Fiber module digital 40km

User manual

PILOTIX™

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Content

1. Product overview

Fig.1. Transceiver for optic fiber module SE 40km

Fig.2. Receiver for fiber module digital

The Pilotix Optic Fiber Module SE 40km system is a professional tethered fiber-optic video and control transmission solution for UAV operations. The complete system consists of two components:

- Transceiver SE (TX) — the sky-side module, mounted on the drone. It captures HD video from its integrated 4K camera, encodes it in H.264 or H.265, and transmits it over a single-mode optical

fiber. It simultaneously carries bidirectional control data (TTL/SBUS) and OSD telemetry. An on-board TF card slot provides independent video recording.

- Fiber Roll SE V2 with Integrated RX (Ground Unit, SKU 6579) — the ground-side unit. The roll houses up to 30 km of single-mode fiber. The integrated RX module (built into the roll housing) decodes the incoming optical signal and outputs analog video (NTSC/PAL/SECAM) and bidirectional TTL/SBUS control data via SH1.0 connectors.

The system replaces RF-based video and control links with a physically secure, EMI-immune fiber-optic tether — ideal for inspection, surveillance, and operations where radio-frequency silence or a guaranteed physical link is required.

2. Transceiver SE — TX Unit (Sky Side)

The TX SE unit integrates a 4K camera, H.264/H.265 encoder, fiber-optic transmitter/receiver, TF card recorder, and USB port. It is a self-contained sky unit requiring only drone power, a flight-controller connection, and the fiber roll cable.

Port Description

- SH1.0 (Camera port) — connects to the integrated 4K camera via the supplied cable
- SH1.0 (FC Interface) — bidirectional TTL/SBUS data link to the drone's flight controller
- Power In — DC 7.4–50 V; compatible with 2S–12S LiPo batteries or any suitable BEC/XT60 source
- FC Fiber Port — single-mode fiber output with FC connector; connects to the free end of the fiber roll cable
- TF Card Slot — accepts microSD card (not included) for on-board video recording
- USB Port — firmware updates and optional wireless module expansion
- Expansion Port — reserved for future accessories (infrared camera, wireless module; currently non-functional)

Mounting

- Four M3 tapped holes at 30.5 mm pitch — fits all standard FC stack frames
- Camera uses a 19 mm universal mount with M2 screws; set tilt angle before flight
- Route the FC fiber port cable toward the rear or bottom of the frame; leave a ~10 cm service loop to absorb vibration without stressing the FC connector
- Keep the fiber away from propeller arcs and ESC motor wires
- Ensure airflow around the TX unit (power consumption: 3.2 W)

Note: Secure all connectors before every flight. A loose FC fiber connector will cause immediate total signal loss.

3. Integrated RX (Ground Side)

The Fiber Roll SE V2 (SKU 6579) is the ground-side unit. It houses up to 30 km of single-mode optical fiber on a spool, with the built-in RX (Ground Unit) module integrated into the roll housing. The roll is placed at the drone's launch point and remains stationary during operation. Fiber pays out freely as the drone moves.

The integrated RX decodes the received optical signal and outputs analog video (NTSC/PAL/SECAM) and bidirectional TTL/SBUS control data via SH1.0 connectors.

Port Description

- FC Fiber Input — receives the optical signal from the TX unit via the roll's internal fiber; this port is at the roll's connector end
- Analog Video Output — decoded video in NTSC/PAL/SECAM format; connect to an FPV monitor, analog video receiver, or analog FPV goggles
- SH1.0 Data Interface — bidirectional TTL/SBUS control data; connects to an RC receiver or ground control relay device
- Power Input — DC 5.5–26 V; connect a dedicated ground power supply (battery or adapter)

LED Indicators

RX LED Indicator Reference

Category	Item	Specification
LED	Power indicator	Lit — RX module powered on normally
LED	Fiber Optic Link	Lit — fiber connection active and signal locked to TX
LED	Image Signal indicator	Active — analog video stream being decoded
LED	Data signal indicator	Active — TTL/SBUS control data passing through

4. Ground-Side Connection

Wireless Ground Connection (Standard)

In the standard wireless ground configuration, the ground unit's outputs connect to a standard RC receiver and analog FPV monitor. This allows the pilot to receive live video while retaining full SBUS/TTL RC control of the drone.

Category	Item	Specification
Video	Analog video output	Connect to FPV monitor, analog video receiver, or analog FPV goggles (NTSC/PAL input)
Control	SH1.0 data cable	Connect to RC receiver (SBUS input) or map transmitter / ground control relay
Power	Ground Unit power	Connect DC 5.5–26V supply (lithium battery pack or AC adapter)
Fiber	FC fiber connector	Connect free end of roll to TX FC fiber port on the drone

Connection with Map Transmitter / Image Relay

For longer-range ground control setups, the ground unit's SH1.0 data output can be connected to a map transmitter or image relay unit, which then distributes the video and SBUS signals wirelessly to a remote operator station. Connect the SH1.0 cable from the ground unit to the receiver and map transmitter as shown in the system connection diagram.

Note: When using a map transmitter relay, ensure the SBUS signal polarity matches the relay device's input requirements. Some devices require inverted SBUS — check compatibility before flight.

5. Installation & Setup

Pre-Flight Checklist

- Verify fiber type: single-mode (SMF), FC connector on both TX and roll end
- Inspect both FC ferrules for dust or contamination; clean with optical-grade wipes
- Charge the ground unit's power supply (lithium battery or confirm adapter output: DC 5.5–26 V)
- Insert microSD card (Class 10 / U3, ≥ 30 MB/s) into TX TF slot if on-board recording is required
- Connect analog FPV monitor or video receiver to ground unit analog video output
- Connect SH1.0 data cable from ground unit to RC receiver or relay device

Step-by-Step Setup

Step 1 — Mount and wire the TX on the drone

- Mount TX to drone stack at 30.5 mm M3 holes; mount camera on 19 mm M2 universal bracket
- Connect SH1.0 camera cable to TX camera port
- Connect SH1.0 FC cable from TX FC interface to the flight controller's UART/SBUS port
- Connect drone battery power lead to TX power input (DC 7.4–50 V)

Step 2 — Configure the flight controller

- Assign the UART connected to the TX SH1.0 FC port to SBUS/TTL receiver mode in Betaflight / INAV / ArduPilot
- Enable MSP OSD on the same UART if flight telemetry overlay is required

Step 3 — Set up the fiber roll on the ground

- Place the roll on stable ground at the launch point
- Connect DC power (5.5–26 V) to the ground unit power input on the roll
- Connect the analog video output of the ground unit to the FPV monitor or video receiver
- Connect the SH1.0 data cable from the ground unit to the RC receiver or map transmitter

Step 4 — Connect the fiber

- Take the free-end FC connector from the roll and route it up to the drone
- Plug it into the TX FC Fiber Port on the drone
- Ensure the FC connector is fully seated and locked — a partial connection causes signal loss

Note: Always connect/disconnect FC fiber connectors with BOTH TX and ground unit powered OFF.

Step 5 — Insert TF card (optional)

- Insert microSD card (Class 10 / U3) into the TF slot on the TX unit
- Insert only while TX is powered off

Note: Use a Class 10 / U3 microSD card with continuous write speed ≥ 30 MB/s for reliable 4K recording.

Step 6 — Power up

- Power on the ground unit first (connect DC 5.5–26 V to the roll's power input)
- Power on the drone — TX initializes automatically; Power and Status LEDs light up
- The Fiber Link LED on the ground unit should illuminate within a few seconds
- If the Fiber Link LED does not light, check that both FC connectors are fully seated

Step 7 — Verify video and control

- Analog video should appear on the connected FPV monitor within seconds
- Confirm OSD data (altitude, speed, battery) is visible if MSP OSD is configured
- Verify the Data Signal LED on the ground unit is active, confirming SBUS/TTL control is live
- Perform a brief ground test: arm/disarm via RC controller to confirm command pass-through

Step 8 — Start on-board recording (optional)

- Short-press the Record button on the TX unit to begin recording to the TF card
- Press again to pause; the Status LED indicates recording state

Note: On-board TF recording is independent of the fiber link — recording continues even if signal is briefly interrupted.

After-Mission Procedure

- Land and disarm the drone; power off the TX (disconnect battery) before reeling in fiber
- Power off the ground unit and disconnect the monitor, RC receiver, and power supply
- Reel fiber back onto the roll at a steady pace — no kinks or tangles
- Cap both FC connectors with dust caps
- Remove microSD card if the recorded footage is needed

6. Troubleshooting

Troubleshooting Guide

Category	Item	Specification
No video on monitor	FC fiber not connected / unseated	Check FC connectors at both TX and ground unit; ensure both are fully latched
No video on monitor	TX not powered	Verify drone battery connected; TX Power LED should be on
No video on monitor	Ground unit not powered	Check DC 5.5–26V supply to roll; verify ground unit Power LED is on
No video on monitor	Monitor input mismatch	Ensure monitor accepts analog NTSC/PAL/SECAM input; check cable connection
Fiber Link LED off	FC fiber damaged or dirty	Inspect FC ferrules for contamination; clean with optical wipe
Fiber Link LED off	Fiber kinked / bent too sharply	Straighten fiber; minimum bend radius is ~30 mm
Noisy / unstable video	Bitrate too high for link quality	Reduce bitrate in OSD config; 1080p@90fps at 10–15 Mbps recommended
No OSD overlay	MSP OSD not enabled on FC	Enable MSP OSD on the UART assigned to TX FC interface
No control signal	SH1.0 FC cable not connected	Check SH1.0 cable at TX and flight controller; verify SBUS on correct UART
TX not powering on	Supply voltage out of range	Verify DC 7.4–50 V at TX power input; check LiPo battery and connector
Ground unit not powering on	Supply voltage out of range	Verify DC 5.5–26 V at ground unit power input
Recording not starting	No TF card / card incompatible	Insert Class 10 / U3 microSD; re-format to exFAT if not recognized

Image interference	EMI on drone power rail	Add ferrite choke on TX power leads; route fiber away from ESC wires
Signal lost mid-flight	Fiber fully paid out from roll	Drone has exceeded roll fiber length; return toward launch point to restore slack
Signal lost mid-flight	Fiber snagged on obstacle	Land immediately; inspect and straighten fiber before resuming

7. Safety & Compliance

- Do not operate the TX with the FC fiber port uncovered — the laser emitter (1310 nm) is invisible and can cause permanent eye damage
- Never look directly into any FC fiber connector end while the TX or ground unit is powered
- Ensure the TX unit is mechanically secure on the drone before every flight — inspect all M3 screws
- Secure the fiber roll against tipping or being dragged by tether tension during flight
- Inspect the full fiber length before every mission — a compromised fiber that fails mid-flight causes total loss of video and control
- Always comply with local aviation regulations for UAV operations, including specific rules for tethered UAV flights
- The expansion port on the TX is NOT functional; do not connect any device to it

8. Technical Notes

Video Output — Analog Format

The ground unit (RX in fiber roll) outputs analog video in NTSC, PAL, or SECAM format. Ensure the connected FPV monitor, analog video receiver, or FPV goggles accept analog composite video input. The TX encodes in H.264/H.265 digitally; the analog output conversion is handled by the RX module inside the roll. Digital HDMI output is not available on the ground unit side.

Control Data — TTL/SBUS

The control link uses TTL/SBUS protocol with a data rate of 0–1 Mbps. On the drone side, connect the TX SH1.0 FC interface to a UART configured for SBUS input on the flight controller. On the ground side, connect the roll's SH1.0 data cable to the SBUS or TTL input of the RC receiver or map transmitter relay.

Fiber Connector — FC Type

Both the TX unit and the ground unit (RX in roll) use FC (Ferrule Connector) type fiber connectors. FC connectors use a threaded coupling mechanism that provides a secure, vibration-resistant connection — important for drone applications. When cleaning FC connectors, use a reel-type optical fiber cleaner or lint-free optical wipes; never use standard cotton swabs.

Power Compatibility

TX input voltage: DC 7.4–50.4 V (2S–12S LiPo). Ground unit input voltage: DC 5.5–26 V. These are independent power domains — the TX is powered from the drone battery, and the ground unit requires its own ground-side power source. Do not power the ground unit from the drone battery via the fiber link.

Fiber Range — SE V2 Roll vs. TX Maximum

The Fiber Roll SE V2 is pre-loaded with up to 30 km of single-mode fiber. The TX SE unit supports a maximum fiber length of 40 km. For missions up to 30 km, the SE V2 roll is sufficient. For distances between 30 km and 40 km, a longer roll with FC connectors and single-mode SMF fiber (ITU-T G.652D or equivalent) can be used in place of the SE V2 roll.

Contacts:

WhatsApp: +420 777 054 888

Email: support@pilotix.eu
Telegram: https://t.me/PilotixSupport_bot