Motorized Filter Wheel
FW-MOT-12.5 / FW-MOT-25

PRODUCT IDENTIFICATION
Part Number: 
Serial Number: 
Date Tested: 

Andover Corporation
4 Commercial Drive
Salem, New Hampshire 03079-2800
Tel: (603) 893-6888
US Toll Free: (888) 893-9992
Fax: (603) 893-6508
Email: techstaff@andovercorp.com
www.andovercorp.com
# TABLE OF CONTENTS

1. **DESCRIPTION** .............................................................. 3

2. **SUPPLIED EQUIPMENT** ....................................................... 3

3. **FEATURES** ................................................................. 3

4. **SPECIFICATIONS** ............................................................ 4  
   - Electrical .................................................................. 4  
   - Mechanical ................................................................ 4  
   - Physical ................................................................... 4  
   - Mechanical Drawings ........................................................ 5

5. **OPERATION** ................................................................. 6  
   - Mounting .................................................................. 6  
   - Power .................................................................... 7  
   - Aperture ................................................................... 7  
   - Manual Control ............................................................. 7  
   - Installing Filters ............................................................. 7  
   - Capacity Switch ............................................................. 7

6. **SOFTWARE** ................................................................. 8

8. **REGULATORY** ............................................................ 10

9. **LIMITED WARRANTY** ........................................................ 11
DESCRIPTION
Stepper Motor driven and Optical Encoder regulated, Andover Corporation’s Motorized Filter Wheel is designed to repeatedly select absolute positions upon manual push button command or remotely through the RS-232 or USB 2.0 interface. It has two aperture positions at 12:00 and 9:00, can accommodate up to six 1” (25mm) filters on interchangeable filter retaining wheels, and features a digital display on the unit that reads the current filter position. An optional twelve position filter retaining wheel which holds up to twelve ½” (12.5mm) filters is also compatible with the unit and easily installed.

SUPPLIED EQUIPMENT
1 FW-MOT-12.5 Filter Wheel
1 12 Position Filter Retaining Wheel
1 5V DC Converter
1 USB 2.0A to USB Micro A (6ft Cable)
1 RS-232 to RS-232 (6ft Cable)
1 Software Flash Drive
2 Threaded Aperture Caps
12 Threaded 1/2” Filter Retaining Rings
1 5/64” Ball Driver
1 Operating Manual
2 Aperture Reducing Caps

OR

1 FW-MOT-25 Filter Wheel
1 6 Position Filter Retaining Wheel
1 5V DC Converter
1 USB 2.0A to USB Micro A (6ft Cable)
1 RS-232 to RS-232 (6ft Cable)
1 Software Flash Drive
2 Threaded Aperture Caps
6 Threaded 1” Filter Retaining Rings
1 5/64” Ball Driver
1 Operating Manual

FEATURES
• Manual or Automated Control Capability
• Multi-Directional Controls
• Interchangeable Filter Retaining Wheels with six 1” (25mm) or twelve ½” (12.5mm) positions
• Selectable Aperture Openings At 12 O’clock and 9 O’clock
• 800 Millisecond Typical Access Time
• Accommodates up to 0.275” Filter Planar Width
• Lightweight with a Diversity of Mounting Capabilities
### Motorized Filter Wheel FW-MOT-12.5 / FW-MOT-25

#### SPECIFICATIONS

<table>
<thead>
<tr>
<th>ELECTRICAL</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter</td>
<td>Description</td>
</tr>
<tr>
<td>Power @ DC Input @ 1.2A</td>
<td>+5VDC</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>0°C to 60°C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MECHANICAL</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter</td>
<td>Description</td>
</tr>
<tr>
<td>Access Time Adjacent Locations</td>
<td>800ms</td>
</tr>
<tr>
<td>Access Time Other Locations</td>
<td>1600ms</td>
</tr>
<tr>
<td>Accuracy/Repeatability</td>
<td>±0.25°</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PHYSICAL</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Parameter</td>
<td>Description</td>
</tr>
<tr>
<td>Power Jack</td>
<td>Male 2.1mm</td>
</tr>
<tr>
<td>USB Connector</td>
<td>Female Micro A</td>
</tr>
<tr>
<td>Mounting</td>
<td>¼-20, 8-32, M6-1, M4-.7, or SM1 Thread</td>
</tr>
<tr>
<td>Max Filter Diameter</td>
<td>1.0” (25.4 mm)</td>
</tr>
<tr>
<td>Max Planar Filter Width</td>
<td>0.275” (7mm)</td>
</tr>
<tr>
<td>Dimensions (L x W x H)</td>
<td>5.48” x 2.15” x 4.38” (139 x 55 x 111mm)</td>
</tr>
</tbody>
</table>
Figure 1: Mechanical Drawing, Front and Right Side

Figure 2: Mechanical Drawing, Top and Bottom
OPERATION

The following sections describe the basic operation of the motorized filter wheel.

Mounting
The base of the unit contains six mounting holes: one 1/4”- 20, two #8-32, one metric M6-1.0, and two M4-0.7 threaded holes for mounting to optical tables and breadboards, see Figure 2. The filter wheel cover contains SM1 threads for attaching lens tubes or for mounting the FW-MOT-25 directly to cameras, microscopes, and telescopes. Andover Corporation sells a host of adapters for the SM1 threads.
Power
The unit comes with an AC wall adapter to supply +5 VDC to the unit. Plug the adapter into a 120V US standard outlet then plug the 2.1 mm male plug from the AC adapter into the DC input jack on the unit. Upon power up, the unit will display the filter number located at the selected aperture. If the wheel is not located at a valid location, it will rotate to the closest valid position.

Aperture
The unit has two aperture locations at 12 O’clock and 9 O’clock. To toggle aperture selection, hold down both the up and down arrow buttons simultaneously for 2 seconds to trigger Aperture Selection Mode. The display will read either A1 or A2 pending the current aperture selection where A1 is the 12 O’clock position and A2 is the 9 O’clock position. You may now switch from one position to another by pressing either the up or down arrow buttons. The unit automatically rotates the selected filter to the correct aperture when the aperture selection is made. To exit Aperture Selection Mode repeat the process to enter it.

Manual Control
Depressing the UP/DOWN arrow buttons on the top of the unit (Figure 2) will increment and decrement the filter location. The arrows also indicate the direction of rotation for the wheel and the display will indicate the filter selection.

Installing Filters

⚠️ WARNING: Prior to changing filters, ensure the unit is disconnected from the DC source.

The filters can be changed by first removing the filter wheel cover. Using the 5/64” ball driver provided, remove the three cover fasteners shown in Figure 3. Filters can now be inserted into the desired locations. Filters are secured to the wheel by inserting the provided the SM1RR-1CT retaining rings. Please note that the rear edge of the threaded filter holes contain a retaining lip to secure one edge of a 1” filter. 25mm filters may require a SM1RR-1CT on each side of the filter. Optionally, the entire filter wheel can be removed by unscrewing the locking knob shown in Figure 1 after removing the cover. When reattaching the filter wheel to the housing, align the guide pins from the housing to the guide holes on the wheel before attaching the locking knob. The unit will reorient after the first selection is made.

Capacity Switch
This switch located on the back of the unit toggles the amount of positions that the unit recognizes. It is used to switch from a six position filter retaining wheel to a twelve position filter retaining wheel. All other functions are unaffected by this switch.
SOFTWARE

This details the serial communication interface for Andover’s Filter Wheel. It also defines setup, data format and modes. Serial communication interface includes the RS232 or USB link. (Terminology: ‘h’ - denotes a hexadecimal number, ‘nibble’ - half of a byte, four bits.)

Serial Communications:
Both hardware connections (USB and RS232) utilize COM ports. The USB link requires drivers to simulate a virtual COM port. They can be downloaded at the link below.

VCP Driver download page:
http://www.ftdichip.com/Drivers/VCP.htm

Follow the instructions found in appropriate document:

Data format:
The “Host” PC initiates each communication session with a single eight bit command. The unit will respond to every valid command with a Status Reply.

Commands:

Increment Position (69h, ASCII i)
- When a 69h is sent to the unit, the position increments.

Decrement Position (64h ASCII d)
- When a 64h is sent to the unit, the position decrements.

Change Position (3xh)
- When the unit receives a byte containing a ‘3’ in the upper nibble, it will change position to ‘x’. The unit will go to either 1, 6 or 12 if ‘x’ is out of range.
- E.g. Byte ‘3A’ is sent to the unit. If the unit was in 12 position mode, the position changes to ten. If the unit was in 6 position mode, the unit will go to position 6 since ten is out of range.

Status Change (4zh)
- When the unit receives a byte containing ‘4’ in the upper nibble, it will change state according to the individual bits of nibble ‘z’. This lower nibble ‘z’ has the same format order as the Status Reply’s upper nibble ‘y’.

- Bit 0 – Aperture setting
  - 0 = A1 (9 o’clock)
  - 1 = A2 (12 o’clock)
• Bit 1 – Jam Error (read only)
  • 0 = No error
  • 1 = Jam

• Bit 2 – 6/12 Wheel (read only)
  • 0 = 6 Filter Wheel
  • 1 = 12 Filter Wheel

• Bit 3 – Sleep
  • 0 = Awake
  • 1 = Sleeping

Status Request / NULL (73h ASCII ‘s’)
• When a 73h is sent to the unit, the unit will do nothing but send a Status Reply.

Status Reply
This is the unit’s reply to any valid command listed above. The lower nibble contains the latest measured position when the command was received. The upper nibble ‘y’ contains the unit’s current status.
• Bit 0 : 3 – Contains the current measured position.
• Bit 4 – Aperture setting
  • 0 = A1 (9 o’clock)
  • 1 = A2 (12 o’clock)

• Bit 5 – Jam Error (read only)
  • 0 = No error
  • 1 = Jam

• Bit 6 – 6/12 Wheel (read only)
  • 0 = 6 Filter Wheel
  • 1 = 12 Filter Wheel

• Bit 7 – Sleep
  • 0 = Awake
  • 1 = Sleeping
REGULATORY

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

- This offer is valid for Andover Corporation electrical and electronic equipment that is:
  - Sold after August 13th 2005
  - 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

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 Andover Corporation 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, housing’s etc.)

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

Waste Treatment is Your Own Responsibility

If you do not return an “end of life” unit to Andover Corporation, 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.

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.
LIMITED WARRANTY

Andover warrants that all Products shall conform to the Product specifications and shall be free from defects in materials and workmanship for a period of one year from date of purchase. This Limited Warranty shall not apply in the event of any failure caused by accident, misuse, neglect, alteration or improper installation or repair by the Purchaser.

DISCLAIMER OF OTHER WARRANTIES – THE LIMITED WARRANTY SET FORTH ABOVE IS IN PLACE OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, AND ANDOVER EXPRESSLY DISCLAIMS ALL OTHER WARRANTIES, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. SPECIFICALLY, IT IS THE PURCHASER’S RESPONSIBILITY TO TEST AND DETERMINE THE SUITABILITY OF THE PRODUCTS FOR PURCHASER’S INTENDED USE WHICH SHALL BE THE SOLE RESPONSIBILITY OF THE PURCHASER.

LIMITATION OF REMEDIES AND DAMAGES - Andover’s sole obligation and the Purchaser’s sole and exclusive remedy under the Limited Warranty set forth above shall be limited to (a) replacement of defective Products provided that written claim of the defect is sent to Andover within the Limited Warranty Period, the original product is returned with transportation prepaid, and Andover’s inspection establishes the existence of such defect; or (b) in the sole discretion of Andover, return of the original purchase price received by Andover from the Purchaser.

Andover shall in no event be liable for any damages, including without limitation, lost profits, incidental or consequential damages by reason of or in connection with the purchase or use of the Products.

INDEMNIFICATION – The Purchaser agrees to indemnify and hold Andover harmless from and against any claim, loss, cost or expense resulting from Purchaser’s use of the Products, whether such claim arises in contract, tort or otherwise.

GOVERNING LAW – All matters arising under this Limited Warranty and other terms and conditions of sale shall be governed by the laws of the State of New Hampshire. The Purchaser consents to the exclusive jurisdiction of the courts of the State of New Hampshire in all matters relating to the purchase, sale and use of the Products.