5. Theory of Operation/Technical Description

Overview

The Digi-Linq transmitter is a component of the Beta Link system, designed for the maintenance and tuning of large engines and compressors. The Digi-Linq accepts signals from a rotary encoder, conditions them, and transmits a multiplexed signal to a receiver embedded in a remote diagnostic console. The Digi-Linq consists of a signal conditioning and battery charger PCB, STR-590 Digital Telemetry Radio Board, battery, and antenna.

The Digi-Linq is attached via a cable to a rotary encoder and accepts two pulse trains representing "Once Per Degree" (OPD) and "Once Per Turn" (OPT) timing. The OPT signal occurs synchronously every 360 or 720 occurrences of the OPD pulses. The STR-590 board transmit logic encodes these pulse trains into a scrambled digital representation and then transmits this information across a wireless link interface operating in the 915 MHz ISM band. A companion STR-590 board is embedded into portable remote diagnostic console. Operating in Receive-Only mode, this board receives the signal, de-multiplexes it and provides the recreated pulse trains for the diagnostic processing of the system.

The STR-590 Digital Telemetry Radio component is manufactured by:

SRI PMD, Inc.
751 North Drive
Melbourne, FL 32934

This board is integrated into the final Digi-Linq product and marketed by:

Dynalco Controls Corporation
3690 N.W. 53 Street
Ft. Lauderdale, FL 33309

Product Description

The STR-590 Digital Telemetry Radio Board is a product specifically produced for Dynalco Controls Corporation under a Technology Use Agreement with SRI/PMD. The basic operation of the system is depicted in the following top level block diagram.

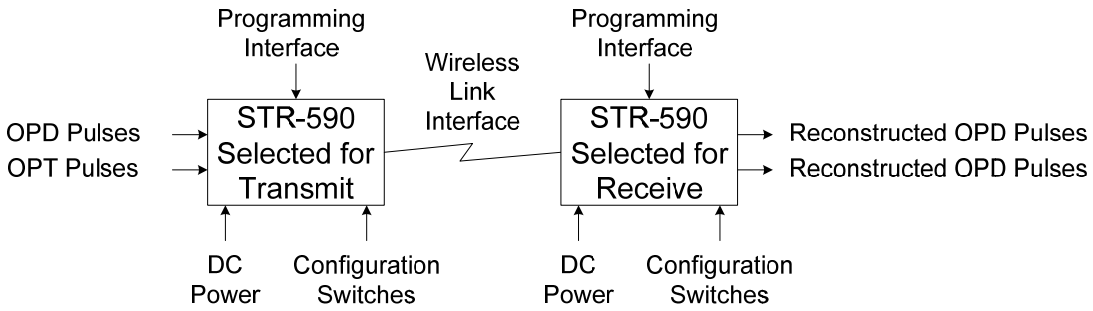

Figure 1 STR-590 Operational Block Diagram

On the transmit side, the system accepts a pulse train representing “Once Per Degree” timing (OPD) and a “Once Per Turn” timing (OPT). OPT occurs synchronously every 360 or 720 occurrences of the OPD pulses. The transmit logic encodes these pulse trains into a scrambled digital representation and then transmits this information across a wireless link interface operating in the 915 MHz ISM band.

Since the STR-590 operational environment is frequently plagued with high level interfering signals, an optional “spread-spectrum” mode of operation is supported. This capability reduces the effective sampling rate of the system, but provides enhanced communications noise performance.

The receive side captures the digital data stream and decodes the information to produce reconstructed OPD and OPT outputs. The receive logic automatically processes the despreading and descrambling of the encoded pulse data.

STR-590 Digital Telemetry Radio Normal Operation

When operating as a regular transmitter, the processor within the STR-590 samples the incoming OPD and OPT signals at the transmit bit rate. For non-spread-spectrum operational mode, this equates to a sample rate of approximately 152.3 KHz. For spread, it is at a rate of approximately 19 KHz. For OPD pulse periods without a corresponding OPT, the data passes the initial encode logic as is. When OPT occurs, the logic “blanks” the corresponding OPD pulse to indicate this occurrence. This is depicted in the top section of the figure on the following page.

On the receive side for this mode, the logic detects a period of a missing pulse and automatically reinserts the missing OPD. Concurrently, the OPT line is also driven high to indicate its occurrence. When operating in this mode, the logic drives an Error indicator line high any time the OPT is not detected to have occurred on exactly a 360 or 720 OPD timing basis. Otherwise, the Error line is driven low.

If the transmit logic detects OPT with no OPD pulses, it changes to where only the OPT pulse is transmitted. This is represented as a low going pulse as opposed to the normal high going pulses of the combined OPD/OPT operation. The receive side for this mode detects a normally high state and interprets this as a OPT only mode. In this case, the Error indicator line is driven high if the OPT to OPT pulse timing is indicating too much variance.

Not depicted in the diagram is the insertion of scrambling and direct spread sequencing. The first is required by FCC in order to be compatible with non-licensed spectrum requirements. The algorithm used for the data scrambling is self-synchronizing and thus requires no acquisition logic on the receive side.

Spread-spectrum operation is optionally added by a dip-switch selection. When active, the logic spreads the transmit data with a PN sequence which is in-turn recovered and despread on the receive side. This allows the communications link to tolerate significant RF interference and still produce good communications performance data results.

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