FreeGo2

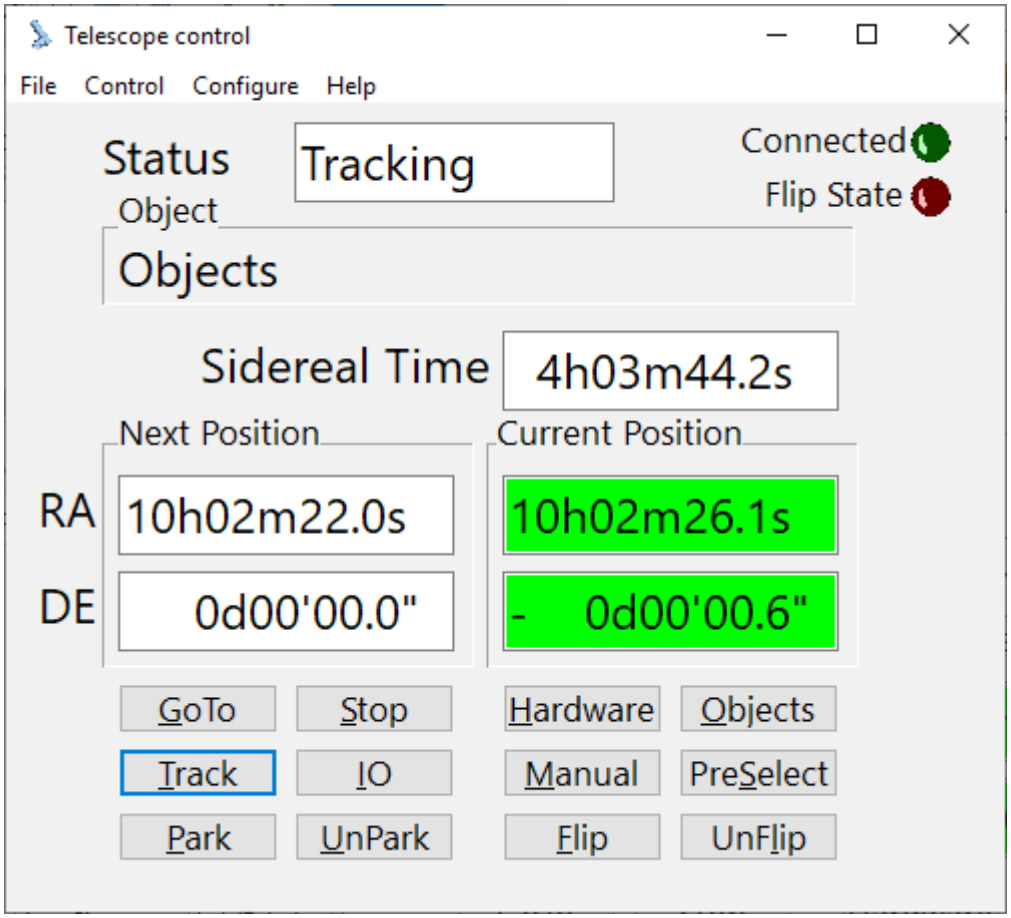
Telescope control program

Manual Version 1.7.1

Table of Contents

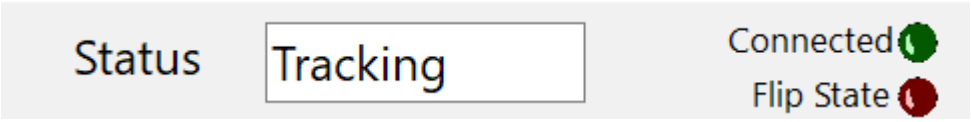
1 Main Window

Controlling the telescope is done by the main window.

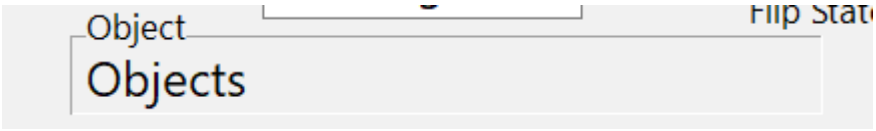


The Main view of the FreeGo2 controller software displays a number of basic functions.

1.1 Status

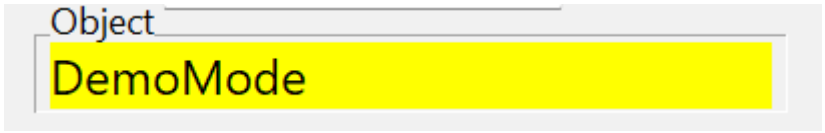


On top there is the State of the control. This can contain Stop, Tracking, Pointing, Moving, Park Move , Parked and if enabled Flip Move. On the right there is an indication light "connection" which indicates that the FreeGo2 controller software is connected over TCP/IP with other software. This can be stellarium, FreeGo2-remote display, ASCOM-driver, INDI-driver or other network connected applications.

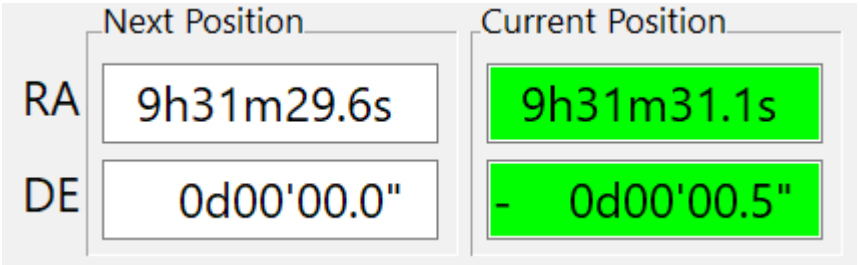


The Object part displays warnings or other messages and objects selected with the Objects function or Preselect function.

If there is no telescope connected through USB this field shows



1.2 Position



Central in the window is the current local sidereal time Next Position and Current Position.
The sidereal time is calculated from the system time and date, so is as accurate as the PC system clock. Next and Current Position are Given in Right Ascension (top value) and Declination (bottom value).

1.3 Control

At the bottom there are a number of buttons to control the status of the telescope and object select functions.

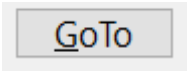
Goto: will slew the telescope to the "Next Position" RA/Dec.
Stop: will abort any movement
Track: will start tracking the current RA/Dec position
IO Control: opens a window with configurable signals.
Park: move to pre-configured Park position In Parked position all functions are blocked except the UnPark button.
UnPark: Unblock Park and start tracking from this position
Hardware: This button opens a window with hardware information.
Objects: This button opens a window with a list of objects.
ManualManual: This button opens a window with movement buttons.
Preselect: This button opens a window with pre-selected objects

If meridial flip is enabled and auto flip is disabled then these buttons appear. These setting can be done in the Configure/Parameters window

Flip: This button activates flipped mode. It will enter "Flip Move" state until in flipped state.

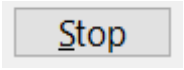
UnFlip: This button returns the telescope in original state (again through "Flip Move" state.

1.3.1 Goto



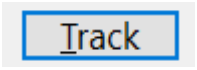
The Goto button initiates a slew to coordinates entered in the Next Position fields. The Next Position fields can be filled manually but most of the time this wil be done by external programs like Stellarium or other programs with ASCOM or INDI.

1.3.2 Stop

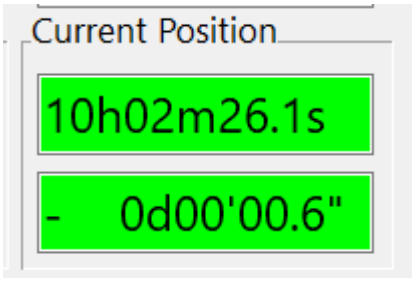


Stop button. Stops all actions in a controlled manner.

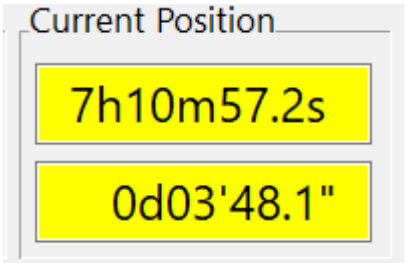
1.3.3 Track



Start Tracking current position. If current position is within configured range the background becomes green. If slewing to object state will change from pointing to tracking when within the configured range.

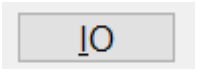


if Meridian flip is enabled the background turns yellow when past the meridian.



The colors of the background can be changed.

1.3.4 IO Control

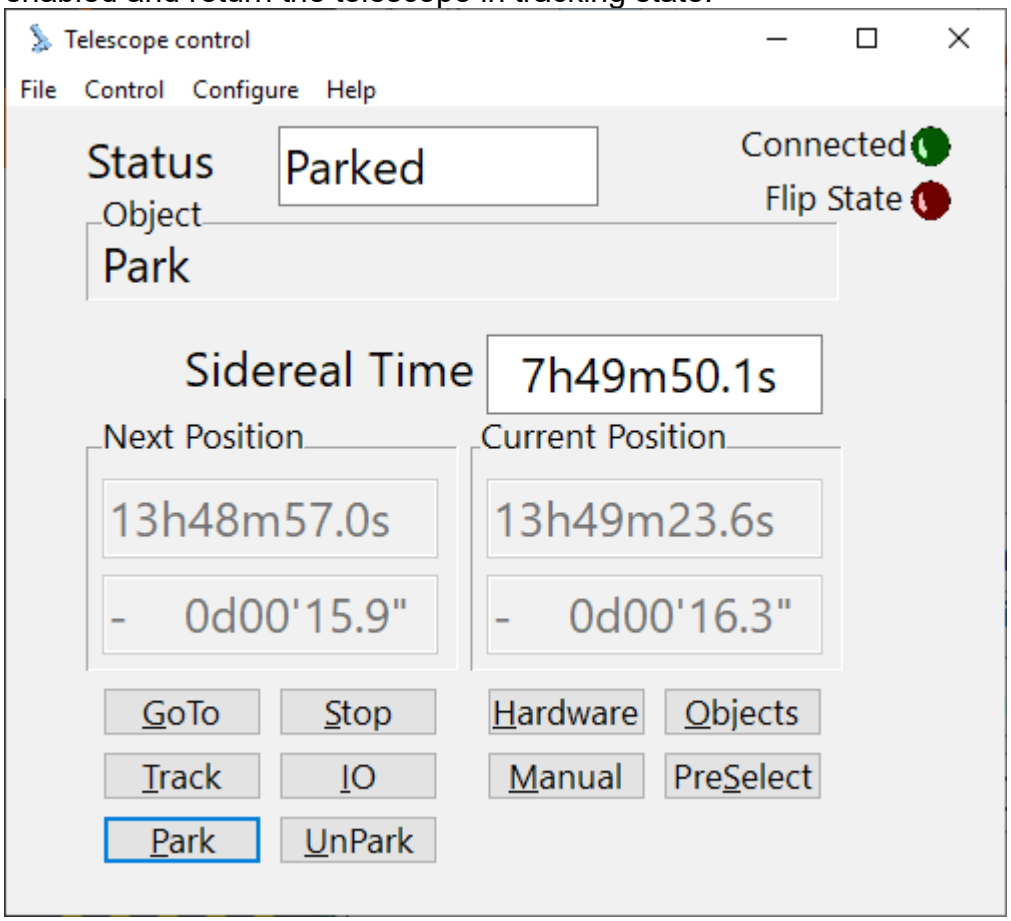


Button to activateIO Control Window To manipulate the extra IO ports on the FreeGo2 board.

1.3.5 Park

Start park function. The status will show "Park move" to indicate the telescope is moving towards the configured park position.

When the telescope reached the park position the background of "Next Position" and "Current Position" will be turned gray to indicate the system is locked. no buttons or commands will be executed. Only UnPark will be enabled and return the telescope in tracking state.

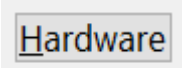


When the program was shutdown in parked state it will be in parked state when turned on again.

1.3.6 UnPark

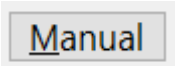
Unpark button Unlocks the system from Park. When the program was shutdown in parked state it will be in parked state when turned on again.

1.3.7 Hardware



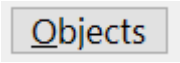
Hardware button activates the Hardware window which shows hardware information.

1.3.8 Manual



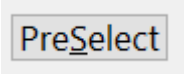
Manual button activates the Manual buttons window. With these button the telescope can be moved in any direction.

1.3.9 Objects



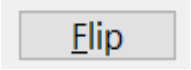
Objects button activates the Objects window where objects form a given file can be selected for got coordinates.

1.3.10 Preselect



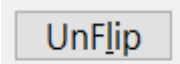
Preselect button activates the PreSelect window where a list of pre-selected objects can be manipulated and used for goto command.

1.3.11 Flip

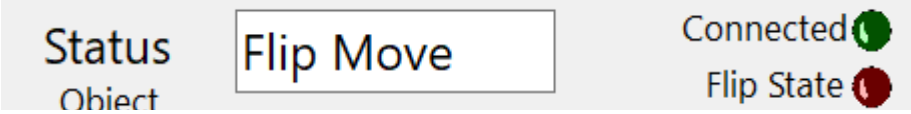


This button will be showed when meridian flip is enabled and auto flip is disabled.
When flip is activated the telescope will rotate the weight from east to west over 180 degrees and rotate the tube around to view the same coordinate. During this move status will show "Flip Move". The "flip state" indicates if telescope is in flipped state or not. Flip button will only work when the telescope is not in flipped mode and only of the telescope is near the meridian.

1.3.12 UnFlip



UnFlip returns the telescope to normal state. This button will only work in flipped state and only if the telescope is near the meridian. This meridian proximity can be adjusted. During this move state will show "Flip Move".



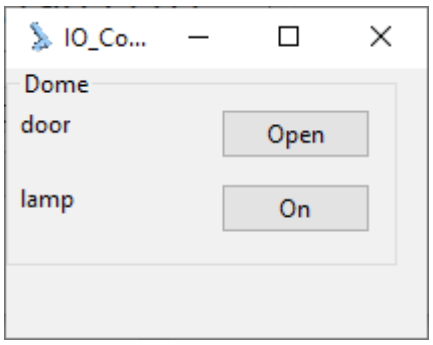
1.4 Menu

- File
  - Objects Open Object list from file. A previously selected file will be remembered.
  - PreSelect Open a file with pre-selected objects. This list can be edited and saved.
- Exit Before leaving the program the settings are saved if the auto-save parameter is set.

- Control This menu contains all functions of the buttons on the main window except for the object views which are under menu-item File
  - Manual Opens a window with buttons to move the telescope.
  - Hardware Opens a Window with hardware data
  - IO Control Opens window with configurable buttons for digital IO
  - Goto Starts moving the telescope to "Next position"
  - Track Keep telescope on current celestial position
  - Stop Stop all movement in a graceful way
  - Park Move telescope to a predefined position and block all commands except UnPark
  - UnPark Unblock the telescope from parked state.
  - Flip Flip telescope to the other side of peer
  - UnFlip Return telescope to normal peer side
- Configure
  - Parameter: Activate Parameter configuration window
  - Language: Select display language
  - Factory Defaults: Reset all settings of the PC software back to original state
  - Initialize: Align with fixed telescope position
  - Star Calibrate: Align with telescope with selected star
  - Calibrate Current: Align current position as Goto position

- Set Park Position: Set current position as Park position
- Help
  - Help File: show this help file
  - About: Information window

2 IO Control



2.1 IO control window

This window can contain buttons to control output signals on the IO port and display signals from the input signals from the IO port. Content of this window is controlled by a configuration file “ioconfig.txt”.

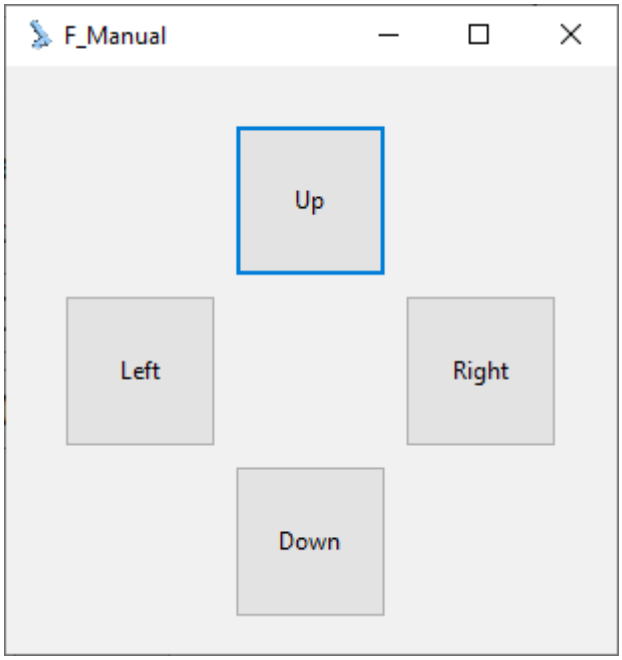
This controls the function, direction and state of the 8-bit digial IO port of the Freego2 board or external IO USB-board.

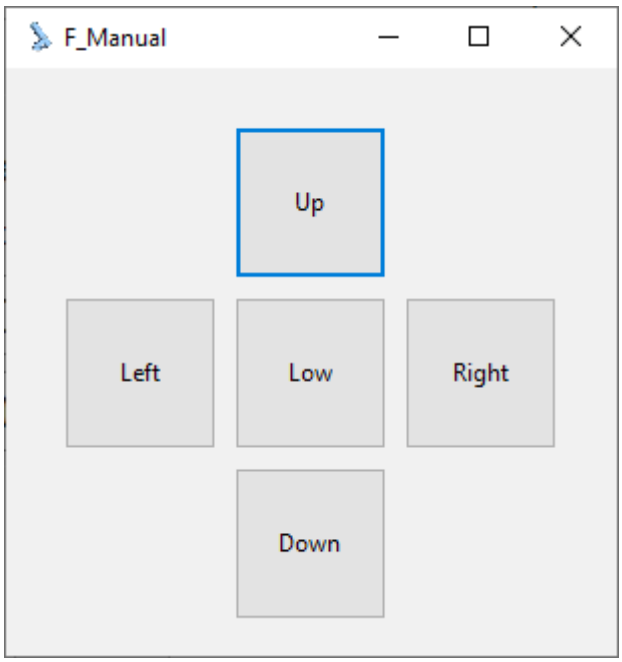
File format is:

```
[Dome]
door:toggle:Open;Close:$10:usbdome
lamp:toggle:On;Off:$02:usbdome
```

`[Dome]`	Is the section indicator
`door:`	Name of the function
`toggle:`	Type of function (Toggle,Click or Check)
`Open;Close:`	If toggle or click show button text
`$10:`	Bit position (hexadecimal indication of single bit)
`usbdome`	Indicate use of external board (or none for Frego2-board)

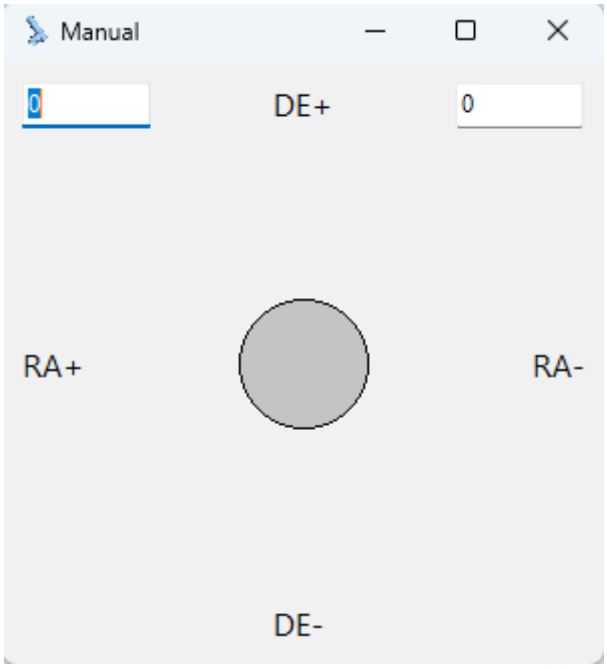
3 Manual



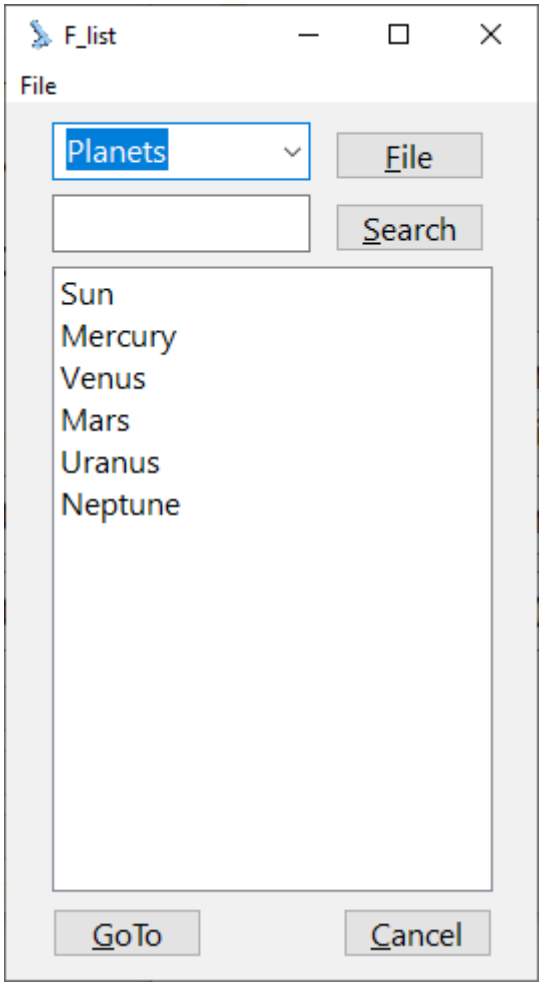


Manual moving or slewing the telescope
can be done by hand. This Window gives you this possibility. Left is RA+; Right is RA-; up is DE+; down is DE-.
If Manual Auto is on then the movement speed will increase gradually to maximum as long as the button is held down.
If Manual Auto is off a button will appear in the middle of the window. Pressing this button will switch speeds between "Low", "Mid" and "High"

An other way to control movement is to set manual control to JoyStick. This shows a joystick that can be dragged by the mouse in all directions.

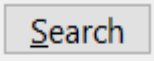


4 Objects



This windows gives the possibility to load a object file. Two files are included: A list of all Messier objects and NGC catalog. In this window it is possible to select a planet. Default it shows only the planets above the horizon at that particular time. The default viewed file is configured in the parameters windows under tab Objects.
Select an object from the list and press GoTo to enter the position of the selected object into the Next position fields and start moving.

Has the same function as menu item File/Open.

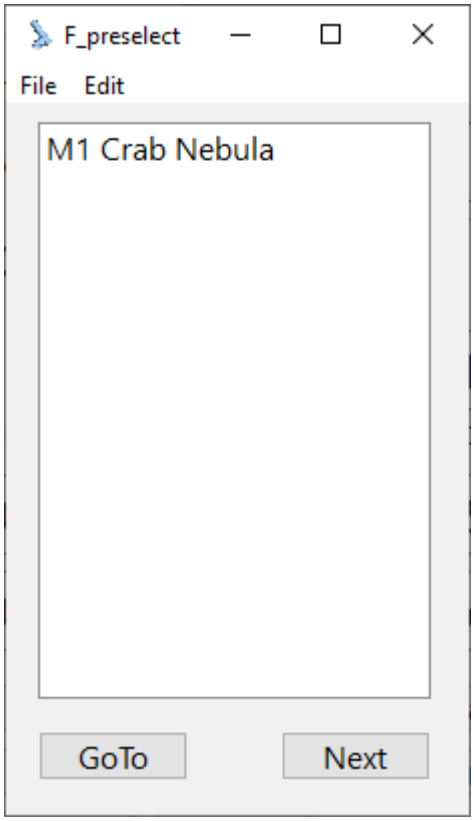


Whith the seach button items can be searched which contain the value netered in the field left of the button.

- File
  - Open Open a file dialog to select an objects file (default extension .lst)

5 PreSelect

5.1 Preselect window



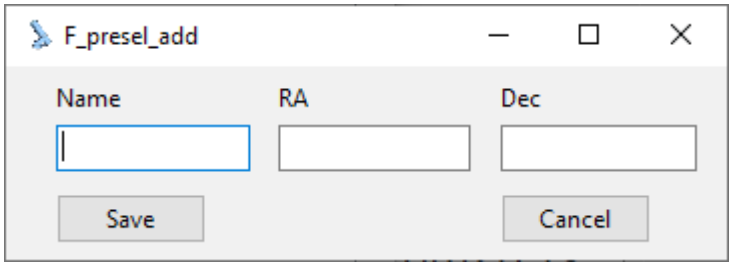
The PreSelect windows gives the possibility to create a list of objects, that later can be used to subsequently point to the selected objects. The list can be selected from known object list, used in the Object window, or manually or from Stellarium. Select an object from the list and press GoTo. To select the next object press Next. When the last object in the list is selected and Next is pressed the first object will be selected.

5.2 Menu

- File
  - Load — It is possible to load a previously created object list.
  - Save — A created object list can be saved to be used later or copied to an other computer.
  - Exit — Close the current list window.
- Edit
  - Add — With this function an object select window appears to select an object to add to the pre-select list.
  - Remove — A previously created line in the objects list can be deleted
  - Upmove — To change the order of the object list this option moves the selected item one row up
  - Downmove — This option move the selected item one row down

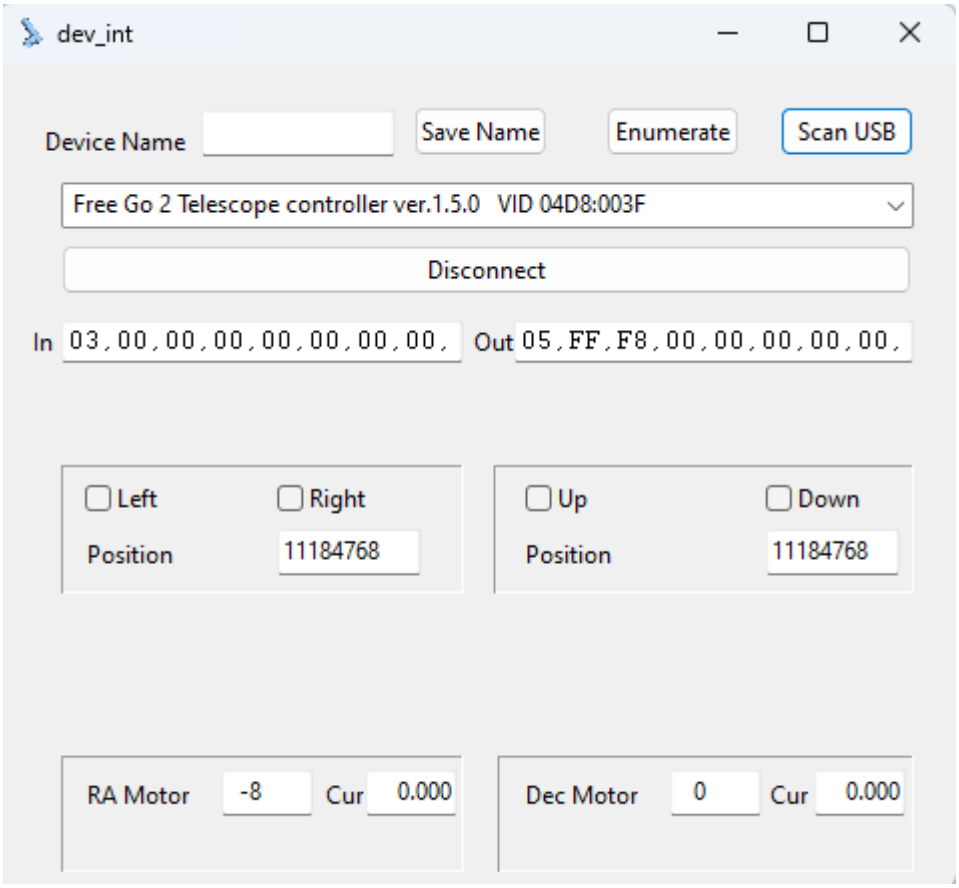
- ManualAdd This function opens a window to enter an object.

5.3 Manual Add



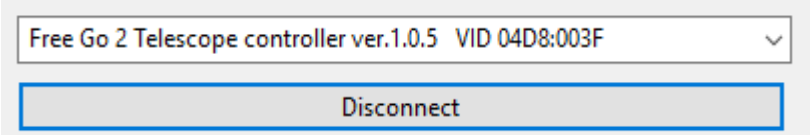
In this window Name, RA and Dec of an object can be entered which will be included in the list when pressing Save. When this window is active it is possible to send coordinates of an object from a star-chart program by selecting an object and give a got command in the star-chart program. This sends the coordinates to the Freego2 program and enters them in the RA and DE field. A name can then be added and saved to the list.

6 Hardware

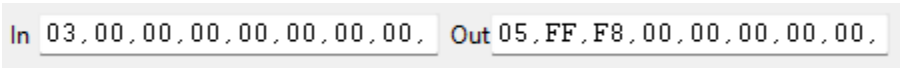


Hardware data presentation window.
Displays information about the USB connection and information to and from the FreeGo2-board.

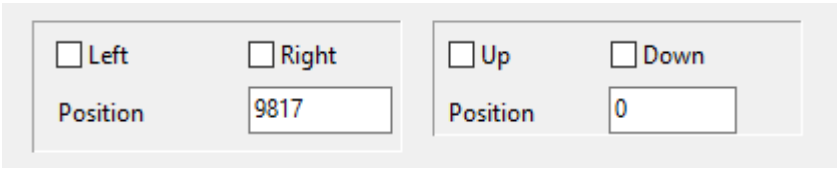
Device Name: If you have more than one device connected you can give them each a different name. To differentiate between same type of boards they can be enumerated. The device version will be extended with a number



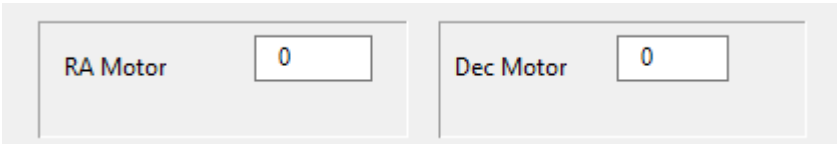
Normally there is only one FreeGo2-board connected to the PC. This board will be recognized by the software and connected. If there are more boards connected or if you want to use the simulator without unplugging the FreeGo2-board you can Disconnect, select an other device and connect again.



Control data as it is received from and transmitted the board.



Information from horizontal (RA) en vertical (DE) position and ST4 or handbox movement indicators.



motor control data as it is transmitted to the board

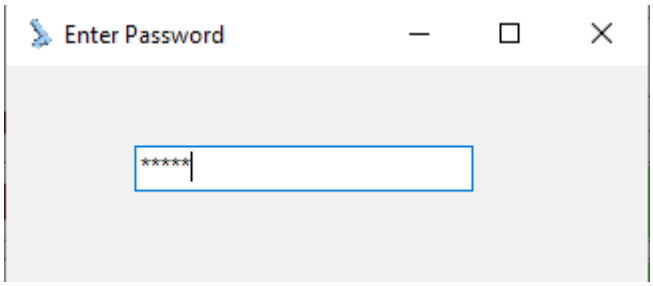
7 Configure

7.1 Parameter

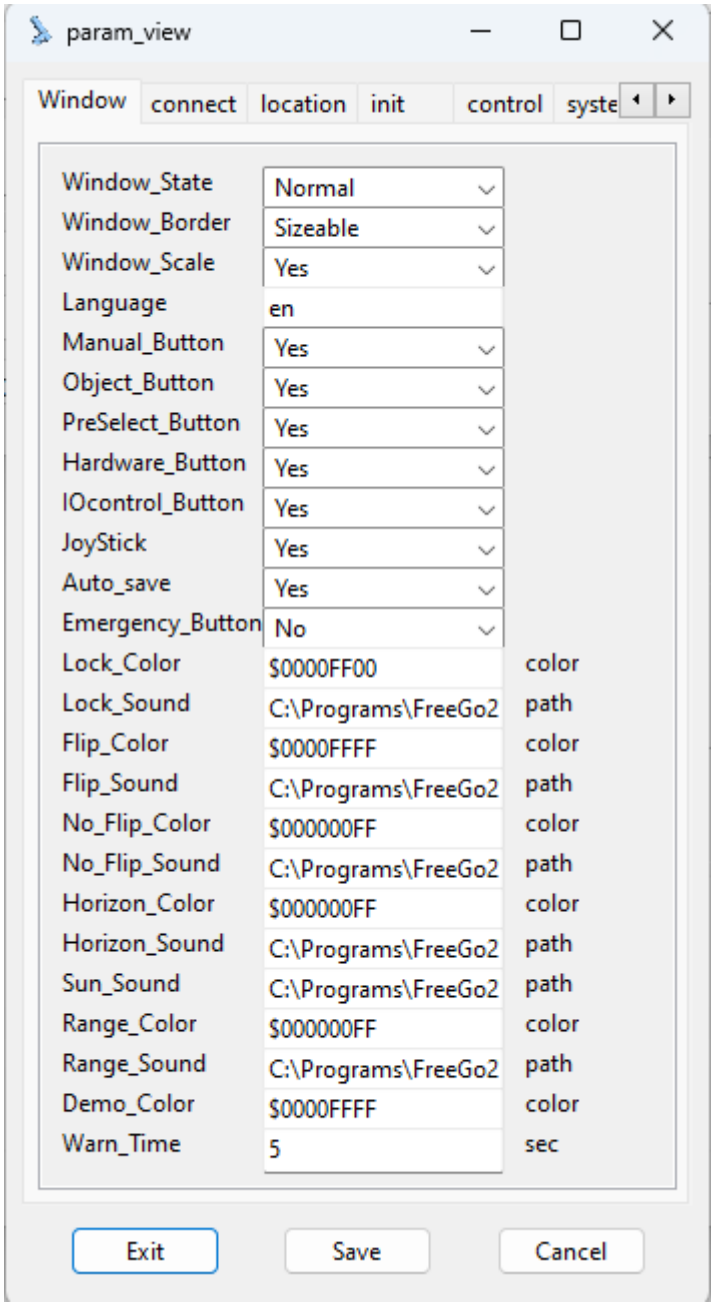
Parameters window is standard protected with a password.

The default pasword is Tru$t

in the tab system the password can be changed.



7.1.1 Window



Window state: Selection possibility is the standard window state Normal, Minimized and Maximized at the start of the program.
Window Border: Select None or Sizable
Window Scale: Select if main windows items are sizable or not.
Language: The value of the language file extension. Language file is in the same folder as the executable and is named free_goto.lng.xx, where xx is the language. Default the program has 2 languages en, nl, de and fr.
Button values: Manual, Object, Pre-Select, Hardware, IOcontrol. All these buttons can be made visible or not.
Joystick: Select movement buttons or a Joystick in the Manual

window.

Auto Save: If selected the configuration settings will be saved on closing the program.

Emergency Button: This shows an Emergency button which when pressed stops all activity of the telescope immediately. (and abrupt)

Lock Color: Select the color of the “current location” background when FreeGo2 is in tracking state.

Lock Sound: Select the sound to play when FreeGo2 enters tracking state.

Flip Color: Select the color of the “current location” background when position is passed the meridian.

Flip Sound: Select the sound to play when FreeGo2 passes the meridian.

No Flip Color: Select the color of the “current location” background when the meridian flip is not executed.

No Flip Sound: Select the sound to play when the meridian flip is not executed.

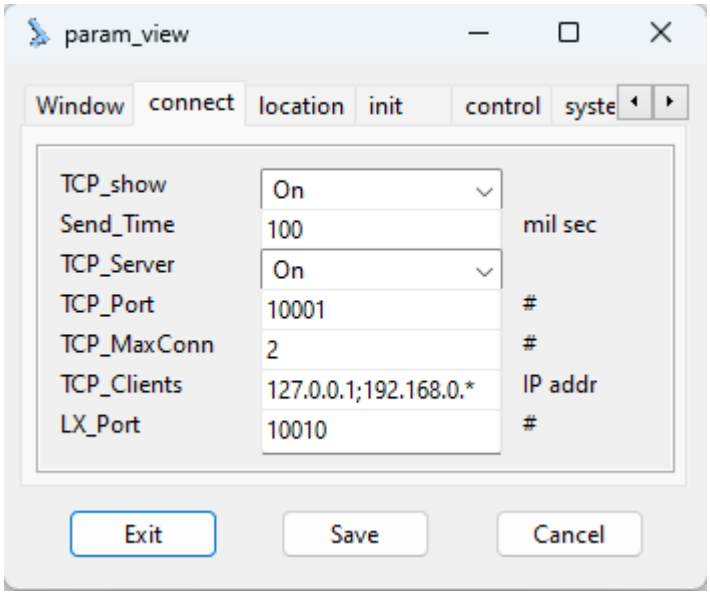
Horizon Color: Select background color of object window when the telescope points below the horizon or the entered destination is below the horizon.

Horizon Sound: Select the sound to play when telescope goes below the horizon.

Sun Sound: Select the sound to play when telescope points to the Sun.

Warn Time: Enter the time the warning message is showed.

7.1.2 connect



TCP show: show TCP connection LED

Send Time: interval of data packages (position and controls)

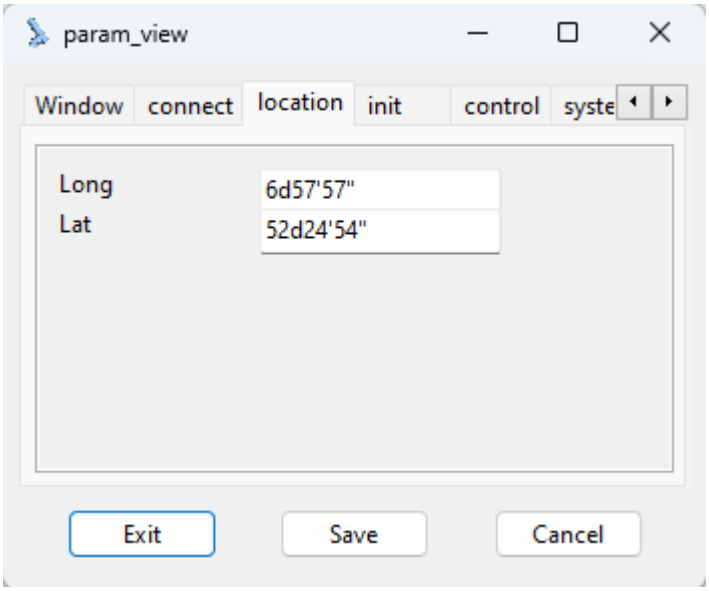
Bluetooth: Not used

TCP Server: enable/disable TCP server for remote connection

TCP Port: set connection port

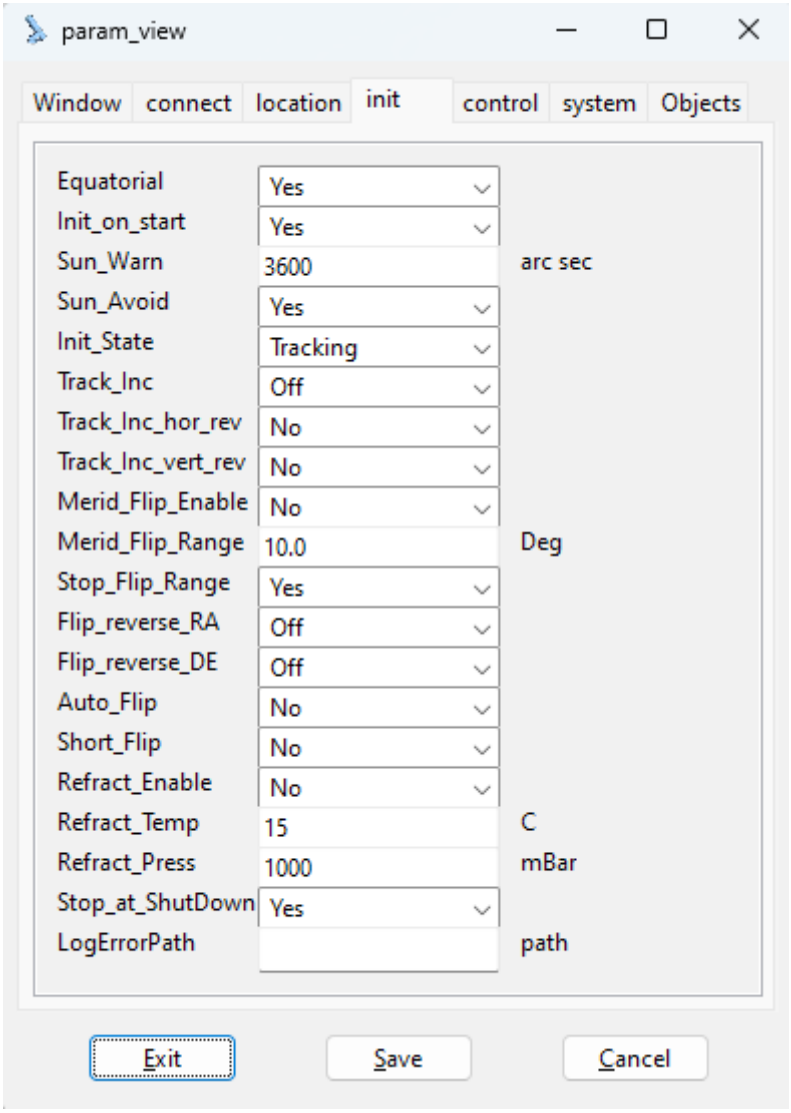
TCP MaxConn: maximum concurrent connections
TCP Clients: IP addresses of allowed connections
LX Port: Port number for LX200 communication protocol

7.1.3 location



Long Longitude location of the telescope (negative is west)
Lat Latitude location of the telescope

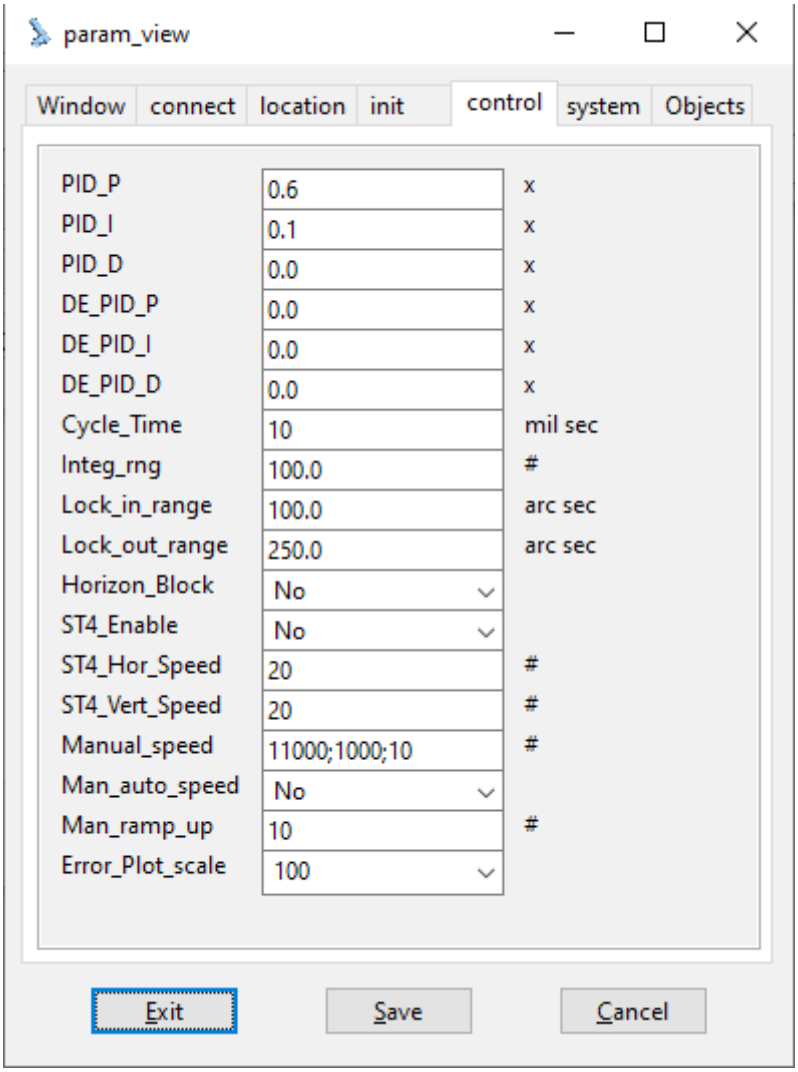
7.1.4 init



Equatorial	Mount positioned Equatorial or Azimuthal.
Init on start	Initialize position at start. (needed for incremental encoder use)
Sun Warn	give warn signal if telescope is within range of the sun.
Sun Avoid	Telescope will move around the sun
Init State	State telescope is in when starting the program
Track_Inc	Use incremental encoders (24bit) for more accurate tracking
Merid Flip Enable	Enable Meridian flip function
Merid Flip Range	range in degrees passed meridian to engage flip
Stop Flip Range	Enable stop tracking at end of flip range
Flip reserve RA	Reverse flip rotation for RA
Flip reserve DE	Reverse flip rotation for DE
Auto Flip	Enable automatic Flip
Short Flip	Stay in flip mode until destination is reached

Refract Enable	Enable refraction correction
Refract Temp	Enter temperature for refraction calculation
Refract Pressure	Enter air pressure for refraction calculation
Stop at ShutDown	Send stop to telescope on FreeGo2 sheutdown
LogErrorPath	Enter path/file to log the tracking control data

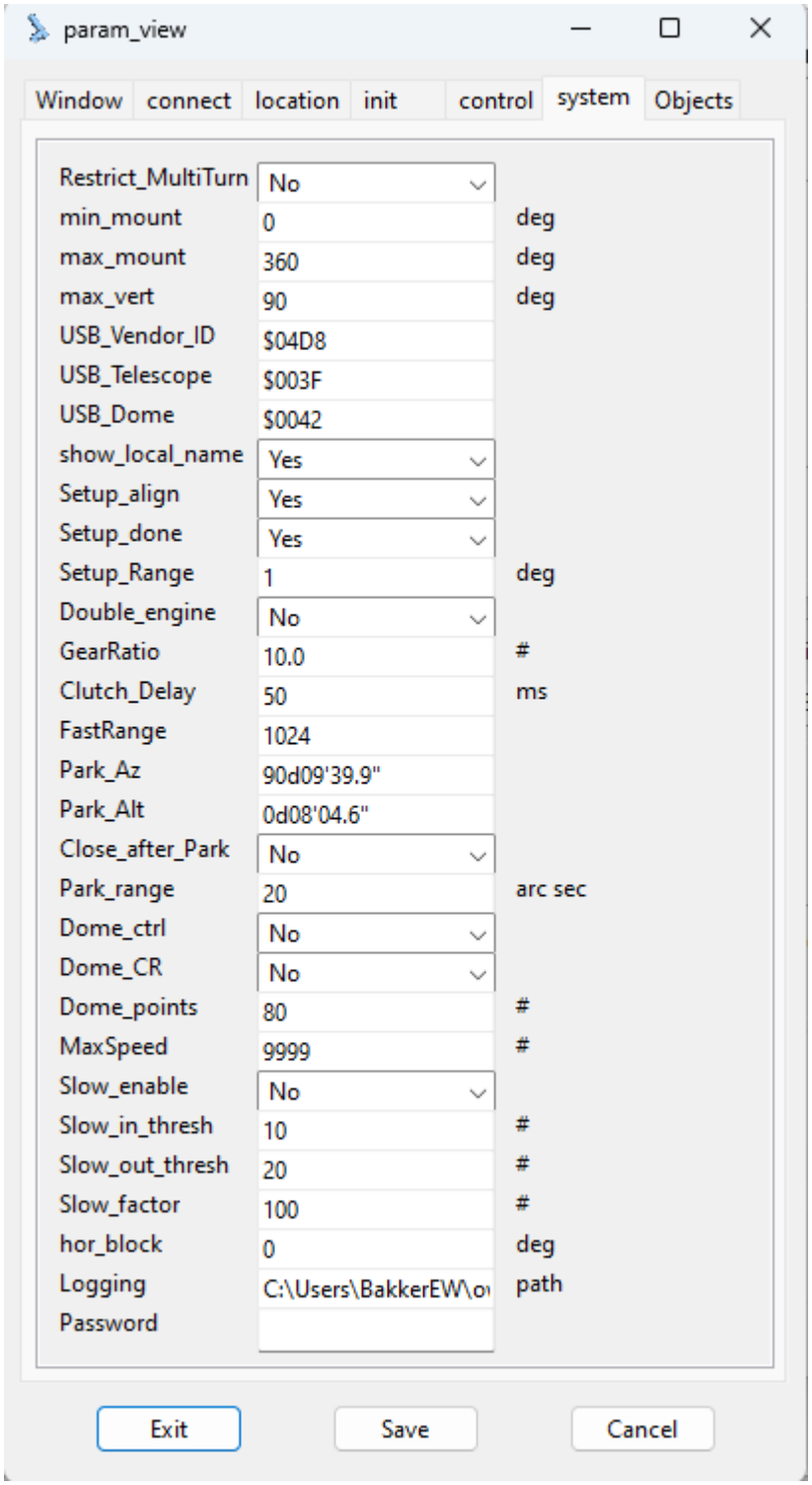
7.1.5 control



PID P	Proportional part value of the PID position control
PID I	Integral part value
PID D	Differential part value
DE PID P	Proportional part value of the PID position control for DE
DE PID I	Integral part value for DE
DE PID D	Differential part value for DE
Cycle Time	Time to wait for next PID position calculation
Integ rng	Range at which the integration will be used
Lock in range	Range in arc seconds at which “In position” is indicated
Lock out range	Range in arc seconds at which “in position” is off

Horizon block	Block manual moving below horizon
ST4 Enable	Enable ST4 interface
ST4 Hor Speed	Set Horizontal moving speed for ST4 movement
ST4 Vert Speed	Set Vertical moving speed for ST4 movement
Manual speed	3 speed values separated by semicolon “;” high, mid, low Range 1 – 10000 (higher will be topped to 10000)
Man auto speed	when enabled speed will slowly rise
Man ramp up	Set Autospeed rise ramp
Error Plot scale	Set initial scale for control error plot

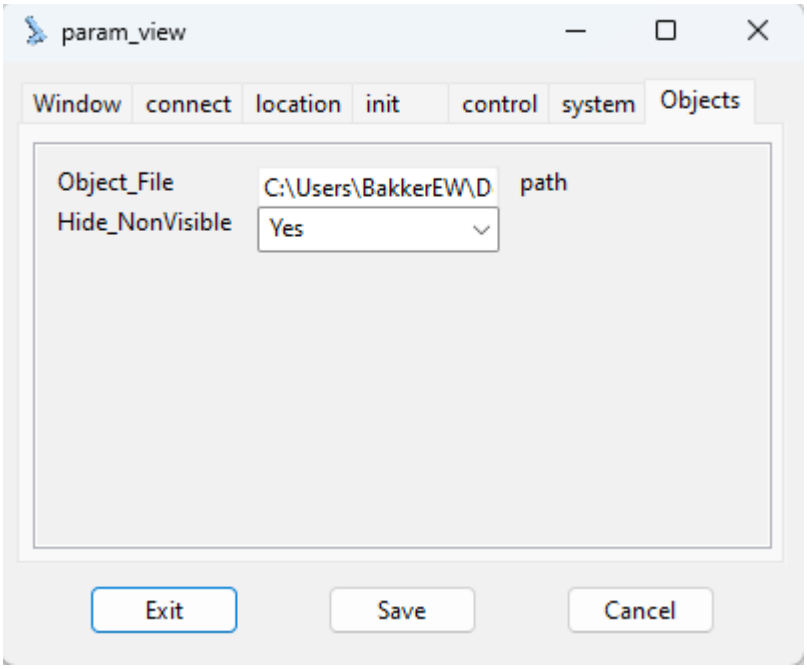
7.1.6 system



Restrict MultiTurn	Control the horizontal movement range of the telescope
min_mount	left movement limit in respect to North
max_mount	right movement limit in respect to North
max vert	maximum vertical angle (equatorial to polar and azimuthal to zenit)

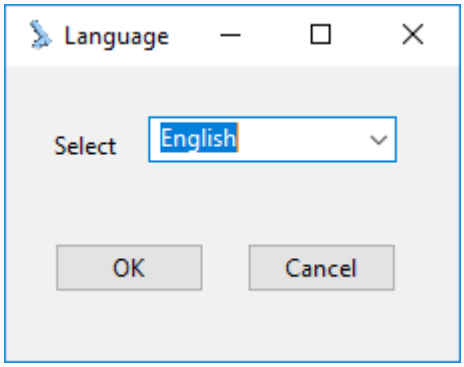
USB Vendor ID	USB Vendor ID number
USB Telescope	USB Product ID number of the telescope interface
USB Dome	USB Product ID number of the dome interface
Setup align	Should an align be initiated at startup
Setup done	Indication that setup is done
Double engine	setup telescope configuration for double engine movement
Gear ratio	For double engine speed difference between fast and slow
Clutch Delay	Delay between disengaging one side and engaging the other
Fast range	speed value to switch to fast motor
Park Az	Horizontal park position (in Azimuth coordinates)
Park Alt	Vertical park position
Close after Park	Close the program if park position is reached
Park range	Approach range value for parked detection
Dome ctrl	Enable dome control
Dome CR	Select dome rotation direction
Dome points	Number of rotation detection points on the dome
Max speed	maximum speed of the motors (default 10000)
hor_block	Deg allowed massed max_mount and min_mount befor movement is blocked
Logging	Path of command actions logging
Password	Change the parameter menu passowrd

7.1.7 Objects



Object File	Default loaded user defined object file
Hide NonVisible	show only objects above horizon

7.2 Language



Select the display language. Parameter names in in the parameters window will not change.

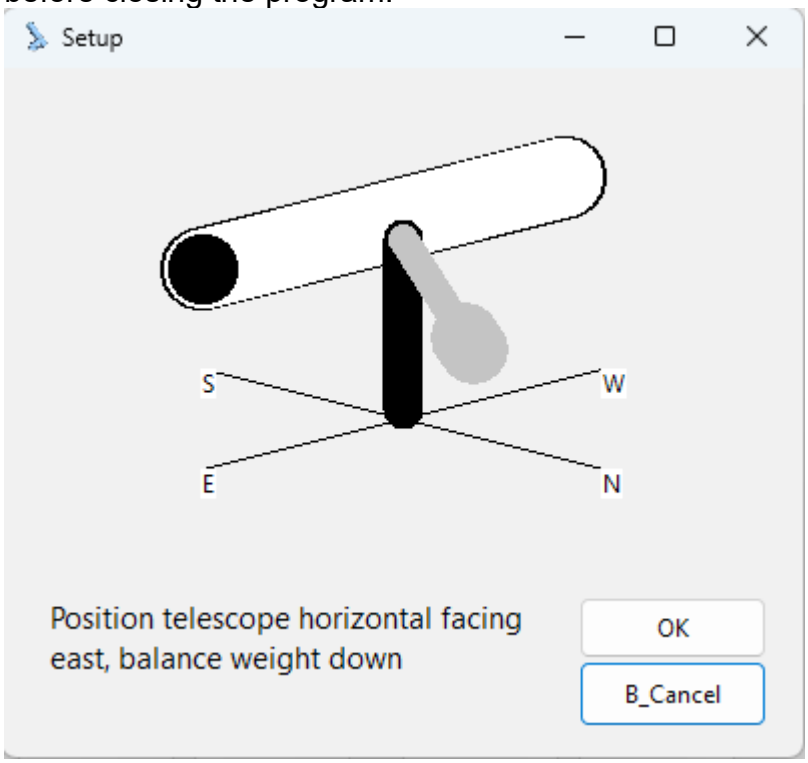
7.3 Factory Defaults

This function resets all settings of the Freego2 PC software. The settings are as the program started for the first time.

This does not change any settings on the FreeGo2-board

7.4 Initialize

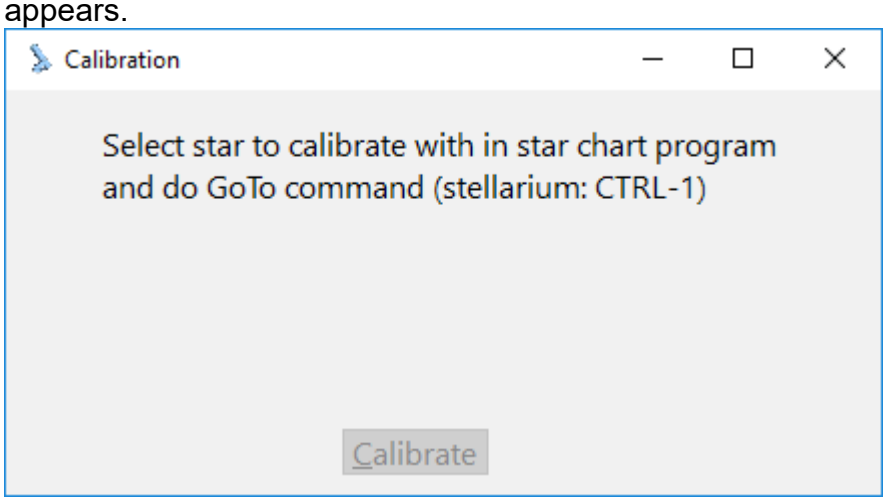
If the telescope is configured with incremental encoders this window will popup every time you start the program unless you parked the telescope before closing the program.



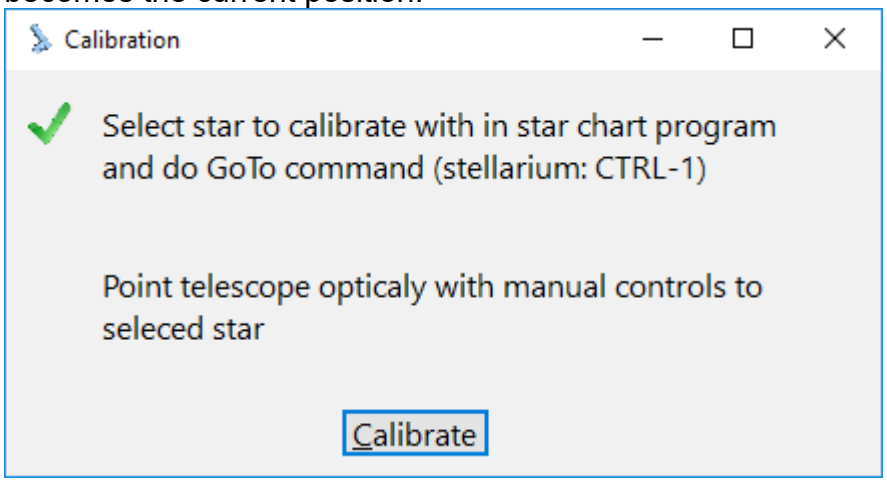
When OK is pressed the program assumes the telescope is facing east and aligns with the current RA/DE coordinates

7.5 Star Calibrate

Star calibrate is a one star alignment procedure. When started a window appears.

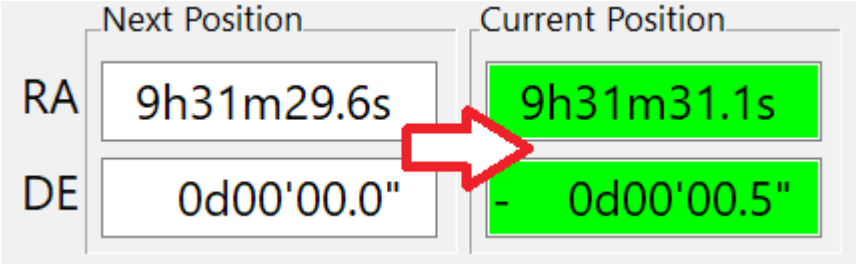


Select a star you have in your telescope with your star chart program (e.g. Stellarium) and give the goto command in your star chart program. The freego2 program locks these coordinates in the Next position fields but does not automatically moves to the given coordinates (as a normal goto would do). Now move the telescope with manual buttons so it views the selected star in the center of your eye-piece and clock "Calibrate" so the Next position becomes the current position.



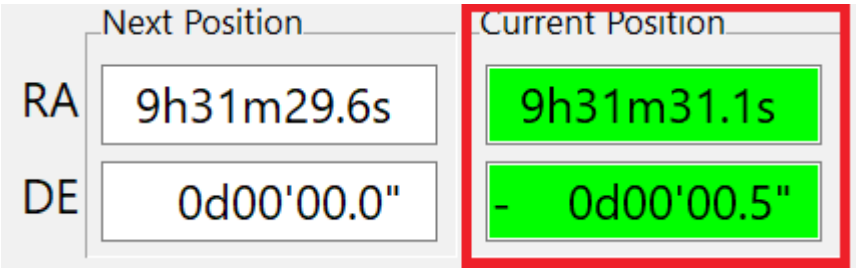
This procedure can be done in the reverse order. So first move the telescope to a star, then do Star Calibrate, select the star in starchart program give goto command (in starchart program) and press Calibrate button (the selected star from starchart program is already in telescope view center)

7.6 Calibrate Current



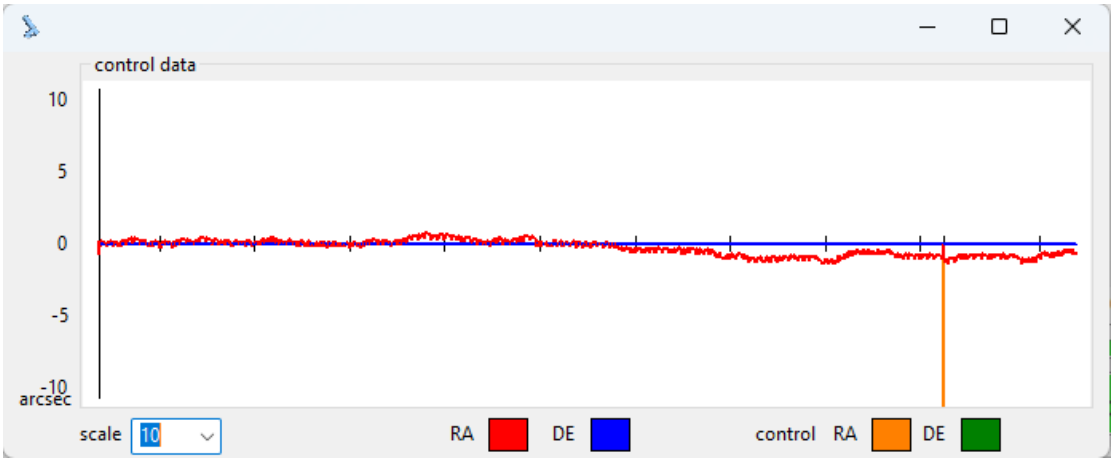
This Command assumes that the "Next Position" is the current position. This way a quick calibration is possible by a "GOTO' command to an object, put the object in the center of the eye-piece and click "Calibrate current".

7.7 Set Park Position



The set park position takes the current RA/DE position of the telescope and converts this to Az/Alt coordinates and stores these values. This way the park position is relative to the mount (earth) and not celestial coordinates.

7.8 Control Display



This window shows the difference between the requested (Next) Position and the Current Position. The scale is in arc-seconds. Also shown are the control signals for RA and DE sent to the board to move the telescope. This display only shows current data when the system is in Tracking mode.

Lines can be hidden by double clicking in the color-box identifying the line.

8 Help

8.1 Help File

This menu Item opens the provided help file. If there is a helpfile in the selected language than that will be opened otherwise the English version will be opened.

8.2 About

The about window gives some information on the program.

8.3 Create Link

With this menu item you can create a short-link file (.lnk) on the desktop to your program. If you gave the USB device a specific name (in the hardware interface window) the current config-file will be saved with a name containing the USB name and will be set in the .lnk file as init file parameter. This way you can configure and use multiple frego2 telescopes on a single PC.