

HARDWARE SPECIFICATION

BFi53ER0 / BFi53ER0S

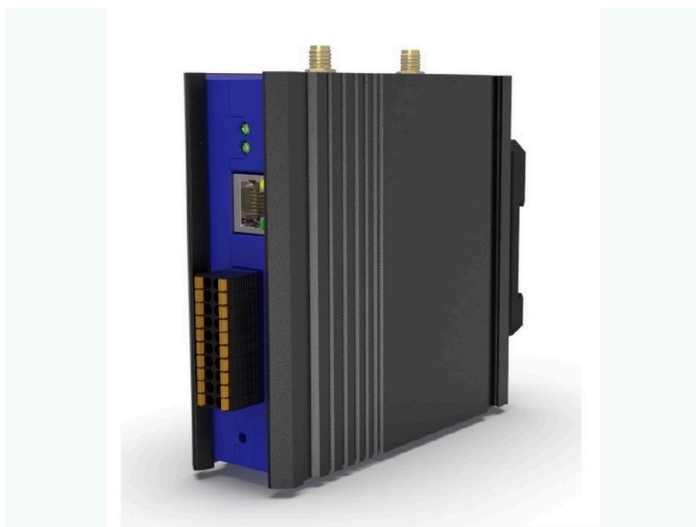
EdgeRouter

Powered IoT edge gateway — Bluetooth 5.3 LE and 10/100 Ethernet with PoE+; RS-485 Modbus and analog and digital I/O on the BFi53ER0; DECT NR+ on the BFi53ER0S. One design and one enclosure for both models.

PATENT PENDING — This product and the technologies it uses are covered by pending and published patent applications in the US, Taiwan and China. Copying of its design or methods is not licensed.

A BANFi Semiconductor Co., Ltd. product · protocol stack and firmware by FLSEMI

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1 Overview

The BFI53ER0 and BFI53ER0S are two builds of one gateway: the same design and the same extruded aluminium enclosure. The BFI53ER0 provides 24 V digital I/O on its terminal block. The BFI53ER0S adds an nRF9151 DECT NR+ radio; its terminal assignment is to be announced. What a unit does in the field is set by the firmware solution it runs — one per unit, chosen with the order.

FEATURE	BFI53ER0	BFI53ER0S
Bluetooth 5.3 LE, front-end module, SMA	✓	✓
DECT NR+ (nRF9151), second SMA	—	✓
10/100 Ethernet, PoE+ PD	✓	✓
RS-485 (A/B), Modbus RTU	✓	to be announced
Analog out 2× 0–10 V · analog in 2× 0–10 V	✓	to be announced
Digital out 4× · digital in 2×, opto-isolated	✓	to be announced
24 V field output, 0.65 A	✓	to be announced
microSD, RGB status LED, reset button	✓	✓

Firmware solutions

Battery-Free Bluetooth Switches & Sensors · BFI53ER0-BF	Battery-free Bluetooth switches and sensors, EnOcean's among them, to JSON over UDP / TCP and to Modbus registers; RS-485 Modbus RTU, field I/O and microSD logging (Battery-Free Bluetooth Gateway)
RS-485 A/B Sensor Data Reporting · BFI53ER0-MB	RS-485 Modbus RTU and Bluetooth Mesh / NLC published as one Modbus TCP server; Battery-free Bluetooth switches and sensors translated into Bluetooth Mesh client or sensor server models on the Mesh / NLC network — in service
Thread over Ethernet & Bluetooth NLC · BFI53ER0-TN	PREVIEW firmware on request

Core module — BFi53MLG, Nordic Semiconductor nRF5340 + FEM



Illustration, not to scale in detail. Pad count and layout are indicative; see the module datasheet.

BFi53MLG module, 12 × 16 mm M.2 LGA (illustration).

Processor	Nordic Semiconductor nRF5340 — application core Arm Cortex-M33 128 MHz, network core Arm Cortex-M33 64 MHz
Memory	1 MB flash, 512 KB RAM, 2 MB QSPI flash (application core)
Security	Arm TrustZone, CryptoCell-312
Radio	2.4 GHz: Bluetooth LE and IEEE 802.15.4, through the front-end module (FEM)
Package	12 × 16 mm, M.2 LGA board-to-board
Temperature	Core module (BFi53MLG): −40 to +105 °C

2 Block diagram

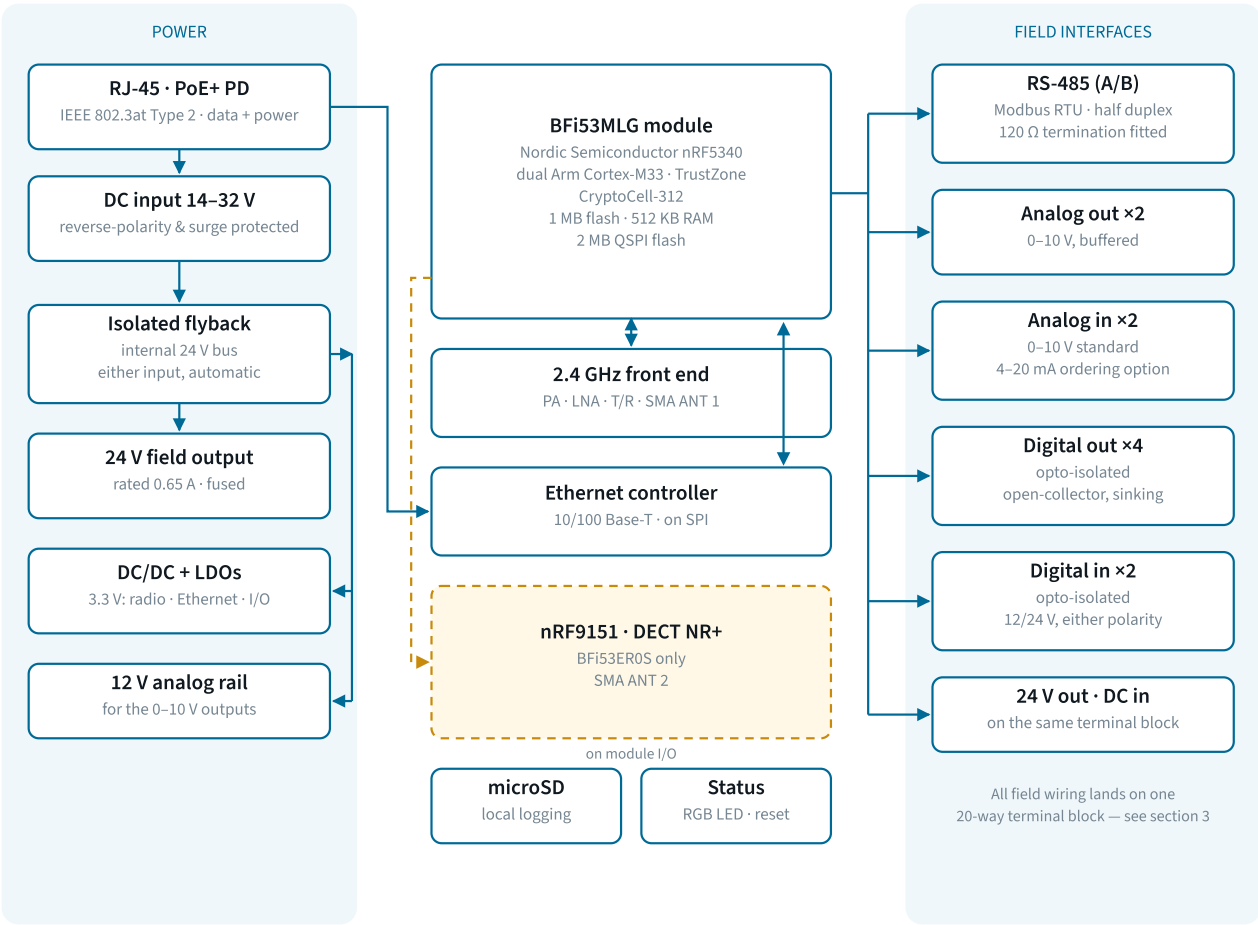


Figure 1 — System block diagram. The dashed block is fitted on the BFi53ER0S only; the field interfaces shown are those of the BFi53ER0.

Power architecture

PoE+ and the DC input feed one isolated flyback converter that makes the internal 24 V bus; either source may be connected, and both may be present at once. The 24 V bus supplies the field output on the terminal block, a buck converter and three 3.3 V regulators (radio, Ethernet, I/O drivers), and a 12 V rail for the analog outputs.

3 Pin definition

3.1 Terminal block — BFi53ER0 (20-way, 2 × 10)

BFi53ER0S: terminal assignment to be announced.

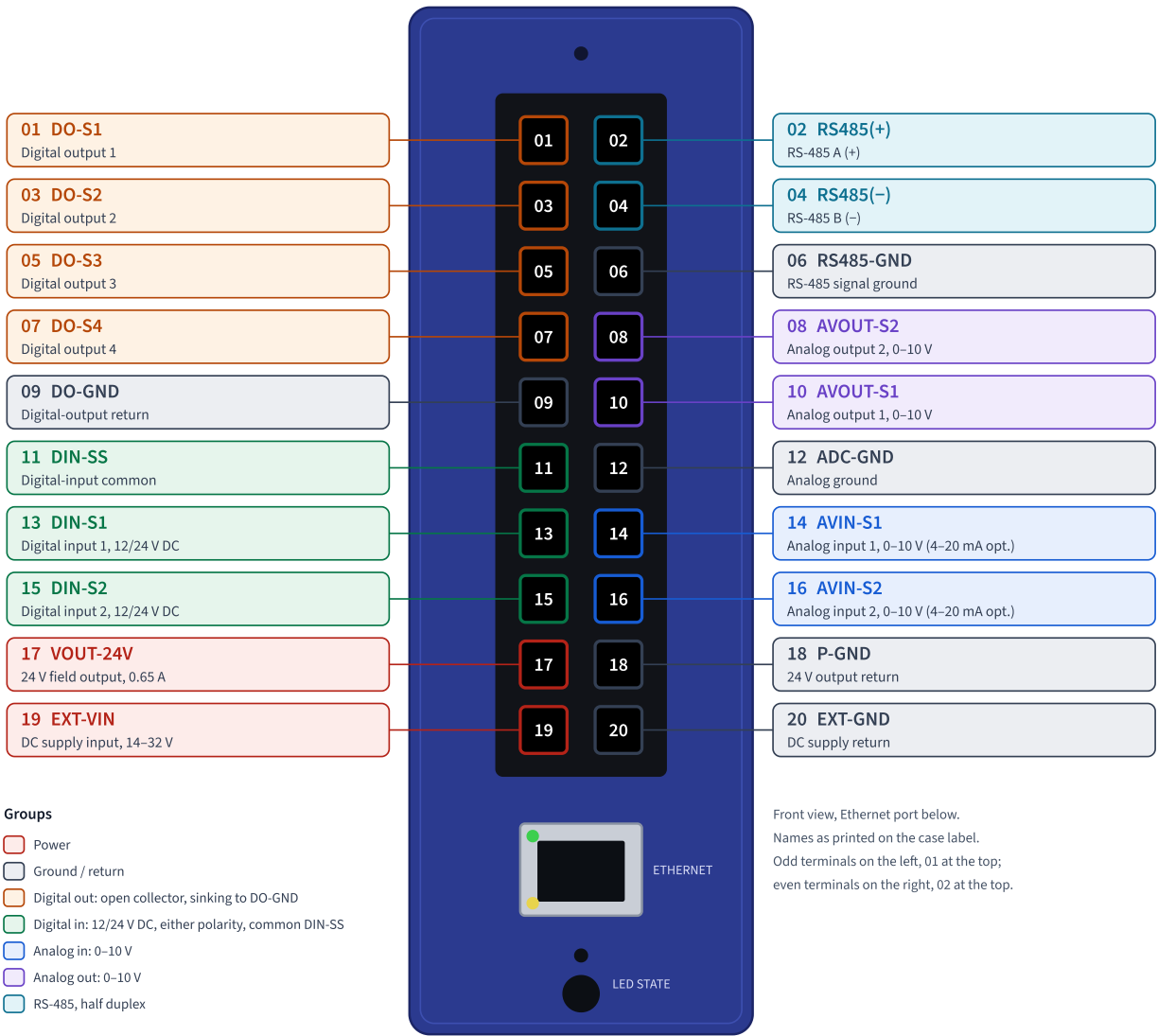


Figure 2 — BFi53ER0 terminal block, front view with the Ethernet port below. Names and numbers as printed on the case label.

PIN	SIGNAL	FUNCTION
1	DO-S1	Digital output 1
2	RS485(+)	RS-485 A (+)
3	DO-S2	Digital output 2
4	RS485(-)	RS-485 B (-)
5	DO-S3	Digital output 3
6	RS485-GND	RS-485 signal ground
7	DO-S4	Digital output 4
8	AVOUT-S2	Analog output 2, 0–10 V
9	DO-GND	Digital-output return
10	AVOUT-S1	Analog output 1, 0–10 V
11	DIN-SS	Digital-input common
12	ADC-GND	Analog ground
13	DIN-S1	Digital input 1, 12/24 V DC
14	AVIN-S1	Analog input 1, 0–10 V (4–20 mA opt.)
15	DIN-S2	Digital input 2, 12/24 V DC
16	AVIN-S2	Analog input 2, 0–10 V (4–20 mA opt.)
17	VOUT-24V	24 V field output, 0.65 A
18	P-GND	24 V output return
19	EXT-VIN	DC supply input, 14–32 V
20	EXT-GND	DC supply return

3.2 Other connectors and controls

RJ-45	10/100 Base-T Ethernet with PoE+ PD; link and activity LEDs
SMA ANT 1	Bluetooth 5.3 LE (both models)
SMA ANT 2	DECT NR+ (BFI53ER0S); not used on the BFI53ER0
microSD	Local data logging
RGB LED	Status indication, set by the firmware
Reset button	Restart; the firmware may add functions to repeated presses
CON1 (SWD)	Debug and firmware download header on the board, see 3.3

3.3 Debug connector CON1 (SWD)

CON1 is a 2.54 mm 1 × 4 pin header on the board, inside the enclosure, for Arm Serial Wire Debug of the nRF5340: firmware download and debugging with a J-Link, a CMSIS-DAP probe or the debug output of a Nordic Semiconductor development kit.

PIN	SIGNAL	NOTES
1 (square pad)	VDD_HV	Reference for the debugger. Do not supply power through it.
2	SWDIO	
3	SWDCLK	
4	GND	

I/O level. Set the debugger's I/O level as given in the SWD Update Guide (available on request from BANFi's technical contact).

There is no reset line: the debugger resets the chip over SWD. On flying leads keep the SWD clock at or below 1 MHz. From an nRF5340 DK's Debug out connector (P19, 2 × 5, 1.27 mm): P19 pin 1 to CON1 pin 1, pin 2 to pin 2, pin 4 to pin 3, and pins 3 and 5 to pin 4 (GND); P19 pin 3 is the kit's external-target detect and must be grounded. The board is powered from its own supply.

4 Electrical characteristics

4.1 Power

Power source	A Listed Class 2 power supply on the DC input, or a Listed IEEE 802.3at PoE switch or injector
DC input	14–32 V DC, 24 V typical; reverse-polarity protected, fused, surge suppressor
PoE	IEEE 802.3at Type 2 PD, either pair set; may coexist with the DC input. A Type 1 (802.3af) supply cannot also carry the 24 V field output
24 V field output	Rated 0.65 A; fused. Measured: stable to 730 mA, protection trips at 750 mA
BFi53ER0 power, measured	4.32 W standby (Bluetooth ready, no external load); 22.56 W maximum at 730 mA on the 24 V output (DC 24 V input)
BFi53ER0S power	Estimated ≈ 4.4 W standby; to be replaced by a measured figure

4.2 Field interfaces — BFi53ER0

RS-485	Half duplex, two wire with signal ground; Modbus RTU master or server. 120 Ω termination fitted (bus endpoint by default); fail-safe biasing; 1/8 unit-load receiver; TVS protected
Analog outputs	2× 0–10 V, buffered; TVS protected
Analog inputs	2× 0–10 V, input impedance ≈ 30 kΩ; 12-bit conversion; TVS protected. 4–20 mA is an ordering option (shunt fitted at build)
Digital outputs	4× open-collector, sinking to DO GND; opto-isolated from the logic; for 24 V relays and indicators. Class 2 loads only: mains is switched by a relay's contacts, never through the terminal block
Digital inputs	2× 12/24 V DC, opto-isolated, shared common; either polarity, so sinking or sourcing field wiring both work

4.3 Radio

Bluetooth	Bluetooth 5.3 LE through an on-board front-end module (PA, LNA, T/R switch); up to +13 dBm design figure; 1M / 2M PHY and LE Coded PHY. Measured range better than 100 m line of sight
DECT NR+ (BFI53ER0S)	nRF9151; +21 dBm at 1.9 GHz (band 1), +19 dBm at 915 MHz (band 4); band chosen at start-up. Throughput and range at 915 MHz not yet characterised

4.4 Battery-free control capacity — BFI53ER0-BF

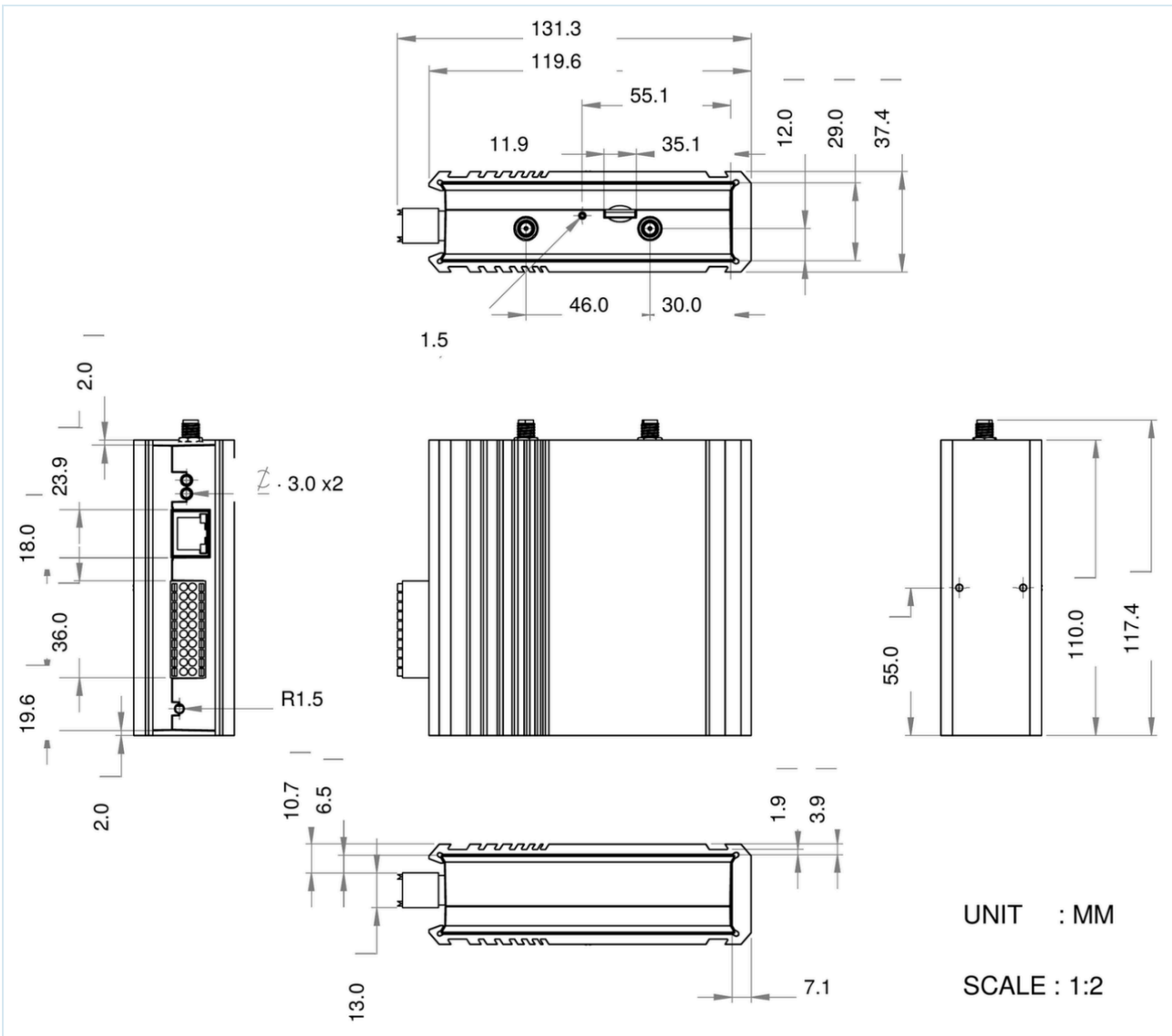
With the BFI53ER0-BF firmware (0.57.96 and later), battery-free Bluetooth switches and sensors work the BFI53ER0's digital outputs and relay modules on its RS-485 bus directly, by rules set on the gateway's settings page; no PLC or server is needed on the path. The figures are the firmware's configuration limits, not measurements with a particular load.

Rules	Up to 64. Each names one switch or sensor and gives each of its events one effect: on, off, toggle, restore, on for a time, arm or disarm
Outputs per rule	Up to 16: digital outputs DO-S1 to DO-S4, and coils of Modbus RTU relay modules at RS-485 addresses 1–255
Switches and sensors	Up to 48 on the gateway's device list; rules act on listed devices. Several rules may use one switch
Supervision	A “not heard” event when a sensor that reports on its own falls silent for a set time (a battery-free switch sends only when pressed); rules that act only while armed
SCADA / PLC	The rules' state and an acknowledge over Modbus TCP; register map in the System Integration Guide (request it at banfiww.com/support/#guide)
Wiring	Examples for the RS-485 bus, a dry-contact roller blind, a two-wire roller motor and a digital output with a 24 V relay: Setup Manual, 11.9

APPLICATION	RULES PER GROUP	GROUPS
Dry-contact roller blind or shutter (up / stop / down)	3	Up to 21; or 20 plus one all-up / all-stop / all-down group
Two-wire roller motor (up / down; stop = both off)	2	Up to 32
Lights or loads switched by one switch or sensor	1	Up to 48 (device list)
Alerts from magnet contacts and occupancy sensors	1	Up to 48 (device list)

A group may be one motor or several wired in parallel as their maker allows. Motor inputs that require dry contacts are driven from relay modules on the RS-485 bus, not from the open-collector digital outputs; a two-wire motor needs an interlock in its wiring or controller. How many devices one RS-485 segment carries depends on their unit loads (the BFI53ER0 is 1/8 unit load). Alerts are not a certified alarm system.

5 Mechanical and environmental



Body	119.6 × 110.0 × 37.4 mm, extruded aluminium
Overall	131.3 × 117.4 mm including mounting brackets; 55.0 mm bracket hole pitch
Mounting	DIN-rail or wall
Shipping carton	151.9 × 151.9 × 57.4 mm, one unit, 588.4 g packed
Operating temperature	Core module (BFi53MLG): -40 to +105 °C; non-condensing
Ingress protection	None rated. Outdoors or in wash-down areas, install in a sealed NEMA / IP cabinet with bulkhead antenna connectors

6 Certification, ordering and notices

6.1 Certification

System RF (Bluetooth)	NCC, CE, FCC, TELEC, RCM and the Bluetooth logo are applied for per project, by target market and production version
Core module	BFI53MLG: NCC, CE, FCC, IC, TELEC, NBTC, Bluetooth
DECT NR+	Not applied for. Approval status for the country of installation is confirmed in writing before shipment

6.2 Ordering information

PART NUMBER	DESCRIPTION
BFI53ER0-BF	EdgeRouter, Bluetooth 5.3 LE, digital I/O — Battery-free Bluetooth firmware
BFI53ER0-MB	EdgeRouter, Bluetooth 5.3 LE, digital I/O — Modbus TCP & Bluetooth Mesh firmware
BFI53ER0-TN	EdgeRouter, Bluetooth 5.3 LE, digital I/O — Thread over Ethernet & Bluetooth NLC PREVIEW firmware, on request
BFI53ER0S	EdgeRouter, Bluetooth 5.3 LE + DECT NR+; terminal assignment to be announced
Options	4–20 mA analog input; mid-bus RS-485 (termination not fitted); OEM / private label

The BFI53ER0 firmware is chosen by part number, installed at the factory and cannot be changed after purchase. Enquiries: **BANFi Semiconductor Co., Ltd.** · banfiww.com

6.3 Notices

PATENT PENDING. This product and the technologies it uses are covered by pending and published patent applications in the US, Taiwan and China. Copying of its design or methods is not licensed.

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Product ownership. The BFI53ER0 / BFI53ER0S is a product of BANFi Semiconductor Co., Ltd. (Taiwan), which owns the product and its hardware design. FL Semiconductor LLC (FLSEMI) is the solution provider for the communication protocol stack and the firmware — the software running in the chip.

The BFI53ER0, the BFI53ER0S and the BFI53MLG module are made in Taiwan. Specifications are subject to change without notice; figures marked estimated or design figure are not measurements. Nordic Semiconductor and nRF5340 / nRF9151 are trademarks of Nordic Semiconductor ASA; Arm, Cortex, TrustZone and CryptoCell are trademarks of Arm Limited; Bluetooth is a trademark of Bluetooth SIG, Inc.; EnOcean is a trademark of EnOcean GmbH. All other trademarks belong to their owners.

6.4 Revision

VERSION	DATE	CHANGE
1.0–1.4	2026-09-27	First issue and same-day revisions
1.5	2026-09-27	Solutions and sub-part numbers as on the website
1.6	2026-09-28	BFI53ER0-TN labelled PREVIEW
1.7	2026-09-28	BFI53ER0-BF named Battery-Free Bluetooth
1.8	2026-09-28	Debug connector CON1 (SWD): pinout and I/O level
1.9	2026-09-28	SWD voltages moved out of the public edition; the pinout stays
2.0	2026-09-29	Product ownership stated: BANFi Semiconductor Co., Ltd. owns the product and its hardware design; FLSEMI provides the protocol stack and firmware
2.1	2026-09-30	Terminal block drawn in front view with the Ethernet port; terminal names as printed on the case label (10 is AVOUT-S1, analog output 1; 8 is AVOUT-S2)
2.2	2026-10-01	Operating temperature stated for the core module (BFI53MLG); BFI53ER0-BF with Modbus registers, RS-485, field I/O and microSD logging
2.3	2026-10-01	Copyright notice: held jointly by BANFi Semiconductor Co., Ltd. and FL Semiconductor LLC; Traditional Chinese edition
2.4	2026-10-01	Terminal block marked as the BFI53ER0's; the BFI53ER0S terminal assignment to be announced
2.5	2026-10-01	BFI53ER0S I/O statements removed from the overview, feature table and block diagram; the BFI53ER0S terminal assignment to be announced
2.6	2026-10-01	Cover subtitle: RS-485 Modbus and analog and digital I/O attributed to the BFI53ER0
2.7	2026-10-01	SWD I/O-level note refers to the SWD Update Guide
2.8	2026-10-02	4.4 Battery-free control capacity of the BFI53ER0-BF firmware: rules, outputs, switches and sensors, typical groups
2.9	2026-10-02	4.4: “not heard” supervision is for sensors; wiring examples referred to the Setup Manual. 4.1 and 4.2: Listed Class 2 power sources and Class 2 loads only
3.0	2026-10-03	The Traditional Chinese edition sends enquiries to BANFi; no change to this edition
3.1	2026-10-04	BANFi edition for BANFi customers: BANFi logo and document ID; enquiries to BANFi Semiconductor Co., Ltd. (banfiww.com)
3.2	2026-10-04	6.3: FLSEMI is named only as the provider of the protocol stack and firmware
3.3	2026-10-04	How to obtain the SWD Update Guide and the System Integration Guide; the 1.9 row reworded
3.4	2026-10-05	“Nordic Semiconductor” written in full