PCAN-MicroMod FD ECU

User Manual

Relevant Products

Designation	Part number
PCAN-MicroMod FD ECU	IPEH-003085
PCAN-MicroMod FD ECU Adapter	IPEH-003086

Imprint

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Document version 1.1.2 (2025-03-04)

Contents

1 Introduction

The PCAN-MicroMod FD ECU is a universal control unit for the integration of customer-specific accessories in automotive applications. It has CAN FD connectivity and a mixture of analog and digital I/Os. With its robust housing and two automotive connectors, it is designed for use in commercial and heavy-duty vehicles under harsh conditions.

PCAN-MicroMod FD products are configured with a free Windows program. In addition to simple I/O mapping to CAN IDs, function blocks are also available for processing the data. The configuration created on the computer is transferred via CAN bus to the PCAN-MicroMod FD, which then runs as a stand-alone CAN node.

1.1 Properties at a Glance

- Module with integrated PCAN-MicroMod FD
- High-speed CAN connection (ISO 11898-2)
  - Complies with CAN specifications 2.0 A/B and FD
  - CAN FD bit rates for the data field (64 bytes max.) from 40 kbit/s up to 10 Mbit/s
  - CAN bit rates from 40 kbit/s up to 1 Mbit/s
- Wake-up by CAN bus or by separate input
- 4 digital inputs
  - Pull-up or pull-down configurable
- 8 digital outputs with High-side switches
  - 2 outputs with 5 A and 6 outputs with 2 A
  - 4 alternatively usable as a digital input or additionally for reading back the output level

- 8 analog inputs
  - Resolution 16 bit
  - Measuring range adjustable: ±2.5 V, ±5 V, ±10 V, ±20 V
- 4 of the analog inputs alternatively usable as analog output
  - Resolution 12 bit
  - Voltage range adjustable: 0 to 5 V or 0 to 10 V
- 2 frequency outputs
  - Low-side switches (3 A)
  - Adjustable frequency range 0 to 20 kHz
  - Alternatively usable as analog inputs with voltage range from 0 to 60 V
- Connections for CAN, I/O, and power supply via two 20-pole automotive connectors (Molex MX150)
- Plastic casing with increased Ingress Protection IP67 and flange
- Operating voltage 8 to 32 V; suitable for use in 12 and 24 V vehicle electrical systems
- Extended operating temperature range from −40 to +85 °C (−40 to +185 °F)
- E1 type approval

1.2 Prerequisites

A PEAK CAN interface is required for configuration.

1.3 Scope of Supply

- PCAN-MicroMod FD ECU including mating connectors

Download

- PCAN-MicroMod FD Configuration for Windows
- Manual in PDF format

Accessories

Separately available from PEAK-System:

- PCAN-MicroMod FD ECU Adapter, IPEH-003086
  Test board for simplified wiring of the PCAN-MicroMod FD ECU using Phoenix connectors (more information: E.1 *PCAN-MicroMod FD ECU Adapter* on page 50

Separately available on the open market:

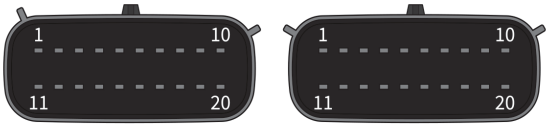
- Additional mating connectors and terminals

Item	Manufacturer	Manufacturer order number	Quantity supplied
Automotive Connector Molex MX150 Type A 20 Pins	Molex	33472-2001	1
Automotive Connector Molex MX150 Type B 20 Pins	Molex	33472-2002	1
Crimp Terminal MX150 F 14 + 16 AWG (1.5 mm^2)	Molex	33012-2001	20
Crimp Terminal MX150 F 18 + 20 AWG (1.00 mm^2 + 0.75 mm^2)	Molex	33012-2002	20
Crimp Terminal MX150 F 0.35 - 0.50 mm^2	Molex	33012-2004	30
Crimp Terminal MX150 F 22 AWG (0.5 mm^2)	Molex	33012-2003	0
Crimp Terminal MX150 Sealed Cavity Plug	Molex	34345-0001	0

- Tools for mating connectors

Item	Manufacturer	Manufacturer order number
Crimping pliers for MX150 (14 - 22 AWG)	Molex	64016-0133
Molex Pin Removal Tool	Molex	63813-1500

2 Connectors



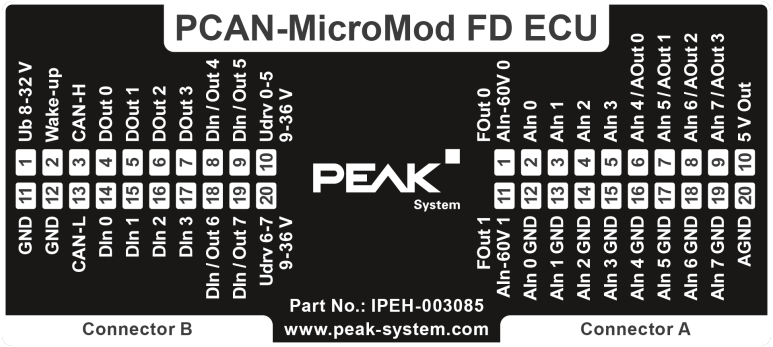
Connector B Connector A

"Connector B" (left) and "Connector A" (right)

The two connectors are coded. The mating connectors only fit the respective designated connector:

- Connector A (right): black mating connector
  type Molex MX150 A 33472-2001
- Connector B (left): light gray mating connector
  type Molex MX150 B 33472-2002

The pin assignment is as follows:



Function	Designation	Pin	Pin	Designation	Function
Ground common	GND	B-11	B-1	Ub 8-32 V	Voltage supply PCAN-MicroMod FD ECU: 8 to 32 V DC
	GND	B-12	B-2	Wake-up	Wake-up input to start the device from idle state
High-speed CAN bus CAN-Low line	CAN-L	B-13	B-3	CAN-H	High-speed CAN bus CAN-High line
Digital input	DIn 0	B-14	B-4	DOut 0	Digital output, High-side switch
	DIn 1	B-15	B-5	DOut 1	
	DIn 2	B-16	B-6	DOut 2	
	DIn 3	B-17	B-7	DOut 3	
Digital input / digital output, High-side switch	DIn/Out 6	B-18	B-8	DIn/Out 4	Digital input / digital output, High-side switch
	DIn/Out 7	B-19	B-9	DIn/Out 5	
Voltage supply for High-side switches DOut 6 and DOut 7	Udrv 6-7 9-36 V	B-20	B-10	Udrv 0-5 9-36 V	Voltage supply for High-side switches DOut 0 to DOut 5

Function	Designation	Pin	Pin	Designation	Function
Frequency output, Low-side switch / analog input 60 V	FOut 1 AIn-60V 1	A-11	A-1	FOut 0 AIn-60V 0	Frequency output, Low-side switch / analog input 60 V
Ground analog input	AIn 0 GND	A-12	A-2	AIn 0	Analog input, 16 bits, measuring range max. ±20 V (adjustable by software)
	AIn 1 GND	A-13	A-3	AIn 1	
	AIn 2 GND	A-14	A-4	AIn 2	
	AIn 3 GND	A-15	A-5	AIn 3	
	AIn 4 GND	A-16	A-6	AIn 4/AOut 0	Analog input, 16 bits, measuring range max. ±20 V (adjustable by software) / analog output, 12 bits, max. 0 to 10 V (adjustable by software)
	AIn 5 GND	A-17	A-7	AIn 5/AOut 1	
	AIn 6 GND	A-18	A-8	AIn 6/AOut 2	
	AIn 7 GND	A-19	A-9	AIn 7/AOut 3	
Ground analog	GND	A-20	A-10	5 V Out	Sensor supply, max. 500 mA, switchable during runtime

3 Hardware Configuration

The chapter covers configuration options being set in the device hardware.

3.1 Module ID

When using several devices from the PCAN-MicroMod FD product range on the same CAN bus, the devices can be differentiated using an adjustable module ID in the range of 0 to 15. A module ID helps in the following cases. It has no direct influence on the CAN communication of the device.

Assignment of Configurations

When creating a configuration on a PC with PCAN-MicroMod FD Configuration, a module ID is assigned to the configuration. When transferring the configuration to a MicroMod FD device, the program checks whether the module ID in the configuration matches that of the MicroMod FD device and shows a message if it does not.

In addition, when starting a MicroMod FD device, the set module ID and the module ID stored in the configuration are compared. A configuration with a different ID is considered invalid. The MicroMod FD device does not execute the configuration and indicates this by means of green-red flashing of LED B (not visible with PCAN-MicroMod FD ECU).

A configuration can also be set to apply to "ANY" ID set on the module (except 15).

Query During Firmware Upload

Similar to transferring the configuration, the current module ID of each MicroMod FD device is queried during a firmware upload with PEAK-Flash. This allows to provide a specific device on the CAN bus with new firmware.

Evaluation in Configuration

The module ID set on the MicroMod FD device can be read out via configuration as signal value and incorporated into the data of a CAN message, for example. The "Statistics" service provides the signal values.

3.1.1 Setting the Module ID on the Device

In contrast to most products in the PCAN-MicroMod FD series, where the module ID is set via hardware, it is done via software in the PCAN-MicroMod FD ECU.

Menu item in PCAN-MicroMod FD Configuration:
Configuration > *Target Hardware* > *Module ID*

More information on the software configuration procedure: 4.3 *Configuring* on page 13

After transferring the configuration, the PCAN-MicroMod FD ECU automatically obtains the module ID specified in the configuration. Exception: If the module ID "ANY" has been defined in the configuration, the previous module ID is retained in the PCAN-MicroMod FD ECU.

4 Commissioning

This chapter covers the basic commissioning of the PCAN-MicroMod FD ECU.

The I/Os are described in detail in chapter 5 *Description I/O* on page 17.

Information on other functions during operation can be found in chapter 6 *Operation* on page 31.

4.1 Connecting CAN

The following pins are used for connecting a High-speed CAN bus (ISO 11898-2):

Pin	Connector
CAN-High	B-3
CAN-Low	B-13

4.2 Establishing Power Supply

For operating the PCAN-MicroMod FD ECU, a voltage supply with nominal 12 V DC is required (8 to 32 V possible). Connection is done via the following pins:

Pin	Connector
Ub	B-1
GND	B-11, B-12

The PCAN-MicroMod FD ECU starts immediately after the supply voltage is applied with the loaded configuration. At delivery, this is an example configuration that uses CAN 2.0 communication at 500 kbit/s.

4.3 Configuring

Configuring is done with the Windows software PCAN-MicroMod FD Configuration. This section covers the basic points for installing and using the configuration software.

4.3.1 Requirements for Transferring a Configuration via CAN

- Computer with operating system Windows 11 (x64/ARM64), 10 (x64)
- Installed configuration software PCAN-MicroMod FD Configuration
- CAN interface of the PCAN series for transferring the configuration to your hardware via CAN
- Installed CAN interface device driver
  (further information in the CAN interface manual)
- CAN cabling between the CAN interface and the PCAN-MicroMod FD ECU with correct termination on both ends of the CAN bus, 120 Ohms each
- Knowledge of the bit rate currently used by the PCAN-MicroMod FD ECU (CAN 2.0 with 500 kbit/s on delivery)

4.3.2 Installing the Configuration Software

Install PCAN-MicroMod FD Configuration on your computer as follows:

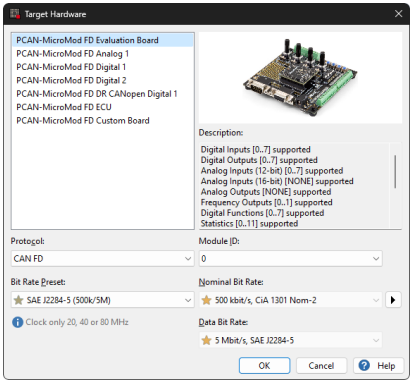
1. Download the configuration software.
   Download page: www.peak-system.com/quick/DL-Software-E
2. Unpack the file.
3. Double-click on the `.exe` file.
4. Follow the instructions of the installation program.

You now can start creating a configuration.

4.3.3 Creating a Configuration

Create a configuration as follows:

1. Start the PCAN-MicroMod FD Configuration software.
2. In the menu bar, select *File* > *New*.
   The *Target Hardware* window appears (here using the PCAN-MicroMod FD Evaluation Board as an example).



3. Select the device type PCAN-MicroMod FD ECU from the list.
4. Indicate the CAN *Protocol* that your CAN bus uses.
5. Indicate the *Bit Rate* of the CAN bus on which the PCAN-MicroMod FD ECU will later be used.
6. For the *Module ID*, indicate “ANY” universally.
7. Confirm your settings with *OK*.
8. Save your configuration.

The configuration has been created and can be transferred to your PCAN-MicroMod FD ECU as a next step.

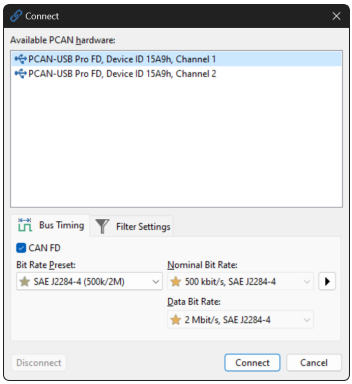
Tip: There is a tutorial for the PCAN-MicroMod FD Configuration software that makes it easier for you to get started with the configuration of your device, available on the following web page in the I/O Modules section:
www.peak-system.com/quick/Documentation

4.3.4 Transferring a Configuration

Establishing the connection:

1. Connect a CAN interface of the PCAN series to your computer.
2. Connect the PCAN-MicroMod FD ECU to the CAN interface via a terminated CAN bus.
3. In PCAN-MicroMod FD Configuration, click on *Connect* to establish a connection to the CAN bus.

   The *Connect* window appears.



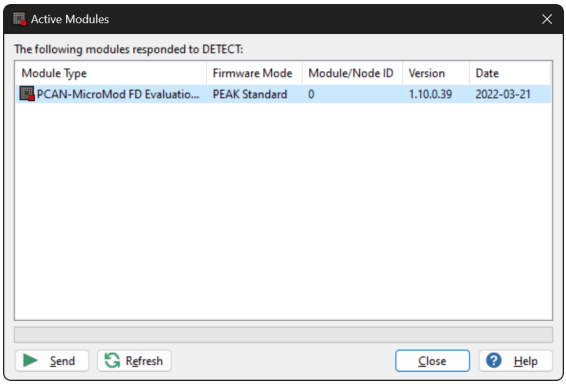
4. In the *Available PCAN hardware* field, select your CAN interface and, if applicable, the used channel.
5. On the *Bit Timing* tab select the *Nominal Bit Rate* currently used by the PCAN-MicroMod FD ECU, with CAN FD additionally the *Data Bit Rate*.

   Note: The bit rates of the CAN bus via which you configure the PCAN-MicroMod FD ECU may differ from the bit rates of the CAN bus in which the PCAN-MicroMod FD ECU is to be used later.

6. Confirm with *Connect*.

Send configuration:

1. For sending the configuration, click on ▶ *Send Configuration*.
   The *Active Modules* window appears and after a short time displays the devices connected to the CAN bus.



   If your device is not shown, check the CAN cabling between the CAN interface and your device, if the device is powered up, and if the currently used bitrates in PCAN-MicroMod FD Configuration and in your device are the same (*Status: OK*).
2. Select your PCAN-MicroMod FD ECU and click *Send*.

After a successful transfer of the configuration, you can use your PCAN-MicroMod FD ECU with the new configuration.

5 Description I/O

This chapter describes the inputs and outputs of the PCAN-MicroMod FD ECU in detail.

5.1 Digital Inputs DIn

Access in PCAN-MicroMod FD Configuration:
Digital Inputs

The 8 digital inputs DIn 0 to DIn 7 can each be provided with pull-up, pull-down, or floating circuitry via software configuration. The setting is applied during initialization of the device according to the configuration. It cannot be changed during runtime.

Each signal on DIn 0 to DIn 7 can be read either as static level, as frequency, or as duty cycle of PWM. A level change can be used as an additional trigger for sending CAN messages.

At connections DIn 4 to DIn 7, the digital outputs DOut 4 to DOut 7 are connected in parallel. If a digital output is used, the associated digital input can be used to read back the actual status at the output.

> **Note:** The pull-up and pull-down configuration influences the voltage levels at the digital outputs.

Required Driver Supply for Digital Inputs

If the digital outputs specified below are not used but the digital inputs connected in parallel are, the output drivers must still be supplied. The input levels at the mentioned digital inputs must not exceed the driver supply voltage.

Unused digital outputs	Used digital inputs	Required driver supply
DOut 0 to DOut 5	DIn 4, DIn 5	Udrv 0-5
DOut 5 and DOut 6	DIn 6, DIn 7	Udrv 6-7

Digital Inputs	
Quantity	4
Connectors	DIn 0 … DIn 7
Input voltage maximum	DIn 0 to DIn 3: +32 V DIn 4, DIn 5: Udrv 0-5, max. +32 V DIn 6, DIn 7: Udrv 6-7, max. +32 V
Input circuitry	Adjustable by configuration per input: ■ Open ■ Pull-up: 4.7 kΩ against supply voltage, 0.5 W ■ Pull-down: 4.7 kΩ against ground, 0.5 W
Switching threshold Low → High	> 6 V typ. (4.5 to 7.5 V)
Switching threshold High → Low	< 3.5 V typ. (2.2 to 4.5 V)

5.2 Digital Outputs DOut

Access in PCAN-MicroMod FD Configuration:
Digital Outputs

The 8 digital outputs are implemented as High-side switches and devided in the two groups DOut 0 to DOut 5 (short: DO_0-5) and DOut 6 and DOut 7 (short: DO_6-7). Each group has its own driver supply (9 to 36 V), independent of the module supply.

DO_0-5 are designed for a continuous nominal current of 2 A, DO_6-7 for 5 A. There are restrictions regarding the sum of all output currents depending on the ambient temperature and during frequency PWM operation (details in 5.4 *Output Load Restrictions at DOut and FOut* on page 22). The current limitation takes effect at typically 5 A (13 A at DO_6-7). Pulsed currents (max. 10 ms) of up to 11 A (25 A with

DO_6-7) are possible, for example relevant for increased cold current in incandescent lamps.

All digital outputs can be used individually either as static or as PWM outputs. Unlike the frequency outputs, the basic frequency of 1 Hz to 10 kHz can only be set identically for all channels in frequency PWM mode and cannot be changed at runtime.

The maximum output current per output results from the current limitation, which comes into effect if the overtemperature protection does not switch off beforehand, i.e. at low ambient temperatures and without relevant additional internal heating from other outputs. If the output driver has switched off due to overcurrent or overtemperature, it switches on again automatically when the current falls below the switch-off condition.

> **Note:** In the event of a permanent short circuit (overcurrent) of an output, the output driver remains in the overtemperature range and thus also heats up the other internal output drivers which can lead to a reduction in their maximum output currents.

The fault status (overcurrent) of each digital output can be acquired via the internal digital inputs “Drv Fault DOut 0” to “Drv Fault DOut 7”.

Access in PCAN-MicroMod FD Configuration:
Digital Inputs

Digital Outputs		
Quantity	8 (6 + 2)	
Connectors	DOut 0 … DOut 5	DOut 6 … DOut 7
Type	High-side switch	High-side switch
Supply voltage	9 to 36 V DC	9 to 36 V DC
Withstand voltage of output supply	55 V	55 V
Output current per output	2.0 A	5.0 A
Initial over-current:		
Duration	10 ms	10 ms
Current limitation activation threshold	12 A	25 A
Current limitation hold current	6 to 11 A	12 to 23 A
Steady-state over-current:		
Current limitation activation threshold	5 A	13 A
Current limitation hold current	2.5 to 4.5 A	6 to 10 A
Slope typical	25 µs	30 µs
PWM mode	Frequency range 1 Hz to 10 kHz PWM resolution determined by internal timer with 10 MHz (e.g. 0.1 % at 10 kHz)	

5.3 Frequency Outputs FOut

Access in PCAN-MicroMod FD Configuration:
Frequency Outputs

The two frequency outputs FOut 0 and FOut 1 are implemented as Low-side switches. The pulse widths and frequencies can be set independently of each other via signal values, i.e. at runtime. The load current of the Low-side drivers is designed for 3 A but, as with the digital outputs, depends on various factors: the frequency, i.e. the number of switching edges per time, the number and current of other outputs,

and the ambient temperature (details in 5.4 *Output Load Restrictions at DOut and FOut* on the next page).

Due to the significantly faster switching edges of typically 1.5 µs compared to 30 µs for the High-side drivers, the frequency dependence of the nominal current is significantly lower. The maximum current of a frequency output is 10 A, but can also be up to 22 A depending on the tolerance. This must be taken into account when dimensioning the cable cross-sections and fuses.

The supply voltage of the connected load must not exceed 36 V. The driver chips have overload protection.

Check Error Status of Driver Chip

Each error status of the driver chips can be determined by digital inputs.

Access in PCAN-MicroMod FD Configuration:
Digital Inputs > *Drv Fault FOut 0* and *Drv Fault FOut 1*

If the current limit is reached, the driver chip attempts to keep the maximum current constant and thus limit it. In this situation, the driver module can become significantly warmer. If the current continues to rise or the driver chip becomes too warm, the driver chip switches off. An error indication takes place.

This also occurs if the driver chip reaches the current limit only briefly and has not switched off due to higher overcurrent or overheating. The driver chip can continue to supply significant current, but a driver error is still indicated.

Tip: The frequency output driver chips with error status can be automatically reset after a certain time.
Access in PCAN-MicroMod FD Configuration:
Device Parameters > *FOut 0/FOut 1 restart time*

Frequency Outputs	
Quantity	2
Connectors	FOut 0 + FOut 1
Frequency range	0.1 Hz to 20 kHz
Voltage load	6 to 36 V
Withstand voltage	60 V
Output current nominal	3 A
Output current maximum (current limiter)	10 A minimum 16 A typical 22 A maximum
Slope typical	1.5 µs

5.4 Output Load Restrictions at DOut and FOut

The PCAN-MicroMod FD ECU combines the widest possible functionality in a small installation space. The design of powerful outputs in a small, closed plastic housing poses a particular challenge.

Even when switched on, every electronic switch has a very low contact resistance which leads to an exponentially increasing power loss in the form of heat as the load current increases, heating up the driver module and the surrounding area. The situation is aggravated by the fact that the contact resistance increases further as the temperature rises, which in turn leads to more heat.

To stop this cycle, the heat must be dissipated, which is possible in two ways:

- internally via the air and then via the housing
- via the circuit board and then further via the connected cables

Therefore, when operating with higher output loads, ensure good air circulation around the housing and cabling with cable cross-sections of 1.5 mm^2 for the power supplies and driver outputs.

The PCAN-MicroMod FD ECU provides digital outputs with the following nominal currents and the following loads:

- 6 High-side drivers with each 2 A (24 W at 12 V, 48 W at 24 V)
- 2 High-side drivers with each 5 A (60 W at 12 V, 120 W at 24 V)
- 2 Low-side drivers with each 3 A (36 W at 12 V, 72 W at 24 V)

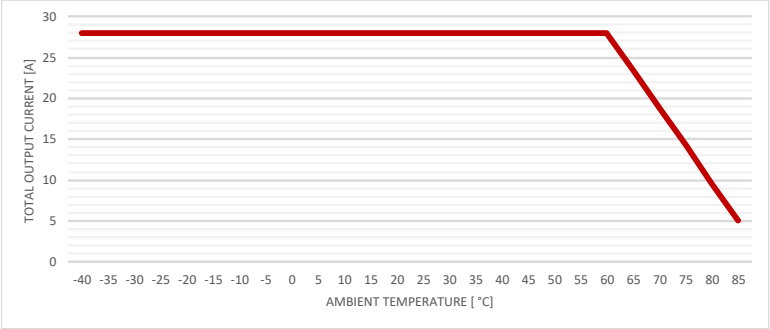
This results in a total output current of 28 A (336 W at 12 V, 672 W at 24 V)

Even with an optimal design (driver, layout), there are physical limits, especially depending on the ambient temperature and on the frequency PWM operation.

The following restrictions were determined as an example in the heating oven with circulation (fan) and complete connector allocation with 2 m cable harness and should therefore be regarded as rough guide values.

We generally recommend monitoring the module temperature (see 5.7 *Internal Measuring Values* on page 27) and the error status of the output drivers (see 5.2 *Digital Outputs DOut* on page 18 and 5.3 *Frequency Outputs FOut* on page 20).

The nominal load of all outputs together (28 A) is possible with an ambient temperature up to about 60 °C (140 °F). At the specified maximum temperature of 85 °C (185 °F), a total static output current of about 5 A is still possible.



Maximum total output current: values across the intended temperature range

There is a further restriction on the permissible load in frequency PWM operation. Here, the output driver passes through the range from high-impedance to conductive

at each switching edge, resulting in additional power loss (heat). This is also clearly dependent on the PWM base frequency, i.e. the number of switching edges per time.

Due to the significantly faster switching edges of the low-side drivers of typically 2 µs compared to 30 µs for the High-side drivers, the additional power loss in frequency PWM operation is considerably lower for the Low-side drivers. The frequency outputs are therefore designed with Low-side drivers.

The High-side drivers are suitable for frequency PWM operation only to a limited extent. At a base frequency of 100 Hz, PWM operation is possible with up to approx. 80 % of the nominal load:

- DOut 0 to 5 each about 19 W (> 7.5 Ω) at 12 V
- DOut 6 to 7 each about 38 W (> 3.8 Ω) at 12 V

At a base frequency of 1 kHz, PWM operation would be possible with a load less than 10 % of the nominal load.

The Low-side drivers (frequency outputs), on the other hand, can still be operated at nominal load even in PWM mode at 1 kHz. At 10 kHz, they can still be operated at approximately half the nominal load.

5.5 Analog Inputs AIn 16 Bit

Access in PCAN-MicroMod FD Configuration:
Analog Inputs

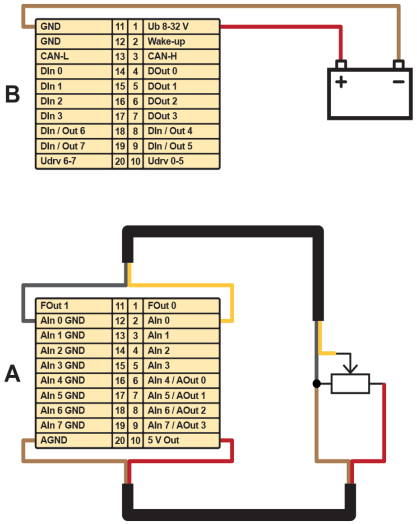
The analog inputs AIn 0 to AIn 7 are captured with an A/D converter resolution of 16 bits. The measuring range can be set in four increments per input via software configuration. The smallest measuring range is ±2.5 V, the largest is ±20 V.

> **Note:** The measured values are provided by the PCAN-MicroMod FD ECU already converted into Volts.

Each analog input has an associated input AIn GND for the reference potential in order to obtain highly accurate measurements. The deviation of the reference potential from the module ground GND must not exceed half of the set measuring range. For example, for a measuring range of ±5 V, the voltage at AIn GND must be in the range of −2.5 to +2.5 V for the analog input to be measured correctly. Thus, the analog inputs are not suitable for real differential measurements.

The deviation of the reference potential from the module ground GND is not to be larger than ±1 V so that the analog input is measured accurately. Thus, the analog inputs are not suitable for real differential measurements. If the analog input is configured to ±20 V, AIn GND should be connected to the module ground (AGND). A potential shift of 1 V would otherwise lead to an inaccurate measurement of approximately 100 mV.

For simple measurements with reference to module ground, the respective input for the reference potential (pin A-12 to pin A-19) can be connected to the analog ground on pin A-20. Connection to the general ground GND on pin B-11 should be avoided, especially if the Low-side frequency outputs are used.



Optimal Wiring for Measuring the Voltage on a Potentiometer

The analog inputs are sampled at a constant rate of 1 ms regardless of the configuration and can then be filtered again using a configurable software low-pass filter.

The connections A-6 to A-9 (AIn 4 to AIn 7) can alternatively be used as analog outputs. An analog output activated by configuration is connected by hardware in parallel with the analog input. The analog input is permanently available and can therefore also be used to read back the analog output.

> **Note:** When used solely as an analog input, the parallel analog output must be deactivated in the configuration so as not to influence the measured value.

Analog Inputs 16 Bits				
Quantity	8			
Resolution A/D converter	16 bits			
Connectors	A-2 “AIn 0” … A-9 “AIn 7” Masse: A-12 “AIn 0 GND” … A-19 “AIn 7 GND”			
Input voltage maximum	± 24 V			
Measuring ranges (adjustable by software)	± 2.5 V	± 5 V	± 10 V	± 20 V
Permissible potential on AIn GND	± 1 V	± 1 V	± 1 V	0 V *
Measuring resolution (per LSB)	76.294 µV	152.588 µV	305.176 µV	644.000 µV
Measuring accuracy	± 0.2 % ± 2 LSB	± 0.2 % ± 2 LSB	± 0.2 % ± 2 LSB	± 0.5 % ± 2 LSB
Input impedance	1 MΩ	1 MΩ	1 MΩ	370 kΩ minimum
Sampling rate	1 ms (independent of CAN transmission)			

* For this measuring range, a connection of AIn GND to the module ground (AGND) is recommended.

5.6 Analog Inputs AIn-60V

Access in PCAN-MicroMod FD Configuration:
Analog Inputs

Parallel or alternatively to the frequency outputs, there are two analog inputs with a measuring range of up to 60 V and a resolution of 12 Bit on pins A-1 and A-11.

> **Note:** The measured values are provided by the PCAN-MicroMod FD ECU already converted into Volts.

60 V is also the maximum input voltage. Voltages greater than 60 V at these connections can cause damage to the device.

Analog Inputs 60 V	
Quantity	2 (external)
Resolution A/D converter	12 bits
Connectors	A-1 “AIn-60V 0”, A-11 “AIn-60V 1”
Measuring range	0 to 60 V
Measuring resolution (per LSB)	14.65 mV
Input impedance	6.7 kΩ
Measuring accuracy	± 0.2 % ± 2 LSB
Low pass	f_g = 340 Hz
Sampling rate	1 ms (independent of CAN transmission)

5.7 Internal Measuring Values

Voltage Values

The PCAN-MicroMod FD ECU uses additional, internally hard-wired analog inputs with 12-bit resolution, which can be used to monitor certain voltage values in the

device. The measuring signals can be processed internally or transmitted via CAN. The measurement signals are already available in Volts.

Access in PCAN-MicroMod FD Configuration:
Analog Inputs

- Ub: supply voltage device, resolution about 0.05 V
- Udrv 0-5: common supply voltage for digital outputs DOut 0 to DOut 5, resolution about 0.1 V
- Udrv 6-7: common supply voltage for digital outputs DOut 6 and DOut 7, resolution about 0.1 V
- 5V Out: 5-Volt sensor supply, resolution about 0.01 V

Temperature Values

Additional temperature measuring signals can also be processed internally or transmitted via CAN.

Access in PCAN-MicroMod FD Configuration:
Statistics

- Temperature: internal module temperature, measured by a temperature sensor on the PCB, accuracy ±2 °C

5.8 Analog Outputs AOut

Access in PCAN-MicroMod FD Configuration:
Analog Outputs

The analog outputs AOut 0 to AOut 3 have a D/A converter resolution of 12 bits. The voltage range can be set to 0 to 5 V or 0 to 10 V per output via software configuration.

The reference potential for the analog outputs is pin A-20 “AGND” which should also be used for the return current.

At connections AOut 0 to AOut 3, the analog inputs AIn 4 to AIn 7 are connected in parallel. The analog input can be used to read back the actual voltage at the output.

Analog Outputs		
Quantity	4	
Connectors	A-6 “AOut 0” … A-9 “AOut 3”	
Resolution D/A converter	12 bits	
Voltage ranges (adjustable by configuration)	0 to 5 V	0 to 10 V
Accuracy	± 0.2 % ± 3 mV	± 0.2 % ± 5 mV
Output current maximum	20 mA	
Protection	Short-circuit protection (< 100 mA)	

5.9 5-Volt Supply of External Devices

The 5-Volt output available via pin A-10 with associated ground at pin A-20 is intended for supplying analog sensors or directly connecting a potentiometer whose output signal can be measured via one of the analog inputs. The 5-volt output voltage has a deviation of less than 1 % and can be loaded with up to 500 mA.

For a more precise evaluation, the exact output voltage can be read out via the internal voltages and included in the calculation.

The output can be permanently activated by configuration or switched at runtime via a CAN signal.

Access in PCAN-MicroMod FD Configuration:
Digital Outputs > 5 V Out

Note: The supply of loads with pulse-like currents (e.g. a device with a switching regulator) via this output, in particular via GND on pin A-20, should be avoided as this can influence the analog measurements.

5-Volt Output	
Connector	A-10 “5 V Out”
Purpose	Supply of external analog sensors, connection of a potentiometer
Output voltage	5 V ± 1 %
Maximum current output	500 mA

6 Operation

6.1 Standby Mode and Wake-up

Device Standby

To enable the device to shut down itself when the supply voltage remains on, the following setting must be adjusted in the configuration:

Device Parameters > CAN Receive Timeout
with a value ≥ 1 [ms]

The module will shut down after the specified time. Prerequisites:

- Low level (< 1 V) at the wake-up input (no influence on the timeout counter)
- No CAN traffic on the connected bus within the configured timeout period

As soon as the device is in standby mode, a wake-up event is required to start up the device again (see below).

The timeout value 0 disables the standby function (default). The device is active as long as the supply voltage is applied to Ub.

The current consumption (quiescent current) of the device in standby mode is approx. 25 µA at Ub. If the drivers also remain supplied in standby mode, the quiescent current via Ub + Udrv 0-5 + Udrv 6-7 is 150 to 350 µA at 12 V or 250 to 700 µA at 24 V, depending on the loads connected to the digital outputs DOut 0 to 7.

Device Startup (Wake-up)

For the device to start, a wake-up event is required. Two options are available:

- Wake-up by CAN traffic on the connected bus, CAN ID and bit rate irrelevant
- High level on the wake-up input, permanently or also briefly, e.g. via push button

Wake-up Input	
Connector	B-2 “Wake-up”
High level	> 7 V
Low level	< 1 V

Additional Settings for Standby Assurance

If there is a change from High to Low level at the wake-up input, the PCAN-MicroMod FD ECU remains active for the preset timeout period before switching to standby mode, particularly with regard to CAN traffic. This can have an unwanted effect on the behavior of the overall system.

The following configuration settings counteract this.

Device Parameters > Disable Tx on Wake-up Low
While a Low level is present at the wake-up input, the transmission of CAN messages is suppressed. This setting prevents other devices on the CAN bus from remaining active or being woken up again based on CAN messages that have been transmitted.

Device Parameters > Disable Rx on Wake-up Low
While a Low level is present at the wake-up input, the evaluation of incoming CAN messages is prevented. This setting avoids, for example, that output states of the PCAN-MicroMod FD ECU are still changed during the timeout period based on incoming CAN messages.

6.2 CAN Operating Modes

PCAN-MicroMod FD products can be used in different operating modes with support for the communication protocols CAN (FD) or CANopen (FD), depending on firmware and model. Furthermore, the operation with custom firmware is possible as well.

Support per Product

Product	CAN CAN FD	CANopen CANopen FD	Custom firmware
PCAN-MicroMod FD Evaluation	■	■	■
PCAN-MicroMod FD Analog 1	■	□	■
PCAN-MicroMod FD Digital 1/2	■	□	■
PCAN-MicroMod FD ECU	■	—	—
PCAN-MicroMod FD DR CANopen Digital 1	■	■	—
PCAN-MicroMod FD Custom Motherboard	■	—	—

■ Operating mode active on delivery
■ Alternative operating mode, license included
□ Alternative operating mode, license purchase required
— Unsupported operating mode

Usage

Operating mode	Key features	Firmware	Configuration
CAN / CAN FD	▪ CAN 2.0 A/B and CAN FD ▪ own definitions	Standard	with PCAN-MicroMod FD Configuration
CANopen / CANopen FD	▪ Communication profiles CiA 301 and CiA 1301 ▪ Device profiles CiA 401 and CiA 401-B/F	Standard	with third-party software for CANopen (FD)
Custom firmware	▪ Creation possible with our free development package	own	according to the firmware definition

6.2.1 Determining the Current Operating Mode

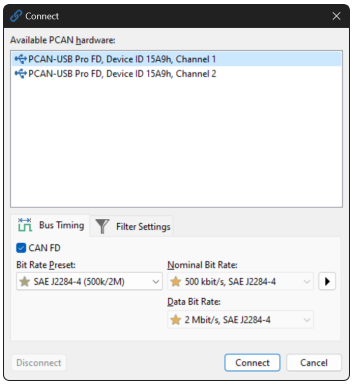
(not applicable for custom firmware)

You can determine the current operating mode of a device of the PCAN-MicroMod FD series with the Windows program PCAN-MicroMod FD Configuration. For the

prerequisites for using the program and for installation, see 4.3 *Configuring* on page 13.

Establishing the connection:

1. Connect a CAN interface of the PCAN series to your computer.
2. Connect the PCAN-MicroMod FD ECU to the CAN interface via a terminated CAN bus.
3. In PCAN-MicroMod FD Configuration, click on *Connect* to establish a connection to the CAN bus.
   The *Connect* window appears.



4. In the *Available PCAN hardware* field, select your CAN interface and, if applicable, the used channel.
5. On the *Bit Timing* tab select the *Nominal Bit Rate* currently used by the PCAN-MicroMod FD ECU, with CAN FD additionally the *Data Bit Rate*.
6. Confirm with *Connect*.

Query status information:

1. Select the menu command *Configuration* > *Read Firmware Information*.
   The *Active Modules* list appears, still empty. After a few seconds, the PCAN-MicroMod FD ECU is listed.
2. From the *Firmware Mode* column, read the current operating mode.

6.2.2 Operating Mode for CAN and CAN FD

Features

- Use in CAN and CAN FD buses
- Complies with CAN specifications 2.0 A/B and CAN FD

Prerequisite

- Installed standard firmware

Activation

- Achieved by switch-over with the configuration software
- Activated for regular PCAN-MicroMod FD products on delivery

Configuration

- Done via CAN bus with the Windows software PCAN-MicroMod FD Configuration
- Manal definition of the transmit and receive CAN messages
- Mapping of I/O signals to the CAN messages

6.2.3 Operating Mode for CANopen and CANopen FD

Features

- Use in CANopen and CANopen FD networks
- Communication profiles according to CiA® 301 version 4.2.0 and CiA® 1301 version 1.0.0
- Device profiles according to CiA® 401 version 3.0.0 and CiA® 401-B/F (not yet published)
- CANopen EDS files available for all supported products

Prerequisite

- Installed standard firmware

Activation

- Achieved by switch-over with the configuration software
- Requires a one-time unlock via the internet with a license that is included or can be purchased from Embedded Systems Academy

Configuration

- Configuration of the bit rates, node ID, and vendor ID is done with the Windows software PCAN-MicroMod FD Configuration
- The behavior of the I/O functionality is specified by the firmware

7 Firmware Upload

The microcontroller in the PCAN-MicroMod FD ECU is equipped with new firmware via CAN. The upload is done with the Windows program PEAK-Flash.

7.1 System Requirements

- CAN interface of the PCAN series for the computer, e.g. PCAN-USB FD
- CAN cabling between the CAN interface and the PCAN-MicroMod FD ECU with correct termination on both ends of the CAN bus, 120 Ohms each.

  > **Note:** We recommend using separate CAN cabling for transferring firmware in order to avoid possible interference with other CAN nodes.

- Operating system Windows 11 (x64/ARM64), 10 (x64) for the flash program

7.2 Firmware Transfer

The transfer of new firmware to the PCAN-MicroMod FD ECU device is done via a CAN bus using the Windows software PEAK-Flash.

Transfer firmware with PEAK-Flash:

1. Make sure that the current configuration of your PCAN-MicroMod FD ECU is available as file on your computer. Usually you have to transfer the configuration to the module again after a firmware update.

2. If PEAK-Flash is not yet installed on your computer, download the installation package from the following web page and run the contained setup program: www.peak-system.com/quick/DL-Software-E

   Tip: With the current installation package for PEAK-Flash, you also receive the latest version of the standard firmware for your device. This is embedded in the program.

3. Start the PEAK-Flash program and click *Next*.
   Page 2 *Select Hardware* is displayed.
4. Select *Modules connected to the CAN bus*.
5. Under *Channels of connected CAN hardware*, select the CAN interface via which your computer is connected to the CAN bus.
6. If the indicated bitrate differs from the one on the CAN bus, adjust it with *Change*. The bitrate set here must match the current one on the PCAN-MicroMod FD ECU.
7. Click *Detect*.
   The list shows the PCAN-MicroMod FD ECU with the module ID and the firmware version. If not, check whether there is a proper connection to the CAN bus with the correct nominal bit rate.
8. Click *Next*.
   Page 3 *Select Firmware* is displayed.
9. Select *Embedded Firmware* to update the standard firmware for the PCAN-MicroMod FD ECU to the current version.
10. Click *Next*.
    Page 4 *Ready to Flash* is displayed.
11. Click *Start* to transfer the new firmware to the PCAN-MicroMod FD ECU.
    Page 5 *Flashing* is displayed. The flash process begins and is indicated by the (*Progress*) bar.
12. Once the process is complete (*Erasing* and *Flashing* each 100 %), check the history in the *Overview* area.

13. In the *Reset Module* area, click *Reset this module* to set the PCAN-MicroMod FD ECU from flash mode to regular operation mode.
14. Click *Next*.

    Page 5 *End* is displayed.
15. You can leave the program via *Exit*.
16. The previous configuration on the PCAN-MicroMod FD ECU may no longer be valid, so you may have to transfer the configuration to the device again before it will work normally.

8 Technical Specifications

CAN			
Protocols	CAN FD ISO 11898-1:2015, CAN 2.0 A/B		
Physical transmission	ISO 11989-2 (High-speed CAN)		
Transceiver	NXP TJA1043		
CAN bit rates	40 kbit/s to 1 Mbit/s		
CAN FD bit rates	40 kbit/s to 10 Mbit/s		
Supported clock frequencies	20 MHz, 40 MHz, 80 MHz		
Supported bit timing values		Nominal	Data
	Prescaler (BRP)	1 to 512	1 to 32
	Time Segment 1 (TSEG1)	1 to 256	1 to 32
	Time Segment 2 (TSEG2)	1 to 128	1 to 16
	Synch. Jump Width (SJW)	1 to 128	1 to 16
Galvanic isolation	not implemented		
Termination	not implemented		
Withstand voltage	± 30 V permanent, ± 30 kV ESD		
CAN ID reserved for configuration transfer	7E7h		

Supply		
Operating voltage Ub	8 to 32 V DC, 12 V or 24 V nominal	
Current consumption during operation	typical: 150 mA at 12 V 100 mA at 24 V	maximum (5 V Out and AOut active): 600 mA at 12 V 450 mA at 24 V
Current consumption during standby	approx. 25 µA at 12 V approx. 30 µA at 24 V	

Measures	
Casing measures	Without mating connectors: 130.3 x 94.9 x 42.3 mm With mating connectors: 130.3 x 112.9 x 42.3 mm See also Appendix C *Dimension Drawing* on page 48
Weight	Without mating connectors: 205 g With mating connectors and crimp contacts: 270 g

Connectors	
Type	Connectors with crimp terminals
Mating connector type of Connector A	Molex MX150 A 33472-2001 black
Mating connector type of Connector B	Molex MX150 B 33472-2002 light gray

Environment	
Operating temperature	−40 to +85 °C (−40 to +185 °F)
Temperature for storage and transportation	−40 to +100 °C (−40 to +212 °F)
Relative humidity	15 to 90 %, not condensing
Ingress protection (ISO 20653)	IP67

Conformity	
RoHS	EU Directive 2011/65/EU (RoHS 2) + EU Directive 2015/863/EU (amended list of restricted substances) DIN EN IEC 63000:2019-05
EMC	EU Directive 2014/30/EU DIN EN 61326-1:2022-11
E1 type approval	E1 10 R - 06 10298

Digital Inputs	
Quantity	4
Connectors	DIn 0 … DIn 7
Input voltage maximum	DIn 0 to DIn 3: +32 V DIn 4, DIn 5: Udrv 0-5, max. +32 V DIn 6, DIn 7: Udrv 6-7, max. +32 V
Input circuitry	Adjustable by configuration per input: ■ Open ■ Pull-up: 4.7 kΩ against supply voltage, 0.5 W ■ Pull-down: 4.7 kΩ against ground, 0.5 W
Switching threshold Low → High	> 6 V typ. (4.5 to 7.5 V)
Switching threshold High → Low	< 3.5 V typ. (2.2 to 4.5 V)

Digital Outputs

Quantity	8 (6 + 2)	
Connectors	DOut 0 … DOut 5	DOut 6 … DOut 7
Type	High-side switch	High-side switch
Supply voltage	9 to 36 V DC	9 to 36 V DC
Withstand voltage of output supply	55 V	55 V
Output current per output	2.0 A	5.0 A
Initial over-current:		
Duration	10 ms	10 ms
Current limitation activation threshold	12 A	25 A
Current limitation hold current	6 to 11 A	12 to 23 A
Steady-state over-current:		
Current limitation activation threshold	5 A	13 A
Current limitation hold current	2.5 to 4.5 A	6 to 10 A
Slope typical	25 µs	30 µs
PWM mode	Frequency range 1 Hz to 10 kHz PWM resolution determined by internal timer with 10 MHz (e.g. 0.1 % at 10 kHz)	

Frequency Outputs

Quantity	2
Connectors	FOut 0 + FOut 1
Frequency range	0.1 Hz to 20 kHz
Voltage load	6 to 36 V
Withstand voltage	60 V
Output current nominal	3 A
Output current maximum (current limiter)	10 A minimum 16 A typical 22 A maximum
Slope typical	1.5 µs

Analog Inputs 60 V	
Quantity	2 (external)
Resolution A/D converter	12 bits
Connectors	A-1 “AIn-60V 0”, A-11 “AIn-60V 1”
Measuring range	0 to 60 V
Measuring resolution (per LSB)	14.65 mV
Input impedance	6.7 kΩ
Measuring accuracy	± 0.2 % ± 2 LSB
Low pass	f_g = 340 Hz
Sampling rate	1 ms (independent of CAN transmission)

Analog Inputs 16 Bits				
Quantity	8			
Resolution A/D converter	16 bits			
Connectors	A-2 “AIn 0” … A-9 “AIn 7” Masse: A-12 “AIn 0 GND” … A-19 “AIn 7 GND”			
Input voltage maximum	± 24 V			
Measuring ranges (adjustable by software)	± 2.5 V	± 5 V	± 10 V	± 20 V
Permissible potential on AIn GND	± 1 V	± 1 V	± 1 V	0 V *
Measuring resolution (per LSB)	76.294 µV	152.588 µV	305.176 µV	644.000 µV
Measuring accuracy	± 0.2 % ± 2 LSB	± 0.2 % ± 2 LSB	± 0.2 % ± 2 LSB	± 0.5 % ± 2 LSB
Input impedance	1 MΩ	1 MΩ	1 MΩ	370 kΩ minimum
Sampling rate	1 ms (independent of CAN transmission)			

* For this measuring range, a connection of AIn GND to the module ground (AGND) is recommended.

Analog Outputs		
Quantity	4	
Connectors	A-6 “AOut 0” … A-9 “AOut 3”	
Resolution D/A converter	12 bits	
Voltage ranges (adjustable by configuration)	0 to 5 V	0 to 10 V
Accuracy	± 0.2 % ± 3 mV	± 0.2 % ± 5 mV
Output current maximum	20 mA	
Protection	Short-circuit protection (< 100 mA)	

5-Volt Output	
Connector	A-10 “5 V Out”
Purpose	Supply of external analog sensors, connection of a potentiometer
Output voltage	5 V ± 1 %
Maximum current output	500 mA

Wake-up Input	
Connector	B-2 “Wake-up”
High level	> 7 V
Low level	< 1 V

Appendix A CE Certificate

EU Declaration of Conformity

This declaration applies to the following product:

Product name:	**PCAN-MicroMod FD ECU**
Item number(s):	**IPEH-003085**
Manufacturer:	PEAK-System Technik GmbH Leydheckerstraße 10 64293 Darmstadt Germany

CE We declare under our sole responsibility that the mentioned product is in conformity with the following directives and the affiliated harmonized standards:

EU Directive 2011/65/EU (RoHS 2) + 2015/863/EU (amended list of restricted substances)

DIN EN IEC 63000:2019-05
Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances (IEC 63000:2016);
German version of EN IEC 63000:2018

EU Directive 2014/30/EU (Electromagnetic Compatibility)

DIN EN 61326-1:2022-11
Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements (IEC 61326-1:2020);
German version of EN IEC 61326-1:2021

Darmstadt, 7 June 2024

Uwe Wilhelm, Managing Director

Appendix B UKCA Certificate

UK Declaration of Conformity

This declaration applies to the following product:

Product name: **PCAN-MicroMod FD ECU**

Item number(s): **IPEH-003085**

Manufacturer:
PEAK-System Technik GmbH
Leydheckerstraße 10
64293 Darmstadt
Germany

UK authorized representative:
Control Technologies UK Ltd
Unit 1, Stoke Mill,
Mill Road, Sharnbrook,
Bedfordshire, MK44 1NN, UK

We declare under our sole responsibility that the mentioned product is in conformity with the following UK legislations and the affiliated harmonized standards:

The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

DIN EN IEC 63000:2019-05
Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances (IEC 63000:2016);
German version of EN IEC 63000:2018

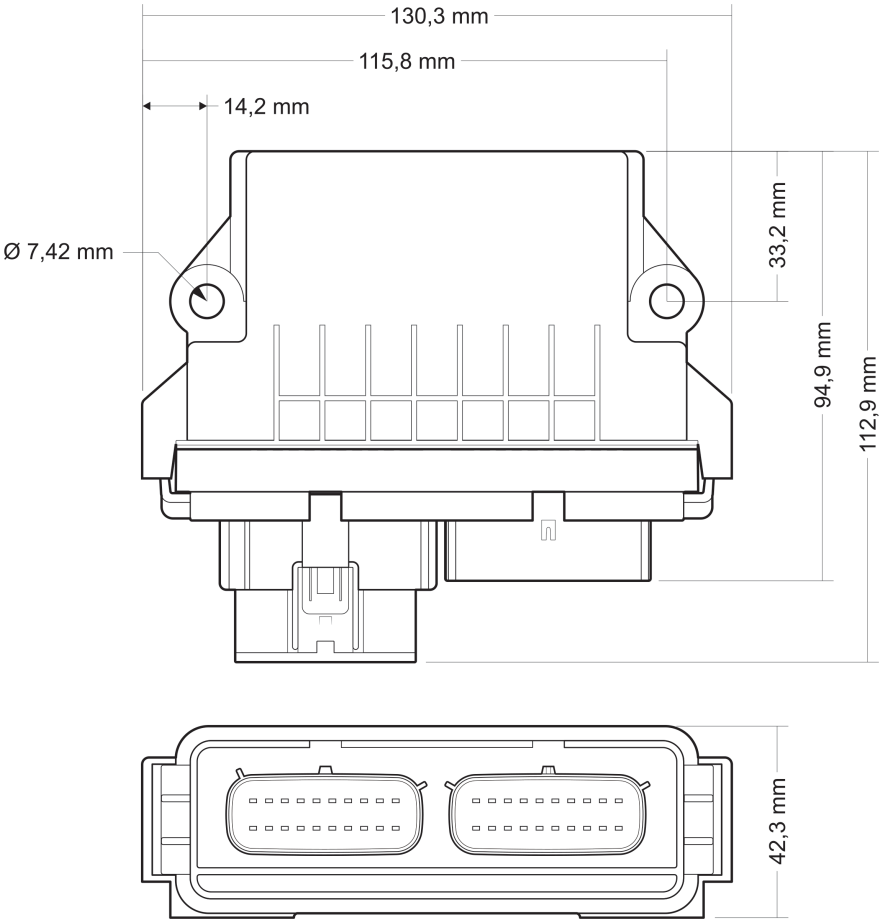
Electromagnetic Compatibility Regulations 2016

DIN EN 61326-1:2022-11
Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements (IEC 61326-1:2020);
German version of EN IEC 61326-1:2021

Darmstadt, 7 June 2024

Uwe Wilhelm, Managing Director

Appendix C Dimension Drawing



Appendix D Disposal

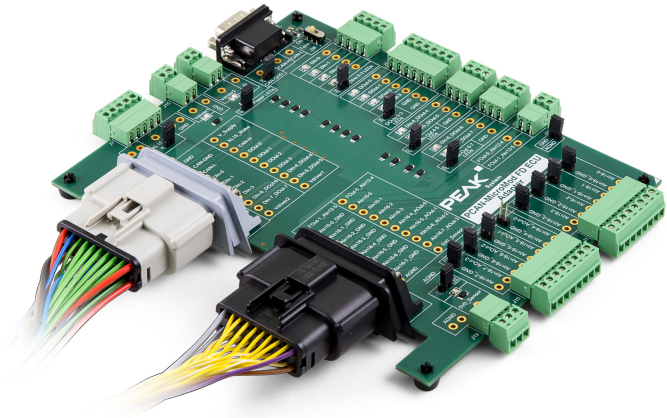
The PCAN-MicroMod FD ECU must not be disposed of with household waste. Dispose of this electronic device in accordance with local regulations.

The PCAN-MicroMod FD ECU does not contain a battery for separate disposal.

Appendix E Accessories

E.1 PCAN-MicroMod FD ECU Adapter

Part number: IPEH-003086



The PCAN-MicroMod FD ECU Adapter allows simplified wiring of the PCAN-MicroMod FD ECU using Phoenix screw terminal connectors for applications like configuration development and validation.

E.1.1 Features

- Adapter board from automotive connectors (Molex MX150) to screw terminal strip connectors (Phoenix)
- Connection to PCAN-MicroMod FD ECU via color-coded cable set
- 9-pin D-Sub socket for CAN bus connection (in accordance with CiA® 106)

- Phoenix connectors for:
  - Power supply and wake-up
  - Supply for High-side switches
  - Analog I/Os
  - Digital I/Os
  - Frequency outputs (Low-side)
  - 5 V output (sensor supply)
- Switchable CAN termination of 120 Ω
- Status LEDs for digital I/Os, power supply, and 5 V output
- LEDs detachable via jumpers to avoid additional current consumption
- Jumpers to connect each analog input ground to the module ground (AGND)

E.1.2 Scope of Supply

- PCAN-MicroMod FD ECU Adapter board
- Pre-configured, color-coded cable set connecting board and ECU