## Relevant products

<table>
<thead>
<tr>
<th>Product name</th>
<th>Part number</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCAN-MiniDiag FD</td>
<td>IPEH-003070</td>
</tr>
</tbody>
</table>

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PEAK-System Technik GmbH
Otto-Roehm-Strasse 69
64293 Darmstadt
Germany

Phone: +49 (0)6151 8173-20
Fax: +49 (0)6151 8173-29

www.peak-system.com
info@peak-system.com

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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 to 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.
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).

![Display structure](image)

**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.

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 △:

<table>
<thead>
<tr>
<th>System Info</th>
<th>D-Sub Voltages</th>
<th>CAN Min/Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firmware: 1.4.10</td>
<td>P6: +5.99 V</td>
<td>CAN-H max +3.35 V</td>
</tr>
<tr>
<td>Hardware: 3.2</td>
<td>P9: +12.07 V</td>
<td>CAN-H min +2.39 V</td>
</tr>
<tr>
<td>S-N: 000026</td>
<td>P-P6: +6.09 V</td>
<td>CAN-L max +2.47 V</td>
</tr>
<tr>
<td>Battery: 3.70 V</td>
<td></td>
<td>CAN-L min +1.55 V</td>
</tr>
</tbody>
</table>

Voltage check at pins 6 and 9

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

<table>
<thead>
<tr>
<th>CAN Voltages</th>
<th>CAN Voltages 2</th>
<th>Termination</th>
</tr>
</thead>
<tbody>
<tr>
<td>H: +3.31V +2.38V</td>
<td>Dom</td>
<td>R: 60 Ω</td>
</tr>
<tr>
<td>L: +1.73V +2.38V</td>
<td>Rec</td>
<td></td>
</tr>
<tr>
<td>Δ: +2.17V +0.08V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

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

Measurement of termination on the CAN bus

<table>
<thead>
<tr>
<th>Bit Rate</th>
<th>Bus Load</th>
<th>Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Press △ to set or ◀ to detect the bit rate.</td>
<td>CAN initialized!</td>
<td>MsgCnt: 0</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>MsgCntFD: 1452</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ErrorCnt: 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bus load: 56%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Time: 0:00:10</td>
</tr>
</tbody>
</table>

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

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](image)

**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-rechargeable** 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:

<table>
<thead>
<tr>
<th>Battery symbol</th>
<th>Option non-recharge</th>
<th>Option rechargeable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>&gt; 3,9 V</td>
<td>&gt; 3,7 V</td>
</tr>
<tr>
<td>Yellow</td>
<td>&gt; 3,3 V</td>
<td>&gt; 3,15 V</td>
</tr>
<tr>
<td>Red</td>
<td>&gt; 3,0 V</td>
<td>&gt; 2,7 V</td>
</tr>
<tr>
<td>Red flashing</td>
<td>&lt; 3,0 V</td>
<td>&lt; 2,7 V</td>
</tr>
</tbody>
</table>

### 3.1.3 Calibration Status

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

![System Info](image)

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.

![D-Sub Voltages](image)

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.

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

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.

![Figure 10: Measurement of dominant and recessive levels at CAN_H (Pin 7) and CAN_L (Pin 2) as well as their differential voltage](image)
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 with the setting manual.

3.5 CAN Voltages 2

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

![CAN Voltages 2](image)

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 (Ø) 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 $\Omega$. The measurement can be performed automatically or manually with the Enter key.

![Termination measurement](image)

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
---|---
\(\sim 60 \Omega\) | 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.
\(\sim 120 \Omega\) | Only one termination resistor is available. Install another 120 ohm resistor.
\(< 45 \Omega\) | 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.
--- | The measurement was not successful.
**missing** | No or a too large termination resistor (> 1,2 k\(\Omega\)) is present on the CAN bus. Set up a correct termination.
**shorted** | Short circuit (< 10 \(\Omega\))! 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 \(\leftarrow\). 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).
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.

**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

<table>
<thead>
<tr>
<th>Status message</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capturing data. 10 to 50 frames required.</td>
<td>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.</td>
</tr>
<tr>
<td>No CAN activity detected. No bit rate scan possible.</td>
<td>The device cannot detect any CAN traffic. Make sure that the PCAN-MiniDiag FD is properly connected and the bus is terminated.</td>
</tr>
<tr>
<td>Not enough CAN frames detected. Please increase the scan time or CAN frame rate.</td>
<td>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.</td>
</tr>
<tr>
<td>Calculation of bit rate is not possible.</td>
<td>Causes for this status message can be too many error frames, different bit rates, or disturbances such as voltage peaks on the CAN bus.</td>
</tr>
</tbody>
</table>

### 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.

![Bus Load measurement](image)

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.

![Statistics Display](image)

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 the bootloader waiting PCAN-MiniDiag FD.

Do the following to get the latest firmware:
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

<table>
<thead>
<tr>
<th>Current consumption</th>
<th>max. 100 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage supply</td>
<td>3 x Micro AAA with 1.2 or 1.5 Volt, replaceable</td>
</tr>
<tr>
<td>Operating time</td>
<td>~ 10 h</td>
</tr>
</tbody>
</table>

### D-Sub Connector

<table>
<thead>
<tr>
<th>Function</th>
<th>CAN connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of pins</td>
<td>9-pole, assignment according to specification CiA® 303-1</td>
</tr>
</tbody>
</table>

### CAN

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical transmission</td>
<td>ISO 11898-2 (High-speed CAN)</td>
</tr>
<tr>
<td>CAN receive rates</td>
<td>10 kbit/s - 1 Mbit/s</td>
</tr>
<tr>
<td>CAN FD receive rates</td>
<td>66.6 kbit/s - 10 Mbit/s</td>
</tr>
<tr>
<td>Transceiver</td>
<td>MCP2558FD</td>
</tr>
</tbody>
</table>

### Measurement Function

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

### Screen

<table>
<thead>
<tr>
<th>Display type</th>
<th>OLED (RGB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>128 x 128 Pixel</td>
</tr>
</tbody>
</table>

### Dimensions

<table>
<thead>
<tr>
<th>Size</th>
<th>119 x 64.9 x 36.5 mm (W x H x D)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>See also dimension drawing Appendix B.</td>
</tr>
</tbody>
</table>
### Environment

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (with batteries)</td>
<td>164 g</td>
</tr>
<tr>
<td>Weight (without batteries)</td>
<td>130 g</td>
</tr>
</tbody>
</table>
| 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

<table>
<thead>
<tr>
<th>Standard</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMV</td>
<td>Directive 2014/30/EU</td>
</tr>
<tr>
<td></td>
<td>DIN EN 61326-1:2013-07</td>
</tr>
<tr>
<td>RoHS 2</td>
<td>Directive 2011/65/EU</td>
</tr>
<tr>
<td></td>
<td>DIN EN 50581 VDE 0042-12:2013-02</td>
</tr>
</tbody>
</table>
Appendix A  CE Certificate

EU Declaration of Conformity

This declaration applies to the following product:
Product name: PCAN-MiniDiag FD
Ident number(s): IP0H-003070
Manufacturer: PEAK System Technik GmbH
Otto-Roehm-Straße 69
64293 Darmstadt
Germany

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

[Signature]

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.

![Diagram of the recessive and dominant signal levels on the CAN bus](image)

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.