



Geo – Fencing Location Tracking & Alarming

Tech Note – TN1034
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Table of Contents

- I. **Overview 3**
- II. **Availability 3**
- III. **Location Source Configuration 3**
- IV. **Geo-Fencing Setup 3**
 - Location Source Screen – System Location Options Panel.....3
 - Location Source Screen – Fence 1&2 Configuration Panels.....4
 - Geo-Fence Alarm Indications6
- V. **Extending Geo-Fencing Capabilities Using Automation 8**
 - The Geo-Fencing Control Function..... 8
 - A Complete Geo-Fence Application Managed by Automation Control..... 8
 - Setup for Input 1.....9
 - Setup for Input 2.....9
 - Setup for Output 110
 - Setup for Input 3.....10
 - Activate Program for Input 311
 - Deactivate Program for Input 311
- VI. **Automation Application Results12**
 - Automation Control Panel12
 - SMS (Text Messaging) Control..... 12
 - XML Control.....12

Overview

This TechNote covers the setup and operation of the SkyRouter's geo-fencing feature. It will also cover how to integrate the geo-fencing feature with Ctek's Automation application to greater enhance and extend the geo-fencing capabilities.

Availability

Model Z4200/Z4400 with firmware release 4.02.02.08 or greater

Model Z4550 with firmware release 6.00.00 or greater

Location Source Configuration

The Location Source configuration consists of 3 main areas, GPS Status, System Location Options, and Geo-Fence Configuration.

Geo-Fencing Setup

Admin Main > Location Source > Geo-Fence Configuration

Geo-fences are defined on the location source page. Geo-fences are also enabled/disabled from this page. In the next section, an alternative method of enabling/disabling geo fences using the Automation application is described.

Location Source Screen – System Location Options Panel

The Location Source screen contains the following fields and controls. See Figure 1 below.

Location Source

GPS (Internal) – Use the inbuilt GPS subsystem [Require for Geo-fencing]

Use Lat/Lon Below –User defined location for stationary installations

Latitude

Latitude expresses as a decimal value for user defined location (Example 42.83169)

Longitude

Longitude expresses as a decimal value for user defined location (Example -77.93366)

Reset Interval

The interval in minutes at which the GPS subsystem will be reset if a fix cannot be obtained.

Location Source Screen – Fence 1&2 Configuration Panels

Fence Type

Options are Disabled, Fence In, Fence Out. Fence In setting enables the fence and generates an alarm when the device leaves the defined area. Fence Out setting enables the fence and generates an alarm when the device enters the defined area.

Coordinate Source

Options are GPS or User Defined. GPS will use the current GPS provided position as a center point of the fence, User Defined will use the user provided Lat/Lon for the fence.

Latitude/Longitude

The User defined values describing the center point of the fence. Decimal format required.

Radius (mi)

The radius of the geo-fence being created in miles. Decimal fractions e.g. 0.4 are allowed. Ctek recommends that the fence radius be greater and 0.2 miles to avoid false positives.

The screenshot displays the 'System Location Configuration' interface. It is divided into three main sections:

- System Location Options:**
 - Location Source: GPS (Internal) [dropdown]
 - Latitude: Enter Decimal Value [input]
 - Longitude: Enter Decimal Value [input]
 - Reset Interval(min): 0 [dropdown]
- Fence 1 Configuration:**
 - Fence Type: Disabled [dropdown]
 - Coordinate Source: GPS (Internal) [dropdown]
 - Latitude: Enter Decimal Value [input]
 - Longitude: Enter Decimal Value [input]
 - Radius (mi): [input]
- Fence 2 Configuration:**
 - Fence Type: Disabled [dropdown]
 - Coordinate Source: GPS (Internal) [dropdown]
 - Latitude: Enter Decimal Value [input]
 - Longitude: Enter Decimal Value [input]
 - Radius (mi): [input]

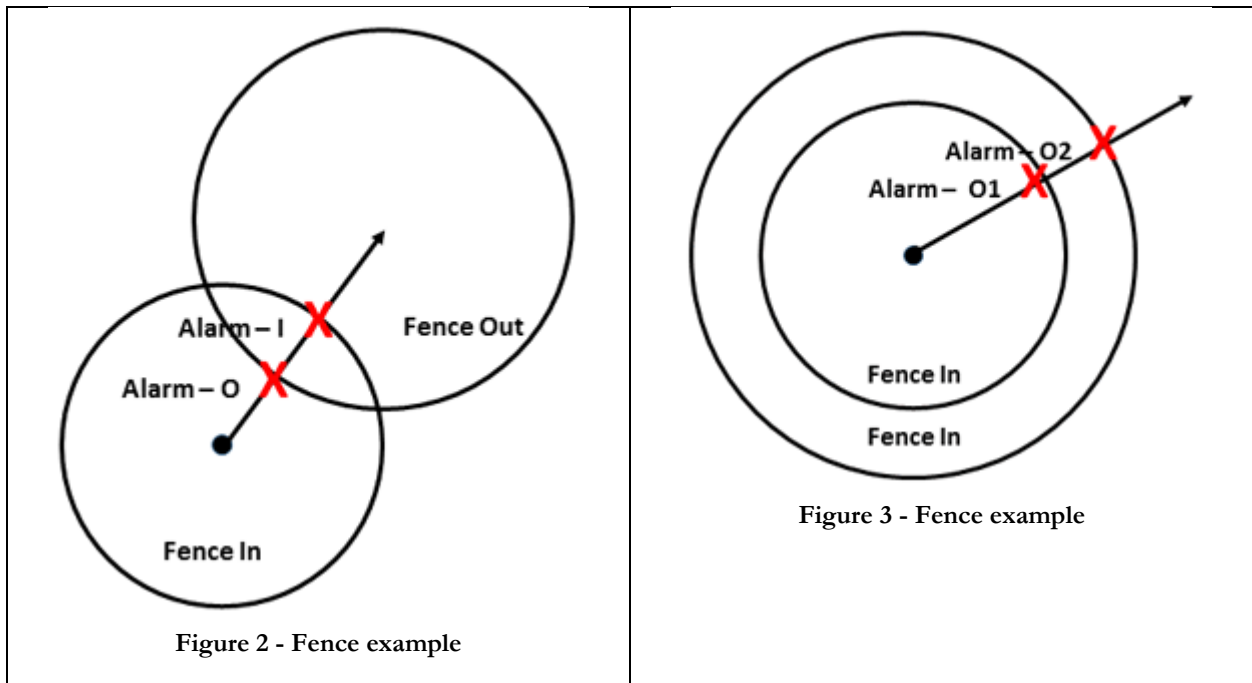
At the bottom of the page, there are two buttons: 'Update' and 'Home'. The footer text reads 'Ctek Automation & Wireless Solutions © Ctek 2015'.

Figure 1 - Location Setting Page

Geo-fence #1 and geo-fence #2 can be configured to describe areas that are either geographically overlapping or geographically mutually exclusive where either fence can be of type “fence In” or Fence Out”. In Figures 1 and 2 below we see some examples of two-fence constructs.

In Figure 2 Alarm O triggers when the device enters the “Fence Out” area and Alarm I triggers when the device leaves the “Fence In” area.

In Figure 3 Alarm O1 triggers when the device leaves the inner fence and Alarm O2 triggers when the device leaves the outer fence.



Geo-Fence Alarm Indications

Geo-fence alarms (violations) are presented as digital signals (alarm/clear) on Automation input pins. Typically, a virtual input pin will be used. The state of the pin can then be used to send SMS and email alarms as defined in the Automation Unit configuration page. In addition, the geo-fence alarm pin can be connected to a physical output pin(s) to set visible or audible alarms if desired. Figure 4 below shows a typical geo-fence alarm pin set up. In the example shown the fence violation alarm is configured to repeat 3 times at 30-minute intervals.

Digital Numeric Hex

Digital Pin Options

Initial Value: Polarity: Log Rate:

Input Source

Primary Source: Additional Modifiers:

Display Options

Input Name: [ON] Label: [OFF] Label:
[ON] Indicator: [OFF] Indicator:
SkyCloud: Dashboard Group: Display Value:

Alarms/Programs

Off State

Alarm: Repeat: Interval:
Threshold Alert:
Program: Repeat: Interval:

On State

Alarm: Repeat: Interval:
Threshold Alert:
Program: Repeat: Interval:

Update

Delete

Back

Figure 4 - Geo-Fence Alarm Pin

Extending Geo-Fencing Capabilities Using Automation

Note – This section assumes that the user is familiar with Ctek’s application note APN007 that documents the Automation Control application

The Geo-Fencing Control Function

The Automation Control application can be used to enable/disable a previously defined individual geo-fence using SMS commands, the Automation Control Panel, or through the SkyRouter’s XML interface. The radius and inner/outer characteristics of the fences must have been previously defined using the web interface. All of the aforementioned control methods are based on assigning an action (function) to one or more Automation programs, which in turn can be assigned to control pins for each geo-fence. The syntax of geo-fencing specific control function is:

Geo-Fence - Set P1 P2

The function **Geo-Fence - Set** will enable or disable (P2) the geo-fence selected by P1.

Note: To insure the validity of the P3 defined status result the program invoking the **Set Geo-Fence** function must set the P3 defined pin to zero (0) in a step prior to invoking **Set Geo-Fence**.

P1 – Geo-fence number (1 or 2)

P2 – Enable/Disable (1 or 0) this fence

P3 – Pin number (numeric) on which to report status

1 – Operation successful

-1 – Operation Failed

P4 – Retry duration (minutes)

A Complete Geo-Fence Application Managed by Automation Control

This example application makes use of the following virtual automation pins:

Input 1 [digital] – Set when geo-fence 1 is violated, reset when geo-fence is activated or deactivated

Input 2 [numeric] – Set to zero (0) in program invoking the **Set Geo-Fence** function. Set to +1 if **Set Geo-**

Fence function is successful and -1 if Set Geo-Fence fails after user specified time.

Input 3 [digital] Activate/deactivate program toggle

Output 1 [digital] – Executes the activate/deactivate geo-fence 1 program. Can be set using SMS (see TN009). Also appears on the control panel for simple web interaction. Used to control input 3 above.

Setup for Input 1

See Figure 4 above

Setup for Input 2

Ctek **Configure Inputs**

Back Submit

Configuring Input 2 To Numeric

Input Name: Fence #1 CMND Status **Unit of Measure:** **Input Source:** Input 02 ▾

Initial Reference: 0.00 **Initial Value:** 0.00 **Formula:** None ▾

Decimal Scale: 2 digits ▾ **Log:** 0 (seconds) **Cloud Display:** Off ▾

Local Display: 01 - Geo-Fence #1 ▾

Threshold 01: Less Than Level Sensitive ▾ **Trigger Value:** -0.50 **Reset Value:** -0.25

Alarm: On ▾ Alarm Repeat: 0 Repeat Rate: 0

Program: 00 - Off ▾ Program Repeat: 0 Repeat Rate: 0

Threshold 02: Greater Than Level Sensitive ▾ **Trigger Value:** 0.50 **Reset Value:** 0.25

Alarm: On ▾ Alarm Repeat: 0 Repeat Rate: 0

Program: 00 - Off ▾ Program Repeat: 0 Repeat Rate: 0

Figure 5 - Numeric Input Pin 2

Setup for Output 1



Configure Outputs

Configuring Output 1 to Digital

Output Name:	Enable Fence #1	Output State:	Off	Shutoff Timer:	0	Seconds
Initial Value:	Last	Log:	Off	Program:	00 - Off	
Label for On:	On	Label for Off:	Off			
Cloud Display:	Parameter 2	Local Display:	01 - Geo-Fence #1			

Figure 6 - Output 1 (control switch)

Setup for Input 3



Configure Inputs

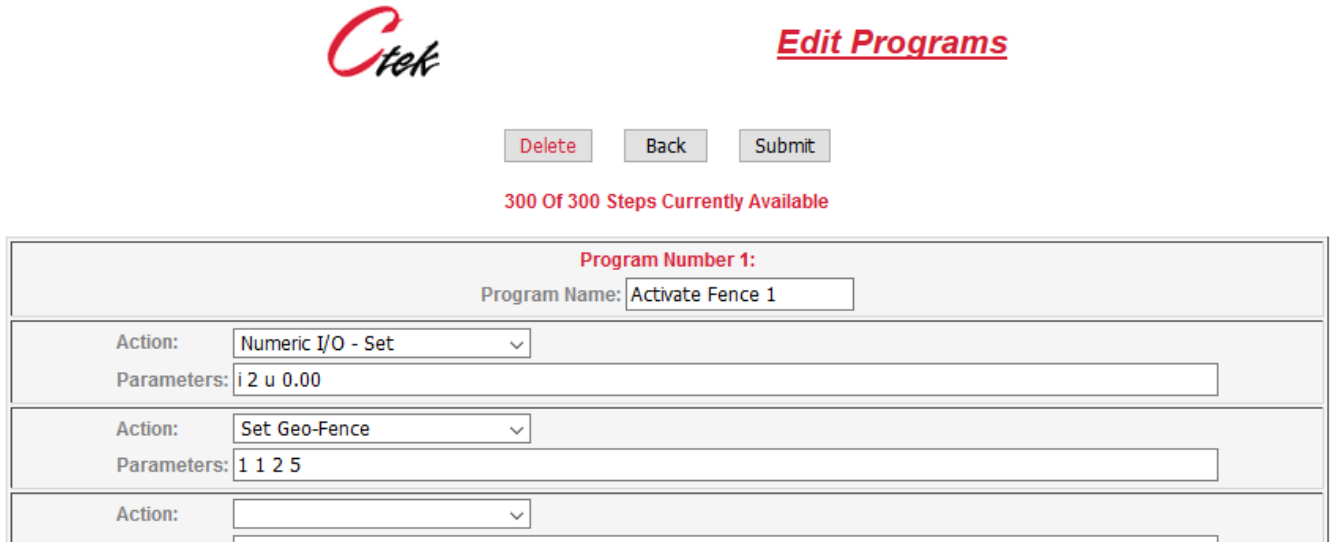
Configuring Input 3 To Digital

Input Name:	Program Toggle	Polarity:	0=Off	Log:	0	(seconds)
Initial Value:	0	Label for On:	On	Label for Off:	Off	
Cloud Display:	Off	Local Display:	00 - Off			
Input Source:	Output 01					

Off Alarm:	Off	Alarm Repeat:	0	Repeat Rate:	0
Off Program:	02 - Deactivate Fence 1	Program Repeat:	0	Repeat Rate:	0
On Alarm:	Off	Alarm Repeat:	0	Repeat Rate:	0
On Program:	01 - Activate Fence 1	Program Repeat:	0	Repeat Rate:	0

Figure 7 - Input 3 (program toggle)

Activate Program for Input 3

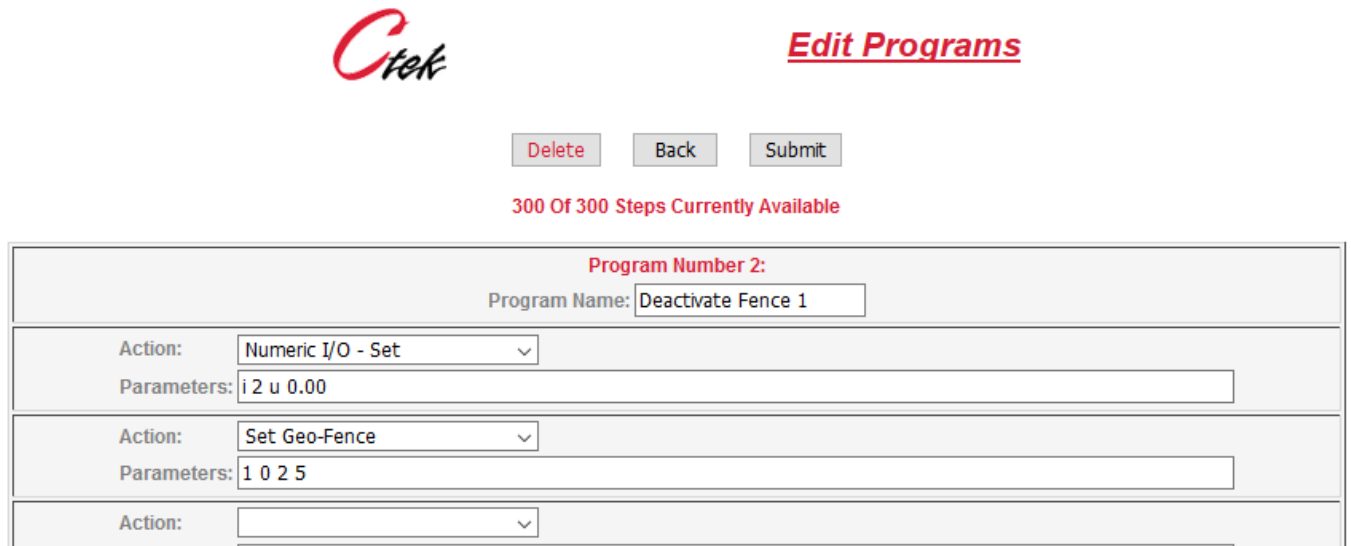


The screenshot shows the Ctek 'Edit Programs' interface. At the top left is the Ctek logo. To the right, the text 'Edit Programs' is displayed in red and underlined. Below this are three buttons: 'Delete', 'Back', and 'Submit'. A red message states '300 Of 300 Steps Currently Available'. The main form area is titled 'Program Number 1:' and contains a 'Program Name' field with the value 'Activate Fence 1'. The form is divided into three rows:

Program Number 1:	
Action:	Numeric I/O - Set
Parameters:	i 2 u 0.00
Action:	Set Geo-Fence
Parameters:	1 1 2 5
Action:	

Figure 8 - Activate Program

Deactivate Program for Input 3



The screenshot shows the Ctek 'Edit Programs' interface. At the top left is the Ctek logo. To the right, the text 'Edit Programs' is displayed in red and underlined. Below this are three buttons: 'Delete', 'Back', and 'Submit'. A red message states '300 Of 300 Steps Currently Available'. The main form area is titled 'Program Number 2:' and contains a 'Program Name' field with the value 'Deactivate Fence 1'. The form is divided into three rows:

Program Number 2:	
Action:	Numeric I/O - Set
Parameters:	i 2 u 0.00
Action:	Set Geo-Fence
Parameters:	1 0 2 5
Action:	

Figure 9 - Deactivate Program

Automation Application Results

In addition to controlling the geo-fence from the Location Source screen the following optional control implementations are now available as a result of the Automation Control design described above.

Automation Control Panel

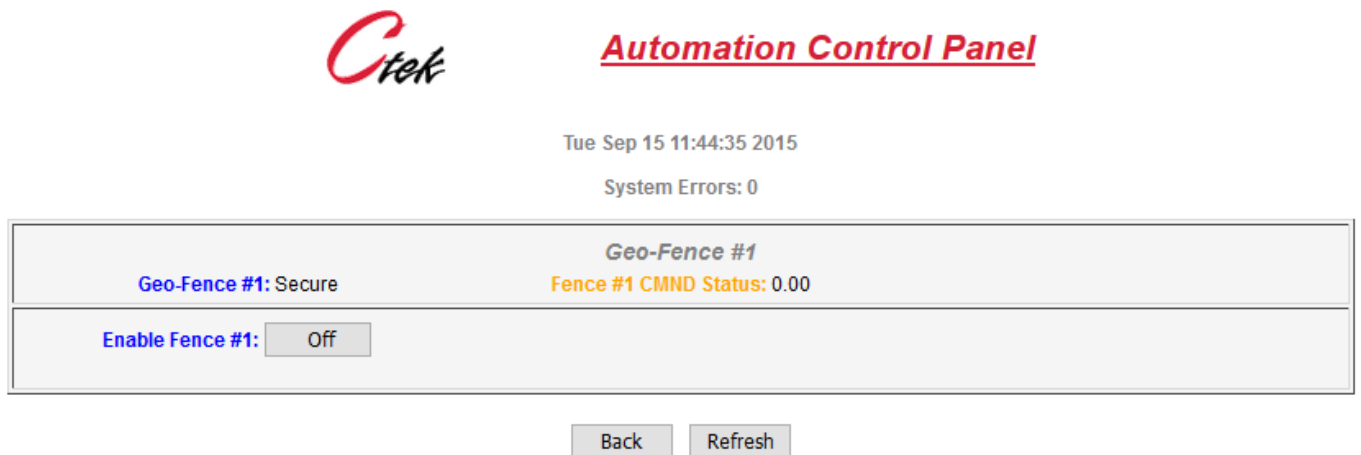


Figure 10 - Control Panel

SMS (Text Messaging) Control

Geo-fence # 1 can be activated using a previously defined radius size by using the text command `===SET o 1 1` and deactivated using the text command `===SET o 1 0`. See TN009 for additional detail. Upon successful fence activation or unsuccessful activation at the end of the time out period a status SMS will be sent to the phone numbers specified in the unit configuration screen.

XML Control

Using the XML messaging structure defined in APN005, output pin 1 can be set and reset, and status can be obtained on input pin 2.