

**UNIVERSAL FLIGHT CONTROLLER**  
**TECHNICAL PRODUCT PASSPORT**

Registration No.: N/A

Effective from «\_\_\_» \_\_\_\_\_ 2025

Заводський №: **SFC-25F02B-CHN-00843**

Factory No.: **SFC-1**

When transferring the product to another owner, this passport must  
accompany the product.

2025

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## REVISION HISTORY

| Revision | Date       | Description of Changes        |
|----------|------------|-------------------------------|
| rev. A   | 01.01.2024 | Initial version               |
| rev. B   | 01.01.2025 | Typo corrections in Section X |

## PURPOSE AND SCOPE OF APPLICATION

The universal flight controller (hereinafter referred to as the "flight controller") is intended for controlling aerial, ground, and surface unmanned vehicles.

It provides reliable control and navigation of unmanned platforms under demanding operating conditions.

## DELIVERY SET

The flight controller is delivered in the configuration specified in Table 1:

Table 1 – Delivery Set

| No | Item                               | Quantity |
|----|------------------------------------|----------|
| 1  | Flight controller                  | 1        |
| 2  | Connectors with pre-attached wires | 12       |
| 3  | Packaging box                      | 1        |
| 4  | Aluminum enclosure                 | 1*       |

\* - The enclosure is included only in the extended configuration and is not supplied with the basic flight controller kit.

## TECHNICAL SPECIFICATIONS

The main components of the flight controller are listed in Table 2:

Table 2 – Core Components of the Flight Controller

| <b>№</b> | <b>Type</b>                                     | <b>Model</b>   | <b>Note</b> |
|----------|-------------------------------------------------|----------------|-------------|
| 1        | Processor                                       | STM32H743      |             |
| 2        | IMU №1                                          | ADIS16470      |             |
| 3        | IMU №2                                          | ICM45686       |             |
| 4        | IMU №3                                          | BMI088         |             |
| 5        | Magnetometer                                    | MMC5983MA      |             |
| 6        | Static air pressure sensor                      | MS5611         |             |
| 7        | Differential air pressure sensor                | 5525DSO-B001DS |             |
| 8        | Temperature sensor №1                           | TMP117         |             |
| 9        | Temperature sensor №2                           | TMP390         | Autonomous  |
| 10       | Memory (FRAM)                                   | MB85RS256      |             |
| 12       | External watchdog timer / power voltage monitor | CAT823         | Autonomous  |

The main interfaces of the flight controller are listed in Table 3:

Table 3 – Main Interfaces of the Flight Controller

| <b>№</b> | <b>Type</b>     | <b>Parameters</b> | <b>Note</b>                                         |
|----------|-----------------|-------------------|-----------------------------------------------------|
| 1        | 1x Ethernet     | 10/100 Mbit/s     | With Passive PoE support (8–50 V)                   |
| 2        | 2x CAN FD       | 1 Mbit/s, 5 V     | Galvanically isolated (5000 V)                      |
| 3        | 2x RS-485       | 16 Mbit/s, 5      | Galvanically isolated (3500 V)                      |
| 4        | 1x SBUS/PPM/DSM | 0...3.3V          | ESD protection + buffer                             |
| 5        | 1x RSSI         | 0...3.3V          | ESD protection                                      |
| 6        | 14x PWM         | 0...3.3V          | ESD protection + buffer                             |
| 7        | 1x I2C          | 400kHz, 0...3.3V  | ESD protection + re-driver                          |
| 8        | 1x USB Type-C   | USB FS 12 Mbit/s  | For setup, firmware flashing, or debug power supply |
| 9        | 1x ARM JTAG     | —                 | Standard full-size ARM JTAG                         |
| 10       | 1x Micro SD     | —                 | ESD protection + power switch                       |

Controller Interface Connections (Tables 4 – 13):

Table 4 – Ethernet/PoE interface Connection

| <b>Ethertnet/PoE</b> |             |             |             |
|----------------------|-------------|-------------|-------------|
| <b>Nº</b>            | <b>Name</b> | <b>Type</b> | <b>Note</b> |
| 1                    | RX+         | Input       |             |
| 2                    | RX-         | Input       |             |
| 3                    | TX+         | Output      |             |
| 4                    | TX-         | Output      |             |
| 5                    | VIN+        | Power       | 8–50V       |
| 6                    | VIN+        | Power       | 8–50V       |
| 7                    | GND         | Power       |             |
| 8                    | GND         | Power       |             |

Table 5 – SBUS/PPM/DSM/RSSI Interfaces Connection

| <b>SBUS/PPM/DSM (RC IN/ RSSI PWM)</b> |             |             |             |
|---------------------------------------|-------------|-------------|-------------|
| <b>Nº</b>                             | <b>Name</b> | <b>Type</b> | <b>Note</b> |
| 1                                     | +5V OUT     | Power       |             |
| 2                                     | RSSI IN     | Input       |             |
| 3                                     | SBUS/DSMX   | Input       |             |
| 4                                     | PPM IN      | Input       |             |
| 5                                     | GND         | Power       |             |

Table 6 – I2C Interface Connection

| <b>I2C</b> |             |                |             |
|------------|-------------|----------------|-------------|
| <b>Nº</b>  | <b>Name</b> | <b>Type</b>    | <b>Note</b> |
| 1          | +5V OUT     | Power          |             |
| 2          | I2C1 SCL    | In/Out         |             |
| 3          | I2C1 SDA    | In/Out         |             |
| 4          | GND         | Ground (Input) |             |

Table 7 – CAN Interface (№1 and №2)

| <b>CAN №1, CAN №2</b> |             |             |                                     |
|-----------------------|-------------|-------------|-------------------------------------|
| <b>№</b>              | <b>Name</b> | <b>Type</b> | <b>Note</b>                         |
| 1                     | VIN         | Power       | Optional external power<br>(8–50 V) |
| 2                     | CAN1 H      | In/Out      |                                     |
| 3                     | CAN1 L      | In/Out      |                                     |
| 4                     | GND         | Input       |                                     |

Table 8 – RS-485 Interface (№1 and №2)

| <b>RS-485 №1, RS-485 №2 (galvanically unleashed)</b> |             |             |                                     |
|------------------------------------------------------|-------------|-------------|-------------------------------------|
| <b>№</b>                                             | <b>Name</b> | <b>Type</b> | <b>Note</b>                         |
| 1                                                    | VIN         | Power       | Optional external power<br>(8–50 V) |
| 2                                                    | RS-485 V    | In/Out      |                                     |
| 3                                                    | RS-485 A    | In/Out      |                                     |
| 4                                                    | GND         | Input       |                                     |

Table 9 – USART Interface (№1, №2, №3)

| <b>SBUS/PPM/DSM (RC IN/ RSSI PWM)</b> |             |             |             |
|---------------------------------------|-------------|-------------|-------------|
| <b>№</b>                              | <b>Name</b> | <b>Type</b> | <b>Note</b> |
| 1                                     | +5V OUT     | Power       |             |
| 2                                     | USART TX    | In/Out      |             |
| 3                                     | USART RX    | In/Out      |             |
| 4                                     | USART CTS   | In/Out      |             |
| 5                                     | USART RTS   | In/Out      |             |
| 6                                     | GND         | Power       |             |

Table 10 – Main Power Input

| <b>PWR IN</b> |             |             |                                  |
|---------------|-------------|-------------|----------------------------------|
| <b>№</b>      | <b>Name</b> | <b>Type</b> | <b>Note</b>                      |
| 1             | VIN         | Power       | External power input<br>(8–50 V) |
| 2             | VIN         | Power       | External power input<br>(8–50 V) |
| 3             | GND         | Power       |                                  |
| 4             | GND         | Power       |                                  |

Table 11 – PWM/GPIO Interface

| <b>PWM/GPIO</b> |             |             |             |
|-----------------|-------------|-------------|-------------|
| <b>№</b>        | <b>Name</b> | <b>Type</b> | <b>Note</b> |
| 1               | PWM1        | In/Out      |             |
| 2               | PWM2        | In/Out      |             |
| 3               | PWM3        | In/Out      |             |
| 4               | PWM4        | In/Out      |             |
| 5               | PWM5        | In/Out      |             |
| 6               | PWM6        | In/Out      |             |
| 7               | PWM7        | In/Out      |             |
| 8               | PWM8        | In/Out      |             |
| 9               | PWM9        | In/Out      |             |
| 10              | PWM10       | In/Out      |             |
| 11              | PWM11       | In/Out      |             |
| 12              | PWM12       | In/Out      |             |
| 13              | PWM13       | In/Out      |             |
| 14              | PWM14       | In/Out      |             |
| 15              | GND         | Power       |             |

Table 12 – ARM JTAG Interface (20 pin)

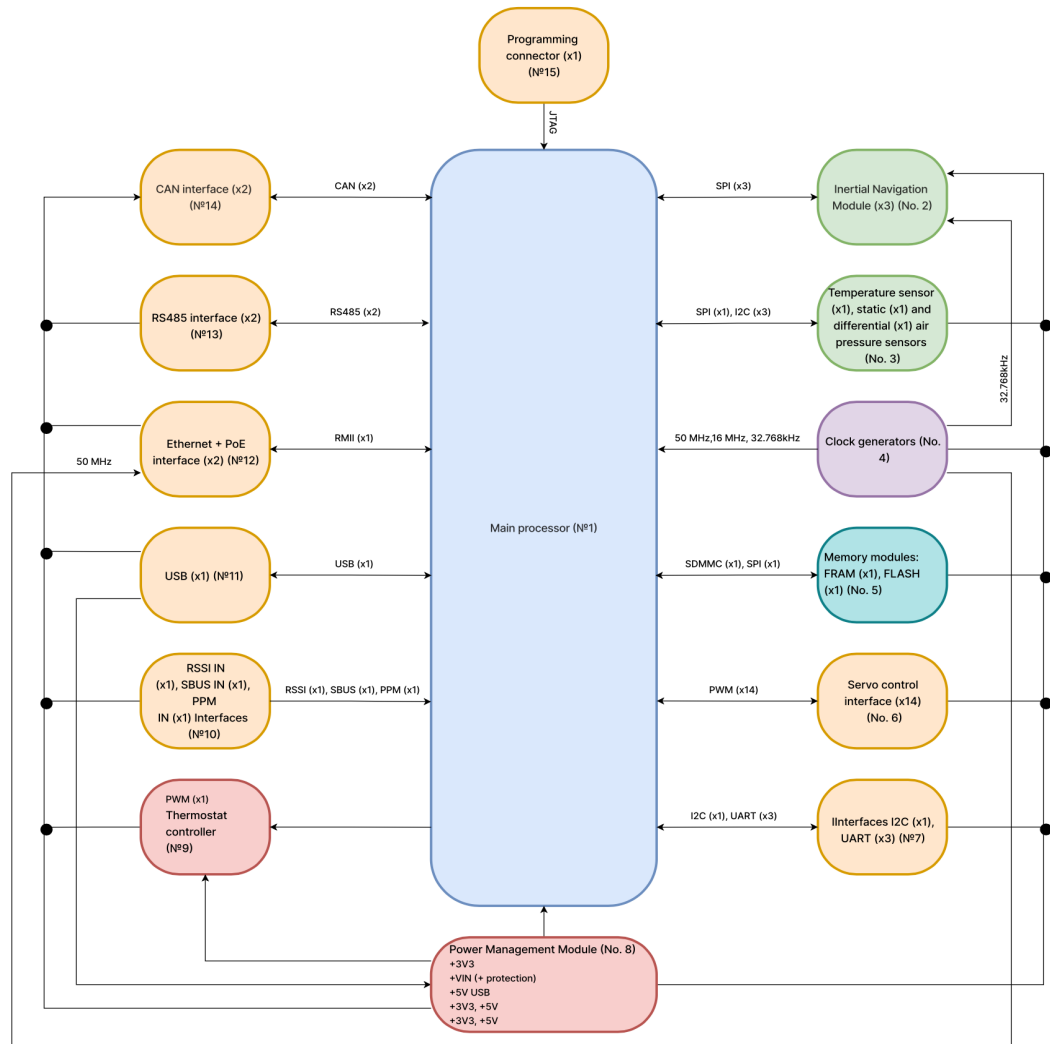
| <b>ARM JTAG (20 pin)</b> |             |             |             |
|--------------------------|-------------|-------------|-------------|
| <b>Nº</b>                | <b>Name</b> | <b>Type</b> | <b>Note</b> |
| 1                        | VTref       | Power       |             |
| 2                        | NC          | —           | Not used    |
| 3                        | nTRST       | In/Out      |             |
| 4                        | GND         | Power       |             |
| 5                        | TDI         | In/Out      |             |
| 6                        | GND         | Power       |             |
| 7                        | TMS         | In/Out      |             |
| 8                        | GND         | Power       |             |
| 9                        | TCK         | In/Out      |             |
| 10                       | GND         | Power       |             |
| 11                       | RTCK        | In/Out      |             |
| 12                       | GND         | Power       |             |
| 13                       | TDO         | In/Out      |             |
| 14                       | GND         | Power       |             |
| 15                       | nRESET      | In/Out      |             |
| 16                       | GND         | Power       |             |
| 17                       | DBGRQ       | In/Out      |             |
| 18                       | GND         | Power       |             |
| 19                       | +5V IN      | Power       |             |
| 20                       | GND         | Power       |             |

Main technical specification of Flight controller is displayed in Table 13:

Table 13 – Technical Specifications

| <b>Nº</b> | <b>Characteristic</b>                             | <b>Unit</b> | <b>Measurement Conditions</b> | <b>Value</b>    |
|-----------|---------------------------------------------------|-------------|-------------------------------|-----------------|
| 1         | Supply voltage<br>(including PoE input)           | V           |                               | 8–50            |
| 2         | Current consumption                               | A           | V = 12 M                      | 0.1±0.05        |
| 3         | Power consumption                                 | W           |                               | 1.5             |
| 4         | Gyroscope zero bias drift                         | °/год       | T = 25 °C                     | 8.0             |
| 5         | Gyroscope angle random walk                       | °/√h        |                               | 0.3             |
| 6         | Gyroscope bandwidth                               | Hz          |                               | 550.0           |
| 7         | Accelerometer offset instability                  | µg          |                               | 13.0            |
| 8         | Accelerometer measurement range                   | g           |                               | ±40             |
| 9         | Relative error of differential airspeed sensor    | %           |                               | ±0.25           |
| 10        | Absolute error of static air pressure sensor      | mBar        |                               | ±2.5            |
| 11        | Absolute resolution of static air pressure sensor | mBar(m)     |                               | 0.012<br>(~0.1) |
| 12        | Absolute temperature measurement error            | °C          |                               | ±0.1            |
| 13        | Moisture protection                               | IP          |                               | IP64 or better  |
| 14        | Operating temperature range                       | °C          |                               | -55...<br>+85   |
| 15        | Main board dimensions                             | mm          |                               | 170*85          |
| 16        | Main board weight                                 | g           |                               | 84              |
| 17        | Mean total lifespan                               | h           |                               | TBD             |

## DEVICE AND PRINCIPLE OF OPERATION



**Figure 1.** Block Diagram of the Flight Controller

The flight controller (see Fig. 1) consists of the following modules:

### **Main Processor**

The central processing unit controlling all autopilot systems, including sensor data processing, mission execution, and coordination between modules.

### **Inertial Navigation Module**

A highly reliable triple-triple redundant module ensuring precise angular orientation and acceleration, even in case of failure of one or more components.

### **Static and Dynamic Pressure Sensors, Thermometer:**

Sensors for measuring static and dynamic air pressure, used for airspeed calculation altitude, and ambient temperature — essential for accurate flight dynamics.

**High-Precision Clock Generators:** Internal highly stable clock sources ( $\pm 2.5/5$  ppm) ensuring synchronization of the processor, navigation module, and interface drivers.

**FLASH and FRAM Memory Modules:** Non-volatile memory devices for storing critical data like system parameters, configurations, tasks, and log files.

**Servo Control Interface:** Supports up to 14 external actuators with EMI and ESD protection, ensuring high-reliability control; also usable as general-purpose I/O (GPIO).

**I2C and UART Interfaces:** Universal protected interfaces with EMI/ESD shielding and re-drivers for signal integrity.

**Power Management Module:** Wide input voltage range (8–50 V) with EMI/ESD filtering, powering all internal subsystems and generating required voltage levels.

**Thermostat Controller:** Stabilizes inertial sensor temperatures, includes autonomous preheating for low-temp operation down to -55 °C.

**RSSI IN, SBUS IN, PPM IN Inputs:** Interfaces for connecting RC receivers and monitoring radio signal strength (RSSI).

**USB Type-C Port:** Universal port for debug powering, firmware flashing (DFU), and connection to onboard computer or configuration software.

**Ethernet 10/100 Base Port:** Network interface with Passive PoE support (up to 50 V) for integration with ground stations or networked devices.

**RS485 Ports:** Two isolated EMI/ESD-protected ports, future support for MODBUS-capable devices.

**CAN Ports:** Two isolated ports with EMI/ESD protection, supporting DroneCAN for integration with modern onboard and peripheral systems.

## **OPERATING INSTRUCTIONS**

The flight controller must be operated according to the requirements and conditions specified in this technical passport. Exceeding operational limits is not permitted.

## **STORAGE AND TRANSPORTATION**

The controller must be stored in an individual box and antistatic bag, in a dry, heated, and clean environment with a temperature from +5 to +40 °C and relative humidity not exceeding 80%.

## CERTIFICATE OF ACCEPTANCE

The primary controlled parameters are listed in Table 14:

Table 14 – Controlled Parameters

| Nº | Characteristic                 | Unit | Measurement Conditions                                              | Acceptable Range | Inspection Result |
|----|--------------------------------|------|---------------------------------------------------------------------|------------------|-------------------|
| 1  | Supply voltage, V              | V    | 8V, 12V, 50BV                                                       | 8..50            | +                 |
| 2  | Standby current, I             | A    | V = 12 V                                                            | 0.05-0.2         | +                 |
| 3  | Absolute heater current        |      |                                                                     | TBD              |                   |
| 4  | Relative data loss overUSART   | %    | Test packet size - 512 bits, transfer rate - 115200 baud, 3 retries | Not allowed      | +                 |
| 5  | Relative data loss over RS-485 |      |                                                                     |                  | +                 |
| 6  | Relative data loss over CAN    |      |                                                                     |                  | +                 |
| 7  | Relative data loss over PPM    |      |                                                                     |                  | +                 |
| 8  | Relative data loss over SBUS   |      |                                                                     |                  | +                 |

Table 14 – Continued

|    |                                                                 |     |                                                                      |             |   |
|----|-----------------------------------------------------------------|-----|----------------------------------------------------------------------|-------------|---|
| 9  | Relative value of data loss when receiving via I2C port         | %   | Test packet size - 512 bits, transfer rate - 115200 baud, 3 retries. | Not allowed | + |
| 10 | Permissible relative error of RSSI level measurement            |     |                                                                      | < 3         | + |
| 11 | Absolute latency (ping) over Ethernet                           | ms  |                                                                      | < 50        | + |
| 12 | Relative packet loss over Ethernet                              | %   | 100 packets of 64-bit length, sent over a local test network.        | < 1         | + |
| 13 | Permissible relative error in servo control signal frequency, f |     | V = 12 V, f = 50 HZ                                                  | < 10        | + |
| 14 | Permissible relative error in servo signal duty cycle, T        |     | V = 12 V, T = 1..2 ms.                                               | < 1         | + |
| 15 | Number of non-operational sensors                               | pcs | All permissible operating conditions                                 | Not allowed | + |

Based on quality control results, the flight controller is deemed fit for operation.