

USER MANUAL

Ctek Z Series SkyRouter

Cellular Application Platform Models Z4200 Z4400 Z4550

(Release 6.00.05 and newer)



Ctek – Things That Move Data

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1 Introduction

Welcome to the Ctek SkyRouter User’s Guide. While the primary focus of this manual is the Z4550 4G/LTE model it also documents variations in the user interface caused by different network technologies, CDMA for the Z4200 and HSPA for the Z4400. These UI variations are focused on the activation and network provisioning aspects of the UI, all other functions are common across these three models. Note that firmware release 6.00.05 and newer will provide support for all three models based on the type of radio module installed.

The Z4550 is a cellular applications platform that provides 4G/LTE service on all North American networks with fallback 3G service appropriate for that network. This User’s Guide will explain the basic operation of the application platform and router, and take you through the necessary settings to get your wireless application online securely. Additional information concerning many of the advanced features of the Z4550 is found in TechNotes available at www.ctekproducts.com.

1.1 See Also

- TN034** – Geo-fencing with the SkyRouter
- TN037** – Updating CK418 Flash Memory
- TN039** - SkyRouter Serial Subsystem
- TN040** - GRE and IPSec Tunneling
- APN007** – Automation Control

2 Getting Started

2.1 Default Factory Settings

The Z4550 leaves the factory with the default settings defined in Figure 1. A Z4550 may be returned to its factory setting at any time by depressing and holding the switch labeled default until the status LEDs begin a repetitive flashing routine, approximately 10 seconds. Once the LED flashing sequence has begun, the unit should be rebooted (power-cycled) and will return to service with the factory defaults in place.

Note – Z4550 units produced after approximately October 1, 2016 will be equipped with a dual-SIM feature. For both dual-SIM operation and restoring factory defaults see dual-Sim section below.

Setting or Parameter	Factory Default
Administrative User ID	ctek *** Change after first login ***
Administrative password	ctek *** Change after first login ***
Administrative IP address	192.168.1.10
Network Configuration	Gateway
DHCP Server	Enabled
Administrative LAN and WAN port	Port 80 – See security section below

Setting or Parameter	Factory Default
Firewall Status	Enabled – See security section below
WAN Ping Response	Disabled – See security section below
NAT Traffic to WAN	Enabled – See security section below
XML Interface	Disabled – See security section below
IP White List	Disabled – See security section below
SMS Management	Disabled – See security section below
SMS White List	Disabled – See security section below
SSH (Secure Shell) Access	Disabled – See security section below
SSH User ID	root – See security section below
SSH Password	pass – See security section below
Enable HTTPS	Disabled – See security section below
Connection State (WAN)	Enabled
Relay Input (Trigger Input)	Disabled
Relay Output (Managed by Automation Control)	No
Time Source	Cellular Network
Location Source	GPS (Internal)
DNS Address Source	Acquire from Wireless Network
Auto Configure (radio firmware)	Disabled
Radio module firmware	Sprint - SWI9X15C_05.05.63.01 or newer

Figure 1

2.2 Administrative Access

All administration and configuration of the Z4550 is accomplished using the web UI, which can be accessed locally throughout the Ethernet connection or over the air through the WAN connection after the unit is connected to a cellular network.

To use the local interface connect a computer to the Z4550's Ethernet port using a standard Ethernet cable. Using a web browser connect to the login page using the administrative IP address and the default login and password. Once you are successfully logged in the Quick Panel display shown in Figure 2 will be presented.

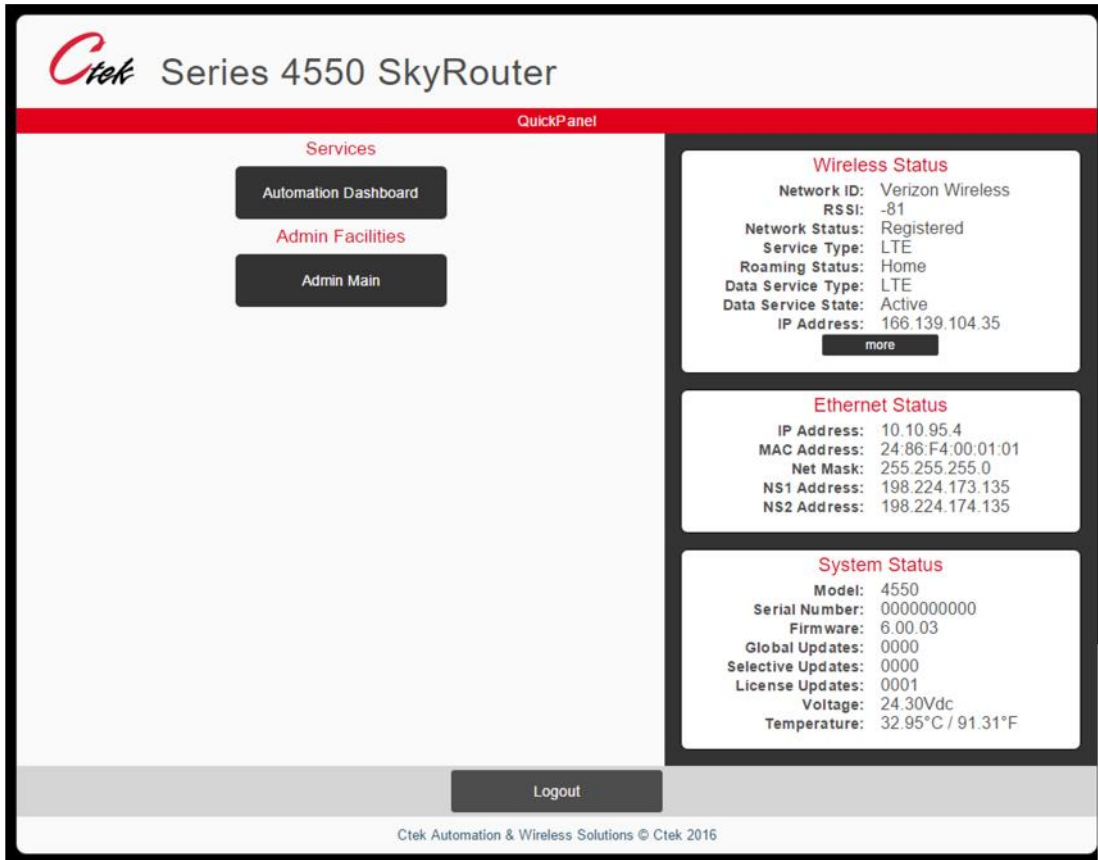


Figure 2

The Quick Panel display presents an overview of the network and equipment status, and provides navigation to the Administrative functions. The Quick Panel status information is a snapshot in time and must be refreshed to observe changes in dynamic parameters such as network connections or signal strength. The Admin Main button on the Quick Panel will display the main administrative screen as shown in Figure 3. Note that the main admin screen maintains the Quick Panel's status display, and offers navigation to all Z4550 SkyRouter administrative functions.

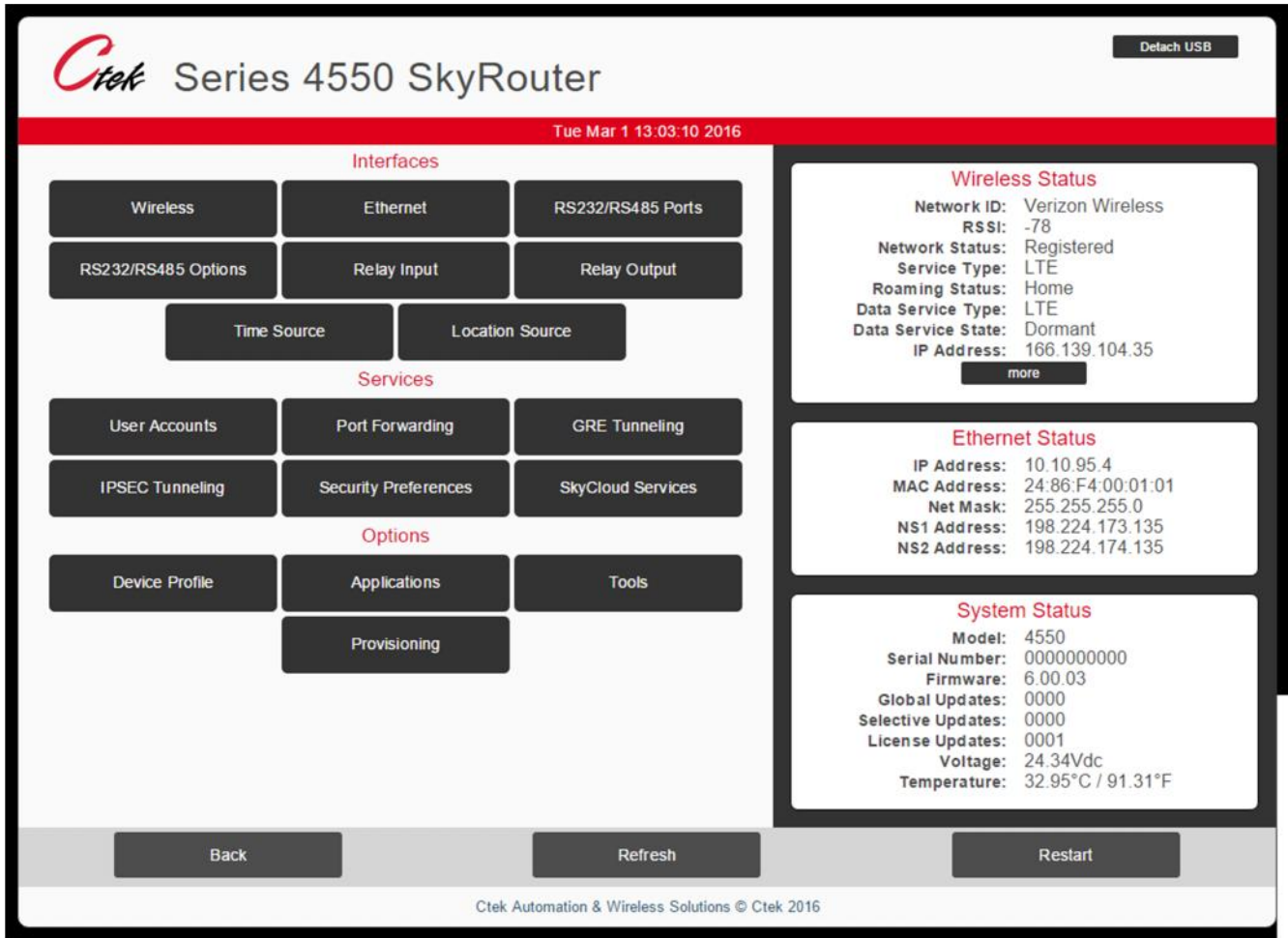


Figure 3

3 Wireless Network Activation – Z4550 4G/LTE

Ctek’s Z4550 SkyRouter operates on North American LTE networks on bands 2, 4, 5, 13, 17, and 25 with fallback to the appropriate 3G network for the selected carrier. The Z4550 will also operate globally on HSPA (UMTS) networks on bands 1,2,4,5, and 8

3.1 Prerequisites

Before you start, you must have:

1. A cellular data account with your selected carrier
2. A SIM card issued by that carrier that conforms to the 2FF form factor
3. At least one antenna suitable for the bands that will be used
4. A source of DC power between 9 and 24VDC

3.2 Activation

1. Insert the SIM card
2. Connect the DC power source to the Z4550 and power up
3. Connect a computer to the Z4550 using an Ethernet cable, a browser, and the default administrative IP address
4. On the Provisioning/Radio Update screen verify that the radio firmware is correct for the network you are using
5. If the firmware is correct, proceed to section 3.4, else see section 3.3

3.3 Installing Radio Network Specific Firmware

1. On the Provisioning/Radio Update screen, select the correct firmware for the network you are using
2. Press the Update Radio button – This process will take between 2 and 3 minutes to complete
3. The SVC and Link LEDs will begin an alternating green pattern
4. The Status button on the Radio Update screen will display the network firmware that is being loaded
5. After a 2 – 3 minute delay the Status button will indicate that the radio programming has completed
6. The LEDs will simultaneously blink green indicating that the programming was successful
7. If the programming step encountered a problem the LEDs will simultaneously blink red/yellow
8. Restart or power cycle the unit

3.4 APN Selection and Account Provisioning

Important Note – For the purposes of this manual, we divide the carriers (network operators) into two groups, legacy CDMA carriers, e.g. Sprint and Verizon, and the legacy GSM group, which is comprised of all other networks. In terms of provisioning the wireless account, especially APNs, these two groups present very different behaviors. Legacy CDMA carriers use an over-the-air provisioning mechanism to “push” the appropriate APNs and settings to the radio module when it connects to the network. Under normal operation, this process is automatic and there should be no need to manually configure an APN. Legacy CDMA carriers currently use APN profile configuration (slot) 3 for the operational APN.

Legacy GSM carriers do not use an over-the-air provisioning mechanism. You must enter the carrier provided APN in APN profile configuration (slot) 1. Some legacy GSM carriers may also require you to enter a User Name, Password, and authentication type along with the APN.

For Legacy CDMA Carriers

After the restart performed in step 8 of section 3.3 the unit will complete its reboot cycle, provision over the air, and will obtain an IP address from the network, and light the Link LED. This process will take between 1 and two minutes. If the Link LED is red it indicates an LTE connection, if the Link LED is green it indicates 3G connection.

For Legacy GSM Carriers

After the restart performed in step 8 of section 3.3 the unit will complete its reboot cycle. When the unit completes its boot cycle reconnect with a browser. On the Wireless Interfaces screen enter the APN specified by your carrier. Optionally, you may also need to enter a User Name, Password, and select an authentication type. When the required information has been entered perform a restart or power cycle. When the unit completes its reboot cycle it will obtain

an IP address from the network, and light the Link LED. This process will take between 1 and two minutes. If the Link LED is red it indicates an LTE connection, if the Link LED is green it indicates 3G connection.

3.5 Dual-SIM Operation

User Interface Control

The dual-Sim feature is managed from the Wireless screen under the Interfaces section. To use this feature select the desired SIM, update, and restart the unit. If the automatic radio configuration feature is enabled the unit will load the appropriate radio module firmware after it has been restarted. See the Installing Radio Network Specific Firmware section above for visual indicators and timing considerations.

Default Switch Operation (dual SIM)

For units equipped with the dual-SIM feature the default settings switch performs both the restore factory defaults function, and provides a secondary method of SIM selection.

To restore factory defaults press and hold the default switch until the Link and Service LEDs blink on and off simultaneously, Link = red and Service = Yellow. As soon as this pattern is observed, release the default button and restart or power cycle the unit. Factory defaults have been restored.

To select the alternate SIM, continue to depress the default switch until the LED pattern shifts to both the Link and Service LEDs blink on and off simultaneously, both with green being displayed. At this point release the default switch and either the Link or Service LED will come on steady green, indicating which SIM slot is currently selected. At this point, a momentary closing (pressing) of the default switch will select the alternate SIM and indicate the selection on either the Service or Link LED. This SIM selection operation may be repeated as many times as desired. When the correct SIM is selected, the unit may be restarted or power cycled. Similar to the User Interface method described above, if the automatic radio configuration feature is enabled the unit will load the appropriate radio module firmware after it has been restarted. See the Installing Radio Network Specific Firmware section above for visual indicators and timing considerations.

4 Wireless Network Activation – Z4200 3G (CDMA/EVDO/1XRTT)

For CDMA models, the Provisioning function on the main menu serves two purposes. First, it provides a mechanism to activate and provision the router on the wireless networks utilizing the OTAS mechanism. Secondly, it may be used as a general interface to directly enter specific commands, known as AT commands, to the router's radio module. The following important notes apply:

Note – Before using the Wireless Activation Services Interface for any purpose, you must first disable the router's WAN interface. This is required because during normal operation the router has a data connection open with the radio module which will cause OTA time outs and potentially other types of OTA failures. To disable the router's WAN interface (1) go to the Wireless Interface screen, (2) set the Wireless Connection pull down on to disabled, (3) press update, and (4) perform restart of the unit on the main menu page.

Note – To insure a stable environment prior to executing an OTAP evolution the SkyRouter verifies that during the previous two minute sample period the RSSI is greater than (smaller negative number) -99dBm, the SID has not changed, and the unit has access to 1xRTT connectivity. 1xRTT is required for OTAP operations.

4.1 AT Commands

Selecting the AT Commands menu option presents a screen as shown below. AT commands are entered in the command field and after submission the commands status string will be displayed in the response area.

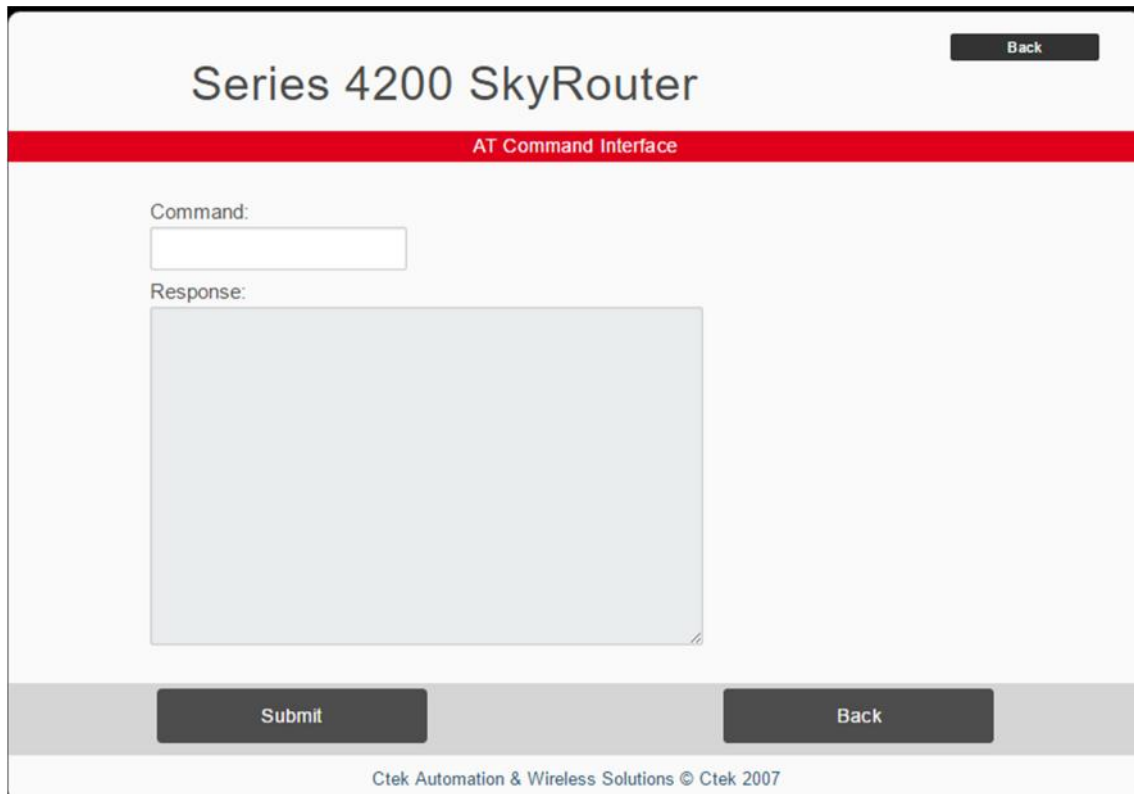


Figure 4

4.2 OTAP/OMA Activation

Selecting the OTA Activation option presents the following screen. Please see notes above about the WAN interface and network stability. Once the Activation function is selected a status button is available to follow the progress of the activation based on responses from the wireless network.

Note – For Verizon Wireless an up-to-date PRL is downloaded for each activation. The activation can be performed whenever a new PRL is available. For Sprint only an additional function is provided to load the latest PRL.

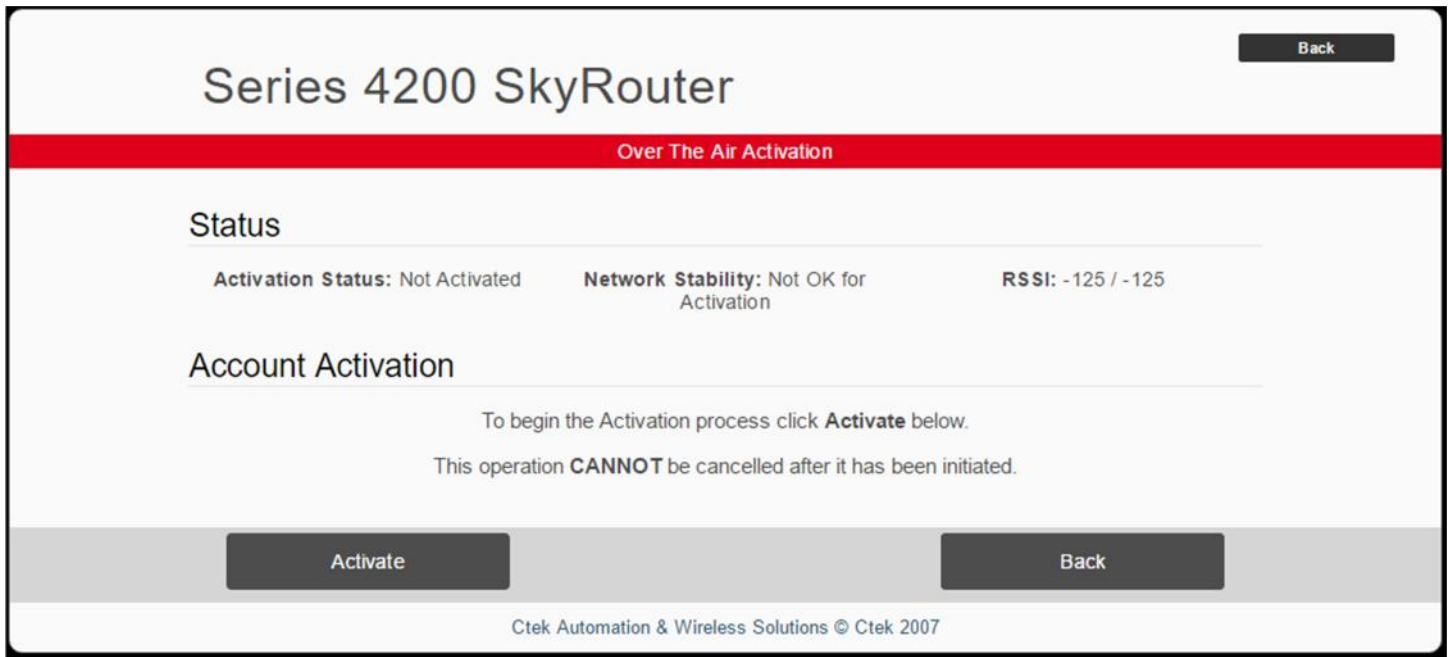


Figure 5

5 Wireless Network Activation – Z4400 3G (GSM/UMTS/HSPA)

Activating a Z4400 on a GSM/HSPA network is performed by inserting a Subscriber Identification Module (SIM) in the appropriate SIM connector and filling in information on the Wireless Interface screen that will have been provided by the Network Operator or Carrier providing the SIM.

At a minimum, you will need to enter the APN provided into the Profile Name field on the Wireless Interface and in most cases will also need to enter an Authentication Type (PAP, CHAP, or both).

Additional information that may be required is:

PDP Address – Seldom used

User Name – May be associated with the network or with an individual SIM

Password - May be associated with the network or with an individual SIM

SMSC Address

Email Gateway

In addition, a specific network ID may be entered to control unwanted roaming in specific areas.

If the Z4400 contains the dual-SIM feature two SIM cards may be installed and managed as described in section 3.5 above.

6 Security

Properly configured, the Ctek Z4550 is the most secure cellular router available in the marketplace. However, the security provided by the Z4550 is only as good as the thought given to its administration. Factory default settings disable all of the Z4550's access mechanisms with the exception of HTTP access on port 80.

6.1 Change the Default User ID and Password

NOTE - The default User ID and password for Ctek's SkyRouters is well known. Failure to perform this step exposes the user's equipment to unauthorized access and tampering.

Select the User Accounts function. The screen shown in Figure 4 will be presented.

The screenshot displays the 'User Account Management' interface for a Ctek Series 4550 SkyRouter. The page title is 'Ctek Series 4550 SkyRouter' with a 'Back' button in the top right. A red header bar contains the text 'User Account Management'. Below this, there are two main sections: 'Active Accounts' and 'New User'. The 'Active Accounts' section has a radio button selected for 'ctek:'. It includes fields for 'Username:' (containing 'ctek'), 'Password:' (masked with '****'), and 'Confirm:' (masked with '****'). Below these are 'Properties:' checkboxes, with 'Admin:' checked and others (1-8) unchecked. The 'New User' section has empty fields for 'Username:', 'Password:', and 'Confirm:', and unchecked checkboxes for 'Properties:' (1-8). At the bottom of the page are three buttons: 'Delete', 'Update', and 'Home'.

Figure 6

1. Select the Ctek login entry
2. Enter a new User ID
3. Enter a new password
4. Enter a confirming password
5. Check the Admin box
6. Press Update
7. When the unit is rebooted the new login information will be in effect

6.2 Security Settings

Select the Security Preferences function. The screen shown in Figure 5 will be presented.

The screenshot displays the 'Security Preferences' configuration page for a Ctek Series 4550 SkyRouter. The page is divided into several sections:

- General Configuration:** Includes dropdown menus for Firewall Status (Enabled), WAN Ping Response (Disabled), NAT Traffic to WAN (Enabled), and XML Interface (Enabled).
- Web Administration:** Includes checkboxes for 'Allow on LAN Interface Port' (checked) and 'Allow on WAN Interface Port' (checked), both with a port number of 80. There is also an unchecked checkbox for 'Enable HTTPS'.
- IP White List:** Features a 'White List Status' dropdown set to 'Disabled' and three pairs of input fields for 'IP Address' and 'Address/Mask Bit'.
- SMS Management:** Includes 'SMS Services' (Enabled) and 'White List Status' (Disabled) dropdowns, and six input fields for 'Phone Number' arranged in two columns of three.
- SSH Access:** Features an 'SSH Service' dropdown set to 'Enabled' and a 'Change Password' section with three input fields for 'Current Password', 'New Password', and 'Confirm Password'.

At the bottom of the page, there are 'Update' and 'Home' buttons, and a footer that reads 'Ctek Automation & Wireless Solutions © Ctek 2016'.

Figure 7

General Configuration

-) Firewall Status - When enabled the firewall blocks all WAN traffic except for port 80 and the serial pad port if, and only if the serial pad is active. Since an SMS command (TechNote TN009) can be used to temporarily open ports for ad-hoc maintenance there are very few reasons to ever disable the firewall.
-) WAN Ping Response – When Disabled ICMP Ping requests will be ignored
-) NAT Traffic to WAN - Must be Enabled for normal operation
-) XML Interface: Can be enabled to open port 5070 for XML applications

IP White List

Enable to limit access to specified addresses or ranges of address. The White list applies to both WAN and LAN side connections. If it is enabled, be sure to create an entry for LAN access.

IP Address (for white list) – specified as an address followed by a netmask in the Classless Inter-Domain Routing (CIDR) format as in 192.168.1.0/24 to allow the entire class C range beginning at 192.168.1.0 for LAN administration

SMS Management

Enable to allow SMS management commands as defined in TechNote TN009

White List Status (SMS)

Enable to limit SMS access to specified phone numbers

SSH Access

Enable to allow SSH access from LAN, WAN, or both

Note – The SSH password can and should be changed if SSH is enabled

Note – For file transfers the Secure Copy (SCP) utility can be used with the same login credentials as SSH

Web Administration

Provides a mechanism to enable or disable HTTP access through the WAN, LAN, or both. Also provides a mechanism to specify an IP port number other than 80 for HTTP access through the WAN, LAN, or both.

6.3 Additional Security Features

Authlogread

Using SSH the command line utility authlogread can be used to determine the last 20 login attempts since the unit was last rebooted.

Intrusion Detection

If the Z4550 has the TCOPlus management option (APN001) installed, the intrusion detection feature under Tools/Wan Management can be used to alarm 3 consecutive failed login attempts, and if desired to lockout any subsequent login activity until the unit receives administrative attention.

7 Device Profile

The Device Profile screen performs two key functions. First, it is used to configure the Z4550's LAN for either network gateway or network client operation. Second, it is used to configure a number of parameters used by SkyRouter resident applications for alarming, reporting, and formatting the dashboard display.

7.1 Device Network Profile

Gateway

In the Gateway mode of operation the Z4550 SkyRouter connects with the cellular network, obtains an IP address from the cellular network, and routes traffic to and from LAN side connections using Network Address Translation (NAT). Gateway mode is the default method of operation.

Client

The Client mode of operation allows the Z4550 to be connected, via Ethernet to an enterprise or home network. In this mode of operation, the Z4550 can be set up to operate either as a DHCP client or with a static address on an established network. Client mode can be a useful tool for loading updates or applications since in the client mode of operation traffic moves through the corporate network instead of over the wireless network.

7.2 Application Parameters

Location

The location name that will be displayed on the dashboard, on SkyCloud, and in reports and alarms

Application Alarming

Enables or disables alarms, selects alarm delivery mechanisms, assigns email addresses and phone numbers for alarm delivery, and assigns GPS/Location coordinates to alarms

Application Logging

Enables or disables application logging, enables or disables log deliver via email, selects a log delivery schedule, and assigns email addresses of log recipients

Email Configuration

The Z4550 has a resident POP3 email server that is used to deliver alarms and logs. This panel is used to configure the SkyRouter with email account information. This set up should be identical to setting up any email client such as Outlook or Thunderbird.

Automation Display Groups

This panel is used to assign names to the display groups shown on the automation dashboard

Dashboard Options

This function is used to configure the number (1-5) of named display groups that will appear on a single row of the dashboard.

8 Local Interfaces

8.1 Overview

Figures 6 and 7 below show the location of local interfaces, indicators, and controls found on the Z4550 SkyRouter.

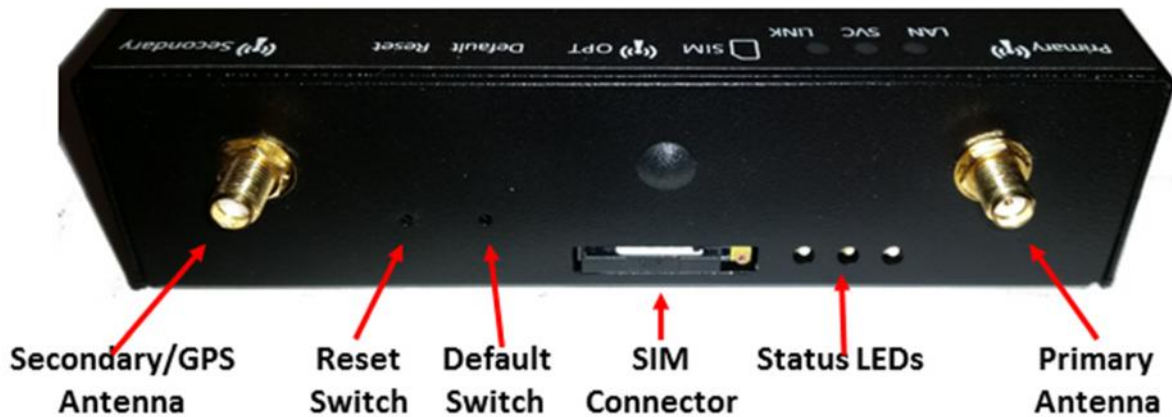


Figure 8

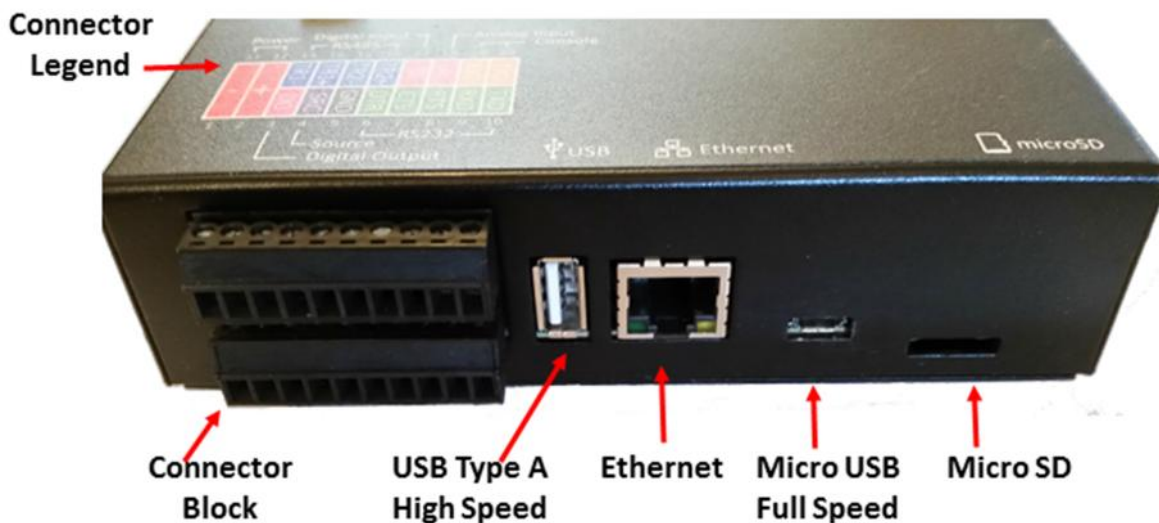


Figure 9

8.2 RS232/RS485 Ports

The RS232/RS485 screen is used to configure the physical (electrical and timing) characteristics of the serial ports. The serial ports can be connected to the TCP/UDP PAD function for WAN transmission. See tN039 for details on Serial PAD settings. Level 2 (link level) settings for this port are made using the RS232/RS485 Ports screen.

RS232

A complete RS232 connection is provided on pins 6 – 10 of the bottom connector block. This is a Data Communication Equipment (DCE) type connection. Connections to a Data Terminal Equipment (DTE) device on a typical DB9 connector are shown in figure 8 below.

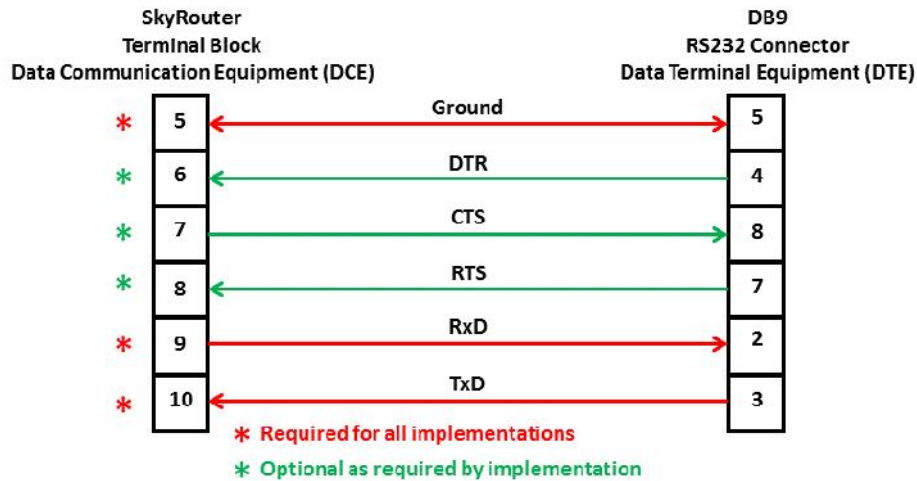


Figure 10

RS485 (TR1)

A general-purpose RS485 connection is provided on pins 13 and 14 of the top connector block. The TR1 connection can be connected to the serial (TCP/UDP/PPP) pad function (TN039), and is used to support RS485 Modbus controllers that interface with Ctek's Automation Control application. See Application Note APN008 for details on interfacing to Modbus controllers using Automation Control.

Level 2 (link level) settings for this port are made using the RS232/RS485 Ports screen.

RS485 (TR2)

The TR2 RS485 connection is reserved for, and programmed by the Automation Control application

Console Port

A two-wire RS232 type connection of type DCE is provided by on pins 19 and 20 of the top connector block.

8.3 RS232/RS485 Options

The screens under this function are used to configure the serial (TCP/UDP/PPP) pad function. For details see TechNote TN039.

8.4 Ethernet Port Forwarding

In the gateway mode of operation (see section 5.1) the Z4550 SkyRouter routes data to and from the wireless network IP connection to a class C range of local (private) IP addresses available on the RJ45 Ethernet connector. To accomplish this the Port Forwarding screen allows you to forward WAN side IP traffic arriving on a specific IP Port to a specific Port at a designated LAN side address. In addition, this screen also allows you to make a named (advertised) service available over the WAN interface.

Each forwarding rules consists of the following field:

-) **Service Name** – A name that will be associated with a service advertised on the Quick Panel of the WAN interface
-) **Forwarding From** – The inbound (WAN side) port number managing the traffic
-) **Local Port** – The port number on the LAN side that the traffic will be routed to
-) **Local IP** – The IP address on the LAN side that the traffic will be routed to. Must be part of the class C range defined in the Ethernet Interface screen.
-) **Advertise** – Yes or no
-) **Protocol** – TCP, UDP, or both
-) **Enable** – Make the rule active (Yes/No)

8.5 Digital and Analog Inputs

Relay Input – (Digital Input)

A digital input is provided on pin 17 of the top connector block. The digital input can be used as a conventional digital input under automation control logic, or to trigger an alarm via SMS. When used to generate an SMS message the destination phone number is entered on this screen.

Relay Output (Digital Output)

A digital output is provided on pin 3 of the bottom connector block. If desired pin 4 (Source) can be used to provide a 5VDC level connected through a 10K ohm pull-up resistor.

The digital output can be managed under automation control, via SMS, or through SkyRouter web screens.

Analog Input

An analog input is provided on pin 18 of the top connector block. It operates on a 0 - 5VDC input range and provides 10 bit A/D conversion. The analog input is accessible through automation control.

9 Tunneling and Encryption

9.1 GRE Tunneling

The Z4550 SkyRouter supports 2 concurrent GRE tunnels. See TechNote TN040 for detailed setup information.

9.2 IPsec

The Z4550 SkyRouter supports 8 concurrent IPsec tunnels. See TechNote TN040 for detailed setup information.

10 Time and Location Source

10.1 Time Source

The Time Source screen allows the user to select from one of three mechanisms to synchronize the time reference on an individual Z4550 SkyRouter.

Cellular Network

The SkyRouter retrieves and synchronizes to time provided by the cellular network

Network Time Protocol (NTP) Server

The SkyRouter retrieves and synchronizes to time provided by an NTP server. An IP address field for the NTP server is provided on the screen.

GPS

The SkyRouter retrieves and synchronizes to time provided by the GPS or GLONASS constellation. This option requires that GPS be enabled on the Location Source screen.

10.2 Location Source

The SkyRouter's location source can be set to originate from the built-in GPS/GLONASS receiver, or by using user defined coordinates. User defined coordinates are especially useful for stationary installations that may not want to incur the expense of a GPS antenna.

The Location Source screen also supports the creation of two geo-fences. Geo-fencing applications are covered in detail in TechNote TN034.

11 SkyCloud Services

The SkyCloud Services screen serves two related purposes. It provides a method of selecting a Dynamic Domain Name Service (DDNS) for the Z4550. Secondly, it is used to configure the unit for operation on Ctek's cloud based visual access and management system, SkyCloud. See Technical Information Bulletin TIB006 for details.

12 Tools

The Z4550 comes standard with two tools installed.

12.1 Flash Update Client

The Flash Update client provides a mechanism to load over-the-air firmware update and to enable additional applications on the SkyRouter. The Flash Update client can be configured for periodic (daily/weekly/monthly) updates, or to perform the updates ad-hoc when the user initiates an update request.

12.2 Backup and Restore

Backup and Restore works in conjunction with a USB stick inserted in the type A USB connector. Types of backups possible include:

-) Automation Control
-) Navigation Services
-) Entire System
-) Product Branding
-) Logs (WAN and System logs)

In addition to a restore option for each backup categories listed above, an additional type of restore allows update installer files to be applied to a SkyRouter via the USB drive.

13 Applications

The Z4550 comes standard with the Automation-Light application installed. Automation-Lite is a scaled back version of the complete Automation application, which can be licensed from Ctek. See Application Note APN008 for details on the Automation application.