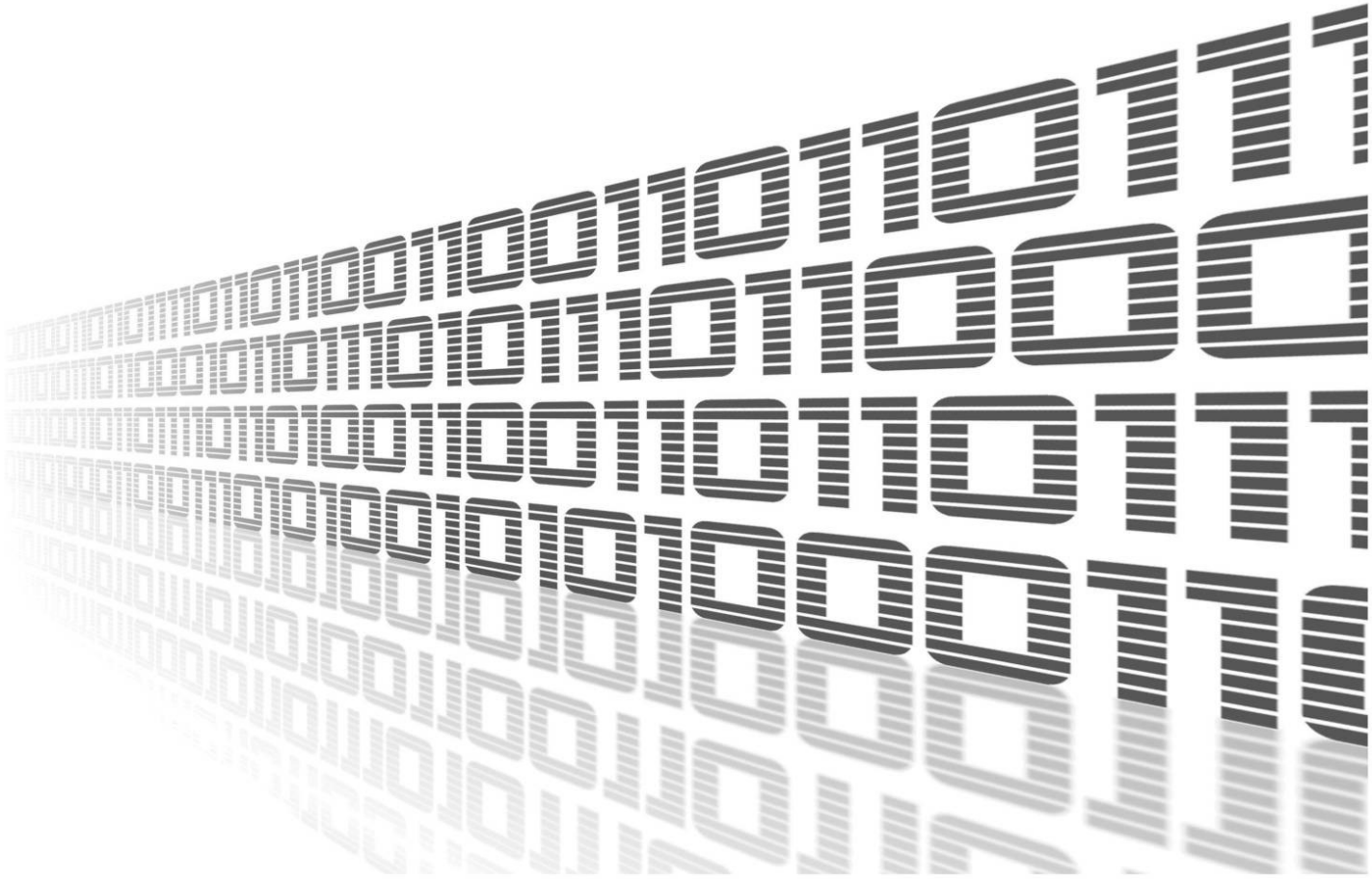
ADVANTECH

RouterApp

Bluetooth



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Used symbols

Important

Important — Indicates a risk to personal safety or potential damage to the router. Follow these instructions precisely to prevent injury or equipment damage.

Warning

Warning — Highlights conditions that may cause malfunction, loss of data, or unexpected behavior in specific situations. Read carefully before proceeding.

Info

Info — Provides helpful tips, context, or references that improve understanding but are not strictly required to complete the task.

Code Example

```
Code Example - Copy-pasteable configuration snippets or CLI commands.
```

Contents

List of Figures

List of Tables

1. Introduction

Warning

This router app is not installed on *Advantech* routers by default. Installation instructions for router apps are described in the *Configuration Manual*.

Info

The router app is supported by the following router models:

- ICR-32xxW
- ICR-44xxW3
- ICR-41xxW and ICR-42xxW

Warning

Note that on v3 and v4i platforms, the Bluetooth interface is unavailable when a Wi-Fi interface (either *AP* or *STA* mode) is active.

Bluetooth is a wireless technology standard used for exchanging data between fixed and mobile devices over short distances. It utilizes UHF radio waves in the industrial, scientific, and medical (ISM) radio bands, ranging from 2.402 GHz to 2.480 GHz. It was originally conceived as a wireless alternative to RS-232 data cables.

There are two main variants of Bluetooth: *Classic Bluetooth* and *Bluetooth Low Energy (BLE)*. Although they exist within the same standard, they are considerably different.

Classic Bluetooth has been part of the standard since its inception and is sometimes referred to as Bluetooth BR/EDR. This variant is designed for higher data throughput applications, such as file transfers and audio streaming. It requires a connection handshake between devices and typically creates continuous data streams.

Bluetooth Low Energy (BLE), previously known as Wibree, was introduced in Bluetooth v4.0. It features an entirely new protocol stack designed for sending short packets, which is ideal for IoT applications. Compared to the protocols in Bluetooth v1.0 through v3.0, BLE is aimed at very low-power applications that can run for several years on a coin cell battery. BLE represents a significant progression in extending the battery life of mobile devices. While the range was relatively short in version 4.x, it was significantly improved in version 5.0 and newer.

The Bluetooth implementation in Advantech routers consists of three parts:

1. Kernel Bluetooth support and drivers (available from firmware version 6.2.6).
2. The Bluetooth Router App, which includes *BlueZ* (the Linux Bluetooth stack).
3. Applications, currently focusing on the *Node-RED* Bluetooth node and C scripts.

The current implementation targets Bluetooth Low Energy sensors and Personal Area Networking (PAN).

2. Web Interface

Once the installation of the module is complete, the module's GUI can be accessed by clicking the module name on the *Router Apps* page of the router's web interface.

The left panel of the GUI contains a menu divided into three sections: *Information* (containing *Status* and *Nearby Devices*), *Configuration*, and *General* (containing *Licenses* and the *Return* item). The *Return* item switches the view back to the router's main web configuration pages. The main menu of the module's GUI is shown in Figure 1.

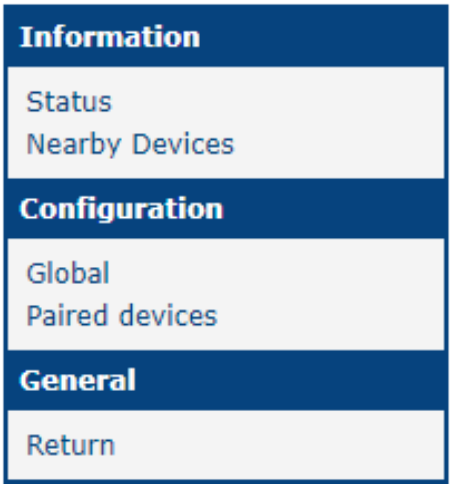

Figure 1: Module menu

2.1 Information

2.1.1 Status

When Bluetooth is active, the current settings of the Bluetooth adapter are displayed here. This includes the device address, the data presented by the device, discovery status, pairability, and the services provided.

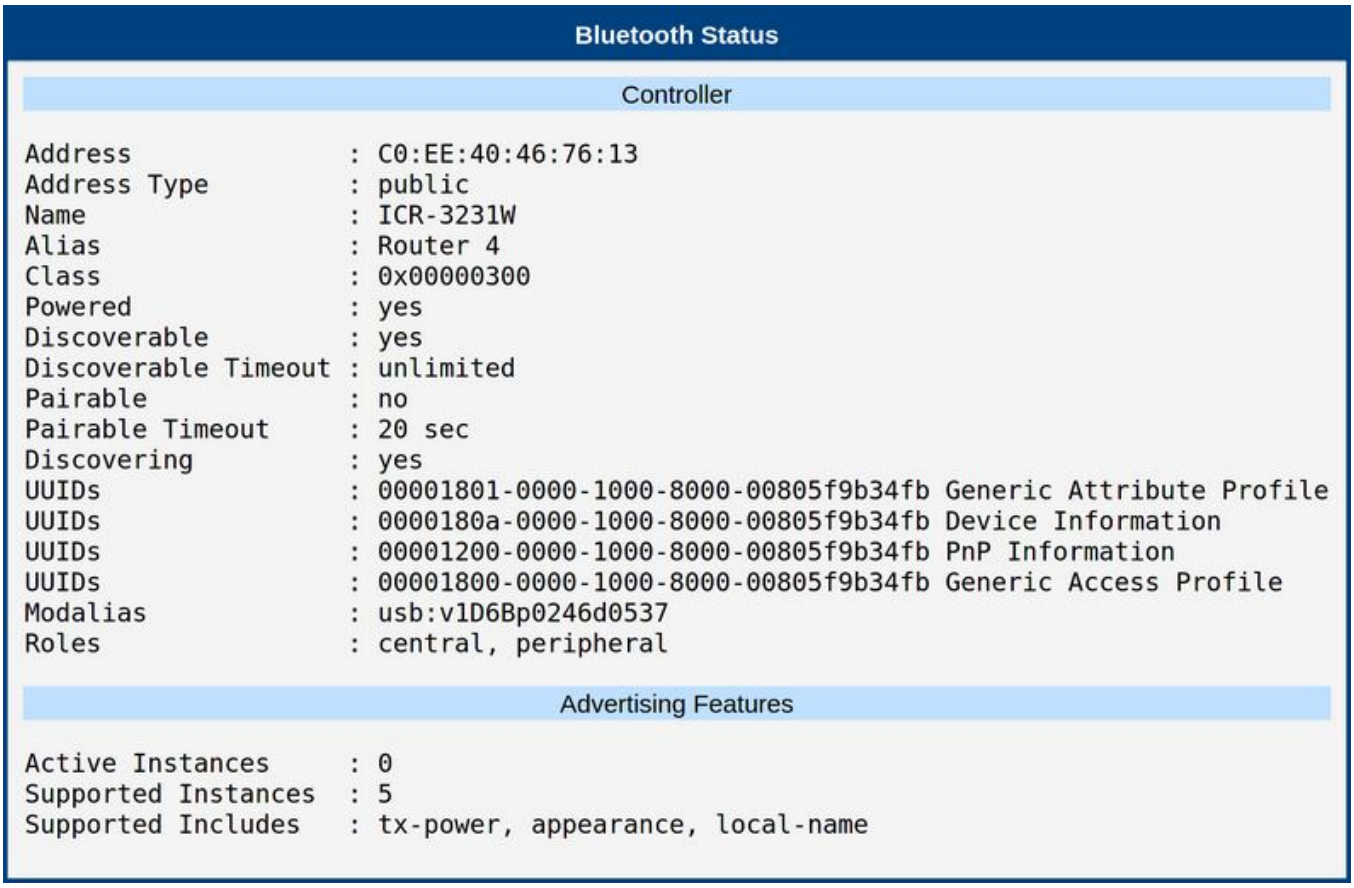

Figure 2: Bluetooth status overview

2.1.2 Nearby Devices

This page lists discoverable Bluetooth devices in the vicinity. The list is dynamic; a device is removed if it is not detected for more than 30 seconds. Note that the list does not refresh automatically; a manual refresh of the page is required to update the results.

Pairing or unpairing of nearby devices is initiated from this list. Detailed information about a specific device can be viewed by expanding its entry. For more information, see Chapter 3.1.

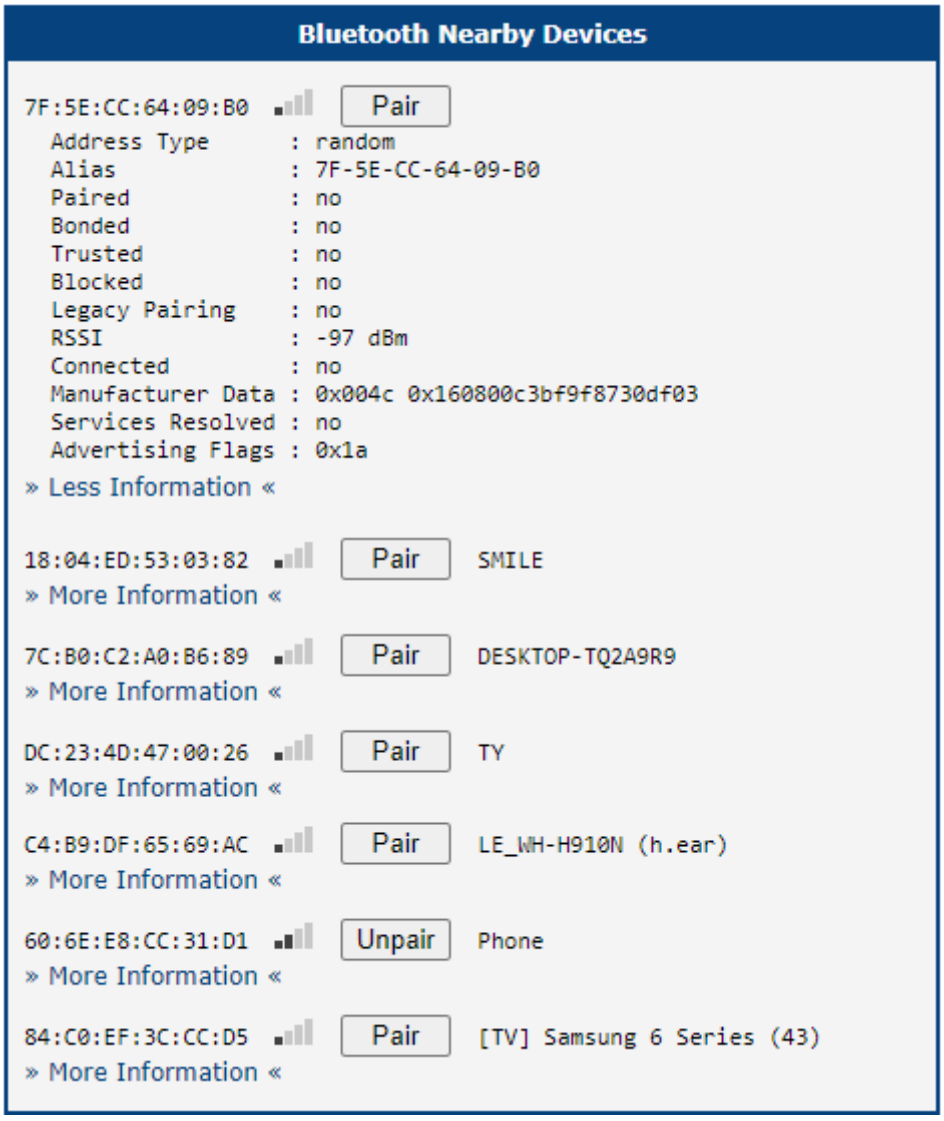

Figure 3: Nearby devices list

2.2 Configuration

2.2.1 Global

Global settings for the Bluetooth router app can be configured on the *Global* page.

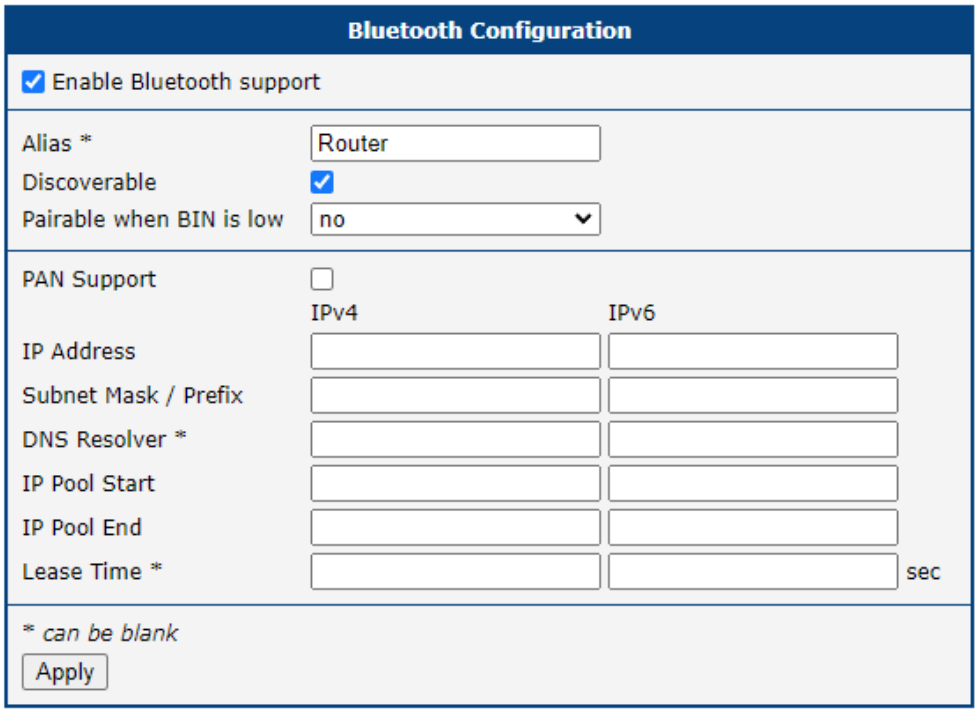

Figure 4: Global configuration page

Item	Description
Enable Bluetooth support	Enables or disables Bluetooth functionality.
Discoverable	Makes the router visible to other Bluetooth devices.
Alias	Sets the name of the router as seen by other devices during a search.
Pairable when BIN is low	Enables pairing mode when a specific binary input is triggered. This is useful when web GUI access is unavailable.
PAN Support	Enables Personal Area Networking (PAN) via Bluetooth.
IP Address	Sets the IP address for the PAN server.
Subnet Mask / Prefix	Sets the subnet mask or prefix for the PAN network.
DNS Resolver	Specifies the IP address of the DNS resolver for PAN clients.
IP Pool Start	Defines the start of the IP address range for PAN clients.
IP Pool End	Defines the end of the IP address range for PAN clients.
Lease Time	Specifies the duration (in seconds) for which an IP address is leased to a client.

Table 1: Global configuration items

2.2.2 Paired Devices

This page displays a list of devices currently paired with the router. Detailed information for each device can be viewed even if the device is not currently within range. For more details on the pairing process, see Chapter 3.1.

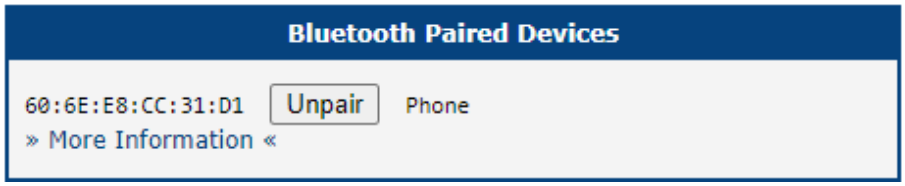

Figure 5: List of paired devices

2.3 General

2.3.1 Licenses

This section lists the Open-Source Software (OSS) licenses used by the Bluetooth module.

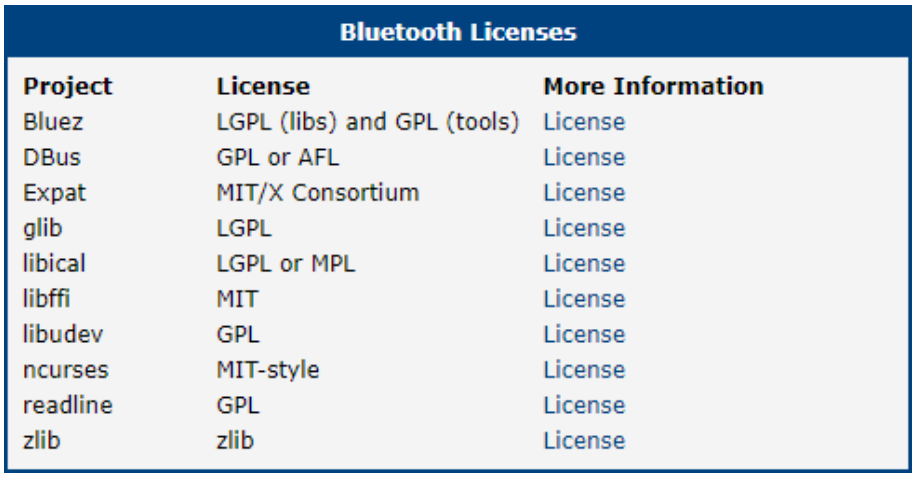

Figure 6: License information

3. Bluetooth Usage

Classic Bluetooth operates using the concept of *profiles*. For instance, if *PAN Support* is enabled, the *Status* page will display a UUID entry such as:

```
UUIDs: 00001116-0000-1000-8000-00805f9b34fb NAP
```

This indicates that the router is acting as a *Network Access Point (NAP)* for PAN.
To use specific profile services, devices must be paired and authorized. You can authorize profiles individually upon each use or mark a device as *Trusted* to allow global access to all profiles without repeated authorization.
For BLE, pairing is often optional, though it provides enhanced security when used. To establish a connection, ensure both devices have Bluetooth enabled and are in pairing mode. Once connected, data such as files or sensor readings can be transferred seamlessly.

3.1 Pairing

Pairing is the process where Bluetooth devices exchange security keys to enable encrypted communication. It is mandatory for Classic Bluetooth and optional for BLE.
The process involves an *initiator* and a *responder*. For a responder to accept a request, it must be in *Pairable* mode. It is also recommended to be in *Discoverable* mode so the initiator can find the device; otherwise, the initiator must know the responder's hardware address.
During pairing, users typically confirm they are connecting to the correct device via various authentication methods. If a device lacks a UI (e.g., no display or keyboard), authentication may be skipped or simplified.
Advantech routers support two primary pairing methods:

1. **Manual Pairing**: Initiated from the *Nearby Devices* page (Authenticated).
2. **Automatic Pairing**: Controlled via a binary input (BIN) (Non-authenticated).

3.1.1 Manual Pairing via Nearby Devices

In this scenario, the router acts as the initiator.

Pressing the *Pair* button next to a visible device initiates the process. If both devices support it, a 6-digit passkey will be displayed on both the router's web interface and the target device for comparison. If the target device does not support manual authentication, pairing proceeds immediately.

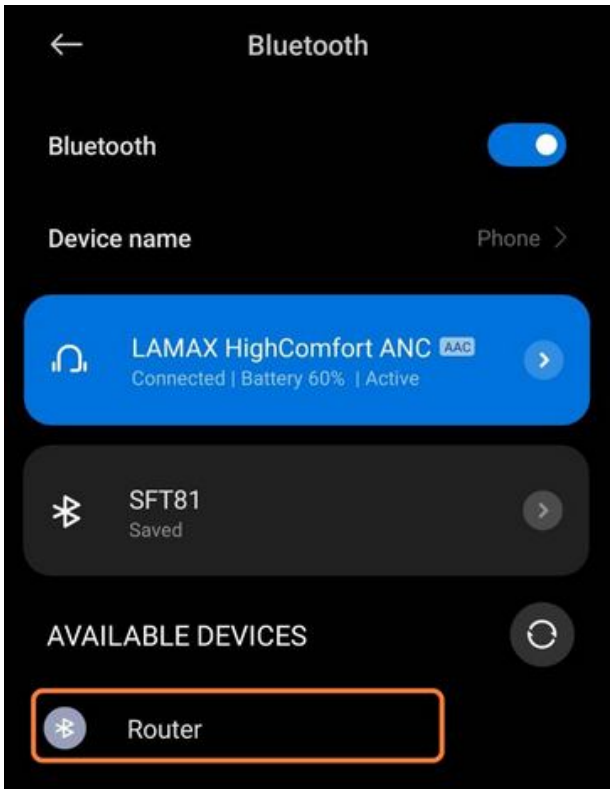

Figure 7: Bluetooth settings on a mobile device

Figure 8: Initiating pairing on the router

If authentication is required, the confirmation code will appear on both the router's page and the device.

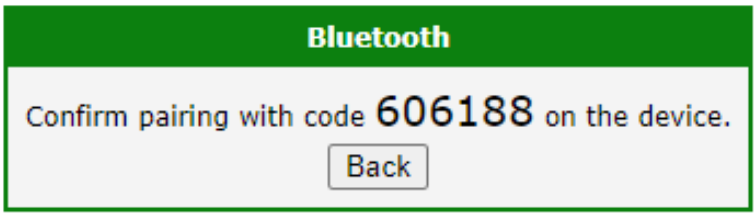

Figure 9: Pairing confirmation on the router GUI

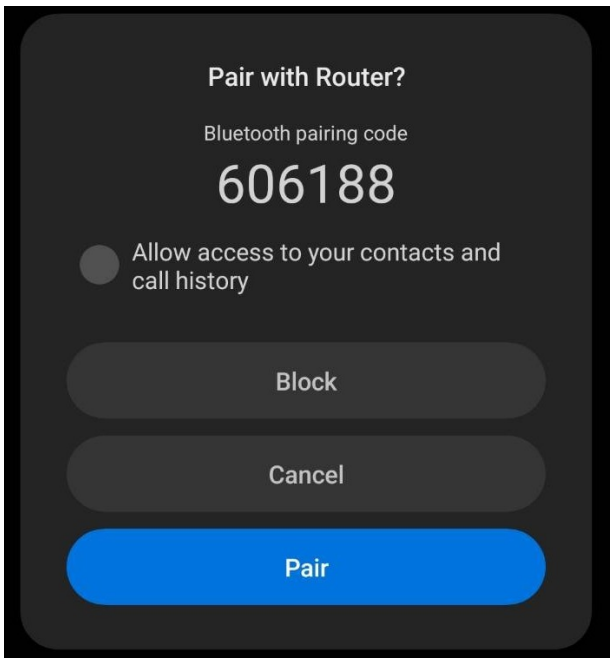

Figure 10: Pairing confirmation on the mobile device

Upon confirmation, the device is successfully paired and will appear in the *Paired Devices* list.

3.1.2 Automatic Pairing Controlled via BIN

In this scenario, the router acts as the responder.

If access to the router's web UI is restricted, pairing can be controlled via a physical binary input. When the binary input is triggered (e.g., by a button press), the router enters *Pairable* mode and automatically approves incoming pairing requests.

The specific binary input is defined in the *Global* configuration using the *Pairable when BIN is low* option. It is recommended to also enable the *Discoverable* option to make the router visible during this time.

Warning

Because this method does not use manual authentication, users should ensure there are no unauthorized devices nearby attempting to pair during this window.

3.1.3 Unpairing and Management

When pairing is successful, the device is automatically set to *Trusted* and *Bonded*, meaning keys are stored for long-term use. These keys are stored on the router in the `/var/data/bluetooth` directory; if this directory is cleared, all pairing information will be lost.

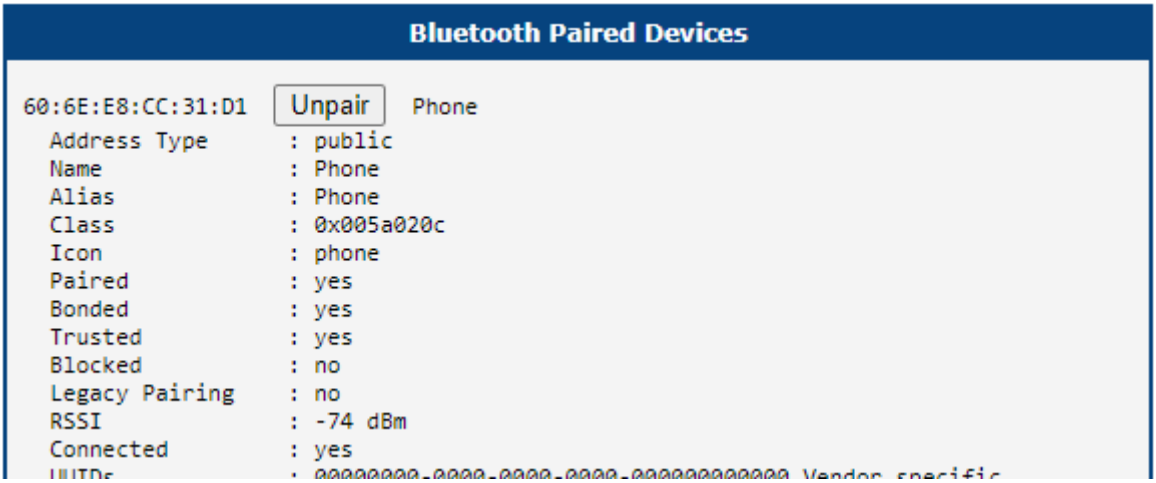

Figure 11: Properties of a paired, bonded, and trusted device

To unpair a device, click the *Unpair* button on the *Paired Devices* page. This can be done even if the device is not currently in range.

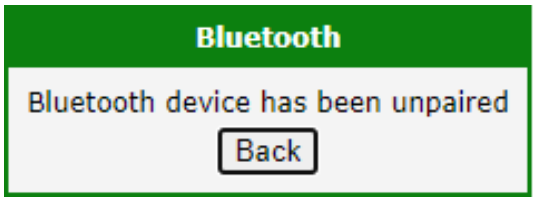

Figure 12: Unpairing a device

Info

If an active device is unpaired, it may take a few moments to reappear in the *Nearby Devices* list.

For automation via scripts, the `bluetoothctl` tool can be used with the `pair` and `remove` commands.

3.2 Networking (PAN)

A *Personal Area Network (PAN)* is a type of network similar to a Local Area Network (LAN) but operates on a smaller scale. Devices connected via PAN can communicate with each other just as they would on a standard Ethernet network.
The router supports the *Network Access Point (NAP)* profile, allowing it to act as a PAN server. In this configuration, the router assigns IP addresses to connected devices and provides routing capabilities, enabling PAN clients to access other networks connected to the router.
To use PAN functionality, the router typically acts as a Network Access Point (NAP). Conversely, the connected device must display the PAN User (PANU) profile:

```
UUIDs: 00001115-0000-1000-8000-00805f9b34fb PANU
```

Info

There is also a GN profile for creating a mesh-type network. However, this is not currently supported on Advantech routers. Likewise, the reverse direction, where the router connects to an access point, is not supported.

On the mobile device, it is necessary to enable *Internet Access* for the paired router in the Bluetooth configuration. For the router to mediate internet connectivity (WAN), the *Masquerade outgoing packets* option must be enabled in the *NAT* menu. Without this, the router allows connected devices to communicate only within the local network.

If the device is not set to *Trusted* on the router, an authorization request will be triggered when enabling the profile on the mobile device, which may fail if the router is not prepared to accept it.

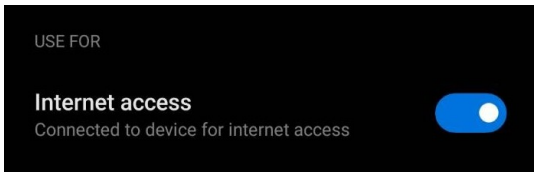

Figure 13: Internet access

Info

When *PAN* is enabled, the `pan0` interface appears in the system. For each connected device, there will be a corresponding `bnepX` interface.

3.3 BLE (Sensors)

While Classic Bluetooth is typically used for transferring continuous data streams, BLE provides alternative methods for data transmission. Very short data payloads are often sent as manufacturer data items within advertising packets. For more complex scenarios, services and characteristics are used, as defined by the Bluetooth standard. In either case, specific software is required to parse and process the incoming data. Refer to Chapter 5 for examples of how to create your own BLE applications.

4. Command Line Tools

In addition to the web-based graphical user interface, the router provides a set of command-line tools for advanced configuration, management, and troubleshooting of Bluetooth connections. These utilities, primarily derived from the *BlueZ* Linux Bluetooth stack, allow users to interact directly with the Bluetooth daemon and low-level protocols.

Below is a list of the most commonly used utilities available in the router's command-line interface (CLI):

- `bluetoothctl` - A powerful command-line utility for discovery, connection, disconnection, scanning, pairing, etc. You will find more details on how to use this tool in shell scripts to work with BLE sensors in Examples 1 and 2.
- `bneptest` - Development and debugging utilities for the Bluetooth protocol stack.
- `btmon` - Bluetooth monitor.
- `dbus-monitor` - This command is used to monitor messages passing through a D-Bus message bus. `dbus-monitor` has two different output modes: the 'classic'-style monitoring mode and the profiling mode. The profiling format is compact, with a single line per message and microsecond-resolution timing information. The `--profile` and `--monitor` options select the profiling and monitoring output formats, respectively. If neither is specified, it defaults to the monitoring format. While `dbus-monitor` is not strictly part of Bluetooth, it is closely connected with BlueZ, which relies primarily on D-Bus for communicating with applications.
- `dbus-send` - Used to send a message to a D-Bus message bus. This tool is very useful for testing and debugging. Similar to the monitor, it is closely tied to BlueZ IPC.
- `l2ping` - Sends an L2CAP echo request to the Bluetooth MAC address (`bd_addr`) given in dotted hex notation. This tool is useful for testing connectivity.
- `l2test` - Tool for testing Bluetooth communication at a lower level.
  Example:
  On the router, run `l2test -r` . On a PC with Bluetooth, run `l2test -s BT_ROUTER_ADDRESS` .
  You should then see the Bluetooth data being received on the router.

5. Examples

The following examples demonstrate how to use Bluetooth capabilities in customer projects. They cover different Bluetooth communication types as well as various programming languages and environments. We hope that a combination of all these examples covers most of your project requirements.

You can also find additional Bluetooth examples in the *Node-RED* application note (Examples 4 and 5).

5.1 Reading From a BLE Sensor Using a Shell Script

In this example, we read the temperature from a TokenCube BLE tag upon receiving an SMS request.

```
E4:AA:EC:37:05:A1  standard demo
     Address Type       : public
     Name               : standard demo
     Alias              : standard demo
     Paired             : no
     Trusted            : no
     Blocked            : no
     Legacy Pairing     : no
     RSSI               : -41 dBm
     Connected          : no
     Service Data       : 0000fe95-0000-1000-8000-00805f9b34fb 0x30588b0958a10537ecaae408
     Services Resolved  : no
     Advertising Flags  : 0x06
```

Figure 14: Manufacturer data for example 1

The sensor mentioned above advertises data via the manufacturer data item. We must know the exact data structure to process it. Advantech does not provide this information; you must consult the sensor vendor. Brief information for this particular example follows:

Byte Nr.	Description	Value
0..1	Manufacturer ID	0xFFEE
2	Hardware ID	0x04 – Token version 4
3	Firmware version	0x01
4	Page number – first nibble is total number of pages, second nibble is page number	0x21 or 0x22 – two pages, first or second page
5	Sensor identifier	0x01..0x0A – normal mode, 0x81..0x8A – alarm mode; see next table for normal mode
6..x1	Sensor value	—
(x1+1)	Next sensor identifier	—
(x1+2)..x2	Next sensor value	—

Table 2: Data structure

ID	Sensor Type	Values	Interpretation	Value
0x01	Temperature	°C	int16, BE	0x14 0x03 = 5123 = 51.23 °C
0x04	Humidity	% RH	int16, BE	0x10 0x87 = 4231 = 42.31 %
Other sensor IDs . . .				

Table 3: Data interpretation

Due to the limited size of the manufacturer data payload, the tag advertises data alternately in two different records. An example of that data, with the temperature bytes representing 22.3 °C highlighted, is shown below:

```
Manufacturer Data : 0xffee 0x0401210108b60409c206ff80ff40f020
Manufacturer Data : 0xffee 0x0401221f00054ec50a64
```

Figure 15: Manufacturer data for example 2

We will use the standard BlueZ tool, `bluetoothctl` , to retrieve the data:

```
# bluetoothctl info ED:75:24:09:F9:37
Device ED:75:24:09:F9:37 (random)
        Name: 37
        Alias: 37
        Paired: no
        Trusted: no
        Blocked: no
        Connected: no
        LegacyPairing: no
        ManufacturerData Key: 0xffee
        ManufacturerData Value:
  04 01 21 01 09 52 04 06 53 06 ff f0 00 50 10 30  ..!..R..S....P.0
        RSSI: -60
        AdvertisingFlags:
  05                                               .
```

Figure 16: Use of bluetoothctl

We will then process the output using the `awk` tool. The script tries to read the data several times to ensure it captures the specific page containing the temperature data.

Info

Many sensors have a much simpler data structure than this tag (e.g., a single data block where values are defined by fixed positions in the data stream instead of prefixes). Although the temperature data should strictly be searched by the ID `0x01` , our tested tags consistently returned temperature as the first value. Therefore, we read it as the first value in our example to keep the code clear and simple.

Place the resulting script in `/var/scripts/sms` . Do not forget to replace the MAC address `ED:75:24:09:F9:37` with your tag's actual address, and ensure the script is marked as executable.

Code Example

```
#/bin/sh

if [ "$3" == "TEMPERATURE" ]; then
  ATTEMPT=200
  while [ $ATTEMPT -gt 0 -a "$TEMPERATURE" == "" ]; do
    TEMPERATURE=`bluetoothctl info ED:75:24:09:F9:37 | \
    awk '/ManufacturerData Value:/ {next} /^\s+04 01 21/ \
        {print (("0x"$5)*256 + ("0x"$6))/100;exit;}'`
    ATTEMPT=$(($ATTEMPT - 1))
  done

  if [ "$TEMPERATURE" != "" ]; then
    gsmsms $2 "Temperature is $TEMPERATURE degree Celsius"
  else
    gsmsms $2 "Temperature value is not available"
  fi
fi
```

Now, when you send an SMS containing the text "temperature" (case-insensitive) to your router's SIM phone number, the `mwan` daemon passes it as argument `$3` to your script. You will then receive the temperature value back on the originating phone number (argument `$2`). Note that the `mwan` service must be running for SMS reception to work. In a real-world application, it is advisable to restrict accepted phone numbers (consult the router's *Configuration Manual*).
Additionally, be aware that the `/var/scripts` folder is cleared upon reboot. You must ensure the script is restored after every boot, for example, by copying it via the system *Startup Script* or via an init script in your own custom Router App.

Figure 17: TokenCube BLE tag

5.2 Writing to a BLE Device Using a Shell Script

In this example, connected devices are switched on and off via a Jollan IoT ZL-RC02V3 BLE relay module at specified times.

```
18:93:D7:00:4D:79 ▂▄▆▇   ZL-RELAY02
     Address Type       : public
     Name               : ZL-RELAY02
     Alias              : ZL-RELAY02
     Appearance         : 0x2
     Icon               : unknown
     Paired             : no
     Trusted            : no
     Blocked            : no
     Legacy Pairing     : no
     RSSI               : -67 dBm
     Connected          : no
     UUIDs              : 0000ffe0-0000-1000-8000-00805f9b34fb Unknown
     Service Data       : 00000b00-0000-1000-8000-00805f9b34fb 0x1893d7004d79
     TxPower            : 2 dBm
     Services Resolved  : no
     Advertising Flags  : 0x06
```

Figure 18: Manufacturer data

The ZL-RC02V3 module uses BLE services and characteristics to control its relays. You can explore these BLE characteristics using the `bluetoothctl` tool. Start the tool, connect to the relay module with the `connect` command (e.g., `connect 18:93:D7:00:4D:79`), and enter the GATT submenu by typing `menu gatt`. From there, you can use the `list-attributes` and `attribute-info` commands. We are specifically interested in the `0000ffe1-0000-1000-8000-00805f9b34fb` characteristic.

```
[ZL-RELAY02]# list-attributes
Primary Service (Handle 0xa1e0)
        /org/bluez/hci0/dev_18_93_D7_00_4D_79/service000c
        00001801-0000-1000-8000-00805f9b34fb
        Generic Attribute Profile
Characteristic (Handle 0xc254)
        /org/bluez/hci0/dev_18_93_D7_00_4D_79/service000c/char000d
        00002a05-0000-1000-8000-00805f9b34fb
        Service Changed
Descriptor (Handle 0x0015)
        /org/bluez/hci0/dev_18_93_D7_00_4D_79/service000c/char000d/desc000f
        00002902-0000-1000-8000-00805f9b34fb
        Client Characteristic Configuration
Primary Service (Handle 0xcd80)
        /org/bluez/hci0/dev_18_93_D7_00_4D_79/service0010
        0000ffe0-0000-1000-8000-00805f9b34fb
        Unknown
Characteristic (Handle 0xff54)
        /org/bluez/hci0/dev_18_93_D7_00_4D_79/service0010/char0011
        0000ffe1-0000-1000-8000-00805f9b34fb
        Unknown
Descriptor (Handle 0x0015)
        /org/bluez/hci0/dev_18_93_D7_00_4D_79/service0010/char0011/desc0013
        00002902-0000-1000-8000-00805f9b34fb
        Client Characteristic Configuration
Descriptor (Handle 0x0015)
        /org/bluez/hci0/dev_18_93_D7_00_4D_79/service0010/char0011/desc0014
        00002901-0000-1000-8000-00805f9b34fb
        Characteristic User Description
[ZL-RELAY02]# attribute-info 0000ffe1-0000-1000-8000-00805f9b34fb
Characteristic - Unknown
        UUID: 0000ffe1-0000-1000-8000-00805f9b34fb
        Service: /org/bluez/hci0/dev_18_93_D7_00_4D_79/service0010
        Notifying: no
        Flags: read
        Flags: write-without-response
        Flags: notify
```

Figure 19: BLE characteristics

Based on the relay module's documentation, we find the following control commands:

Command	Byte sequence
Close the first relay	C5 04 XX XX XX XX XX XX XX XX AA
Open the first relay	C5 07 XX XX XX XX XX XX XX XX AA
Close the second relay	C5 05 XX XX XX XX XX XX XX XX AA
Open the second relay	C5 06 XX XX XX XX XX XX XX XX AA
Where the 8 XX bytes represent a password. The default password is "12345678" (in ASCII).	

Table 4: Relay control commands

Info

You must contact the relay module vendor to obtain full documentation. Advantech does not provide it.

We will again use `bluetoothctl` to control the relays via a script. Save the following script as `/var/scripts/relays` :

Code Example

```
#/bin/sh

case "$1" in
  ON)
    R1=0x04
    ;;
  OFF)
    R1=0x06
    ;;
  *)
    echo "The first relay state is invalid"
    exit 1
    ;;
esac

case "$2" in
  ON)
    R2=0x05
    ;;
  OFF)
    R2=0x07
    ;;
  *)
    echo "The second relay state is invalid"
    exit 1
    ;;
esac

bluetoothctl connect 18:93:D7:00:4D:79
if [ $? -ne 0 ]; then
  logger -t relays "Failed to connect to relays"
fi

echo -e \
"menu gatt\n" \
"select-attribute 0000ffe1-0000-1000-8000-00805f9b34fb\n" \
"write \"0xC5 $R1 0x31 0x32 0x33 0x34 0x35 0x36 0x37 0x38 0xAA\"\n" \
"write \"0xC5 $R2 0x31 0x32 0x33 0x34 0x35 0x36 0x37 0x38 0xAA\"\n" \
| bluetoothctl

bluetoothctl disconnect 18:93:D7:00:4D:79
```

Next, create the following configuration in `/var/scripts/crontab` :

Code Example

```
00 02 * * * root /var/scripts/relays ON OFF
10 02 * * * root /var/scripts/relays ON ON
00 03 * * * root /var/scripts/relays OFF OFF
```

Finally, start the cron daemon by executing: `/etc/init.d/cron start`

The script will now switch on the first relay at 2:00 AM, the second relay 10 minutes later, and switch off both relays at 3:00 AM every day.

Note: The `/var/scripts` folder is cleared upon reboot, so you must restore the scripts after every boot (e.g., using the *Startup Script* or a custom Router App init script).

Figure 20: Jollan relay

5.3 Reading a BLE Sensor in C

This example demonstrates how to read data from a BLE Tyre Pressure Monitoring Sensor (TPMS) using the C programming language.

```
80:EA:CA:10:FC:67   TPMS1_10FC67
» More Information «

82:EA:CA:30:FD:67   TPMS3_30FD67
» More Information «

81:EA:CA:20:FD:A4   TPMS2_20FDA4
» More Information «

83:EA:CA:40:FB:6F   TPMS4_40FB6F
     Address Type      : public
     Name              : TPMS4_40FB6F
     Alias             : TPMS4_40FB6F
     Paired            : no
     Trusted           : no
     Blocked           : no
     Legacy Pairing    : no
     RSSI              : -53 dBm
     Connected         : no
     UUIDs             : 0000fbb0-0000-1000-8000-00805f9b34fb Unknown
     Manufacturer Data : 0x0100 0x83eaca40fb6f00000000270b00005500
     Services Resolved : no
     Advertising Flags : 0x06
```

Figure 21: Sensor data

The sensors used in this example propagate data via manufacturer data advertising items. Note that to save battery, these sensors broadcast at very long intervals and immediately upon detecting a pressure change. Therefore, a real-world application requires a permanently running daemon. This example is written to run in the foreground and output results for demonstration purposes. You can mount or dismount the sensor from the tyre to force it to transmit data.

We have two options when using BlueZ: HCI and D-Bus. We will use the HCI API in this example. Because HCI can be complex for advanced applications, the BlueZ authors generally recommend using the newer D-Bus API. (See the next example for a D-Bus approach).

Info

You need a Linux environment for the following steps. Ubuntu is suggested.

This example is a bit complex as it requires a cross-compiler and several dependencies. We resolve the compiler prerequisite using our Router App SDK. Please clone the following repositories from the public Git:

```
git clone https://marek_cernocky@bitbucket.org/bbsmartworx/modulessdk.git
git clone https://marek_cernocky@bitbucket.org/bbsmartworx/toolchains.git
```

Rename the first repository to `ModulesSDK` . Install the deb or rpm packages from the second repository. You can find more details about building a Router App in the *DevZone* section on the Advantech Engineering Portal.

The `Makefile` resolves dependencies by downloading their source codes from the internet and building them automatically. Note that it attempts to build only the necessary components.

Next, navigate to `ModulesSDK/modules` and copy the template to create a new project called `tyres` . You can optionally change the contents of `tyres/merge/etc/name` and `tyres/merge/etc/version` .

Then, remove all contents of the `tyres/source` folder and place the following two files in it:

1. `Makefile`
Download the `example3-makefile.txt` file from the *Bluetooth Router App* page and rename it to `Makefile` .

2. `tyres.c`
Download the `example3.c` file from the *Bluetooth Router App* page and rename it to `tyres.c` .

The `Makefile` is not commented as it falls outside the scope of this documentation. All logical steps in the C source code are commented, and a brief overview of the process follows:

The common steps for working with BLE sensors via HCI are:

- **Initialize**: Open the device, set the filter, configure parameters, and enable scanning.
- **Wait and read data**: Use `read()` , optionally combined with `select()` .
- **Process**: Parse the read data by navigating through the event structures (see below).
- **Stop**: Disable scanning and close the device.

Although you can interface directly with HCI via sockets alone, it is highly recommended to use the BlueZ API with its HCI structure definitions and higher-level functions. We use the following structures when parsing a received HCI event during scanning:

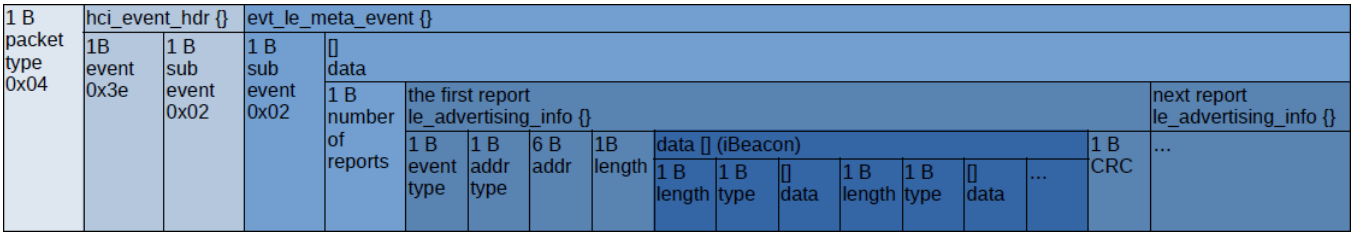

Figure 22: Structure of an HCI event

Unfortunately, the API lacks strict definitions for parsing beacon data payloads, as the structure is not fully standardized and multiple proprietary formats exist (e.g., AltBeacon, iBeacon, URIBeacon). The sensors in this example broadcast using the iBeacon format.

We must understand the manufacturer's data structure to extract the exact pressure and temperature values. The necessary offsets for this example are documented in the code comments. Advantech does not provide documentation for third-party sensors; you must consult the sensor vendor for their specific data specifications.

Once everything is prepared, run `make PLATFORM=v3` (adjusting the platform flag if needed). The resulting `tyres` binary will be located in the `obj.v3` subfolder. Copy this binary to your router (e.g., via SFTP) and execute it from the terminal.
Alternatively, you can install the fully built Router App package `tyres.v3.tgz`, and you will find the binary pre-installed at `/opt/tyres/bin/tyres`. After execution, you should see an output similar to the following:

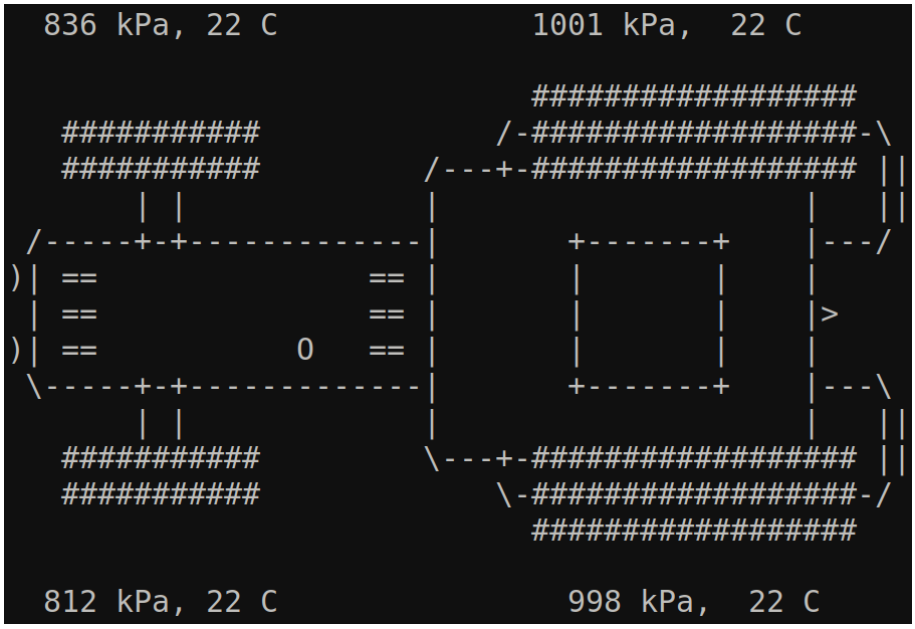

Figure 23: Example output of the BLE sensor reader

Figure 24: Tyre pressure sensor

6. Related Documents

You can obtain product-related documents on *Engineering Portal* at *icr.advantech.com* address.

To get your router's *Quick Start Guide*, *User Manual*, *Configuration Manual*, or *Firmware* go to the *Router Models* page, find the required model, and switch to the *Manuals* or *Firmware* tab, respectively.

The *Router Apps* installation packages and manuals are available on the *Router Apps* page.

For the *Development Documents*, go to the *Development* page.