

**User Guides – MODBUS protocol
 Firmware Version : 1400**

DAT 1485

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 (*)	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	Input type	R/W
40012	Degree Type	R/W
40013	Offset CJC	R/W
40014	Measure CJC	RO
40015	Input Value	RO
40023	Sync Input value	RO
40031	Input Offset	R/W

COILS TABLE

(*)Coil (Hex)	(*)Coil (Dec)	Description	Access
0x0001	00001	Input Open Detection	RO
0x0009	00009	Watchdog Enable	R/W
0x000A	00010	Watchdog Event	R/W
0x000B	00011	PowerUp Event	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
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.

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).

DESCRIPTION MODBUS REGISTERS

40001 : TEST

This register is used for the following function:
- Synchronized Sampling (refer to section "Procedures")

40002 / 40003 : FIRMWARE

Field of 2 read only registers ; contains the firmware identifier provided by the manufactured.
- Default value: 1400 (hex)

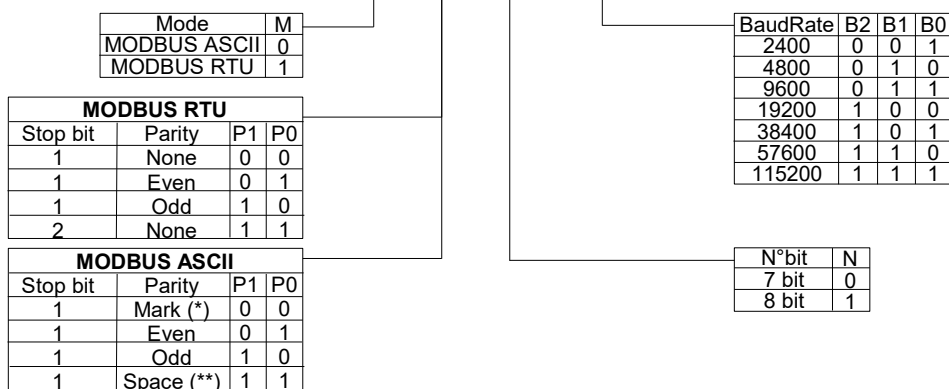
40004 / 40005 : NAME

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: "1485" (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

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 1 stop bit

- (**) In ASCII mode, the "Space" 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 244 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

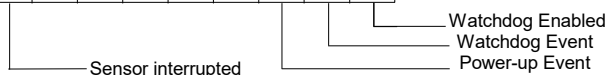
1 = reset not occurred

COIL 00001: INPUT OPEN DETECTION

When a sensor connected to a channel is on break condition (rupture of the sensor, cables not connected or over-temperature), the coil associated to the channel is forced to 1.

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).

Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
Coil	-	-	-	-	-	-	-	01	-	-	-	-	-	11	10	09



40011: INPUT TYPE / CHANNEL ENABLING

Contains the configuration of the sensor type connected to each input.

- Default value: 12h (Pt100)

Insert the values of configuration in the register as indicated in the table below:

Bit	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
40011	Input Type															

Value (Dec)	Value (Hex)	Input Type
0	00h	Disabled
1	01h	90 mV
2	02h	200 mV
3	03h	800 mV
7	07h	Tc J
8	08h	Tc K
9	09h	Tc R
10	0Ah	Tc S
11	0Bh	Tc T
12	0Ch	Tc B
13	0Dh	Tc E
14	0Eh	Tc N

Value (Dec)	Value (Hex)	Input Type
16	10h	2000 ohm (Res H)
17	11h	500 ohm (Res L)
18	12h	Pt100
19	13h	Ni100
20	14h	Pt1000
21	15h	Ni1000
22	16h	Pot < 500 ohm
23	17h	Por < 50 kohm

40012 : DEGREE TYPE

In this register it is possible to set the type of degree or the temperature scale for displaying the measurement.

This option is valid only if the selected input is a resistance thermometer or a thermocouple.

The available temperature scales are:

Value	Type
0	Celsius (°C)
1	Fahrenheit (°F)
2	Kelvin (K)

Note: In the case of Fahrenheit temperature scale, the maximum temperature value that can be displayed on the Input Value register (40015) is 32000 (3200.0 ° F equivalent to 1760.0 ° C).

40013 : OFFSET CJC

Value of calibration of the offset of the CJC measure of thermocouples. The value is expressed as hundredths of °C, signed.

40014 : MEASURE CJC

Shows the value of the temperature of CJC of thermocouples (temperature of the terminal). The value is expressed as tenths of °C.

40015 : INPUT VALUE

This register contain the measure converted in engineering unit.

The value is expressed as hundredths of mV (for voltage inputs) or tenths of °C

(for Thermocouple and RTD inputs).

The numeric format is 16 bit signed integer.

The number of decimals depends of the input type as indicated in the table on the side.

Input Type	Decimal	Format
90 mV	2	Hundredths of mV
200 mV	2	Hundredths of mV
800 mV	1	Tenths of mV
Thermocouple	1	Tenths of °C
Pt100/Ni100	1	Tenths of °C
Pt1000/Ni1000	1	Tenths of °C
Res 2000 ohm	0	Ohm
Res 500 ohm	1	Tenths of ohm
Potentiometer	1	Tenths of percentage

40023 : SYNC INPUT VALUE

When the device receives the Synchronism command (refer to section "Procedures"), the input value measured in that moment and contained into the register 40015 is saved into this register.

40031 : INPUT OFFSET

Introduces an offset to the input measure. The value is expressed in the same format of the input register.

PROCEDURES

USE OF "INIT" FUNCTION

The "INIT" function allows you to set the device in the default configuration, regardless of the programming stored in EEprom.

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.
- Remove the slot cover on the top of the device and move the switch INIT located inside it (towards the central hole).
- Power-on the device.

- 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.
- Move the switch to the outside of the device and close the slot with its slot cover.
- 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

WATCHDOG

The device has 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 to register 40009.

In alarm condition the coil "Watchdog Event" is forced to 1.

To exit from the alarm condition, send a command to the device, reset the coil "Watchdog Event".

SYNCHRONISM

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, the input value measured at the reception of it is saved into the proper register.

To send the command, write the value 10 into the register "Test" (40001), to the address '255'.

NOTE: the values of synchronism is not saved in eeprom; this involves that at each power-on the value in the register is resetted.
