

Innovation First, Inc.

EDU Default Software Reference Guide

For the 2004 EDU RC

```
void Default_Routine(void)
{
  /*----- 1 Joystick Drive -----*/
  *
  * This code mixes the Y and X axis on one joystick for driving.
  * Joystick forward = Robot forward
  * Joystick backward = Robot backward
  * Joystick right = Robot rotates right
  * Joystick left = Robot rotates left
  * Connect the left drive motors to PWM OUT 1 and/or PWM OUT 3 on the RC.
  * Connect the right drive motors to PWM OUT 2 and/or PWM OUT 4 on the RC.
  */
  pwm01 = pwm03 = Limit_Mix(2000 + PWM_in1 + PWM_in2 - 127); /* LEFT WHEELS */
  pwm02 = pwm04 = Limit_Mix(2000 + PWM_in2 - PWM_in1 + 127); /* RIGHT WHEELS */
  pwm01 = pwm03 = 255 - pwm01; /* reverse direction of left side */

  /*----- Other PWM OUTPUT Mapping -----*/
  pwm05 = PWM_in5; /* limited by digital inputs 1 & 2 below */
  pwm06 = PWM_in6; /* limited by digital inputs 3 & 4 below */
  pwm07 = PWM_in7;
  pwm08 = PWM_in8;

  /*----- Limit Switches to limit PWM OUTPUTS 3 & 4 -----*/
  Limit_Switch_Max(!rc_dig_in10, &pwm05); /* PWM05 won't go FWD if rc_dig_in10 is low. */
  Limit_Switch_Min(!rc_dig_in12, &pwm05); /* PWM05 won't go REV if rc_dig_in12 is low. */
  Limit_Switch_Max(!rc_dig_in14, &pwm06); /* PWM06 won't go FWD if rc_dig_in14 is low. */
  Limit_Switch_Min(!rc_dig_in16, &pwm06); /* PWM06 won't go REV if rc_dig_in16 is low. */

  /*----- R/C PWM INPUTS toggle solenoids -----*/
  if (PWM_in3 < 95) /* PWM_in3 forward (typically) */
  {
    solenoid1 = 1; /* turns on Solenoid 1 */
    solenoid2 = 0; /* turns off Solenoid 2 */
  }
  else if (PWM_in3 > 160) /* PWM_in3 reverse (typically) */
  {
    solenoid1 = 0; /* turns off Solenoid 1 */
    solenoid2 = 1; /* turns on Solenoid 2 */
  }
  else /* PWM_in3 neutral band */
  {
    solenoid1 = 0; /* turns off Solenoid 1 */
    solenoid2 = 0; /* turns off Solenoid 2 */
  }
}
```

Table of Contents

1. Overview.....	2
2. Default Pre-Programmed Software.....	3
3. Drive Motor Control.....	4
4. General Purpose Motor Control.....	5
5. Solenoid Control.....	6
6. Robot Drive Direction and Wheel Rotation.....	7

1. Overview

The EDU Robot Controller comes pre-programmed to perform basic driving and movement functions. When interfaced with one or two standard hobby radio-control (R/C) transmitter/receiver pairs, human operators can drive motors and energize solenoids, while onboard switches are used for other actions.

The EDU RC can be re-programmed to create almost any custom functionality based on operator and sensor inputs, but this document describes the default operation of the unit when taken right out of the box. If you change the program inside your Robot Controller and need to restore the default program, you can download the EDU Default Code at www.EduRobotics.com.

Refer to the EDU Robot Controller User's Reference Guide for details on how to set up and connect your EDU Robot Controller to motors, solenoids, switches, and radio-control receivers.

This document contains no references to specific directions of joystick movement because they vary between manufacturers of radio-control (R/C) equipment. If opposite movement is desired from how your equipment behaves, you can toggle the corresponding SERVO REVERSE switches on your transmitter. These switches are usually located on the bottom of the unit or inside the battery compartment.

2. Default Pre-Programmed Software

The following picture illustrates the functions of the default code that is pre-programmed into the EDU Robot Controller. This default code requires one or two radio-controlled receivers to be connected to the R/C PWM IN receptacles as specified in the EDU Robot Controller Reference Guide. The primary function of this software is to map these PWM inputs to PWM outputs for motor drive. Some PWM inputs as well as switch inputs are used to energize solenoids.

Default robot operation can be divided into three primary categories:

- Drive Motor Control – p.4
- General Purpose Motor Control – p.5
- Solenoid Control – p.6

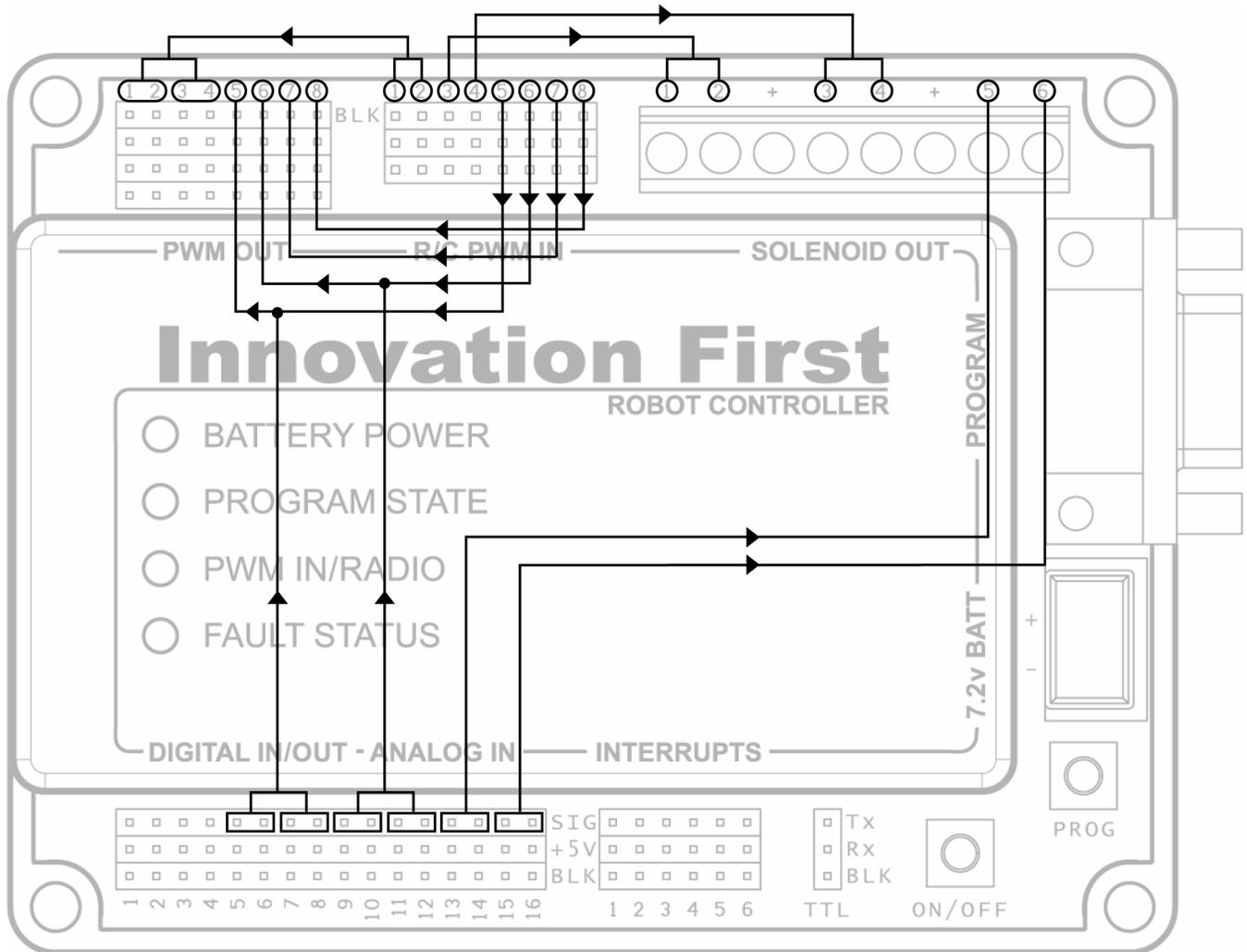
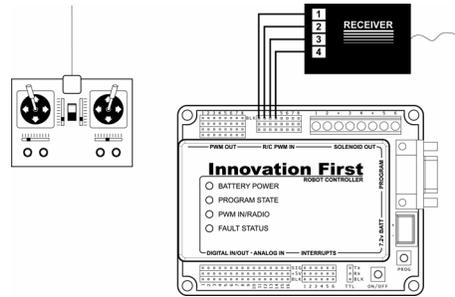


Table 1: Default Software Function Summary

Input	Output	Notes (see following pages for details)
R/C PWM IN 1	PWM OUT 1-4	Mixed with PWM IN 2 for one joystick drive.
R/C PWM IN 2	PWM OUT 1-4	Mixed with PWM IN 1 for one joystick drive.
R/C PWM IN 3	SOLENOID OUT 1 & 2	Each direction triggers one solenoid.
R/C PWM IN 4	SOLENOID OUT 3 & 4	Each direction triggers one solenoid.
R/C PWM IN 5	PWM OUT 5	Limited by DIGITAL IN/OUT 6 & 8
R/C PWM IN 6	PWM OUT 6	Limited by DIGITAL IN/OUT 10 & 12
R/C PWM IN 7	PWM OUT 7	
R/C PWM IN 8	PWM OUT 8	
DIGITAL IN/OUT 6	PWM OUT 5	Disable PWM OUT 5 in one direction.
DIGITAL IN/OUT 8	PWM OUT 5	Disable PWM OUT 5 in other direction.
DIGITAL IN/OUT 10	PWM OUT 6	Disable PWM OUT 6 in one direction.
DIGITAL IN/OUT 12	PWM OUT 6	Disable PWM OUT 6 in other direction.
DIGITAL IN/OUT 14	SOLENOID 5	
DIGITAL IN/OUT 16	SOLENOID 6	

3. Drive Motor Control

Inputs: R/C PWM IN 1 & 2 (Typically the X and Y axes of the right joystick.)

Outputs: PWM OUT 1-4

The signals from PWM IN 1 & 2 are mixed together to control PWM OUT 1, 2, 3, and 4. This allows you to drive your robot with only one joystick. For example, if you connect servo outputs 1 & 2 from your radio-control receiver to R/C PWM IN 1 & 2, you typically will be able to drive your robot using the right joystick on your transmitter. For four-wheel drive, connect PWM OUT 1 & 3 to the motors on one side of your robot, and PWM OUT 2 & 4 to the motors on the other side. For two-wheel drive, connect only PWM OUT 1 and PWM OUT 2 to each side of your robot.

For more details on robot drive direction and wheel rotation, see p.7.

4. General Purpose Motor Control

Inputs: R/C PWM IN 5-8, DIGITAL IN/OUT 10,12,14,16

Outputs: PWM OUT 5-8

The signals from PWM IN 5, 6, 7, and 8 are all directly mapped to PWM OUT 5, 6, 7, and 8. This means that motors plugged into these outputs can be directly controlled by the joystick axes which are plugged into these inputs. This also allows a robot's drive motors to be controlled by two joysticks with tank-style steering.

Additionally, PWM OUT 5 & 6 can be limited by switches or jumpers plugged into DIGITAL IN/OUT 6, 8, 10, and 12. If you connect the SIG pin of these inputs to ground (0V or BLK), then the limiting behavior will be observed. Using the default code, you may also connect these pins to their adjacent pins (DIGITAL IN/OUT 5, 7, 9, and 11). These pins have been configured as outputs with a LOW value, or 0V. This enables the following behavior:

- Connect DIGITAL IN/OUT 9 and DIGITAL IN/OUT 10 with a jumper or a switch to keep PWM OUT 5 from driving a motor in one direction.
- Connect DIGITAL IN/OUT 11 and DIGITAL IN/OUT 12 with a jumper or a switch to keep PWM OUT 5 from driving a motor in the other direction.
- Connect DIGITAL IN/OUT 13 and DIGITAL IN/OUT 14 with a jumper or a switch to keep PWM OUT 6 from driving a motor in one direction.
- Connect DIGITAL IN/OUT 15 and DIGITAL IN/OUT 16 with a jumper or a switch to keep PWM OUT 6 from driving a motor in the other direction.

5. Solenoid Control

Inputs: R/C PWM IN 3-6, DIGITAL IN/OUT 14 & 16

Outputs: SOLENOID 1-6

In the Default Code there are two methods to trigger solenoids: remotely using a joystick or locally using a switch on the robot.

The joystick controlling R/C PWM IN 3 can trigger solenoids 1 and 2. Pushing the joystick in one direction will trigger SOLENOID 1. Pushing the joystick in the other direction will trigger SOLENOID 2. When in neutral, both solenoids will be off.

The joystick controlling R/C PWM IN 4 can trigger SOLENOIDS 3 and 4 in a similar manner.

The digital inputs on DIGITAL IN/OUT 14 & 16 will also trigger solenoids like this:

- Connect a switch between DIGITAL IN/OUT 13 and DIGITAL IN/OUT 14 to trigger SOLENOID 5.
- Connect a switch between DIGITAL IN/OUT 15 and DIGITAL IN/OUT 16 to trigger SOLENOID 6.

6. Robot Drive Direction and Wheel Rotation

Typical two-wheel and four-wheel robots require the motors to rotate in different directions based on their mounting orientation. The diagram below shows the motors and wheels of a four-wheel robot driving forward. The left wheels must rotate counter-clockwise (CCW) and the right wheels must rotate clockwise (CW) to provide a forward movement of the robot. The EDU Default program on the Robot Controller accommodates this.

If this mirrored behavior is not observed, check the SERVO REVERSE switches on your radio-control transmitter. These are sometimes located inside the battery compartment.

If this mirrored behavior is not desired, toggle the two corresponding SERVO REVERSE switches on your radio-control transmitter.

Inputs	Output	Motor
R/C PWM IN 1 & 2	PWM1	Left Rear Motor
	PWM2	Right Rear Motor
	PWM3	Left Front Motor
	PWM4	Right Front Motor

