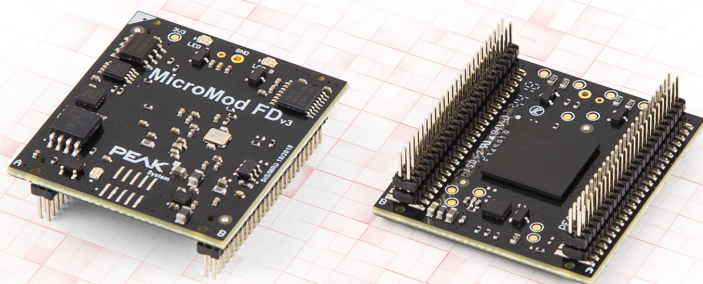


PCAN-MicroMod FD

User Manual



Relevant products

Product designation	Model	Part no.
PCAN-MicroMod FD		IPEH-003080

Imprint

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Document version 1.1.1 (2020-10-21)

Essential changes in this document are listed in Appendix E on page 34.

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1 Introduction

The PCAN-MicroMod FD is a small plug-in board with CAN and CAN FD connection on the one side and various physical inputs and outputs on the other side. The logical linking of both sides is done by the microcontroller NXP LPC54618. With the MicroMod FD, electronics developers can easily integrate I/O functionality with CAN connection into their project.

The PCAN-MicroMod FD is configured using the supplied Windows software. 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 the CAN bus to the MicroMod FD which then runs as an independent CAN node. Multiple modules can be configured independently on a CAN bus.

For the PCAN-MicroMod FD, ready-to-use motherboards in an aluminum housing and an Evaluation Board for the development of own applications are available.

This document describes the hardware and the functions of the plug-in board PCAN-MicroMod FD. Separate documents exist for the motherboards from PEAK-System (e.g. Analog 1) and for the Evaluation Board.

1.1 Features Overview

- Plug-in board with 2 double pin strips of 50 pins each, 50 mil pitch (1.27 mm)
- NXP LPC54618 microcontroller with Arm® Cortex® M4 core

- 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 (max. 64 bytes) from 20 kbit/s up to 10 Mbit/s
 - CAN bit rates from 20 kbit/s up to 1 Mbit/s
 - Microchip CAN transceiver MCP2558FD
- 8 analog inputs
 - Measuring range unipolar 0 to 3 V
 - Resolution 12 bits, sample rate 1 kHz
- 8 digital inputs
- 8 digital outputs
- 2 frequency outputs
- Selective configuration of up to 16 devices in a CAN network based on the module ID
- Supply voltage 3.3 V
- Dimensions 33 x 36 mm
- Extended operating temperature range from -40 to 85 °C (-40 to 185 °F)

1.2 Operation Requirements

- Board with socket strips or hole grid for mounting the PCAN-MicroMod FD (Evaluation Board, motherboard from PEAK-System or self-development), see also Appendix B *Dimension Drawings* on page 24.

Possible socket strip (2 pieces) as counterpart to the PCAN-MicroMod FD: Amtek 5PS3MSA44-225GONPNRU-00

- For the creation and transfer of a configuration:
Computer with Windows 10, 8.1 (32/64-bit) and a PC-CAN interface from PEAK-System
(Recommendation: PC-CAN interface with CAN FD capability, e.g. PCAN-USB FD)

1.3 Scope of Supply

- PCAN-MicroMod FD plug-in board
- Configuration software for Windows
- Manual in PDF format
- Optional: Pin adapter for 100 mil pitch

2 Electrical Connection

This chapter covers the signal assignment of the pins on the PCAN-MicroMod FD and its possible circuitry.

2.1 Connectors

The PCAN-MicroMod FD has two double pin rows (A, B) with 50 pins each (first column in the following tables). Thus, the MicroMod FD can be plugged onto boards with matching socket strips (50-mil/1.27-mm grid, see also Appendix B *Dimension Drawings* on page 24).

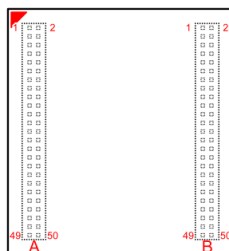
Possible socket strip (2 pieces) as counterpart to the PCAN-MicroMod FD: Amtek 5PS3MSA44-225GONPNRU-00

On request, PEAK-System offers an adapter for circuit boards with 100-mil/2.54-mm grid). See also Appendix C *CPU Adapter for 2.54 mm Pitch* on page 25.

The MicroMod FD has a white mark on the upper left corner (pin A1) for better orientation when plugged in.



Attention! Electrostatic discharge (ESD) can damage or destroy components on the circuit board. Take precautions to avoid ESD when handling the circuit board.



Pin layout of the two double pin headers, direction of view from above through the circuit board (orientation when plugged in).

Pin MMFD	Designation	Function
A1	GND	Ground
A3	LED-A_red	Open-drain outputs for external status LEDs
A5	LED-A_green	
A7	LED-B_red	
A9	LED-B_green	
A11	FC1_I2C-SDA	I ² C 1: identification of the motherboard type via external EEPROM
A13	FC1_I2C-SCL	
A15		
A17		Reserved
A19	Ext-CAN-Sel#	Alternative, external CAN transceiver is used if put on ground
A21		Reserved
A23		Reserved
A25		Reserved
A27	Dout-0	Digital outputs 0 to 7 for switching external output drivers, 3.3 V level Static state: 0, 1 PWM at 1 – 10,000 Hz (common frequency for all outputs)
A29	Dout-1	
A31	Dout-2	
A33	Dout-3	
A35	Dout-4	
A37	Dout-5	
A39	Dout-6	
A41	Dout-7	
A43	CAN-H	High-speed CAN ISO 11898-2: differential signal High
A45	CAN-L	High-speed CAN ISO 11898-2: differential signal Low
A47	Reset-in#	Module reset, Low-active, internal pull-up 10 kΩ to 3.3 V
A49	GND	Ground

Pin MMFD	Designation	Function
A2	GND	Ground
A4		Reserved
A6		Reserved
A8		Reserved
A10		Reserved
A12		Reserved
A14		Reserved
A16		Reserved
A18		Reserved
A20		Reserved
A22		Reserved
A24		Reserved
A26		Reserved
A28		Reserved
A30		Reserved
A32	Boot-CAN#	CAN bootloader is started if put on ground during start-up (CAN pins: A43, A45)
A34		Reserved
A36		Reserved
A38		Reserved
A40		Reserved
A42	Ext-CAN_M1	Connection to alternative, external CAN transceiver (is enabled by pin A19)
A44	Ext-CAN_M0	
A46	Ext-CAN_TxD	
A48	Ext-CAN_RxD	
A50	GND	Ground

Pin MMFD	Designation	Function
B1	GND	Ground
B3	FC0_V24_TxD	Serial RS-232 interface for firmware updates
B5	FC0_V24_RxD	
B7	FC0_V24_RTS	
B9	FC0_V24_CTS	

Pin MMFD	Designation	Function
B11		Reserved
B13		Reserved
B15	ID_Bit-0#	Module ID (4 bits → values 0 – 15): - Pin open (internal pull-up): 0 - Pin on ground: 1
B17	ID_Bit-1#	
B19	ID_Bit-2#	
B21	ID_Bit-3#	
B23	Vbus	Connection to a USB host (PC) for firmware update
B25	USB1_P	
B27	USB1_N	
B29		Reserved
B31	Din-0	Digital inputs 0 to 7, level 3.3 V Inputs 0 to 5: measurment of the frequency or the duty cycle possible
B33	Din-1	
B35	Din-2	
B37	Din-3	
B39	Din-4	
B41	Din-5	
B43	Din-6	
B45	Din-7	
B47	3V3in	Supply voltage input 3.3 V DC, 100 mA (connected to B48)
B49	GND	Ground

Pin MMFD	Designation	Function
B2	GND	Ground
B4	Boot-Serial#	Bootloader is started if put on ground during start-up (RS-232 pins: B3, B5, B7, B9)
B6	Boot-USB#	USB bootloader is started if put on ground during start-up (USB pins: B23, B25, B27)
B8	Fout-0	Frequency outputs 0 and 1, level 3.3 V
B10	Fout-1	
B12		Reserved
B14		Reserved
B16		Reserved
B18		Reserved

Pin MMFD	Designation	Function
B20		Reserved
B22		Reserved
B24		Reserved
B26		Reserved
B28	Ain-0	Analog inputs 0 to 7, resolution 12 bits
B30	Ain-1	
B32	Ain-2	
B34	Ain-3	
B36	Ain-4	
B38	Ain-5	
B40	Ain-6	
B42	Ain-7	
B44	Vref-out	Reference voltage 3.0 V, can be connected to pin B46 as internal reference
B46	Vref-in	Reference voltage input for 12-bit ADC, pin B44 recommended as source
B48	3V3in	Supply voltage input 3.3 V DC, 100mA (connected to B47)
B50	GND	Ground

2.2 Circuitry

For the basic operation of the PCAN-MicroMod FD, a **minimal circuitry** with the following components is required:

- Voltage supply 3.3 V DC
- CAN connection (CAN-High, CAN-Low)
- Pull-down for module ID inputs
- Feedback of the analog reference voltage
- Push button to ground for CAN flash mode (with pull-up resistor)
- Reset push button to ground

The minimum circuitry is shown in the circuit diagram in Appendix D *Minimum Circuitry* on page 32.

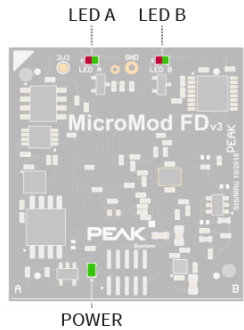
A **comprehensive circuit example** can be found in the circuit diagram for the separately available Evaluation Board. The circuit diagram is part of the corresponding user manual PCAN-MicroMod FD Evaluation Board.



Tip: When designing the circuitry for the PCAN-MicroMod FD, also observe the protection against overvoltage and reverse polarity at inputs.

3 Operation

3.1 Status LEDs



Positions of status LEDs on the PCAN-MicroMod FD

LED A (upper left)	Status	Description
No function		Reserved

LED B (upper right)	Status	Description
Green blinking (1 Hz)	Normal operation	
Green flickering	Receiving configuration	
Green and red blinking alternately	No valid configuration	
Orange quick blinking (4 Hz)	CAN Bootloader	Ready for transfer. New firmware can be transferred to the PCAN-MicroMod FD via CAN bus using the Windows program PEAK-Flash.
Red on	Firmware error	The PCAN-MicroMod FD does not have a valid firmware.

Power LED (lower location)	Status	Description
Green on	Power Supply	The supply voltage of 3.3 V is applied to the PCAN-MicroMod FD.

3.2 Reserved CAN ID 7E7h

To configure the PCAN-MicroMod FD, the 11-bit CAN ID 7E7h is used. Accordingly, the PCAN-MicroMod FD Configuration program exchanges data with the module via the CAN bus. When designing your CAN network, make sure not to use the CAN ID 7E7h in any way.

3.3 Overview of Services

The PCAN-MicroMod FD provides various functions, called services. The availability of services depends on the used motherboard.

Service	Remark
Symbols (CAN messages)	Definition of the CAN messages used by the PCAN-MicroMod FD with Symbol names (CAN ID) and Variables resulting from Signals within the data bits. Signals can contain initial values and timeout periods (e.g. for CAN problems).
Digital Inputs	Assigned CAN messages can also be transmitted event-controlled. For this purpose, the type of signal change (positive edge, negative edge or both edges) is set as trigger.
Digital Outputs	A Signal has influence either on the state of a digital output or on the duty cycle at a preset frequency.
Analog Inputs	An A/D value can be adjusted with scale and offset. Furthermore, a software low-pass can be activated.
Analog Outputs	This service is only available with a D/A converter being applied to the PCAN-MicroMod FD (e.g. using the Analog 1 motherboard). A D/A value can be adjusted with scale and offset.
Frequency Outputs	Frequency and duty cycle are controlled independently with one Signal each.
Digital Functions	The digital inputs can be logically combined with each other. The result can be passed on to a Signal, to a digital output, or internally as feedback to an input.
Statistics	Statistical data generated by the PCAN-MicroMod FD about the processing and the environment can be passed to Signals.

Service	Remark
Curve Definitions/Curves (characteristic curves)	Analog input data can be converted with the help of curves.
Rotary Encoders	The service can process the signals of manual encoders connected to digital inputs (standard quadrature with 2 bits, max. 500 pulses/sec.).
Functions	A collection of functions that convert one Signal value and place the result on another Signal. Excerpt from the collection: Mult, Mod, And, Hysteresis, Limit, RS Flip Flop, Switch Delay, Greater Than.

Find more details about the functionality and the application of the services in the help of the PCAN-MicroMod FD Configuration program.

4 Configuration Program

With the enclosed configuration program PCAN-MicroMod FD Configuration for Windows you can create, edit, and then transfer configurations to one or more PCAN-MicroMod FD via CAN.

4.1 Prerequisites for the Configuration Transfer

- Windows 10, 8.1 (32/64-bit)
- PC-CAN interface from PEAK-System, e.g. PCAN-USB FD
- CAN bus connection between the PCAN-MicroMod FD and the CAN interface of the PC

On a computer without PCAN environment, you can create and edit a configuration with the program and transfer the configuration later to the MicroMod FD using another computer with PC CAN interface.

4.2 Installing the Configuration Program

The installation program for PCAN-MicroMod FD Configuration is located on the supplied Product DVD.

Steps of the software installation:

1. Insert the Product DVD into the computer drive and execute the navigation program either on request or manually (`Intro.exe`).
2. Klick on *English > Tools*.

3. In the list, find the *PCAN-MicroMod FD Configuration* entry and click on *Install*.
4. Follow the instructions of the installation program.

Retrieve further information about the use of PCAN-MicroMod FD Configuration in the provided help that you can reach via the program (e.g. with the **F1** key).

5 Firmware Update

Different ways are available in order to update the firmware on the PCAN-MicroMod FD.

Way	Pins for transfer	Pin for flash mode	File type	Required supplements
RS-232	B3: TxD, B5: RxD	B4	Hex	Flash program Flash Magic for Windows
CAN	A43: CAN-H, A45: CAN-L	A32 (LED A blinks quickly orange)	Binary	PC-CAN interface from PEAK-System PEAK-Flash for Windows (freely available)
USB	B23: Vbus, B25: USB1_P, B27: USB1_N	B6	Binary	None (mass storage device in operating system)

* Must be connected to ground during switch-on.



Tip: In order to update the firmware, we recommend the use of the Evaluation Board for the PCAN-MicroMod FD (IPEH-003081 or kit IPEH-003082). This simplifies the connection of the cabling on the one hand and the setting of the flash mode on the other hand.

6 Technical Specifications

Supply

Supply voltage	3.3 V DC
Current consumption	180 mA max.

Connectors

Connection strips	2 double strips, each with 50 pins
Grid	50 mil (1.27 mm)
See also Appendix B <i>Dimension Drawings</i> on page 24	

Control and Communication

Microcontroller	NXP LPC54618, Arm® Cortex® M4 Core
Standard firmware	Configuration via reserved CAN ID 7E7h

CAN

Channels	1
Specification	ISO 11898-2, CAN 2.0 A/B and CAN FD
Transceiver	Microchip MCP2558FD
Nominal bitrates	20 kbit/s – 1 Mbit/s
CAN FD data bitrates	20 kbit/s – 10 Mbit/s
Galvanic isolation	none
Termination	none

Digital Inputs

Count	8
Sampling functions	Static state: 0, 1 Frequency: 0 – 20 kHz (only inputs 0 ... 5) Duty cycle: 0.0 – 100.0 % (only inputs 0 ... 5) Manual rotary encoder (occupies 2 digital inputs each): standard quadrature with 2 bit, max. 500 pulses/sec.
Level	3.3 V nominal

Analog Inputs

Count	8
Voltage range	0 – 3 V unipolar
Resolution	12 bits
Sample rate	1 kHz

Digital Outputs

Count	8
Functions	Static state: 0, 1 PWM at 1 – 10,000 Hz (common frequency for all outputs)

Frequency/PWM Outputs

Count	2
Frequency	20 kHz max.

Temperature Sensor

Design	integrated
Measuring range	–55 – +125 °C (–67 – +257 °F)
Accessed via configuration	Service “Statistics”

Additional Data Channels

USB	For firmware update, only via separately available Evaluation Board
RS-232	For firmware update, only via separately available Evaluation Board and with separate flash software

Measures

Size of board	33 x 36 mm
Height incl. pins	13 mm
	See also Appendix B <i>Dimension Drawings</i> on page 24
Weight	9 g

Environment

Operating temperature	-40 – +85 °C (-40 – +185 °F)
Temperature for storage and transport	-40 – +100 °C (-40 – +212 °F)
Relative humidity	15 – 90 %, not condensing

Conformity

RoHS	EU directive 2011/65/EU (RoHS 2) EU directive 2015/863/EU (revised list of restricted substances) DIN EN IEC 63000:2019-05; VDE 0042-12:2019-05
EMC	EU directive 2014/30/EU DIN EN 61326-1:2013-07; VDE 0843-20-1:2013-07

Appendix A CE Certificate

EU Declaration of Conformity



This declaration applies to the following product:

Product name: **PCAN-MicroMod FD**
Item number(s): **IPEH-003080**
Manufacturer: **PEAK-System Technik GmbH**
Otto-Roehm-Strasse 69
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; VDE 0042-12:2019-05

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

EU Directive 2014/30/EU (Electromagnetic Compatibility)

DIN EN 61326-1:2013-07; VDE 0843-20-1:2013-07

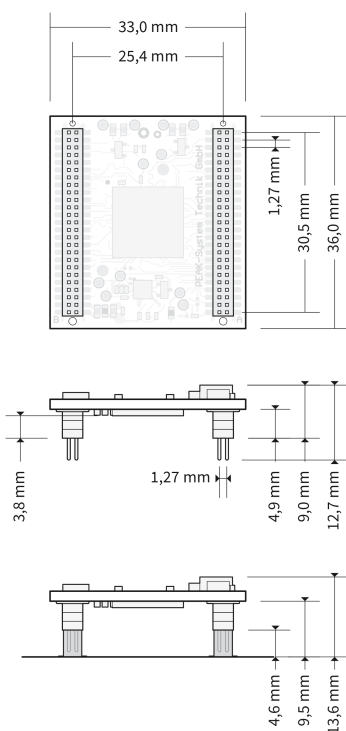
Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements (IEC 61326-1:2012); German version EN 61326-1:2013

Darmstadt, 7 May 2020

A handwritten signature in black ink, appearing to read "Uwe Wilhelm".

Uwe Wilhelm, Managing Director

Appendix B Dimension Drawings



The scale of the drawings differs from an 1-to-1 representation.

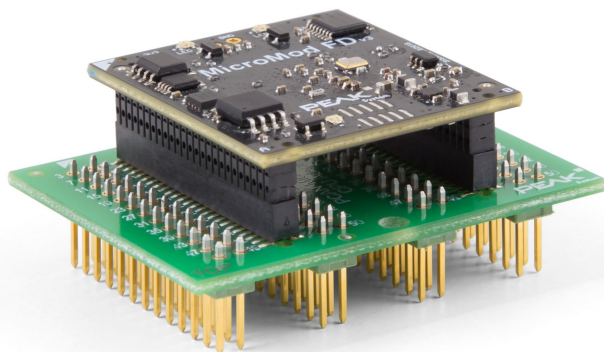
Pitch of connection pins: 50 mil $\hat{=}$ 1.27 mm

Lower figure: example for plug-in positioning on a motherboard. Possible socket strip (2 pieces) as counterpart to the PCAN-MicroMod FD: Amtek 5PS3MSA44-225GONPNRU-00

Appendix C CPU Adapter for 2.54 mm Pitch

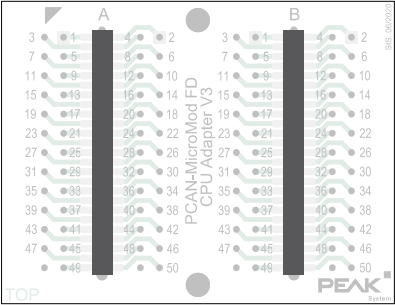
C.1 Description CPU Adapter

The pin strips of the PCAN-MicroMod FD have a 50 mil/1.27 mm pitch. On request, PEAK-System offers an adapter for circuit boards with 100-mil/2.54-mm grid.

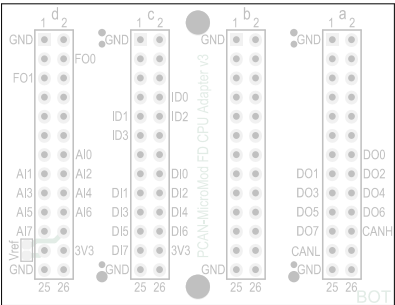


The CPU adapter has a circuit board with two socket strips for holding the PCAN-MicroMod FD and four pin strips with 100-mil-/2.54-mm pitch. The latter are supplied loose and can be plugged into the board and soldered if required.

C.2 Pin Assignment CPU Adapter



Schematic view of the adapter from above (two socket strips for holding the PCAN-MicroMod FD)



Schematic view of the adapter from below (4 pin strips with 26 pins each, 100 mil/2.54 mm pitch)

Pin MMFD	Pin Adapter	Designation	Function
A1	a1	GND	Ground
A3	a2	LED-A_red	Open-drain outputs for external status LEDs
A5	a3	LED-A_green	
A7	a4	LED-B_red	
A9	a5	LED-B_green	I ² C 1: identification of the motherboard type via external EEPROM
A11	a6	FC1_I2C-SDA	
A13	a7	FC1_I2C-SCL	
A15	a8		Reserved
A17	a9		Reserved

Pin MMFD	Pin Adapter	Designation	Function
A19	a10	Ext-CAN-Sel#	Alternative, external CAN transceiver is used if put on ground
A21	a11		Reserved
A23	a12		Reserved
A25	a13		Reserved
A27	a14	Dout-0	Digital outputs 0 to 7 for switching external output drivers, 3.3 V level Static state: 0, 1 PWM at 1 – 10,000 Hz (common frequency for all outputs)
A29	a15	Dout-1	
A31	a16	Dout-2	
A33	a17	Dout-3	
A35	a18	Dout-4	
A37	a19	Dout-5	
A39	a20	Dout-6	
A41	a21	Dout-7	
A43	a22	CAN-H	High-speed CAN ISO 11898-2: differential signal High
A45	a23	CAN-L	High-speed CAN ISO 11898-2: differential signal Low
A47	a24	Reset-in#	Module reset, Low-active, internal pull-up 10 kΩ to 3.3 V
A49	a25	GND	Ground

Pin MMFD	Pin Adapter	Designation	Function
A2	b1	GND	Ground
A4	b2		Reserved
A6	b3		Reserved
A8	b4		Reserved
A10	b5		Reserved
A12	b6		Reserved
A14	b7		Reserved
A16	b8		Reserved
A18	b9		Reserved
A20	b10		Reserved
A22	b11		Reserved
A24	b12		Reserved

Pin MMFD	Pin Adapter	Designation	Function
A26	b13		Reserved
A28	b14		Reserved
A30	b15		Reserved
A32	b16	Boot-CAN#	CAN bootloader is started if put on ground during start-up (CAN pins: A43, A45)
A34	b17		Reserved
A36	b18		Reserved
A38	b19		Reserved
A40	b20		Reserved
A42	b21	Ext-CAN_M1	Connection to alternative, external CAN transceiver (is enabled by pin A19)
A44	b22	Ext-CAN_M0	
A46	b23	Ext-CAN_TxD	
A48	b24	Ext-CAN_RxD	
A50	b25	GND	Ground

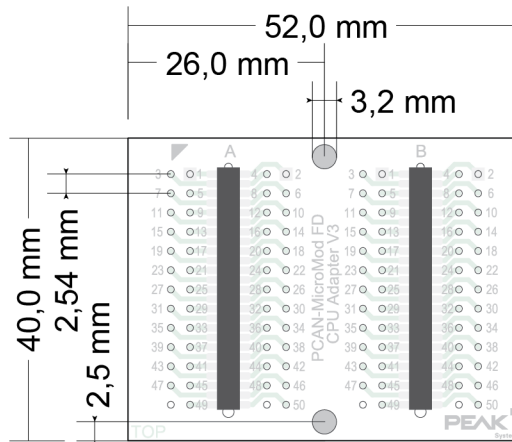
Pin MMFD	Pin Adapter	Designation	Function
B1	c1	GND	Ground
B3	c2	FC0_V24_TxD	Serial RS-232 interface for firmware updates
B5	c3	FC0_V24_RxD	
B7	c4	FC0_V24_RTS	
B9	c5	FC0_V24_CTS	
B11	c6		Reserved
B13	c7		Reserved
B15	c8	ID_Bit-0#	Module ID (4 bits → values 0 – 15): - Pin open (internal pull-up): 0 - Pin on ground: 1
B17	c9	ID_Bit-1#	
B19	c10	ID_Bit-2#	
B21	c11	ID_Bit-3#	
B23	c12	Vbus	Connection to a USB host (PC) for firmware update
B25	c13	USB1_P	
B27	c14	USB1_N	
B29	c15		Reserved

Pin MMFD	Pin Adapter	Designation	Function
B31	c16	Din-0	Digital inputs 0 to 7, level 3.3 V Inputs 0 to 5: measurment of the frequency or the duty cycle possible
B33	c17	Din-1	
B35	c18	Din-2	
B37	c19	Din-3	
B39	c20	Din-4	
B41	c21	Din-5	
B43	c22	Din-6	
B45	c23	Din-7	
B47	c24	3V3in	Supply voltage input 3.3 V DC, 100 mA (connected to B48)
B49	c25	GND	Ground

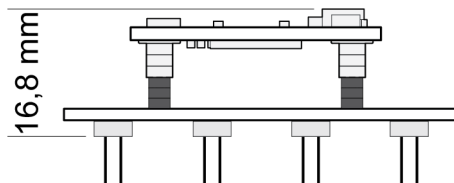
Pin MMFD	Pin Adapter	Designation	Function
B2	d1	GND	Ground
B4	d2	Boot-Serial#	Bootloader is started if put on ground during start-up (RS-232 pins: B3, B5, B7, B9)
B6	d3	Boot-USB#	USB bootloader is started if put on ground during start-up (USB pins: B23, B25, B27)
B8	d4	Fout-0	Frequency outputs 0 and 1, level 3.3 V
B10	d5	Fout-1	
B12	d6		Reserved
B14	d7		Reserved
B16	d8		Reserved
B18	d9		Reserved
B20	d10		Reserved
B22	d11		Reserved
B24	d12		Reserved
B26	d13		Reserved

Pin MMFD	Pin Adapter	Designation	Function
B28	d14	Ain-0	Analog inputs 0 to 7, resolution 12 bits
B30	d15	Ain-1	
B32	d16	Ain-2	
B34	d17	Ain-3	
B36	d18	Ain-4	
B38	d19	Ain-5	
B40	d20	Ain-6	
B42	d21	Ain-7	
B44	d22	Vref-out	Reference voltage 3.0 V, can be connected to pin B46 as internal reference
B46	d23	Vref-in	Reference voltage input for 12-bit ADC, pin B44 recommended as source
B48	d24	3V3in	Supply voltage input 3.3 V DC, 100mA (connected to B47)
B50	d25	GND	Ground

C.3 Dimension Drawings CPU Adapter



Dimensions of the CPU adapter (top view)



Height dimension of the CPU adapter including PCAN-MicroMod FD

Appendix D Minimum Circuitry

The following diagram shows the minimum circuitry required to operate the PCAN-MicroMod FD.



Tip: The download area for the PCAN-MicroMod FD on our website contains additional library files (Altium Designer file formats) that can be used for simplified integration in own circuit diagrams with the MicroMod FD.

A

B

C

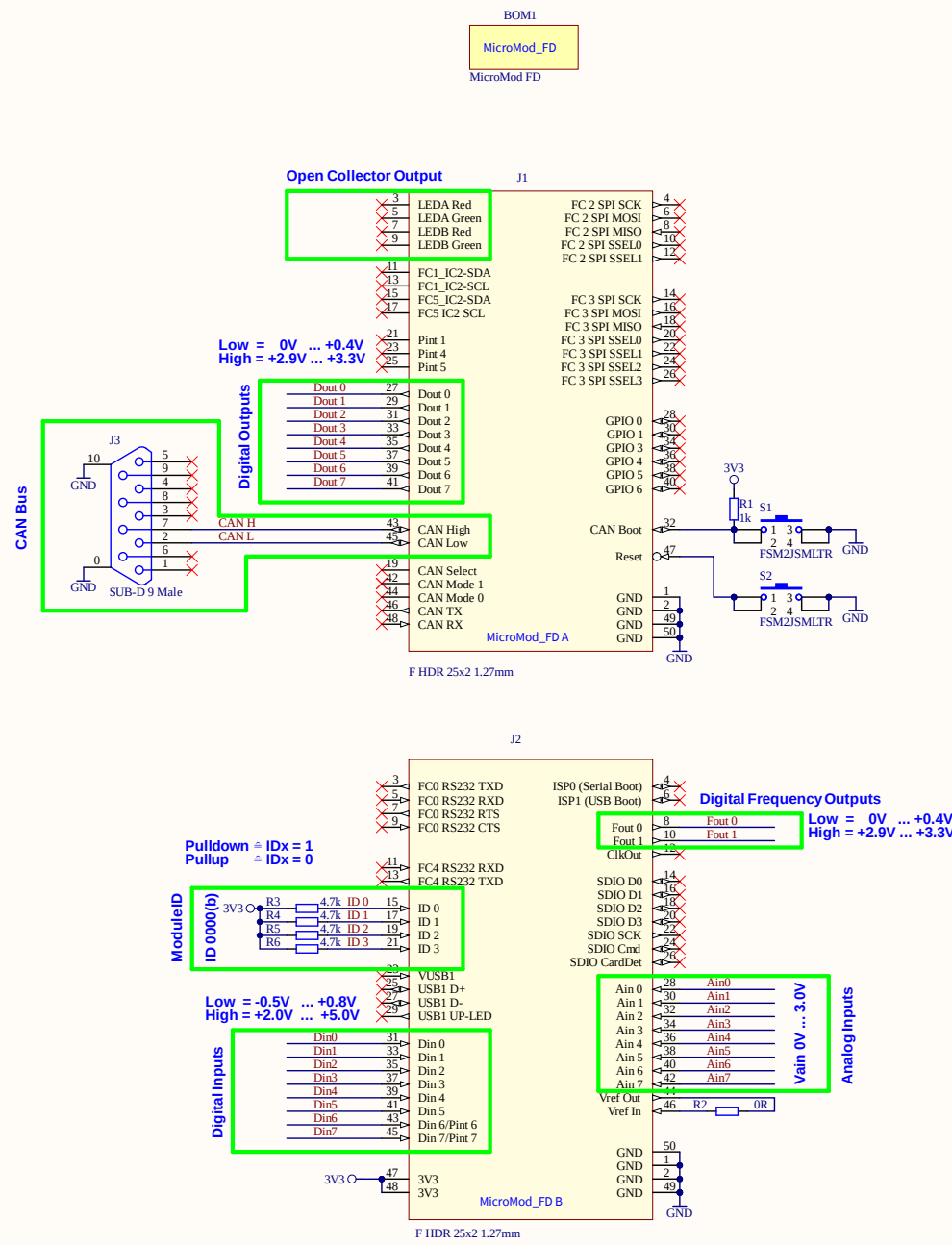
D

A

B

C

D



Appendix E Changelog User Manual

This section lists essential changes in the recent User Manual releases.

Changes since document version 1.0.0

- Documentation of the pin adapter for the 100 mil/2.54 mm pitch (on page 25)
- Diagram for minimum circuitry contains more explaining captions (on page 32)
- LED B of the MicroMod FD indicates invalid configuration with alternating red-green blinking (since firmware version 1.9.7, was quick green blinking before) (on page 14)