# MR310

## ZapFree™ REMOTE ENCODER INTERFACE MODULE

# MICRONOR
### *automation components*

## Products

The MR310 ZapFREE™ REI module is the electronic interface to the ZapFREE™ Fiber Optic Rotary Encoder System. The module converts a ZapFREE™ encoder's optical signals to standard A/B quadrature signals for direct connection to any conventional counter, PLC or computer interface board.

Two programmable analog outputs (4-20mA and ±10V) can be set for Speed or Position modes. An RS422/RS485 serial interface is provided for setting the MR310's internal parameters for standalone operation as well as real-time serial control and communications. The optional MR232-1 (RS232) or MR232-2 (USB) adapter cables also facilitate convenient connections to PC controllers. The MR310 mounts on standard DIN rails and operates from readily available 24VDC (+15 to +32V).

**Intrinsically Safe
[Ex op is I/II Ga]**

## Features

The ZapFREE Encoder system offers an intrinsically safe feedback solution for motion control applications. Under the EU ATEX directive, the encoders are classified as "simple apparatus" and certified as intrinsically safe.
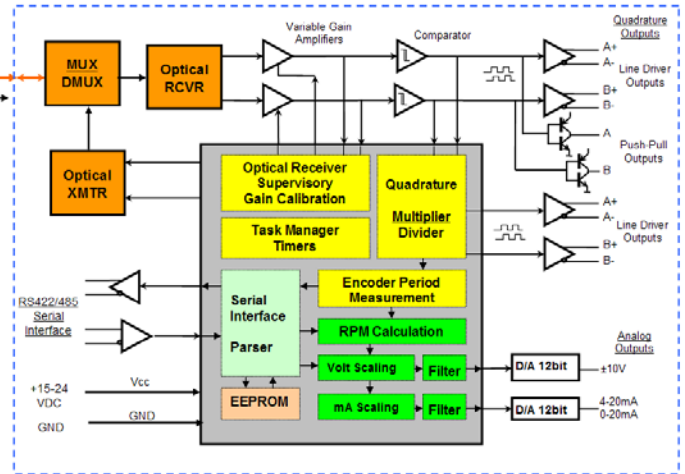
Special features include:

- Quasi-absolute multiturn position function (24-bit)
- Programmable MULTIPLIER/DIVIDER Mode
- Programmable analog outputs for Speed or Position



MR310 Remote Encoder Interface (REI) Module

## System Planning

**MR310 Remote Encoder Interface (REI) Module**

All Control Electronics, Optoelectronics And Host System Connections

No Electronics

**MR3XX Series Fiber Optic Rotary Encoders**

MR314    MR316    MR312    MR318

Power Connections and Encoder Signal Output to Control System

Simplex Multimode 62.5/125 Fiber Optic Link With ST-PC Connections (Up to 1000 meters)
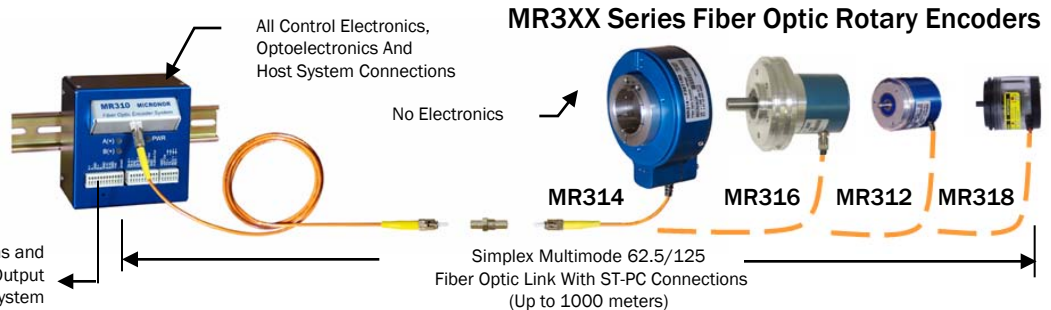
1. Verify that the optical link loss is within system's two-way loss margin of 6.5dB
    — Account for losses of inline connectors, splices and cable
    — For example, 4 interconnections (0.5dB each) over 400-meter (3dB/km) = 6.4dB
2. Follow industry-specific FOLAN component selection and installation guidelines
    — Always follow bend radius, flex, clamping and routing conventions.
    — Recommend industrial-grade PUR cable and connectors for industrial environments

### MR312 ZapFREE® Encoder
- Size 58mm, IP64
- 6mm Shaft ∅
- 100, 128, 256 or 360ppr

### MR314 ZapFREE® Encoder
- Size 100mm, IP65
- 38mm ∅ Hollow Shaft
- 1024ppr resolution

### MR316 ZapFREE® Encoder
- Size 90mm, IP66
- 12mm Shaft ∅
- 100, 128, 256 or 360ppr

### MR318 ZapFREE® MRI Encoder
- Non-metallic, MRI compatible
- Size 58mm
- 6mm Shaft ∅
- 360ppr resolution

## What is ZAPPY™?

As delivered, the Micronor ZapFREE™ Fiber Optic Encoder System (consisting of MR3XX series fiber optic encoder and MR310 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. To connect a PC to the MR310 module, the user will need to purchase either the MR232-1 RS485-to-RS232 or MR232-2 RS485-to-USB Converter Cables.  Typical ZAPPY™ screens are shown below:
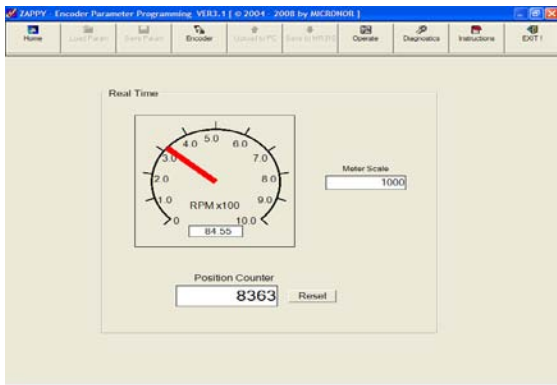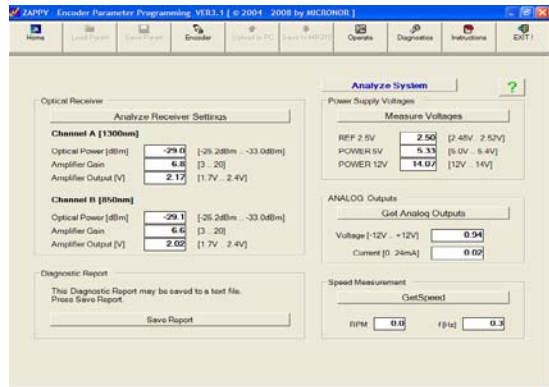
Start-Up Screen
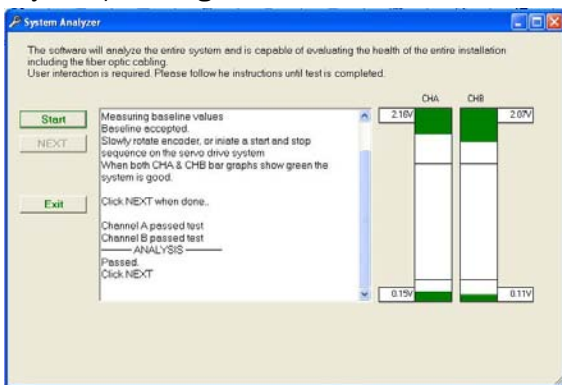


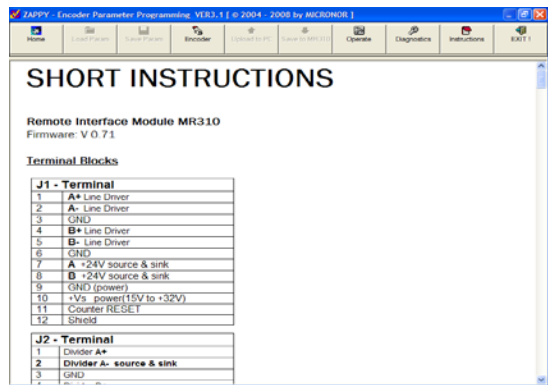Encoder Parameters Display Screen
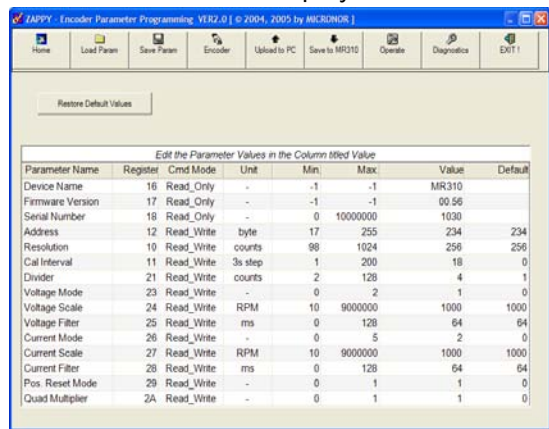


Real-Time Diagnostics Screen



Internal Diagnostics Screen



System/Cabling Test Mode



Online Instructions

## How Do I Connect My PC to the MR310 Module for Running ZAPPY™?

The serial interface (J3) on the MR310 module supports RS422/485 serial communications. Unless the user 's PC has serial port directly compatible with this interface, then a converter /adapter cable will be needed.

To support running ZAPPY ™ on a standard PC, Micronor offers two types of converter /adapter cables:
• Model 232-1 allows connection via a PC's RS232 OOM port
• Model 232-2 allows connection via a PC's USB port

## Do I Need To Purchase an MR232 Cable for Every Module?

No. If your only intent is to run ZAPPY software for initially configuring the MR310 module (such a s setting up the analog outputs) or running diagnostics, then you will only need to purchase one cable. One MR232 series converter cable can be used to support multiple modules.

**MR232-1** RS422/485 to RS232 Converter Cable
• Interconnects MR310-J3 and a PC's 9-pin COM port
• Length, 3 meters (nominal)
• Temperature Range: +5°C to +30°C



**MR232-2** RS422/485 to USB Converter Cable
• Interconnects MR310-J3 and a PC's USB port
• Length, 3 meters (nominal)
• Temperature Range: +5°C to +30°C
• Includes miniCD with PC Software Driver (for Windows XP and higher)

### How do I interface the MR310 to my motion control system?

The MR310 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 ±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 MR310 at 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.
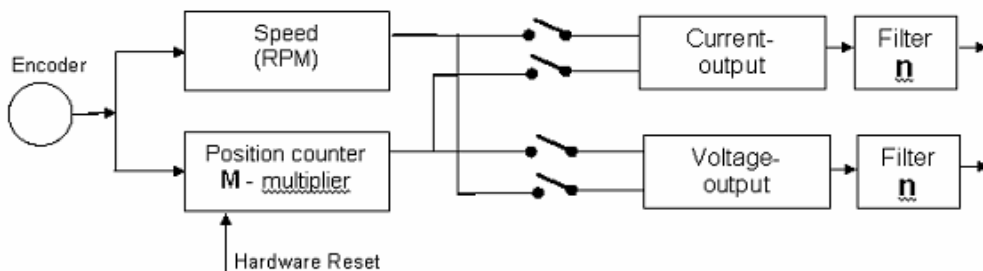


### How Do I Program The *Voltage and/or Current* Analog Output for Speed (RPM)?

- **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

**Analog Output**

| Voltage SPEED Mode (Register 23) | |
|---|---|
| 0 | **Voltage Speed Mode 0**<br><br>+12V<br>+10V<br>0V<br>-10V<br>-12V<br>Overrange / CCW / Overrange / CW<br>-SCALE / 0 / +SCALE<br>RPM |
| 1 | **Voltage Speed Mode 1**<br><br>Overrange / +12V / +10V / 0V / -10V / -12V / Overrange<br>CCW / CW<br>-SCALE / 0 / +SCALE<br>RPM |
| Current SPEED Mode (Register 26) | |
| 0 | **Current Speed Mode 0**<br><br>24mA<br>20mA<br>Overrange / 4mA / Overrange<br>CCW / 0mA / CW<br>-SCALE / 0 / +SCALE<br>RPM |
| 1 | **Current Speed Mode 1**<br><br>24mA<br>20mA<br>Overrange / Overrange<br>4mA<br>CCW / 0mA / CW<br>-SCALE / 0 / +SCALE<br>RPM |
| 2 | **Current Speed Mode 2**<br><br>24mA<br>20mA<br>Overrange / Overrange<br>4mA<br>CCW / 0mA / CW<br>-SCALE / 0 / +SCALE<br>RPM |

### 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)



When Hardware Reset Input goes to Logic 1 (High), analog output goes to 12mA because R=1/2 Scale in this example.
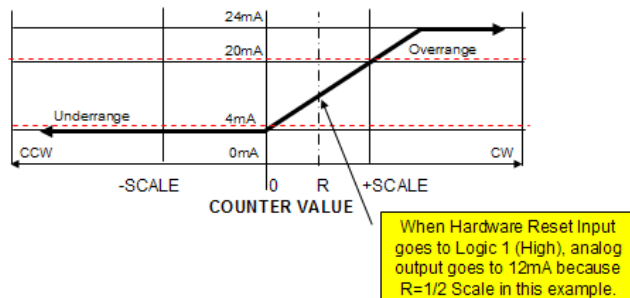
- **Reset On Count/Homing** mode (Register 2D)
  - Internal Position Counter is automatically reset to 0 whenever its absolute value matches this preprogrammed value
  - 0 = mode deactivated
  - Accepts input value of 1-8,388,607 for active mode.  Here is an example:

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

**Analog Output**
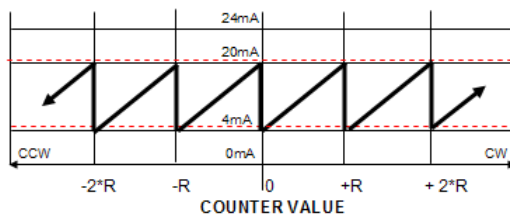
| Voltage POSITION Mode (Register 23) | |
|---|---|
| 2 | **Voltage Position Mode 2**<br> |

| Current POSITION Mode (Register 26) | |
|---|---|
| 3 | **Current Position Mode 3**<br> |
| 4 | **Current Position Mode 4**<br> |
| 5 | **Current Position Mode 5**<br> |
| 6 | **Current Position Mode 6**<br> |

*Specifications Subject To Change Without Notice*

### Functional Specifications

| DIRECT Quadrature Outputs | |
|---|---|
| Bandwidth | 70kHz max. (Contact Micronor concerning modifications for higher bandwidth applications.) |
| Format | A/B Push-Pull and A/A'/B/B' Line Driver |
| **POSITION COUNTER Range** | Direction/Sign Bit plus 24-bit counter value (±8,388,607, equivalent to 8,192 revolutions with MR314 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: 500Ω (24V supply) |
| Voltage Output: | Range: ±12V; Max Current: 5mA (2kΩ load); Short Circuit < 5 seconds |
| **Fiber Optic Link** | ST-PC. MM 62.5/125µm, GI, 0.275NA. Up to 1000m (3280 ft). Two-way link margin is 6.5dB. |
| | ST-PC Requirements: IL<0.5dB, RL>27dB and TELCORDIA/IEC SPC End Face Geometry |
| **Serial Interface** | RS422/RS485 (RS232 with optional MR232-1 adapter cable) |
| **Electrical Connections** | J1, J2 J3 connections (see diagram below) via WAGO QuickConnect Plugs (supplied with MR310) |

### Power Supply Specifications

| 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 Specifications

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

### Physical Specifications

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



| 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 | Position Counter Reset |
| 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- ← |
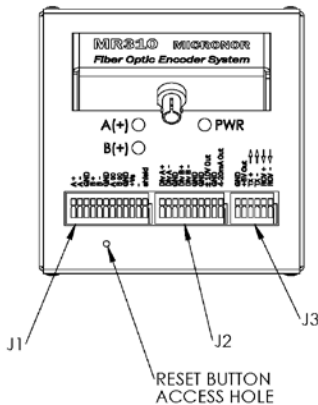
# MR310 REI Module

Related Items:
- MR232-1 RS422/485-to-RS232 Adapter Cable
- MR232-2 RS422/485-to-USB Adapter Cable
- MR312 or MR314 or MR316 ZapFREE® Rotary Encoders (std metallic housing)
- MR318 ZapFREE® MRI Rotary Encoders (non-metallic)
- MR320-M06Lxx Fiber Optic Cable Assemblies
- MR320A ST-to-ST Mating/Bulkhead Adapter

For additional technical information, contact Micronor and request:
- MR3XX ZapFREE™ Encoder System User Guide
- MR3XX ATEX Declaration of Conformity Report
- Data sheets and User Guides can also be downloaded from www.micronor.com

MICRONOR_DATA_SHEET MR310 RevG 091125