

TRIS10

ROBOTICS

FindBall NXT
FindBall Open

Table of Contents

1.0 Electrical Characteristics	2
2.0 Operation	3
2.1 Waveforms	3
2.2 Sensor Placement	3
2.2.1 FindBall NXT.....	3
2.2.2 FindBall Open (Version 1A).....	4
3.0 Pin Descriptions	5
3.1 GND (1 – closest to processor)	5
3.2 Vcc (2)	5
3.3 SCL (3)	5
3.4 SDA (4)	5
3.5 NC (5)	5
3.6 NC (6)	5
4.0 I2C Interface	6
4.1 I2C Bus Requirements	6
4.2 I2C Address	6
4.3 I2C Registers	6

1.0 Electrical Characteristics

Characteristic	Value	Units
Supply Voltage, V_{cc}	5	V
Current Consumption, I	7	mA

TRIS10
ROBOTICS

2.0 Operation

2.1 Waveforms

The FindBall devices are designed for use with the RCJ-05 Mode A waveform shown in Figure 2, however they can lock onto any infrared waveform with the following characteristics:

- 40kHz pulses,
- a minimum of 6 pulses, and
- a minimum of 8 pulses off.

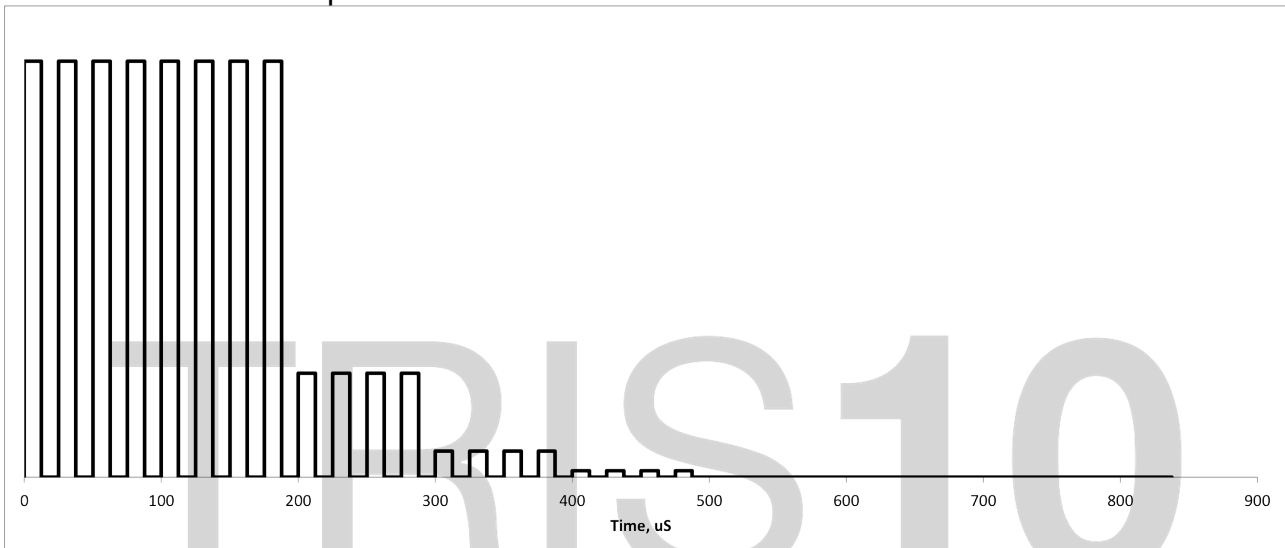


Figure 1: RoboCup Junior Mode A Waveform

2.2 Sensor Placement

2.2.1 FindBall NXT

In the FindBall NXT variant, the five IR sensors are located at 45° increments, as shown in Figure 2. As such, it is recommended that it be placed with an obstructed view on the front of the robot. Mounting the sensor so that it is inline with the centre of the ball will optimise its sensitivity.

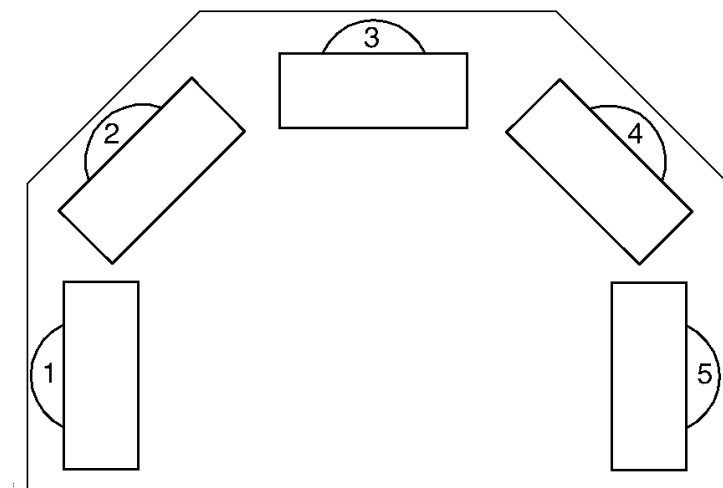


Figure 2: FindBall NXT Sensor Placement

The FindBall NXT is compatible with both Lego NXT™ and Lego EV3™ systems. The FindBall NXT appears as a Lego Ultrasound (Sonar) Sensor where the best sensor is returned as a value in the range of 1-5. A value of 0 is returned when no sensor is detecting the ball.

2.2.2 FindBall Open (Version 1A)

The FindBall Open is software identical to the FindBall NXT but does not come in a case or with sensors mounted on the PCB. This allows flexibility to integrate the FindBall in a custom robot with a wide range of controlling processors. Sensors may be mounted individually around the robot and simple mounting PCBs are provided for each sensor. Each sensor of the FindBall open should be fully insulated from IR light with the exception of a small (3mm diameter) collimator of length between 5 to 10mm located at the top of the curved centre on the front of the sensor (Fig 3 shows the required direction of IR onto sensor). Each sensor should be mounted on a FindBall Mount board (included) to avoid stress on the sensor leads. The pin connections for the main PCB and the sensor mount PCBs are printed on the PCBs.

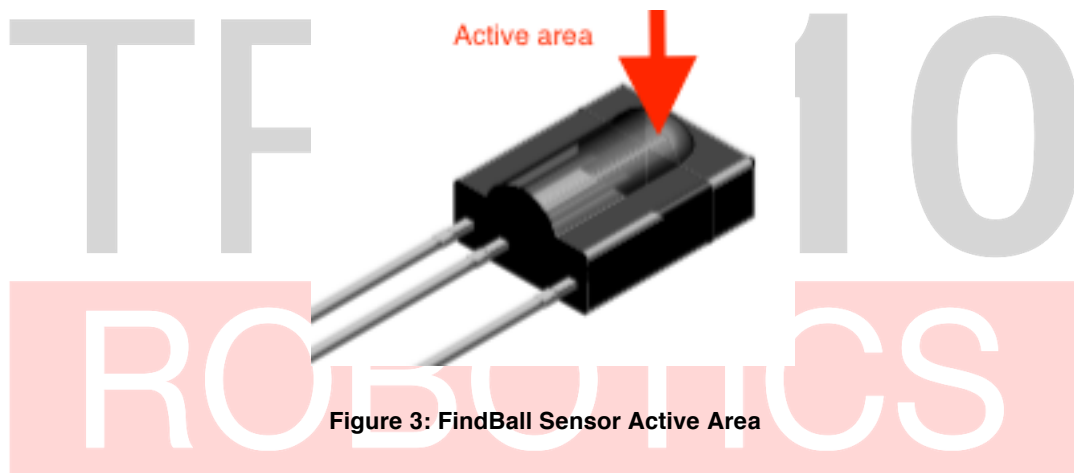


Figure 3: FindBall Sensor Active Area

3.0 Pin Descriptions

The control pins for the FindBall Open are listed below. These pins are the six pins in the centre of the PCB. Each pin name is clearly marked on the PCB underside.

3.1 GND (1 – closest to processor)

This pin should be connected to Ground.

3.2 Vcc (2)

This pin should be connected to a stable and regulated 5V.

3.3 SCL (3)

This pin is the clock line for the I2C interface. It has an 10k pull-up resistor to Vcc on it.

3.4 SDA (4)

This pin is the data line for the I2C interface. It has an 10k pull-up resistor to Vcc on it.

3.5 NC (5)

This pin can be used to set the I2C address of the device. See 4.2 I2C Address for more information.

3.6 NC (6)

This pin can be used to set the I2C address of the device. See 4.2 I2C Address for more information.

TRIS10
ROBOTICS

4.0 I2C Interface

This document omits the I2C specification requirements, however it fully complies with the Philips I²C interface and the open I2C interface.

4.1 I2C Bus Requirements

FindBall devices operate as a Slave device on an I2C bus. The FindBall Open devices have 10kohm pull-up resistors on the SCL and SDA lines connected to Vcc (5V) to provide compatibility with I2C Master devices such as Arduinos or similar processors.

The speed the I2C bus can operate at is proportional to the value of Vcc, however at Vcc = 5V, it cannot operate at greater than 100kHz (i.e. this device does not support I2C fast-mode).

4.2 I2C Address

The FindBall devices operate as slave I2C devices. The default 7-bit address of a FindBall is 0x01.

If the two NC pins are connected together during power-up, the 7-bit address of the FindBall will be 0x03.

4.3 I2C Registers

In Version 1A, the FindBall Open register values are identical to the FindBall NXT.

Address	Description	Length	Default Value
0x00	The software version number as an ASCII string	4	'V1.0' 0x56 0x31 0x2E 0x30
0x08	The manufacturer as an ASCII string	4	'LEGO' 0x4C 0x45 0x47 0x4F
0x10	The sensor type as an ASCII string	5	'Sonar' 0x53 0x6F 0x6E 0x61 0x72
0x42	The best IR sensor (1 to 5) or 0 if none	1	
0x43	The strength of the best IR sensor or 0 if none	1	
0x44	The strength of sensor 1	1	
0x45	The strength of sensor 2	1	
0x46	The strength of sensor 3	1	
0x47	The strength of sensor 4	1	
0x48	The strength of sensor 5	1	

Some other registers are set to 1 to provide compatibility with the LEGO NXT/EV3 devices. These registers are used for calibration and testing. All other registers return 0.