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Distributed I/O device in 6 DIN module box 16 digital input channels Communicating over RS-485

SS 10148

User Guides – MODBUS protocol Firmware Version : 5101

All the data shared by a device communicating by Modbus RTU / Modbus ASCII protocol are mapped in tables wherein to each data is associated a determined address.
Each data could be of two types:
- "REGISTER", data of 2 bytes size (word of 16 bits) that can be associated to analogue input or output, variables, set-point, etc...
- "COIL", data of 1 single bit that can be associated to digital input or output or to a logic state.

A register could contain the image (mirror) of more coils; in example the 16 digital inputs of a device could be read or written as bit (singularly) addressing the coil related to each input or can be read or written as a single word addressing the associated register wherein each bit corresponds to a coil.
In the Modbus protocol, registers and coils are divided as per the following groups of addresses:
0xxxx and 1xxxx = Coils (bit)
3xxxx and 4xxxx = Registers (word)
When read and write functions are performed, use the tables indicated below to address the registers and coils.

REGISTER TABLE

Register Position (*)	Description	Access
40001	Test	R/W
40002	Firmware [0]	RO
40003	Firmware [1]	RO
40004	Name [0]	R/W
40005	Name [1]	R/W
40006	Communication	R/W
40007	Address	R/W
40008	Delay RX/TX	R/W
40009	Watchdog Timer	R/W
40010	System Flags	R/W
40011	Digital Inputs	RO
40012	Rise Latch	R/W
40013	Fall Latch	R/W
40014	Sync. Value	R/W
40015	Counter #0	R/W
40016	Counter #1	R/W
40017	Counter #2	R/W
40018	Counter #3	R/W
40019	Counter #4	R/W
40020	Counter #5	R/W
40021	Counter #6	R/W
40022	Counter #7	R/W

NOTES:
(*) Subtract 1 to the address position number of the register and/or coil.
Registers and coils marked as RO in the column 'Access' are Read Only registers.
Registers and coils marked as R/W in the column 'Access' are Read and Write registers.
For the devices of SS10000 series, the group of data 0xxxx is the mirror of the group 1xxxx, the group of data 3xxxx is the mirror of the group 4xxxx, therefore the first register could be addressed either as 30001 (with function 04) or 40001 (with function 03).
(**) The functions 01, 02 and 15 support a maximum number of 32 consecutive coils for reading and writing .

SUPPORTED MODBUS FUNCTIONS CODES

Function	Description
01(**)	Read Coil Status (0xxxx)
02(**)	Read Inputs Status (1xxxx)
03	Read Holding Registers (4xxxx)
04	Read Inputs Registers (3xxxx)
05	Force Single Coil
06	Preset Single Register
15 (0F)	Force Multiple Coil
16 (10)	Preset Multiple Registers

COILS TABLE

(*)Coil (Hex)	(*)Coil (Dec)	Description	Access
0x0001	00001	Watchdog Enable	R/W
0x0002	00002	Watchdog Event	R/W
0x0003	00003	PowerUp Event	R/W
0x0004	00004	Auto Reset Counter #0	R/W
0x0005	00005	Auto Reset Counter #1	R/W
0x0006	00006	Auto Reset Counter #2	R/W
0x0007	00007	Auto Reset Counter #3	R/W
0x0008	00008	Auto Reset Counter #4	R/W
0x0009	00009	Enable Counter #0	R/W
0x000A	00010	Enable Counter #1	R/W
0x000B	00011	Enable Counter #2	R/W
0x000C	00012	Enable Counter #3	R/W
0x000D	00013	Enable Counter #4	R/W
0x000E	00014	Enable Counter #5	R/W
0x000F	00015	Enable Counter #6	R/W
0x0010	00016	Enable Counter #7	R/W
0x0011	00017	Input #0	RO
0x0012	00018	Input #1	RO
0x0013	00019	Input #2	RO
0x0014	00020	Input #3	RO
0x0015	00021	Input #4	RO
0x0016	00022	Input #5	RO
0x0017	00023	Input #6	RO
0x0018	00024	Input #7	RO
0x0019	00025	Input #8	RO
0x001A	00026	Input #9	RO
0x001B	00027	Input #10	RO
0x001C	00028	Input #11	RO
0x001D	00029	Input #12	RO
0x001E	00030	Input #13	RO
0x001F	00031	Input #14	RO
0x0020	00032	Input #15	RO
0x0021	00033	Rise Latch #0	R/W
0x0022	00034	Rise Latch #1	R/W
0x0023	00035	Rise Latch #2	R/W
0x0024	00036	Rise Latch #3	R/W
0x0025	00037	Rise Latch #4	R/W
0x0026	00038	Rise Latch #5	R/W
0x0027	00039	Rise Latch #6	R/W
0x0028	00040	Rise Latch #7	R/W
0x0029	00041	Rise Latch #8	R/W
0x002A	00042	Rise Latch #9	R/W
0x002B	00043	Rise Latch #10	R/W
0x002C	00044	Rise Latch #11	R/W
0x002D	00045	Rise Latch #12	R/W
0x002E	00046	Rise Latch #13	R/W
0x002F	00047	Rise Latch #14	R/W
0x0030	00048	Rise Latch #15	R/W
0x0031	00049	Fall Latch #0	R/W
0x0032	00050	Fall Latch #1	R/W
0x0033	00051	Fall Latch #2	R/W
0x0034	00052	Fall Latch #3	R/W
0x0035	00053	Fall Latch #4	R/W
0x0036	00054	Fall Latch #5	R/W
0x0037	00055	Fall Latch #6	R/W
0x0038	00056	Fall Latch #7	R/W
0x0039	00057	Fall Latch #8	R/W
0x003A	00058	Fall Latch #9	R/W
0x003B	00059	Fall Latch #10	R/W
0x003C	00060	Fall Latch #11	R/W
0x003D	00061	Fall Latch #12	R/W
0x003E	00062	Fall Latch #13	R/W
0x003F	00063	Fall Latch #14	R/W
0x0040	00064	Fall Latch #15	R/W

DESCRIPTION MODBUS REGISTERS

40001 : TEST
This register is used for the function of Synchronized Sampling (refer to description register 40014)

40002 / 40003 : FIRMWARE
Field of 2 read only registers ; contains the firmware identifier provided by the manufactured.
- Default value: 5101 (hex)

40004 / 40005 : NAME
Field of 2 read/write registers (4 bytes or 4 ASCII characters) available for the user, it can contain the name of the device or an abbreviation that identifies its function inside the plant. Each one of the 4 bytes could be written by values from 0 to 255, ASCII characters included.
The default value of this field contains the identifier of the device expressed in ASCII characters.
- Default value: "A148" (ASCII).

40006 : COMMUNICATION
If the user wants to set the communication parameters by PC, it is necessary to set the bits of this register referring to the table below in order to configure baud-rate, parity and mode. The configuration of the parameters via software is not necessary if it is done by dip switches.

- Default of manufacturer: 38400 bps, mode RTU, parity NONE

Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Desc.	-	-	-	-	-	-	-	-	-	M	P1	P0	N	B2	B1	B0

Mode	M
MODBUS ASCII	0
MODBUS RTU	1

Parity RTU	Parity ASCII	P1	P0
None	Mark	0	0
Even	Even	0	1
Odd	Odd	1	0
Space	Space	1	1

BaudRate	B2	B1	B0
2400	0	0	1
4800	0	1	0
9600	0	1	1
19200	1	0	0
38400	1	0	1
57600	1	1	0
115200	1	1	1

N°bit	N
7 bit	0
8 bit	1

NOTE:
- the number of bits is ignored, in ASCII mode is fixed to 7; in RTU mode is fixed to 8.

40007 : ADDRESS
Contains the MODBUS address of the device; the values allowed are from 1 to 247 decimal.
Each node connected to the same line has a unique address.
The address 255 is used for broadcast function.
- Default value: 01

40008 : DELAY RX/TX
Indicates the value of the delay time between the reception of a query and the transmission of the response, expressed as milliseconds.
- Default value: 01(1 ms.)

40009 : WATCHDOG TIMER
Contains the value of WatchDog timer , expressed of intervals of 0.5 seconds. If the WatchDog is enabled and the device doesn't receive command for the time set in this register , the WatchDog Alarm will be activated (refer to section "Procedures").
- Default value: 10 (5 sec.)

40010 : SYSTEM FLAGS
Contains the enable bits and system events of the device. The following parameters are configurable:

WATCHDOG ENABLE
Enables the WatchDog alarm. If the alarm is enabled and the device doesn't receive commands for a time higher than the one specified in register 40009, the WatchDog Alarm will be activated (refer to section "Procedures").
0 = Watchdog disabled.
1 = Watchdog enabled.

WATCHDOG EVENT
Indicates the state of the WatchDog Alarm. If the alarm is enabled and the device doesn't receive commands for a time higher than the one specified in register 40009, this bit is forced to 1. To erase the alarm set this bit to 0. If the bit is forced to 1 by a command of the Master unit, a Watchdog event will be simulated and consequently an alarm condition will be created.
0 = Normal condition
1 = Alarm condition

POWER-UP EVENT
This bit is forced to 1 each time the device is powered-on in order to indicated that the device has been switched-off or a reset is occurred. By the set of this bit to 0 and check its state it is possible to monitor if a reset of the device is occurred.
0 = reset not occurred
1 = reset not occurred
It is possible to use this register to read and write at the same time all the bits without to implement the specific functions of read and write of coils (01-02-05-15).

Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Set	-	-	-	-	-	3	2	1	-	-	-	-	-	-	-	-

Watchdog Event Enable
Watchdog Event
Power-up Event

40011 : DIGITAL INPUTS

This register shows the state of the digital inputs (0 = OFF , 1 = ON).
It is possible to use this register to read and write at the same time all the bits without to implement the specific functions of read of coils (01-02).

Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Descr.	Input															
Channel	#7	#6	#5	#4	#3	#2	#1	#0	#15	#14	#13	#12	#11	#10	#9	#8
Coil	24	23	22	21	20	19	18	17	32	31	30	29	28	27	26	25

40012 : RISE LATCH

Contains the value of the rise latch (event of change from logic state 0 to logic state 1) of the digital inputs .
The event latch signals the single change of state and is not updated by the system; in the case of it is necessary to monitor this parameter for more that one variation, it is necessary to reset the bit writing its value to 0. Each bit corresponds to a digital input, in function of the table below:
- Default value: 0

Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Descr.	Input															
Channel	#7	#6	#5	#4	#3	#2	#1	#0	#15	#14	#13	#12	#11	#10	#9	#8
Coil	40	39	38	37	36	35	34	33	48	47	46	45	44	43	42	41

40013 : FALL LATCH

Contains the value of the fall latch (event of change from logic state 1 to logic state 0) of the digital inputs .
The event latch signals the single change of state and is not updated by the system; in the case of it is necessary to monitor this parameter for more that one variation, it is necessary to reset the bit writing its value to 0. Each bit corresponds to a digital input, in function of the table below:
- Default value: 0

Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Descr.	Input															
Channel	#7	#6	#5	#4	#3	#2	#1	#0	#15	#14	#13	#12	#11	#10	#9	#8
Coil	56	55	54	53	52	51	50	49	64	63	62	61	60	59	58	57

40014 : SYNC VALUE

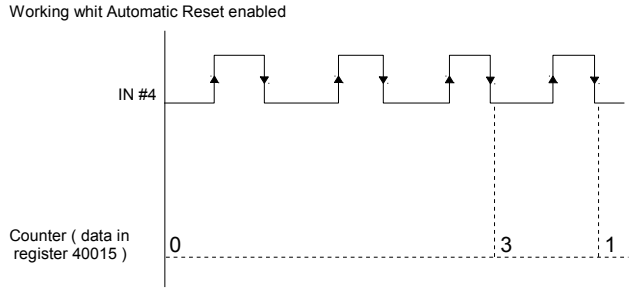
When the device receives the command of Synchronism, the value of the register 40011 are saved into this register.

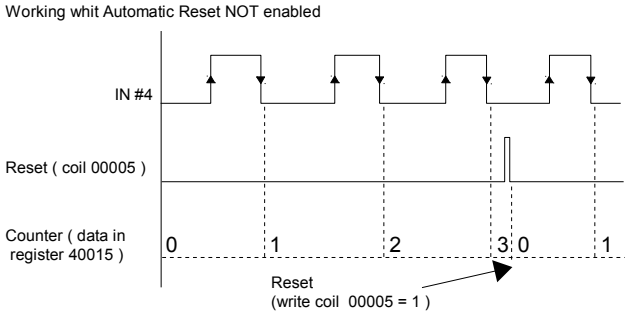
Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Input	#7	#6	#5	#4	#3	#2	#1	#0	#15	#14	#13	#12	#11	#10	#9	#8

The function of Synchronism is a broad-cast command sent to all the device of the net RS-485. When the devices receive this command, all the input values measured at the reception of it are saved into the proper registers.
To send the command, write the value 10 into the register “Test” (40001), to the address '255'.
NOTE: the values of synchronism are not saved in eeprom; this involves that at each power-on the values in the registers are reset.

40015 : COUNTER #0
40016 : COUNTER #1
40017 : COUNTER #2
40018 : COUNTER #3
40019 : COUNTER #4
40020 : COUNTER #5
40021 : COUNTER #6
40022 : COUNTER #7

Contains the counting of pulses detected on the associated digital input starting from the last reset of the counter. The format of the number is unsigned integer 16 bit (0 ÷ 65535).
When a pulse on input happens (rising edge followed by a falling edge), the value of the register associated to the digital input is increased of 1.
If the “Automatic Reset ” is enabled, at each reading of these registers, the value contained is automatically forced to 0.
If the “Automatic Reset ” is not enabled, the value of these registers can be reset only by writing of the value 0 into it.
NOTE: when the device is powered-on the value of these register is set to 0.





COILS DEDICATED TO DIGITAL COUNTERS

00004 ÷ 00008 : ENABLE OF THE AUTOMATIC RESET FOR COUNTER #0 ÷ #4

Enables the automatic reset (Auto reset) of a counter: if this parameter is enabled, each time that the register associated to the counter is read, its value is reset immediately after the data has been transmitted; if this parameter is not enabled the counter can be reset only by writing of the value 0 into the associated register.
0 = Manual Reset
1 = Automatic Reset (default)

00009 ÷ 00016 : COUNTER ENABLED #0 ÷ #7

Write this coil to 1 to activate the digital counter associated to the input channel.
Write this coil to 0 to stop the operation of counting.

PROCEDURES

USE OF “INIT” FUNCTION

The “INIT” function allows to set the device in the default configuration, independently of the software configuration made.
To use this function the dip-switches must be all in OFF position.

The INIT forces: mode RTU, parity NONE, baud rate 9600, number of bit = 8, address 1

- Connect to the line RS485 only the device to configure.
- Switch-off the device.
- Connect the terminal INIT to the terminal REF.
- Power-on the device.
- Check that the green led “PWR” on the front of the device is on.

If not, check the connection of power supply (terminals V+ and V-).

- Set the communication port with the following values:
  - Mode = Modbus RTU
  - baud-rate = 9600 bps
  - parity = None
  - n° bit = 8
  - bit di stop = 1
- the device will respond to the address 01 .
- Read or write the desired settings into the registers:
  - 40006 : “Communication” to set the baud-rate.
  - 40007 : “Address” to set the address of the device.
- Switch-off the device.
- Disconnect the terminal INIT from the terminal REF.
- Power-on the device with all the dip-switches in OFF position.
- Set the communication port with the baud-rate configured in the register 40006.
- the device will respond to the address configured in the register 40007.

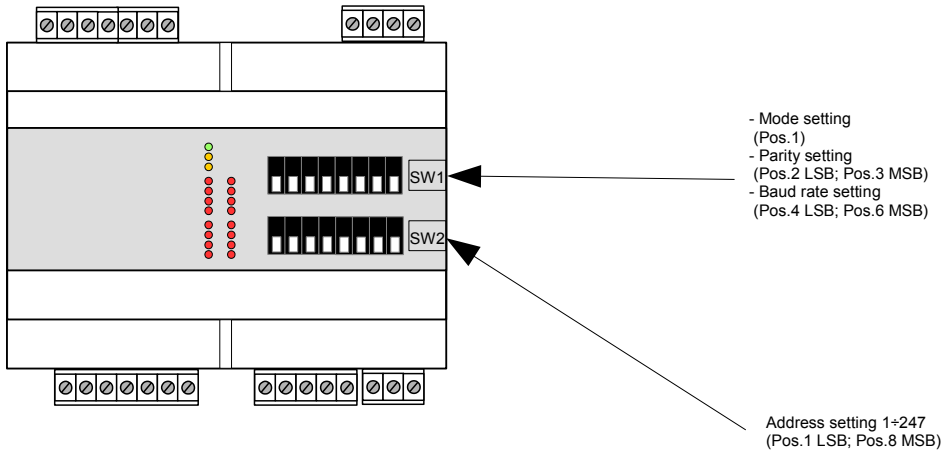
NOTE: the default configuration values are the following:
- Address : 01
- Baud-rate : 38400 bps
- Protocol : RTU
- Parity : None

WATCHDOG

The devices of the SS10000 series have the Watchdog timer that, if enabled, activates an alarm each time that the communication between the device and the Master unit is not performed for a time higher that the one configured.
The light signalling the green led PWR on the front starts to blink one time per second and is forced to 1 the coil “Watchdog Event”.
To exit from the alarm condition, send a command to the device, reset the coil “Watchdog Event”: the led will stop to blink.

CONFIGURATION BY DIP SWITCHES

Notice: set all the dip-switche in OFF position to access to the device in EEPROM mode (the device will follow the configuration parameters set by software) and INIT mode.
Switch-off the device before to program it by dip-switches.



Notes (*):
- in **Modbus RTU** mode the setting is **NONE; number of bit = 8**
- in **Modbus ASCII** mode the setting is **MARK; number of bit = 7**

For the tables of configuration refer to the technical data-sheet of the device.

DIP-SWITCHES SETTING

ON OFF

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ED.04.16 REV.00