

UE Multiplexer

User Guide



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1.0 Introduction

Purpose of the Guide

This guide provides the information needed to set up, configure and use the TellCore UE Multiplexer.

Intended Audience.

This guide is intended for anyone that wants to integrate TellCore's UE Multiplexer into their test system.

Overview

TellCore's UE Multiplexer is a simple to use solution for expanding the test automation capabilities of any wireless test system.

Traditional wireless test systems can only test a single device at a time. Since these tests can take many hours to complete, it is normal for a device to complete the tests during non-working hours. Unless the system is manned 24/7, the test system will sit idle for several hours each day.



Figure 1-1. UE Multiplexer

The UE Multiplexer allows for multiple devices to be connected and provides the test manager the ability to programmatically select which device is connected through to the test system. By queueing up multiple devices for test this allows the test system to be fully utilized, reducing overall testing cycle times and saving money.

An individual UE Multiplexer supports connections for up to 4 devices. Device connections consist of a USB connection and 1 or 2 RF connections for single or dual-antenna devices. This allows the UE Multiplexer to be used with a wide variety of test systems with different RF requirements (e.g. 2x2 MIMO, Rx Diversity, Tx Diversity, etc...).

2.0 Getting Started

What's in the box

When you unpack TellCore's UE Multiplexer you should find the following item:

- TellCore UE Multiplexer
- 24v Power Supply
- Region Specific Power Cable
- Ethernet Cable, 6-foot
- USB Cable, 6-foot (Qty. 2)

If there is anything missing or damaged, please contact our customer support team for assistance.

Control Mechanisms

There are 3 ways to control the UE Multiplexer:

1. The Front Panel
This is limited to the 'Select' push button, which allows for manual selection of which of the 4 devices is connected through to the test system.
2. The UE Multiplexer Manager software
This provides a simple GUI to the user to manually configure the unit. This uses the USB control port on the rear panel.
3. The Remote Control Interface (RCI)
This provides a Telnet server and command set to the user to support both manual and programmatic configuration of the unit. This uses the Ethernet port on the rear panel.

The anticipated majority use case for the UE Multiplexer is as a fully integrated resource in the user's test system. The user's Test Manager software shall programmatically control the unit using the RCI.

The unit may be initially connected to via a Telnet session utilizing the command set described below in the RCI chapter. The UE Multiplexer factory default assumes a private network with the unit IP Address set to 192.168.0.1.

For first use, the UE Multiplexer Manager software (connected via USB) may be a more convenient method for initial introduction to the unit. This is discussed next.

UE Multiplexer Manager Installation

The UE Multiplexer Manager application software must be installed onto a Windows computer. The UE Multiplexer Manager application has been tested with the following Microsoft operating systems:

- Windows XP (32 bit)
- Windows 7 (32 bit)
- Windows 7 (64 bit)

The latest version can be found on our web site: www.tellcore.com

Download and run the setup.exe to start installing the application. Follow all of the instructions to complete the installation. Once the installation has completed, start the application and the following window should now be visible.

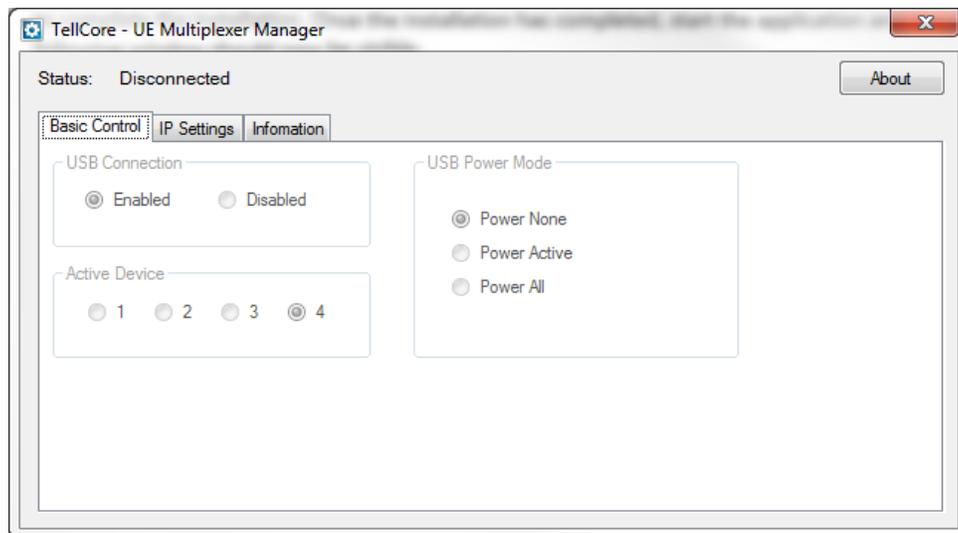


Figure 2-1: UE Multiplexer Manager Application

Connect the computer to the USB control connector on the *rear* of the UE Multiplexer, using the supplied USB cable.

Connect power to the UE Multiplexer and turn it on using the front panel Power switch. You will see all the lights on the front panel as yellow until the power-up process completes (approx. 2s), at which point LED 1 will transition to green indicating device 1 as the Active Device (the system default).

Once the UE Multiplexer is powered up, the UE Multiplexer Manager application will auto-detect its presence and should now show the Status as 'Connected'. The GUI controls shall also become enabled allowing you to manually operate the UE Multiplexer from the Manager.

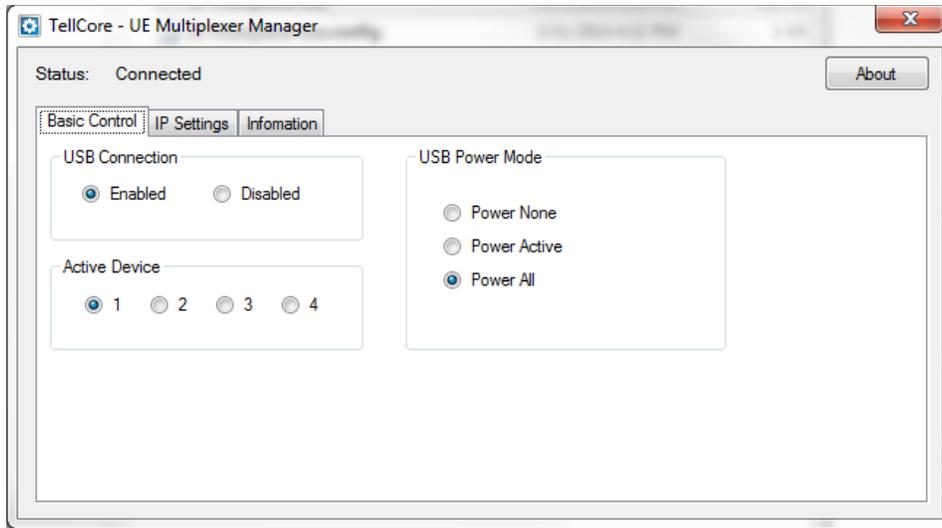


Figure 2-2: System Management - Basic Control

3.0 Basic Operation

The UE Multiplexer connects a test system to one of four test devices via USB and 1 or 2 RF connections, as the following image indicates.

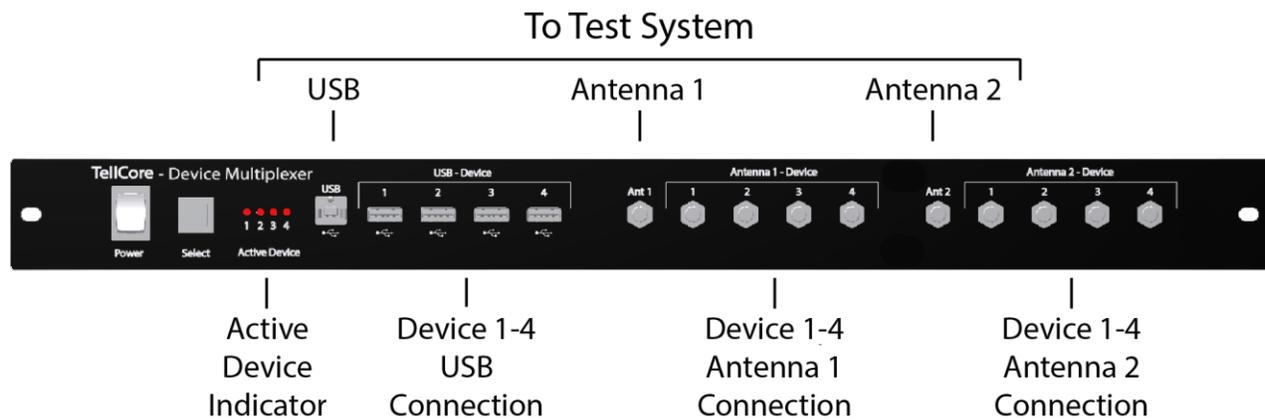


Figure 3-1 Test System Connections

Active Device selection

Only one device can be connected through to the test system at a time - the 'Active Device'.

The Active Device will be connected via

- a USB connection for control and power;
- two RF connections for a single or dual antenna test configuration;

The device selection can be made from the front panel using the 'Select' push button. This push button cycles the Active Device from Device 1 through 4 incrementally per push.

This functionality is also available using the Remote Control Interface and the UE Multiplexer Manager.

USB Data Connection

A feature of the UE Multiplexer is the ability to programmatically engage or disengage the USB data connection of the Active Device.

It is not uncommon that during testing a device may stop responding to USB commands. If this occurs, traditionally the test will fail and the test system will remain idle until an operator resets the USB connection and restarts the test.

This feature is made available so that the test system, upon detection of a non-responsive device, can programmatically reset the USB by disabling and re-enabling the USB connection. This valuable feature increases the likelihood that a device can complete the testing without human intervention. This increases utilization of the test system, saving time and money.

This functionality is also available using the Remote Control Interface and the UE Multiplexer Manager.

USB Power Connection

A feature of the UE Multiplexer is the ability to programmatically control whether USB power is provided to connected devices. To support this, USB power to devices is sourced from the UE Multiplexer rather than the control PC.

This feature allows for

- charging of all attached devices;
 - All devices can have power applied for charging purposes, allowing them to be fully charged and ready for testing.
- disconnection of power from devices;
 - Power can be disconnected from devices, which may assist in device reset or for tests such as Battery Life Testing.

The Power Mode control functionality is available via the Remote Control Interface and the UE Multiplexer Manager.

Active Device Indicator

A bank of 4 LEDs provide a visual indication of the configuration state of the unit. The following table describes how the LED state should be interpreted.

Green	Current Active Device; USB Charging Enabled;
Red	Current Active Device, USB Not Charging;
Yellow	Not Active Device; USB Charging Enabled;
Off	Not Active Device; USB Not Charging

Table 3-1: LED Indicator Color Chart

4.0 Remote Control Interface

The Remote Control Interface provides for user control of the UE Multiplexer via a Telnet interface. This interface provides a simple string-based command set for ease of human interaction via a console application and for automated control in user-defined test applications.

The Ethernet jack on the rear panel shall be used for this application.

Ethernet Configuration

An initial connection can be made to the UE Multiplexer based upon the factory default static IP Address. The unit's IP settings are thereafter configurable via the Telnet command set (described below). Alternatively these parameters may be changed via the UE Multiplexer Manager in Administrator mode.

Configurable parameters

NOTE: A change to any of the IP settings will not take effect until the unit is powered down and then rebooted, regardless of the change mechanism. These changes will then persist from one power cycle to the next unless subsequently changed.

IP Mode

There are 3 modes of operation for the Ethernet on the UE Multiplexer:

Static (default)

The user can configure a fixed IP Settings for the unit.

DHCP Client

The UE Multiplexer will acquire its IP Settings from a DHCP Server on the test network.

DHCP Server

The UE Multiplexer acts as DHCP Server and assigns an IP Address to a connected control PC. This mode is ONLY for use in a standalone **one-to-one connection** with a controller PC. ***This must not be used in a networked environment.***

IP Address

The IP Settings are utilized in the Static and DHCP Server modes of operation only. They reflect the static settings assigned by the user

The IP Address, Subnet Mask and Gateway are configurable. These values are utilized as the static address for the unit in the Static and DHCP Server IP Modes.

For DHCP Client mode, the active address information will be provided by the network. The static settings remain available for use if and when the IP Mode is subsequently changed to one of the other modes.

IP Port

This is the port address on the unit used for the Telnet session.

Default Settings

The factory default settings upon first use of the instrument are as follows:

IP Address	192.168.0.1
Subnet Mask	255.255.255.0
Gateway	192.168.0.1
IP Mode	STATIC
IP Port	9760

Table 4-1 IP Settings factory defaults

Reset to Factory Default

If the user wishes to reset the UE Multiplexer back to the original factory defaults use the following procedure.

1. Power down the UE Multiplexer.
2. Press and hold the 'Select' button on the front panel while powering on the unit.
3. Continue to hold the 'Select' button until the LEDs indicate RED.
4. Release the 'Select' button and the UE Multiplexer will be reset to defaults.

Command Set

This section describes the command set available in a Telnet session.

Note

- Upon connection to the Telnet server the user will be presented with a command line prompt: "UEMux>"
- Each command if typed with a question mark (example: "POWER?<return>") will present a description of the command usage and parameter range.
- A successful command execution will result in a response of: "OK"<new line>"UEMux>"
- A failed command will result in an error indication replacing the "OK"

Operational Commands

These commands provide the control necessary for the basic operations of the unit.

'SELECT'

Selects the active device. This switches both the USB and RF connections.

Range: 1 to 4

Default: 1 – Device 1 is Active

Example: SELECT=2<return>

'CONNECT'

Sets the USB connection state for the active device. This command enables the USB connection to be connected and disconnected without changing the RF switches.

Range: 0 – Disconnect USB for active device
1 – Connect USB for active device

Default: 1 – Connected

Example: CONNECT=1<return>

'POWER'

Sets the USB power mode of the UE Multiplexer. This determines which of the user devices connected to the UE Multiplexer receive USB power.

Range: ALL – All connected user devices are powered
ACTIVE – Only the active (selected) device is powered
NONE – None of the user devices are powered

Default: ALL – All connected user devices are powered

Example: POWER=ACTIVE<return>

'BUTTON'

Enables or disables the front panel push button for selecting Active Device. This allows automation control software to protect against accidental and undesirable human intervention during a test.

Note: The push button will be automatically re-enabled once the UE Multiplexer is power cycled.

Range: 0 – Disables the front panel button
1 – Enables the front panel button

Default: 1 – All connected user devices are powered

Example: BUTTON=1<return>

IP Commands

'IP_MODE'

Sets the IP mode to be used by the UE Multiplexer. The default IP mode is the Static IP address.

Note: DHCP Server should be used ONLY in the context of a standalone one-to-one direct connection to the controller PC. It supports only the UE Multiplexer and should not be placed on a network with other equipment or another DHCP Server. In this mode the connected computer will be assigned an IP address by the UE multiplexer. This value will be 1 higher, than the programmed IP address (i.e. if the UE Multiplexer is programmed with 192.168.0.2, this will assign 192.168.0.3 to the computer).

Note: This command takes effect during the next power cycle of the UE Multiplexer. The updated field will then persist through power cycles until subsequently changed.

Range: STATIC – Fixed IP address programmed into UE Multiplexer
 CLIENT – UE Multiplexer will request an IP address from a DHCP server
 SERVER – UE Multiplexer will assign an IP address to the control PC.

Default: STATIC
 Note this is factory default. Once changed, the new value persists.

Example: IP_MODE=CLIENT<return>

'IP_ADDR'

Sets the IP Address settings to be used by the UE Multiplexer for STATIC and SERVER modes. This is a multi-parameter command which accepts three fields in one command. The command parameter order is:

IP Address, Subnet Mask, Gateway Address.

Note: This command takes effect during the next power cycle of the UE Multiplexer. The updated fields will then persist through power cycles until subsequently changed.

Range: Each parameter is an ASCII representation of an IP address within standard range constraints.

Default: 1 – 192.168.0.1,255.255.255.0,192.168.0.1
 Note this is factory default. Once changed, the new values persist.

Example: IP_ADDR= 10.16.0.8,255.255.255.0,10.16.0.1<return>

'IP_PORT'

Sets the IP port number to be used for the Telnet interface by the UE Multiplexer.

Note: This command takes effect during the next power cycle of the UE Multiplexer. The updated fields will then persist through power cycles until subsequently changed.

Range: 1024 - 9999

Default: 9760

Note this is factory default. Once changed, the new value persists.

Example: IP_PORT=9760<return>

Information Commands

'HELP' or '?'

Displays the help menu.

Options: None

Example: HELP<return>

'INFO'

Displays device information about the UE Multiplexer, including manufacture date, calibration date, hardware and software versions.

Options: None

Example: INFO<return>

Sample Code

The following code snippet demonstrates how one might code to send commands to the UE Multiplexer. It is part of a C# example Visual Studio solution that can be downloaded from the www.tellcore.com website.

```
// issue a series of commands to the unit
public void SendExampleCommands()
{
    // Select UE #3 as the Active UE
    string testCmd = "SELECT=3\r\n"; // All capitalized; no spaces; CR+LF;
    SendCommand(testCmd);

    // Provide USB power only to the ACTIVE UE
    testCmd = "POWER=ACTIVE\r\n"; // All capitalized; no spaces; CR+LF;
    SendCommand(testCmd);

    // Connect the Active UE
    testCmd = "CONNECT=1\r\n"; // All capitalized; no spaces; CR+LF;
    SendCommand(testCmd);
}

// Send the command via Telnet and accept any return string
public bool SendCommand(string Command)
{
    bool retStatus = true; // prime for success
    byte[] tBuf = Encoding.Default.GetBytes(Command);
    mySocket.Send(tBuf);

    // Successful return string would expect: "OK\r\nUEMux>"
    byte[] rBuf = new byte[255];
    int rcvCnt = mySocket.Receive(rBuf);

    // convert to string for easy manipulation
    string rcvStr = System.Text.Encoding.UTF8.GetString(rBuf, 0, rcvCnt);
    if (!rcvStr.Contains("OK")) // Confirm success
    {
        MessageBox.Show("Command error: " + rcvStr);
        retStatus = false;
    }

    return (retStatus);
}
```

5.0 UE Multiplexer Manager

The UE Multiplexer Manager control software can be initially launched by navigating to the application via the Start menu or Desktop. Once launched the application presents a main Control GUI (discussed below) and will also provide an icon in the notification area located at the far right of the Windows task bar. The Control GUI can be closed without exiting the application, and the GUI can then be accessed again via the notification area icon.



Figure 4-1 UE Multiplexer Manager Icon

Right-click on this icon to access a menu list which will allow the user to show the Control GUI at any time, to show an administrative login window for the application, or to exit the application entirely.



Figure 4-2 Icon right-click menu

The UE Multiplexer Manager control software operates under two levels of access privilege:

User Mode (default)

Provides for all the basic controls and informational feedback required for normal operation of the unit. It does not require a login.

Administrator Mode

Extends User Mode to allow configuration of the IP Settings. This mode requires a login.

The Administrator Mode provides an alternate mechanism (from the Telnet command interface) for configuring the IP mode of operations and address settings. The Administrator mode can be entered from the Login selection using the following settings (case sensitive):

Username: Admin
Password: UEMux

Once the IP Settings have been finalized, the Administrator mode should be exited using the Logout menu item which will now be presented when the user right-clicks on the icon.

Basic Control Tab

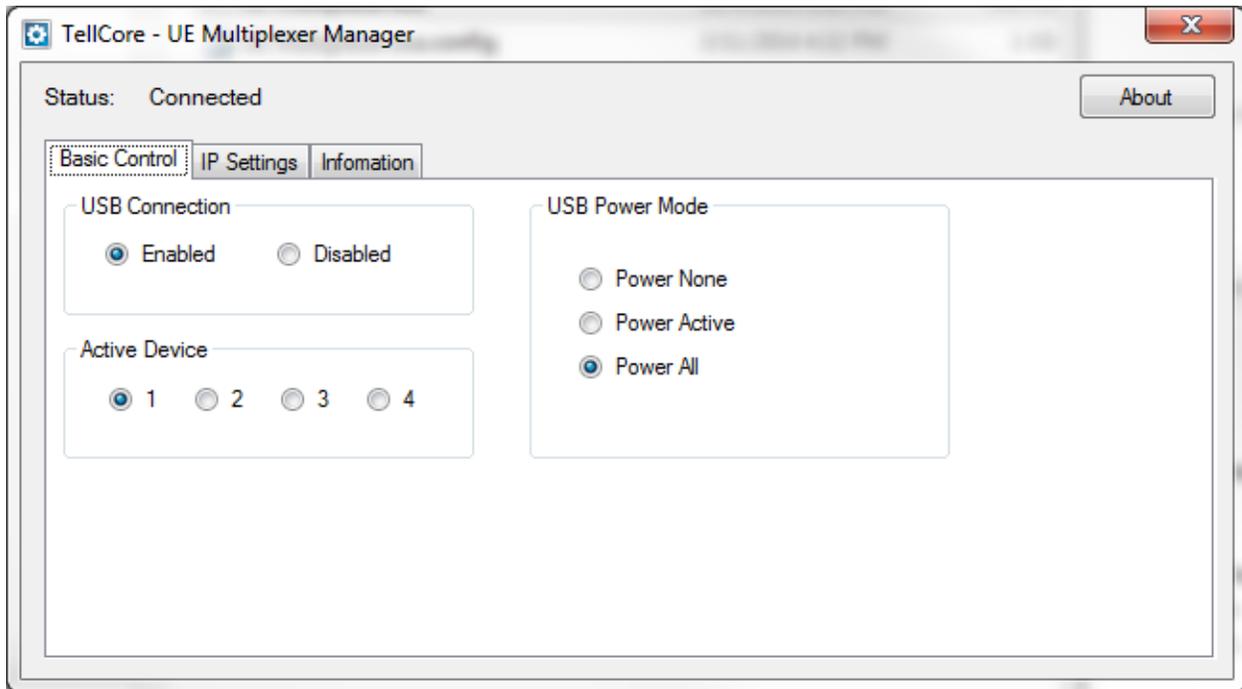


Figure 4-3 Basic Control tab

This tab provides control over all the basic operations discussed in earlier sections for normal operations of the unit in a test environment.

IP Settings Tab

The Ethernet port is used for the Remote Control Interface and its configuration parameters are discussed in more depth in that chapter.

In User Mode this tab is informational only and presents the current configuration of this port (as read only).

In order to edit these parameters the user must enter Administrator Mode. As discussed, the Administrator Mode provides this alternate configuration mechanism for IP Settings.

The following figure shows this tab under Administrator Mode where the IP Settings controls become editable and the 'Set' buttons and warning message are exposed.

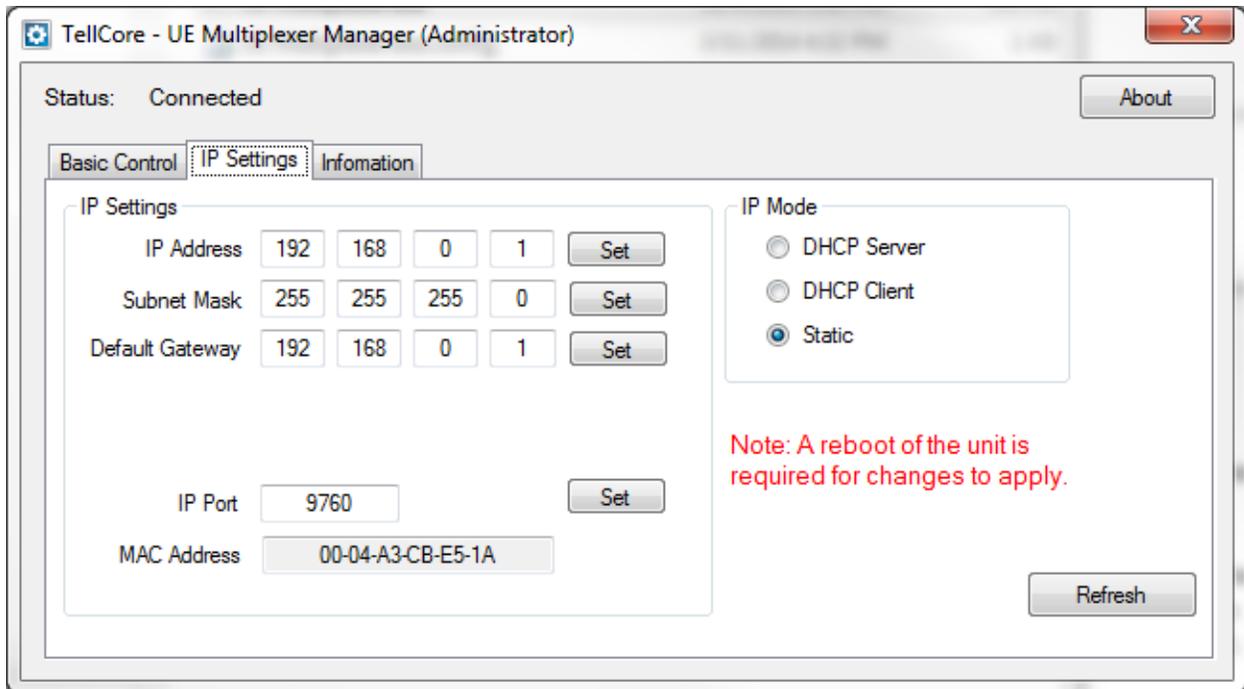


Figure 4-4 IP Setting tab

The IP Address, Subnet Mask and Gateway settings configured under this context will be used under the Static and DHCP Server modes only.

The Port will be used for Telnet under all IP Modes.

Information Tab

The Information tab provides read-only information about the instrument. The available information is self-evident in the following image.

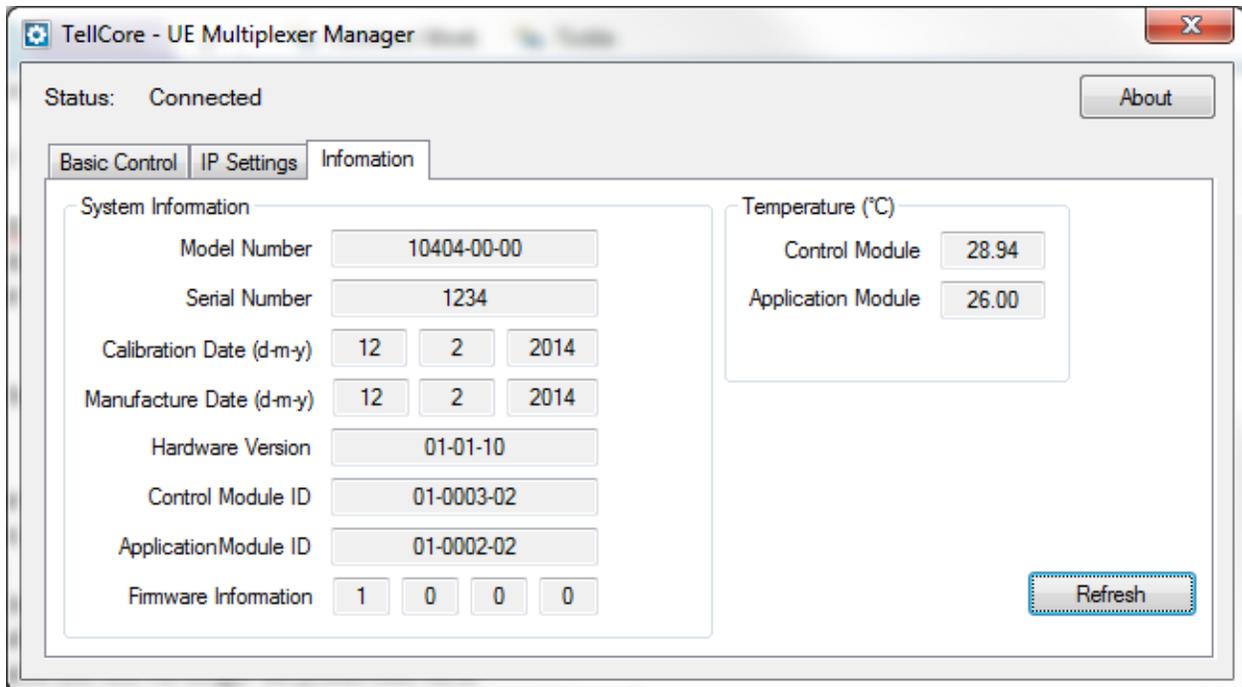


Figure 4-5 Information tab

6.0 Environmental Compliance

Restriction of Hazardous Substances (RoHS)

This product fully complies with the EU RoHS Directive restricting the use of certain hazardous substances in products.

Waste Electrical & Electronic Equipment (WEEE)

TellCore has taken the following approach to complying with this Directive:

- TellCore will, where applicable, register with national authorities in accordance with the requirements of each Member State and the EU for TellCore products that are subject to the WEEE Directive
- Microsoft works cooperatively with treatment facilities and governmental agencies to provide information that enables the successful treatment of TellCore WEEE products.
- TellCore will provide information to reuse centers, treatment, and recycling facilities regarding new TellCore electrical and electronic equipment as required by each Member State and the WEEE Directive.
- TellCore WEEE products will be designed with recycling, reuse, and waste management as a consideration.
- TellCore WEEE products will be labelled or stamped with the WEEE marking as shown below in accordance with European Standard EN 50419.



- WEEE labelled products must be returned to a designated collection point for their dismantling, recycling, and/or reuse.

Packaging

TellCore designs its hardware and software packaging to reduce environmental impact.