

User Guide – MODBUS protocol

SS 3188

PRELIMINAR DESCRIPTION

All the data variables shared by a Modbus module are shown in tables, where each data is linked to one address. Each data can be of two types:

- “COIL”, composed by a single bit, can be associated to digital input (switch), digital outputs (relays), logic states (alarms).
- “REGISTER”, composed by 2 bytes (16 bits), can be associated to analog input or outputs, variables, set-point, etc...

A register can also include the image of more coils, for example the 16 digital inputs of a device can be read and write as bit, one by one, addressing the relative coil, or they can be read or write as a single 16-bit port addressing the associated register, where for example the last significant bit will respond to the first coil.

In the Modbus protocol, coils and registers are divided in banks:
 0xxxx and 1xxxx = Coils (bits)
 3xxxx and 4xxxx = Registers (words)

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 | Digital Inputs (Coils) | R | |
| 40010 | Digital Outputs (Coils) | R/W | |
| 40011 | Coils | R/W | |
| 40012 | PowerUp/Safe Value | R/W | * |
| 40013 | Watchdog Timer | R/W | * |

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.

COILS TABLE

| Coil | Description | Access | E ² P |
|-------|---------------------|--------|------------------|
| 00001 | Input #0 | R | |
| 00002 | Input #1 | R | |
| 00003 | Input #2 | R | |
| 00004 | Input #3 | R | |
| 00005 | Input #4 | R | |
| 00006 | Input #5 | R | |
| 00007 | Input #6 | R | |
| 00008 | Input #7 | R | |
| 00017 | Output #0 | R/W | |
| 00018 | Output #1 | R/W | |
| 00019 | Output #2 | R/W | |
| 00020 | Output #3 | R/W | |
| 00021 | Output #4 | R/W | |
| 00022 | Output #5 | R/W | |
| 00023 | Output #6 | R/W | |
| 00024 | Output #7 | R/W | |
| 00033 | Watchdog Enable | R/W | |
| 00034 | Watchdog Event | R/W | |
| 00035 | PowerUp Event | R/W | |
| 00036 | Short-circuit Alarm | 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 |
| 15 | Write multiple coils |
| 16 | Write multiple registers |
| 08 | Diagnostic |

NOTE:

For SS3000 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)

REGISTER DESCRIPTION

40001 : TEST

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

40002 / 40003 : FIRMWARE VERSION

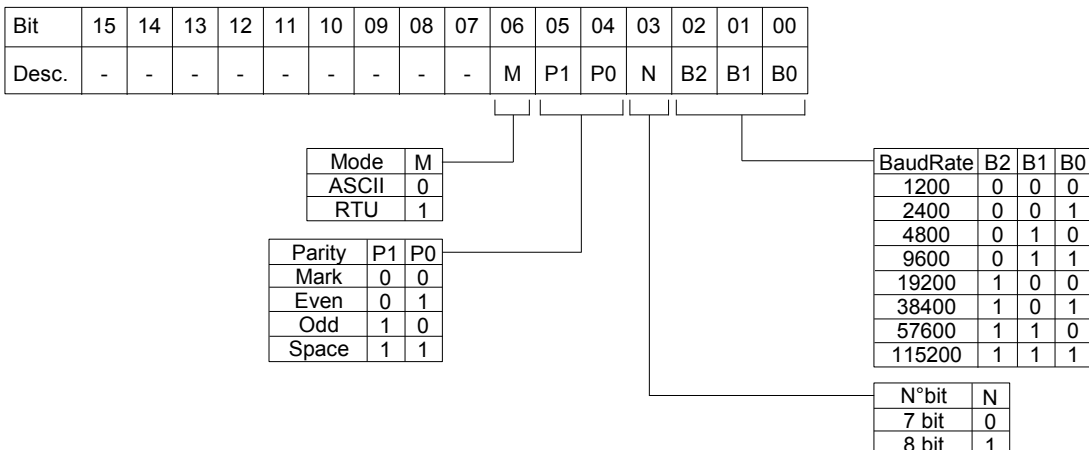
Read-only 2-register field, that hold the manufacturer firmware identifier.
 - Manufacturer default: 6200 (hex)

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 writed with each value from 0 to 255, than ASCII characters too.
 The manufactures value of this field hold the device identifier.
 - Manufacturer default: "3188" (ASCII).

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



NOTES:

- the bit number is ignored, as for in ASCII mode it is fixed to 7 and in RTU mode it is fixed to 8.
- In RTU mode the parity is ignored (parity NONE)

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 univocal 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 : DIGITAL INPUTS (COILS)

This register show digital inputs state (0 = OFF , 1 = ON).
 The same values can be read by the coils table, of which this register is a mirror.

| 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 | | | | | | | | |
| Coil | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 | - | - | - | - | - | - | - | - |

40010 : DIGITAL OUTPUTS (COILS)

This register allow to drive directly the output state (0 = OFF , 1 = ON).
 The same values can be read/write by the coils table, of which this register is a mirror.

| Bit | 15 | 14 | 13 | 12 | 11 | 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 | 00 |
|--------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Output | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 | | | | | | | | |
| Coil | 24 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | - | - | - | - | - | - | - | - |

40011 : 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 | - | - | - | - | 36 | 35 | 34 | 33 | - | - | - | - | - | - | - | - |

40012 : POWERUP/SAFE VALUE

When the device is tuned-on (PowerUp) and in case of watchdog alarm (Safe), the outputs are automatically forced to the value specified in this register. Each bit corresponds to an output, as shown in the table.

- Manufacturer default: 0

| | | | | | | | | | | | | | | | | |
|--------|----------|----|----|----|----|----|----|----|------|----|----|----|----|----|----|----|
| Bit | 15 | 14 | 13 | 12 | 11 | 10 | 09 | 08 | 07 | 06 | 05 | 04 | 03 | 02 | 01 | 00 |
| Output | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 | #7 | #6 | #5 | #4 | #3 | #2 | #1 | #0 |
| Value | Power Up | | | | | | | | Safe | | | | | | | |

40013 : 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.)

COILS DESCRIPTION

00001 / 00008 : DIGITAL INPUTS

Each coil show the corresponding input state (0 = OFF , 1 = ON).

00017 / 00024 : DIGITAL OUTPUTS

These coils allow to drive directly the output state (0 = OFF , 1 = ON).

- In alarm condition the outputs can not be driven.

- In Watchdog alarm condition the outputs are forced to the specified value.

00033 : 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 40013 register, the WatchDog alarm Event coil is forced to 1 (see the "Procedures" section).

0 = Watchdog alarm disabled

1 = Watchdog alarm enabled

00034 : 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

00035 : 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

00036 : SHORT-CIRCUIT ALARM

This device is equipped with a short-circuit sensor (protection against overcurrent) on digital outputs.

In case of alarm, this coil will be forced to 1.

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 bits = 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 addressprogrammed in the 40007 register.

NOTE: The default manufacturer programmation is the following:

- Address : 01
- Baud-rate : 38400 bps
- Protocol : RTU

WATCHDOG

The modules has been provided of a Host Watchdog timer which, when it is enabled, makes to start the alarm each time the communication between the module and the host is inactive for a period time greater then the programmed one. When the alarm goes on, the values of the outputs are automatically converted to the values set as 'safety value', that corresponding to the state in which the outputs must be putted, and therefore the actuators are putted, to avoid damages to the system in case of failure. Moreover, under the alarm condition the green LED on the front of the enclosure is blinking and the "Watchdog Event" coil is forced to 1.

To return from the alarm condition, reset the coil "Watchdog Event" coil: the LED stop blinking and it is possible to set the outputs.

There is also a Module Watchdog timer that monitor the internal CPU work and is active when the CPU don't function correctly for any reason, and resets the module. After the reset, all outputs will assume their initial default value ("powerup value"), that may be different to the output value after the reset.