

User Guides – MODBUS protocol Firmware Version : D102

DAT 3148

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

Posizione Registro (*)	Descrizione	Accesso
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 DAT3000 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.**

COILS TABLE

(*)Coil (Hex)	(*)Coil (Dec)	Descrizione	Accesso
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
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
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

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

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.

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.

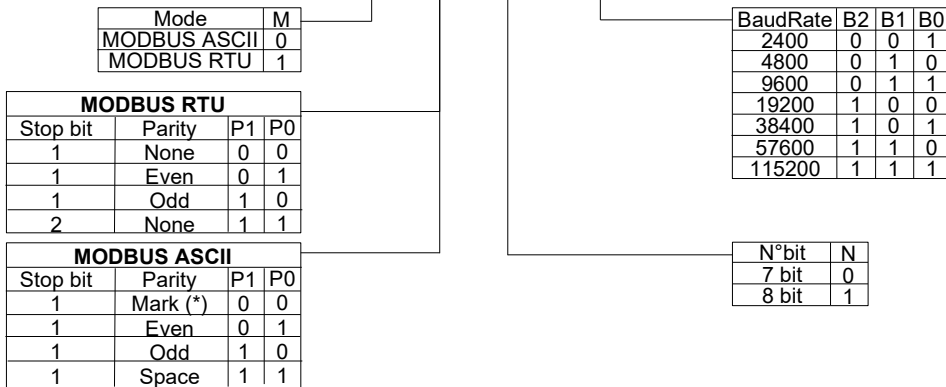
- Default value: "3148"

40006 : COMMUNICATION

Set the bits of this register as shown in the following table, to set the baud-rate, the bit number, the parity type and the protocol type.

- Manufacturer default: 38400 bps, RTU mode, parity NONE, stop bit 1

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



NOTE:

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

- RTU mode and ASCII mode, the "Stop bit" number is fixed in relation to the parity selected.

- (*) In ASCII mode, the "Mark" parity configuration with 1 stop bit is equivalent to the "No Parity" configuration with 2 stop bit

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

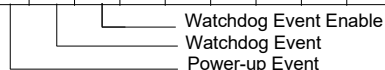
1 = reset not occurred

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
Coil	08	07	06	05	04	03	02	01	16	15	14	13	12	11	10	09

Coils 9 ÷ 16: counters enabled

Coils 4 ÷ 8: automatic reset counters enabled



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. The coils are forced to 0 each time the device is switched off. Write this coil to 0 to stop the operation of counting.

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 than 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 than 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).

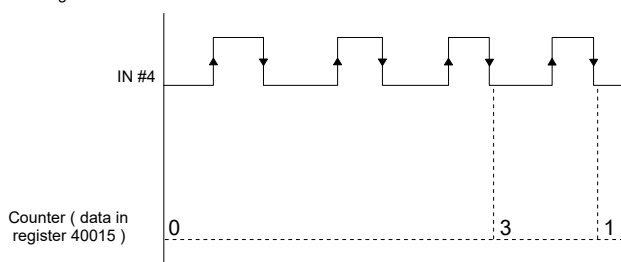
When a pulse on input happens (rising edge followed by a falling edge), the value of the register associated to the digital input is increased of 1.

If the "Automatic Reset " is enabled, at each reading of these registers, the value contained is automatically forced to 0.

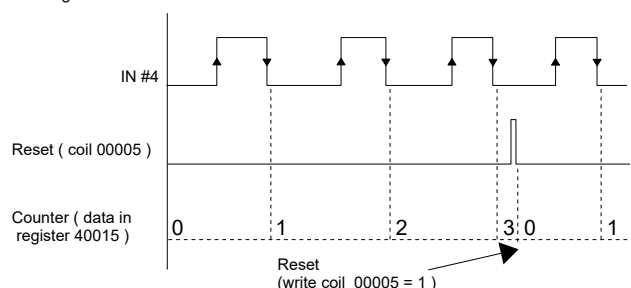
If the "Automatic Reset " is not enabled, the value of these registers can be reset only by writing of the value 0 into it.

NOTE: when the device is powered-on the value of these register is set to 0.

Working whit Automatic Reset enabled



Working whit Automatic Reset NOT enabled



PROCEDURES

HOW TO USE THE "INIT" FUNCTION

If the exact configuration of a module is unknown, it can result impossible to establish a communication with it.

The "INIT" function gives a solution to this trouble:

- Connect to the RS485 net only the device to configure.
- Turn off the device.
- Connect the INIT pin (D) to the GND pin (C).
- Turn on the device.
- Ensures that the "PWR" green LED on the front of the enclosure is lighted.

If not, control the voltage supply connections (I and J pins) and RS485 net connections (A and B pins).

If the supply connection is right, and the led still unlighted, it can be necessary to invert the RS485 pins connection.

- Set the communication port to these values:
 - baud-rate = 9600 bps
 - parity = None
 - n° bits = 8
 - stop bit = 1
- The device now communicates at the address 01 with the RTU protocol.
- Read or program the desired settings on the registers:
 - 40006 : "Communication" for the baud-rate setting
 - 40007 : "Address" for the net address of the device
- Turn off the device.
- Disconnect the INIT pin from the GND pin.
- Turn on the device.
- Set the communication port at the baud-rate programmed in the 40006 register.
- The device now communicates with the address programmed in the 40007 register.

NOTE: The default manufacturer programming is the following:

- Address : 01
- Baud-rate : 38400 bps
- Protocol : RTU
- Parity: None
- Stop bit : 1

WATCHDOG

The devices of the DAT3000 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.

In alarm condition, the state of output relays are forced as set into the register "Safe" that is the condition to which the outputs and consequently the actuators must be set to avoid damage to the system in case of danger. Moreover as 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 and will be possible to drive the outputs again.
