Instructions manual

MCZR0XX-00Y

Macro Zoom lenses with motorized control

www.opto-engineering.com
# Table of contents

1. Product overview ....................................................................................................................... pag. 3
2. Safety warnings ........................................................................................................................ pag. 3
3. Warranty ........................................................................................................................................ pag. 4
4. Specifications ............................................................................................................................. pag. 4
   4.1 Optical Specifications
   4.2 Mechanical Specifications
      4.2.1 Mass
      4.2.2 Dimensions
   4.3 Electrical and Electronics Specifications
   4.4 Working Conditions

5. Instructions for use ....................................................................................................................... pag. 8
   5.1 Clamping, turning on and focusing
   5.2 How to change magnification
      5.2.1 Magnification change by pressing the button
      5.2.2 Magnification change by DLL
      5.2.3 Alarms, errors and solutions

6. Software demo ........................................................................................................................... pag. 16
   6.1 DEMO mode Control Panel
1. Product overview

Macro Zoom Revolver MCZR 0XX-00Y are zoom lenses that provide up to four different magnification changes. In particular, they are varifocal lenses, i.e. they perform discrete (non-continuous) magnification changes while working at the same fixed working f-number WF/#.

2. Safety warnings

- **Read carefully this instructions manual**
  This document contains the necessary information to use the product properly.

- **Do not inspect the internal parts of the product. Warranty will not be valid if product is opened**
  This product contains very delicate components that might be permanently damaged if handled without care.

- **Product must be adequately shielded if employed in dusty and humid places**

- **Do not use togheter with machines that generate strong vibrations**
  Macro Zoom Revolver might be permanently damaged if deployed in the presence of strong vibrations and impulsive forces.

- **Zoom Revolver must be properly clamped before usage**
  Zoom Revolver must be mechanically constrained by adequate clamps, specifically where indicated (see Mechanical Specifications).

- **Do not use the product out of the fields of usage marked in the specifications**
  See paragraph 4 for the Specifications.

3. Warranty

Opto Engineering offers 100,000 magnification changes as warranty for products that have been installed according to the installation instructions supplied. The product will be either replaced or repaired in case of defects presence in any component. Warranty does not cover parts damaged as a result of incorrect usage.
4. Specifications

4.1 Optical specifications

4.1.1 Optical parameters specifications
The following MCZR0XX-00Y optical specifications are relative to a 2/3" detector (8.8 mm x 6.6 mm).

MCZR 033-008
MCZR033-008 performs the following 4 magnification changes: 0.083x, 0.167x, 0.250x, 0.333x. The following table lists usage specifications for each different magnification:

<table>
<thead>
<tr>
<th>OPTICAL PARAMETERS</th>
<th>0.083x</th>
<th>0.167x</th>
<th>0.250x</th>
<th>0.333x</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working Distance¹ WD</td>
<td>208.4 mm</td>
<td>208.4 mm</td>
<td>208.4 mm</td>
<td>208.4 mm</td>
</tr>
<tr>
<td>F number ² F/#</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Distortion</td>
<td>&lt; 0.2%</td>
<td>&lt; 0.1%</td>
<td>&lt; 0.05%</td>
<td>&lt; 0.05%</td>
</tr>
<tr>
<td>Field depth</td>
<td>18 mm</td>
<td>4.5 mm</td>
<td>2 mm</td>
<td>1.1 mm</td>
</tr>
<tr>
<td>CTF@50 [lp/mm]</td>
<td>&gt; 40%</td>
<td>&gt; 50%</td>
<td>&gt; 60%</td>
<td>&gt; 60%</td>
</tr>
<tr>
<td>Object field of view [mm x mm]</td>
<td>105.8 x 79.4</td>
<td>52.8 x 39.6</td>
<td>35.2 x 26.4</td>
<td>26.4 x 19.8</td>
</tr>
</tbody>
</table>

MCZR 025-006
MCZR025-006 performs the following 4 magnification changes: 0.063x, 0.125x, 0.188x, 0.251x. The following table lists usage specifications for each different magnification:

<table>
<thead>
<tr>
<th>OPTICAL PARAMETERS</th>
<th>0.063x</th>
<th>0.125x</th>
<th>0.188x</th>
<th>0.251x</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working Distance¹ WD</td>
<td>275.9 mm</td>
<td>275.9 mm</td>
<td>275.9 mm</td>
<td>275.9 mm</td>
</tr>
<tr>
<td>F number ² F/#</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Distortion</td>
<td>&lt; 0.2%</td>
<td>&lt; 0.1%</td>
<td>&lt; 0.05%</td>
<td>&lt; 0.05%</td>
</tr>
<tr>
<td>Field depth</td>
<td>30 mm</td>
<td>8 mm</td>
<td>3.5 mm</td>
<td>1.9 mm</td>
</tr>
<tr>
<td>CTF@50 [lp/mm]</td>
<td>&gt; 50%</td>
<td>&gt; 50%</td>
<td>&gt; 60%</td>
<td>&gt; 50%</td>
</tr>
<tr>
<td>Object field of view [mm x mm]</td>
<td>140.6 x 105.5</td>
<td>70.2 x 52.6</td>
<td>46.8 x 35.1</td>
<td>35.1 x 26.3</td>
</tr>
</tbody>
</table>

1. Distance between the front lens and the object. Set this distance within +/- 3% of the nominal value for maximum resolution and minimum distortion
2. Working F-number: the real F-number of a lens when used as a macro
### MCZR 018-004
MCZR018-004 performs the following 4 magnification changes: 0.047x, 0.094x, 0.141x, 0.188x. The following table lists usage specifications for each different magnification:

<table>
<thead>
<tr>
<th>OPTICAL PARAMETERS</th>
<th>0.047x</th>
<th>0.094x</th>
<th>0.141x</th>
<th>0.188x</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working Distance¹ WD</td>
<td>384.8 mm</td>
<td>384.8 mm</td>
<td>384.8 mm</td>
<td>384.8 mm</td>
</tr>
<tr>
<td>F number² F/#</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Distortion</td>
<td>&lt; 1.0%</td>
<td>&lt; 0.2%</td>
<td>&lt; 0.1%</td>
<td>&lt; 0.05%</td>
</tr>
<tr>
<td>Field depth</td>
<td>55 mm</td>
<td>14 mm</td>
<td>6 mm</td>
<td>3.5 mm</td>
</tr>
<tr>
<td>CTF@50 [lp/mm]</td>
<td>&gt; 40%</td>
<td>&gt; 40%</td>
<td>&gt;60%</td>
<td>&gt; 60%</td>
</tr>
<tr>
<td>Object field of view [mm x mm]</td>
<td>187.5 x 140.6</td>
<td>93.6 x 70.2</td>
<td>62.4 x 46.8</td>
<td>46.8 x 35.1</td>
</tr>
</tbody>
</table>

¹ Distance between the front lens and the object. Set this distance within +/- 3% of the nominal value for maximum resolution and minimum distortion.

² Working F-number: the real F-number of a lens when used as a macro.

### MCZR 014-003
MCZR014-003 performs the following 4 magnification changes: 0.035x, 0.070x, 0.105x, 0.140x. The following table lists usage specifications for each different magnification:

<table>
<thead>
<tr>
<th>OPTICAL PARAMETERS</th>
<th>0.035x</th>
<th>0.070x</th>
<th>0.105x</th>
<th>0.140x</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working Distance¹ WD</td>
<td>532.3 mm</td>
<td>532.3 mm</td>
<td>532.3 mm</td>
<td>532.3 mm</td>
</tr>
<tr>
<td>F number² F/#</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Distortion</td>
<td>&lt; 1.0%</td>
<td>&lt; 0.2%</td>
<td>&lt; 0.1%</td>
<td>&lt; 0.05%</td>
</tr>
<tr>
<td>Field depth</td>
<td>100 mm</td>
<td>25 mm</td>
<td>11 mm</td>
<td>6 mm</td>
</tr>
<tr>
<td>CTF@50 [lp/mm]</td>
<td>&gt; 40%</td>
<td>&gt; 40%</td>
<td>&gt;60%</td>
<td>&gt; 60%</td>
</tr>
<tr>
<td>Object field of view [mm x mm]</td>
<td>252.1 x 189.1</td>
<td>125.8 x 94.4</td>
<td>84 x 63</td>
<td>63 x 47.2</td>
</tr>
</tbody>
</table>
4.2 Mechanical Specifications

4.2.1 Mass
MCZR033-008: \( m = 0.98 \text{ kg} \);
MCZR025-006: \( m = 0.98 \text{ kg} \);
MCZR018-004: \( m = 1 \text{ kg} \);
MCZR014-003: \( m = 1 \text{ kg} \).

4.2.2 Dimensions
Refer to the following tables for product dimensions

MCZR 033-008
MCZR025-006

275.9 Working Distance

Best Focus Plane

Change Mag Button

LED Position Indicator

Mini-USB Signal Connector

Power (24V) Connector

109876543210

1/1

Drawing No.

Scale

N.A.

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Description

Design

Undimensioned bevels

Material

Surface treatment

Geometrical tolerance (ISO 2768-2)

Linear tolerance (ISO 2768-2)

Undimensioned

÷3

0.5

÷2000

R 0.5

÷1x45°

÷3

0.5

÷30

>3÷

÷30÷

÷400

>120

÷4000

±0.1 ±0.1 ±0.2 ±0.3 ±0.5 ±0.8 ±1.2 ±2

Class

Class m

K

>2000

Date

First Light A A.Vismara 23/02/13

Rev No.
4.3 Electrical and electronic specifications

- Input voltage: 24V±2%;
- MCZR can be connected to PC via USB 2.0 (cable provided). Connect the standard-A plug end of the cable to the PC and the mini-B plug end of the cable to the MCZR.

4.4 Working conditions

- Max temperature: 60 °C;
- The product must be shielded from vibration sources and impulse forces
5. Instructions for use

5.1 Clamping, turning on and focusing

MCZR must be mounted on a rigid support. It can be locked on a support through the 4 threaded holes located on the bottom.

1. Adjust the WD until it is equal to the WD value listed on the optical specifications.

2. Set the maximum magnification position by rotating the carousel until you reach the maximum magnification position.
3. Precisely adjust the mount position by means of adding/removing back focal adjustment spacers until you find the best focusing position.

4. Adjust the phase angle. Once you find the right phase, lock the screws (M2 metric thread)
5.2 How to change magnification

Macro Zoom Revolver offers two ways to change magnification: **Stand alone** mode by pressing the button; **On-line mode** by DLL.

5.2.1 Magnification change by pressing the button

When used in “stand alone” mode, MCZR is not connected to a PC: change magnification by simply pressing the blue magnification button located below the LED position indicators. Just press the button until you reach the desired magnification position (the corresponding LED position indicator will show the position); after a few seconds the carousel will rotate until it reaches the selected position and the corresponding LED position indicator will turn green.

In case of failure of the procedure defined above, connect the MCZR to a PC and proceed as described in paragraph 5.2.3.

5.2.2 Magnification change by DLL

On-line mode magnification change requires the following system specification:

- 512 MB RAM
- 1.5 MB free hard disk space
- XGA or higher-resolution monitor
- Mouse or other pointing device
- Intel® Pentium® III/M 1.4 GHz Processor minimum
- Operating System 32 bit:
  - Microsoft® Windows XP Home or Professional (SP2)
  - Microsoft® Windows Vista (requires Administrator rights)
  - Microsoft® Windows 7 (requires Administrator rights)

You additionally need to implement a DLL that resembles the following DLL Function prototypes.
5.2.3 Alarms, errors and solutions

In case of failure, MCZR must be connected to a PC in order to visualize the error type.

Once your Macro Zoom Revolver is connected to the PC, call the *GetState function to get the error type. You can subsequently visualize the device state, in particular:

- **Position**
  - return the current position of the device

- **ErrorOverSupply**
  - return 1 if supply voltage (Vin) is too high, otherwise 0

- **ErrorUnderSupply**
  - return 1 if supply voltage (Vin) is too low, otherwise 0

- **ErrorOverCurrent**
  - return 1 if coil current is too high (over Imax), otherwise 0

- **ErrorI2T**
  - return 1 if I2T error, otherwise 0

- **ErrorPosition**
  - return 1 if position not reached, otherwise 0

- **WarningPosition**
  - return 1 if position reached with more steps than StepPulse, otherwise 0

- **StepDone**
  - return to the steps performed to reach the position

- **Busy**
  - return 1 if the device is busy, otherwise 0

- **Run**
  - return 1 if the device is moving, otherwise 0

In case of:

- **ErrorOverSupply**
- **ErrorUnderSupply**
- **ErrorOverCurrent**

Adjust the system’s power supply. If that is not the cause of the failure, contact the seller.

State **ErrorI2T** is a self-protective condition of the system: the device stops working and then automatically re-starts after a certain amount of time. In case of **ErrorI2T** keep monitoring error state and wait for system recovery. Contact the seller if the system does not re-start correctly.

In case of ErrorPosition call the DLL *Trillo or reboot the system. If the problem persists contact the seller.
// DLL Function prototypes  --------------------------------------------------------

// Start communication  ----------------------------------------------------------
//
// Parameters:
// PortNumber: Serial port number  1 = COM1 , 2 = COM2 etc.. etc.. max 99
// Baud      : Baud 1200,2400,4800,9600,19200,38400,57600,115200
//
// Return value: 0 = ok, -1 = error
int (__stdcall *InitComm)(int PortNumber,int Baud) ;

// Close communication  --------------------------------------------------------
//
// Parameters : none
//
// Return value: none
//
void (__stdcall *CloseComm)(void) ;

// Return the DLL version -------------------------------------------------------
//
// Parameters: none
//
// Return value: pointer to the version string
//
char * (__stdcall *GetDllVersion)(void) ;

// Set the timeout for a command response  --------------------------------------
//
// Parameters : timeout in ms (value > 0 and <= 5000) default 500 ms
//
// Return value: 0 = OK, -1 = value <= 0, -2 = value > 5000
//
int (__stdcall *SetTimeOutRxCommand)(int milliseconds) ;

// Return the firmware version --------------------------------------------------
//
// Parameters:
//
// Version     : pointer to the string which contains the version (minimum size 10 bytes)
//
// Return value: 0 = 0k ; -1 = timeout error; -2 = Checksum error , -3 = serial communication not
// started (InitComm)
//
int (__stdcall *GetFwVersion)(char *Version) ;

// -----------------------------------------------------------------------------
// Return the device status ---------------------------------------------------
// Parameters:

// Position : return the current position of the device
// ErrorOverSupply : return 1 if supply voltage (Vin) is too high, otherwise 0
// ErrorUnderSupply : return 1 if supply voltage (Vin) is too low, otherwise 0
// ErrorOverCurrent : return 1 if coil current is too high (over Imax), otherwise 0
// ErrorI2T : return 1 if I2T error, otherwise 0
// ErrorPosition : return 1 if position not reached, otherwise 0
// WarningPosition : return 1 if position reached with more steps than StepPulse, otherwise 0
// StepDone : return to the steps performed to reach the position
// Busy : return 1 if the device is busy, otherwise 0
// Run : return 1 if the device is moving, otherwise 0

// Return value: 0 = 0k ; -1 = timeout error ; -2 = Checksum error ; -3 = serial communication not started (InitComm)

int (__stdcall *GetState)(char unsigned *Position,char unsigned *ErrorOverSupply,
char unsigned *ErrorUnderSupply,char unsigned *ErrorOverCurrent,
char unsigned *ErrorI2T,char unsigned *ErrorPosition,
char unsigned *WarningPosition,char unsigned *StepDone,
char unsigned *Busy,char unsigned *Run);

// Read working parameters stored in the device --------------------------------
// Parameters:

// T1 : 0 .. 10000 ms | <- Pulse
// T2 : 0 .. 10000 ms | <- special pulse (Trillo)
// T3 : 0 .. 10000 ms |
// TDuty : 0 .. 2 | (0 = 25%, 1 = 50%, 2 = 75%)
// TT1 : 0 .. 10000 ms |
// TT2 : 0 .. 10000 ms | <- special pulse (Trillo)
// TT3 : 0 .. 10000 ms |
// TTDuty : 0 .. 2 | (0 = 25%, 1 = 50%, 2 = 75%)
// I2Tmax : 0 .. 100000 Thermal image limit
// VinMin : 0 .. 60000 mV minimum input voltage
// VinMax : 0 .. 60000 mV maximum input voltage
// Imax : 0 .. 60000 mA maximum current
// StepPulse : 0 .. 200 pulses needed to move to a position (step)
// ExtraPulse : 0 .. 200 Extra pulses

// Return value: 0 = 0k ; -1 = timeout error ; -2 = Checksum error ; -3 = serial communication not started (InitComm)

int (__stdcall *GetParameters)(int *T1,int *T2,int *T3,int *TDuty,int *TT1,int *TT2,int *TT3,int
*TTDuty, int *I2Tmax, int *VinMin, int *VinMax, int *Imax, int *StepPulse, int *ExtraPulse) ;

// Move command -----------------------------------------------
// Parameters:
// Position : 0 .. 3 possible positions of the device
// Return value: 0 = 0k, -1 = timeout error; -2 = Checksum error; -3 = NAK device busy; -4 = serial
// communication is not open (InitComm)
//
int (__stdcall *GoToPosition)(int position) ;

// Trillo command (special pulse) -------------------------------
// Parameters: none
// Return value: 0 = 0k, -1 = timeout error; -2 = Checksum error; -3 = NAK device busy; -4 = serial
// communication is not open (InitComm)
//
int (__stdcall *Trillo)(void) ;

// Functions for debugging purposes ----------------------------
// Return the pointer to the transmit buffer (for debugging)
char * (__stdcall *DebugBufferTx)(void) ;

// Return the pointer to the receive buffer (for debugging)
char * (__stdcall *DebugBufferRx)(void) ;
6. Software demo

Together with your MCZR, you additionally get the demo software “test DLL”. System requirements for installing the demo software are the following:

- 512 MB RAM;
- 1.5 MB free hard disk space;
- XGA or higher-resolution monitor;
- Mouse or other pointing device;
- Intel® Pentium® III/M 1.4 GHz processor minimum;
- Operating Systems 32 bit:
  - Microsoft® Windows XP Home or Professional (SP2);
  - Microsoft® Windows Vista (requires Administrator rights);
  - Microsoft® Windows 7 (requires Administrator rights).

Run the executable file (setup.exe) to start software installation.

6.1 DEMO mode Control Panel

MCZR control panel consists of 5 sections:

- Ports
- Parameters
- Versions
- Device Status
- Commands

In section Ports press the OPEN button to connect your TCZR to the PC. The "Common Port" window shows the virtual serial port number where the device is found. Three state coloured indicators show state messages: the system is correctly connected if the Connected indicator turns green while Timeout and Checksum are error messages.

In section Parameters, the default factory settings are listed. Press the “GET” button to update and get the present values.

Section Versions lists the DLL release and firmware version.
In the Device Status Section, the following error, warning and state indicators are listed.

In detail:
1. Over supply error (see 5.2.3);
2. Under supply error (see 5.2.3);
3. Over current error (see 5.2.3);
4. I2T error
5. Position Error (see 5.2.3);
6. Position warning (see 5.2.3);
7. Busy (see 5.2.3);
8. Run (see 5.2.3).

Commands section allows the user to set the Macro Zoom Revolver magnification by selecting the corresponding position (0,1,2,3). In case of position Error, press the “Trillo” button to recover the position.

You can download the complete software package from one of these locations:

www.opto-engineering.com/download/MCZR0XX-00Y_SW_package.rar
www.opto-engineering.com/download/MCZR0XX-00Y_SW_package.zip
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