

# NexStar Alt-Az Remote Operation Options

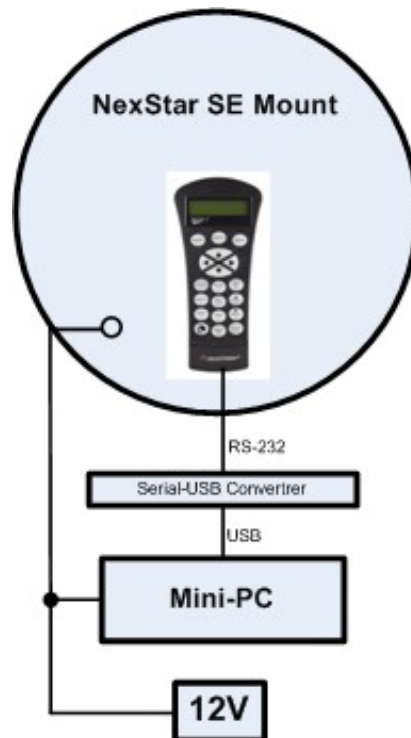
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## Introduction

This document describes a remote controlled telescope mount and associated configuration options. A **Celestron NexStar** Alt-Az mount and a CMOS digital camera were used in the system described below with the primary goal designed to minimize astronomer outdoor exposure. A similar system configuration would depend largely on where an outside telescope mount is located, e.g., in a home backyard, etc.

## Hardware

Component powering and wired connections are shown below.



## Basic System Configuration Details

A Windows **Mini-PC** is attached to the telescope mount where power and USB connections are then available. The Mini-PC has applicable mount and camera software installed. The Windows **Remote Desktop** application is used to remotely access the Mini-PC where mount and camera control may be asserted. In addition, serial data connectivity to the mount hand controller port is connected to a Mini-PC USB port. Careful attention to cable management is required to avoid cable entanglement as the mount is slewed to various night sky objects.

In addition to power, USB and serial data connections, the following system configuration details are defined:

- The Mini-PC is configured to auto logon upon system startup.
- The Mini-PC is configured to automatically join a nearby WiFi network that may provide Internet access.
- A CMOS or DSLR camera USB interface may be used for initial mount alignment and subsequent astrophotography activity.

### Notes:

1. A Windows batch file similar to the one below may be created to automatically join a nearby WiFi network when the Mini-PC is powered on. A batch file shortcut with administrator privileges may be stored in the Windows Startup folder.

```
REM AutoWiFi.bat
REM Batch file to automatically connect to WiFi network
@echo off
cls
netsh wlan set hosted network mode=allow ssid="aaaaaa" key="bbbbbb"
netsh wlan connect ssid=aaaaaa name=aaaaaa
cls
EXIT/B
```

(where aaaaaa is the network SSID and where bbbbbb is the network password)

2. Windows 10 Pro version is required for Remote Desktop operation.
3. Both the Mini-PC and the control computer/laptop must be connected to the same local data network.

### System Operation

1. Once the mount is leveled and power is connected to the Mini-PC and mount, the Mini-PC is powered on.
2. The Mini-PC then automatically joins the pre-configured nearby WiFi network with or without Internet access.
3. The hand controller serial data connection is assigned a computer COM port which is used to establish remote mount control.
4. Manual OTA focusing may be completed at this point in order to provide optimum night sky images.
5. Appropriate mount control and camera software may be used to complete initial star alignment, e.g., **NexStar Remote**. Additional alignment accuracy is provided by using the mount **ALIGN** feature where additional stars are located and centered.

## NexStar Remote Alignment Example - Northern sky – rough alignment

1. Start **NexRemote** software. Enter the Mini-PC COM port in **PC Port** box.
2. Assign a second (virtual) COM port in the NexRemote **Virtual Port** box.
3. Select **OK** to connect NexRemote to the telescope mount.



4. Click **ENTER** to begin alignment.
5. Scroll to **Auto Two Star** alignment. Click **ENTER**.
6. Step through time, date, etc., settings using the **ENTER** key.
7. Scroll to select the **first** alignment star (e.g., Polaris). Click **ENTER**.
8. Use the direction keys to center Polaris in the eyepiece or camera. Click **ALIGN**.
9. Scroll to select the **second** alignment star (e.g., Kochab). Click **ENTER**.
10. Use the direction keys to center Kochab in eyepiece or camera. Click **ALIGN**.
11. Rough alignment is achieved at this point.
12. Leave NexRemote running in the background.
13. Execute **TheSky6** or similar planetarium software.
14. Configure the planetarium telescope settings to select the mount type and the NexRemote **virtual** COM port.
15. Establish a connection to the mount . Planetarium display will show **Kochab** as the current object if mount alignment was successful.

## Notes:

- Initial mount alignment may also be accomplished using only the mount hand controller in lieu of a remote connection. A parallel serial data connection to the hand controller serial port will not interfere with hand controller operation.
- After a successful mount alignment has been achieved, planetarium software, such as Stellarium, TheSky or other Windows telescope mount control applications installed on the Mini-PC may be used.
- Alt-Az telescope mounts are less desirable for astrophotography applications due to image rotation. However, the same basic procedure outlined above also applies for equatorial mounts with the exception of the need for initial mount polar alignment.
- The Mini-PC minimum specifications should include adequate processing power and the amount of RAM required to run installed software.

Other options may include:

- Running Windows **NINA** software to accommodate additional remote control features such as auto focus, dew heater, dome controls, auto-guiding, etc.
- Enhanced camera software that may include live auto stacking, etc.
- Automatically generating Email message alerts.
- DC power and/or Ethernet cabling may be extended considerable distances to the outside mount location where reliable WiFi connectivity is not possible.

## Conclusion

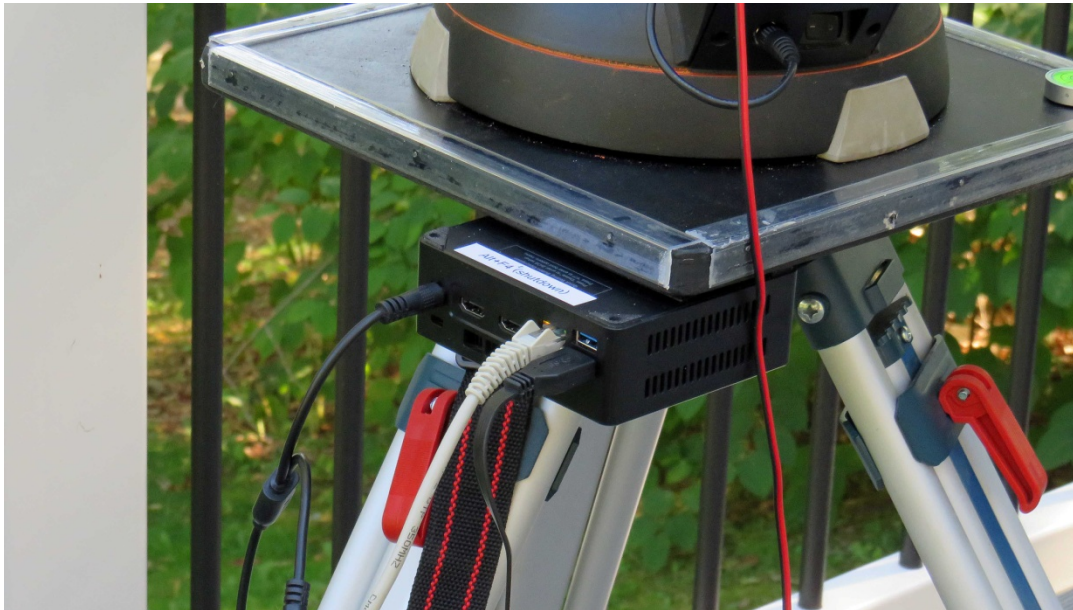
The use of mount attached Mini-PC processing power opens up a number of potential enhancements, enhancements not easily accommodated without this option. Mount processors using Raspberry Pi platforms may also be used to provide similar capabilities.

Depending on the amateur astronomer's budget, a wide range of remote control options are possible. From the relatively simple system described in this document to more elaborate and expensive system configurations, only your imagination limits additional possibilities.

The following page includes photographs of initial trials of the test system.



Celestron NexStar Alt-Az mount and Short Tube Refractor Testing



Mini-PC mounting showing power, data and USB camera connections

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