

MODBUS RTU USER MANUAL

Linear Potentiometers (DMRTL)

Magnetostrictive Position Sensors (DMMSS, DMMSW, DMMST)



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1. INTRODUCTION

Megatron magnetostrictive position sensors are linear position sensors. Measured position value send with Modbus communication system between 0 to 32767.

Modbus is a communication protocol developed by Modicon systems. In simple terms, it is a method used for transmitting information over serial lines (RS485 interface) between electronic devices. The device requesting the information is called the Modbus Master and the devices supplying information are Modbus Slaves. In a standard Modbus network, there is one Master and up to 247 Slaves, each with a unique Slave Address from 1 to 247. The Master can also write information to the Slaves.

Modbus is an open protocol, meaning that it's free for manufacturers to build into their equipment without having to pay royalties. It has become a very common protocol used widely by many manufacturers throughout many industries. Modbus is typically used to transmit signals from instrumentation and control devices back to a main controller or data gathering system.

Since the MODBUS signals are represented on the bus as differential levels, the bus line is relatively insensitive to interference (EMI). As always both lines are concerned, the interference almost does not affect the difference level.

2. TECHNICAL PROPERTIES

Mechanical Data

Case Dimensions 33mm x 33mm

Case Material Anodized Aluminium

Rod Diameter 6mm

Rod Material Stainless Steel

Mechanical Life 100 million movement

Mechanical Fixing Variable brackets

Electrical Data

Power Supply / 8V DC up to 28V DC

Current Consumption typ: 60mA at 24V DC

Power Consumption max. 2 W

Protection Reverse Polarity

Sensor Data

Measurement Stroke 30 to 1000 mm

Resolution 25um-100um depends on stroke, check resolution table

Linearity $\pm 0,05$ (>200mm), $\pm 0,1$ (130 - 200mm), $\pm 0,05$ (75 - 130mm), $\pm 0,5$ (<75mm)

Response Time 10 ms (at 56700 bit/s)

Termination 120R Configure with Software

Interface

Interface RS485

Protocol MODBUS RTU

Communication Profile Modbus RTU V1.1

Node Number 1 up to 247 (default Node ID : 20)

Baud Rate 9600bit/s to 115200/s (default Baud Rate : 57600bit/s)

Diagnostic Leds

Green Led Power On, Modbus Communication Active



Red Led Error, Stop Mode

General Data

Protection IP65

Working Temperature Range -20°C to 80°C

2.1 Led Diagnostics

LED GREEN 	LED RED 	MEANING
ON	OFF	Power On, No Communication
ON	Flash 500ms	Error or Search Bus Communication
Flash 100ms	OFF	Bus Communication Active, Operational Mode
Flash 500ms	Flash 100ms	Sensor faulty

Sensor faulty can be, no valid cursor, cursor out of range of min. or max. point.

3. STANDARDS AND PROTOCOLS

Modbus RTU is RS485 bus communication.

MODBUS data format:

Modbus RTU package consist of Adres, function, Data and CRC code of all package.

Address	Function	Data	CRC Code
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Address: On Modbus RTU, address field only contains Slave address. 1 to 247.

Function: Opkon Modbus RTU support functions; 0x03 read holding registers, 0x06 write single holding register, 0x10 write holding registers.

Data: Data will be orginized depends on function code, register address, register qty, data value will be there depends on function codes.

CRC code: Modbus RTU will send 16 bit CRC code calculation of address, function and data for package security.

Node_ID, Baude rate, Bus termination, can be changed with MODBUS software menu with standards simply.

3.1 Registers

Read registers:

Registers and data values are 16 bit. Register offset is 40001 for PLC systems.

READ HOLDING REGISTERS MAP (Function: 03 read hold registers)					
Register	Data	Order register	Data value explanation		Active
40002	Position MSB	0x0001	Value is zero		Value is zero
40003	Position_LSB	0x0002	15 bit position value		yes
40004	Direction	0x0003	CW=0, CCW=1		no
40005	Termination	0x0004	120R termination On=1, Off=0		yes
40006	Serial	0x0005	0x3418		yes
40007	Sensor error	0x0006	0x00	0xXX	yes

Position Value: Megatron modbus sensors are 15 bit (0 to 32767) so register 40003 (order register 0x0002) is real position value. Position MSB is zero (register: 40002, order register: 0x0001)

Direction: shows rotation of encoder clockwise or anticlockwise direction. This register is active for encoders, it is not active for linear positions sensors and magnetostrictive position sensors.

Termination: 120R bus termination is active if value: 0x0001, not active if value: 0x0000.

Serial: Megatron modbus serial is 0x3418

Sensor Error : Megatron magnetostrictive Modbus sensors error definitions defined below. These errors about sensor limit not about bus communication.

Error codes	Explanation	Position Value	Red Led
0x00H, 00000000b	No error	Position value: 0 to 32767	off
0x01H, 00000001b	No valid cursor dedected	0x0000	Flash 100ms
0x02H, 00000010b	internal sensor error	0x0000	Flash 100ms
0x04H, 00000100b	Out of range (min. Deadzone)	0x0000	Flash 100ms
0x08H, 00001000b	Out of range (max. Deadzone)	0xFFFF	Flash 100ms

Write registers:

Registers and data values are 16 bit. Register offset is 40001 for PLC systems.

WRITE HOLDING REGISTERS MAP (Function: 0x06 or 0x10 write register)				
Register	Data	Order register	Data value explanation	Active
40257	Baude Rate	0x0100	Baude Rate: 0x0001=9600, 0x0002=19200, 0x0003=38400, 0x0004= 57600, 0x0005=115200	Fabric : 0x0004= 57600,
40258	Node ID	0x0101	1 to 247	Fabric: 0x0014=20d
40259	Direction	0x0102	CW=0, CCW=1	no
40260	Termination	0x0103	120R termination On=1, Off=0	yes

3.2 Functions

Megatron Modbus RTU use three function for read and write registers.

Function Code	Explanation
0x03	Read holding registers
0x06	Write single holding register
0x10	Write holding registers.

Read Holding Registers (0x03):

Read Holding Registers (0x03) reads data values of registers with start adress of registers and quantity of registers.

Example_1:

Read Serial:

PLC Master -----> Slave Modbus RTU

Slave Address	Function	Data		CRC_check
		Start Address	Number of registers	
0x14	0x03	0x0005	0x0001	0xFFFF

Slave Modbus RTU -----> PLC Master

Slave Address	Function	Data		CRC_check
		Number of data bytes	Data (serial 2 byte)	
0x14	0x03	0x0002	0x3418	0xFFFF

Example:2

Read position value : register 40002 (16 bit position value MSB), register 40003 (16 bit position value LSB), (order adress 40002: 0x0001, 40003:0x0002)

Note: Megatron Modbus position sensors are 15 bit, so position value LSB at register 40003 (0x0002) is meaningfull and change from 0 to 32767(0x7FFF). Position value MSB is always 0x0000.

assume that sensor position is midpoint: register 40003 (16 bit position value LSB) will be 16383=0x3FFF

PLC Master -----> Slave Modbus RTU

Slave Address	Function	Data		CRC_check
		Start Address	Number of registers	
0x14	0x03	0x0002	0x0002	0xXXXX

Slave Modbus RTU ----> PLC Master

Slave Address	Function	Data			CRC_check
		Number of data bytes	Position value MSB register 4002	Position value LSB register 4003	
0x14	0x03	0x0004	0x0000	0x3FFF	0xXXXX

Calculation of real position in milimeters:

Resolution Table:

STROKE mm	Resolution [um]
50	25
100	25
200	25
250	25
300	25
350	25
400	25
450	50
500	50
550	50
600	50
650	50
700	50
750	50
800	50
850	50
900	50
950	50
1000	50
1250	50

1500	50
1750	50
1950	50
2000	50
2500	50
3000	50
4000	100
5000	100
6000	100

Table 1: Resolution depends on Stroke.

resolution*Modbus_data_value

Example_1: Sensor is 150mm, resolution is 25um from table_1.

If read Modbus_data_value=1000; **25um*1000=25mm;**

If read Modbus_data_value=3000; **25um*1000=75mm;**

If read Modbus_data_value=6000; **25um*1000=150mm;**

Example_2: Sensor is 1900mm, resolution is 50um from table_1.

If read Modbus_data_value=1000; **50um*1000=50mm;**

If read Modbus_data_value=10000; **50um*10000=500mm;**

If read Modbus_data_value=38000; **50um*38000=1900mm;**

Write Single Holding Register (0x06):

Write Single Holding Register (0x06) write new data value to defined register with register address and new register value.

Example:

Change baud rate with 115200 (0x0005):

PLC Master -----> Slave Modbus RTU

Slave Address	Function	Data		CRC_check
		Register address	New baude rate value	
0x14	0x06	0x0100	0x0005	0xXXXX

Slave Modbus RTU ----> PLC Master

Slave Address	Function	Data		CRC_check
		Number of data bytes	Data (serial 2 byte)	
0x14	0x06	0x0100	0x0005	0xXXXX

Note: New parameters will be activated after sensor power off than on.

Change Node ID with 64 (0x0040):

PLC Master -----> Slave Modbus RTU

Slave Address	Function	Data		CRC_check
		Register address	New baude rate value	
0x14	0x06	0x0101	0x0040	0xXXXX

Slave Modbus RTU ----> PLC Master

Slave Address	Function	Data		CRC_check
		Number of data bytes	Data (serial 2 byte)	
0x14	0x06	0x0101	0x0040	0xXXXX

Note: New parameters will be activated after sensor power off than on.

Write Holding Registers (0x10):

Write Holding Registers (0x10) write new data value to defined registers with start register address, number of registers, and new values data.

Example:

Change baude rate with 115200 (0x0005)

Change Node ID with 64(0x0040)

2 register value will be changed, start adress 0x0100, total new data bytes 4 byte.

PLC Master -----> Slave Modbus RTU

Slave Address	Function	Data			Data of new Baude	Data of new Node ID	CRC_check
		Start Register address	Number of registers	Number of data bytes			
0x14	0x10	0x0100	0x0002	0x0004	0x0005	0x0040	0xFFFF

Slave Modbus RTU ----> PLC Master

Slave Address	Function	Data		CRC_check
		Start Register address	Number of registers	
0x14	0x10	0x0100	0x0002	0xFFFF

Note: New parameters will be activated after sensor power off than on.

Change Node ID with 64 (0x0040):

PLC Master -----> Slave Modbus RTU

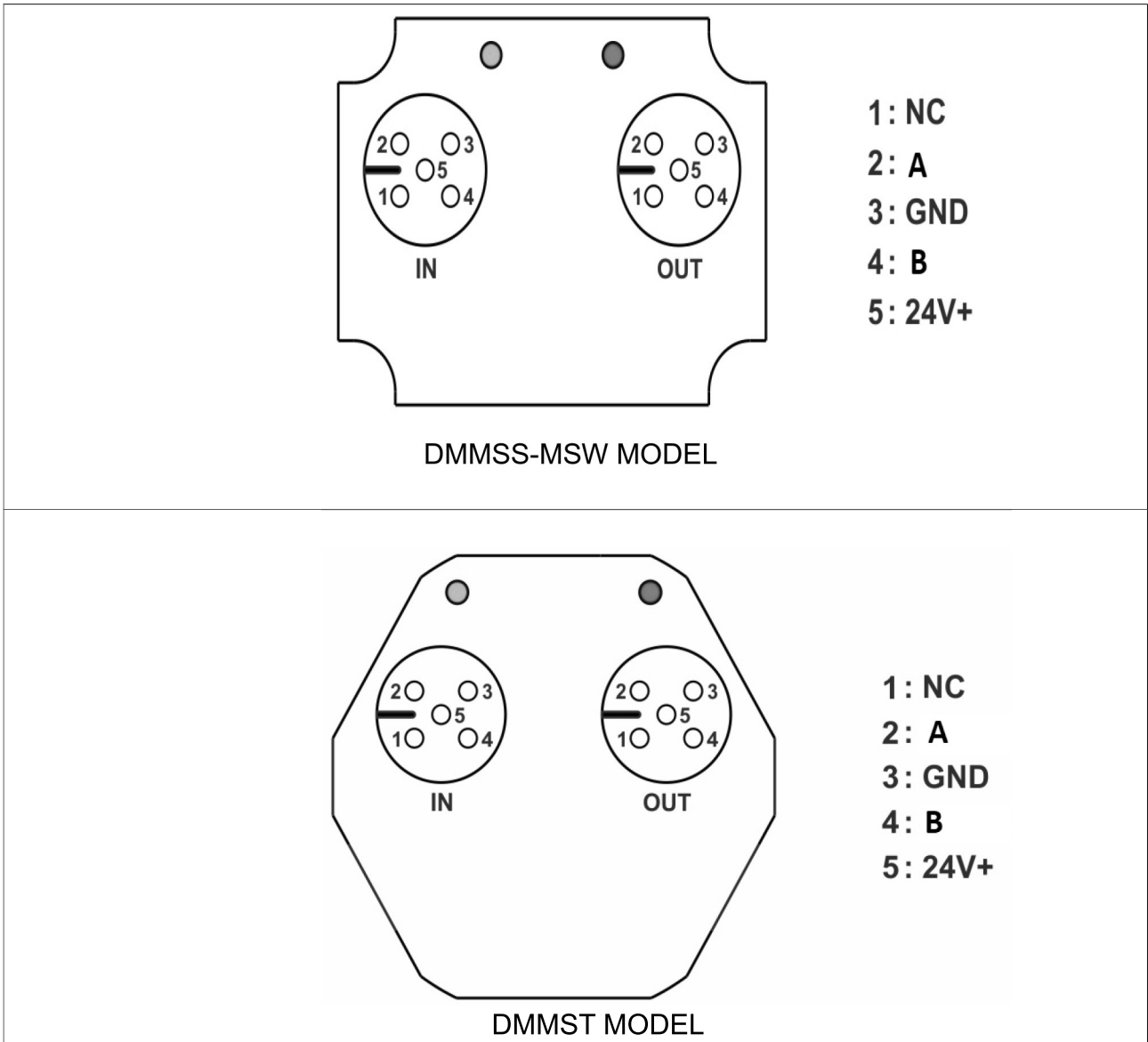
Slave Address	Function	Data		CRC_check
		Single Register Adress	New baude rate value	
0x14	0x06	0x0101	0x0040	0xFFFF

Slave Modbus RTU ----> PLC Master

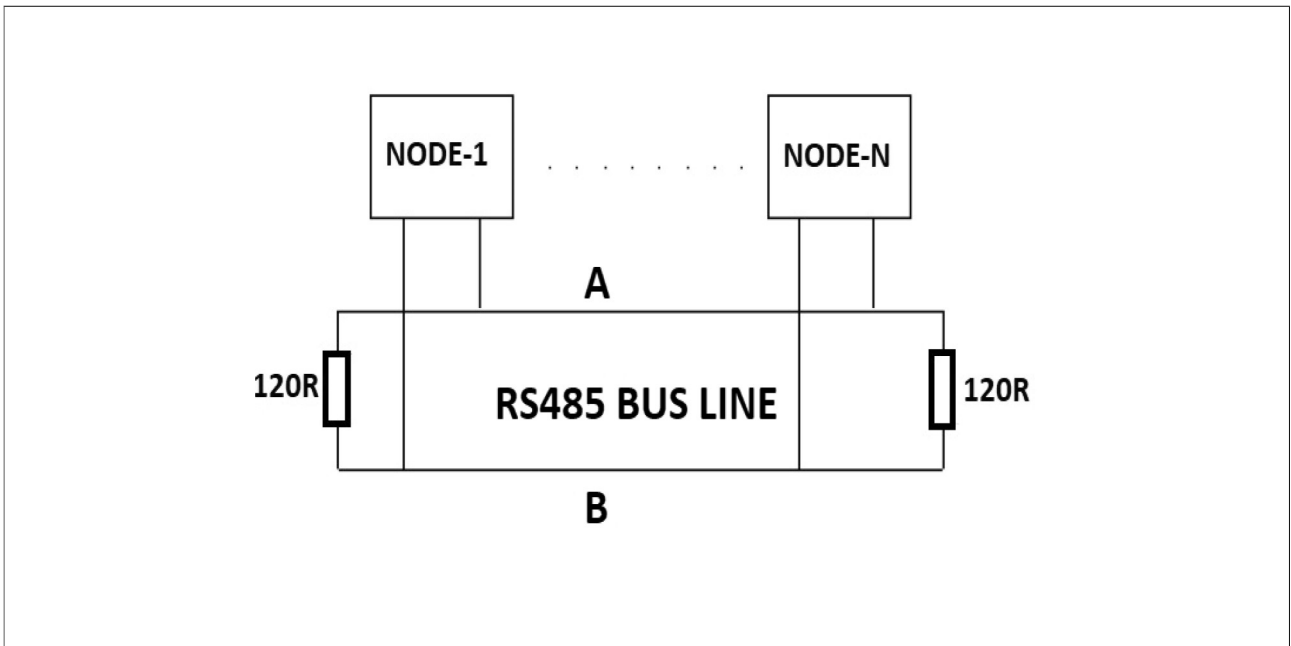
Slave Address	Function	Data		CRC_check
		Single Register Adress	Data (serial 2 byte)	
0x14	0x06	0x0101	0x0040	0xFFFF

4. CONNECTION

Modbus RTU has 2 data line and 2 power line.



Connector is M12 Female, cable must be M12 Male connector.



Bus termination can be done with software. First and last nodes must be terminated with 120ohm resistor. Megatron Modbus sensors bus terminations can be done with software.

Write Single Holding Register (0x06):

Write Single Holding Register (0x06) write new data value to defined register with register address and new register value.

Example:

Set bus termination (0x0001):

PLC Master -----> Slave Modbus RTU

40260	Termination	0x0103	120R termination On=1, Off=0	yes
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Slave Address	Function	Data		CRC_check
		Single Register Adress	Bus termination on	
0x14	0x06	0x0103	0x0001	0xXXXX

Slave Modbus RTU -----> PLC Master

Slave Address	Function	Data		CRC_check
		Single Register Adress	Data (serial 2 byte)	
0x14	0x06	0x0002	0x0001	0xXXXX

Note: New parameters will be activated after sensor power off than on.

5. QUICK START

- * Connect data and power cables defined before.
 - * Power on, check green led on, red led flash 500ms. (bus communication not started)
 - * Set up bus communication paramaters.
- Baude rate 57600, 8 data bits, none parity, 1 Stop bit.

- * Read position value LSB (adress 40003) with read function 0x03
sed slave node_id: 20

When data transfer is achived with Modbus RTU, green led flash, red led will be off.