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N3410 Modbus

N3410 Series Programming Guide
Modbus Protocol

Modbus

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1 Preface

Dear Customers,

First of all, we greatly appreciate your choice of N3410 series DC power supply (N3410 for short). We are also honored to introduce our company, Hunan Next Generation Instrumental T&C Tech. Co.,Ltd. (NGI for short).

About Company

NGI is a professional manufacturer of intelligent equipment and test & control instruments, committed to developing, manufacturing battery simulators, power supplies, electronic loads, and many more instruments. The products can be widely used in the industries of battery, power supply, fuel cell, consumer electronics, new energy vehicle, semiconductor, etc.

NGI maintains close cooperation with many universities and scientific research institutions, and maintains close ties with many industry leaders. We strive to develop high-quality, technology-leading products, provide high-end technologies, and continue to explore new industry measurement and control solutions.

About Manual

This manual is applied to N3410 series DC power supply, including programming guide based on standard Modbus protocol. The copyright of the manual is owned by NGI. Due to the upgrade of instrument, this manual may be revised without notice in future versions.

This manual has been reviewed carefully by NGI for the technical accuracy. The manufacturer declines all responsibility for possible errors in this operation manual, if due to misprints or errors in copying. The manufacturer is not liable for malfunctioning if the product has not correctly been operated.

To ensure the safety and correct use of N3410, please read this manual carefully, especially the safety instructions.

Please keep this manual for future use.

Thanks for your trust and support.

2 Safety Instructions

In the operation and maintenance of the instrument, please strictly comply with the following safety instructions. Any performance regardless of attentions or specific warnings in other chapters of the manual may impair the protective functions provided by the instrument.
NGI shall not be liable for the results caused by the neglect of those instructions.

2.1 Safety Notes

- **Confirm the AC input voltage before supplying power**.
- **Reliable grounding**: Before operation, the instrument must be reliably grounded to avoid the electric shock.
- **Confirm the fuse**: Ensure to have installed the fuse correctly.
- **Do not open the chassis**: The operator cannot open the instrument chassis. Non-professional operators are not allowed to maintain or adjust it.
- **Do not operate under hazardous conditions**: Do not operate the instrument under flammable or explosive conditions.
- **Confirm the working range**: Make sure the DUT is within N3410's rated range.

2.2 Safety Symbols

Please refer to the following table for definitions of international symbols used on the instrument or in the user manual.

Table 1

Symbol	Definition	Symbol	Definition
⎓	DC (direct current)	N	Null line or neutral line
~	AC (alternating current)	L	Live line
≂	AC and DC	I	Power-on
3~	Three-phase current	O	Power-off
⏚	Ground	⏻	Back-up power
⏚	Protective ground	⏹	Power-on state
⏚	Chassis ground	⏹	Power-off state
⊥	Signal ground	⚠	Risk of electric shock
WARNING	Hazardous sign	⚠	High temperature warning
Caution	Be careful	⚠	Warning

3 Modbus Overview

Modbus protocol was originally developed by Modicon. At the end of 1979, Modicon became part of Schneider Automation. Now Modbus is the most popular protocol in industrial field. This protocol supports traditional serial link RS-232, RS-422, RS-485 and Ethernet. Many industrial equipment including PLC, DCS, smart meters, etc. are adopting Modbus protocol as the communication standard among them.

Modbus protocol includes ASCII, RTU, TCP, etc., which does not specify the physical layer. This protocol defines the message structure which the controller can recognize and use, regardless of what kind of network they communicate through. The standard Modicon controller uses RS232C to achieve serial Modbus. Modbus's ASCII and RTU protocols stipulate the structure of messages and data, the way of inquiry and answer. The data communication adopts master/slave method. The master station sends out a data request message. The slave station sends data to the master station for responding to the request after receiving the correct message. The master station can also directly send messages to modify the data of slave station to realize bidirectional reading and writing.

If the data format is not easy for understanding, it is recommended to use the tools "Modbus Poll", "Modbus Slave" to send and receive data packets, and "AccessPort" to capture the contents of data packets for analysis.

4 Modbus RTU Description

1) Multiple bytes apply Big-Endian.
2) The starting addresses of all readable and writable registers are even numbers.
3) The readable and writable numbers are even numbers.
4) 4 bytes are applied.
   For example, the value of register address 2 is written as 0x12345678. Then the hexadecimal number of the written data packet is:
   01 10 00 02 00 02 04 56 78 12 34 EE 90
5) The read register adopts the function code 0x03. The write register adopts the function code 0x10. Other function codes are reserved.
6) ID in the following ranges from 1 to 248. Value 255 means a broadcast packet which does not need to be returned.

5 Modbus RTU Protocol Format

5.1 Master Computer Reading Multiple Registers (0x03)

5.1.1 Master Computer Sending

ID	FunctionCode	StartReg	RegCount	Checksum

Field	No. of Bytes	Definition
ID	1	Device/card ID
FunctionCode	1	Fixed as 0x03
StartReg	2	To read start register
RegCount	2	To read register counts
Checksum	2	CRC value of all data except itself

5.1.2 Slave Computer Correct Return

ID	FunctionCode	RegDataBytes	RegData	Checksum

Field	No. of Bytes	Definition
ID	1	Device/card ID
FunctionCode	1	Fixed as 0x03
RegDataBytes	1	Register data bytes, RegCount*2 in practice
RegData	2* RegCount	Register data
Checksum	2	CRC value of all data except itself

5.2 Master Computer Writing Multiple Registers (0x10)

5.2.1 Master Computer Sending

ID	FunctionCode	StartReg	RegCount	RegDataBytes	RegData	Checksum

Field	No. of Bytes	Definition
ID	1	Device/card ID
FunctionCode	1	Fixed as 0x10
StartReg	2	To write start register
RegCount	2	To write register counts

RegDataBytes	1	Register data bytes, RegCount*2 in practice
RegData	2* RegCount	Register data
Checksum	2	CRC value of all data except itself

5.2.2 Slave Computer Correct Return

ID	FunctionCode	StartReg	RegCount	Checksum

Field	No. of Bytes	Definition
ID	1	Device/card ID
FunctionCode	1	Fixed as 0x10
StartReg	2	To write start register
RegCount	2	To write register counts
Checksum	2	CRC value of all data except itself

6 Operation

6.1 Channel Selection

Address: 2
Attribute: WR
Type: Uint32
Byte: 4Byte
Parameters: 1: the first channel
2: the second channel
3: the third channel

6.2 Output Mode Selection

Address: 4
Attribute: WR
Type: Uint32
Byte: 4Byte
Parameters: 0: normal mode
1: parallel mode
2: series mode
3: trace mode

Note: Before selecting the output mode, please turn off output of channel one&two. And channel one should be selected.

6.3 ON/OFF Switch

Address: 6
Attribute: WR
Type: Uint32
Byte: 4Byte
Parameters: 0: OFF
1: ON

6.4 Voltage Setting

Address: 8
Attribute: WR
Type: Float
Byte: 4Byte
Unit: V
Description: The setting value should be within the rated voltage. Rated voltage can be read via register 16.

6.5 Current Setting

Address: 10
Attribute: WR
Type: Float
Byte: 4Byte
Unit: A
Description: The setting value should be within the rated current. Rated current can be read via register 18.

6.6 Readback Voltage

Address: 12
Attribute: RO
Type: Float

Byte: 4Byte
Unit: V

6.7 Readback Current

Address: 14
Attribute: RO
Type: Float
Byte: 4Byte
Unit: A

6.8 Rated Voltage

Address: 16
Attribute: RO
Type: Float
Byte: 4Byte
Unit: V
Description: The setting value should be within the rated voltage.

6.9 Rated Current

Address: 18
Attribute: RO
Type: Float
Byte: 4Byte
Unit: A
Description: The setting value should be within the rated current.

6.10 Parallel Mode

Address: 20
Attribute: WR
Type: Uint32
Byte: 4Byte
Parameters: 0: disabling the parallel mode. The device is under normal state now.
1: enabling the parallel mode. It is equal to that the register 2 is set to 1.

Note: Before selecting the output mode, please turn off output of channel one&two. And channel one should be selected.

6.11 Series Mode

Address: 22
Attribute: WR
Type: Uint32
Byte: 4Byte
Parameters: 0: disabling the series mode. The device is under normal state now.
1: enabling the series mode. It is equal to that the register 2 is set to 2.

Note: Before selecting the output mode, please turn off output of channel one&two. And channel one should be selected.

6.12 Trace Mode

Address: 24
Attribute: WR
Type: Uint32
Byte: 4Byte
Parameters: 0: disabling the trace mode. The device is under normal state now.
1: enabling the trace mode. It is equal to that the register 2 is set to 3.

Note: Before selecting the output mode, please turn off output of channel one&two. And channel one should be selected.

6.13 Alarm

Address: 26
Attribute: WR
Type: Uint32
Byte: 4Byte
Parameters: Bit1: over voltage
Bit2: over current
Bit4: over temperature
Bit5: temperature sensor failure

Note: To clear the alarm, please write 0.

6.14 Over Current Protection(OCP) Setting

Address: 28
Attribute: WR
Type: Float
Byte: 4Byte
Unit: A
Description: CH1/CH2 of N3411/N3411P/N3411E OVP setting range: 1~3.25A
CH3 of N3411/N3411P/N3411E OVP setting range: 1~3.25A
CH1/CH2 of N3412/N3412P/N3412E OVP setting range: 1~5.35A
CH3 of N3412/N3412P/N3412E OVP setting range: 1~3.25A
CH1/CH2 of N3413/N3413P/N3413E OVP setting range: 1~3.25A
CH3 of N3413/N3413P/N3413E OVP setting range: 1~3.25A

6.15 Over Voltage Protection(OVP) Setting

Address: 30
Attribute: WR
Type: Float
Byte: 4Byte
Unit: V
Description: CH1/CH2 of N3411/N3411P/N3411E OVP setting range: 3~34.12V
CH3 of N3411/N3411P/N3411E OVP setting range: 3~6.8V
CH1/CH2 of N3412/N3412P/N3412E OVP setting range: 3~34.12V
CH3 of N3412/N3412P/N3412E OVP setting range: 3~6.8V
CH1/CH2 of N3413/N3413P/N3413E OVP setting range: 3~63.5V
CH3 of N3413/N3413P/N3413E OVP setting range: 3~6.8V

6.16 DVM Readback

Address: 200
Attribute: R0
Type: Float
Byte: 4Byte
Unit: V

6.17 DVM Present Range

Address: 202
Attribute: R0
Type: Uint32

Byte: 4Byte

7 Register List

Address	Name	Read/Write	Data Type	Description
2	Channel Selection	WR	Uint32	1: the first channel 2: the second channel 3: the third channel
4	Output Mode Selection	WR	Uint32	0: normal mode 1: parallel mode 2: series mode 3: trace mode Note: Before selecting the output mode, please turn off output of channel one&two. And channel one should be selected.
6	ON/OFF Switch	WR	Uint32	0: OFF 1: ON
8	Voltage Setting	WR	Float	The setting value should be within the rated voltage. Rated voltage can be read via register 16.
10	Current Setting	WR	Float	The setting value should be within the rated current. Rated current can be read via register 18.
12	Readback Voltage	RO	Float	Unit: V
14	Readback Current	RO	Float	Unit: A
16	Rated Voltage	RO	Float	The setting value should be within the rated voltage.
18	Rated Current	RO	Float	The setting value should be within the rated current.
20	Parallel Mode	WR	Uint32	0: disabling the parallel mode. The device is under normal state now. 1: enabling the parallel mode. It is equal to that the register 2 is set to 1. Note: Before selecting the output mode, please turn off output of channel one&two. And channel one should be selected.

22	Series Mode	WR	Uint32	0: disabling the series mode. The device is under normal state now. 1: enabling the series mode. It is equal to that the register 2 is set to 2. Note: Before selecting the output mode, please turn off output of channel one&two. And channel one should be selected.
24	Trace Mode	WR	Uint32	0: disabling the trace mode. The device is under normal state now. 1: enabling the trace mode. It is equal to that the register 2 is set to 3. Note: Before selecting the output mode, please turn off output of channel one&two. And channel one should be selected.
26	Alarm	WR	Uint32	Bit1: over voltage Bit2: over current Bit4: over temperature Bit5: temperature sensor failure Note: To clear the alarm, please write 0.
28	Over Current Protection(OCP) Setting	WR	Float	CH1/CH2 of N3411/N3411P/N3411E OVP setting range: 1~3.25A CH3 of N3411/N3411P/N3411E OVP setting range: 1~3.25A CH1/CH2 of N3412/N3412P/N3412E OVP setting range: 1~5.35A CH3 of N3412/N3412P/N3412E OVP setting range: 1~3.25A CH1/CH2 of N3413/N3413P/N3413E OVP setting range: 1~3.25A CH3 of N3413/N3413P/N3413E OVP setting range: 1~3.25A

30	Over Voltage Protection(OVP) Setting	WR	Float	CH1/CH2 of N3411/N3411P/N3411E OVP setting range: 3~34.12V CH3 of N3411/N3411P/N3411E OVP setting range: 3~6.8V CH1/CH2 of N3412/N3412P/N3412E OVP setting range: 3~34.12V CH3 of N3412/N3412P/N3412E OVP setting range: 3~6.8V CH1/CH2 of N3413/N3413P/N3413E OVP setting range: 3~63.5V CH3 of N3413/N3413P/N3413E OVP setting range: 3~6.8V
200	DVM Readback	RO	Float	Unit: V
202	DVM Present Range	RO	Uint32	