Getting Started with SMD & Modbus RTU Communications

Overview

Modbus is an internationally accepted asynchronous serial protocol designed for commercial and industrial automation. Modbus RTU is an RS485 based master/slave system that can operate over a selected range of baud rates. It was Developed by Modicon for PLC communications, but today is also commonly used for basic parameter control on drives.

All **L** variant SMD drives have an integrated RS485 serial communication port and can fully support communication from a Modbus RTU master device, such as a PC, HMI or PLC.
Example part number of an L variant SMD drive:-
   ESMD371**L**2YXA

Scope

This document is intended to provide a helpful *getting started* guide for configuring the Modbus RTU master to correctly communicate with a SMD drive and is aimed to accompany the "SMD Modbus RTU Operations Manual".

It is assumed that the user has familiarised themselves with how to navigate through the drive parameters using the keypad. Refer to the drive user manual for details.

Methods for configuring master devices can differ greatly between manufacturers, therefore details for configuring a specific network master are NOT provided herein. However, a very basic generic guide is provided.

Serial Port Parameters

For devices that communicate on a Modbus serial network using the RTU (Remote Terminal Unit) mode, it is possible to configure the master and slave serial ports in several different ways. In order for communication to work correctly all devices on the network must be configured the same, i.e.

- Baud rate
- Start bits
- Data size
- Parity
- Stop bits

Drive Configuration

Set the following drive parameters:-

- C01 - Control Source: Must be set to a value of 8 to 11 (see the drive Operating Instructions for full details).
- c25 - Baud Rate: This parameter actually configures more than just the drive baud rat, it also configures all of the serial parameters as described above. (see the drive Operating Instructions for full details).
- n22 and n23 - Serial Fault and time out: see the drive Operating Instructions for full details).

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Modbus frame structure

The message structure for a Modbus message is as follows:-

Address	Function Code	Data	Error Check

Address:
- Size = 1 byte
- Valid slave nodes addresses are in the range of 0 – 247 decimal, however, address 0 is reserved for use as a broadcast address.
- The individual slave devices are assigned addresses in the range of 1 – 247, each slave node on the network must have an individual address, if two of more nodes have duplicate addresses this may prevent the network from functioning correctly.
- A master addresses a slave by placing the slave address in the address field of the message. When the slave returns its response, it places its own address in the response address field to let the master know which slave is responding.

Function Code
- Size = 1 byte
- The function code indicates what kind of action to perform.
- The function code (depending upon the function) is normally followed by a data field that contains request and response parameters.
- The SMD supports function codes:-
  - 3 - Read Holding Registers*
  - 4 - Read Input Registers
  - 6 - Preset Single Register
  - 16 - Preset Multiple Registers*
  - * - Note: In general the SMD is limited in that it will only support Read and Write access to one register at a time. See the SMD Modbus Control Operation Manual section 2 for details and exceptions.

Data
- Master frame size = 4 bytes
  - 2 bytes for register number
  - 2 bytes for either number of register to read, or data to be written
- Slave frame size = 3 or 4 bytes
  - 3 bytes for read response; data size in byte followed by the actual data (there is an exception to this which is detailed in the "SMD Modbus RTU Operations Manual").
  - 4 bytes for a write response; which is a repeat of the original master data that was written.

Error Check
- The Error checking field is the result of a "Cyclical Redundancy Checking" (CRC) calculation that is performed on the message contents.
- For full details on how to calculate the CRC please refer to the official Modbus RTU specification.

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Modbus Registers

- The "SMD Modbus Control Operation Manual" provides a complete list of many of which have a direct relationship to actual drive parameters.
- For every drive parameter there is a corresponding Modbus register. However, in addition to these there also several additional registers that are only accessible through Modbus. All of these registers are detailed in the "SMD Modbus Control Operation Manual".
- To help clarify the statement in "SMD Modbus Control Operation Manual" section "2C": Due to the way in which most Modbus masters typically access slave registers it may be necessary to add "1" to the SMD register number to ensure access to the correct register because the master automatically deducts "1" from the register number, e.g.

  > C37 - Fixed setpoint1 is listed as register address 74 (for SMD PV507). To correctly access this address, the master actually needs to use register 400**75,** thereafter the master automatically deducts "1" during its message frame construction and will therefore really access drive register 40074.

- Some Modbus Master devices have the option to use zero base addressing; de-selecting this will simply everything as all registers will then have the correct off-set, i.e. 1 to 1 register addressing.

Drive Security

- For read access no security has to be set as read only access is always granted (while C01 = 8 - 11).
- Assuming that the drive password has not been activated, (see C94), writing a value of "0" to drive register 48 (40048) will unlock both drive control and parameter access.
- If a password has been configured, then writing the password number to drive register 48 will again unlock access to both areas.
  Writing only "0" to drive register 48 after a password has been configured will then only unlock access to the drive control registers.
- Parameter access can be unlocked independently by writing "0" to drive register 49
- To re-activate / re-secure access to these areas simply set BIT-1 of the drive control register 1.

Examples

Example 1 - Reading Fixed Setpoint 1 (C37 default value of 20)

Address 01	Function Code 03	Reg # 00 4A	Reg Qty 00 01	CRC A5 DC

Modbus Master request frame transmission

Address 01	Function Code 03	Data Size 02	Data Value 00 C8	CRC B9 D2

Modbus Slave response frame transmission

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Example 2 - Writing to a value of 12.3Hz to Fixed Setpoint 1 (C37)
    Modbus Master request frame transmission

Address 01	Function Code 06	Reg # 00 4A	Reg Data 00 7B	CRC E8 3F

    Modbus Slave response frame transmission

Address 01	Function Code 06	Reg # 00 4A	Reg Data 00 7B	CRC E8 3F

Example 3 - unlock security, enable drive and control the motor speed
    The following drive parameters are assumed to have been already set:-
    • C01 = 11 (default value is 0)
    • C09 = 1 as per default
    • C94 = 0 as per default
    • Close terminal 20 and 28

1. Unlocking security, set a value of 0 to drive register 48
    Modbus Master frame transmission

Address 01	Function Code 06	Reg # 00 30	Reg Data 00 00	CRC 89 C5

2. Set BIT-8 of the Control Word to select "Serial Speed Reference"
    Modbus Master frame transmission

Address 01	Function Code 06	Reg # 00 01	Reg Data 01 00	CRC D9 9A

3. Set BIT-3 of the Control Word to enable the drive, the drive display will change
    Modbus Master frame transmission

Address 01	Function Code 06	Reg # 00 01	Reg Data 00 08	CRC D9 CC

4. Set a value of 250 to the serial speed reference register 40. The drive display will change to display the output frequency which will be 25.0Hz.
    Modbus Master frame transmission

Address 01	Function Code 06	Reg # 00 28	Reg Data 00 FA	CRC 89 81

5. Set BIT-2 of the Control Word to disable the drive, the drive display will change to "Inh" for inhibit
    Modbus Master frame transmission

Address 01	Function Code 06	Reg # 00 01	Reg Data 00 04	CRC D9 C9

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