OP-735 Bluetooth Optical Probe
User Manual

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GERMAN METERING
German Metering GmbH
www.german-metering.com

Address:
German Metering GmbH
Reuterweg 65
D-60323 Frankfurt am Main
Germany

Tel.: +49 (0) 69 / 770 622 - 06
Fax: +49 (0) 69 / 770 622 - 05

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Reuterweg 65, 60323 Frankfurt am Main, Germany
Tel: +49 (0)69 / 77062206
Fax: +49 (0)69 / 77062205
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1 How to use the device

1.1 Bluetooth Optical Probe

The OP-735 is a device that facilitates communication between measurement devices that comply with IEC62056-21 (mode C, E), IEC62056-31, and DLMS standards for optical ports, such as electricity meters and gas correctors, and computers, handheld devices, tablets, and other Bluetooth-enabled devices. The Bluetooth of OP-735 supports both Classic and BLE (Bluetooth Low

Energy) modes, and it is also possible to communicate in transparent mode. All steps involved in using the optical port, including pairing, connecting to the meter, and checking the battery charge, can be easily monitored through the device's LEDs.

The Lithium Polymer battery has a capacity of 470mAh and provides up to 14 hours of working time per charge. The device can be charged using either the adapter or a USB Type C cable connected to a PC.

Table 1 contains descriptions of the Bluetooth commands that can be used to change configurations in OP-735, such as Bluetooth name, Optical port frame and baud rate, and mode.

1.2 Electrical Specifications

- IEC 62056-21 standard for optical port
- Bluetooth version 4.1 standard, Classic and BLE modes
- Communication with measurement devices according to IEC62056-21 (Mode C, E), IEC62056-31, DLMS standards and TRANSPARENT mode for other standards such as MODBUS
- 10m unobstructed Bluetooth connection range
- Communication speed (baud rate) from 300 to 19200 bps
- 3-colored LEDs for displaying battery charge
- Pairing status, Sending and receiving data LED indicator
- Lithium Polymer 3.7V, 470mAh battery
- On/off switch
- USB Type C port for charging

1.3 Mechanical Specification

- Weight: 50 gr
- Dimension: 32x43mm
- Magnet power: more than 15 Newtons
- Body Material: ABS
- Ambient light filter

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1.3.1 USB Connector

The battery can be charged using the embedded USB C connector. After connecting the USB cable, the Bluetooth and data transfer LEDs will flash three times. The corresponding LED will then start blinking, indicating the amount of charge:

- Blinking Red: charge rate 0-33%
- Blinking Orange: charge rate 34-66%
- Blinking Green: charge rate 67-100%
- Green: complete charge

1.3.2 Battery Indicator LEDs (Charge)

These LEDs represent the amount of battery charge as follows:

- Blinking Red: Battery charge is less than 10%
- Red: Battery charge is 10-33%
- Orange: Battery charge is 34-66%
- Green: Battery charge is 67-100%

1.3.3 STATUS Indicator LED

The green LED indicates the status of data transfer on the optical interface. It blinks during data transfer via the optical interface.

1.3.4 Bluetooth Status Indicator LED

The blue LED indicates the status of the Bluetooth connection. It remains illuminated when the device is connected to another Bluetooth device and blinks when data is being transferred via Bluetooth.

1.3.5 POWER Button

The purpose of this button is to power the OP-735 on and off. Press and hold for 2 seconds to turn on, and press and hold again to turn off.

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1.4 Software Specifications

1.4.1 Working Modes

The OP-735 is capable of connecting with all devices in IEC62056-21 standards.

OP-735 can work on two Transparent and IEC modes. The functionality is as follows:

IEC

In this mode, the optical port can automatically change baud rate during communication according to the IEC62056-21 standard. It can also communicate with meters that support direct DLMS at 9600 baud rate and IEC62056-31 standard at 1200 baud rate without requiring any additional settings.

Transparent

In this mode, the optical port can automatically change baud rate during communication according to the IEC62056-21 standard. It can also communicate with meters that support direct DLMS at 9600 baud rate and IEC62056-31 standard at 1200 baud rate without requiring any additional settings.

Note. At this mode optical probe cannot do any changes in the communication frame with the meter and will only transfer the received data from one side to another.

1.4.2 Settings

To send the settings or upgrade firmware, you can use any program that is capable of sending commands using Bluetooth. You can also use windows/android application (see 4. Application for setting OP-735).

1.4.2.1 Using Commands

The following table shows the commands associated with each configuration that must be sent to optical probe.

Command Type	Possible options	Command	Answer
Read Serial	10 bytes digits or letters	**AT+AD Serial?**<CR><LF>	Serial Number=OP-735<CR><LF>
Read Bluetooth Name	10 bytes digits or letters	**AT+AD Name?**<CR><LF>	Name=OP-735<CR><LF>
Set Bluetooth Name	10 bytes digits or letters	**AT+AD Name=OP-735**<CR><LF>	Name=OP-735<CR><LF>
Read Optical Probe Model	OP-735, OP-745	**AT+AD Model?**<CR><LF>	Model = OP-735<CR><LF>
Read Software Version		**AT+AD Software Version?**<CR><LF>	Version:01.01.01<CR><LF>
Read Automatic Power Off Time (Minute)	1 to 9	**AT+AD AutoPowerOff?**<CR><LF>	AutoPowerOff=5<CR><LF>
Set Automatic Power Off Time (Minute)	1 to 9	**AT+AD AutoPowerOff=3**<CR><LF>	AutoPowerOff=3<CR><LF>
Read Working Mode	TRANSPARENT, IEC	**AT+AD Mode?**<CR><LF>	CommunicationMode=IEC<CR><LF>
Set Working Mode	TRANSPARENT, IEC	**AT+AD Mode=IEC**<CR><LF>	CommunicationMode=IEC<CR><LF>
Read Optical Port Frame	Note*	**AT+AD Frame?**<CR><LF>	Frame=300,7,E,1<CR><LF>
Set Optical Port Frame	Note*	**AT+AD Frame=300,7,E,1**<CR><LF>	Frame=300,7,E,1<CR><LF>

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Note*:
Set up and collection of the optical port communication frame is as follows:

- Baud rate, Number of Bit, Parity, Stop bit

The values for each parameter are as follows:

- Baud rate: 300, 1200, 2400, 4800, 9600, 19200
- Number of Bit: 7, 8
- Parity: N (none), E (even), O (odd)

According to the above description, if we want to connect with the meter with baud rate: 4800 and number of bits: eight and parity: E with the last 1 bit, the command format will be as follows:

- **AT+AD Frame =4800,8,N,1**<CR><LF>

Note*:
Generally, for meters that comply with IEC 62056-21 standard, the command should be:

- **AT+AD Frame =300,7,E,1**<CR><LF>

Note*:
In case any command other than the mentioned commands are sent to the optical probe, "Invalid Command!" will be returned and if parameters are not set correct, "Invalid Parameters!" will be returned.

1.4.2.2 Upgrading Firmware

The firmware can be upgraded in two ways:

- Send the file through the windows/android application (see 4. Application for setting OP-735).
- Send the file through any program via Bluetooth that can send commands.

Upgrading via other applications

To send the file through other programs, each line of the file must be sent separately to the device. For each line, an ACK (06H) must be received from the device before sending the next line. If a NACK byte (15H) is received instead of an ACK, the line must be resent. Receiving a NACK indicates an error in the sent line format.

Sample sent file:

```
Send From PC:      AT+AD BOOT
Receive From PC:   06
Send From PC:      :020000040800F2
Receive From PC:   06
Send From PC:      :10480000000E00208D4900086DB700089DB4000817
Receive From PC:   06
Send From PC:      :1048100000000000000000000000000000000000098
Receive From PC:   06
Send From PC:      :1048200000000000000000000000000039B800088F
……
```

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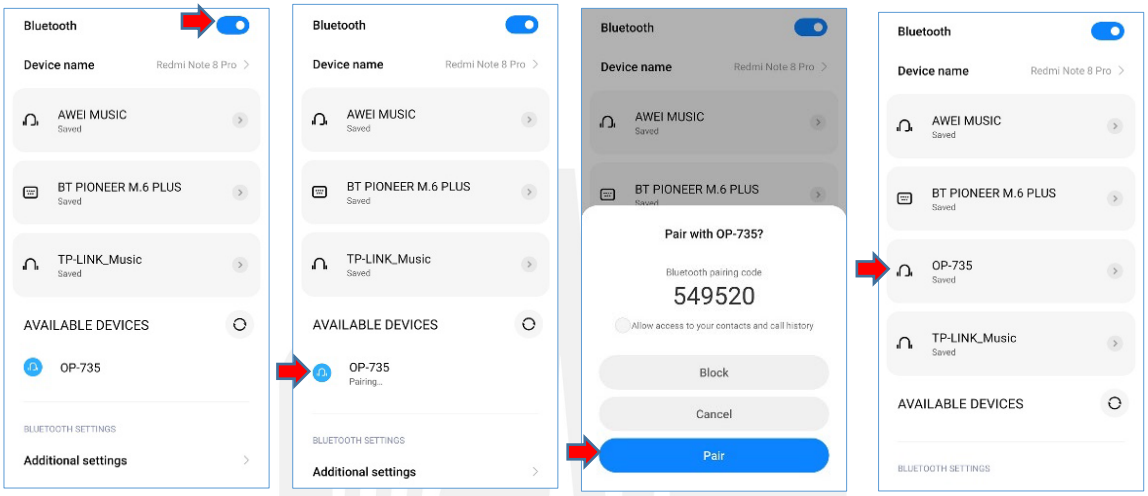
2 How to pair with devices

2.1 How to pair with Android device

To connect the OP-735 to your Android device, first enable Bluetooth on your device. Then, turn on the OP-735 and navigate to the Bluetooth settings on your Android device to pair the two devices.

After pairing, there is no need to re-pair (even after turning device on and off).

These pictures show all steps of pairing OP-735 with android:

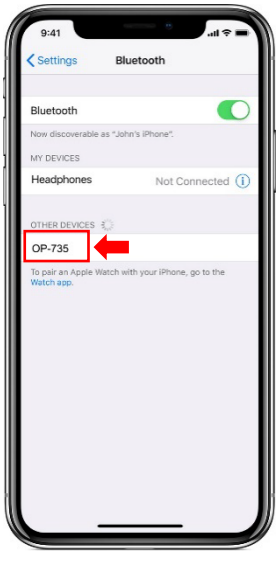


2.2 How to pair with IOS device

Turn on the OP-735 and follow steps below:

Step 1: On your IOS device, go to Settings > Bluetooth and turn on Bluetooth. Stay on this screen until you see the OP-735.

Step 2: Tap on OP-735.



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Step 3: You might need to enter the PIN. The OP-735 pin code is "0" (zero).

After pairing, there is no need to re-pair (even after turning device on and off).

2.3 BLE Communication Guide

OP-735 BLE mode has 3 options which are set via

- **AT+AD Command:at+ab config var60=[0-2]**<CR><LF>

as follows:

0: Demo, battery service used to exchange data in transparent mode.

1: Modem, Custom Service is used to exchange data in transparent mode.

2: Profile, transparent mode not allowed.

Note: Default mode is "modem mode".

1. Demo

The Demo mode is battery service-based data exchange in transparent mode. A BLE connection is used to transfer data between any BLE compatible software and the module. Also, writing to the battery state of the module will result in a notification from the module by the software.

Service UUID= 26CC3FC0-6241-F5B4-5347-63A3097F6764

2. Modem mode (default mode)

Using transparent mode, the first characteristic of customer service can be written to the module and notifications can be received from the module through the software.

1st characteristics UUID: bf8796f1-64f7-70b5-1e41-09bb46d79100
Readable, Writeable, Writeable Without Response, Notify

2nd characteristics UUID: bf8796f1-64f7-70b5-1e41-09bb46d79101
Readable, Writeable

3th characteristics UUID: bf8796f1-64f7-70b5-1e41-09bb46d79102
Readable, Writeable

4th characteristics UUID: bf8796f1-64f7-70b5-1e41-09bb46d79103
Readable, Writeable

3. Profile mode

If the module is in profile mode, it will not go into transparent mode after the connection is made. Each characteristic of customer service can be read and written in the module and the module can send notifications using AT commands to get and set characteristics locally.

Note: if it's necessary being in Profile mode, some changes must be implemented in OP-735 by German metering.

Example: Connecting OP-735 and LightBlue software:

- Connect the module to the PC or iPad.
- Establish BLE connection between the iOS device and the OP

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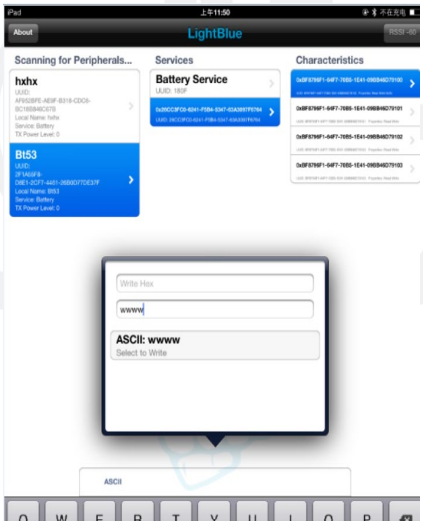
Data Exchange:

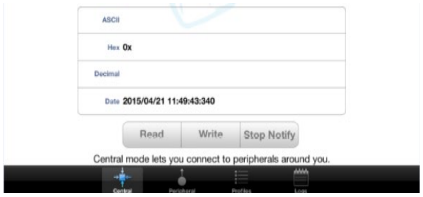
Select the 1st characteristic of customer service.

Click "Write", fill in the desired data in the "Write ASCII" window (≤ 20 bytes), and then click "Send".



Optical probe will receive the data.

If the data needs to be sent to an iPad, first click "Start Notify" on the demo, which will change to "Stop Notify".



The other side will receive data one byte by one byte.

- Disconnect by iOS device
  Click "Disconnect" to close the BLE connection.

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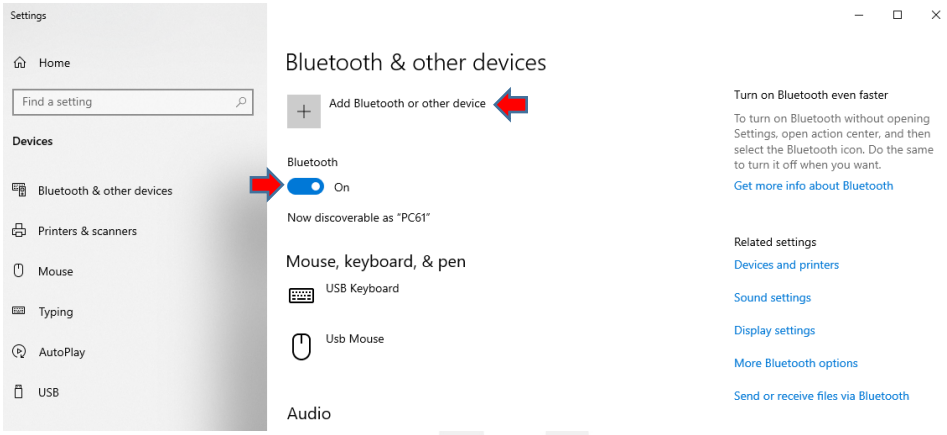
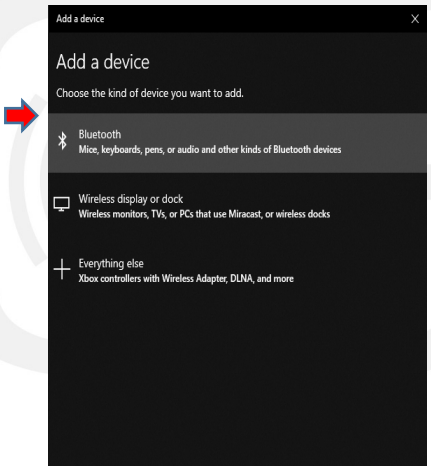
2.4 How to connect in Windows 10

The OP-735 is Bluetooth-enabled, and other device should be Bluetooth-enabled too. To connect OP-735 to your Computer/Laptop follow steps below:

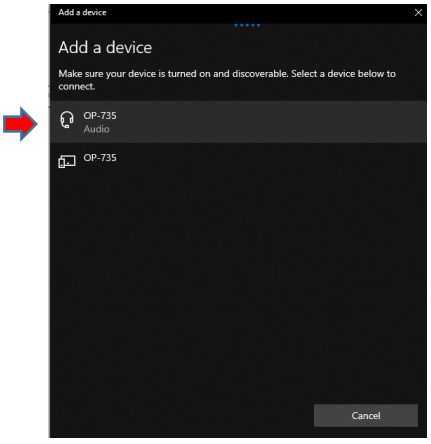
Step 1: Make sure your device Bluetooth is on and click on "Add Bluetooth or other device" in the Bluetooth settings in Settings Menu:



Step 2: In New form click on "Bluetooth":



Step 3: Click on found OP-735 with audio type and click "Connect":



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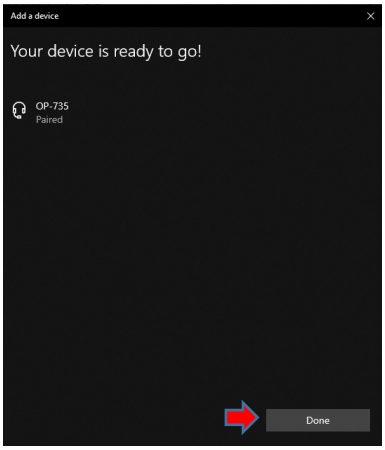
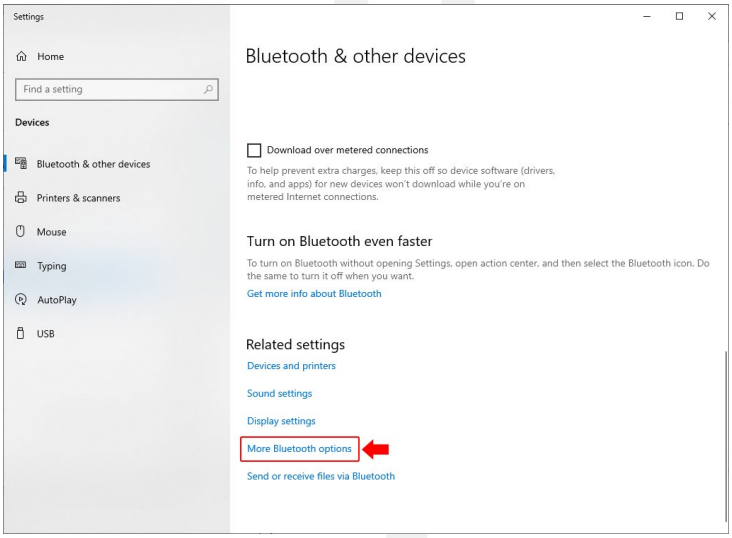
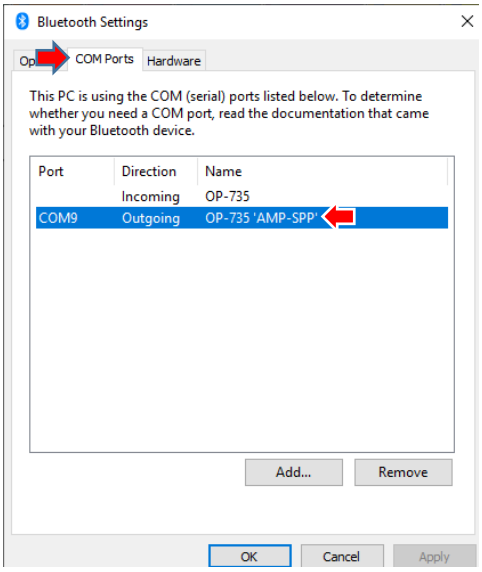
Step 4: Click "done" after connection is complete.



Step 5: After connecting, a COM port for the OP-735 is created on the computer, to know its port number, scroll down to the end of the form and click on "More Bluetooth options":



Click on "COM Ports" tab and find your OP-735 serial number with outgoing direction.



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2.5 How to connect in Linux

To connect OP-735 with your Linux device flow steps below:

Step 1: Install BlueZ packages by using any of the following commands that matches your Linux distribution:

```
-----Ubuntu / Debian-----
$ sudo apt-get -y install bluetooth bluez bluez-tools rfkill

-----Fedora-----
$ sudo dnf -y install bluez bluez-tools

-----Arch Linux / Manjaro-----
$ sudo pacman -S bluez bluez-utils
```

This installation provides the *bluetoothctl* utility.

Step 2: You need to add your account to the lp group if you wish to connect to a bluetooth tether:

```
sudo usermod -aG lp $USER
newgrp lp
```

Step 3: Start and enable the Bluetooth:

```
$ systemctl is-enabled bluetooth.service
enabled
```

Use this command to check it out:

```
$ systemctl status bluetooth.service
```

Step 4: Ensure Bluetooth is not disabled:

```
$ rfkill
ID TYPE      DEVICE              SOFT         HARD
 0 bluetooth tpacpi_bluetooth_sw  blocked      unblocked
 1 wlan      phy0                unblocked    unblocked
```

If it is blocked, unblock it by using the command below:

```
$ rfkill unblock bluetooth
```

Confirm it is unblocked:

```
$ rfkill
ID TYPE      DEVICE                   SOFT      HARD
 0 bluetooth tpacpi_bluetooth_sw unblocked unblocked
 1 wlan      phy0                unblocked unblocked
 2 bluetooth hci0                unblocked unblocked
```

Step 5: Use bluetoothctl to connect to OP-735. Start the bluetoothctl interactive command:

```
$ bluetoothctl
Agent registered
```

Use this command to check it out:

```
$ bluetoothctl show
```

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Step 6: Turn on your bluetooth adapter:

```
[bluetooth]# agent KeyboardOnly
Agent is already registered

[bluetooth]# default-agent
Default agent request successful

[bluetooth]# power on
Changing power on succeeded
```

Step 7: Turn OP-735 on and do a scan to detect it:

```
# scan on
Discovery started
[CHG] Controller 20:79:18:5E:4B:64 Discovering: yes
[NEW] Device 5C:FB:7C:A4:17:C6 OP-735
```

To stop scanning use this command:

```
# scan off
```

Step 8: To pair with OP-735 use command "*pair <Bluetooth address>*". You may need to confirm it.

```
[bluetooth]# pair 5C:FB:7C:A4:13:C6
Attempting to pair with 5C:FB:7C:A4:17:C6
[CHG] Device 5C:FB:7C:A4:13:C6 Connected: yes
Pairing successful

# trust 5C:FB:7C:A4:17:C6
[CHG] Device 5C:FB:7C:A4:17:C6 Trusted: yes
Changing 5C:FB:7C:A4:17:C6 trust succeeded
```

Use this command to check it out:

```
# paired-devices
Device 5C:FB:7C:A4:17:C6 OP-735

# devices
Device 5C:FB:7C:A4:17:C6 OP-735
```

Step 9: Connect to OP-735 after pairing:

```
[bluetooth]# connect 5C:FB:7C:A4:17:C6
Attempting to connect to 5C:FB:7C:A4:17:C6
[CHG] Device 5C:FB:7C:A4:17:C6 Connected: yes
Connection successful
```

Use this command to check it out:

```
[OP-735]# info
Device 5C:FB:7C:A4:17:C6 (public)
 Name: OP-735
 Alias: OP-735
```

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3 Preparing for reading meter

Turn on OP-735 and put it on the optical port of the meter. After OP is turned on and before connecting with other Bluetooth device, LED will turn orange. First pair your tablet or laptop with the optical probe. After pairing with tablet or laptop, the LED on OP will turn green.

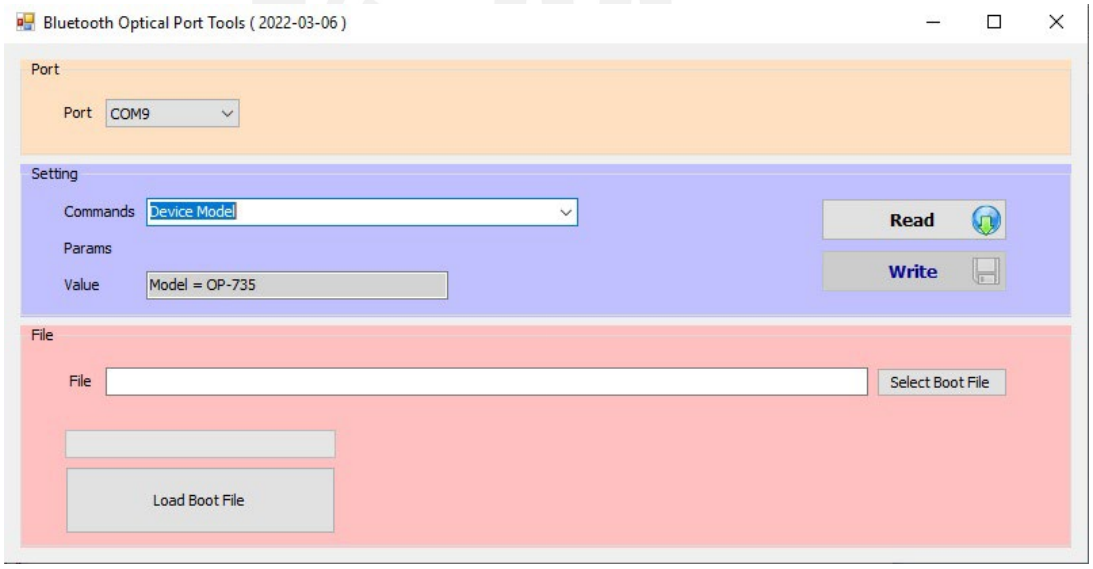
If you are using pc for connecting with OP, first choose the Com port corresponding to the optical port in the software used correctly and then start transferring data.

If you are using the meter reading application from German Metering, after pairing with tablet or phone, in Digital collection window, choose the serial number of the optical probe and then collect data from meter.

4 Application for setting OP-735

4.1 Using Windows Configuration Application

Open "Bluetooth Optical port tools" and choose the corresponding COM port to the optical probe. On the "Settings" section, choose the desired "commands" and click "Read" to collect data and "Write" to configure. If the selected command has the configuration capability, the parameters can be chosen in the "Params" section according to the configuration type.
For example, the parameters for optical port communication frame in transparent mode.
The collected value will be displayed in front of "Value" after collection.



Firmware Upgrade using windows-based application

In order to upgrade OP-735 using "Bluetooth Optical port tools", first choose the associated file in "File" section by clicking on the "Select Boot File" and then press the "load boot file" button.

4.2 Using Android Configuration Application

To config your OP-735 with android application flow steps below:

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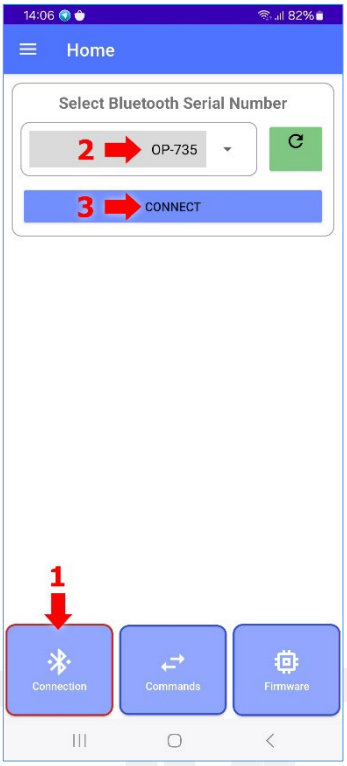
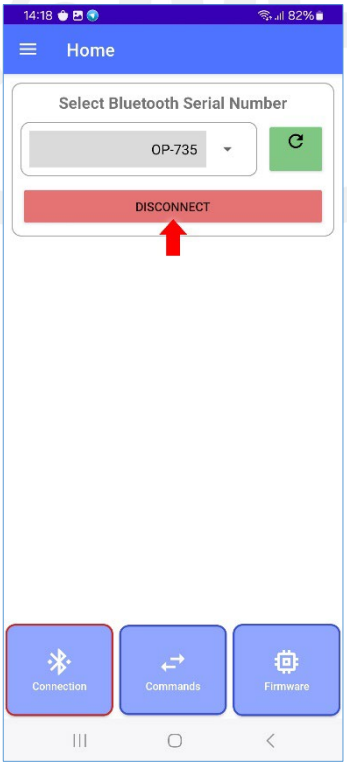
Step 1: Select your paired OP-735 from list and click on "CONNECT":



To disconnect your OP-735 click on "DISCONNECT":



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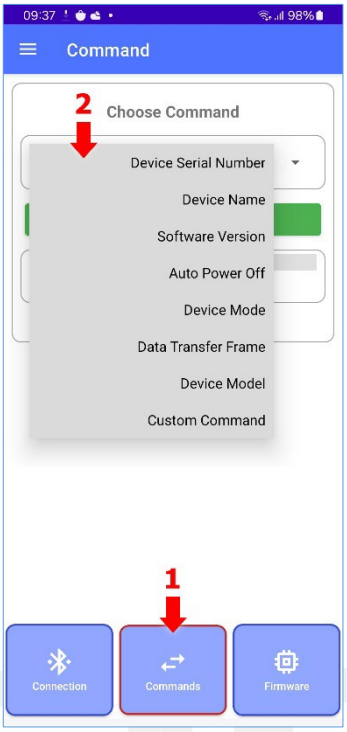
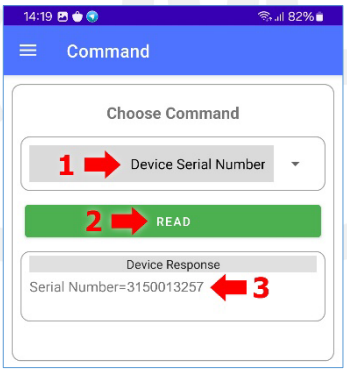
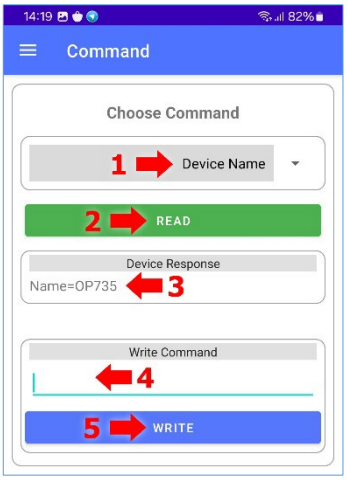
Step 2: To send READ/WRITE commands click on "Commands" and choose desired command:



- Device Serial Number: Click on "READ" and get device serial number:



- Device Name: Click on "READ" to get device name and click on "WRITE" to set desired name:



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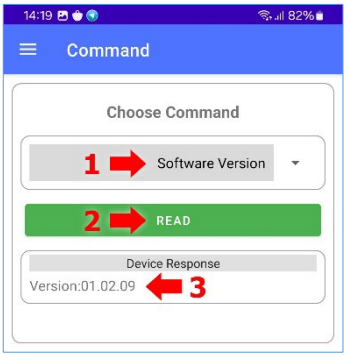
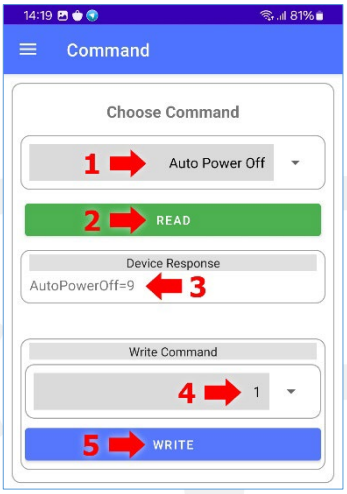
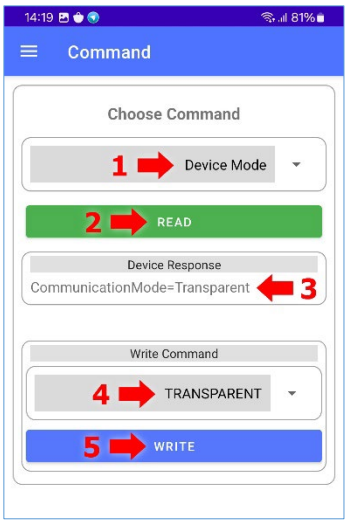
- Software Version: Click on "READ" and get device software version:

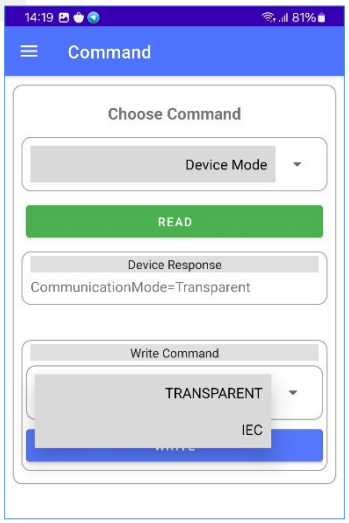


- Auto Power Off: Click on "READ" to get and "WRITE" to set auto power off time:



- Device Mode: Click on "READ" to get and "WRITE" to set device mode:





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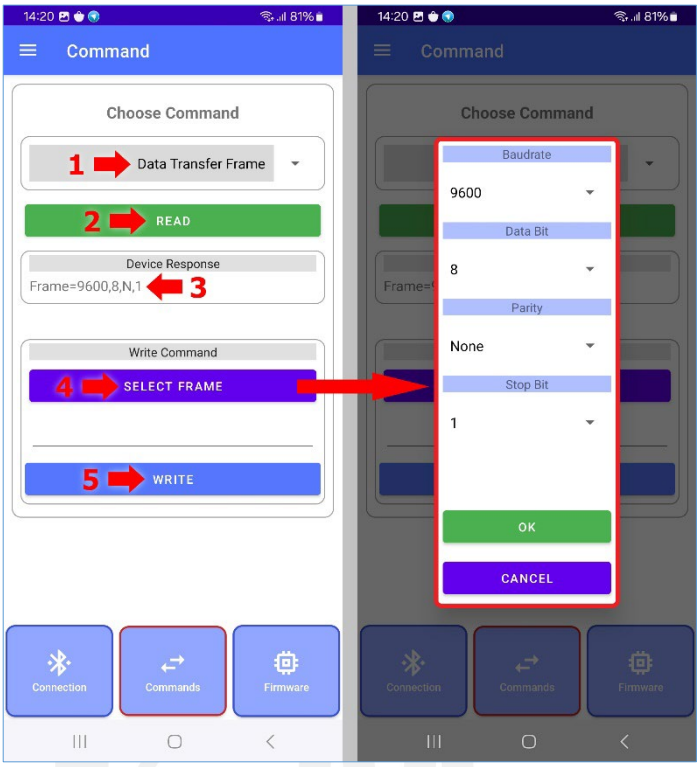
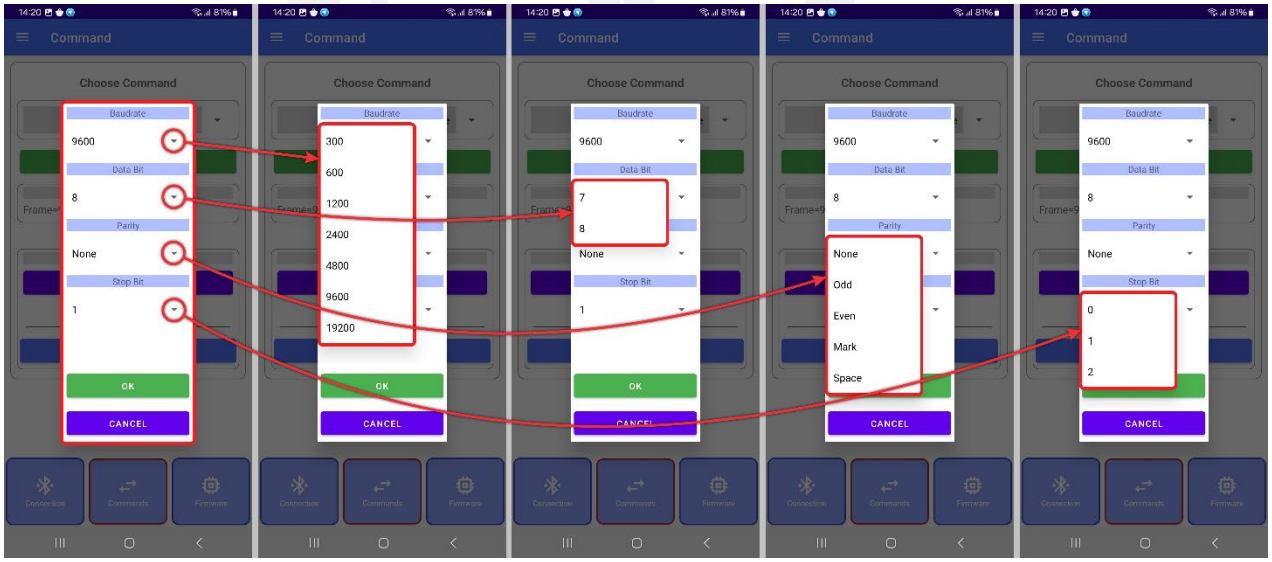
- Data Transfer Frame: Click on "READ" to get and "WRITE" to set data transfer frame. Click on "SELECT FRAME" (4) to select Baudrate, Data Bit, Parity and Stop Bit:



Click on each of Baudrate, Data Bit, Parity or Stop Bit to select desired value:



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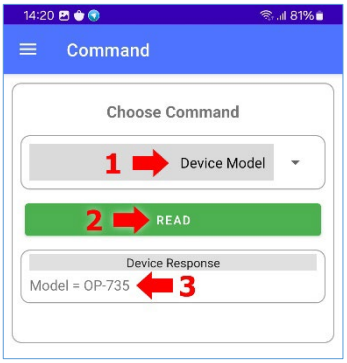
➢ Device Model: Click on "READ" and get device model:



➢ Custom Command: Enter desired command in "Write Command" section and click on "WRITE" to send command and receive device response:

Use following commands:

Command Type	Possible options	Command	Answer
Read Serial	10 bytes digits or letters	**Serial?**	Serial Number=OP-735
Read Bluetooth Name	10 bytes digits or letters	**Name?**	Name=OP-735
Set Bluetooth Name	10 bytes digits or letters	**Name=OP-735**	Name=OP-735
Read Optical Probe Model	OP-735, OP-745	**Model?**	Model = OP-735
Read Software Version		**Software Version?**	Version:01.01.01
Read Automatic Power Off Time (Minute)	1 to 9	**AutoPowerOff?**	AutoPowerOff=5
Set Automatic Power Off Time (Minute)	1 to 9	**AutoPowerOff=3**	AutoPowerOff=3
Read Working Mode	TRANSPARENT, IEC	**Mode?**	CommunicationMode=IEC
Set Working Mode	TRANSPARENT, IEC	**Mode=IEC**	CommunicationMode=IEC
Read Optical Port Frame	Note*	**Frame?**	Frame=300,7,E,1
Set Optical Port Frame	Note*	**Frame=300,7,E,1**	Frame=300,7,E,1

Note*:
Set up and collection of the optical port communication frame is as follows:

- Baud rate, Number of Bit, Parity, Stop bit

The values for each parameter are as follows:

- Baud rate: 300, 1200, 2400, 4800, 9600, 19200
- Number of Bit: 7, 8
- Parity: N (none), E (even), O (odd)

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According to the above description, if we want to connect with the meter with baud rate: 4800 and number of bits: eight and parity: E with the last 1 bit, the command format will be as follows:

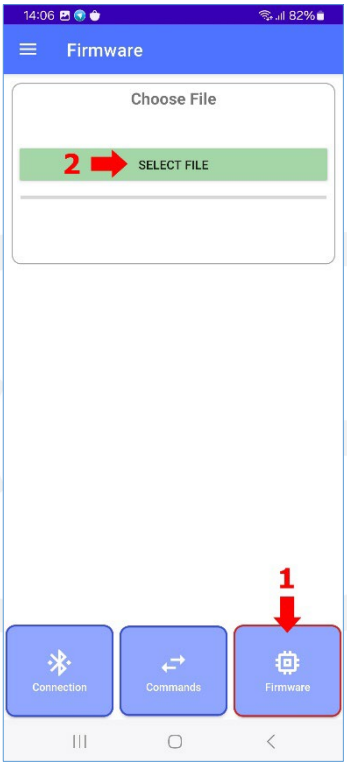
- `Frame =4800,8,N,1`

Note*:
Generally, for meters that comply with IEC 62056-21 standard, the command should be:

- `Frame =300,7,E,1`

Note*:
In case any command other than the mentioned commands are sent to the optical probe, "Invalid Command!" will be returned and if parameters are not set correct, "Invalid Parameters!" will be returned.

Step 3: To upgrade firmware, click on "Firmware" and choose file to send to device:



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