

Crux170HD User Manual



HOBYM 
OBSERVATORY

Ver 1.41

Thank you for choosing the Crux170HD, an ultra-lightweight, portable equatorial mount with a highly advanced reducer system, the harmonic gear system. The Crux170HD, despite its small size and lightweight of only 4.7kg, will showcase outstandingly precise processing and quick response time for full-fledged astronomical observation and astrophotography.

The Crux170HD is a steady seller harmonic gear equatorial mount produced at HOBYM Observatory. A long time has been dedicated to its development as well; the points of improvement found from the field photography tests during the development process are closely reflected and will continue to be upgraded and developed. Designed and built for the consumers, the Crux170HD is a portable device for expeditions and ensures the highest efficiency and ease of use. The Crux170HD will be a perfect companion to your astronomical activities. HOBYM Observatory has succeeded in mass-production of the world's first small-sized harmonic gear equatorial mount, creating new standards, and will continue to launch competitive products through continuous research and development as an industry leader.

HOBYM Observatory Product Family



Features of the Crux140Traveler

- ➔ Crux170HD adopts a harmonic gear system, which makes it powerful while using less driving force by using greater contact surface than the general worm wheel method. This allows a high payload compared to the light bodyweight of the equatorial mount.
- ➔ Crux170HD. has no backlash, which provides quick feedback that allows a 0.1-second guide to be possible.
- ➔ Crux170HD is capable of time-lapse shooting by setting the rotating speed with Titan TCS.\
- ➔ Crux170HD can be used as an alt-azimuth mount and supports GoTo and tracking function. Users can also use GoTo function and observe and photograph astronomical objects in situations where the polar alignment is not available.
- ➔ Crux170HD can be transformed into a free stop alt-azimuth mount by a simple operation and can be used without power. It can also be used for birdwatching and insect photography.
- ➔ Crux170HD is separated into mechanical parts and electronic parts so that each part can be upgraded separately.
- ➔ Crux170HD uses reliable harmonic gear produced in Korea and stepping motor produced in Japan for the stability and reliability.
- ➔ Crux170HD shows a stable guide and tracking performances even after passing the meridian. This allows a reliable autoguiding regardless of the location.
- ➔ Crux170HD maintains a constant contact surface and frictional force regardless of the temperature change thanks to its harmonic gear. Unlike other worm wheel equatorial mounts, the performance of Crux170HD is not influenced by the changes in a backlash resulting from temperature fluctuations.
- ➔ Crux170HD has a high payload compared to the bodyweight of the mount. It can mount up to 10kg of load assuming the telescope's center of mass is 7cm away from the DEC mounting surface without counterweights, and the payload can be increased up to 20Kg when the user attaches an optional counterweight or a camera with ball head.
- ➔ Crux170HD is extremely useful in observational expedition including oversea observations. Although the equatorial mount in total weighs only 5kg, it can mount a 4~5-inch refractor (Vixen VSD, FSQ106, TEC140), a 8-inch reflector or an right 10-inch RC telescope with a cooling CCD.
- ➔ Crux170HD is as light as a piggyback mount but is as functional as a small-sized equatorial mount. It also supports the Time-Lapse shooting.

- ➔ Adopting harmonic gear reducer, Crux170HD does not have many factors to cause functional problems as it has a simple structure, shows consistent performance and is durable. This allows the mount to have a long product life unless there were severe damages from external factors.
- ➔ Crux170HD is equipped with Titan TCS, which makes it one of the most efficient portable mounts among all.
- ➔ Crux170HD reduces the periodic error using the P-motion control function of Titan TCS. This ensures the final periodic error value not to exceed about ± 8 arcsec. Therefore, for most of the short focus refractors, you can take photographs without any guide if you invest about 20 minutes in P-motion correction training at the initial set up.
- ➔ Crux170HD is controllable anytime and anywhere via Titan TCS. Titan TCS supports Bluetooth and WiFi (soon to be released) wireless environment and the user may choose which to use by a firmware update.
- ➔ Titan TCS accommodates ASCOM Driver and INDI Driver that enables the connection with various astronomical software.



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Product Details

Mount Mechanism

- Type: German-style equatorial type and alt-azimuth type using harmonic gear reducers at RA and DEC.
- RA drive: Harmonic gear reducer (SCSG14-100_2UA) driven by a stepper motor with a microstep driver.
- DEC drive: Harmonic gear reducer (SC17-100_2UA) driven by a stepper motor with a microstep driver.
- Azimuth adjustment: Fine adjustment of about 10° available
- Altitude adjustment: can be adjusted from 18° to 55°
- Payload: assuming the telescope's center of mass is 5cm away from the DEC mounting surface, the payload is 10kg without any weight. Can load up to 20 kg if the optional 3.8kg counterweight is attached.
- Equatorial mount total weight: 4.7kg (excluding the weight and Titan TCS)
- Polar Axis Alignment: available using QHY's Pole Master, sold separately.
- Operating temperature: -30 °C degrees to +40 °C degrees
- Parts Provided: Motor Cable, RS232 cable, USB Cable, DC power connection cable.
- Warranty: 5 years of mechanism
(Cost is at the user's expense if defects were caused by the user's fault.)

Motor drive system

- Drive system: RA motor - about 355 pps
DEC Motor - about 177 pps
- Operating area: Almost anywhere in the world, where the altitude is adjustable.
- Recommended fast slewing speed: about 1000 times faster than sidereal rate
- Input voltage: 12V 3.0A or more
- GoTo: GoTo available both from the hand controller and PC.
- Warranty: 3 years of electronic parts
(Cost is at the user's expense if defects were caused by the user's fault.)

What's Included in the Box and Optional Parts

In-the-Box Items

- Crux170HD
- Titan TCS
- PoleMaster Adapter
- Bubble level
- 6mm L-wrench
- M8X12, two each
- 8mm knob bolt
- Card USB Memory – Programs and Manuals
- Motor cable, RS232 cable, power cable, USB cable
- HOBYM Observatory Stickers variety pack
- Luxury plastic hard case for Crux140 Traveler
- Weight shaft (diameter-18mm)

Optional Parts (Sold separately)

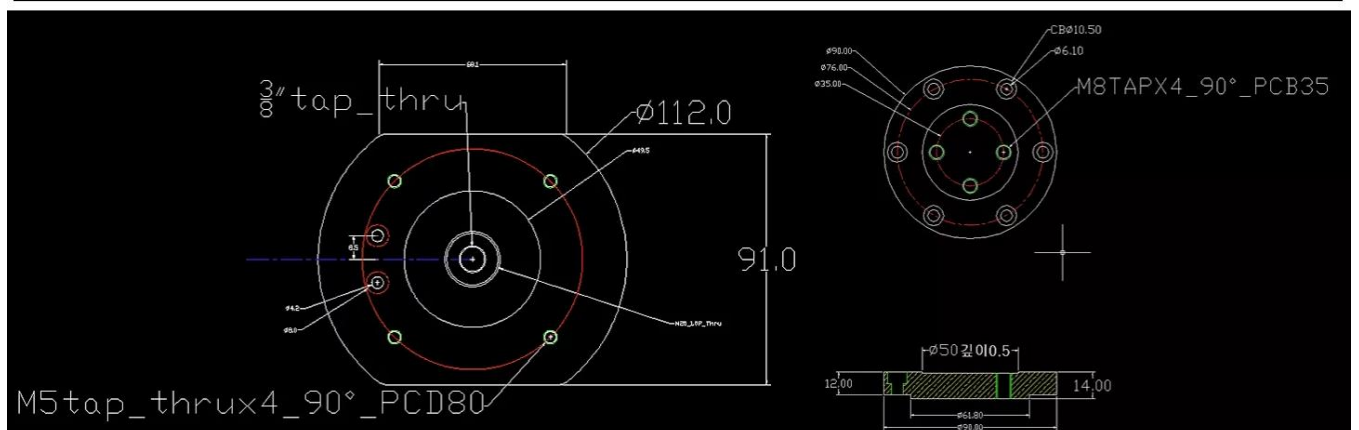
- 3.8kg stainless steel weight
- Ball head adapter

Mount Layout



1. Scope Mount Adaptor : M8x2_PCD35/ M6x2_PCD35
2. DEC Housing : contains DEC motor and harmonic gear.
3. RA Harmonic Gear
4. RA Housing : contains RA motor
5. RA motor bracket
6. Weight shaft / Ball head Adapter Mounting Bolts: a 3/8-inch screw and can be equipped with a weight shaft or ball head adapter
7. DEC Motor cable connection jack
8. RA Motor cable connection jack.
9. Altitude adjustment knob: turn clockwise to lower altitude and counterclockwise to increase altitude.
10. Azimuth adjustment knob: push and pull to adjust azimuth
11. Azimuth adjustment lock handle: locking bolts to tighten after azimuth adjustment, one in front and one in back.
12. Altitude adjustment lock handle: a handle that unlocks before adjusting the altitude and locks after adjusting
13. PoleMaster Adapter: An adapter that can attach a PoleMaster.
14. Altitude adjustment support block
15. Azimuth adjustment support block
16. TiTaN TCS
17. Alt-azimuth Mode fixing bolt mounting tap: for fixing by attaching the handle bolt to it after matching M8 tap hole with an inner hole

Dimensions of the Mount



Precautions for Use

1. If you forcibly mount a large telescope, it may damage the equatorial mount. The payload may vary depending on the size of the telescope, even in the case that the telescopes have the same weight.
2. When using bolts other than the supplied M8 bolt, pay attention to the length of the bolts and use only the ones with the proper length. If the bolt is too long, it may damage the parts protecting the harmonic gear system.
3. Adjust the altitude azimuth after loosening the fixing handle. Forcibly adjusting with a wrench in a tightly joined state will cause damage to the mount.
4. Do not supply more than the specified voltage. (DC 12V)
5. Please refrain from using the equatorial mount in case of excessive moisture and rain.
6. Since the driving torque is strong, make sure to fully understand the safety zone function of Titan TCS and carefully set it up at the initial set up.
7. Avoid applying excessive shock to the mount or dropping it. In these cases, the axis may bend, or the tooth surface of the harmonic gear may be damaged, causing a decrease in its accuracy.
8. Tripods and piers should be sturdy. Especially, tripods for general photography have a narrow angle compared to astronomical use. We recommend using an astronomical tripod.
9. Do not loosen the altitude adjustment lock handle too much when adjusting the altitude. If you loosen it too much, the polar axis may deviate after locking.
10. In case of using GoTo function frequently, lower the slewing speed to prevent the motor from overheating. When operated at the highest speed for a too long time, it may lower the performance of the motor due to the overheating.

How to set up in Equatorial Mode

1. Set up a tripod on a firm, level surface and place one of the tripod legs toward the north or south pole



2. The Crux140 Traveler has a 3/8-inch female screw tap on the bottom. Crux140 Traveler can be mounted on any tripod as long as it has a 3/8-inch bolt.



3. Assemble the removable tripod head and Crux170HD.



4. Tighten the L-shaped knob on the tripod strongly.



5. After mounting on a tripod, hold the body and tighten it more clockwise.



6. Once secured to the tripod, loosen the altitude adjustment handle loosely counterclockwise. At this time, about half a turn is enough.



8. Introduce the polestar on the Polemaster by adjusting it with the azimuth adjustment handle released. Precise polar alignment should be done after all equipment has been mounted.



7. After installing the pole master, use the control knob to orient it to the North Pole.



9. Connect the Declination cable of TiTaN TCS.



10. Connect the RA cable to the bottom of the RA axis.



12. Attach the dovetail holder. At this time, two M8X12 are included in the package. Secure with a suitable bolt. Be careful when tightening with a long bolt as the mounting tabs on the telescope connection head may be damaged..



11. Connect motor cable to TiTan TCS.



13. Connect the power line to the TiTaN TCS.



14. . Determine the telescope's approximate center of mass. This is to minimize the load on the equator during operation.



15. Secure the telescope to the dovetail holder and turn on the TiTaN TCS.



16. Plug in the Titan TCS to power, and you are ready to go. The telescope in the photo below is headed for due east. In the Titan TCS Object menu, select Manual > East > Sync. Use GoTo function targeting the celestial object you know using the Titan TCS Object menu. The telescope will move near the selected target. Then center your target using TCS's keypad and sync..



How to Set Up in Alt-Azimuth Mode

1. After the installation in the same manner as the equatorial mode, loosen the altitude holding handle to some extent and set the right ascension to 90 degrees. There is an M8 tapped hole on the left side of the body. Through this tap hole to match the hole inside.



2. Insert the supplied M8 Knob bolt into the tapped hole and tighten it clockwise. After that, tighten the altitude adjustment handle as much as possible.



3. Determine the telescope's approximate center of mass. This is to minimize the load on the equator during operation.



4. After the declination head points north, the telescope points west. Then we put the weight on the end as shown below.



5. When using the Alt-az mode, installation is very important to level. Installation should be done using the provided bubble level.



- In the Titan TCS Object menu, select Manual > East > Sync
- Use GoTo function targeting the celestial object you know using the Titan TCS Object menu. The telescope will move near the selected target. Then center your target using TCS's keypad and sync.

Now you can observe any object using GoTo.

7. In case of previous version Crux170HD can be used with the Alt-Az mode with firmware upgrade. However, when using Alt-Az mode, use it in balance with enough weight.

6. The installation position and simple instructions for Titan TCS in alt-azimuth mode are as follows. Please refer to the manual for Titan TCS for more detailed information.

- Menu > System > Mount Type > Alt-Az mode> Enter
- Menu > Save > Save & Exit > Enter
- Restart the Titan TCS.
- The telescope should be to the south and the pier to the north.
- Point the telescope to the due east.

Features of Titan TCS

Titan Telescope Control System (TCS) is compact but one of the most powerful equatorial mount control system. Titan TCS comes with a list of nearly 14000 objects that can be used by all astrophotographers in its memory.

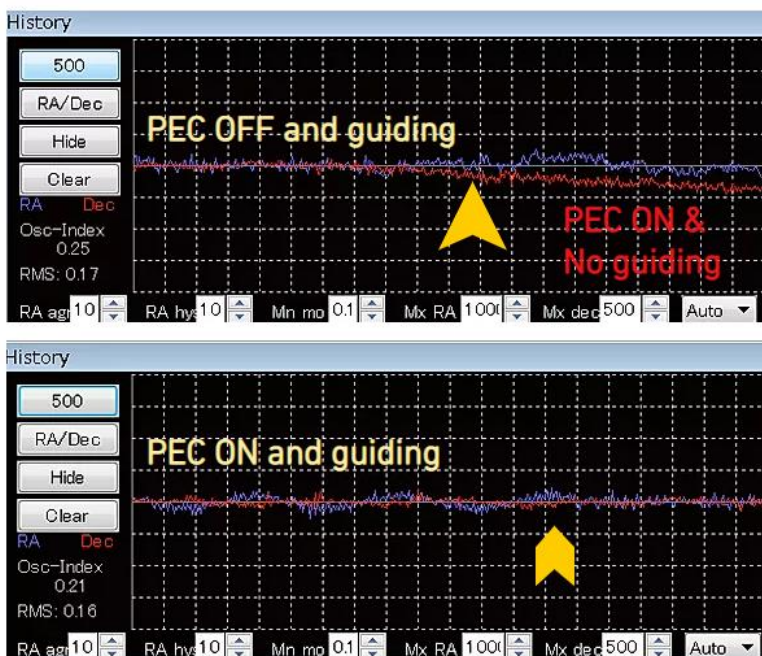
- List of Objects -

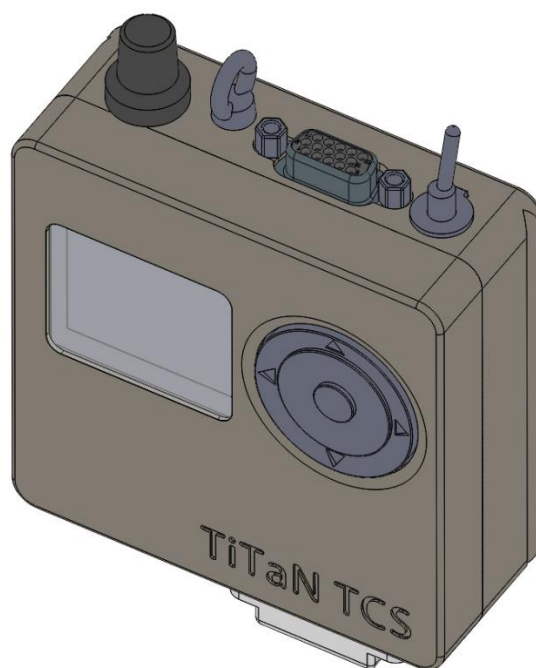
IAU-approved Star Name 240 items
New General Catalogue 7840 items
Messier Catalogue 110 items
IC (Index Catalogue) Objects 5386 items
Caldwell catalogue 109 items
Sharpless catalog 341 items
RCW 182 items
Gun 94 items
Barnard 174 items



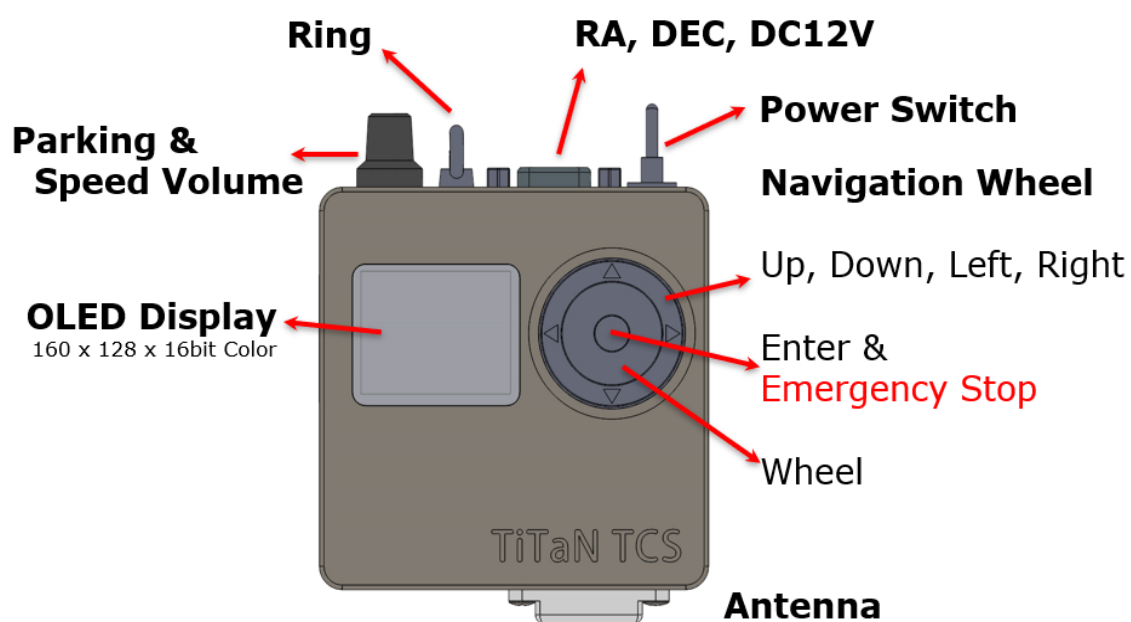
1. Titan TCS equipped with controlling CPU (120MHz / 32bit) and 32bit CPU for communication and user interface to secure the expandability
2. Titan TCS has a total of 5 megabytes of memory. It stores an embedded object list for GoTo,
3. Bluetooth and Wi-Fi (soon to be released) compatible, User may choose which to use by firmware update.
4. Uses microstep (1/4 ~ 1/128): It controls the current and voltage according to the speed of the motor, which results in maximum efficiency with less power consumption.
5. Voltage boost and current control up to 30V by internal self-boosting function: maximizes the power of stepper motor and enables powerful and smooth driving.
6. Titan TCS supports LX200 compatible protocol, which makes it compatible with many kinds of astronomical software.
7. Remote observation through built-in parking function
8. Compact Size of 88mm x 108mm x 35mm with high density PCB design.

9. Titan TCS is specialized for the harmonic gear mounts; all of the CRUX mounts can take photographs without guide up to 400 ~ 500mm focal length by using Titan TCS PEC function.
10. Small graphic high-resolution OLED display: High resolution OLED to monitor the current consumption of motor and various information on the current state of the mount. (1.69 "Diagonal Size, 160X128 Pixels, Full Color)
11. Input power (12V / 3A): DC Adapter should be 12V/3A or have higher current.
12. Minimal power requirement for star tracking (0.5A ~ 0.7A).
13. USB port supports two virtual serial connection: can be directly connected to PC
14. Equipped with a small LED light indicating the guide situation in real time.
15. Built-in beeper notifies a job completion of the controller and allows a simple melody alarm function.
16. The guide port prevents electrical damage incurring from external surge using optocoupler.
17. The latest Titan TCS (HW Ver2.0) has a built-in camera shutter release that allows the user to control the camera such as DSLR.
18. The latest firmware has added the alt-azimuth mount mode to existing Titan TCS.

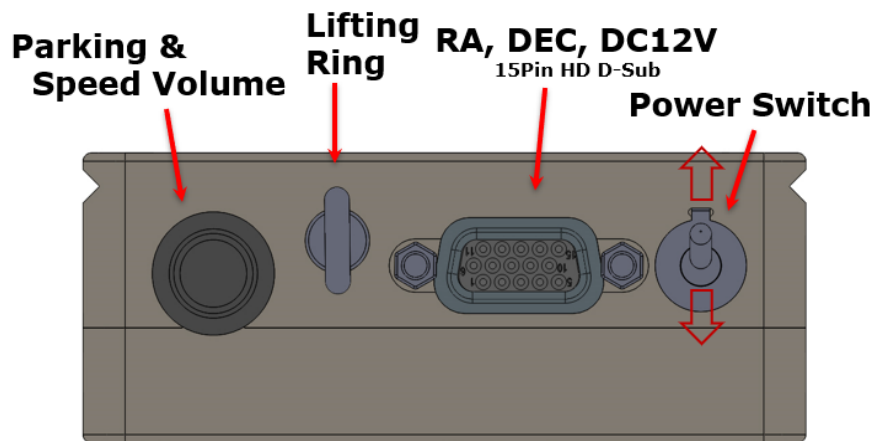




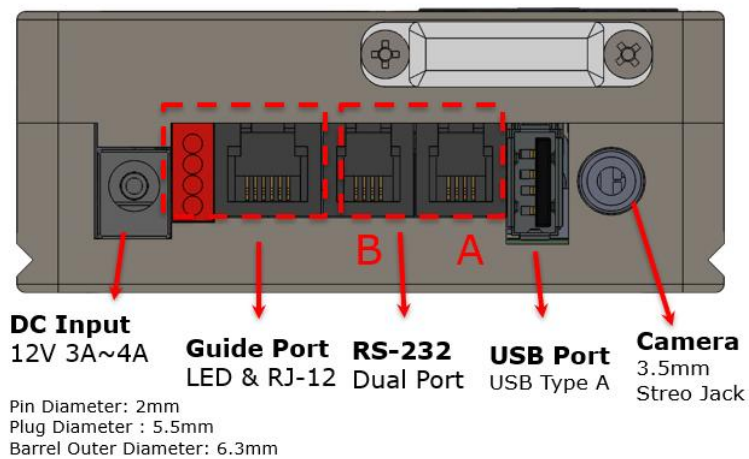
Front View

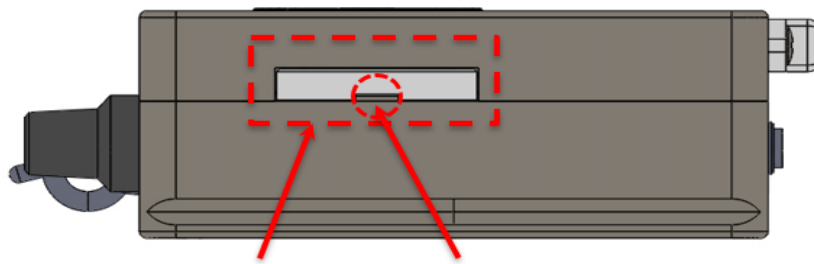


Top View



Bottom View

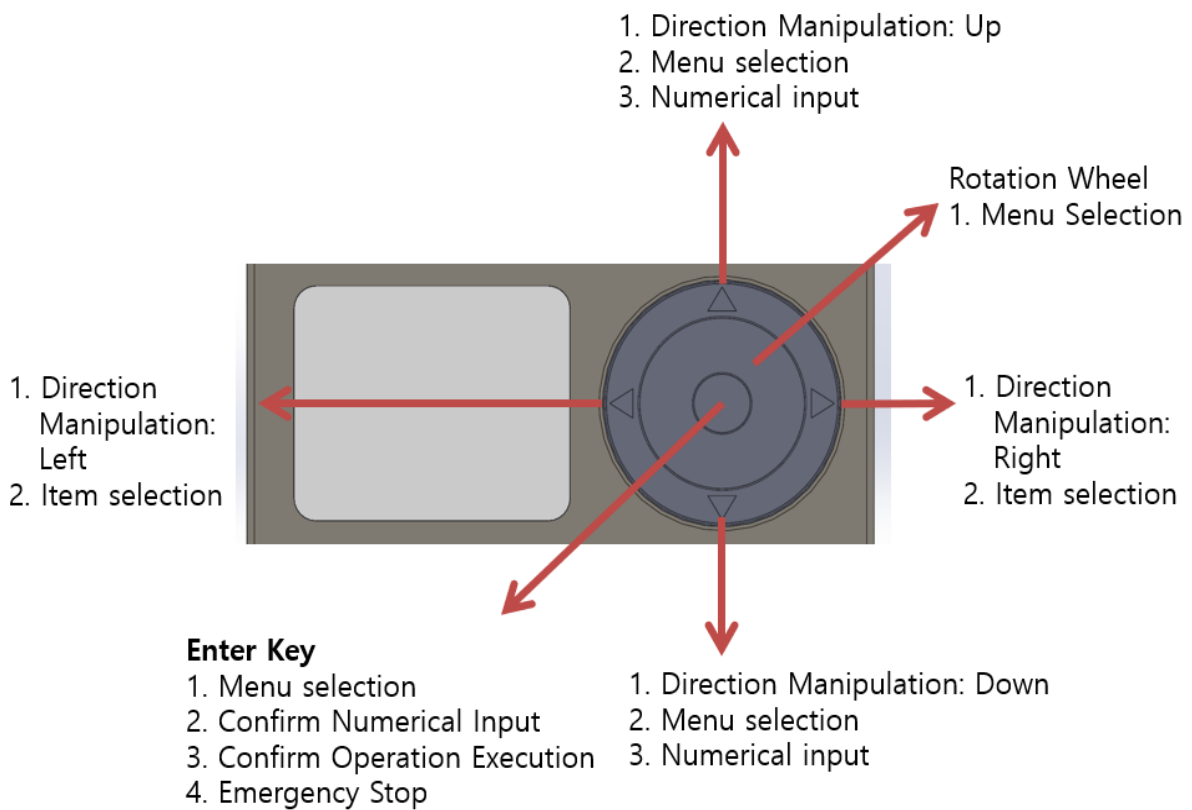




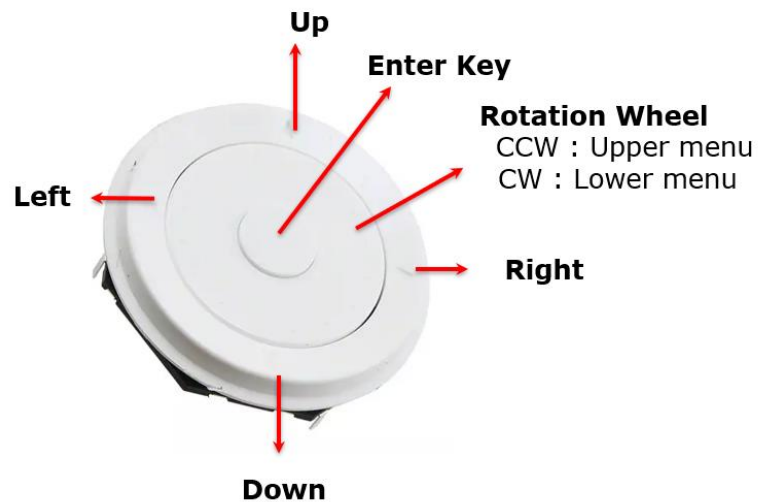
CR2032 Battery Tray

Eject Hole

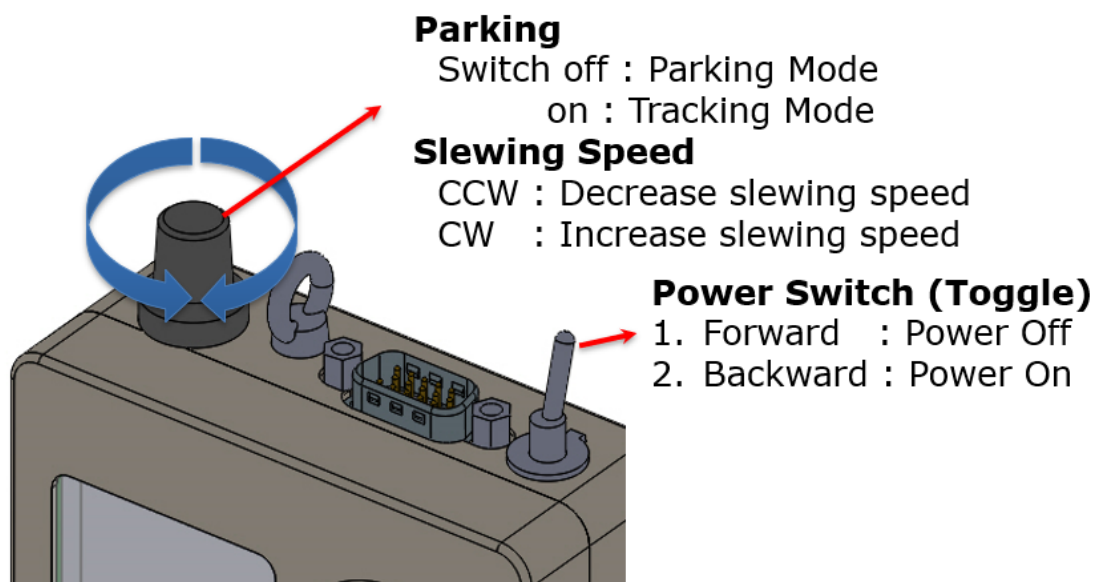
Use small slot head screwdriver



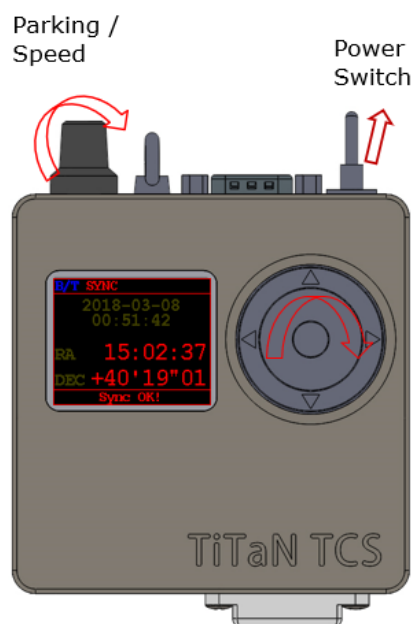
Navigation Switch



Volume Knob (Parking & Speed)

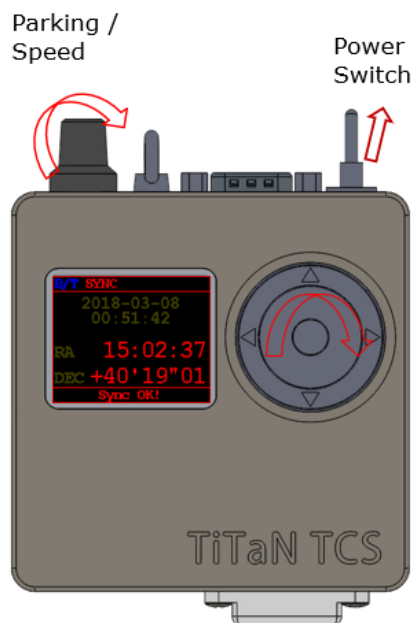


Date/Time Setup



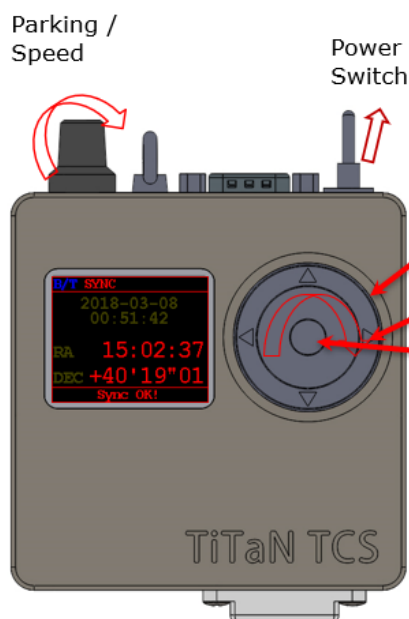
1. Power on (move to backward power switch)
The display turns on after a few seconds.
2. Turn volume knob until right end position.
Release parking & slewing speed up(100%)
3. Rotate navigation wheel quickly 1 turn.
Menu screen is displayed.
4. Select "System" Menu using navigation wheel or Up/Down button. Press "Center" button.
5. Select "Date/Time" submenu in "System". Press "Center" button to input Date/time.
6. After input your new local time, press "Center" button. New date & time will apply to TCS. Also, you can cancel input using wheel rotate CCW 1 click.
7. Select "Telescope" menu using wheel or up/down key, then press "Center" button.
Telescope screen is appeared.

Observatory Location Setup



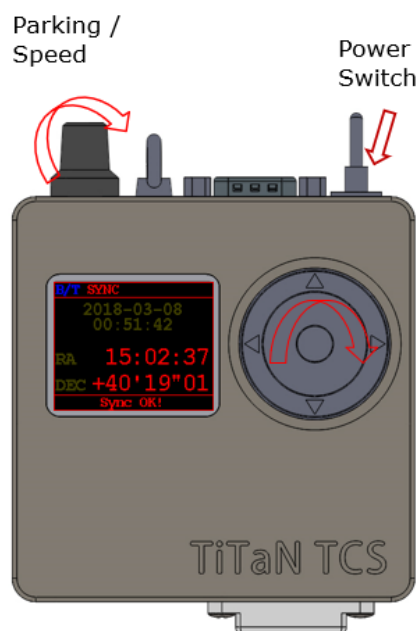
1. Power on (move to backward power switch)
The display turns on after a few seconds.
2. Turn volume knob until right end position.
Release parking & slewing speed up(100%)
3. Rotate navigation wheel quickly 1 turn.
Menu screen is displayed.
4. Select "Observatory" Menu using navigation wheel or Up/Down button. Press "Center" button.
5. Select "Location" submenu in "Observatory". Press "Center" button to input new location.
6. After input your new location, press "Center" button. New location will apply to TCS. Also, you can cancel input using wheel rotate CCW 1 click.
7. Input time zone information same way.
8. Select "Telescope" menu using wheel or up/down key, then press "Center" button.
Telescope screen is appeared.

Start (Power on)



1. Power on (move to backward power switch)
The display turns on after a few seconds.
2. Turn volume knob until right end position.
Release parking & slewing speed up(100%)
3. Move telescope using Navigation button.
Aim to east side star.
(You must know the star name)
4. Rotate navigation wheel quickly 1 turn.
Menu screen is displayed.
5. Select "Goto(Object)" Menu
using navigation wheel or Up/Down button.
Press "Center" button.
6. Search & select the star name you aimed.
7. Goto/Sync/Cancel appeared.
Select "Sync", then press "Center" button.
8. Sync Complete, You can hear melody
9. Select "Telescope" menu using wheel or
up/down key, then press "Center" button.
Telescope screen is appeared.

Finish (Power off)



1. Turn volume knob until left end switch off.
2. Wait until "Parking OK" message.
3. Power off (Move power switch to forward)
The display turns off immediately.

Caution.

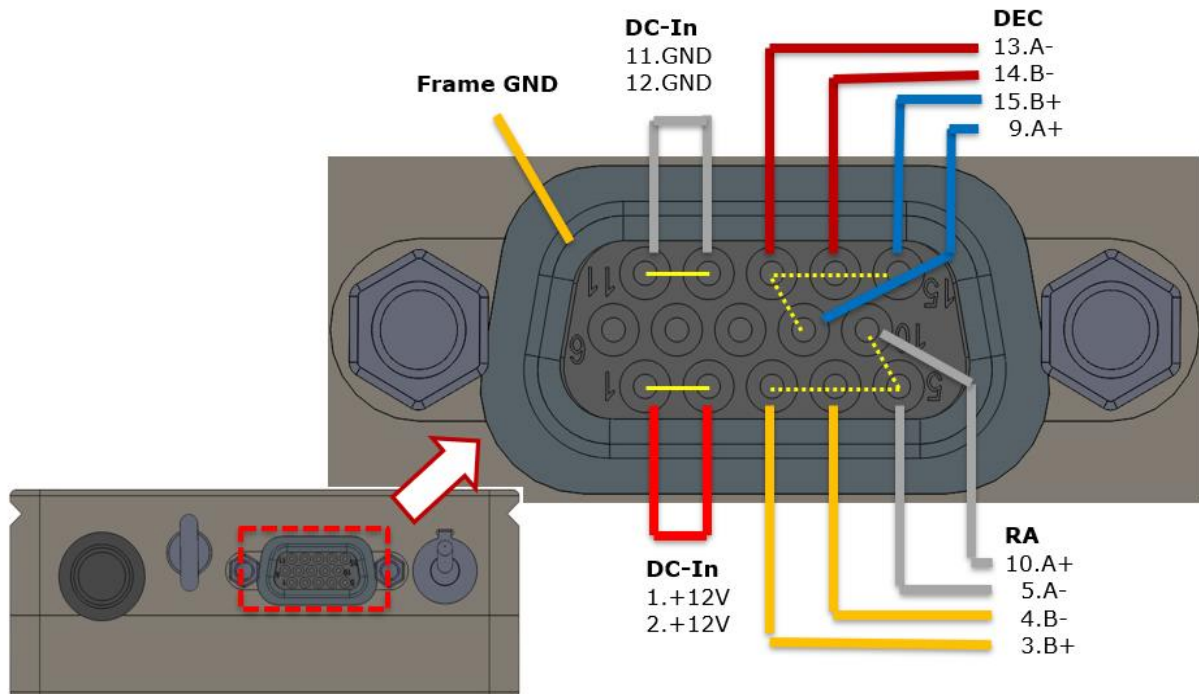
When the PEC information is valid or synchronized,
TitanTCS can only be powered off via the switch once
parking is complete.

You can change this setting in the menu.
[Safety]> [Safe Power off]

Caution : Case is connected to DC-In GND.

**When user make custom D-Sub cable,
the GND of the cable must be connected to the D-Sub shell.**

Pins 11 and 12 must be connected together to provide sufficient current.
Pins 1 and 2 must be connected together to provide sufficient current.



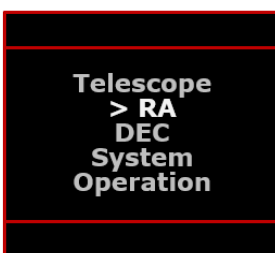
Menu Operation / Date & Time (1/3)

Top / Telescope



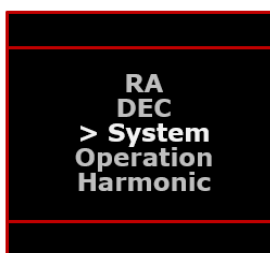
Quickly Rotate Wheel 1
turn -> Menu Mode

Menu Mode



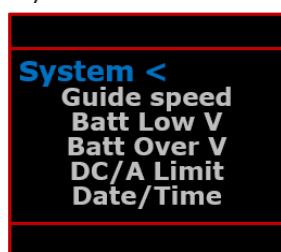
Up/Down Key
-> Highlight menu item

Select menu



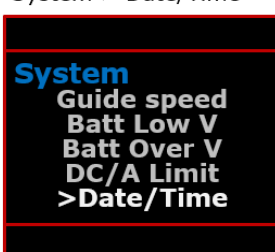
Center Key
-> Select menu

System



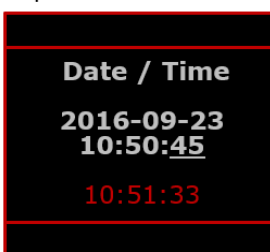
Up/Down Key
-> Highlight menu item

System > Date/Time



Center Key
-> Select Sub-menu

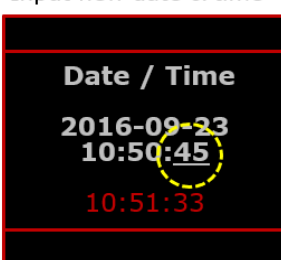
Input new date & time



Input Menu has
cursor(under line)

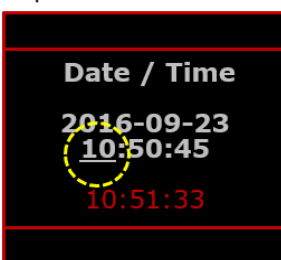
Menu Operation / Date & Time (2/3)

Input new date & time



Left/Right Key
-> Move cursor

Input new date & time



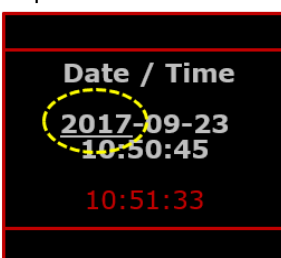
Left/Right Key
-> Move cursor

Input new date & time



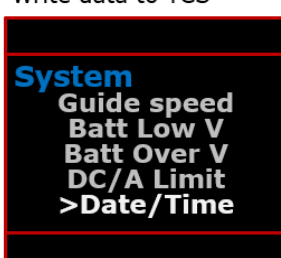
Up/Down Key
-> Change value

Input new date & time



Up/Down Key
-> Change value

Write data to TCS



Center Key
-> Apply New Date/Time
& exit input menu

Also, you can cancel input
using wheel rotate CCW 1
click.

Menu Operation / Date & Time (3/3)

Return to Telescope

System
Guide speed
Batt Low V
Batt Over V
DC/A Limit
>Date/Time

Up Key or Rotate Wheel CCW
-> Select upper menu

Return to Telescope

System <
Guide speed
Batt Low V
Batt Over V
DC/A Limit
Date/Time

Center Key
-> Select Sub-menu

Return to Telescope

Telescope
> RA
DEC
System
Operation

Up/Down Key
-> Highlight menu item

Return to Telescope

RA
DEC
> **System**
Operation
Harmonic

Center Key
-> Select menu

Return to Telescope

>**Telescope**
RA
DEC
System
Operation

Center Key
-> Select Telescope Menu

Top / Telescope

2017-10-11
09:01:02
RA 03:33:01
DEC +01'02'03

Telescope Menu

Menu Operation / RA Max Speed (1/3)

Top / Telescope

2017-10-11
09:01:02
RA 03:33:01
DEC +01'02'03

Quickly Rotate Wheel 1
turn -> Menu Mode

Menu Mode

Telescope
> RA
DEC
System
Operation

Up/Down Key
-> Highlight menu item

RA

RA <
Max Speed
Acc. Rate
Reverse

Up/Down Key
-> Highlight menu item

RA > Max Speed

RA >
Max Speed
Acc. Rate
Reverse

Center Key
-> Select Sub-menu

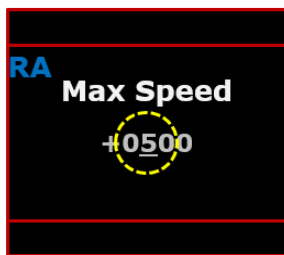
Input

RA
Max Speed
+0500

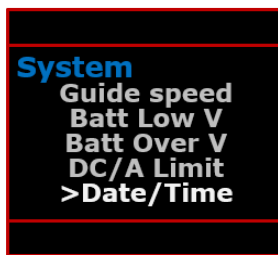
Input Menu has
cursor(under line)

Menu Operation / Date & Time (2/3)

Input

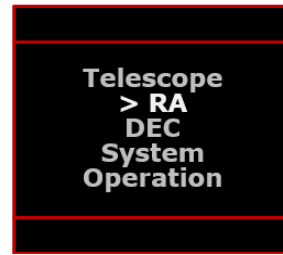


Left/Right Key
-> Move cursor



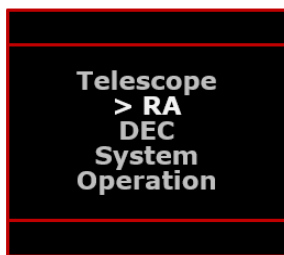
Center Key
-> Apply New Date/Time
& exit input menu

Return to Top Menu



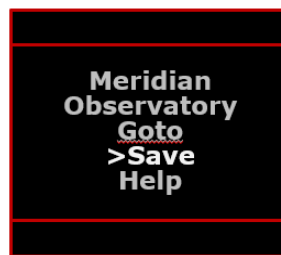
Up/Down Key
-> Highlight menu item

Return to Top Menu



Up/Down Key
-> Highlight menu item

Save Setting



Up/Down Key
-> Highlight menu item

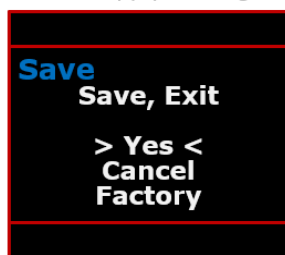
Save Settings



Up Key or Rotate Wheel CCW
-> Select upper menu

Menu Operation / Date & Time (3/3)

Save & Apply Settings



Up/Down Key
-> Select action item

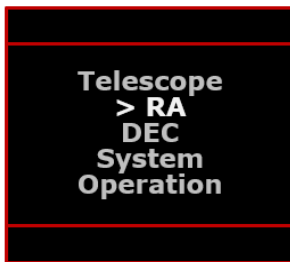
Top / Telescope



Center Key
-> Save & Apply date
Return to "Telescope"

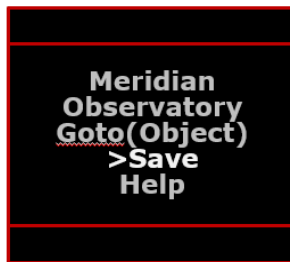
Menu Operation / Save Settings (1/2)

Top Menu



Up/Down Key
-> Highlight menu item

Menu Mode



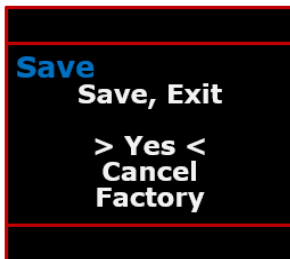
Up/Down Key
-> Highlight menu item

Save Settings



Up Key or Rotate Wheel CCW
-> Select upper menu

Save & Apply Settings



Up/Down Key
-> Select action item

Yes
-> Save new settings & apply new settings.
But, some setting need reboot

Cancel
-> Exit this menu

Factory
-> Factory Reset
This is used for technician.
Never use it if you are not expert.

Top / Telescope



Center Key
-> Save & Apply date
Return to "Telescope"

Menu Operation / Date & Time (2/2)

Save & Apply Settings



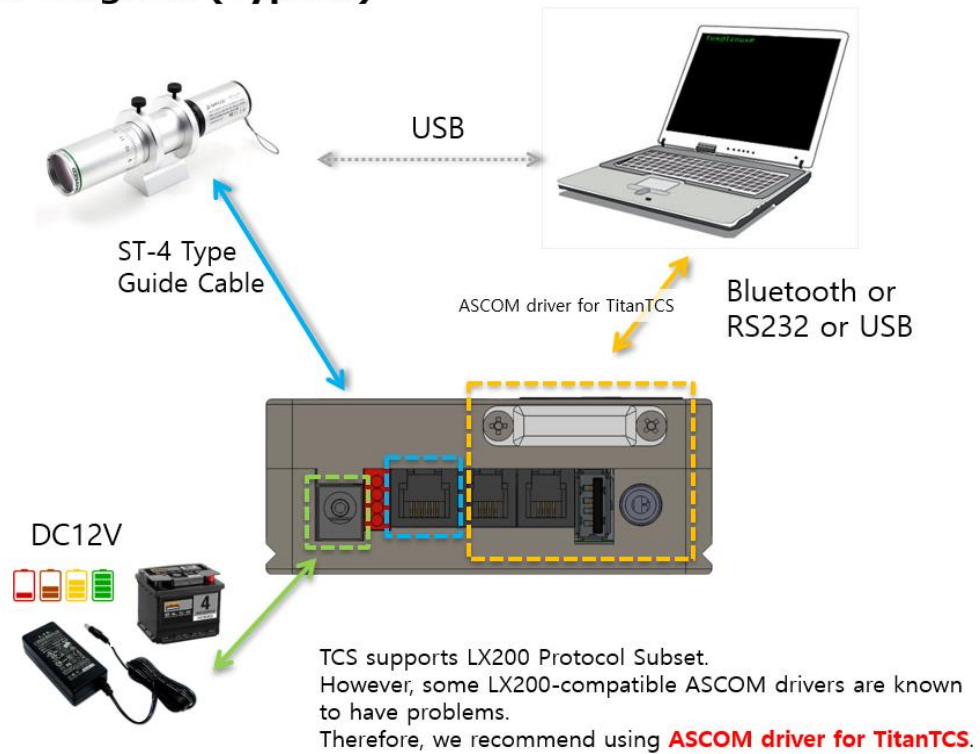
Up/Down Key
-> Select action item

Top / Telescope

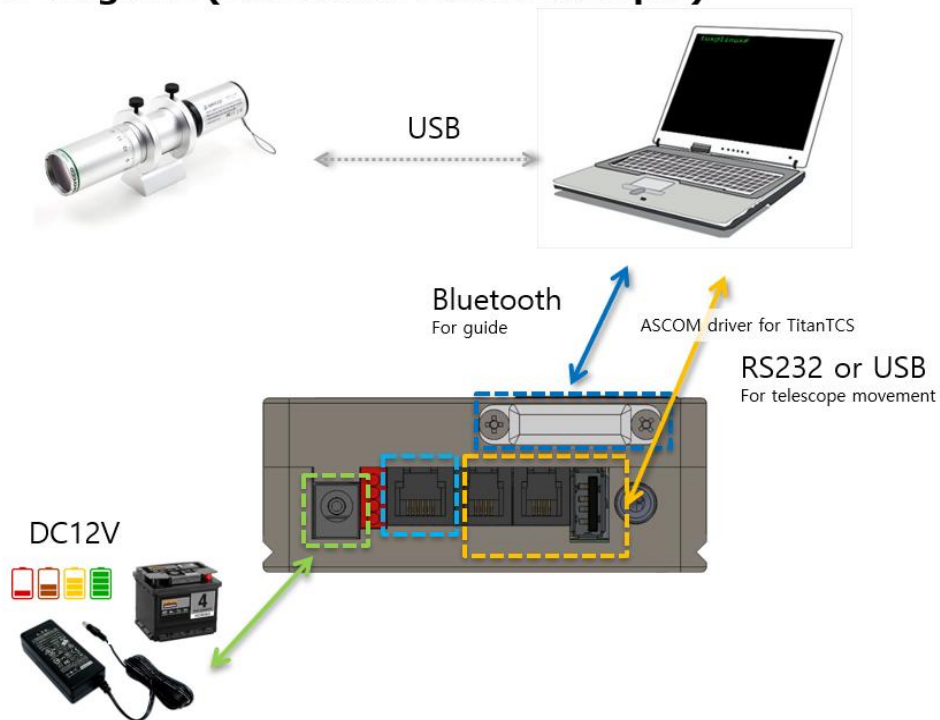


Center Key
-> Save & Apply date
Return to "Telescope"

System Diagram (Typical)

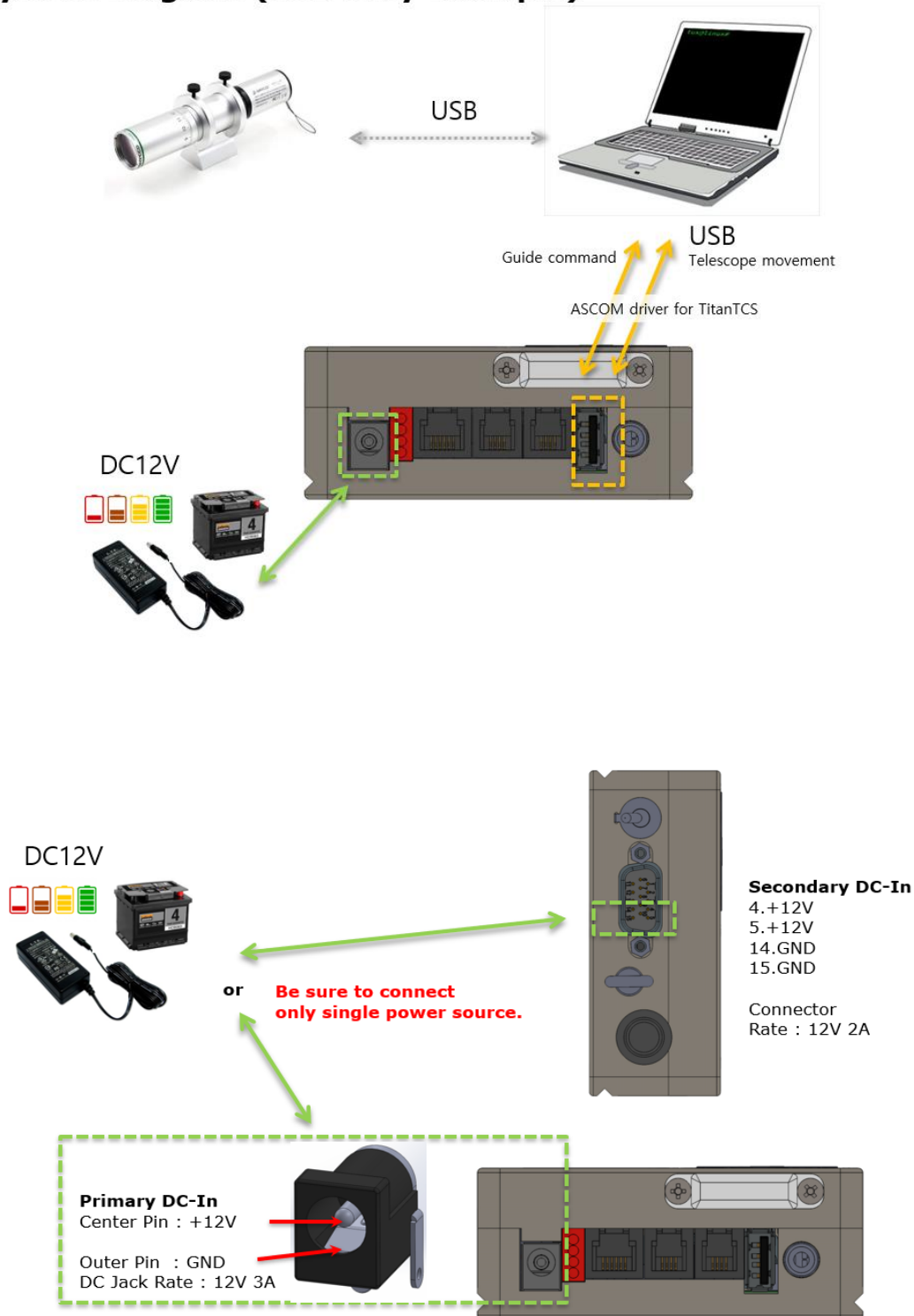


System Diagram (Bluetooth Guide Example)



ASCOM driver for TitanTCS support pulse guide protocol.

System Diagram (USB Only Example)



Caution :
 The two DC inputs are connected each other inside the TCS.
 Never connect multiple power to DC inputs. Multiple power will damage your system.
 DC Jack below can be supplied with more current capacity.

System Diagram (Camera shutter release)

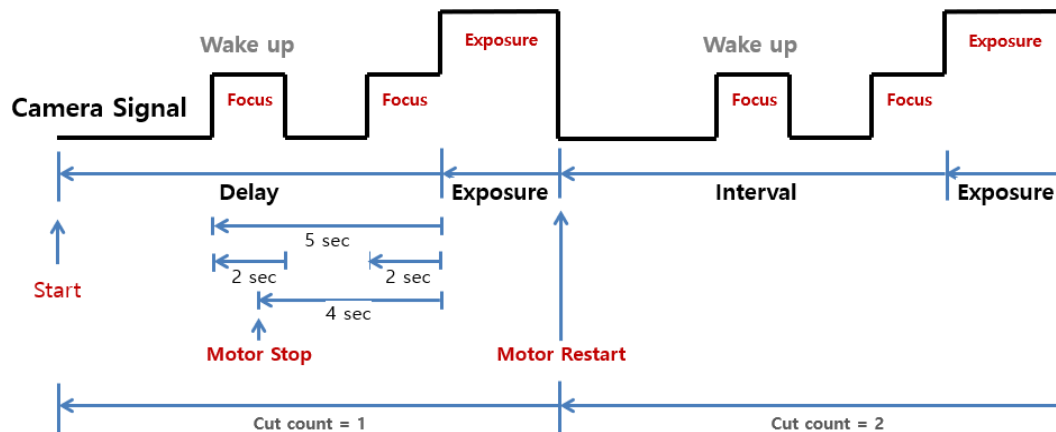


The shutter release cable that is connected to the camera can use the accessories of "Pixel TW-283 Shutter Release".

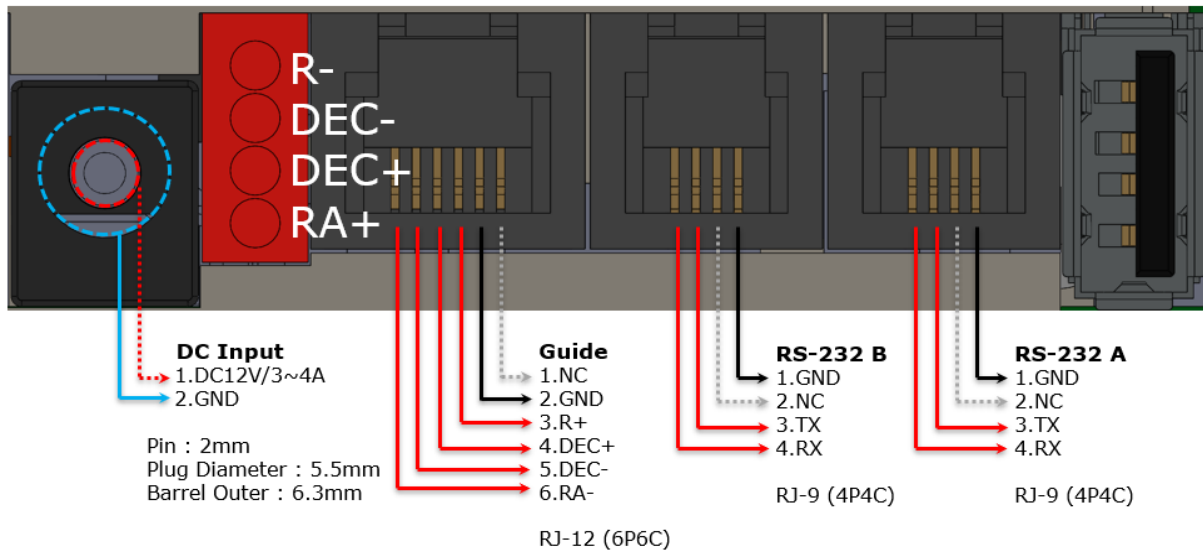
Note: The connector to the TitanTCS is a 3.5 mm stereo jack.

Time chart about interval timer

example case : single set, two cuts, wake up, stop mount



Pin map / Bottom View



Frequently Asked Questions

- It does not guide well: There may be several reasons for low guide quality:
 1. The cable of guide CCD is not properly fixed
 2. The guide CCD is not securely fixed
 3. The payload for CRUX is exceeded or counterweight is not properly used
 4. Smoking nearby the mount
 5. There is a source of heat or an entrance where the guide camera is facing.
 6. Seeing is poor
 7. The focus of the guide CCD is not clear
 8. The guide star is too bright
 9. The guide is too dark
 10. The guide star is located at the edge of the guide CCD.
 11. There was too little movement during the guide calibration
 12. There was too much movement during the guide calibration
 13. The guide exposure was too long
 14. The guide exposure was too short
 15. Guiding speed is too fast for the focal length
 16. Guiding speed is too slow for the focal length
 17. The lens or the primary mirror of the guide telescope is not securely fixed
 18. The focal length of the guide telescope is too long
 19. The focal length of the guide telescope is too short
- What is the safe payload?
 - When the CRUX mount is appropriately loaded, the mount should not be slipped when the telescope is mounted, the declination is completely parallel to the ground, and the power is turned off. In case of the telescope is being slipped, the counterweight may be needed. The safe payload for the mount is the load that does not make it be slipping, even when the power is off.
 - When the power is supplied, the torque generated by the electromagnetic of the motor may allow additional load, but this load should not be considered safe payload.
When testing, put your hands under the telescope to prevent any unexpected collision.
- What is the amount of periodic error?
 - The periodic error of the CRUX mount is about ± 20 seconds, the same as that of a harmonic gear. In the case of high magnification observations, the object seen by the eyepiece may be wobbling about the diameter of the Saturn or the Jupiter. This is much larger than the periodic error of EM200, which is about ± 7 seconds. The biggest advantage of the harmonic gear mount is that it has no backlash and a large payload compared to the weight of the mount. In general, photography using the harmonic gear mount presupposes a guided shooting. When taking a guided shot, its advantages are maximized, unlike the usual worm wheel mount. The Titan TCS has a built-in PEC function. The user can take the most advantage of harmonic gear mount using PEC function in that it eliminates the backlash.
- ASCOM Driver for CRUX series
 - The ASCOM Driver designed for Titan TCS is available. It can be downloaded from the *Download* page of the HOBYM Observatory homepage. Please upgrade the old firmware to the latest version before using it.

- On a very cold day, there is a stall or vibrational noise while slewing and does not properly move.
 - If the weather is below -10 °C, it is recommended to attach counterweight or to reduce the maximum motor speed to about 50% level to minimize the mechanical burden to the mount. Please contact HOBYM Observatory if you continue to experience the same problem after trying the above-mentioned suggestion.
- What telescopes can be mounted without counterweights?
 - The Crux140Traveler has a large payload, but it is recommended to use a counterweight or to mount less than the recommended payload when taking photographs. Maintaining a safe payload will ensure the quality of photography. Please refer to *"What is the safe payload?"* section of the FAQ for more details.
 - The example below is the case of observing with an eyepiece.
 - Takahashi: Refractors under FSQ106, Cassegrain telescopes under Mewlon-200, Epsilon-160
 - GSO: 8-inch RC telescope or less, 8-inch reflector or less
 - Celestron, Meade: 8-inch Schmidt Cassegrain Telescope or less
 - Vixen: Visac 8-inch, R200ss, 4-inch Refractor or less
 For astrophotography, use smaller telescope because extra equipment is required.
- The guide graph is poor.
 - There can be two major causes.
 - The first is when the polar alignment is not precisely done. If the tripods are lightweight, the polar alignment can be distorted after you mount the telescope to the tripod. It is recommended to install on a hard floor, set the telescopic cameras, etc. and then proceed to polar alignment.
 - The second case is when the seeing is not good.
 - Since the CRUX mount has no backlash, the seeing has a major influence on the guide quality. Often, when seeing is poor, the guide graph has a high correction level and large peak-to-peak.
- The motor stalls while slewing.
 - There can be two causes.
 - The first is power issues. The problem may occur due to the low voltage because of the insufficient DC adapter capacity or a low battery. In this case, use a DC adapter with a higher capacity or charge the battery.
 - The second is when the payload weight is exceeded. In this case, reduce the load to the mount.
 - Even if the telescope is within the recommended payload, when it has a large aperture, the payload will be lower as it gets farther away from the DEC mounting surface.
- About the holding torque of the motor
 - There may be a possibility that the mount slips when a heavy telescope is mounted, and the mount turns off. Therefore, it is recommended to uninstall the telescope before you turn off the mount. Do not forcibly rotate the axis of the mount, as it generates electrical power and may cause severe damage to the Titan TCS.
- The mount/tripod falls over due to the unbalance.
 - The problem may be because the center of mass of the total system changes as the mount rotates and cause unbalance in weight distribution. If the center of mass is near the outer

edge of the total system, the system may fall over with a very small additional force. Use the tripod that can extend the legs as wide as possible or use a heavier one.

- Can it be used in the southern hemisphere sky?
 - Manu> Observatory> Enter longitude and latitude> Change time> Save, and restart.
- GoTo is not precise
 1. Check whether the target star is precisely synced
 2. Check polar alignment
 3. Check if there is an error message displayed on the TCS.
 4. The gear ratio was incorrectly set at the initial setting
- The telescope moves in the wrong direction when slewing or GoTo.
 1. Check the date/time settings.
 2. Check the observatory location setting in the menu.
 3. The telescope and the target star both must be above the horizon while synchronizing.
 4. Check if there is an error message displayed on the TCS.
 5. If the problem persists, contact HOBYM Observatory.
- When operating at the highest speed, there is a motor sound, but the mount does not move (The motor stalled).
 1. The motor stalled due to the mechanical overload caused by a temperature drop
 2. Low input voltage
 3. There is too much weight unbalance. Maintain the weight balance while operating.
 4. Check the Acceleration setting [Acc. Rate]. When the Acc. Rate is set too high, the operational load increases. Lower the maximum speed and acceleration setting.
- GoTo takes too much time.

For accurate pointing, it slows down near the target point.

 1. Check the current coordinate values from OLED.
 2. Check whether the speed volume is at or near parking.
 3. Check the maximum speed setting.
- Bad connection with the simulation programs.
 - When connecting with a serial port, make sure to use an RS-232 cable dedicated to Titan TCS.

The RS-232 cable used by TCS is not a standard cable, and the pin connections are different for each manufacturer. Be extremely careful.
 - Even if the connectors are the same shape, never use unidentified serial cables. There is a potential for permanent damage to the TCS or PC.
 1. Check the serial communication speed for TCS.

The default baud rate is 115,200 bps. You can change the baud rate to suit your needs in the [System] menu.

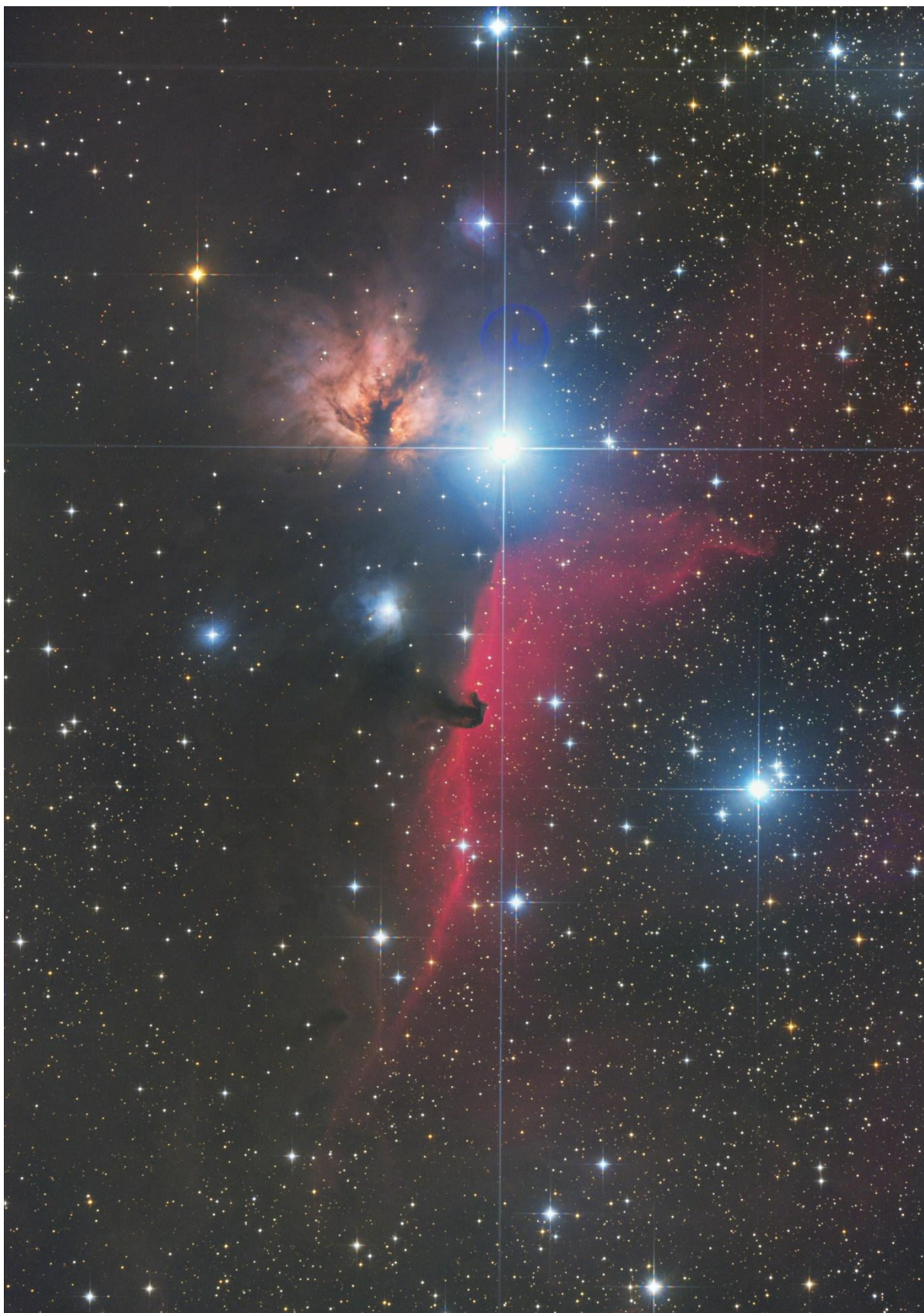
You can check the communication speed at [Help]-[Serial BPS]
 2. Check USB, Bluetooth and the COM port number: number of the serial ports of TCS in Device Manager.
 3. When connecting via Bluetooth, a blue color "B/T" indication should appear at the top of TCS.

4. Confirm that communication protocol is selected as LX200 in the astronomical programs. Please note that the setting method for each program is slightly different. Follow the manual provided by the software distributor.
- The time and location of the simulation program do not match with the ones of TCS.
 1. Check the settings of the simulation software: Some simulation software supports a function to download the data such as time and location of PC to TCS.
 2. If it is difficult to set the date/time and observatory location by software, use the functions of TCS itself and set it the same as software.
 3. TCS does not allow the user to enter the time before 2017. Therefore, date/time information only after 2017 is available.
 - Poor guide performance
 1. Try to adjust the guide speed from the System menu. Lower the guide speed for long focal length guiding, and increase the guide speed for short focal length guiding.
 2. Check the status of the LED at the bottom of the TCS. LEDs directly connected to the guide signal are arranged as RA +, DEC +, DEC-, RA-.
 3. Confirm whether all LEDs respond to the signal or not.
 4. Make sure that the mount, telescope and guide scope are securely fastened. You can also check by gently shaking the tip of the telescope by hand.
 5. Try to turn off the PEC function. In rare cases, the guide signal and PEC processing may interfere.
 - Date and time settings are not maintained between power downs.
 - Open the battery cover of the side of the device to replace the battery. Replace with a new CR 2032 lithium button cell.
Normally, the battery should be maintained for more than 2 years after purchase. If the problem suddenly occurs before the expected battery life ends, contact the manufacturer or the seller.
 - If the current date and time are cleared each time the power is turned off, try moving the battery tray back and forth several times. Moisture or other causes may cause poor contact.
 - If the problem persists does not improve, replace the CR2032 button cell. When replacing the battery, please refer to the above for instructions.
 - When the automatic meridian flip function is undesired for photographing.
 - Select Disable from [Meridian]-[Meridian Flip] Menu.
 - When disabling the meridian reversal function, always be careful of moving the telescope. In this case, it is programmed to reject the GOTO command which goes below the horizontal line.
 - When it automatically stops with a melody sound while tracking.
 - The RA Auto Stop function is activated.
 - Check the time and location settings to accurately calculate the meridian information.
 - Check the RA Auto Stop function.
 - Please check the message at the bottom of the screen.
 - When TCS receives a command from Object / GOTO, the error message is displayed without moving.
 - Check the time and location setting.

- The first star has to be synced and Object / GOTO.
- Do not GOTO near the horizon.
- PEC is turned off but dimmed gray color "PEC" appears in the display.
 - It is normal. Indicates that the PEC function is disabled, but has valid PEC training information.
 - If there is no "PEC" indication, you cannot use the PEC function until you refresh the PEC training.
- Turning PEC on worsens the guide performance.
 1. In a case the load on the telescope caused a slip after PEC training.
 2. In a case that the position was lost due to the stall of the motor.
 3. In a case that the power was turned off without Parking.
 - Refresh the PEC Training. The PEC function uses newly trained PEC data.
 - If the PEC function is not activated automatically, redo PEC Training and use newly trained data to operate PEC function.

CRUX170HD	ITEM	Specification
MAIN SPEC	Type	German Equatorial Mount
	Azimuth Adjustments	$\pm 15^\circ$
	Elevation Adjustments	18° to 55°
	Weight (without counterweight)	4.9kg
	Counterweights	3.7kg
	Optimal Loading Capacity without Counterweights	10kg (The position of 100mm from DEC head)
	Maximal Loading Capacity with Counterweights	20kg (The position of 100mm from DEC head)
	Operating Voltage	12V DC
	Tube mountings	4 x M8 screws (separated by 35mm)
MECHANICAL SPEC	R.A. Reduction Gear	SCSG-17-100-2AU or Equivalent
	DEC. Reduction Gear	SCSG-17-100-2AU or Equivalent
	Final Reduction Gear Backlash	Zero
	P-motion	$\pm 20''$ w/PEC $\pm 3''$
	High Speed Mode	1000x the sidereal rate (12V DC)
		Computerized-GoTo
		K-Astec Carbon Tripod
		Ball Head Base
		Laser Adapter
Telescope Control System TiTaN TCS	Option Parts	3.7 Kg Counterweight
	Dimension	312mm x 268mm x 113mm (In case of Altitude 35°)
	RA Stepping Motor	50:1 reduction geared PM Stepper motor 48step
	Dec Stepping Motor	25:1 reduction geared PM Stepper motor 48step
	RA total output PPS	355pps
	Dec total output PPS	176pps
	Frexible micro step control	Tracking : 1/128 Microstep Slewing : 1/4
	Maxumum Slewing Speed	1000x the sidereal rate (12V DC)
	Input Voltage Translation	12V DC -> 30V
	Main CPU spec	ARM Cortex-M4F
		120MHz Operation ; 150DMIPS
		1024KB Flash memory System SRAM
		6KB of EEPROM
	Communication Protocol	Meade LX200 Compatible
	PEC Function	P-motion control under $\pm 2''$
	Object Database	NGC, IC, M, Plenet, etc. over 12,000
	OLED Color Display	1.69" Diagonal Size, 160X128 Pixels
	Tracking current sinking	12V / 0.3~0.5A
	Max speed Slewing current sinking	12V / 1.5~2A
	Wireless Control	Bluetooth module
	Various Port	RS232, USB, Guider port,

Have a great astronomical life with the Crux140Traveler. HOBYM Observatory will do our best to support the product until its lifetime.



Horse Head Nebula / FDK150/SBIG STL11K/Crux170HD / Hwang, Injoon / 2018



M42 / FDK150/SBIG STL-11k/ Crux170HD / Hwang, Injoon / 2018

Equipment setting reference



Crux170HD + TEC140FL



Crux170HD + VSD100

참조 웹 페이지

- HOBYM Observatory main homepage : www.hobym.net
- HOBYM Observatory Facebook Page
: <https://www.facebook.com/HOBYM-Observatory-1414619488756747/>
- Crux170HD webpage : <https://www.hobym.net/crux170hd>
- TiTaN TCS webpage : <https://www.hobym.net/titan-tcs>
- Download Manuals: <https://www.hobym.net/manual-1>
- Blog : <https://www.hobym.net/blog>
- International Distributor : <https://www.hobym.net/partner>
- Contact Info. : <https://www.hobym.net/contact>
- Facebook User Group : <https://www.facebook.com/groups/193879510629347/>
- Facebook Japanese User Group :
<https://www.facebook.com/groups/165687264123804/>

Limited Warranty

CRUX equatorial mounts are warranted by HOBYM Observatory(HOBYM) to be free of defects in materials and workmanship for period of 5 Years(Mechanical parts) and 3 Years (Electronical parts) from the date of original purchase. Your official HOBYM dealer or Hobym will repair or replace(period of 90 days from the date of purchase) a product or part thereof, which upon inspection by HOBYM or official HOBYM dealer, is found defective in materials or workmanship. Provided the defective part is return to HOBYM observatory, freight-prepaid, with proof of purchase.

This warranty is not valid in cases where the product has been damaged, dropped, abused, mishandled, subjected to temperature or weather extremes, where unauthorized repairs have been attempted or performed, connect to improper voltage supply, or where depreciation of the product is due to normal wear-and-tear. HOBYM observatory specifically disclaims special, indirect, or consequential damages or lost profit which may result from a breach of this warranty.

This warranty gives you specific legal rights, and you may have other rights which vary from country to country (US, state to state)

