

PCAN-MiniDiag FD

Diagnostic Device for CAN FD Buses

User Manual



Document version 1.2.0 (2019-05-13)

PEAK
System

Relevant products

Product name	Part number
PCAN-MiniDiag FD	IPEH-003070

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1 Introduction

The PCAN-MiniDiag FD is a compact, low-cost handheld device for basic diagnosis and checking of CAN and CAN FD buses. Service technicians and developers can easily access networks of vehicles, machines, or industrial equipment whose configuration is unknown. For this, the nominal bit rate for CAN and additionally the data bit rate for CAN FD are determined using bit timing measurement. Furthermore, the device has measuring functions for the termination, bus load, and voltage levels at the CAN connector.

The PCAN-MiniDiag FD has an increased protection due to its membrane keypad and casing. The power is supplied by three replaceable batteries.

The new CAN FD standard (CAN with Flexible Data rate) is primarily characterized by higher bandwidth for data transfer. The maximum of 64 data bytes per CAN FD frame (instead of 8 so far) can be transmitted with bit rates up to 10 Mbit/s. CAN FD is downward-compatible to the CAN 2.0 A/B standard, thus CAN FD nodes can be used in existing CAN networks. However, in this case the CAN FD extensions are not applicable.



Note: This user manual refers to devices that are running with firmware version 1.4.10.

1.1 Properties at a Glance

- High-speed CAN connection (ISO 11898-2)
 - Complies with CAN specifications 2.0 A/B and FD
 - CAN FD support for ISO and Non-ISO standards
 - CAN FD bit rates for the data field (64 bytes max.) from 66.6 kbit/s up to 10 Mbit/s

- CAN bit rates from 10 kbit/s up to 1 Mbit/s
- Microchip CAN transceiver MCP2558FD
- └ CAN bus connection via D-Sub, 9-pin
(in accordance with CiA® 303-1)
- └ No influence to the CAN bus due to permanent listen-only mode
- └ OLED display with 128 x 128 pixel resolution
- └ Power supply via exchangeable batteries
(3 x Micro AAA with 1.2 V or 1.5 V)
- └ Operation via membrane keypad with four keys
- └ Plastic casing with increased Ingress Protection IP42
- └ Dimensions: 122 x 69 x 44 mm
- └ Operating temperature range from -10 to 50 °C (14 to 122 °F)

Measuring Functions

- └ Detection of bit rates via exact bit timing measurements
- └ Measurement of the CAN termination
- └ Measurement of the CAN bus load with display in diagram
- └ Voltage measurement for CAN-High and CAN-Low at the CAN connector (D-Sub) via pin 2 and 7
- └ Voltage check at pin 6 and 9 with display of the voltage difference
- └ Counter for CAN, CAN FD, and error frames

1.2 System Requirements

- └ 3 x AAA batteries for operating

1.3 Scope of Supply


- └ PCAN-MiniDiag FD in plastic casing
- └ Batteries (4 x 1,5 V Micro AAA)
- └ Manual in PDF format
- └ Printed quick start guide

2 Putting the Device into Operation

For operating the PCAN-MiniDiag FD, go through the sections in this chapter one after the other.


2.1 Inserting Batteries/Accus

For operation, three AAA batteries and opening the battery case are required.



 Do the following the insert the batteries:

1. Remove the two Phillips screws on the case underside and remove the battery cover.
2. Insert the batteries. Make sure that the polarity is correct (+/-).
3. Put back the cover and tighten the two Phillips screws again.

The device is now ready for operation.

 **Note:** In the options under **System Info**, you can choose between non-rechargeable and rechargeable batteries. For more information, see to the section 3.1.1 on page 13.

2.2 Turning on/off

The PCAN-MiniDiag FD is turned on and off by pressing the Enter key . Press the Enter key  once to turn on the device.

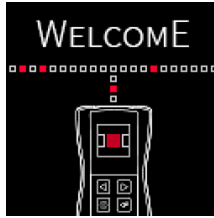



Figure 1: Start screen after turning on

To turn off the device again, press and hold the Enter key  for three seconds.

2.3 User Interface

The display consists of three fixed areas: status bar (top), main bar (middle), and info bar (bottom).

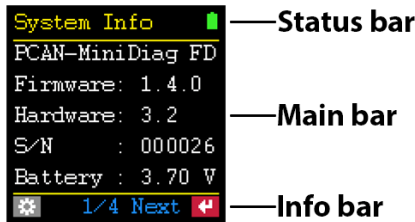



Figure 2: Display structure

Status Bar



In the status bar, the currently selected function and the status of the battery are displayed. As soon as the gear wheel  appears next to the name of the function in the status bar, you are in the options of the respective function.

Main Bar





In the main bar, depending on the function, various information such as instructions and measurement results are displayed.

Info Bar

In the info bar, actions that can be performed, selected settings, or both are displayed.

In the options, the bar is divided into  **ESC** and **OK** . With **OK** the settings are accepted. With **ESC** the previous settings are not changed.

2.4 Operation

The PCAN-MiniDiag FD is operated via four keys. Navigation and selection are done using the arrow keys  . The gear wheel key  opens the options of the currently displayed function. The Enter key  executes actions or confirms changed settings.

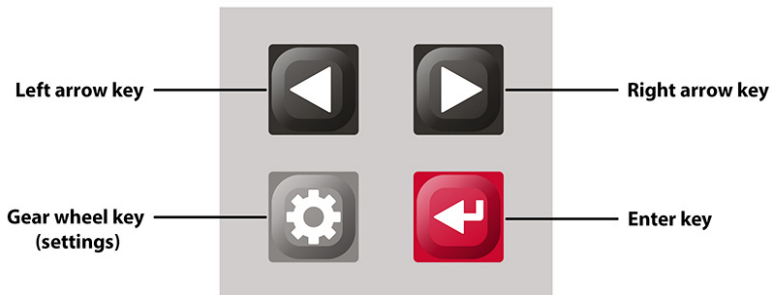


Figure 3: Key assignment of the PCAN-MiniDiag FD

2.5 Connecting to the CAN Bus

The PCAN-MiniDiag FD has a 9-pin D-Sub connector. The CAN assignment corresponds to the CiA® 303-1 specification.

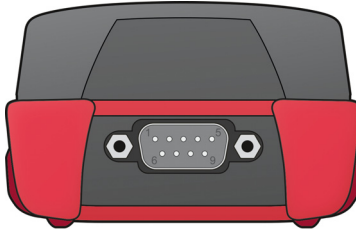


Figure 4: D-Sub connector of the PCAN-MiniDiag FD at the rear of the housing.

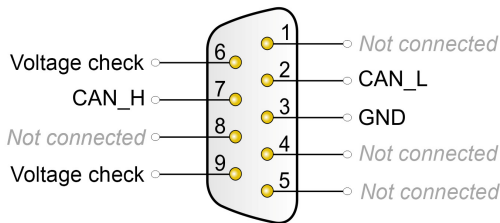





Figure 5: Pin assignment D-Sub according to specification CiA® 303-1

The shielding of the D-Sub connector is connected with high-impedance to ground (pin 3). Pins 6 and 9 can be used for general voltage checking in the range -40 to +43 volts. This is described in section 3.2 on page 15.



3 Device Functions

This chapter deals with the device functions of the PCAN-MiniDiag FD. The following subchapters describe the nine functions.



The Navigation is carried out using the arrow keys  . In the following table, all functions are listed in order to the right :

System Info	
PCAN-MiniDiag FD	
Firmware:	1.4.10
Hardware:	3.2
S/N :	000026
Battery :	3.70 V
 1/4 Next 	



Firmware and hardware version, serial number, battery voltage

D-Sub Voltages	
P6:	+5.99 V
P9:	+12.07 V
P9-P6:	+6.09 V
 Update 	



Voltage check at pins 6 and 9

CAN Min/Max		
CAN-H	max	+3.35V
	min	+2.39V
CAN-L	max	+2.47V
	min	+1.55V
 Reset 		


Measurement of minimum and maximum voltage for CAN-High and CAN-Low

CAN Voltages		
	Dom	Rec
H:	+3.31V	+2.38V
L:	+1.73V	+2.38V
Δ:	+2.17V	+0.08V
 Update 		

Voltage measurement of the CAN levels as well as their differential voltage

CAN Voltages 2		
	Dom	Rec
↑:	+2.18V	+0.12V
∅:	+2.17V	+0.11V
↓:	+2.18V	+0.12V
 Reset 		

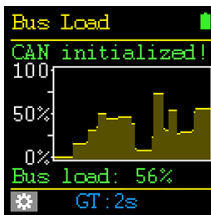
Minimum, mean and maximum values of the differential voltages of the CAN levels

Termination	
R:	60 Ω
 Update 	



Measurement of termination on the CAN bus

Bit Rate	
Press  to set or  to detect the bit rate.	
 TO:20s 	

Automatic detection or manual configuration of the transmission rate



Measurement of the bus load on the CAN bus and representation in the graph

Statistics	
MsgCnt	0
MsgCntFD	1452
ErrorCnt	0
Bus load	17 %
Time	0:00:10
 Reset 	

Counter for CAN, CAN FD, and error messages on the CAN bus, bus load, time


3.1 System Info

With the **System Info** function, information about the installed **Firmware**, the **Hardware** version, the serial number (**S/N**) and the charge status of the batteries (**Battery**) is displayed. Further information and the status of the calibration can be reached by pressing the Enter key **↵** (**Next**).

```
System Info   
PCAN-MiniDiag FD  
Firmware: 1.4.10  
Hardware: 3.2  
S/N : 000026  
Battery : 3.70 V  
 1/4 Next ↵
```

Figure 6: System information about the device

3.1.1 Available Options

The following options are available via the gear wheel  key:

Shutdown time

A time from **2** to **30** minutes can be set after which the PCAN-MiniDiag FD shuts down. The time-controlled turn off is deactivated with the setting **never**.

Supply type

The used battery type is set: **rechargeable** for rechargeable batteries and **non-recharge** for non-rechargeable batteries. The setting affects the display of the battery icon in the status bar.

Call bootloader

The bootloader can be activated in order to perform a firmware

update with the help of the PCAN-Flash software. The bootloader is loaded by selecting the option **yes** and confirming with the Enter key **↵**. If no firmware update is performed within a period of **45 seconds**, the device turns off.

Note: A detailed step-by-step guide for the firmware update with PCAN-Flash can be found in section 4.

3.1.2 Battery Voltage Display

The voltage value of the three batteries is displayed under **Battery**. The values can be interpreted as follows:

Battery symbol	Option non-recharge	Option rechargeable
Green	> 3,9 v	> 3,7 v
Yellow	> 3,3 v	> 3,15 v
Red	> 3,0 v	> 2,7 v
Red flashing	< 3,0 v	< 2,7 v

3.1.3 Calibration Status

The measurement functions calibrated before delivery are displayed under **Calibration**. The status has to be **OK** everywhere.

```

System Info █
-----
Calibration
Termination :OK
CAN voltage :OK
DSub coltage:OK
Supply volt.:OK
* 4/4 Next ←
  
```

Figure 7: Overview of the calibration status

Important note: If **NOK** is displayed, contact our support for recalibration of the device function(s) via E-mail to the following address: support@peak-system.com.

3.2 D-Sub voltages

⚠ Attention! Do not apply voltages out of the measuring range from -40 to 43 volts in order to avoid damage to devices and persons.

At the **D-Sub Voltages** function, the external voltages at pins 6 (**P6**) and 9 (**P9**) opposite pin 3 (GND) as well as the difference between the two pins (**P9-P6**) are displayed. Precondition for the display of the voltage difference is the presence of voltages at both pins. The measuring range for **P6** and **P9** is between -40 and 43 volts. The measured value **open** means that 1.5 volts are applied to the open pin.

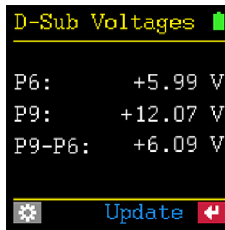




Figure 8: An external voltage is applied to the pins.


3.2.1 Available Options

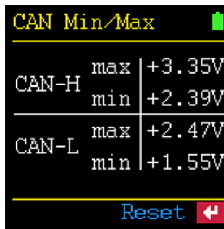
The following option is available via the gear wheel  key:

Update time

A time from **1** to **15** seconds can be set in which the measurement should be repeated. Alternatively, the values at the setting **manual** can be updated by pressing the Enter key  (**Update**).

3.3 CAN Min/Max

With the **CAN Min/Max** function, the minimum and maximum voltages at **CAN-H** (pin 7) and **CAN-L** (pin 2) are measured and stored. The values can be reset via the Enter key  (**Reset**). The measuring range is within -5 to +8 volts. No options are available for this function.




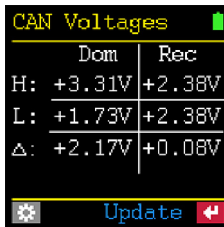
CAN Min/Max	
CAN-H	max +3.35V
	min +2.39V
CAN-L	max +2.47V
	min +1.55V
Reset 	

Figure 9: Measurement of minimum and maximum voltages at CAN-High (pin 7) and CAN-Low (pin 2)

3.4 CAN Voltages

At the **CAN Voltages** function, the voltages of the dominant (**Dom**) and recessive (**Rec**) levels within a CAN frame at **CAN-High** (pin 7) and **CAN-Low** (pin 2) are measured as well as their differential voltage (**Δ**). The measuring range is within -5 to +8 volts.







CAN Voltages		
	Dom	Rec
H:	+3.31V	+2.38V
L:	+1.73V	+2.38V
Δ:	+2.17V	+0.08V
 Update 		

Figure 10: Measurement of dominant and recessive levels at CAN_H (Pin 7) and CAN_L (Pin 2) as well as their differential voltage





3.4.1 Available Options

The following option is available via the gear wheel  key:

Update time

A time of **1** to **15** seconds can be set in which the measurement should be repeated. The values can also be updated using the Enter key  (**Update**) with the setting **manual**.

3.5 CAN Voltages 2

The **CAN Voltages 2** function determines the minimum () , mean () and maximum () values of the differential voltages () of the dominant (**Dom**) and recessive (**Rec**) levels.








CAN Voltages 2 		
	Dom	Rec
↑:	+2.18V	+0.12V
∅:	+2.17V	+0.11V
↓:	+2.18V	+0.12V
Reset 		

Figure 11: Minimum, mean and maximum values of the differential voltages of the dominant and recessive level

The minimum () and maximum () values are saved. The mean value () is continuously updated. The values can be reset via the Enter key  (**Reset**). No options are available for this function.

3.6 Termination

At the **Termination** function, the termination at the CAN bus or the total resistance between pin 2 and 7 is displayed. The CAN traffic is not affected. The resistance R is displayed in Ohm Ω . The measurement can be performed automatically or manually with the Enter key .

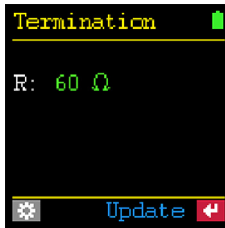




Figure 12: Measurement of correct termination

3.6.1 Available Options

The following option is available via the gear wheel  key:

Update time


A time from **1** to **15** seconds can be specified here in which the measurement is to be repeated. The value can also be updated by the setting **manual** by pressing the Enter key  (**Update**).

3.6.2 Evaluation of the Measurement


A high-speed CAN bus (ISO 11898-2) has to be terminated at both ends with $120\ \Omega$ each between the CAN lines CAN-Low and CAN-High. The two resistors connected in parallel result in a total resistance of $60\ \Omega$.


The following table describes possible reasons for the respective measurement result:

Measurement result	Meaning
~ 60 Ω	The termination on the CAN bus is metrologically ok. Make sure that the termination resistors are present at the bus ends and not, for example, at the taps in the middle of the bus.
~ 120 Ω	Only one termination resistor is available. Install another 120 ohm resistor.
< 45 Ω	Too many termination resistors are present on the CAN bus. This can occur, for example, if both a separate termination resistor and a CAN node with internal termination are present at one bus end.
--- Ω	The measurement was not successful.
missing	No or a too large termination resistor (> 1,2 kΩ) is present on the CAN bus. Set up a <u>correct</u> termination.
shorted	Short circuit (< 10 Ω)! Check whether the PCAN-MiniDiag FD has been properly connected and terminated.
Jumping value	Check whether the PCAN-MiniDiag FD has been connected correctly. For example, the CAN lines CAN-High and CAN-Low may have been reversed.

 **Note:** A correct termination is important to avoid signal reflections at the cable ends and to guarantee a correct function of the CAN transceivers at the CAN bus.

3.7 Bit Rate

With the **Bit Rate** function, the nominal bit rate, the data bit rate, and the related sample points are automatically determined by bit timing measurements. The automatic detection is started with the Enter key . The detection range is from 10 kbit/s to 8 Mbit/s.

 **Note:** The automatic detection of the bit rate is done with the CAN FD ISO protocol. The CAN FD non-ISO protocol can only be set if the bit rate is configured manually (see section 3.7.3).

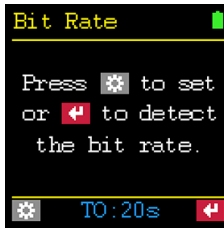


Figure 13: Automatic detection or manual configuration of the transmission rate

The capture of the required sample data can take more time at low bus load and cannot be interrupted. The **Scan Timeout (TO)** option can be used to set a maximum measurement time. Alternatively, a manual configuration can be done.

If, for example, the measurement of the transmission rate of a CAN FD bus was successful, the nominal bit rate (**Nom.**), the data bit rate (**Data**), the sample point range (**SP rng.**) and the sample point (**SP used**) required for further measurements are displayed. The result or configuration is saved.

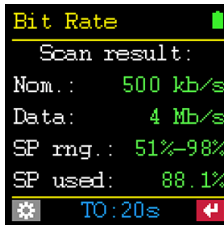



Figure 14: Measurement results of a CAN FD network


 **Note:** The automatic detection of CAN FD messages only works correctly if the Bit Rate Switch is activated. A mixed operation of CAN FD messages with and without Bit Rate Switch also works, but the measurement results may differ.

If the **Bit Rate** function is left and called up again later, the values may appear **green**, **red** or **grey**. If **green**, the values correspond to the connected CAN bus. If the values are **red**, they no longer match. If the values are **grey**, there is no active connection to a CAN bus and the configuration cannot be checked.






Tip: If the measurement of the transmission rate remains unsuccessful, check the termination under **Termination** and the voltage values on the CAN line under **CAN Voltages**.

3.7.1 Available Options

The following options are available via the gear wheel  key:

Bit Rate

The automatic detection or the manual configuration of the transmission rate can be selected. The setting **auto-detect** is set by default. If you use the arrow keys   to change to **user-defined** and confirm this setting with the Enter key , the configuration can be entered manually.

Scan timeout (TO)


A time from **1** to **20** seconds can be set in which the PCAN-MiniDiag FD waits for incoming CAN and CAN FD messages. The option appears after confirming the setting **auto-detect**. The selected time is displayed in the function **Bit Rate** in the info bar under the abbreviation **TO**.

3.7.2 Status Messages

The PCAN-MiniDiag FD outputs the following status messages during or after an unsuccessful measurement of the transmission rate:

Status message	Meaning
Capturing data. 10 to 50 frames required.	Device is measuring and data is still being collected. 10 to 50 CAN frames are required by the PCAN-MiniDiag FD to determine the transmission rate. The message is an indication of little CAN traffic on the CAN bus.
No CAN activity detected. No bit rate scan possible.	The device cannot detect any CAN traffic. Make sure that the PCAN-MiniDiag FD is properly connected and the bus is terminated.
Not enough CAN frames detected. Please increase the scan time or CAN frame rate.	The device has received too few CAN frames. Select the maximum measurement time of 20 seconds using the Scan timeout setting. If the search for the transmission rate continues to fail, increase the number of CAN frames on the bus or configure the transmission rate manually.
Calculation of bit rate is not possible.	Causes for this status message can be too many error frames, different bit rates, or disturbances such as voltage peaks on the CAN bus.

3.7.3 Manual Configuration

The manual configuration is started after confirmation of the setting **user-defined** with the Enter key . Therefore, the following CAN and CAN FD options are queried one after the other:

CAN options

Nominal BR

The nominal bit rate for CAN frames from **10 kbit/s** up to **1 Mbit/s** has to be set.

Nominal SP

The sample point for the nominal bit rate from **50** to **99.9** percent has to be set.

Enable CAN FD

CAN FD is enabled with **yes**. This is followed by CAN FD options. If **no** is selected, the configuration is completed.


CAN FD Options

Enable Data BR

A data bit rate for CAN FD frames is enabled with **yes**. In addition, the following options appear: **Data BR** and **Data SP**. With **no**, the set nominal bit rate is also used for the data part of CAN FD frames.

CAN FD ISO mode

The protocol CAN FD ISO (**on**) or CAN FD non-ISO (**off**) has to be set.

 **Note:** CAN FD ISO corresponds to the in 2015 standardized CAN FD standard ISO 11989-1:2015. CAN FD non-ISO was the first protocol from Bosch and was implemented for a short time by some chip manufacturers.

Data BR

The data bit rate for CAN FD frames from **66.6 kbit/s** up to **10 Mbit/s** has to be set.


Data SP

The sample point for the data bit rate from **50** to **99.9** percent has to be set.

3.8 Bus Load

With the **Bus Load** function, the bus load on the CAN bus is represented by percentage value(s) and a progression chart. The progress diagram is represented by a graph whose speed is influenced by the set measurement time (**GT**).

The function adapts depending on whether the CAN controller is initialized (**CAN initialized!**) or not (**Not initialized!**). The following subchapters describe the two measurements.

 **Note:** An exact bus load measurement is only possible if the transmission rate has been configured correctly before. If this has failed, the bus load measurement can provide further indications for a diagnosis without initializing the CAN controller.

3.8.1 Initialized CAN Controller

The CAN controller is initialized (**CAN initialized!**) when a transmission rate has been set by using the **Bit Rate** function. Then the **Bus Load** function calculates the percentage bus load (**Bus load:**) from the ratio of the set measurement time (**GT**) and the measured total time of the CAN frames on the CAN bus.

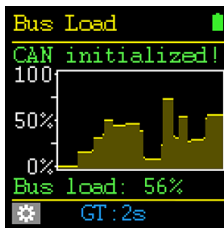


Figure 15: Bus load measurement with existing connection to an active CAN bus

3.8.2 Non-Initialized CAN Controller

If the CAN controller has not been initialized (**Not initialized!**), a value range for the bus load is displayed in the **Bus Load** function. Within this range lies the exact bus load value. This is made possible by measuring the duration of the dominant states on the CAN bus. The number of recessive states of the CAN frames has to be estimated. The calculated total time of the CAN frames within the set measuring time (**GT**) results in the percentage value range after **Bus load:** and in the graph.

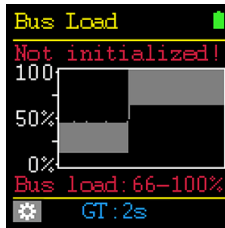



Figure 16: Bus load measurement with non-initialized CAN controller

The measurement without an initialized CAN controller can provide further indications for a diagnosis. If the percentage value is greater 0, the CAN bus is active (dominant). If the percentage value equals 0, the CAN bus is in idle state (recessive) or not in operation.


3.8.3 Available Options

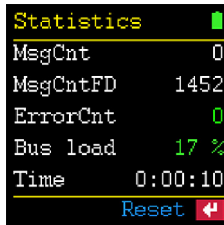
The following option is available via the gear wheel  key:

Gating time (GT)

A time span from **0.5** to **15** seconds for measuring the bus load is set.

3.9 Statistics

The **Statistics** function can only be completely displayed after the bit rate has been determined successfully. Then messages for CAN (**MsgCnt**) and CAN FD (**MsgCntFD**) as well as faulty CAN frames (**ErrorCnt**) on the bus are counted. Likewise, the current bus load (**Bus load**) and the time of the measurement (**Time**) are displayed. All values are reset by the Enter key  (**Reset**), when the device is turned off or when the function is left. No options are available for this function.

A screenshot of a terminal window showing the 'Statistics' function. The title 'Statistics' is at the top left in yellow, followed by a green bar. Below it, five lines of text show: 'MsgCnt 0', 'MsgCntFD 1452', 'ErrorCnt 0', 'Bus load 17 %', and 'Time 0:00:10'. At the bottom, the word 'Reset' is in blue, followed by a red arrow icon pointing right.



```
Statistics   
MsgCnt      0  
MsgCntFD    1452  
ErrorCnt     0  
Bus load    17 %  
Time        0:00:10  
Reset 
```

Figure 17: Statistics with counters, bus load, and time display

4 Firmware Update




The current firmware version can be downloaded directly from PEAK-System's product DVD website. To update the PCAN-MiniDiag FD with a new firmware, the PCAN-Flash tool is required. The firmware file is then transmitted in PCAN-Flash via the CAN bus to in the bootloader waiting PCAN-MiniDiag FD.

▶ Do the following to get the latest firmware:


1. Go to *www.peak-system.com/Support.55.0.html*.
2. Click **Browse Product DVD**.
The product DVD directories will be displayed.
3. Open the `Firmware` folder and select PCAN-MiniDiag FD.
4. Download the file (*.bin).

▶ Do the following to do a firmware update with PCAN-Flash:

1. Make sure that a proper CAN connection to the PCAN-MiniDiag FD is established via a CAN interface from PEAK-System.
2. Start PCAN-Flash.
3. Click on the **PCAN** menu command and on **Connect**.
4. Make sure that the CAN interface connected to the PCAN-MiniDiag FD is also connected to the software.
5. Click on the **Application** menu command and on **Option**.
6. Select as the PCAN-MiniDiag FD in the **Hardware Profile** drop-down list.
7. Then enter the path of the *.bin file in the **Filename** field. Click on the button to include the storage location of the file via the file explorer.

8. Confirm with **Ok**.
9. Set the PCAN-MiniDiag FD to bootloader mode. If the device is switched off, hold down the arrow keys   and the Enter key  until the **Bootloader** appears.

Alternatively the bootloader can be started in the **System Info** function via the **Call bootloader** option with **yes**.

10. If the **Bootloader** is active, click on the **Modules** menu command and on **Detect**.
PCAN-Flash now searches for the PCAN-MiniDiag FD. An entry appears in the main window.
11. Select the new entry with a left click, where **PCAN-MiniDiag-FD** appears in the **Hardware Type** column.
12. Click on the **Modules** menu command and on **Program**.
The firmware is now updated.
13. When the bootloader is finished, the PCAN-MiniDiag FD must be restarted via the Enter key .

The new firmware is now ready for operation. Check under the function **System Info** whether the current version is displayed under **Firmware**.

5 Technical specifications

Supply

Current consumption	max. 100 mA
Voltage supply	3 x Micro AAA with 1.2 or 1.5 Volt, replaceable
Operating time	~ 10 h

D-Sub Connector

Function	CAN connector
Number of pins	9-pole, assignment according to specification CiA® 303-1

CAN

Specification	CAN FD ISO 11898-1:2015, CAN FD non-ISO, CAN 2.0 A/B
Physical transmission	ISO 11898-2 (High-speed CAN)
CAN receive rates	10 kbit/s - 1 Mbit/s
CAN FD receive rates	66.6 kbit/s - 10 Mbit/s
Transceiver	MCP2558FD

Measurement Function	Measurement Range	Accuracy
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Bit timing measurement to detect the bit rate	10 kbit/s to 8 Mbit/s	-/-
Voltage at pins 6 and 9	-40 to +43 V	±1 %
Voltage at pins 2 and 7 (CAN_L and CAN_H)	-5 to +8 V	±1 %
Termination	10 Ω to 1.2 kΩ	±1 % ±2 Ω

Screen

Display type	OLED (RGB)
Resolution	128 x 128 Pixel

Dimensions

Size	119 x 64.9 x 36.5 mm (W x H x D) See also dimension drawing Appendix B.
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Weight (with batteries)	164 g
Weight (without batteries)	130 g

Environment

Operating temperature	With supplied batteries: -10 - +50 °C (-14 - 122 °F) Without supplied batteries: -20 - +70 °C (-4 - 158 °F)
Temperature for storage and transport	-30 - +80 °C (-22 - 176 °F) (without batteries)
Relative humidity	15 - 90 %, not condensing
Ingress protection (DIN EN 60529)	IP42

Conformity

EMV	Directive 2014/30/EU DIN EN 61326-1:2013-07
RoHS 2	Directive 2011/65/EU DIN EN 50581 VDE 0042-12:2013-02

Appendix A CE Certificate

EU Declaration of Conformity



This declaration applies to the following product:

Product name: PCAN-MiniDiag FD
Item number(s): IPEH-003070
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)

DIN EN 50581 VDE 0042-12:2013-02

Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances;
German version EN 50581:2012

EU Directive 2014/30/EU (Electromagnetic Compatibility)

DIN EN 61326-1:2013-07

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, 2 November 2018

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

Uwe Wilhelm, Managing Director

Appendix B Dimension Drawing

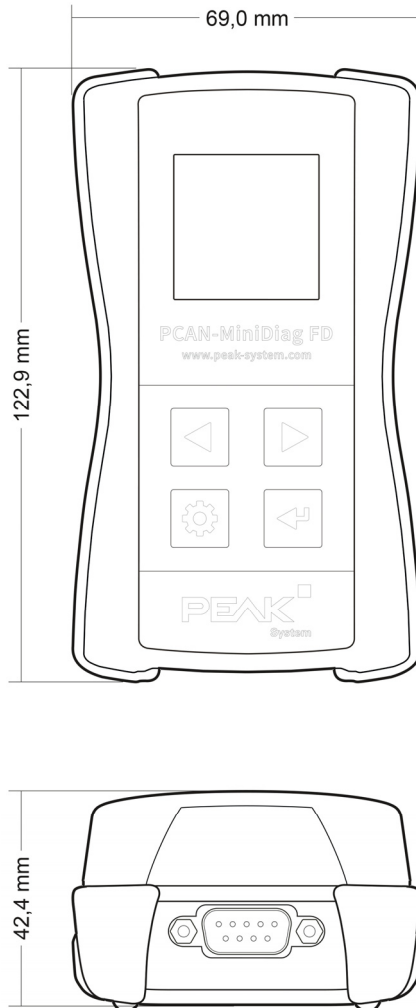


Figure 18: Dimension drawing of the PCAN-MiniDiag FD.
The figure does not correspond to the actual size.

Appendix C Disposal Info (Batteries)

The device and the batteries it contains must not be disposed of with household waste. Remove the batteries from the unit for proper separate disposal.

The PCAN-MiniDiag FD contains the following batteries:

- 3 batteries/rechargeable batteries, size AAA, 3 x 1.5 V or 3 x 1.2 V

Appendix D Signal Level of a High-speed CAN Bus

The PCAN-MiniDiag FD provides two device functions for checking the CAN lines CAN-High and CAN-Low. This appendix provides a brief explanation of the interpretation of the measurement results.

Basically, a distinction is made between the recessive (passive) and the dominant (active) state for the signal level of a high-speed CAN bus. In the recessive state, the voltages of the two lines CAN-High and CAN-Low are approximately 2.5 volts.

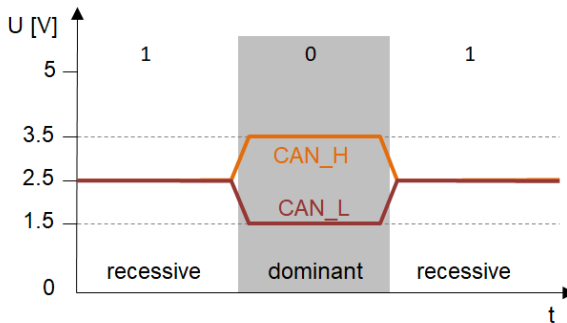


Figure 19: Diagram of the recessive and dominant signal levels on the CAN bus

When the recessive changes to the dominant state, CAN-High rises and CAN-Low falls by 1 volt each. The voltage difference between CAN-High and CAN-Low is 0 volt in the recessive state and 2 volts in the dominant state.