LEADERS THROUGH INNOVATION
STARLIGHT XPRESS ltd

Handbook for the Starlight Xpress Midi Filter Wheel with OAG

Thank you for your purchase of the Starlight Xpress Midi Filter Wheel. We hope that you will enjoy using this advanced SX unit, which offers many unique features. This handbook will help you to put it into operation and to understand its capabilities.

Please register your product and warranty at https://forms.gle/tmsHEJfQG2bLJjr57 .

Description:

The SX Midi Wheel is especially designed for use with medium format CCD cameras and can use interchangeable carousels for 1.25 inch threaded.

The SX Midi Filter Wheel has several important advantages over older and less sophisticated designs:

1) The wheel uses an internal sub-miniature DC motor drive to turn the filter plate. This consumes far less power than the more typical stepper motor and allows wheel operation directly from the USB input, thus eliminating the cumbersome power supply and extra power cable. The DC drive also produces a quiet and vibration-free filter translation and eliminates a significant amount of bulk and weight.
2) The filter locations are encoded by 2 Hall-effect magnetic sensors, which permit up to 7 unique filter positions to be defined. The control software can specify a particular filter without prior knowledge of the location of 'position 1' – so the filters can never get out of sequence. The lack of any infrared optical sensors also prevents stray infrared light from entering the CCD camera and causing strange image artefacts.
3) The input and output adapters are both removable and also may be oriented at any rotational angle to set the wheel and camera into optimum positions. The standard male 42mm x 0.75mm 'T2' thread adapter and female 48mm x 0.75mm thread adapter may be replaced with other versions, simply by unscrewing three fixing bolts.
4) The integrated OAG pick-off prism makes off-axis guiding extremely easy. The prism is par-focal with most SX cameras and may be adjusted to suit many other makes.
5) The slim design of the Midi Wheel minimises the loss of optical back focal distance to only 38mm overall (including the threaded adapters).

Loading the filters:

Open the wheel by unscrewing the 6 small thumbscrews from around the periphery of the wheel chamber, lift off the cover and then remove the single large thumbscrew and washer from the internal central pillar and slide the OAG out of the way. You can now lift the filter plate off the centre bearing and place it down with the magnet pillars facing upwards. Your filters may now be screwed into the plate from the magnet screw side, placing them in the desired numerical order according to the engraving on the plate. Re-assemble the wheel by reversing the sequence of operations above.

Installing the software:

No drivers are required for the SX Midi Wheel. The USB input is an 'HID' device which Windows recognises automatically. Popular third-party software, such as AstroArt and Maxim DL include the command sets for the SX Midi Wheel, and the latest SX software can also be used with the wheel. You may also use a simple Windows 'Console' program, which is provided on the USB Stick. This program, 'SX Filter Wheel.exe', may be copied into a folder on your computer and will display a filter wheel control panel when executed. It may be found useful for both testing the

wheel and operating it when the camera software does not support the SX wheel protocols.

Connecting up the wheel:

USB control:
If you are using USB control, then the only connection required is that between the USB port on the wheel and a USB output on your computer. You may, of course, use a USB hub, if necessary – a powered hub is recommended to ensure that the wheel motor has sufficient torque to operate reliably. When the wheel is first connected, Windows will display a message about 'New hardware found' followed by 'SX filter wheel'. Shortly afterwards, the wheel will rotate once or twice as it calibrates and determines the number of filter positions available. It is now in position 1 and ready to use. If the wheel motor 'pulses' in a cyclic fashion and doesn't stop, then the calibration has failed and you need to check that the USB connection is good and that the carousel can move freely.

Using the OAG pick-off:

The OAG pick-off assembly is designed to be used with an SX Lodestar or Ultrastar guide camera, but other types may be employed if they have a 'C' mount (1 inch) threaded input collar. Fit the guide camera onto the C mount ring and slide the ring onto the OAG tube. Use the small lock screw to fix it about halfway down the tube. Loosen the large lock screw and slide the prism tube until the prism is roughly tangential with the edge of the filter aperture. With this assembly attached to the 'scope and the main camera operating, focus the main camera to give a sharp image. Now switch to the guide camera images and adjust the C mount ring along the pick-off tube until the guide camera is focused on any visible stars in the guider field. If you cannot see many stars, or they are badly distorted, slide the prism assembly a little further in, but be careful not to 'shadow' the main camera field.

Filter Wheel maintenance:

Very little maintenance is required and is limited to occasionally cleaning the carousel and drive wheel to remove any dirt or grease deposits that might cause slippage. A few drops of alcohol on a soft cloth will clean the surfaces and fix any drive problems. Under very cold conditions, residual moisture might cause the central bearing to freeze to the brass shaft. This can be alleviated by applying a single drop of light oil to the shaft to repel moisture.

Starlight Xpress Midi Filter Wheel Communication Protocols

Interfaces available:
USB: 1.1 or 2.0

General parameters:
Total Filters: This is the number of filters fitted on the wheel, and is 7 for the standard Midi Wheel.
Filter number: This is any number from 1 to <Total Filters>
(If a Filter Number higher than Total Filters is requested then the Filter Number is set to <Total Filters>)

USB Protocol:
The SX filter wheel uses a simple "Human Interface Device" protocol, so no special driver needs to be installed. The driver is an integral part of the Windows PC operating system.
Communications between the PC & filter wheel is by input and output reports (referenced to the PC). These reports are both of a fixed length of two bytes. The PC sends the output report and the filter wheel, about 1ms later, will send an input report in response.

The output report data is formatted thus:

Description	1st byte	2nd byte
Select Filter	New Filter number	Zero (0)
Request current filter number	Zero	Zero
Get Filter Total	Zero	One (1)

The input report data is formatted thus:

Response To:	1st byte	2nd byte
Select New Filter	New Filter number or Zero = filters moving	Total filters
Request current filter number	Current Filter number or Zero = filters moving	Total filters
Get Filter Total	Current Filter number or Zero = filters moving	Zero

NB: The 'Get Filter Total' command responds straight away with a "filters moving" message. However, there is a delay of several seconds before the Total Filters data is available to the "Request Current Filter Number" command. This is the time taken for the wheel to complete between one and

two complete rotations. During this period the Total Filters will be reported as zero. When this command is completed filter 1 is automatically selected.

Serial Port Protocol:

The SX filter wheel implements a four-character format, which has just three commands thus:

Notes: Checksum is 8bit addition of Header + Command + Data
　　　0xA5 is the hexadecimal number = decimal number 165
　　　0x20 is the hexadecimal number = decimal number 32

Output Command/Data from PC

Description	Header (1)	Command (2)	Data (3)	Checksum (4)
Select Filter	0xA5	1	New Filter number	4 = 1+2+3
Request Current Filter	0xA5	2	0x20	4 = 1+2+3
Get Filter Total	0xA5	3	0x20	4 = 1+2+3

Input Data to PC

Description	Header (1)	Response (2)	Data (3)	Checksum (4)
Select Filter	0xA5	0x81	New Filter Number	4 = 1+2+3
Request Current Filter	0xA5	0x82	Filter Number + 0x30	4 = 1+2+3
Get Filter Total	0xA5	0x83	Total Filters + 0x30	4 = 1+2+3

Examples, (all characters expressed in hexadecimal):

Select Filter Number 3:
PC -> Filter Wheel,　　0xA5, 0x01, 0x03, 0xA9
Filter Wheel -> PC,　　0xA5, 0x81, 0x03, 0x29

Request Current Filter (which is 2):
PC -> Filter Wheel,　　0xA5, 0x02, 0x20, 0xC7
Filter Wheel -> PC,　　0xA5, 0x82, 0x32, 0x59

Get Filter Total:
PC -> Filter Wheel,　　0xA5, 0x03, 0x20, 0xC8
Filter Wheel -> PC,　　0xA5, 0x83, 0x37, 0x2F (after delay)

Note: The 'Get Filter Total' command has a delay of several seconds before the response is sent back. This is the time taken for the wheel to complete between one and two rotations. When completed, filter 1 is selected. Do not send any new requests until the response is received. Any data sent during this period would be read but then discarded.

Dear Observer,

Thank you for purchasing a Starlight Xpress Filter Wheel. We are confident that you will gain much satisfaction from this equipment, but please read carefully the accompanying instruction manual to ensure that you achieve the best performance that is capable of providing.

Please register your product and warranty at https://forms.gle/tmsHEJfQG2bLJjr57 .

As with most sophisticated equipment a certain amount of routine maintenance is necessary to keep the equipment operating at its optimum performance. The maintenance has been kept to a minimum, and is fully described in the manual.

In the unfortunate instance when the equipment does not perform as expected might we recommend that you first study the fault finding information supplied. If this does not remedy the problem, then contact Starlight Xpress for further advice. Our message board service on the Starlight Xpress web site will often provide solutions to any problems.

The equipment is covered by a 12-month guarantee covering faulty design, material or workmanship in addition to any statutory Consumer Rights of Purchasers.

CONDITIONS OF GUARANTEE

1) The equipment shall only be used for normal purposes described in the standard operating instructions, and within the relevant safety standards of the country where the equipment is used.

2) Repairs under guarantee will be free of charge providing proof of purchase is produced, and that the equipment is returned to the Service Agent at the Purchaser's expense and risk, and that the equipment proves to be defective.

3) The guarantee shall not apply to equipment damaged by fire, accident, wear and tear, misuse, unauthorised repairs, or modified in any way whatsoever, or damage suffered in transit to or from the Purchaser.

4) The Purchaser's sole and exclusive rights under this guarantee is for repair, or at our discretion the replacement of the equipment or any part thereof, and no remedy to consequential loss or damage whatsoever.

5) This guarantee shall not apply to components that have a naturally limited life.

6) Starlight Xpress's decision in all matters is final, and any faulty component which has been replaced will become the property of Starlight Xpress Ltd.

For further info. or advice, please call:

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