THORLABS

MFF101 and MFF102
Motorized Filter Flippers

User Guide

Original Instructions

Contents

Chapter 1 Safety

1.1 Safety Information

For the continuing safety of the operators of this equipment, and the protection of the equipment itself, the operator should take note of the **Warnings, Cautions** and **Notes** throughout this handbook and, where visible, on the product itself.

The following safety symbols may be used throughout the handbook and on the equipment itself.

Shock Warning

Given when there is a risk of injury from electrical shock.

Warning

Given when there is a risk of injury to users.

Caution

Given when there is a risk of damage to the product.

Note

Clarification of an instruction or additional information.

1.2 General Warnings

Warnings

When the unit is powered up, do not move the flipper arm by hand.

If this equipment is used in a manner not specified in the handbook, the protection provided by the equipment may be impaired. In particular, excessive moisture may impair operation.

Spillage of fluid, such as sample solutions, should be avoided. If spillage does occur, clean up immediately using absorbent tissue. Do not allow spilled fluid to enter the internal mechanism.

The equipment is for indoor use only.

When running custom move sequences, or under fault conditions, the stage may move unexpectedly. Operators should take care when working inside the moving envelope of the stage.

Chapter 2 Overview

2.1 Introduction

These two position high speed flippers have been designed to flip a lens, filter or other optical component into and out of an open beam.

The flip action is controlled by a button on the top of the unit, via the remote handset included, or via a control PC. The flipper position toggles 90° between vertical and perpendicular with each button press. The unit has two SMA connectors, marked DIG I/O 1 and DIG I/O 2, for use in applications requiring an external or remote trigger, e.g the remote handset. The trigger is a button press or a TTL logic pulse, which toggles the flipper position. The rear face of the unit features an array of vent holes to aid cooling.

This small (70 mm x 30 mm x 30 mm) unit is powered by the included 15V power supply. It is shipped with a 1.5 m (59.0”) USB cable.

The MFF101(/M) is supplied complete with our LMR1 (/M) Ø1" optics mount, while the MFF102 is shipped with the LMR2(/M). Other holders in the LMR range are compatible, up to a maximum diameter of 50.8 mm (2”). The flipper mount is ideal for many optics, including mirrors. When used with a mirror, please note that the unit is not recommended for applications requiring better than 100 µrad beam stability.

Fig. 2.1 MFF101 Motorized Filter Flipper

2.2 APT Software Overview

2.2.1 Introduction

As a member of the APT range of controllers, the MFF series Filter Flippers share many of the associated software benefits. This includes USB connectivity (allowing multiple units to be used together on a single PC), fully featured Graphical User Interface (GUI) panels, and extensive software function libraries for custom application development.

The APT software suite supplied with all APT controllers, including the MFF series filter flipper, provides a flexible and powerful PC based control system both for users of the equipment, and software programmers aiming to automate its operation.

For users, the APTUser (see Section 2.2.2.) and APTConfig (see Section 2.2.3.) utilities allow full control of all settings and operating modes enabling complete 'out-of-box' operation without the need to develop any further custom software. Both utilities are built on top of a sophisticated, multi-threaded ActiveX 'engine' (called the APT server) which provides all of the necessary APT system software services such as generation of GUI panels, communications handling for multiple USB units, and logging of all system activity to assist in hardware trouble shooting. It is this APT server 'engine' that is used by software developers to allow the creation of advanced automated positioning applications very rapidly and with great ease. The APT server is described in more detail in Section 2.2.4.

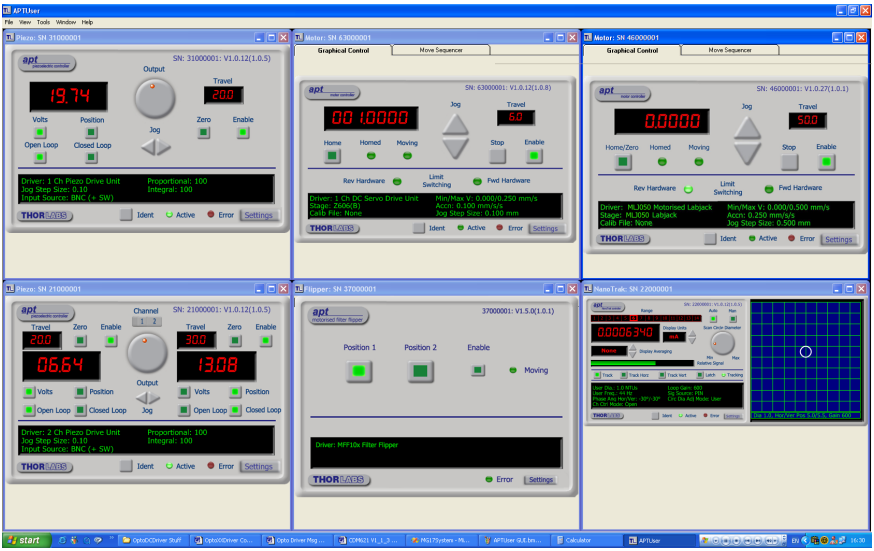
Aside

ActiveX®, a Windows®-based, language-independent technology, allows a user to quickly develop custom applications that automate the control of APT system hardware units. Development environments supported by ActiveX® technology include Visual Basic®, LabView™, Borland C++ Builder, Visual C++, Delphi™, and many others. ActiveX® technology is also supported by .NET development environments such as Visual Basic.NET and Visual C#.NET.

ActiveX controls are a specific form of ActiveX technology that provide both a user interface and a programming interface. An ActiveX control is supplied for each type of APT hardware unit to provide specific controller functionality to the software developer. See Section 2.2.4. for further details.

2.2.2 APTUser Utility

The APTUser application allows the user to interact with a number of APT hardware control units connected to the host PC. This program displays multiple graphical instrument panels to allow multiple APT units to be controlled simultaneously.



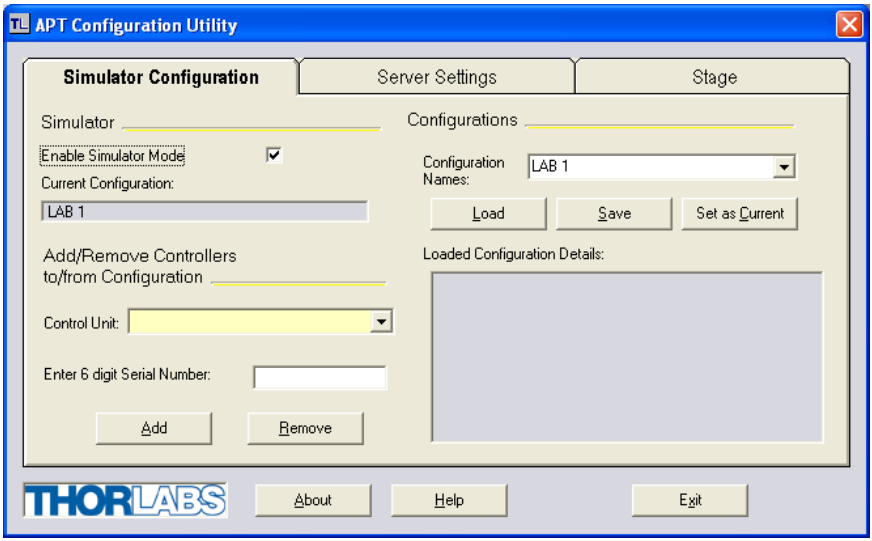
All basic operating parameters can be altered and, similarly, all operations can be initiated. Settings and parameter changes can be saved and loaded to allow multiple operating configurations to be created and easily applied.

For many users, the APTUser application provides all of the functionality necessary to operate the APT hardware without the need to develop any further custom software. For those who do need to further customize and automate usage of the controller (e.g. to implement a positioning algorithm), this application illustrates how the rich functionality provided by the APT ActiveX server is exposed by a client application. The complete Visual Basic source project is provided as a useful aid to software developers.

Use of the APT User utility is covered in the PC tutorial (Chapter 6) and in the APTUser online help file, accessed via the F1 key when using the APTUser utility.

2.2.3 APT Config Utility

There are many system parameters and configuration settings associated with the operation of the APT Server. Most can be directly accessed using the various graphical panels, however there are several system wide settings that can be made 'off-line' before running the APT software. These settings have global effect; such as switching between simulator and real operating mode, associating mechanical stages to specific actuators and incorporation of calibration data.



The APTConfig utility is provided as a convenient means for making these system wide settings and adjustments. Full details on using APTConfig are provided in the online help supplied with the utility.

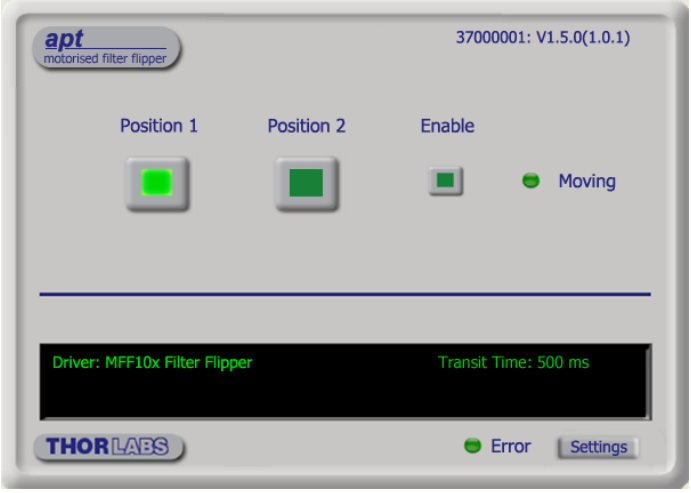
Use of the APT Config utility is covered in the PC tutorial (Chapter 6) and in the APTConfig online help file, accessed via the F1 key when using the APTConfig utility.

2.2.4 APT Server (ActiveX Controls)

ActiveX Controls are re-usable compiled software components that supply both a graphical user interface and a programmable interface. Many such Controls are available for Windows applications development, providing a large range of re-usable functionality. For example, there are Controls available that can be used to manipulate image files, connect to the internet or simply provide user interface components such as buttons and list boxes.

With the APT system, ActiveX Controls are deployed to allow direct control over (and also reflect the status of) the range of electronic controller units, including the MFF series filter flipper. Software applications that use ActiveX Controls are often referred to as 'client applications'. Based on ActiveX interfacing technology, an ActiveX Control is a language independent software component. Consequently ActiveX Controls can be incorporated into a wide range of software development environments for use by client application developers. Development environments supported include Visual Basic, Labview, Visual C++, C++ Builder, HPVEE, Matlab, VB.NET, C#.NET and, via VBA, Microsoft Office applications such as Excel and Word.

Consider the ActiveX Control supplied for the filter flipper.



This Control provides a complete user graphical instrument panel to allow the stage to be manually operated, as well as a complete set of software functions (often called methods) to allow all parameters to be set and operations to be automated by a client application. The instrument panel reflects the current operating state of the unit to which it is associated (e.g. such as filter position). Updates to the panel take place automatically when a user (client) application is making software calls into the same Control.

The APT ActiveX Controls collection provides a rich set of graphical user panels and programmable interfaces allowing users and client application developers to interact seamlessly with the APT hardware. Each of the APT controllers has an associated ActiveX Control and these are described fully in system online help or the handbooks associated with the controllers. Note that the APTUser and APTConfig utilities take advantage of and are built on top of the powerful functionality provided by the APT ActiveX Server (as shown in Fig. 2.2).

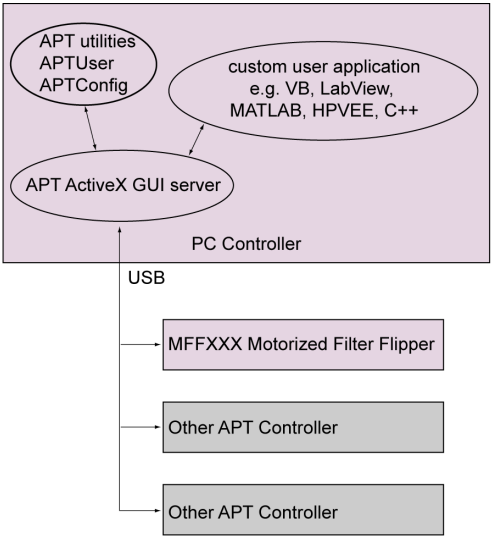


Fig. 2.2 System Architecture Diagram

Refer to the main APT Software online help file, APTServer.chm, for a complete programmers guide and reference material on using the APT ActiveX Controls collection. Additional software developer support is provided on the 'Support' tab in the Downloads section of our website.

2.2.5 Software Upgrades

Thorlabs operate a policy of continuous product development and may issue software upgrades as necessary.

The latest APTServer software version is available from the dowmloads section of www.thorlabs.com.

Chapter 3 Mechanical Installation

3.1 Unpacking

Note

Retain the packing in which the unit was shipped, for use in future transportation.

Caution

Once removed from its packaging, the filter flipper is easily damaged by mishandling. The unit should only be handled by its base.

3.2 Environmental Conditions

Warning

Operation outside the following environmental limits may adversely affect operator safety.

Location	Indoor use only
Maximum altitude	2000 m
Temperature range	5°C to 40°C
Maximum Humidity	Less than 80% RH (non-condensing) at 31°C

To ensure reliable operation the unit should not be exposed to corrosive agents or excessive moisture, heat or dust.

If the unit has been stored at a low temperature or in an environment of high humidity, it must be allowed to reach ambient conditions before being powered up.

The unit must not be used in an explosive environment.

3.3 Mounting to a Work Surface

Warning

The safety of any system incorporating this equipment is the responsibility of the person performing the installation.

3.3.1 General

When mounting the flipper close to other equipment, ensure that the travel is not obstructed. If a device mounted on the flipper is driven against a solid object, damage to the internal mechanism and the optic fitted could occur. The range of travel is 90°

3.3.2 Mounting the Unit to the Work Surface

The filter flipper is normally used mounted to standard post via the 8-32 (M4) hole in the base, as shown in Fig. 3.1.

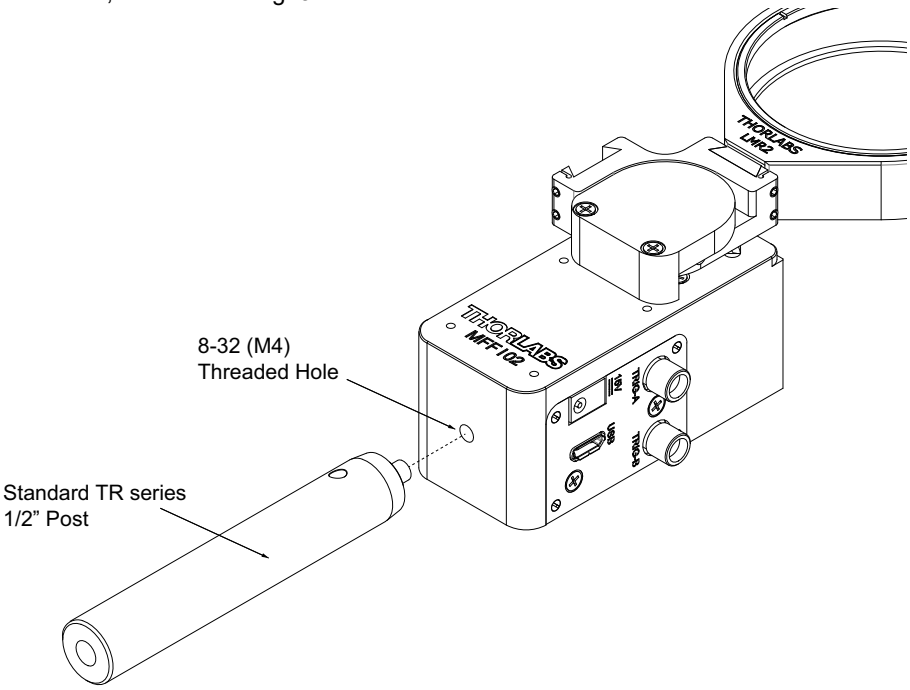


Fig. 3.1 Installation

3.4 Transportation

Caution

When packing the unit for shipping, use the original packing. If this is not available, use a strong box and surround the unit with at least 100 mm of shock absorbent material.

3.5 Dimensions

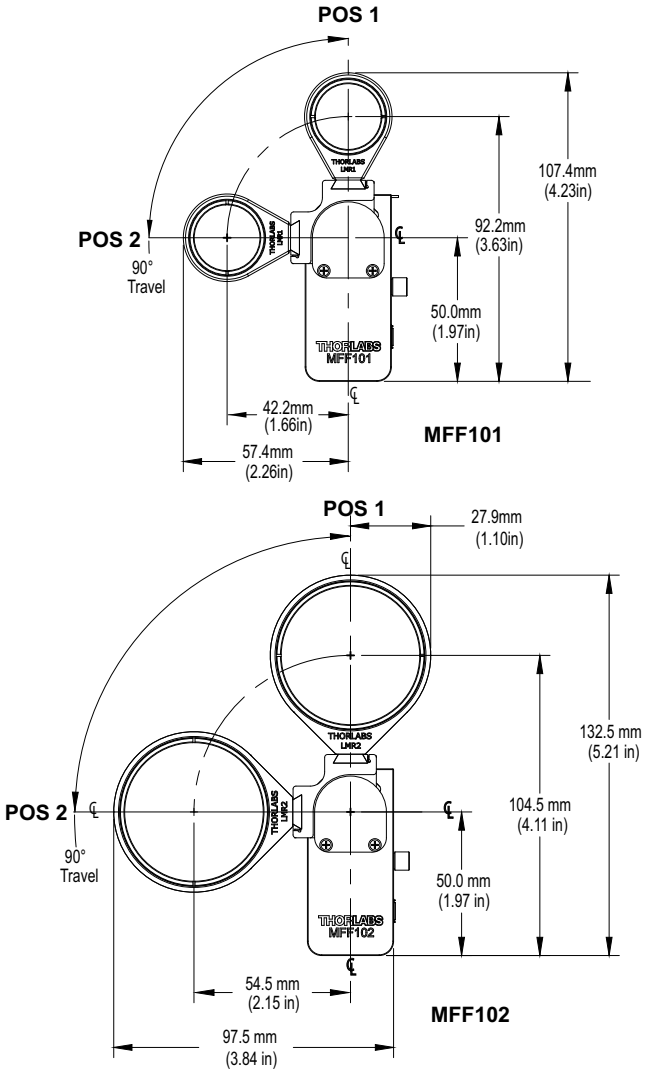


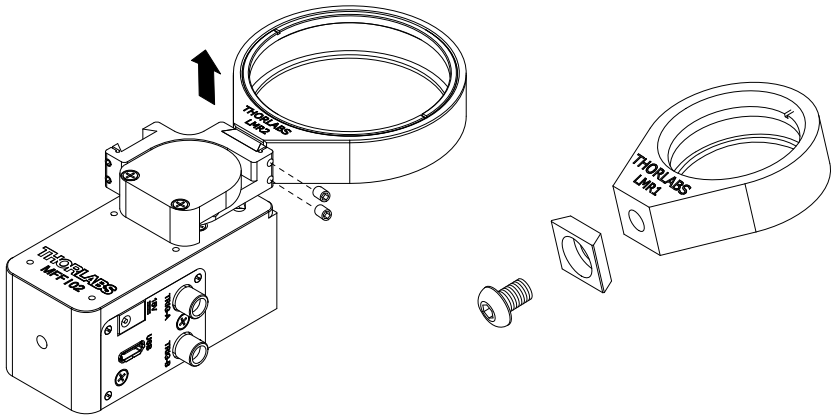
Fig. 3.2 Dimensions

3.6 Changing The Lens Mount

The mount is supplied complete with our LMR1(/M) 1" or LMR2(/M) 2" optical lens holder, but is compatible with other holders in the LMR range. Please note that the maximum load of 120g is based on using 2 x 2" optical lens holders.

To change the optics mount, proceed as follows:

1) Loosen the two grub screws securing the lens mount base and remove the lens mount from the unit.



2) Undo the screw securing the base to the lens mount. Retain the base and the screw.
3) To fit a lens mount, fit the base plate to the replacement mount using the appropriate screw supplied with the flipper unit, either #8-32 UNC or M4.
4) Fit the lens mount to the flipper unit and tighten the grub screws.

Chapter 4 Software & Electrical Installation

4.1 Installing APT Software

Caution

If your PC becomes unresponsive (e.g due to an operating system problem, entering a sleep state condition, or screen saver operation) for a prolonged period, this may interrupt communication between the APT Software and the hardware, and a communications error may be generated. To minimize the possibility of this happening it is strongly recommended that any such modes that result in prolonged unresponsiveness be disabled before the APT software is run. Please consult your system administrator or contact Thorlabs technical support for more details.

Caution

Some PCs may have been configured to restrict the users ability to load software, and on these systems the software may not install/run. If you are in any doubt about your rights to install/run software, please consult your system administrator before attempting to install.

If you experience any problems when installing software, contact Thorlabs on +44 (0)1353 654440 and ask for Technical Support.

DO NOT CONNECT THE CONTROLLER TO YOUR PC YET

5) Go to Services/Downloads at www.thorlabs.com and download the APT software.
6) Run the .exe file and follow the on-screen instructions.

4.2 Electrical Installation

4.2.1 Connecting To The Supply

Warning

The unit must be connected only to a 15 V DC supply. Connection to a supply of a different rating may cause damage to the unit and could result in injury to the operator.

4.3 Connecting The Hardware

1) Perform the mechanical installation as detailed in Section 3.
2) Install the APT Software - see Section 4.1.
3) Using the USB cable supplied, connect the stage unit to your PC.

Note

The USB cable should be no more than 3 metres in length. Communication lengths in excess of 3 metres can be achieved by using a powered USB hub).

4) Connect the flipper to the power supply unit (PSU) - see Section 4.2.1.
5) Connect the PSU to the mains supply wall outlet and switch 'ON' if required.
6) Wait for the unit to initialize (about 5 sec). Do not press any controls during this time.
7) Windows® should detect the new hardware. Wait while Windows® installs the drivers for the new hardware - see the Getting Started guide for more information.

4.4 Verifying Software Operation

4.4.1 Initial Setup

1) Run the APTUser utility and check that the Graphical User Interface (GUI) panel appears and is active.

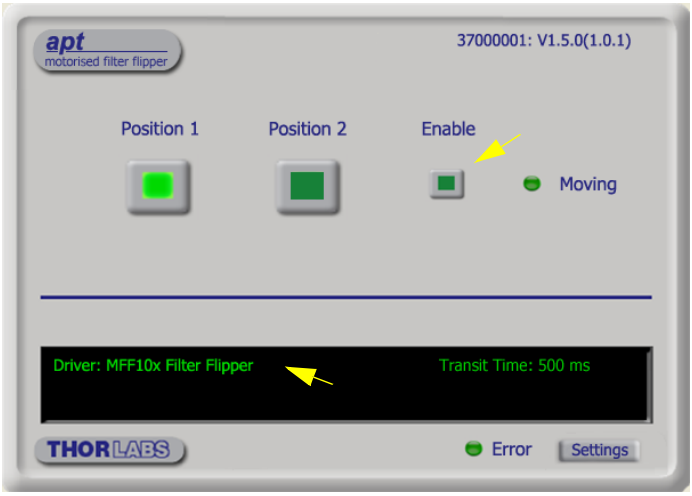


Fig. 4.1 Gui panel showing jog and ident buttons

2) Check that the correct stage type and serial number are displayed in the GUI panel.
3) Manually position the mount away from its end stop, then click the 'Position 1' or 'Position 2' button. The 'Moving' LED is lit while the move is in progress, then the LED in the position button is lit to show that the move is complete.

Follow the tutorial steps described in Chapter 6 for further verification of operation.

Note

The 'APT Config' utility can be used to set up simulated hardware configurations and place the APT Server into simulator mode. In this way it is possible to create any number and type of simulated (virtual) hardware units in order to emulate a set of real hardware. This is a particularly useful feature, designed as an aid to application program development and testing. Any number of 'virtual' control units are combined to build a model of the real system, which can then be used to test the application software offline. If using real hardware, ensure that Simulator Mode is disabled. If using a simulated setup, enable Simulator Mode and set up a 'Simulated Configuration' - see Section 5.4. or the *APTConfig* helpfile for detailed instructions.

Chapter 5 Operation

Warning

When the unit is powered up, do not move the flipper arm by hand.

5.1 Manual Operation

The Filter Flipper offers a fully featured motion control capability including Transit Time and I/O Configuration. When the unit is connected to the PC, these parameters are automatically set to allow “out of the box” operation with no further “tuning” required. However, further adjustment is possible via the APT Server software - see Chapter 6.

The flip action is activated manually by a button on the top of the unit, or by handset supplied.

The unit features two SMA connectors, marked DIG IO 1 & DIG IO 2. A TTL trigger input (configured in the Settings panel - see Section 6.3.) causes the flipper to toggle to the next state. If the user button or another trigger signal comes in before the end of the move then the flipper will ignore the demand until the current move is complete.

Notes

If power is removed, the unit may remain in the same position, or due to gravity, may move to the lower limit.

The external DIG IO connectors can be configured as input or output to accept various different signal types. A particular IO configuration can be ‘persisted (saved) within the unit for future use when operating in Stand Alone mode without a control PC - see Section 6.3. for more information.

5.2 PC-Base Operation

5.2.1 Introduction

The following brief tutorial guides the user through a typical series of moves and parameter adjustments performed using the PC based APT software. It assumes that the unit is electrically connected as described in Section 4.2. and that the APT Software is already installed - see Section 4.1.

Warning

As the unit is raised and lowered, items can become trapped in the mechanism. During operation, keep fingers, clothing and tools away from any moving parts.

When the unit is powered up, do not move the flipper arm by hand.

5.2.2 Using the APT User Utility

The APT User.exe application allows the user to interact with any number of APT hardware control units connected to the PC USB Bus (or simulated via the APTConfig utility). This program allows multiple graphical instrument panels to be displayed so that multiple APT units can be controlled. All basic operating parameters can be set through this program, and all basic operations can be initiated. Hardware configurations and parameter settings can be saved to a file, which simplifies system set up whenever APT User is run up.

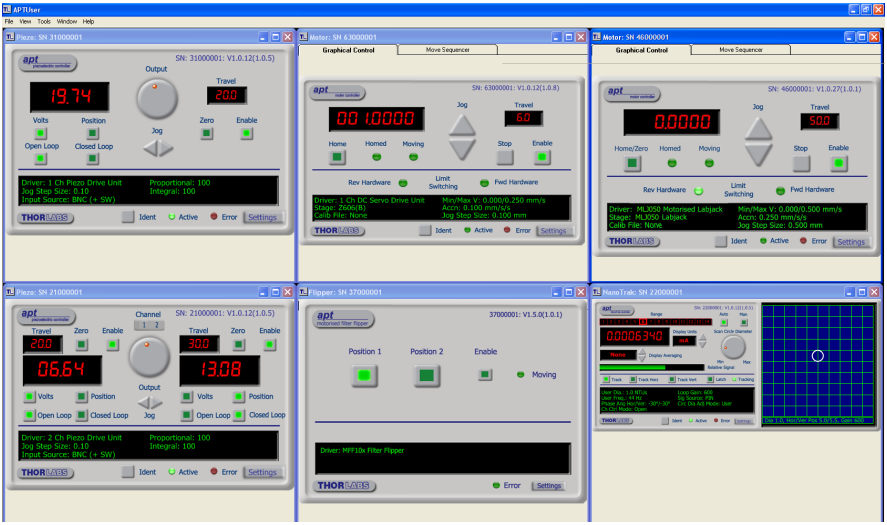


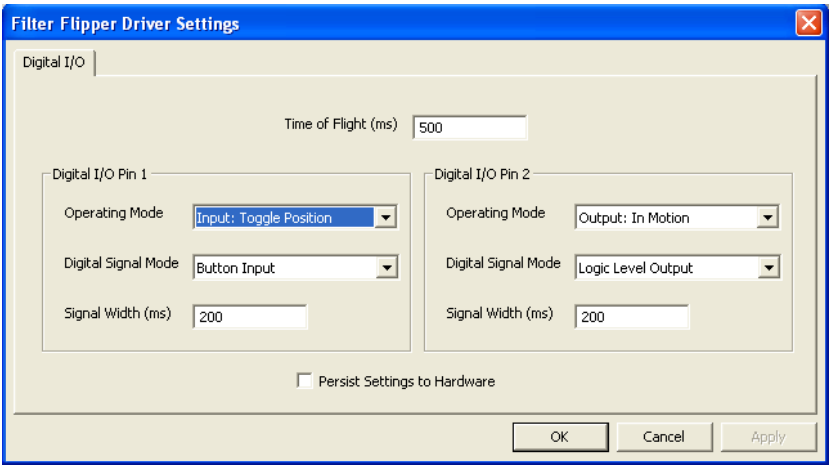
Fig. 5.1 Typical APT User Screen

1) Run the APT User program - Start/All Programs/Thorlabs/APT User/APT User.

5.2.3 Master/Slave Operation

If required, two flipper units can be wired in a master/slave configuration, such that a demanded flip on one unit, also triggers the other unit to flip.

1) From the GUI panel of the Master unit, click the Settings button to display the settings panel.



2) Make parameter settings as follows:

Digital I/O Pin 1

Operating Mode: Input: Toggle Position

Digital Signal Mode: Button Input

These settings set the Master unit to flip the optic position, each time the button is pressed.

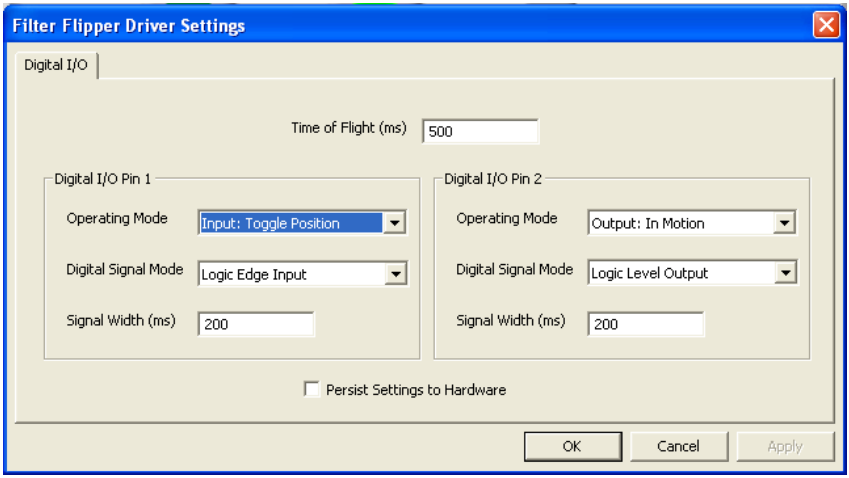
Digital I/O Pin 2

Operating Mode: Output: In Motion

Digital Signal Mode: Logic Level Output

These settings set the Master unit to output a logic high signal on DIG I/O 2 while the flipper is in motion.

3) From the GUI panel of the Slave unit, click the Settings button to display the settings panel.



4) Make parameter settings as follows:
Digital I/O Pin 1
Operating Mode: Input: Toggle Position
Digital Signal Mode: Logic Edge Input
These settings set the Slave unit to flip the optic position, each time a Logic High (5V) Edge is received on DIG I/O 1.

Digital I/O Pin 2
In the two unit master slave configuration, these settings are not used, though it is recommended that the DIG I/O Pin 2 Operating Mode be set to an Output option to avoid accidental triggering of the flip action.

5) Connect the DIG I/O Pin 2 terminal on the Master unit to the DIG I/O Pin 1 terminal on the slave unit.

5.3 Using the Software Commands

In software, the filter flipper is moved using the motor 'MoveJog' method. This method contains a parameter 'lJogDir' that takes values from the MOTORJOGDIRECTION enumeration to specify the direction of the move, '1' for clockwise and '2' for counterclockwise.

To read the flipper position, the motor 'LLGetStatusBits' method is used. If bit1 is set to 1, the flipper is in the upright position, if bit 1 is set to 0, the flipper is horizontal.

See the APTServer helpfile for more details on the use of these functions.

5.4 Creating a Simulated Configuration Using APT Config

The 'APT Config' utility can be used to set up simulated hardware configurations and place the APT Server into simulator mode. In this way it is possible to create any number and type of simulated (virtual) hardware units in order to emulate a set of real hardware. This is a particularly useful feature, designed as an aid learning how to use the APT software and as an aid to developing custom software applications 'offline'.

Any number of 'virtual' control units can be combined to emulate a collection of physical hardware units For example, an application program can be written, then tested and debugged remotely, before running with the hardware.

To create a simulated configuration proceed as follows:

1) Run the APT Config utility - Start/All Programs/Thorlabs/APT/APT Config.
2) Click the 'Simulator Configuration' tab.

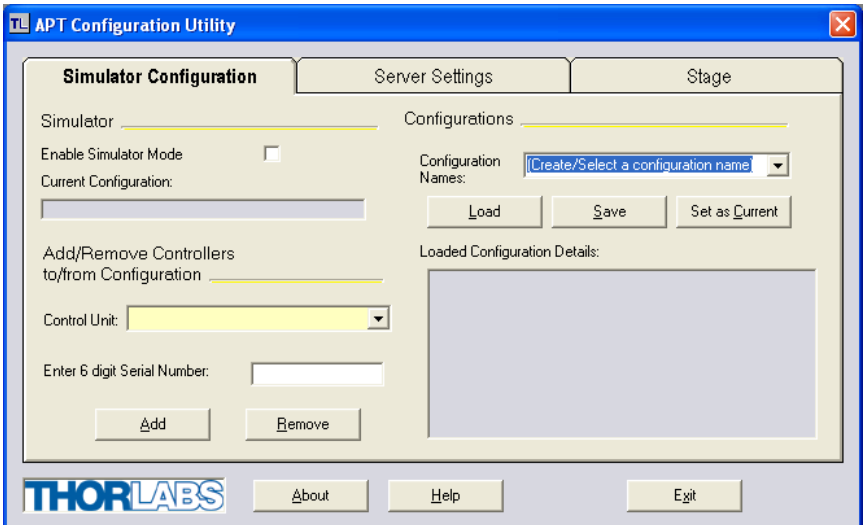
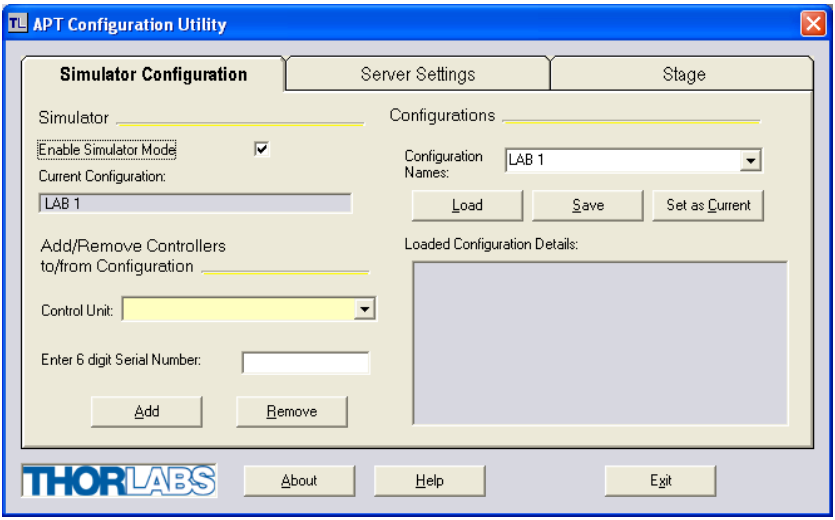


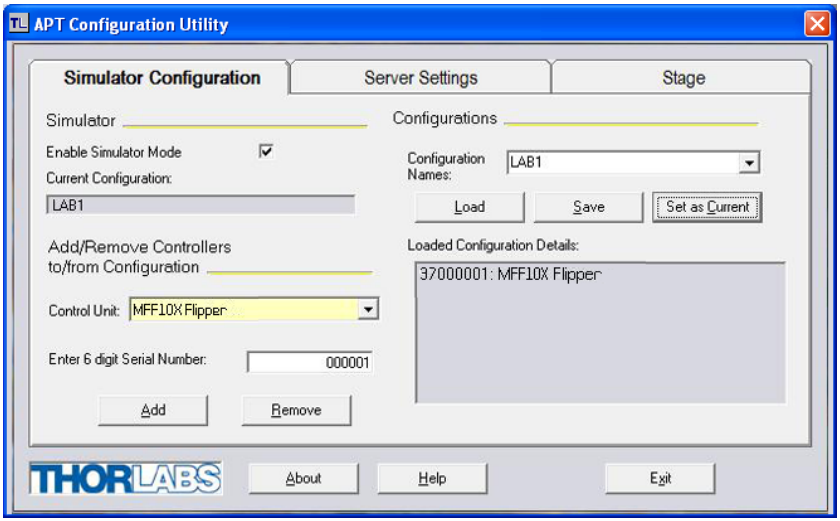
Fig. 5.2 APT Configuration Utility - Simulator Configuration Tab

3) Enter 'LAB1' in the Configuration Names field.

4) In the 'Simulator' field, check the ‘Enable Simulator Mode’ box. The name of the most recently used configuration file is displayed in the 'Current Configuration' window.



5) In the ‘Control Unit’ field, select the MFF10X Flipper’.



6) Enter a 6 digit serial number.

Note

Each physical APT hardware unit is factory programmed with a unique 8 digit serial number. In order to simulate a set of 'real' hardware the Config utility allows an 8 digit serial number to be associated with each simulated unit. It is good practice when creating simulated configurations for software development purposes to use the same serial numbers as any real hardware units that will be used. Although serial numbers are 8 digits (as displayed in the 'Load Configuration Details' window, the first two digits are added automatically and identify the type of control unit.

The prefixed digits relating to the MFF Filter Flipper are:
37xxxxxx - MFF Series Motorized Filter Flipper

7) Click the 'Add' button.
8) Repeat items (1) to (7) as required. (A unit can be removed from the configuration by selecting it in the 'Loaded Configuration Details' window and clicking the 'Remove' button or by right clicking it and selecting the 'Remove' option from the pop up window).
9) Enter a name into the 'Configuration Names' field.
10) Click 'Save'.
11) Click 'Set As Current' to use the configuration.

Chapter 6 Software Reference

6.1 Introduction

This chapter gives an explanation of the parameters and settings accessed from the APT software running on a PC.

6.2 GUI Panel

The following screen shot shows the graphical user interface (GUI) displayed when accessing the filter flipper using the APTUser utility.

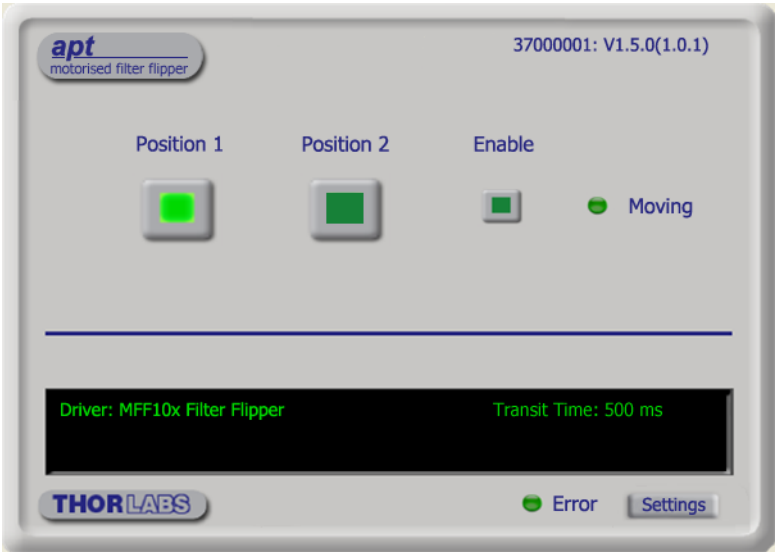


Fig. 6.1 Filter Flipper Software GUI

Note

The serial number of the MFF filter flipper associated with the GUI panel, the APT server version number, and the version number (in brackets) of the embedded software running on the unit, are displayed in the top right hand corner. This information should always be provided when requesting customer support.

Position 1 - used to initiate a move to position 1. When the button is clicked, the flipper is driven to the position at the speed entered in the 'Transit Time' field in the 'Settings' panel (see Section 6.3.). When at position, the LED in the button is lit.

Position 2 - used to initiate a move to position 2. When the button is clicked, the flipper is driven to the position at the speed entered in the 'Transit Time' field in the 'Settings' panel (see Section 6.3.). When at position, the LED in the button is lit.

Enable - applies power to the motor in the unit. With the flipper unit is enabled, the associated LED in the button is lit. Power is removed from the motor when a channel is disabled.

Moving- lit when the flipper is in motion. When the demanded position is reached, the moving LED is extinguished and the Position 1 or Position 2 LED is lit.

Error - lit when a fault condition occurs.

Settings button - Displays the 'Settings' panel, which allows the operating parameters to be entered - see Section 6.3.

6.3 Settings Panel

When the 'Settings' button on the GUI panel is clicked, the 'Settings' window is displayed. This panel allows the operating parameters of the unit to be modified. Note that all of these parameters have programmable equivalents accessible through the ActiveX methods and properties on this Control (refer to the *Programming Guide* in the *APTServer helpfile* for further details and to Section 2.2.4. for an overview of the APT ActiveX controls). The various parameters are described below.

6.3.1 Settings Panel

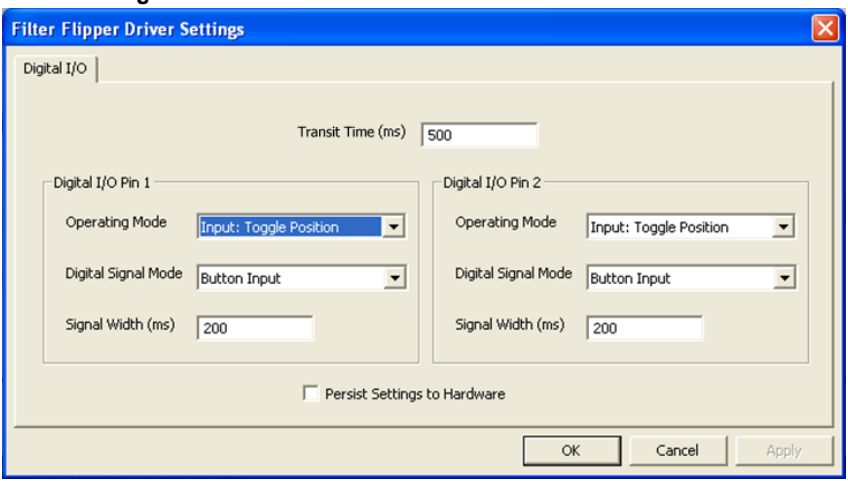


Fig. 6.2 Filter Flipper - Settings

Transit Time (ms) - The time taken (in milliseconds) for the flipper to move from position 1 to position 2 and vice versa, in the range 300 ms to 2800 ms.

The following parameters dictate the function of the SMA Digital I/O connectors on the unit. They are identical for Digital I/O Pin 1 and Digital I/O Pin 2.

Operating Mode - This parameter specifies the operating mode

Input: Toggle Position - Sets IO connector to input and 'toggle position' mode. In this mode, the input signal causes flipper to move to opposite position).

Input: Goto Position - Sets IO connector to input and 'goto position' mode. In this mode, the input signal dictates flipper position, POS 1 or POS 2 as dictated by the *Button Input* or *Button Input (Swap Pos)* parameters described below. See Fig. 3.2 for details of POS 1 and POS 2.

Output: At Position - Sets IO connector to output mode, where the O/P signal indicates the flipper is ‘at position’.

Output: InMotion - Sets IO connector to output mode, where the O/P signal indicates the flipper is in motion (i.e. between positions).

Digital Signal Mode - This parameter specifies the functionality of the input/output signal.

Button Input - The connector can be short circuited (e.g. with button). If the Operating Mode above is set to *Input:Toggle Position* then a short circuit causes the flipper to toggle position. If the Operating Mode is set to *Input: Goto Position* then a short circuit causes the flipper to move to POS 1 and open circuit causes flipper to move to POS 2.

Button Input (Swap Pos.) - As above but the open circuit and short circuit functionality is swapped when operating in *Input: Goto Position* mode. If operating in *Input:Toggle Position* mode, the functionality swap has no effect and the position toggles in the same way.

Logic Edge Input - The connector is set to logic input where a logic transition (edge) dictates flipper operation. If the Operating Mode above set to *Input:Toggle Position,* then a LO to HI edge causes flipper to toggle position. If the Operating Mode is set to *Input: Goto Position*, then a LO to HI edge causes the flipper to move to POS 1 and a HI to LO edge causes the flipper to move to POS 2.

Logic Edge Input (Swap Pos.) - As above but the logic transition (edge) functionality is swapped when operating in *Input: Goto Position* mode. If operating in *Input:Toggle Position* mode, the functionality swap has no effect and the position toggles in the same way.

Logic Level Output - The connector is set to a logic output where the logic transition (edge) represents flipper position. If the Operating Mode above is set to *Output: At Position*, then a LO to HI edge (HI level) indicates flipper is at POS 1 and a HI to LO edge (LO level) indicates the flipper is at POS 2. If the Operating Mode above is set to *Output: InMotion*, then a LO to HI edge (HI level) indicates the flipper is moving between positions and a HI to LO edge (LO level) indicates the flipper has stopped moving.

Logic Level Output (Inverted) - As above but the edge transition (level) functionality is swapped.

Logic Pulse Output - The connector is set to a logic output where a logic pulse indicates flipper operation. If the Operating Mode above is set to *Output: At Position*, then a logic HI pulse indicates flipper has reached a position. If the Operating Mode above is set to *Output: InMotion*, then a logic HI pulse indicates the flipper has started moving. The Pulse width is set in the Signal Width parameter below.

Logic Pulse Output (Inverted) - As above but the pulse functionality is swapped.

Signal Width (ms) - The pulse width when the *Digital Signal Mode* described previously is set to *Logic Pulse Output* or *Logic Pulse Output* (Inverted).

Persist Settings to Hardware

Many of the parameters that can be set for the MFF series flipper can be stored (persisted) within the unit itself, such that when the unit is next powered up these settings are applied automatically. This is particularly important when the driver is being used manually in the absence of a PC and USB link. The Transit Time, Operating Mode and Digital Signal Mode parameters described previously are good examples of settings that can be altered and then persisted in the unit for use in absence of a PC. To save the settings to hardware, check the 'Persist Settings to Hardware' checkbox before clicking the 'OK button.

Caution

The 'Persist Settings' functionality is provided to simplify use of the unit in the absence of a PC. When the unit is connected to a PC and is operated via APTUser, the default APTServer settings will be loaded at boot up, even if the 'Persist Settings' option has been checked.

Appendix A Preventive Maintenance

Warning

The equipment contains no user serviceable parts. There is a risk of electrical shock if the equipment is operated with the covers removed. Only personnel authorized by Thorlabs Ltd and trained in the maintenance of this equipment should remove its covers or attempt any repairs or adjustments. Maintenance is limited to safety testing and cleaning as described in the following sections.

A.1 Cleaning

Warning

Disconnect the power supply before cleaning the unit.

Never allow water to get inside the case.

Do not saturate the unit.

Do not use any type of abrasive pad, scouring powder or solvent, e.g. alcohol or benzene.

The outside of the unit may be cleaned with a soft cloth, lightly dampened with water or a mild detergent.

A.2 Troubleshooting

If an unexpected obstruction to the flipper motion is encountered, the control system interface software disables the current to the drive channel, which may or may not result in the channel being disabled. After the obstruction is removed, the unit should first be disabled to clear any fault codes, then re-enabled.

In the event of a breakdown, or malfunction of the product please contact Thorlabs Tech Support. Contact details are contained in Appendix E .

Appendix B Specifications

Parameter	Value
Travel	90°
Flip Time[1]	500 ms to 2800 ms
Optic Diameter	MFF101: 1” MFF102: 2”
Flip to Flip Repeatability	50 µrad
Angular Repeatability	240 µrad
Max Load[1]	120 g (4.23 oz)
Max Torque	0.1 Nm
DIG IO Connector Type	SMA
Power Input	15V DC
Weight	100 g (3.53 oz)

[1] For higher loads, the flip time must be increased. Settings will differ for each application, but as a rough guide, for loads >50 g the flip time should be > 1 second.

Appendix C Flipper Control Method Summary

The 'Flipper' ActiveX Control provides the functionality required for a client application to control one or more flipper units.

To specify the particular unit being addressed, every unit is factory programmed with a unique 8-digit serial number. This serial number is key to the operation of the APT Server software and is used by the Server to enumerate and communicate independently with multiple hardware units connected on the same USB bus. The serial number must be specified using the HWSerialNum property before an ActiveX control instance can communicate with the hardware unit. This can be done at design time or at run time. Note that the appearance of the ActiveX Control GUI (graphical user interface) will change to the required format when the serial number has been entered.

A brief summary of each method and property is given below, for more detailed information and individual parameter descriptions please see the on-line help file supplied with the APT server.

Methods

EnableHWChannel	Enables the drive output.
GetMFFOperParams	Gets the operating parameters for the filter flipper
Identify	Identifies the controller by flashing unit LEDs.
LLGetStatusBits	Gets the controller status bits encoded in 32 bit integer.
MoveJog	Initiates a jog move.
SetMFFOperParams	Sets the operating parameters for the filter flipper
StartCtrl	Starts the ActiveX Control (starts communication with controller)
StopCtrl	Stops the ActiveX Control (stops communication with controller)

Properties

APTHelp	Specifies the help file that will be accessed when the user presses the F1 key. If APTHelp is set to 'True', the main server helpfile *APTServer* will be launched.
HWSerialNum	specifies the serial number of the hardware unit to be associated with an ActiveX control instance.

Appendix D Regulatory

D.1 Declarations Of Conformity

D.1.1 For Customers in Europe

See Section D.3.

D.1.2 For Customers In The USA

This equipment has been tested and found to comply with the limits for a Class A digital device, persuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Changes or modifications not expressly approved by the company could void the user's authority to operate the equipment.

D.2 Waste Electrical and Electronic Equipment (WEEE) Directive

D.2.1 Compliance

As required by the Waste Electrical and Electronic Equipment (WEEE) Directive of the European Community and the corresponding national laws, we offer all end users in the EC the possibility to return "end of life" units without incurring disposal charges.

This offer is valid for electrical and electronic equipment

- sold after August 13th 2005
- marked correspondingly with the crossed out "wheelie bin" logo (see Fig. D.1)
- sold to a company or institute within the EC
- currently owned by a company or institute within the EC
- still complete, not disassembled and not contaminated

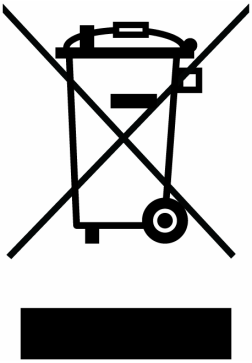


Fig. D.1 Crossed out "wheelie bin" symbol

As the WEEE directive applies to self contained operational electrical and electronic products, this "end of life" take back service does not refer to other products, such as

- pure OEM products, that means assemblies to be built into a unit by the user (e. g. OEM laser driver cards)
- components
- mechanics and optics
- left over parts of units disassembled by the user (PCB's, housings etc.).

If you wish to return a unit for waste recovery, please contact Thorlabs or your nearest dealer for further information.

D.2.2 Waste treatment on your own responsibility

If you do not return an "end of life" unit to the company, you must hand it to a company specialized in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.

D.2.3 Ecological background

It is well known that WEEE pollutes the environment by releasing toxic products during decomposition. The aim of the European RoHS directive is to reduce the content of toxic substances in electronic products in the future.

The intent of the WEEE directive is to enforce the recycling of WEEE. A controlled recycling of end of life products will thereby avoid negative impacts on the environment.

EU Declaration of Conformity

in accordance with EN ISO 17050-1:2010

We: Thorlabs Ltd.

Of: 204 Lancaster Way Business Park, Ely, CB6 3NX, UK

in accordance with the following Directive(s):

2006/42/EC	Machinery Directive (MD)
2014/30/EU	Electromagnetic Compatibility (EMC) Directive
2011/65/EU + 2015/86	Restriction of Use of Certain Hazardous Substances (RoHS)

hereby declare that:

Model: ***MFF10X Series***

Equipment: ***1" or 2" Motorised Filter Flipper - (Imperial or Metric)***

is/are in conformity with the applicable requirements of the following documents:

EN ISO 12100	Safety of Machinery. General Principles for Design. Risk Assessment and Risk Reduction	2010

Authorised to compile the technical file: Thorlabs GmbH
Münchner Weg1, 85232 Bergkirchen, Deutschland

EN 61326-1	Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements	2013
EN 63000	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances	2018

and which, issued under the sole responsibility of Thorlabs, is/are in conformity with Directive 2011/65/EU of the European Parliament and of the Council of 8th June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment, for the reason stated below:

exempt from the requirements of the Directive because its intended application is excluded pursuant to Annex III or Annex IV of the Directive.

I hereby declare that the equipment named has been designed to comply with the relevant sections of the above referenced specifications, and complies with all applicable Essential Requirements of the Directives.

Signed: Keith Dhese *On:* 21 April 2023

Name: Keith Dhese

Position: General Manager

Appendix E Thorlabs Worldwide Contacts

USA, Canada, and South America
Thorlabs, Inc.
56 Sparta Avenue
Newton, NJ 07860
USA
Tel: 973-300-3000
Fax: 973-300-3600
www.thorlabs.com
www.thorlabs.us (West Coast)
Email: sales@thorlabs.com
Support: techsupport@thorlabs.com

Europe
Thorlabs GmbH
Hans-Böckler-Str. 6
85221 Dachau
Germany
Tel: +49-(0)8131-5956-0
Fax: +49-(0)8131-5956-99
www.thorlabs.de
Email: europe@thorlabs.com

France
Thorlabs SAS
109, rue des Côtes
78600 Maisons-Laffitte
France
Tel: +33 (0) 970 444 844
Fax: +33 (0) 825 744 800
www.thorlabs.com
Email: sales.fr@thorlabs.com

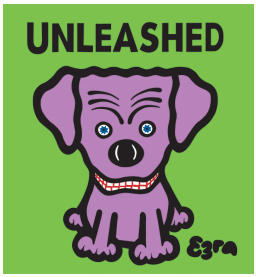
Japan
Thorlabs Japan, Inc.
Higashi-Ikebukuro Q Building, 2F
2-23-2, Higashi-Ikebukuro,
Toshima-ku, Tokyo 170-0013
Japan
Tel: +81-3-5979-8889
Fax: +81-3-5979-7285
www.thorlabs.jp
Email: sales@thorlabs.jp

UK and Ireland
Thorlabs Ltd.
1 Saint Thomas Place, Ely
Cambridgeshire CB7 4EX
Great Britain
Tel: +44 (0)1353-654440
Fax: +44 (0)1353-654444
www.thorlabs.de
email: sales@uk.thorlabs.com
Support: techsupport.uk@thorlabs.com

Scandinavia
Thorlabs Sweden AB
Bergfotsgatan 7
431 35 Mölndal
Sweden
Tel: +46-31-733-30-00
Fax: +46-31-703-40-45
www.thorlabs.com
Email: scandinavia@thorlabs.com

Brazil
Thorlabs Vendas de Fotônicos Ltda.
Rua Riachuelo, 171
São Carlos, SP 13560-110
Brazil
Tel: +55-16-3413 7062
Fax: +55-16-3413 7064
www.thorlabs.com
Email: brasil@thorlabs.com

China
Thorlabs China
Room A101, No. 100
Lane 2891, South Qilianshan Road
Putuo District
Shanghai
China
Tel: +86 (0) 21-60561122
Fax: +86 (0)21-32513480
www.thorlabschina.cn
Email: chinasales@thorlabs.com



Thorlabs Inc.
56 Sparta Ave
Newton, NJ07860
USA
Tel: +1 973 300 3000
Fax: +1 973 300 3600
www.thorlabs.com

Thorlabs Ltd.
Saint Thomas Place, Ely
Cambridgeshire CB7 4EX,
UK
Tel: +44 (0) 1353 654440
Fax: +44 (0) 1353 654444
www.thorlabs.com