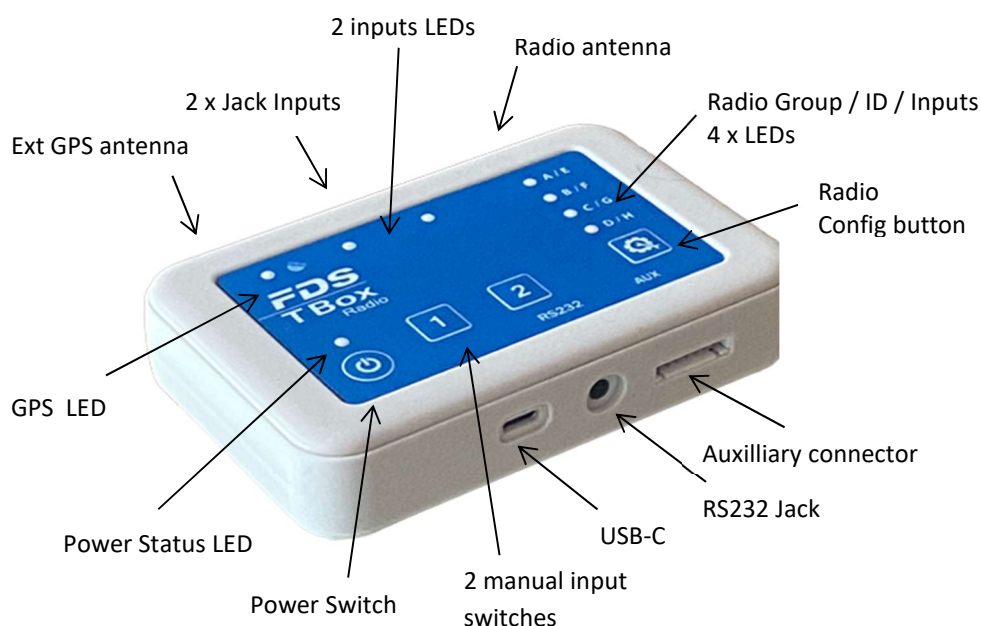# TBOX-RADIO

1. Appearance

The TBox-Radio is a compact and well-equipped timing console. It accepts wired and wireless peripherals like photocells, start gates or other starting devices. It has been mainly designed to generate and deliver time of day data to external timing applications.

TBox-41 (SN >= 00600):

TBox-41 (SN < 00600):

TBox-40:

Radio antenna

Radio Group / ID / Inputs
4 x LEDs

2 x Jack Inputs

Ext GPS antenna

Radio
Config button

2 inputs LEDs

Sync Jack

2 manual
input switches

RS232 Jack

Mini USB

GPS LED

Power Switch

Power Status

FDS
TIMING SOLUTIONS

2. Power control and status

2.1. Power On/Off

The *"Normal"* power On/Off sequence is as followed.

a) Press briefly the power switch (0.5s – 1.5s) until the battery status is indicated on the Radio input's LEDs 1-4.

b) Release the power switch and repress it within 1 second, and hold down until the 4 Radio inputs LEDs are ON, and the audible beep signal is emitted (provided that the buzzer is not deactivated).

Starting from firmware version V3.2.0 of TBox model 41, you select two other power sequence options.

The *"Simplified"* sequence.

a) Press the power switch for about 3sec until all the Radio inputs and power LEDs are green and the audible beep signal is emitted (the first second, the battery status is indicated on the Radio input's LEDs 1-4.)

The *"Automatic"* sequence.

In this sequence, the TBox turn itself on when the USB external power is applied, and turn off after a defined period of time following a USB power down. It is still possible to manually turn on/off the TBox in which case it revert to the *"Normal"* sequence describe above.

2.2. Battery status

Press and hold the ON/OFF button for about 1sec.
The Radio Inputs LEDs (1 – 4) will illuminate to indicate the battery charge status

4 LEDs ON green: 75-100 %
3 LEDs ON green: 50-75%
2 LEDs ON green: 25-50%
1 LED ON green: 10-25%
1 LED ON red: < 10% (Will work only with external power plugged)

Power Status LEDs

	TBox On/Off	USB	Battery
Yellow ON	OFF	connected	Battery Charging
Green ON	OFF	connected	100% charged
Yellow blinking	ON	connected	Battery Charging
Green blinking	ON	connected	100% Charged
Green blinking	ON	disconnected	> 25%
Red blinking	ON	disconnected	Low battery

3. Timing Inputs

The TBox-Radio comprises of 2 wired Inputs and 6 wireless Inputs

- Manual Push Buttons (inputs 1 & 2)
- Jack inputs (inputs 1 & 2)
  Working contact without potential (short-circuit)
- Wireless inputs for WIRC / WINP (inputs A - F)

Jack inputs:
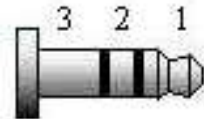
1: Input
2: Reserve
3: GND

Each press of a manual push button, short-circuits on the wired Inputs or radio impulse are stored in the TBox memory with associated date and time of impulse.
The user has the possibility to configure a locking time using our PC or mobile setup applications. This facility allows the blocking of undesired impulses on the corresponding input.
E.g. – To ignore multiple impulses from dirt or snow dust.

4. Radio configuration

The TBox-Radio is configured and linked to WIRC photocells using two Parameters:

- **Group** (radio frequency)
- **Input/ID** (TBox Input / WIRC-WINP serial number)

NOTE: TBox-Radio and WIRC photocells must be configured with an identical Group setting

4.1. Groups (Radio Frequencies) - Europe / India / Russia

6 Groups are available.

Group A, B, C, D:

Wireless Transmission Distance: up to 2000m (clear line of sight)

Each group uses ¼ of the full frequency band

Min locking time of 200ms

Group E, F:

Wireless Transmission Distance: up to 5000m (clear line of sight)

Each group uses the full frequency band

Min locking time is longer: 500ms

OFF:

The radio transmission function is disabled. This mode is selected to save power when you prefer to connect TBox-Radio to photocells using a hard-wired solution rather than wireless.

4.2. Groups (Radio Frequencies) - North America / Japan

8 Groups are available

Group A, B, C, D:

Tested wireless Transmission Distance (clear line of sight)

> US   : up to 4000m
> Japan   : up to 1000m

Min locking time of 200ms

Group E, F, G, H:

Tested wireless Transmission Distance (clear line of sight)

> US   : up to 6000m
> Japan   : up to 1500m

Min locking time of 500ms

OFF:

The radio transmission function is disabled. This mode is selected to save power when you prefer to connect TBox-Radio to photocells using a hard-wired solution rather than wireless.

To select your desired Group, press the Setup button

The current Group selected is indicated by the LED array **A, B, C & D**.

Release and press the number of times you want to change the setting.

Group	LED A	LED B	LED C	LED D
A	GREEN			
B	GREEN	GREEN		
C	GREEN	GREEN	GREEN	
D	GREEN	GREEN	GREEN	GREEN
E	YELLOW			
F	YELLOW	YELLOW		
G (*)	YELLOW	YELLOW	YELLOW	
H (*)	YELLOW	YELLOW	YELLOW	YELLOW
OFF	RED	RED	RED	RED

(*) only available for North America and Japan

To prevent unwanted radio group changes, the radio Setup button can be locked / unlocked by a simultaneous long press on both radio button and Power button.

LEDs A and Led D will flash red (locked) or green (unlocked).

4.3   Radio Inputs pairing (WINP/WIRC)

Each WINP/WIRC has a unique ID (serial number) that can be paired with a TBox-Radio input (A-F).

Pairing can be performed via our PC or mobile setup applications (no need to power ON WIRC/WINP). It can also be performed manually without any application. In this case, both TBox-Radio and WINP/WIRC have to be powered and the following procedure executed.

1) Make sure the TBox and the WINP/WIRC are both powered On.

2) On the TBox-Radio, enter the pairing mode by pressing the Setup button for 3 sec until a long beep sounds and LED A flash yellow.

3) Now select the desired input (A, B, C or D) by performing a short press on the same button.

4) Finally enter the pairing mode on the WINP/WIRC by pressing the Setup button for 3 second.

When pairing is completed, LEDs A to D of the TBox flash yellow and both TBox and WINP/WIRC resume normal operation.

To exit the pairing mode on either TBox or WINP/WIRC, just press the Setup button for 3 second until a long beep sound.

NOTE: In case an IOS or PC application is used to configure the radio inputs, do not use the same WIRC/WINP serial number for more than one input.

5. Radio communication

Every time an impulse is received from a WINP/WIRC, the corresponding input LED flash on the TBox-Radio and an acknowledgement is sent back to the WIRC/WINP.

WIRC/WINP radio protocol will resend any message several times if no ACK is received form the TBox-Radio.

⚠️ Radio transmissions cannot be 100% guaranteed. An unfavorable environment, lack of line of sight, interference or an improper installation might lead to the loss of data.
FDS cannot be held responsible for any of the above.

5.1. Time delay and precision

In case of a good radio communication with no interference, the time delay from the IR beam detection to the generation of a time event by the TBox-Radio will vary from 10ms to 150ms depending of the selected Group. In case of interferences this delay might reach a few seconds. However, whatever the value of this delay, the TBox-Radio takes it into account and generates a corrected time with a precision of 1/10'000 sec.

6. Mini-USB / USB-C

The USB connector has various functions including:

- External power supply and battery charging
- COM port emulation for RS232 communication and data transfer
  - Time of day (protocol FDS, TAG Heuer, Alge, Seiko)
  - Configure the TBox-Radio options and parameters (with the app "TBox-Setup")
- 4GB USB Flash Drive (2GB for model TBox-40)
  - All impulse data is stored in a .csv file on the TBox internal SD drive
    A new file is created every time the TBox-Radio is swiched ON
  - A log file is updated in an event of a firmware crash.
  - User needs to maintain sufficient memory availability to ensure storage of data
  - The space required for a competition of 1000 times is approximately 40 Kbytes
  - Flash Drive access is only possible when the TBox-Radio is turned OFF

7. RS232

Jack-Stereo connection 3.5mm.

The output protocol can be configured by the user via our PC or mobile setup applications

- FDS / TAG Heuer / Alge / Seiko Time of day protocol
- Serial printer
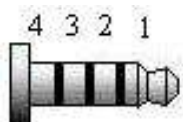- LEDs Display Output (FDS-MLED & TAG Heuer)
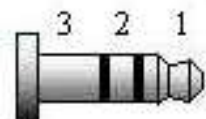
1: TBox TXD
2: TBox RXD
3: GND

8. In/Out Synchro (TBox-40)

Jack-4pin connection 2.5mm.

- Allows to synchronize the TBox with other timing systems

1: TBox +3.3V
2: TBox Sync In
3: TBox Sync Out
4: GND

TBox Sync In:
Internal resistor to Vcc: 10 kOhm
Active state: Tie to Gnd, Sink current 0.3mA
Inactive state: Leave unconnected

TBox Sync Out:
Min ext resistor to Vcc: 1 kOhm
Max Vcc: 5V
Active state: Tied to Gnd (1ms)
Inactive state: Open circuit

9. In/Out Synchro + 2nd RS232 (TBox-41)

7 pin 2.54 header

- Allows to synchronize the TBox with other timing systems
- Has a secondary RS232 port for auxiliary units

1: Supply +3.3V
2: Aux units detection
3: TBox Sync In
4: TBox Sync Out
5: Aux RS232 RXD
6: Aux RS232 TXD
7: GND

TBox Sync In:
Internal resistor to Vcc:	10 kOhm
Active state:	Tie to Gnd, Sink current 0.3mA
Inactive state:	Leave unconnected

TBox Sync Out:
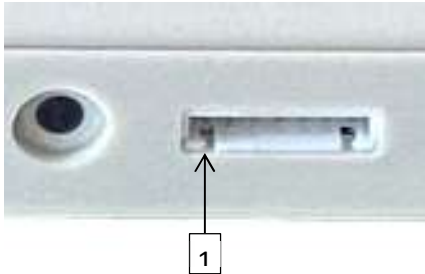|	
	(Optocoupler)
Internal resistor:	33 Ohm
Max Vcc:	16V
Active state:	Tied to Gnd (1ms)
Inactive state:	Open circuit

10. Printer

FDS offer a dedicated thermal printer which can be connected either to the TBox via its RS232 port or via Bluetooth using one of our iOS timing applications. In case of a TBox direct connection, all the TBox generated time stamps will be printed, as well as the synchro time and the GPS status if used in synchro.

The user can also reprint all times stamps of the run. Whilst pressing and holding down the ON/OFF button, press the manual input 1 switch.

11. Synchronization

There are 5 different methods to synchronize the TBox-Radio.

All manual input LEDs will flash yellow until a synchro is completed.

a) Sync at Zero

- This is the default synchro method for **TBox-40**. Once the TBox-Radio is switched ON, the first impulse will sync the internal time at Zero

b) Internal Sync (TBox-41 only)

- This is the default synchro method for **TBox-41**. Once the TBox-Radio is switched ON, it is synchronized with the internal RTC. RTC value is updated during a GPS or App Sync

c) GPS Sync

- To start the GPS Sync, ensure TBox-Radio is powered off, hold down the switch "Input 1" while powering ON the TBox-Radio. Our PC or IOS setup application can also be used to start the Synchro.
- The sync will commence once the TBox-Radio receives sufficient GPS data
- Once synchronized, the internal clock drift is constantly compensated by GPS signals (as long as GPS coverage is maintained)

d) Manual

- A user defined time of day is sent via Bluetooth or via a com port. The synchro is started using one of the 2 inputs or a radio impulse.

e) External

- External synchro uses the auxiliary 7 pins connector as the source of synchro. First a time stamp has to be received on the aux RS232 port followed by the top synchro signal.
- This can be used to keep a perfect synchronization between two TBox (using a dedicated cable). The Master TBox can be first synchronized using any other mode, then external synchro is selected on the slave TBox.
- External synchro can be selected manually by pressing the switch "Input 2" while powering the TBox.

f) Sync via app

- All synchro methods presented above can be controlled manually or automatically by our Timing Applications

12. Bluetooth

A Bluetooth connection can be established with compatible FDS timing or setup Apps.

Just after power up, the Bluetooth send advertising frames at fast rate to speed up detection and connection. After 1 min this rate is decreased for power saving purpose, and connection might be slower. Hower the user can manually switch to a fast rate again just by a quick press of the power switch.

13. Switches settings & shortcuts

Power OFF when plugging USB in Auto power ON sequence:

 Switch <Radio>:   Do not power ON TBox to have access to USB drive

During power ON:

 Switch <1> :   Set GPS synchro
 Switch <2> :   set External synchro
 Switch <Radio>:

While power is ON:

 Switch <1> short press :   Manual pulse 1
 Switch <2> short press : Manual pulse 2
 Switch <Radio> short press : Radio Group change
 Switch <Radio> long press : Enter/Leave pairing mode
            Change pairing input with short press

 Switch <1> & Switch <Power> short press : Print or download all TOD of the Run on RS232 port
 Switch <Radio> & Switch <Power> long press : Lock/Unlock radio switch

14. Auto Timing (Training mode)

The TBox has been mainly designed to generate TOD for external timing applications. However, for training and auto timing purpose an internal timing mode has been implemented on the TBox 41 model.

- This mode has to be activated and all parameters set using one of our TBox PC or mobile setup applications
- Beside the Start and Finish inputs, 2 intermediates are accepted
- For each inter and finish, a min and max detection time has to be defined
- The start pulse can be identified either using our RCID (RFID identification box) or with an auto incrementing counter (max 250 then back to 1)
- This mode handles data output on an MLED display via RS232 or Radio as well as a on a printer (Main RS232 jack or RS232 on the auxiliary connector)

15. How to update the TBox-Radio Firmware

No software is required.

a) Copy and paste the ".bin" file to the USB Flash Drive root directory of the TBox.
   Note that you should have only ONE ".bin" file on the drive. If you want to save the previous ".bin" files, create a sub-directory
b) Delete the file "UPDATLOG.txt" if it exists on the TBox drive
c) Disconnect the USB connector from your TBox
d) Wait 1-2 seconds and reconnect the USB cable between the TBox and your PC.
   All LED's will switch yellow for a few seconds and update is complete when extinguished
e) A file "UPDATLOG.txt" is created on the Drive. Open it and check that the update completes with success. **Do not delete this file**

16. Technical specifications

Frequencies & Power :	
Europe	869.4 - 869.65 MHz 100mW
India	865 - 867 MHz 100mW
Russia	868.7 - 869.2 MHz 100mW
North America	920 - 924 MHz 100mW
Japan (TBox-41 only)	922 - 927 MHz 20mW
Inputs precision	1/10'000 sec
Operating temperature	-20°C to 60°C Battery charge possible only between 0°C and 45°C
Timer Precision Temperature drift	1ppm @ 20°C, Recalibration possible at 0.2ppm 2.5ppm from -20°C to 60°C (SN < 00850) 0.5ppm from -20°C to 60°C (SN >= 00850)
External power input	USB compatible (5V +/- 10%) up to 1.5A

Battery:
    TBox-40
    TBox-41
	
	LiPo 2200mAh
	LiPo 2500mAh (SN < 00600)
	LiPo 2900mAh (SN >= 00600)

Autonomy:
    GPS and Radio inactive
    Radio On and GPS Off
    Radio and GPS On
	
	140 hours
	70 hours
	45 hours

Bluetooth module:
    TBox-40
    TBox-41
	
	BLE 4.1
	BLE 5

Dimensions	124x86x31mm
Weight	180gr
Homologation (TBox-41)	FIS : FDS.001T.20 FEI : 2019001-1B/C

17. Copyright and Declaration

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