F-TEL

Fiber Optic Phone Converter
Installation and Operation Manual

Notice

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Warranty

This RAD product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, RAD will, at its option, either repair or replace products which prove to be defective. For warranty service or repair, this product must be returned to a service facility designated by RAD. Buyer shall prepay shipping charges to RAD and RAD shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties and taxes for products returned to RAD from another country.

Limitation of Warranty

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied firmware or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

Exclusive Remedies

The remedies provided herein are the Buyer's sole and exclusive remedies. RAD shall not be liable for any direct, indirect special, incidental, or consequential damages, whether based on contract, tort, or any legal theory.

Safety Warnings

The exclamation point within a triangle is intended to warn the operator or service personnel of operation and maintenance factors relating to the product and its operating environment which could pose a safety hazard.

Always observe standard safety precautions during installation, operation and maintenance of this product. Only a qualified and authorized service personnel should carry out adjustment, maintenance or repairs to this instrument. No adjustment, maintenance or repairs should be performed by either the operator or the user.

Regulatory Information

FCC-15 User Information

This equipment has been tested and found to comply with the limits of the Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to the radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Warning per EN 55022

This is a Class A product. In a domestic environment, this product may cause radio interference, in which case the user may be required to take adequate measures.

Declaration of Conformity

Manufacturer's Name: RAD Data Communications Ltd.

Manufacturer's Address: 24 Raoul Wallenberg St.
Tel Aviv 69719
Israel

declares that the product:

Product Name: **F-TEL**

Conforms to the following standard(s) or other normative document(s):

EMC:	EN 55022 (1994)	Limits and methods of measurement of radio disturbance characteristics of information technology equipment.
	EN 50082-1 (1992)	Electromagnetic compatibility – Generic immunity standards for residential, commercial and light industry.
Safety:	EN 60950 (1992/93)	Safety of information technology equipment, including electrical business equipment.

Supplementary Information:

The product herewith complies with the requirements of the EMC Directive 89/336/EEC and the Low Voltage Directive 73/23/EEC. The product was tested in a typical configuration.

Tel Aviv, October 28th, 1996

Haim Karshen
VP Quality

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Chapter 1
Introduction

1.1 General

The F-TEL converts electrical telephone signals into optical transmission over fiber-optic cables. Two versions of the F-TEL are available: F-TEL/SUB for connecting to a telephone (Subscriber) and F-TEL/CO for connecting to a PBX. The product is used for extending subscriber telephone lines to ranges up to 50 km/31 miles over fiber optic cables. The use of optical cable media provides immunity to electrical interference such as EMI, RFI, spikes and differential ground loops as well as protection from sparking and lightning.

A special version of the product includes nickel-cadmium rechargeable batteries which when the telephone is off-hook, isolate the product from the main power source. This feature, coupled with the metallic box and the fiber immunity, prevent all possibilities of tapping into a telephone conversation. The F-TEL supports both DTMF and pulse dialing. The F-TEL also supports hot-line applications where two telephones are connected directly with no PBX in-between. During hot-line applications when one telephone is off-hook, the other telephone rings continuously until the call is answered. The voice and dialing signals are modulated using an FM modulator with a 100 kHz carrier transmitted between the sites. Amongst its other functions, the carrier also passes an off-hook signal (received from the telephone) or a ringing signal (received from the PBX) over the fiber cable.

1.2 Physical Description

The F-TEL is available as a stand-alone unit (F-TEL/CO and F-TEL/SUB).

Figure 1-1 illustrates the connectivity of both available F-TEL versions used in typical applications.

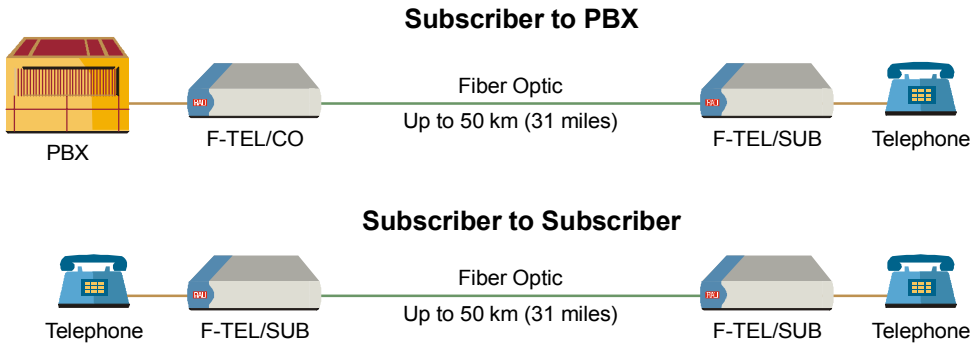

Figure 1-1. Typical F-TEL Applications

Conversion Description

The voice and the telephone signaling are converted to optical signals using 850 nm or 1300 nm LED, or 1300 nm laser diodes. At the opposite side, the optical signal is converted back into an electrical signal.

Voice Hybrid

The voice hybrid converts the 2-wire full duplex telephone or PBX interface into a 4-wire interface where transmit and receive signals are separated (each on 2-wires). The voice hybrid also includes an echo canceling circuit to prevent local voice echo.

Ringing/Loop Detector

This module is different in the two versions of the F-TEL. In the F-TEL/SUB the module is responsible for detecting the off-hook signal for the subscriber telephone. In the F-TEL/CO, the module is responsible for detecting the ringing signal coming from the PBX.

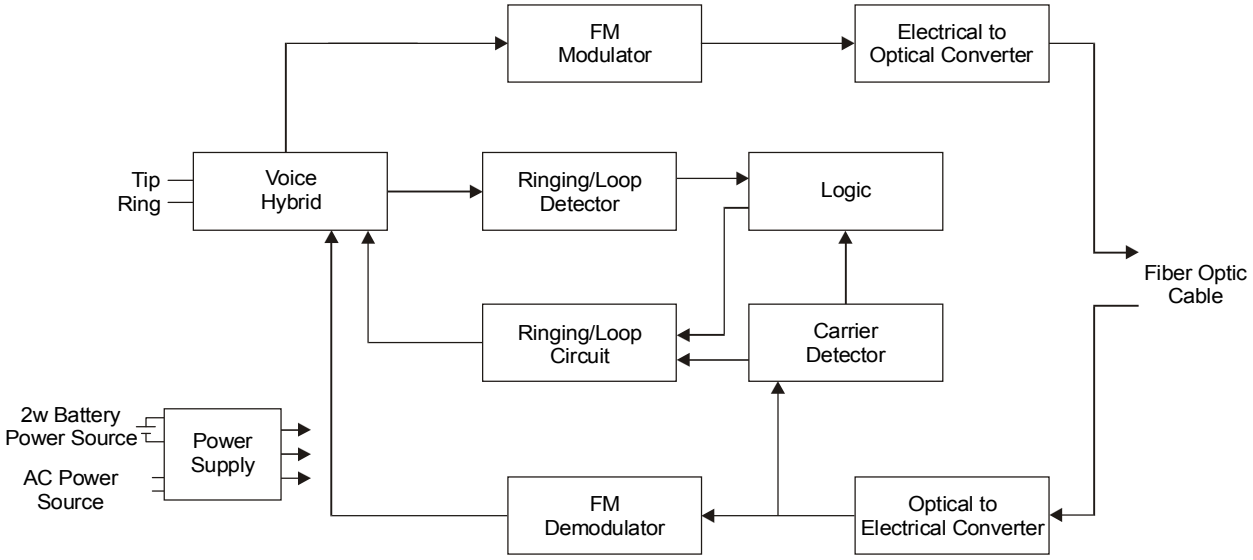

Figure 1-2. Block Diagram

Ringer/Loop Circuit

This module is different for each version and is described as follows:

- F-TEL/SUB: the module generates a ringing signal
- F-TEL/CO: the module simulates off-hook to the PBX.

FM Modulator

The FM Modulator modulates the voice and the signaling over the 100 kHz carrier in accordance with the telephone or PBX status. The carrier is activated only during signaling or voice transfer. When the F-TEL/SUB detects an off hook state, or when the F-TEL/CO detects a ringing signal coming from the PBX, only the carrier is passed to the remote unit.

FM Demodulator

The FM Demodulator demodulates the signal received from the remote unit and distributes it to the voice hybrid.

Logic Module

The logic module controls the operation of the F-TEL, the status of the LED indicator and the process of ringing or simulating off-hook. The F-TEL/SUB logic module prevents the transmission of a ringing signal when the phone is off-hook. The F-TEL/CO logic module prevents off-hook simulation when receiving a dialing tone from the PBX.

Power Module

The F-TEL utilizes two different power sources: a main AC power source and rechargeable nickel-cadmium batteries (special version). When the telephone is on-hook and no signal is detected at the PBX, the unit uses the main AC power while charging the batteries. In the battery version; as soon as the unit detects an off-hook of the telephone or a ringing signal transmitted by the PBX, it automatically switches to battery power.

1.3 Technical Specifications

Electrical	*Transmission line*	2-wire telephone lines
	Connector	RJ-45
	Ringer F-TEL/SUB	
	Output Voltage	60 VRMS nominal (measured on a 3kΩ resistor)
		Ring rate standard (1 second ringing / 2 seconds break)
	Ringer F-TEL/CO	
	Ring Detector Level	Ring detection: >14 VRMS
		No ring: <11 VRMS
	End-to-End Performance	
	Overall Loss	Less than 4 dB at -10 dBm input, 800 Hz
	Total Harmonic Distortion	-36 dB min
Optical	*Operating Wavelength*	• 850 nm for multimode operation • 1300 nm for single mode operation • 1300 nm for the laser diode operation
	Transmission Line	Dual fiber optic cable
	Optical Connectors	SMA, ST or FC

	Power Range	
	Typical Output Power	-18 dBm into 62.5/125 fiber for 850 nm
		-24 dBm into 9/125 fiber for 1300 nm
		-12 dBm into 9/125 fiber for laser diode at 1300 nm
	Receiver Sensitivity	-38 dBm at 850 nm
		-40 dBm at 1300 nm
	Optical Power Budget	20 dB into 62.5/125 fiber for 850 nm
		16 dB into 9/125 fiber for 1300 nm
		28 dB into 9/125 nm for laser diode at 1300 nm
Indicators	*POWER (green)*	ON: Unit is powered
	LOW BAT (red)	ON: Low battery voltage is detected
	F-TEL/SUB	
	SIGNAL LOSS (red)	ON: Local off-hook and loss of optical signal are detected
	LOCAL OFF HOOK (yellow)	ON: Local off-hook is detected
	REMOTE CALL (yellow)	ON: A remote call (ring) from the other unit is detected
	F-TEL/CO	
	SIGNAL LOSS (yellow)	ON: A call (ring) from the PBX and loss of optical signal are detected
	RING (yellow)	ON: When a call (ring) from PBX is detected
	REMOTE OFF HOOK (yellow)	ON: A remote off-hook on the subscriber unit is detected
Power	*AC Source*	115 VAC or 230 VAC, 47–63 Hz
	DC Source	-48 VDC
	External Battery (not supplied)	9–12 VDC battery connected to a DC jack located on the rear panel
	Battery Charge Life (nickel-cadmium battery option)	On-Hook: 6 hours
		Off-Hook: 3 hours
		Continuous ringing: 0.5 hours

Physical	*Height*	4.6 cm / 1.8 in
	Width	19.5 cm / 7.5 in
	Depth	25.5 cm / 10.0 in
	Weight	1.5 kg / 3.3 lb
	Battery weight	0.5 kg / 1.1 lb
Environment	*Temperature*	0–50°C / 32–122°F
	Humidity	Up to 90%, non–condensing

Chapter 2
Installation

This chapter provides instructions for mechanical and electrical installation of the F-TEL. After completing the installation, perform the system check-out (*Chapter 3*) to ensure normal operation.

2.1 Site Preparation

Install the F-TEL within 1.5 m (5 feet) of an easily accessible grounded AC outlet. The AC outlet should supply 115 VAC or 230 VAC (depending on the rated voltage of the unit).

Allow at least 90 cm (36 in) of frontal clearance for operating and maintenance accessibility. Allow at least 10 cm (4 in) of clearance at the rear of the unit for signal lines and interface cables.

2.2 Electrical Installation

AC power is supplied to the F-TEL through a 5-foot (1.5 m) power cord. The power cord is located on the rear panel, and is terminated by a standard 3-prong plug (refer to *Figure 2-1*).

DC power connector is described in the *DC Power Connection Supplement*.

Warning

Grounding – This unit should always be grounded through the protective earth lead of the power cable.
Before connecting AC power to this unit the mains plug should only be inserted in a socket outlet provided with a protective earth contact. The protective action must not be negated by use of an extension cord (power cable) without a protective conductor (grounding). Interrupting the protective (grounding) conductor (inside or outside the unit), or disconnecting the protective earth terminal can make operating this unit dangerous.
The line fuse is located in an integral-type fuse holder located on the rear panel (as shown in *Figure 2-1*). Make sure that only fuses of the required rating, as marked on the rear panel, are used for replacement. Do not use repaired fuses or short-circuit the fuse holder. Always disconnect the mains cable before removing or replacing the fuse.
Whenever it is likely that the fuse protection has been damaged, make the unit inoperative and secure it against unintended operation.

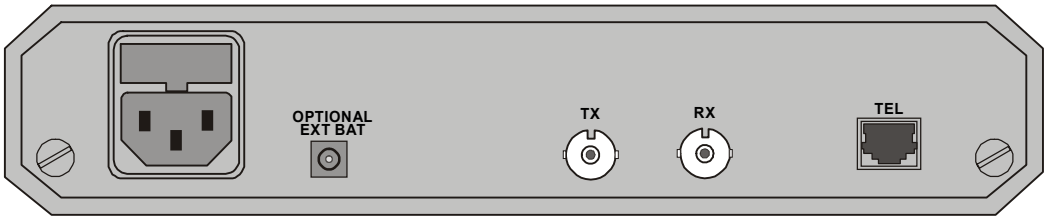

Figure 2-1. F-TEL Rear Panel (AC Version)

Rear Panel Connectors

The rear panel includes an AC or DC power connection, a telephone-interface connector and optical connectors.

Strap Selection

Once the electrical installation has been completed and checked:

- Determine the configuration required for the F-TEL.
- Set the strap positions to suit the chosen configuration.

Warning

Disconnect the AC power cord before removing the unit's cover. Installation, operation and maintenance of this unit should only be performed by an experienced technician.

Installation of Internal Jumpers

Prior to electrical installation, the F-TEL's internal jumpers should be set according to the application.

1. Disconnect all cables connected to F-TEL.
2. Loosen the two screws on the rear panel using a flat blade screwdriver.
3. Slide out the PCB in order to gain access to the internals.
4. Adjust the jumpers to suit the selected configuration.
5. Slide the PCB back into the housing and tighten the retaining screws.

Table 2-1. F-TEL Jumper Settings

Jumper	Description	Values	Factory Setting
BAT B.U., JP1 The JP1 jumpers is relevant only when an external battery is included or the unit includes the nickel-cadmium battery	Selects the battery operation when the telephone is off-hook or the PBX is transmitting a ringing signal transfer voice	ON – F-TEL receives power from a nickel-cadmium or external battery OFF – F-TEL receives power from an AC source	ON for F-TEL units with nickel-cadmium battery OFF for F-TEL units without nickel-cadmium battery
CHASS GND, JP2	Controls connection between the signal ground and the chassis ground	⏚ – Signal ground is connected to chassis ground N.C. – Signal ground is disconnected from chassis ground	⏚

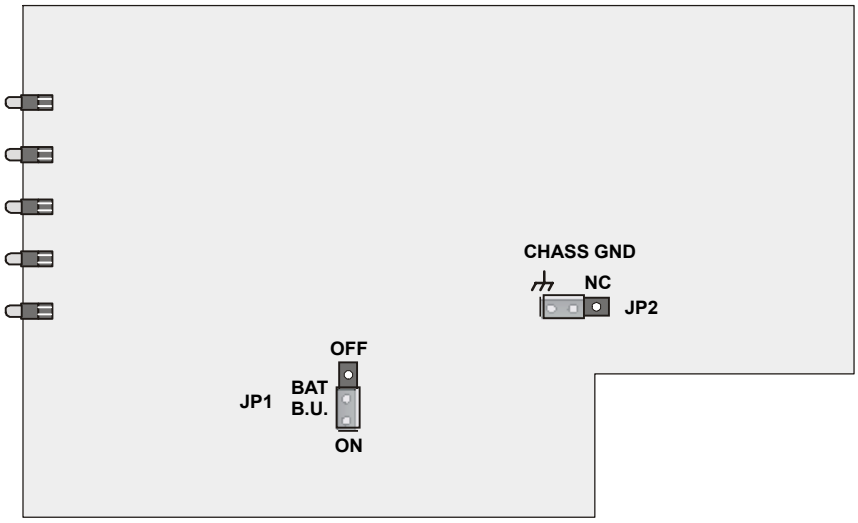

Figure 2-2. Location of F-TEL Internal Jumpers

Table 2-2. TEL Connector Pinout

Pin	Function
4	Tip
5	Ring
1, 2, 3, 6, 7, 8	N.C.

Chapter 3

Operation

This chapter provides the information needed to operate the F-TEL unit. Topics such as F-TEL indicators, operating procedures and field strapping changes are discussed.

3.1 F-TEL Controls and Indicators

All indicators (LEDs) are located on the F-TEL front panel. The functions of the LEDs shown in *Figure 3-1* and *Figure 3-2* are described in *Table 3-1*.

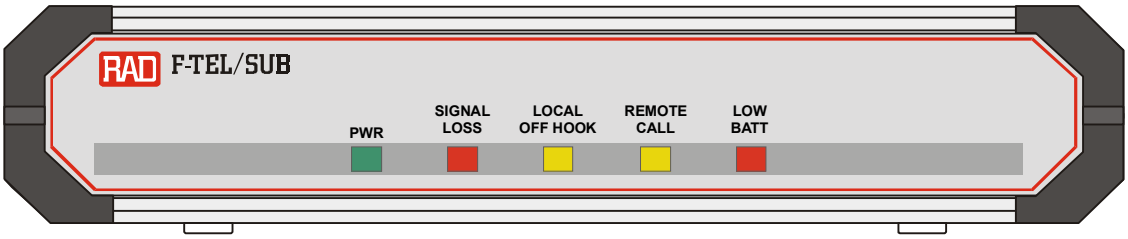

Figure 3-1. F-TEL/SUB Front Panel

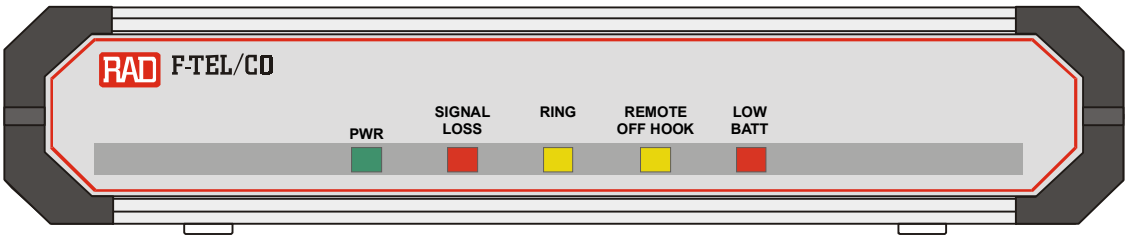

Figure 3-2. F-TEL/CO Front Panel

Table 3-1. F-TEL Indicators

Name	Type	Function
POWER	Green LED	ON – F-TEL is powered up
SIGNAL LOSS	Red LED	ON – Local unit detects a loss in the optical signal transmitted by the remote unit
LOCAL OFF HOOK	Yellow LED	ON – Attached telephone set is off-hook
REMOTE CALL	Yellow LED	ON – Local unit detects a ringing signal trnsmitted by th remote unit
LOW BATT	Yellow LED	ON – Internal nickel-cadmium battery or external battery voltage level drops below the minimum level required to operate the unit. (The unit switches to the AC power supply.)

Table 3-1. F-TEL Indicators (Cont.)

Name	Type	Function
RING	Yellow LED	ON – An incoming ringing signal is detected from the attached PBX side
REMOTE OFF HOOK	Yellow LED	ON – The local unit detects an off-hook signal transmitted by the remote telephone

3.2 Operating Procedure

The F-TEL operates unattended once installed (refer to *Chapter 2*). Intervention is only required when:

- The F-TEL is set up for the first time.
- F-TEL settings need to be changed to suit operational requirements.

Power-On Procedure

The F-TEL is turned on as soon as the AC or DC power cord is connected to the AC or DC power mains outlet. The PWR LED should light up to indicate successful power supply. Verify that the local and remote F-TEL units are in operation, and that the front panel LEDs match the indicator conditions described below.

Note *Nickel Cadmium batteries included with the F-TEL (battery) version, should be charged for at least 14 hours before beginning normal operations. Insufficient battery power may be supplied if this procedure is not performed.*

Indicator Conditions

- PWR – ON
- SIGNAL LOSS – OFF
- LOCAL OFF HOOK/RING – Depends on the product input
- REMOTE CALL/REMOTE OFF HOOK – Depends on the product input
- LOW BAT – OFF.

Operation

The F-TEL operates entirely unattended. Occasionally, the LED indicators should be monitored, as needed.

Power-Off Procedure

To turn off the AC or DC power to the F-TEL, simply remove the AC or DC power cord from the AC or DC source.

3.3 Operational Field Strapping Changes

Field straps should be changed according to the configuration required for each option of operational mode used.

Warning

Disconnect the AC power cord before removing the unit's cover. For guidance in repositioning the straps, refer to *Table 2.1*. Field straps should only be changed by an experienced technician.