

## Operational Description

The TX unit receives user input from several interfaces including; a potentiometer, rotary encoder, 4 momentary buttons, and a 3-position toggle switch. The TX unit operates off 5 volt DC and can be powered by 4 AAA batteries, or with 5 volt USB power. A power regulator is used to drop voltage to 3.3 volts DC for the wireless module. The user input is received by the micro-controller operating at 16Mhz and is translated into position and acceleration values which are sent wirelessly to the RX unit with a Nordic NRF24L01+ transceiver module that features a PCB planar meandering inverted-F antenna. A planar inverted-F antenna includes a ground element, a shorting element, a radiating element, and a feeding element. The shorting element extends upwardly from the ground element. The radiating element is disposed above the ground element, and extends transversely from the shorting element. The radiating element includes a meandering strip and a flat plate. The meandering strip has opposite first and second ends. The first end of the meandering strip is coupled to the shorting element. The flat plate has a connecting side that is connected to the second end of the meandering strip and that has a length different from that of the second end of the meandering strip. The feeding element has a first end that is connected to the radiating element, and a second end that extends through and that is free from electrical contact with the ground element.

The RX unit receives information from the controller unit and moves a stepper motor to the corresponding position. The RX unit is powered by a 12 volt DC battery pack to provide direct power to the stepper driver. Onboard power regulators drop voltage to 5 volts DC for the micro-controller and 3.3 volts DC for the wireless transceiver. This device has a micro-controller operating at 16Mhz and utilizes a Nordic NRF24L01+ transceiver with SMD chip antenna to receive wireless transmissions from the controller. The Fusca SMD chip antenna is intended for use with all 2.4 GHz applications. The antenna uses a ground plane in order to radiate efficiently, but this ground plane must not extend underneath the antenna itself.