**ZB485-MODBUS Specification**

*Rev 0.3*

*Last Updated, Sep/30/2019*

*Scanjet Macron*

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Revision History

|  |  |
| --- | --- |
| Rev 0.3 | * Added EEPROM Reset Register (Section 6.4) * Added firmware version input register (Section 6.5) * Added running mode holding register (Section 6.6) * Added Special Condition on Address Selector 15 (Section 4) |

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1. Objective

This document aims at describing MODBUS protocol of ZB485 board.

1. Introduction

ZB485-MODBUS acts as MODBUS RTU slave. ZB485-MODBUS accepts requests from MODBUS RTU master and responds appropriately as specified in MODBUS RTU standard literatures and this document.

1. Communication Parameters

ZB485 -MODBUS board provides industry standard RS485 interface to communicate with MODBUS RTU masters. The communication parameters used by ZB485 -MODBUS are as follows.

|  |  |  |
| --- | --- | --- |
| Parameter | Value | Note |
| Baud Rate | 38400 BPS | - |
| Parity | No parity | - |
| Stop Bit | 1 stop bit | - |
| Data | 8 bit | - |

1. MODBUS RTU Slave Address

MODBUS RTU Slave address is set by adjusting address selector rotary switch on the board. MODBUS RTU Address is decided using the following formula.

***MODBUS RTU Address = 10 + Rotary Switch Value***

For example, if you set the rotary switch to 5, the MODBUS RTU address becomes 15.

***Rotary Switch Address 15, that is, MODBUS address 25, isn’t available for normal use. The rotary switch position is used to force the board to enter bootloader mode so that the board can be recovered from corrupted application firmware.***

1. AN-SGCNV MODBUS Registers

***X is port number and its range is from 1 to 8.***

|  |  |  |  |
| --- | --- | --- | --- |
| Register Type | Address | Description | Multiply |
| Input | X000 | Status for CH 0 of AN-SGCNV board at PORT-X | - |
| Input | X001 | Value for CH 0 of AN-SGCNV board at PORT-X | - |
| Input | X002 | Status for CH 1 of AN-SGCNV board at PORT-X | - |
| Input | X003 | Value for CH 1 of AN-SGCNV board at PORT-X | - |
| Input | X004 | Status for CH 2 of AN-SGCNV board at PORT-X | - |
| Input | X005 | Value for CH 2 of AN-SGCNV board at PORT-X | - |
| Input | X006 | Status for CH 3 of AN-SGCNV board at PORT-X | - |
| Input | X007 | Value for CH 3 of AN-SGCNV board at PORT-X | - |
| Input | X008 | Status for CH 4 of AN-SGCNV board at PORT-X | - |
| Input | X009 | Value for CH 4 of AN-SGCNV board at PORT-X | - |
| Input | X010 | Status for CH 5 of AN-SGCNV board at PORT-X | - |
| Input | X011 | Value for CH 5 of AN-SGCNV board at PORT-X | - |
| Input | X012 | Status for CH 6 of AN-SGCNV board at PORT-X | - |
| Input | X013 | Value for CH 6 of AN-SGCNV board at PORT-X | - |
| Input | X014 | Status for CH 7 of AN-SGCNV board at PORT-X | - |
| Input | X015 | Value for CH 7 of AN-SGCNV board at PORT-X | - |
| Input | X016 | Status for CH 8 of AN-SGCNV board at PORT-X | - |
| Input | X017 | Value for CH 8 of AN-SGCNV board at PORT-X | - |
| Input | X018 | Status for CH 9 of AN-SGCNV board at PORT-X | - |
| Input | X019 | Value for CH 9 of AN-SGCNV board at PORT-X | - |
| Input | X020 | Status for CH 10 of AN-SGCNV board at PORT-X | - |
| Input | X021 | Value for CH 10 of AN-SGCNV board at PORT-X | - |
| Input | X022 | Status for CH 11 of AN-SGCNV board at PORT-X | - |
| Input | X023 | Value for CH 11 of AN-SGCNV board at PORT-X | - |
| Input | X024 | Status for CH 12 of AN-SGCNV board at PORT-X | - |
| Input | X025 | Value for CH 12 of AN-SGCNV board at PORT-X | - |
| Input | X026 | Status for CH 13 of AN-SGCNV board at PORT-X | - |
| Input | X027 | Value for CH 13 of AN-SGCNV board at PORT-X | - |
| Input | X100 | Raw value for CH 0 of AN-SGCNV board at PORT-X | - |
| Input | X101 | Raw value for CH 1 of AN-SGCNV board at PORT-X | - |
| Input | X102 | Raw value for CH 2 of AN-SGCNV board at PORT-X | - |
| Input | X103 | Raw value for CH 3 of AN-SGCNV board at PORT-X | - |
| Input | X104 | Raw value for CH 4 of AN-SGCNV board at PORT-X | - |
| Input | X105 | Raw value for CH 5 of AN-SGCNV board at PORT-X | - |
| Input | X106 | Raw value for CH 6 of AN-SGCNV board at PORT-X | - |
| Input | X107 | Raw value for CH 7 of AN-SGCNV board at PORT-X | - |
| Input | X108 | Raw value for CH 8 of AN-SGCNV board at PORT-X | - |
| Input | X109 | Raw value for CH 9 of AN-SGCNV board at PORT-X | - |
| Input | X110 | Raw value for CH 10 of AN-SGCNV board at PORT-X | - |
| Input | X111 | Raw value for CH 11 of AN-SGCNV board at PORT-X | - |
| Input | X112 | Raw value for CH 12 of AN-SGCNV board at PORT-X | - |
| Input | X113 | Raw value for CH 13 of AN-SGCNV board at PORT-X | - |
| Input | X200 | Cal value for CH 0 of AN-SGCNV board at PORT-X | - |
| Input | X201 | Cal value for CH 1 of AN-SGCNV board at PORT-X | - |
| Input | X202 | Cal value for CH 2 of AN-SGCNV board at PORT-X | - |
| Input | X203 | Cal value for CH 3 of AN-SGCNV board at PORT-X | - |
| Input | X204 | Cal value for CH 4 of AN-SGCNV board at PORT-X | - |
| Input | X205 | Cal value for CH 5 of AN-SGCNV board at PORT-X | - |
| Input | X206 | Cal value for CH 6 of AN-SGCNV board at PORT-X | - |
| Input | X207 | Cal value for CH 7 of AN-SGCNV board at PORT-X | - |
| Input | X208 | Cal value for CH 8 of AN-SGCNV board at PORT-X | - |
| Input | X209 | Cal value for CH 9 of AN-SGCNV board at PORT-X | - |
| Input | X210 | Cal value for CH 10 of AN-SGCNV board at PORT-X | - |
| Input | X211 | Cal value for CH 11 of AN-SGCNV board at PORT-X | - |
| Input | X212 | Cal value for CH 12 of AN-SGCNV board at PORT-X | - |
| Input | X213 | Cal value for CH 13 of AN-SGCNV board at PORT-X | - |
| Holding | X300 | Offset for CH0 of AN-SGCNV board at PORT-X |  |
| Holding | X301 | Offset for CH1 of AN-SGCNV board at PORT-X |  |
| Holding | X302 | Offset for CH2 of AN-SGCNV board at PORT-X |  |
| Holding | X303 | Offset for CH3 of AN-SGCNV board at PORT-X |  |
| Holding | X304 | Offset for CH4 of AN-SGCNV board at PORT-X |  |
| Holding | X305 | Offset for CH5 of AN-SGCNV board at PORT-X |  |
| Holding | X306 | Offset for CH6 of AN-SGCNV board at PORT-X |  |
| Holding | X307 | Offset for CH7 of AN-SGCNV board at PORT-X |  |
| Holding | X308 | Offset for CH8 of AN-SGCNV board at PORT-X |  |
| Holding | X309 | Offset for CH9 of AN-SGCNV board at PORT-X |  |
| Holding | X310 | Offset for CH10 of AN-SGCNV board at PORT-X |  |
| Holding | X311 | Offset for CH11 of AN-SGCNV board at PORT-X |  |
| Holding | X312 | Offset for CH12 of AN-SGCNV board at PORT-X |  |
| Holding | X313 | Offset for CH13 of AN-SGCNV board at PORT-X |  |
| Holding | X320 | Gain for CH0 of AN-SGCNV board at PORT-X |  |
| Holding | X321 | Gain for CH1 of AN-SGCNV board at PORT-X |  |
| Holding | X322 | Gain for CH2 of AN-SGCNV board at PORT-X |  |
| Holding | X323 | Gain for CH3 of AN-SGCNV board at PORT-X |  |
| Holding | X324 | Gain for CH4 of AN-SGCNV board at PORT-X |  |
| Holding | X325 | Gain for CH5 of AN-SGCNV board at PORT-X |  |
| Holding | X326 | Gain for CH6 of AN-SGCNV board at PORT-X |  |
| Holding | X327 | Gain for CH7 of AN-SGCNV board at PORT-X |  |
| Holding | X328 | Gain for CH8 of AN-SGCNV board at PORT-X |  |
| Holding | X329 | Gain for CH9 of AN-SGCNV board at PORT-X |  |
| Holding | X330 | Gain for CH10 of AN-SGCNV board at PORT-X |  |
| Holding | X331 | Gain for CH11 of AN-SGCNV board at PORT-X |  |
| Holding | X332 | Gain for CH12 of AN-SGCNV board at PORT-X |  |
| Holding | X333 | Gain for CH13 of AN-SGCNV board at PORT-X |  |
| Holding | X340 | Update Offset/Gain |  |
| Holding | X350 | Setup for CH0 of AN-SGCNV board at PORT-X |  |
| Holding | X351 | Setup for CH1 of AN-SGCNV board at PORT-X |  |
| Holding | X352 | Setup for CH2 of AN-SGCNV board at PORT-X |  |
| Holding | X353 | Setup for CH3 of AN-SGCNV board at PORT-X |  |
| Holding | X354 | Setup for CH4 of AN-SGCNV board at PORT-X |  |
| Holding | X355 | Setup for CH5 of AN-SGCNV board at PORT-X |  |
| Holding | X356 | Setup for CH6 of AN-SGCNV board at PORT-X |  |
| Holding | X357 | Setup for CH7 of AN-SGCNV board at PORT-X |  |
| Holding | X358 | Setup for CH8 of AN-SGCNV board at PORT-X |  |
| Holding | X359 | Setup for CH9 of AN-SGCNV board at PORT-X |  |
| Holding | X360 | Setup for CH10 of AN-SGCNV board at PORT-X |  |
| Holding | X361 | Setup for CH11 of AN-SGCNV board at PORT-X |  |
| Holding | X362 | Setup for CH12 of AN-SGCNV board at PORT-X |  |
| Holding | X363 | Setup for CH13 of AN-SGCNV board at PORT-X |  |
| Holding | X370 | Update Channel Setup |  |
| Holding | X400 | Pressure Filter |  |
| Holding | X401 | Temperature Filter |  |
| Holding | X402 | Other Filter |  |
| Holding | X403 | Update Filter |  |

**All the 16 bit registers are in big-endian format, that is, high byte comes first.**

* 1. Channel Status

This input register represents channel setup status, conversion, and calibration status. It is 8 bit value and its bit representation is as follows.

|  |  |
| --- | --- |
| Bit 432 | Channel setup  000 – unused  001 – temperature  010 – inclinometer  011 – pressure  1xx – setup from PC |
| Bit 1 | Calibration status. 0 = OK, 1 = Fail |
| Bit 0 | Conversion status. 0 = OK, 1 = Fail |

* 1. Channel Value

This input register represents calculated, gain/offset adjusted sensor data. The original floating point data I multiplied by 100. So 27.5 is represents as 27500. It’s 2 byte signed format.

* 1. Channel Raw Value

This input register represents raw data from sensors. It’s 2 byte signed format.

* 1. Channel Calibration Value

This input register represents calibration data for each channel. It’s 2 byte signed format.

* 1. Channel Offset

This input register represents offset value for calculating temperature for the channel. It’s 2 byte signed format and the temperature data is calculated by using the following equation.

temp\_data = temp\_data – (float)offset / 10.0

* 1. Channel Gain

This input register represents gain value for calculating temperature for the channel. It’s 2 byte signed format and the temperature data is calculated by using the following equation.

gain = gain\_signed\_2\_byte\_value / 1000.0

temp\_data = temp\_data \* gain

* 1. Update Offset/Gain

Due to interface protocol with AN-SGCNV board, simply updating offset or gain offset doesn’t trigger actual offset/gain update on AN-SGCNV. To update offset/gain of a channel, first users have to update both offset/gain registers, then have to write a value to this update offset/gain holding register.

The register content is a bitmap of each AN-SGCNV channel. Bit 0 represents channel 0 and bit 13 represents channel 13. Writing 1 for each bit triggers offset/gain update for each channel. For example, to trigger offset/gain update for channel 0 and 13, the user first have to update both offset/gain registers for those channels, then have to write 0x2001 to this register.

* 1. Channel Setup

This input register represents channel setup for each channel of AN-SGCNV board. The register content is as follows.

|  |  |
| --- | --- |
| Bit 432 | Channel setup  000 – unused  001 – temperature  010 – inclinometer  011 – pressure  1xx – setup from PC |

* 1. Update Channel Setup

Due to interface protocol with AN-SGCNV board, updating only channel setup registers doesn’t trigger any actual update on AN-SGCNV board. To update channel setup,

1. User should update channel setup values for the whole 14 channels  
   Channel setup update isn’t performed on per channel basis due to interface protocol with AN-SGCNV.
2. Write 1 to update channel setup register.
   1. Filter

Filter is used to calculate the final data using the following equation.

mes\_data = mes\_data + (temperature\_data – mes\_data) / ((float)filter + 1.0)

Filter is an 8 bit unsigned value.

* 1. Update Filter

Due to interface protocol with AN-SGCNV board, P/T/O filters should be updated simultaneously. So updating individual P/T/O filter register doesn’t trigger actual update on AN-SGCNV board.

To update filter values, users should follow the following procedure.

1. Update P/T/O filter registers
2. Write 1 to Update Filter register
3. ZB485 MODBUS Registers

|  |  |  |
| --- | --- | --- |
| Register Type | Address | Description |
| Coil | 10000 | ZB485 Port 1 Power |
| Coil | 10001 | ZB485 Port 2 Power |
| Coil | 10002 | ZB485 Port 3 Power |
| Coil | 10003 | ZB485 Port 4 Power |
| Coil | 10004 | ZB485 Port 5 Power |
| Coil | 10005 | ZB485 Port 6 Power |
| Coil | 10006 | ZB485 Port 7 Power |
| Coil | 10007 | ZB485 Port 8 Power |
| Discrete Input | 10000 | ZB485 Port 1 Communication Status |
| Discrete Input | 10001 | ZB485 Port 2 Communication Status |
| Discrete Input | 10002 | ZB485 Port 3 Communication Status |
| Discrete Input | 10003 | ZB485 Port 4 Communication Status |
| Discrete Input | 10004 | ZB485 Port 5 Communication Status |
| Discrete Input | 10005 | ZB485 Port 6 Communication Status |
| Discrete Input | 10006 | ZB485 Port 7 Communication Status |
| Discrete Input | 10007 | ZB485 Port 8 Communication Status |
| Holding | 10000 | ZB485 Port 1 Sensor Type |
| Holding | 10001 | ZB485 Port 2 Sensor Type |
| Holding | 10002 | ZB485 Port 3 Sensor Type |
| Holding | 10003 | ZB485 Port 4 Sensor Type |
| Holding | 10004 | ZB485 Port 5 Sensor Type |
| Holding | 10005 | ZB485 Port 6 Sensor Type |
| Holding | 10006 | ZB485 Port 7 Sensor Type |
| Holding | 10007 | ZB485 Port 8 Sensor Type |
| Holding | 20000 | UART-0 Response Delay |
| Holding | 20001 | UART-1 Response Delay |
| Coil | 40000 | Reset EEPROM content |
| Input | 30000 | Firmware Version |
| Holding | 32000 | Running Mode |

**All the 16 bit registers are in big-endian format, that is, high byte comes first.**

* 1. Port Power

These registers represent power on/off status of ports on ZB485 board. 1 represents power on and 0 represents power off. Writes to these registers are saved to internal EEPROM and preserved across power cycle.

* 1. Communication Status

These registers represent communication status of each port of ZB485 board. 1 represents communication OK and 0 represents communication failure.

* 1. Sensor Type

These registers represent sensor type connected to each port of ZB485 board. Its contents are described in the following table. Writes to these registers are saved to internal EEPROM and preserved across power cycle.

|  |  |
| --- | --- |
| 0 | AN-SGCNV |
| 1 | WIS |
| 2 | Radar |

* 1. Reset EEPROM content

By writing Logic High (1) to this MODBUS coil register, MODBUS masters can reset the EEPROM content to factory default. The change is in effect immediately and all the EEPROM contents are set to factory default.

* 1. Firmware Version

Firmware version reflects current firmware version installed on the board.

Version number 234 means version “2.34”.

* 1. Running Mode

Running Mode holding register reflects current running mode of the board. There are two running modes defined. The following modes are defined.

|  |  |
| --- | --- |
| Mode | Description |
| 0 | Bootloader Mode  Bootloader mode is used to upgrade firmware. |
| 1 | Application Mode  Application Mode is normal mode and application firmware is run in this mode |

By writing to running mode register, users can change running mode

* 1. Response Delay

Response Delay is a feature to delay the transmission of actual MODBUS response for a specified time in millisecond after handling of a MODBUS request. The response delay value ranges from 0ms to 5000ms. The default value of response delay is 0ms.

