MODbus

A little history

MODbus is an industrial standard for serial communication introduced in 1979 by the company Modicon, now Schneider Electric, for use in client/server communication between units, which may be connected via different networks. MODbus is now a completely open standard available for all without the need for licenses or rights. MODbus has been called the „de facto standard in multi-vendor integration".

The HC family

Since the HC family of transmitters should be modular, a communication between the units was needed, which could handle an „arbitrary" number of units. It should be possible to always add a new unit. Thus a multi drop bus was needed. Instead of introducing a proprietary protocol it was decided to look for an existing standard and MODbus was chosen. Now all transmitters in the family are capable of communicating - not only with the master HC300

- but with any system as long as the system has a MODbus interface. This makes the transmitter family applicable in almost all SCADA systems and gives the user the possibility of building a simple network and enhancing it later if the need arrises.

Structure

The implementation of the MODbus in the HC family is based on an RS485 connection between the units. The driver circuit in each of the transmitters allows up to 32 units without the use of repeaters (see figure 2), while the address may be set within the whole address space of the MODbus standard (247). Using the 'dat'-unit HC300 as the master only the addresses 1..14 are valid, since the format in the data acquisition limits the number of nodes to 14 (see figure 1). Naturally two units on the network are not allowed to share the same address.
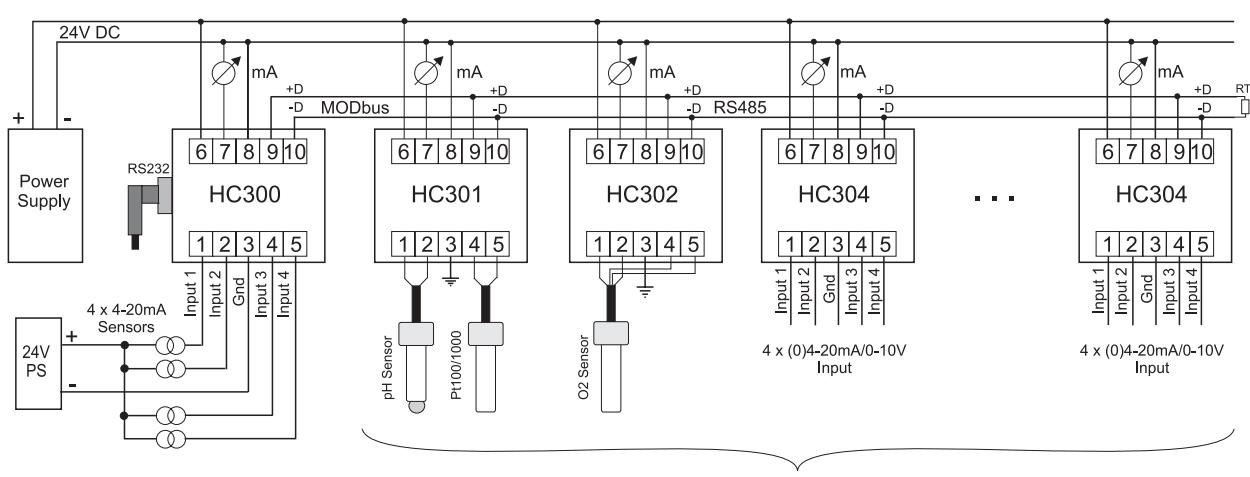

Figure 1. Example of a network with the HC300 as the master

HC300

The example in figure 1 shows a number of HC units connected to the master HC300. Which units and in which order is of course of no importance. Please note the terminating resistor (Rt) at the end of the network. It should be present if the distance between the units is significant. The value of this resistor is typically 120Ω. The

HC300 has a built-in terminating resistor of 120Ω, always giving the network a terminating resistor in at least the one end. The MODbus standard prescribes a terminating resistor in both ends, but for short distances this has proven unnecessary.
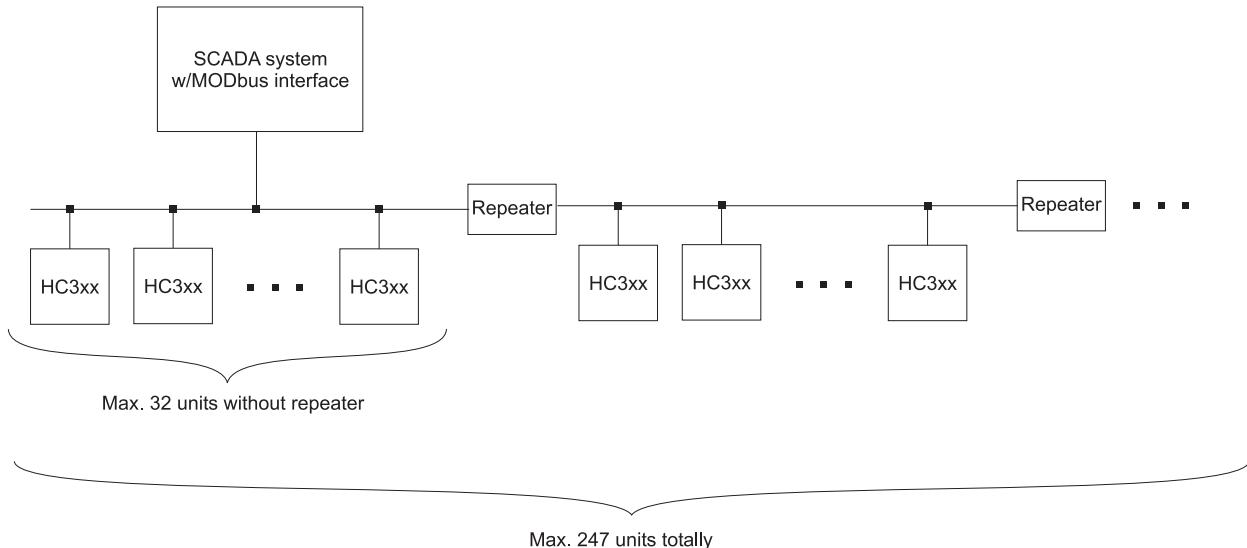
Figure 2. Principle of a network with a SCADA system as the master

SCADA system

The principle of a network with a SCADA system as the master is shown in figure 2. Here the MODbus standard sets the limit of the number of units, since the maximum valid address is 247. As shown in the figure up to 32 units may be connected without the use of a repeater. The same demands apply to the terminating resistor as described in the paragraph about the HC300.

Protocol

The MODbus standard includes a number of function codes giving the master of the network the ability of gathering or placing values/parameters in every slave connected to the network. The transmitters in the HC family has all the required function codes built-in as well as the relevant codes for each unit.

The transmitters each contain a number of measurements (1..4), which may be collected via the MODbus. Access to these measurements is common to all units in the family and is gained via the function code *Read_Input_Registers (04)*. Furthermore the units give acces to various diagnostics values via *Diagnostics (08)*, as shown in the following.

Read_Input_Registers

Function code Start address Number of measurements

04	1	1, 2, 3 or 4

The measurements are always sent in succession; If 2 values are chosen the measurements 1 and 2 are sent. Asking for more measurements than the unit contains is invalid and will produce an exception reply; If the unit contains only 2 values it will be invalid to ask for 3. The start address is of no importance - only the number of measurements determine the returned values.

Diagnostics

Fct. code Sub code(HEX) Description

Fct. code	Sub code(HEX)	Description
08	00	Echoes this telegram
	0A	Resets counters and registers
	0B	Returns number of messages
	0C	Returns number of comm. errors
	0D	Returns number of exception err.
	0E	Returns number of received msg.
	0F	Returns number of non-answered messages
	12	Returns number of overrun errors

If the unit receives an invalid function code or an invalid combination of function code/sub code an „exception" error is returned to the master.

For a detailed description of the MODbus protocol please refer to the MODbus website: www.modbus.org