

User Guides – MODBUS protocol Firmware Version : DA01

DAT 3116

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 |
|------------------------|-----------------|---------|
| 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 |
| 40010 | Digital Outputs | R/W |
| 40011 | System Flags | R/W |
| 40012 | Safe | R/W |
| 40013 | Watchdog Timer | R/W |
| 40014 | PowerUp | R/W |

COILS TABLE

| (*)Coil (Hex) | (*)Coil (Dec) | Descrizione | Accesso |
|---------------|---------------|-----------------------|---------|
| 0x0019 | 00025 | Output #0 | R/W |
| 0x001A | 00026 | Output #1 | R/W |
| 0x001B | 00027 | Output #2 | R/W |
| 0x001C | 00028 | Output #3 | R/W |
| 0x001D | 00029 | Output #4 | R/W |
| 0x001E | 00030 | Output #5 | R/W |
| 0x001F | 00031 | Output #6 | R/W |
| 0x0020 | 00032 | Output #7 | R/W |
| 0x0011 | 00017 | Output #8 | R/W |
| 0x0012 | 00018 | Output #9 | R/W |
| 0x0013 | 00019 | Output #10 | R/W |
| 0x0014 | 00020 | Output #11 | R/W |
| 0x0015 | 00021 | Output #12 | R/W |
| 0x0016 | 00022 | Output #13 | R/W |
| 0x0017 | 00023 | Output #14 | R/W |
| 0x0018 | 00024 | Output #15 | 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 1 | RO |
| 0x0025 | 00037 | Short circuit Alarm 2 | RO |

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 |

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 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.**

DESCRIPTION MODBUS REGISTERS

40002 / 40003 : FIRMWARE

Field of 2 read only registers ; contains the firmware identifier provided by the manufactured.

- Default value: DA01 (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.

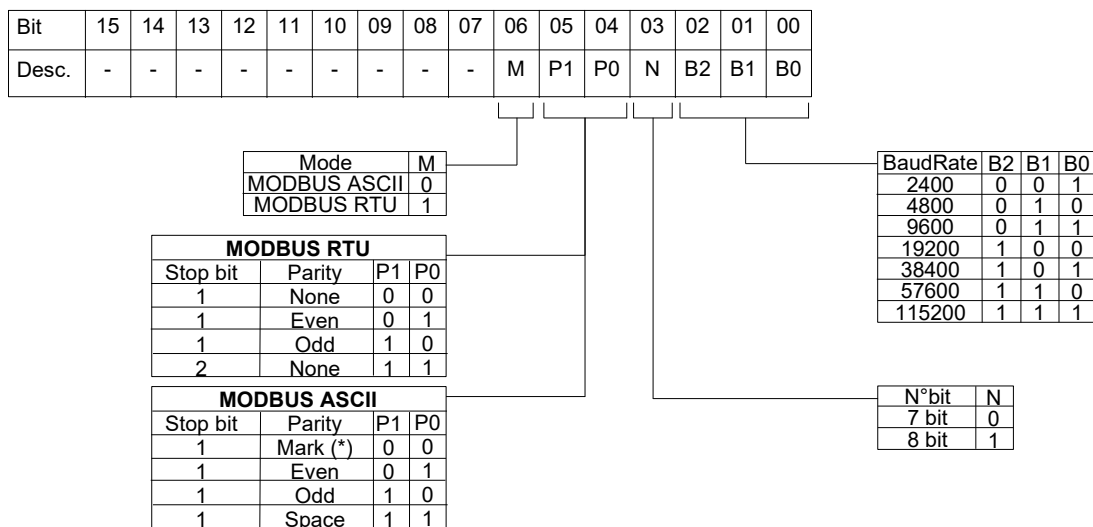
The default value of this field contains the identifier of the device expressed in ASCII characters.

- Default value: "3116" (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.

- 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.)

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 | #15 | #14 | #13 | #12 | #11 | #10 | #9 | #8 | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
| Coil | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 32 | 31 | 30 | 29 | 28 | 27 | 26 | 25 |

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").

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 indicate 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 detect 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 (to switch off and to switch on).

The bit / coil called "Short-circuit alarm 1" refers to the digital output bank from 0 to 7.

The bit / coil called "Short Circuit Alarm 2" refers to the digital bank from 8 to 15.

If at least one of the two bits relating to the two output banks is forced to 1, ie in the event of a short-circuit alarm, the yellow STS LED on the front remains on steady and all outputs related to that bank are forced to 0 (open).

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 | - | - | - | 37 | 36 | 35 | 34 | 33 | - | - | - | - | - | - | - | - |

Bit 08: Watchdog Enable
Bit 07: Watchdog Event
Bit 06: Power-up Event
Bit 05: Short circuit Alarm 1
Bit 04: Short circuit Alarm 2

40012 : SAFE

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 | #15 | #14 | #13 | #12 | #11 | #10 | #9 | #8 | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |

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 : POWER-UP

At the power on (Power-Up), 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 | #15 | #14 | #13 | #12 | #11 | #10 | #9 | #8 | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |

PROCEDURES

USE OF "INIT" FUNCTION

The "INIT" function allows to set the device in the default configuration, independently of the software configuration made.

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 (D) to the terminal V- (E).
- 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 (D) from the terminal V- (E).
- Power-on the device
- 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

In INIT mode the STS LED (yellow) on the front of the device blinks.

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.
