

User Guide – MODBUS protocol Firmware Version : 5205

DAT 10188

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
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	Digital Inputs	RO
40010	Digital Outputs	R/W
40011	System Flags	R/W
40012	PowerUp/Safe	R/W
40013	Watchdog Timer	R/W
40014	Fall Latch / Rise Latch	R/W

COILS TABLE

(*)Coil (Hex)	(*)Coil (Dec)	Description	Access
0x0001	00001	Input #0	RO
0x0002	00002	Input #1	RO
0x0003	00003	Input #2	RO
0x0004	00004	Input #3	RO
0x0005	00005	Input #4	RO
0x0006	00006	Input #5	RO
0x0007	00007	Input #6	RO
0x0008	00008	Input #7	RO
0x0011	00017	Output #0	R/W
0x0012	00018	Output #1	R/W
0x0013	00019	Output #2	R/W
0x0014	00020	Output #3	R/W
0x0015	00021	Output #4	R/W
0x0016	00022	Output #5	R/W
0x0017	00023	Output #6	R/W
0x0018	00024	Output #7	R/W
0x0021	00033	Watch-dog Enable	R/W
0x0022	00034	Watch-dog Event	R/W
0x0023	00035	Power-Up Event	R/W
0x0024	00036	Short circuit Alarm	R/W
0x0051	00081	Rise Latch #0	R/W
0x0052	00082	Rise Latch #1	R/W
0x0053	00083	Rise Latch #2	R/W
0x0054	00084	Rise Latch #3	R/W
0x0055	00085	Rise Latch #4	R/W
0x0056	00086	Rise Latch #5	R/W
0x0057	00087	Rise Latch #6	R/W
0x0058	00088	Rise Latch #7	R/W
0x0059	00089	Fall Latch #0	R/W
0x005A	00090	Fall Latch #1	R/W
0x005B	00091	Fall Latch #2	R/W
0x005C	00092	Fall Latch #3	R/W
0x005D	00093	Fall Latch #4	R/W
0x005E	00094	Fall Latch #5	R/W
0x005F	00095	Fall Latch #6	R/W
0x0060	00096	Fall Latch #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 DAT10000 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 30002 (with function 04) or 40002 (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

DESCRIPTION MODBUS REGISTERS

40002 / 40003 : FIRMWARE

Field of 2 read only registers ; contains the firmware identifier provided by the manufactured.
 - Default value: 5203 (hex)

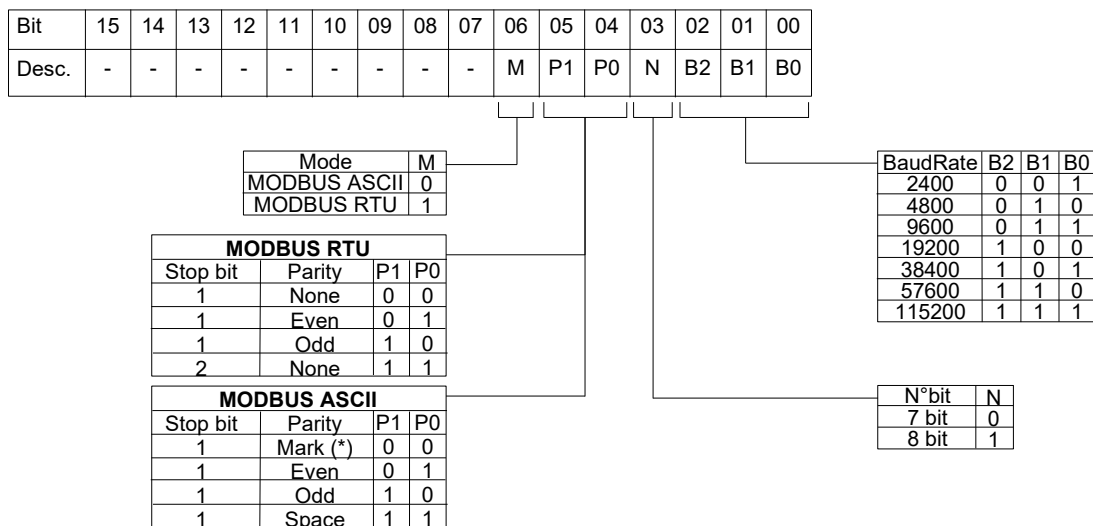
40004 / 40005 : NAME

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: "A188" (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, stop bit 1



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 : 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
Desc.	Input															
Channel	#7	#6	#5	#4	#3	#2	#1	#0	-	-	-	-	-	-	-	-
Coil	08	07	06	05	04	03	02	01	-	-	-	-	-	-	-	-

40010 : DIGITAL OUTPUTS

This register allows to drive directly the state of output transistors (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 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
Channel	#7	#6	#5	#4	#3	#2	#1	#0								
Coil	24	23	22	21	20	19	18	17	-	-	-	-	-	-	-	-

40011 : 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 40013, the WatchDog Alarm will be activated (refer to section "Procedures").

Note: **the state of this bit is saved in Eeprom starting from the firmware version 5205.**

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 40013, 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).

SHORT CIRCUIT ALARM EVENT

The device is equipped with a sensor to detected short-circuits (protection against the over-currents) on digital outputs.

In case of short-circuit on output, this coil is forced to 1. If this alarm is active check the connections; to exit from the alarm condition the device must be reset.

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).

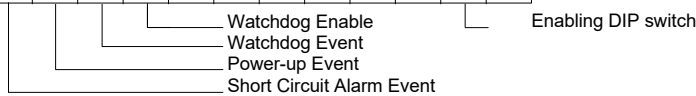
DIP SWITCH ENABLE (DS)

Editable only in INIT after a power supply cycle, the level of this bit enables or disables the reading of DIP switches. If this bit is set to 1, the device will follow exclusively the parameters of communication saved in Eeprom independently of the setting of DIP switches; if this bit is set to 0, the device will follow the standard working giving priority to the configuration set by DIP switches.

0 = Reading of Dip-switch enabled (standard working)

1 = Reading of Dip-switch disabled (communication following parameters saved in Eeprom)

Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Set	-	-	-	-	36	35	34	33	-	-	-	-	-	-	DS	-



40012 : POWERUP/SAFE

At the power-on (PowerUp) and in case of Watchdog Alarm (Safe), the state of outputs is automatically driven to the value set in this register.

Each bit corresponds to one digital output, 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
Channel	#7	#6	#5	#4	#3	#2	#1	#0	#7	#6	#5	#4	#3	#2	#1	#0
Value	Power Up								Safe							

40013 : 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.)

40014 : RISE LATCH / FALL LATCH

Contains the value of the fall latch (event of change from logic state 1 to logic state 0) and 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.	Rise								Fall							
Channel	#7	#6	#5	#4	#3	#2	#1	#0	#7	#6	#5	#4	#3	#2	#1	#0
Coil	88	87	86	85	84	83	82	81	96	95	94	93	92	91	90	89

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, stop bit = 1, 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
- Stop bit : 1

WATCHDOG

The devices of the DAT10000 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 than the one configured.

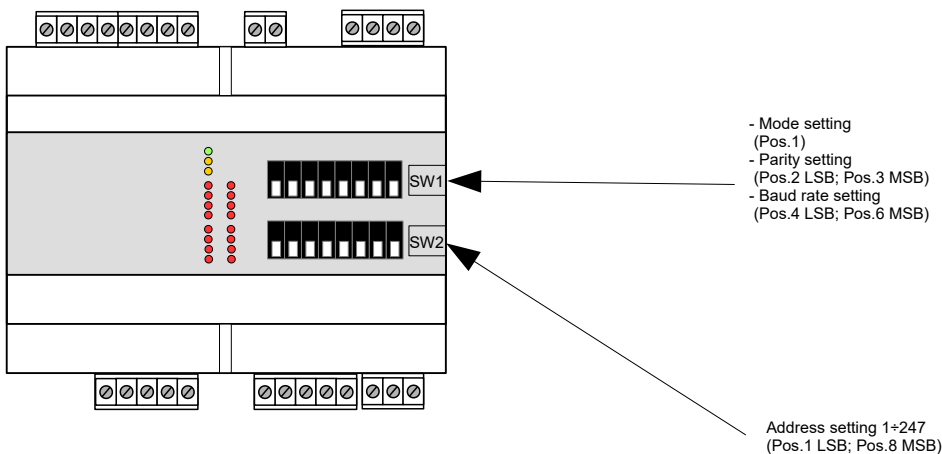
In alarm condition, the state of output relays are forced as set into the register "Safe" that is the condition to which the outputs and consequently the actuators must be set to avoid damage to the system in case of danger. Moreover as light signalling the green led PWR on the front starts to blink 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.

CONFIGURATION BY DIP SWITCHES

Notice: set all the dip-switches 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