Nexus DSC *Pro*
USER MANUAL

NGC 104
←0.002↓0.005
0h 24m 5s
-72° 4' 53"
◄GLOBULAR IN TUC ►

01:29:47 75%

| 1 | 2 | 3 | ESC | OK |

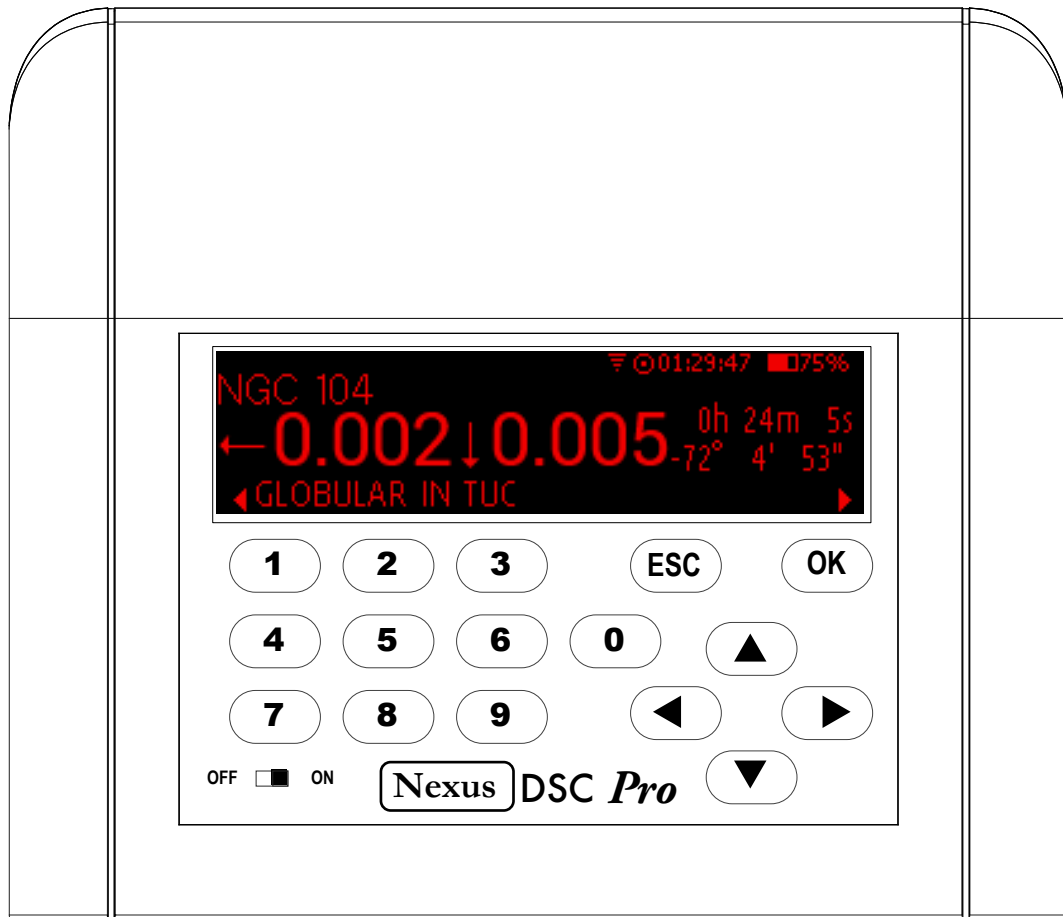| 4 | 5 | 6 | 0 | ▲ |

| 7 | 8 | 9 | ◄ | ► |

OFF ▭ ON   Nexus DSC *Pro* ▼

astro
DEVICES

User Manual for Nexus DSC *Pro*

Version 1.3
Firmware version 1.x.x
Last revised on November 18th, 2022
Printed in Australia

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Precautions and Safety

Electricity

Nexus DSC *Pro* contains a rechargeable Lithium-ion battery. Lithium-ion batteries can explode or cause a fire if they are used incorrectly or if they are defective. Therefore, you are recommended to read the following instructions very carefully:
NEVER leave Nexus DSC *Pro* where it is subjected to extremes in temperatures. This includes low levels as well as high.
DO NOT leave Nexus DSC *Pro* where it is in direct sunlight or in an enclosed space, such as a car, that can become extremely hot very rapidly.
Do not drop or subject the Nexus DSC *Pro* to impact.
Use only approved power adapter to charge your Nexus DSC *Pro*.

Do not handle power plug and adapter with wet hands. Electrical shock may result. Immediately power off the product and unplug the DC adapter and/or batteries if smoke or odours emit from the product. Immediately power off the product and unplug the DC adapter if water or other liquids are present.

Product

Keep it away from harsh environments including humid, dusty, and smoky areas.
Do not use excessive force on the connectors.
Do not attempt to disassemble the device without prior consultation with Astro Devices.
Do not place heavy objects on the product. Damage to your products may result from improper use.

Technical Support

Astro Devices
198 The Esplanade,
SYLVANIA, NSW 2224
AUSTRALIA
ABN 75 270 616 917
E-Mail: support@astrodevices.com
Website: http://www.astrodevices.com

Thank You!

Thank you for purchasing Nexus DSC *Pro* digital setting circles telescope computer. We hope you enjoy it!

You have purchased one of the most advanced Digital Setting Circles computers. It will allow you to located celestial objects quickly and easily. Nexus DSC *Pro* has a huge database of objects – planets, galaxies, star clusters, globular clusters, nebulae and others. It also provides extensive descriptions for those objects – magnitudes, sizes, common names, alternative designators, surface brightness, separations for double stars, spectral class, galaxy morphology. It is all available at a press of a button!

This user manual will get you started and help you make the most of your Nexus DSC *Pro*.

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Introduction

Nexus DSC *Pro* is a digital setting circles computer with optional WiFi interface for your telescope. It works with most popular telescopes – on equatorial or Alt-Azimuth mounts.

Nexus DSC *Pro* is a very sophisticated device for locating celestial object in the sky. Only two rotary encoders are required to be fitted to your telescope in order to be able to locate celestial object with Nexus DSC *Pro*.

Product Features

Below is a short outline of main features of your Nexus DSC *Pro*.

Technical specifications

- CPU – 32 bit, Cortex M7 running at 400MHz
- Memory – 32MB internal FLASH
- External memory – up to 512GB on micro SD card
- 3.12" Red OLED screen (256x64 pixels) with 256 levels of brightness
- Full numeric keypad with adjustable back light
- Real time clock with thermal compensation
- Built-in GPS receiver with support for GPS and GLONASS
- Built-in 5200mAh rechargeable Lithium battery
- Operating temperature range from -20 $^{\circ}$C to +50 $^{\circ}$C (-5 $^{\circ}$F to +120 $^{\circ}$F)
- Humidity 10%-90% non-condensing
- Optional WiFi interface
- FCC / CE/ IC certified 2.4GHz IEEE 802.11b/g transceiver
  - o Supports Access Point and infrastructure WiFi networks
  - o Secure Wi-Fi authentication schemes
  - o Class I WiFi device (up to 150 meters)
  - o Uses 2412 ~ 2484MHz Unlicensed ISM band (channels 1-14)
  - o Output power 0.08W
- One RS232 port
- One USB port
- Upgradeable firmware and catalogues (firmware is upgraded using a USB memory stick)
- Can be charged/powered by an external power source of 5-16V DC; can be charged from a cigarette lighter socket in a car
- Reverse polarity protection
- RoHS compliant
- Size: 140 x 120 x 30mm (5.5" x 4.7" x 1.2")
- Weight: 260g (9oz)

Digital setting circles specifications

- Intuitive graphical user interface
- Supports Alt-Az mounts, Equatorial Mounts, Equatorial Platforms

- Supports a two star alignment
- Filter objects by magnitude, constellation and object type
- Displayed angular resolution is 0.001 of a degree
- Internal FLASH memory contains a database of more than 90000 objects:
  - o Named stars
  - o Bright stars, Flamsteed, Bayer, Asterisms
  - o Planets, Sun, Moon
  - o Common named objects
  - o Full catalogues of popular catalogues.
- Around 2.5 million objects are located on optional microSD card
- Displays object's information: magnitude, size, surface brightness, spectral class, double star separations, galaxies morphology, alternative names, rise time, set time, transit time etc.
- Identify function; can also display up to 256 nearby objects
- Tour modes: within a radius and within a constellation
- Supports a multi point telescope pointing analysis system for telescope pointing corrections
- Supports rotary encoders with up to 999999 steps per revolution
- Shows internal battery status – remaining capacity, current power consumption and percentage of charge remaining
- Can be interfaced to a tablet/smartphone/computer using a standard RS232 interface or optional WiFi interface
- Internal real-time clock can be synchronised with GPS time automatically
- Time display of local time, UTC and local sidereal time
- Supports LX200 emulation
- Supports ServoCAT, SiTech, SkyTracker and ScopeDog motor controllers

## *Package Content*

The package contains:
- Nexus DSC *Pro*
- User manual
- DC 2.1mm to cigarette lighter power cable
- USB to DC 2.1mm cable (for charging only)
- *Optional* serial cable
- *Optional* power adapter Introduction
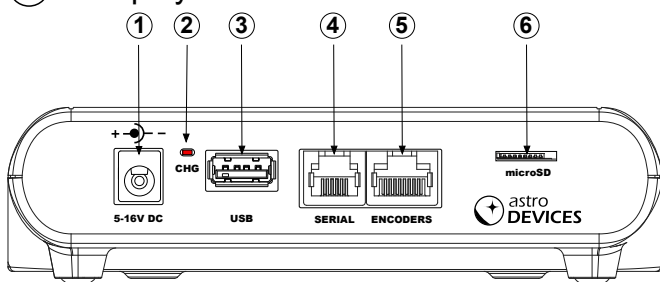
Unpacking

Nexus DSC *Pro* has a protective film covering the front panel. Please peel it off to be able to see the display clearly.

Controls

All controls are situated on front panel of Nexus DSC *Pro*:
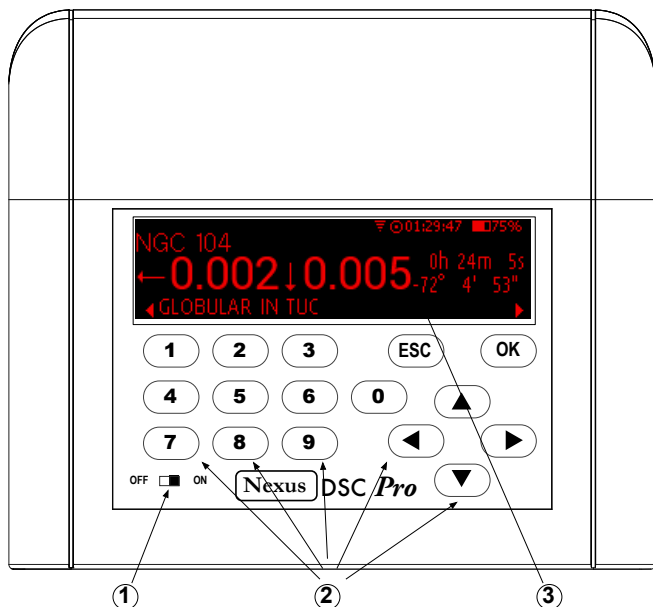
① – power switch

② – keypad

③ – display

① – external power connector (DC 2.1mm)

② – charging status LED

③ – USB connector

④ – Serial (RS232) port

⑤ – Encoders port

⑥ – Micro SD socket

① is used to charge the battery; can be connected to a power adapter or to a cigarette lighter socket (using the supplied cable)

② indicates the charging status of the battery

Blinking type	Description
Solid ON	The internal battery charging is in progress
OFF	The internal battery has been fully charged
Flashing	Flashing LED is indicating an error (power source is not supplying sufficient voltage and or current)

③ The USB port acts as a USB host. It cannot be used to connect Nexus DSC *Pro* to a computer directly.

The USB port on Nexus DSC *Pro* is used for:
- To interface Nexus DSC *Pro* to ServoCAT
- To interface Nexus DSC *Pro* to SiTech motor controller

⚠️ The USB port is not intended for charging Nexus DSC *Pro*. Never connect any power source to the USB port. This will void the warranty

④ Serial port is a standard RS232 port, 6P6C RJ connector. It is used for the following purposes:
- To connect Nexus DSC *Pro* to a computer
- To connect Nexus DSC *Pro* to motor controller

⑤ Encoder port is used to connect encoders using an 8P8C RJ connector

⑥ microSD socket is push-in push-out type

Charge the battery

The battery may not be fully charged at first. Start by fully charging the battery.

Please use either the provided power adapter or one of the recommended power adapters to charge the battery.

⚠️ Power source must have the following minimum ratings:
- 5-6 V DC – 2A is recommended
- 9-12 V DC – 1.5A is recommended

Some inexpensive power adapters do not have an over-current protection and when connected to Nexus DSC *Pro* will fail and damage the unit and that will void the warranty

It is also possible to use the supplied USB to DC 2.1mm cable to charge the battery from a power adapter with a USB socket. The power adapter should be capable of supplying at least 1.5A at 5V otherwise it will take much longer to fully charge the battery in Nexus DSC *Pro*.

Connect the power adapter to Nexus DSC *Pro* and plug the adapter into a power point.

It is best to keep Nexus DSC *Pro* turned off during charging to reduce charging time.

WARNING:

⚠️ Do not connect Nexus DSC *Pro* to an external power source that is not within the specified voltage range. Nexus DSC *Pro* has internal over-current protection but it is safer to use it with the power source specified.

The internal Lithium battery can only be charged at a temperature range of 0 $^{\circ}$C to +30 $^{\circ}$C (32 $^{\circ}$F to 86 $^{\circ}$F)

In order to keep the battery lasting a long time it is best to keep it charged at around 60% especially if leaving Nexus DSC *Pro* unused for long periods of time.
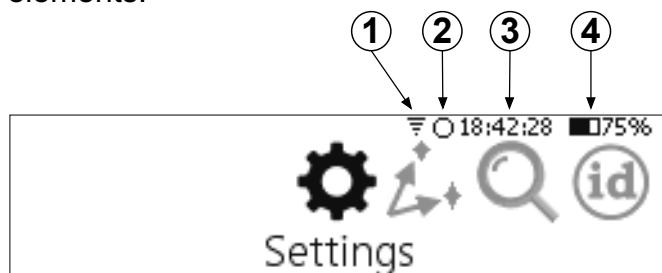
User interface

Main menu

The main screen consists of a status bar, horizontal menu with icons and a text description of the currently selected menu item:

① ⎯ Status bar

② ⎯ Main menu

③ ⎯ Menu description

Status Bar

The status bar shows basic information about battery state, current time, GPS receiver status and WiFi. The status bar has the following elements:

① WiFi status is only shown if the WiFi is enabled

② GPS fix status - the dot in the centre is flashing until the GPS receiver acquires the current location

③ Current time in 24 hour format

④ Battery charge level in %

Keypad

Nexus DSC *Pro* has a full numeric (0-9) keypad with directional keys ((◀),(▶),(▲),(▼)), (OK) and (ESC) to allow an easy method of control.

The keys have the following functions:

- (0) to (9) keys are used to specify a numeric information to Nexus DSC *Pro*
- (◀) and (▶) keys on the keypad move between previous and next menu item, they are also used to move between control fields (edit value, list, check box, on-screen buttons) in a dialogue screen. The (◀) key also acts as a backspace when editing a value in edit fields.

- (▲) and (▼) keys are used to select an item from a list, to adjust value in numeric fields with predefined steps (like 'Time Zone') or to change a character in an edit field; they can also be used to go to the previous/next menu level.
- The (OK) key activates the selected menu item (on-screen button press, accepts a selection from a list, finish editing a text or numeric value).
- The (ESC) key goes back to the previous menu level/screen.

📎 Special note about the (OK) and the (ESC) keys: in all settings pressing the (OK) key accepts the changes that you see on the screen while pressing the (ESC) key cancels the changes and switches back to the previous screen discarding the new values.

Initial Setup

This section describes how to setup Nexus DSC *Pro* to start locating celestial objects. The following sections will describe all features of Nexus DSC *Pro* in detail.

In order to be able to use Nexus DSC *Pro* for locating celestial object it is necessary to set a few parameters first:

- Time and date
- Mount Type
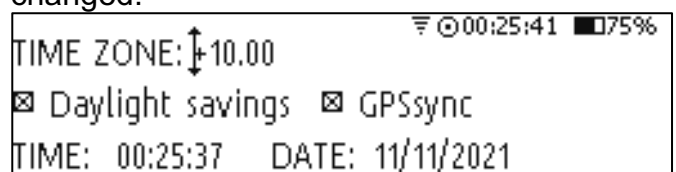- Encoders' resolution

Setting the time and date

Please select 'Settings' from the main menu:

Then select 'Time and Date':

It will show the current time and date that can be changed:

If all parameters are set correctly then you can use the (ESC) to avoid changing any parameter.

If the time zone, time and date need to be changed then ◀ and ▶ keys can be used to select the parameter that needs to be adjusted. ▲ and ▼ keys are used to change the value.

Setting the time and date is only required if time synchronisation with GPS is disabled. However, the time zone and date need to be set for Nexus DSC *Pro* to show the local time correctly.

📎 It usually takes 30 to 60 seconds for the GPS receiver to get a fix on the location (under open sky conditions). Nexus DSC *Pro* will update the internal real-time clock with the time received by the GPS receiver at this time. The GPS receiver will automatically be switched into a power saving mode after it acquired the location to conserve the battery power.

Connecting to your telescope

For basic operation, the Nexus DSC *Pro* only requires a connection to the encoders on your telescope. Please plug the encoder cable into **Encoders** port on Nexus DSC *Pro*.

For operating Nexus DSC *Pro* with a motorised telescope either the serial port or the USB port or both ports need to be connected to motor controller. A special cable may be required for the connection(s). Please refer to *Settings for motorised telescope* for additional information on how to setup Nexus DSC *Pro* to work correctly with the motor controller installed on your telescope.

Please use the test mode to test the encoders to make sure that encoders are functioning correctly with the Nexus DSC Pro. Selecting **Test** from the main menu activates it:
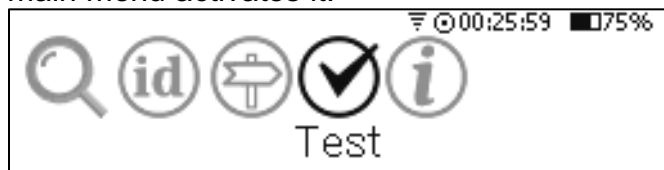
Then select **Encoders**:

will show the current angles and encoder steps:
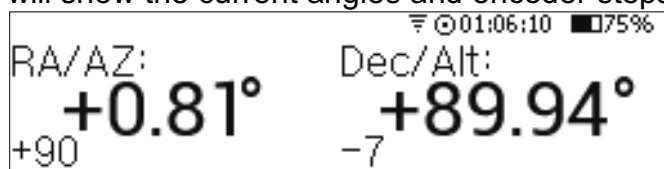
Please adjust the encoder steps to make sure that they function correctly with the Nexus DSC *Pro*, so that:

- the RA/AZ current position in degrees is increasing when rotating the telescope clockwise around RA/AZ axis
- the Dec/Alt current position in degrees is increasing when moving the telescope up in declination/altitude

If either of those values is decreasing then set the encoder steps' sign for that axis to a negative sign in the Telescope Settings:
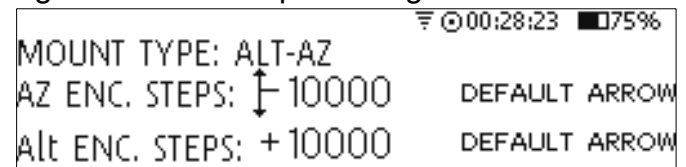
Telescope Settings

Nexus DSC *Pro* needs the mount type and encoder steps to be set correctly before it can be used to locate celestial object precisely.

The mount type and encoder steps are set in the Telescope Settings that can be accessed by selecting 'Setting' from the main menu:

then by selecting 'Telescope':

Then you need to select the telescope:
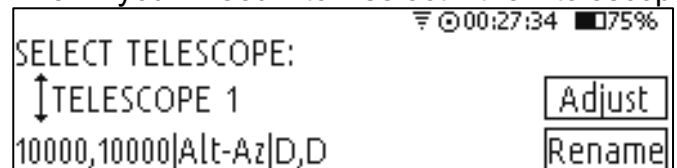
Nexus DSC Pro allows you to store up to five different telescope configurations. ▲ and ▼ keys are used to switch between telescope configurations. You can also rename **TELESCOPE 1** to your telescope's name. You just need to activate the **Rename** button by using ▶ and then press the OK key. A text cursor now appears under the name:

You will now be able to edit the name and change it to your telescope name:

```
                              ▼ ☉ 13:50:03  ▮▮75%
SELECT TELESCOPE:
 ↕18" Obsession                    ┌────────┐
                                   │ Adjust │
                                   ├────────┤
10000,10000|Alt-Az|D,D             │ Rename │
                                   └────────┘
```

Now you need to set other parameters for your telescope:

```
                              ▼ ☉ 00:28:25  ▮▮75%
MOUNT TYPE:↕ALT-AZ
Alt ENC. STEPS: +10000      DEFAULT ARROW
AZ ENC. STEPS: +10000       DEFAULT ARROW
```

where the mount type can be selected by using (▲) and (▼) keys. The encoder steps are set to 10000 steps by default and should be set to the number of steps corresponding to the number of steps of the encoder installed on your telescope. Encoder steps can be set by using the numeric keys on the keypad. Please change the sign in front of encoder steps for either one or both encoders if required as described previously:

```
                              ▼ ☉ 00:28:49  ▮▮75%
MOUNT TYPE: ALT-AZ
Alt ENC. STEPS: ╠10000      DEFAULT ARROW
AZ ENC. STEPS: +10000       DEFAULT ARROW
```

Two stars alignment

Nexus DSC *Pro* needs to be aligned on two stars before it can locate celestial objects.

📎 Your telescope does not need to be levelled for Nexus DSC *Pro* to locate celestial objects accurately unless the one star alignment method is used.

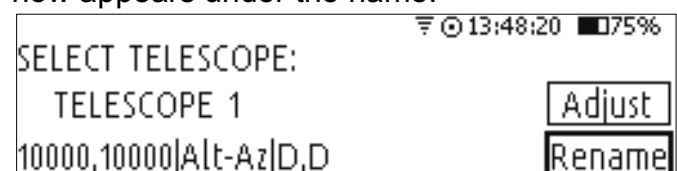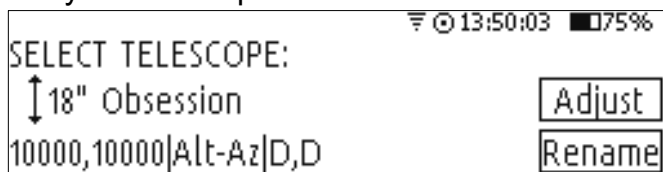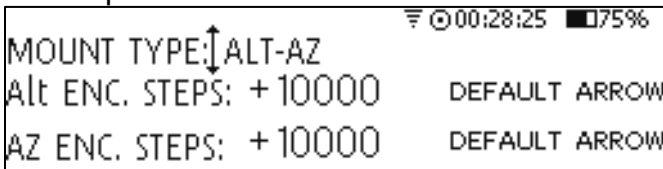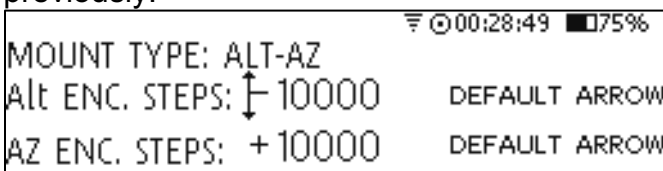The two stars alignment is performed in three steps.

Please go to the Align menu:

```
                              ▼ ☉ 00:29:07  ▮▮75%
  ⚙      ⚡      🔍     (id)    🪧
              Align
```

Then select Altitude Reference:

```
                              ▼ ☉ 00:29:15  ▮▮75%
       🏠      ↗¹     ↗²     ◎
         Altitude Reference
```

Adjust the altitude reference angle if required:

```
                              ▼ ☉ 01:09:12  ▮▮75%
Altitude angle:↕90°
Telescope coordinates:
       0.81°, 89.94°
```
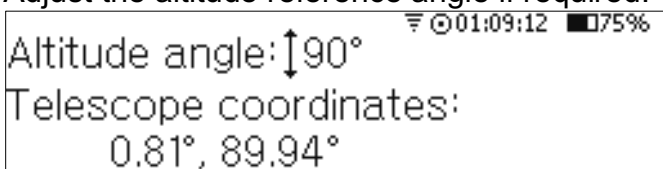
Now move the telescope into position depending on the mount type (for 90 degrees reference): Telescopes on Alt-Azimuth mount should be positioned vertically:

The same rule applies to telescopes installed on equatorial platforms. Please note that the telescope should be at 90 degrees to the ground board, not the ground.

For equatorial mounts 0 degrees altitude reference is more convenient.

Telescopes on an Equatorial Fork for a 0 degrees altitude reference then be positioned as below:

📎 The telescope does not have to be positioned exactly at the angle specified, but it should be within ±10°.

The following information applies only to German Equatorial mounts.

It is worth noting that the 90° altitude reference for the German Equatorial mode means that the telescope is pointing at the celestial pole while positioned in the top position (i.e. the counterweight is at the bottom). Please see the *Test* section of this manual to find how the encoder steps should be setup for a German Equatorial mount.

• For the 0° Altitude reference the telescope should be positioned horizontally pointing west if aligning first on a star in the western part of the sky and pointing east if aligning first on a star in the eastern part of the sky.

Nexus DSC *Pro* will automatically switch the screen to the selection of first alignment object:

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ALIGN I ● 〒 ⊙01:10:53 ▉75%

‡Capella

CATALOGUE | OBJECT | INFO HELP

While Nexus DSC *Pro* can be aligned on any object in its database it is best to use objects form either **Named Stars** catalogue or **Bright Stars** catalogue.

Pressing (◀) will switch to the CATALOGUE tab and a different catalogue can be selected then pressing the (▶) key will return to the object selection.

It is time to select the first alignment object – by pressing (▲) and (▼) to change to another star:

ALIGN I ● 〒 ⊙01:12:59 ▉75%

‡Gacrux

CATALOGUE | OBJECT | INFO HELP

Gacrux was selected as it is well above 30 degrees. Now the telescope should be pointed at **Gacrux** using an eyepiece with a reticle/crosshair or a very high magnification eyepiece. Press the (OK) button once the telescope is pointing at the star.

Nexus DSC *Pro* will now switch to the selection of a second alignment object:

ALIGN II ● ● 〒 ⊙01:19:27 ▉75%

‡Rigil Kentaurus

CATALOGUE | OBJECT | INFO HELP
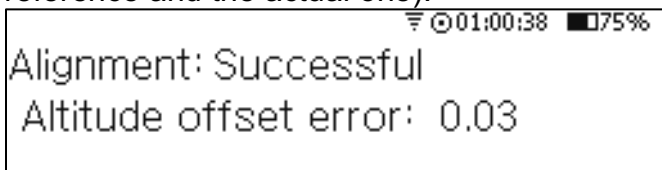
Please follow the procedure described above to change the selection of the second alignment object if necessary.

Press the (OK) button once the star is in the centre of the eyepiece.

Now Nexus DSC *Pro* will show the altitude offset error (difference between a true altitude reference and the actual one):

〒 ⊙01:00:38 ▉75%
Alignment: Successful
Altitude offset error: 0.03

Now you can press either the (OK) key or the (ESC) key to go to the previous menu.

⋃ You can go back to align on first or second object at any time in case the alignment error is too big.

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Alignment object screen

Alignment object screen has four tabs: CATALOGUE, OBJECT, INFO and HELP. You can use (◀) and (▶) keys to switch between the tabs. The OBJECT tab is selected by default:

ALIGN I ● 〒 ⊙01:10:53 ▉75%

‡Capella

CATALOGUE | OBJECT | INFO HELP
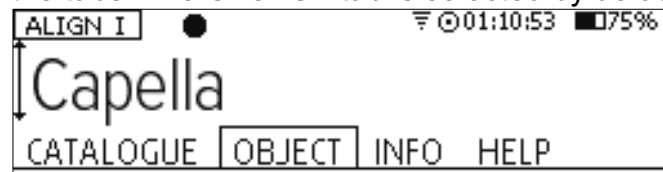
The INFO tab shows additional information about the object:

①   ②   ③

ALIGN I ●   〒 ⊙01:24:16 ▉75%
γ Cru   AZ:220.54° 12h32'15"
[113.91°,63.61°] Alt:38.00° -57°13'17"
CATALOGUE OBJECT | INFO | HELP

④   ⑤   ⑥   ⑦
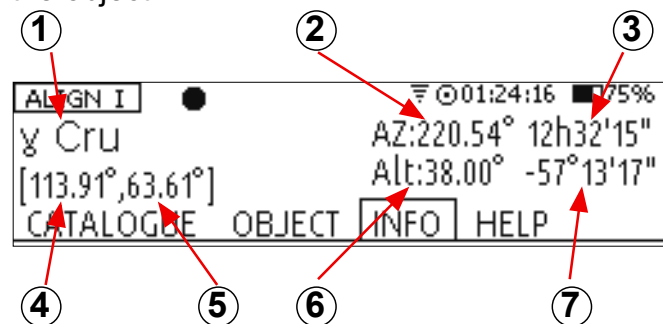
where:
① – Object's information
② – Currently selected object's azimuth
③ – Currently selected object's RA
④ – Telescope's AZ/RA
⑤ – Telescope's Altitude/Declination
⑥ – Currently selected object's altitude
⑦ – Currently selected object's declination

Pointing accuracy

Pointing accuracy depends on a number of factors:
- Quality of the telescope mount
- Choice of alignment stars
- Accuracy in pointing on alignment objects

To achieve the best pointing accuracy with an Altitude-Azimuth mount it is recommended that:
- The alignment stars chosen should always be at 30 to 80 degrees in altitude and separated by at least 70 degrees in azimuth.
- Alignment stars should ideally have at least a few degrees separation in altitude
- Polaris can be used as one of the alignment stars

To achieve the best pointing accuracy on an Equatorial mount it is recommended that:
- Polaris should never be used as one of the alignment stars
- Alignment stars with a declination greater than 80 degrees should be avoided

- The alignment stars chosen should always be at 30 to 80 degrees in altitude and separated by at least 70 degrees in RA.

Locating an object

Once the two star alignment is performed Nexus DSC *Pro* can locate celestial object in the sky. The following steps describe a basic method of location of celestial objects.

Go to the top menu and select *Find*:

```
 ⏧ ⊙01:01:01  ■□75%
⚙ 𝌋 Q (id) 🛆 ✓
        Find
```

Select *From Catalogues*:

```
 ⏧ ⊙01:01:12  ■□75%
                    RA,DEC
 🗀 📋 (RA DEC) ALT,AZ
   From Catalogues
```
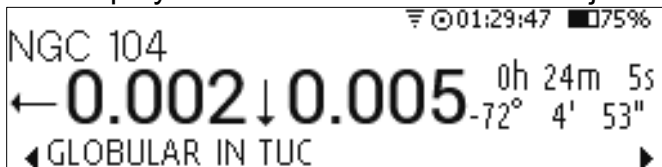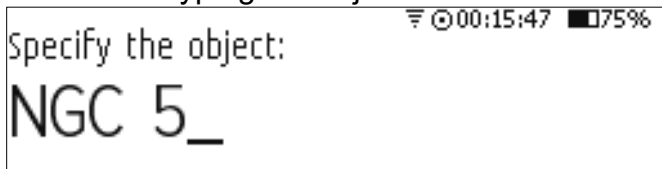
Select a catalogue by using the (▲) and (▼) keys and then press the (OK):

```
 ⏧ ⊙01:25:02  ■□75%
NGC
              Index: 39
CATALOGUE  FILTER  HELP  INFO
```

The display will show the last selected object:

```
 ⏧ ⊙01:29:47  ■□75%
NGC 104
←0.002↓0.005 0h 24m 5s
                  -72° 4' 53"
◀ GLOBULAR IN TUC          ▶
```
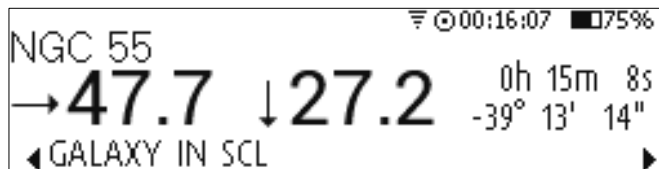
Suppose we would like to find NGC55. Just press the (5) key and the display will prompt to continue typing the object number:

```
 ⏧ ⊙00:15:47  ■□75%
Specify the object:
NGC 5_
```

Now press the (5) key again and then press (OK):

```
 ⏧ ⊙00:15:56  ■□75%
Specify the object:
NGC 55_
```

Nexus DSC *Pro* will now show where to move the telescope to aim at NGC55:

```
 ⏧ ⊙00:16:07  ■□75%
NGC 55
→47.7 ↓27.2 0h 15m 8s
                 -39° 13' 14"
◀ GALAXY IN SCL          ▶
```
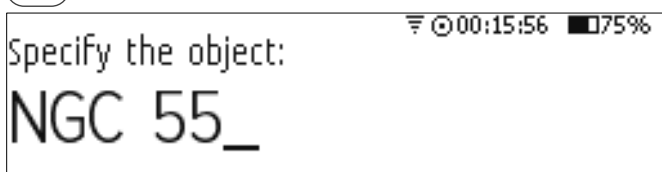
It shows that the telescope needs to be moved down by 27.2 degrees and counter clockwise by 47.7 degrees. As you start moving the telescope the numbers will start updating. Continue to move until both numbers are close to 0s:

```
 ⏧ ⊙00:20:15  ■□75%
NGC 55
←0.008↓0.005 0h 15m 8s
                 -39° 13' 14"
◀ GALAXY IN SCL          ▶
```
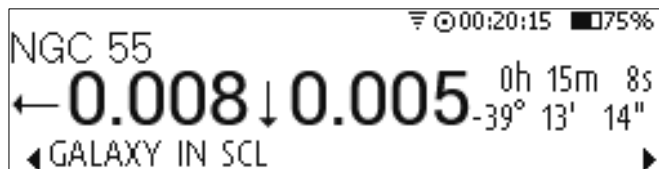
If you look through the eyepiece you should see NGC55 in the field of view.

To display additional information about the object just press (◀) or (▶) key:

```
 ⏧ ⊙00:18:17  ■□75%
NGC 55: Galaxy in Sculptor, also
known as ESO 293- G 050
size:32.4'x5.6' magnitude:8.8 SB:
◀                        ▶
```
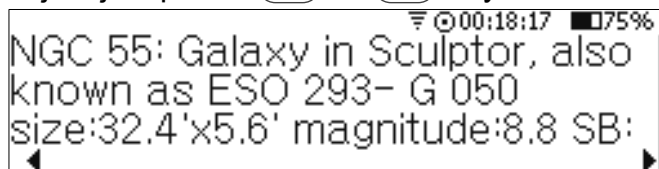
Pressing (◀), (▶) or (ESC) will take you back to the previous screen.

📎 If a description for the object fits on one screen then no scroll bar is displayed on the right.

Improving pointing accuracy

Every telescope has some kind of imperfections. Nexus DSC *Pro* supports two methods of improving pointing accuracy that compensate for those imperfections: sync objects and Mpoint. Mpoint is described later in this manual.

Sync objects are used to improve the pointing accuracy when a telescope is pointing in the proximity of a synced object. Nexus DSC *Pro* limits the number of sync objects to 1024. The size of the area is limited to 10º radius. If there are more than one sync objects in the area then corrections from the closest sync objects are used.

Once the two star alignment is performed Nexus DSC *Pro* will enable an additional mode to allow adding sync objects. Use (◀) to activate it while an object from one of the catalogues is selected:

```
 ⏧ ⊙00:13:25  ■□75%
Catalogue: Messier
Objects M79
Objects:4    Reset  ADD SYNC/MPOINT
```
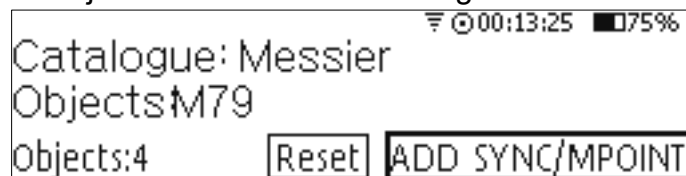
To sync to the object (M79 in this example), make sure it is precisely in the centre of the field of view. If any of offsets are not exactly 0, press the (OK) key to add it to the sync objects list. Once you press the (OK) key you will see that offsets became 0s:

```
M79                            ⌘ ☉00:14:47 ◼75%
←  0.00   ↓ 0.00            5h 24m 11s
                              -24° 31' 27"
GLOBULAR IN LEPUS
```
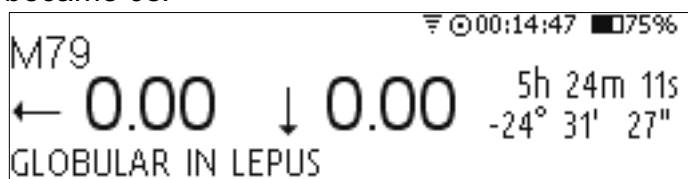
Nexus DSC *Pro*'s menus

Settings

Nexus DSC *Pro* has a number of parameters that can be adjusted. All of the adjustable parameters are stored in non-volatile memory and will be used every time you turn Nexus DSC *Pro* on.

! Please note that all settings can be reset back to their default values by turning Nexus DSC *Pro* on while holding the (ESC) key. You will be asked to confirm the reset to the factory settings.

Telescope

Nexus DSC *Pro* needs the mount type and encoder steps to be set correctly before it can be used to locate celestial object precisely.

The mount type and encoder steps are set in the Telescope Settings that can be accessed by selecting *Setting* from the main menu:
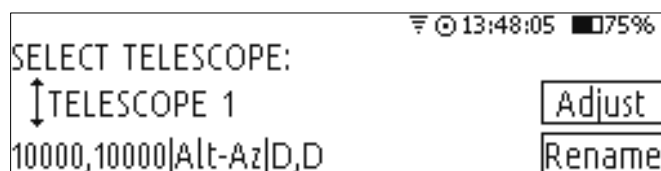
```
              ⌘ ☉00:25:25 ◼75%
   ✿  ⭣  Q  (id)
      Settings
```

then by selecting *Telescope*:

```
              ⌘ ☉00:27:21 ◼75%
   🏠  ⭣  Q  ☰
      Telescope
```
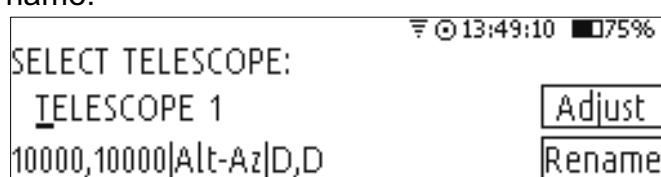
Nexus DSC *Pro* supports up to five different telescope configurations. Each telescope configuration has its own mount type, encoder steps, altitude reference angle value. Having different telescope configurations allows you to use Nexus DSC *Pro* with different telescopes without spending time on setting all parameters. You can switch between your telescope configurations as follows:

```
              ⌘ ☉13:48:05 ◼75%
SELECT TELESCOPE:
 ↕TELESCOPE 1                    Adjust
10000,10000|Alt-Az|D,D          Rename
```

(▲) and (▼) keys are used to switch between telescope configurations.

📎 To select a telescope configuration without changing any parameters just press the (ESC) key.

You can also rename **TELESCOPE 1** to your telescope name. You just need to activate the *Rename* button by using (▶) and then press the (OK) key. A text cursor now appears under the name:

```
              ⌘ ☉13:49:10 ◼75%
SELECT TELESCOPE:
 ↓TELESCOPE 1                    Adjust
10000,10000|Alt-Az|D,D          Rename
```

You will now be able to edit the name and change it to your telescope name:

```
              ⌘ ☉13:50:18 ◼75%
SELECT TELESCOPE:
 18" Obsession_                  Adjust
10000,10000|Alt-Az|D,D          Rename
```
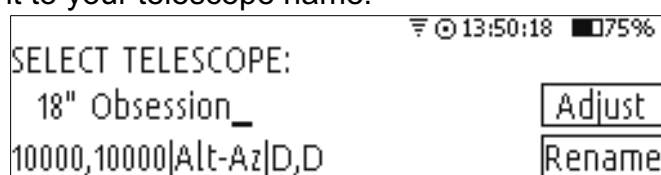
Now you need to set other parameters for your telescope (by pressing the (OK) key when the *Adjust* button is active):
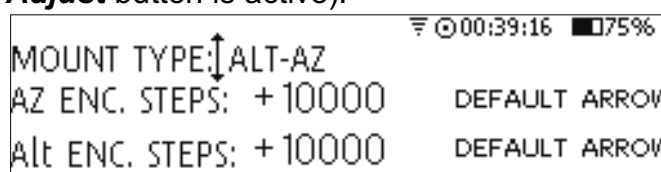
```
              ⌘ ☉00:39:16 ◼75%
MOUNT TYPE:↕ALT-AZ
AZ ENC. STEPS: +10000     DEFAULT ARROW
Alt ENC. STEPS: +10000    DEFAULT ARROW
```

where the mount type can be selected by using (▲) and (▼) keys. The encoder steps are set to 10000 steps by default and should be set to the number of steps corresponding to the number of steps installed on your telescope. Encoder steps can be set by using the numeric keys on the keypad. Change the sign to negative if required as described previously:

```
              ⌘ ☉00:28:23 ◼75%
MOUNT TYPE: ALT-AZ
AZ ENC. STEPS: ⊦10000     DEFAULT ARROW
Alt ENC. STEPS: +10000    DEFAULT ARROW
```
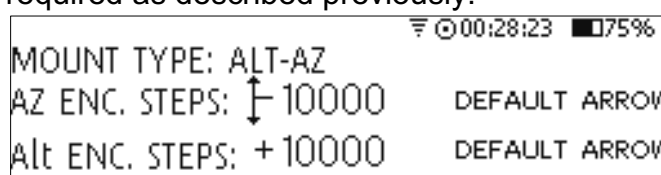
Nexus DSC Pro has a provision for changing the

default direction of the arrows indicating the direction to move the telescope. The direction can be changed by selecting **REVERSE ARROW**:

```
                    ☰⊙13:48:44 ■□75%
MOUNT TYPE: ALT-AZ
AZ ENC. STEPS: +10000   ↕REVERSE ARROW
Alt ENC. STEPS: +10000  DEFAULT ARROW
```
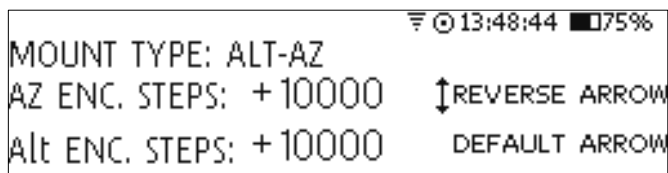
Align

The **Align** settings menu is used to control the behaviour during alignment.

```
              ⊙22:55:45 ■□75%
      🏠  ↗✦  🔍  ☰  🔒
              Align
```

It enables to set various parameters that are used only during the alignment:
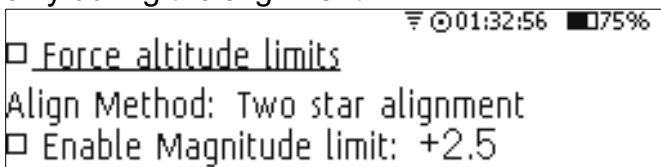
```
                    ☰⊙01:32:56 ■□75%
□ Force altitude limits
Align Method: Two star alignment
□ Enable Magnitude limit: +2.5
```

• *Force altitude limits* will force Nexus DSC *Pro* to display only objects that are within altitude limits (specified in **Settings->Other Parameters**) if checked.

• *Alignment Method* selects the alignment method used for the telescope alignment. Four methods are supported: *One star, Two stars, Two stars without altitude reference and Three stars*:

```
                    ⊙21:41:16 ■□75%
□ Force altitude limits
Align Method: ↕One star
□ Enable Magnitude limit: +2.5
```
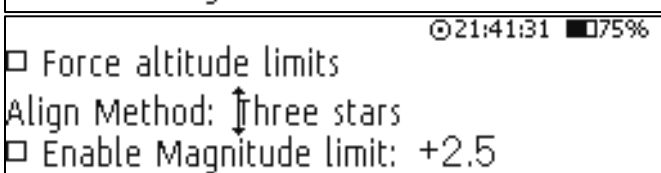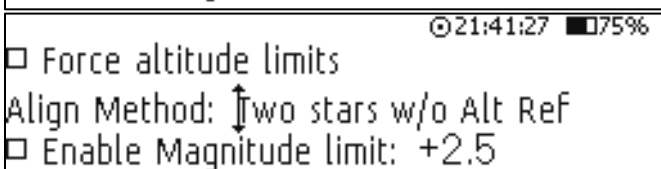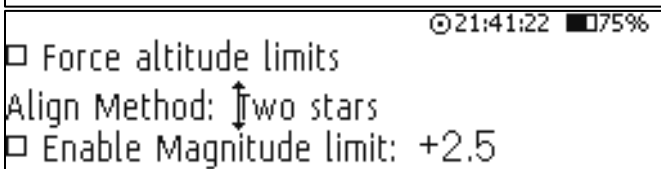
```
                    ⊙21:41:22 ■□75%
□ Force altitude limits
Align Method: ↕Two stars
□ Enable Magnitude limit: +2.5
```

```
                    ⊙21:41:27 ■□75%
□ Force altitude limits
Align Method: ↕Two stars w/o Alt Ref
□ Enable Magnitude limit: +2.5
```

```
                    ⊙21:41:31 ■□75%
□ Force altitude limits
Align Method: ↕Three stars
□ Enable Magnitude limit: +2.5
```
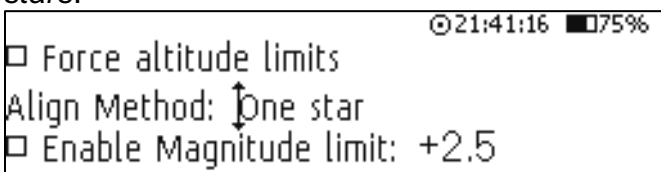
📎 *Two star alignment or Two stars w/o Alt Ref* should be used for most cases as they provide the best pointing accuracy.

One star alignment should only be used on a perfectly polar aligned German Equatorial mount or on perfectly levelled Alt-Azimuth mounts. The pointing accuracy will depend on the accuracy of polar alignment/levelling the telescope.

Three stars alignment should be used very carefully as the resulting pointing accuracy depends on the correct choice of alignment stars. To achive the best results we recommend aligning on stars that are 120º from each other.

You can use the *Enable magnitude limit* setting to limit the display to only objects brighter than a given magnitude limit. This limit only applies to objects displayed during the alignment process.

Find

The **Find** settings menu is to control the behaviour of Nexus DSC *Pro* in all **Find** modes.

```
              ⊙22:55:46 ■□75%
      🏠  ↗✦  🔍  ☰  🔒  ⟲
              Find
```

• *Force altitude limits* will force Nexus DSC *Pro* to display only objects that are within altitude limits (specified in **Settings->Other Parameters**) if checked.

```
                    ☰⊙01:33:15 ■□75%
⊠ Force altitude limits │Enabled Catalogues│
Precision: 0.001°
Display coordinates: Equatorial
```
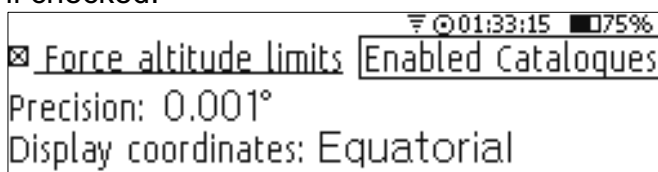
• *Enabled catalogues* specifies which catalogues will be displayed in **Find->From Catalogues** mode.

Use (▶) key to activate the *Enabled Catalogues* button and then press the (OK) key to select/deselect catalogues that are shown in the **Find** mode.

```
                    ☰⊙01:33:36 ■□75%
⊠ Force altitude limits │Enabled Catalogues│
Precision: 0.001°
Display coordinates: Equatorial
```
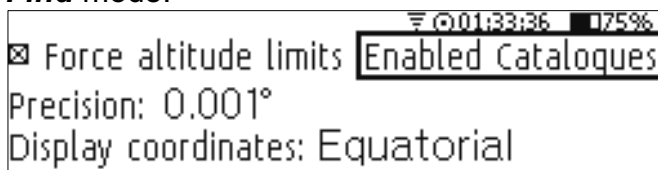
Now the screen will list all catalogues installed:

```
                                    ⌖ 15:12:12  ■□75%
⊠ (1) Named Stars
⊠ (2) Sun & Planets
⊠ (3) Bright asteroids
   Page 1 of 22              [All ON][All OFF]
```
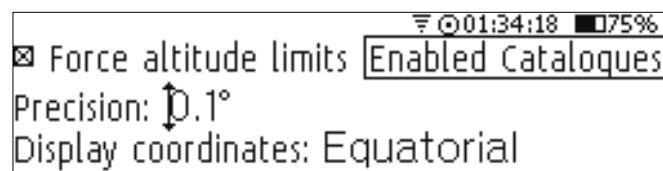
Pressing (▲) and (▼) keys selects/deselects a catalogue, (◄) and (►) keys to switch between catalogues, (4) and (6) keys switches between pages. Pressing the (OK) key will switch to the next page if *All ON* and *All OFF* buttons are inactive.

All ON and *All OFF* selects/deselects all catalogues (in case only a few catalogues need to be selected one can deselect all catalogues and then go and select only catalogues that are needed:

```
                                    ⌖ 15:18:15  ■□75%
⊠ (1) Named Stars
⊠ (2) Sun & Planets
⊠ (3) Bright asteroids
   Page 1 of 22              [All ON][All OFF]
```
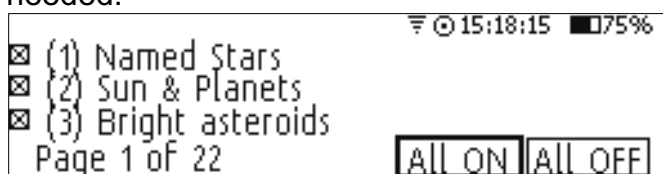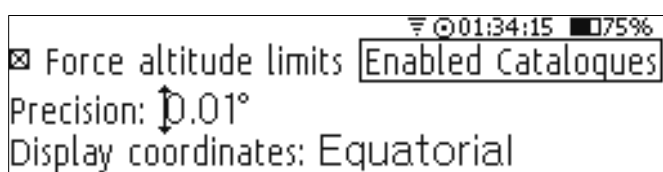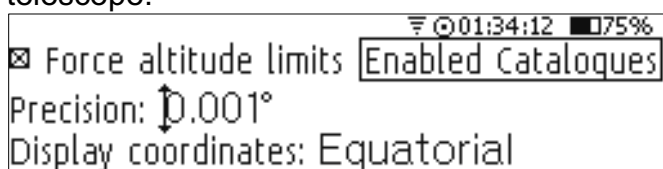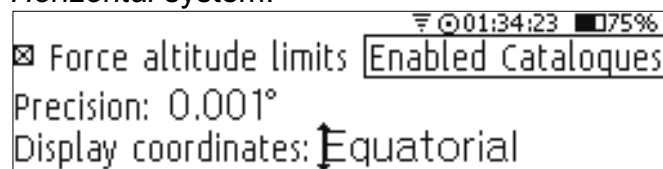
```
                                    ⌖ 15:18:29  ■□75%
⊠ (1) Named Stars
⊠ (2) Sun & Planets
⊠ (3) Bright asteroids
   Page 1 of 22              [All ON][All OFF]
```

```
                                    ⌖ 15:18:35  ■□75%
☐ (1) Named Stars
☐ (2) Sun & Planets
☐ (3) Bright asteroids
   Page 1 of 22              [All ON][All OFF]
```

Use (◄) and (►) keys to switch between catalogues for selecting/deselecting and also to get to *All ON* and *All OFF* buttons.
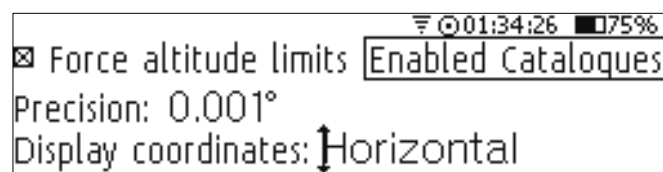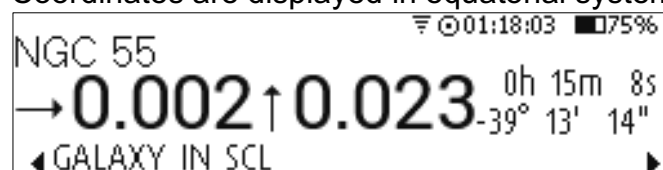Press the (ESC) key to finish the selection.

• *Precision* setting controls the number of digits displayed after the decimal point in all *Find* modes. It can be set to display one, two or three digits after the decimal point. It is saved for each telescope.
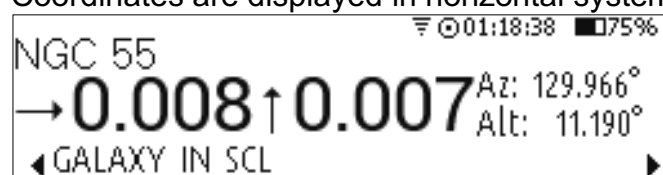
```
                                    ⌖ 01:34:12  ■□75%
⊠ Force altitude limits [Enabled Catalogues]
Precision: ↕0.001°
Display coordinates: Equatorial
```

```
                                    ⌖ 01:34:15  ■□75%
⊠ Force altitude limits [Enabled Catalogues]
Precision: ↕0.01°
Display coordinates: Equatorial
```

```
                                    ⌖ 01:34:18  ■□75%
⊠ Force altitude limits [Enabled Catalogues]
Precision: ↕0.1°
Display coordinates: Equatorial
```

• *Display coordinates* controls the type of coordinate system used to display coordinates of objects on the object screen in *Find* mode. It can be switched between *Equatorial* (J2000) and *Horizontal* system.

```
                                    ⌖ 01:34:23  ■□75%
⊠ Force altitude limits [Enabled Catalogues]
Precision: 0.001°
Display coordinates: ↕Equatorial
```

Coordinates are displayed in equatorial system:

```
                                    ⌖ 01:18:03  ■□75%
NGC 55
→0.002↑0.023  0h 15m  8s
                            -39° 13'  14"
◄ GALAXY IN SCL                          ►
```

```
                                    ⌖ 01:34:26  ■□75%
⊠ Force altitude limits [Enabled Catalogues]
Precision: 0.001°
Display coordinates: ↕Horizontal
```

Coordinates are displayed in horizontal system:

```
                                    ⌖ 01:18:38  ■□75%
NGC 55
→0.008↑0.007  Az: 129.966°
                            Alt:  11.190°
◄ GALAXY IN SCL                          ►
```

Other Parameters

The Other Parameters menu is to set other settings that do not fall under a specific category for your Nexus DSC *Pro*.

```
                                  ⌖22:55:49  ■□75%
 🏠  ⚡  🔍  ☰  🔒  🔌  🕐
           Other Parameters
```

```
                                    ⌖ 01:34:47  ■□75%
Altitude limit low: ↕10°  ☐ Reverse Scrolling
Altitude limit high: 85°  ⊠ Play sounds
```
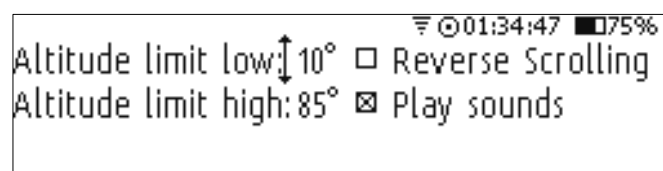
• *Altitude limits* can be specified that are used for:
  • Limiting a range of objects' search in *Align/Find/Tour* modes
  • Limiting slewing the telescope when Nexus DSC *Pro* is used with a motor controller (ServoCAT, SiTech, SkyTracker)
• *Reverse Scrolling* changes the behaviour of (▲) and (▼) key presses.

AstroLock

AstroLock™ menu allows you to set parameters which control tracking objects when Nexus DSC *Pro* is used with motor controllers (like ServoCAT, SiTech, SkyTracker).

AstroLock™ helps tracking objects when the motor controller used does not have the gear ratios configured precisely. Nexus DSC *Pro* detects when the telescope starts tracking, and will lock onto those coordinates. Drive rates will be adjusted automatically to keep telescope tracking locked onto those. Since backlash can alter tracking direction you can also compensate for a backlash when slewing the telescope to an object.
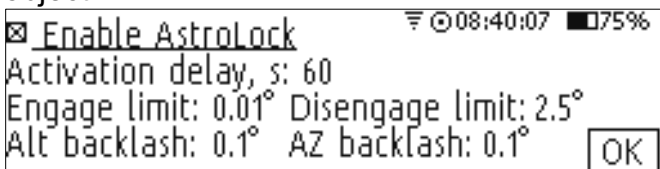
• *Enable AstroLock* – enables or disables AstroLock

• *Activation delay* – sets the delay after the slew is complete and before AstroLock is engaged; this delay is to allow using the motor controller's hand pad to adjust the telescope's position – this is especially important in case of using ServoCAT or SkyTracker; the delay is not required in case of using SiTech motor controller as any key presses on the handpad disengages the lock.

• *Engage limit* – specifies the threshold for Nexus DSC *Pro* to detect that the telescope started tracking (in degrees per one quarter of a second)

• *Disengage limit* – specifies a threshold when the lock is disengaged; to allow using the motor controller's handpad to move the telescope when the lock is active.

• *Alt backlash* and *AZ backlash* – specify the backlash values for the altitude and the azimuth motors.
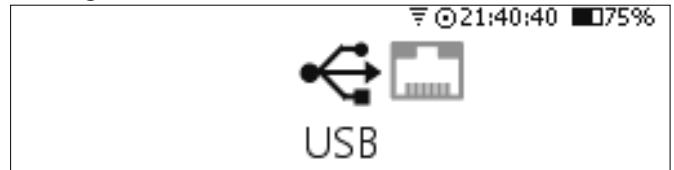
Communications

Communications menu allows you to set parameters for serial port and USB port. Please select **Communications** from the **Settings** menu:

You can use the USB menu to change USB port settings:

Nexus DSC *Pro* supports interfacing to ServoCAT through the USB port for performing GOTO commands from a planetarium application. For third generation of ServoCAT you will need a USB cable supplied with ServoCAT, for the first and the second generation of ServoCAT a USB to serial adapter is required – the adapter must be based either on FT232 chipset, on CP210x chipset or on PL2303 chipset. Please contact Astro Devices for a list of compatible USB to serial adapters.
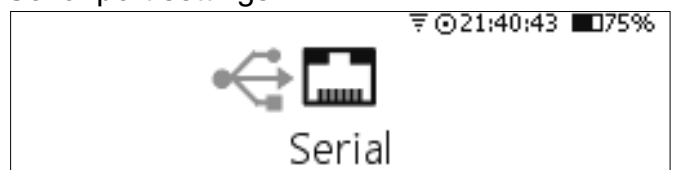
For operating Nexus DSC *Pro* with ServoCAT it is necessary to set a few parameters:

• *Communication protocol* set to **ServoCAT**
• *Baud rate* set to 9600
• *Stop bits* set to 1
• *Data bits* set to 8
• *Parity* set to None

Serial

You can use the **Serial** menu to change the Serial port settings:

Now the serial port parameters can be adjusted as required:

• *Communication protocol*
• *Baud rate*
• *Stop bits*
• *Data bits*
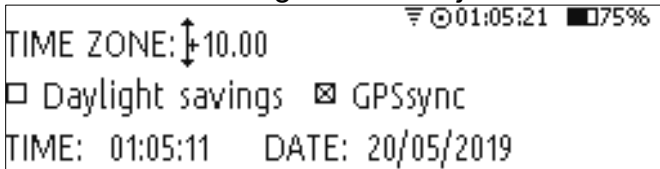• *Parity*

Nexus DSC *Pro* User Manual

Time and Date

Nexus DSC *Pro* has a built-in battery backed real time clock.

To set the time you need to select ***Time & Date***:

then the time settings can be adjusted:

 The easiest method of setting the time and date parameters is to set *TIME ZONE, Daylight Savings*, enable *GPSsync* and then step outside to allow the GPS receiver to get a fix on the location and the time and date will be set automatically.
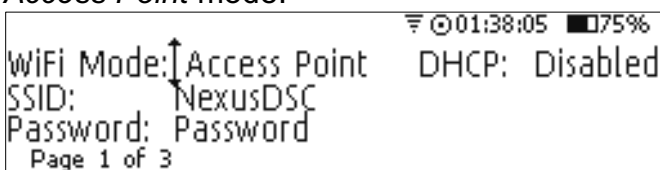
WiFi

Nexus DSC *Pro*'s optional WiFi interface can be disabled, set to *Access Point* mode (when Nexus DSC *Pro* acts as a WiFi access point thus allowing other devices to joins its network) or it can be set to *Infrastructure* mode (for connecting to an existing WiFi network). You can use the ***Settings->WiFi*** menu to change various WiFi parameters:
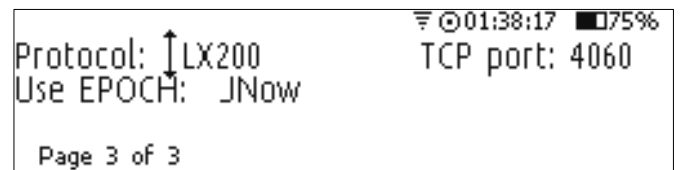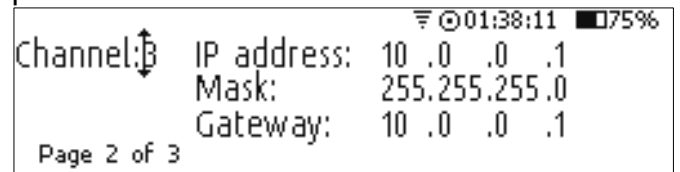

The WiFi is disabled by default.
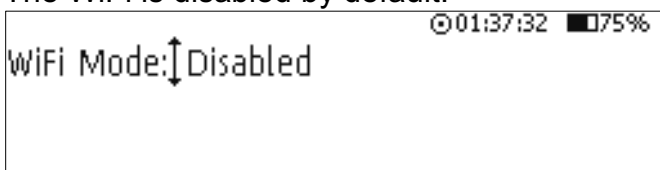
The easiest way to use Nexus DSC Pro with a smartphone/tablet/laptop is to switch WiFi to *Access Point* mode:

After changing WiFi Mode to Access Point, you can press the (OK) key three times to use default WiFi parameters. Optionally, two additional

pages allow you to change all available parameters.

The ***Use EPOCH*** is set to *JNow* by default as most planetarium applications use the current epoch for the coordinates. Some planetarium applications can only accept *J2000*.

! Please note that any WiFi password you set is required to be at least 8 characters long. If *Password* is set to *Password* (case sensitive) then Nexus DSC *Pro* will create an open WiFi network.

Sound

Nexus DSC *Pro* allows you to adjust the volume and enable/disable sounds.
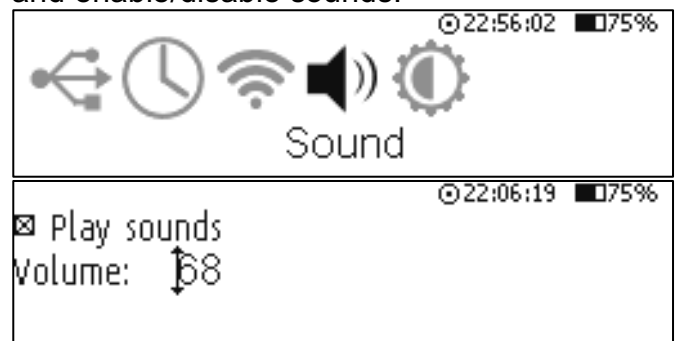
• *Play Sounds* enables/disables sounds when aligning, sending commands from a planetarium application, command completion confirmation.
• *Volume* can be used to adjust the volume of sounds played; it can be from 0 (mute) to 100 (maximum).

Display/Keypad

Nexus DSC *Pro* allows you to adjust the brightness of display and keypad backlighting. The display brightness has a range from 0 to 255 (255 is the maximum) while the back light has a range from 0 to 100 (0 will turn the back light off while 100 is the maximum level).

To adjust the levels of brightness is done through ***Display/Keypad***:

which bring up the controls:

Use ◀ and ▶ keys to switch between *Display* and *Keypad* and ▲ and ▼ keys to adjust the levels.

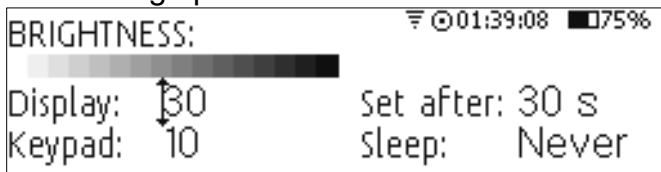*Set After* is used to set the time period after which the selected display brightness will be set. For example, if the display brightness level was left at a low level and Nexus DSC *Pro* was turned ON during daytime then it would be very difficult to see the text on the screen. The delayed setting of the display brightness will allow you to set the brightness to the desired level while operating the device.

Sleep controls when Nexus DSC *Pro* will turn the display OFF if no key has been pressed for the selected time period. Nexus DSC *Pro* is fully operational when the display is turned OFF. Pressing any key will turn the display back ON.

Once you have adjusted the brightness levels to the ones you desire press the OK key to save them.

Align

Align menu contains all functions handling the telescope alignment:

- Altitude reference alignment
- First object alignment
- Second object alignment
- Alignment status
- Mpoint start
- Mpoint parameters
- Mpoint analyse
- Equatorial platform timer

All alignment functions are accessed by selecting *Align* from the top level menu:

There are currently four methods of aligning the telescope:

- One star alignment
- Two stars alignment
- Two stars w/o Alt ref alignment
- Three stars alignment

The method used is specified in **Settings->Align**. Two stars alignment should be used in most cases. One star alignment should only be used on:

- Perfectly levelled altitude-azimuth mount
- Perfectly polar aligned German equatorial mount

The steps to align the telescope depend on the selected method:

- **One star alignment**:
  1) First Object Alignment
  2) Alignment status
- **Two stars alignment**:
  1) Altitude Reference
  2) First Object Alignment
  3) Second Object Alignment
  4) Alignment status
- **Two star w/o Alt reference alignment**:
  1) First Object Alignment
  2) Second Object Alignment
  3) Alignment status
- **Three stars alignment**:
  1) Altitude Reference
  2) First Object Alignment
  3) Second Object Alignment
  4) Third Object Alignment
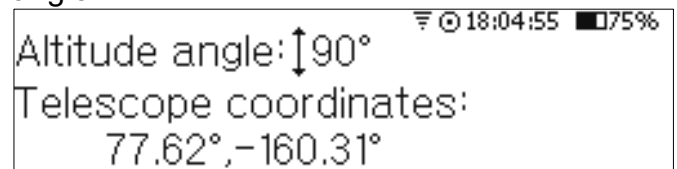 5) Alignment status

Altitude Reference

The first step of the telescope alignment is to set the initial altitude reference.

It is done by selecting **Altitude Reference** from the **Align** menu:
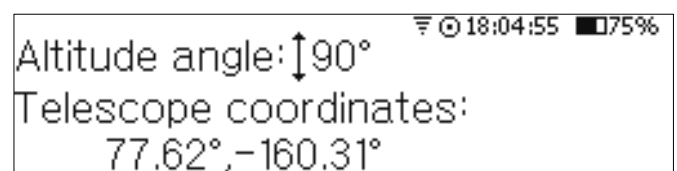

Now you can select the initial altitude reference angle:

There are three choices with the angle:

- 90°
- 0°
- Custom

Altitude angle: ↕0°
Telescope coordinates:
   77.62°,−160.31°

Altitude angle: ↕Custom +090.00
Telescope coordinates:
   77.62°,−160.31°

The custom angle can be set with a precision of 1/100 of a degree. Once *Custom* is selected you can change the integer part (from -180° to +180°) using (▲) and (▼) keys:

Altitude angle: Custom ↕+090.00
Telescope coordinates:
   77.62°,−160.31°

And then you can set the fractional part using (▲) and (▼) keys:

Altitude angle: Custom +065.50
Telescope coordinates:
   77.62°,−160.31°

First Object Alignment

You can choose first alignment object by selecting *First object alignment* from the *Align* menu:

First object alignment

Use (◄) and (►) keys to switch to the CATALOGUE tab to change the catalogue if required. Use (▲) and (▼) keys to change the selection.
Aim the telescope at the selected object using an eyepiece with a reticle or a high magnification eyepiece and once the object is in the centre press (OK) key:

ALIGN I   ●
Gacrux
CATALOGUE │OBJECT│ INFO   HELP

Nexus DSC *Pro* will automatically switch to the *Second object alignment*.

Second Object Alignment

You can choose second alignment object by selecting *Second object alignment* from the *Align* menu if Nexus DSC *Pro* did not activate it automatically – for example, if you decided that the telescope was not aimed at the second alignment object precisely.

Second object alignment

Please repeat the procedure describe above for the second alignment:

ALIGN II   ● ●
Rigil Kentaurus
CATALOGUE │OBJECT│ INFO   HELP

📎 Nexus DSC *Pro* will store your selection of alignment catalogues and objects in non-volatile memory which means that you don't need to change the selection next time you observe.

Alignment Status

The alignment status:

Alignment Status

shows whether the two stars alignment was successful (it will show the error if unsuccessful).

Alignment: Successful
Altitude offset error: 0.03

The accuracy of the alignment is shown only in case of using three stars alignment method. Three values displayed show differences between angular separations based on catalogued positions of three stars and angular separations based on the encoder positions.

Alignment: Successful
Errors: -0.02, 0.04, 0.02

Mpoint Start

Every telescope has some kind of imperfections:
• Fabrication errors

- Mechanical and optical axes not being perpendicular
- Flexure of telescope mechanical structure

Nexus DSC *Pro* can compensate for most of systematic errors.

Mpoint calculates a mathematical model of your telescope and performs pointing corrections in real time.

Using Mpoint telescope pointing correction involves:

1. Performing the initial two star alignment
2. Starting an Mpoint run of calibration objects (from 4 to 128 objects)
3. Analysing the results
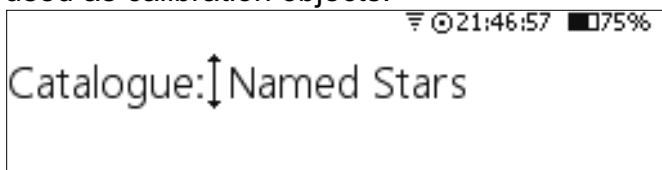4. Enabling the model to be used for pointing corrections

The first step has been described earlier. The second steps starts with selecting **Mpoint Start** from the **Align** menu:

Then you can select a catalogue of objects to be used as calibration objects:

It is always better to use either *Named Stars* catalogue or *Bright Stars* catalogue for calibration objects as it is much easier to put stars in centre of eyepiece. It is best to use an eyepiece with a reticle for the calibration run to achieve the precise pointing of the telescope at calibration objects. It is also advisable to use stars that are currently at 30° to 80° in altitude (the current altitude is displayed in square brackets at the bottom of the screen).

Once you selected a catalogue you can start the calibration run:

The screen shows you where to move the telescope to *Ankaa* in this example. Move move the telescope and put the star in the centre of your eyepiece as precise as possible:
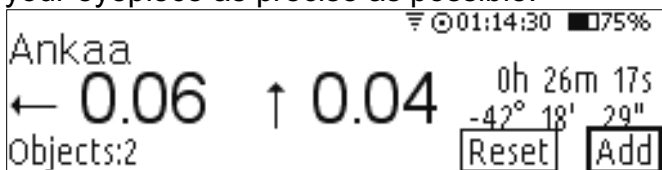
Now press the (OK) key. You will see that the counter at the bottom of the screen (after the

closing square bracket) has been incremented and becomes 3:
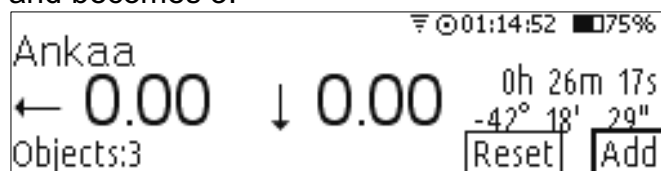
Now continue the calibration run until you collect enough calibration stars:
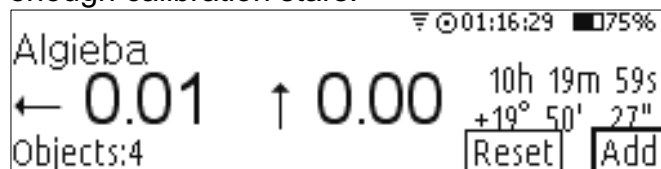
Calibration stars are automatically added to sync objects list and Nexus DSC *Pro* will apply the correction to pointing immediately and the offsets will become equal zero;

It is always good to have the calibration stars spread across the whole sky for achieving the best results.

Adding calibration stars in Find/Identify/Tour modes

It is also possible to add calibration stars in Find/Identify/Tour modes. The two star alignment needs to be performed before adding calibration stars for MPoint analysis.

For example, in *Find* mode when Acrux is shown and the telescope has it in the centre of the field of view:
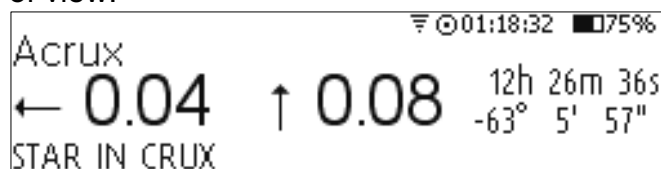
Pressing the (◀) key will display the following screen:

The current object will be added for the analysis:

The same procedure is used in Identify and Tour modes. The screen will show:

```
Alpha, α Cru
→ 0.02   ↑ 0.08    12h 26m 37s
                    -63°  5'  58"
DOUBLE STAR IN CRUX         2 OF 6
```

Pressing the (◀) key will display the following screen:

```
                    ⏳ ⊙01:19:41 ■□75%
Catalogue: Bayer Stars
Objects:Alpha, α Cru
Objects:5      Reset  ADD SYNC/MPOINT
```

Mpoint Parameters

Once you performed the calibration run on a good number of stars (>7) you can select which errors you would like to account for. There is a mathematical formula associated with each error and it is referred to as a term. You can select which terms to use for your telescope model by selecting **Mpoint Parameters** from the **Align** menu:

```
                    ⏳ ⊙01:05:28 ■□75%
 ∡²  ◎  ▶  ✓  ⊖  ✛  🕐

         Mpoint Parameters
```

Use (◀) and (▶) keys to choose a check box for a term. Use (▲) and (▼) keys to enable/disable the term.

The bottom left corner of the screen shows a page number of terms. There are currently 19 terms spread over 4 pages.

```
                    ⏳ ⊙21:49:56 ■□75%
☒RA Offset          ☒RA Scale
☒Dec Offset         ☐Dec Scale
☐Tube Square        ☒Mount Square
  Page 1 of 4                   Next
```

Activate the *Next* button and press (OK) key to go to the next page:

```
                    ⏳ ⊙21:50:03 ■□75%
☒NPAE               ☐PAxis NS
☐PAxis EW           ☐Tube Flexure
☐Fork Flexure       ☐DEC Axis Flexure
  Page 2 of 4                   Next
```
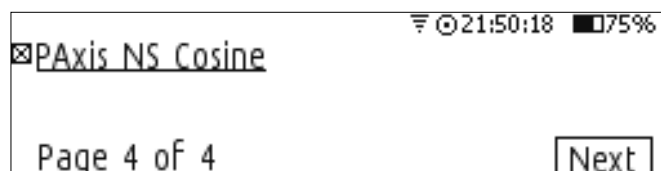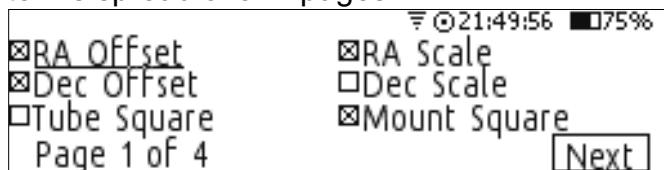
```
                    ⏳ ⊙21:50:10 ■□75%
☒RA Sine            ☒RA Cosine
☐Dec Sine           ☐Dec Cosine
☐Mount Square Sine  ☐PAxis NS Sine
  Page 3 of 4                   Next
```

```
                    ⏳ ⊙21:50:18 ■□75%
☒PAxis NS Cosine


  Page 4 of 4                   Next
```
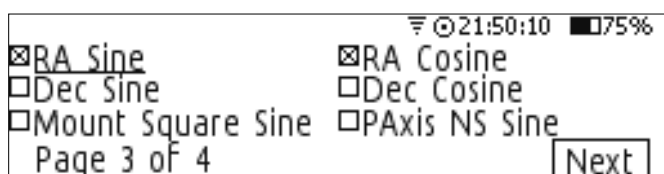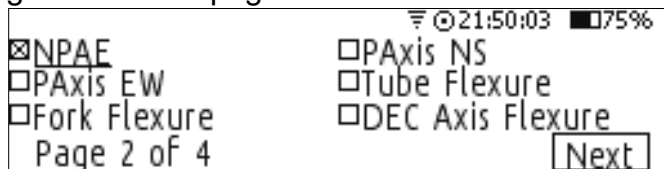
Term	Mount Type	Description
RA Offset	All	IA (AZ offset for AltAz)
RA Scale	All	Usually equal 1
Dec Offset	All	IE (Alt offset for AltAz)
Dec Scale	All	Usually equal 1
Tube Square	AltAz	or Collimation error: for Alt/Azimuth mounts it is a non perpendicularity between pointing direction and altitude axis.
Mount Square	EQ	Non-perpendicular error - in equatorial mount if the RA and Declination axes are not perpendicular.
NPAE	AltAz	non perpendicular axis error
PAxis NS	AltAz	Azimuth Axis Misalignment North-South (AN)
PAxis EW	AltAz	Azimuth Axis Misalignment East-West (AW)
Tube Flexure	AltAz	Tube Flexure (TF)
Fork Flexure	EQ	For fork mounts - the flexure in fork arms
DEC Axis Flexure	EQ	Declination Axis flexure (DAF)
RA Sine	All	AZ Sine for AltAz (HCES)
RA Cosine	All	(HCEC)
Dec Sine	All	(DCES)
Dec Cosine	All	(DCEC)
Mount Square Sine	EQ	
PAxis NS Sine	EQ	Polar Axis North-South Misalignment Sine

Term	Mount Type	Description
PAxis NS Cosine	EQ	Polar Axis North-South Misalignment Cosine

The terms above are in the order of significance.

Mpoint Edit Points

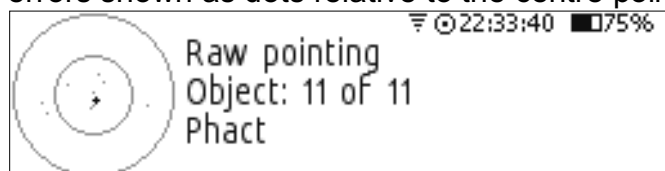Once the telescope is aligned on a number of objects you can check how they errors are distributed in relation to the average centre. To see all alignment objects' error distribution you need to select *Mpoint Edit Points*:

This screen shows a diagram that has pointing errors shown as dots relative to the centre point:

The first line on the right shows the pointing type, next line shows the current point (object) and the last line shows the object name.

You can switch between *Raw Pointing* errors (uncorrected pointing without the pointing model) and *Corrected pointing* by using (▲) and (▼) keys. To go to next/previous point use (◄) and (►) keys. To delete a point press (0) key.

Mpoint Analyse

Once you aligned your telescope on a reasonable number of calibration stars and selected terms that you want to use for your telescope's model you can analyse the results. Select *Mpoint Analyse* from the *Align* menu:

The screen will show a diagram for two modes – *Raw Pointing* (without the model) and *Corrected Pointing* (when using the model calculated). You can switch between them by using (▲) and (▼) keys:
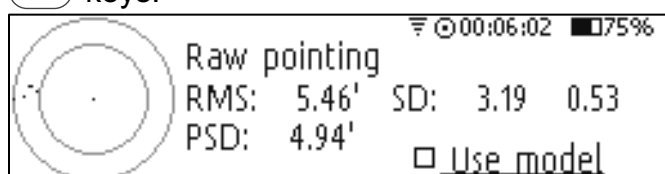
If the results are suitable then you can enable using the calculated model for telescope pointing:
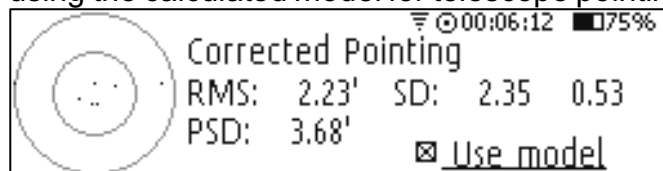
The calculated model terms can be inspected by pressing the (►) key:
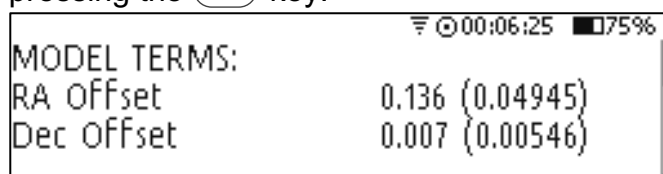
The first column shows the name of the model term, the second is the calculated value and the last columns shows the uncertainty of the term. If the uncertainty of the term is greater than the term's value then the term is most likely not required for the model. Both values are in degrees.

If you wish to adjust the model then you can:

* Add more calibration stars
* Add or delete which terms are used for the model

If you did not align on a sufficient number of calibration stars then the following error message will be displayed:
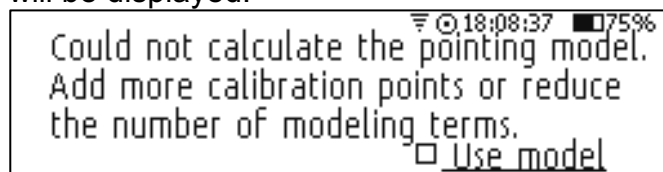
Equatorial Timer

Equatorial Timer is intended to be used when Nexus DSC *Pro* is operated with a telescope mounted on an equatorial platform.

Once you performed the two star alignment (with the platform in its starting but stopped position) you need to start the equatorial platform and the equatorial timer at the same time. You can access the timer control by selecting **EQ Platform Timer** from the **Align** menu:
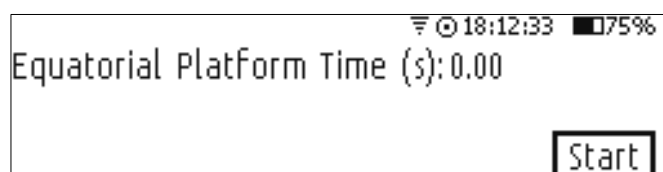
And press the (OK) key and start the equatorial table at the same time. You will see that the timer starts incrementing and the *Start* button change to *Stop*:

Equatorial Platform Time (s): 21.15
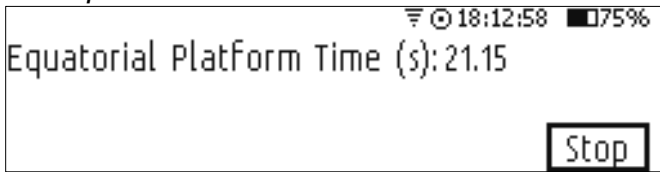
Stop

When the equatorial platform reaches its end position you can stop the timer by selecting it is necessary to stop the equatorial timer by selecting **EQ Platform Timer** from the **Align** menu, the (OK) key. The timer value is reset and the *Stop* button is changed to *Start*:

Equatorial Platform Time (s): 0.00
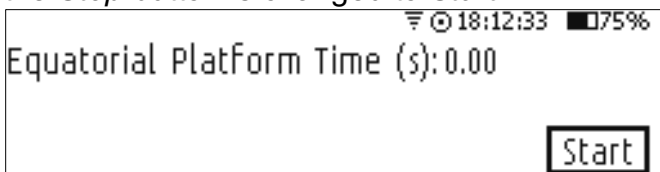
Start

After moving the platform to its starting position, you will need to start the equatorial platform timer again using the procedure described above.

Find

Nexus DSC *Pro* allows you to locate celestial objects by using one of the following modes:

- From Catalogues
- From Observation List
- Object At RA/Dec
- From Planetarium

The following sections describe each mode in detail.

Find

From Catalogues

This mode:

From Catalogues

allows you to locate objects from extensive range of catalogues.

First you need to select a catalogue:

NGC   Index: 39

CATALOGUE | FILTER   HELP   INFO
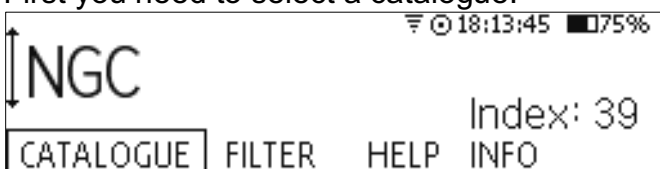
There are four tabs at the bottom of the screen – CATALOGUE, FILTER, HELP and INFO. A tab is selectable by pressing (◄) and (►) keys:

None

CATALOGUE | FILTER | HELP   INFO

All objects are displayed. Use up/down arrow keys to go to next/previous object.

CATALOGUE   FILTER | HELP | INFO

NGC
contains 8292 entries

CATALOGUE   FILTER   HELP | INFO |

Nexus DSC allows you to use different filters to limit the list of objects. The *Filter* determines a criteria for showing you a list of objects:

- *None* – all objects from selected catalogue are shown

None

CATALOGUE | FILTER | HELP   INFO

- *Constellation* – only objects from the specified constellation are shown.

Constellation
Andromeda

CATALOGUE | FILTER | HELP   INFO

- *Object Type* – only objects of the specified type are shown

Object Type
Star

CATALOGUE | FILTER | HELP   INFO
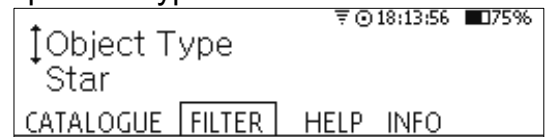
- *Magnitude* – the top of the list will be at the object of the specified magnitude

Magnitude
+12.00

CATALOGUE | FILTER | HELP   INFO
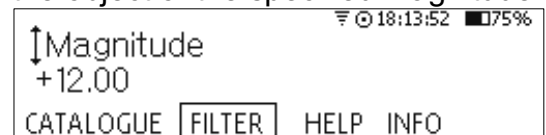
The *Index* field is for information purposes – it is the index of the currently selected catalogue. The index can be used to select a catalogue by its index instead of scrolling through the list.

Catalogue↕Named Stars
Filter: None   Index: 1

To select a catalogue by its index just start typing its index and using number keys. For example, the NGC has an index of 39. Press ③ followed by ⑨:

Catalogue: 3_
(screen: ⊚ 08:50:32 ■75%)
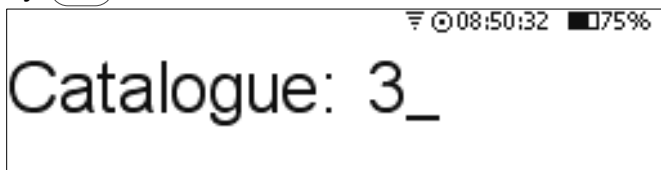
And the NGC catalogue will be selected:

Catalogue↕NGC
Filter: None   Index: 39
(screen: ⊚ 08:50:41 ■75%)
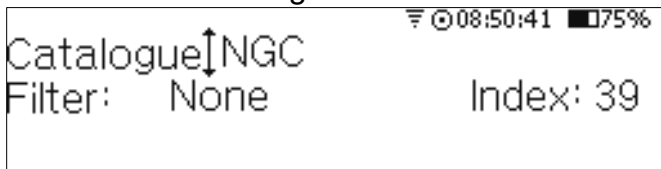
Once indices of catalogues most frequently use are memorised there may not be any need to disable catalogues that are shown on the list.

A catalogue needs to be enabled in ***Settings->Find->Catalogues*** to be selectable by its index. Nexus DSC *Pro* has a support for locating comets and asteroids. It is necessary to load orbital elements for comets and asteroids you require from http://www.minorplanetcenter.net:

- Go to http://www.minorplanetcenter.net
- Select Observers->Orbital Elements->Orbital elements for Software
- Click on MPC Format then click on a link to complete MPCORB database
- Download orbital elements for comets (Soft00Cmt.txt), NEAs (NEA.txt), PHAs (PHA.txt), TNOs, Centaurs and SDOs (Distant.txt) and Other unusual objects (Unusual.txt)
- We strongly recommend to open NEA.txt and Unusual.txt in a text editor and delete all entries that are not required; otherwise it takes a long time for Nexus DSC Pro to start up as it has to process all orbital elements it is turned on
- copy those files to the micro SD (you may copy only ones you need)
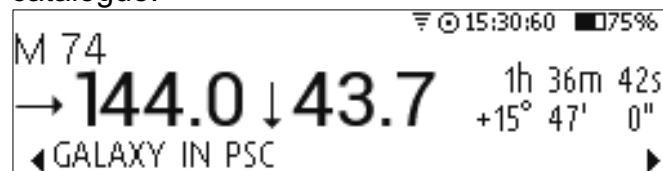- Turn Nexus DSC on and you will see additional catalogues – Asteroids - Bright, Asteroids - NEA, Asteroids - Distant, Asteroids – PHA, Asteroids - Unusual, Comets; the list of new catalogues will depend on which orbitals elements are loaded onto the micro SD card

None

Use this mode when you wish to locate any object from the specified catalogue. After selecting a catalogue just press OK key:

↕Messier
                       Index: 36
CATALOGUE | FILTER   HELP INFO
(screen: ⊚ 15:30:50 ■75%)

Now you can see the last selected object in the catalogue:

M 74
→144.0 ↓43.7   1h 36m 42s
                +15° 47'   0"
◄GALAXY IN PSC   ►
(screen: ⊚ 15:30:60 ■75%)

📎   You can go to previous/next object in the catalogue by pressing ▲ / ▼ keys.

You can now move the telescope in directions of the arrows until the numbers become 0s to point the telescope at the selected object.

Nexus DSC *Pro* allows you to show additional information on the current object. This information is accessed by pressing ◄ or ► key:

M 74: Galaxy in Pisces, also known as NGC628 size:10.5'x9.5' magnitude:9.4 SB: 14.1
◄   ►
(screen: ⊚ 15:31:17 ■75%)
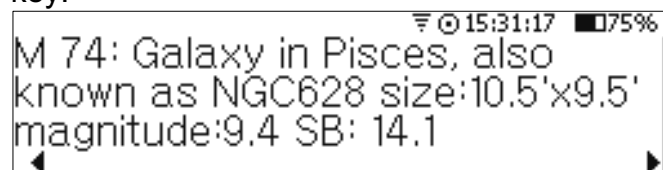
❗ Please note that you cannot go to previous/next object in the catalogue by pressing ▲ / ▼ keys while the description is shown on the screen – you need to go back to previous screen by pressing ◄ or ► key first.

If the current object's description does not fit on one screen then a scroll bar is shown on the right:

NGC 2808: Globular Cluster in Carina, also known as ESO 91 SC 001 size:13.8'x13.8'
                           ►
(screen: ⊚ 15:31:51 ■75%)
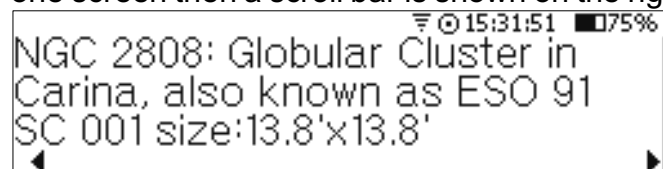
You can use ▲ and ▼ keys to scroll the description up and down:

SC 001 size:13.8'x13.8' magnitude:6.3 SB: 11.7 Globular Other info:GCL
                           ►
(screen: ⊚ 15:32:02 ■75%)
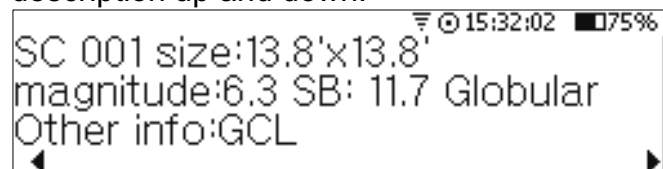
Some objects have additional information available. You will notice that the bottom right corner will display an arrow in that case:

M 33: Galaxy in Triangulum, also known as NGC598 size:71'x42' magnitude:5.7 SB: 14.1
◄   ►
(screen: ⊚ 15:32:26 ■75%)
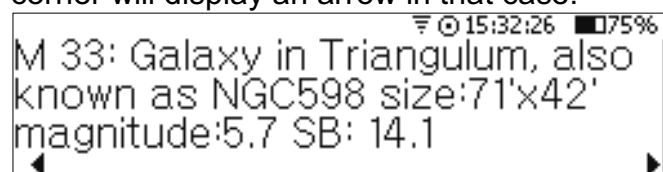
The additional information is accessed by pressing the ► key.

Currently the available additional information is an observing note from a very experienced observer (Steven Gottlieb):

S. Gottlieb's Notes: ⑦⊙15:32:29 ◼◻75%
17.5" (11/1/86): bright, very large, elongated 3:2 SSW-NNE, weakly concentrated irregular halo, rises ◀ ↻

You can use ▲ or ▼ keys to scroll the text up and down. For a faster scrolling use 4 and 6 keys that act as a page scroll. ↻ - indicates the pressing the ▶ key will return back to the object screen.

The last page shows the daily altitude of the object:

DAILY VISIBILITY ⊙22:21:40 ◼◻75%
◀12 14 16 18 20 22 0 2 4 6 8 10 ↻
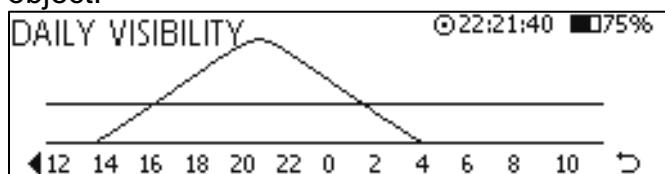
The graph above has two horizontal lines – the bottom line represents 0º altitude and the one above represents 30º altitude. The bottom of the graph shows the hourly scale in a 24 hour format.

To go to an object quickly and easy you can start typing the object's number. For example, if you wish to go to NGC55 then after you pressed 5 key the display will prompt to continue typing the object number:

Specify the object: ⑦⊙15:32:46 ◼◻75%
NGC 5_

Now press the 5 key again and then press OK :

Specify the object: ⑦⊙15:32:56 ◼◻75%
NGC 55_

Nexus DSC *Pro* will now show where to move the telescope to aim at NGC55:

NGC 55 ⑦⊙15:33:03 ◼◻75%
→87.6 ↓28.0 0h 15m 8s -39° 13' 14"
◀GALAXY IN SCL ▶

Some catalogues require a bit more complex input. For example, if you wish to locate

WDS01362-5732 then you need to press 0 key first:

Specify the object: ⑦⊙15:33:22 ◼◻75%
WDS 0_ +

then continue typing 1362 until you get to the sign:

Specify the object: ⑦⊙15:33:34 ◼◻75%
WDS 01362⇕+

Then you need to change the sign by pressing ▲ or ▼ key:

Specify the object: ⑦⊙15:33:36 ◼◻75%
WDS 01362⇕

After changing the sign press the ▶ key and finish typing the rest – 5731 and Nexus DSC *Pro* will automatically switch back to the previous screen showing where to move the telescope to find WDS01362-5731:

WDS 01362-5731 ⑦⊙15:33:57 ◼◻75%
→77.8 ↓7.6 1h 36m 11s -57° 31' 6"
◀DOUBLE STAR IN ERI ▶

Another example is the GCVS catalogue. To specify *alf And* press any numeric key and that will bring up the following:

Specify the object: ⑦⊙15:34:45 ◼◻75%
⇕α alf A Andromeda

Press the ▶ key and then ▲ or ▼ key until no letter is displayed:

Specify the object: ⑦⊙21:18:09 ◼◻75%
α alf ⇕ Andromeda

Specify the object: ⑦⊙21:18:19 ◼◻75%
α alf ⇕Andromeda

```
alf And                        ⓦ☉15:36:14  ▮75%
→145.3↓69.0      0h 8m 23s
                              +29°  5'  26"
◀OUTSIDE ALTITUDE LIMITS              ▶
```

Now suppose you need to select **R And** – just scroll the first field to letter **R**:

```
                              ⓦ☉15:36:44  ▮75%
Specify the object:
R               Andromeda
```

```
R And                          ⓦ☉15:36:53  ▮75%
→157.3↓69.6      0h 24m 2s
                              +38° 34'  37"
◀VARIABLE STAR IN AND                ▶
```

If you need to select **VX And** – scroll the second field until the letter **X** is displayed:

```
                              ⓦ☉21:20:41  ▮75%
Specify the object:
V       X           Andromeda
```

```
VX And                         ⓦ☉15:37:40  ▮75%
→164.2↓72.2      0h 19m 54s
                              +44° 42'  34"
◀VARIABLE STAR IN AND                ▶
```

If **V443 And** is desired then type 443 in the third field:

```
                              ⓦ☉15:38:16  ▮75%
Specify the object:
V        443_ Andromeda
```

```
V0443 And                      ⓦ☉15:38:31  ▮75%
→165.5↓63.1      1h 10m 42s
                              +42° 55'  55"
◀VARIABLE STAR IN AND                ▶
```

Now if you need to go back to **VX And** the second field needs to be set back to the letter **X**:

```
                              ⓦ☉22:07:22  ▮75%
Specify the object:
V        X443  Andromeda
```

Now the third field needs to be cleared:

```
                              ⓦ☉22:07:27  ▮75%
Specify the object:
V        X443  Andromeda
```

Now press the (0) key:

```
                              ⓦ☉22:07:33  ▮75%
Specify the object:
V        X0_     Andromeda
```

Then press (◀) key to clear the field, then (OK) key:

```
                              ⓦ☉22:07:44  ▮75%
Specify the object:
V        X         Andromeda
```

```
VX And                         ⓦ☉15:39:45  ▮75%
→164.0↓72.6      0h 19m 54s
                              +44° 42'  34"
◀VARIABLE STAR IN AND                ▶
```

A similar approach applies to some other catalogues like ESO, Herschel and others.

! Please note that this quick access to objects is only available when the **Filter** is set to *Disable.*

The last selection of the catalogue and object will be save in non-volatile memory.

Constellation
This mode is used when you need to find objects from a catalogue that are situated in one constellation.

You can select a constellation once **Filter** is set to *Constellation*:

```
                              ⓦ☉15:40:32  ▮75%
  Constellation
 ↕Carina
CATALOGUE │FILTER│  HELP  INFO
```

Pressing (OK) key now will take you to the first object in the selected constellation:

```
NGC 2191                       ⓦ☉15:40:42  ▮75%
→75.4 ↑29.2      6h  8m 24s
                              -52° 30'  44"
◀GALAXY IN CAR                       ▶
```

Pressing ▲ / ▼ key will switch the screen to next/previous object in the constellation.

Object Type

This mode is used when only objects of a certain type need to be shown.

You can select an object type once **Filter** is set to *Object Type*:

Pressing OK key now will take you to the first object of the selected type:

Pressing ▲ / ▼ key will switch the screen to next/previous object of the selected object type.
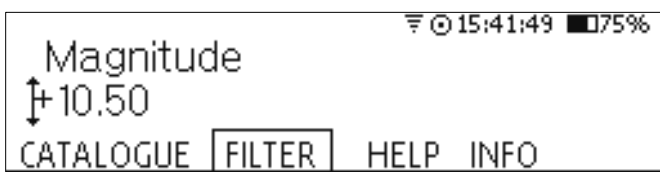
Magnitude

You can use this mode when you need to show objects whose magnitude is brighter than a certain value.

You can set the maximum magnitude once **Filter** is set to *Magnitude*:

Pressing ▲ / ▼ key increase/decrease the magnitude limit.

Pressing OK key now will take you to the first object whose magnitude is equal or lower than the specified magnitude:

Pressing ▲ key will go to the object whose magnitude values is greater or equal the specified magnitude while pressing ▼ key will switch to object whose magnitude value is lower than the specified magnitude.

From Observation List

Nexus DSC *Pro* supports observation lists in SkySafari's format. Most popular observation planning applications support export of observation lists in SkySafari's format (Astro Planner, Deep Sky Planner and SkyTools). SkySafari can also be used to create observation lists. Please refer to the user manual of your favourite application on instructions on how to export an observation list. An observation list will have the *.skylist* file extension. The exported observation list needs to be copied to the root folder of the micro SD card. Once the observation list is copied to the micro SD card Nexus DSC *Pro* will be able to guide you to an object from the list.

To find an object from an observation list is achieved by selecting **Find->From ObservationList**:

Nexus DSC *Pro* will show the currently selected observation list and the number of objects on the list:
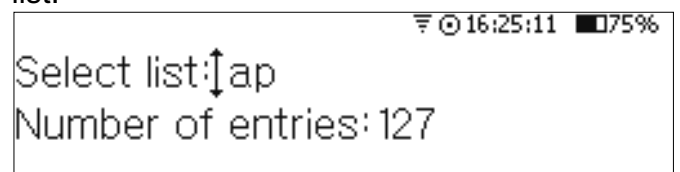
Pressing ▲ / ▼ key will select a different list:

Pressing OK key now will select the first object from the list:

Pressing ▲ / ▼ key will select next/previous object from the list:

```
HD 68273                    ⏻ ⊙15:56:38  ▮▯75%
                                  8h  9m 35s
→32.3 ↑40.7                    -47° 20'  43"
◄STAR IN VEL                            5(184) ►
```

! Please note that Nexus DSC *Pro* will only be able to shown an object from the observation list if it exists in one of the Nexus DSC *Pro*'s databases.

Object at RA/Dec

Nexus DSC *Pro* allows you to find an object whose coordinates are specified manually.

This mode can be used if you need to find an object that is not included in any of the Nexus DSC *Pro*'s databases. You need to specify the coordinate of an object in J2000 epoch or in JNOW.

This mode is activated by selecting *Object at RA/Dec*:


```
                            ⏻ ⊙01:06:56  ▮▯75%
   📁   🗏   (RA DEC)  RA,DEC   🖥
                       ALT,AZ   ⬇
       Object at RA/Dec
```

Now you need to specify the coordinate:


```
                            ⏻ ⊙22:00:27  ▮▯75%
Specify coordinate (J2000):

RA:_ h   m   s DEC:+    °    '    "
```

The epoch can be changed by pressing the pressing (◄) key and then by pressing (▲) / (▼) key:


```
                            ⏻ ⊙01:13:32  ▮▯75%
Specify coordinate ↕(JNOW):

RA:12 h0  m12 s DEC:−24°24'12 "
```
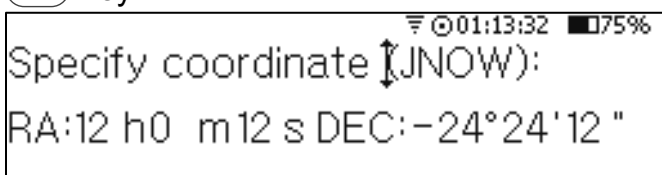
You can change the sign for the declination by using (▲) and (▼) keys:
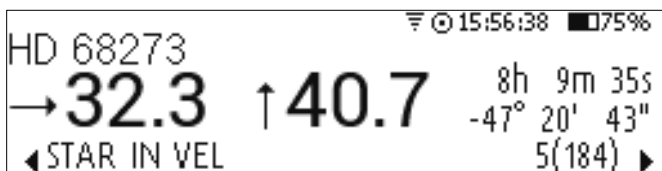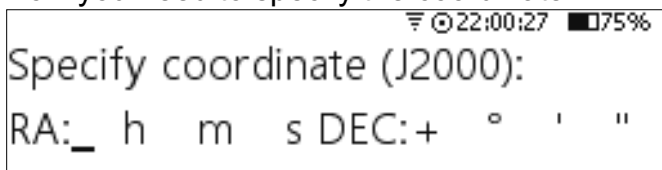


```
                            ⏻ ⊙22:02:13  ▮▯75%
Specify coordinate (J2000):

RA:0  h24m6  s DEC:↕    °    '    "
```
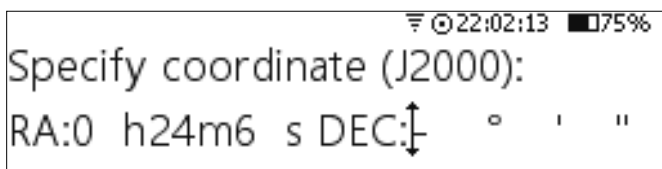
After the coordinate has been specified Nexus DSC *Pro* will show where to move the telescope to point at the object:


```
Corvus                      ⏻ ⊙15:59:47  ▮▯75%
                                 12h  0m 12s
→0.037↑0.041                  -24° 24'  12"
12h 0m19s −24°21'33"
```

Nexus DSC *Pro* shows the current telescope position at the bottom of the screen and on the right is the coordinate of the object transformed to the current epoch. The top left corner shows the constellation where the telescope is currently pointing.

Telescope Position

Nexus DSC *Pro* allows you to show the current telescope position by selecting this mode:


```
                            ⏻ ⊙01:07:02  ▮▯75%
   📁   🗏   (RA DEC)  RA,DEC   🖥
                       ALT,AZ   ⬇
       Telescope Position
```

The top line on the display shows the current right ascension and declination of the telescope in and the bottom line shows the current altitude and azimuth of the telescope :


```
Carina                      ⏻ ⊙01:07:14  ▮▯75%
  6h 32m 21s  -52° 42'30"
+53°00'23"  +134° 21'47"
```
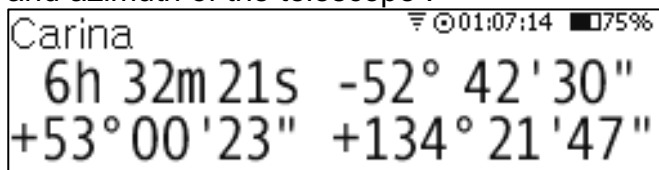
From Planetarium

Nexus DSC *Pro* allows you to connect to a planetarium software using either via the serial port or via optional WiFi interface.

A GOTO (even though Nexus DSC *Pro* is a 'Push-To' system when used without motor controllers) command can be executed from the planetarium software and Nexus DSC *Pro* will show where to move the telescope to point at the object.

This mode is entered by selecting *From Planetarium* from the *Find* menu:


```
                            ⏻ ⊙01:07:36  ▮▯75%
   🗏   (RA DEC)  RA,DEC   🖥
                  ALT,AZ   ⬇
       From Planetarium
```

Nexus DSC *Pro* shows the current telescope position at the bottom of the screen and on the right is the coordinate of the object that was received from the planetarium software. The top left corner shows the constellation where the telescope is currently pointing.

Please note that in any of the *Find* modes one can press the (OK) key to bring up a telescope control panel (only after performing the star alignment). This is only applicable when Nexus DSC *Pro* is used with a motor controller (ServoCAT, SiTech, SkyTracker, ScopeDog and AZ-EQ5/6):
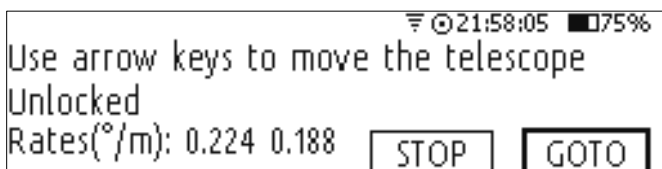
The screen above shows the current drive rates and the state of *AstroLock*. If *AstroLock* is engaged then the following will be shown:
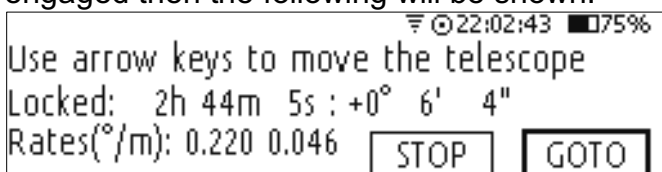

One can slew the telescope around and issue a GoTo/Stop command by using the arrow keys to slew the telescope and by selecting *Stop* or *GOTO* buttons on the screen and pressing the (OK) key. If the *GOTO* button is selected then pressing the (OK) key will switch the screen back to the object.

The *Locked* field show the coordinate Nexus DSC *Pro* is currently locked on (in JNow).

! Please note that pressing any of the arrow keys disengages AstroLock. Pressing any arrow keys on SiTech's handpad also disengages AstroLock.

! In order to be able to use the telescope control with **ServoCAT** the following is required:

- For Gen 3 – USB PC port on ServoCAT needs to be connected to the USB port on Nexus DSC *Pro*
- For Gen 1/2 – the PC port on ServoCAT needs to be connected to the USB port on Nexus DSC *Pro*
- Additionally the ServoCAT needs the latest firmware to be able to use the arrow keys to move the telescope

In order to be able to use the telescope control with **SkyTracker** the following is required:

- The AUX2 port on SkyTracker needs to be connected to the USB port on Nexus DSC *Pro*

Identify

Nexus DSC *Pro* can identify celestial objects in the sky. This mode is activated by selecting *Identify* from the top menu:

In the *Identify* mode you can select catalogues of objects where Nexus DSC *Pro* will try to find an object that is most close to the current telescope coordinate. Object type, limiting magnitude and search radius can also be specified.
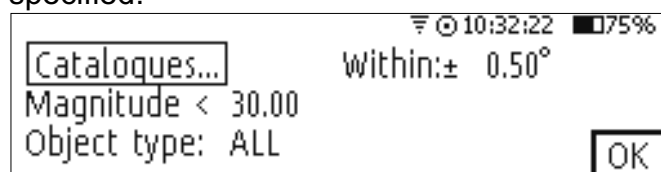
You can select catalogues by pressing the (◄) key until the 'Catalogues…' is highlighted and then pressing the (OK) key:
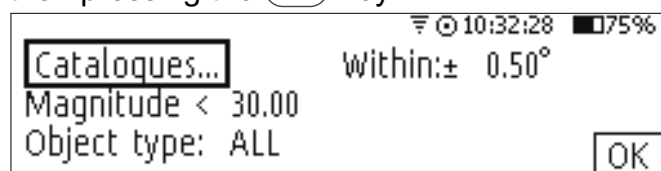
A list of catalogues included in the search will be shown:

Numeric keys (4) and (6) can be used to flip pages (previous page and next page).

Catalogues with the check mark are used to perform the search.

Nexus DSC *Pro* will generate a list of all objects of selected type in the vicinity of the current telescope coordinate. The list can contain up to 256 entries and it is sorted based on a distance to the current telescope coordinate:

You can switch between objects from the list by using ▲ and ▼ keys:

NGC 121
→ **0.62** ↓ **0.22**   0h 26m 48s
                         -71° 32'   8"
◄ GLOBULAR IN TUC   7 OF 16   ►

Setting the 'Magnitude' field to 30 disables limiting magnitude and all objects will be added to the list irrespective of their magnitude.

📎 You can also use the ***Identify*** function of Nexus DSC *Pro* when you wish to find other objects nearby.

Nexus DSC *Pro* will show the following message when it cannot find any objects within the specified parameters:

No object found at the current position.

                                      OK
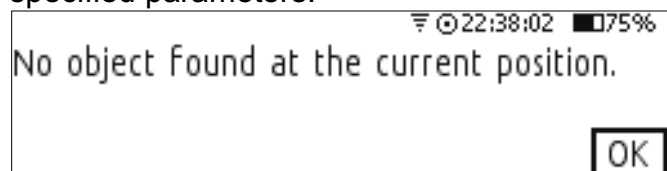
❗ It usually takes a short moment for Nexus DSC *Pro* to generate the list. Please note however that for big catalogues (like PGC with more than 1.5 million entries) the search may take a considerable amount of time and that depends on the number of objects in the vicinity of the current telescope coordinate and also on the value of the search radius.
It is best not to have asteroids and comets enabled for Identify/Tour mode if they are not required as Nexus DSC *Pro* will need to calculate the current coordinates for them every time Identify/Tour is selected and it can take a while.

Tour

The tour mode is selecting by choosing:

Tour

Nexus DSC *Pro* has two *Tour* modes – *Within range* and *Within Constellation*:

Within range

The tour mode *Within Range* allows you to find objects within specified search radius specified (from the current telescope position):

Catalogues... In Carina
Magnitude < 30.00   ☐ Use Altitude limits
Object type: ALL

Press the OK key and the following screen will be shown:

Searching...

Searching may take a while if large catalogues are selected in the tour. Once finished the object screen will appear. The bottom right of the screen shows the number of objects found (up to a maximum of 256) and the currently selected object.

ACO 4066
← **0.91** ↓ **2.1**   23h 58m 54s
                        -71° 30' 18"
◄ GALAXY IN TUC   1 OF 256   ►

Pressing ▲ / ▼ key will select next/previous object from the list.
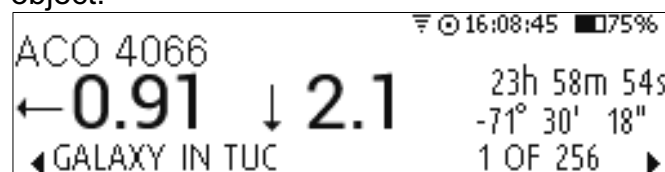
Within constellation
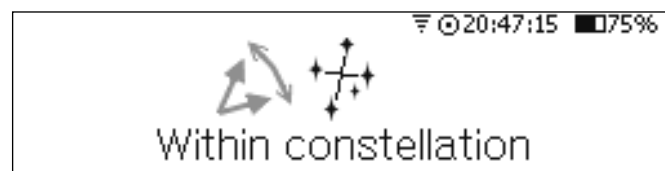
The *Within Constellation* mode allows one to search for objects within the selected constellation:

Catalogues... In Carina
Magnitude < 30.00   ☐ Use Altitude limits
Object type: ALL

For example, if touring Carina and only galaxies are selected without then Nexus DSC *Pro* will show:

ACO 3385
→ **43.0** ↓ **16.7**   6h 17m 44s
                         -52° 1' 15"
◄ GALAXY IN CAR   1 OF 256   ►
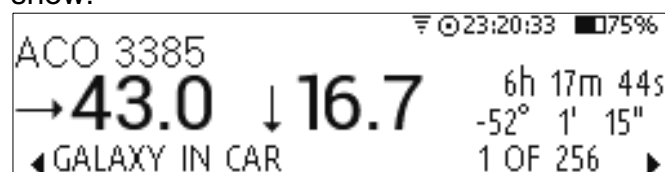
Setting the *Object type* to *Open Cluster* will generate a smaller list:

C 91
← 53.1 ↑ 27.8
OPEN CLUSTER IN CAR
11h 6m 24s
-58° 40' 0"
1 OF 143
16:14:25 75%

! Please note that some objects will have duplicate entries if they exist in several catalogues selected.

Setting the 'Magnitude' field to 30 disables limiting magnitude and all objects will be added to the list irrespective of their magnitude.

Test

Nexus DSC *Pro* has a test mode that will help you to diagnose a possible problem.

Select *Test* from the main menu:
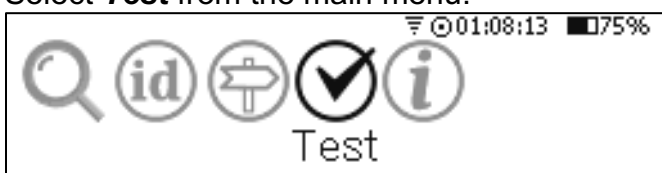
Test

Encoders

This mode allows you to test the connection with encoders and also to make sure that the encoder steps are set correctly.

Select *Encoders*:

Encoders

It will show you the current encoder steps and angles:

RA/AZ:
+4.68°
+130
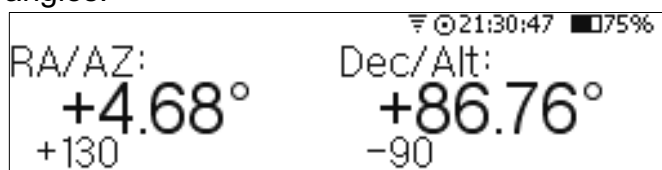
Dec/Alt:
+86.76°
-90

In order for Nexus DSC *Pro* to function correctly it is required to adjust the encoder steps to make sure that:

- the RA/AZ current position in degrees is increasing when rotating the telescope clockwise around RA/AZ axis
- the Dec/Alt current position in degrees is increasing when moving the telescope up in declination/altitude

If either of those values is not increasing then change the sign in front of the encoder steps to a negative sign if required as described previously.

If Nexus DSC *Pro* is used together with SiTech servo controller then two additional values are displayed on the screen – motor encoder tics at the bottom of the screen:

RA/AZ:
+0.00°
+0   +0

Dec/Alt:
+90.00°
+0   +0
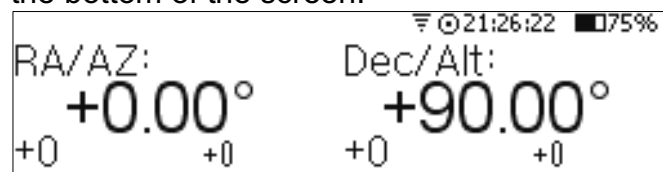
📎 This is only applicable when using Nexus DSC *Pro* with a SiTech servo controller.

Motor encoder tics can be used to verify the current configuration of SiTech by performing a 45º turn (or 90º/180º) turn and checking the change in motor encoder tics compared to angles from the telescope encoders. Once the number of motor encoder tics per 360º is determined that can be used to configure the servo controller.

Telescope encoders have to be connected to the telescope encoders port of SiTech servo controller.

The following information applies only to German equatorial mounts:

Northern hemisphere:
a) Position the telescope on top and pointing roughly at the celestial pole (Polaris)
b) Go to *Test->Encoders*
c) Move the telescope in RA only towards the west - if the RA /AZ value on the screen is increasing then the encoder steps' sign for the RA encoder is correct; if not then take a note of that
d) Now move the telescope in declination only towards the west - the Dec/Alt value should be increasing - take a note if it is not (assuming the first alignment star will be east of the meridian)
e) if the encoder value during c) or d) was not changing as described then go to **Settings->Telescope->Adjust** and change the sign in front of the corresponding encoder steps to opposite
f) if the first alignment star is in the west then the logic for the step d) is opposite (i.e. the value should be decreasing)

Southern hemisphere:
a) Position the telescope on top and pointing roughly at the celestial pole
b) Go to *Test->Encoders*
c) Move the telescope in RA only towards the east - if the RA /AZ value on the screen is

increasing then the encoder steps' sign for the RA encoder is correct; if not then take a note of that

d) Now move the telescope in declination only towards the west - the Dec/Alt value should be increasing - take a note if it is not (assuming the first alignment star will be east of the meridian)

e) if the encoder value during c) or d) was not changing as described then go to **Settings->Telescope->Adjust** and change the sign in front of the corresponding encoder steps to opposite

f) if the first alignment star is in the west then the logic for the step d) is opposite (i.e. the value should be decreasing)

WiFi

This mode helps identify problems with WiFi connectivity. Select **WiFi**:

It will show you the IP address of your Nexus DSC *Pro*, number of bytes received and number of bytes sent:

If some of the WiFi settings are incorrect then the IP address will be 0.0.0.0. This mode is also used to determine the IP address assigned by your WiFi network router when Nexus DSC *Pro* is set to *Infrastructure* mode.

USB

The USB test mode shows if there is a compatible serial USB adapter is connected to Nexus DSC *Pro*.

It shows you the type of the adapter connected (FTDI, CP210x or PL2303), number of bytes received and number of bytes sent:
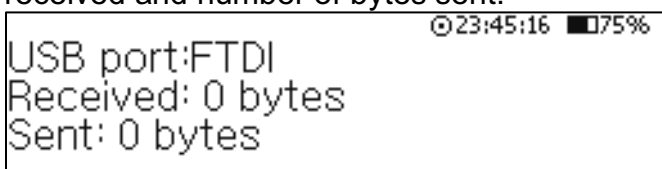
Serial

The Serial test mode will help you to determine if communications between a serial device connected to Nexus DSC *Pro* (ScopeDog, ServoCAT, SiTech or SkyTracker motor controller) are working.

It shows you the type of the communication protocol selected, number of bytes received and number of bytes sent:

Display

The Display test mode is designed to check if all pixels on the screen are working:

You can press the (OK) key to cycle through various test patterns:

Info

Nexus DSC *Pro* displays various information to the user. It can be accessed by selecting **Info** from the main menu screen:

About Nexus DSC *Pro*

This screen is activated by selecting **About Nexus DSC Pro**:

Once selected the display will present Nexus DSC *Pro*'s serial number, firmware version and firmware date (Year.month.day):

```
                              ⏱22:10:34  ■□75%
Serial Number:      001500
Firmware Version:   1.0.0a
Firmware Date:      2021.02.07
```
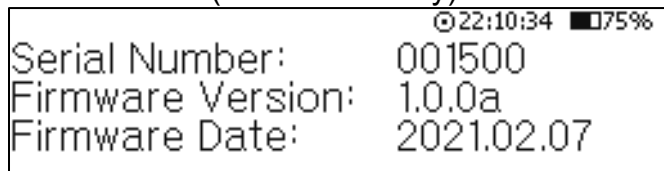
Time

Nexus DSC *Pro* can show local time, UTC and sidereal time. This is activated by selecting *Time*:

```
                        ⏱01:09:31  ■□75%
    (i)  (🕐)  (🔋)  (🌡)  (📡)
              Time
```

which presents:

```
                        ⏱23:25:54  ■□75%
 LOCAL: 23:25:54
UTC: 13:25:54  SIDEREAL:15:29:48
```
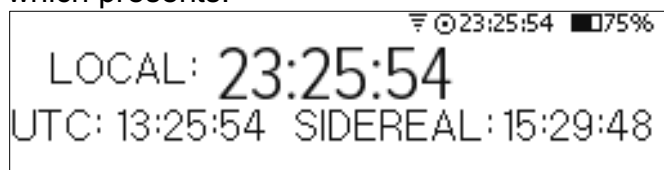
For the local time to be correct the *time zone* and *daylight savings* must be set correctly in *Time and Date* settings.

Battery

Nexus DSC *Pro* has a built-in battery fuel gauge that stays active even when Nexus DSC *Pro* is turned off.

Main parameters of the state of the battery can be accessed through the *Battery* menu:

```
                        ⏱01:09:34  ■□75%
    (i)  (🕐)  (🔋)  (🌡)  (📡)
             Battery
```

Once selected Nexus DSC *Pro* displays *state of charge* (*State of* charge, percentage of charge – 100% - fully charged, 0% - fully discharged), *remaining capacity* (*Capacity*, in mAh), current *battery voltage* (*Voltage*, nominal battery voltage is 3.7V), *current temperature* inside Nexus DSC *Pro* (*Temperature*, in degrees Celsius), *draw current* (*Current*, in mA, negative when the battery is discharging and positive when the battery is being charged from external power source) and *elapsed time since power up*(*t* , in seconds):

```
                              ⏱23:03:04  ■□75%
State of charge:75%   Capacity:3750 mAh
Voltage : 3.8V        Temperature:24.5C
Current :-115 mA      t:133.80
```
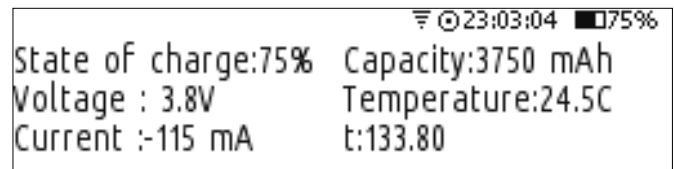
📎 Please note that the remaining capacity may be lower or higher than nominated 5000 mAh for the battery. It may take a few full charge/discharge cycles for Nexus DSC *Pro* to adjust the value.

Environment

Nexus DSC *Pro* has a built-in environmental sensor that measures barometric pressure, relative humidity and ambient temperature.

```
                        ⏱01:09:37  ■□75%
    (i)  (🕐)  (🔋)  (🌡)  (📡)
  Pressure/Humidity/Temperature
```

Once selected Nexus DSC *Pro* displays barometric pressure, relative humidity and ambient temperature:

```
                         ⏱00:42:16  ■□75%
Barometric pressure: 1007hPA/755.6mmHg
Relative humidity   :  55.7%
Temperature         :  23.4°C/74.1°F
```

GPS
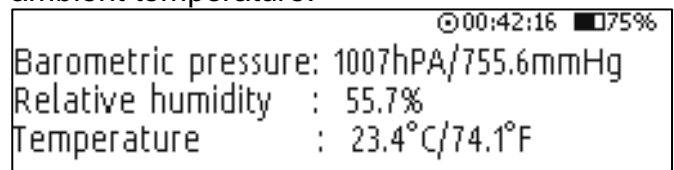
```
                        ⏱01:09:45  ■□75%
    (🕐)  (🔋)  (🌡)  (📡)
              GPS
```
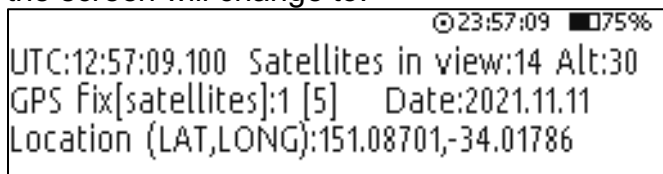
This is the additional information that might be useful in determining if the GPS receiver has acquired a GPS fix and the time and date.
Upon a power-up Nexus DSC *Pro* will show:

```
                              ⏱22:30:45  ■□75%
UTC:11:30:45           Satellites in view:0
GPS fix[satellites]:0 [0]    Date:?
Location old (LAT,LONG):-34.01777,151.08681
```
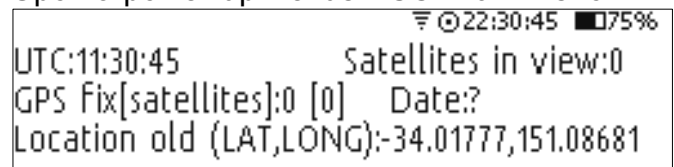
Question mark next to *Date* indicates that the GPS receiver has not yet received the date information yet. *Location old* indicates that the location is the location Nexus DSC *Pro* acquired last time it was used.

Once the GPS receiver acquires a fix and a date the screen will change to:

```
                              ⊙23:57:09  ▮75%
UTC:12:57:09.100 Satellites in view:14 Alt:30
GPS fix[satellites]:1 [5]    Date:2021.11.11
Location (LAT,LONG):151.08701,-34.01786
```

Satellites in view is the number of satellites the GPS receiver currently receives a signal from. *GPS fix* shows the type of a GPS fix the receiver acquired (1- 2D fix, 2-3D fix) and the number of satellites used to determine the fix. The location also does not have *old* and *Date* also has a valid date displayed next to it (in YYYY.MM.DD format).

! Please do not power down Nexus DSC *Pro* while in this mode otherwise you may loose some settings that are stored in non-volatile memory. It is because Nexus DSC *Pro* is constantly updating the time, date and location while in this mode.

📎 Please note that the GPS fix is not required before performing the star alignment. The location, date and time are used to calculate the position of objects in Solar system, determine if an object is above the horizon, rise and set times of objects. However the location, date and time are not used for the two star alignment and calculations of the telescope pointing coordinates.

Settings for Motorised Telescopes

This section describes how to setup Nexus DSC *Pro* with various telescopes that are motorised.

AZ-EQ5 & AZ-EQ6

Please note that Nexus DSC *Pro* is capable of controlling AZ-EQ5 and AZ-EQ6 mounts but the testing has been done only in Alt-Azimuth mode. Nexus DSC *Pro* replaces the SynScan hand controller and connect directly to the mount using a special USB cable.

Settings

Please go to **Settings->Communications->USB** and set the parameters as follows:

```
                              ⊙23:28:24  ▮75%
Communication Protocol:↕EQ Direct
Baudrate:  9600   Stop bits: 1
Data bits: 8      Parity:   None
```

Now go to **Settings->Telescope->Adjust** and set the encoder steps according to the model of the mount.

AZ-EQ5:!!!!!!

```
                              ⊙20:55:47  ▮75%
MOUNT TYPE:↕ALT-AZ
AZ ENC. STEPS: −5184000 DEFAULT ARROW
Alt ENC. STEPS: +5184000 DEFAULT ARROW
```
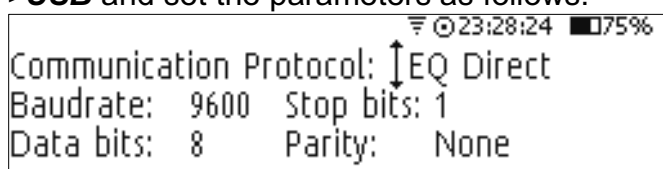
AZ-EQ6:!!!!!!

```
                              ⊙20:54:34  ▮75%
MOUNT TYPE:↕ALT-AZ
AZ ENC. STEPS: −9216000 DEFAULT ARROW
Alt ENC. STEPS: +9216000 DEFAULT ARROW
```
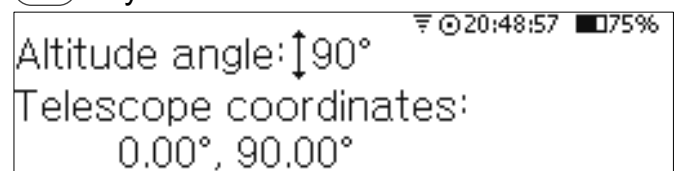
📎 Please note that the sign in front of Altitude encoder steps depends on the location of the OTA. We recommend performing encoder test to verify that the signs are correct.

Alignment

The two stars alignment is almost the same as with a non-motorised telescope. We recommend using the semi-automatic twos star alignment as described below.

Position the telescope pointing North as precisely as possible.

Start with the altitude reference alignment by going to **Align->Altitude Reference** – position the telescope vertically (or horizontally depending on the selected angle) and press the (OK) key:
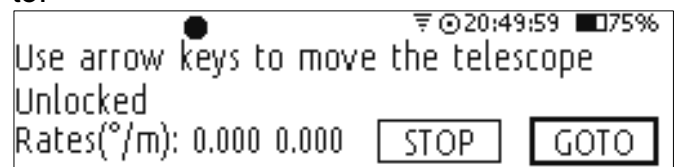
```
                              ⊙20:48:57  ▮75%
Altitude angle:↕90°
Telescope coordinates:
       0.00°, 90.00°
```

Then select the first alignment star:

```
ALIGN I      ●               ⊙20:50:05  ▮75%
↕Gacrux
CATALOGUE │ OBJECT │ INFO  HELP
```

Now press the (0) key. The screen will change to:

```
             ●               ⊙20:49:59  ▮75%
Use arrow keys to move the telescope
Unlocked
Rates(°/m): 0.000 0.000   │ STOP │   │ GOTO │
```

Press the (OK) key to slew the telescope to the alignment star. If the telescope is not pointing precisely at the star after the slew press (0) key again and use (▲) / (▼) / (◀) / (▶) keys to position the telescope pointing precisely at the star and press the (OK) key.

Repeat the same procedure for the second star:

Sabik

CATALOGUE OBJECT INFO HELP

Nexus DSC *Pro* will report the status of the alignment:

⊙01:00:38 ▬75%

Alignment: Successful
Altitude offset error: 0.03
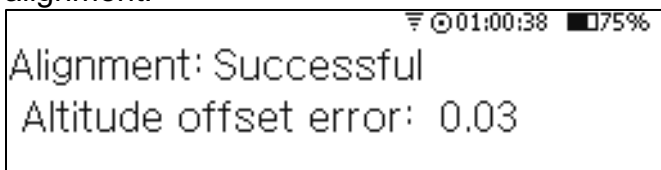
After that the telescope will start tracking and performing GOTO commands.

ScopeDog

Nexus DSC *Pro* needs to be configured for operating with ScopeDog. Please go to **Settings->Communications->Serial** and set the parameters as follows:

⊙23:29:28 ▬75%

Communication Protocol: ↕Scope Dog
Baudrate: 19200 Stop bits: 1
Data bits: 8   Parity: None

ServoCAT

Nexus DSC *Pro* is configured for operating with ServoCAT by default. However, if any of the communication settings have been changed it is advised to compare them with what is described here.

Please go to **Settings->Communications->Serial** and set the parameters as follows:

⊙01:36:04 ▬75%

Communication Protocol: ↕ServoCAT
Baudrate: 19200 Stop bits: 1
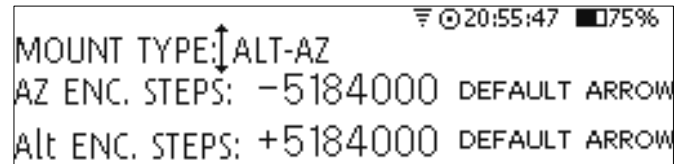Data bits: 8   Parity: None

Then go to **Settings->Communications->USB** and set the parameters as follows:

⊙01:36:23 ▬75%

Communication Protocol: ↕ServoCAT
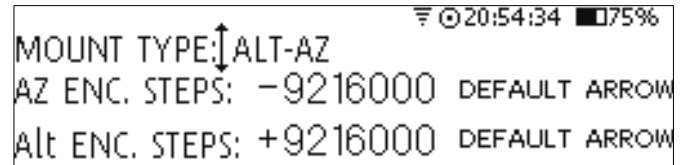Baudrate: 9600 Stop bits: 1
Data bits: 8   Parity: None
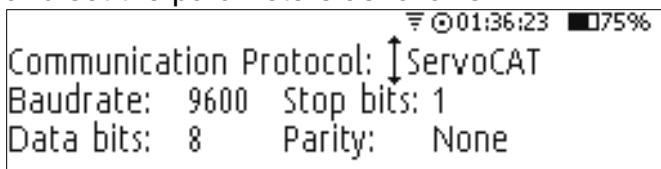
SiTech

Nexus DSC *Pro* needs to be configured for operating with SiTech servo controllers.

Nexus DSC *Pro* supports SITech servo controller only with the telescope encoders installed. The encoder steps need to be set to the actual encoder resolution. SiTech's configuration must have Argo Navis and SkyCommander disabled.

Please go to *Settings->Communications->Serial* and set the parameters as follows:
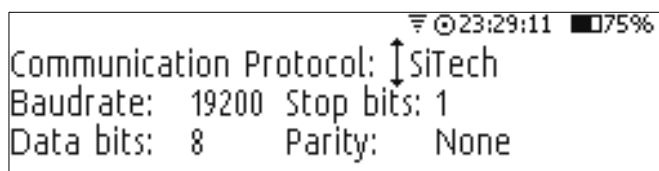
⊙23:29:11 ▬75%

Communication Protocol: ↕SiTech
Baudrate: 19200 Stop bits: 1
Data bits: 8   Parity: None

Then go to *Settings->Communications->USB* and set the parameters as follows:

⊙23:27:25 ▬75%

Communication Protocol: ↕SkyCommander
Baudrate: 9600 Stop bits: 1
Data bits: 8   Parity: None

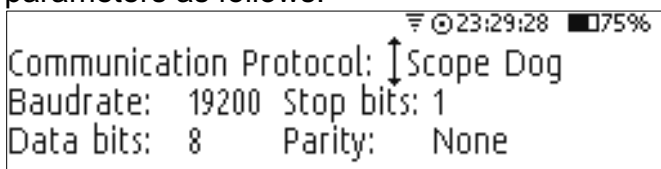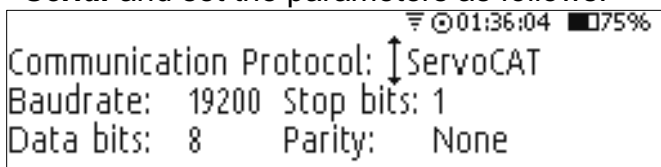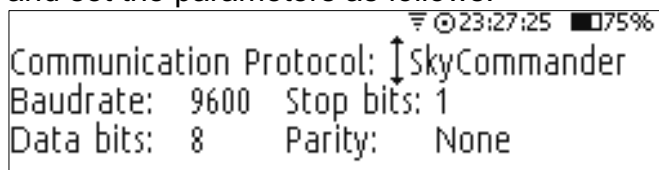Nexus DSC *Pro* is connected to a SiTech servo controller using a serial cable (SERIAL port on Nexus DSC *Pro* to RS232 port on SiTech).

📎 Please note that it is best to turn on Nexus DSC *Pro* first and then SiTech.

SkyTracker

Nexus DSC *Pro* needs to be configured for operating with SkyTracker. Please go to **Settings->Communications->Serial** and set the parameters as follows:
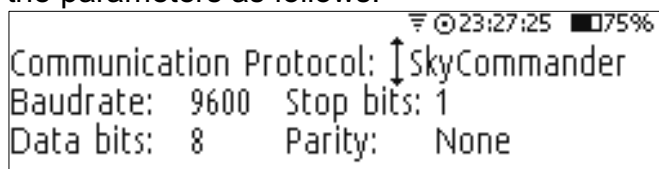
⊙23:27:25 ▬75%

Communication Protocol: ↕SkyCommander
Baudrate: 9600 Stop bits: 1
Data bits: 8   Parity: None

Then go to **Settings->Communications->USB** and set the parameters as follows:

⊙23:27:33 ▬75%

Communication Protocol: ↕SkyTracker
Baudrate: 9600 Stop bits: 1
Data bits: 8   Parity: None
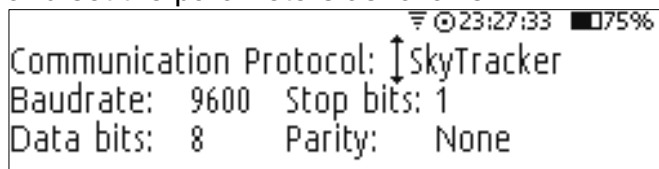
Advanced Topics

Daylight Testing

In order to test that everything is setup correctly you can perform a faux two star alignment during the day. It is especially important to do when Nexus DSC *Pro* is used together with ServoCAT or SiTech controller.

The following procedure describes how to perform a faux two star alignment during the day:

1. Perform **Altitude Reference** alignment as described before.
2. Select the first alignment star that is currently above the horizon and switch to the INFO tab.

```
┌─────────────────────────────────────┐
│ [ALIGN I]  ●        ▼ ⊙01:24:16 ■▶75%│
│ γ Cru            AZ:220.54° 12h32'15"│
│ [113.91°,63.61°] Alt:38.00° -57°13'17"│
│ CATALOGUE  OBJECT │INFO│ HELP         │
└─────────────────────────────────────┘
```

① ② ③ ④ ⑤ ⑥ ⑦
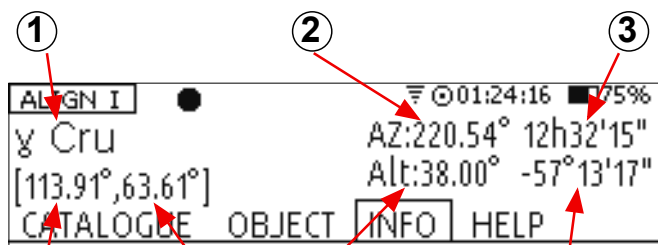
Nexus DSC *Pro* shows the current azimuth and altitude for the selected alignment object (② and ⑥ above)

3. Move the telescope until its azimuth (④) and altitude (⑤) match the ones of the alignment object and press the (OK) key now.
4. Perform the same steps (2-3) for the second alignment object.
5. The alignment error should be very small.

Once Nexus DSC *Pro* is aligned you can go to the main menu, go to **Find->From Catalogue**, select an object from a catalogue and perform a GOTO.

Firmware and Catalogues Update

The firmware and internal catalogues update is performed using the micro SD card installed in Nexus DSC *Pro*.

Download Nexus DSC *Pro* firmware and catalogues package from the *Downloads* section of our website. Please read the release notes for the firmware package to check if you need to update the internal catalogues.

The following steps describe the update procedure:

- Remove the micro SD card from the unit
- Insert the micro SD card into a card reader of your computer
- Copy the firmware image (***nxpro.fw***) from uncompressed package to the micro SD card
- Copy the catalogues image (**ADCATS.bin**) from uncompressed package to the micro SD card
- Make sure you properly eject the micro SD card from your computer
- Make sure Nexus DSC *Pro* has more than 20% battery charge left
- Turn Nexus DSC *Pro* off
- Insert the micro SD card back into the slot of Nexus DSC *Pro*
- Press and hold the (OK) button and turn Nexus DSC *Pro* on until the following screen is shown:

```
┌─────────────────────────────────────┐
│ UPDATING FIRMWARE:                    │
│ Current FW: 1.0.1A (2021.02.03)       │
│ New FW    : 1.0.2  (2021.02.06)       │
│ PRESS OK TO PROCEED, ESC TO CANCEL    │
└─────────────────────────────────────┘
```

- Where *Current FW* is the firmware currently installed and *New FW* is the firmware that is to be installed (the version number and the date in YYYY.MM.DD format is shown for each firmware)
- Press the (OK) button to proceed with the update
- The firmware update will start immediately and the progress indicator will be shown on the screen:

```
┌─────────────────────────────────────┐
│                                       │
│         UPDATING FIRMWARE             │
│                                       │
│ ████████                              │
└─────────────────────────────────────┘
```

- Once the firmware update is finished it will proceed to the catalogues update:

```
┌─────────────────────────────────────┐
│        UPDATING CATALOGUES:           │
│ Current Catalogues: 0.1.0             │
│ New Catalogues    : 1.0.1             │
│ PRESS OK TO PROCEED, ESC TO CANCEL    │
└─────────────────────────────────────┘
```

- The screen above shows the version numbers of both images of internal catalogues
- Press the (OK) button to proceed with the update

```
┌─────────────────────────────────────┐
│                                       │
│        UPDATING CATALOGUES            │
│                                       │
│ ████████                              │
└─────────────────────────────────────┘
```

- Once finished Nexus DSC Pro will check the installed images against the imaged on the micro SD card

```
┌─────────────────────────────────────┐
│                                       │
│         CHECKING FIRMWARE             │
│                                       │
│ ████████                              │
└─────────────────────────────────────┘
```

```
┌─────────────────────────────────────┐
│                                       │
│        CHECKING CATALOGUES            │
│                                       │
│ ████████                              │
└─────────────────────────────────────┘
```
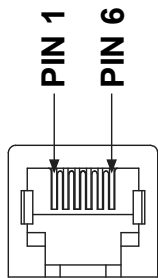
- Once the checking is complete the new firmware will start automatically
- Now you can go to **Info->About Nexus DSC Pro** and verify that the firmware version is correct
- Done!

Apendix

Ports Pinouts

Serial Port

Nexus DSC *Pro* has one RS-232 serial port. It uses a standard 6P6C connector. The pins are numbered according to the following diagram:

The pins description is as follows:

Port	Pin	Description
Serial	1	Ground
	2	TxD – transmitted data (output)
	3	RxD – received data (input)
	4	Ground
	5	Ground
	6	Not connected

Encoders Port

Nexus DSC *Pro* has a standard RJ-45 connector to connect it to rotary encoders of your telescope. The pins are numbered according to the following diagram:
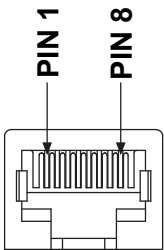
The pin descriptions are in the following table:

Pin	Description
1	Channel B of Azimuth or RA encoder
2	+5 V
3	Channel A of Azimuth or RA encoder
4	Ground
5	Channel B of Altitude or Declination encoder
6	+5V
7	Channel A of Altitude or Declination encoder
8	Ground

WARNING:

! Nexus DSC *Pro*'s encoders' inputs do have input protection but care must be taken not to exceed the maximum input voltage of +5V DC on any input, and the inputs should never be driven to negative voltages below GROUND. This will cause permanent damage to the internal circuits of Nexus DSC *Pro*. Nexus DSC *Pro* only works with TTL (Transistor-Transistor Logic) rotary encoders with quadrature output.

List of Compatible Planetarium Software

Nexus DSC *Pro* is compatible with most planetarium software packages that support LX200 protocol. You can also use planetarium software that supports ASCOM platform (http://ascom-standards.org). The table below lists just a few software packages that Nexus DSC *Pro* was tested with.

Software Name	Platform	Website
AstroPlanner	Windows Mac OS	http://www.astroplanner.net/
Cartes du Ciel	Windows	http://sourceforge.net/projects/skychart/
DeepSky	Windows	http://www.deepsky2000.net
Hallo northern sky	Windows	http://www.hnsky.org/
Megastar	Windows	http://www.willbell.com/
SkySafari Plus/Pro	Android iOS MacOS	http://www.southernstars.com/
Starry Night®	Windows/Mac OS	http://www.starrynightstore.com
TheSky 6	Windows	http://www.bisque.com
TheSky X	Windows/Mac OS	http://www.bisque.com

FREQUENTLY ASKED QUESTIONS (FAQ)

Q: What kind of power source can I use to power Nexus DSC *Pro*?

A: Nexus DSC *Pro* can be powered with a DC power source with a voltage from 5V to 16V. The power source must be capable of supplying at least 2A at 5V/6V or 1.5A at 12V for best results.

Q: How long does the fully charged Nexus DSC *Pro*'s battery last?

A: The running time depends on a number of factors: type of the encoders used, whether the WiFi is enabled or not, display brightness level, keypad backlight brightness to a lesser extent. Assuming that telescope is equipped with US Digital S2/S6, 10000 steps optical encoders and the display brightness level set to minimum level, the battery will last around 16 hours with WiFi enabled and around 22 hours with WiFi disabled.

Q: Does Nexus DSC *Pro* work with a standard Android based device (without any modifications to the device's firmware?

A: Yes, Nexus DSC *Pro* (with the WiFi option) works with any recent Android based phone/tablet without any need to modify the firmware on that device. Nexus DSC *Pro* is acting as a WiFi Access Point.

Troubleshooting

Encoders related problems

Problem	Source of the problem	Solution
Display is blank	Internal battery is exhausted	Connect Nexus DSC *Pro* to external power to charge the battery
The keys are not illuminated	The keypad brightness level is set to 0	Change the keypad brightness level to a value other than 0
The charging status LED is flashing	External power does not meet the power requirements	Connect Nexus DSC *Pro* to a power source that meets the power requirements

Problem	Source of the problem	Solution
Poor pointing accuracy	The number of steps for encoder(s) was set incorrect	Check that the encoder steps were set for the encoders used
Pointing accuracy deteriorates with time	Equatorial platform timer was activated	Turn off the equatorial platform timer
Encoder(s) count does not change in Test mode	Poor connection to encoders	Check that the encoders cable is properly inserted into Encoders port
	Faulty encoder cable	Replace the encoder cable
	Faulty encoder(s)	Replace the encoder(s)
Encoder count does not always change the value when moving the telescope	Encoder shaft's slippage	Tighten the grub screw on the encoder's adapter.
	Faulty encoder cable	Replace the cable
Encoder count does not change the value when the telescope is in a certain position (for example, the azimuth encoder count does not change when the telescope is positioned between 200° and 205°)	Encoder's shaft is tilted	Adjust the encoder's mounting to avoid exerting any pressure on the axle while the telescope is moving.

Alignment problems

Problem	Source of the problem	Solution
Alignment error is large	Encoder(s) resolution is not set correctly	Set the encoder(s) resolution to the correct number of steps corresponding to the number of steps of the encoders installed.
	Telescope was pointed at the wrong star while performing the three star alignment procedure	Make sure the telescope is pointed at the selected stars
	Telescope was not set at the reference star while performing the two star alignment procedure	Set the telescope to the reference altitude before pointing at the alignment stars
	Alignment star(s) selected are below or close to 30° in altitude where the refraction has a much greater effect	Make sure that the alignment stars selected are positioned between 50-70° in altitude
Pointing accuracy is poor when moving the telescope to a different part of the sky	Alignment stars selected had a small separation angle in azimuth	Please select stars that have a separation of at least 70° in azimuth.

Warranty

Nexus DSC *Pro* is covered by a one-year limited warranty. Please refer to the enclosed warranty certificate for full details.

Technical Support

You can find the latest version of the manual and firmware in the support section of our website. Please feel free to e-mail us should you require further technical assistance.

Technical Support

You can find software updates and user documentation on the Astro Devices website.
http://www.astrodevices.com

e-mail: mailto:support@astrodevices.com?subject=Nexus DSC support

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FCC Statement for Nexus DSC *Pro*

Contains:
FCC ID:XF6-M7DB6
IC ID: 8407A-M7DB6

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: To comply with FCC RF exposure compliance requirements, the antenna used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

NOTE: 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

C E

DECLARATION OF CONFORMITY

We, Astro Devices, ABN 75 270 616 917, 198 The Esplanade, SYLVANIA, NSW 2224, AUSTRALIA, E-mail: info@astrodevices.com,

As manufacturer/producer declare that:

Product Name: Nexus DSC *Pro*
Product Series: **NXD200**
Product Description: **Digital setting circles for telescopes**

conforms to the following directives and standards therein

Directives:
WEEE- Waste from Electrical and Electronic Equipment - 2002/96/EC
Radio Equipment & Telecommunications Terminal Equipment (R&TTE) - 1999/5/EC
RoHS- Restriction of use of Hazardous Substances in Electrical and Electronic Equipment - 2002/95/EC
Standards:
EMC: EN 55022: EN 301 489-1 V1.8.1:2008-04, EN 301 489-17 V2.1.1:2009-05
RADIO: EN 300 328 V1.7.1:2006-10
Immunity: EN 55024: EN 61000-4-2:2001, EN 61000-4-3:2002
Safety: EN 60950-1:2006+A11:2009+A1:2010
Supplementary Information:
Nexus DSC *Pro* contains Model number: M7DB6. This unit is a battery-operated appliance.

Date of issue:
January 22nd 2021

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