1/10/2007
Operational Description

The DIA-TRAC Product will be used to collect various types of data from a truck. This data is collected and stored in flash memory until the truck approaches a designated hub. At this point a communication link is established and the data is transmitted to the host server. The data will be transmitted to the server using a pair of 915 Mhz ISM Band frequency hopping radios.

The DIA-TRAC Product consists of two systems. The Truck System, which is used to collect, store, and transmit the data. And the Server Radio System, which is used to receive the data from the trucks, then to send the data to a Data Collection Server thru a RS-232 interface. The following is a list of components that make up each of the systems.

Truck System - The Truck system consists of the following:

1. Truck Radio Module
2. Antennae/GPS Dome assembly.
3. Wiring Harness to connect the Truck Module to Antennae/GPS Dome.
4. Wiring Harness to connect the Truck Module to the Sensors
5. Wiring Harness to connect the Truck Module to the J-Buss and +12 VDC power.
6. Current sensors and temperature sensor.

Server Radio System – The Server Radio System consist of the following:

1. Server Radio Module.
2. AC power adapter with +9 VDC out.
3. Antennae.
4. RF Cable to connect Server Module to antennae.
5. RS232 cable to connect Server Radio Module to a Server Computer.

The J1708 Controller Card, which is located inside the DIA-TRAC Truck Radio Module housing, is the device that gathers and stores the information. The various types of collected data would include:

1. J-Buss information. The J1708 Controller Card will collect data from the J-Buss system, which is standard on most of the trucks manufactured today. The DIA-TRAC system is configurable to collect any or all the data that is available from the J-Buss system.
2. GPS information. The J1708 Controller Card has a RS-232 interface to collect data from the GPS module. The controller card collects the time stamp and the location from the external GPS module.
3. Current data. There are 3 analog inputs connected to the DB-15 Analog Input Connector. These will be connected to current sensors to monitor various points of the trucks charge and discharge systems.
4. Temperature data. There is 1 analog input connected to the DB-15 Analog Input Connector. This will be connected to a temperature sensor to monitor the batteries temperature.
5. There is also an optional RS-232 interface labeled FPS on the box. This port is for future uses.

The J1708 Controller card (412-0990-000) uses a Phillips LPC2212FBD144 Microcontroller CPU (U13) to control all of its functions. The LP2212FBD144 uses a 14.7456 Mhz Crystal (Y2) to set the clock of the CPU. The operational program and the boot program are programmed into the LPC2212's internal memory. There is an additional memory device M29W641DH (U14), this is a flash memory

device used to store the accumulated truck data. Another flash memory device AT240C4(U11) is for future use. It is not used at this time.

The DS3777 (U25) is the J-Buss transceiver interface between the external connector P1, and the LPC2212 Microcontroller. This IC serves as a level translator between the trucks J-Buss system and the microcontroller.

The TL16C754BPN IC is a quad serial interface. This IC interfaces the GPS system (J8), the unused FPS connector (J9), and the interface to the 413-0002-000 Radio Board. This chip uses a 3.6864 Mhz crystal (Y3) to set the timing.

The Truck Radio Module will be powered by the battery system of the truck. The power supply input comes in on pins 7 and 8 of connector P1. This input voltage will be approx +12 to +14 VDC. The power input then goes thru a 1 amp fuse, a low pass filter and is applied to U27 a LT1076HVIR step-down switching regulator. The input voltage is converted down to +6VDC. The +6 VDC is routed to the 413-002-000 to provide power to the radio board. The +6VDC is also routed to U2 which provides +5VDC. The +5VDC is routed to U4 to provide +3.3VDC. The +3.3VDC is routed to U18 to provide 1.8VDC. All of the various power supply voltages are used to provide power to the components that populate the 412-0990-000.

413-002-000 915 Mhz Radio Board is also located inside the DIA-TRAC truck module housing. This board handles the communication between the J1708 Controller card and the Data Collection Server at the data collection area.

The 915 MHz Radio (413-0002-000) uses a Atmel Mega128 Microcontroller CPU (U9) to control all of its functions. The Atmel Mega128 uses a 14.7456 Mhz Crystal (Y1) to set the clock on the CPU. The operational program and the boot program are programmed into the Mega128's internal memory.

The AT45B011 (U2) is a 1Mbit SRAM memory chip used to store a new program if a software upgrade should become necessary.

The Chipcon CC1021 (U4) is the radio transceiver chip used to transmit and receive the data. The radio is programmed to transmit with the following specifications.

Frequency Band:	902-928 Mhz
Power Output:	.823Watt
Channel Separation:	500 Khz
Channel Bandwidth:	307Khz
Number of Channels	50
Hop interval	200 mS (198mS active dwell, 2 mS blanking period)
Hop Sequence	pseudo-random

The transmitted RF signal from the CC1021 is sent to a MAAPSS095 (U11). (U11) is a 1 watt power amplifier. The amplifier is turned on and off by the Mega128 CPU (U2). The control line from the CPU is connected to a SN74AHCT1G04 (U8) a single inverter buffer which controls a NDS352PCT mosfet switch (Q1). The switch is configured to bias the amplifier to its on an off state.

The amplified RF signal from (U11) is routed to the MASWSS0006 (SW2) RF switch. This switch is also controlled by the Mega128 (U2). The same control line from (U2) is used to control another SN74AHCT1G04 (U7). (U7) is used to toggle the RF switch (SW2) between transmit and receive modes. The amplified RF signal is routed thru (FL1) a 915 Mhz center frequency filter to the RF Output Connector (P1).

The DIA-TRAC Truck Module is programmed to gather the information and listen for a beacon. When the Truck Module hears the beacon, a program is run to establish a communication link. Once the link is established, the Data Collection Computer sends commands to the Truck Module. These commands are used to determine what data is to be sent. Next the appropriate data is sent to the Data Collection Computer.

The DiaTrack Server Module consists of a single board located inside the module. Inside the module is a 413-002-000 - 915 Mhz Radio Board. This is the same radio board located inside the DIA-TRAC truck module housing. This board handles the communication between the DIA-TRAC Truck module and the Data Collection Server.

The software on both the Truck Module and the Server Module is the same. The only difference between the operation of the Truck Module and the Server Module radio boards are:

1. The power supply for the Server Module is a +9VDC external AC Power Adapter.
2. RS232 transceivers (U5 and U3) on 413-002-000 are populated along with connector J1 to allow an external interface with the Server Computer.
3. The Truck Module Radio board is programmed to have a unique 12 digit identification code. This code is used to identify each individual truck.

INSTALLATION

THIS PRODUCT IS TO BE PROFESSIONALLY INSTALLED ONLY

THIS EQUIPMENT COMPLIES WITH PART 15 OF THE FCC RULES. ANY CHANGES OR MODIFICATIONS NOT EXPRESSLY APPROVED BY THE MANUFACTURER COULD VOID THE USER'S AUTHORITY TO OPERATE THIS EQUIPMENT.

THIS EQUIPMENT COMPLIES WITH PART 15 OF THE FCC RULES. OPERATION IS SUBJECT TO THE 2 FOLLOWING CONDITIONS: (1) THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE, AND (2) THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING INTERFERENCE THAT MAY CAUSE UNDESIRED OPERATION.

USER'S GUIDE

There is no User's Guide required as this is a passive data collection device that requires no operational activity as defined for the user of this product.