PIKE TECHNOLOGIES
Spectroscopic Creativity

Installation and User Guide

MappIR™
Automated Sampling Accessory

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PN 350-001600-05

Contents

Introduction

The PIKE MappIR accessory is a sample compartment accessory for the analysis of semiconductor wafers. The accessory may be configured to allow the analysis of the wafer either in reflectance or transmittance. Changing from reflectance to transmittance is by means of a single slide control.

Wafers up to 8 inches in diameter may be measured with this accessory. Sample rings are available to hold 2, 3, 4, 5, and 6 inch wafers.

The accessory is supplied with a motion controller and software to perform automated mapping of the sample. Stepper motors are used to perform the motion. The resolution of the motors is approximately 1000 steps per inch in the linear direction and approximately 6 steps per degree in the angular direction.

When used in the reflectance mode, the thickness of the epitaxial layer may be measured. In transmittance, measurements may be made of interstitial carbon and substitutional oxygen concentration as well as boron and phosphorus concentration of borophosphosilicate glass deposited on the surface of the wafer.

The autosampler is controlled by PIKE AutoPRO™ software which integrates easily with other FTIR and NIR software packages.

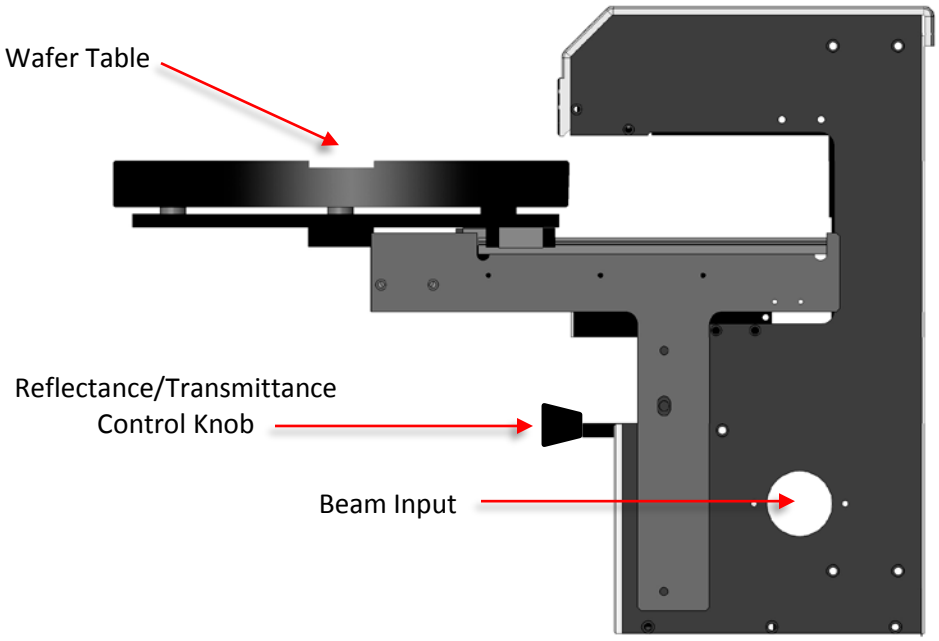


Figure 1. MappIR diagram

Unpacking Your Accessory

In order for you to quickly verify receipt of your accessory, we have included a packing list. Please inspect the package carefully. Items with part numbers can be ordered separately. Contact PIKE Technologies for replacement of other items.

Packing List

MappIR Manual and CD
PN 350-001600
Quantity 1

AutoPRO Manual and Software
PN 350-000070
Quantity 1

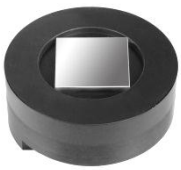
MappIR Accessory
PN 016-28XX
Quantity 1

Motor Controller
Quantity 1

MappIR Cables & Power Cord
Quantity 1

8” Ring
PN 073-3880
Quantity 1

Alignment Mirror
PN 016-1010
Quantity 1



Purge Tube
Quantity 1

Purge Donuts
Quantity 8

Packing List, continued

Wrench Set
Quantity 1

Optical Description

The optics may be conveniently split into the following three parts.

Transfer Optics

The baseplate of the accessory holds a mirror assembly which converts the incoming focused beam from the spectrometer into a collimated, upwardly traveling beam. It also takes the downward collimated beam from the sample and focuses it to be accepted by the spectrometer detector optics.

Reflectance Focusing Optics

The collimated beam from the base transfer optics is focused by a parabolic mirror onto the surface of the sample. The reflected beam from the sample is collimated by a similar parabolic mirror and sent to the transfer optics. The angle of the beam from normal as it strikes the surface of the sample is 15°.

Transmittance Focusing Optics

In this configuration, one leg of the reflectance optics is intercepted by the slider mirror. The beam from the instrument is focused by a parabolic mirror onto the surface of the sample. The beam passes through the sample and is transferred by two flat mirrors and a focusing mirror to the slider mirror which then directs the beam back to the transfer optics and then to the instrument detector.

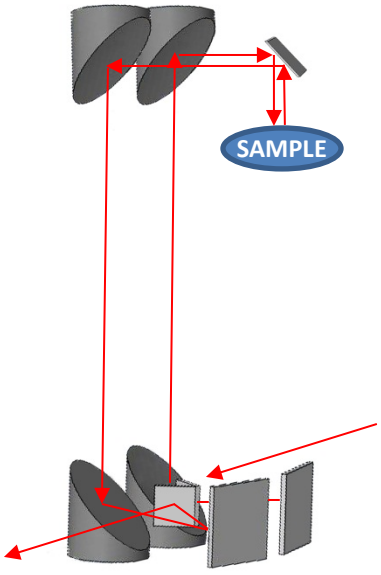


Figure 2. Reflectance optics.

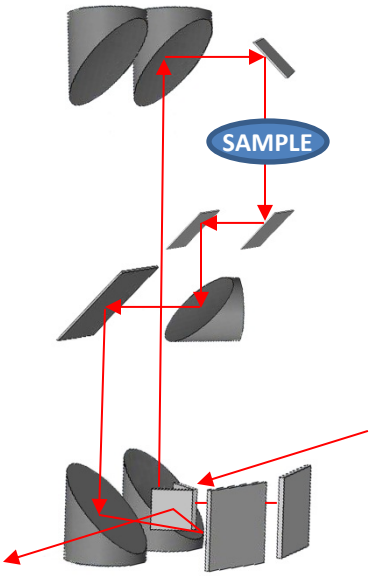


Figure 3. Transmittance optics.

Choosing Reflectance or Transmittance

The accessory may be configured to perform either a reflectance or transmittance analysis. To choose **reflectance**, pull the Reflectance/Transmittance Control Knob **out** (Figure 4). To choose **transmittance**, push the Reflectance/Transmittance Control Knob **in** (Figure 5).

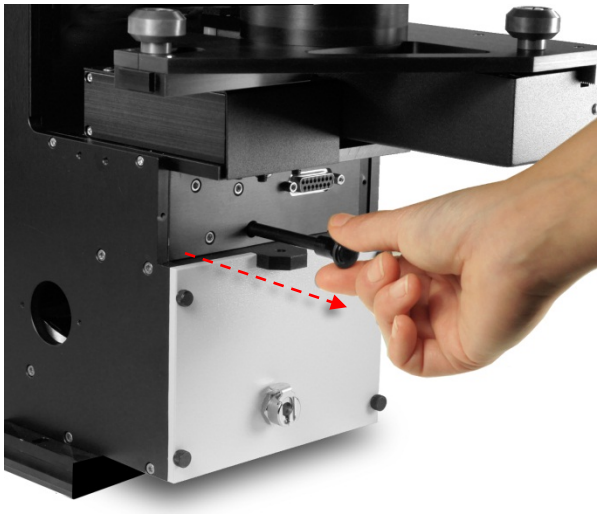


Figure 4. Reflectance/Transmittance Control Knob ***pulled out*** *for* ***reflectance mode.***

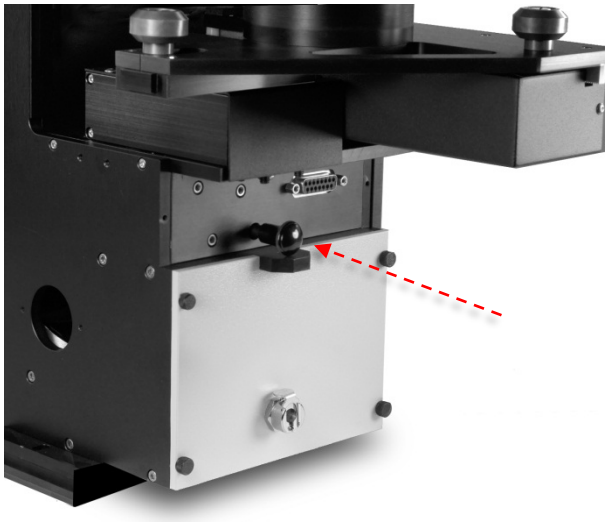


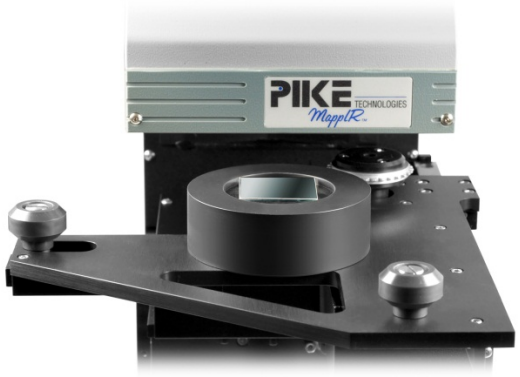
Figure 5. Reflectance/Transmittance Control Knob ***pushed in*** *for* ***transmittance mode.***

Installation and Alignment

The accessory is mounted onto a sample compartment baseplate. The assembly may be placed into the sample compartment of the spectrometer and bolted down using the screws provided. The accessory is purgeable. In order to seal the accessory to the sample compartment, sliding purge tubes are provided which may be adjusted to give a good seal. The only portion of the beam that is not purged is the path from the upper window of the accessory to the sample and back to the window, a path of approximately 2 inches. If complete purge is needed an optional purge box assembly, that encloses the stage, is available. In order to align the accessory, perform the following steps.

Reflectance Mode

1. Place the alignment puck onto the stage. This allows the accessory to be aligned in reflectance.



2. Pull the Reflectance/Transmittance Control Knob **out** all the way (see Figure 4, Page 5).

3. Remove the front access panel of the accessory that is held on with four black thumbscrews.

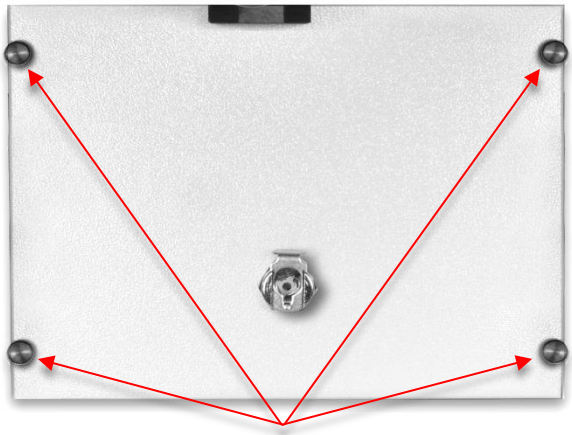


Figure 6. Front view, bottom half of MappIR with cover attached.

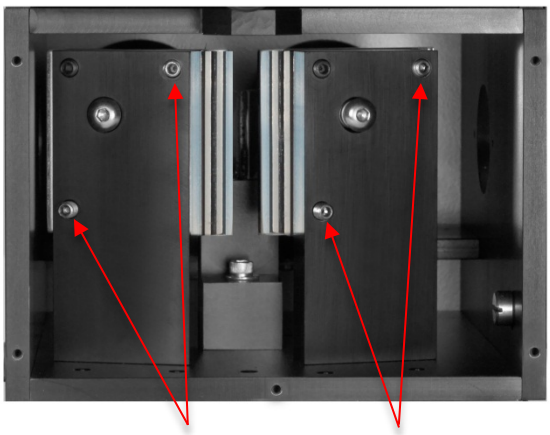


Figure 7. Front view, bottom half of MappIR with cover removed. ***Adjust ONLY the screws indicated with arrows.***

4. There are two flat mirrors that may be adjusted (Figure 7). Using the 3/32 hex wrench provided, adjust the left mirror by turning on the two adjustment screws to maximize the IR signal.

5. Adjust the right mirror to maximize the signal.

6. Return to adjust the left mirror and right mirror again. This procedure may need to be repeated two or three times until the signal is maximized.

The accessory is now aligned in reflectance. Replace the front cover panel.

Transmittance Mode

1. Locate the two adjustment screws on the adjustable transmission mirror.

Figure 8. Underside view of MappIR.

Figure 9. Close up view of transmission mirror alignment screws. **IMPORTANT: Adjust ONLY the 2 screws circled above. DO NOT ADJUST any other screws as damage may occur.**

2. Remove the alignment mirror from the center of the sample ring.

3. Push the Reflectance/Transmittance Control Knob all the way in (Figure 5, Page 5).

4. Adjust the two adjustment screws to maximize the transmission throughput of the accessory.

Performance Verification

1. Set your FTIR spectrometer to collect data at 4 cm^{-1} spectral resolution (including the FTIR J-stop).

2. Ensure that your spectrometer is aligned. If the instrument is not aligned, maximize the interferogram signal (the IR energy throughput) of your FTIR spectrometer. This should be performed by following the manufacturer's instructions.

3. Collect an open beam background scan.

4. Place the MappIR into the sample compartment of the spectrometer.

5. Set the accessory in reflectance mode. Insert the reflectance alignment mirror on the stage and collect a sample spectrum. The energy throughput value should be greater than 30%. If not, adjust the two front lower mirrors as described earlier in the manual.

6. Remove the alignment mirror and set the accessory in transmittance mode. Collect a sample spectrum. The energy throughput value should be greater than 30%. If not, adjust the transmission mirror as described earlier in the manual.

7. The energy throughput in reflectance mode and transmittance mode should be at least 30%, and within a 2% of each other. For example, if you are achieving 35% in reflectance mode then you should be measuring between 33 – 37% in transmittance mode.

8. If you are not obtaining matching throughput values in the transmittance and reflectance mode, readjust the front and transmission mirrors.

Installing the AutoPRO Motor Controller

The motion control electronics interface the MappIR to your computer. Commands are sent to this electronics unit using a USB cable. A 15-pin accessory cable is used to connect this unit to the accessory.

Connecting the Motor Controller to Your Computer

The power supply for the motor controller is self-adjusting and can be used in most locations. Please read the labels on the rear of the motor controller before attempting to connect the system.

The power for the motor controller should always be turned off when attaching the cables.

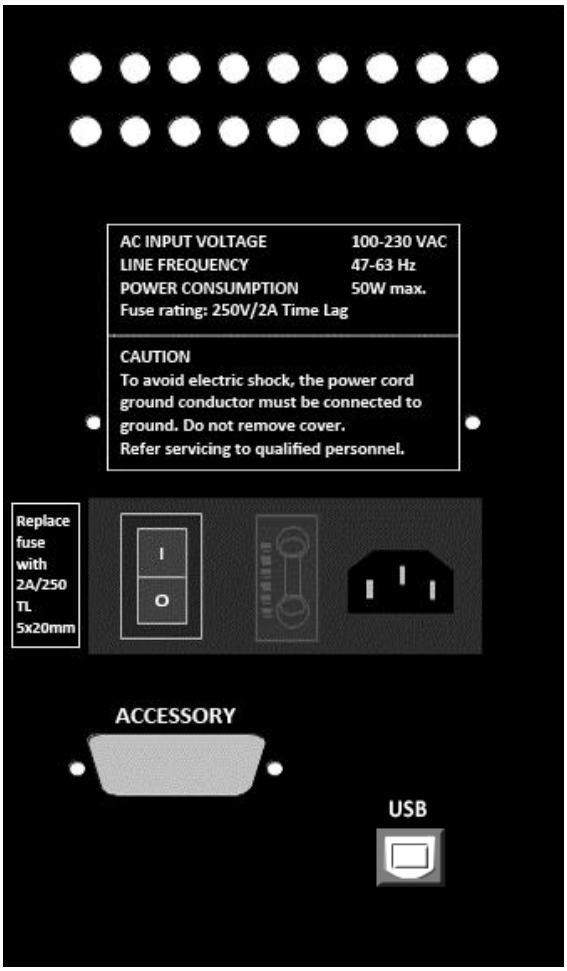


Figure 10. Motor controller rear panel

Correct Cabling Procedure

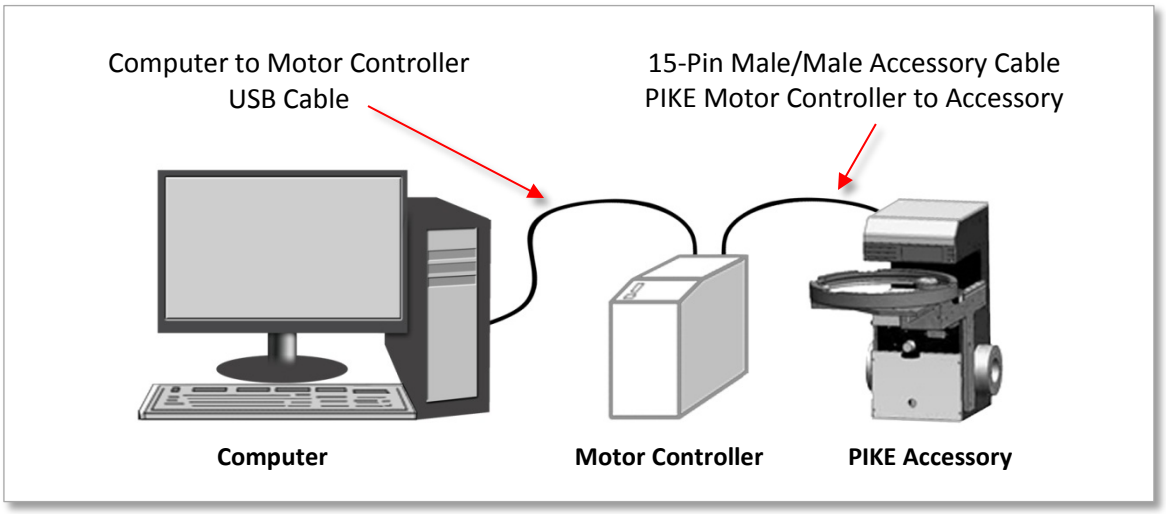


Figure 11. Correct cabling procedure for the MappIR

- The accessory port of the motor controller should be connected to the accessory through the 6 foot, male-to-male 15-pin cable provided.

- Connect the USB cable from the controller to the PC.

Installation of the AutoPRO Software

System Requirements

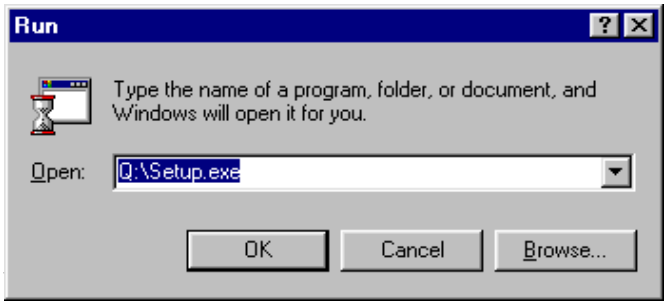
AutoPRO is a Microsoft Windows compliant program. The program was designed to run within XP or Windows 7.

Loading from Windows

1. Insert the program disk into the CD-ROM drive of your computer.

2. If the installation doesn't start automatically from within the Program Manager, select **Run** from the File Menu. The Run dialog box will appear to enter a filename.

3. You may either enter **x:setup.exe** or "browse" to the CD Disk directory and select **setup.exe**.



A setup dialog box will appear for a few moments while the installation program checks for available memory and configuration.

The AutoPRO dialog box will appear:

- Choose to use the default path and select: Enter, or
- Choose to enter an alternative path and then select: Enter, or
- Choose to exit Setup by selecting: EXIT

The software will be copied. The source and destination files, and the percentage of the completed task are displayed. A dialog box will appear when the program has been loaded. Click on the OK button to complete installation.

Files Placed on Your Hard Disk

During installation the following files are placed on your hard drive in the AutoPRO subdirectory:

Ap5.exe	main AutoPRO app
Apd5.exe	programmer for AutoDiffusIR
Apv5.exe	programmer for VeeMax ,ATRmax and polarizers (stand-alone)
Apvp5.exe	programmer for VeeMax and ATRMax with polarizers (combinations)
Apw5.exe	programmer for wafer stages - MappIR, Map300, Six inch, Autosamplers
Apxy5.exe	programmer for XY plate reader
Comment.exe	self-contained executable that writes into the spectral header
First.exe	self-contained executable that moves the stage to the first point in profile
Init.exe	self-contained executable that initializes the stage and moves it home
Load.exe	self-contained executable that loads the stage
Newfile.exe	self-contained executable that opens the file open dialog box
Next.exe	self-contained executable that moves the stage to the next point in the profile
Point.exe	self-contained executable that moves the stage to point n of the profile
Unload.exe	self-contained executable that unloads the stage
Ap5.hlp	Help files
350-000700 AutoPRO software.pdf	AutoPRO5 operation manual

Sample profiles installed in the AutoPRO5\Profile subdirectory:

- example.vep
- example.apd
- example.xya
- example.map
- example.waf
- example.pol
- example.atr
- example.vee
- 18 point samp.waf
- 36 point sample.map

Sample macros installed in the AutoPRO5\Macro subdirectory:

- Preexp.ab
- preexp.bas
- presamp.ab
- presamp.bas
- postsamp.ab
- postsamp.bas
- postexp.ab
- postexp.bas
- ap5.bas

Online Help

AutoPRO provides on-screen help for commands and functions. More information on the general attributes of the Help screens may be found in the AutoPRO Manual.

How to Use Help

Choose Help from the menu, or press F1 on the keyboard.

- **Index** - Displays an index of Help topics including menus, commands, and shortcuts.
- **Using Help** - Provides information on how to use Windows Help.
- **About** - Provides specific information regarding the version of AutoPRO and current system information.

You can use the Help buttons to display related Help topics. Options are:

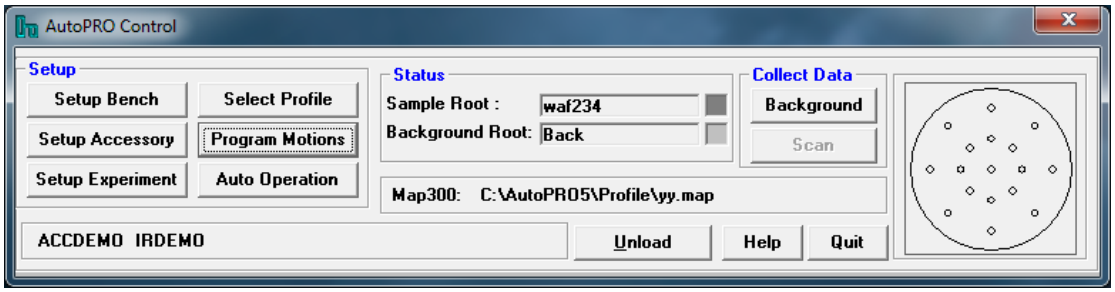
- **Contents** - Displays a list of Help topics.
- **Search** - Lists the keywords for AutoPRO. Enter a keyword or phrase in the **Search For** text box or select a keyword from the list box.
- **Back** - Displays the last topic you displayed.
- **History** - Displays a list of recent topics displayed.
- **Glossary** - Displays a list of terms and parameters used in AutoPRO and their definitions.

AutoPRO Overview

AutoPRO is a Windows based automation software program for use with PIKE automated accessories and the AutoPRO motion controller. With this software package a range of automated accessories may be programmed and operated in conjunction with most Windows based FTIR software packages. Several programs comprise the complete software package, but the following two programs are central to the function of the software and will be introduced briefly here.

AutoPRO Control

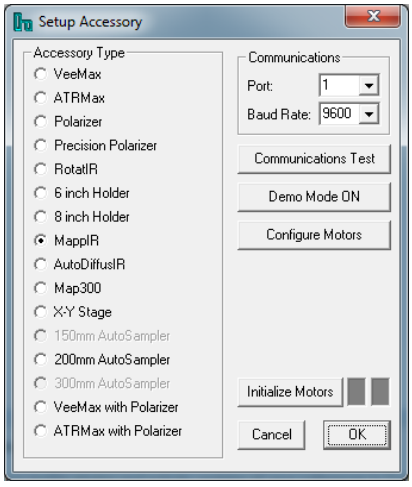
This program contains the tools required to operate your automated accessory.



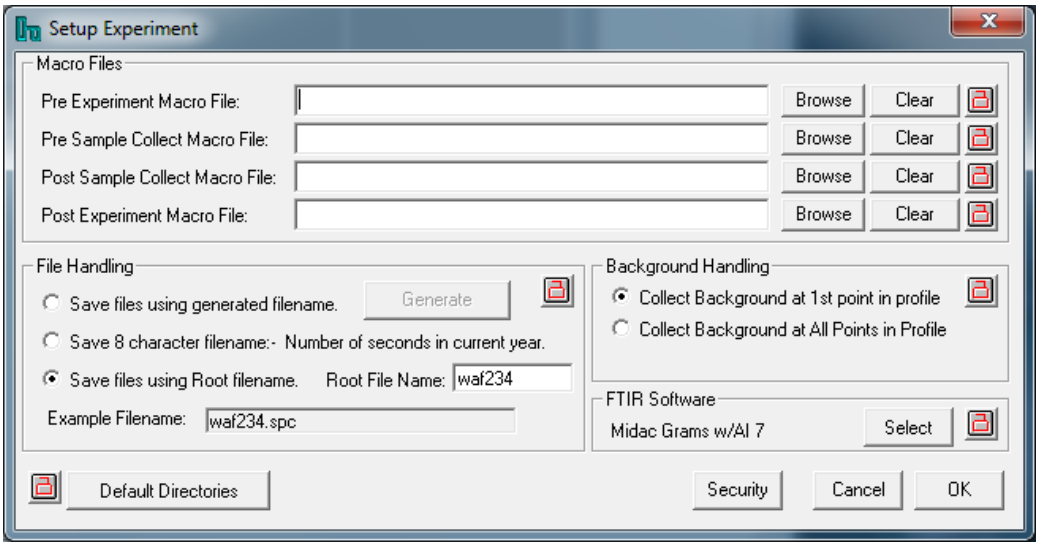
The AutoPRO control panel contains the following major functions:

- **Setup Bench -** Basic parameters for data collection (number of scans, resolution, etc.) may be defined and stored to a file.

- **Setup Accessory -** This function allows selection of the actual accessory used with the spectrometer, computer/accessory communication test, and basic accessory setup.



- **Setup Experiment -** Macros and executable files can be integrated into the autosampler routine. This function also allows special handling of multiple filenames and provides different security options.



- **Program Motions** - A series of samples may be defined and stored to a file. This file may be subsequently used to move your accessory while collecting data from your spectrometer.

- **Load and Unload** - The MappIR may be moved to an unload position to simplify the insertion of new samples.

Status

The status of the accessory at any time is displayed. This includes the position of the accessory, the current status of the motors and a thumbnail view of the file being used for programming the motion.

These and all other functions are described fully in the AutoPRO manual.

Init.exe, First.exe…

These are programs which may be inserted into an FTIR macro. With these programs the basic functions required to run the accessory may be accessed from within the macro. While the software is running a small AutoPRO status box is displayed in the lower right hand corner.

More details of how to use this and other .exe files available in the AutoPRO software are given in the AutoPRO User's Manual.

Operation of the MappIR

Removing the Holder from the Accessory

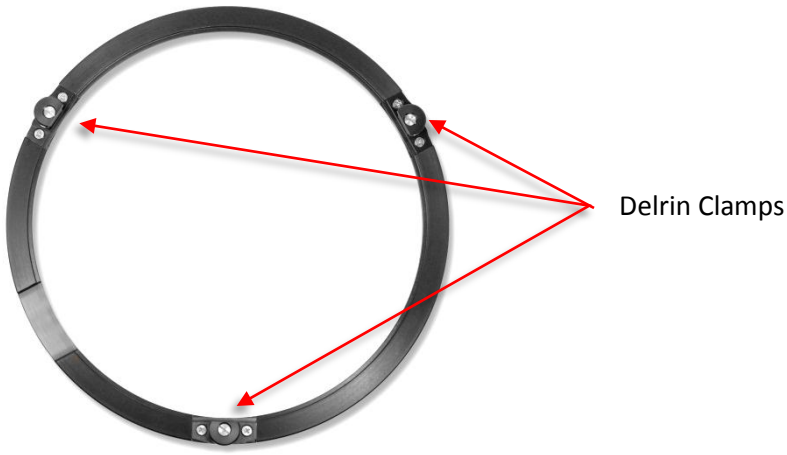
Perform the following steps:

1. Move the sample ring to the unload position.
2. Push the left side of the sample ring to the right. Then pull the right side of the ring up slightly.
3. Push the lifted right side of the sample ring horizontally toward the instrument.
4. When the sample ring has cleared the idler pulley, lift up on the front of the ring to clear the idler pulley.
5. Push the sample ring towards the accessory so that it clears the driver pulley and remove the ring.

Inserting a Wafer

Perform the following steps:

1. Place the sample ring on a flat surface.
2. Rotate the three clamps so that the flats are facing inwards.
3. Place a wafer in the sampling ring. The wafer will rest on three Delrin surfaces beneath the clamps.
4. Rotationally orient the flat on the wafer to the desired position. It may be useful to place a mark on the sample ring to aid in this positioning.
5. Carefully rotate the wafer clamps through 180° to secure them in place.



Precautions

Mirrors

In order to provide maximum transmission in the infrared, with minimum spectral interferences, the mirrors used in this device are uncoated (bare) aluminum on a glass substrate. Since the coatings are soft, care must be taken to avoid damage. Normally, these mirrors will not need cleaning, since they are contained within the housing of the accessory. If they do need cleaning, they may be gently swept with a camel hair brush. Under no circumstances must the mirrors be rubbed with paper products such as "Kleenex" since this will produce scratching of the mirror coating.

SAFETY

When selecting an AC power cord for this unit, select one that has an appropriate source connector at the plug end and an IEC60320 C13 connector at the power supply end of the cord.

Please do not touch or operate any moving parts until motor has stopped. Also before touching moving parts, ensure that the power to the motor controller is off.

Environmental Conditions for Operation

Altitude	**Up to 2000 m**
Temperature Range	**5 °C to 40 °C**
Humidity Range	**Max relative 80% RH**
Mains Supply Fluctuation	**+/- 10% unless otherwise specified**
Applicable Pollution Degree	**Category 2 (Normally only non-conductive)**
Transient Voltages Typically Present on Mains	**<1500 V**

Replacement Parts and Options

The following parts and options may be ordered for the MappIR accessory:

Part Number	Description
016-1010	Alignment Mirror

Other PIKE Products Available for Use with the MappIR

073-3880	Additional 8” Wafer Mount
073-3860	Insert to Support 6” Wafer
073-3850	Insert to Support 5” Wafer
073-3840	Insert to Support 4” Wafer
073-3830	Insert to Support 3” Wafer
073-3820	Insert to Support 2” Wafer
073-3800	Blank Support – for custom wafers
	Purge Box (Please contact PIKE Technologies for ordering information)

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