Certification Exhibit

FCC ID: V5E-DCX
IC: 7620A-DCX

FCC Rule Part: 15.249
IC Radio Standards Specification: RSS-210

ACS Report Number: 07-0246 - 15C

Manufacturer: Applied Mesh Technologies, LLC
Model: DCX iDEN, DCX CDMA

Installation Guide

DCX
(Direct Connect External)

OPERATIONS GUIDE
Remote Metering,
Monitoring and Control

APPLIED MESH TECHNOLOGIES

Table of Contents

Safety Instructions/Warning Information

The DCX is intended to be installed and maintained by trained and/or qualified technicians. The input voltages needed to operate this equipment are extremely dangerous to the inexperienced person. For this reason, it is strongly recommended that only those persons who have advanced technical training service the DCX and attached equipment.

These instructions are not intended to be a substitute for proper training and experience. Please take note of the following safety information. For safe installation and operation of this equipment, be sure to read and understand all cautions and warnings.

WARNING: This equipment is not intended to protect human life. Follow all locally approved procedures and safety practices when installing or operating this equipment. Failure to comply can result in death, severe personal injury and equipment damage.

DANGER: Hazardous voltage. Contact with hazardous voltage will cause death or severe personal injury. Follow all locally approved safety procedures when working around high and low voltage lines and equipment.

WARNING: Before installing, operating, maintaining, or testing this equipment, carefully read and understand the contents of this manual. Improper operation, handling or maintenance can result in death, severe personal injury, and equipment damage.

WARNING: Power distribution equipment must be selected for the intended application. It must be installed and serviced by competent personnel who have been trained and understand proper safety procedures. These instructions are written for such personnel and are not a substitute for adequate training and experience in safety procedures. Failure to properly select, install, or maintain this equipment can result in death, severe personal injury, and equipment damage.

Introduction

Applied Mesh Technologies has created the DCX (Direct Connect eXternal) unit. This device is a small, communications interface unit that connects to any solid-state meter via a standard RS-232 connection. While originally created to serve as a metering communication gateway, providing two way communication services for the retrieval of meter data (register, interval and power quality); the DCX has found applications in Load Control, SCADA, Distribution Automation, Power Quality Monitoring, Outage Notification and other uses requiring robust, hardened communication services.

Figure 1: Typical DCX with Antenna

Features

The DCX offers many advantages over other competitor's products including flexibility in WAN communications. WAN communication networks supported include digital cellular (iDEN, CDMA and GSM) and Ethernet. Each of these WAN options all have been integrated and are being used for communicating data from the DCX back to a customer's location. The customer simply chooses the WAN option that offers the best rate plan or coverage.

The DCX also includes LAN communications via Bluetooth™. Each unit comes equipped with the ability to act as a "host" or "client". For example, using one DCX with a cellular modem (host), up to ten other DCX units can be connected to meters (clients) with no modems. In this way, monthly communication costs are minimized because only one modem is needed to read all the meters. Figure 2 shows this architecture:
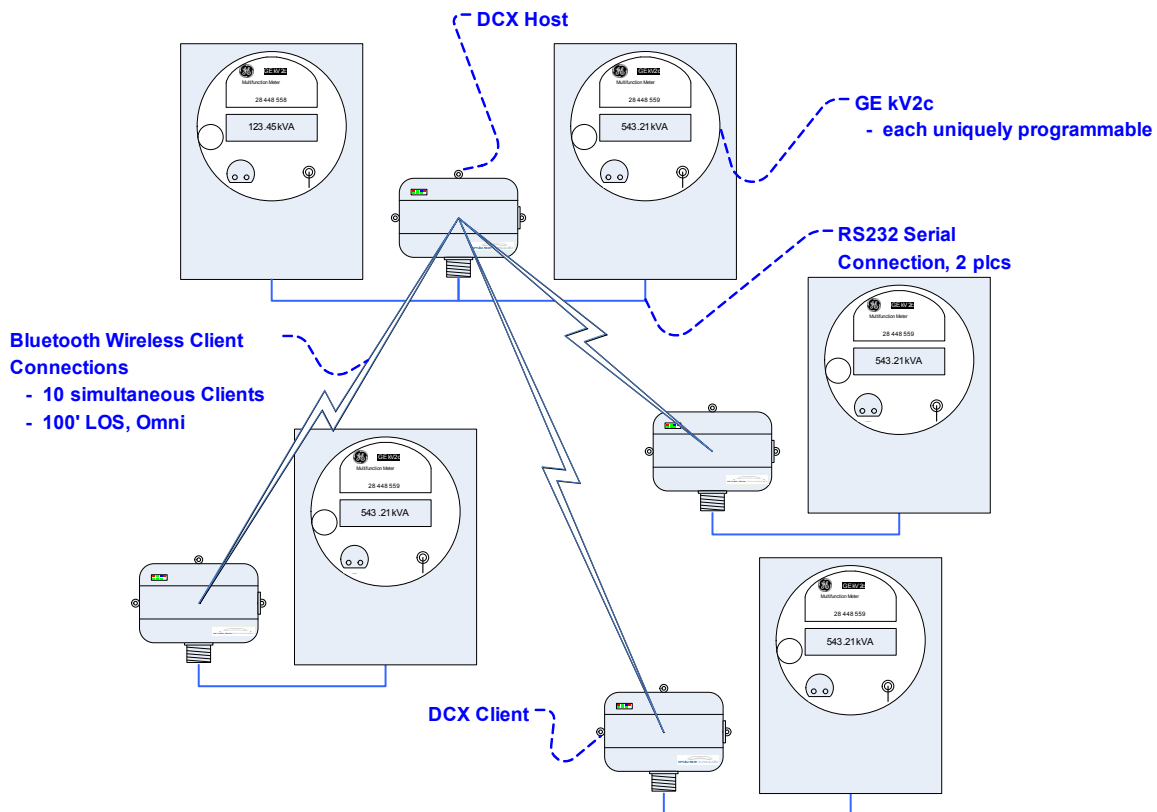

Figure 2: DCX Modem Host Client Connections

Features

Each individual DCX unit hosts it's own web server. Using the units' installed modem IP, the user can gain access via any internet web browser. This feature was originally added to benefit the installer. By using the onboard web server, the installer could test communications and verify valid data. The web server can be completely customized to user specifications and formatted to work with any application.
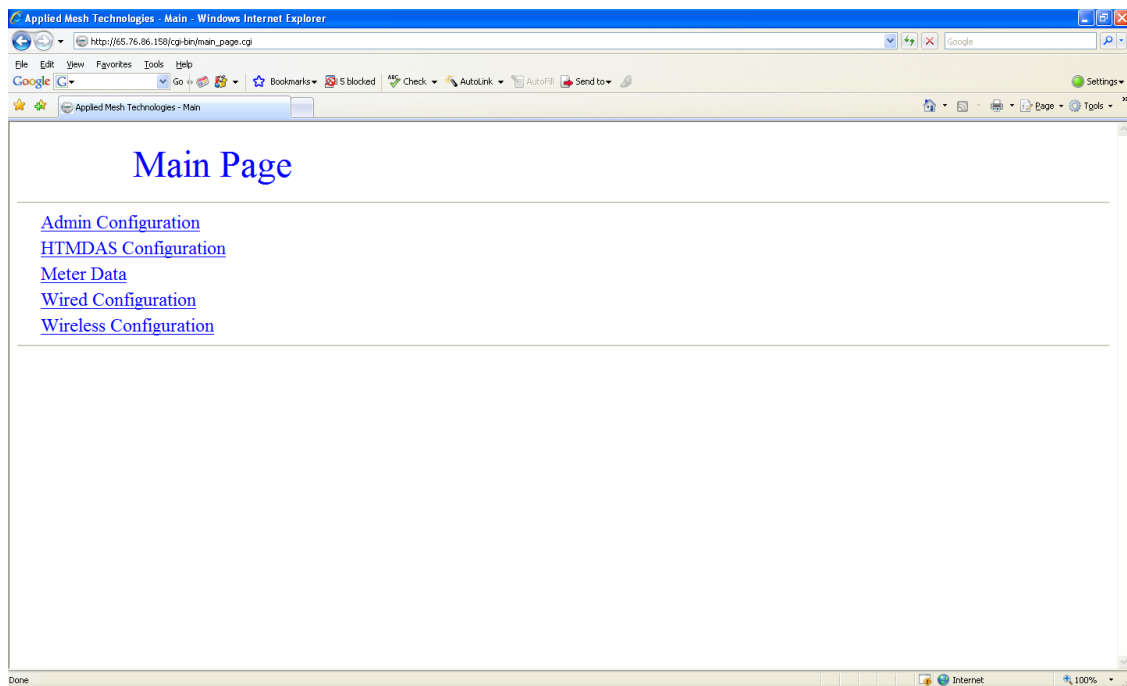

Figure 3: Standard Main Page

A copy of a typical main web server page is shown in Figure 3. From this page, a number of configuration pages can be accessed as well as the meter data page.

Features

The Wired Configuration page, as shown in Figure 4, is used to configure serial port and TCP settings for specific serial communication. The TCP Direct Connect Port is the user-entered port through which the meter will be read using MV-90 or similar meter management software packages. The meter password can also be entered on this page to allow the user to test the meter communication for certain meters.
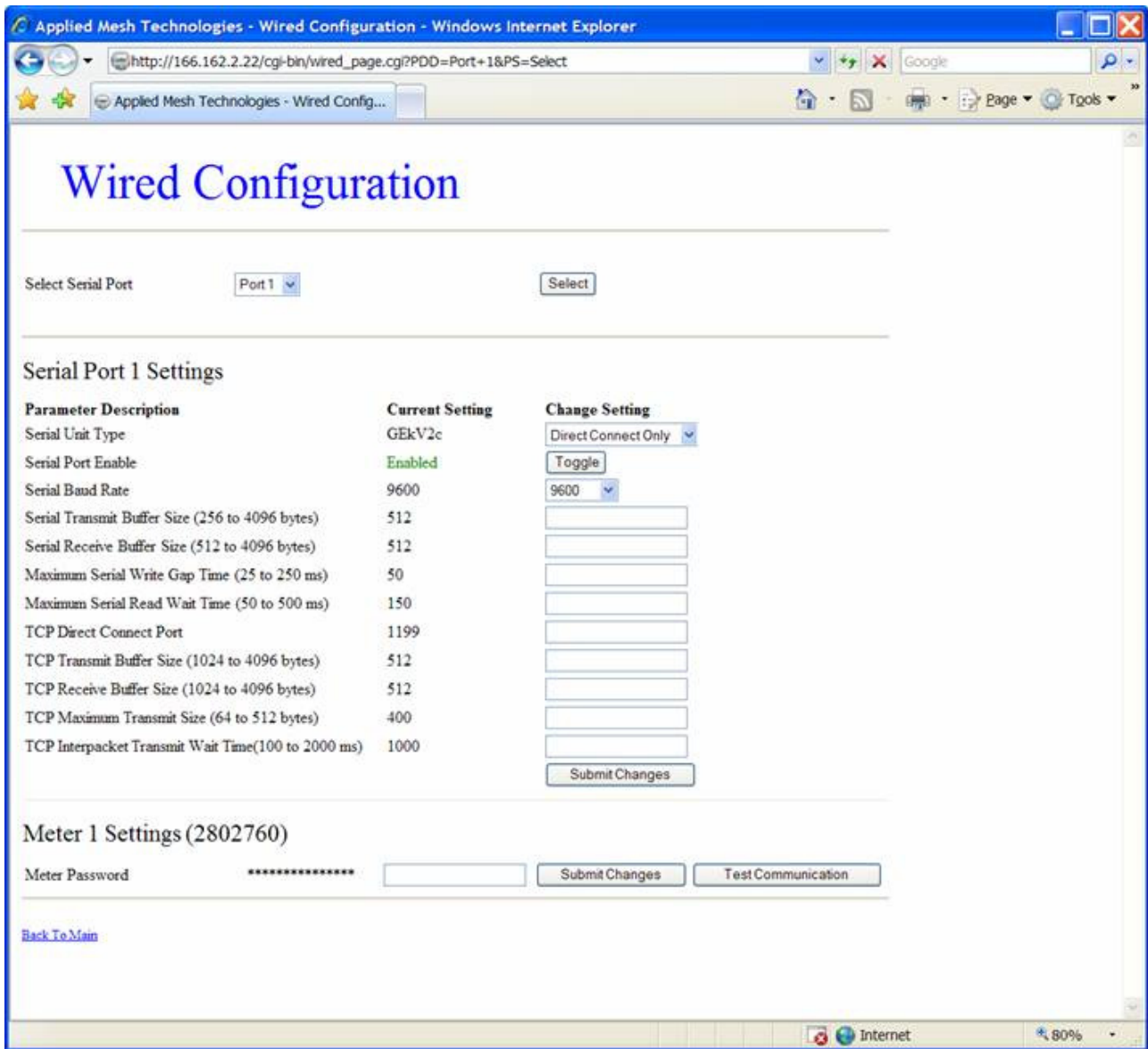

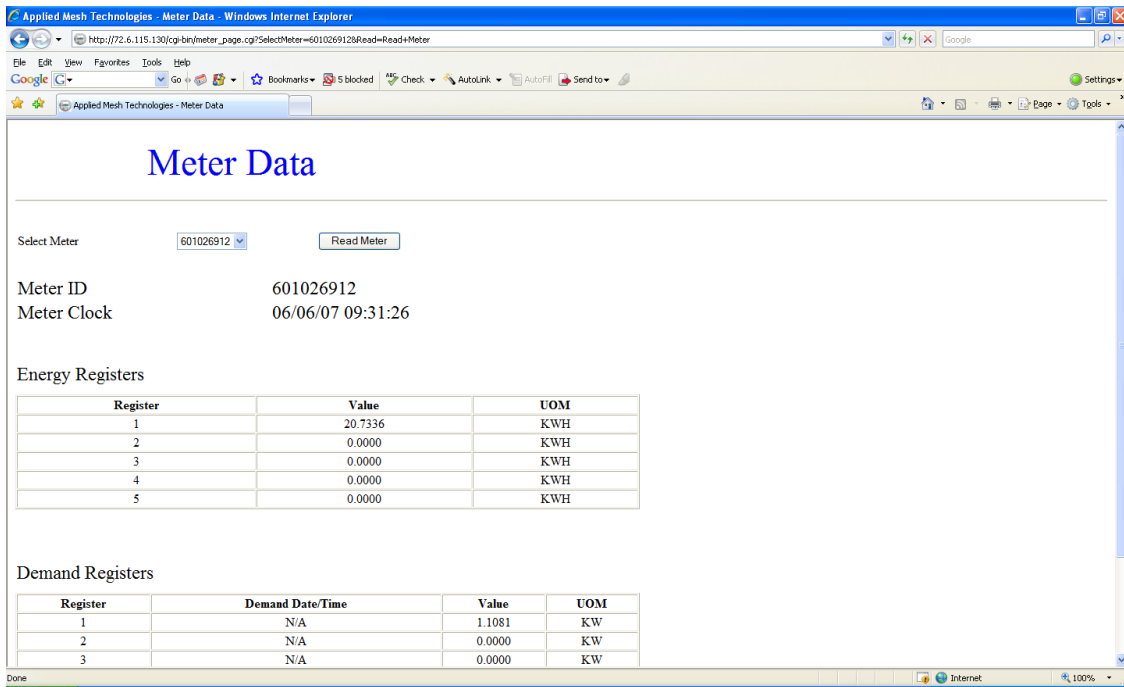**Figure 4:** Wired Configuration Page

Features

Figure 5: Retrieved Data From Meter

Data retrieved from a particular meter is depicted in Figure 5. This type of information is critical for the metering engineer or technician who will to test the DCX after installation.

Connections

Figure 6 shows two meters connected to the DCX via a RS-232 connection. Up to four meters can be connected to the DCX via RS-232, reducing redundant communication costs. Two meters can be connected with the standard, single, serial board provided in the DCX. An optional serial board is required to connect two additional meters. Figure 6 shows a typical location where two meters are installed and one DCX is connected serially.

Figure 6: Two Connected Meters

The firmware in the DCX is capable of being updated over the air (OTA). Thus, if an additional feature or capability is desired by the customer, this can be implemented without having to physically visit the unit. The unit can be updated by sending the code update over the wireless connection.

An optional relay board can be connected to the DCX transforming it into a powerful control device. The relay board is equipped with two latching relays allowing the equipment to be started and/or stopped remotely.

Unit Components

The standard DCX unit is made up of six circuit boards. The circuit boards are each identified and described below:

AC Input

The AC Input board is the connection point for AC power and serves as the surge protection point for the DCX. The AC input was designed for input voltages of 85 to 305 VAC and can withstand surges of 6,000 volts. This board also provides monitoring points for incoming AC voltage.

AC to DC Power Supply

AC power leaves the AC Input board and travels to the AC to DC Power Supply board. Here, the incoming AC voltage is stepped down to 4.8 volts DC for use by the DCX's other circuitry. The AC to DC Power Supply board also monitors the incoming voltage and relays a message to the other DCX circuitry if AC power fails.
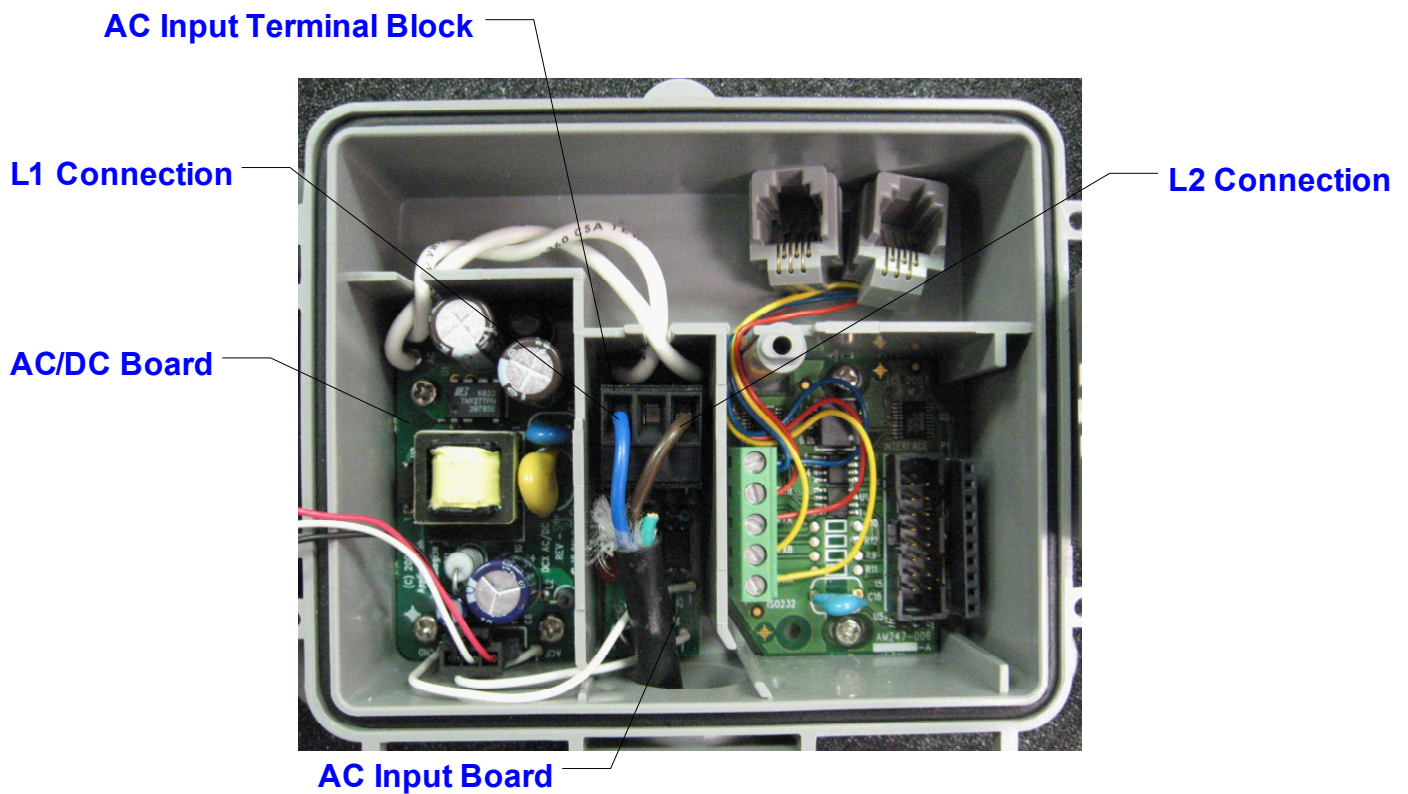

Figure 7: AC to DC, AC Input, and Serial Boards

Unit Components

DC to DC Power Supply
The DC to DC Power Supply takes the 4.8 volt input and uses it to create several other DC voltages. The additional voltages are used as a power sources for the microcontroller, the Bluetooth™ and the modem. The DC to DC Power Supply board also hosts the Bluetooth circuitry. Also, this board includes two super capacitors that will engage if a loss of incoming power is detected at the AC to DC Power Supply.
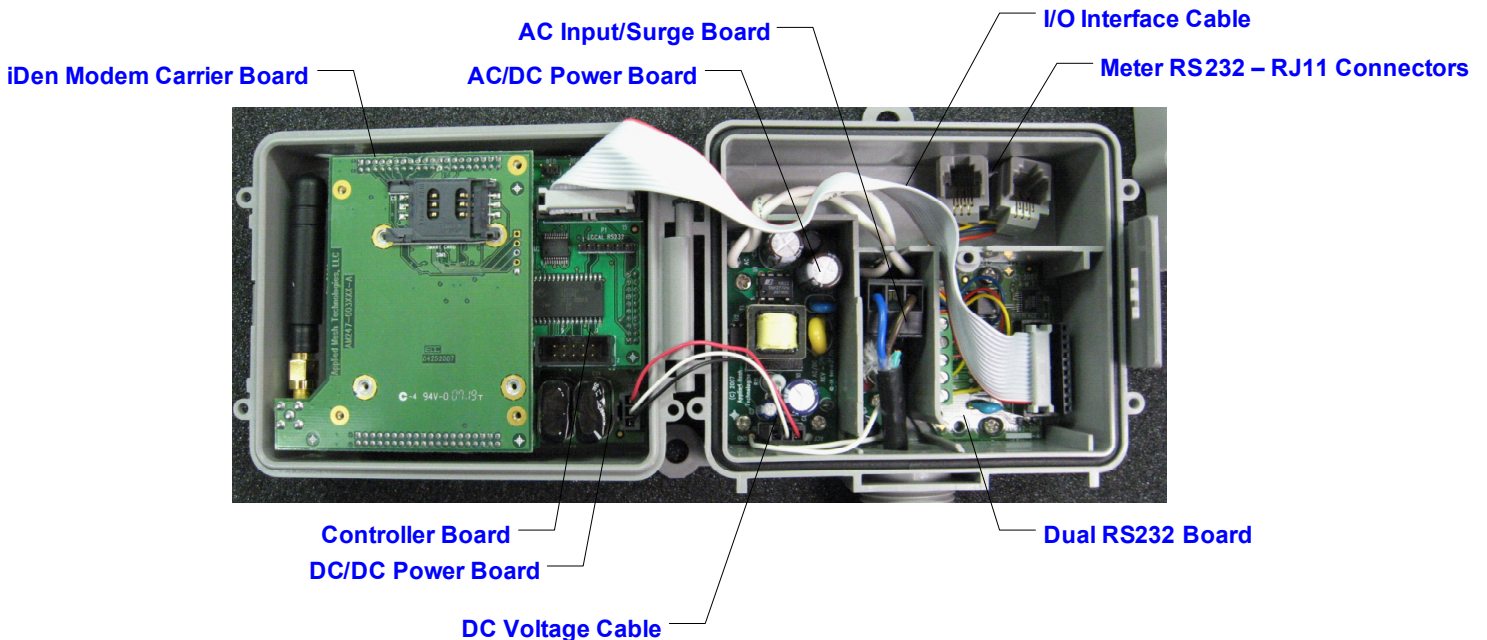

Figure 8: DCX Components

Controller
The Controller board contains the "brains" of the unit. This is where the microprocessor and memory reside.

Carrier
The specific Carrier board can be interchanged depending upon the particular WAN communication desired. Figure 8 above shows an iDEN (Nextel) modem Carrier board after it is installed. To date, AppMesh offers a solution for Nextel (iDEN), Southern Linc (iDEN), Verizon (CDMA), Sprint (CDMA), and Ethernet.

Unit Components

RS232 Serial

The RS232 Serial board is the connection point for all hard wired devices. Using a the standard three wire connection (transmit, receive and ground), the unit can easily be interfaced. Figure 9 below shows two female RJ11 connectors wired to the isolated RS232 Serial board ready for connection to two meters.
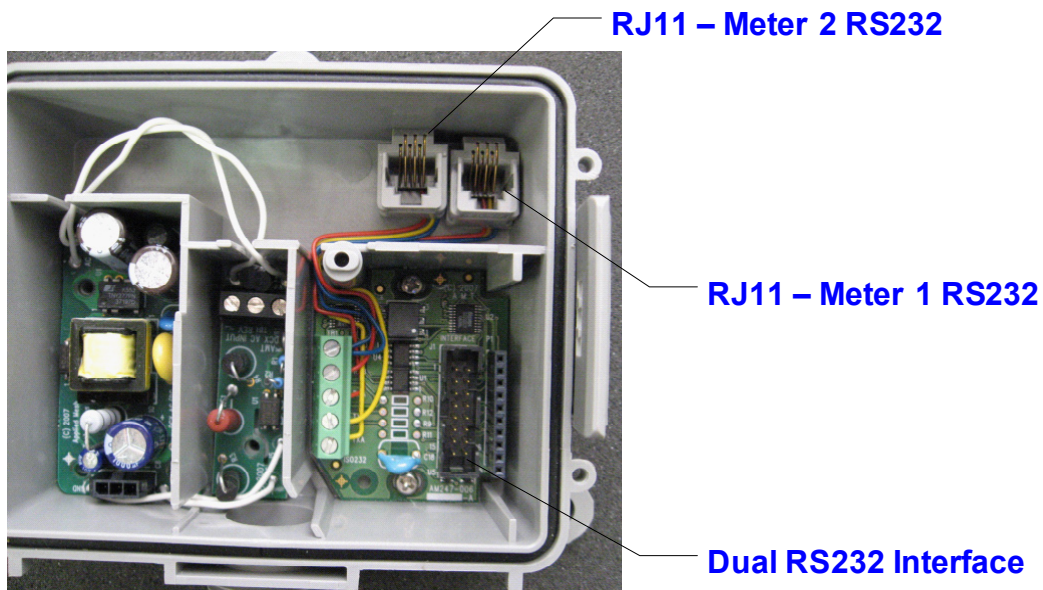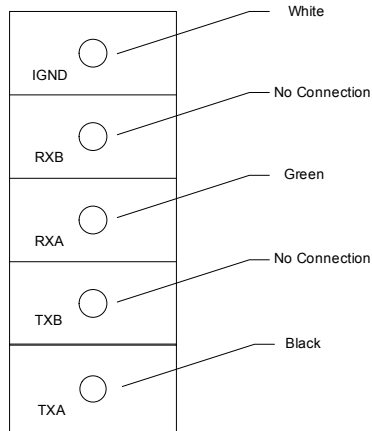

RJ11 – Meter 2 RS232

RJ11 – Meter 1 RS232

Dual RS232 Interface
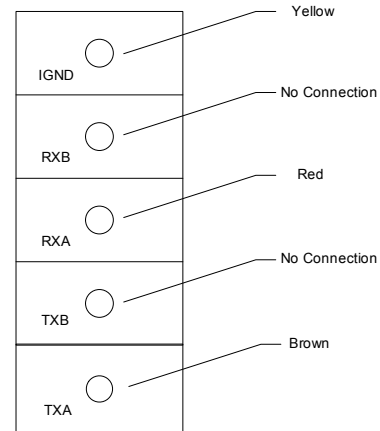
Figure 9: RS232 Serial Board and Connections

Unit Components

Single Meter Connection

GE kV2 or kV2c Meter with male RJ11 connector on cable
Remove RJ11 connector and wire per diagram

IGND — White
RXB — No Connection
RXA — Green
TXB — No Connection
TXA — Black

GE kV2 or kV2c Meter with male DB9 connector on cable
Remove DB9 connector and wire per diagram

IGND — Yellow
RXB — No Connection
RXA — Red
TXB — No Connection
TXA — Brown

Elster A3 Meter with male RJ11 connector on cable
Remove RJ11 connector and wire per diagram

IGND — Green
RXB — No Connection
RXA — Yellow
TXB — No Connection
TXA — Red
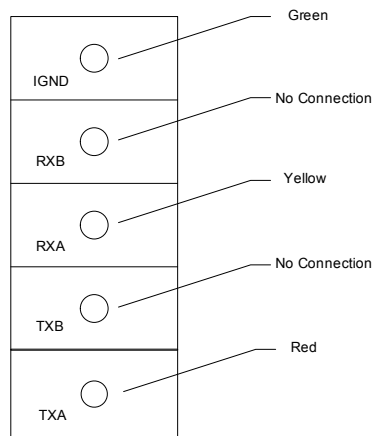
L+G S4e Meter
Wire per diagram

IGND — Black
RXB — No Connection
RXA — Red
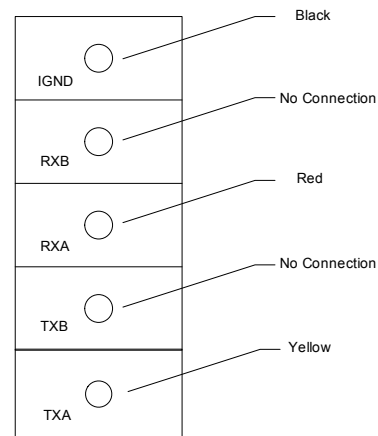TXB — No Connection
TXA — Yellow

Figure 10: RS-232 Connection Diagram to AppMesh DCX Isolated Serial Board from the Meter

NOTE: Any solid-state meter can readily be connected to the DCX serially using a three wire connection (transmit, receive, and ground). The above connections are for several common meter types. Please consult the meter manufacturer's manual for the correct connections. Dual meter connections are completed using the same wiring configurations shown above but use terminals RXB and TXB with IGND being shared by both meters.

LED Indicators

The DCX is equipped with a clear viewing window on the upper left side. Inside this window are a various status LEDs that provide an indication of several different operations including: modem registration, signal strength, Bluetooth™ connection and faults. Figure 11 explains what the different LEDs indicate.

Registration
Looking at the front of the DCX with the cover closed, the upper left green LED and the lower left red LED indicate registration. If the lower left red LED is on, the modem has not completed initialization. Once the modem has been powered up and initialization complete, the lower left red LED will be off. When the modem is registered, the upper left green LED will blink slowly. For iDEN modems (Nextel or Southern Linc), the upper left green LED is solid when a data call is in progress and communication is taking place. For CDMA modems (Sprint or Verizon), the upper left green LED blinks rapidly when a data call is in progress and communication is taking place. For CDMA modems if the upper green LED is solid, then the modem is no longer registered on the carrier's network; it returns to blinking slowly when the modem re-registers on the network.

Fault LED
A fault LED is located in the upper right hand corner. This LED is on during the DCX initialization and will turn off when initialization is complete and the DCX ready to use. This LED may also turn on during operation if a fault is detected.
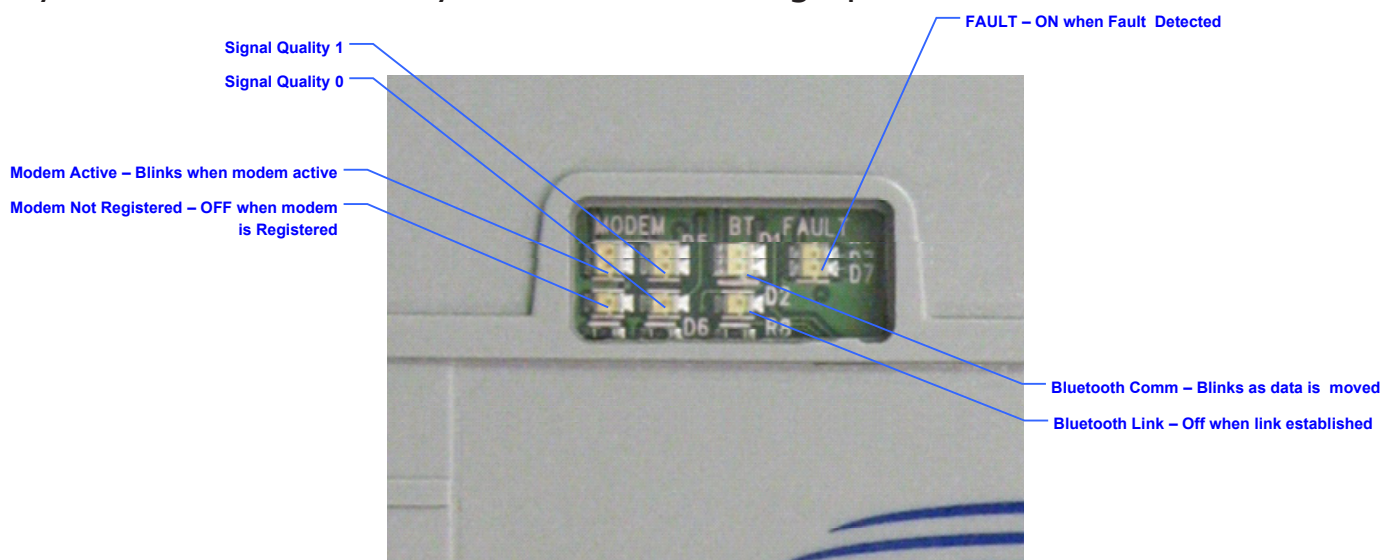

Figure 11: LED Window

LED Indicators

Bluetooth Connection
Directly to the right of the signal strength LEDs are two LEDs that are used for Bluetooth™ operation. The top LED here is blue and indicates that Bluetooth™ communications are enabled. This blue LED will flash quickly when Bluetooth™ communications are underway. Directly below the blue LED is a red LED that also indicates an actual Bluetooth™ connection. This red LED will turn off when a Bluetooth™ communications session begins.

Signal Quality
There are two LEDs that indicate signal quality. These LEDs are the top and bottom pair located immediately to the right of the registration LEDs. When the DCX has poor service, neither of the signal quality LEDs will be on. If the DCX has fair service, the bottom signal quality LED (SQ0) will be on. Good service is denoted when the top signal quality LED (SQ1) is lit only. Finally, signal strength is excellent when both the signal quality LEDs are lit. Table 1 illustrates the different signal strengths.

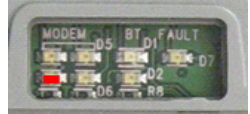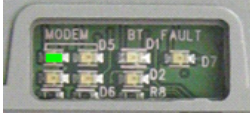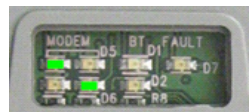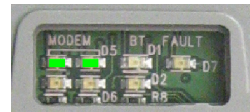**NOTE:** The top left green LED will be blinking slowly if the modem is registered.

Signal Quality LED Encoding				
LED Photo	Modem Registered	SQ1	SQ0	Signal Quality
	NO	OFF	OFF	No Service
	YES	OFF	OFF	Poor
	YES	OFF	ON	Fair
	YES	ON	OFF	Good
	YES	ON	ON	Execellent

Table 1: LED Signal Indication

General Specifications

Overall Dimensions: 4.5"x 3.75"x 2.5"

Enclosure Material: Lexan 503R

Rating: NEMA 3, UL916

Temperature: -40˚ to +65˚ C

AC Input: 85-305 VAC (2W Max)

Automatic Discovery of Clients

Built in Watch Dog with Hardware Restart

Self Registration on Cellular Network

Firmware Update Over-the-Air

FCC & Industry Canada Certification

WARNING: Changes or modifications to this device not expressly approved by Applied Mesh Technologies, LLC could void the user's authority to operate the equipment.

"**NOTE:** This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

· Reorient or relocate the receiving antenna.
· Increase the separation between the equipment and receiver.
· Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
· Consult the dealer or an experienced radio/TV technician for help."

"This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter."

FCC & Industry Canada Certification

This Class B digital apparatus meets all requirements of the Canadian Interference Causing Equipment Regulations. Operation is subject to the following two 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.

Cet appareillage numérique de la classe B répond à toutes les exigences de l'interférence canadienne causant des règlements d'équipement. L'opération est sujette aux deux conditions suivantes: (1) ce dispositif peut ne pas causer l'interférence nocive, et (2) ce dispositif doit accepter n'importe quelle interférence reçue, y compris l'interférence qui peut causer l'opération peu désirée.