

**Z-D-IO**  
**MODULE: 6 DIGITAL INPUTS, 2 RELAY OUTPUTS, MODBUS**  
**COMMUNICATION ON RS485**  
**WITH MOTOR COMMAND INTERNAL LOGIC AND PNEUMATIC AND**  
**MOTORIZED VALVES**

The Z-D-IO Module has 6 digital inputs and 2 relay outputs, with serial communication on bus RS485, with MODBUS protocol. The module can be used:

- as a pure I/O module controlled by a supervision system via Modbus,
- as a module for controlling starting/stopping of electric motors or for activating pneumatic and motorised valves both combined with a supervision system and as an independent unit.

**GENERAL CHARACTERISTICS**

- 6 opto-insulated digital inputs with a common contact. Internal or external power supply of inputs selectable via a jumper.
- Protection of inputs by TVS 600V/ms transient suppressors.
- Insulation of the 1500Vac inputs with respect to the remaining low voltage circuits.
- 2 SPST relay outputs with common contact, capacity of 5AAC1 250Vac. Selection of N.O. or N.C. contact for each relay via a jumper.
- 3750Vac insulation between the outputs and the remaining low voltage circuits.
- Internal logic for commanding motors, pneumatic valves and motorised valves, with management of thermal protection, feedback, travel limit and alarm.
- RS485 serial communication with MODBUS-RTU protocol, 32 nodes maximum (without repeater).
- Communication times shorter than 10 ms (@ 38400 baud).
- Connection distance up to 1200m.
- Pull-out terminals, with 2.5mm<sup>2</sup> cross-section
- Facilitated wiring of power supply and serial connection by means of a bus which can be housed in the DIN guide.
- Bus can be fitted and removed without interrupting communication or power supply to the system.

**TECHNICAL SPECIFICATIONS**

Power Supply : 10..40 Vcc, 19..28 Vca 50..60Hz, max consumption 2 W.

Inputs : 6 opto-insulated inputs for REED, PROXIMITY PNP, NPN, contact, etc. - Internal jumper for selecting internal or external power supply for the inputs.

Discrimination limits : according to IEC1131.2 type 1

Transition level : 10 Vdc and 3 mA ± 10%

Minimum pulse length : 20 ms

Outputs : 2 SPST relay outputs with common contact, capacity 5A<sub>ac</sub>, 250Vac. Internal jumpers for selecting an NO or NC contact for each relay

Communication Port : Serial RS485, 2 wires, with speed settings (9600, 19200, 38400, 57600, 115200 baud) and type of parity (None, Even, Odd).

Protocol : Modicon MODBUS RTU.

Environmental conditions : Temperature: 0..55°C, Humidity : 30..90% a 40°C not condensing, installation category II, pollution degree 2.

Protection degree : IP20.

Weight, Dimensions : 150g , 100 x 17,5 x 112 mm

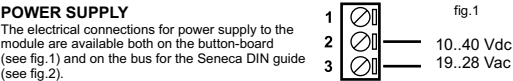
Regulatory conformity : EN61000-6-4/2002 (electromagnetic emission, industrial environment)  
 EN61000-6-2/2002 (electromagnetic emission, industrial environment)  
 EN61010-1 (safety).

**INSTALLATION INSTRUCTIONS**

The Z-D-IO module is designed for fitting on a DIN 46277 guide, in vertical position. For excellent operation and long life, make sure that the module/s is/are adequately ventilated. Do not place any raceways or other objects that obstruct the ventilation louvers. Do not fit the modules over appliances that generate heat; we advise you to install the module/s in the lower part of the panel.

**NOTE:** If you use the DIN guide connectors to install, this will facilitate installation and ensure correct ventilation of the modules.

**ELECTRICAL CONNESSIONS**



Power supply voltage must be in the range from 10 to 40 Vdc (any polarity), 19 to 28 Vac - also see the **INSTALLATION INSTRUCTIONS**.  
**The upper limits must not be exceeded, as there is a risk of serious damage to the module.**  
 The power supply source must be protected against any troubles on the module, by using an appropriately sized fuse. The module can be powered via the DIN guide connectors.

**SERIAL PORT RS485**

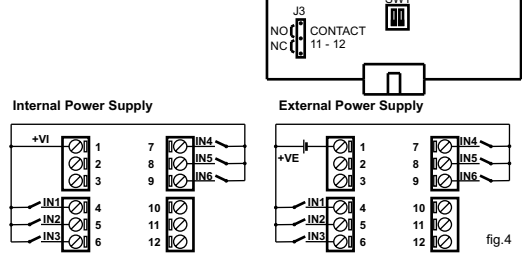
The electrical connections for the RS485 bus are available only by using the bus for the Seneca DIN guide.

The connections of the bus connector for the DIN guide can be seen in fig.2.

**INPUTS**

Sensors REED, PROXIMITY PNP, NPN, contact, can be connected to the input terminals. The power supply to these sensors can be obtained directly from the Z-D-IO Module (factory configuration), or it can be externally supplied.

Procedure for modifying the configuration of the inputs: open the side closing element and shift the configuration jumper J1 to position I for internal power supply, or in position E for external power supply (see fig. 3).



For the meanings of the inputs, see section "Module Configuration".

**OUTPUTS**

The relay outputs can be configured to use the NO contact (factory configuration), or the NC contact. To change the output configuration, open the side closing element and shift the configuration jumpers J2 and J3 (see fig.3).

**MODULE CONFIGURATION (DIP-SWITCH SW2-1 and SW2-2)**

The module can be configured by the SW2 Dip-switch in order to function in four different operating modes:

- **I/O MODE**
- **MOTOR COMMAND MODE**
- **PNEUMATIC VALVE COMMAND MODE**
- **MOTORIZED VALVE COMMAND MODE**

I/O MODE			OUTPUTS		
Terminal	Meaning	Type	Terminal	Meaning	Type
4 - 1	IN 1	N.O.	10 - 12	OUT 1	N.D. (**)
5 - 1	IN 2	N.O.	11 - 12	OUT 2	N.D. (**)
6 - 1	IN 3	N.O.	<b>SETTING OF DIP-SWITCH SW2</b>		
7 - 1	IN 4	N.O.	ON   1   2   3   4		
8 - 1	IN 5	N.O.			
9 - 1	IN 6	N.O.			

MOTOR COMMAND MODE			OUTPUTS		
Terminal	Meaning	Type	Terminal	Meaning	Type
4 - 1	Local / Remote	N.O.	10 - 12	Alarm	N.E. (**)
5 - 1	Start (*)	N.O.	11 - 12	Start	N.D. (**)
6 - 1	Stop (*)	N.C.	<b>SETTING OF DIP-SWITCH SW2</b>		
7 - 1	Thermal Protection	N.C.	ON   1   2   3   4		
8 - 1	Feedback	N.O.			
9 - 1	Silence Alarm	N.O.			

PNEUMATIC VALVE COMMAND MODE			OUTPUTS		
Terminal	Meaning	Type	Terminal	Meaning	Type
4 - 1	Local / Remote	N.O.	10 - 12	Alarm	N.E. (**)
5 - 1	Activation (*)	N.O.	11 - 12	Start	N.D. (**)
6 - 1	Return (*)	N.C.	<b>SETTING OF DIP-SWITCH SW2</b>		
7 - 1	Return Travel-Limit	N.C.	ON   1   2   3   4		
8 - 1	Activation Travel-Limit	N.O.			
9 - 1	Silence Alarm	N.O.			

**MOTORIZED VALVE COMMAND MODE**

INPUTS			OUTPUTS		
Terminal	Meaning	Type	Terminal	Meaning	Type
4 - 1	Local / Remote	N.O.	10 - 12	Return	N.E. (**)
5 - 1	Activation (*)	N.O.	11 - 12	Activation	N.E. (**)
6 - 1	Return (*)	N.C.	<b>SETTING DIP-SWITCH SW2</b>		
7 - 1	Return Travel-Limit	N.C.	ON   1   2   3   4		
8 - 1	Activation Travel-Limit	N.O.			
9 - 1	Not used	N.O.			

(\*) These commands are effective only if the Local / Remote input is in Local position (open contact). If the Local / Remote input is in Remote position (closed contact), the respective commands are sent to the module by writing in the respective registers.

(\*\*) N.D. = Normally de-energised relay N.E. = Normally energised relay.

**MOTORS COMMAND LOGIC (in LOCAL mode)**

To start the motor, close the "START" input. The module controls if the "THERMAL PROTECTION" and "STOP" inputs are closed - in this situation it enables the "START" output.

After the programmed time (see DIP-switches SW2-3 and 4 and modbus 40005 register) the closure of the "FEEDBACK" input is verified. If still open, the module enables the "ALARM" output (the "START" output remains enabled).

If the "THERMAL PROTECTION" input opens during operation, the "ALARM" output is immediately enabled, and the "START" output is disabled. To silence the alarm, close the "SILENCEALARM" input. To stop the motor, open the "STOP" input - the module disables the "START" output. The "FEEDBACK" input must open within the programmed time, otherwise the module enables the "ALARM" output.

**PNEUMATIC VALVE COMMAND LOGIC (in LOCAL mode)**

To enable the pneumatic valve, close the "ACTIVATION" input. The module controls if the "RETURN" input is closed - in this situation it enables the "ACTIVATION" output. After the programmed time (see DIP-switches SW2-3 and 4 and modbus 40006 register), the opening of the "ACTIVATION TRAVEL-LIMIT" input is verified. If it is still closed, the module enables the "ALARM" output (the "ACTIVATION" output remains enabled). To silence the alarm, close the "SILENCEALARM" input. If you open the "RETURN" input, the module disables the "START" output. The "RETURN TRAVEL-LIMIT" input must open within the programmed time, otherwise the module enables the "ALARM" output. An incongruous situation of the travel-limit devices (simultaneous opening of the two inputs "ACTIVATION TRAVEL-LIMIT" and "RETURN TRAVEL-LIMIT") immediately activates the "ALARM" output and lights up the "FAIL" LED.

**MOTORIZED VALVE COMMAND LOGIC (in LOCAL mode)**

To enable the motorised valve, close the "ACTIVATION" input. The module controls if the "RETURN" input is closed, and in this situation, it disables the "RETURN" output, (if it was enabled) and enables the "ACTIVATION" output. After the programmed time (see DIP-switches SW2-3 and 4 and modbus 40007 register), the opening of the "ACTIVATION TRAVEL-LIMIT" input is verified. If it is still closed, the module disables the "ACTIVATION" output and activates the alarm (Modbus and LED only). If you open the "RETURN" input, the module disables the "ACTIVATION" output (if it was enabled), and enables the "RETURN" output. After the programmed time, the opening of the "RETURN TRAVEL-LIMIT" input is verified - if it is closed, the module enables the alarm. An incongruous situation of the travel-limit devices (simultaneous opening of the two inputs "ACTIVATION TRAVEL-LIMIT" and "RETURN TRAVEL-LIMIT") immediately activates the alarm (only modbus and LED).

**ALARM DELAY DIP-SWITCHES (SW2-3 and SW2-4)**

SW2-3 and SW2-4	Motor	Pneu. Valve	Mot. Valve
ON   1   2   3   4	Delay alarm from EEPROM	10 s (default)	10 s (default)
ON   1   2   3   4	"Short" alarm delay	2 s	4 s
ON   1   2   3   4	"Medium" alarm delay	5 s	30 s
ON   1   2   3   4	"Long" alarm delay	30 s	120 s

**SERIAL COMMUNICATION DIP-SWITCHES (SW1-1 and SW1-2)**

SW1-1 : COMMUNICATION PARAMETERS	SW1-2 : LINE TERMINATOR
ON   1   2	Terminator On
ON   1   2	No termination

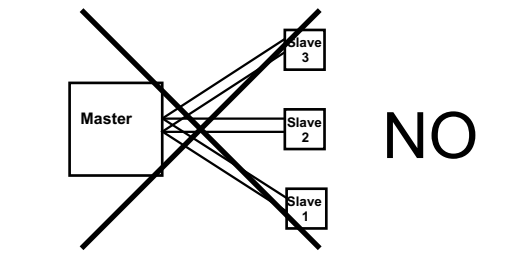
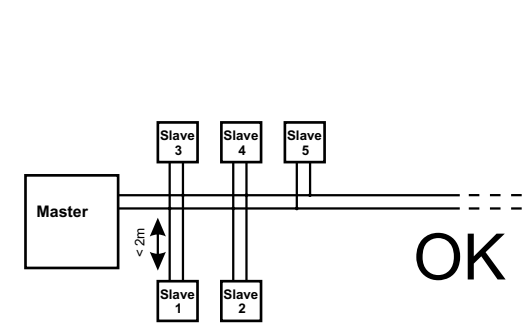
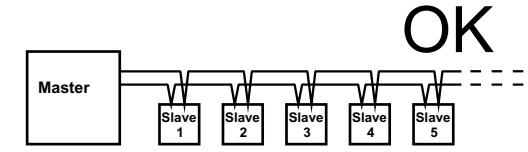
**SIGNALLING LEDS**

Twelve LEDs indicating status and error are located in the Z-D-IO. The type of signalling they provide is described below.

- **PWR:** (Green) indicates Power ON or not ON.
- **FAIL:** (Yellow) signals an error or trouble.
- **Tx:** (Red) indicates if the module is transmitting data.
- **Rx:** (Red) indicates if the module is receiving data.
- **Inputs Status:** 6 green leds verdi, lighted when energised.
- **Stato Usctate:** 2 red leds, lighted when energised.

**SERIAL INTERFACE**

The RS485 serial interface is based on a differential balanced communication line with typical impedance of 120 ohm. The maximum length of the connection is not defined but depends on communication speed, disturbance signal ratio, and cable quality. Generally, the maximum length is fixed at 1200 m, for guaranteed operation. The connection cable need not be screened, if the distance is a few meters in an electrically not very 'noisy' environment. For distances from 15 to 100 m, a screened twisted cable without any special characteristics can be used, whereas for connections of over 100 m, we advise you to use, for example, a CEAM CPR 6003 or BELDEN 9841 cable. The communication line should preferably be of the chain type, thus avoiding star-configurations and limiting shunts to a few meters (see figure below). The ends of the line must be terminated by turning ON the relevant dip-switch on the module, or by inserting a 120 ohm resistance parallel to the line. The cable screen must be connected to the GND terminals on both sides, and must be earth connected on at least one side. If noise has to be reduced, the other side should be connected to earth via a 10 nF capacitor.



**MODBUS REGISTERS**

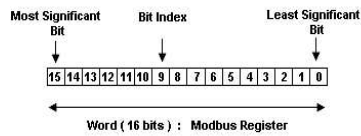
The Z-D-IO module contains 16-bits (words) ModBus registers, accessible via the RS485 serial communication. In the next paragraphs we shall describe the supported Modbus commands, and the functions of the various registers and individual bits.

**Supported MODBUS commands**

Code	Function	Description
01	Read Coils	Reading in bit
02	Read Inputs	Reading in bit
03	Read Holding Registers	Reading of word registers up to 16 at a time
04	Read Input Registers	Reading of word registers up to 16 at a time
05	Write Single Coil	Writing in bit
06	Write Single Register	Scrittura di un registro a word
15	Write Multiple Coils	Writing in multiple bits
16	Write Multiple Registers	Writing of word registers up to 16 at a time

**Holding Registers**

In the following table, we shall describe the functions of the 16-bit Holding Registers, with reference to the following structure:

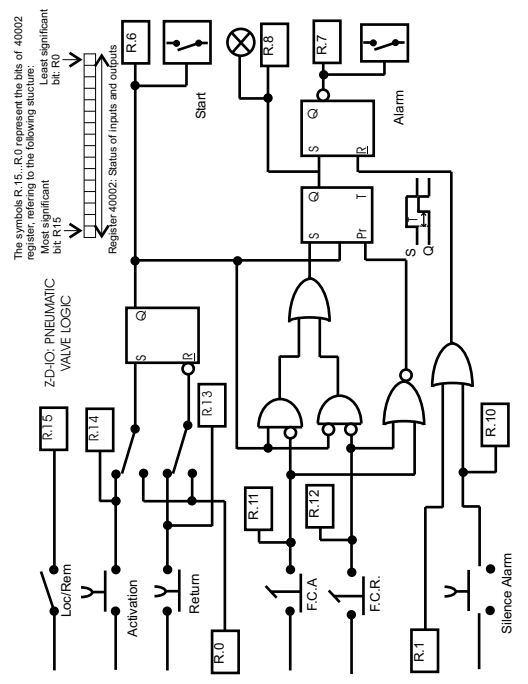


The Bit [x:y] notation shown in the table indicates all bits from x to y: xy. For example, Bit [2:1] indicates bit 2 and bit 1 and is used to illustrate the meaning of the different joined combinations of the values of the two bits. Remember that reading and writing individual and multiple Modbus functions 3,4, 6 and 16, can be executed on the following registers.

<b>Bit 1</b>	<b>Command of the Alarm / Return output</b> In <b>I/O Mode</b> : enables the Alarm (Return) output In <b>M o V Mode</b> : resets the alarm output.	
<b>Bit 0</b>	<b>Command of the Start / Activation output</b> In <b>I/O Mode</b> : sends the command of the Start / Activation output to the other status modes (Start, Stop, etc...)	
<b>DIP-SWITCH STATUS</b>	<b>Register indicating the status of the dip-</b>	<b>40003</b> R/W
<b>Bit [15:0]</b>	Indicates the status of the dip-switches, which is updated at start-up.	
<b>DSW DELAY</b>	<b>Delay register of alarm being used</b>	<b>40004</b> R
<b>Bit [15:0]</b>	Indicates the delay in tenths of a second (time elapsing between the moment when the activation is commanded or disabled and the moment when successful outcome of the action is verified) of the alarm being used, which is updated at start-up according to the setting of the dip-switches.	
<b>MOTOR DELAY</b>	<b>Register used for setting the delay time of the alarm for the Motor mode.</b>	<b>40005</b> R/W
<b>Bit [15:0]</b>	Sets the delay time, in tenths of a second, elapsing between the moment when the activation is commanded or disabled and the moment when successful outcome in the motor mode is verified	
<b>PNEUMATIC VALVE DELAY</b>	<b>Register used for setting the delay time of the alarm for the Pneumatic Valve mode.</b>	<b>40006</b> R/W
<b>Bit [15:0]</b>	Sets the delay time, in tenths of a second, elapsing between the moment when the activation is commanded or disabled and the moment when successful outcome in the pneumatic valve mode is verified	
<b>MOTORISED VALVE DELAY</b>	<b>Register used for setting the delay time of the alarm for the Motorised Valve mode.</b>	<b>40007</b> R/W
<b>Bit [15:0]</b>	Sets the delay time, in tenths of a second, elapsing between the moment when the activation is commanded or disabled and the moment when successful outcome in the motorised valve mode is verified	

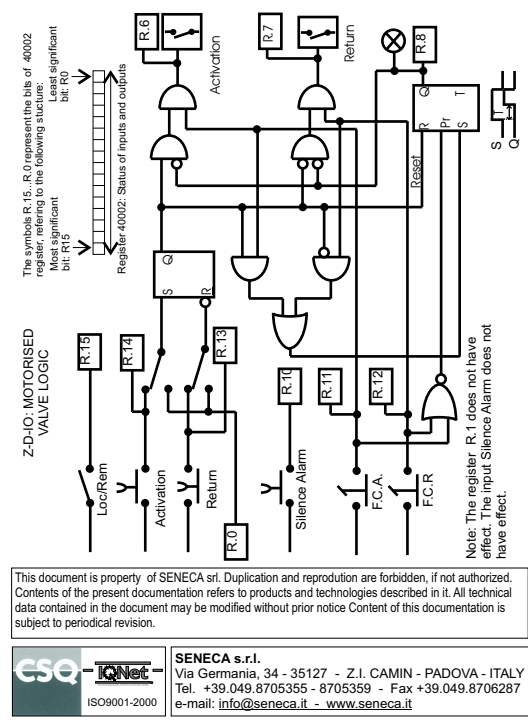
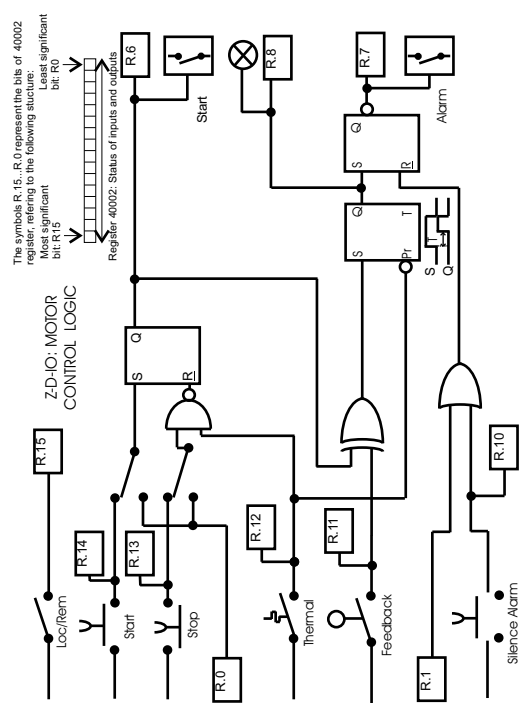
**INPUTS**  
Instead, as regards the Inputs (digital inputs), the only supported function is bit reading 02. The following table shows the functions of the individual inputs:

INPUT	Description	ADD.	R/W
<b>ST_LOC_REM</b>	<b>Status of the Local terminal</b> Indicates the status of the local terminal: 0: Local 1: Remote	<b>10001</b>	<b>R</b>
<b>ST_START</b>	<b>Status of the Start / Activation terminal</b> Indicates the status of the Start / Activation terminal	<b>10002</b>	<b>R</b>
<b>ST_STOP</b>	<b>Status of the Stop / Return terminal</b> Indicates the status of the Stop / Return terminal	<b>10003</b>	<b>R</b>
<b>ST_THERMAL</b>	<b>Status of the Thermal breaker / F.C.R.</b> Indicates the status of the Thermal breaker / F.C.R. terminal	<b>10004</b>	<b>R</b>
<b>ST_FEEDBACK</b>	<b>Status of the Feedback/F.C.A. terminal</b> Indicates the status of the Feedback/F.C.A. terminal	<b>10005</b>	<b>R</b>
<b>ST_SILENC_AL</b>	<b>Status of the Alarm Silencing terminal</b> Indicates the status of the Alarm Silencing terminal	<b>10006</b>	<b>R</b>
<b>DETECTED ALARM</b>	<b>Alarm indicator</b> Indicates that an alarm was detected	<b>10008</b>	<b>R</b>
<b>STATUS ALARM OUTPUT</b>	<b>Status of alarm output</b> Indicates the status of the alarm output	<b>10009</b>	<b>R</b>
<b>STATUS ACTIVATION OUTPUT</b>	<b>Status of the Start / Activation output</b> Indicates the status of the Start / Activation output	<b>10010</b>	<b>R</b>



REGISTER	Description	ADD.	R/W
<b>MACHINE ID</b>	The top part of the register contains the module ID (16) The lower part contains the firmware revision (01)	<b>40001</b>	<b>R</b>
<b>IN OUT STATE</b>	<b>Status register of inputs and outputs</b>	<b>40002</b>	<b>R/W</b>
<b>Bit 15</b>	Status of the Local terminal 0: enables the local control mode (from the operator panel) 1: enables the local control mode (by supervision)		
<b>Bit 14</b>	Status of Start / Activation terminal 0: open 1: closed		
<b>Bit 13</b>	Status of Stop / Activation terminal 0: open 1: closed		
<b>Bit 12</b>	Status of Thermal breaker/ F.C.R. 0: open 1: closed		
<b>Bit 11</b>	Status of Feedback / F.C.A. terminal 0: open 1: closed		
<b>Bit 10</b>	Status of alarm Silencing terminal 0: open 1: closed		
<b>Bit 9</b>	Not used		
<b>Bit 8</b>	Alarm 0: no alarm detected 1: alarm detected		
<b>Bit 7</b>	Status of Alarm output 0: de-energised 1: energised		
<b>Bit 6</b>	Status of the Start / Activation output 0: de-energised 1: energised		
<b>Bit [5:3]</b>	Not Used		
<b>Bit 2</b>	On-panel Alarm LED command Sets the on-panel LED alarm command in the I/O mode in which the module performs only the I/O functions via Modbus, excluding any internal automatism.		

<b>ADDR</b>	<b>Register used for setting the address of the module and of the parity control</b>	<b>40008</b>	<b>R/W</b>
<b>Bit [15:8]</b>	They set the module's address. Permissible values from <b>0x00 to 0xFF</b> (decimal values in the range 0-255).		
<b>Bit [7:0]</b>	They set the type of control on parity: 00000000 : no parity (NONE) 00000001 : even parity (EVEN) 00000010 : odd parity (ODD)		
<b>BAUDR</b>	<b>Register used for setting the baudrate and the response delay time in characters.</b>	<b>40009</b>	<b>R/W</b>
<b>Bit [15:8]</b>	They set the value of the serial communication speed (baudrate): 00000000 : 4800 baud 00000001 : 9600 baud 00000010 : 19200 baud 00000011 : 38400 baud 00000100 : 57600 baud 00000101 : 115200 baud 00000110 : 1200 baud 00000111 : 2400 baud		
<b>Bit [7:0]</b>	They set the delay time of the response in characters. Represents the number of pauses from 6 characters each to be inserted between the end of the RX message and the start of the TX message. The Default value is 00x00 (0 decimal value).		
<b>COILS</b>	As concerns the Coils (digital outputs), the supported functions are: 1, 5, and 15 of individual and multiple reading and writing of bits. The following table shows the functions of the individual coils:		
<b>COIL</b>	<b>Description</b>	<b>ADD.</b>	<b>R/W</b>
<b>LED</b>	<b>On-panel alarm LED command.</b> Sets the on-panel LED alarm command in the I/O mode in which the module performs only the I/O functions via Modbus, excluding any internal automatism.	<b>00001</b>	<b>R/W</b>
<b>ALLRET</b>	<b>Command of Alarm / Return output</b> In <b>I/O Mode</b> : enables the Alarm (Return) output. In <b>M o V Mode</b> : resets the alarm output.	<b>00002</b>	<b>R/W</b>
<b>START</b>	<b>Command of Start/Activation output</b> In <b>I/O Mode</b> : sends the command of the Start / Activation output to the other status modes (Start, Stop, etc...)	<b>00003</b>	<b>R/W</b>



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