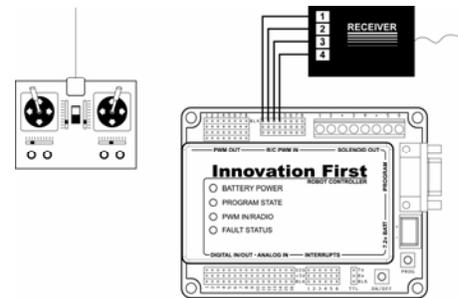


Selecting a Radio-Control System for the 2004 EDU Robot Controller

1. Overview

While the 2004 EDU Robot Controller can operate entirely autonomously, most users will primarily wish to operate it by remote user control. In the past this necessitated purchasing an entire Innovation First Control System, including radio modems and an Operator Interface. To reduce the cost of the overall system, the new EDU Robot Controller can be interfaced with standard off-the-shelf hobby radio-control (R/C) systems. Virtually any industry standard hobby R/C system can be used. The two main considerations when choosing a transmitter/receiver pair are how many control channels it has and which frequency it uses.



2. Number of Control Channels

Hobby R/C transmitters and receivers are available with as few as two control channels (X & Y axes on one joystick) or as many as nine (two joysticks plus various buttons and switches). The more expensive models with more channels often have extra features such as programmability, timers, and visual displays. Since the EDU Robot Controller itself is programmable, these features are usually not needed. For most purposes a simple four-channel system is sufficient. If more control channels are desired, it is usually more cost-effective to buy two four-channel systems, which will allow two users to control the functions of the robot.

3. Frequency Bands

The following explanation is only applicable in the United States. In other countries the laws may differ, so please consult your local R/C hobby shop to find out which systems are legal for robot use.

In the United States, the Federal Communications Commission (FCC), has set aside three frequency bands for radio-control hobbyist use.

- The 27 MHz AM frequency band can be used for surface or air vehicles.
- The 72 MHz FM frequency band is reserved for aerial vehicles only. Do not use for robots!
- The 75 MHz FM frequency band is reserved for surface vehicles only (including robots).

When choosing an R/C system to use on your ground-based robot, you must make sure that it operates using either the 27 MHz or the 75 MHz bands. Before ordering a system, verify that it is legal to be used for ground-based vehicle operation.

27 MHz AM R/C systems:

These are usually the cheapest option, but have a few drawbacks. They usually have a shorter range than FM systems, and are also more susceptible to interference, which could occasionally cause unexpected operation of your robot. This frequency band is divided into 6 user channels, which can be changed by changing the channel crystals in the transmitter and receiver. This means that a maximum of six AM systems can be operational at the same time in a given area. These control systems are usually available with no more than 4 control channels, and are usually used for controlling R/C cars and boats.

75 MHz FM R/C systems (including PCM systems):

These are more expensive than AM systems, but operation is generally more reliable since they are subject to less interference. They have a longer range, but you probably don't need to be a mile away from your robot when operating it. Models are available with up to 9 control channels, which would allow one user to use one transmitter/receiver set to control all 8 of the "R/C PWM IN" inputs on the EDU Robot Controller. Also, there are 30 user channels in this FM frequency band, which means that 30 systems (each with different crystals) can be operating in the same area at the same time without interfering with each other.

It is easy to find systems with 2 and 3 control channels that operate in this frequency, since cars and boats usually require few channels. If you have an R/C car with a removable receiver, you may be able to take it out and use it with the EDU Robot Controller as it is.

Most systems with 4 or more control channels use the 72 MHz frequency band, which is reserved for aerial use. There are, however, certain 4 and 6 channel models which can be ordered off-the-shelf for ground frequency use (such as the Futaba 4YF or 6YG). Many others can be converted at the factory to use the 75 MHz frequency, usually for a \$40 charge. Some vendors, such as robotmarketplace.com, sell pre-converted systems specifically for use with robots.

4. Conclusion

The recommended base system to purchase is an FM four-channel transmitter/receiver pair, such as the Futaba 4YF (75 MHz model) or the JR Quattro (factory-converted to 75 MHz). This will allow a user to drive the robot and still have two control channels available for other functions. An additional four-channel system can be added at a later date to allow two human operators to control different functions of the robot.

If you still have questions, call or visit your local radio-control hobby shop or club to find out more, or to try out different systems to see which ones you like.