MODBUS SUPPLEMENT FOR 3TX-TOT

MODBUS PROTOCOL SUMMARY

The basic communication information for the RS485 MODbus RTU protocol as implemented in the 3TX family of transmitters is as follows: 8-bit, even parity with 1 stop bit (all standards compliant). The MODbus standard includes a number of function codes giving the master of the network the ability of gathering or placing values and parameters in every slave connected to the network. The transmitters in the 3TX family have all the required function codes built-in as well as the relevant codes for each unit. The 3TX transmitters each contain a number of measurements (anywhere from 1 to 5 depending upon the module type), which may be collected via the MODbus protocol. Access to these measurements is common to all units in the 3TX family and is gained via the function code Read_Input_Registers (04). Furthermore the units give access to various diagnostics values via Diagnostics Function Code (08). The details of these function codes are described in the relevant sections of the given 3TX-pH, 3TX-ISE, 3TX-TOT, 3TX-CON and 3TX-DO transmitter specification sheets and manuals and the relevant portions are extracted reproduced below for summarization purposes. The summarized form below is not intended to be a replacement for the more detailed individual manual for each 3TX module but rather as a convenience supplement for just some of the more commonly used portions when configuring a system for MODbus data acquisition and/or control.

3TX-TOT MODBUS DETAILS

In order to utilize the MODbus interface the 3TX-TOT must be ordered with MODbus. 3TX-TOT may be used as a slave for the 'Dat' - unit 3TX-DAT or as a slave in a SCADA system. The setup / communication for each case will be explained in the following.

With 3TX-TOT
If 3TX-TOT is used together with the 3TX-DAT, the user must pay attention to two things: The baud rate on the MODbus as well as the address of the 3TX-TOT. **The baud rate (P27)** must be set to the baud rate of the 3TX-DAT. Whether a baud rate of 19,200 or 9,600 is used is of no importance, as long as all units on the MODbus are the same baud rate.

The address (P02) must be unique in the network; Two units are not allowed to have the same address. In a network with the 3TX-DAT as the master, all addresses must be assigned without leaving any address out; The order of the addresses is of no importance. In a network with an 3TX-DAT, up to 63 slaves may be connected with valid addresses from 1 to 247.

In a SCADA system
Since different SCADA systems may have different restrictions only the general are mentioned here: **The baud rate (P37)** must be set to the baud rate of the SCADA system. **The address (P02)** must be unique in the network; Two units are not allowed to have the same address.

MODbus Scaling
The scaling for the computed Total ISE output is defined by the range selected in P24 (low 0-10ppm, mid 0-100ppm or high 0-999ppm). Note that this MODbus output for the computed Total ISE may differ from the analog 0/4-20mA scaling defined by P25 & P26.

The 3TX-TOT contains a maximum of 4 input measurements (Free ISE, pH, Temp and Auxiliary) and a fifth value for the computed Total ISE as the output. All five of these can be transmitted on the MODbus. Access to these values are gained through the function code *Read_Input_Registers (04)*. The 3TX-TOT gives access via *Diagnostics (08)*.

Read_Input_Registers

Function code	Start address	Number of values
04	**1**	**1, 2, 3, 4 or 5**

Measurements are transmitted in sequence; All values are rated to 0-1000 corresponding to the range, Output (Total ISE – 1st value) has no offset, Input 1 (Free ISE – 2nd value) an offset of 1024, Input 2 (pH – 3rd value) an offset of 2048, Input 3 (Temp – 4th value) an offset of 3072 and Auxiliary has no offset (5th value); Total ISE is sent as 0-1000, Free ISE as 1024-2024, pH as 2048-3048, Temp as 3072-4072, and Aux (when present) as 0-1000.

Summary of TOT MODbus outputs

Value Number	Measurement	Sent as	Scaling
1	Total ISE (Output)	0-1000	As per P24 on TOT (Lo 0-10, Mi 0-100, or Hi 0-1000)
2	Free ISE (Input 1)	1024-2024	Range as per P04 on TOT (Lo 0-10, Mi 0-100, or Hi 0-1000) Low setpoint as per P05 on TOT High setpoint as per P06 on TOT
3	pH (Input 2)	2048-3048	Low setpoint as per P08 on TOT High setpoint as per P09 on TOT
4	Temp	3072-4072	0-105 °C (Default)
5	Aux (OPTIONAL) *When used Input 3*	0-1000	Aux Measurement as per P15 on TOT Low setpoint as per P18 on TOT High setpoint as per P19 on TOT

Diagnostics

Function Code	Sub Code (HEX)	Description
08	00	Return Query Data
	0A	Clear counters and diagnostics register
	0B	Return Bus Message Count
	0C	Return Bus Communication Error count
	0D	Return Exception Error count
	0E	Return Slave Message count
	0F	Return Slave No Response count
	12	Return Bus Character Overrun count

NOTES:

The MODbus output from the 3TX-TOT module can be interfaced to any standard RS-485 RTU compliant MODbus data acquisition or control device. In addition, this MODbus output can be accepted by the ASTI 3TX-DAT MODbus datalogger as well as the ASTI Windows Datalogging software for 3TX Transmitters with MODbus outputs. Find below links to download the current manuals for the software of each these data acquisition options for the TOT.

ASTI Windows Datalogging Software for 3TX Transmitters with MODbus output

http://www.astisensor.com/ASTI_Datalogging_Graphing_Windows_Software_3TX_MODbus_Transmitters_pH_ORP_ISE_Dissolved_Oxygen_Conductivity_Version_2.2_Installation_User_Guide.pdf

ASTI 3TX-DAT MODbus Datalogger Download and Configuration Upload Windows Software

http://www.astisensor.com/ASTI_DAT_Configuration_Upload_Logged_Data_Download_Windows_Software_3TX_MODbus_Transmitters_pH_ORP_ISE_Dissolved_Oxygen_Conductivity_Version_1.5_Installation_User_Guide.pdf

3TX-DAT MODbus Datalogger Module

http://www.astisensor.com/3TX-DAT.pdf

The software referenced above can be used to test the configuration of your TOT module prior to interfacing with your own MODbus data acquisition or control system or for diagnostic/testing purposes. All of the Windows software is supplied free of charge. ASTI factory supplied RS-485 to USB hardware converter and RS-232 to USB hardware converter can be purchased. The 3TX-DAT is sold separately and can be added at any time after commissioning so long as the modules to be interfaced have the MODbus output option.