

# MR320

ZapFREE® Incremental Encoder CONTROLLER Module

**MICRONOR**  
automation components

## Products

The MR320 ZapFREE® Controller module is the active half of the MR320 series ZapFREE® Fiber Optic Incremental Encoder System. The module incorporates multiple built-in interfaces for compatibility with PLCs, motor drives and other motion control systems.

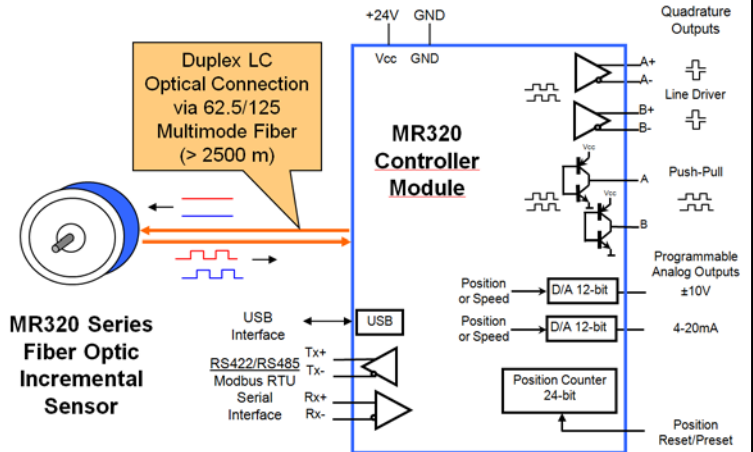
- Mounts on standard 35mm DIN Rail
- Operates from +15C to +32 VDC power supply
- A/B quadrature outputs – line driver and push-pull
- Two programmable analog outputs (4-20mA and ±10V)
- USB, Modbus RTU or RS422/RS485 serial interface
- RS232 connections available with optional adapters



**Inherently Safe Optical Radiation**  
[Ex op is I/II Ga]

## Features

- All optical, passive sensor does not emit EMI
- Sensor is immune to EMI, RFI, lightning and ground loops
- Interference-free transmission up to 2500 meters (8000 feet)
- Sensor is ATEX classified as “Simple Apparatus” and is approved for use in all types of hazardous locations and explosive atmospheres (gas and dust), including mines and oil rigs.
- Multiple built-in interfaces



## System Planning



1. Verify that the optical link loss is within system’s two-way loss margin of 12.5dB  
Account for losses of inline connectors, splices and cable  
For example, 4 interconnections (0.5dB each) over 400-meter (3dB/km) = 6.4dB
2. Follow industry-specific FOLAN component selection and installation guidelines  
Always follow bend radius, flex, clamping and routing conventions.  
Recommend industrial-grade PUR cable and connectors for industrial environments

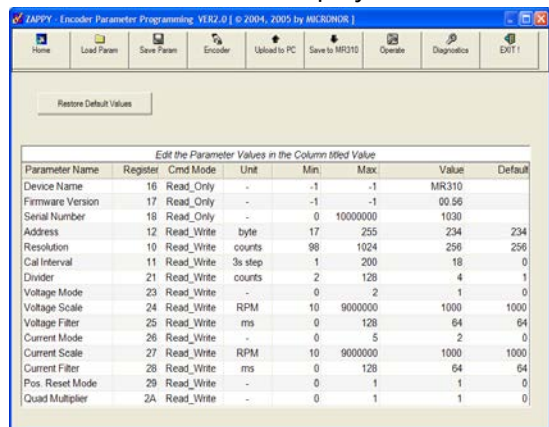
## What is ZAPPY™?

As delivered, the Micronor ZapFREE™ Fiber Optic Encoder System (consisting of MR320 series fiber optic encoder and MR320 module) are preprogrammed, ready to be connected and operated using the Direct Quadrature outputs. However, many user applications intend to use the auxiliary functions and operating modes within the encoder firmware, including Quadrature Multiplier/Divider, Position Counter, Analog Outputs or to run Diagnostics. For these latter functions, the user needs to use the supplied ZAPPY™ Configuration/Diagnostics program to perform a one-time setup for configuring functions. The software is designed to run on a PC running under Windows XP or later. The PC can be connected to the MR320 module, via USB or RS232 COM port (with optional MR232-1 RS485-to-RS232 Converter Cable). Typical ZAPPY™ screens are shown below:

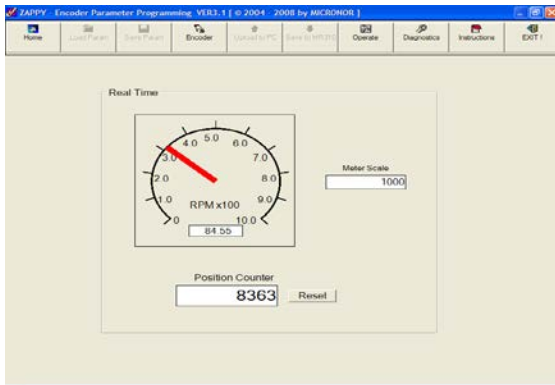
### Start-Up Screen



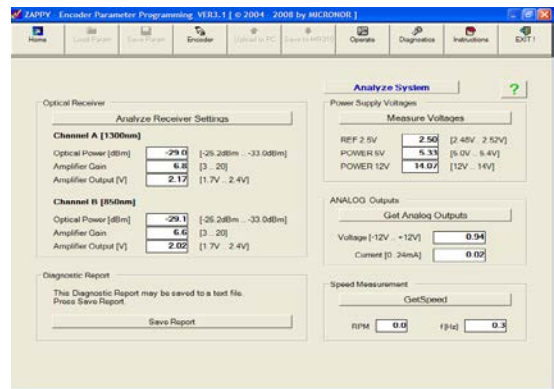
### Encoder Parameters Display Screen



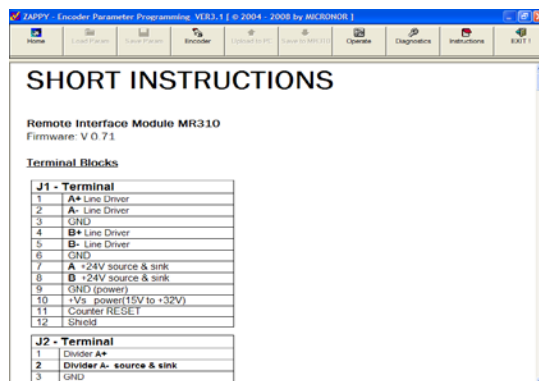
### Real-Time Diagnostics Screen



### Internal Diagnostics Screen



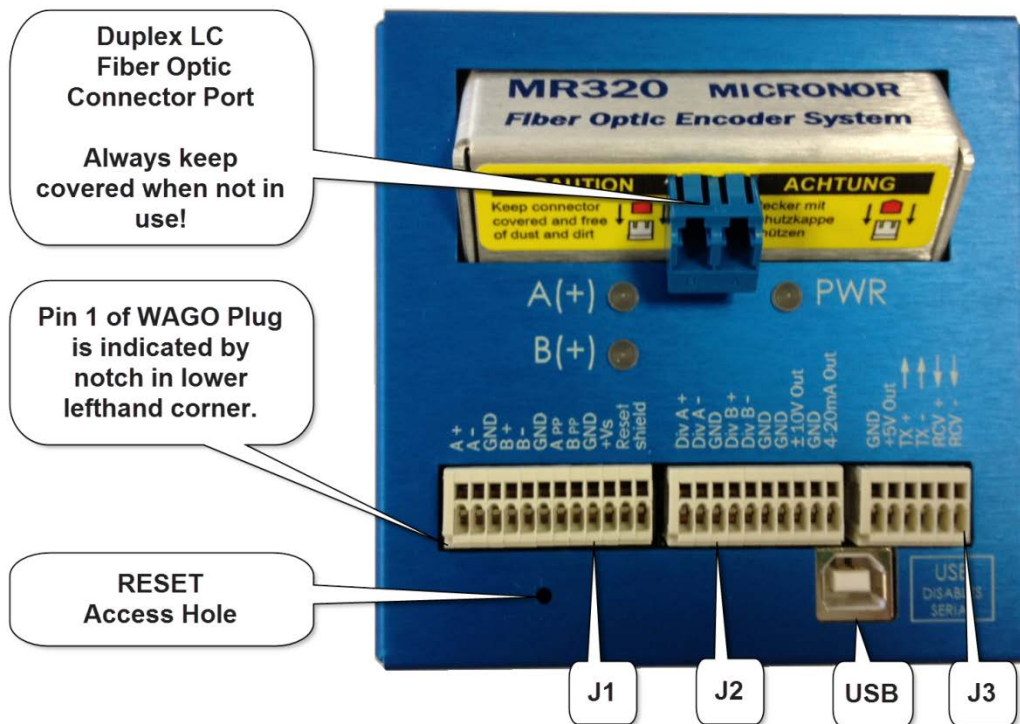
### Online Instructions



## How Do I Connect My PC to the MR320 Module for Running ZAPPY™?

There are three methods provided for connecting your PC or laptop to the MR320 module for purposes of running ZAPPY™:

- USB interface via built-in Type B connector receptacle (a USB cable is supplied with MR320)
- RS422/RS485 serial interface via RX/TX serial port connection on J3
- RS232 (PC COM Port) serial interface via J3 connection with optional MR232-1 Converter Cable



J1 WAGO PN: 733-112 (12 PIN TERMINAL)	
1	A+
2	A-
3	GND
4	B+
5	B-
6	GND
7	A oc
8	B oc
9	GND
10	+Vs
11	not used
12	shield

J2 WAGO PN: 733-110 (10 PIN TERMINAL)	
1	Div A+
2	Div A-
3	GND
4	Div B+
5	Div B-
6	GND
7	GND
8	±10V Out
9	GND
10	4-20mA Out

J3 WAGO PN: 733-106 (6 PIN TERMINAL)	
1	GND
2	+5V Out
3	TX+ →
4	TX- →
5	RCV+ ←
6	RCV- ←

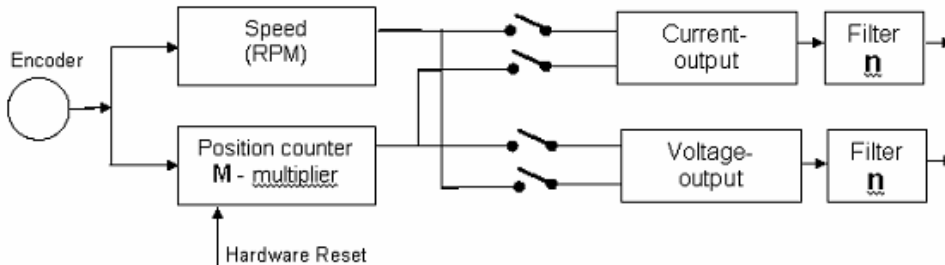
## How do I interface the MR320 to my motion control system?

The MR320 offers a broad array of standard encoder/motion control interface options:

- A/B push-pull quadrature outputs (typically used for 24V inputs)
- A/A'/B/B' line driver quadrature outputs (also TTL compatible)
- Fully programmable 4-20mA analog output, configurable for speed or position output
- Fully programmable  $\pm 10V$  analog output, configurable for speed or position output
- RS422/RS485 serial interface using commands and protocols described in Technical Manual/User Guide. You can download the full technical manual via the "manual" link for the MR320 at [www.micronor.com](http://www.micronor.com)

## How do I setup the parameters for operating the Analog Outputs?

The two analog outputs can be independently configured as a Speed (RPM) or an absolute Position indicator. Any Full Scale value  $>0$  will activate the output. The Mode defines which Function the output performs. Each analog output is followed by a programmable low pass Filter. Consult following summary or MR3XX User Guide for details.



## How Do I Program The *Voltage or Current* analog outputs for Speed (RPM)?

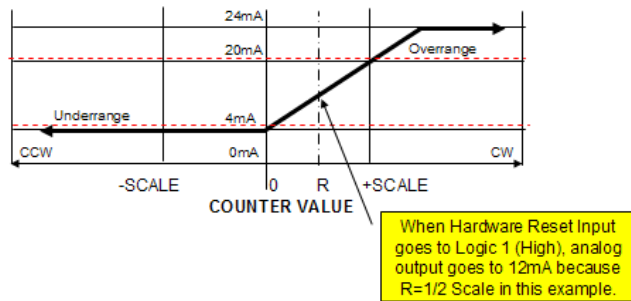
- **Encoder Direction** (Register 2B) accepts values of 0=CW (default) and 1=CCW
- **Output Function** (Voltage register 23 and Current register 26)
  - See following page for output modes available
- **Full Scale** value (Voltage register 24 and Current register 27)
  - 0 turns the Voltage analog output OFF – regardless of selected Output mode
  - Accept full scale value of 10-10,000 (RPM)
- **Filter** values (Voltage register 25 and Current register 28)
  - Value 0 corresponds to no filtering
  - 1-256 correspond to the 3dB filter point per equation provided in the Technical Reference

Voltage SPEED Mode (Register 23)	
0	<p style="text-align: center;"><b>Voltage Speed Mode 0</b></p> <p>The graph shows a linear relationship between RPM and voltage. The y-axis represents voltage with markers at +12V, +10V, 0V, -10V, and -12V. The x-axis represents RPM with markers at -SCALE, 0, and +SCALE. The plot starts at (-SCALE, -12V) and ends at (+SCALE, +12V). Horizontal dashed lines at +10V and -10V are labeled 'Overrange'. The direction of rotation is indicated as CCW for negative RPM and CW for positive RPM.</p>
1	<p style="text-align: center;"><b>Voltage Speed Mode 1</b></p> <p>The graph shows a V-shaped relationship between RPM and voltage. The y-axis represents voltage with markers at +12V, +10V, 0V, -10V, and -12V. The x-axis represents RPM with markers at -SCALE, 0, and +SCALE. The plot starts at (-SCALE, -12V), goes up to (0, 0V), and then up to (+SCALE, +12V). Horizontal dashed lines at +10V and -10V are labeled 'Overrange'. The direction of rotation is indicated as CCW for negative RPM and CW for positive RPM.</p>
Current SPEED Mode (Register 26)	
0	<p style="text-align: center;"><b>Current Speed Mode 0</b></p> <p>The graph shows a linear relationship between RPM and current. The y-axis represents current with markers at 24mA, 20mA, 4mA, and 0mA. The x-axis represents RPM with markers at -SCALE, 0, and +SCALE. The plot starts at (-SCALE, 0mA) and ends at (+SCALE, 24mA). Horizontal dashed lines at 20mA and 4mA are labeled 'Overrange'. The direction of rotation is indicated as CCW for negative RPM and CW for positive RPM.</p>
1	<p style="text-align: center;"><b>Current Speed Mode 1</b></p> <p>The graph shows a V-shaped relationship between RPM and current. The y-axis represents current with markers at 24mA, 20mA, 4mA, and 0mA. The x-axis represents RPM with markers at -SCALE, 0, and +SCALE. The plot starts at (-SCALE, 0mA), goes up to (0, 24mA), and then up to (+SCALE, 24mA). Horizontal dashed lines at 20mA and 4mA are labeled 'Overrange'. The direction of rotation is indicated as CCW for negative RPM and CW for positive RPM.</p>
2	<p style="text-align: center;"><b>Current Speed Mode 2</b></p> <p>The graph shows a V-shaped relationship between RPM and current. The y-axis represents current with markers at 24mA, 20mA, 4mA, and 0mA. The x-axis represents RPM with markers at -SCALE, 0, and +SCALE. The plot starts at (-SCALE, 0mA), goes up to (0, 24mA), and then up to (+SCALE, 24mA). Horizontal dashed lines at 20mA and 4mA are labeled 'Overrange'. The direction of rotation is indicated as CCW for negative RPM and CW for positive RPM.</p>

## How Do I Program The Voltage and/or Current Analog Output for POSITION?

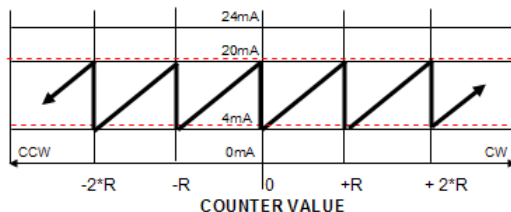
- **Encoder Direction** (Register 2B) accepts values of 0=CW (default) and 1=CCW
- **Output Function** ( Voltage register 23 and Current register 26, see table below for output functions)
- **Full Scale** value (Voltage register 24 and Current register 27)
  - 0 turns the Current Voltage analog output OFF – regardless of selected Mode
  - Accepts full scale value of 1-8,388,607 counts
- **Filter** values (Voltage register 25 and Current register 26)
  - 0 corresponds to no filtering
  - 1-256 correspond to the 3dB filter point per equation provided in the Technical Reference
  - Default value is 32 (corresponding to 10Hz)
- **Counter Reset** mode (Register 29)
  - 0 = Counter is reset on first rising edge of RESET input
  - 1 = Allows debounce period of 60ms
- **Counter Multiplier** mode (Register 2A)
  - 0 = Normal counting (every cycle is one count)
  - 1 = Allows ½ quadrature cycle to increment/decrement internal Counter – effectively doubling the position resolution.
- **Hardware Reset Value** (Register 2C)
  - Internal Counter resets to this value when RESET input is activated
  - Accepts input value of 0-8,388,607
  - Sometimes this function is also called “homing”
  - Analog output value will be determined by Mode selected. Here is an example:

**HARDWARE RESET VALUE Mode**  
 (Example shown uses Current Position Mode 6  
 Where R (RESET Value) = ½ of Current Scale Value)



- **Reset On Count/Homing** mode (Register 2D)
  - Internal Position Counter is automatically reset to 0 whenever its absolute value matches this preprogrammed value
  - 0 = mode deactivated
  - Accepts input value of 1-8,388,607 for active mode. Here is an example:

**RESET ON COUNT Mode**  
 (Example shown uses Current Position Mode 6  
 Where R=RESET Value)



Voltage POSITION Mode (Register 23)	
2	<p style="text-align: center;"><b>Voltage Position Mode 2</b></p>
Current POSITION Mode (Register 26)	
3	<p style="text-align: center;"><b>Current Position Mode 3</b></p>
4	<p style="text-align: center;"><b>Current Position Mode 4</b></p>
5	<p style="text-align: center;"><b>Current Position Mode 5</b></p>
6	<p style="text-align: center;"><b>Current Position Mode 6</b></p>

**Functional and Electrical Interface**

DIRECT Quadrature Outputs	
Bandwidth	70kHz max. (Contact Micronor concerning modifications for higher bandwidth applications.)
Format	A/B Push-Pull and A/A'/B/B' RS422 Line Driver
POSITION COUNTER Range	
	Direction/Sign Bit plus 24-bit counter value ( $\pm 8,388,607$ , equivalent to 8,192 revolutions with MR324 1024ppr encoder). Both software and hardware Zero (calibration) Set available.
DIVIDER Quadrature Outputs	
	DIVIDER range is 2-128. A/A'/B/B' Line Driver (A/B Push-Pull available as option.)
Analog Outputs	
	Each output is individually programmable for POSITION (full-scale range of 1-8,388,607 counts) or SPEED (full-scale range of 10-10,000 RPM)
Current Output:	Range: 0mA to 24mA, Max Burden Resistance: 500 $\Omega$ (24V supply)
Voltage Output:	Range: $\pm 12V$ ; Max Current: 5mA (2k $\Omega$ load); Short Circuit < 5 seconds
RS422/485 Interface	Direct connection via J3, also Modbus (RTU) compatible)
RS232 Interface	With optional MR232-1 Converter Cable
Modbus interface	Modbus (RTU) compatible RS422/RS485 interface
USB interface	USB, disables RS485/Modbus interface when used
Electrical Connections	J1, J2 J3 connections via WAGO QuickConnect Plugs (supplied with MR320)

**Fiber Optic Interface**

Connector Type	Duplex LC plug with Super PC Polish
	Performance Requirements: IL<0.5dB, RL>24dB, Telecordia GR-326 Endface Geometry
Fiber Type	2 x Multimode 62.5/125, Graded Index, 0.275NA
Maximum Optical Link Length	Maximum of 2500 meters (8300 ft) or 2-way optical loss of 12.5dB at 850nm (Contact Micronor for longer distance requirements)

**Power Supply**

Power Supply Input	+15VDC to +32VDC, 60mA (During Power Up, power supply should be capable of delivering a momentary current in excess of 100mA.)
+5V Output	10mA maximum load. (Designed for powering MR232-1 RS485/RS232 adapter cable)

**Environmental Performance**

Temperature/Humidity	-5° to +55°C / 30% to 85% RH (non-condensing)
Seal Rating	IP40
ATEX Rating	[ Ex op is 55°C/T6 ] per IEC 60079-28.

**Physical Attributes**

Mounting	35mm DIN Rail
Housing Dimensions	102mm W x 102mm D x 68mm H ( / 300g (10.5oz)

**Specifications Subject To Change Without Notice****MR232-1 RS422/485 to RS232 Converter Cable**

- Interconnects MR320-J3 and a PC's 9-pin COM port
- Length, 3 meters (nominal)
- Temperature Range: +5° C to +30° C

**Ordering Info**

# MR320 Controller Module

## Related Items:

- MR232-1 RS422/485-to-RS232 Adapter Cable
- MR322, MR324, MR326 or MR328 ZapFREE® Encoders
- MR320-D06Cxx Duplex LC Fiber Optic Cable Assemblies
- MR320C Duplex LC Mating/Bulkhead Adapter

For additional technical information, contact Micronor and request:

- MR310-MR320 ZapFREE™ Fiber Optic Encoder System User Manual
- MR320 ATEX Declaration of Conformity Report
- Data sheets and User Guides can also be downloaded from [www.micronor.com](http://www.micronor.com)

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