Tecfluid

Instructions manual

MT03
MODBUS communications protocol
(supplement)

The art of measuring

PREFACE

Thank you for choosing a Tecfluid S.A product.

This instruction manual allows the installation, programming and operation of the device. It is recommended to read it before using the equipment.

WARNINGS

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ÍNDICE

1 INTRODUCTION

Modbus is a communication protocol commonly used to connect industrial electronic devices. It is based in a master-slave architecture.

Protocol Modbus RTU uses a compact binary representation of the data and ends its frames with a cyclic redundancy check code.

2 MODBUS DATA MODEL

Modbus bases its data model in four tables with differentiated characteristics.

Discrete Inputs: Read only bits. This type of data can be read by a master device. They are not implemented in Tecfluid Modbus protocol devices.

Coils: Read write bits. These data can be read or written by a master device. They are not implemented in Tecfluid Modbus protocol devices.

Input Registers: 16 bits read only data. This type of data can be read by a master device.

Holding Registers: 16 bits read write data. These data can be read or written by a master device.

3 MODBUS FUNCTIONS

Modbus functions allow access to a device in order to read or modify the value of some of its data. The Tecfluid devices support the following functions:

3.1 Function "Read Input Registers"   0x04h

Gets the value of the "Input Registers" of one or more consecutive addresses of the selected device.

3.2 Function "Read Holding Registers"   0x03h

Gets the value of the "Holding Registers" of one or more consecutive addresses of the selected device.

3.3 Function "Write Single Register"   0x06h

Writes the value of a "Holding register" to the address of the selected device.

3.4 Function "Write Multiple Registers"   0x10h

Writes the value of the "Holding Registers" to several consecutive addresses of the selected device.

4 MODBUS IN MT03 CONVERTER

4.1 Data access and register addresses

The data that can be accessed in a MT03 converter and their format are the following:

Address (Hex)	Data	Format	MT03FB	MT03LB	MT03AB
0x2000	Reserved	----	x	x	x
0x2001 … 0x200F	Identification	String	o	o	o
0x2010 - 0x2011	Flow rate	Floating point	o	x	o

Address (Hex)	Data	Format	MT03FB	MT03LB	MT03AB
0x2012 - 0x2013	Reserved	----	x	x	x
0x2014	Status	Integer	o	o	o
0x2015	Level	Floating point	x	o	x

Input Registers (Read only)

Address (Hex)	Data	Format	MT03FB	MT03LB	MT03AB
0x3000	Reserved	----	x	x	x
0x3001 - 0x3002	K factor	Floating point	o	x	x
0x3003	Input	Integer	o	o	o
0x3004	Analog filter	Integer	o	x	x
0x3005 - 0x3006	Partial	Floating point	o	x	o
0x3007 - 0x3008	Totalizer	Floating point	o	x	o
0x3009	Flow rate units	Integer	o	x	o
0x300A	Totalizer units	Integer	o	x	o
0x300B	Level units	Integer	x	o	x
0x301C	Reserved	Integer	x	x	x
0x300d	Filter time	Integer	o	o	o
0x300E - 0x300F	Alarm 1 Activation	Floating point	o	o	o
0x3010 - 0x3011	Alarm 1 Deactivation	Floating point	o	o	o
0x3012 - 0x3013	Alarm 2 Activation	Floating point	o	o	o
0x3014 - 0x3015	Alarm 2 Deactivation	Floating point	o	o	o
0x3016	Cutoff	Floating point	o	x	o
0x3018 … 0x301B	Reserved	----	x	x	x
0x301C	Decimals	Integer	o	o	o
0x301D	Default screen	Integer	o	x	o
0x301E	Brightness	Integer	o	o	o
0x001F	Reserved	----	x	x	x
0x3020	Language	Integer	o	o	o
0x3021 - 0x3022	Preset 1	Floating point	o	x	x

Address (Hex)	Data	Format	MT03FB	MT03LB	MT03AB
0x3023 - 0x3024	Preset 2	Floating point	o	x	x
0x3025 … 0x302A	Reserved	----	x	x	x
0x302B - 0x302C	Beginning of scale	Floating point	x	o	o
0x302D - 0x302E	End of scale	Floating point	x	o	o
0x302F - 0x3030	Density	Floating point	o	x	o
0x3031 … 0x3036	Reserved	----	x	x	x
0x3037	Contrast	Integer	o	o	o

Holding Registers (Read write)

5 DEVICE DATA ACCESS

NOTE: Floating point data are all 32-bits in accordance with IEEE 754 standard and therefore use two registers. To access this data on the device it is necessary to do it in a single message instead of two consecutive readings or writings.

Decimal	Floating point (ABCD)	Transmitted bytes (DCBA)
1	3F 80 00 00	00 00 80 3F
43.2	42 2C CC CD	CD CC 2C 42
-31.84	C1 FE B8 52	52 B8 FE C1

Registers containing floating point data are transmitted in CDBA mode, that means, words and bytes are inverted. For example:

On the other hand, integer data are all 16 bits.

M	T	0	3	x	B

5.1 Identification

The identification string comprises the following characters::

where "x" indicates the model of the converter (F, L or A)

5.2 Flow rate

Flow rate data contains the numeric value of the instantaneous flow rate corresponding to flow rate units programmed into the device.

Bit	Status
4 ...15	Reserved
3	Status relay 2 Batching mode
2	Status relay 1 Batching mode
1	Status relay 2 Alarm mode
0	Status relay 1 Alarm mode

5.3 Status

Contains the status bits of the converter.

5.4 Level

Level data contain the numeric value of the instantaneous level corresponding to level units programmed into the device.

5.5 K factor

K factor data contain the numeric value of the pulses per litre factor of the device.

Default value: 1

Input type	Data (Hex)
Pulses	0x0001
Turbine	0x0002
Resistance	0x0003
Current	0x0004

5.6 Input:

Input data contains the corresponding code to the sensor input of the converter.

Default value:

MT03FB: 1

MT03LB: 3

MT03AB: 4

Filter	Data (Hex)
< 150 Hz	0x0001
< 1500 Hz	0x0002
< 5000 Hz	0x0003

5.7 Analog filter

It contains the code for the hardware filter applied to the signal input.

Default value: 3

5.8 Partial

This data contains the numeric value for the partial counter in the totalizer units programmed into the device.

Default value: 0

5.9 Totalizer

The totalizer data contains the numerical value of the cumulative total corresponding to the units programmed into the device.

Default value: 0

Units	Data (Hex)		Units	Data (Hex)
US gal/h	0x0001		g/h	0x0065
US gal/min	0x0002		g/min	0x0066
US gal/s	0x0003		g/s	0x0067
UK gal/h	0x0004		kg/h	0x0068
UK gal/min	0x0005		kg/min	0x0069
UK gal/s	0x0006		kg/s	0x006A
l/h	0x0007		t/h	0x006B
l/min	0x0008		t/min	0x006C
l/s	0x0009		t/s	0x006D
m³/h	0x000A		lb/h	0x006E
m³/min	0x000B		lb/min	0x006F
m³/s	0x000C		lb/s	0x0070

5.10 Flow rate units

It contains the code corresponding to the flow rate units of the converter.

Default value: 7

Units	Data (Hex)
US gal	0x0001
UK gal	0x0002
l	0x0003
m³	0x0004
g	0x000B
kg	0x000C
t	0x000D
lb	0x000E

5.11 Totalizer units

It contains the code corresponding to the totalizer units of the converter.

Default value: 3

Units	Data (Hex)
%	0x0001
mm	0x0002
cm	0x0003
m	0x0004
in	0x0005
ft	0x0006

5.12 Level units

It contains the code corresponding to the level units of the converter.

Default value: 3

5.13   Filter time

It contains the integration time value between 0 and 25 s.

Default value: 5

5.14   Alarm 1 Activate

It contains the numeric value of the flow rate in the flow rate units programmed into the device, corresponding to the activation of the alarm 1 output, when it is in Alarm mode.

Default value: 100

5.15   Alarm 1 Deactivate

It contains the numeric value of the flow rate in the flow rate units programmed into the device, corresponding to the deactivation of the alarm 1 output, when it is in Alarm mode.

Default value: 200

5.16   Alarm 2 Activate

It contains the numeric value of the flow rate in the flow rate units programmed into the device, corresponding to the activation of the alarm 2 output, when it is in Alarm mode.

Default value: 100

5.17   Alarm 2 Deactivate

It contains the numeric value of the flow rate in the flow rate units programmed into the device, corresponding to the deactivation of the alarm 1 output, when it is in Alarm mode.

Default value: 200

5.18   Cutoff

It contains the flow rate cutoff value, that means, the flow rate below which the flow rate indication will be zero.

5.19   Decimals

It contains the value of the decimals for the primary variable indication. It can be between 0 and 2.

Default value: 2

Screen	Data (Hex)
Flow rate	0x0001
Partial	0x0002
Total	0x0003
Flow rate + Total	0x0004
Partial + Total	0x0005
Flow rate + Partial	0x0006

5.20   Default screen

It contains the screen displayed when the device is powered on.

Default value: 4

5.21   Brightness

It contains the value of the brightness for the LCD. It can be between 0 and 100.

Default value: 80

Bit	Status
4 ...15	Reserved
3	Relay 2 in Batching mode
2	Relay 1 in Batching mode
1	Relay 2 in Alarm mode
0	Relay 1 in Alarm mode

5.22 Flags

It contains some bits related to working modes.

Idioma	Dato (Hex)
Català	0x0001
Castellano	0x0002
English	0x0003
Français	0x0004

Default value: 12

5.23 Language

It contains the corresponding code to the language of the device.

Default value: 3

5.24 Preset 1

It contains the numeric value of a preset in a batching process.

Default value: 100

5.25 Preset 2

It contains the numeric value of preset in a batching process.

Default value: 200

5.26 Beginning of scale value

It contains the numeric value of the primary variable (flow rate in MT03AB, and level in MT03LB) corresponding to the beginning of scale of the analog input of the converter (resistance or current).

Default value:

MT03LB: 100

MT03AB: 0

5.27 End of scale value

It contains the numeric value of the primary variable (flow rate in MT03AB, and level in MT03LB) corresponding to the end of scale of the analog input of the converter (resistance

or current).

Default value:

MT03LB: 200

MT03AB: 3600

5.28 Density

It contains the density value in kg/l for mass measurements.
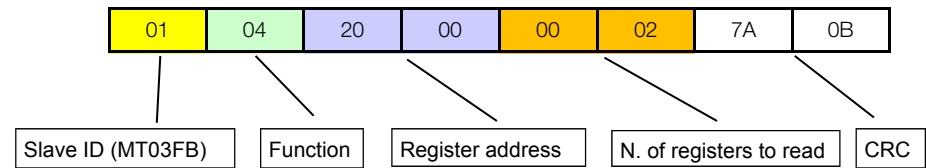
Default value: 1

5.29 Contrast

It contains the value of the contrast for the LCD. It can be between 0 and 100.
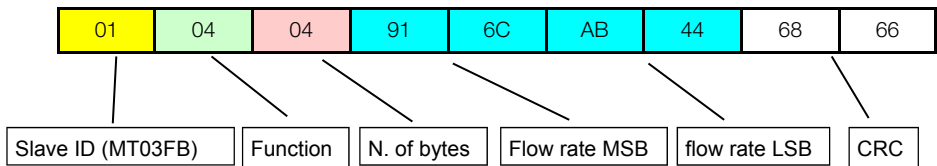
Default value: 75

6 EXAMPLES

NOTE: In all examples, where said CRC refers to "Cyclic redundancy check", that is an error detecting code sent at the end of each frame.

Example 1: Flow rate reading

Master requests the slave number 0x01 (MX4B converter) a flow rate.

01	04	20	00	00	02	7A	0B

Slave ID (MT03FB)	Function	Register address	N. of registers to read	CRC

Slave ID: 0x01

01	04	04	91	6C	AB	44	68	66

Slave ID (MT03FB)	Function	N. of bytes	Flow rate MSB	flow rate LSB	CRC

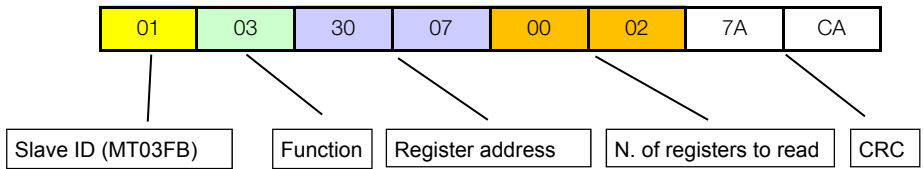Function: 0x04 (Read input registers)

Initial address: 0x2000

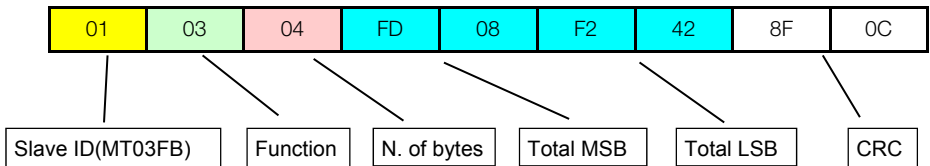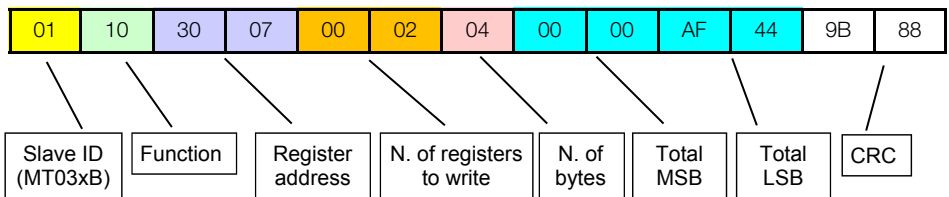Number of registers to read: 2

The slave responds after more than 3.5 characters, indicating its identification, the requested function code, the number of data bytes to be sent, data and the CRC.

The flow rate received is the floating point 32 bits data 0x44AB6C91 = **1371,31**

Example 2: Totalizer reading

01	03	30	07	00	02	7A	CA

| Slave ID (MT03FB) | | Function | Register address | | N. of registers to read | | CRC |

Master requests the slave number 0x01 (MT03xB converter) the totalizer value.

01	03	04	FD	08	F2	42	8F	0C

| Slave ID(MT03FB) | Function | N. of bytes | Total MSB | | Total LSB | | CRC |

Slave ID: 0x01

Function: 0x03 (Read holding registers)

Initial address: 0x3007

Number of registers to read: 2

The slave responds after more than 3.5 characters, indicating its identification, the requested function code, the number of data bytes to be sent, data and the CRC.

The totalizer value is the floating point data 0x42F208FD = **121,017555**

Exemple 3. Writing the totalizer value

Master requests slave number 0x01 (MT03xB converter) to write the contents corresponding

01	10	30	07	00	02	04	00	00	AF	44	9B	88

| Slave ID (MT03xB) | Function | Register address | N. of registers to write | N. of bytes | Total MSB | | Total LSB | | CRC |

to the totalizer. The value to write is 1400.

Slave ID: 0x01

01	10	30	07	00	02	FF	09

| Slave ID (MT03xB) | | Function | Register address | | N. of written registers | | CRC |
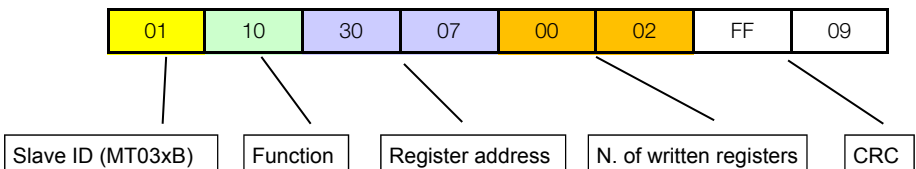
Function: 0x10 (Write multiple registers)
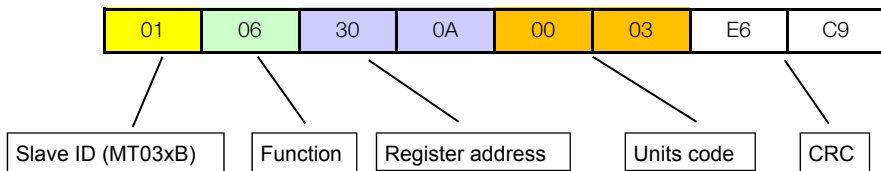
Initial address: 0x3007

Number of registers to write: 2
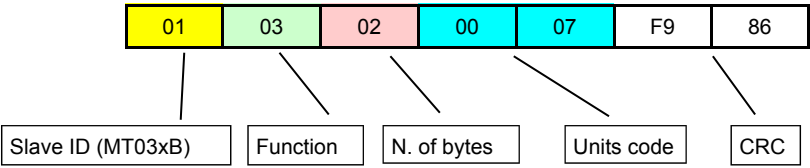
Data to write: 1400 = 0x44AF0000

The slave responds after more than 3.5 characters, indicating its identification, the requested function code, the register address, the number of registers, the number of written data bytes, data and the CRC.

01	06	30	0A	00	03	E6	C9

Slave ID (MT03xB) — Function — Register address — Units code — CRC
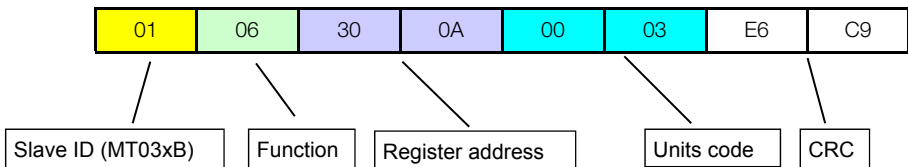
Example 4. Writing totalizer units.

01	06	30	0A	00	03	E6	C9

Slave ID (MT03xB) — Function — Register address — Units code — CRC

Master requests slave number 0x01 (MT03xB converter) to write the corresponding code to totalizer units. The value to write is 0x03 (liters).

Slave ID: 0x01

Function: 0x06 (Write Single register)

Initial address: 0x300A

Data to write: 3 = 0x0003

The slave responds after more than 3.5 characters, indicating its identification, the requested

01	03	30	09	00	01	5B	08

Slave ID (MT03xB) — Function — Register address — N. of registers to read — CRC
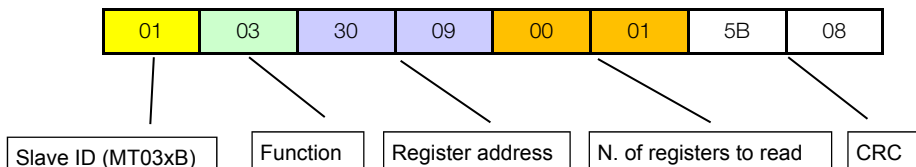
function code, the register address, written data and the CRC.

01	03	02	00	07	F9	86

| Slave ID (MT03xB) | Function | N. of bytes | Units code | CRC |

Example 5. Read flow rate units

Master requests slave number 0x01 (MT03xB converter) to read the corresponding code to flow rate units.

Slave ID: 0x01

Function: 0x03 (Read Holding registers)

Initial address: 0x3009

Number of registers to read: 1

The slave responds after more than 3.5 characters, indicating its identification, the requested function code, the number data bytes, read data and the CRC.

The received code in the example is 0x0007 that corresponds to **l/h**.

7 ELECTRICAL CONNECTION

Note: This chapter replaces the section "Analog output connection" of the instruction manuals R-MI-MT03F, page 10, R-MI-MT03L, page 8 or R-MI-MT03A, page 8.

The connection of the equipment is via plug-in connectors, polarized to avoid mistakes when plugged in. The connectors have screw terminals, as per VDE standards, to accept cables with section of 1.5 mm^2 .

The picture of the connection in this manual is looking at the equipment from the back.

To help in the wiring of the equipment, the description of the terminals is marked on a label in the rear side of the device.
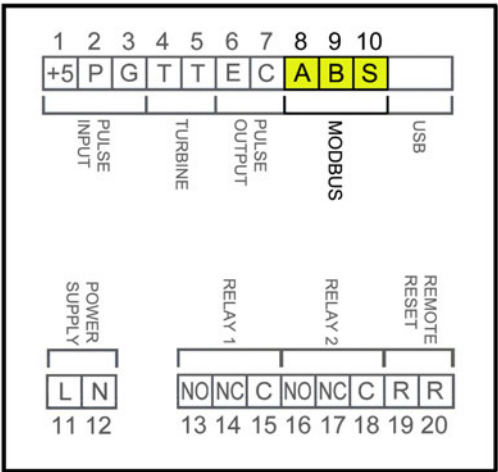
For the electrical installation it is recommended to use multiple conductor cables with individual cable sections in the order of 0.25 to 0.5 mm² in order to make it easier to connect. It is better to maintain a single cable for the MODBUS connection.

To connect the cables, peel the outside insulation to free the inner cables. It is recommended to put a terminal at the ends of the wires to avoid loose ends.
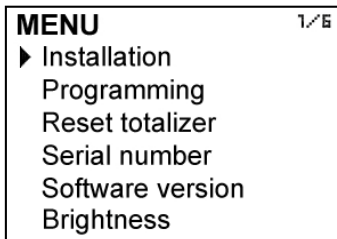
MT03xB converter	Master
Terminal A	A/D-
Terminal B	B/D+
Terminal S	G/Reference

Then, screw the wires into the corresponding positions in the female aerial connector. Finally, place each connector with its corresponding male connector on the rear side of the converter.
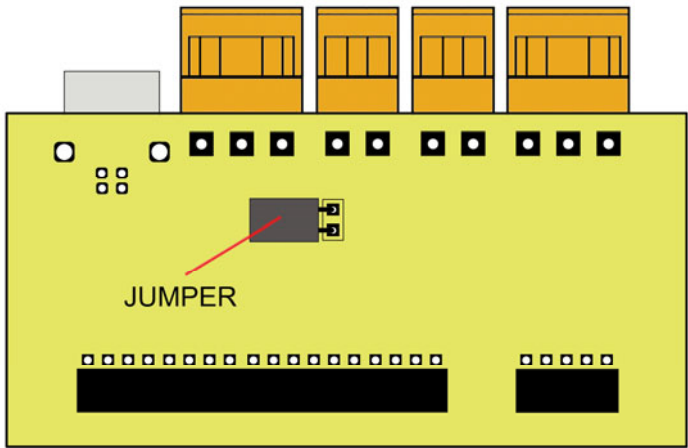
The recommended cable is a three wire cable with a shield. These cables should have a characteristic impedance of 120 Ω.

Terminal	
8	A
9	B
10	S (shield)

```
MENU              1/6
▶ Installation
  Programming
  Reset totalizer
  Serial number
  Software version
  Brightness
```

It is recommended that the shield is connected to ground only in one of its ends.

The cable connection between the MT03xB converter and a Master is the following:

In some cases in which several devices are connected in a line it is necessary to incorporate an impedance at the end. If the converter MT03xB is the last device of the line, the impedance can be set by placing a jumper in the position shown in the following figure.

8   CONVERTER PROGRAMMING

```
PROGRAMMING       1/8
  Language
  Units
  Decimals
  Filter
  Outputs
  Password
▶ Modbus
  USB HID
```
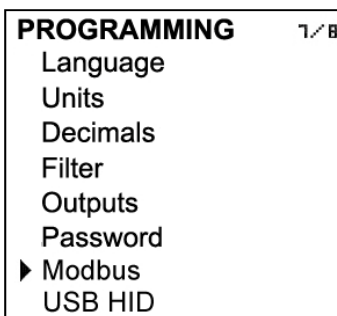
The MT03xB converter can communicate via USB with WinsmeterMT03 program (see converter manual for details) and via MODBUS.

```
USB HID            1/2
▶ Activation
  Deactivation
```
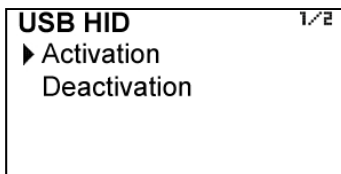
This chapter explains how the desired communication type is selected and the configuration parameters for the MODBUS protocol.

Turn on the converter and press (Enter) to go to the main menu. The following screen appears:

```
MODBUS             2/5
  ID
▶ Baud rate
  Parity
  Stop bits
  Time out
```
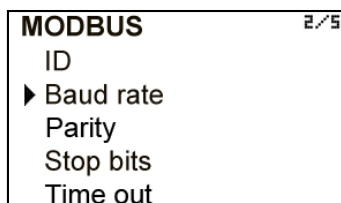
With the keys (Down / Left) and (Up), select Programming, and then validate with the key (Enter).
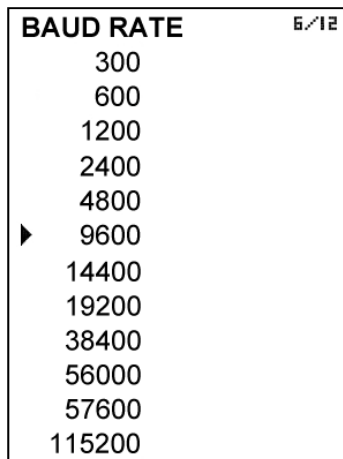
ADDRESS

Min: 1   Max: 255

01

If the converter has the password option enabled, a password must be entered. For more details about the password, see the instructions manual of the instrument R-MI-MT03F, page. 14, R-MI-MT03L, page. 12 o , R-MI-MT03A, page. 13.

BAUD RATE   6/12

        300
        600
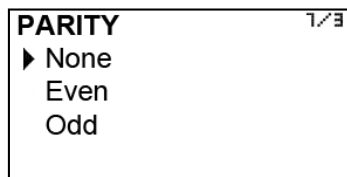   1200
      2400
      4800
▸   9600
   14400
   19200
   38400
   56000
   57600
  115200

Once the password is entered, the first screen allows to choose between the different programming options (example for MT03LB screen).
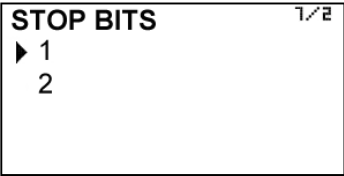
PARITY   7/3

▸ None
  Even
  Odd

Go to the USB HID and press (Enter). It appears the screen that allows to select the communication mode.

Activate the communication USB HID in order to communicate by USB with a computer and the software WinsmeterMT03, y deactivate to communicate by MODBUS.

To configure the MODBUS data, once the option USB HID is deactivated, go to the option "Modbus" and press (Enter). The screen that allows to program the communication parameters appears.
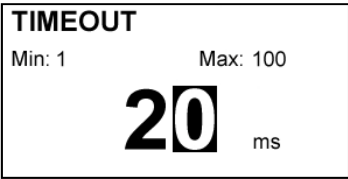

8.1   Slave address

In this screen the slave address can be assigned to the converter. This address must be unique, that is, no other slave devices in the bus can have the same number.

8.2   Baud rate

Error	Code (Hex)	Description
Function not implemented	0x01	The function requested by the master is not implemented by the MT03xB converter
Wrong data address	0x02	The register intended to be accessed (read or write) is beyond the limits allowed by the converter
Wrong data value	0x03	The value contained in the data field is not allowed by the converter.

It determines the data transmission speed. All the devices in the bus have to be configured with the same baud rate.
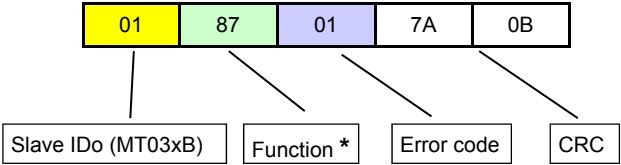
8.3   Parity

It is used to detect communication errors. All the devices in the bus have to be configured with the same parity .

WARRANTY

Tecfluid S.A. guarantees all the products for a period of 24 months from their sale, against all faulty materials, manufacturing or performance. This warranty does not cover failures which might be imputed to misuse, use in an application different to that specified in the order, the result of service or modification carried out by personnel not authorized by Tecfluid S.A., wrong handling or accident.

This warranty is limited to cover the replacement or repair of the defective parts which have not damaged due to misuse, being excluded all responsibility due to any other damage or the effects of wear caused by the normal use of the devices.

Any consignment of devices for repair must observe a procedure which can be consulted in the website www.tecfluid.com, "After-Sales" section.

All materials sent to our factory must be correctly packaged, clean and completely exempt of any liquid, grease or toxic substances.

The devices sent for repair must enclose the corresponding form, which can be filled in via website from the same "After-Sales" section.

Warranty for repaired or replaced components applies 6 months from repair or replacement date. Anyway, the warranty period will last at least until the initial supply warranty period is over.

TRANSPORTATION

All consignments from the Buyer to the Seller´s installations for their credit, repair or replacement must always be done at freight cost paid unless previous agreement.

The Seller will not accept any responsibility for possible damages caused on the devices during transportation.

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