Instruction Manual for FrSky Two-Way System

1   Introduction

The two-way system developed by FrSky provides not only the normal RC control but also a true telemetry system to return measurements from the model to the transmitter. This new capability allows for the real time display of quantities such as altitude, GPS location, battery levels, speed, etc. to the operator.

2   Overview of System Components

2.1   Transmitter modules
2.1.1   Model: DFT
Compatible with the following transmitters:
Futaba: 3PM, 3PK, 7U, 8U, 8J, 9C, 9Z, 10C, FN series, T10C, FC-18, FC-28.
Hitec: Optic 6, Eclipse 7, Prism 7.
WFLY: WFT09, WFT08.
2.1.2   Model: DJT
Compatible with the following transmitters:
JR: 347/388/783/U8/PCM10/PCM10S/PCM10SX/PCM10IIS/8103/J9303/ PX/9XII.
2.1.3   Model: DHT
Installable in almost any PPM modulation transmitter

2.2   Receiver modules
2.2.1   Model: D8R (V2)/D6FR/D4FR
Compatible with FrSky Two Way modules DFT/DJT/DHT/DHT-U
2.2.2   Model: V8FR-HV, V8R7-HV, V8R7-SP, V8R4
These receivers are one-way only but operate with transmitters that are switched to one-way mode.

3   System Features

- FrSky's Advanced Continuous Channel Shifting Technology (ACCST SYSTEM) giving a highly reliable link, especially in high interference environments.
- Easy to bind and has instant link-up between transmitter and receiver.
- Excellent reboot times.
- All channels offer failsafe.
- Quick response.
- Very smooth servo movement.
- Alarms on monitored conditions in the receiver (e.g. low battery voltage, poor reception, etc.)
- Error-free link, through the use of a 48-bit CRC algorithm (Data contains error detection bits)
- Low power consumption.
- True two-antenna diversity.
- Firmware upgradable.

4   Function of Two Way Communication

4.1   Two way communication between receiver and transmitter
4.1.1   The receiver is able to accept up to 2 analog inputs, which can be used to monitor battery voltage, temperature, etc., and transfer the data to the transmitter. Users can set the Alarm Level for each of these separate analog voltages in the transmitter. The alarms can be programmed to a voltage above or below a settable threshold or disabled.
4.1.2   The receiver is also able to accept serial data streams from its simple 3-wire RS232 port. Such information as GPS, altitude, and user-developed data can be transferred to the transmitter without error. This serial data is then available at the RS232 port on the Transmitter.
4.1.3   Technical data about the protocols are also available at the download portion of the FrSky website.

5   Specifications

5.1   Receiver specifications
Model: D8R (V2)
Number of Channels: 8
Weight: 16.2g
Dimension: 54*27*17mm (2.13" x 1.06" x 0.67")
Operating Voltage Range: 3.5V-10.0V
Operating Current: 100mA
Specified Range: 1.5km (Ground Range)
Resolution: 3072 (>11bit)
Switchable Frame Rate: 18ms (FS) for analog servos or 9ms (HS) for digital servos
Built-in battery voltage sensor: Sent on A1 analog channel to transmitter
Analog input voltage (A2): 0~3.3V from user supplied sensor
Upgradable firmware without opening the receiver case

Model: D6FR
Number of Channels: 6
Weight: 7.1g
Dimension: 42*22*11mm (1.65" x 0.87" x 0.43")
Operating Voltage Range: 3.5V-10.0V
Operating Current: 50mA
Specified Range: 1.5km (Ground Range)
Resolution: 3072 (>11bit)
Switchable Frame Rate: 18ms (FS) for analog servos or 9ms (HS) for digital servos
Built-in battery voltage sensor: Sent on A1 analog channel to transmitter

5.2   Transmitter module specifications
Model: DFT, DJT, DHT
Operating Voltage Range: 6.0V-13.0V
Operating Current: 50mA
Output Power: 60mW
Resolution: 3072

Important!

The effective range of control refers to the distance between the transmitter and the receiver. All data was tested and verified by FrSky. However this is not guaranteed due to many factors such as the flying environment and the weather, which can greatly affect the effective range of control.
   It is extremely important to range check your models prior to each flying session!

---

6   How To Use

6.1   Setup
6.1.1   Installation of the transmitter modules:
6.1.1.1 Remove the original transmitting module.
6.1.1.2 Ascertain that the transmitter is set to broadcast PPM and not PCM. Turn off the transmitter.
6.1.1.3 Put the FrSky 2.4GHz transmitter module into the module port of your RC transmitter and screw on the transmitting antenna. The DHT module may be internally installed in the transmitter.
6.1.1.4 Check the MODE switch to its corresponding position.

Mode	Switch 1	Switch 2	Mode
1	OFF	OFF	Two-way Mode
2	OFF	ON	V8 Mode
3	ON	OFF	Not Defined
4	ON	ON	Firmware Upgrade

6.1.1.5 Turn the transmitter power on and check the LED status on the module. Normal operation on the transmitter is indicated with the RED LED on and the GREEN LED flashing.

6.1.2   Installation of receivers:

The D8R (V2)/D6FR receivers incorporate two separate antennas that enable them to receive the radio signal at two different locations (spatial diversity). Please make sure that the two antennas are separated and oriented 90 degrees to each other. This will guarantee sufficient reception regardless of aircraft orientation.

> **Please note:**
> As the wavelength of the new 2.4GHz frequencies is shorter than older RC systems, its ability to go around solid obstacles is less than older 72 or 36 MHz systems. Also, the antenna patterns are more affected by metallic objects, such as metal parts, servos, ESC's, battery packs, wires, and carbon fiber structures. If possible, put the tip of the antennas outside of the fuselage for the best reception.

6.2   Binding the Receiver and Transmitter

Binding is the process of uniquely associating a particular receiver and transmitter, to exclude any potentially interfering transmitters. A transmitter can be bound to multiple receivers (not to be used simultaneously). A receiver can only be bound to one transmitter. This association is a key component in newer 2.4 GHz radio systems and must be done before the equipment can be used.

6.2.1   Turn your transmitter on while holding the F/S button on the transmitter module **(For the two-way mode, make sure that both switches on the transmitter module are OFF).** Release the button. The RED LED on the transmitter module will flash, indicating the transmitter is ready to bind the receiver. The GREEN LED will be off.

6.2.2   Turn on the receiver while holding the F/S button. The RED LED on the receiver will flash, indicating the binding process is completed.

6.2.3   Turn off both the receiver and transmitter

6.2.4   Turn on the transmitter and the receiver. The RED LED on the receiver will be on and the GREEN LED on the receiver will continually flash as the commands from the transmitter are received.

6.2.5   After the steps above are completed, both the transmitter and receiver are ready to be used.

6.3   Range check

It is highly recommended that you perform a pre-flight range check. Caution must be paid when you do a range check in an environment with metal fences, concrete buildings, or rows of trees. Loss of signal may be experienced around these objects.

Follow the steps below to perform range check with a completed model:

6.3.1   Place the model at least two feet (60cm) above the ground (like on a wooden bench). Shallow buried metal may disturb this check. Keep any part of the model's receive antenna off the ground.

6.3.2   Place the antenna of the transmitter in a vertical position.

6.3.3   Turn on the transmitter and receiver, press the F/S button of the transmitter for 4 seconds to enter the special range check mode, the RED LED of the transmitter module will be off indicating much reduced power output. The effective working distance will be decreased to 1/30.

6.3.4   Walk away from the model while simultaneously operating the controls on the transmitter, confirming that all controls are completely and correctly operational at least 30 meters away.

6.3.5   Push and release the F/S button, the transmitter will exit range check mode.

7   Safe Flying Distance

The two-way system has a feature to return the Received Signal Strength Indication (RSSI) of the receiver to the transmitter. The transmitter develops an internal voltage representing the receiver signal strength. Alarms are programmed in the transmitter to warn the pilot when the model is nearing maximum control range. These alarms are given arbitrary color designators in this manual (not on the equipment). The meaning each of these levels and the result is given in the table below.

Color Code	Meaning	Transmitter
Green	The signal strength is strong	No beeps
Yellow	The signal strength is adequate	Single beeps
Orange	The model is at far, but safe, range	Constant double beeps
Red	The model is near maximum range	Constant triple beeps

Note: It is normal to hear an intermittent, and not frequent, single beep as the model flies through signal fade points. Control will not be affected.

8   Failsafe

For those instances when the model flies out of range of the transmitter for more than a brief instant, the receiver provides a settable failsafe function on all servo channels. There are two implementations of this failsafe function. The ROM A version is shipped with all receivers.

8.1 ROM A version
To use the failsafe function, follow the steps below.
8.1.1 Bind the receiver first (see section 6.2 above).
8.1.2 Move the transmitter controls for all channels to the desired position whenever failsafe occurs.
8.1.3 Press briefly the F/S button of the receiver (less than 1 second), the transmitter module will make a long "beep", indicating the failsafe position is stored in the receiver. These settings will be remembered until the receiver is every rebound to the transmitter.

8.2 ROM B version
This version is provided as a user installed firmware upgrade. The firmware is available from the download section of the FrSky website. With this version you can set failsafe position on the Transmit module at any time during your flight.
8.2.1 Bind the receiver first (see section 6.2 above).
8.2.1.1 Set the transmitter controls to the desired failsafe position of all channels
8.2.1.2 Press briefly the F/S button of the Transmitter module (less than 1 second), the transmitter module will make a long "beep", indicating the failsafe position is remembered by the receiver, even when flying. The same action can be achieved when the model is on the ground by pushing the F/S button on either the transmitter or the receiver.

8.3 If you want to disable the failsafe function, with either ROM version, re-bind the receiver to the transmitter. This will set the failsafe feature in the normal off state.

Note: Note that if you accidently press the "F/S Range" button of the transmitter module during your flight (with ROM B), you will update the failsafe positions inadvertently.

9 Alarm operation

9.1 Alarm states
The transmitter module monitors the receiver voltages and notifies the user by audible alarm. The alarm thresholds and direction (either above or below threshold) can be programmed into the transmitter module using a standard PC and a special cable available from FrSky.
9.1.1 The signals being measured depend on the version of the receiver. For the earlier D8R or D8R (V1), there are two analog input pins, called A1 and A2. For the later D8R (V2) one of the previous pair of pins has been dedicated to the measurement of internal receiver voltage. The remaining A2 is still available.
9.1.2 As with the RSSI, there are three alarm states. The result of a voltage passing the programmed threshold for these three alarm states is the same as shown in the table in section 7.
9.1.3 The alarms are derived from the following sources.
Rx interface 1: Analog Port 1 on Rx
Rx interface 2: Analog Port 2 on Rx
Rx interface 3: RSSI of Rx

Note: Both Analog Ports have a settable alarm point while the RSSI alarm setting is set at the factory.

9.2 Telemetry Connector Pin Definition
9.2.1 The pin definition on the D8R (V2) receiver telemetry port is as shown in the table below.

RXD	+5V	GND
AD2	×	GND

The pin, at position +5V, is connected internally to receiver TXD and should not be used with user circuitry. AD1 is connected internally to the battery voltage. The maximum battery voltage reportable is 13.2V although the maximum safe receiver power voltage is 10V. The AD2 pin is the user analog voltage input (0-3.3V). The RXD pin is the serial input pin for a user bit stream (9600 Baud 0 -> 3.3V signaling levels)

9.3   The pin definition on the transmitter telemetry port is as shown in the table below

RXD	Input to Transmitter module
TXD	Output from Transmitter module
+5V	Unregulated voltage
GND	Ground

9.4   A photo of the DFT transmitter with the telemetry connector pins is shown here

10   LED Status

10.1   LED status on Transmitter module
RED LED on and GREEN LED flashing: Normal Operating Mode.
RED LED off and GREEN LED flashing: Range Check Mode.
RED LED flashing GREEN LED Off: Binding Mode.

10.2   LED status on Receiver
RED LED on and GREEN LED Dim: Normal Operating Mode.
RED LED flashing and GREEN LED off: No Signal.
RED LED flashing and GREEN LED on: Binding OK.

11   Firmware Upgrade

FrSky has developed a mechanism to allow firmware upgrade of these radios. This allows the user to upgrade to new version of software as soon as it's available.

11.1   The upgrade steps are as follows
•Download the new firmware and upgrade loader from the FrSky web site.
•Set the FrSky module to Upgrade Mode (See section 6.1.1.4).
•Connect the module to a PC with a RS232 cable (USB Version is available from FrSky).
•Start Upgrade software on PC.
•Select file and corresponding port.
•After the Serial Number is retrieved by the program press "Download."
•After the progress bar reached 100% the software of the module is updated.

12   How to switch between two PPM modes

•Turn the transmitter off and turn on the receiver.
•Press the F/S button of receiver for 6 seconds and then release.
•The red LED will then flash fast when in HS Mode and slow in FS Mode.
•Repeat the steps to alternate back to the other mode.
•
Note: The receivers are shipped preset to the Full Speed (FS) mode for analog servos. Use the High Speed (HS) mode for digital servos only.

Warning HS mode may damage analog servos.

FCC Statement

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following

Measures:

-- Reorient or relocate the receiving antenna.

-- Increase the separation between the equipment and receiver.

-- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-- Consult the dealer or an experienced radio/TV technician for help.

FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

CE in which countries where the product may be used freely: Germany, UK, Italy, Spain, Belgium, Netherlands, Portugal, Greece, Ireland, Denmark, Luxembourg, Austria, Finland, Sweden, Norway and Iceland.

France: except the channel 10 through 13, law prohibits the use of other channels.

For more information, refer to the Two Way Protocol available in the "downloads" section of the FrSky website (www.frsky-rc.com).

Should you have further questions, please feel free to contact FrSky technical support by e-mail: sales4tech@gmail.com