Skyan

Wireless Control System for Telescopes

Content

Introduction

Skyan, the wireless telescope control system, consists of two units: the RF remote control and the Receiver module (radio receiver and microprocessor control module). This is a stand-alone system and *you do not need any additional hardware or software in order to use it* with the telescope and focuser. It can be used in conjunction with your existing Celestron's Hand Control unit (HC) and/or Celestron's NexRemote software.

Skyan monitors the communication between the HC (NexRemote) and telescope and automatically re-transmits tracking commands if the telescope operates in ALT/AZ mode. There will be no interruption of operation due to 30sec tracking updates coming from the HC (NexRemote).

You are able to wirelessly control all basic functions of your telescope and focuser:

- move the telescope in all directions at any preset speed rate
- change the speed rate (1-9)
- do the centering during alignment and calibration, "Precise GoTo", "Sync" and other similar commands supported by your mount
- reverse buttons direction (LEFT-RIGHT, UP-DOWN)
- move your focuser IN and OUT

The speed rate is constantly displayed on the front panel of the Receiver module. In "Control" mode (while setting the speed rate), each step is followed by the sound of internal buzzer that helps you monitor the remote operation even without looking at the display (this is very convenient when you operate in the dark). The size of the Remote control is so small that you can keep it in your hand in the pocket and comfortably command your telescope and focuser in cold weather.

If you use either the HC or your computer to control the telescope via NexRemote software (with or without using the HC), it is extremely convenient to use Skyan for final centering and focusing on your selected object without the need to move your eye from the eyepiece at any time. You can easily move and focus the telescope during observation without fear that you will hit a wrong button and send an undesired command (like with the regular HC).

Disclaimer

Belsico Inc. is continually working to improve the quality and function of its products; for this reason, we reserve the right to make changes without notice. The information contained in this manual is believed to be accurate as of the time of publication.
Skyan is a wireless, radio frequency operated device, and as such, is a device that is prone to RF interference, noise and other influence that may interrupt its operation. Under no conditions will Belsico Inc. be responsible for any damage and/or personal injury arising from the use or failure of the device in any application. The user assumes full liability for the use of product and should monitor the operation and prevent any damage and/or personal injury resulting from the malfunction of the device.

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1   Installation

1.1   Receiver Module

The Receiver module (Fig. 1) connects to your Celestron GOTO telescope's AUX port and Technical Innovations' Robofocus[1] control box. There is no need for any external power supply since the unit is powered from the telescope's port.[2]
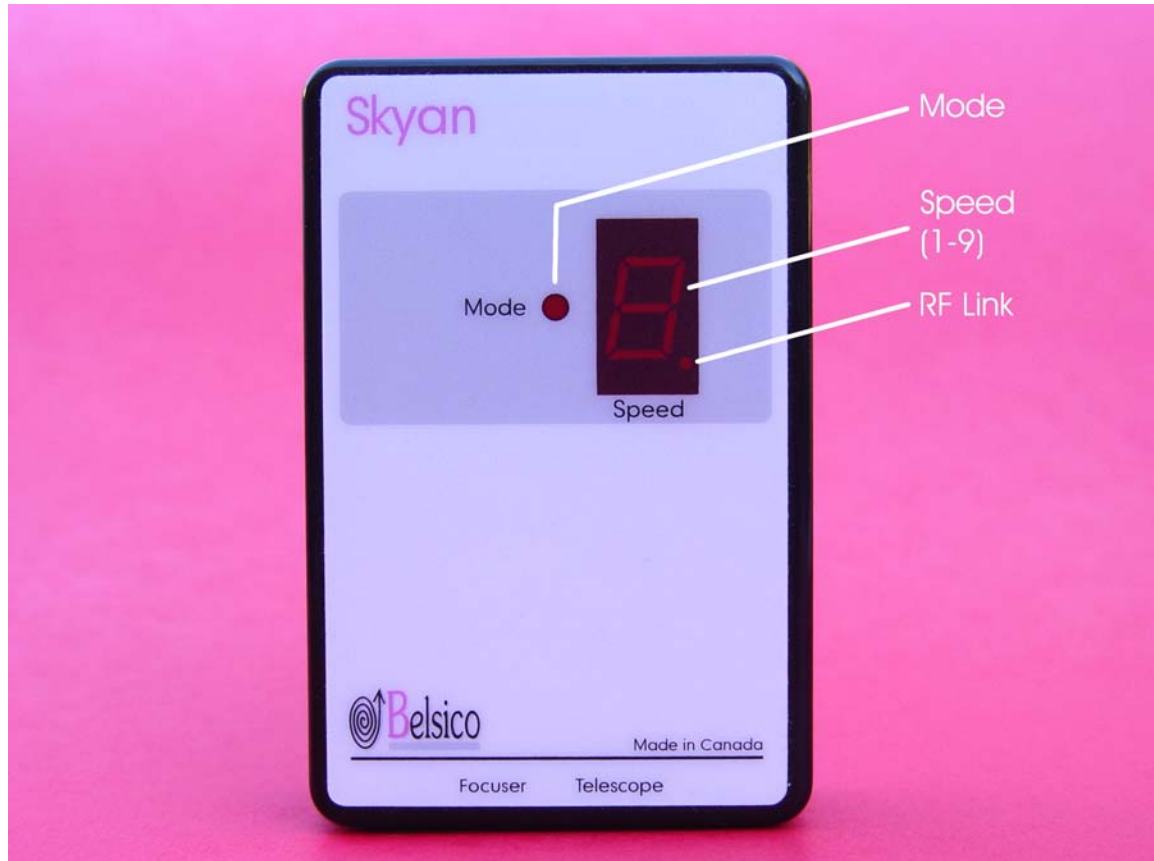

Fig. 1

The installation of Skyan is very simple (Fig. 2). Use the straight cable provided with the unit to connect the "Telescope" port of the Receiver module to AUX port of the telescope (any AUX port will work if there is more than one on your telescope). It will work with the HC port as well if you use NexRemote instead of HC.

Use the second cable to connect Skyan with the focuser. Connect the "Focuser" port to the "Scope/Hand" port of the Robofocus control box (or the equivalent port if you use some other type of focuser with the same type of interface).

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[1] It can be any focuser with a contact type interface for IN and OUT controls (serial interface is not supported). If some other unit than a Technical Innovations' Robofocus box is used for focusing then an optional connection cable may be required (e.g. for Optec's TCF-S focuser).
[2] Always use the original cable in order to avoid any possible damage to your telescope and/or control box.
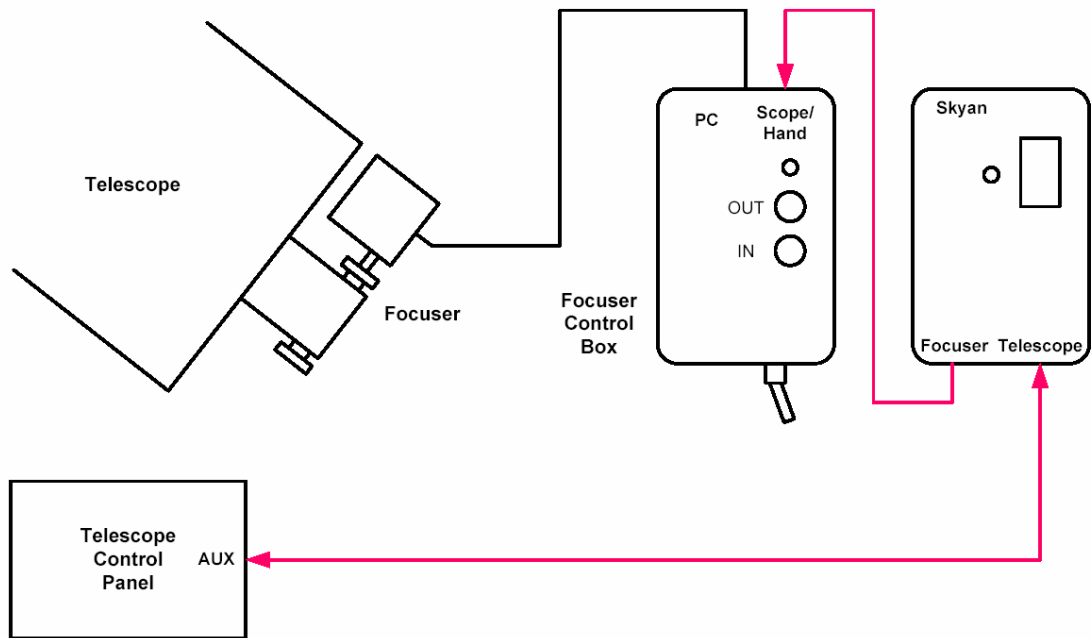
Fig. 2

For mounting the receiver module on the telescope or tripod/pier you may use the self-adhesive fastener set provided in the Skyan package. One example of the mounted device is shown in Fig. 3.

Fig. 3

2   Operation

2.1   Receiver Module

The Receiver module (Fig. 1) connects to your Celestron GOTO telescope's AUX serial port and Technical Innovations' Robofocus[3] control box. It receives commands from the RF Remote control (Fig. 4), re-formats commands and re-routes them to the telescope and focuser. It can be used in any possible configuration: it can control both the telescope and focuser but it can also be used with either your telescope or focuser exclusively.[4]

The module is powered from the telescope and consumes a very low current (~50mA average). There is no extra power consumption if used with the focuser. If used with the focuser exclusively then an optional power adapter is required.

The receiver module has two ports and three indicators:

- Telescope port
- Focuser port
- Mode indicator
- Speed indicator
- RF link indicator

2.1.1   External Ports

The telescope port typically connects to the telescope AUX port(s). It may be connected to the HC port if HC is not used (NexRemote is used instead).

The focuser port connects to the Robofocus or similar focuser control box.

2.1.2   Indicators

The mode indicator indicates the mode of operation. When the indicator is OFF, the module is in the "Normal" mode of operation (direction buttons are used to control the telescope motion). When the indicator is ON, the module is in the "Command" mode of operation (setting the telescope speed rate and focuser position).

The speed indicator displays the speed rate of the telescope. When you use the direction buttons, the telescope will move at the rate selected in the "Command" mode and displayed on this 7-segment indicator.

The RF link indicator is ON whenever the receiver receives a signal from the RF Remote control. This indicates that there is a valid link between the RF Remote control and the Receiver module.[5]

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[3] It can be any focuser with a contact type interface for IN and OUT controls (serial interface is not supported). If some other unit than a Technical Innovations' Robofocus box is used for focusing then a different connection cable may be required (e.g. for Optec's TCF-S focuser).

[4] If you use Skyan exclusively with the focuser, you will need an optional power adapter.

[5] This indicator may be triggered by any radio signal of the same frequency as the RF remote control (another remote control, garage door opener, etc.). Only the signal from your remote control will command the telescope and focuser; all other sources will be ignored by the receiver but may jam your system operation (see Section 2.4 as well).

2.1.3 Buzzer

There is an internal buzzer that assists the user during operation of the unit in the "Command" mode (see Section 2.3).

When you enter the "Command" mode, one short beep will be generated. When you exit the "Command" mode, two short beeps are generated.

Every time the speed rate is changed, you will hear a short beep. Once you reach either the maximum (9) or the minimum speed rate (1), each additional press will generate a long beep to warn you that the maximum/minimum speed has been reached.

Every time the direction buttons reversal is done, you will hear one long beep.

If, at any point, the serial communication between the Receiver Module and telescope is lost, the buzzer will generate five short beeps and the speed indicator will display the "E" character for 5 seconds.

2.2   RF Remote Control

The RF Remote control (Fig. 4) has five buttons (S1-S5) and transmits commands to the Receiver module which is connected to your telescope and focuser. Every command from the RF remote control is decoded and sent to either your telescope ALT/AZ motor controllers or your focuser controller.

There are four direction buttons (S1-S4) with the same functionality as on the regular HC from Celestron. You are able to move the telescope up and down (ALT controller) and left to right (AZM controller) at the speed rate displayed on the front panel of the Receiver module.

The fifth button in the center (S5) is used to change the mode of operation. When the "Mode" indicator on the front panel of the Receiver module is OFF, the unit is in the "Normal" mode of operation: four direction buttons move the telescope in the desired direction at the speed rate displayed on the Receiver's module front panel. When the "Mode" indicator is ON, the unit is in the "Command" mode of operation, where you can change the speed rate and command the focuser IN and OUT.
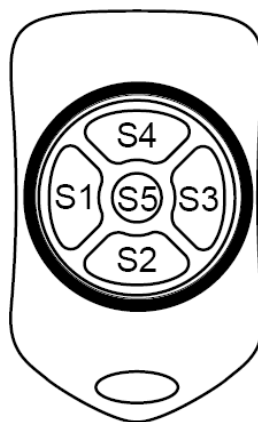

Fig. 4

2.2   Normal Mode

In this mode, you use four direction buttons (S1-S4) to move the telescope LEFT, DOWN, RIGHT and UP. If you use the telescope in equatorial mode, then buttons S1 and S3 control RA movement (AZM motor controller) and S2 and S4 DEC movement (ALT motor controller). In the ALT/AZ mode of operation, the buttons S1 and S3 control the azimuth movement and S2 and S4 the altitude movement.

Note: You may use the RF Remote Control simultaneously with either the regular HC or NexRemote during the alignment and calibration, "Precise GoTo", "Sync" and other similar commands supported by your mount.

The speed rate is displayed on the front panel of the Receiver module. Skyan remembers the last speed rate setting and uses the stored value after powering up.

As with the original HC, you are able to use the maximum speed rate (9) regardless of the current setting if you press the opposite direction button while moving at the selected speed. The maximum speed will be maintained as long as you keep the opposite button pressed.

If you want to change the speed rate, you need to enter the "Command" Mode.

2.3   Command Mode

The speed rate as well as the direction of S1/S3 and S2/S4 button pairs can be changed at any time by entering the "Command" mode of operation. This is done by pressing the button in the centre of the RF Remote control. When you press the central button, Skyan will enter the "Command" mode and the "Mode" indicator on the front panel of Receiver module will light up. The short beep will sound at the same time.

In this mode, you can control the focuser as well.

In order to exit the "Command" Mode, you need to press the central button again. The indicator "Mode" will go OFF and two short beeps will sound.

With every press of the central button, the mode will toggle. The beeper will sound once when entering the "Command" mode and two times when exiting it.

Note: If there is no activity in the "Command" mode for more than 3 minutes, the mode will automatically switch back to "Normal". Two short beeps will sound.

2.3.1 Speed Rate

By pressing the upper direction button (S4), you may increase the speed rate by one step with each press. Every time the speed rate is changed, you will hear a short beep. Once you reach the maximum speed rate (9), each additional press will generate a long beep to warn you that the maximum speed has been reached.

By pressing the lower direction button, you may decrease the speed rate by one step with each press. Every time the speed rate is changed, you will hear a short beep. Once you reach the minimum speed rate (1), each additional press will generate a long beep to warn you that the minimum speed has been reached.

2.3.2 Direction Buttons Reversal

The direction an object appears to move in the eyepiece changes depending on your set up and, if in EQ mode, on which side of the Meridian the telescope tube is on. This may create confusion and to compensate for this the direction of the S1/S3 and S2/S4 button pairs can be changed. You can change the direction of the buttons by pressing either S1 and S3 or S2 and S4 at the same time. Each time you press S1 and S3 at the same time, the direction of AZM control will reverse and one long beep will sound. If you press S2 and S4 at the same time, the direction of ALT control will reverse and one long beep will sound. As with the original HC, this action will affect only speed rates 6 and lower. The speed rates 7, 8 and 9 are not affected (S1: LEFT, S3: RIGHT, S2: DOWN and S4: UP).

Skyan remembers the direction settings and uses the stored value after powering up.

2.3.3 Focuser

The focuser is controlled by the left (S1) and right (S3) direction buttons. By default, the left button performs the IN focuser operation and the right button performs the OUT focuser operation (Robofocus defaults).

2.4 Device Address

Each Skyan device has a unique address that prevents any other Skyan device from sending a command to either your telescope or focuser. It is highly unlikely that any other similar device will match the address/frequency combination of your device within the usable range of the device. Theoretically, it is still possible that some other device (like your neighbour's garage door opener) can communicate with your Skyan receiver and affect telescope operation. In such rare cases, you may change your device address; this is done by cutting one or more traces on both the RF remote control and the Receiver module printed circuit boards. You may use a small cutter to cut out a piece of the trace.
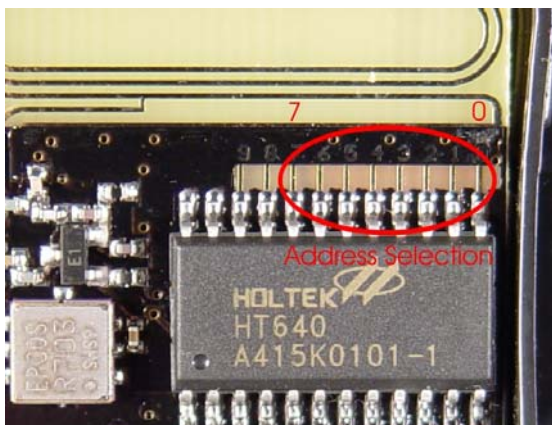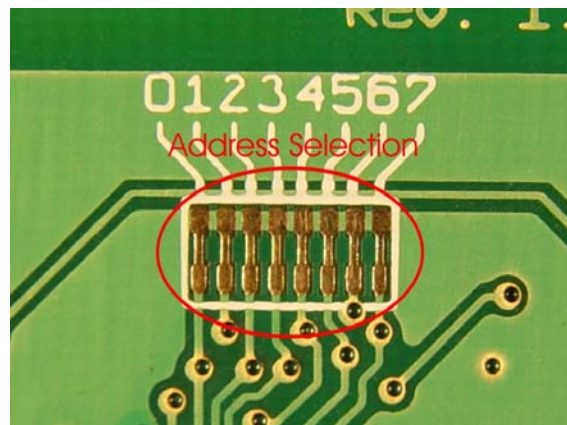
| a) Remote Control | b) Receiver Module |

Fig. 5

There are 256 address combinations available to the user[6] (8 jumper traces on printed circuit boards – see Fig. 5) and they must match on both the RF Remote control and the Receiver module. Whenever you cut a trace on the RF remote control, you must do the same on the Receiver module (e.g., if you cut traces 3 and 5 on the Remote Control, you must cut traces 3 and 5 on the Receiver Module as well). The jumper traces can be accessed by removing the rear cover of both units.

2.5　Battery Replacement

Normally, the battery will last for a few months of observation. Avoid using long slews and long focuser travel frequently.

The remote unit utilizes a CR-2032 Button Lithium Cell. Access for replacement is accomplished by gently prying apart the two halves of the RF Remote control at the seam. Once the unit is open, remove the battery by sliding it out from beneath the retainer. Replace it with the same type of cell while observing the polarity shown (Fig. 6). When replacing the new battery, do not push too far – it should not touch the pins of the integrated circuit.
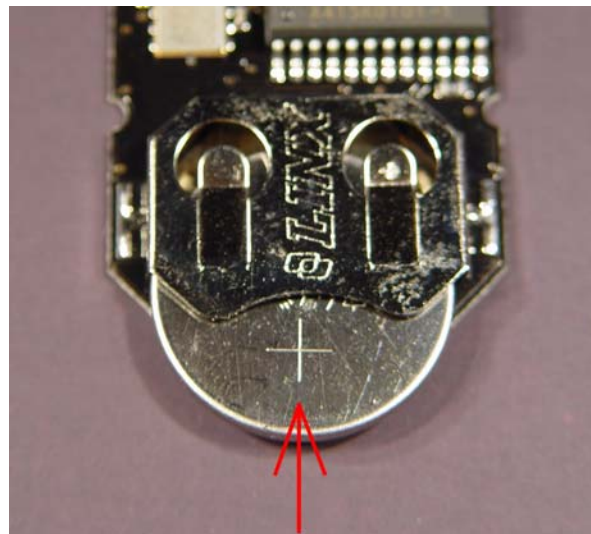

Fig. 6

2.6　Default Settings

The default settings are: Speed rate 7 with no buttons reversal (S1: LEFT, S2: DOWN, S3: RIGHT and S4: UP). If you want to restore these settings at any time just keep pressing the central button of your remote (S5) and direct it at your telescope (receiver module) as it is powering up. One long beep will sound to indicate the default settings are restored.

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[6] Never cut or modify jumpers 8 and 9 on the RF Remote control since there are no physical pairs for these jumpers on the Receiver board. Any changes on jumpers 8 and 9 will render your unit no longer operational.

Specification

Operating voltage:	12VDC nominal (7VDC to 15VDC)
Current consumption:	50mA (average), 80mA (max.)
Overvoltage/Reverse polarity protection	TVS diode and resettable fuse
Operating temperature range:	-25°C to +60°C (-13°F to 140°F)
Transmitter/receiver frequency options:	315MHz, 418MHz (standard), 433.92MHz
Encoder/decoder address range:	2^{10} (1024 combinations)
Dimensions (Receiver module):	85mm x 56mm x 21mm (3.3" x 2.2" x 0.8")
Dimensions (RF Remote):	57.4mm x 34.6mm x 11.5mm (2.24" x 1.35" x 0.45")

Warranty

Belsico Inc. warrants this product to be free from defects in materials and workmanship for one year. Belsico Inc. will repair or replace the product which, upon inspection by Belsico Inc., is found to be defective in materials or workmanship. As a condition to the obligation of Belsico Inc. to repair or replace this product, the product (both the RF Remote control and Receiver module) must be returned to Belsico Inc. together with the proof of purchase.

The customer shall be responsible for the shipping and other associated costs of sending the unit to Belsico Inc.

Belsico Inc. shall expend reasonable efforts to repair or replace the product covered by this warranty within thirty days of receipt. In the event that repair or replacement should require more than thirty days, Belsico Inc. shall notify the customer accordingly and the warranty will be extended by the number of days between reception and shipment date.

This warranty shall be void and of no effect in the event that a product has been modified or subjected to abuse, misuse, mishandling or unauthorized repair.
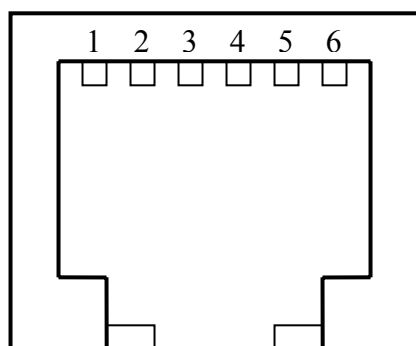

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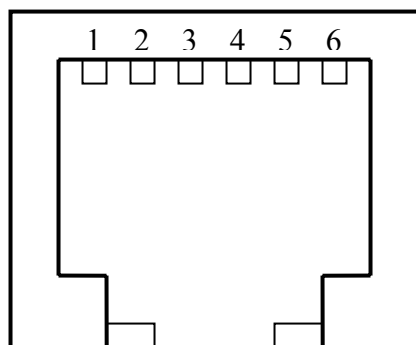
Appendix A

Connector pinout

Telescope (front view)

<table>
<tr><td>

```
 1  2  3  4  5  6
 □  □  □  □  □  □
```

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1 **RTS** (output)
2 **GND**
3 **TX** (output)
4 **+12V** (power in)
5 **RX** (input)
6 **CTS** (input)

Logic levels: CMOS 5V
ESD protection (signal lines): 6.1V

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Focuser (front view)

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<tr><td>

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 1  2  3  4  5  6
 □  □  □  □  □  □
```

</td><td>

1 **Focus IN** (output – active LOW)
2 **GND**
3 No connection
4 No connection
5 No connection
6 **Focus OUT** (output – active LOW)

Outputs are open drain with 5V pull-ups
Max. sink current: 200mA
ESD protection: 6.1V

</td></tr>
</table>