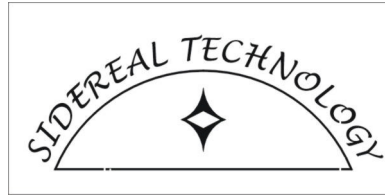


**SIDEREAL TECHNOLOGY RADIO HANDPAD
MODEL HR-1 and MODEL HT-1
USER INSTRUCTION MANUAL**
<http://www.siderealtechnology.com/>



**Last revised September 27th, 2005
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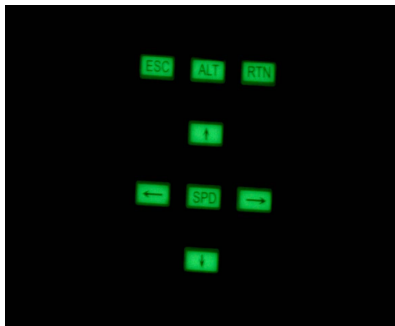
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This exciting new product from Sidereal Technology has many cool features in addition to remote handpad control of your telescope or tracking platform. This product was engineered and tested by amateur astronomers, for amateur astronomers!

Features:

1. **Connects to the Sidereal Technology Dual Servo Controller** for wireless remote control of your telescope. Eliminates the wired Handpad for tangle free operation.
2. **Emulates the old standard Mel Bartels Stepper System Handpad:** The receiver has a mode which emulates the original Mel Bartels handpad, so can be used with the Mel Bartels Stepper system with only the application of a jumper, and a ground wire.
3. **Addressable:** (easily changeable with a keyboard sequence). This allows many users with many telescopes on the same telescope field.
4. **Low Duty Cycle Transmit Time:** Special micro controller routine only transmits about 1/20th of the time, even when a button is continually pressed. There are no transmissions when no buttons are pressed. This allows multiple use from several identical handpads and telescopes without interruption of any one user.
5. **Instant, imperceivable delay** between a button press and action of the telescope. This is a real plus when centering an object at pan speeds, there will be no overshoot, as the scope starts and stops movement at exactly the same perceived time as you press and release the key.
6. **Built in Micro-Processor Based astronomers LED flashlight.** There are 4 super bright LEDs which work in tandem. The brightness is adjustable from very dim to very bright in 16 linear perceived steps. The brightness is “remembered” across a power down.
7. **Keypad lock feature:** When in the locked mode, only the 4 direction keys work. This is a great (nearly mandatory) feature for public star parties where the handpad is given to the general public for panning the moon at high power (it also helps us more experienced observers at 3:00 AM!!!!).
8. **Glow in the dark keypad:** A lot of research went into finding the perfect glow in the dark base and the percentage used. This glow in the dark is not too bright for even the most



2 Second time exposure in a dark room

hardcore dark sky enthusiasts! Approval was given by both Chuck Dethloff and Howard Banich (experienced dark sky observers from the Portland Oregon area). In addition to this, the glow lasts all night long, making it easy to find on the observing table in the darkest night. Although the labeling on the buttons may not be discernible, the shape (and thus the location of specific

keys) are easily discerned.

9. **Keypad:** Reliable, custom manufactured Silicone One Piece Push Button pad, which presses against gold plated contacts.
10. **Industry standard, autoguider port** is built in to the receiver. This port can be used to autoguide a telescope, with or without the ASCOM driver or Mel Bartels scope control software. It will even work with the Argo Navis, or stand alone tracking.
11. **Auto Off** for both the flashlight (7.5 minutes) and the transmitter (15 minutes).
12. **Long Battery Life** (Years, if a button is not inadvertently left pressed). It uses an easily replaceable standard 9 volt alkaline battery.
13. **Wide keypad spacing** for gloved operation.
14. **Transmitter can be used with a direct connection** to the telescope controller (in case of interference or if the battery runs down (SiTech Controller Only).
15. **Digital I/O added.** 4 inputs, or 2 inputs and 2 outputs are available for software to use.
16. **Handy necklace** is included.

Technical Information:

The transmitter and receiver utilize a pair of Lynx Technologies OOK (On Off Keying) transmitter and receiver chips. The crystal controlled frequency used is 433.92 Mhz. The antenna is internal to both the transmitter and the receiver.

A very quick bit rate, and only 16 bits per packet (including address, data bits and error checking) are needed to activate the receiver. This is one reason for the perceived instantaneous response.

While a button is pressed on the transmitter, there is an initial burst of data, and following this, there is a burst of data every second. Each burst is very short, and is 2 packets of data in case of interference during one of them. Included in this burst of data is the address, and the data, and a checksum.

Now when the button is released, there is another burst of data which has the key released information.

The receiver is programmed to expect a burst every second, and if it doesn't get an expected burst, it will stop. Normally this will not happen, as it will get a burst when the key is released, which will stop the movement of the telescope, but it is there for safety, in case both key release bursts are missed.

You can order the handpad without the radio components, and it will serve as a wired handpad (SiTech Controller only). In order to upgrade from a wired handpad to a wireless system, you will have to purchase a receiver, and send the handpad back to our factory for addition of the radio components. The cost of the wired handpad, and upgrading to the wireless will add up to the same price (except for shipping and handling).

TECHNICAL SUPPORT:

If you are using ScopeII and having issues, you need to contact Mel Bartels for Technical

Support. Mel is extremely patient and will work with you until you are up and working, if necessary, he will provide telephone support.

If you are having problems with the controller, radio handpad, or the ASCOM driver, or are having problems with the Argo Navis controlling your telescope, Sidereal Technology will help you. We are available by email anytime. grayarea@tms-usa.com. Please be sure to include "Servo" in the subject line, or your email may be rejected as spam. You will receive a response, generally within 8-10 hours. You can also call Dan Gray anytime before 10:00 PM Pacific Time. His phone number is 503-887-3701.

Mounting the Receiver:

The receiver should be mounted where there are no obscuring metal parts for best reception. If you want to see the LED's for status, mount the unit close to where it will be visible from the eyepiece side of your telescope.

You can use Velcro to mount the unit.

Connecting the Receiver:

The Receiver connector labeled “Handpad Connector” should be connected to the SiTech Controller port labeled “Handpad”. Use a flat 6 conductor cable with two 6 position modular jacks. Pin 1 should be connected to pin 1 on each connector. This cable is normally supplied with the unit.

If connecting to a Mel Bartels Stepper system, the flat cable will be the same type, but you will also need to connect a ground wire from the connector labeled “Ground” to the Ground of the Stepper board. You must also be sure the internal jumper inside the receiver is set to the side labeled “Stepper” instead of the side labeled “Servo”.

Operation, All Systems:

Setting Address: To select the address of the transmitter, hold down the “ALT” key, and press the “<---”, “SPD”, “--->” keys, one at a time, in the left to right sequence. The LED's will start flashing, and the 7 keys take on the value of 7 digits. The keys take on the following values:

[1]	[2]	[3]
	[5]	
[7]	[8]	[9]
	[0]	

Now press any 3 key sequence that doesn't create a value over 254, and the transmitter is programmed. You may start your sequence with one or two zero's if you like. The LED will stop flashing to indicate successful change of address. The address is stored in the microprocessors flash ROM.

Receiver address change: Unplug your receiver from the telescope controller. Wait about 2 or 3 seconds, then plug it back in. Within the first 10 seconds of power application, press both the

ESC key and the RTN key together, 3 or 4 times. The receiver will take on the address of the transmitter. The 4 lights on the receiver make a cute flash sequence to indicate it re-programmed its address. It may be a good idea to make sure no others on the telescope field are powering up their receivers at this time!!!

It may also be a good idea to write your address down, so when at a star party, you may discuss your chosen address with all of the (hopefully many other) Sidereal Technology radio handpad users. You may also control other folks scopes if you get them to tell you their address (or use process of elimination). This can make a really interesting evening of observing (Sidereal Technology will not be responsible for any black eyes!!!!).

Normal Slew/Pan/Guide operation:

The arrow keys on the handpad will operate the telescope. You can move Altitude/Declination and Azimuth/Right Ascension at the same time if using the SiTech Servo system. If using Mel Bartels Stepper System, simultaneous combinations are not possible.

To change speeds, simply press the center “SPD” button for 1/8th to 1/4 of a second. If using the SiTech system, you will toggle between the Slew mode, to the Pan mode, and then the Guide mode, then it will be in the slew mode again. You can watch the lights on the receiver to see which mode you're in. You must be using version 1.6 or later in the SiTech servo controller for the lights to operate properly, and also to sequence into the guide mode.

If you are using Servo version 1.5 or earlier in the SiTech controller, you will only have the Slew/Pan modes, and the indicator lights will not work properly. This will be evident because the slew and pan LED's will be on faintly, but when the SPD button is pressed, the slew and pan LED's will get brighter.

If using the Stepper system, your choices are Slew and Pan modes. The guide mode will only be available from the Guide port, and also the Scope.exe software will have to be put in the guide mode.

Flashlight Operation: The top center button (among many other uses) is used to turn the flashlight on and off. When the flashlight is on, top right key presses (“RTN”) brighten the flashlight, and top left key presses (“ESC”) dim the flashlight. When the flashlight is on, the normal functions of the top right and top left key are disabled. The flashlight automatically turns off after about 7.5 minutes.

Keyboard Lock Mode: In this mode, the only keys that are operational are the direction keys (Up, Left, Right, and Down keys), and the combination ESC and RTN (pressed at the same time). You must select your preferred speed before locking the handpad. This mode is very useful at public star parties, and provides the option of giving the handpad to the general public for panning the moon, etc., without re-initializing, slewing, etc. It may also help you on those very late nights fumbling in the dark!

To lock the keypad, hold down the “ALT” key, and press the Up direction key (scope will not

move if the “ALT” key is pressed). When the handpad is in the locked mode and the flashlight is off, the LED's will flash if an illegal key is pressed.

To unlock the keypad, hold down the “ALT” key, and press the Down direction key (scope will not move if the “ALT” key is pressed).

After an automatic power down, the keyboard will automatically be unlocked.

Turning the Handpad On:

To turn the handpad on, simply press the SPD key. The unit powers up and remains on until about 15 minutes have elapsed, or a user turns it off.

Turning the Handpad Off:

To turn off the handpad, hold down the “ALT” key, and press the “SPD” button. If this is not done, the transmitter will power down by itself (to save batteries) after about 15 minutes.

DragNTrack and SlewNTrack Operation (Alt/Az scopes only):

Tracking Control:

The top right key will stop and start the tracking (flashlight must be off).

Initializing:

To initialize if your scope latitude is not programmed into the Servo Controller, point the telescope at the scope zenith, then press and hold the top right key for more than 5 seconds (when the LED on the controller flashes fast, you may let up). Now, point the scope at the Celestial Pole. Now press and hold the Top Left key for more than 5 seconds (when the LED on the controller flashes fast, you may let up). Your scope is now initialized, and the DragNTrack or SlewNTrack will be working (assuming the Servo controller is properly configured).

Scope latitude is the effective latitude of your scope. It is the same as your own latitude if your scope is level, but will be a slightly different latitude if the scope is not level in a north/south direction.

If you want to save this automatically calculated latitude in the Servo Controllers' Flash ROM, simply press and hold both the top right (RTN) key and the top left (ESC) key simultaneously for more than 10 seconds.

Note: The latitude calculation was wrong on the SiTech Controller Firmware versions 1.5 and earlier. If you have version 1.5 or earlier, you will have to enter the latitude using the ServoConfig software, or upgrade to version 1.6 or later.

If your scope latitude is known, and it is programmed in the Sidereal Technology Dual Servo Controller, simply point the scope at the Celestial pole, now press and hold the Top Left (ESC) key for more than 5 seconds (when the LED on the Servo Controller flashes fast, you may let up).

Entering and Leaving the Guide Mode:

The guide mode can be entered if using SiTech Controller firmware version 1.6 or later by simply pressing the SPD button and toggling through the speed sequences. If version 1.6 or later, the controller will also automatically enter the guide mode if guiding signals appear on the receiver AutoGuider port.

If you are using Servo firmware version 1.5 or earlier, you will need to use the following methods.

To enter the Guide mode: Hold down the top right key (RTN), and press the Right button (flashlight must be off).

To Leave the Guide Mode: Hold down the Top Right key (RTN) and press the Right button again (flashlight must be off).

Equatorial Mode Operation:

Tracking Control:

The top right key will stop and start the tracking (flashlight must be off).

Entering and Leaving the Guide Mode:

The guide mode can be entered if using SiTech Controller firmware version 1.6 or later by simply pressing the SPD button and toggling through the speed sequences. If version 1.6 or later, the controller will also automatically enter the guide mode if guiding signals appear on the receiver AutoGuider port.

If you are using firmware version 1.5 or earlier, you will need to use the following methods.

To enter the Guide mode: Hold down the top right key (RTN), and press the Right button (flashlight must be off).

To Leave the Guide Mode: Hold down the Top Right key (RTN) and press the Right button again (flashlight must be off).

To Increase the tracking rate: Hold the top left key down (ESC) and press the Up key. Repeat process for more increases.

To Decrease the tracking rate: Hold the top left key down (ESC) and press the Down key. Repeat process for more decreases.

Platform Rewind: If using a platform, to rewind the platform, press the ESC and the RTN keys simultaneously.

Mel Bartels Stepper System Operation Using “SCOPE.EXE”:

If not ordered from the factory as such, you will need to remove the cover from the receiver, using the 4 Philips head screws. Find the jumper labeled: “STP/SRV”. Install the jumper toward the side marked “STP”. You will also need to connect a ground wire from the terminal block

labeled “Ground”, to the ground of the stepper system. There are two terminals provided, but that is because a “one” terminal device wasn't available. You can connect either terminal on the receiver to the ground of the stepper system.

When the receiver is connected to a Mel Bartels controlled system (SiTech or original stepper system), the 7 buttons take on the same action as the 7 buttons provided in the Mel Bartels stepper system, using Scope.exe. Instead of a switch, there is a center push button labeled “SPD”. You can push it for ¼ of a second or so, and it will switch from Pan speed to Slew speed. Push it again for changing from Slew speed to Pan speed. The Pan and Slew LED's on the receiver will indicate which mode you're in.

Argo Navis® Mode Operation:

It is now possible to connect the SiTech Controller to an Argo Navis. The encoders are connected to the SiTech Controller instead of to the Argo Navis. This is different than most other systems. The telescope location information is passed to the Argo Navis via the serial connection. There is a section in the SiTech Controller manual on setting up the Argo Navis and setting up the SiTech Controller configuration. The handpad operation is very simple. After the SiTech Controller is connected to the Argo Navis, and power is applied to them both, press the top left (ESC) and the top right (RTN) keys at the same time. This will initiate communication with the Argo Navis. Now align the Argo Navis, following the Argo Navis instructions. Once alignment is complete, you can select an object using the “Catalog” menu of the Argo Navis. Now press both the ESC and RTN keys at the same time. The scope will GoTo the selected object and start tracking. If the object is not centered, you can center it using the handpad. If the scope is moved manually, you can return to the last object by pressing the two buttons again.

Using the Radio Handpad with the SiTech ASCOM driver:

There are no special features used with the SiTech ASCOM driver. You can center objects as you normally would, or manually slew if needed.

Transmitter LED's:

The transmitter has 4 LED's on the front, which mainly operate as a flashlight. If the transmitter is used as a wired handpad, and there is no battery, only two of the LED's work, because there is not enough voltage from the 5 volts to operate the 4 LED's in series.

If the power is on, and the flashlight is off, the 4 LED's will be on very faintly. This is the only indication that the power is on.

If the flashlight is off, whenever a transmit burst happens, the LED's flicker. This is an indication of the radio transmission. If you are using the handpad in the wired mode, the radio transmitter is disabled, but the flicker is still visible. If you press a button, you will see the initial transmission, and when you release the button you can see the release transmission. If you press and hold a button, you can see the initial transmission, then every second, there will be another transmission, as the receiver expects a transmission every second to “assume” the button is still pressed.

Receiver LED's:

There are 4 LED's on the receiver. Three LED's on the receiver are for indicating the current handpad speed of the system. They are 3 different colors so you can easily see the current mode with a quick glance at the receiver. The fourth LED flickers whenever the receiver receives a valid signal from the handpad transmitter.

Slew LED. This Red LED is on if the handpad is in the slew mode.

Pan LED: This Yellow LED is on if the handpad is in the Pan mode.

Guide LED: This Green LED is on when the SiTech Controller is in the guide mode. The LED is on medium brightness if the controller is in the guide mode, but it is on brighter when there is a guiding signal present. When the controller is in the guide mode, guiding pulses can appear on the external Guide port, or the handpad arrow keys, however the LED only gets brighter when a guiding signal is on the guide port..

Whenever a guide signal is present on the guide port, the receiver will put the SiTech Controller in the Guide mode. To exit from the guide mode, press the middle SPD button (Servo Version 1.6 or later).

If the receiver is used on a Mel Bartels Stepper system, the Guide mode LED only illuminates when a guide signal is received. The receiver only assumes that the Stepper system is in the guide mode.

Receive LED: This Red LED flickers brightly, each time a valid radio signal with a valid address and valid checksum is received. It flickers faintly if it receives a valid signal with the wrong address.

Using the Handpad as a wired handpad:

There is a 6 position modular connector on the end of the handpad. This can be connected to the SiTech Controller directly. Any SiTech handpad will work for this, whether it has radio components or not. If your handpad has radio components, the radio is disabled when connected to the SiTech controller. This can be useful if the battery runs down in the middle of the night with no 7-11 around the corner to purchase a new one, or if there is interference for some reason.

You can purchase the handpad without the radio components. It will then simply serve as a wired handpad. You will not be able to use the guide mode from the handpad (from software only), and then you will have no indication of which mode you are in (unless it is on-screen).

It will not work properly as a wired handpad on Mel Bartels Stepper System.

Trouble Shooting:

Problem: There are no LED's on when the system is connected to the scope controller.

Solutions: Check the modular cable. This must be a 6 conductor flat cable, with pin 1 connected to pin 1. Many modular cables connect pin 1 to pin 6, 2 to 5, etc. Check that the jumper is in the proper mode for your system (Stepper vs. Servo). On the Servo controller, check that the jumper next to the handpad button is in the proper position (It must be nearest to the edge of the board).

If this is a Stepper system, check that the ground wire is connected between the receiver and the controller. Check that the Servo/Stepper jumper is in the correct position.

Problem: The receive light flickers faintly when I press keys on the transmitter. The LED flashlight works properly on the transmitter.

Solution: The transmitter and the receiver are on different addresses. Please set the addresses of both units (see section titled "Setting Address").

Problem: Sometimes I let up on the key, but the telescope keeps moving for 1 second longer.

Solution: This is caused by interference, or a poor radio connection. Occasionally, you may have interference from some unknown source. When you let up on a key, the transmitter sends out TWO sequences to stop the telescope. If radio interference interferes with both signals, and both stop sequences are missed, the telescope will keep moving until 1 second later, it detects a lack of the next expected "keep going" burst, and it will stop by itself. Using the radio chips we've selected, this shouldn't be much of a problem. If it is, try mounting the receiver closer to the eyepiece, and be sure it is not obscured by metal.

Problem: I'm using an Argo Navis, and I press the top two buttons, but the telescope doesn't GoTo. It's tracking OK (See the SiTech manual for other Argo Navis problems).

Solution: Assuming you've already been using it earlier in the evening, be sure the flashlight is off. Make sure the transmitter hasn't turned itself off. If it has, you will have to press the SPD key to turn it back on.

For other Argo Navis problems, see the SiTech Controller Document.

APPENDIX A - AGENCY APPROVALS:

FCC:

This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- * Reorient or relocate the receiving antenna.
- * Increase the separation between the equipment and receiver.
- * Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- * Consult the dealer or an experienced radio/TV technician for help.

The user is cautioned that changes and modifications made to the equipment without the approval of manufacturer could void the user's authority to operate this equipment.

C-Tick

Manufacturers Name: Sidereal Technology
Manufacturers Address: 6040 N. Cutter Circle #302
Portland, OR 97217 (USA)

Australia Representative Name:
Wildcard Innovations
ACA Suppliers Code: N11511

Declares that the products
Dual Servo Telescope Controller, Model DSTC 1
Handpad Transmitter, Model HT1
and Handpad Receiver, Model HR 1
conforms to the following standards:
EMC: AS/NZS 3548 Class B Complies
AS/NZS 61000-4-3 Complies, Criterion A
These units are not for mains connections.

Industry Canada:

United States Company number: 5942A
Canadian Representative: Nova Astronomics
Canadian Representative Company number: 5930A

APPENDIX B – ACCESSING THE RECIEVER I/O:

There is a 6 position modular jack which has the digital inputs and outputs on it. The inputs can be read by the serial port on the servo controller, and the digital outputs can be controlled by the serial port on the servo controller. The inputs could be connected to limit switches or home switches. The outputs could be connected to a relay, to activate an accessory of some type, such as a toaster, or a lava lamp.

There are 4 digital inputs and 2 digital outputs on the receiver. If the digital outputs are used, there are only 2 digital inputs, as two of the pins are shared with the outputs and the inputs.

For these to be used, the servo controller must have 1.6 or later firmware version. The digital inputs appear on Y_Bits bits 4-7. To read the inputs, issue the command YB<E>, the controller will respond with the value of the Y_BITS. The upper nibble holds the current value of the digital inputs.

The digital inputs are floating, and must be held low for a 'zero' and pulled high for a 'one'. No more than 5 volts should be on the inputs or the outputs. It may be a good idea to use an opto coupler to use these digital inputs and outputs.

+5 volts and ground are provided on the I/O connector.

To turn on the outputs, the ASCII serial command XXQ is used.

To turn on output 1 and keep output 2 off, issue the command: XXQ1<E>

To turn on output 2, and keep output 1 off, issue the command: XXQ2<E>

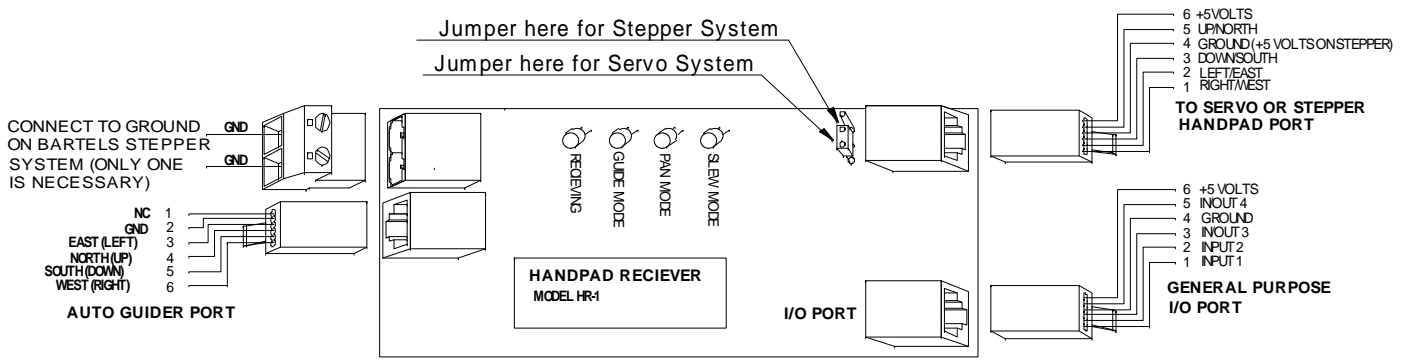
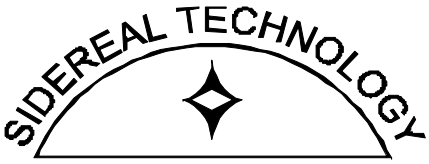
To turn on both outputs, issue the command: XXQ3<E>

To Turn them both off, issue the command: XXQ0<E>

To read the current output status, issue the command: XXQ<E> response will be 0,1,2 or 3.

When the outputs are on, the associated inputs will read a '0'.

The outputs are open collector sinking current.



Appendix C: Receiver Wiring Diagram: