

**User Guide – MODBUS protocol
Firmware Version : D601**

DAT 3019

PRELIMINAR DESCRIPTION

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.

REGISTERS TABLE

Register	Description	Access	E ² P
40001	Test	R/W	
40002	Firmware Version	R	
40003		R	
40004	Device Name	R/W	*
40005		R/W	*
40006	Communication	R/W	*
40007	Address	R/W	*
40008	RX/TX Delay	R/W	*
40009	Watchdog Timer	R/W	*
40010	Coils	R/W	
40011	Input Type &	R/W	*
40012	Channel Enable	R/W	*
40013	--- reserved ---	R/W	
40014	--- reserved ---	R/W	
40015	Input # 0	R	
40016	Input # 1	R	
40017	Input # 2	R	
40018	Input # 3	R	
40019	Input # 4	R	
40020	Input # 5	R	
40021	Input # 6	R	
40022	Input # 7	R	
40023	Sync. value input # 0	R	
40024	Sync. value input # 1	R	
40025	Sync. value input # 2	R	
40026	Sync. value input # 3	R	
40027	Sync. value input # 4	R	
40028	Sync. value input # 5	R	
40029	Sync. value input # 6	R	
40030	Sync. value input # 7	R	
40031	Offset # 0	R/W	*
40032	Offset # 1	R/W	*
40033	Offset # 2	R/W	*
40034	Offset # 3	R/W	*
40035	Offset # 4	R/W	*
40036	Offset # 5	R/W	*
40037	Offset # 6	R/W	*
40038	Offset # 7	R/W	*

COILS TABLE

Coil	Description	Access	E ² P
00001	Open Detect #0	R	
00002	Open Detect #1	R	
00003	Open Detect #2	R	
00004	Open Detect #3	R	
00005	Open Detect #4	R	
00006	Open Detect #5	R	
00007	Open Detect #6	R	
00008	Open Detect #7	R	
00009	Watchdog Enable	R/W	
00010	Watchdog Event	R/W	
00011	PowerUp Event	R/W	

IMPLEMENTED MODBUS FUNCTIONS

Function	Description
01	Read multiple coils (0xxxx bank)
02	Read multiple coils (1xxxx bank)
03	Read multiple registers (4xxxx bank)
04	Read multiple registers (3xxxx bank)
05	Write single coil
06	Write single register
16	Write multiple registers

NOTE:

For DAT3000 series devices, the bank 0xxxx is a mirror of bank 1xxxx, as the 3xxxx bank is a mirror of bank 4xxxx, as for i.e. the first register can be read indifferently as 30001 (with the function 04) or 40001 (with the function 03)

NOTE:

The registers marked with ' * ' in the ' E²P ' column are saved in EEPROM each time they are written, to be automatically reloaded to each power-on of the device.

REGISTER DESCRIPTION

40001 : TEST

This register is used to perform the following functions:
 - Synchronized sampling (see the "Procedures" section).

40002 / 40003 : FIRMWARE VERSION

Read-only 2-register field, that hold the manufacturer firmware identifier.
 - Manufacturer default: D601 (ASCII)

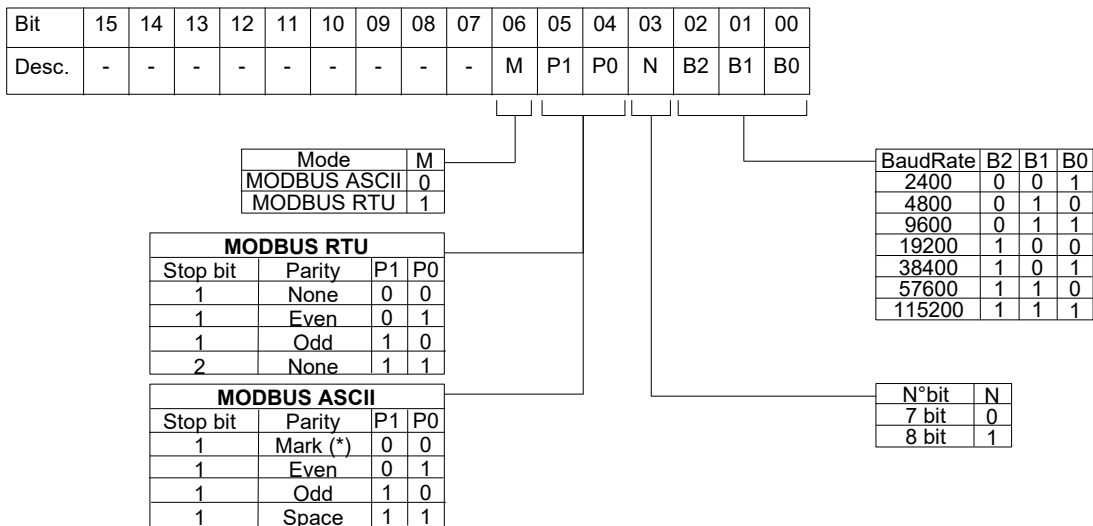
40004 / 40005 : DEVICE NAME

2-registers field (4 byte or 4 ASCII characters) user free, that can hold the device name or a function identifier. Each byte can be written with each value from 0 to 255, than ASCII characters too.
 - Manufacturer default: "3019" (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

Specify the net address of the device; there are allowed the address from 1 to 255.
 Each device connected to the same net must have a unique address.
 The address 255 is used for broadcast functions (i.e. synchronized sampling)
 - Manufacturer default: 01

40008 : RX/TX DELAY

Specify the value of the delay between the reception of a command and the response transmission, indicated in milliseconds.
 - Manufacturer default: 1 (1 ms.)

40009 : WATCHDOG TIMER

Specify the value of the WatchDog Timer (see the "Procedures" section), indicated in steps of 0.5 seconds.
 - Manufacturer default: 10 (5 sec.)

40010 : COILS

This register is a mirror of the coils table: each bit of this register corresponds to a coil, as shown in the following table.

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	-	-	-	-	-	11	10	09

40011 / 40012 : INPUT TYPE CONFIGURATION & CHANNEL ENABLE

Specify the sensor type connected to the inputs. Each channels can be programmed independently; it is suggested to disable the channels not used.
 The code for each input type (4 bits), is indicated in the table.
 - Manufacturer default: 05h (Pt100)

Write the programming values in these registers as shown in the table below:

Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
40011	Input #3 type				Input #2 type				Input #1 type				Input #0 type			
40012	Input #7 type				Input #6 type				Input #5 type				Input #4 type			

Value	Type	Group
00h	Disabled	
01h	500 Ohm	A
02h	2 Kohm	B
05h	Pt100	A
06h	Ni100	A
07h	Pt1000	B
08h	Ni1000	B

NOTE: The channels can be programmed as different input types, provided that they are of the same group (see table).
 For example, if the channel 0 is set as Pt100 (group A), the other channels can be set as 500 ohm but not as Pt1000 (group B).

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

These registers contain the measure value for each input channel, converted in engineering units: the values are expressed in Ohm (for resistance) or °C (for RTD inputs). The format is a 16bit signed integer, with 1 decimal point

40023 : SYNCHRONISM INPUT VALUE # 0
40024 : SYNCHRONISM INPUT VALUE # 1
40025 : SYNCHRONISM INPUT VALUE # 2
40026 : SYNCHRONISM INPUT VALUE # 3
40027 : SYNCHRONISM INPUT VALUE # 4
40028 : SYNCHRONISM INPUT VALUE # 5
40029 : SYNCHRONISM INPUT VALUE # 6
40030 : SYNCHRONISM INPUT VALUE # 7

When the device receive the Sync command (see the “Procedures” section), the actual input values in the 40015+40018 registers are saved in these registers, channel by channel, to be read in a following time.

40031 : INPUT OFFSET # 0
40032 : INPUT OFFSET # 1
40033 : INPUT OFFSET # 2
40034 : INPUT OFFSET # 3
40035 : INPUT OFFSET # 4
40036 : INPUT OFFSET # 5
40037 : INPUT OFFSET # 6
40038 : INPUT OFFSET # 7

Introduces an offset over the measure for each analog channel. The value is expressed in the same format of the input registers.

COILS DESCRIPTION

00001 / 00008 : OPEN DETECT

When the sensor connected to one channel goes in break condition (sensor damage, unconnected wire or out-range), the corresponding coil is forced to 1.

00009 : WATCHDOG ALARM ENABLE

Enable the WatchDog alarm. If the alarm is enabled and the device does not receive any command for a time longer than the time specified in the 40009 register, the WatchDog alarm Event coil is forced to 1 (see the “Procedures” section).

0 = Watchdog alarm disabled
1 = Watchdog alarm enabled

00010 : WATCHDOG ALARM EVENT

This coil indicates the condition of WatchDog Alarm. If the alarm is enabled and the device does not receive any command for a time longer than the time specified in the 40009 register, this coil is forced to 1. To return from the alarm condition, set this coil to 0.

0 = Normal Condition
1 = Alarm Condition

00011 : POWER-UP EVENT

This coil is forced to 1 at each power-on of the device; this state indicates that the device has been switched off. It is possible to know if a reset of the device is happened clearing this coil and monitoring its state.

0 = reset not happened
1 = reset happened

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 throuble:

- 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 programmation 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, activate 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 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.

SYNCHRONISM

The Synchronism function is performed by a command sent to all devices connected on the net. When the devices receive the Sync command, all input states are saved in the relative register, to be read after time. Doing this, it is possible to read the value of all inputs at the Sync command time.

To send the synchronism command, write the value 10 in the "Test" register (40001) at the address 255.

NOTE: The sync values are not saved in EPROM.