



SurgASSIST Wireless Remote Control System Theory of Operation

1 Introduction

This document describes the technical aspects of the transmitter and receiver components that comprise the PC100 Wireless Remote Option. Included are technical descriptions, block diagrams and schematics for each of these two components. The wireless system is capable of providing remote control operation of the Power Console (PC100) within a 15-foot radius of the instrument.

2 Terminology

The following terms are used throughout this document:

Wireless Remote Control Unit (RCU)

The Wireless Option consists of a hand held, battery-powered transmitter and a receiver mounted within the Power Console (PC100). The Wireless Remote Control Unit (RCU) is the transmitter portion of the remote control sub-system.

Receiver Module

The Receiver module receives the RCU transmission, demodulates the signal and sends it to the PC100. It is field replaceable and easily accessible through the rear access door of the PC100.

Power Console (PC100)

The Power Console (PC100) contains the motors and electronics that comprise the core of the SurgASSIST System. The controls on the PC100 consist of a main power switch and a volume control. Pushbutton switches located on the Remote Control Unit (RCU) activate all other functions. The Wireless RCU keys duplicate those found on the wired RCU keypad.

3 General Description

All Wireless Remotes share the same transmit frequency, but each is preprogrammed with a unique identification code. When the RCU is used to start the PC100, its identification code is read and stored in memory by the PC100. This Power Console will then only respond to commands issued by its mated RCU, commands from any other RCU are ignored.

The Wireless Remote Control Unit (RCU) contains a permanently installed battery capable of supplying power throughout the life of the product. A hermetically sealed case allows the unit to be sterilized by a variety of methods, including autoclave.

The Receiver module is installed by plugging into a connector located behind the Power Console rear access panel.

4 Transmitter Technical Description (Wireless RCU)

Power Supply

A permanently installed 3.9-volt lithium battery supplies operating power to the Remote Control Unit (RCU). When one of its keypad switches is closed (depressed), current flows through the base of Transistor Q1, switching the negative terminal of the battery to circuit ground, turning ON the RCU. When all pushbutton switches are in the open state, the battery is completely disconnected from the circuit resulting in zero current drain. If any pushbutton is held down for more than 5 seconds, the micro-controller sets itself to the sleep mode, reducing battery drain and terminating the RF transmission signal.

Message Signal Generation

A one-chip micro-controller (U1) generates the data stream containing the transmission message. The message consists of the unique identification code (3 bytes), a Status byte containing the battery discharge state, a PC100 Command Message (2 bytes), the complement of the Command Message and the Transmission Packet Verification Code. All nine bytes are transmitted in approximately 40 milliseconds; the repetition rate is once every 100 milliseconds. Data rate is 2400 baud. The micro-controller automatically terminates the transmission at five seconds if the key is held depressed. Data output to the Radio Frequency Module is from U1 pin 17. A logic "1" turns the RF Carrier ON, a logic "0" turns the Carrier OFF. The RF Carrier remains OFF between the 40-millisecond messages.

RF Module (Transmitter)

The Radio frequency transmitter module (U3) incorporating a high performance SAW (Surface Acoustic Wave) design is manufactured by Linx Technologies. The module transmits data using CPCA (Carrier –Present, Carrier Absent) modulation. Data is input on U3 pin 1 from the micro-controller (U1) as described above. Resistor R14 sets the transmit output power level. The RF signal is coupled from U3 pin 5 to the Antenna Input (E2) pin 1. The antenna is resonant at the carrier frequency and is also manufactured by Linx Technologies.

5 Receiver Module Technical Description

Power Supply

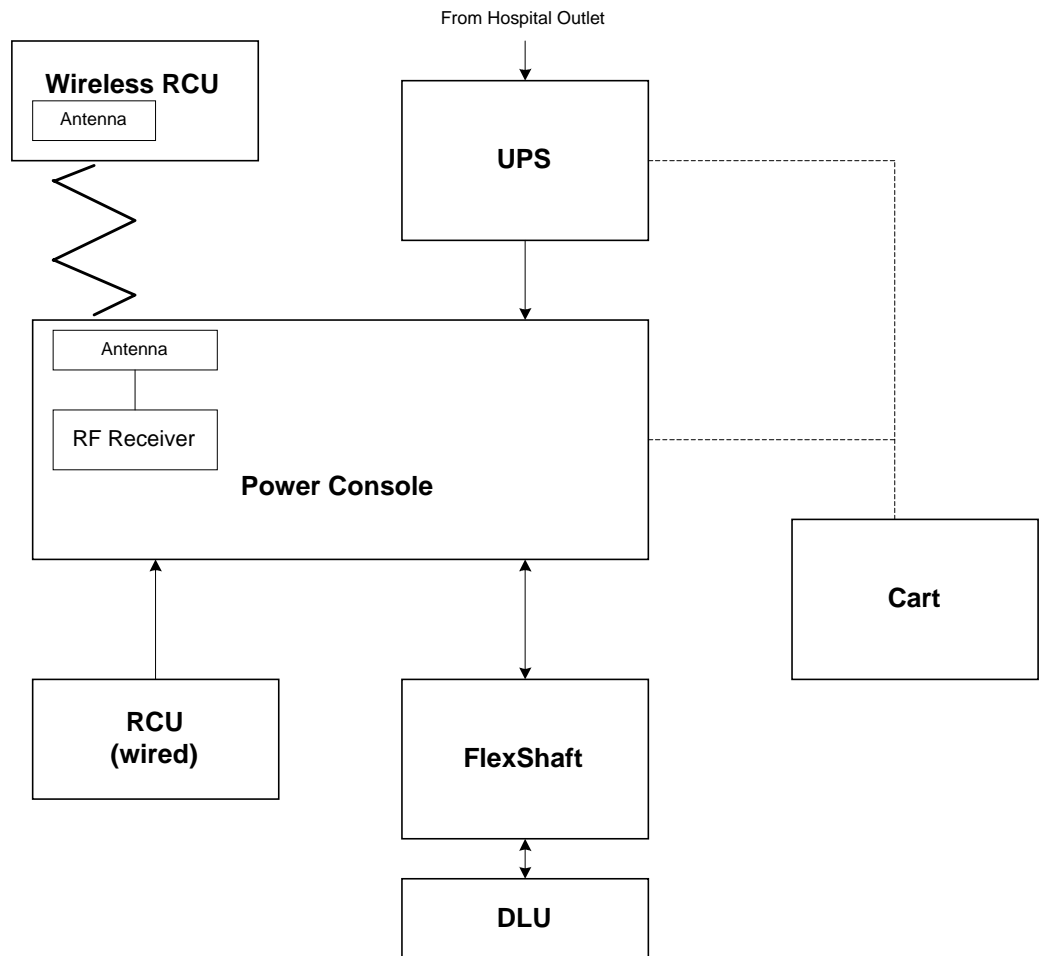
The receiver requires 5 volts and it is obtained from the PC100 Power Supply. The supply is filtered and decoupled by resistor R1, ferrite R2 and associated bypass capacitors C1 through C4.

RF Module (Receiver Component)

The Radio Frequency Receiver (U2) is manufactured by Linx Technologies. Its design incorporates high performance SAW (Surface Acoustic Wave) technology. Integrated onto the RCU receiver card is the antenna. The antenna is connected to the receiver input via an attenuator pad whose purpose is to reduce sensitivity to minimize interference from outside sources. Prior to startup, the attenuation is increased to prevent the Power Console (PC100) from detecting nearby RCU transmitters. Upon detection of the nearby RCU signal and by validating that a correct message was received, micro-controller U1 turns diode D1 off. The antenna attenuation factor is reduced, increasing receiver sensitivity. The PC100 is now "mated" to its RCU and will not respond to signals received from any other nearby RCU.

Message Signal Processing

A one-chip micro-controller (U1) receives the data stream containing the transmission message from the RF module (U2, pin 5). The message contents are as described in the RCU transmitter portion of this document. The transmitted data rate is 2400 baud to comply with Linx module specifications. One of the micro-controller functions is to convert the data stream to the 9600-baud rate required by the Power Console. The 9600 baud data stream is outputted on pin 2 of Connector P1 and applied to the Power Console for Command interpretation.



Appendix I

SurgASSIST System with Wireless Remote Control