The Cyclops software is a program developed in C++ using Spatial Analyzer’s SDK which allows the user to interact with Spatial Analyzer to take measurements and run measurement plans using either the interface for Cyclops, or by using hot keys on a keyboard. The primary purpose of the Cyclops program is to increase the efficiency of a survey by allowing one person to both control the laser tracker and handle the SMR target.

The Cyclops program was developed for use of the 403 Laser Trackers and has not been thoroughly tested on any other instrument, thus it cannot be guaranteed to work with the 903 laser tracker or any measurement arms.

**For future development**

The cyclops program has never been claimed or licensed by Argonne National Laboratory and currently resides in a public git repository. If future development on the Cyclops software is desired, the source code can be found here:

<https://github.com/rexngreen/Ack>

The installer was created using Inno Setup, and the repository also includes a Cyclops\_Setup\_2.0.iss file. This is the file that was used with Inno Setup to create the included installer. The .iss file can be edited and then run with Inno Setup to create a new .exe installer file if it is still desired for future versions of the Cyclops software. Otherwise, you can devise whatever method you would like for installing the software onto computers.

**Installation**

There is a Cyclops\_Setup.exe file in the Git repository. Simply run the .exe file to install the Cyclops software. I realized upon running through this for the purposes of this documentation that the installer doesn’t allow you to chose where the Cyclops program gets placed. My apologies. However, if you leave the option to “Create a desktop shortcut” checked, then once the desktop shortcut is created, you can right click on the desktop shortcut and select “Open File Location” to open the location of the .exe file (named Ack.exe, in tribute to the roots of the program) and all its supporting files. You can then move them to anywhere you would like, just be careful to keep all the files together.

**Supporting Files**

Each of the listed supporting folders or supporting files must be located in the same directory as Ack.exe, otherwise the Cyclops program will fail to find them.

**MEASUREMENT\_PLANS**

MEASUREMENT\_PLANS is a folder containing Spatial Analyzer measurement plan (.mp) files. This folder is searched when the Cyclops program starts and the location of each measurement plan is saved in the program for the duration of its runtime, allowing the measurement plans to be run from Cyclops, without having to import and run them in the current SA job.

Important notes: This folder is only every searched during program launch. If, during the lifetime of the program, the user adds or removes files from this folder, Cyclops will not know or update the dropdown list until it is closed and re-opened. Trying to run an MP that has been removed from this folder will result in an error. If Cyclops is unable to find this folder, it will load with an error.

**Supporting\_MP**

Supporting\_MP is a folder which contains .mp files which are used for certain basic functions built into the Cyclops software. Altering or removing the .mp files in this folder will result in the basic functionality of the Cyclops software being changed or even eliminated.

These files may need to be edited if the current functionality that they provide doesn’t produce desirable results or if changes to Spatial Analyzer have impacted their functionality. Altering these files should be done with caution.

This folder must be located in the same directory as Ack.exe. If Cyclops cannot find the folder or its files, the software will fail to function correctly.

**MeasurementModes.txt**

The Cyclops software allows the user to choose the measurement mode that they wish to take measurements. Instead of loading in every default type of measurement mode, the user can choose to load only the options that are relevant to their current work by editing this file. Measurement plans can be added to or removed from this file as the user sees fit. Cyclops loads in the different types of measurements on program launch and does not update its list of measurement modes until the program has been closed and re-launched. So if the user updates the list of measurement modes, it will not take effect until the next time the Cyclops software is launched.

When adding measurement modes to this file, be sure to add one singular measurement mode per line. It is important that the measurement mode is added to the file exactly as it appears in Spatial Analyzer, without any additional spaces at the start or end of the name.

Examples:  
Standard Pt. To SA

Steady Pt. To SA

Fast Stable Pts. To SA

**Nominal\_Point\_Names.txt**

The Nominal\_Point\_Names.txt text file is also loaded by Cyclops at the launch of the program and will not be updated again for the duration of its runtime. Any changes made to this file will not take effect until the Cyclops program is closed and re-run.

The Nominal\_Point\_Names.txt text file is used by Cyclops while locating the instrument. The file is formatted in the following way: The first line of the file is the name of the nominal point group to locate to. The second line of the file is the name of the point group into which the measured points will be placed. Each subsequent line in the file is the base name of a point which can be shot. See Point\_Names.txt for more information on these base point names.

**Point\_Names.txt**

The contents of Point\_Names.txt is also loaded by Cyclops at the launch of the program and will not be updated again for the duration of its runtime. Any changes made to this file will not take effect until the Cyclops program is closed and re-run.

Every line of the file should contain one singular base point name. When the Cyclops program is being run, the user can cycle through these base names, increment, and decrement these point names at the press of a button, rather than typing each individual point name into Spatial Analyzer. Blank lines are ignored.

Each base point name typically represents a feature or a component to be surveyed. For example: column\_front\_1, upstream\_plate\_top\_1, FD30\_BM3\_1, etc.

In the current version of the Cyclops software, every base point name must end with a number. Otherwise, when the program attempts to increment or decrement a point (which is does automatically after taking a measurement), the program will crash. If this behavior is undesirable or if users wish to be able to increment letters as well as numbers, the source code could be altered to fix this.

**Using Cyclops**

The current Cyclops interface consists of two parts. The main menu with which the user can interact and perform functions, and the display screen, which displays the current point group and point name in a larger font so it can be read from afar.

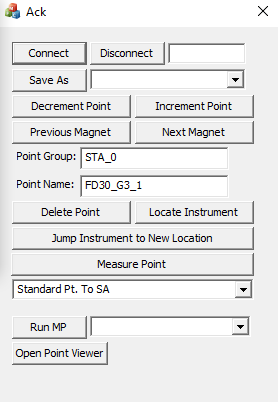


Figure : The main menu, with which the user can interact to control the program

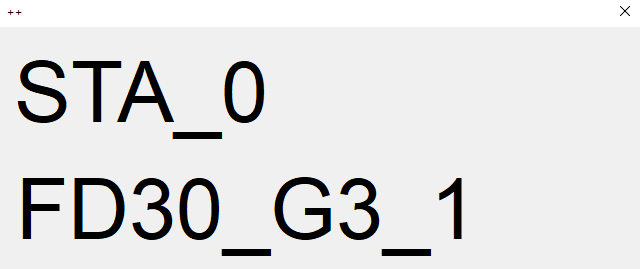


Figure : The display window, showing that the current point group is STA\_0 and that the current point is FD30\_G3\_1

**Getting Started**

Before using the Cyclops program, ensure that all the necessary supporting files are set up correctly and to the user’s liking. Every folder and every file that the Cyclops program looks for and information on their usage can be found in the Supporting Files section of this document. Every supporting item must be in the same directory as the Ack.exe file, otherwise the Cyclops program will fail to locate the files and their information.

Because of the restrictions of various Spatial Analyzer licenses, this software requires an Ultimate License in order to use the Cyclops program.

**Getting Connected To SA**

1. Open Spatial Analyzer and open the desired job file
2. Connect the measurement instrument
3. Perform any other setup in Spatial Analyzer that is desired before starting to take measurements
4. Launch the Cyclops software
5. Click the “Connect” button in the top left corner of the main menu
6. If Cyclops has connected to Spatial Analyzer, a popup will appear saying “Success!”

Important note: Click the “Disconnect” button in the main menu of Cyclops before closing the software. Not doing so may cause errors with Cyclops being unable to connect to Spatial Analyzer in the future. If such an issue does occur, simply closing all instances of Cyclops, the Spatial Analyzer SDK Engine, and Spatial Analyzer before trying again should resolve the issue.

**Using Cyclops**

* **Connect** button will allow the Cyclops program to connect to Spatial Analyzer
* **Disconnect** button will disconnect the Cyclops program from Spatial Analyzer
* The text box in the upper right-hand corner of the can be used to enter a desired name for the connected Spatial Analyzer file. Clicking the **Save As** button will save the connected Spatial Analyzer file using the name that is shown in the dropdown menu next to the **Save As** button
* The dropdown menu next to the **Save As** button will offer the user the choice between the name entered in the text box in the upper right-hand corner, as well as various options where USMN\_Iteration\_# has been appended to the name entered in the text box. This was deliberately designed for module assembly and can be altered in the source code
* **Decrement Point** decrements the current point by 1. If the current point is Flange\_21, decrement point will change the current point name to Flange\_20
* **Increment Point** increments the current point by 1
* **Previous Magnet** will change the point name to the previous base point name as listed in the Point\_Names.txt file.
* **Next Magnet** will change the point name to the next base point name as listed in the Point\_Names.txt file
* The text box next to the text which says “Point Group:” can be manually changed to overwrite or customize the current point group
* The text box next to the text which says “Point Name:” can be manually changed to overwrite or customize the current point name
* **Delete Point** will delete the point from Spatial Analyzer from the active collection which has the currently shown point group and point name
* **Locate Instrument** uses the Nominal\_Point\_Names.txt file. This feature works in two parts. At first click, it will begin take measurements and save them in the point group shown. Upon being clicked again, it will perform a best fit location of the instrument to the nominal point group listed in the Nominal\_Point\_Names.txt file
* **Jump Instrument to New Location** follows the same sequence as Locate Instrument, but with the added step of jumping the current instrument
* **Measure Point** takes a measurement using the currently selected Point Group, Point Name, and Measurement Mode. It will then increment the current point name to prepare for the next measurement.
* The dropdown menu below Measure Point is used to select the Measurement Mode that is used for taking measurements. The measurement mode options that it has are loaded from the MeasurementModes.txt file on program launch
* **Run MP** will run the mp that is selected from the dropdown menu right beside the button. The possible measurement plan options are loaded from the MEASUREMENT\_PLANS folder on program launch
* **Open Point Viewer** will re-open the display window if it has been closed

**Using Cyclops With A Number Pad**

Several of the Cyclops software’s functions can be controlled with a number pad. Please note, the number keys on the top row of a keyboard above the letters will not control the Cyclops program, it must be a number pad. This was an intention decision as it allows you to still type numbers while using the Cyclops program. A Bluetooth number pad or programmable keypad can also be used. Below are the hot keys for each function

**Button on the number pad** function that it activates on press

**8** Previous Point

**9** Next Point

**5** Previous Magnet

**6** Next Magnet

**0** JumpInstrument to New Location

**1** Delete Point

**-** Measure Point

**Common Issues**

Below is a short list of common causes for errors while using Cyclops:

* Not disconnecting from Spatial Analyzer before closing Cyclops. Because of how Spatial Analyzer’s SDK Engine works, if Cyclops is connected to Spatial Analyzer and you close Cyclops, it often renders the user unable to connect cyclops to Spatial Analyzer again until every instance of Spatial Analyzer and every instance of Cyclops and the SDK Engine have been closed
* Cyclops not connecting to Spatial Analyzer. Spatial Analyzer’s SDK Engine can be really persnickety about connecting to Spatial Analyzer for a variety of reasons. The most surefire way to reset this issue and be able to connect properly is to close Cyclops, close every instance of the SDK engine, close every instance of Spatial Analyzer, wait a moment, and then re-open Spatial Analyzer and Cyclops and try again
* STA\_14216814616 or some other bizarre number when trying to locate the instrument. This happens when Cyclops is trying to locate an instrument but is unable to find an active instrument. The likely cause is that Cyclops is either not connected to Spatial Analyzer, or there are no live instruments in the Spatial Analyzer job
* Cyclops is not taking measurements and is simply incrementing my point. The most likely cause is that Cyclops is not connected to Spatial Analyzer
* Having multiple Spatial Analyzer files open at once may cause a variety of unexpected behaviors from the Cyclops software. Disconnect Cyclops from Spatial Analyzer, close all Spatial Analyzer files besides the active job, and try again

**Suggested Improvements**

Some things I would recommend improving about Cyclops that I never had the opportunity to do during my time as a Survey and Alignment Technician here at Argonne.

* Change how the Save As feature works. It was designed specifically for module assembly and likely will not be super useful for other applications
* Add a “Collection” text box for the user to change the collection being used without having to do so in Spatial Analyzer. During module assembly, it had been rare for a technician to need to use more than one collection for a survey, so it was not a needed feature. However, it could be very useful for other types of work
* Make it so that locating an instrument doesn’t use fast mode. Once upon a time, the locate features of Cyclops used whatever measurement mode was currently selected in the main menu, but I received complaints that it was slow for locating, because during module assembly we exclusively used fast mode for locating but standard mode for taking measurements. As a result, I changed the locating features to simply use fast mode, because that was optimized for module assembly. However, I imagine fast mode will often not be the ideal measurement mode for locating instruments outside of module assembly
* Change the names of the buttons “Previous Magnet” and “Next Magnet” to “Previous Feature” and “Next Feature”. The current naming made sense for module assembly when almost everything that was measured using Cyclops was a magnet on a magnet module.
* The ability to customize what button performs what feature. This isn’t actually vital or probably important, but I always thought it would’ve been neat to add.