_OUT | C6 18 | PWM1_OUT | C6 18 | PWM1_OUT | C6 18 |
| PWM3_OUT | A7 19 | RS232_Rx | A7 19 | RS232_Rx | A7 19 |
| GP_OUT3 | B7 20 | RS232_Tx | B7 20 | RS232_Tx | B7 20 |
| PWM2_OUT | C7 21 | PWM2_OUT | C7 21 | PWM2_OUT | C7 21 |
| +12Vin_PWM | A8 22 | +12Vin_PWM | A8 22 | +12Vin_PWM | A8 22 |
| RS232_Rx | B8 23 | GP_OUT4 | B8 23 | GP_OUT4 | B8 23 |
| RS232_Tx | C8 24 | GP_OUT3 | C8 24 | GP_OUT3 | C8 24 |

**<= HW2.0** **| HW3.x** **| HW3.x**

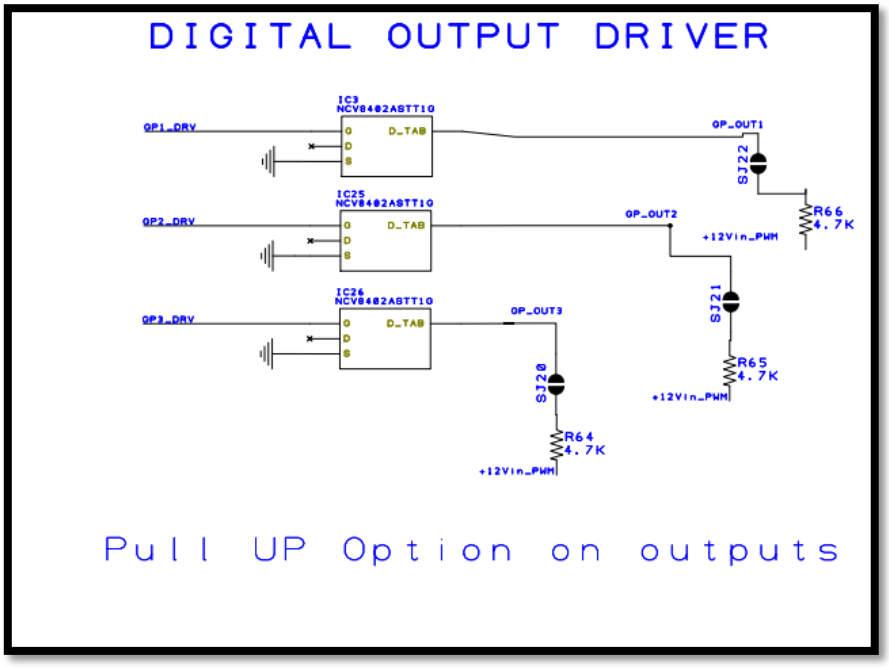
| | |
|---|---|
| Connector PN | : **211PC249S0018** |
| BIG PIN | : |
| SMALL PIN | : |

**Notes:**

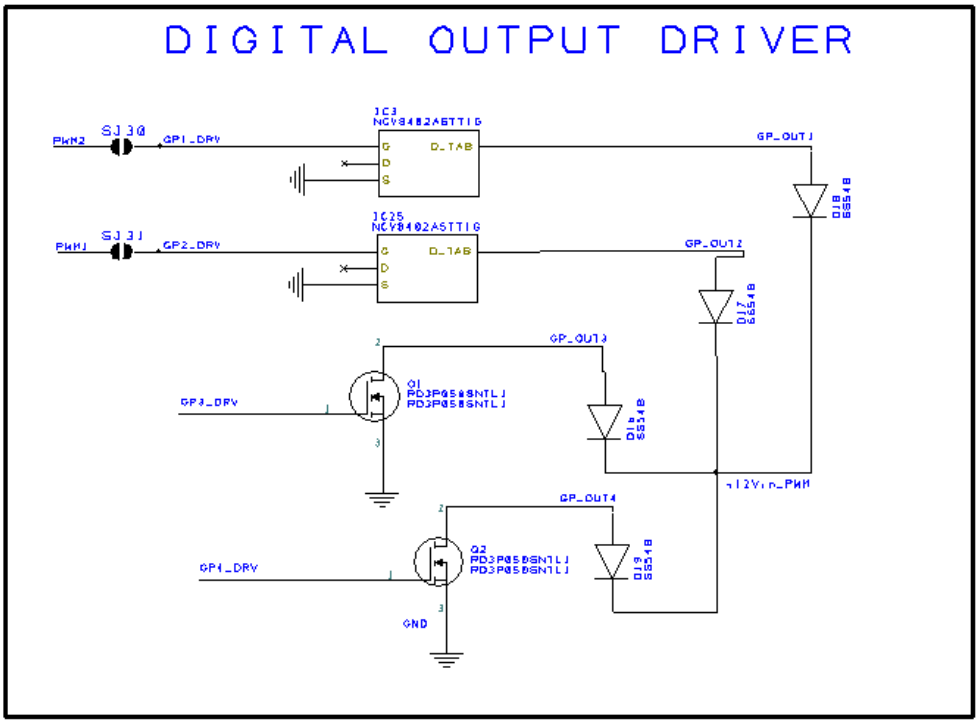
The +12Vin_PWM is fused on the board with an SMD fuse (5A Chip Fuse 19mΩ Slow Blow 2410 Surface Mount Fuses ROHS);
All outputs are diode (relais) protected so **connect** the +12Vin_PWM pin to coil supply line.

- The +12Vin is diode polarity protected;
- The GP_OUTx are sinking outputs. A pull-up can be activated (HW2.0 only) with a jumper on the print (default 4K7), power comes from fused PWM main connection;
- CCMxP / CCMxN the string connections from the MC33664 to the Battery daisy chain. 1:1 Positive to Positive and Negative to Negative.

## Digital Outputs



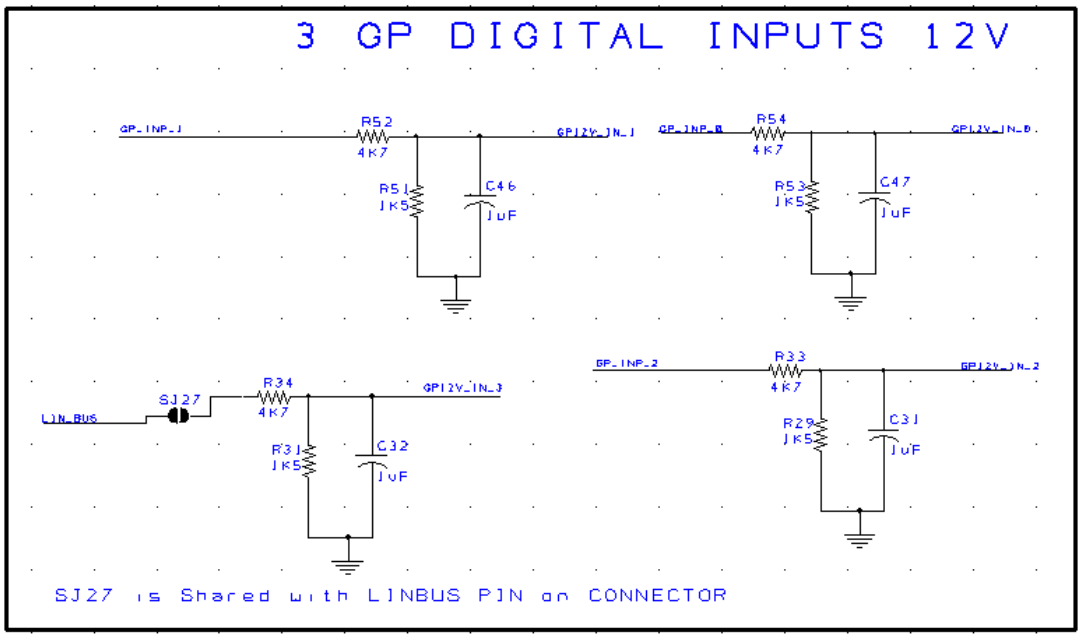

**Note: HW2.0 | Outputs are current sinking (switching low side), as of HW V3.0 pull-ups are replaced with diodes.**




**Note: HW3.0 | Outputs are current sinking (switching low side) with fly-back diodes onboard, connect +12Vin_PWM to coil supply;**

**Attention! : Depending on wire lengths and thickness this might <u>not</u> be sufficient, please make sure the output stage is protected.**

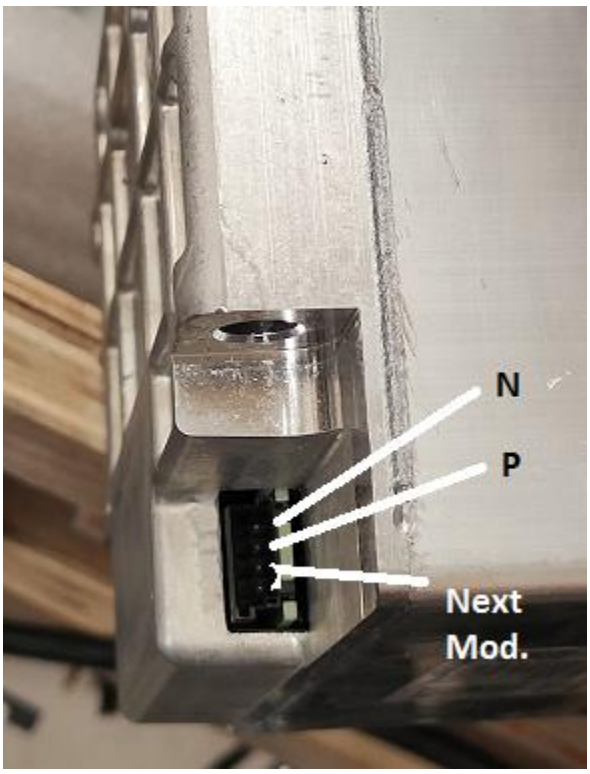
## Digital Inputs




**Note: Due to density on the PCB a simple filter and voltage divider forms the input circuitry. +14.4VDC is maximum! (Change resistors R52/R54/R34/R33, 0508 package, if higher voltage is desired). PCB V2.0 design, by default only 3GP_INPUTS are connected to CPU.**

# Connecting a battery module

## Porsche TayCan

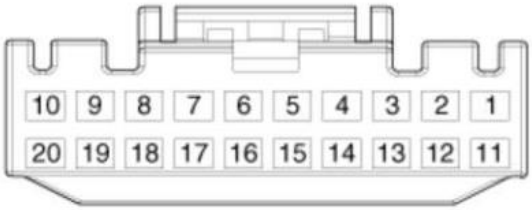



The CCMx_N pin from the controller goes to the TOP pin in this picture.
The CCMx_P pin goes to the second pin (P pin). The next module is connected to pin 3 and pin 4.

At the time of writing the TayCan battery supports:

- Module voltage;
- Cell voltages;
- 2 Temperature sensors;
- 1 Chip temperature;
- Cell balancing;
- Temperature latch bits;
- Voltage latch bits;

## Hyundai Kona


B Connector [B01-1B] (20pin)

Connector B has the 4 wires of the internal dataBUS, connection to the first module.

Connect as follow:

| Terminal on BMS B | Signal Name | On CMC MAX |
|---|---|---|
| 1 (Bl) | Module Nr1, TXNL | RxN (A3) |
| 2 (Rd) | Module Nr1, TXPL | RxP (A2) |
| 11 (BlWh) | Module Nr1, RXNL | TxN (B3) |
| 12 (RdWh) | Module Nr1, RXPL | TxP (B2) |

(Note: Hyundai nomenclature is used)

Each CMC (aka Device) has 4 incomeing connections and 4 outgoing connections to connect to the next modules incomeing port. In that way a ring is formed. It's important that the last module incorporates the loopback connection.

So please make sure its present in your loom.
The loopback connection makes sure the chain forms a ring:

| Signal Name | On Cell Module |
|---|---|
| Last Module Nrx, TXUN | Last Module Nrx, RXUN |
| Last Module Nrx, TXUP | Last Module Nrx, RXUP |

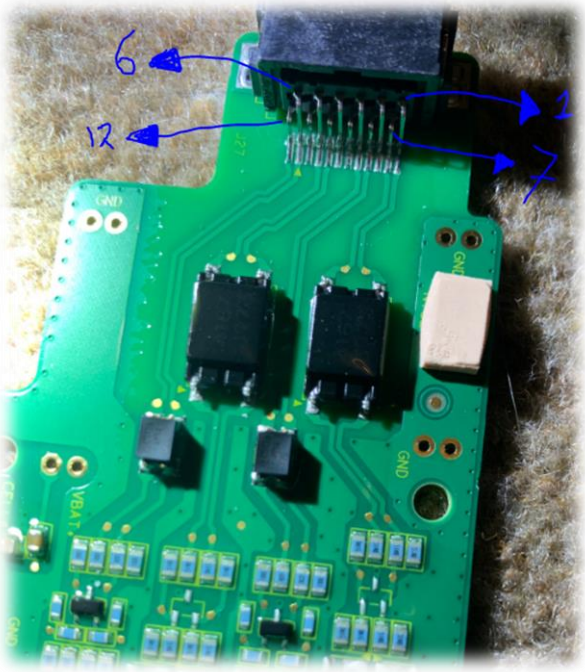
(Note: Maxim nomenclature is used)

## Peugeot E-208

MAX

| Pin Number | Signal Number | On CMC MAX (only to first module) | only last module |
|---|---|---|---|
| Pin 1 | RXNL | TxN (B3) | |
| Pin 2 | blank | | |
| Pin 3 | TXPL | RxP (A2) | |
| Pin 4 | blank | | |
| Pin 5 | goes to pin 8 on next Module; | | Bridge to Pin 12 |
| Pin 6 | goes to pin 7 on next Module; | | Bridge to Pin 10 |
| Pin 7 | RXPL | TxP (B2) | |
| Pin 8 | TXNL | RxN (A3) | |
| Pin 9 | blank | | |
| Pin 10 | goes to pin 3 on next Module; | | Bridge to Pin 6 |
| Pin 11 | blank | | |
| Pin 12 | goes to pin 1 on next Module; | | Bridge to Pin 5 |

If wired correctly a ring has formed with the CMC as first devices and in the last devices the circle is closed.




**[Source: OpenInverter.org]**

Wiring on the Modules, look at the rear of the connector plugged in the module the right way up.

Pin 1 Top Left, Pin 6 Top Right, Pin 7 Bottom Left, Pin 12 Bottom Right

# Interfaces

## CAN BUS

At the time of writing the CANBus data is present, by default, on the **EXT2** output (A4 and C3 pins). It's also distributed if the GUI is connected.

On initialization of the device, after the command is received, the battery string is explored for the configured devices.
If the configured amount of devices is found and configured with a default internal configuration the internal BMS state of the bgtw module will change to running. In the running state the values of the battery modules are cyclically (50mS) send over the CanBus @500Kbs.

| CAN ID | Direction | Description |
|---|---|---|
| 0x598 | IN | Listening for configuration |
| 0x599 | OUT | IO status; Input states, Output states etc. |
| 0x600 | OUT | This message sends the Battery module and Port number; It's like a header in normal comm.; Contains Module total voltage; Temperature etc. |
| 0x601 | OUT | Cell voltages |
| 0x602 | OUT | Cell voltages |
| 0x603 | OUT | Cell voltages |
| 0x604 | OUT | Muxed (1-5): Analog DAC voltages / Coulomb counter / Analog To NTC Celsius |
| 0x605 | OUT | Threshold Bits |

With parameters (CMD:0x5) the BMSPort can be moved and a different speed can be set for the **EXT** canbus port.

## Output Data description

The header file is available for implementation on the receiving end of the solution.

```
struct Canx599{
    uint8_t Inputs;
    uint8_t Outputs;
    uint16_t uint16_tPWM1;
    uint16_t uint16_tPWM2;
    uint16_t uint16_tPWM3;
};

* typedef enum {
   BMS_Unknown     = 0,                                                    //!< used by GUI
   BMS_Init        = 1,                                                    //!< init phase is assigning CID
   BMS_Config      = 2,                                                    //!< config phase applies initial loading of registers
   BMS_Running     = 3,                                                    //!< bms is running
   BMS_Sleeping    = 4,                                                    //!< bms is sleeping
   BMS_Error       = 5,                                                    //!< error phase
   BMS_Idle        = 6,                                                    //!< BMS_Idle
   BMS_Off         = 7,                                                    //!< BMS_Off
   BMS_ConfigMainCB    = 8,
   BMS_ConfigCellCB    = 9
TYPE_BMS_STATUS; */

struct Canx600{
    uint8_t  CID;                //block # in order of daisy chain & ( NUMBER OF MODULES FOUND << 4 )
    uint8_t  BMSNum;             //#of string connected to the device & ( TYPE_BMS_STATUS << 4 );
    uint16_t uint16_tStackVoltage;
    uint16_t uint16_tTChip;      //miliKelvin / bit
    uint8_t  uint16_t2;
};

struct Canx601{
    uint16_t uint16_tCell1Voltage;
    uint16_t uint16_tCell2Voltage;
    uint16_t uint16_tCell3Voltage;
    uint16_t uint16_tCell4Voltage;
};

struct Canx602{
    uint16_t uint16_tCell5Voltage;
    uint16_t uint16_tCell6Voltage;
    int32_t int32_tCurrent;    //6ma / bit
};
```

**Note:**

**When the device receives the module count config from the user control unit, it responses back with that number of modules (Message 0x600; byte 0; mask 0x0F); After the string is activated the config value will be overwritten with the actual number of modules found during discovery and subsequently programming of the modules.**

**This serves two purposes:**

1) **User can check if correct amount is configured before activation of the string (starting discovery);**
2) **User can check runtime if correct amount of modules has been identified on the bus (if the status is running, the value is valid);**

```
struct Canx603_1{
    uint8_t  datamux; //=0x1;
    uint8_t spare;
    uint16_t uint16_tAN1Voltage;
    uint16_t uint16_tAN2Voltage;
    uint16_t uint16_tAN3Voltage;
};

struct Canx603_2{
    uint8_t  datamux; //=0x2;
    uint8_t spare;
    uint16_t uint16_tAN4Voltage;
    uint16_t uint16_tAN5Voltage;
    uint16_t uint16_tAN6Voltage;
};

struct Canx603_3{
    uint8_t  datamux; //=0x3;
    uint8_t spare;
    uint16_t uint16_tAN7Voltage;
    uint16_t uint16_tspare;
    uint16_t uint16_tspare2;
};
```

```
struct Canx603_4{
    uint8_t  datamux; //=0x4;
    uint8_t  uint8_CBStatus; //the CellBalanceSwitchStatus is only 6BITS
    uint16_t uint16_tCCSamples;
    int32_t  int32_tCoulombCounter;
 };

truct Canx603_5{
    uint8_t  datamux; //=0x5;
    uint8_t uint8_tAN1Voltage;
    uint8_t uint8_tAN2Voltage;
    uint8_t uint8_tAN3Voltage;
    uint8_t uint8_tAN4Voltage;
    uint8_t uint8_tAN5Voltage;
    uint8_t uint8_tAN6Voltage;
    uint8_t uint8_tAN7Voltage;
};
```

```
struct Canx604{
    uint16_t uint16_tSpare;
    uint16_t uint16_tSpare2;
    uint8_t uint8_tThresholdUVBITS; //under voltage
    uint8_t uint8_tThresholdOVBITS; //over voltage
    uint8_t uint8_tThresholdUTBITS; //under Temperature
    uint8_t uint8_tThresholdOTBITS; //over Temperature
};
```

## Calculations

### [0x600 t/m 0x603]

```
if (msg.ID == 0x600)
{
    fieldnr = Convert.ToInt32(msg.DATA[0]);

    dgvBMS.Rows[PACKVOLTS].Cells[fieldnr + 1].Value = FormatS((((msg.DATA[2] << 8) + msg.DATA[3])  * 24.4414) /10000);
    dgvBMS.Rows[TCHIP].Cells[fieldnr + 1].Value = FormatS(((((msg.DATA[4] << 8) + msg.DATA[5]) * 32) /1000.0) -273.0);

}
else if (msg.ID == 0x601)
{
    dgvBMS.Rows[CELL1].Cells[fieldnr + 1].Value = FormatS(( ( (msg.DATA[0] << 8) + msg.DATA[1]) * 1.5259) / 10000);
    dgvBMS.Rows[CELL2].Cells[fieldnr + 1].Value = FormatS(( ((msg.DATA[2] << 8) + msg.DATA[3]) * 1.5259) / 10000);
    dgvBMS.Rows[CELL3].Cells[fieldnr + 1].Value = FormatS(( ((msg.DATA[4] << 8) + msg.DATA[5]) * 1.5259) / 10000);
    dgvBMS.Rows[CELL4].Cells[fieldnr + 1].Value = FormatS(( ((msg.DATA[6] << 8) + msg.DATA[7]) * 1.5259) / 10000);
}
else if (msg.ID == 0x602) {
    dgvBMS.Rows[CELL5].Cells[fieldnr + 1].Value = FormatS(( ((msg.DATA[0] << 8) + msg.DATA[1]) * 1.5259) / 10000);
    dgvBMS.Rows[CELL6].Cells[fieldnr + 1].Value = FormatS(( ((msg.DATA[2] << 8) + msg.DATA[3]) * 1.5259) / 10000);

    Int32 ti32 = 0;
    byte[] barr;
    barr = msg.DATA;

    ti32 = BitConverter.ToInt32(barr, 4);

    dgvBMS.Rows[CURRENT].Cells[fieldnr + 1].Value = FormatS((ti32 * 6) / 1000);

}
```

[0x604]

```
else if (msg.ID == 0x603)
{
    int mux = msg.DATA[0];


    //int temp = ((msg.DATA[0] << 8) + msg.DATA[1]);
    //dgvBMS.Rows[ANCELL1].Cells[fieldnr + 1].Value = FormatS((temp * 1.5259) / 10000);

    int temp = ((msg.DATA[2] << 8) + msg.DATA[3]);

    if (mux == 1)
    {
        dgvBMS.Rows[ANCELL1].Cells[fieldnr + 1].Value = FormatS( (temp * 1.5259) / 10000);

        temp = ((msg.DATA[4] << 8) + msg.DATA[5]);
        dgvBMS.Rows[ANCELL2].Cells[fieldnr + 1].Value = FormatS( (temp * 1.5259) / 10000);

        temp = ((msg.DATA[6] << 8) + msg.DATA[7]);
        dgvBMS.Rows[ANCELL3].Cells[fieldnr + 1].Value = FormatS( (temp * 1.5259) / 10000);

    } else if (mux == 2)
    {
        dgvBMS.Rows[ANCELL4].Cells[fieldnr + 1].Value = FormatS( (temp * 1.5259) / 10000);

        temp = ((msg.DATA[4] << 8) + msg.DATA[5]);
        dgvBMS.Rows[ANCELL5].Cells[fieldnr + 1].Value = FormatS( (temp * 1.5259) / 10000);

        temp = ((msg.DATA[6] << 8) + msg.DATA[7]);
        dgvBMS.Rows[ANCELL6].Cells[fieldnr + 1].Value = FormatS( (temp * 1.5259) / 10000);

    } else if (mux == 3)
    {
        temp = ((msg.DATA[2] << 8) + msg.DATA[3]);
        dgvBMS.Rows[CCSamples].Cells[fieldnr + 1].Value = temp.ToString();

        Int32 ti32 = 0;
        byte[] barr;
        barr = msg.DATA;

        ti32 = BitConverter.ToInt32(barr, 4);

        dgvBMS.Rows[CCounter].Cells[fieldnr + 1].Value = ti32;

    }
```

```
} else if (mux == 4)
{
    UInt16 tuin16 = Convert.ToUInt16((msg.DATA[3] << 8) + msg.DATA[2]);
    dgvBMS.Rows[CCSamples].Cells[fieldnr + 1].Value = tuin16.ToString();

    Int32 ti32 = 0;
    byte[] barr= new byte[8];
    barr = msg.DATA;


    ti32 = BitConverter.ToInt32(barr, 4);

    dgvBMS.Rows[CCounter].Cells[fieldnr + 1].Value = ti32;

    temp = (msg.DATA[1]); // + msg.DATA[4]);
    dgvBMS.Rows[CBStatus].Cells[fieldnr + 1].Value = Convert.ToString(temp, 2);

} else if (mux == 5)
{
    temp = (msg.DATA[1]);
    dgvBMS.Rows[ANTCELL1].Cells[fieldnr + 1].Value = FormatS((temp));// * 1.5259) / 10000);
    temp = (msg.DATA[2]);
    dgvBMS.Rows[ANTCELL2].Cells[fieldnr + 1].Value = FormatS((temp));// * 1.5259) / 10000);
    temp = (msg.DATA[3]);
    dgvBMS.Rows[ANTCELL3].Cells[fieldnr + 1].Value = FormatS((temp));// * 1.5259) / 10000);
    temp = (msg.DATA[4]);
    dgvBMS.Rows[ANTCELL4].Cells[fieldnr + 1].Value = FormatS((temp));// * 1.5259) / 10000);
    temp = (msg.DATA[5]);
    dgvBMS.Rows[ANTCELL5].Cells[fieldnr + 1].Value = FormatS((temp));// * 1.5259) / 10000);
    temp = (msg.DATA[6]);
    dgvBMS.Rows[ANTCELL6].Cells[fieldnr + 1].Value = FormatS((temp));// * 1.5259) / 10000);
    temp = (msg.DATA[7]);
    dgvBMS.Rows[ANTCELL7].Cells[fieldnr + 1].Value = FormatS((temp));// * 1.5259) / 10000);

}
```

## Scaling

| Data Parameter | Scale | |
|---|---|---|
| PACKVOLTS | 2.44148 | mV/LSB |
| CELLVOLTS | 152.58789 | µV/LSB |
| TCHIP | 0.032 | K/LSB |
| CURRENT | 0.6 | µV/LSB |
| CELL OV/UV | 19.53125 | mV/LSB |
| AN OT/UT | 4.8828125 | mV/LSB |
| | | |
| | | |

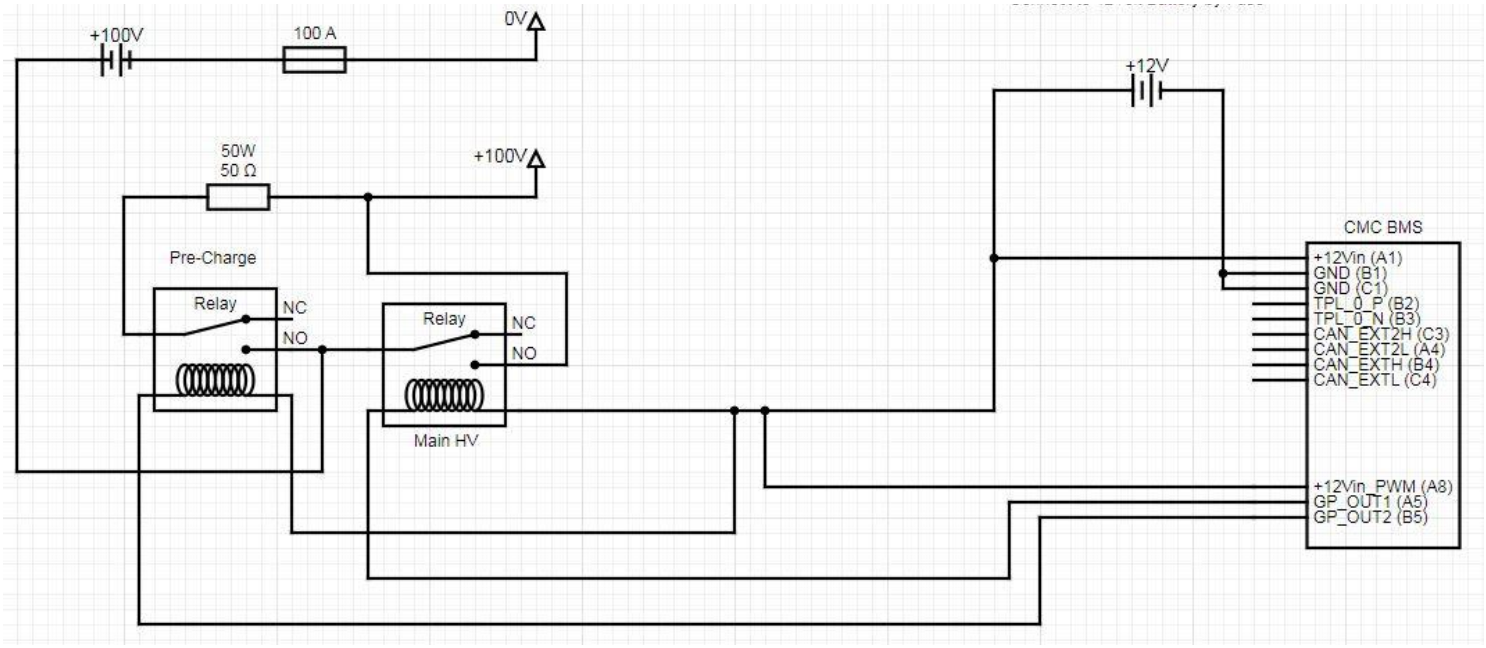
# Blue BMS / ESS BMS

## Additional Connections

| Pin | Function | Notes |
|---|---|---|
| GPOUT3 | Free Function 1 | +12VDC 5Amp max. economized coils only; |
| GPOUT4 | Free Function 2 | +12VDC 5Amp max. economized coils only; |
| | | |
| GPOUT2 | Main batterypack Coil, switch negative side of coil; | +12VDC 3Amp max. / current sinking; |
| GPOUT1 | Pre-Charge Coil, switch negative side of coil; | +12VDC 3Amp max. / current sinking; |
| | | |
| | | |

**Note:Recommended choice;**

## Basic Schematic




## ESS BMS Parameters / Configuration

In the GUI all present parameters can be loaded from the device. With the button [**GET Settings**].

For now all parameters are set by our support team. Please make an appointment to discuss your project and needs.

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