



# ***TTM NoXygen<sup>®</sup>*** ***Modbus AVP***

MODBUS SPECIFICATION

## Background

This document describes the Modbus functionality of the system.

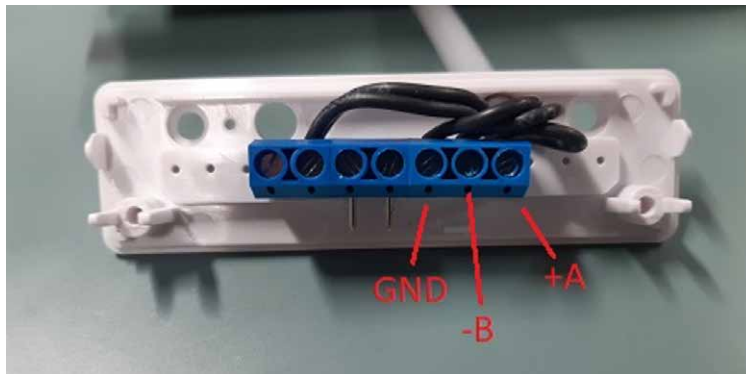
## TTM NoXygen® AVP MB

TTM NoXygen® AVP MB is equipped with Modbus support. Note that if the device is connected to an existing RS485 bus, correct termination must be ensured.

### Hardware interface

Parameter	Value
Baud rate	9600
Parity	None
Stop bits	1
Modbus mode	RTU

### Modbus socket



### Modbus Addressing

The device needs to be given an address for it to function in a Modbus system. Setting an address is done by performing the following steps using the devices display. Press down both the “Down” and “Up” arrows at the same time to enter the settings menu. Then use the left and right arrow keys for finding the setting “Modbus ID”. To change the setting, once again press down both the “up” and “down” arrows. The value can now be adjusted using the “up” and “down” buttons. This is the devices server-address (formerly slave address). Valid values range from 1 to and including 247. Finally, press the enter key to save.

### Termination of Modbus

If the Modbus unit is placed on the end of the bus a 120hm termination resistor must be connected between A and B in the device’s terminal block.

## Modbus Registers

The following table lists holding registers accessible using Modbus.

### Holding register read/write using Modbus function 3 respectively 6

Name	Address	Read/Write	Comment
On/Off	0	Read/write	Read/set whether the device is started/ stopped
Date - Year	1	Read/write	Read/set year for system date
Date - Month	2	Read/write	Read/set month for system date
Date - Day	3	Read/write	Read/set day for system date
Time - Hour	4	Read/write	Read/set hour for system time
Time - Minute	5	Read/write	Read/set minute for system time
Time - Second	6	Read/write	Read/set second for system time
Start time - Hour	7	Read/write	Read/set hour for start time of the degassing
Operating time	8	Read/write	Read/set number of hours per degas sing run
Initial operating time	9	Read/write	Read/set initial run time in number of days
Safety valve pressure	10	Read/write	Read/set the safety valve's max pressure in milli Bar
Max pressure	11	Read/write	Read/set maximum target pressure
Min pressure	12	Read/write	Read/set lower target threshold for pressure
Target max fill vol/refill	13	Read/write	Read/set maximum target refill volume in Liters
Max refill count	14	Read/write	Read/set max number of refills
Refill vol since last reset	15	Read/write	Read/zero refilled volume since last zeroing in liters
Alarm type	16	Read/write	Read/clear alarms

### (Holding register 0)

Read/set whether the device is started/stopped.

#### On / Off status:

0 = Device is turned off.

1 = Device is turned on.

### Date - Year (Holding register 1)

Used to read/set the year part of the device's system date. Note that this is a number between 0 and 99.

### Date - Month (Holding register 2)

Used to read/set the month part of the device's system date.

**Note:** When changing the multiple parts of the date, please make sure that the complete data is valid through every step of the process. For example, when changing from January the 31<sup>st</sup> to 1<sup>st</sup> of February. If the month is changed first, we would end up with an invalid date. To avoid this, we would in this case have to first set the day and then update the month.

### Date - Day (Holding register 3)

Used to read/set the day of month part of the device's system date.

**Note:** When changing the multiple parts of the date, please make sure that the complete data is valid through every step of the process. For example, when changing from January the 31<sup>st</sup> to 1<sup>st</sup> of February. If the month is changed first, we would end up with an invalid date. To avoid this, we would in this case have to first set the day and then update the month.

### Time - Hour (Holding register 4)

Used to read/set the 24-hour part of the device's system time.

### Time - Minute (Holding register 5)

Used to read/set the minute part of the device's system time.

### Time - Second (Holding register 6)

Used to read/set the second part of the device's system time.

### Start Time - Hour (Holding register 7)

Used to read/set hour for start time (hour) of the degassing. The list of valid values is:

Value	Description
9	Start at 9:00
13	Start at 13:00
19	Start at 19:00

### Operating time (Holding register 8)

Used to read/set number of hours per degassing run. The valid range of values is 1-8.

### Initial operating time (Holding register 9)

Used to read/set initial degassing time in number of days left. The valid range of values is 0-90 where 0 means that the initial operating period has passed.

### Safety valve pressure (Holding register 10)

Used to read/set the safety valve's max pressure in milli Bar.

**Note:** This value needs to be greater than max pressure and smaller than 9000 milli Bar. When updating both values please ensure that the condition is upheld during every step of the process.

### Max pressure (Holding register 11)

Used to read/set the maximum target pressure in milli Bar.

**Note:** This value needs to be greater than min pressure and smaller than safety valve pressure. When updating multiple of these values please ensure that the condition is upheld during every step of the process.

### Min pressure (Holding register 12)

Used to read/set lower target threshold for pressure in milli Bar.

**Note:** This value needs to be smaller than max pressure. When updating both values please ensure that the condition is upheld during every step of the process.

### Target max fill vol/refill (Holding register 13)

Used to read/set target max fill volume per refill in liters, Valid range: 0-49 Liters.

### Max refill count (Holding register 14)

Used to read/set maximum number of refills. Valid range: 0-200.

### Refill volume since last reset (Holding register 15)

Used to read/zero the total refilled volume since last reset of the value. When writing to this register, the only valid value to set is: 0.

### Alarm type (Holding register 16)

Used to read/clear any alarms. When writing to this register the only valid value to set is 0 which will clear the alarm. Note however that this is only possible for some of the alarm types, see table below.

Value	Alarm type	Description	Can be reset
0	None	There are no alarms, write this value to clear the current alarm.	-
1	Vmax exceeded	Target refill volume exceeded.	Yes
2	Low pressure	The system pressure is lower than the lower target threshold.	No, Will reset itself once the pressure rises.  Note: The device might transfer from this alarm directly to "Vmax exceeded" or "Fmax exceeded" when trying to refill. Those alarms will have to be reset manually.
3	Fmax exceeded	The maximum refill count has been exceeded.	Yes
4	SafeP exceeded	The safety valve pressure has been exceeded.	No, Will reset itself once the pressure falls.
5	Pressure timeout	Timed out waiting for pressure to return after pumping.	No, Will reset itself once the pressure increases.

The following table lists input registers accessible using Modbus.

### Input registers

Name	Address	Read	Comment
Pressure	0	Read	Present pressure in milli Bar
Total refill volume	1	Read	Total refilled volume in liter
Total refill count	2	Read	Total number of refills
Total pump start count high	3	Read	Total number of pump starts, most significant 16 bits
Total pump start count low	4	Read	Total number of pump starts, least significant 16 bits
Stop reason	5	Read	Reason for system not running
Reserved	6	Read	Reserved, reads as 0
Reserved	7	Read	Reserved, reads as 0
Reserved	8	Read	Reserved, reads as 0
Reserved	9	Read	Reserved, reads as 0
Log entry 1 (newest) – Month	10	Read	Month for log entry 1 (newest)
Log entry 1 (newest) – Day	11	Read	Day for log entry 1 (newest)
Log entry 1 (newest) – Hour	12	Read	Hour for log entry 1 (newest)
Log entry 1 (newest) – Minute	13	Read	Minute for log entry 1 (newest)
Log entry 1 (newest) – Code	14	Read	Code for log entry 1 (newest)
Log entry 2 – Month	15	Read	Month for log entry 2
Log entry 2 – Day	16	Read	Day for log entry 2
Log entry 2 – Hour	17	Read	Hour for log entry 2
Log entry 2 – Minute	18	Read	Minute for log entry 2
Log entry 2 – Code	19	Read	Code for log entry 2
Log entry 3 – Month	20	Read	Month for log entry 3
Log entry 3 – Day	21	Read	Day for log entry 3
Log entry 3 – Hour	22	Read	Hour for log entry 3
Log entry 3 – Minute	23	Read	Minute for log entry 3
Log entry 3 – Code	24	Read	Code for log entry 3
Log entry 4 – Month	25	Read	Month for log entry 4
Log entry 4 – Day	26	Read	Day for log entry 4
Log entry 4 – Hour	27	Read	Hour for log entry 4
Log entry 4 – Minute	28	Read	Minute for log entry 4
Log entry 4 – Code	29	Read	Code for log entry 4
Log entry 5 – Month	30	Read	Month for log entry 5
Log entry 5 – Day	31	Read	Day for log entry 5
Log entry 5 – Hour	32	Read	Hour for log entry 5
Log entry 5 – Minute	33	Read	Minute for log entry 5
Log entry 5 – Code	34	Read	Code for log entry 5
Log entry 6 – Month	35	Read	Month for log entry 6
Log entry 6 – Day	36	Read	Day for log entry 6
Log entry 6 – Hour	37	Read	Hour for log entry 6
Log entry 6 – Minute	38	Read	Minute for log entry 6
Log entry 6 – Code	39	Read	Code for log entry 6

### Pressure (Input register 0)

Used to read the current system pressure in milli Bars.

### Total refill volume (Input register 1)

Used to read the all-time total refilled volume in liters.

### Total refill count (Input register 2)

Used to read the all-time total number of refills.

### Total pump start count (Input register 3 and 4)

Used to read the all-time number of pump starts. This is a 32bit integer and is thus spread out across both register 3 and 4:

Register	Description
3	Most significant bits, MSB, the highest 16 bits
4	Least significant bits, LSB, the low 16 bits

### Stop reason (Input register 5)

Used to read list of potential reason the device is not currently running.

Bit	Reason	Description
0	Reserved	Reads as 0
1	Low pressure	The current system pressure is too low
2	Wrong time	The time of day is outside of the devices running schedule
3	Wrong day	The day is outside of the devices running schedule
4	Reserved	Reads as 0
5	Reserved	Reads as 0
6	Reserved	Reads as 0
7	Reserved	Reads as 0
8	Reserved	Reads as 0
9	Reserved	Reads as 0
10	Reserved	Reads as 0
11	Reserved	Reads as 0
12	Reserved	Reads as 0
13	Reserved	Reads as 0
14	Reserved	Reads as 0
15	Reserved	Reads as 0



**Reserved (Input register 6, 7, 8, 9)**

Reserved, reads as 0.

**Log entry 1, 2, 3, 4, 5, 6 – Month (Input register 10, 15, 20, 25, 30, 35)**

Used to read the month from log entry 1, 2, 3, 4, 5, 6, with 1 being the newest at address 10.

**Log entry 1, 2, 3, 4, 5, 6 – Day (Input register 11, 16, 21, 26, 31, 36)**

Used to read day of month from log entry 1, 2, 3, 4, 5, 6, with 1 being the newest at address 11.

**Log entry 1, 2, 3, 4, 5, 6 – Hour (Input register 12, 17, 22, 27, 32, 37)**

Used to read hour from log entry 1, 2, 3, 4, 5, 6, with 1 being the newest at address 12.

**Log entry 1, 2, 3, 4, 5, 6 – Minute (Input register 13, 18, 23, 28, 33, 38)**

Used to read minute from log entry 1, 2, 3, 4, 5, 6, with 1 being the newest at address 13.

**Log entry 1, 2, 3, 4, 5, 6 – Code (Input register 14, 19, 24, 29, 34, 39)**

Used to read the alarm type from log entry 1, 2, 3, 4, 5, 6, with 1 being the newest at address 14.

The following table describes the meaning of the values:

Value	Alarm type	Description
1	Vmax exceeded	Target refill volume exceeded.
2	Low pressure	The system pressure is lower than the lower target threshold.
3	Fmax exceeded	The maximum refill count has been exceeded.
4	SafeP exceeded	The safety valve pressure has been exceeded.
5	Pressure timeout	Timed out waiting for pressure to return after pumping.