

# ConSensus<sup>®</sup> CMA-02

## *multi analog interface*

### *Modbus manual*

#### **Introduction:**

This document describes how to connect the ConSensus CMA-02 to a Modbus network. It describes:

1. Configuring the device for Modbus.
2. Selecting the communication settings.
3. Supported commands and data format.
4. Register list.
5. Temperature sensor types.
6. Tips and tricks.

#### **1. configuring a ConSensus device for Modbus:**

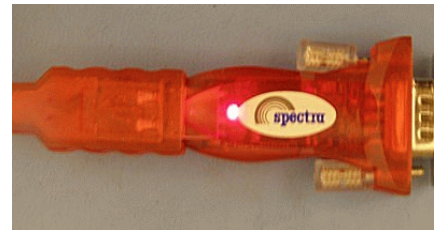
By default, ConSensus devices use a fast and efficient proprietary RS485 protocol at 115200 baud. Through configuration, devices can be instructed to start-up in Modbus mode, with specific baudrates and communication parameters. These settings take effect at the next power-up of the device.

To reconfigure a device that is running Modbus, disconnect it from power, press and hold the configuration button down and re-apply the power. This will temporarily overrule the configuration settings and force the device to start-up with the proprietary protocol and device number 1.



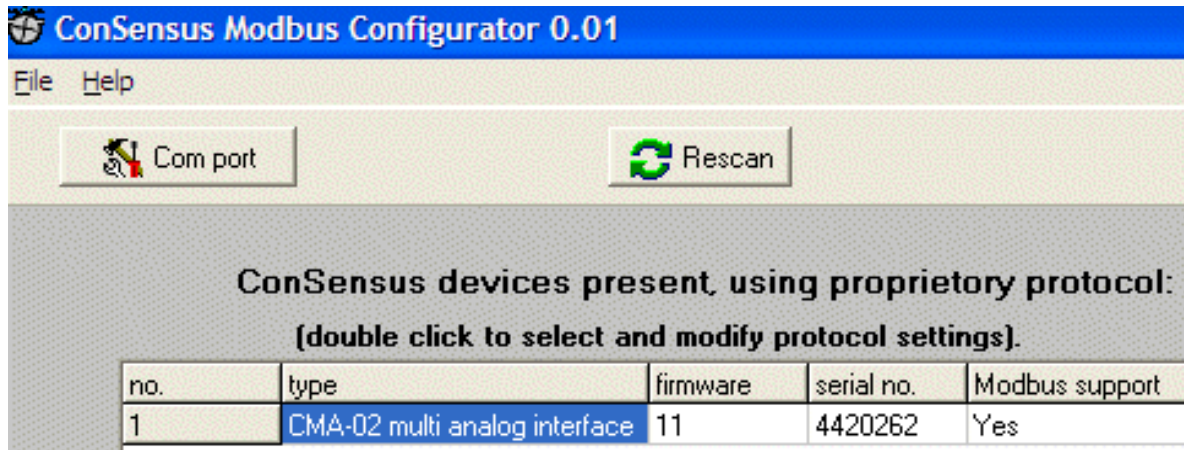
The configuration software ConSensModBus.exe runs on a Windows PC and expects a COM port with a RS485 driver to connect to the device to configure.

A suitable convertor is the Spectra USB to RS485 adapter, available from Exatech by



#### **2. Modbus communication settings.**

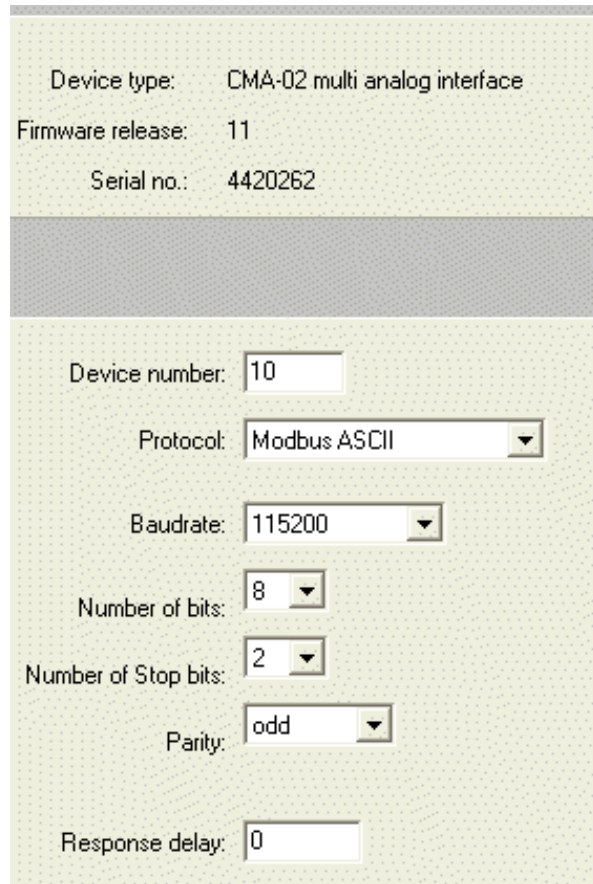
Run the ConSensModBus.exe program and select the COM port to which the device is connected. The device will appear in the list of connected devices, with its type, serial number and firmware release.



Double-click the device to modify, and set:

- C Device number (1-149).
- C Modbus type (RTU or ASCII).
- C baudrate (1200 - 115200).
- C bits (8 for RTU, 7 or 8 for ASCII).
- C parity (none, odd or even).
- C stopbits (1 or 2).
- C response delay: ASCII: extra milliseconds, or RTU: extra bits after 3 bytes, before the device switches on its transmitter).

If all settings are made, click the OK button to store the settings in the device and return to the overview screen. Note that the changes will only take effect after resetting the device through a power cycle.



### **3. supported commands and data formats:**

ConSensus devices support a subset of the modbus protocol. Commands supported are:

<b>Function</b>	<b>Code</b>	<b>Remarks</b>
Read Holding registers	0x03	16 bits registers. LongInts <sup>(*)</sup> occupy 2 registers.
Read Input register	0x04	same as 0x03.
Preset Single register	0x06	16 bits registers. LongInts <sup>(*)</sup> occupy 2 registers
Preset Multiple registers	0x10	16 bits registers. LongInts <sup>(*)</sup> occupy 2 registers
Report slave ID	0x11	5 chars device type ("CMA02") followed by "-", 3 chars firmware version, followed by '#' spacer, 8 chars serial number, 0xFF run indicator, 1 byte protocol version number.

The device makes no distinction between holding and input registers: there is just one list of registers and both types of commands are valid and working on the same data..

Protocol errors return the command code logically OR-ed by 0x80, and one databyte indicating:

<b>Error code</b>	<b>Meaning</b>
0x01	illegal function
0x02	illegal address
0x03	illegal value

<sup>(\*)</sup> LongInt registers of 32 bits occupy two 16 bits registers in big endian format. To read a LongInt, it is essential to read the even numbered register with the MSB first, and the odd numbered register with the LSB immediately afterwards within the same read command. This ensures an "atomic" read of the two registers.

The ConSensus CMA-02 device does not support floating point values. In stead, all values are scaled to an appropriate integer format, e.g. 1FA per bit. In this example, a value of 1000 represents 1000FA, or 1mA.

Broadcasts are not supported..

#### 4. Register list.

No.	Type	R/W	Remark	Note
0x0000	Word	R	device status: bit 0: configured.	1
0x0010	Word	R/W	Use Iin-1 (0:disable, 1:enable)	2
0x0011	Word	R/W	Use Iin-2 (0:disable, 1:enable)	
0x0012	Word	R/W	Use Iin-3 (0:disable, 1:enable)	
0x0013	Word	R/W	Use Int. Temp sensor (0:disable, 1:enable)	2
0x0014	Word	R/W	Ext. Temp sensor type (see below)	2
0x0015	Word	R/W	Iin-1 averaging (0-50 samples)	
0x0016	Word	R/W	Iin-2 averaging (0-50 samples)	
0x0017	Word	R/W	Iin-3 averaging (0-50 samples)	
0x0018	Word	R/W	Int. Temp sensor averaging (0-50 samples)	
0x0019	Word	R/W	Ext. Temp sensor averaging (0-50 samples)	
0x0020	Word	R/W	Use Iout (0:disable, 1:enable)	3
0x0021	Word	R/W	Iout minimum (4000-20000F A)	
0x0022	Word	R/W	Iout maximum (4000-20000F A)	
0x0023	Word	R/W	Iout up ramp (0-20000F A/s)	4
0x0024	Word	R/W	Iout down ramp (0-20000F A/s)	4
0x0025	Word	R/W	Iout timeout (0-60s)	5
0x0026	Word	R/W	Iout timeout value (4000-20000F A)	5
0x0027	Word	R/W	Iout setpoint (4000-20000F A)	
0x0030	Word	R	Iin-1 actual (0-20000F A)	
0x0031	Word	R	Iin-2 actual (0-20000F A)	
0x0032	Word	R	Iin-3 actual (0-20000F A)	
0x0033	Word	R	Iout actual value (4000-20000F A)	6

0x0034 + 0x0035	LongInt	R	Internal Temperature * 0.001EC	7
0x0036 + 0x0037	LongInt	R	External Temperature * 0.001EC	8

Reading undefined registers will return 0x0000.

Notes:

1. Any valid Write Register command in the range 0x0010 - 0x0030 will change the device status from unconfigured to configured, causing the red LED to go off.
2. Conversion time depends on the number of active sensors. For higher speed, disable all unused or uncritical inputs.
3. The analog 4-20mA output Iout must be explicitly enabled. By default the value is 4mA after power-up. If disabled, the output is simply no longer updated and keeps the latest value.
4. Iout can be programmed to slowly ramp up or down by programming registers 0x23 and 0x24. The output is updated 10x per second with a resolution of 10FA/s. If 0, the output changes immediately to the new value without ramp.
5. Safety feature to ensure a safe shut-down of the analog output in case the communication fails. If the output value is not refreshed within the time programmed into register 0x0025, the output will automatically assume the current level of register 0x0026. This feature will use the settings of minimum and maximum current, and of the ramp-up/ramp-down to prevent abrupt changes. If no time-out is required, leave register 0x0025 at 0.
6. Iout actual value is the calculated setting of the output, after modifying the setpoint with the minimum/maximum values, ramping up/down and timeout guard.
7. Temperatures are in milli-Centigrade [mC], or 0.001EC.
8. If the external sensor is a thermocouple, the internal temperature is automatically added to the result. In fact, not the temperature is added, but the voltage that this particular thermocouple would have at this temperature. The resulting voltage is then converted to temperature in milli-Centigrade.  
Note: the value can be negative!

### **5. Temperature sensor types:**

Value of register 0x0014	Type
0	disabled
1	2-wire Pt-100
2	3-wire Pt-100
3	4-wire Pt-100
4	2-wire Pt-1000
5	3-wire Pt-1000
6	4-wire Pt-1000

7	Thermocouple B
8	Thermocouple E
9	Thermocouple J
10 (0x0A)	Thermocouple K
11	Thermocouple N
12	Thermocouple R
13	Thermocouple S
14	Thermocouple T

Note: if a thermocouple type is selected, the device will automatically enable the internal temperature measurement for cold-junction compensation.

**5. Tips and tricks:**

- C After power-up, the device is not configured and does not measure anything. At least one of the registers in the range 0x0010 - 0x0030 must be written to start any action on the device and make the red configuration LED go off.
- C Do not change the configuration registers while a measurement is taking place, since the values may change unexpectedly.

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