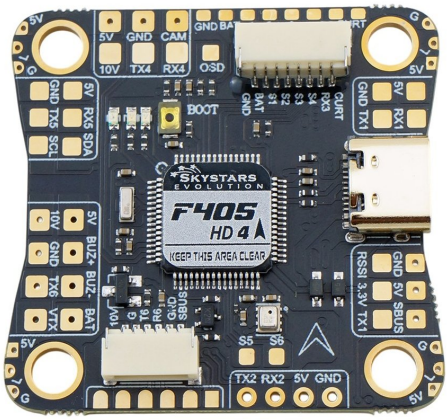
F405 HD4

Skystars

Flight controller (FC) 30.5 × 30.5 mm, 3–6S



Read the entire manual before installation and first power-up. Always remove the propellers during configuration.

User manual · www.rotorama.com

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1. Safety instructions

1.1 Before you start

The Skystars F405 HD4 is a flight controller (FC) designed to be built into an FPV drone. Installation requires experience with soldering electronics and wiring FPV components. The product is not a toy and is not intended for children. Read this entire manual and the manuals of all components you connect to the flight controller before installation.

- Work on a dry, clean, non-flammable workbench with good lighting.
- Before making any connection, check the pad description in Chapter 2.4 – incorrect power wiring can permanently damage the flight controller and the connected devices.
- Damage caused by incorrect wiring, reverse polarity, short circuits or mechanical modification of the board is not a product defect.

1.2 Power supply and short circuits

- The flight controller is designed to be powered from a **3S to 6S Li-Po** battery. A higher voltage will destroy it.
- The battery voltage is supplied to the flight controller by the electronic speed controller (ESC) via the SH1.0-8P connector. Always connect the battery to the ESC, never directly to a pad on the flight controller.
- Before connecting a battery for the first time, use a multimeter to check that there is no short circuit between the positive and negative supply terminals. For the first power-up we recommend a protective current limiter (smoke stopper).
- Never short-circuit or overload the 5 V, 10 V and 3.3 V outputs. Do not connect devices requiring a higher voltage to the 5 V and 3.3 V pads; do not connect devices that cannot withstand that voltage to the 10 V and BAT pads.
- The flight controller must not come into contact with water, moisture or conductive debris (e.g. metal filings, carbon dust from the frame).

1.3 Propellers during setup

Always remove the propellers during any configuration, motor testing and firmware update. The motors may start spinning unexpectedly.

1.4 Li-Po and LiHV batteries

The battery is not included. Observe the following rules when handling batteries:

- Charge only with a charger designed for the battery type, under supervision and on a non-flammable surface.
- Do not use a swollen, mechanically damaged or overheated battery.
- Do not discharge the battery below 3.5 V per cell during flight; set it to 3.8 V per cell for storage.

- LiHV batteries are charged to 4.35 V per cell – use them only if all components of the drone (especially the ESC) can withstand their voltage.

Configuration	Fully charged	End flight	Storage
1 cell Li-Po	4.20 V	3.5 V	3.8 V
3S Li-Po	12.6 V	10.5 V	11.4 V
4S Li-Po	16.8 V	14.0 V	15.2 V
5S Li-Po	21.0 V	17.5 V	19.0 V
6S Li-Po	25.2 V	21.0 V	22.8 V

1.5 Soldering and static electricity

- The board contains components sensitive to electrostatic discharge. Discharge yourself by touching a grounded object before handling and hold the board by its edges.
- Use a temperature-controlled soldering iron and good-quality solder with flux. Do not overheat the pads – they may lift off.
- After soldering, check that no solder bridges adjacent pads and remove flux residue.
- Do not solder in the immediate vicinity of the USB-C connector and do not apply lateral force to it.

2. Product description

2.1 Package contents

Item	Qty
Skystars F405 HD4 flight controller	1×
Accessory kit (damping grommets and connection cables)	1×

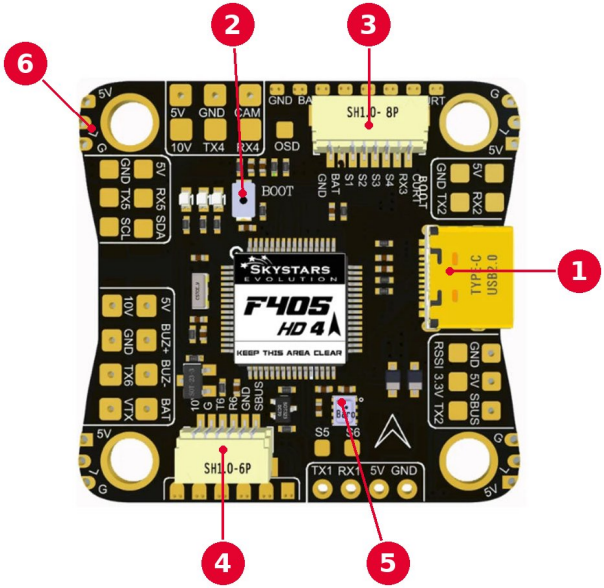
Not included: electronic speed controller (ESC), receiver, video transmitter, camera, GPS module, battery or screws for mounting in the frame.

2.2 Specifications

Parameter	Value
Processor (MCU)	STM32F405 (STM32F405RGT6)
Gyroscope and accelerometer (IMU)	ICM42688-P
OSD	AT7456E (for analogue video)
Blackbox memory	16 MB
Barometer	yes
Serial ports	6 × UART (UART1–UART6)
Power supply	3–6S Li-Po
BEC 5 V	5 V / 3 A
BEC 10 V	10 V / 2 A ※
Motor outputs	S1–S4 in the ESC connector, S5 and S6 on pads
LED	WS2812 (pads in the board corners)
Buzzer	yes (BUZ+ / BUZ−)
USB	USB-C (USB 2.0)
Connectors	SH1.0-8P (ESC), SH1.0-6P (digital VTX)
Firmware	Betaflight – target SKYSTARSF405 INAV – target SKYSTARSF405HD
Mounting pattern	30.5 × 30.5 mm, 4 mm holes with rubber grommets for M3 screws
Dimensions	36 × 36 mm
Weight	6 g

※ The rated current of the 10 V output differs in the available documentation (2 A or 3 A). Plan with 2 A; the total current drawn by devices connected to the 10 V output (typically the video transmitter) must not exceed it.

2.3 Board overview



Top side of the flight controller (source: Skystars)

① USB-C connector – connection to a computer

② BOOT button – enters bootloader (DFU) mode for firmware updates

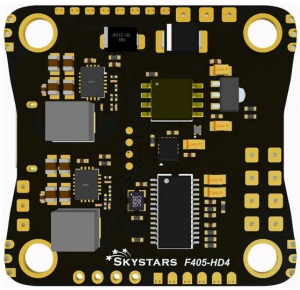
③ SH1.0-8P connector – connection to the electronic speed controller (ESC)

④ SH1.0-6P connector – connection of a digital video transmitter

⑤ Barometer

⑥ LED strip pads (5V, L, G) – in each of the four corners of the board

The arrow on the top side of the board indicates the direction of flight (forward). The designation **F405-HD4** is printed on the bottom side.



Bottom side of the flight controller (source: Skystars)

2.4 Solder pads and connectors

The description corresponds to the silkscreen on the top side of the board (figure in Chapter 2.3).

Pads	Function
5V, GND, CAM	power supply and video signal of an analogue camera
10V, TX4, RX4	10 V output; UART4 (free)
5V, GND, TX5, RX5, SCL, SDA	GPS module (UART5) and compass (I2C bus)
GND, 5V, TX2, RX2	UART2 (free)
RSSI, 3.3V, TX2	analogue RSSI input, 3.3 V output, TX2 (e.g. S.Port of a FrSky receiver)
GND, 5V, SBUS	receiver with SBUS output
TX1, RX1, 5V, GND	receiver with a serial protocol, e.g. CRSF (UART1)
10V, GND, TX6, VTX	analogue video transmitter: 10 V supply, control (TX6), video signal
5V, BUZ+, BUZ−, BAT	buzzer; BAT – battery voltage
S5, S6	outputs 5 and 6 (fifth and sixth motor)
5V, L, G (corners)	WS2812 LED strip

▶ SH1.0-8P connector (ESC)

Pin	GND	BAT	S1	S2	S3	S4	RX3	CURT
Function	ground	battery voltage	motor 1	motor 2	motor 3	motor 4	ESC telem.	current sensor

▶ SH1.0-6P connector (digital VTX)

Pin	10V	G	T6	R6	GND	SBUS
Function	10 V supply	ground	TX6	RX6	ground	SBUS

※ The wire order on the connector of an ESC or digital VTX from another manufacturer may differ. Before connecting, compare the pin descriptions at both ends of the cable and re-pin the cable if necessary.

2.5 Serial port (UART) assignment

Port	Recommended use	Pins
UART1	receiver (Serial RX)	TX1, RX1
UART2	free	TX2, RX2
UART3	ESC telemetry	RX3 in the 8P connector
UART4	free	TX4, RX4
UART5	GPS	TX5, RX5
UART6	video transmitter (DJI / VTX)	TX6; T6, R6 in the 6P connector

This port assignment is recommended by the manufacturer; the free ports UART2 and UART4 can be used for further peripherals.

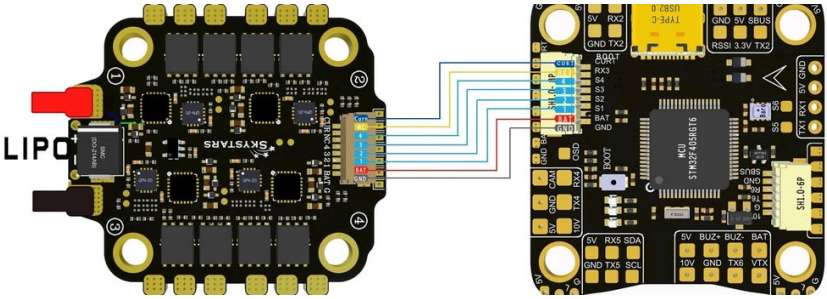
3. Installation and wiring

3.1 Mounting in the frame

- Mount the flight controller in a frame with a 30.5 × 30.5 mm hole pattern, with the arrow pointing in the direction of flight. If you have to rotate it, set the orientation in the configuration software (Chapter 4.3).
- Use the rubber damping grommets – they reduce the transmission of vibrations to the gyroscope. Tighten the screws only lightly so that the grommets are not fully compressed.
- The board must not touch the carbon frame or metal parts – carbon is conductive.
- Leave the USB-C connector accessible so that you can configure the flight controller without disassembly.

3.2 Connecting the electronic speed controller (ESC)

The flight controller is connected to a 4-in-1 electronic speed controller (4in1 ESC) with a cable to the SH1.0-8P connector. This cable also powers the flight controller and carries the motor signals S1–S4, ESC telemetry (RX3) and current measurement (CURT).

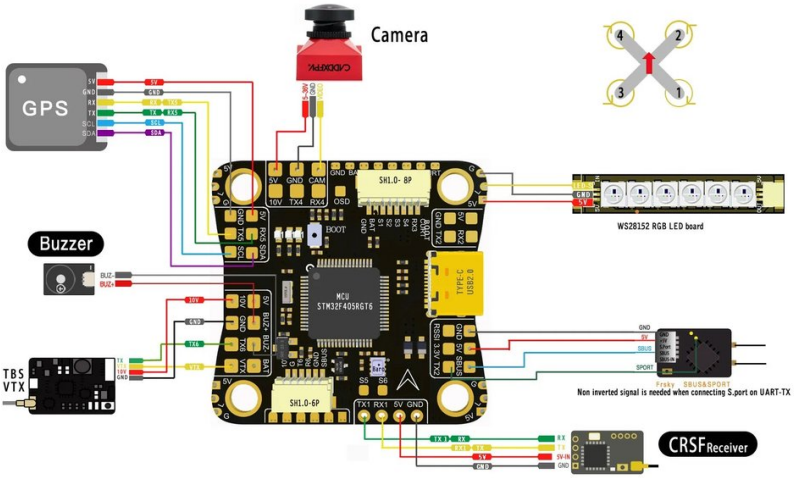


Example connection to a Skystars 4in1 ESC (source: Skystars). The NC pin on the ESC side is not connected.

- For its ESC, the manufacturer emphasises the use of the supplied low-ESR capacitor on the ESC power leads. Solder the capacitor as close as possible to the ESC power pads and observe the polarity.
- If the ESC does not support telemetry or current measurement, the corresponding pins remain unconnected – the flight controller will work without them.

3.3 Receiver

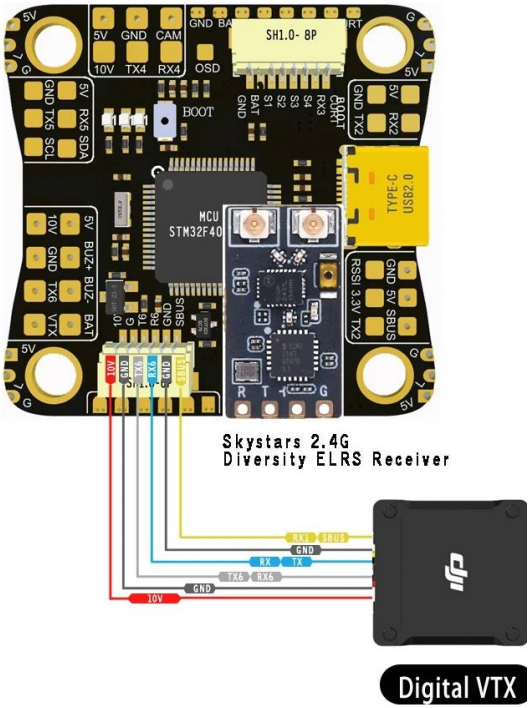
- **Receivers with a serial protocol** (e.g. CRSF – ExpressLRS, TBS Crossfire): receiver TX to RX1, receiver RX to TX1, power from the 5V and GND pads next to UART1.
- **SBUS receivers**: SBUS signal to the SBUS pad, power from the 5V and GND pads next to it. Connect the S.Port telemetry of FrSky receivers to TX2 – the manufacturer points out that S.Port on UART-TX requires a non-inverted signal.
- Check the supply voltage of the receiver in its manual – the receiver pads supply 5 V.



Peripheral wiring diagram (source: Skystars): GPS, camera, buzzer, analogue VTX, LED strip, FrSky receiver (SBUS and S.Port) and CRSF receiver; top right: motor order.

3.4 Video transmitter (VTX)

- **Digital VTX** (e.g. DJI): connect with a cable to the SH1.0-6P connector. The connector carries the 10 V supply, UART6 (T6, R6) and SBUS. Before connecting, check the wire order on the VTX side (Chapter 2.4).
- **Analogue VTX**: power from the 10V and GND pads (check that the VTX can withstand 10 V), VTX video input to the VTX pad, control wire (SmartAudio / Tramp) to TX6.
- Never power up the video transmitter without an antenna connected – it may be damaged.



Wiring a digital VTX to the SH1.0-6P connector; a Skystars ELRS receiver is placed on the board (source: Skystars).

3.5 GPS, camera, buzzer and LEDs

- **GPS module**: 5V, GND, GPS TX → RX5, GPS RX → TX5. If the module has a compass, connect SCL to SCL and SDA to SDA.
- **Analogue camera**: power from the 5V and GND pads, camera video output to the CAM pad. If the camera requires a different supply voltage, follow its manual.
- **Buzzer**: positive lead to BUZ+, negative lead to BUZ−.
- **WS2812 LED strip**: pads 5V, L (signal) and G (ground) in any corner of the board. Do not overload the strip – it draws current from the 5 V output.

3.6 Electromagnetic compatibility

To ensure that the flight controller works reliably and does not interfere with other devices, observe the following rules during installation:

- Solder a low-ESR capacitor to the ESC power leads – it suppresses voltage spikes that interfere with the gyroscope, video and receiver.
- Keep the battery and motor power wires as short as possible and away from signal wires, the receiver antenna and the GPS module.
- Place the receiver and video transmitter antennas as far apart from each other and from the flight controller as possible.
- Place a GPS module with compass as far as possible from power wires and motors.
- Do not tension the cables between the boards and secure them against vibration.

4. Configuration and firmware

4.1 Connecting to a computer

The flight controller is configured with **Betaflight Configurator** (Betaflight firmware) or **INAV Configurator** (INAV firmware). The programs can be downloaded free of charge from the official websites of the Betaflight and INAV projects.

① Remove the propellers.

② Start the configuration software and connect the flight controller with a USB-C cable with data wires.

③ Select the serial port and click *Connect*.

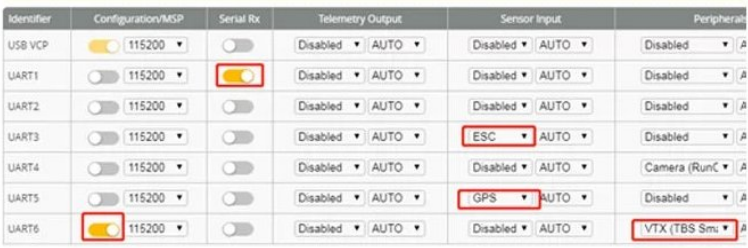
④ To work with the ESC, video transmitter and receiver powered from the battery, connect the battery as well.

※ If the computer does not recognise the flight controller, try a different cable or USB port and install the drivers offered by the configuration software.

4.2 Ports tab

On the *Ports* tab, set the serial port functions according to your wiring. The manufacturer specifies these settings:

Port	Setting on the Ports tab
UART1	*Serial Rx* enabled (receiver)
UART3	*Sensor Input* → *ESC* (ESC telemetry)
UART5	*Sensor Input* → *GPS*
UART6	DJI digital VTX: *Configuration/MSP* enabled; other VTX: *Peripherals* → *VTX* (e.g. TBS SmartAudio)



Example of the Ports tab in Betaflight Configurator (source: Skystars)

After saving (*Save and Reboot*), set the receiver protocol (e.g. CRSF or SBUS) on the *Receiver* tab and check that the stick movements of the radio are displayed correctly.

4.3 Board orientation and motor order

- The default orientation corresponds to the arrow on the board pointing in the direction of flight. If the board is rotated, set the angle in *Configuration → Board and Sensor Alignment* and check on the *Setup* tab that the model on the screen follows the movement of the drone.
- Motor order in Betaflight (top view, arrow forward): **1** rear right, **2** front right, **3** rear left, **4** front left.
- On the *Motors* tab (without propellers), spin up the individual motors one by one and check their position and direction of rotation. If they do not match, change the output assignment or the direction of rotation in the ESC – do not re-solder wires blindly.

4.4 Voltage and current measurement

- The flight controller measures the battery voltage via the BAT pin. On the *Power & Battery* tab, compare the displayed voltage with a multimeter and adjust the voltage scale if necessary.
- Current is measured by the sensor in the ESC (CURT pin). Set the *Scale* and *Offset* according to the data from the manufacturer of the ESC used.
- Set the low-voltage warning according to the values in Chapter 1.4.

4.5 Arm, Disarm and failsafe

- Assign **Arm** (motors on) and **Disarm** (motors off) to a switch on the radio on the *Modes* tab – not to a stick command.
- On the *Failsafe* tab, set the behaviour on signal loss. Test the function without propellers: after Arm, switch off the radio – the motors must stop.
- Disarm immediately after every crash or collision.

4.6 Firmware update

Firmware is flashed on the *Firmware Flasher* tab. Select the target **SKYSTARSF405** (Betaflight); in INAV Configurator select the target **SKYSTARSF405HD**.

① Before updating, save your settings (CLI command *diff all*).

② Select the target and firmware version and click *Load Firmware [Online]*.

③ Click *Flash Firmware* and wait until it finishes.

④ If the flight controller does not connect, unplug USB, hold the **BOOT** button, plug USB back in and release the button. The flight controller is now in bootloader (DFU) mode and can be flashed.

⑤ Restore your settings and check orientation, ports, motors and failsafe again.

※ Do not unplug USB while flashing. In INAV, check the available motor outputs on the Outputs tab.

5. Operating the drone

5.1 The law of the country where you fly applies

Regulations (EU) 2019/947 and 2019/945 apply in all member states of the European Union, but national implementing rules differ from country to country – registration portals, minimum pilot age, geographical zones, compulsory insurance, permitted frequency bands and maximum transmit power. The information in this chapter describes the situation in the Czech Republic. If you operate the drone in another country, you must follow the regulations of the country in which you fly.

5.2 A drone built with this flight controller

The flight controller itself is a component and the drone regulations do not apply to its sale. However, the drone you build with it is an unmanned aircraft and its operation is governed by Regulation (EU) 2019/947:

- A drone assembled from individual components is a **privately built unmanned aircraft system** without a class label. In the open category it can be operated in subcategory A1 if its take-off mass is less than 250 g and its maximum speed is lower than 19 m/s, otherwise in subcategory A3.
- If the drone has a camera, the operator must register (in the Czech Republic with the Civil Aviation Authority) and display the registration number on the drone.
- The maximum flight height is 120 m above ground. Do not fly over assemblies of people and respect geographical zones.
- When flying with FPV goggles, an observer who watches the drone directly must stand next to the pilot.
- We recommend taking out liability insurance for damage caused by operating the drone.
- Actually weigh the take-off mass of the finished drone including the battery.

6. Maintenance and storage

- After every crash, check the board, solder joints, cables and connectors. Repair a loose or cracked joint before the drone flies again.
- Remove dirt with a dry, soft brush. Do not wash the board with water or solvents.
- If the board gets wet, disconnect the battery immediately and let it dry thoroughly before switching it on again.
- Check the condition of the damping grommets – replace hardened or torn ones.
- Store the drone and the flight controller itself in a dry place, out of direct sunlight, with the battery disconnected. Store a loose board in an antistatic bag.
- Back up your settings regularly (CLI command *diff all*).

7. Troubleshooting

Problem	Possible cause and solution
The computer does not recognise the flight controller	Charge-only cable – use a data cable. Missing driver – install it. Try DFU mode (BOOT button, Chapter 4.6).
Nothing lights up after connecting the battery	Check the SH1.0-8P cable and its pin order. Disconnect the battery immediately if anything heats up.
The receiver does not respond	Check the TX/RX wiring (crossed), the *Serial Rx* setting on the correct UART and the protocol on the *Receiver* tab.
OSD does not work in DJI goggles	Enable *Configuration/MSP* on UART6. Check the SH1.0-6P cable.
VTX channel cannot be changed	On UART6 set *Peripherals* → *VTX* with the protocol matching the VTX; control wire to TX6.
Motors spin the wrong way or the wrong motor spins	Adjust the output order or the direction of rotation in the ESC (Chapter 4.3).
GPS does not find satellites	Check TX/RX (crossed) and the UART5 setting. Place the GPS away from the VTX and power wires and leave it under open sky.
The drone will not Arm	On the *Setup* tab, check the reason why Arm is blocked (e.g. tilt, active failsafe, USB connected, throttle above minimum).
Video noise, unsteady flight	Add a low-ESR capacitor, check the damping grommets and the wire routing (Chapter 3.6).

8. Information for the EU and Czech Market

8.1 Importer and responsible person in the EU

The product is placed on the European Union market by the importer stated below, who is at the same time the responsible person within the meaning of Article 16 of Regulation (EU) 2023/988 of the European Parliament and of the Council on general product safety (GPSR).

Importer / responsible person in the EU	Rotorama, s.r.o.
Company ID (IČO)	051 57 692
VAT ID (DIČ)	CZ05157692
Registered office	Okrajová 1351, 674 01 Třebíč, Czech Republic
E-mail	info@rotorama.cz
Phone	+420 252 252 098
Website	www.rotorama.com

8.2 Product conformity

CE

- The product bears the **CE** marking and complies with the requirements of the applicable European Union harmonisation legislation.
- A copy of the **EU Declaration of Conformity** is available from the importer at the address stated above or at the e-mail address info@rotorama.cz.
- **Product identification:** the type designation (F405 HD4) is printed directly on the board – “F405 HD 4” on the top side and “F405-HD4” on the bottom side. The installed firmware version is shown by the configuration software (e.g. Betaflight Configurator) after connecting via USB.

8.3 Disposal of electrical equipment



- The crossed-out wheeled bin symbol on the product, its packaging or in the documentation means that at the end of its service life the product **must not be disposed of together with mixed municipal waste**.
- Hand it over at a take-back point for electrical equipment – at a collection yard, at a take-back point of a collective system, or at the retailer when purchasing a new equivalent product. Take-back is free of charge for the end user.
- The obligations under Act No. 542/2020 Coll., on end-of-life products, are fulfilled by the importer through a collective take-back system.
- Proper disposal helps prevent negative impacts on the environment and human health and contributes to the reuse of secondary raw materials.

Through its contractual partner **ASEKOL a.s.**, the company ensures the take-back of waste electrical equipment from households and the separate collection of waste electrical equipment, batteries and accumulators in accordance with the applicable legislation. The customer is entitled to hand over old electrical equipment or a battery or accumulator at any collection point of the above contractual partner. The addresses of these take-back points are listed at www.asekol.cz, www.ecobat.cz and also https://visoh2.mzp.cz/RegistrMistZO/RegistrMistZOPublic/MapaMistZpetOdberu.

9. Warranty and rights arising from defective performance

The rights and obligations of the contracting parties are governed by Czech law, in particular by Act No. 89/2012 Coll., the Civil Code, and Act No. 634/1992 Coll., on consumer protection.

- The seller is liable to the buyer for the product being free of defects on receipt. If the buyer is a consumer, a defect may be notified **within two years of receipt** of the product (Section 2165 of the Civil Code).
- If a defect appears within **one year** of receipt, the product is deemed to have been defective already at the time of receipt (Section 2161(5) of the Civil Code).
- When purchasing online, a consumer has the right to **withdraw from the contract within 14 days** of receiving the goods without giving a reason (Section 1829 of the Civil Code).
- Claims should be made with the retailer from whom you purchased the product. The importer's contact details are given in Chapter 8.1.
- The competent body for out-of-court settlement of consumer disputes is the **Czech Trade Inspection Authority**, Štěpánská 796/44, 110 00 Prague 1, www.coi.cz.