

INSTRUCTION BOOKLET

AQ-200 series Modbus

Revision	1.00
Date	22.10.2013
Changes	First revision.
Revision	1.01
Date	2.6.2017
Changes	Added connector pin assignment table.

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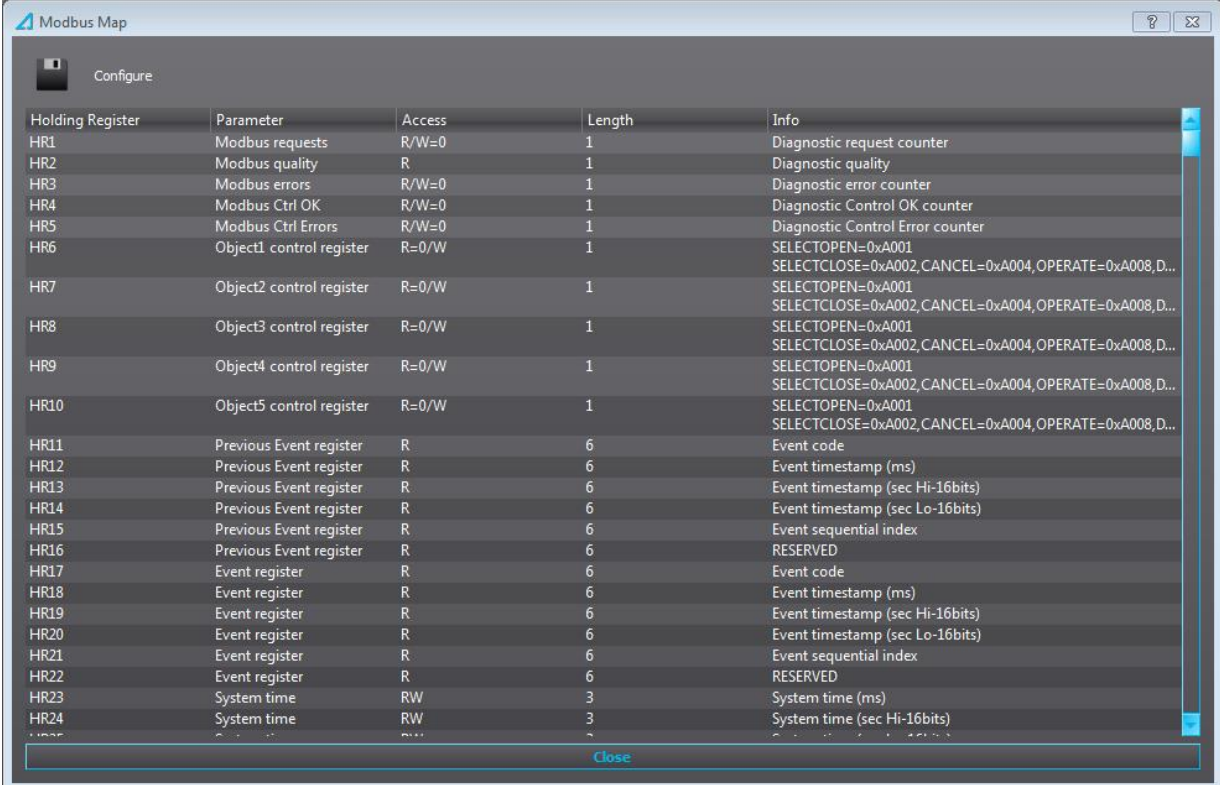
1 MODBUS COMMUNICATION IN AQ-200 SERIES

AQ-200 series devices can communicate using both Modbus RTU serial protocol and Modbus TCP protocol. Same data can be accessed using both these protocols.

To use Modbus TCP it can be activated with parameter *Modbus TCP enable* in menu *Communication → Protocols → Modbus TCP*.

Modbus RTU can be activated with parameter *Protocol* in menu *Communication → Connections*.

Data accessible via Modbus in AQ-200 series can be viewed in the Modbus map. The map can be opened from *Tools → Communication → Modbus Map* in Aqivate setting tool. Modbus map can be saved into a text file with *Save*-icon.



Holding Register	Parameter	Access	Length	Info
HR1	Modbus requests	R/W=0	1	Diagnostic request counter
HR2	Modbus quality	R	1	Diagnostic quality
HR3	Modbus errors	R/W=0	1	Diagnostic error counter
HR4	Modbus Ctrl OK	R/W=0	1	Diagnostic Control OK counter
HR5	Modbus Ctrl Errors	R/W=0	1	Diagnostic Control Error counter
HR6	Object1 control register	R=0/W	1	SELECTOPEN=0xA001 SELECTCLOSE=0xA002,CANCEL=0xA004,OPERATE=0xA008,D...
HR7	Object2 control register	R=0/W	1	SELECTOPEN=0xA001 SELECTCLOSE=0xA002,CANCEL=0xA004,OPERATE=0xA008,D...
HR8	Object3 control register	R=0/W	1	SELECTOPEN=0xA001 SELECTCLOSE=0xA002,CANCEL=0xA004,OPERATE=0xA008,D...
HR9	Object4 control register	R=0/W	1	SELECTOPEN=0xA001 SELECTCLOSE=0xA002,CANCEL=0xA004,OPERATE=0xA008,D...
HR10	Object5 control register	R=0/W	1	SELECTOPEN=0xA001 SELECTCLOSE=0xA002,CANCEL=0xA004,OPERATE=0xA008,D...
HR11	Previous Event register	R	6	Event code
HR12	Previous Event register	R	6	Event timestamp (ms)
HR13	Previous Event register	R	6	Event timestamp (sec Hi-16bits)
HR14	Previous Event register	R	6	Event timestamp (sec Lo-16bits)
HR15	Previous Event register	R	6	Event sequential index
HR16	Previous Event register	R	6	RESERVED
HR17	Event register	R	6	Event code
HR18	Event register	R	6	Event timestamp (ms)
HR19	Event register	R	6	Event timestamp (sec Hi-16bits)
HR20	Event register	R	6	Event timestamp (sec Lo-16bits)
HR21	Event register	R	6	Event sequential index
HR22	Event register	R	6	RESERVED
HR23	System time	RW	3	System time (ms)
HR24	System time	RW	3	System time (sec Hi-16bits)

From the map it can be seen that Modbus data is arranged in registers, HR stands for Holding Register and one register is 16bits. Some data in a protection relay does not map directly to 16bits, therefore there is data that requires more than one register in the map.

1.1 TOOL FOR TESTING MODBUS COMMUNICATION

One useful tool for testing Modbus communication is the Modscan tool. An evaluation version is available from here; <http://www.win-tech.com/html/demos.htm>.

Modscan tool can communicate using both Modbus TCP and Modbus RTU. If using Modbus RTU you need to make sure you have a serial port with RS-485 converter for your PC. Arcteq have successfully been using MOXA UPort 1150 USB-to-Serial Adaptor with RS-485 support. For connector pin assignment, please check table below.

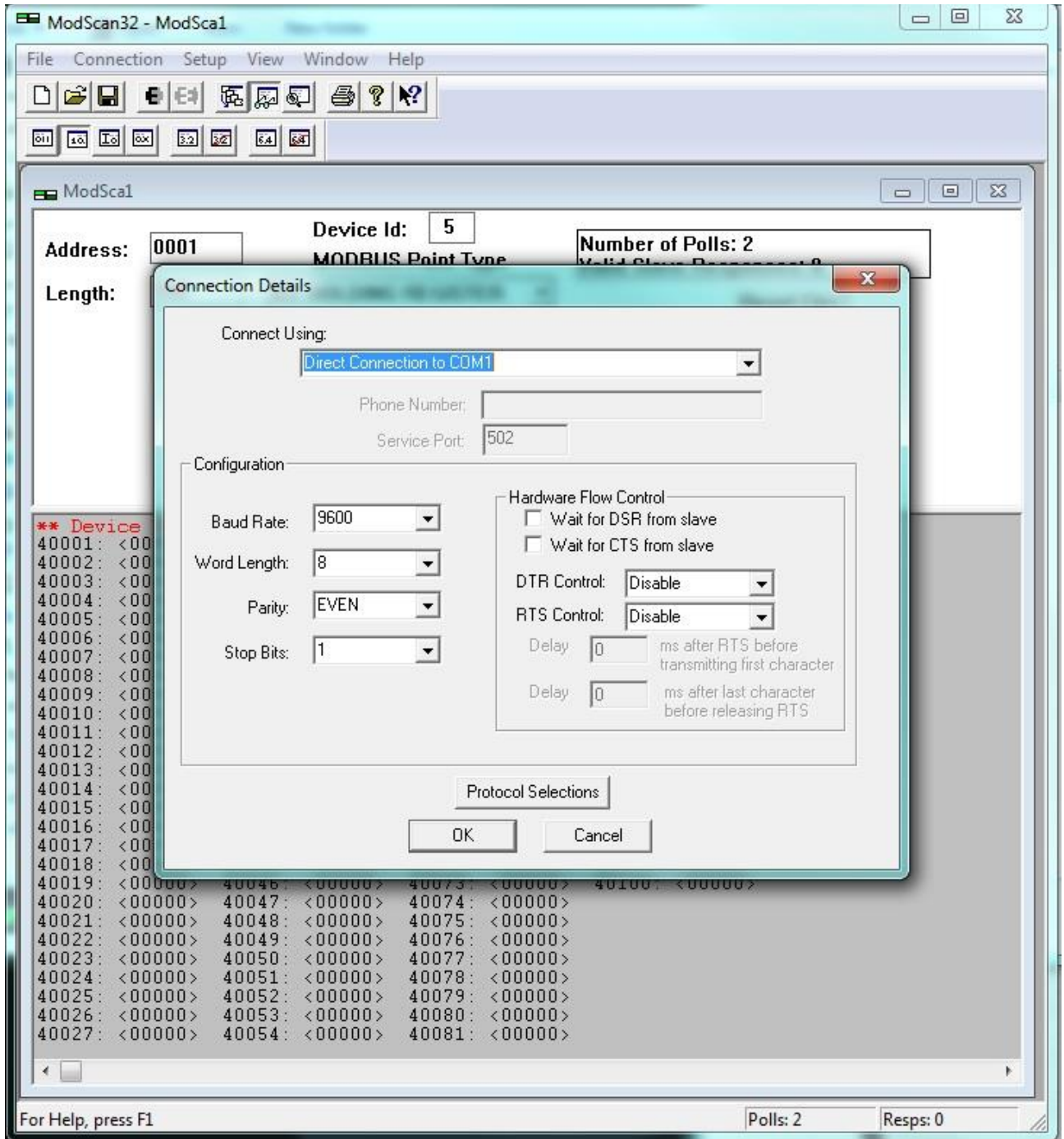
COM B RS-485 pin-out description

Pin number (1=leftmost)	Description
1	DATA +
2	DATA -
3	GND
4 , 5	Terminator resistor enabled by shorting pins 4 and 5.

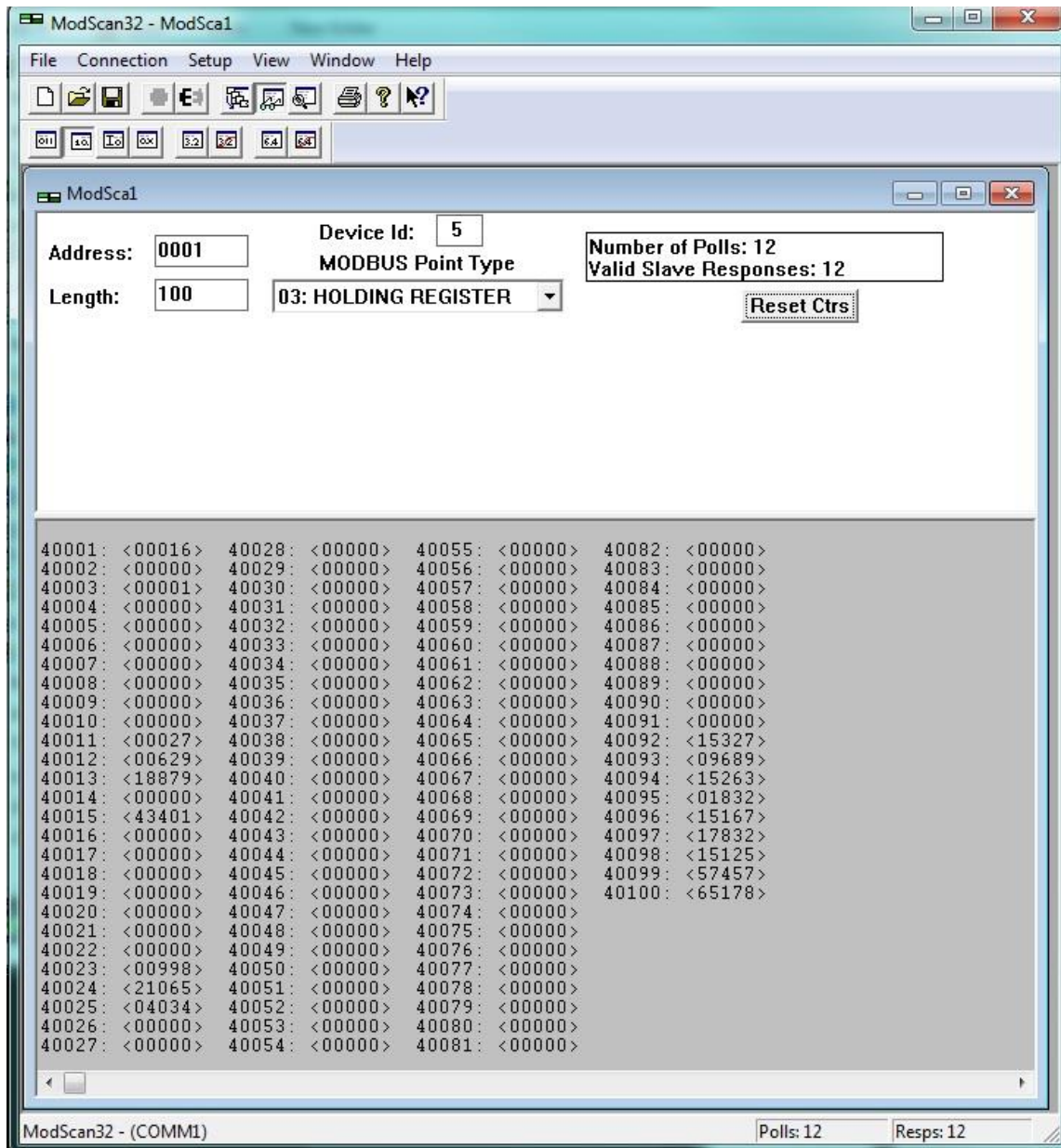
1.2 SETTING UP MODBUS RTU COMMUNICATION

In the AQ-200 series you need to set only slave address to unique number after selecting ModbusRTU for serial protocol.

Setup the Modscan tool according to following pictures.

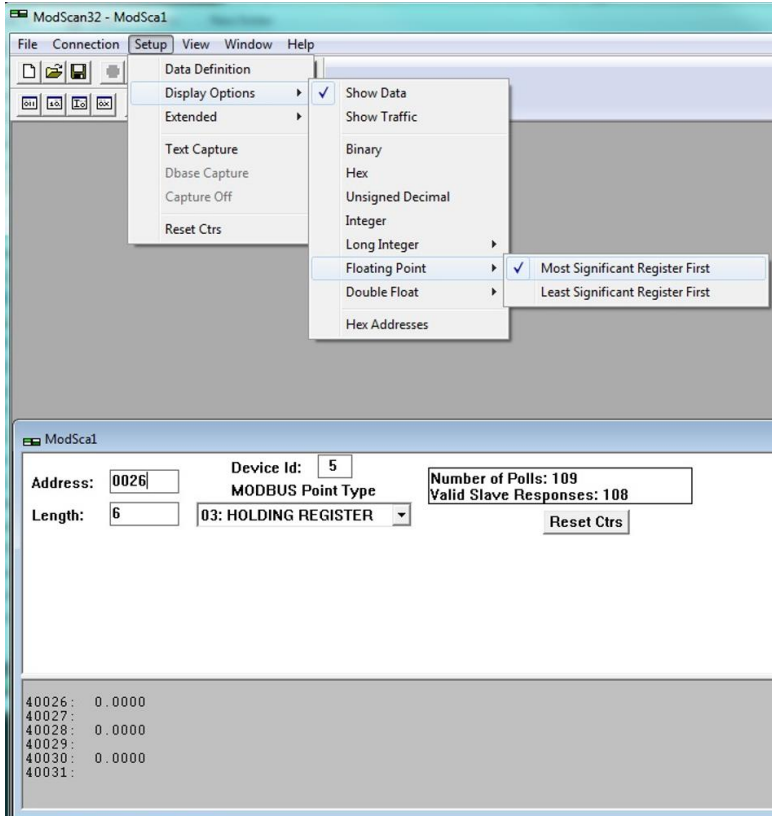


In following picture slave device 5 is polled for 100 holding registers starting at register 1. HR1 contains the Modbus request counter and will increase by 1 for each request received.



1.3 READING MEASUREMENTS (FLOAT)

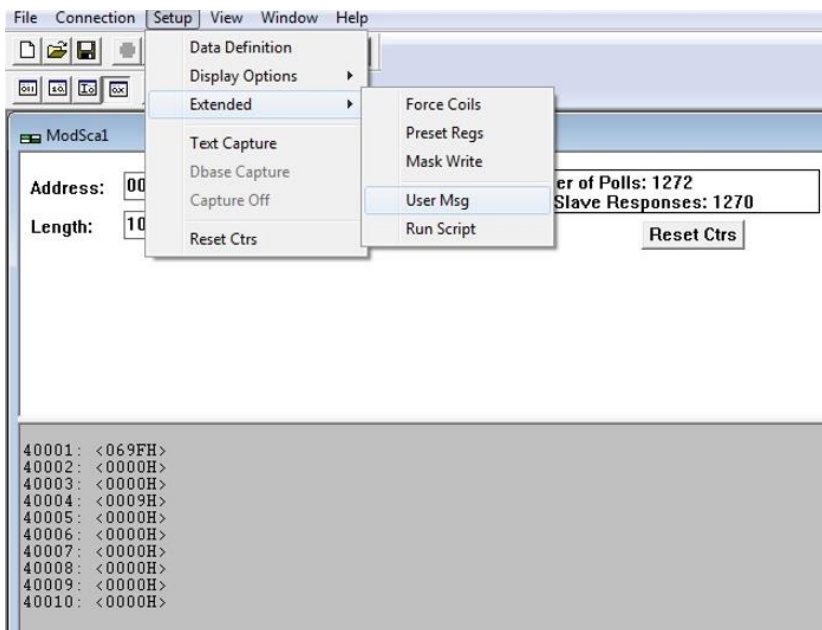
For example, phase currents are mapped to Modbus as 32bit floating point values. This means that 2 holding registers are used for 1 current measurement. In the below picture HR26 to HR31 is read from the device and the data is displayed in floating point.

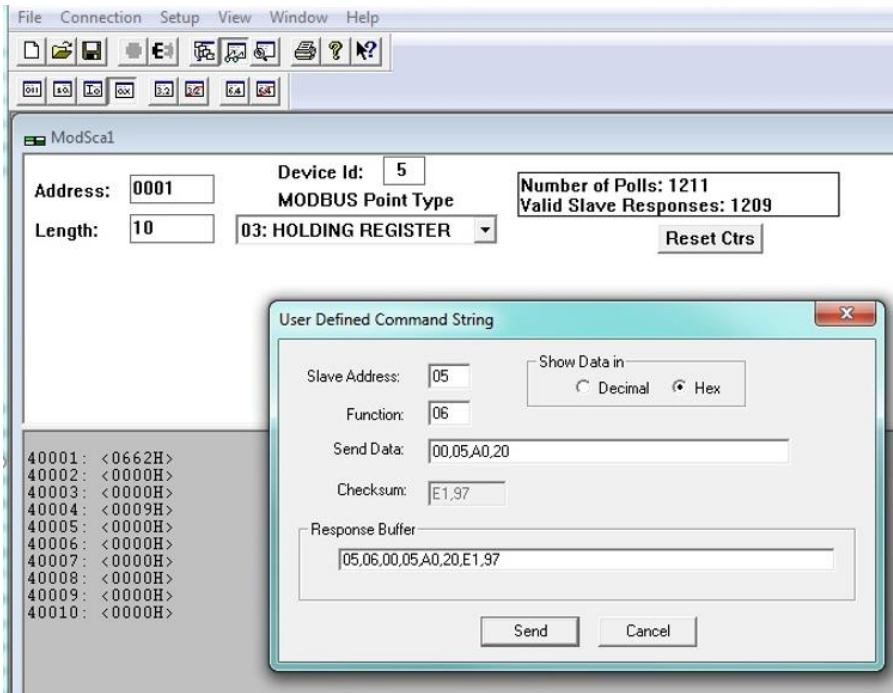


1.4 CONTROLLING OBJECTS

Controlling objects in AQ-200 series Modbus implementation is done by issuing a PRESET SINGLE REGISTER command, Modbus function 6. In Modscan this function is not well supported so to test this you need to issue a user defined message. From the Modbus Map you can see that Object 1 control is done by writing to HR6. Different commands can be written, for example; direct close is 0xA020. In second picture below 0xA020 is written to HR6 which causes the Object 1 to close.

Note the offset of 1 between raw Modbus data and HR definition in Modbus Map.

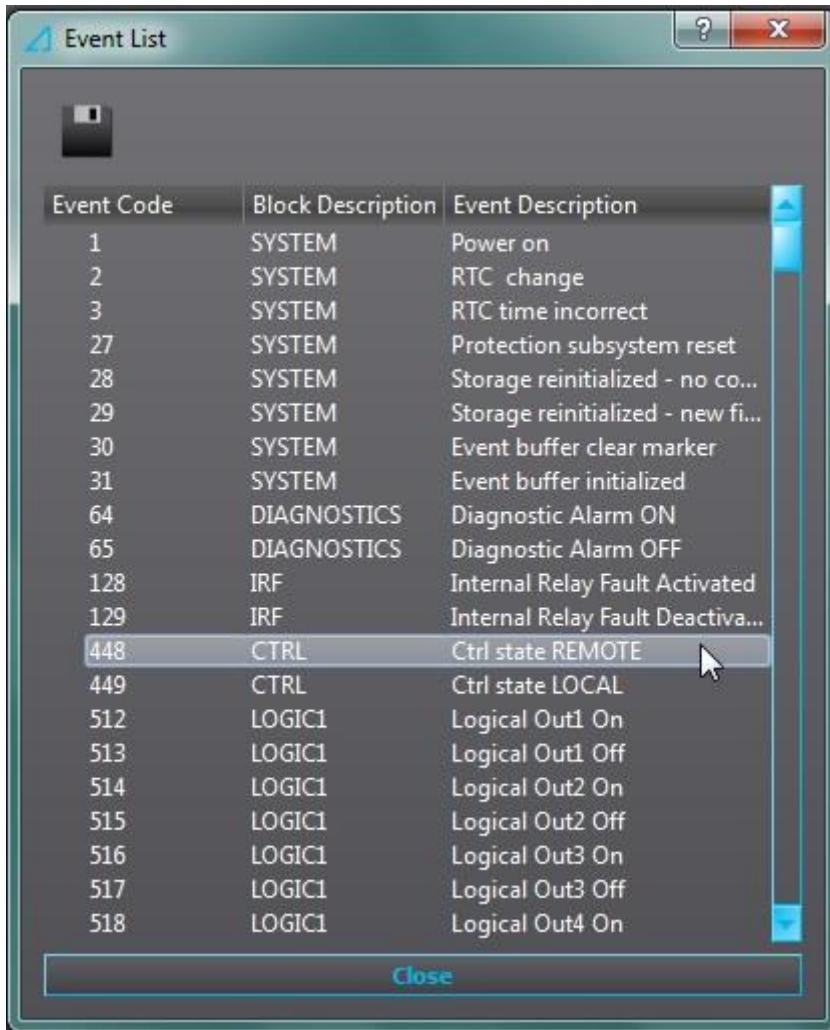




1.5 READING EVENTS FROM THE AQ-200 VIA MODBUS

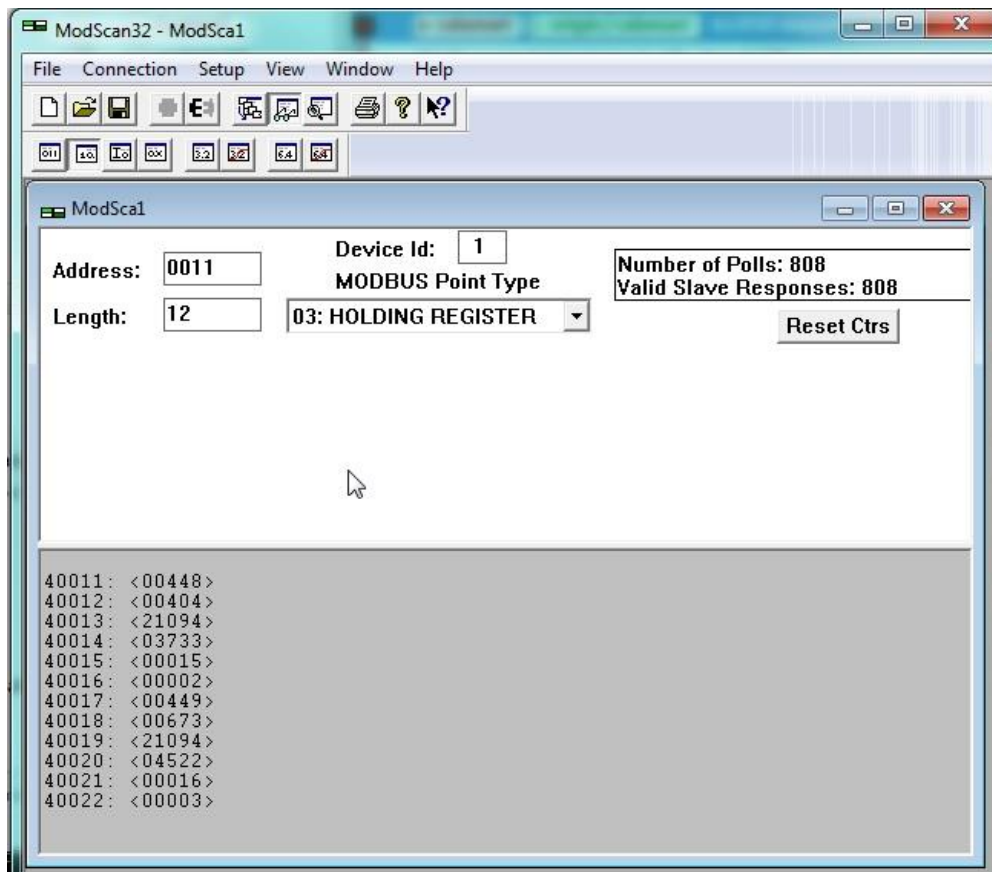
Modbus protocol does not support time-stamped events by standard definition. This means that every vendor must come up with their own definition how to transfer events from the device to the client. In Arcteq 200 series events can be read from HR17...HR22. HR17 contains the event-code, HR18...20 contains the time-stamp in UTC, HR21 contains a sequential index and HR22 is reserved for future expansion. See the Modbus Map for more information. The event-codes and their meaning can be found from Aqivate program under Tools menu and Event List. The event-code in HR17 is 0 if no new events can be found in the device event-buffer. Every time HR17 is read from client the event in event-buffer is consumed and on following read operation the next un-read event information can be found

from event registers. HR11...HR16 registers contains a back-up of last read event. This is because some users want to double-check that no events were lost.



Event Code	Block Description	Event Description
1	SYSTEM	Power on
2	SYSTEM	RTC change
3	SYSTEM	RTC time incorrect
27	SYSTEM	Protection subsystem reset
28	SYSTEM	Storage reinitialized - no co...
29	SYSTEM	Storage reinitialized - new fi...
30	SYSTEM	Event buffer clear marker
31	SYSTEM	Event buffer initialized
64	DIAGNOSTICS	Diagnostic Alarm ON
65	DIAGNOSTICS	Diagnostic Alarm OFF
128	IRF	Internal Relay Fault Activated
129	IRF	Internal Relay Fault Deactiva...
448	CTRL	Ctrl state REMOTE
449	CTRL	Ctrl state LOCAL
512	LOGIC1	Logical Out1 On
513	LOGIC1	Logical Out1 Off
514	LOGIC1	Logical Out2 On
515	LOGIC1	Logical Out2 Off
516	LOGIC1	Logical Out3 On
517	LOGIC1	Logical Out3 Off
518	LOGIC1	Logical Out4 On

In below picture Modscan is set up to read registers HR11...HR22. HR11...16 contains the previously read event information. HR17 has value 449 which translates to Ctrl state LOCAL in the event list. Time-stamp of this event is decoded like this; HR19 SecsHi: 21094, HR20 SecsLo: 4522 => Seconds $(21094 \ll 16 + 4522) = 1382420906s$.HR18: 673ms. This time-stamp of 1382420906,673 is in UTC and equals Tue, 22 Oct 2013 05:48:26.673 GMT. HR21 contains a running sequential number.



2 REFERENCE INFORMATION

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