

BLE communication protocol, model PEW-1000

EN



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Prior to starting work, read the operating instructions!
Keep for later use!

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1. General Information

1.1 Abbreviations and Definitions

ATT	Attribute Protocol
BLE	Bluetooth® Low Energy
GAP	Generic Access Profile
GATT	Generic Attribute Profile
LPWAN	Low-Power Wide-Area Network
N	Notify
R	Read
SIG	Special Interest Group
TLV-Format	Type, Length, Value Format
UUID	Universal Unique Identifier
W	Write

1.2 Scope of this Document

This document describes the protocol for the Bluetooth® communication with PEW-1000 devices. The communication interface can be used together with the dedicated 'myWIKa wireless device' mobile application, which is available for Android and iOS. It is also possible to communicate with the device using for example a compatible Bluetooth® gateway together with the information on the following pages.

1. General Information

1.3 Conventions

Multi-byte fields are encoded following a “big-endian” convention (“network order”). The order for the transmission of bytes is the same as the left-to-right reading order, and bytes are numbered starting with 0.

Bits are numbered from left-to-right, starting at 7 and ending at 0, with bit 7 representing the most significant bit (MSB).

Example

Byte	0								1								2...		
Bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	...
Value	MSB	...						LSB	MSB	...						LSB	MSB	...	

The digits in the document are written in English notation using ‘.’ as decimal separator and ‘,’ as a separator for large numbers. Example: 1,023.42

2. Protocol Description

2.1 General architecture

The Bluetooth® Low Energy communication in PEW-1000 provides two different operating modes.

Advertising Mode

- Identify a device.
- Provide data at regular time intervals (Logging).
- Enter connected mode.

Connected Mode

- Detailed Device information.
- Customize the device.
- Send Commands.

2.2 Device compatibility

The device is compatible with Bluetooth® Low Energy 4.2 and newer versions. For the connected mode, the communication partner must support BLE Secure Pairing with Passkey.

2.3 Bluetooth® password protection

To connect to the PEW-1000 device each product has been assigned an individual 6-digits password. The password is provided in the Quick Start Guide documents packed in a red envelope in your device packaging. When connected to the device, the password can be changed by the user.

The device allows up to 5 tries to enter the correct password during the pairing process. After that the device will be locked. After interrupting the power supply or removing the battery, 5 attempts are available again. If this is not possible for technical reasons, e.g. because the sensor cannot be reached to open the housing, contact technical support.

3. Advertising mode

3. Advertising mode

Advertising frames are sent every 1,25 seconds. Please note that the measured value is only updated in the configured measurement period.

The advertising data is organised in a format similar to the TLV (type, length, value) format used in data communication, except that the length comes before the type:

Advertising Data Structure		
Length	AD Type	AD Data

Two data structures are used, one for the device name and the other one to represent the sensor data. Each advertising message has a total length of 31 bytes.

3.1 Device name

The device name consists of 11 ASCII bytes. By default, after production, it represents the device serial number but can also be changed depending on individual needs (e.g., to represent a specific measurement point).

Bluetooth® SIG AD type: 0x09 Complete Local Name

AD Structure for Device name		
Length	AD Type	AD Data
0x0C	0x09	“Device Name”

3.2 Sensor data

The measured sensor value is included in the advertising by default. The data can also be hidden using the “[Hide Advertising Data](#)” characteristic described in the configuration service. In this case Byte 3...15 are not transmitted.

Bluetooth® SIG AD type: 0xFF Manufacturer Specific Data

AD Structure for Sensor data		
Length	AD Type	AD Data
0x11/0x03	0xFF	See specific payload below

3. Advertising mode

Sensor data Payload

Byte	Name	Note
0-1	BLE manufacturer ID	0x0989: WIKA manufacturer ID
2	Product ID	11 = BLE + LoRaWAN version 12 = BLE only version 22 = BLE + mioty version
3	Ongoing Alarm	Alarm status: Bit 0: Board alarm Bit 1: Sensor Failure alarm Bit 2: Applicative alarm Bit 3: Measurement input alarm
4	Update Counter	Incremented by one on each change on measure or alarm status
5	Measuring Unit Channel A	See Appendix A
6-9	Measurement Value Channel A	32 bits float value (LSB first) of the sensor value
10	Measuring Unit Channel B	See Appendix A
11-14	Measurement Value Channel B	Temperature coded in °C 32 bits float value (LSB first)
15	Battery Level	% of remaining capacity

4. Connected mode

4.1 GATT general description

To establish a two-way communication via Bluetooth[®], a connection based on the GATT (Generic Attribute Profile) protocol is required. The peripheral device can only connect to one central device (e.g. Smartphone) at the same time. During a connection, Advertising frames are no longer published.

The device provides three services adopted from the SIG and three custom services.

4.2 Adopted Services

The following Bluetooth[®] SIG standard services are integrated in the device. For more information, please refer to the specification on the Bluetooth[®] website.

- Generic Access Service (GAP)
- Battery Service
- Device Information Service

4.3 Custom Services

The following terminology is used in the following service description:

- R Read action is possible
- W Write action is possible
- N Notification is possible

The “Notify” action permits to update the data automatically without activating the “Read” function each time data is updated.

4. Connected mode

4.3.1 Configuration Service

The configuration service allows configuration of the device including alarm and transmission parameters. For details on how to configure the device via Bluetooth® please also refer to chapter 4.4.

Characteristic	UUID	Format	Length [Bytes]	Unit	Type	Description
Configuration ID	F13A1001164C469787E9EDF95FD0653F	uint8	1	-	R	A new configuration ID is generated automatically for each new configuration.
Measurement period with alarm	F13A1002164C469787E9EDF95FD0653F	uint32	4	Seconds	R/W	Measurement period when ≥ 1 alarm is active
Measurement period no alarm	F13A1003164C469787E9EDF95FD0653F	uint32	4	Seconds	R/W	Measurement period when no alarms are active
Transmission multiplier with alarm	F13A1004164C469787E9EDF95FD0653F	uint16	2	-	R/W	Transmission period = measurement period * transmission multiplier
Transmission multiplier no alarm	F13A1005164C469787E9EDF95FD0653F	uint16	2	-	R/W	Transmission period = measurement period * transmission multiplier
Command Status	F13A1006164C469787E9EDF95FD0653F	uint8	1		R/W/N	See Chapter 4.4

4. Connected mode

Characteristic	UUID	Format	Length [Bytes]	Unit	Type	Description
Hide advertising data	F13A1008164C469787E9EDF95FD0653F	bool	1	-	R/W	0 = Advertising frame contains measurement data 1 = Advertising frame does not contain measurement data
Custom BLE Name	F13A1009164C469787E9EDF95FD0653F	utf8[]	0-11	-	R/W	Device name in Advertisement frame. When this field is empty, the device serial number is used.
BLE Security Key	F13A100A164C469787E9EDF95FD0653F	utf8[]	6	-	R/W	6-digit Passkey for pairing with the device

4. Connected mode

4.3.2 Pressure Channel Configuration

Characteristic	UUID	Format	Length [Bytes]	Unit	Type	Description
Pressure activation state	F13A3000164C469787E9EDF95FD0653F	Bool	1	-	R/W	Activation / Deactivation of the channel pressure and alarms. Value will be still provided. 1=true=activated
Pressure Offset	F13A300A164C469787E9EDF95FD0653F	float	4	<u>Measure Unit</u>	R/W	Measuring value Offset added automatically to the sensor reading. Max. 15% of sensor span
Pressure Alarm Configuration	F13A3001164C469787E9EDF95FD0653F	uint8	1	Bitfield	R/W	Enable or disable alarms: Bit 0: Low threshold Bit 1: High Threshold Bit 2: Low slope Bit 3: High slope Bit 4: Delayed Low threshold Bit 5: Delayed High threshold Bit = 1 → Enabled
Pressure Low Alarm threshold	F13A3002164C469787E9EDF95FD0653F	float	4	<u>Measure Unit</u>	R/W	Low threshold value when the alarm is activated.
Pressure High Alarm threshold	F13A3003164C469787E9EDF95FD0653F	float	4	<u>Measure Unit</u>	R/W	High threshold value when the alarm is activated.

4. Connected mode

Characteristic	UUID	Format	Length [Bytes]	Unit	Type	Description
Pressure Falling Alarm slope	F13A3004164C469787E9EDF95FD0653F	float	4	Measure Unit	R/W	Low slope value when the alarm is activated.
Pressure Rising Alarm slope	F13A3005164C469787E9EDF95FD0653F	float	4	Measure Unit	R/W	High slope value when the alarm is activated.
Pressure Delayed Low Alarm threshold	F13A3006164C469787E9EDF95FD0653F	float	4	Measure Unit	R/W	Delayed Low threshold value when the alarm will be activated.
Pressure Delayed Low Alarm delay	F13A3007164C469787E9EDF95FD0653F	uint16	2	Seconds	R/W	Delay value for delayed low threshold alarm
Pressure Delayed High Alarm threshold	F13A3008164C469787E9EDF95FD0653F	float	4	Measure Unit	R/W	Delayed High threshold value when the alarm is activated.
Pressure Delayed High Alarm delay	F13A3009164C469787E9EDF95FD0653F	uint16	2	Seconds	R/W	Delay value for delayed high threshold alarm
Pressure Dead band	F13A300B164C469787E9EDF95FD0653F	float	4	Measure Unit	R/W	Hysteresis value for the threshold alarms

4. Connected mode

4.3.3 Temperature Channel Configuration

Characteristic	UUID	Format	Length [Bytes]	Unit	Type	Description
Temperature activation state	F13A2000164C469787E9EDF95FD0653F	Bool	1	-	R/W	Activation / Deactivation of the temperature channel and alarms. Value will be still provided. 1=True=activated
Temperature Offset	F13A200A164C469787E9EDF95FD0653F	float	4	Measure Unit	R/W	Measuring value Offset added automatically to the sensor reading. Max. 15% of sensor span
Temperature Alarm Configuration	F13A2001164C469787E9EDF95FD0653F	uint8	1	Bitfield	R/W	Enable or disable alarms: Bit 0: Low threshold Bit 1: High Threshold Bit 2: Low slope Bit 3: High slope Bit 4: Delayed Low threshold Bit 5: Delayed High threshold Bit = 1 → Enabled
Temperature Low Alarm threshold	F13A2002164C469787E9EDF95FD0653F	float	4	Measure Unit	R/W	Low threshold value when the alarm is activated.
Temperature High Alarm threshold	F13A2003164C469787E9EDF95FD0653F	float	4	Measure Unit	R/W	High threshold value when the alarm is activated.

4. Connected mode

Characteristic	UUID	Format	Length [Bytes]	Unit	Type	Description
Temperature Falling Alarm slope	F13A2004164C469787E9EDF95FD0653F	float	4	Measure Unit	R/W	Low slope value when the alarm is activated.
Temperature Rising Alarm slope	F13A2005164C469787E9EDF95FD0653F	float	4	Measure Unit	R/W	High slope value when the alarm is activated.
Temperature Delayed Low Alarm threshold	F13A2006164C469787E9EDF95FD0653F	float	4	Measure Unit	R/W	Delayed Low threshold value when the alarm will be activated.
Temperature Delayed Low Alarm delay	F13A2007164C469787E9EDF95FD0653F	uint16	2	Seconds	R/W	Delay value for delayed low threshold alarm
Temperature Delayed High Alarm threshold	F13A2008164C469787E9EDF95FD0653F	float	4	Measure Unit	R/W	Delayed High threshold value when the alarm is activated.
Temperature Delayed High Alarm delay	F13A2009164C469787E9EDF95FD0653F	uint16	2	Seconds	R/W	Delay value for delayed high threshold alarm
Temperature Dead-band	F13A200B164C469787E9EDF95FD0653F	float	4	Measure Unit	R/W	Hysteresis value for the threshold alarms

4. Connected mode

4.3.4 Pressure status information

Characteristic	UUID	Format	Length [Bytes]	Unit	Type	Description
Pressure Alarm status	B75C30013BBC4FB7A7EA37BA44F4C0B0	uint8	1	-	R/N	Active alarm bitfield: Bit 0: Low threshold Bit 1: High threshold Bit 2: Falling slope Bit 3: Rising slope Bit 4: Low threshold with delay Bit 5: High threshold with delay
Pressure Value	B75C30003BBC4FB7A7EA37BA44F4C0B0	float	4	Measure Unit	R/N	Value measured by the device. Note: Value is updated in the configured measurement period only.
Pressure Alarm threshold	B75C30023BBC4FB7A7EA37BA44F4C0B0	float	4	Measure Unit	R/N	In case of rising or falling threshold alarm: Device sensor value when alarm condition is raised.
Pressure Delayed Alarm threshold	B75C30033BBC4FB7A7EA37BA44F4C0B0	float	4	Measure Unit	R/N	In case of delayed rising or falling threshold alarm: Device sensor value when alarm condition is raised.
Pressure Alarm Slope	B75C30043BBC4FB7A7EA37BA44F4C0B0	float	4	Measure Unit	R/N	In case of rising or falling slope alarm: Computed slope value when alarm condition is raised.

4. Connected mode

Characteristic	UUID	Format	Length [Bytes]	Unit	Type	Description
Pressure Measurement Range Start	B75C30053BBC4FB7A7EA37BA44F4C0B0	float	4	Measure Unit	R	Start of pressure measuring range
Pressure Measurement Range End	B75C30063BBC4FB7A7EA37BA44F4C0B0	float	4	Measure Unit	R	End of pressure measuring range
Pressure Unit	B75C30073BBC4FB7A7EA37BA44F4C0B0	uint8	1	Measure Unit	R	Device Pressure Unit

4. Connected mode

4.3.5 Temperature status information

Characteristic	UUID	Format	Length [Bytes]	Unit	Type	Description
Temperature Alarm status	B75C20013BBC4FB7A7EA37BA44F4C0B0	uint8	1	-	R/N	Active alarm bitfield: Bit 0: Low threshold Bit 1: High threshold Bit 2: Falling slope Bit 3: Rising slope Bit 4: Low threshold with delay Bit 5: High threshold with delay
Temperature Value	B75C20003BBC4FB7A7EA37BA44F4C0B0	float	4	Measure Unit	R/N	Value measured by the device. Note: Value is updated in the configured measurement period only.
Temperature Alarm threshold	B75C20023BBC4FB7A7EA37BA44F4C0B0	float	4	Measure Unit	R/N	In case of rising or falling threshold alarm: Device sensor value when alarm condition is raised.
Temperature Delayed Alarm threshold	B75C20033BBC4FB7A7EA37BA44F4C0B0	float	4	Measure Unit	R/N	In case of delayed rising or falling threshold alarm: Device sensor value when alarm condition is raised.
Temperature Alarm Slope	B75C20043BBC4FB7A7EA37BA44F4C0B0	float	4	Measure Unit	R/N	In case of rising or falling slope alarm: Computed slope value when alarm condition is raised.

4. Connected mode

Characteristic	UUID	Format	Length [Bytes]	Unit	Type	Description
Temperature Measurement Range Start	B75C20053BBC4FB7A7EA37BA44F4C0B0	float	4	Measure Unit	R	Start of temperature measuring range
Temperature Measurement Range End	B75C20063BBC4FB7A7EA37BA44F4C0B0	float	4	Measure Unit	R	End of temperature measuring range
Temperature Unit	B75C20073BBC4FB7A7EA37BA44F4C0B0	uint8	1	Measure Unit	R	Device Temperature Unit

4. Connected mode

4.3.6 Device status information

Characteristic	UUID	Format	Length [Bytes]	Type	Description
BLE MAC address	B75C10013BBC4FB7A7EA37BA44F4C0B0	uint8[]	6	R	Bluetooth® module MAC address
LPWAN EUI	B75C10033BBC4FB7A7EA37BA44F4C0B0	uint8[]	8	R	In the case of an LPWAN device: LoRaWAN® DevEUI mioty® EUI
LPWAN Version	B75C100A3BBC4FB7A7EA37BA44F4C0B0	uint8[]	5	R	LPWAN specification version
LoRaWAN® AppEUI	B75C10093BBC4FB7A7EA37BA44F4C0B0	uint8[]	8	R	LoRaWAN® AppEUI
LoRaWAN® Join Status	B75C10073BBC4FB7A7EA37BA44F4C0B0	bool	1	R/N	True if Device has joined a network
Technical Alarm Status	B75C10043BBC4FB7A7EA37BA44F4C0B0	uint8	1	R/N	Internal failure status code
Device Alarm Status	B75C10053BBC4FB7A7EA37BA44F4C0B0	uint8	1	R/N	Bit 0: Low Battery Bit 2: LPWAN Duty Cycle Bit 3: Internal Error All others reserved
Battery Voltage	B75C10063BBC4FB7A7EA37BA44F4C0B0	uint16	2	R	Battery Voltage in mV Devices with external power: 0xFFFF
Pressure Type	B75C10083BBC4FB7A7EA37BA44F4C0B0	Uint8	1	R	1 = Absolute 2 = Gauge / relative

4. Connected mode

4.3.7 Data Logging Service

The PEW-1000 device keeps track of all Process alarms that appear and stores them in a list together with the corresponding measurement value. The log file can be retrieved via Bluetooth® using the following procedure.

A maximum of 256 log entries can be stored in a ring buffer style.

The Request commands will open a logging retrieve session window. The session has a timeout of 30s which is restarted with each following command. After the timeout or when the close command is sent, the complete log buffer will be cleared automatically (One time read only!)

Characteristic	UUID	Format	Length [Bytes]	Type
Logging Command	0A40000198FE43598EC97CCE2662D06F	uint8[]	256	R/W/N

Command Table

Command	Description
0x00	Request data logging info table
0x01	Request data logging data
0x02	Close logging session

Step 1: Request data logging information

Writing the command value 0x00 to the Logging command will request the data logging information table answer containing an overview of the active alarms:

Byte	Field	Note
0	Response	0x80: Get data logging information table
1	Last packet indicator	While cleared, the 0x00 command need to be sent to get the whole table of information. When set to 1, the packet contains the last information table element
2	Payload length	The length of the whole payload excluding Command field, Last packet field and Payload length field
3	Alarm x ID	An arbitrary generated alarm ID unique for each alarm
4-5	Alarm x Start index	The start index into the data table for this alarm (index starting at 0)
6-7	Alarm x End index	The end index into the data table for this alarm (index starting at 0)

4. Connected mode

8-11	Alarm x code	The alarm type according to alarm status encoding in product status service with: Byte [8] = Unused Byte [9] = Sensor failure alarm Byte [10] = Temperature alarm status Byte [11] = Pressure alarm status
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The Alarm x ID + Alarm x Start index + Alarm x End index + Alarm x code are repeated for the total number of alarms with x = 1 to x = number of alarms

Example

Command: 00

Response:

80 → Get data logging info
01 → Last package
12 → Payload length (18 byte)
00 → Alarm ID 0
00 00 → Start Index
04 00 → End Index
00 00 00 01 → Pressure Alarm, Low Threshold
01 → Alarm ID 1
00 00 → Start Index
04 00 → End Index
00 01 00 00 → Pressure Alarm, Delayed Low

4. Connected mode

Step 2: Request data logging data

Writing the command value 0x01 to the Logging command will request the data logging data table containing the measurement data when the respective alarm ID occurred:

Byte	Field	Note
0	Response	0x81: Get data logging data table
1	Last packet	While cleared, the 0x01 command need to be sent to get the whole table of data. When set to 1, the packet contains the last logging data element
2	Payload length	The length of the whole payload excluding Command field, Last packet field and Payload length field
3 - ...	Data of data logging	Organized into n couples of 4 bytes for pressure followed by 4 bytes for temperature. Float values in sensor unity encoded MSB first (with n = 1 to n = 256)

Example

Command: 01

Response:

81 → Get data logging data
00 → one packet remaining
20 = packet length
B91D4952 → -0.00015 bars
41b21f34 → 22.2652 °C
B9 9D 49 52 → -0.0003

...

Command: 01

Response:

81 → Get data logging data
01 → last packet
08 = packet length
B9 51 B7 17 → -0.0002 bar
41 B1 CF 48 → 22.2262 °C

Step 3: Close data logging session

Writing the command value 0x02 to the Logging command will close the data logging session.

Byte	Field	Note
0	Response	0x82: Logging session closed

4. Connected mode

4.4 Device Commands

Via the Command Status characteristic in the configuration service, multiple device commands can be triggered. Also, any changes of the device configuration are only applied using the respective command. Each command is answered with a corresponding status that informs about success or failure.

Device Commands

Value	Command	Description
1	Apply Config	Applies all configuration parameters that have been changed.
2	Force LoRaWAN [®] Join	Triggers a LoRaWAN [®] Join Request if not yet connected to a network.
3	Force Data Transmission	Sends the current measurement value via LPWAN.
4	Factory config	Reset device to factory settings.
5	Force Measurement	Refresh measurement value.
6	Reset Energy Counter	Reset energy counter after battery has been replaced.

Return Status

Value	Description
0x80	Command Success
0x81	Error, unknown command
0x82	Device busy, action could not be executed
0x83	Configuration check failed
0x84	Error writing Settings

Appendix

A. Unit Identifier

Unit ID (dec)	Description
32	[°C] degree Celsius
7	[bar] Bar
237	[MPa] Mega Pascal
6	[psi] Pound force per square inch

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