PlaneWave™ INSTRUMENTS

IRF90

User Manual



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Introduction

User Manual Overview:

This user manual is a guide to assist personnel with a basic understanding of the operation and setup of the IRF90. It may not cover future modifications made by PlaneWave or the customer. Features and appearances may vary between models due to continuous improvements, so the images may not exactly match your equipment. Always review the entire manual thoroughly before operating the EFA.

For any questions or assistance please contact PlaneWave support. PlaneWave is not liable for any damage or injury resulting from this product.

General Disclaimers:

- Use at Your Own Risk: The IRF90 is designed for astronomical observation and imaging purposes. While we strive to ensure the highest quality and reliability, its use is ultimately at the discretion and risk of the user.
- Professional Installation Recommended — Proper installation of the IRF90 is crucial for optimal performance. We strongly recommend professional installation by trained personnel familiar with astronomical equipment.
- Check Compatibility: Ensure that all components are compatible with the IRF90 before use. Incompatibility may result in damage to equipment or compromised performance.
- Operational Safety: Exercise caution when operating the IRF90, especially during setup and operation. Avoid placing hands or objects near moving parts to prevent injury or damage.
- Environmental Considerations: Protect the IRF90 from adverse environmental conditions such as extreme temperatures, moisture, dust, and vibrations. Failure to do so may affect performance and longevity.
- Voltage Warning: The IRF90 operates at 12V 5A. Exercise extreme caution when accessing internal components or performing maintenance to avoid the risk of electric shock.
- Hot Swapping Warning: Do not attempt to connect or disconnect any components to the EFA Controller while it is powered on. Hot swapping may result in damage to the equipment or pose a risk of electric shock.
- Surge Protector: The use of surge protector is recommended to avoid any damage to electrical components that will result in a repair not covered by the warranty.
- Limitations of Liability: PlaneWave Instruments shall not be held liable for any damages, direct or indirect, arising from the use or misuse of the IRF90, including but not limited to loss of data, loss of revenue, or personal injury.
- Modifications and Alterations: Any modifications or alterations made to the IRF90 without authorization from PlaneWave Instruments may void the warranty and compromise its safety and performance.
- Technical Support: For assistance with setup, troubleshooting, or any inquiries regarding the EFA, please contact PlaneWave Instruments' technical support team for prompt assistance.

Product Information

The IRF90 is a large capacity Integrated Focuser and Rotator for use with Alt/Az, or equatorially mounted systems.

Specifications:

- Weight: 12 lbs.
- Weight Capacity: 40 lbs. (18 kg).
- Backfocus: 3.5” fully racked in and 4.7’ when fully racked out.
- Focuser Range: 30 mm (30000 microns).
- Aperture: 90mm
- Rotator Range: 365 degrees with hard stops to eliminate any chance of cord wrap.
- PWI4 software: For autofocusing and optional field de-rotation (if using an Alt/Az mounted system).

Electrical Connection Panel:

- CAT6: RJ-45 port that is used to connect to the EFA-240901 focus/rotate port.
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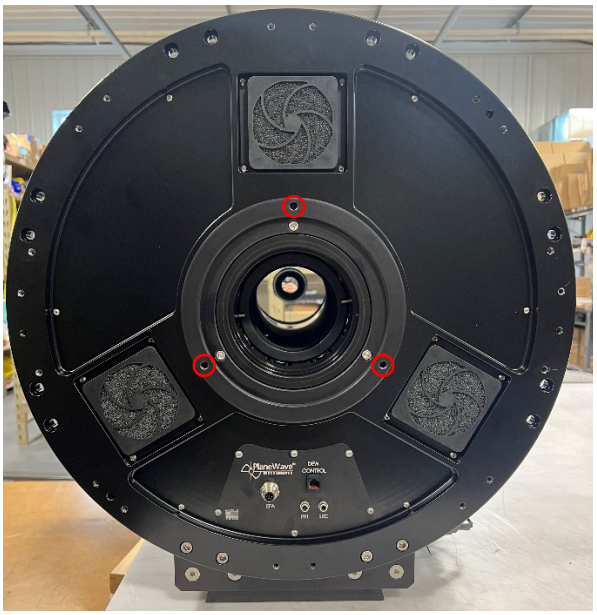
Included Items:

Item	Quantity
CAT6 Focus/Rotate Cable	2
5/16-18 x1/2 SHCS	3
IRF90	1

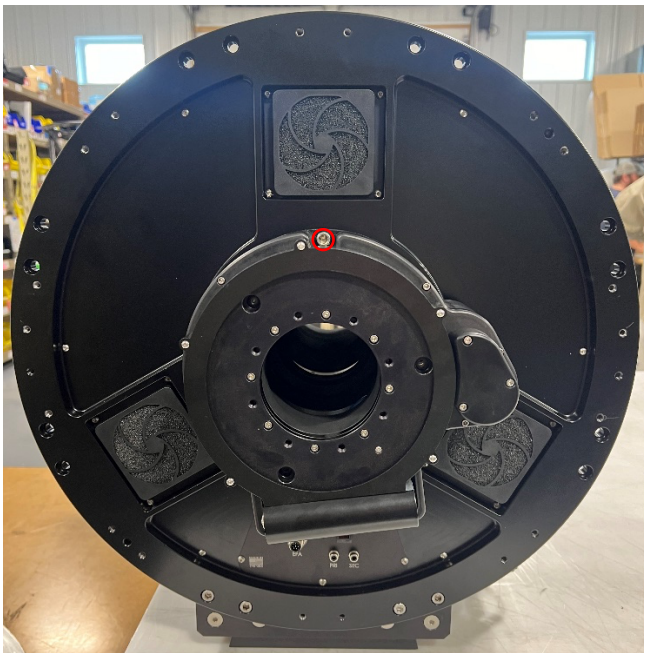
Installation:

Mount the IRF90:

1. Locate the mounting holes located on the backplate of the telescope.



2. Use 3 (5/16 -18 x 5/8 SHCS) to mount the IRF90 onto the backplate of the telescope. (Only one mounting screw is visible in the picture shown.)

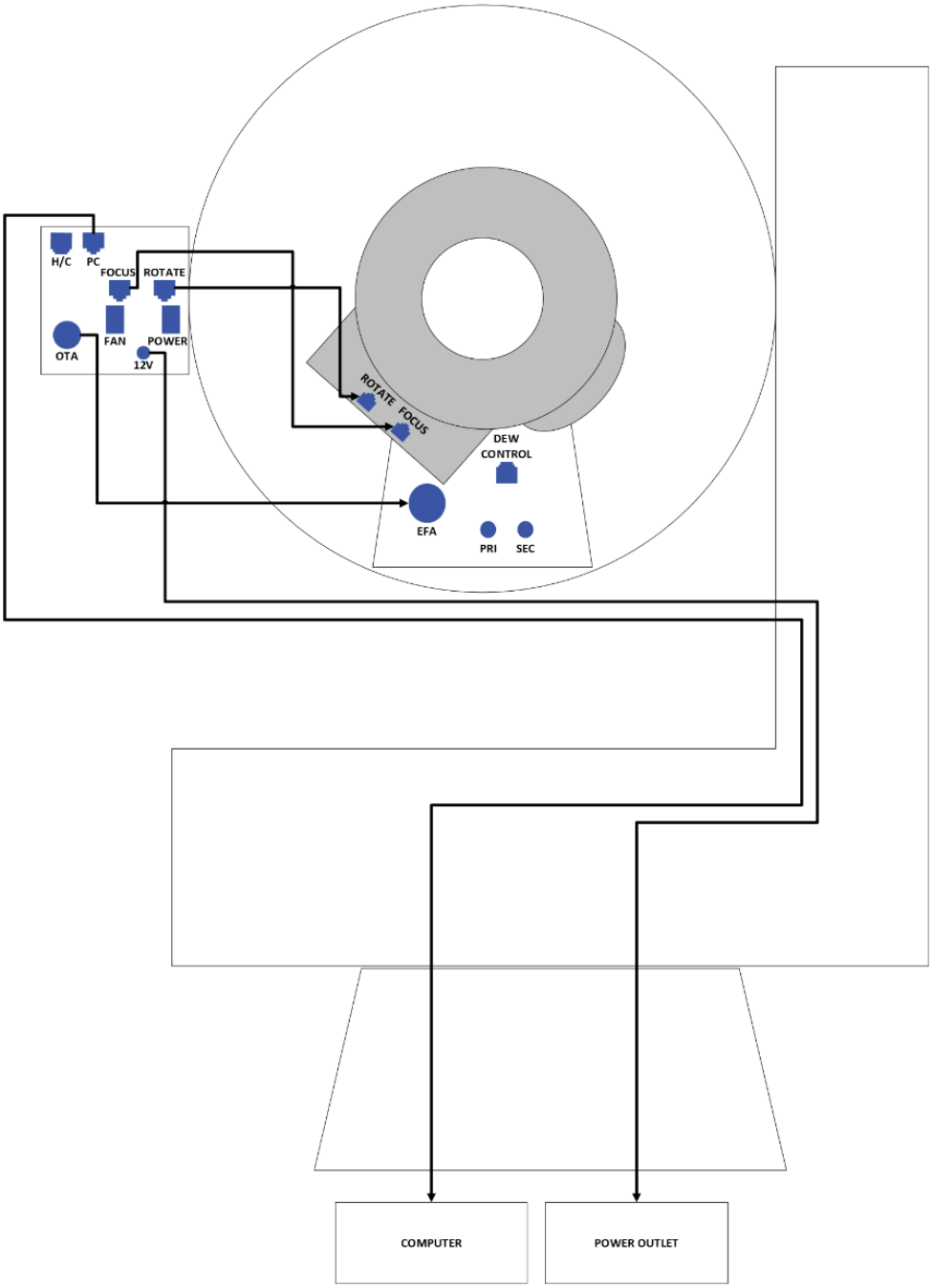


3. There are 8 (1/4-20) threaded holes that are available for attaching spacers and adapters.

Note: Using any screws longer than provided (1/4-20 x 1/2 SHCS) with adapter #200361 may press onto the rotating plate within the IRF90 and cause overcurrent errors and physical damage to the rotator. This will NOT be covered under the warranty.

4. Connect the supplied CAT6 Focus/Rotate cables to the installed EFA-240901 Controller.

IRF90 wiring diagram for illustrative purposes

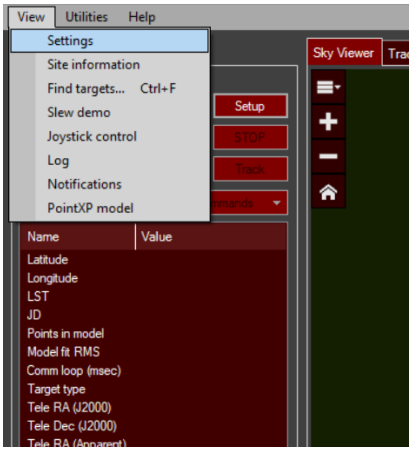


Software Setup

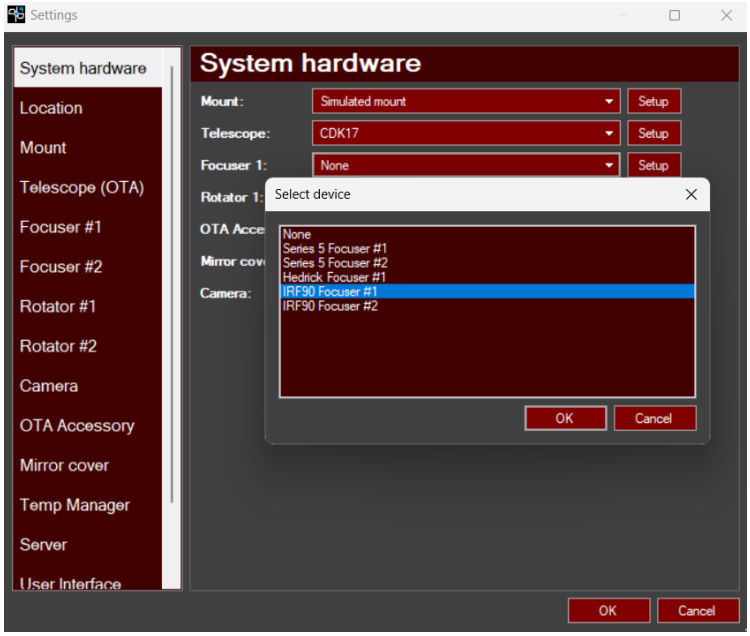
This manual will provide information on how to connect to the EFA with an IRF90 within PWI4. For direct information regarding PWI4, refer to the PWI4 manual.

Connect to EFA via USB:

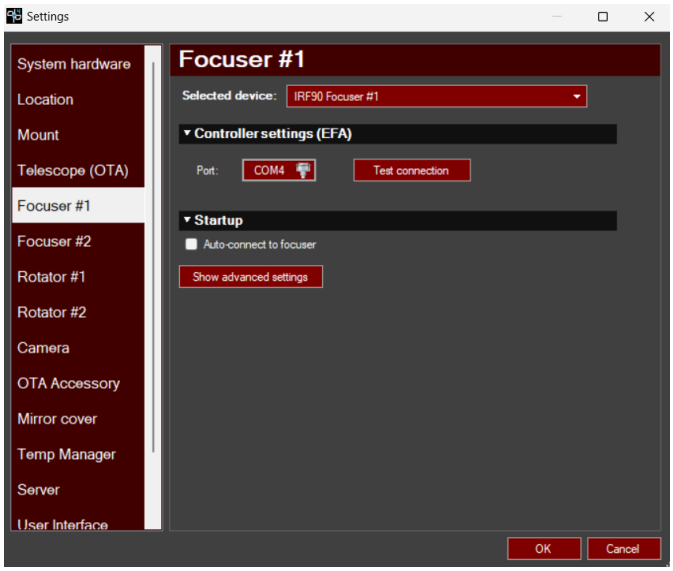
1. Open PWI4 > View > Settings



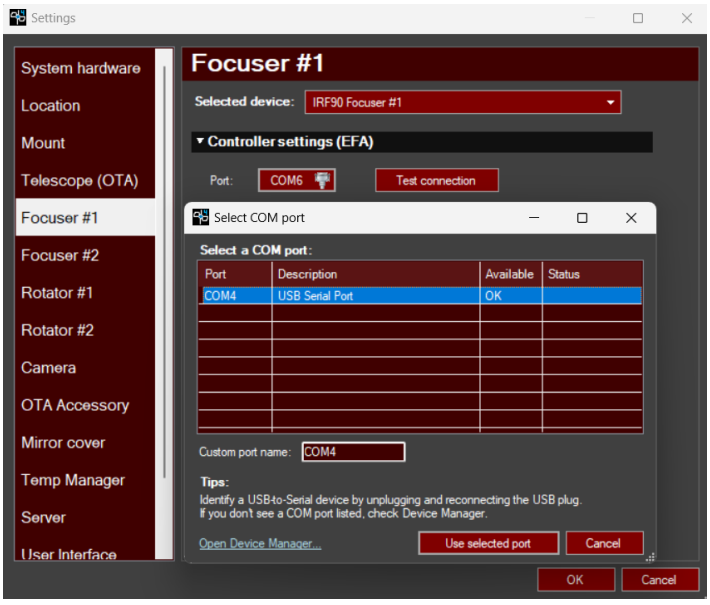
2. From the Focuser #1 tab select the drop-down menu > Hedrick Focuser #1



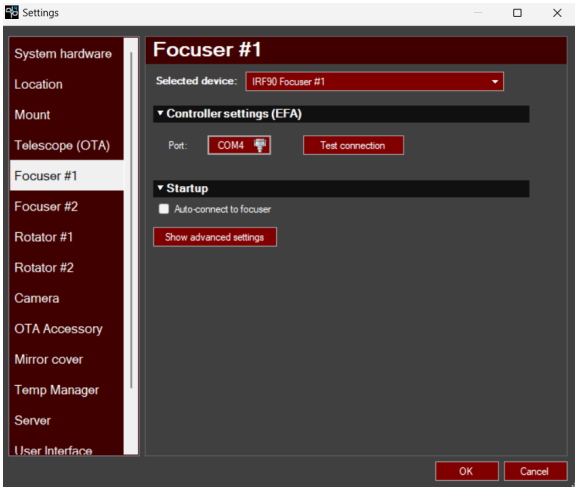
3. To select the correct port click the COM button. The EFA will show up as USB Serial Port. The availability will display OK when not connected and will change to IN USE when connected via PWI4.



4. Select “Use selected port”



5. Select OK from the settings window.



6. PWI4 will auto populate the same IRF90 connection for the Rotator #1 tab.

Controlling the Focuser:

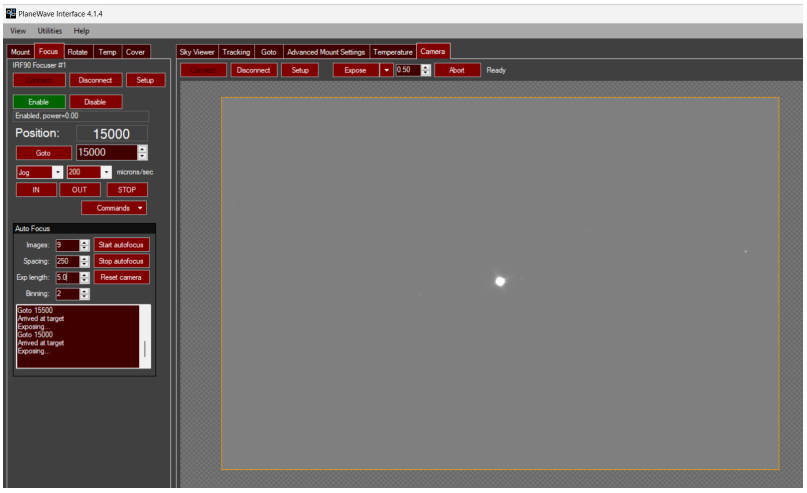
This will provide an overview of the buttons and their functions within PWI4 for controlling the IRF90 Focuser.

1. **Connect and Disconnect:** These buttons provide/end communication between the PWI4 and IRF90 Focuser
2. **Setup:** This will open the settings window for the Focuser. Here you can change the COM port being used, select Auto-connect to focuser, or select show advanced settings.
3. **Position:** This reads the current position of the focuser in microns. (0 = fully racked IN and 30000 = fully racked OUT)
4. **Goto:** This box allows you to manually enter a desired position in terms of microns.
5. **Jog/Offset Dropdown:** Allows you to choose Jog or Offset and select a desired speed in terms of microns/sec (500,200,100,50, or 25)
6. **IN:** Jogs the focuser inwards decreasing the position in microns by the chosen amount.
7. **OUT:** Jogs the focuser outwards increasing the position in microns by the chosen amount.
8. **STOP:** Aborts all focuser commands to stop any motion.
9. **Commands > Find home:** This will rack the focuser towards the home position of 1000 microns. This should be done upon commissioning the focuser or to resolve incorrect encoder position readings.



Auto Focus:

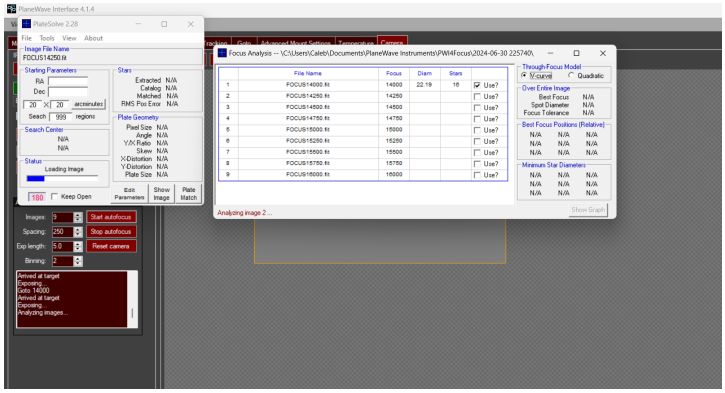
1. Manual Adjustment:
    - Get near best focus manually by adjusting the Goto position of the focuser.
    - The approximate best focus position is in the middle of the focuser's travel range. For IRF90 with 30000 microns of travel, the best focus will be near 15000 microns on an ideal setup but may vary depending on back focus spacers/adapters.



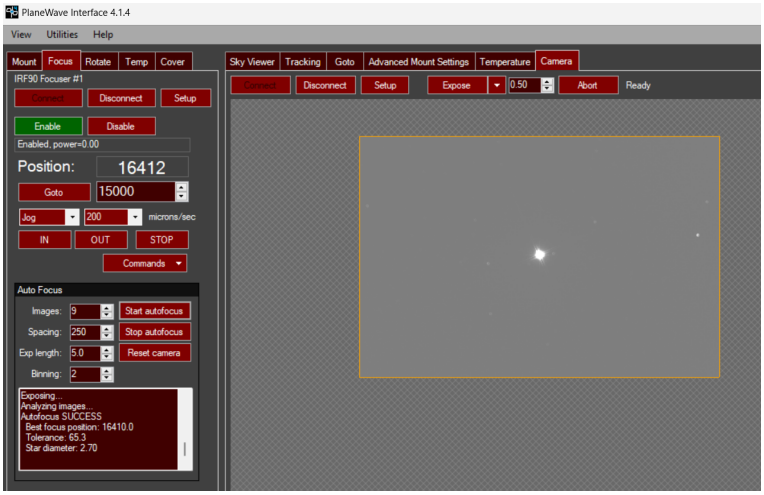
2. Autofocus Settings
    - Set the autofocus settings according to the recommended values below:

Settings	RC	CDK	DR
Images	9	9	9
Spacing	500	250	25
Exp Length	5	5	5
Binning	2	2	2

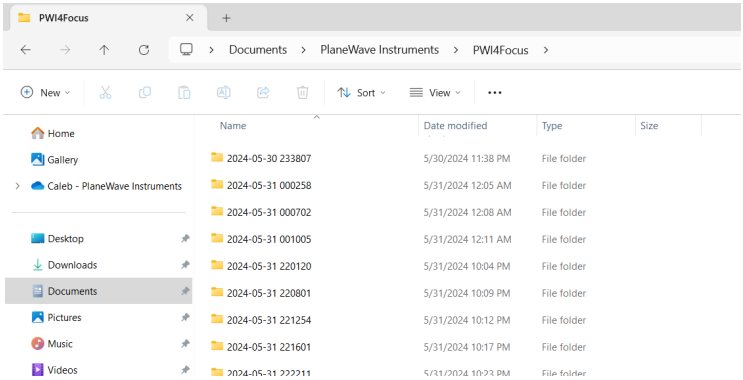
3. Start Autofocus.
    - Select “Start Autofocus”
    - PlateSolve windows will open and begin the autofocus process.



4. Completion
    - Upon successful autofocus, the PlateSolve windows will close automatically.
    - You will see "Autofocus SUCCESS" in the status box on the left-hand side.
    - The focuser will have changed its position to the calculated best focus.



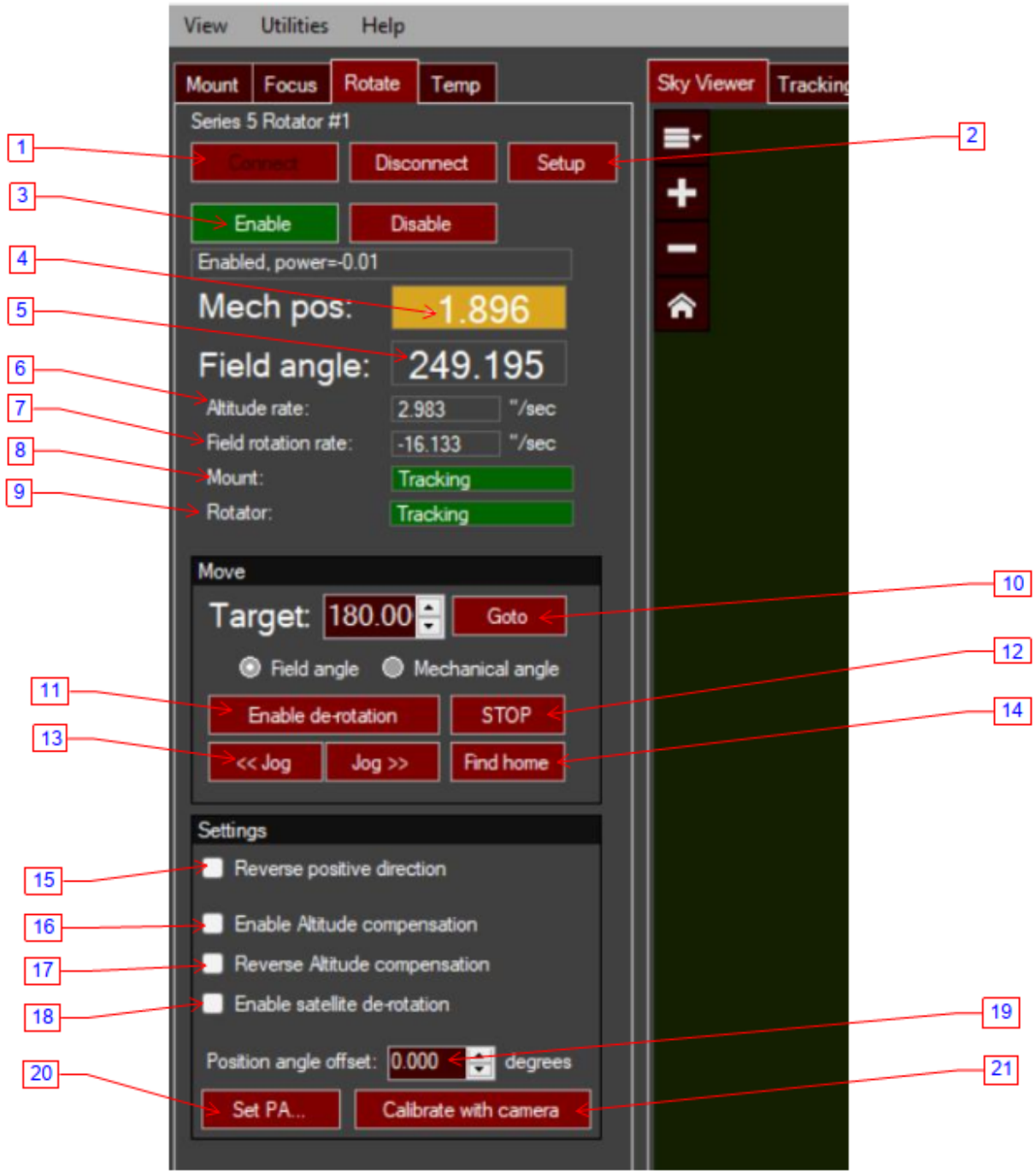
5. Accessing Auto Focus Data:
    - Navigate to the file path Documents/PlaneWave Instruments/PWI4Focus. To see recent autofocus runs.



Controlling the Rotator:

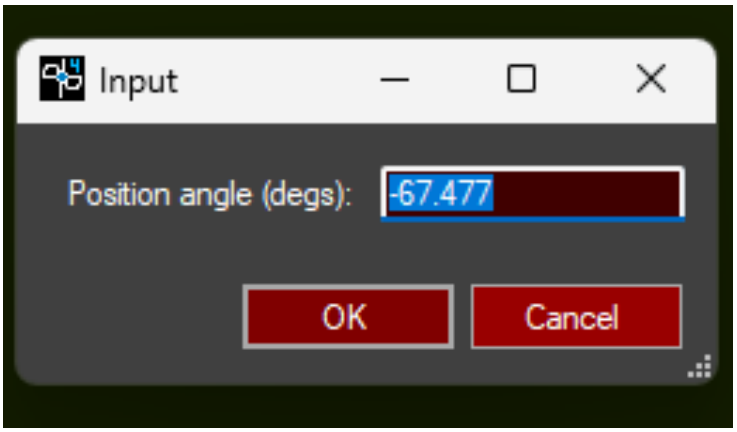
This will provide an overview of the buttons and their functions within PWI4 for controlling the IRF90 rotator.

Below is a picture of the Rotate Tab within PWI4. The labeled points correspond to the numbered list on the following pages.

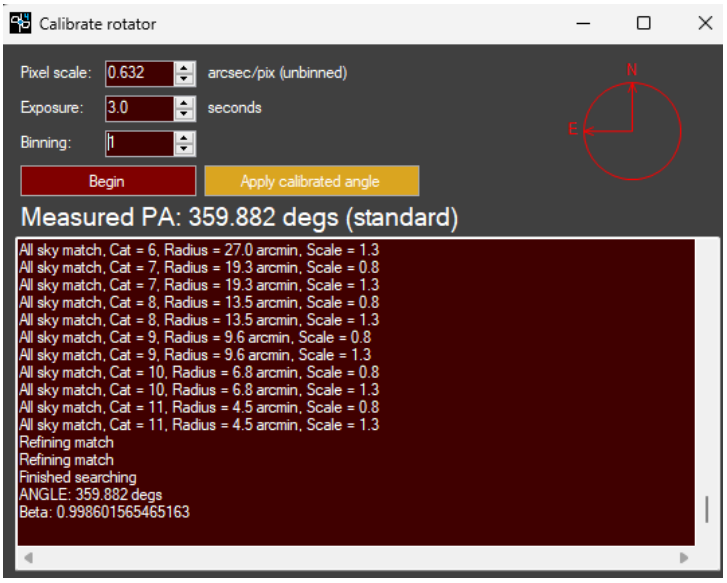


1. **Connect and Disconnect:** These buttons provide/end communication between the PWI4 and IRF90.
2. **Setup:** This will open the settings window for the Rotator. Here you can change the COM port being used, select Auto-connect to rotator, or select show advanced settings.
3. **Enable/Disable:** These buttons enable/disable the rotator motor.
4. **Mech Pos:** This displays the current Mechanical Position (angle) of the rotator in degrees.
5. **Field Angle:** This displays the current Field Angle of the sky in degrees.
    - Field Angle represents how the starfield / object is oriented in the image taken based on your mount and rotator positions.
6. **Altitude Rate:** This displays the current velocity of the Alt/Dec axis. This is in arcseconds per second. This value is only applicable to RC700 and PW1000 observatory systems.
7. **Field Rotation Rate:** This displays the velocity of apparent rotation of the starfield due to the mount's geometry in arcseconds per second. The rotator will rotate at this speed when de-rotation is enabled. For EQ mounts, it's near zero; for Alt-Az mounts, it varies and is highest near the meridian at high altitudes.
8. **Mount**: Displays the status of the mount.
9. **Rotator**: Displays the status of the rotator.
10. **Target/Goto:** This allows you to enter a value between 0 and 365 degrees.
    - **Field Angle/Mechanical Angle:** These radio buttons allow you to select which reported angle you would like to move the rotator to when using the Goto command.
    - Moving to a particular field angle allows you to maintain the same orientation of the target regardless of where it is in the sky.
11. **Enable de-rotation:** Once pressed this begins to de-rotate the rotator at the calculated rate based on the Field Rotation Rate and changes the rotator status to “Tracking”.
12. **Stop:** Aborts all motion commands to the rotator immediately.
13. **Jog:** Press and hold either jog button to manually rotate the rotator in the positive (clockwise) or negative (counterclockwise) direction.
14. **Find home:** This will rotate the rotator in the negative direction (counterclockwise) until it reaches the hard stop and resets the encoder to 0 degrees mechanical angle. This should be done upon commissioning the rotator or to resolve incorrect encoder position readings.
15. **Reverse positive direction:** Enables the rotator to rotate in the opposite direction. Use this setting for optical systems with an odd number of reflections. For example: The standard CDK700 has three mirrors (odd reflections), while the CDK24 only has two mirrors (even reflections).
16. **Enable Altitude compensation:** Incorporates the altitude rate into de-rotation calculations. This is should only be checked for RC700/PW1000 observatory systems.
17. **Reverse Altitude compensation:** Incorporates the altitude rate into de-rotation calculations and reverses the direction of the rotator. This is only applicable for RC700/PW1000 observatory systems and should not be checked unless stated from PlaneWave Support.

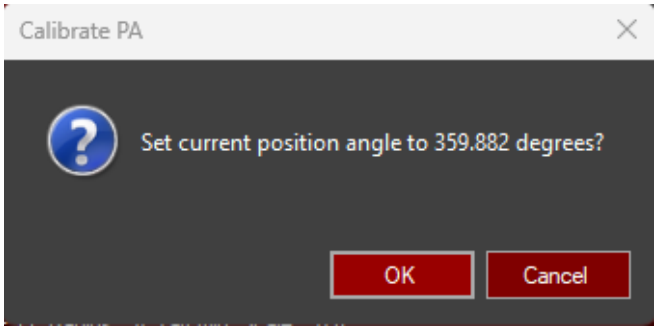
18. **Enable satellite de-rotation:** This is an experimental feature to rotate the field ensuring the direction of star streaks passing behind the satellite remain in the same direction throughout the pass.
19. **Position angle offset:** This box allows you to enter a value (in degrees) that offsets the Field Angle so that it represents a true Position Angle.
    - In PWI4 the term "Field angle" is used instead of "Position angle" due to a potential arbitrary constant offset between the true position angle and the image orientation.
    - Position angle (PA) is used to indicate the orientation of the starfield captured. A position angle of 0 means that the top of the camera chip points North. The field angle reported may not accurately display the position angle until a proper offset has been applied.
    - For instance, if the camera is mounted 90 degrees off, a field angle of 0 might result in "North" pointing to the left. Applying 90-degree position angle offset would ensure the reported Field Angle represents the true position angle.
20. **Set PA:** Opens an input window, that allows you to manually enter a known Position angle offset in degrees.
    - For instance, while tracking a starfield: Take an exposure and then analyze the image with other software (PlateSolve, PinPoint, ImageLink, etc) and analyze the astrometric result for Position angle and enter the calibrated value.



21. **Calibrate with camera:** This button is used to automatically apply a calibrated offset within PWI4 using PlateSolve as an astrometric solution.
    - The calibrate rotator window will open. Enter the correct pixel scale $(pixel\ size\ \mu m\ *\ 206.265)/(Focal\ Length\ mm)$. Leave the exposure time at 3 seconds and binning at 1.
    - Select begin and an exposure will be taken and analyzed. The results will be shown and the Apply calibrated angle button will be yellow.



    - Select Apply calibrated angle and then select OK from the pop-up window.



    - The position angle offset will auto populate. An example of what the reported positions may look like after using the Goto command to target field angle 0 is shown below. An exposure at this position would have North being up in the image taken.

Hand Controller Setup

The EFA 240901-KIT includes a hand controller for adjusting the standard focuser's travel and rotating the optional IRF90. While both can be controlled via the PWI4 software, the hand control is convenient for initial setup and visual observations.

Connect Hand Controller

1. Switch EFA Power to OFF.
2. Disconnect the PC RJ45 cable from the EFA controller.
3. Connect the provided EFA Controller to the H/C port.
4. Switch EFA Power to ON.

Hand Controller Use

5. Use the IN and OUT buttons to move the focuser position inwards or outwards.
6. If connected to an IRF90 use the CCW and CW buttons to move the rotator clockwise or counterclockwise.
7. Press the rate button toggle between the two speeds for the focuser (slow or fast).
8. The rate button does not affect the optional IRF90 rotator.

Maintenance and Warranty Guidelines

Maintenance:

For the IRF90 regular maintenance may involve:

- Inspection: Regularly inspect the product for any signs of wear, damage, or loose components, particularly focusing on the cables and connections.
- Cleaning: Keep the product clean from dust and debris. Use a soft, dry cloth to wipe down the exterior, avoiding harsh chemicals.
- Electrical Connections: Inspect all electrical connections for signs of corrosion or wear and ensure they are secure.

By performing these maintenance tasks, the IRF90 can operate reliably.

Standard Warranty:

PlaneWave warrants your product to be free from defects in materials and workmanship for a period of one year for optical coatings and two years for mechanics and electronics from the date of delivery. This warranty does not cover damage resulting from misuse, abuse, modification not authorized by PlaneWave, control systems that bypass PlaneWave's software, weather, or poor environmental control (rain, ice, snow, dust/sand, pollen, power surges, brownouts, etc.), improper storage, pests, lightning, fire, flood, earthquake, riot, war, or acts of God. Items sold by PlaneWave, but manufactured by a third party, are warranted by the third-party manufacturer.

How to obtain warranty service:

1. Contact PlaneWave to open a warranty-service ticket. This may be done via phone at (310) 639-1662 during normal business hours (M-F, 9 AM-5 PM Eastern) or via email at *support@planewave.com*.
2. Work with PlaneWave technical staff to diagnose issue(s).
3. Package and/or crate the product, and ship to PlaneWave, noting the return authorization number you have been issued on the shipping label or boldly on the exterior of the shipping container. You will be responsible for the cost of shipping the product to PlaneWave.
4. PlaneWave will inspect and determine if the product is defective in either workmanship or materials. If the returned product is determined to be covered by warranty, PlaneWave will repair or replace all or part of the product, quote and charge return shipping costs, and return the product to you.
5. Alternatively, and at PlaneWave's discretion, you may be shipped the replacement part(s) necessary for PlaneWave technical staff to guide you through minor repairs.

What is covered:

- Optical coatings defects, or any related workmanship defects or deficiencies, for 1 year from the date of delivery
- Mechanical and electronic components, or any related workmanship defects or deficiencies, for 2 years from the date of delivery

What is NOT covered:

- Shipping costs
- Duties, customs fees, or taxes relating to international shipments
- Scratches, chips, or other surface defects in optical surfaces and/or coatings resulting from cleaning or other handling
- Cosmetic wear
- Damage resulting from misuse, abuse, or modification not authorized by PlaneWave
- Damage resulting from customer/integrator bypassing PlaneWave control software, such as using third-party and/or custom control software that communicates directly with hardware controllers
- Damage due to impact resulting from software not correctly implementing mechanical motion limits
- Damage to motors or control electronics resulting from software overriding motor current limits
- Damage resulting from weather or poor environmental control, including but not limited to rain, ice, snow, dust/sand, pollen, power-surges, or brownouts
- Damage resulting from improper storage, pests, lightning, fire, flood, earthquake, riot, war, or acts of God
- Maintenance, including but not limited to cleaning, collimation, and mechanical lubrication
- Compatibility with third-party equipment, unless installed by PlaneWave – Compatibility with third-party software
- Shipping costs relating to warranty-service – On-site labor day-rate and travel-costs (airfare, rental-car, room and board) for PlaneWave staff (and/or authorized third-party) if onsite-repair is required

If there are any questions regarding this warranty and how it relates to this product, please contact support@planewave.com.