HP8440 Power Box

The Intelligent Power Distribution Module

Installation and User Guide for PCM Version 9.37

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1 Introduction

The Power Control Module is an innovative, intelligent and programmable module that replaces relays and circuit breakers, simplifies wiring harnesses and provides diagnostic capabilities.
The PCM is ultra-compact (197 x 107 x 46 mm including the Autosport connectors) and lightweight (only 710 Grams), providing an effective and inspired alternative to conventional relays, circuit breakers, fuses and wires that can so often be a tangle of complexity and untidiness around a typical racing car's power junction box.
The PCM exchanges data with other modules in the car primarily via CAN. It can be controlled entirely by CAN or by combining any of the 32 CAN channels and additional 11 digital input switches. By using CAN channels to activate inputs in the PCM as few as two wires could control the switching of the system's 34 outputs.
Its CAN communication is highly user-defined, allowing an optimum integration with other modules in the car - for example the engine management system, our switch panel, CAN expansion modules, dashboard (to display error messages and status) and data logging system.
20 virtual input channels based on any combination of conventional inputs, CAN channels or outputs are also available, used to create logic links.

18 high power channels are available, each offering maximum peak current in excess of 35-65 amps and individual adjustable peak current time of up to 10 seconds.
Please note that the current draw per channel is limited by the connector - not by the driver stages. Each driver stage can handle in excess of 35-65 amps continuously.
We have rated the individual channel's current draw in relation to the connector manufacturer's specifications**.**
Additionally, 16 low power channels are available for secondary power supply.

Channel names, types of activation (toggle or momentary, pulse), switch configuration and current trip values (in 0.1 amp steps) are user-configurable.
In its basic configuration the PCM is programmed to shut down overloaded channels. It is, however, possible to override this function and to program the module to reset automatically a number of times within a programmable time interval.
A manual reset function of all overloaded channels is also available.
The current draw status for the module and diagnostics for each channel can be logged via CAN. In addition, the power consumption of each high power channel can be monitored and exported via CAN to the vehicle's data logging system.

The PCM's programmability enables not only channel cut at specific currents, but also, for example, high initial peak current draw followed by a decrease to a lower, steady threshold level. So, something like an assisted gearshift compressor with a high startup current can be catered for without simply fitting a high rated fuse or circuit breaker.
The PCM's intelligence also enables the user to deactivate non-essential channels in the case of low battery voltage and it has a dedicated engine start feature to shut down circuits not needed during engine start.

Please note that the PCM is not intended to be used to control safety-critical systems on a vehicle, such as ABS braking, power steering, etc.
HP ELECTRONIK shall not be responsible for any incidental or consequential damages or injuries that may occur if the unit is used to control these, or similar, safety-critical systems.

2 Hardware

The PCM enclosure is CNC machined to the highest standards.
The two parts of the casing are sealed by an O-ring, located in a recess in the lower half. A lip in the upper casing presses on the O-ring and assures a water tight sealing. O-rings are also used around each of the four connectors and the tapped holes for the connector mountings are not drilled through the casing.

Connector 1 is a Deutsch Ltd. Autosport Heavy Duty single pin connector, type ASHD014-1PN. This is a specially developed connector, designed to conduct very high currents with very low losses and to withstand very high temperatures.
The mating connector on the wiring loom must be ASHD614-1SN-C35.

Connector 2 is a Deutsch Ltd. Autosport connector, type AS014-97 SN. This connector has four size AWG 16 socket contacts and eight size AWG 20 socket contacts.
Deutsch Ltd. rates the AWG 16 contacts at 20 Amps and the AWG 20 contacts at 7.5 Amps. The PCM uses each of the AWG 16 contacts for a single output driver. Four of the AWG 20 contacts are connected as two pairs, each pair connected to one output driver. In this way some channels can be rated at 15 Amps.
The mating connector on the wiring loom must be AS614-97PN – (red ring).

Connector 3 is a Deutsch Ltd. Autosport connector, type AS014-97SA. It has a different keyway compared to connector 2, preventing incorrect connections.
This connector has four size AWG 16 socket contacts and eight size AWG 20 socket contacts. Deutsch Ltd. rates the AWG 16 contacts at 20 Amps and the AWG 20 contacts at 7.5 Amps.
The PCM uses each of the AWG 16 contacts for a single output driver. Four of the AWG 20 contacts are connected as two pairs, each pair connected to one output driver. In this way some channels can be rated at 15 Amps.
Two contacts (pin F and pin H) are Power Ground connections and must be connected to Ground.
The mating connector on the wiring loom must be AS614-97PA – (yellow ring).

Connector 4 is a Deutsch Ltd. Autosport connector, type AS014-35SN. This connector has 37 size AWG 22 contacts and is used for the low power output channels, for the conventional input switches, and for USB and CAN communication.
Deutsch Ltd. rates the AWG 22 contacts at 5 Amps.
The mating connector on the wiring loom must be AS614-35PN. (red ring)

Regarding Tools for the connectors – please download the Technical Brochure from Deutsch –
It can be found on www.hpelec.dk in the Download section.

Please note, the current values written in this manual are based on our own and our clients experience of the current draw in practical, we have much higher load on cables and connectors than the technical brochure advices, without any problems at all. It is of course important that loom and connectors are kept in good conditions to be able to make higher current draw.

3 Software installation

The software can be installed either from a software CD, provided with the PCM or downloaded from our web site – http://motorsportelectronic.com/

3.1 Software installing from a CD

Ask us for a CD Rom – Normally all files is to find on our website

3.2 Software installation from web-download

It is possible to download the PCM software from our web site. Go to http://motorsportelectronic.com/download.html and please select the Download tab.

When you have downloaded the PCM software, open the folder where you saved the file and double click on the installation file.

PC Software and Firmware Releases
For feature updates, please visit the site to get the latest information.

3.3 Connection to system

Communication with the PCM is established using a conventional USB cable. No dongle or interface is required.

HP ELECTRONIK or your wiring loom manufacturer can provide you with the cable suitable for your installation and selected connectors.
First time you plug your cable in, Windows will install some drivers. Wait until you see that drivers are installed. After this, click CONNECTION in the main menu, click the proposed USB connection in the communication window and then click OK.
This procedure is done for each new PCM you connect to and for each USB port used. Once installed, the definitions are stored on your PC and used next time you connect to a particular PCM.

The software opens in the GENERAL section.

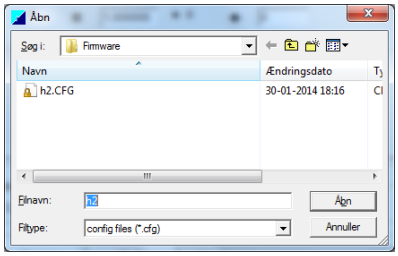
If you disconnect from the system, communication will be re-established when you plug the cable in again.

4 Main Menu

The software main menu has 4 sections:

4.1 File

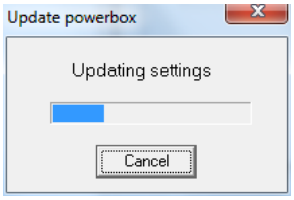
You can open an existing configuration file by clicking on FILE and then select OPEN.



Files are located in this folder: C:\Program Files (x86)\HPelec\HP8440.Vxxx\Config

You can save a configuration file on your PC by clicking on FILE, then SAVE. Now select the folder where you want to save the file (by default C:\Program Files (x86)\HPelec\HP8440.Vxxx\Config), type a file name and click OK.

You can read the PCM configuration file by clicking on READ or by pressing F8.



You can send a new configuration from your laptop to the PCM by clicking on UPLOAD or by pressing F9.

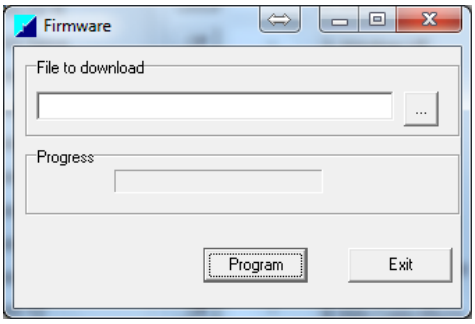
You can discard all changes and revert to the PCM default configuration file by clicking on DEFAULT SETTINGS.

4.2 Connection

Click here to establish a link between your PC and the PCM.
When connected, the PCM configuration file is loaded and displays the PCM status in real time in the General tab.
The PCM's configuration file will be loaded automatically when you establish communication.

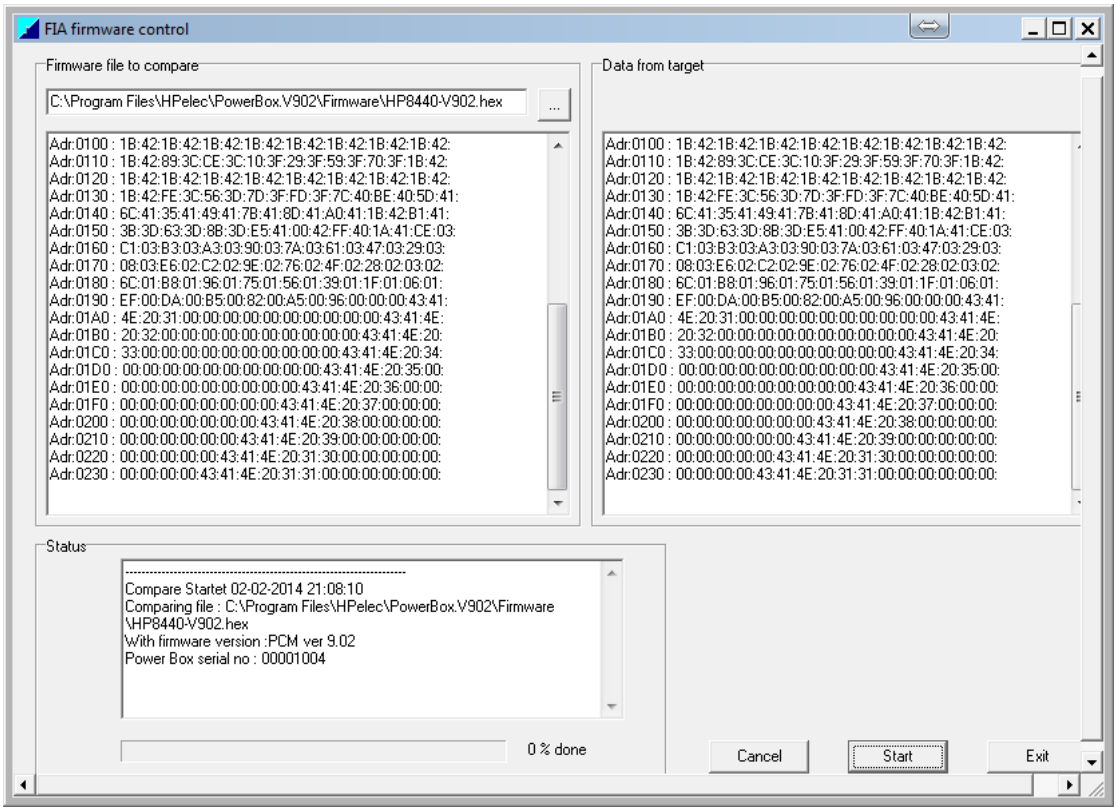
4.3 Tools - Firmware

Use this option only when you want to update the PCM firmware.
If no connection to the PCM is established, a warning message will appear. Connect to the PCM. A window called FIRMWARE opens. If the correct firmware file name is not displayed in the "File to Download" window, click the button on the right of this window.
Browse for the correct file.
When the selected firmware is displayed, click "Program". Switch the PCM OFF, then ON to send the firmware.
Once the firmware is sent, reset the module by switching power off for some seconds and then switch it on again.



4.4 Tools - FIA

The Power Control Module is homologated by FIA for use in touring cars.
This section is for use by FIA scrutineers to verify the legality of the PCM firmware.



4.5 Help

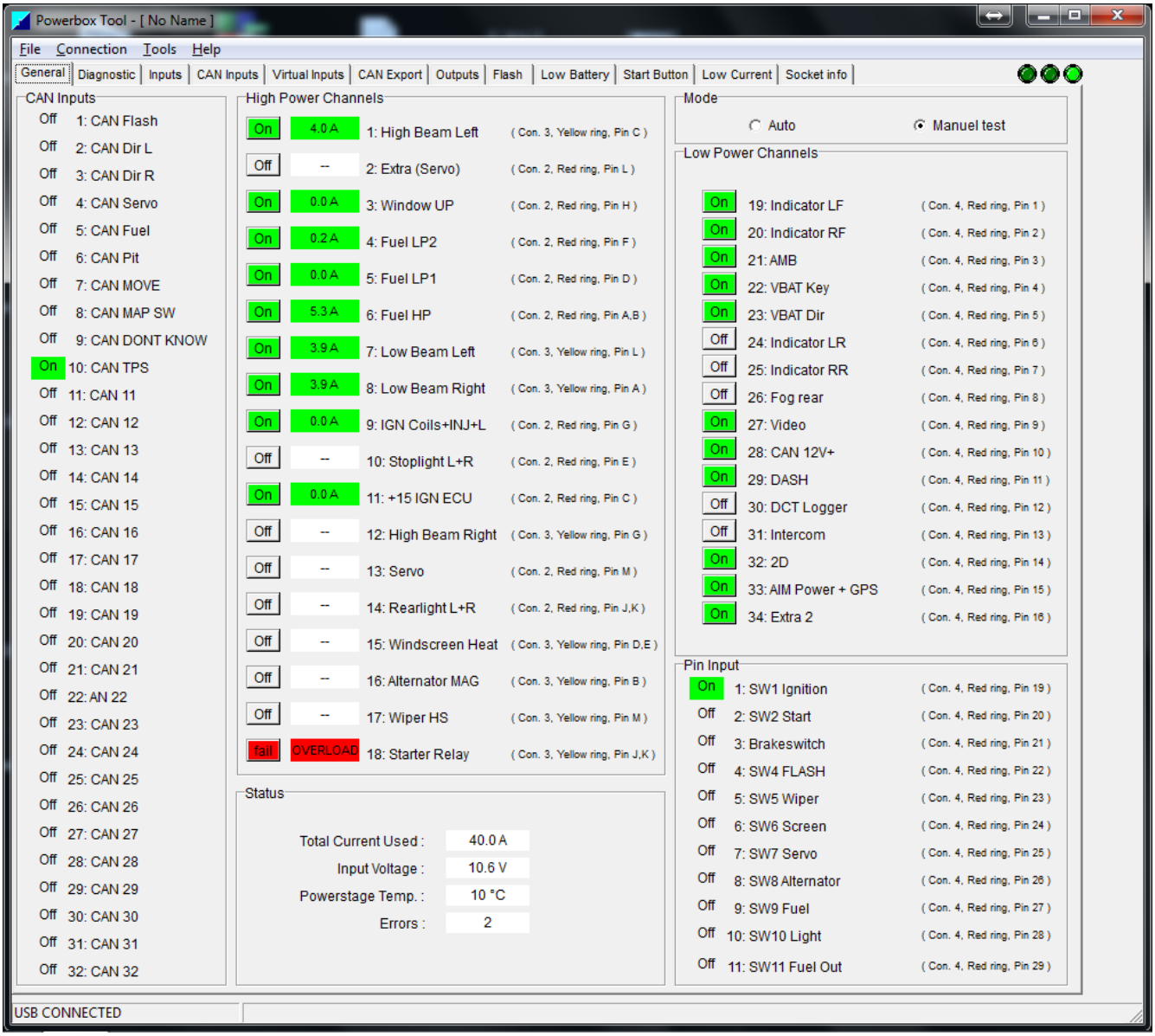
Click HELP, then ABOUT to see the PC software version in use and to see which firmware is currently loaded into the PCM.

5 General

Connecting to the PCM when it is switched ON, the software reads the configuration file from the PCM and displays data in the General tab in real time.

The left section displays an overview of configured input channels and the status of the input channels. When a switch is ON, the window displays ON in a green window for each switch.

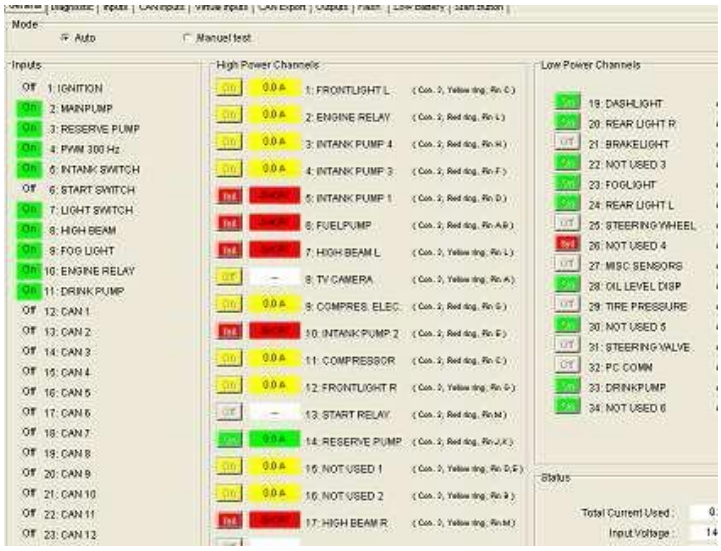
The center section shows the status of the HIGH power channels.
If a channel is switched ON, the button color changes to green and displays ON.
Next to the button each channels current draw is displayed in real time if switched ON. The system checks for overload and short circuitry. Color coding is used to show the individual channel status:



- The channel status button and current draw window color is green for active, non-faulty channels.

- The channel status button and current draw window color changes to yellow if the system has detected an error since the last reset of the diagnostics.

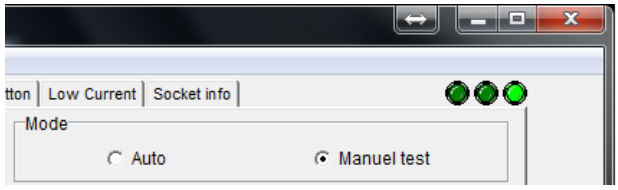
- The channel status button and current draw window color is red if a fault is detected and still present. The button will display FAIL and the window displays for example SHORT.



The right section shows the status of the LOW power channels.

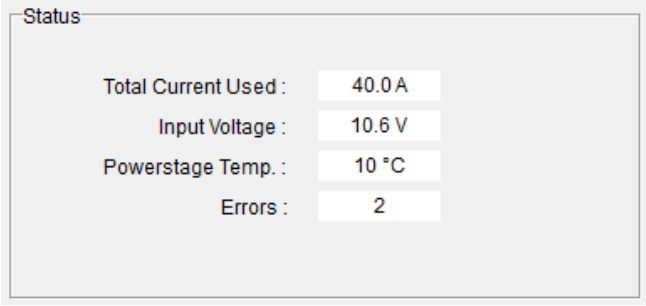
- The channel status button color is green for active, non-faulty channels.
- The channel status button color is red if a fault is detected and still present. The button will display FAIL.

The "*Auto*" setting displays status of the system switches. Switching to "*Manual*" overrides external or CAN switches. Manual mode allows toggling channels on/off using the button to the left of the channel name window for testing purpose.



The Status window in the lower area of the General tab displays vital PCM information in real time:

- Total current draw
- Battery voltage
- Actual temperature of the driver stages
- Number of recorded errors

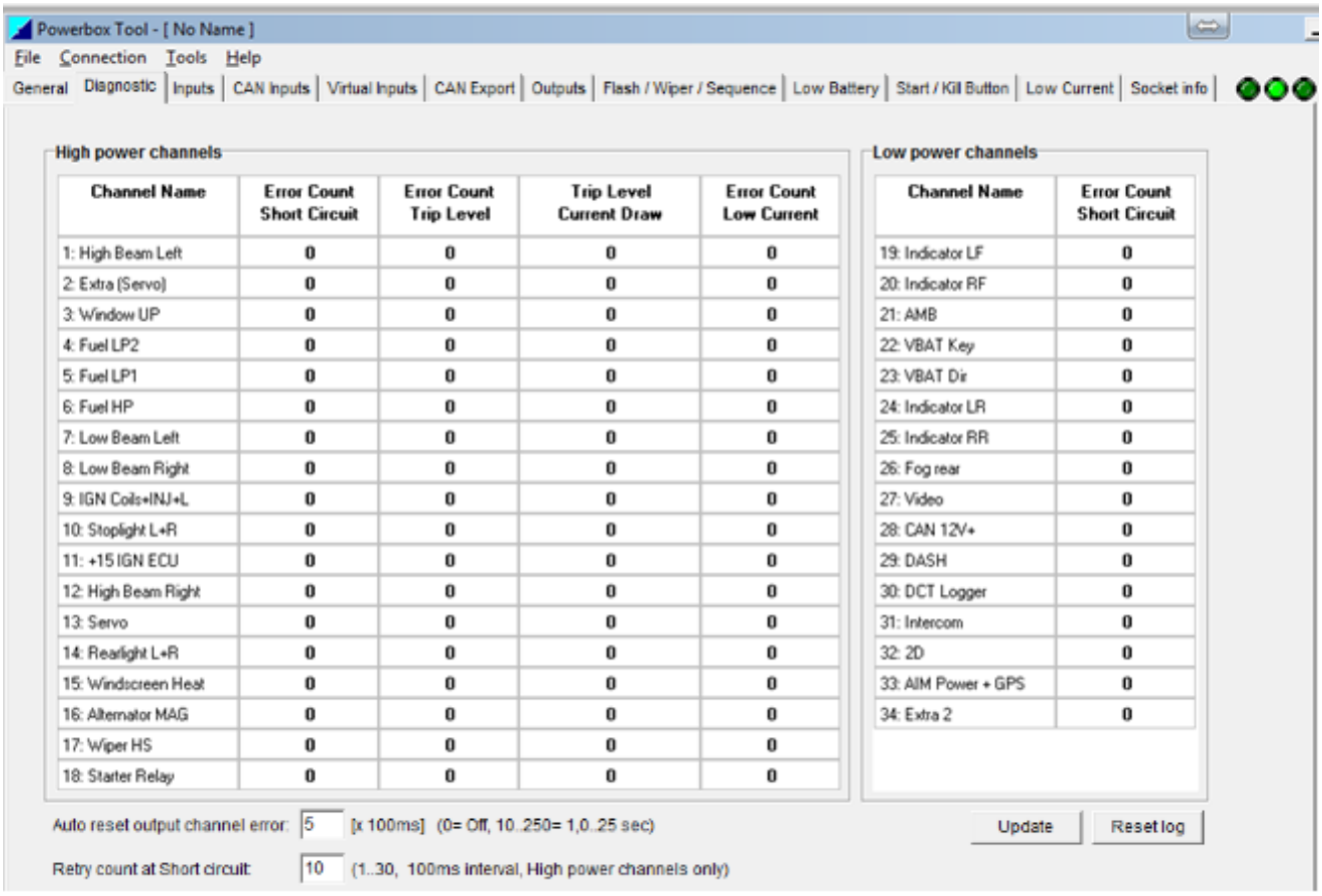


If you disconnect from one PCM and then re-connect to another module, the screen is cleared automatically and re-loaded once connection is established to the next PCM.

A status bar with 3 green LED's is located in the upper right-hand corner of the screen and displays the PCM's connection status.

6 Diagnostic

Click the Diagnostic tab to see the channels status, fault code and max recorded current at the moment when the fault happened.



Channel Name	Error Count Short Circuit	Error Count Trip Level	Trip Level Current Draw	Error Count Low Current
1: High Beam Left	0	0	0	0
2: Extra (Servo)	0	0	0	0
3: Window UP	0	0	0	0
4: Fuel LP2	0	0	0	0
5: Fuel LP1	0	0	0	0
6: Fuel HP	0	0	0	0
7: Low Beam Left	0	0	0	0
8: Low Beam Right	0	0	0	0
9: IGN Coils+INJ+L	0	0	0	0
10: Stoplight L+R	0	0	0	0
11: +15 IGN ECU	0	0	0	0
12: High Beam Right	0	0	0	0
13: Servo	0	0	0	0
14: Rearlight L+R	0	0	0	0
15: Windscreen Heat	0	0	0	0
16: Alternator MAG	0	0	0	0
17: Wiper HS	0	0	0	0
18: Starter Relay	0	0	0	0

Channel Name	Error Count Short Circuit
19: Indicator LF	0
20: Indicator RF	0
21: AMB	0
22: VBAT Key	0
23: VBAT Dir	0
24: Indicator LR	0
25: Indicator RR	0
26: Fog rear	0
27: Video	0
28: CAN 12V+	0
29: DASH	0
30: DCT Logger	0
31: Intercom	0
32: 2D	0
33: AIM Power + GPS	0
34: Extra 2	0

The diagnostic screen is divided into two windows, one for the high power channels and one for the low power channels:

- **Error Count Short Circuit** displays the number of times the channel has been short circuited to ground.
- **Error Count Trip Level** displays the number of times the current draw has exceeded the trip level entered for that particular channel. The error count is activated AFTER the set peak time has expired.
- **Trip Level Current Draw** displays the maximum current drawn from the failing channel just before the channel shuts down.
- **Error Count Low Current** displays how many times the current draw for specific channels has dropped below the normal level defined at the “Low Current” tab.

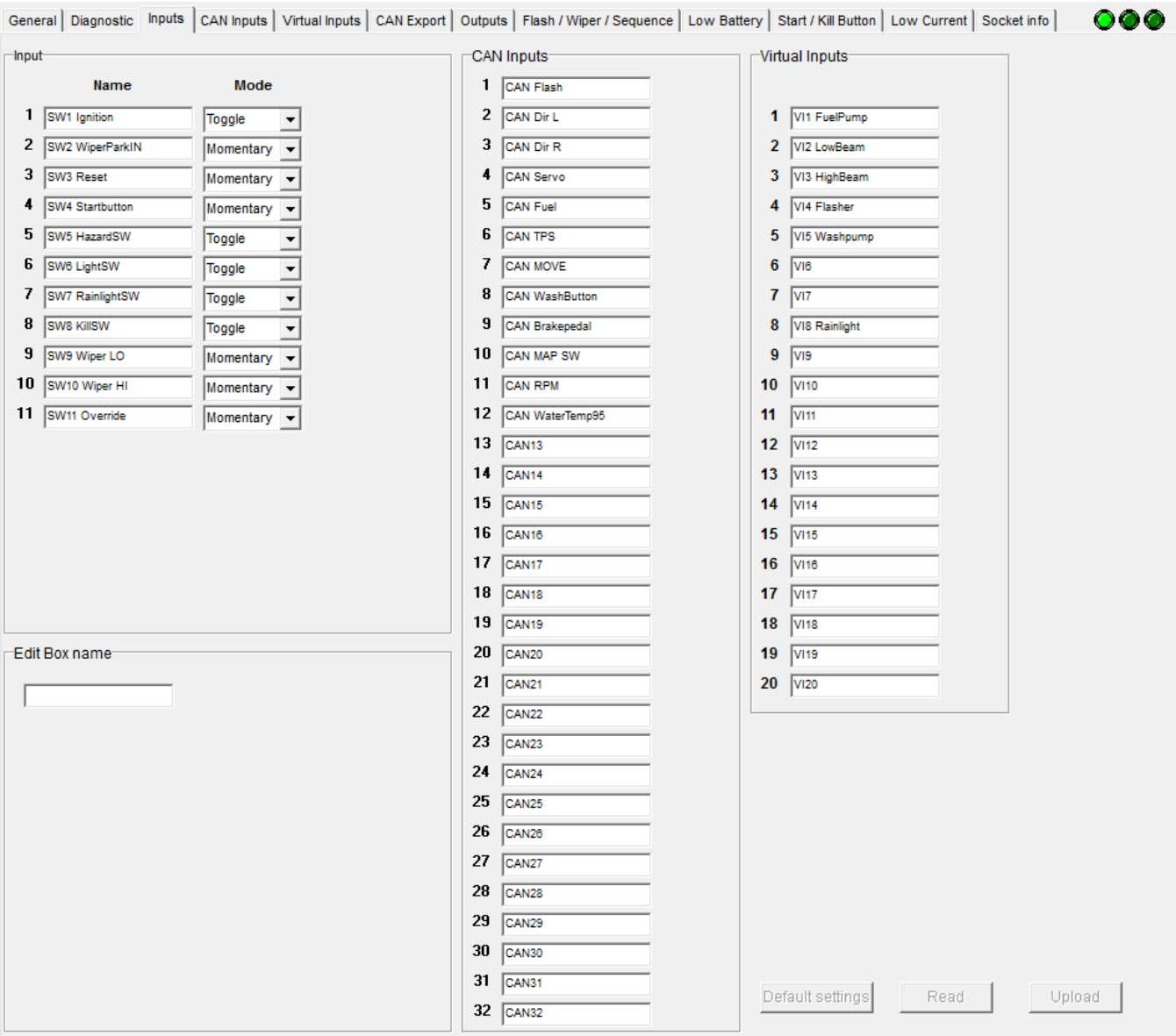
On the bottom of the page you may define an optional automatic reset function for high power channels:

- **Auto reset output channel error**: the time between retries when a fault is detected
- **Retry count at Short circuit**: how many retries to reactivate the output will be done on tripped channels

Note: low power channels will always try to auto-reset for 15 times within a few seconds before they are switched off until a user reset happens.
After a fault has been detected and corrected, the diagnostic counters can be reset by clicking the button “Reset Log”.

7 Inputs

The Power Control Module has 11 inputs from conventional switches and 32 inputs via CAN. Additionally, 20 virtual channels can be created, combining any input and output channels to generate logic switching conditions.
Flashing outputs are defined in a separate section.



With **Edit Box Name** you can label the actual Power Control Module, for example “Car 1”.

The conventional inputs are digital channels. The standard configuration of the PCM only accepts connections switching to ground (except Switch #1 which has to switch to battery voltage to activate), either to enable or to disable a channel.
These inputs can be controlled by either manual external switches or by programmable outputs from the engine management system and data logging modules.

The intention with the PCM is to simplify the wiring installation as much as possible.
If you use the digital switches, you have to connect up to 11 signal wires to the module. But if you choose to control the PCM via CAN, you can control all functions, using only a 2-wire data bus.
HP ELECTRONIK can supply A/D-to-CAN converter modules, which converts for example 6 analogue inputs to CAN channels.

You can rename all available input switches in this section, conventional switches, CAN and virtual channels. Click on the switch window and type the name you want to assign to each individual switch.

You can define the functionality of each conventional input switch (NOTE: There was a change of the input logic so the following description accounts for software/firmware version V9.33 and newer).

- In **Toggle** mode the channel switches ON when the switch briefly gets activated. Pressing the switch once again, making a brief contact switches the channel OFF. This means it is edge-triggered and used for example when momentary pushbuttons should act as latching switches.
- In **Momentary** mode the channel is ON only while the switch input is active.

The trigger signal from either type of switch must be present in excess of 20 msec to be recognized as a valid trigger signal.

Pin Configuration Conventional Input Switches

Switch	Connector 4	Pin	active when	approx. threshold value
1	14-35 red	19	connected to +12V	active when > 4.5 V
2	14-35 red	20	connect to GND	active when < 3.5 V
3	14-35 red	21	connect to GND	active when < 3.5 V
4	14-35 red	22	connect to GND	active when < 3.5 V
5	14-35 red	23	connect to GND	active when < 3.5 V
6	14-35 red	24	connect to GND	active when < 3.5 V
7	14-35 red	25	connect to GND	active when < 3.5 V
8	14-35 red	26	connect to GND	active when < 3.5 V
9	14-35 red	27	connect to GND	active when < 3.5 V
10	14-35 red	28	connect to GND	active when < 3.5 V
11	14-35 red	29	connect to GND	active when < 3.5 V

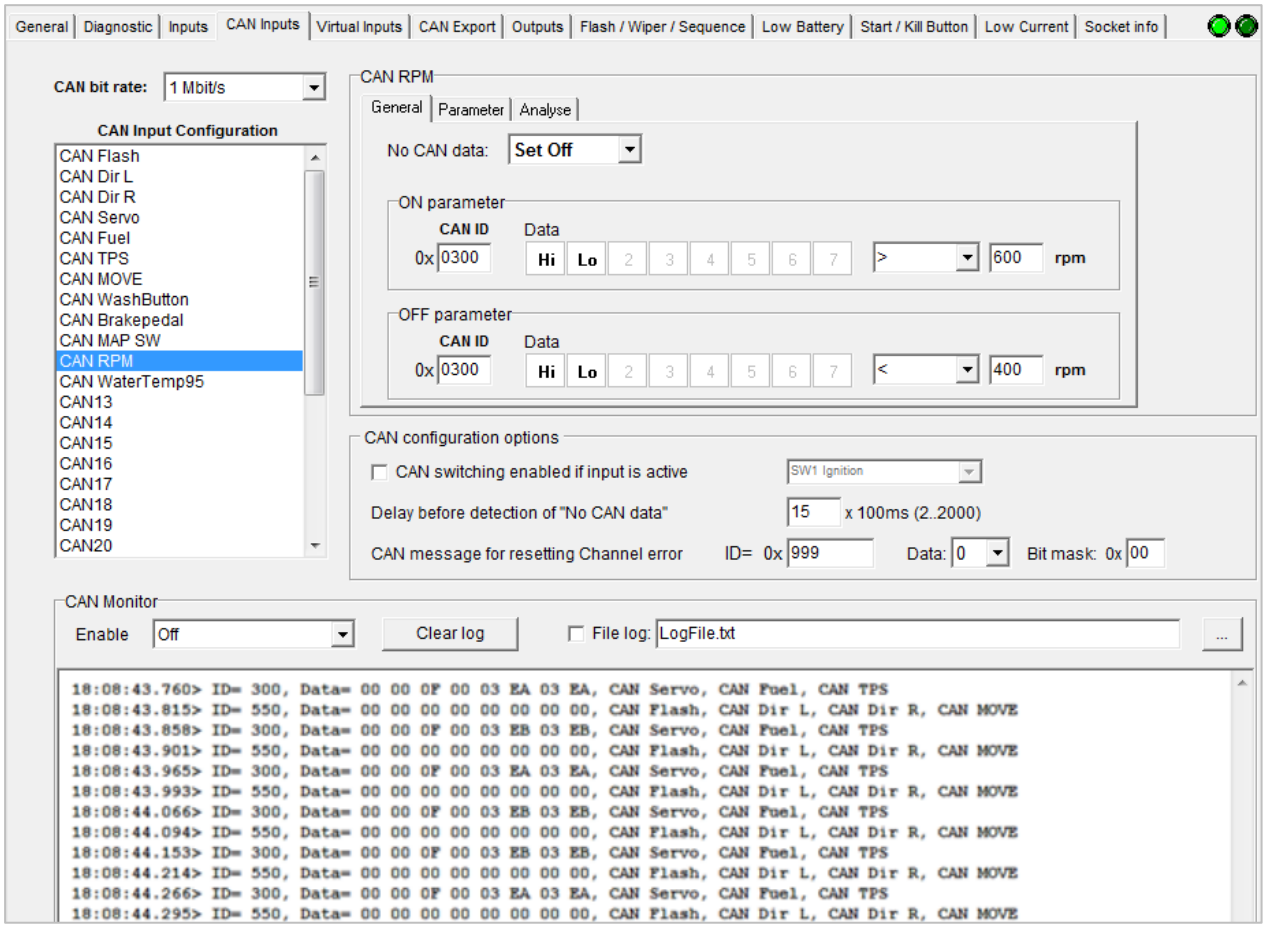
8 CAN Inputs

The PCM CAN bus is configured according to the 2.0B protocol, using 11 bit identifiers and Motorola or Intel data format. The CAN line is NOT terminated internally.

8.1 General

There are no limitations to the numbers of CAN identifier selected. Each of the 32 available CAN inputs can use a unique identifier. Identifiers don't have to be arranged in special groups.
The ID is specified in hex, for example 0x0300, and contains 8 bytes of information.

CAN speed can be selected in the *CAN bit rate* menu, the box supports 500Kbit/s and 1Mbit/s rates.



Section **CAN configuration options**:

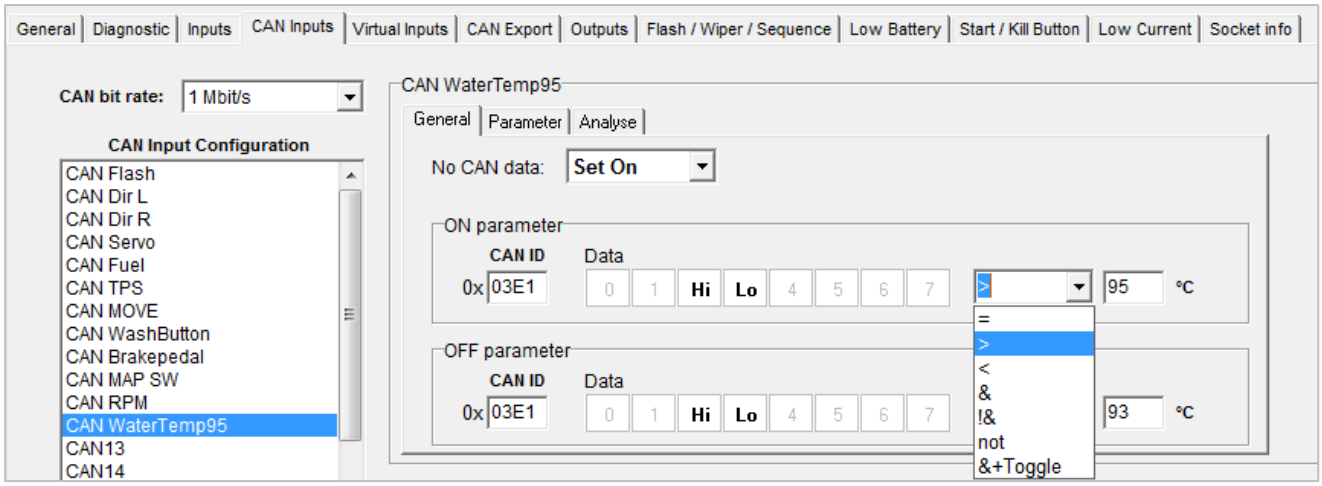
- You may assign a master switch channel for CAN. Tick the box *CAN switching enabled if input is active* and select one of the 11 conventional input switches. In this configuration, the CAN messages are only used when the selected digital channel is switched ON.
- All CAN switching is disabled if the time interval between messages on the CAN bus is longer than *Delay before detection of "No CAN data"*
- Optionally a specific *CAN message for resetting channel errors* can be defined. If reset by a CAN message isn't used then simply use an ID that isn't in use and additionally set the Bitmask to 00. This assures that no unwanted error reset happens from CAN messaging.

By ticking the ENABLE box in the **CAN Monitor** window the software can show CAN traffic in the *CAN Monitor* window. It is possible to select between different filters, which helps to analyze the CAN traffic. Furthermore a log-to-file function is also available.

8.2 Configuring a CAN Input

Refer to the CAN specifications for the modules in use and select the channels desired.
Specify the ID for the channel and the channels position within that particular ID. This position is defined by one byte (marked LO) for an 8 bit channel or by two bytes (marked HI and LO respectively) for a 16 bit channel.
Click on the numbers in the **Data** area to select the desired channel position. First click assigns the LO byte location, the next click on another number sets the HI byte position (to the left of the LO byte for Motorola format (Big Endian), or to the right of the LO byte for Intel format (Little Endian)).

The following screenshot shows an input named *WaterTemp95* with CAN ID 0x03E1. The parameter water temperature is transmitted within Byte 2+3 in big endian format (Motorola). The LO byte therefore is positioned on byte 3 and then HI on byte 2.

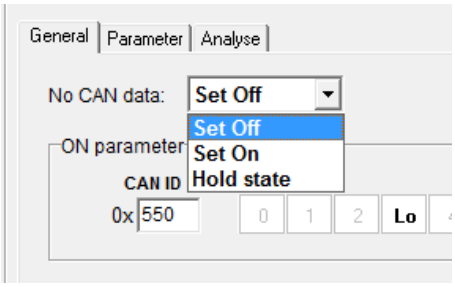


It is possible to specify the following conditions:

= activate or deactivate if the channel value is equal to the selected value
> activate or deactivate if the channel value is greater than the selected value
< activate or deactivate if the channel value is less than the selected value
& logic “and” - bit wise operator addressing individual bits within a selected byte
!& logic “not” - bit wise operator addressing individual bits within a selected byte
not byte condition defining any value but the one selected
&+Toggle uses bitwise operator and sets the opposite state of what it is at that moment

In case the CAN traffic stops there is the possibility to keep the CAN channel in different states (for example because of a broken CAN line).
Please set the **No CAN data** option for each CAN input:

- *Set Off*: Sets the CAN channel state to OFF in case of loss of communication
- *Set On*: Sets the CAN channel state to ON in case of loss of communication
- *Hold state*: Holds the channel at the state it was before loss of communication (example light switch: with *Hold state* the headlight will not turn off in case it was active before loss of communication).



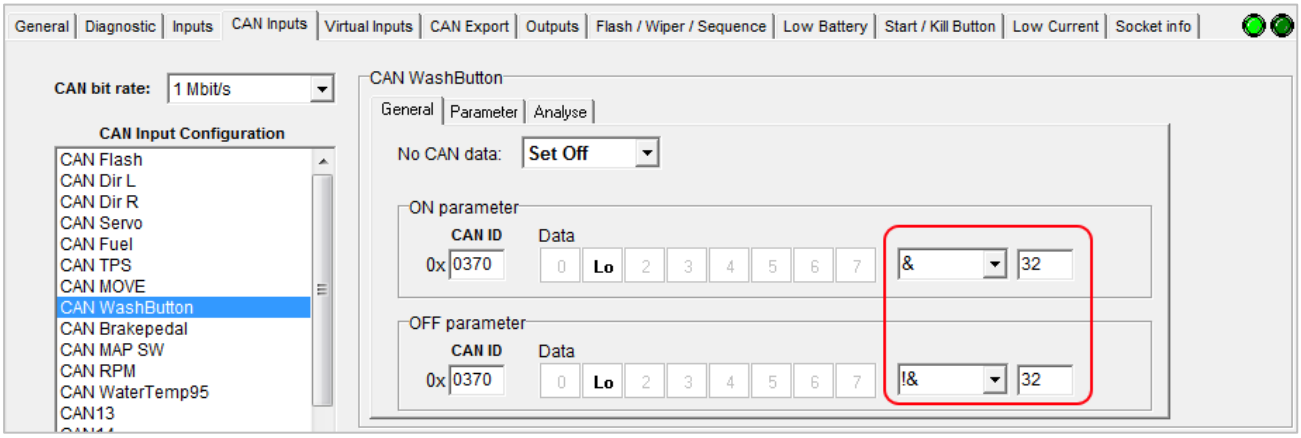
8.3 Bit Wise Operator for single bits

Using the built-in bit wise operator it is possible to address each individual bit within a selected byte. Use the **&** condition as the activation parameter and the **!&** as the de-activation parameter. Each individual bit within a single byte can be addressed by using the corresponding value:

- Bit 0 is identified by value 1
- Bit 1 is identified by value 2
- Bit 2 is identified by value 4
- Bit 3 is identified by value 8
- Bit 4 is identified by value 16
- Bit 5 is identified by value 32
- Bit 6 is identified by value 64
- Bit 7 is identified by value 128

Example (see picture down below for reference):

- let's assume a signal for the windscreen-washer button is transmitted on CAN as a single bit located at:
  - CAN ID 0x370
  - Byte 1
  - Bit 5
- The ID and byte configuration is the same as always. However to address just a single bit from within the byte we have to use the symbol **&** for the ON condition and **!&** for the OFF condition.
- Furthermore as listed above Bit 5 corresponds to a value of 32, which needs to be entered accordingly.
- The result is that when Bit 5 of byte 1 is received and true then the CAN input *CAN_WashButton* is ON, when this bit is false then *CAN_WashButton* is OFF.



It would also be possible to use different bits to switch on and off where one could be the ON parameter and then another bit would be used for the OFF parameter (in this case the "&" symbol would be used for both the ON and OFF parameter but with different values to make use of whatever bits are needed). This kind of method however is not very common in real life situations and hardly used.

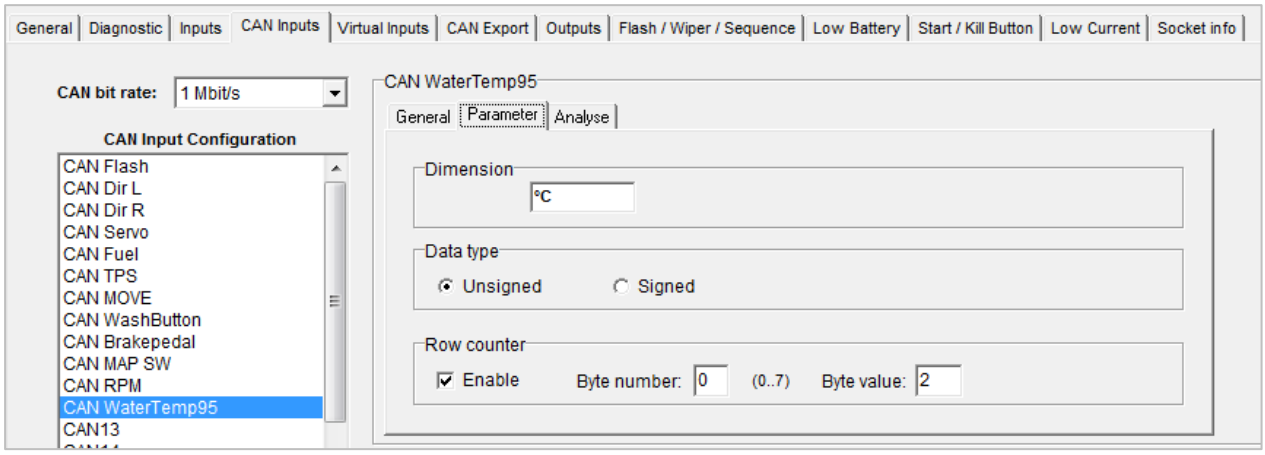
8.4 Parameter

The unit which is shown on the “General” tab next to the entered value can be specified within the **Dimension** field. This doesn’t have any effect to the system at all and is purely for easier understanding during the setup process.

With **Data type** the bytes are treated as *“Unsigned”* by default. This means that data is read in bits from 0..255 or 0..65535 for example.
If a data channel is transmitted using the signed format, then tick the box *“Signed”*.

The PCM can be controlled by an advanced CAN bus using **Row counters**, sometimes also referred to as multiplexed CAN or compound message.
It is possible to assign any byte as the row counter and then to assign the required byte to control the switching.
Tick the box *Row counter Enable* to enable the use of rolling data channels in the CAN bus.

- In **Byte number** type the byte number used as row counter.
- In **Byte value** type the row count number in which the desired data channel is found.

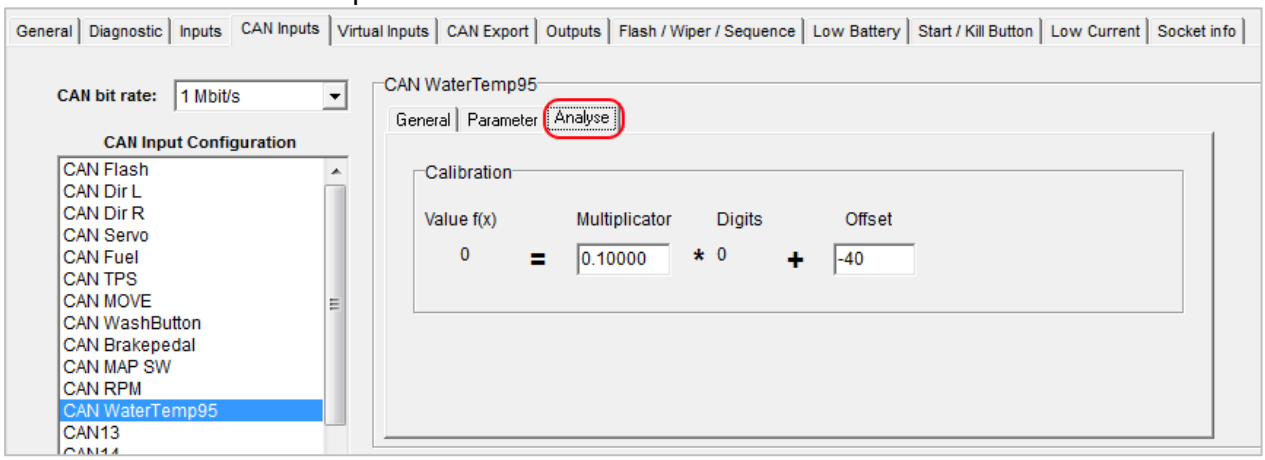


8.5 Analyze

Use this section to scale the raw data input to an engineering unit for easier understanding during the setup process of the PCM. The values entered within the *General* tab will only make sense when the scaling is entered correctly here in the *Analyse* section too.

Example:

- An ECU transmits a temperature sensor with a resolution of 0.1°C per bit starting at -40°C
- Therefore the multiplication factor is 0.1 and the offset is -40

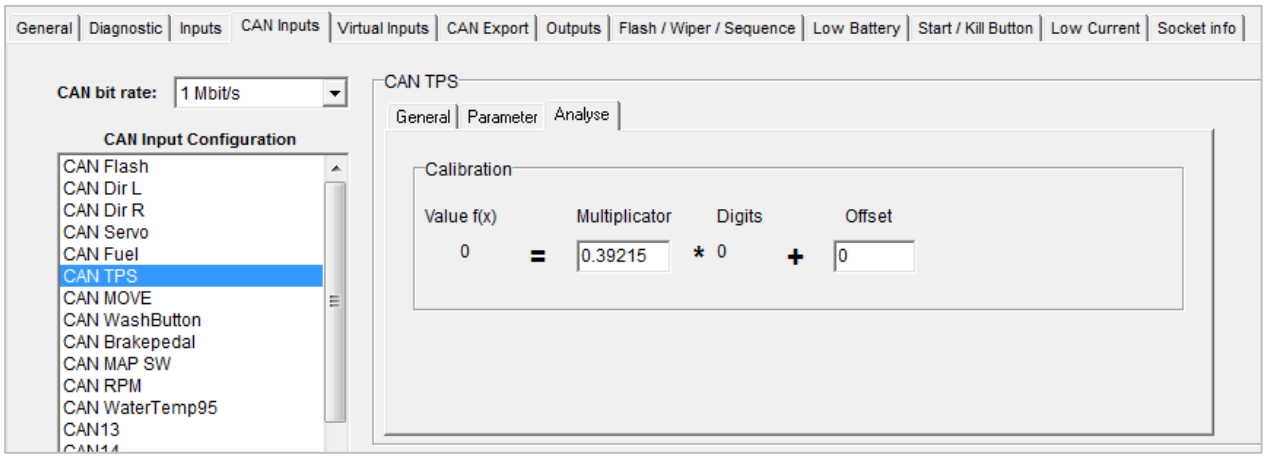


In general the multiplier is the increase in engineering value per bit and the offset adjusts the channel's starting value at zero.

Another example would be a throttle position signal that is transmitted probably within a single byte.
A raw value of 0-255 could equal 0-100% throttle position.

The multiplier is calculated this way:

- 100 / 255 => Multiplier = 0.39215



Pin Configuration for CAN Communication:

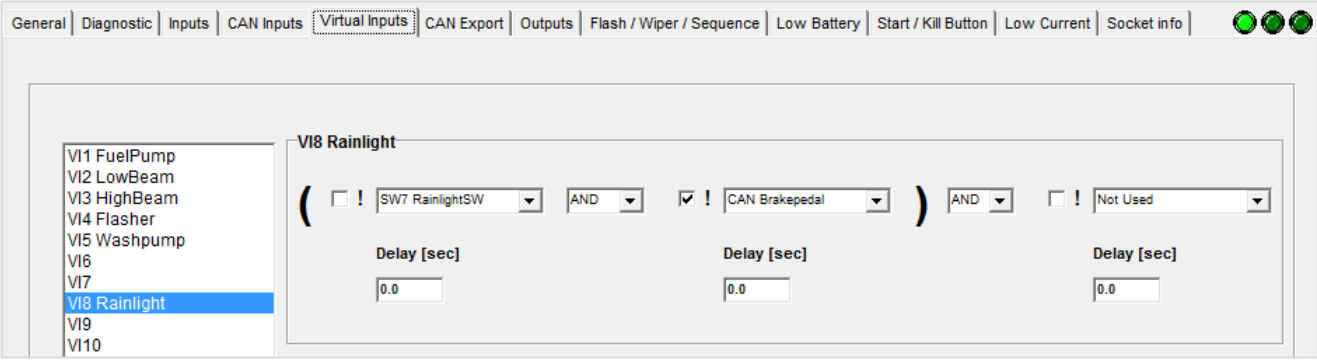
Name	Connector 4	Pin
CAN H	14-35 red	31
CAN L	14-35 red	33

9 Virtual Inputs

Virtual inputs are used to create logic connections.
A logic connection combines two or three channels, creating conditions which can be used to switch output channels on.
Up to 20 individual virtual channels can be created. A virtual channel can include other virtual channels to set up even more complex conditions.

In general the selected virtual channel will be switched on only if the outcome of the combination of channels X and Y is true and then only if the outcome of the combination of the first statement and the third channel is true.
Additionally, each input channel has a delay timer. The channel value has to be true for the period of time entered here before the channel condition is evaluated.

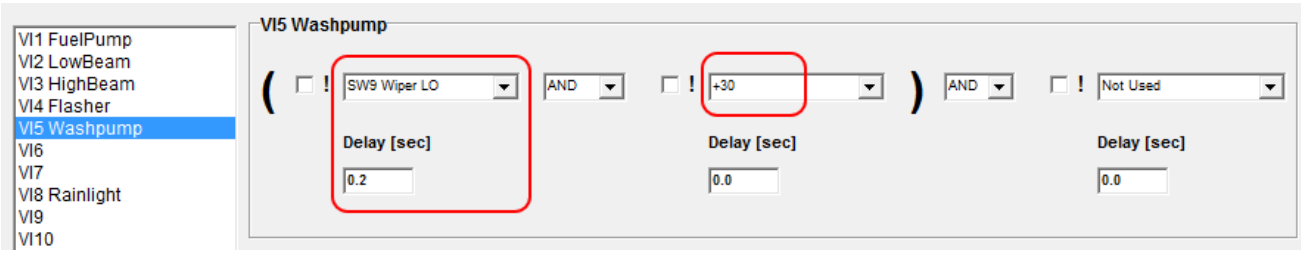
(**Channel X** [AND / OR / NOR] **Channel Y**) [AND / OR / NOR] **Channel Z**



The box marked "**!**" sets the selected channel to **NOT**, meaning the expression is true if the channel is NOT active.
Looking at the screenshot above the virtual channel *VI8_Rainlight* will be ON when the input *RainlightSW* is ON but only when the input ***CAN_Brakepedal*** is **NOT** on.

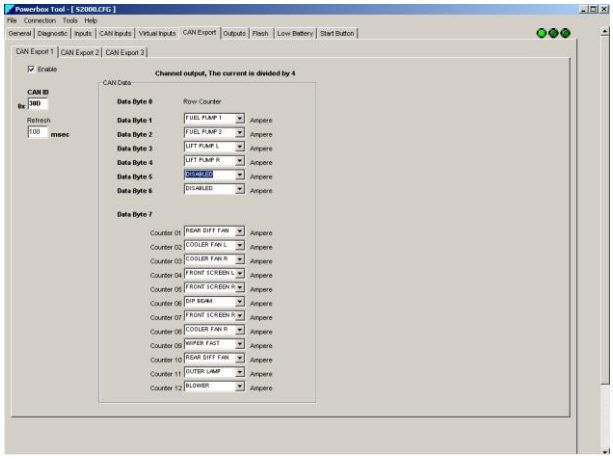
If only one or two channels are used within a virtual channel, those **must be entered starting from the left side of the equation** i.e. within the brackets. Therefore "Not Used" must be placed on the right side of the equation.
Channels X, Y and Z can be analogue switches, CAN channels, other virtual channels, output channels or sequence channels.

This virtual channel's timer function can also be used even if there is no need for logic combination of channels but simply to have some timer/delay on any of the inputs before they become valid. This could be created here by choosing the channel in question as the first condition, entering the *Delay* time, and using *+30* as the second channel (hint: +30 is a channel that is always on when the unit receives power).



10 CAN Export

CAN export can be split into 5 sections



10.1 CAN Export 1

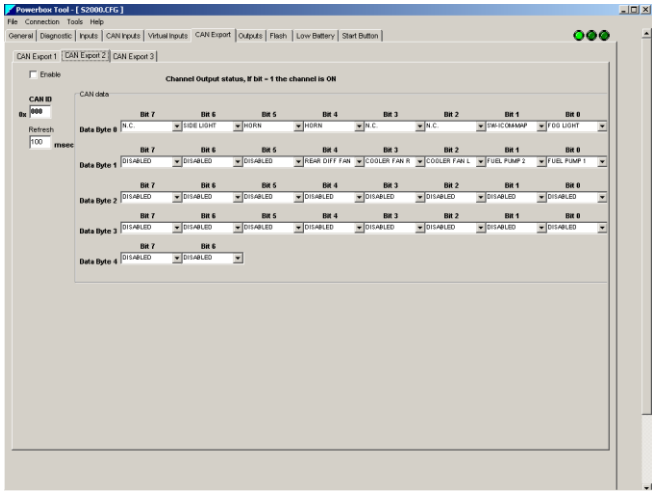
CAN Export 1 transmit the current draw for each of the 18 high power channels.
Tick the box *Enable* to transmit this ID.

In *CAN ID*, type the ID number (in hex) you want to assign to this packet.
In *Refresh*, type the broadcast rate with which you want to export the packet.
The first data byte (byte 0) in the ID is used as the row counter, defining the data within byte 7.
Data in bytes 1…6 are broadcasted at the transmission rate defined by *Refresh*. Each time the packet has been transmitted, a new channel assigned in byte 7 will be sent. So, channels in byte 7 rotate each time a packet is being broadcasted.
This means that if you have assigned 20 msec (50Hz) as the broadcast rate, channels in byte 7 are broadcast at 20 msec x 12 = 240 msec intervals (4.2 Hz).
The channel data has a resolution of 0.2 ampere per bit. This means the receiving device (display or logger) will need a CAN multiplier of 0.2 and Offset 0.

Type the number of channels rotating in byte 7 in the **Row Count** window.

10.2 CAN Export 2

CAN Export 2 transmit the output status of all 34 low and high power channels.



Tick the box *Enable* to transmit this ID.
In CAN ID, type the ID number (in hex) you want to assign to this packet.

In *Refresh*, type the broadcast rate you want for exporting the packet.

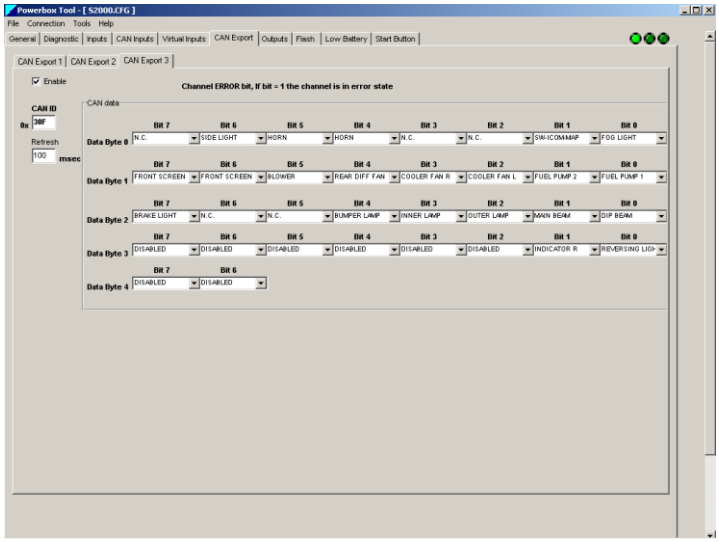
If only the channel assigned to bit 0 is ON and other channels are OFF, the byte value is 1.
If only the channel assigned to bit 1 is ON and other channels are OFF, the byte value is 2.
If only the channel assigned to bit 2 is ON and other channels are OFF, the byte value is 4.
If only the channel assigned to bit 3 is ON and other channels are OFF, the byte value is 8.
If only the channel assigned to bit 4 is ON and other channels are OFF, the byte value is 16. If only the channel assigned to bit 5 is ON and other channels are OFF, the byte value is 32. If only the channel assigned to bit 6 is ON and other channels are OFF, the byte value is 64. If only the channel assigned to bit 7 is ON and other channels are OFF, the byte value is 128.

If for example channels assigned to bit 2 and 6 are ON and all other channels are off, the byte value is 68.

The **total current** consumption is exported in byte 5. Scaling factor is 1 ampere per bit.

10.3 CAN Export 3

CAN Export 3 transmit the error status of all 34 low and high power channels.
Tick the box Enable to transmit this ID.



In CAN ID, type the ID number (in hex) you want to assign to this packet.
In Refresh, type the broadcast rate with which you want to export the packet.

If an error is detected for the channel assigned to bit 0, but no other channels have any errors, the byte value is 1.
If an error is detected for the channel assigned to bit 1, but no other channels have any errors, the byte value is 2.
If an error is detected for the channel assigned to bit 2, but no other channels have any errors, the byte value is 4.
If an error is detected for the channel assigned to bit 3, but no other channels have any errors, the byte value is 8.
If an error is detected for the channel assigned to bit 4, but no other channels have any errors, the byte value is 16.
If an error is detected for the channel assigned to bit 5, but no other channels have any errors, the byte value is 32.
If an error is detected for the channel assigned to bit 6, but no other channels have any errors, the byte value is 64.
If an error is detected for the channel assigned to bit 7, but no other channels have any errors, the byte value is 128.
If errors are detected for the channels assigned to bit 3 and 7, but no other channels have any errors, the byte value is 136.

The **module temperature** is exported in byte 5. Scaling factor is 1 degC per bit.

10.4 CAN Export 4

CAN Export 4 combines Export 2 and 3 in one CAN identifier.
The first 4 bytes are used to transmit output channels switch status while the last 4 bytes transmits error status of selected output channels.
Tick the box Enable to transmit this ID.

- In byte 0 - 3 assign the channel active status.
- In byte 4 - 7 assign the channel error status

10.5 CAN Export 5

CAN Export 5 will use a base ID + 12 following CAN ID's and combine different parameters into one stream (details directly shown in software).

CAN Export 1 | CAN Export 2 | CAN Export 3 | CAN_Export 4 | CAN_Export 5

Interval: 1 [x10ms] (0= Off, 1..255)

CAN base ID: 700 [hex]

CAN ID	D0	D1	D2	D3	D4	D5	D6	D7
Base+0	Input state		Virtual input		CAN input signal state			
	8..1	11..9	8..1	16..9	8..1	9..16	17..24	25..32
Base+1	Out1	Out2	Out3	Out4	Out5	Out6	Out7	Out8
Base+2	Out9	Out10	Out11	Out12	Out13	Out14	Out15	Out16
Base+3	Out17	Out18	Out19	Out20	Out21	Out22	Out23	Out24
Base+4	Out25	Out26	Out27	Out28	Out29	Out30	Out31	Out32
Base+5	Cur1	Cur2	Cur3	Cur4	Cur5	Cur6	Cur7	Cur8
Base+6	Cur9	Cur10	Cur11	Cur12	Cur13	Cur14	Cur15	Cur16
Base+7	Cur17	Cur18	Cur19	Cur20	Cur21	Cur22	Cur23	Cur24
Base+8	Cur25	Cur26	Cur27	Cur28	Cur29	Cur30	Cur31	Cur32
Base+9	Temp. [0,1 degree]		Battery [mV]		00	00	00	00
	High	Low	High	Low				
Base+10	00	00	00	00	Total current[2Amp]		00	00
					High	Low		
Base+11	Virtual 20..17	Out33	Out34	Cur33	Cur34	00	00	00
Base+12	Firmware version		Serial number		00	00	00	00
	High	Low	High	Low				

Out1..32 state: 0= Off, 1= On, 100= Short, 101= High current trip, 102= Low current.
Cur1..18 : Load current in 200mA step.
Cur19..34 : 0= Off, 15(=3A)= On

11 Outputs

The PCM has 18 high power channels and 16 low power channels. Each high power channel allows a maximum peak current in excess of 35-65 amps and individual adjustable peak current time of up to 10 seconds.

Please note that the current draw per channel is limited by the connector - not by the driver stages. Each driver stage can handle in excess of 35-65 amps continuously.

We have rated the individual channel's current draw against our own experience. Please also check the connector manufacturer's specifications.

The 16 low power channels are arranged in groups of 4. The maximum continuous current draw for each group is 8 amps, but the maximum continuous current draw for one channel is 2.9 Amps.

Proceed as follows to configure an output channel:

- Re-name the output channel in the section "**Name Pin**".
- Select the input trigger from the drop-down column "**Input Trigger**". Select "DISABLED" if you do not want to use the output or if you only want to use the output with the flash function.
- Define switch configuration "**Trig By**" (only valid for hardwired switches 1-11).
  - Select GND if you want to switch the channel ON by switching to ground.
  - Select OPEN if you want to switch the channel OFF when switching to ground.
- Set the delay for activating the output after switching it on in column "**Delay [sec]**".
- "**Timer**" defines a time interval during which the channel is switched ON. When expired, the channel resets to OFF and requires re-activation to switch ON. Set the timer to 0 to disable the timer function.
- Set the trip level for the normal current draw in steps of 0.1 Amp in column **"Max [A]"**

General | Diagnostic | Inputs | CAN Inputs | Virtual Inputs | CAN Export | Outputs | Flash / Wiper / Sequence | Low Battery | Start / Kill Button | Low Current | Socket info

Input Pin Conn.	Input Trigger	Trig By	Delay [sec]	Timer[sec]	Max. [A]	Peak [sec]	Name Pin	Output Pin Conn.	
(Virtual input 1)	VI1 FuelPump	-	0.0	CONT.	90.0	2.0	HP1 FuelPump	1 (Con. 3, Yellow ring, Pin C)	
	+30	+30	0.0	CONT.	15.0	1.0	HP2 ECU 12V	2 (Con. 2, Red ring, Pin L)	
	+30	+30	0.0	CONT.	17.0	1.0	HP3 Injectors	3 (Con. 2, Red ring, Pin H)	
	+30	+30	0.0	CONT.	20.0	1.0	HP4 IGN Coils	4 (Con. 2, Red ring, Pin F)	
	DISABLED	-	0.0	CONT.	20.0	2.0	HP5	5 (Con. 2, Red ring, Pin D)	
(Con. 4, Red ring, Pin 19)	SW1 Ignition	+12v	0.0	CONT.	20.0	2.0	HP6 Starter 50	6 (Con. 2, Red ring, Pin A,B)	
(Virtual input 2)	VI2 LowBeam	-	0.0	CONT.	15.0	2.0	HP7 LowBeam	7 (Con. 3, Yellow ring, Pin L)	
(Wiper High speed)	Wiper Fast	-	0.0	CONT.	20.0	2.0	HP8 WiperHiSpd	8 (Con. 3, Yellow ring, Pin A)	
(Virtual input 3)	VI3 HighBeam	-	0.0	CONT.	15.0	2.0	HP9 HighBeam	9 (Con. 2, Red ring, Pin G)	
(Wiper Low speed)	Wiper Slow	-	0.0	CONT.	17.0	2.0	HP10 WiperLoSpd	10 (Con. 2, Red ring, Pin E)	
	+30	+30	3.0	CONT.	32.0	2.0	HP11 InterioFan	11 (Con. 2, Red ring, Pin C)	☐ Soft start
	DISABLED	-	0.0	CONT.	15.0	2.0	HP12 Fan Brake	12 (Con. 3, Yellow ring, Pin G)	☑ Soft start
(CAN input 3)	CAN Dir R	-	0.0	CONT.	29.0	2.0	HP13 CoolingFan	13 (Con. 2, Red ring, Pin M)	☑ Soft start
(CAN input 25)	CAN25	-	0.5	CONT.	15.0	2.0	HP14 GearFan	14 (Con. 2, Red ring, Pin J,K)	
(CAN input 26)	CAN26	-	1.5	CONT.	17.0	2.0	HP15 DiffPump	15 (Con. 3, Yellow ring, Pin D,E)	
(CAN input 27)	CAN27	-	0.5	CONT.	15.0	2.0	HP16 DiffFan	16 (Con. 3, Yellow ring, Pin B)	
(CAN input 24)	CAN24	-	1.0	CONT.	16.0	2.0	HP17 GearPump	17 (Con. 3, Yellow ring, Pin M)	
	+30	+30	0.0	CONT.	10.0	1.0	HP18 BrakeLight	18 (Con. 3, Yellow ring, Pin J,K)	
	DISABLED	-	0.0	CONT.			LP19	19 (Con. 4, Red ring, Pin 1)	
	+30	+30	0.0	CONT.			LP20 ZeitronCAN	20 (Con. 4, Red ring, Pin 2)	
(Virtual input 6)	VI6	-	0.0	CONT.			LP21 BlinkFR L	21 (Con. 4, Red ring, Pin 3)	
(Virtual input 7)	VI7	-	0.0	CONT.			LP22 BlinkFR R	22 (Con. 4, Red ring, Pin 4)	
(Virtual input 6)	VI6	-	0.0	CONT.			LP23 BlinkRE L	23 (Con. 4, Red ring, Pin 5)	
(Virtual input 7)	VI7	-	0.0	CONT.			LP24 BlinkRE R	24 (Con. 4, Red ring, Pin 6)	
	+30	+30	0.0	CONT.			LP25 E-Ventile	25 (Con. 4, Red ring, Pin 7)	
	+30	+30	0.0	CONT.			LP26 FireExting	26 (Con. 4, Red ring, Pin 8)	
(Con. 4, Red ring, Pin 24)	SW6 LightSW	GND	0.0	CONT.			LP27 ParkIght L	27 (Con. 4, Red ring, Pin 9)	
(Con. 4, Red ring, Pin 24)	SW6 LightSW	GND	0.0	CONT.			LP28 ParkIght R	28 (Con. 4, Red ring, Pin 10)	
	+30	+30	0.0	CONT.			LP29 AIM MXG	29 (Con. 4, Red ring, Pin 11)	
(CAN input 21)	CAN21	-	0.0	CONT.			LP30	30 (Con. 4, Red ring, Pin 12)	
(CAN input 2)	CAN Dir L	-	0.0	CONT.			LP31 AC Compr	31 (Con. 4, Red ring, Pin 13)	
(CAN input 2)	CAN Dir L	-	0.0	CONT.			LP32 AC Compr	32 (Con. 4, Red ring, Pin 14)	
(Virtual input 5)	VI5 Washpump	-	0.0	CONT.			LP33 WashPump	33 (Con. 4, Red ring, Pin 15)	
(Con. 4, Red ring, Pin 25)	SW7 RainlightSW	GND	0.0	CONT.			LP34 Rain LED	34 (Con. 4, Red ring, Pin 16)	

- Set the peak time in seconds during which the output channel can draw in excess of 35-65 Amps in column **"Peak"**. This peak time is applied when the channel is switched on and every time the current draw exceeds the trip level set in column "Max".

11.1 High Power Channels

The pin configuration and maximum current draws for the high power channels are:

Channel	Max current [A]	Connector 2	Pin
2	35	14-97 red	L
3	35	14-97 red	H
4	35	14-97 red	F
5	35	14-97 red	D
6	35	14-97 red	A + B
9	65	14-97 red	G
10	35	14-97 red	E
11	65 (and softstart)	14-97 red	C
13	65 (and softstart)	14-97 red	M
14	35	14-97 red	J + K

Channel	Max current [A]	Connector 3	Pin
1	65	14-97 yellow	C
7	65	14-97 yellow	L
8	35	14-97 yellow	A
12	35 (and softstart)	14-97 yellow	G
15	35	14-97 yellow	D + E
16	35	14-97 yellow	B
17	65	14-97 yellow	M
18	35	14-97 yellow	J + K

11.2 Low Power Channels

The pin configuration and maximum current draws for the high power channels are:

Channel	Max current [A]		Connector 4	Pin
19	2.9	group A*)	14-35 red	1
20	2.9		14-35 red	2
21	2.9		14-35 red	3
22	2.9		14-35 red	4
23	2.9	group B*)	14-35 red	5
24	2.9		14-35 red	6
25	2.9		14-35 red	7
26	2.9		14-35 red	8
27	2.9	group C*)	14-35 red	9
28	2.9		14-35 red	10
29	2.9		14-35 red	11
30	2.9		14-35 red	12
31	2.9	group D*)	14-35 red	13
32	2.9		14-35 red	14
33	2.9		14-35 red	15
34	2.9		14-35 red	16

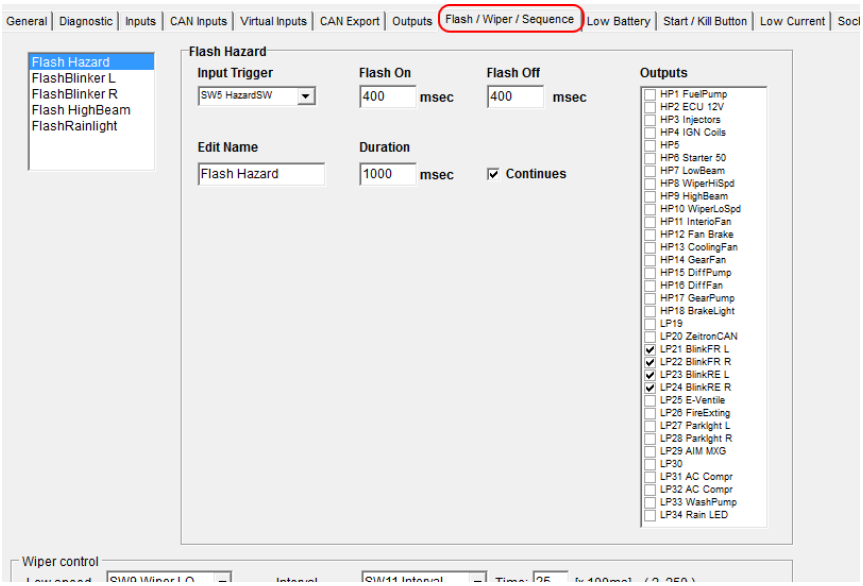
The current ratings are for continuous current draw. Peak ratings are much higher.

One input channel can control one or more output channels.

Note regarding the groups:
Group A: Max 2.9 amps per channel in this group but max 8 amps for the group in total.
Group B: Max 2.9 amps per channel in this group but max 8 amps for the group in total.
Group C: Max 2.9 amps per channel in this group but max 8 amps for the group in total.
Group D: Max 2.9 amps per channel in this group but max 8 amps for the group in total.

Overload on low power channels is managed by predefined hardware limits. In case where a single low power channel may consume slightly more than 2.9 A (e.g. 3.7 A) then at the beginning it may look as if the output could withstand these higher loads. Anyway the internal temperature of the low power output chip will rise and probably shut down the channel after some time. Therefore keep the output current within the specified limits to avoid unexpected shutdown of channels.

12 Flash Function



You can create up to 5 individual flash functions.
A flash enabled always has the highest switch priority. When activated, the assigned outputs will flash despite their current switch settings. From the window select which of the 5 flash channels you want to configure.

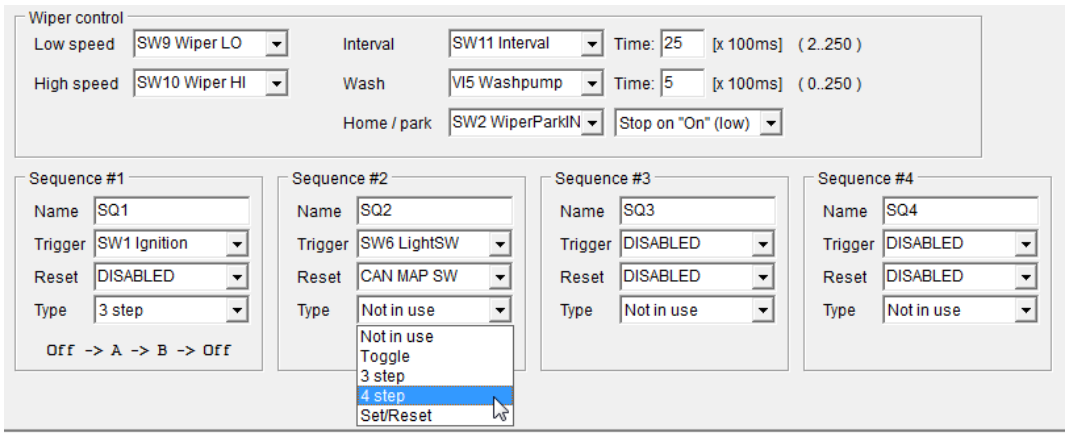
- *Input Trigger* selects which input channel activates the flash function.
- *Edit Name* to label the flash channel.
- *Flash On* and *Flash Off* set the time in msec which will be used to flash. For example, select 400 + 400 and the output channel(s) will be ON for 400 msec, then OFF for 400 msec etc.
- In "Duration" set the total activation time for the flash channel. Maximum time is 25 seconds (25000 msec).

If you want the channel to flash as long as the input switch is activated, tick the box "*Continues*". The flash returns to its OFF position after time-out and when the input switch is switched off.

Take care when using more than one flash function on the same output, as they may interact against each other. To avoid weird flash behavior in case where an output should be used with different flash functions (and possible overlap of these flash functions) a proper way is to create a virtual input and use it as the flash trigger input. Such virtual input could be configured in a way so that only one of the possibly overlapping flash triggers can become active at a time. A good idea is to also use a small delay of 0.1 sec when creating such a virtual channel, so that overlapping is impossible.

12.1 Wiper control and Sequence function

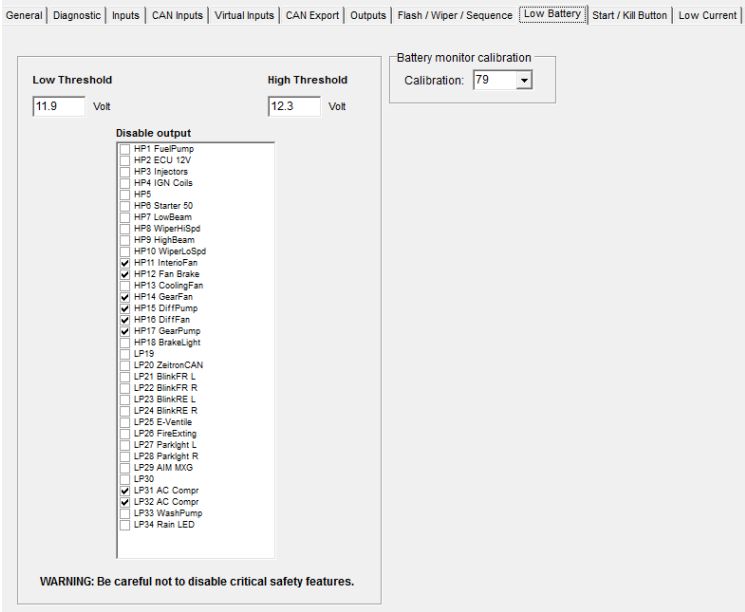
In the lower area of the *Flash/Wiper/Sequence* tab there are special functions for wiper control as well as 4 different sequence functions to generate different states from a single input. The sequences generate separate triggers that you can choose from the dropdown menu when assigning input triggers to the output channels. For further information contact your HP Electronik dealer.



13 Low Battery

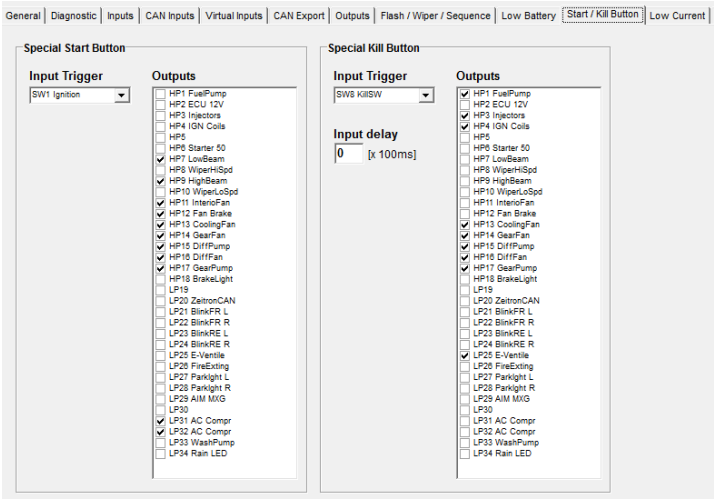
The Power Control Module can switch power channels off automatically to preserve battery power.
Set a threshold for low battery voltage in “Low Threshold”.
If the battery voltage drops below this voltage the PCM can switch channels off automatically. In the window “Disable Outputs” tick the boxes for the channels you want the PCM to switch off (in case they are switched on) if the battery voltage drops below the low threshold.
The channels will automatically switch on when the battery voltage exceeds the high threshold.

With *Battery monitor calibration* the measured input voltage of the PCM can be calibrated (value 76 - 79 are common from experience).



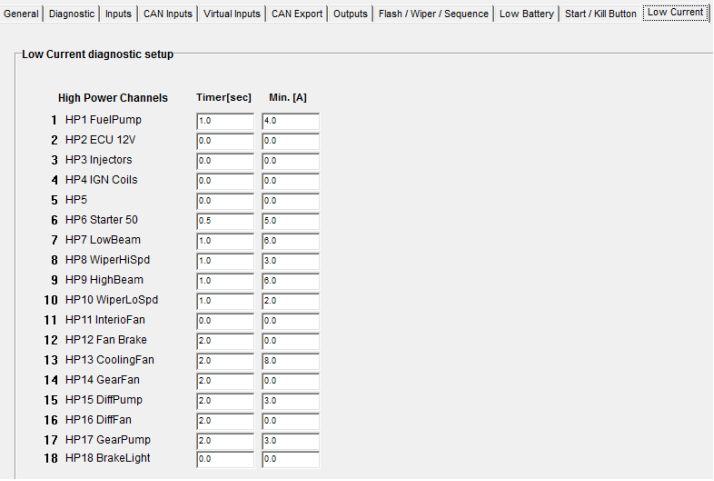
14 Start Button / Special Kill Button

To maximize engine cranking speed and to preserve battery power the PCM can be configured to disabled other outputs whilst the starter motor is powered.
Select the starter switch in “Input Trigger”.
In the window “Outputs” tick the boxes for the channels you want the PCM to switch off (in case they are switched on) during the activation of the starter switch.
In a similar way a special kill button can be used and any channels that should be shut off when hitting a kill switch can be assigned here. Reactivation happens as soon as the correlating input is switched off again.



15 Low Current

The PCM can detect failing and faulty components in the car and automatically warn the driver.
When the output driver is active, the PCM measures the current draw of each highpower output. If the current consumption drops below a minimum threshold for a predefined time, the system will set a flag in the diagnostics.



16 Additional Features

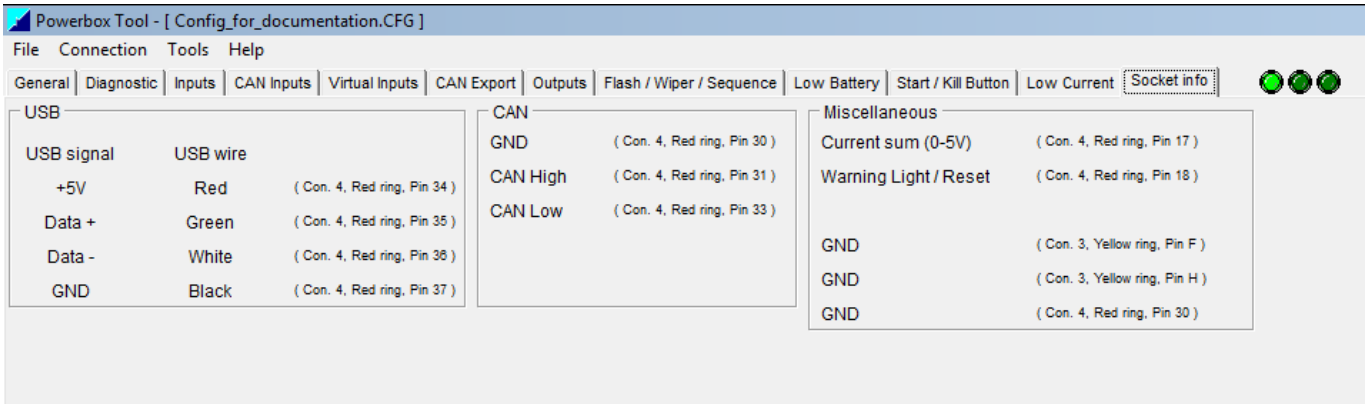
16.1 Warning Light

The PCM is equipped with a warning light for error detection. The driver output is found in connector 4, pin 18. If a fault is detected, the channel switches 12 volts to the output to activate a warning light.

16.2 Output Reset

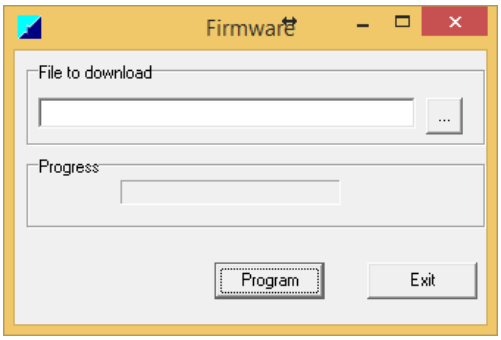
You can reset all output channels in error status by briefly connecting the warning light signal, pin 18 in connector 4, to ground.
This does not influence other channels but those in error status.

16.3 Socket info



This window explains the pin out of the USB, CAN and miscellaneous functions.

16.4 Upgrade the firmware



This window allows you to flash the newest firmware to the HP8440 Powerbox. If you download the program then the latest hex file (firmware for the controller) will be included. Please see our website http://motorsportelectronic.com/download for the latest updates.

17 Pin Configuration

Connector 1 – battery power supply - Mating connector: ASHD614-1SN-C35

Connector 2 – high power outputs - Mating connector: AS614-97PN – RED

Pin	Contact size	Description	Max. internal Rating [A] *)	Max. Pin Rating [A]
A	20	Channel 6 High Power	35	7.5
B	20			7.5
C	**16**	Channel 11 High Power	65	20
D	20	Channel 5 High Power	35	7.5
E	20	Channel 10 High Power	35	7.5
F	20	Channel 4 High Power	35	7.5
G	**16**	Channel 9 High Power	65	20
H	20	Channel 3 High Power	35	7.5
J	20	Channel 14 High Power	35	7.5
K	20			7.5
L	**16**	Channel 2 High Power	35	20
M	**16**	Channel 13 High Power	65	20

Connector 3 – high power outputs - Mating connector: AS614-97PA - YELLOW

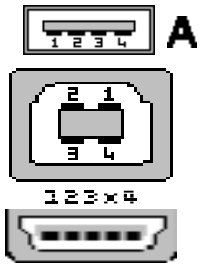
Pin	Contact size	Description	Max. internal Rating [A] *)	Max. Pin Rating [A]
A	20	Channel 8 High Power	35	7.5
B	20	Channel 16 High Power	35	7.5
C	**16**	Channel 1 High Power	65	20
D	20	Channel 15 High Power	35	7.5
E	20			7.5
F	20	**Power Ground**		20
G	**16**	Channel 12 High Power	35	7.5
H	20	**Power Ground**		20
J	20	Channel 18 High Power	35	7.5
K	20			7.5
L	**16**	Channel 7 High Power	65	20
M	**16**	Channel 17 High Power	65	20

*) Please note that the current draw per channel is limited by the connector - Each driver stage can handle in excess of 35-65 amps continuously.
The individual channel's current limit should be selected in relation to the connector manufacturer's specifications and the operating conditions (intermediate or continuous current draw).

Connector 4 – low power outputs - Mating connector: AS6 14-35 PN

Pin	In / out	Used for	Max Rating [A]	Other
1	Output	Channel 1 Low Power	2.9 each channel, 8 amp / group	group A
2	Output	Channel 2 Low Power	2.9 each channel, 8 amp / group	
3	Output	Channel 3 Low Power	2.9 each channel, 8 amp / group	
4	Output	Channel 4 Low Power	2.9 each channel, 8 amp / group	
5	Output	Channel 5 Low Power	2.9 each channel, 8 amp / group	group B
6	Output	Channel 6 Low Power	2.9 each channel, 8 amp / group	
7	Output	Channel 7 Low Power	2.9 each channel, 8 amp / group	
8	Output	Channel 8 Low Power	2.9 each channel, 8 amp / group	
9	Output	Channel 9 Low Power	2.9 each channel, 8 amp / group	group C
10	Output	Channel 10 Low Power	2.9 each channel, 8 amp / group	
11	Output	Channel 11 Low Power	2.9 each channel, 8 amp / group	
12	Output	Channel 12 Low Power	2.9 each channel, 8 amp / group	
13	Output	Channel 13 Low Power	2.9 each channel, 8 amp / group	group D
14	Output	Channel 14 Low Power	2.9 each channel, 8 amp / group	
15	Output	Channel 15 Low Power	2.9 each channel, 8 amp / group	
16	Output	Channel 16 Low Power	2.9 each channel, 8 amp / group	
17	Output	VREF		
18	Output	Warning Light / Reset	Connect to ground to reset	
19	Input	Switch 1	Must switch +12 Volts to activate	
20	Input	Switch 2	Must switch to ground to activate	
21	Input	Switch 3	Must switch to ground to activate	
22	Input	Switch 4	Must switch to ground to activate	
23	Input	Switch 5	Must switch to ground to activate	
24	Input	Switch 6	Must switch to ground to activate	
25	Input	Switch 7	Must switch to ground to activate	
26	Input	Switch 8	Must switch to ground to activate	
27	Input	Switch 9	Must switch to ground to activate	
28	Input	Switch 10	Must switch to ground to activate	
29	Input	Switch 11	Must switch to ground to activate	
30	GND	GND General	Ground	
31	Comms	CAN H	CAN is NOT terminated	
32	GND	CAN Gnd	---	
33	Comms	CAN L	CAN is NOT terminated	
34	Comms	USB 5V	Red	USB pin 1
35	Comms	USB data +	Green	USB pin 3
36	Comms	USB data -	White	USB pin 2
37	Comms	USB Gnd	Black	USB pin 4

USB Connector layout:



18 Specifications

18.1 Inputs

Number of input switches	11 (selectable functions: Momentary or Latch)
Number of CAN input channels	32

18.2 Outputs

Output Protection	All driver stages are thermally protected in addition to software selectable limits on the high power outputs
Maximum recommended overall current	170 continuously

High power channels

Number of individual channels	18
Current rating of contacts size 16	20 A *)
Current rating of contacts size 20	7.5 A *)
Maximum peak current each driver	65 A for short periods each channel

***) Please note that the current draw per channel is limited by the connector - not by the driver stages. Each driver stage can handle in excess of 35-65 amps continuously.**
The individual channel's current limit should be selected in relation to the connector manufacturer's specifications and the operating conditions (intermediate or continuous draw).

Low power channels

Number of individual channels	16
Maximum continuously current draw per driver	3 A
Maximum current draw each block of 4 drivers	8 A
Low power channel overload protection	Thermal shutdown determined by hardware chip

18.3 Temperatures

Maximum operating temperature	> 100 degC
Typical temperature rise over ambient	< 5 degC @ 80 amps; 30 minutes < 20 degC @ 170 amps; 30 minutes

18.4 Communication

PC Interface	USB
CAN communication	2.0B @ 500Kbit or 1 Mbit/sec (11 bit identifiers)
CAN messaging	Motorola or Intel format Free definition of identifiers Bit wise operator

18.5 Power Supply

Supply Voltage	6.5 to 22 Volt DC

18.6 Dimensions

Length x Width x Height	197 x 107 x 46 mm incl. connectors
Weight	710 grams