ModBUS Protocol for SMART 3

The communication between Smart 3 unit and a CPU is made by means of the ModBUS RTU protocol. Please refer to the specific documentation of the ModBUS RTU protocol for implementing it. In the following brief you'll find listed the supported commands and the exchanged registries.

The serial line used is a RS485. The Smart 3 manages the RTS signal and is working as slave (normally receiving).

The parameters of the serial port are:

- baud rate 9600 baud
- data length 8 bit
- stop bit 1
- no parity

The ModBUS RTU commands implemented are:

- command 1 – read digital outputs
- command 3 – read analogue outputs
- command 4 – read analogue inputs
- command 5 – write digital outputs
- command 6 – write analogue outputs
- command 7 – read central unit state

command 1 – read digital outputs

By means of this command the following registers will be queried:

- register 4000 – output sequence type
- register 4001 – outputs active level (0 active high, 1 active low)
- register 4002 – forcing pwm calibration

command 3 – read analogue outputs

By means of this command the following registers will be queried:

- register 2000 – multiplication factor full scale channel 1
- register 2001 – threshold 1 channel 1
- register 2002 - threshold 2 channel 1
- register 2003 - threshold 3 channel 1
- register 2004 – histeresys channel 1
- *register 2005 – multiplication constant for normalizing methane
- *register 2006 - multiplication constant for normalizing readout
- register 2007l – sensor power supply

- register 2007h – measure unit channel 1
- register 2008 – zero value
- register 2009l – serial number (low)
- register 2009h – serial number
- register 200Al - serial number
- register 200Ah - serial number (high)
- register 200Bl – lot number (low)
- register 200Bh – lot (audit date (DD))
- register 200Cl - lot (audit date (MM))
- register 200Ch - lot (audit date (YY))
- register 200El – sensor type
- register 200Eh – calibration number
- register 2013 – actual zero of channel 1

command 4 – read analogue inputs

By means of this command the following registers will be queried:

- register 1000 – actual value of channel 1 related to gross zero
- register 1001 – actual value of channel 2
- register 1002 – value of channel 1 in points gas related to net zero
- register 1003 – actual/previous state of channel 1
- register 1004 – zero value of pwm
- register 3000l – version number (high)
- register 3000h - version number (low)
- register 3001l – firmware release date (DD)
- register 3001h – firmware release date (MM)
- register 3002l - – firmware release date (YY - low)
- register 3002h - – firmware release date (YY - high)
- register 3003l – hardware model - low
- register 3003h - hardware model - high

command 5 – write digital outputs

By means of this command the following registers might be set:

- register 4000 – output sequence type
- register 4001 – output activation level (0 active high, 1 active low)
- register 4002 – forced command for electro valve

command 6 – write analogue outputs

By means of this command the following registers might be set:

- register 2000 – full scale channel 1
- register 2001 – threshold 1 channel 1
- register 2002 - threshold 2 channel 1
- register 2003 - threshold 3 channel 1
- register 2004 - histeresys channel 1
- register 2005 - multiplication constant for normalizing methane
- register 2006 - multiplication constant for normalizing readout
- register 2007l - sensor power
- register 2007h - measure unit channel 1
- register 2008 - zero value
- register 2009l - serial number (low)
- register 2009h - serial number
- register 200Al - serial number
- register 200Ah - serial number (high)
- register 200Bl - lot number (low)
- register 200Bh - lot (audit date (DD))
- register 200Cl - lot (audit date (MM))
- register 200Ch - lot (audit date (YY))
- register 200El – sensor type
- register 200Eh – calibration number

NOTE: all analogue registers managed by ModBUS are in 16 bit. In many cases, for the necessary information 8 bit are enough.

In this case, in an unique ModBUS register two values were grouped together. The register's code is replicated and identified by a suffix letter (l or h) to indicate the high/low side of the register (byte).

All register's codes are expressed in hexadecimal.

DETAILS:

Register 4000

- Bit 0 => If Addressable => bit 0 Address - If Analogical 0= 4–20 – 1 = Twin
- Bit 1 => If Addressable => bit 1 Address - If Analogical bit 0 alarm thresholds
- Bit 2 => If Addressable => bit 2 Address - If Analogical bit 1 alarm thresholds
- Bit 3 => If Addressable => bit 3 Address - If Analogical bit 2 alarm thresholds
- Bit 4 => If Addressable => bit 4 Address - If Analogical bit 3 alarm thresholds

- Bit 5 => If Addressable => Not used - If Analogical bit 4 alarm thresholds
- Bit 6 => If Addressable => Not used - If Analogical bit 5 alarm thresholds
- Bit 7 => 0 = Addressable configuration – 1 = Analogical configuration

Register 4001

- Value 0 = do not reset base
- Value > 0 reset base (not used for v.1.14A)

Register 4002

- Value 0 = Run calibration 4–20 mA from Pc
- Value 1 = Run calibration 4–20 mA from display
- Value 2 = Reset Base (only for v.1.14A)

Register 2000

- Full scale in points. Real FS = ((FS in points* 418) /4096)

Register 2001

- Threshold 1 in points.

Register 2002

- Threshold 2 in points.

Register 2003

- Threshold 3 in points.

Register 2004

- Histeresys in points.

Register 2005

- Gas coefficient multiplication factor, in points.

Register 2006

- Calibration coefficient multiplication factor in points.

Register 2007 low (byte basso)

- PWM coefficient multiplication factor, in points.

Register 2007 high (byte alto)

- Bit 0 => 0 = 60% thresholds no limit – 1 = 60% thresholds limit
- Bit 1 => 0 = rising threshold – 1 = dropping threshold
- Bit 2 => Not used
- Bit 3 => Not used
- Bit 4÷7 => Indicates the measurement's number of decimals
    - Value 0 = No decimals
    - Value 1 = 1 decimal
    - Value 2 = 2 decimals
    - Value 3 = 3 decimals

Register 2008

- Zero from calibration, in points.

Register 2009 low (byte basso)

- Serial number (low) in ASCII.

Register 2009 high (byte alto)

- Serial number (middle low) in ASCII.

Register 200A low (byte basso)

- Serial number (middle high) in ASCII.

Register 200A high (byte alto)

- Serial number (high) in ASCII.

Register 200B low (byte basso)

- Lot number (lot sequential number of day (xx)) in ASCII.

Register 200B high (byte alto)

- Lot number (audit date – day (dd)) in ASCII.

Register 200C low (byte basso)

- Lot number (audit date – month (mm)) in ASCII.

Register 200C high (byte alto)

- Lot number (audit date – year (yy)) in ASCII.

Register 200D

- Not used.

Register 200E low (byte basso)

- Value 0 = Custom sensor.
- Value 1 = Disabled sensor.
- Value > 1 = Sensor types configured in the remora.ini file + 2.
  Ex. NameX = sensor, if X = 4 ; 4+2 → Value = 6

Register 200E high (byte alto)

- Number of calibrations made.

Register 200F low

- Serial number (low) amplification board, in ASCII.

Register 200F high

- Serial number (middle low) amplification board, in ASCII.

Register 2010 low

- Serial number (middle high) amplification board, in ASCII.

Register 2010 high

- Serial number (high) amplification board, in ASCII.

Register 2011 low

- Lot number (lot sequential number of day (xx)) for the amplification board, in ASCII.

Register 2011 high

- Lot number (audit date – day (dd)) for the amplification board, in ASCII.

Register 2012 low

- Lot number (audit date – month (mm)) for the amplification board, in ASCII.

Register 2012 high

- Lot number (audit date – year (yy)) for the amplification board, in ASCII.

Register 2013

- Zero from auto-zero, in points.

Register 1000

- ADC converter's signal value in points uPc (0÷1024). Vcc_uPC ≅ 5
  Signal in mV = ((Signal in points * Vcc_uPC) / 1024)

Register 1001

- Power supply value, in points.
  Power supply mV = ((Power supply in points *(5.337/100)) + 0.74)

Register 1002

- Signal's zero shift value "delta Δ" in points (0÷418)
  Real signal = ((signal in points * FS real) / 418) or
  Real signal = (FS in points / 4096)

Register 1003 low (byte basso)

Actual state of detector:

- Bit 0 = 1 => FLT (Fault)
- Bit 1 = 1 => ALL1 (Threshold 1)
- Bit 2 = 1 => ALL2 (Threshold 2)
- Bit 3 = 1 => ALL3 (Threshold 3)
- Bit 4 = 1 => OVR (Over Range)
- Bit 5 = 1 => Calibration 4-20mA successfully executed
- Bit 6 = 1 => Not used
- Bit 7 = 1 => Auto-zero executed

If the bits from 0÷4 are equal to zero, the detector is in the normal operating state (OK – without gas).

Register 1003 high (byte alto)

- Bit 0÷7 => Indicates the error state of detector:
  - Value 0 = OK (the device has no HW fault)
  - Value 1 = Pre-Start (the device is in the starting phase)
  - Value 2 = E2prom (checksum error)
  - Value 3 = uPc Flash (checksum error)
  - Value 4 = uPc Ram (operating error)
  - Value 5 = Device power supply out of normal range
  - Value 6 = External E2prom I2C "Amplif. board." (comm. error)

- Value 7 = Serial number non corresponding between base and amplification board.

Register 1004

- Value for generating the 4mA of the current output (4-20mA) in points.

Register 3000 low

- Version number high (x). Version **x**.yyz.

Es. Version 1.14 => 1; Version 1.14A => 1

Register 3000 high

- Version number low(yyz). Version x.**yyz**, z is facultative.

Es. Version 1.14 => 0D hex = 14 dec
Version 1.14A => 8C hex = 140 dec => 14-0 => 14 =14 and 0=A

Register 3001 low

- Firmware date day (dd).

Register 3001 high

- Firmware date month (mm).

Register 3002

- Firmware date year (yy) low Es.07D3 hex = 2003.

Register 3003

HW model low.

- Value = 0 => Not used
- Value = 1 => Smart 3 (Base)
- Value = 2 => Multichannel / Display Smart 3 (have the same code)