FreeGo2 interface

Universal telescope mount interface.

Manual. ((*))

FreeGo2-Lite   FreeGo2-Big
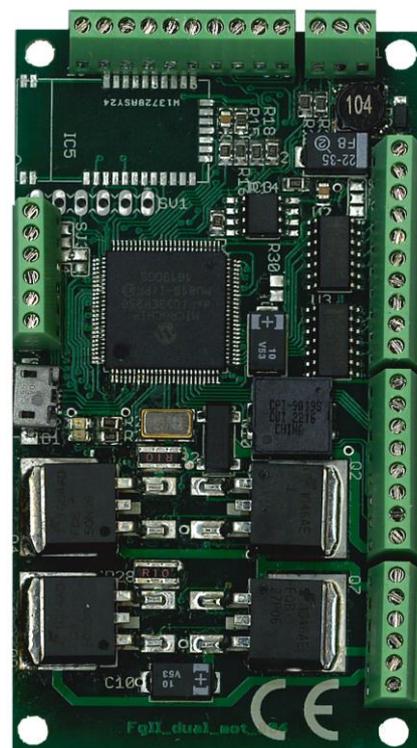
Een product van CAMPUSSTERNWARTE - SENNA MultiMedia

INHOUD

How do you install the FreeGo2 interface?

The FreeGo2 interface has been designed to be as compact as possible to give all flexibility to the telescope builder or designer. That is why we have opted for fuse holders, lights, switch and JR6 or JR45 connectors. All connections to the FreeGo2 are made via screw connectors with the mini USB. All components that can quickly break down, such as the RJ6 connector for ST4 Guiding, have been placed on a separate PCB.

Connectors, fuse holder (2A), switches etc. are thus installed outside the interface.

To make the installation as easy as possible, we have put together an installation procedure for you. It is important that you first read this to avoid unnecessary damage to servos, interface and annoyance.

Tools:

To install the interface, the following resources are required: adjustable power supply, universal meter, soldering iron and tin, small watchmaker screwdriver, mounting cable and a cable stripper.

Servo's:
The FreeGo2 supports DC servos up to 24V 1.5A without cooling, up to 4A and more with cooling. Make sure you test the Servo beforehand and that it runs correctly.

Incr. encoders:
The FreeGo2 supports two AB encoders at TTL level. Older encoders (analogue disc with LED and photo sensor only) are not supported.

Absolute encoders:
Absolute encoder are supported with SPI or I² d.m. port mapping. In addition, two absolute encoders can be supported with the SSI protocol.

Zekeringhouder:
When using a battery or a fixed power supply, make sure that a fuse is placed between the power source. There can always be situations where the interface is overloaded. Especially with the installation, small errors can lead to short circuits and a fuse saves you much worse. An adjustable power supply with current limiter is therefore very desirable during installation. When the interface works properly you can switch to a battery.

Switches and connectors:

Use good connectors and cables. It is advisable to install a USB mounting connector because the mini-usb connector on the PCB can break when the load becomes too large. This can be done with a small extension cable (1) or directly on the print (2).
This is advantageous when configuring the interface.

It is also advisable to install a switch per motor But also to switch off the motors quickly in the event of a possible failure..

Computer:
At the moment the FreeGo2 works with windows 7,8 and 10. If your computer can work with these operating systems and has approx. 1 Gb of free memory you can work with the FreeGo2 interface card. More information in the Software chapter.

For the Raspberry PI. a stripped-down version of our software is available. Read more about this in the software chapter.

Stellarium
The FreeGo2 software for windows can communicate with Stellarium directly via USB.

Because the Telescope Control software checks at every start whether all drivers are present at stellarium and possibly adjusts, it is possible that the standard telescope that is created is not recognized. When configuring (F2) with Plug-Ins, check the option to load the box when startup is checked. Read more about this in the description Telescope Control..
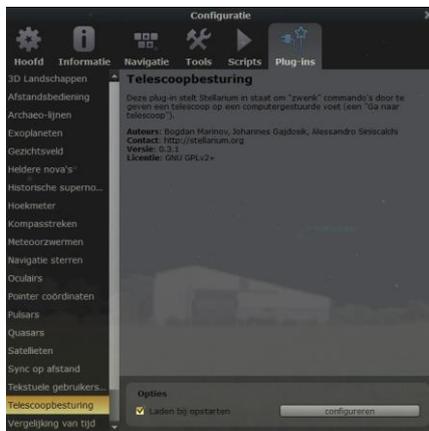
SSI   Analog in

1 GND
2 CLK2-
3 CLK2+
4 D2-
5 D2+
6 CLK1-
7 CLK1+
8 D1-
9 D1+
10 VCC 5V

1 GND
2 Analog in 2
3 Analog in 1

SPI/I²C

VCC (in) 6
SEL (out) 5
SDI 4
SD0 3
SCK 2
GND 1

USB

Digital I/O

1 VCC
2 D7 RD7
3 D6 RD6
4 D5 RD5
5 D4 RD4
6 D3 RD3
7 D2 RD2
8 D1 RD1
9 D0 RD0
10 GND

Quadered Encoders

1 VCC 5V
2 Uur as encoder signaal A
3 Uur as encoder signaal B
4 *Uur As encoder IX 1*
5 Declinatie as signaal A
6 Declinatie as signaal B
7 *Declinatie signaal IX 2*
8 GND   Min voor encoders

Motor Drive

1 V++ Spanning servo Max. 24V
2 Motor1A uuras servo
3 Motor 2A declinatie as servo
4 Motor1B uuras servo
5 Motor2B declinatie as servo
6 GND
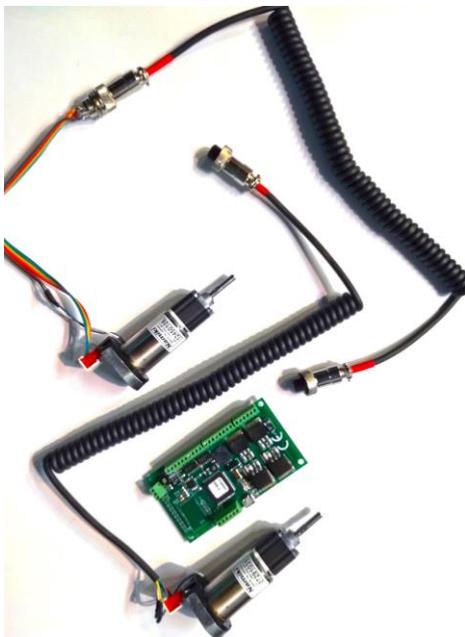
For this configuration, we choose the FreeGo2 lite. Because servos are very powerful and very precise to arrange
often very small servos can be used. It is important that you choose good cables and connectors.
 That picture shows a set that we supply, but of course you can also put together your configuartie yourself.

Data Servos: (for a 32cm RC telescope)
12V max. 700mA
max. 1800 rpm
Delay box 1:80
Shaft diameter 4mm
Cui incremental encoder (AB TTL) 100 to 2048 ppr.

Step 1: Test the interface with your computer

1.   . Connect pin 1 (V ++) and pin 10 (GND) of the Motor Drive connector with an adjustable power supply.   Ensure that the voltage at the start of the installation does not exceed 7V and limit the current to 500mA. If you use a fixed power supply, then provide a 1A fuse. When the interface works properly, the maximum voltage that is required for the servos can be selected.
2.   Switch on the power supply. At the USB connector of the interface, the red LED briefly lights up, And then the green LED starts to flash. The interface works!
3.   3. Connect the interface to your computer with a USB cable. It does not matter which USB port you use. You should hear a ping if all goes well.
4.   Create a folder on the computer and extract the zip file FreeGo2.zip. Start the program Free_Go2_x.y.EXE   (x.y. is the version number). Windows may come with a blue screen with the message that it may be malicious software.   No worries, everything is okay, so click on "other information" and start the program.   You get two screens: On the left you see your control screen and the right screen shows how the interface is currently   set for your montage. The telescope is facing east and the counterweight is pointing downwards.
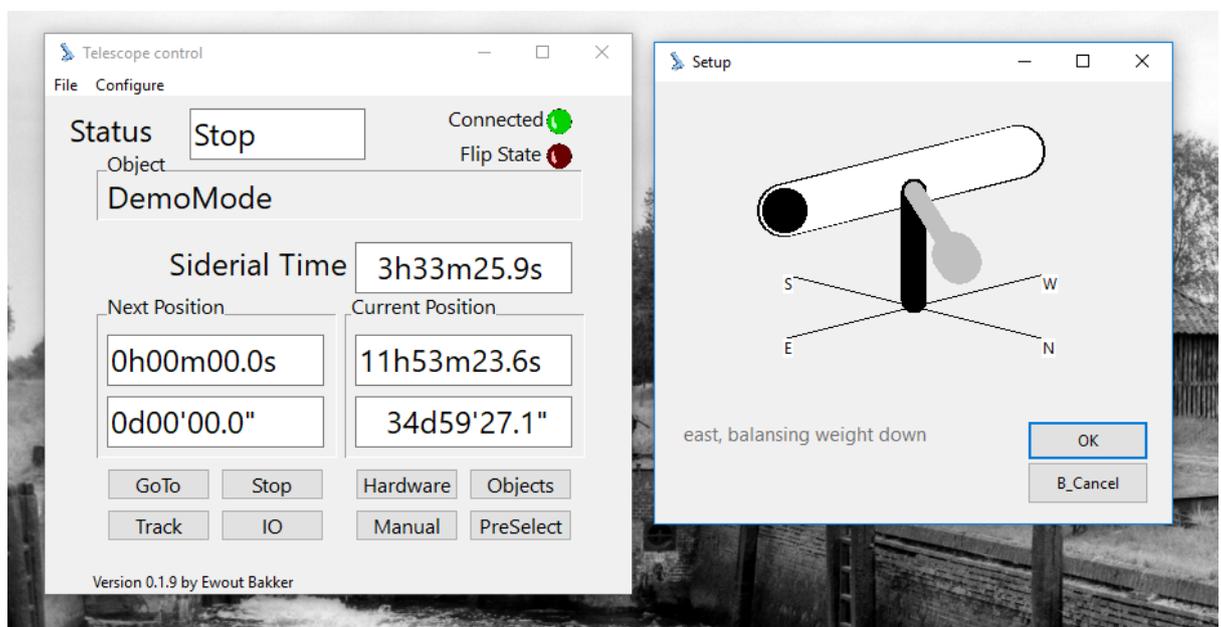
This screen will help you later on configuring the motors and servos. If the text "DemoMode" is not visible, you have connected to the interface. When the text "DemoMode" remains visible, remove the usb plug, wait 5 seconds and reconnect it. The connection must be made after a ping.
 If it still does not work, click the "Hardware" button.
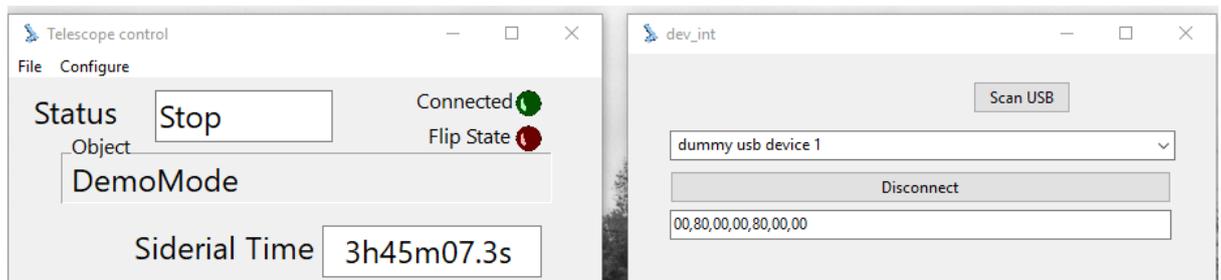
 Click on Scan USB and if the FreeGo2-lite interface reports,   make a connection (Connect). The Connected light should turn bright green.
 If this does not work, check everything again. If everything works, the program closes and switches off the power.

   Continue with step 2.".

Step 2: Connecting the incremental encoders

For example, we use a Cui encoder for a parallactic mount. With an azimuthal mount, the hour axis is the horizontal axis and the declination is the vertical axis. Read Chapter software for Azimuth or Equatorial selection.

1. The FreeGo2 has a built-in power supply that converts the motor drive voltage (up to max. 24V) into 5V for the encoders. On pin 1 of the "Quadered Encoders" connector 5Volt are available for the encoders.   Connect both encoders to the 5V pin 1 and the G (GND) to pin 8. Figure below shows two types of Cui encoders that you can mount on a servo yourself. The pinning is clearly indicated. B, 5V, A, X, G, T. X and T are not used by us.

2. Connect the **signal A** of the **hour** axis encoder to **pin 2**
3. Connect the **signal B** of the **hour** axis encoder to **pin 3**
4. Connect the **signal A** of the **declination** axis with **pin 5**
5. Connect the **signal B** of the **declination** axis with **pin 6**
6. Turn on the power supply (**minimum 7V**).
   Connect the interface to your computer, you hear a ping
   Start the Telescope control (Free_Go2_x.y.exe).

   Carefully turn the shaft of the encoders. When the values count up or count down depending on the direction you are running, the connection is good. Note: the "current position" hour axis runs as standard due to the time.
   So take a good look at the hour axis encoder or count down.
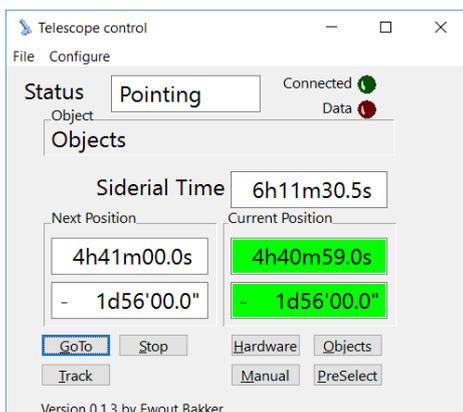
If the values change randomly, disconnect the USB connection, wait a few seconds and reconnect the interface.
When no numbers change then again check all cables properly.
Measure the voltages with a universal meter.

If necessary, check with an oscilloscope whether A and B signals are present at the connection points.
Continue with step 3 if this works

Step 3 Connect servos

Preparation software (just do it, later comes the explanation).

1. Connect the interface to the computer, switch on the power supply and start the FreeGo2_set.exe program
2. Create a "Connect" with the interface, click on "read". ll empty fields are loaded with the default data.
3. Enter the gear override in "Gear".
    Voorbeeld, uw telescoop heeft een wormwiel met 360 tanden, een overbrenging van 1:4 en een servo gearbox van 1:80
    Gear = 360 x 4 x 80
    Gear = 115200
4. PPR= encoder pulses per rotation. Usually a value between 4 and 2048. The higher the value, the better the motor can be controlled Cui encoder default value is20 48.
    PPR=2048
5. Repeat these settings for the declination servo and encoder
6. Click on **"Write"** to save the data.
7. Check if everything is saved by disconnecting and re-reading the connection. (disconnect - connect - read).   If everything is correct, the program closes.
8. Start the program Free_Goto_*versienr*.exe
9. Go to "configure" and choose TAB "Window"
    Check that the Hardware_Botton field is set to Yes .
10. Go to "configure" and choose TAB "Param"
    Check the field Med_Flip_Enable set to No (Important By Installation and testing!)
11. Go to "configure" And Choose TAB "Location" Enter the position of your observatory. If you do not know it, go to Google Maps, go to the spot where your telescope or observatory is located, click on the right mouse button and choose option, "what is here".Below is a screen with the location in decimals.
    Click on the location in this screen and on the top right you will see the coordinates

that you have to enter in the location tab.
Write down these numbers and enter them in the Telescope control program. In our case (Campussternwarte) you have to fill in: Long 7d18'21.5" So also the d (degrees) '(minutes) and" (seconds)
Lat 51d58'39.3" Note, use the. (point) as a separator for the tenths.

Then click on SAVE to save the data. This location is used for all calculations regardless of which planetarium you use.
If you use stellarium with a sky for spain, then the freego2 telescope control software will convert the chosen positionto your specified
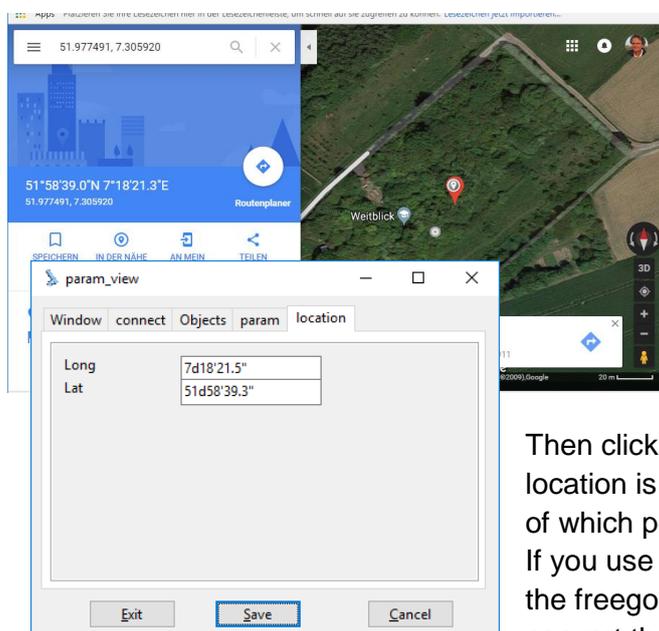
location.
An object that can not be seen here is indicated by the freeGo2 telescope control as **"below the horizon".**
check if the **Med_Flip_Enable** field is set to **No** (Important during installation and testing!)

Connecting Servos to the FreeGo2 interface
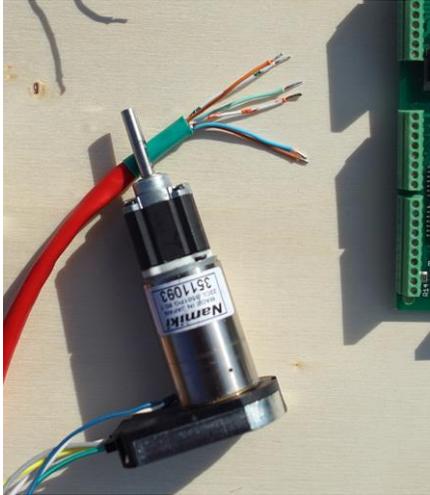
the FreeGo2 Go2 interface allows servos from 7V to 24V. For currents greater than 1.5A, cooling is required for the FETs. You can make it yourself or use our aluminum housing that cools the FETs sufficiently.
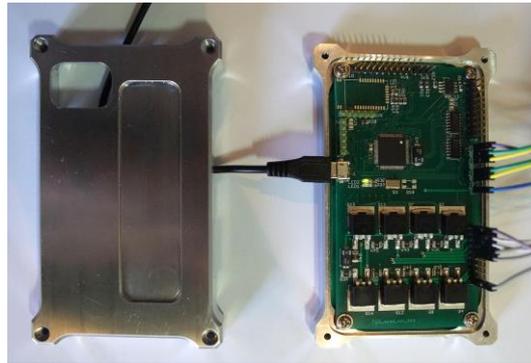
PLEASE WATCH THE CONNECTION!

1. **Hour Servo comes on Motor Drive pin 2 and pin 4!**
2. **Declination comes on Motor Drive pin 3 and pin 5!**
3. Connect the power supply **(7V)** and check that there are no large currents (more than 1A). It is possible that engines start spontaneously "wild". That is why a switch to connect the motors temporarily is very handy..
4. Open Free_go2_set
   Click on Connect and Read.
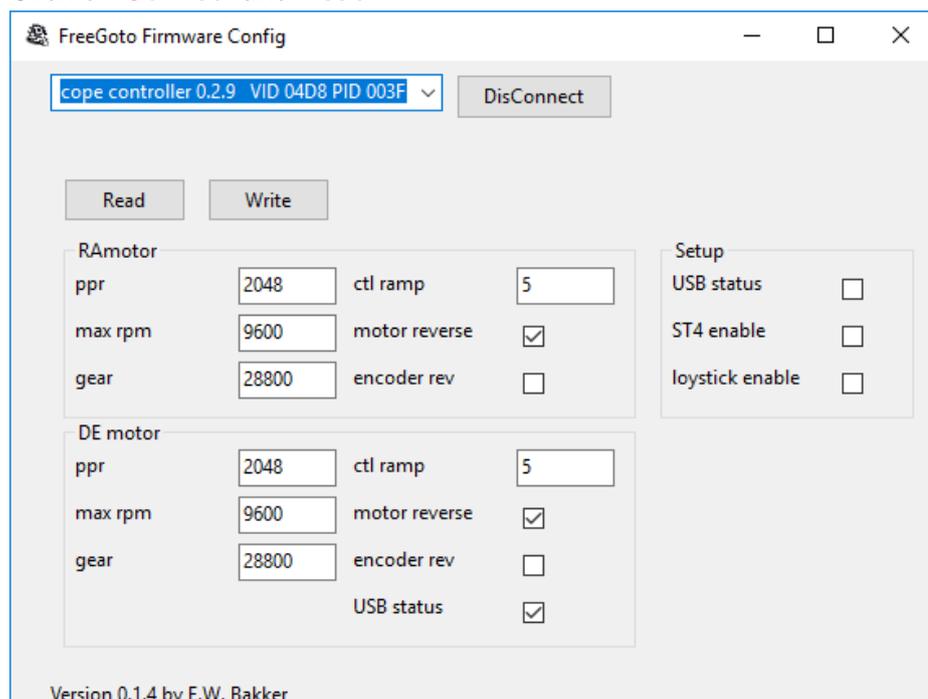
5. When the motors start to run, it may be necessary to turn the encoder direction. Click on the encoder rev field.

or

encoder rev	☐

of

encoder rev	☑

lick on **Write** and if necessary recheck with **Read** if the values are stored correctly. The engines then have to stop spontaneously running.

Testing with FreeGo2 software

Start Telescope Control (Free_Go2.exe). You will see the following screen:
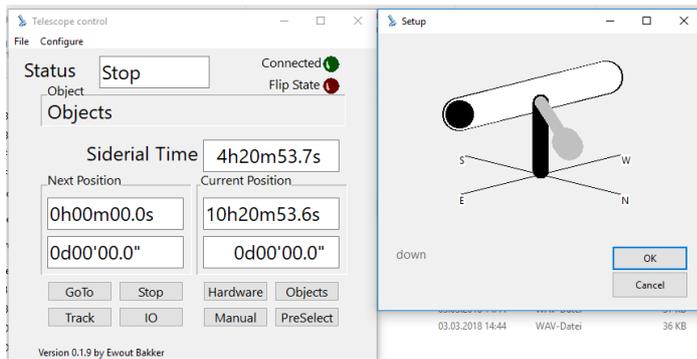
The right-hand screen shows how the software thinks your telescope is configured. If that's right click OK. If not, position the telescope in this position and click OK. Perform the following tests::

1. Set the telescope to the east..
   For Next Position enter the following values Deconation values: **90d00'00,0''** " (also the d, ', ") Click GoTo.. When the telescope is aligned with the zenith, continue with point two. Moving is the telescope (down) change in the setup (Free_goto_set) the RA motor direction Motor reverse and save the data. Repeat this test.

motor reverse	☑

of

motor reverse	☐

2. Now we test the hour axis (RA) through the hour axis from east to west. and we do this with a trick by first focusing your telescope on the east. Now at Next Position we run **00h00m00.0s** (also specify the h, m, s) and go after configure, click calibrate.Current position is now equal to Next Position. These values are only for the test. Now enter **6h00m00.0s** at Next Position and click **GoTo**. If the motor runs in the right direction and the telescope points to the south, the test procedure is completed. If the direction is not correct then change the Motor reverse as with the declination motor.

Joystick

As an example we use a Joystick that can also be used for a Raspberry PI. This joystick has the following values:

2 axes - XY
1 pressure switch
Input voltage 5V
Pegs GND, 5V, VRx, VRy, SW
Dimensions 4 x 2.6 x 3.1cm
To use this joystick, we use the analog input of our FreeGo2 interface.

1. Connect 5V to Pin 10 SSI connector (other 5V source also allowed)
2. Connect GND to pin 3 (Analog in)
3. Connect VRx to Pin 2 (Analog in)
4. Connect VRy to Pin 3 (Analog in)
5. Start the setup program (Free_go_set.exe)
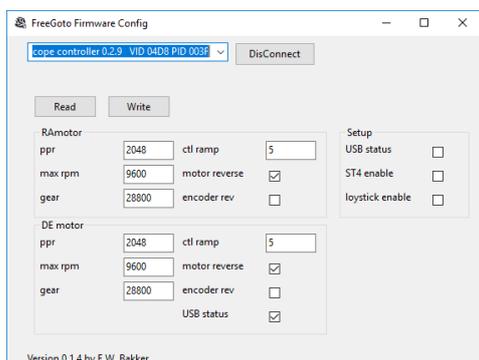
Tick Joystick enable and click Write. you can now use the Joystick. Read chapter Software about Joystick enable.

The FreeGo2 comes with the following software:

1. FreeGo2 setup (Free_goto_set.exe)
2. Freego2 telescope controll (Free_goto_1.9.exe) 1.9 is version no.
3. FreeGo2 test (Free_goto_test.exe)
4. FreeGo2 ASCOM Driver
5. FreeGo2 Android APP

Windows comes the first time with a message that this software may be harmful to your computer. Ignore this message and start the software. Then you can start the software without warning.

FreeGo2 setup

The Freegoto setup consists of a number of setting options to configure the FreeGo2.
Connect the FreeGo2 interface to the computer, and click connect. Windows connects to the interface card. Then click on Read. The fields are filled in with the data (image on the right) that is stored in the MicroChip
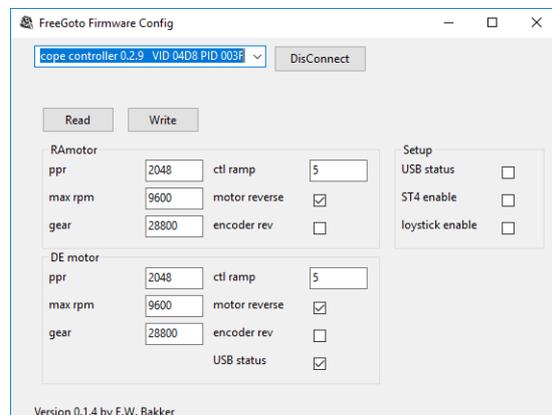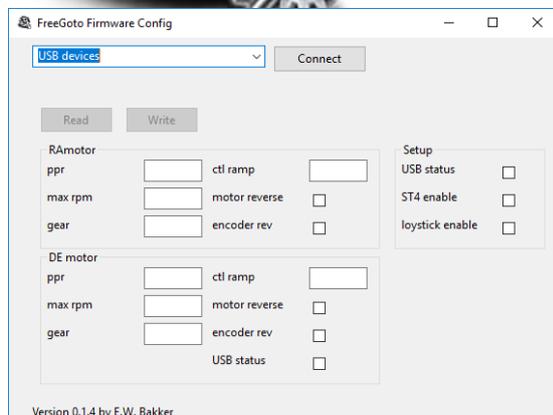
In the setup program you can configure your servos for your montage. There are three input fields, RAmotor, DEmotor and optional setup settings.
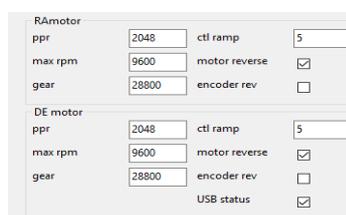
RA motor & DE motor
In this box the parameters for the hourly axis motor or Horizontal motor and encoders can be set.

ppr:
number of pulses per rotation of the incremental encoder. This value can range from 4 to 2048.

The software of the FreeGo2 quadruples these values by counting the edges of the signal.

An Encoder of 2048 pulses becomes 8192 pulses per revolution.

This allows a very precise and very low speed to be achieved on the motor shaft.

A controlled rotation of 1 rev. in 20 seconds can be realized with a few servos!!

max rpm

a guide number where the value is 9600 for maximum speed. In some cases, too high a speed is not desired and the user can reduce the speed.

The value can be set between 100 (very slow) and 9600 (maximum speed)

Gear

The Gear is the ratio of gears to motor shaft - hour axis.

Suppose your mount has a worm gear of 360 teeth, a belt transmission of 1: 2 and a servo gearbox 1:80.

Gear = 360 x 2 x 80

Gear = 28800

Do you use a friction drive with e.g. a disc of 270mm and a pin of 6mm, then the delay of the friction is 45x, and comparable to a worm wheel of 45 teeth.

With a comparable servo and with a belt transmission of 1: 2 gear is:

Gear = 45 x 2 x 80

Gear = 7200

It is obvius that a friction drive can make a rotation much faster on its axis. In this case, you can adjust the Max rpm to avoid dangerous situations with large-scale displacement.

ctl ramp

Control ramping also called the aggressiveness, determines the time of the engines to go from minimum to maximum speed.

This value is adjustable from 1 (low) to 5 (high) ramping. When the disaster is high, the telescope will shoot over the object,

the motor will correct this and try to get the object in the picture again.

There are situations imaginable that the servos then start to oscillate because they are set too aggressively.

In that case you will have to lower this value.

Motor reverse

Determined what left or right engine movement is. If the motor direction is wrong, you can turn it over here.   This setting has no effect on the encoder reverse!

Encoder reverse

Here, the right or left of the encoder is determined. If the servo starts to run uncontrolled, the encoder can be set. In that case, change the Encoder rev. This setting has no effect on the Motor reverse!

For the DE motor, the same settings apply as the RA motor. In addition, a number of options are available with the setup.

Because a part of the software is open source, the settings may differ. By default you will find the following options:
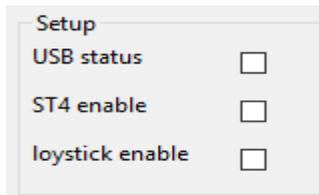
USB Status

When this option is checked, the ????????? be shown

ST4 Enable

When this option is enabled, the ports D0 t.m. D4 of the digital ports for ST4 configured and a guider camera can take over the operation for correction. Read more about this in chapter ST4. When this function is enabled, the tracking function lapses because the guider has taken over the control. We recommend disabling the ST4 option if this is not used.

Joystick enable

The interface has 2 analog inputs that can be used for a joystick, among other things. When this function is activated, the joystick takes over the function.
Here too, when this function is enabled, the chosen location is canceled because the joystick has taken over the control. Read more about Joystick in the chapter Joystick.

Telescope Control Programma
The telescope control program (Free_goto_versienr.exe) will first show you a screen

as the program expects the telescope to be set.
If this is correct then click OK to continue.
shows a concise or extended screen. These additional buttons can be switched on or off at the configuration menu.
The screens below show the standard settings as applied by us from version 1.9. Because programmers can add their own options,
this can vary per observatory. Below are the default options displayed with minimum and maximum buttons.
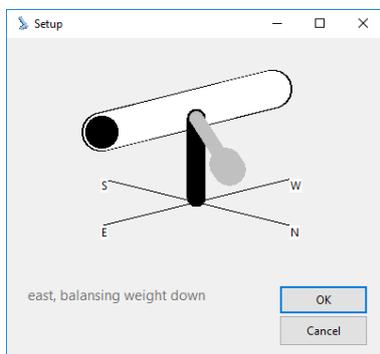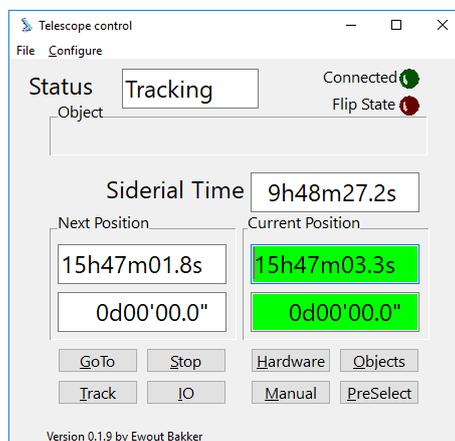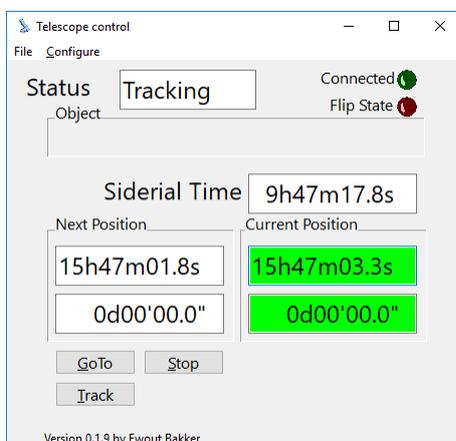
We assume that the user has sufficient elementary knowledge about the astronomical concepts such as siderial time, RA, Decl. etc.
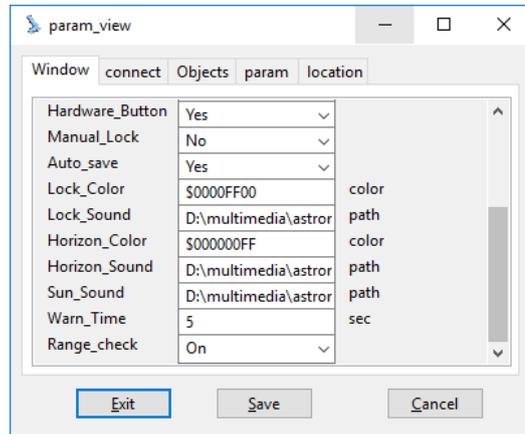
Hier komt nog text…

Telescope Control and Stellarium (also works in simulation mode).

When Telescope control is started, the program automatically performs a number of checks, including the existence of a few folders and files.
If those folders are not yet available, they are automatically created and the necessary files copied there.
The Telescope control program can communicate directly with stellarium without the intervention of an (ascom) driver.

Here too, the necessary files are installed directly in Stellarium and the default telescope "Cosmos" is added.
if the Cosmos telescope can not be found (possibly due to a setting error), or if you want to add your own telescope name, you can adjust it manually.
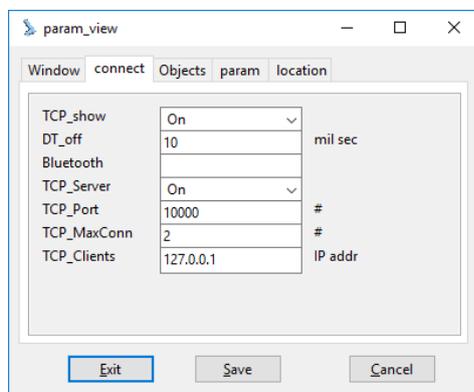
Select Configure - Parameters and choose Connect from Param_view. Here are the TCP / IP communication options that our FreeGo2 telescope control works with.Om goed met Stellarium te kunnen werken moet optie TCP_Port gelijk zijn met die van Stellarium. Wanneer er al een telescoop is aangemaakt in Stellarium (Signal) zorg dan dat de optie Externe software of een computer op afstand geselecteerd is. Scroll naar onderen en zorg dat bij het onderdeel verbindingsinstellingen de localhost poort gelijk is aan de waarde van Param_view. In ons voorbeeld moet TCP_server op on en TCP_port 10000 zijn.

TCP_server = on
TCP_port = 10000
Save this setting.
In Stellarium Iit shows as:

:
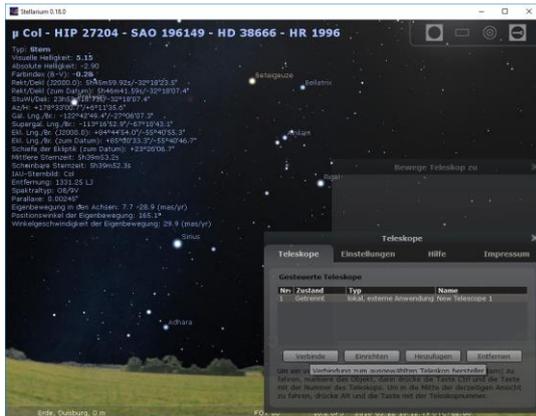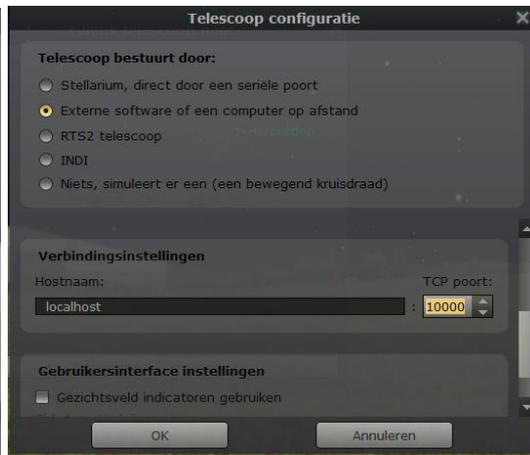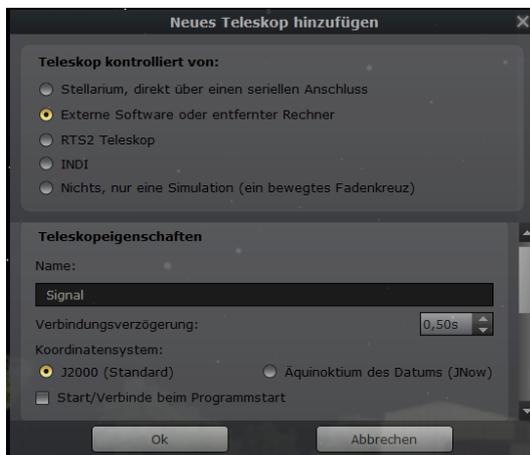
The telescope can now connect with stellarium by clicking on connect. If it does not work, stellarium will start again.
Usually the telescope is then recognized. The telescope will log in automatically the next time the Telescop control program is started.

It is advisable to test this first in simulation mode, so without an interface card.
From Telescope control you can then simulate the telescope movement in the manual option.
he servos start very slowly and continue to run faster until their maximum speed is reached, over the period that the button is pressed.