B Series
Modular Integrated I/O

User Manual

V1.08

B Series - Modular Integrated I/O

Odot Automation System Co., Ltd.

Version Information

Date	Version	Content	Author
2021-04-20	V1.00	Release version	GJ/CCL
2021-07-27	V1.01	Updated AI and AO module	CCL
2021-08-16	V1.02	Updated wiring diagram	CCL
2022-03-22	V1.03	Updated BN-8011, BN-8021	CCL
2022-06-20	V1.04	Updated BT-5102, BT-5112, BT-5121, BT-5141	CCL
2023-07-12	V1.05	Updated IO selection data sheet	XWL
2023-11-02	V1.06	Updated BT-3168	QYZ
2024-05-09	V1.07	Updated BN-8031-68S, BN-8031-6V	QYZ/LY
2024-08-02	V1.08	Updated BT-5312	YPP

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Content

1 Product Overview

ODOT B series integrated I/O module consists of communication board (COMM board) module and extended IO module. The COMM board module is responsible for the fieldbus communication and realizes the communication connection with the master controller or the upper computer software.

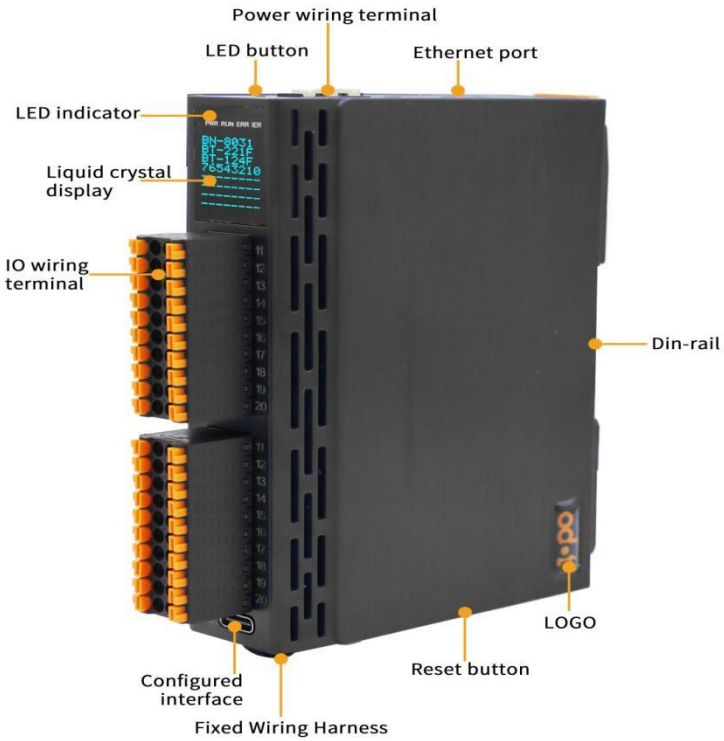
The extended IO module is responsible for connecting the input and output sensors on the site. The input IO module collects various signals on the site and sends them to the COMM board through the internal bus. And the controller reads and processes data from the COMM board through the field bus, and then writes the output data to the COMM board. So, the COMM board could write the output data to the output IO module through the internal bus, thus realizing the control of the device.

The COMM board could select the corresponding bus module according to the communication interface of the controller system. The mainstream industrial communication protocols include Modbus-TCP, Modbus-RTU, Profibus-DP, Profinet, EtherCAT, EtherNet/IP, CANopen, CC-Link, PowerLink, etc. The extended I/O module is divided into six categories: digital input module, digital output module, analog input module, analog output module, special module, and hybrid I/O module.

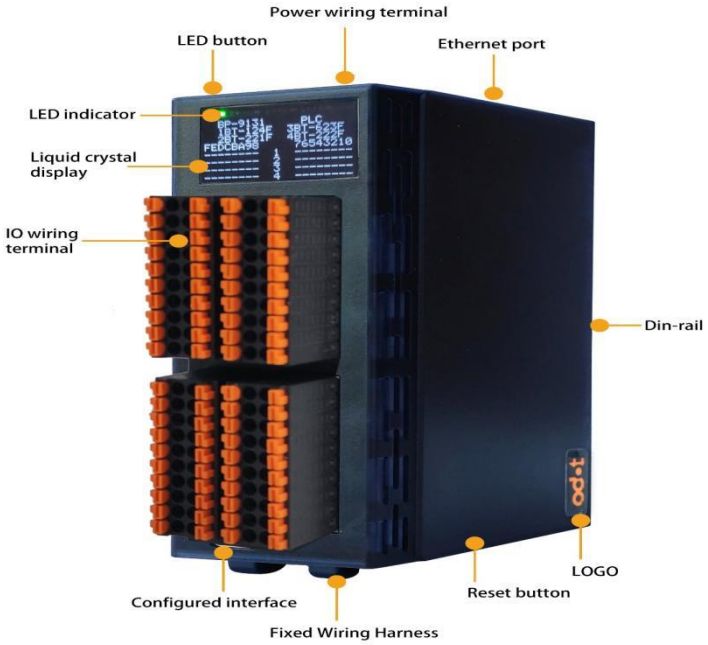
The COMM board and extended IO module modules could be freely combined based field requirements. The integrated IO module could lower the cost when there are few data points.

1.1 Module Feature

B32



B64



1. It could support a variety of communication protocols and IO point expansion of various PLC brands, such as Siemens, Omron, Delta, Mitsubishi, Rockwell, Beckhoff, Keyence, etc.

2. It carries optional modular IO. Each single module supports a max of 16 channels.

3. It could support max expansion of 4 modules, with a total of 64 channels.

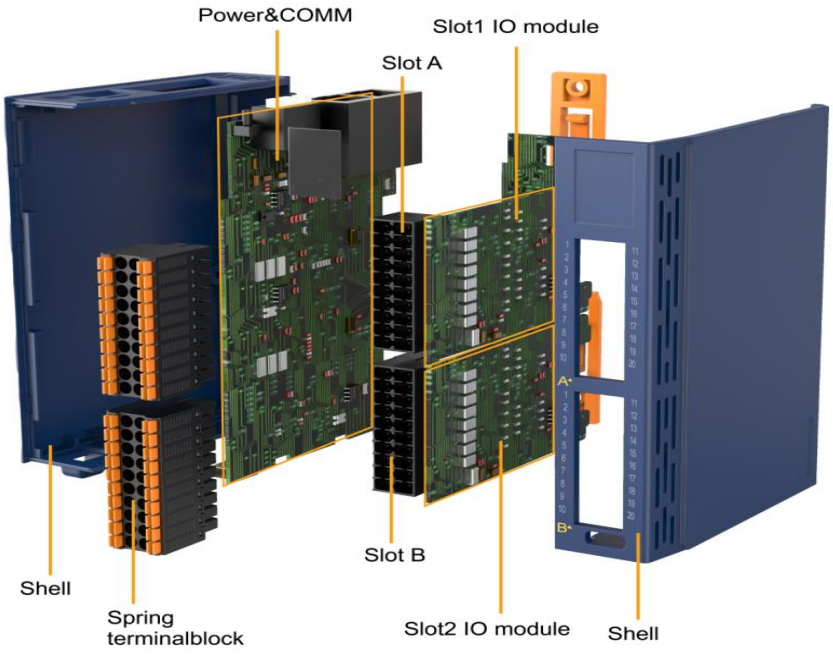
4. It carries LCD Display and communication parameters, IO channel status, module version and other information could be viewed.

5. It is designed with plastic shell, compact size, easy to install.

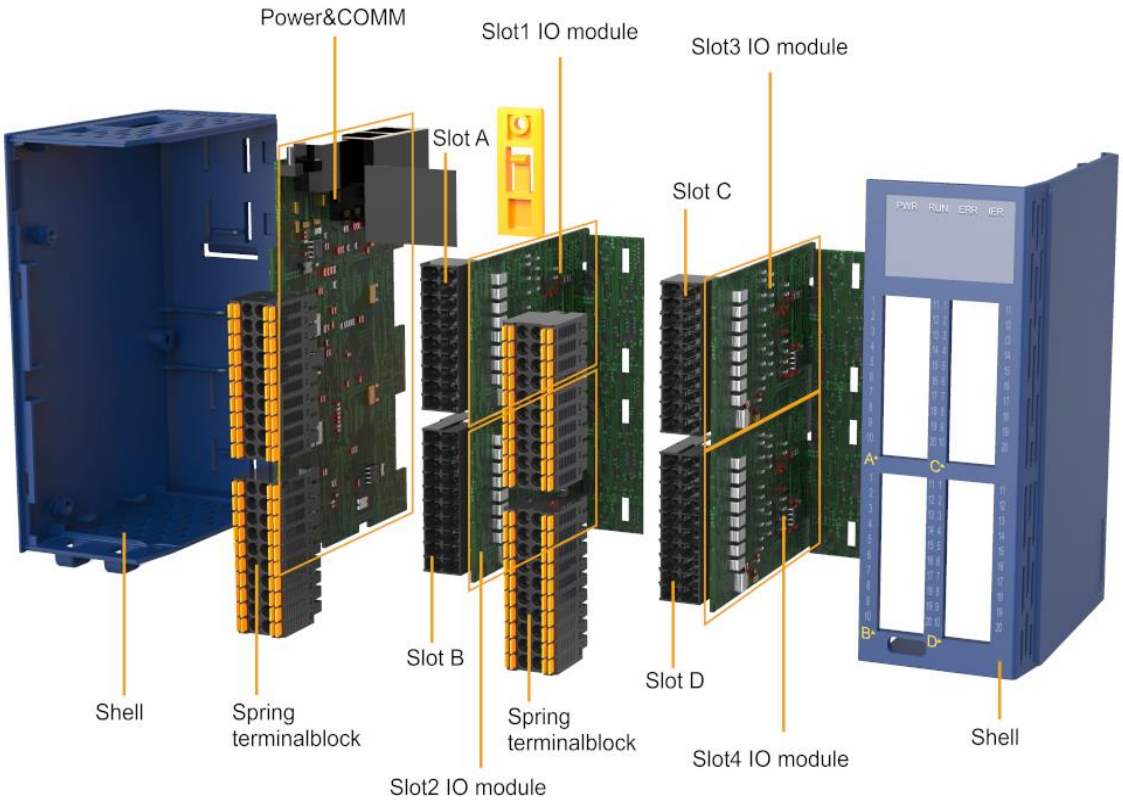
1.2 Module Structure

ODOT B series is integrated I/O module with modular combinations inside. The power supply and COMM board are at the bottom, and the IO module communicates with the COMM board through the backplane (the green module as below). It could support expansion max of 4 IO slots (only 2 IO slots are installed in below diagram).

B32



B64


Power&COMM
Slot1 IO module
Slot3 IO module
Slot A
Slot C
Slot B
Slot D
Shell
Spring terminalblock
Spring terminalblock
Slot2 IO module
Slot4 IO module
Shell

1.3 Module selection table

No.	Name	Model	Installation slots	Module sort	Product Series	IO type	IO point	Module description	Status
1	B32	BOXIO-32	/	32 channel sets	BOXIO	/	/	32 channel shell, small LCD display, 32 backplanes	Published
2	B64	BOXIO-64	/	64 channel sets	BOXIO	/	/	64 channel shell, big LCD display, 64 backplanes	Published
1	-MR	BN-8011	/	COMM board	BOXIO	/	/	Modbus-RTU slave function	Published
2	-CA	BN-8021	/	COMM board	BOXIO	/	/	CANopen slave function	Published
3	-MT	BN-8031	/	COMM board	BOXIO	/	/	Modbus-TCP slave function	Published
4	-MT6V	BN-8031-6V	/	COMM board	BOXIO	/	/	Modbus-TCP slave function, 8DI&8DO	Published
5	-MT68S	BN-8031-68S	/	COMM board	BOXIO	/	/	Modbus-TCP slave &Modbus-RTU master function, 4DI&4DO	Published
6	-PN	BN-8032	/	COMM board	BOXIO	/	/	Profinet slave function	Published
7	-EC	BN-8033	/	COMM board	BOXIO	/	/	EtherCAT slave function	Published
8	-EP	BN-8034	/	COMM board	BOXIO	/	/	EtherNet/IP slave function	Published
9	-PK	BN-8035	/	COMM board	BOXIO	/	/	PowerLink slave function	Unpublished
10	-CF	BN-8036	/	COMM board	BOXIO	/	/	CC-Link IE Field slave function	Unpublished
11	-CB	BN-8037	/	COMM board	BOXIO	/	/	CC-Link IE Field Basic slave function	Unpublished
0	-00	Empty	Slots 1, 2, 3, 4	Name only	BOXIO	/	/	Indicates that the corresponding slot is vacant	Published
1	-11	BT-124F	Slots 1, 2, 3, 4	DI	BOXIO		16	16 channel / digital input / 24VDC /dual direction, the input high&low level is valid	Published
2	-25	BT-221F	Slots 1, 2, 3, 4	DO	BOXIO		16	16 channel / digital output / 24VDC / sink, the output low level is valid	Published
3	-26	BT-222F	Slots 1, 2, 3, 4	DO	BOXIO		16	16 channel / digital output / 24VDC / source, the output high level is valid	Published
4	-3A	BT-3158	Slots 1, 2, 3, 4	AI	BOXIO		8	8 channels voltage input, 0~5VDC/0~10VDC/±5VDC/±10VDC, 12-bit	Published
5	-3G	BT-3168	Slots 1, 2, 3, 4	AI	BOXIO		8	8 channels voltage input, 0~5VDC/0~10VDC/±5VDC/±10VDC, 16 bit	Published

6	-3B	BT-3238	Slots 1, 2, 3, 4	AI	BOXIO		8	8 channels / current input / 0&4-20mA, 16 bit single-ended,	Published
7	-3C	BT-3244	Slots 1, 2, 3, 4	AI	BOXIO		4	4 channels/current input /0&4-20mA, ±20mA, 16-bit, single-ended bipolar,	Published
8	-3D	BT-3714	Slots 1, 2, 3, 4	AI	BOXIO		4	4 channels thermal resistance input, RTD-PT100	Published
9	-3E	BT-3724	Slots 1, 2, 3, 4	AI	BOXIO		4	4 channels thermal resistance input, RTD-PT1000	Published
10	-3F	BT-3804	Slots 1, 2, 3, 4	AI	BOXIO		4	4 channels Thermocouple input, TC-J / K/ E / T / S / R / B / N type, fixed filtering parameters	Published
11	-4P	BT-4234	Slots 1, 2, 3, 4	AO	BOXIO		4	4 channels current output, 0&4-20mA, 16-bit, single-ended,	Published
12	-4Q	BT-4154	Slots 1, 2, 3, 4	AO	BOXIO		4	4 channels voltage output, 0~5VDC/0~10VDC/±5VDC/±10VDC, 16-bi	Published
13	-5A	BT-5102	Slots 1, 2, 3, 4	Special module	BOXIO		2	2 channels orthogonal/pulse encoder input, 5V single-ended, 1.5MHz	Published
14	-5B	BT-5112	Slots 1, 2, 3, 4	Special module	BOXIO		2	2 channels orthogonal/pulse encoder input, 24V single-ended, 1.5MHz	Published
15	-5C	BT-5121	Slots 1, 2, 3, 4	Special module	BOXIO		1	1 channel SSI encoder input, 5V differential, 2MHz	Published
16	-5D	BT-5141	Slots 1, 2, 3, 4	Special module	BOXIO		1	1 channel orthogonal/pulse encoder input, 5V differential, 10MHz	Published
17	-5E	BT-5212	Slots 1, 2, 3, 4	Special module	BOXIO				Unpublished
18	-5F	BT-5222	Slots 1, 2, 3, 4	Special module	BOXIO				Unpublished
19	-5G	BT-5312	Slots 1, 2, 3, 4	Special module	BOXIO	/	/	2-Channel Modbus Serial Port Module	Published
20	-6V	BT-623F	Slots 1, 2, 3, 4	DI & DO	BOXIO		8/8	8 channels / digital input, source & sink /NPN&PNP/ 24VDC, supports counter function (counter frequency up to 200Hz); 8 channels / digital output / source / PNP / 24Vdc/0.5A	Published

For example, the I/O module type **B32-MT-11-26** consists of the following sub-modules:

Set	COMM Board	Slot 1	Slot 2
B32	BN-8031	BT-124F	BT-222F

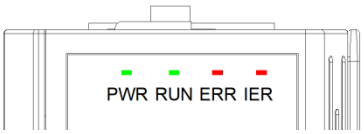
The I/O module type **B64-PN-11-11-26-26** consists of the following sub-modules:

Set	COMM Board	Slot 1	Slot 2	Slot 3	Slot 4
B64	BN-8032	BT-124F	BT-124F	BT-222F	BT-222F

Note: Details, please see the selection table above.

1.4 LED Indicator

Users can easily check the power status and communication status of the COMM board and I/O module, as well as the running status of the I/O channel through the LED status indicator. For details about the indicator status, please check each COMM board.

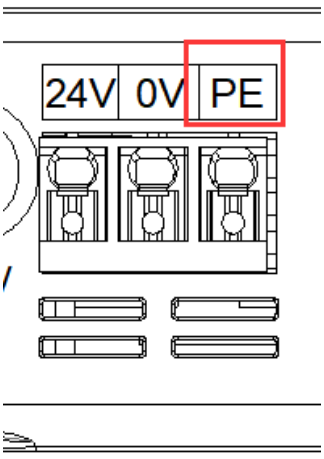


1.5 LCD (Liquid Crystal Display)

The front of the module provides 8*8 OR 16*8 LCD to view the module type, IO channel working status, and version information. For details about the LCD, please check the corresponding chapter of the corresponding module.

1.6 Ground Protection

In order the system and the system connected instrument could all run reliably and ensure the measurement and control accuracy. The module is provided with a ground terminal at the top.



1.7 Wiring

Using push-in connection to connect single wire or crimp terminal (ferrule) wire, no need any other tools. It could save wiring time for users regardless of wiring experience, and ensure safe connection.

The IO carries wiring harness at the bottom of the module. It could fix cables when the I/O module is connected to multiple cables.

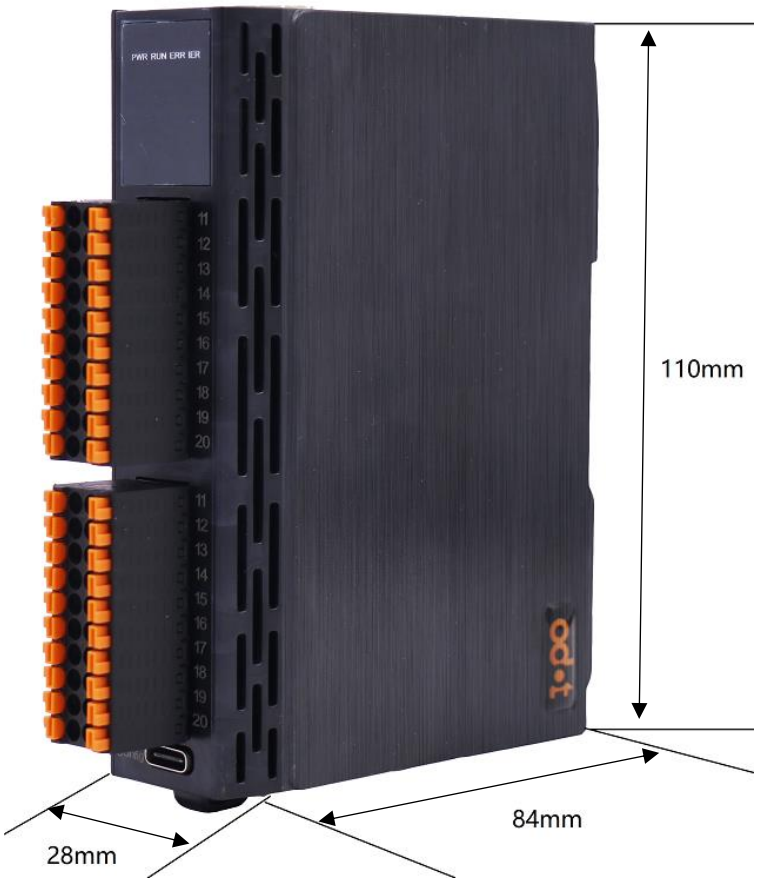
1.8 DIN-Rail installation

DIN-Rail Lock could be safely and reliably installed on 35 mm DIN-Rail.

1.9 Installation Size

B32 module installation size: 110*84*28mm,

Plused IO wiring terminal size: 110*100*28mm



2 Communication Board (COMM Board)

BN-8011: Modbus-RTU COMM Board

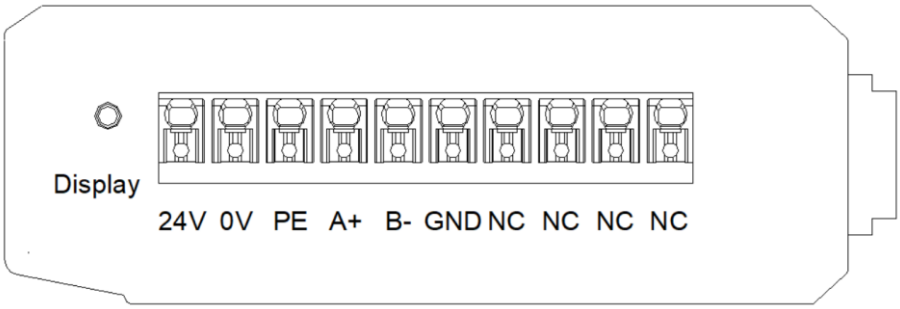
1 The COMM board overview

CN-8011 Modbus-RTU bus adapter supports standard Modbus-RTU communication, it supports function code of 01/02/03/04/05/06/15/16/23, and this device could monitor the IO module communication state in real time.

2 Technical parameters

Adapter Hardware Parameter	
System Power	Nominal: 24Vdc, Range: 19.2～28.8Vdc Protection: Reverse Protection, Overcurrent Protection
Power Consumption	30mA@24Vdc
Internal Bus Supply Current	Max: 2.5A@5VDC
Isolation	System Power to Field Power Isolation
Power Supply	Nominal: 24Vdc, Range: 19.2～28.8Vdc
Field Power Current	Max. DC 8A
IO Modules Supported	B32: 2pcs, B64: 4pcs
Wiring	Max.1.5mm² (AWG 16)
Mounting Type	35mm DIN-Rail
Environment Specification	
Operation Temperature	-30~75℃
Operation Humidity	5%-95% (No Condensation)
Ingress Protection Rating	IP20
Modbus-RTU Parameter	
Protocol	Modbus-RTU/ASCII
Function Code	01 / 02 / 03 / 04 / 05 / 06 / 15 / 16/ 23
Process data area	The sum of input and output is a maximum of 8192 bytes
Baud Rate	2400~115200bps
Station No.	1~63 (Dial-code switch configuration), 64~247 (Software configuration)
Interface	10 Pin screw terminal
Data Bits	7, 8
Parity Checking	None, Even, ODD
Stop Bit	1, 2
Max. bus length	1200m (RS485, 2400 baud rate)
Terminal resistance and offset resistance	N/A

3 Hardware Interface



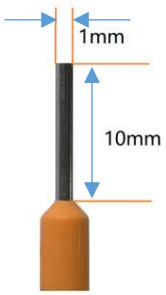
3.1 System power supply and RS485 port

10PIN terminals are used for device wiring, and the terminal definition is as shown in the figure below:

Pin	Identification	Definition
1	NC	Not used
2	NC	Not used
3	NC	Not used
4	NC	Not used
5	GND	Signal Grounded
6	B-	RS 485 B-
7	A+	RS 485 A+
8	PE	Protect Earthing
9	0V	Power input negative
10	24V	Power input positive

It is recommended to use cables with cores greater smaller than 1mm.

The cold-pressed terminal parameters are as follows:



3.2 Reset button

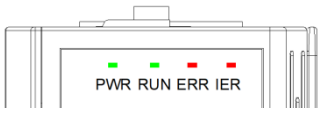
Reset: Press down the “RESET” button for 5 seconds, all parameters of the module will be restored to the default values.

3.3 Configuration Interface

Config

Config: configured ports, it is standard Type-C interface for configuring device parameters and firmware upgrades.

3.4 LED Indicator



PWR Power State (GREEN)	Definition
ON	System Power Normal
OFF	System Power Failure
RUN Network State (GREEN)	Definition
OFF	No data exchanging.
Flash	Modbus data exchanging
ERR Network Error (RED)	Definition
OFF	Modbus data exchanging error
Flash	Modbus data exchanging normal
IER bus Error (RED)	Definition
OFF	IO communication normal
Flash	IO communication failure

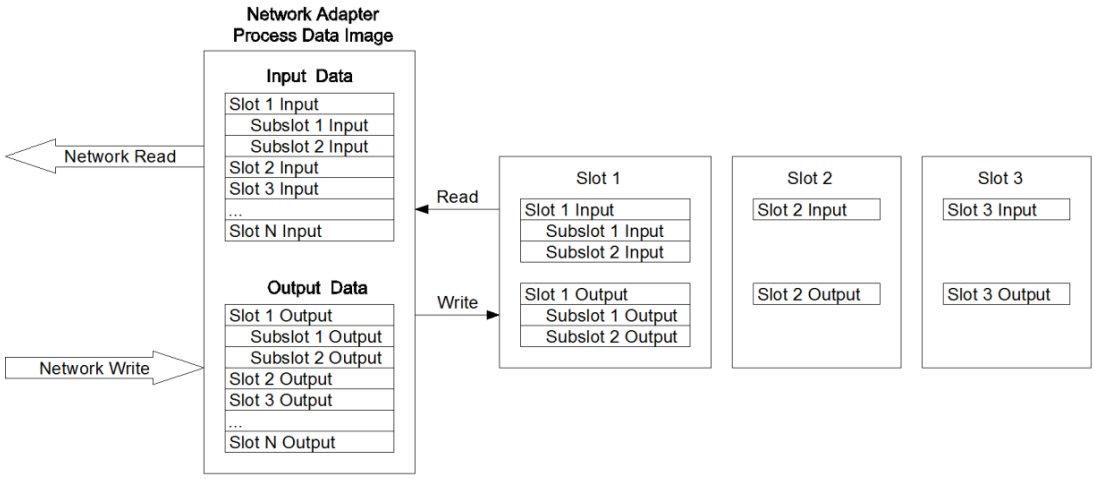
4 Process data definition

4.1 Communication board process data definition

The Modbus-RTU communication board has no input/output process data.

4.2 IO Module process data mapping

The network adapter reads and writes input and output process data of IO module in real time through the internal bus, and its data mapping model is shown as follow:



Modbus address mapping table varies according to module combination, and detailed.

address mapping table could be viewed through IO Config, the configuration software.

First way, can be checked through the IO Config configuration software, DI is mapped to area 1, DO is mapped to area 0, AI is mapped to area 3, and AO is mapped to area 4. Please check the address table in the IO Config configuration software for special module addresses.

Second way, DI, DO, AI, AO, and special module addresses are mapped to area 4, corresponding to different fixed address intervals respectively. The addresses of special modules are sorted in order according to the address table in IO Config. The mapped address intervals are shown in the following:

Module Type	Address offset		Read-write attribute
	Hexadecimal	Decimalist	
AO	0x0000	0	Read and Write
DO	0x3000	12288	Read and Write
AI	0x4000	16384	Read
DI	0x5000	20480	Read

5 Configuration parameter definition

Configuration Parameter								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved					Fault Action for Output	Fault Action for Input	Source of Configuration Data
Byte 1	Slave ID							
Byte 2 Byte 3 Byte 4 Byte 5	BaudRate							
Byte 6	Reserved		Serial Mode	Stop Bits		Parity Bits		Data Bits
Byte 7	Char Pitch							
Byte 8 Byte 9	Response Delay (ms)							
Byte 10	Reserved							
Byte 11	Reserved							
Byte 12	Reserved							
Byte 13	OLEDDisplay Time (min)							
Byte 14 ... Byte 29	Reserved							

Data description:

Source of Config Data: Parameter configuration mode (Default: 0)

0: Configuration Software

Fault Action for Input: Input fault handling mode, when IO module is offline, the adapter will process IO module input data according to this mode. (Default: 0, Hold Last Input Value)

0: Hold Last Input Value

1: Clear Input Value

Fault Action for Output: Output fault handling mode, when the IO module is offline, the adapter will process the IO module output data according to this mode. (Default: 1, Clearing Output Value)

0: Hold Last Output Value

1: Clearing Output Value

Slave ID: Modbus slave ID, hardware dial code or software configuration, 1-247

Baud Rate: Serial port baud rate, (Default: 2, 9600bps)

0: 2400bps

1: 4800bps

2: 9600bps

3: 14400bps

4: 19200bps

5: 38400bps

6: 57600bps

7: 115200bps

Data Bits: data bits (default: Bit 1, 8)

0: Bit 7

1: Bit 8

Parity Bits: Parity Checking, (default: 0, no parity)

0: None

1: ODD

2: EVEN

Stop Bits: stop bits (default: Bit 0, 1)

0: Bit 1

1: Bit 2

Serial Mode: Serial port mode (default: 0, RTU)

0: RTU

1: ASCII

Char Pitch: Character Pitch is the detection time of frame interval when receiving a message (T is the time of single character transmission, related to baud rate) (default: 2, 5 characters)

0: 1.5 characters

1: 3.5 characters

2: 5 characters

3: 10 characters

4: 20 characters

5: 50 characters

6: 100 characters

7: 200 characters

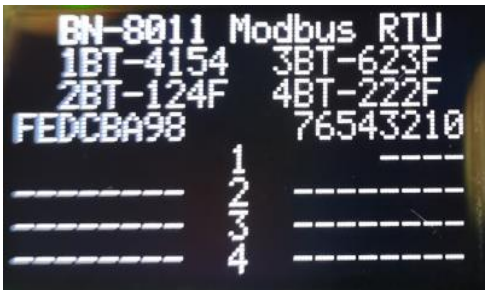
Response Delay (ms): Reply delay time from Slave, self-defined, default 10ms, effective range: 0-65535.

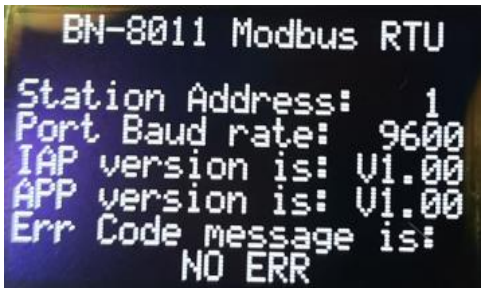
OLED Display Time: LCD display time (S), set to 0 the LCD is steady on.

6 LCD display Interface

B32 Display Interface:

B64 Display Interface:





Note: The module information display is a total of 2 pages, the first line of each page shows the slave station model, the first page mainly shows the module model and the channel status of the corresponding module, the second page shows the software version information, error code and so on.

7 System diagnostic area

Part 1: "Status Input" storage area, address 0x2000-0x2030, a total of 49 words.

No	Storage area	Description	Storage Capacity	Address Range	Read-write
1	Area 3	System diagnosis - Status input	49 Word	0x2000~0x2030	RO

Modbus client monitors the address area 0x2000~0x2068 by calling Modbus 04 function code to obtain the current working status and error code of the adapter and IO module, the data format is shown as below:

No.	Modbus Address (Decimalism)	Address (Hexadecimal)	Data Name	Description
1	8192	0x2000	Reset Mode	Reset State*
2	8193	0x2001	Reserve	
3	8194	0x2002	DIP switch value	
4	8195	0x2003	Running time - Second	
5	8196	0x2004	Running time - Minute	
6	8197	0x2005	Running time - Hour	
7	8198	0x2006	Running time - Day	
8	8199	0x2007	N/A	
9	8200	0x2008		
10	8201	0x2009		
11	8202	0x200A	N/A	
12	8203	0x200B		
13	8204	0x200C	N/A	
14	8205	0x200D		
15	8206	0x200E	N/A	
16	8207	0x200F		
17	8208	0x2010	DI-size	Discrete quantity input area data size
18	8209	0x2011	DO-size	Coil output area data size
19	8210	0x2012	AI-size	Input register area data size

20	8211	0x2013	AO-size	Holding register area data size
21	8212	0x2014	N/A	
22	8213	0x2015		
23	8214	0x2016	N/A	
24	8215	0x2017	N/A	
25	8216	0x2018	N/A	
26	8217	0x2019		
27	8218	0x201A	N/A	
28	8219	0x201B	N/A	
29	8220	0x201C		
30	8221	0x201D	N/A	
31	8222	0x201E	N/A	
32	8223	0x201F		
33	8224	0x2020	N/A	
34	8225	0x2021	N/A	
35	8226	0x2022		
36	8227	0x2023	N/A	
37	8228	0x2024	N/A	
38	8229	0x2025		
39	8230	0x2026	N/A	
40	8231	0x2027	Module_Error [0]	Module 0 error code
41	8232	0x2028		
42	8233	0x2029	Module_Error [1]	Module 1 error code
43	8234	0x202A		
44	8235	0x202B	Module_Error [2]	Module 2 error code
45	8236	0x202C		
46	8237	0x202D	Module_Error [3]	Module 3 error code
47	8238	0x202E		
48	8239	0x202F	Module_Error [4]	Module 4 error code
49	8240	0x2030		

*Reset state Register 38193 address data format is shown as below:

Address offset	Address name	Description	Power on default value
Bit 0	Power_On_Reset	Power on reset	0/1
Bit 1-3	Reserved	Reserved	0
Bit 4	External_Reset	External Reset	0/1
Bit 5	Reserved	Reserved	0
Bit 6	Soft_Reset_Request	Soft Reset	0
Bit 7	Reserved	Reserved	0
Bit 8	Hard Fault	Hard Fault Reset	0

Bit 9	Stack Over	Stack Over Reset	0
Bit 10	Memory Over	Memory Over Reset	0
Bit 11-15	Reserved	Reserved	0

BN-8021: CANopen COMM Board

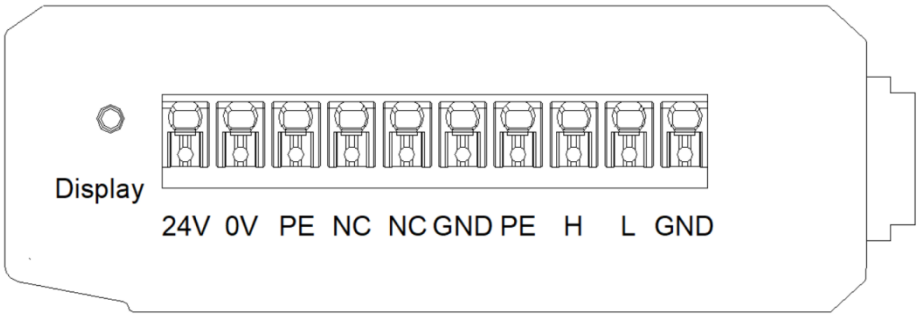
1 The COMM board overview

CN-8021 CANopen bus adapter supports standard CANopen communication and device specification DS401.

2 Technical parameters

COMM Board Hardware Parameter	
System Power	Nominal: 24Vdc, Range: 19.2～28.8Vdc Protection: Reverse Protection
Power Consumption	50mA@24Vdc
Internal Bus Supply Current	Max: 2.5A@5VDC
Isolation	System Power to Field Power Isolation
Power Supply	Nominal: 24Vdc, Range: 19.2～28.8Vdc
Field Power Current	Max. DC 8A
IO Modules Supported	B32: 2pcs, B64: 4pcs
Wiring	Max.1.5mm² (AWG 16)
Environment Specification	
Operation Temperature	-30~75℃
Operation Humidity	5%-95% (No Condensation)
Ingress Protection Rating	IP20
CANopen Parameter	
Protocol	CANopen DS401
Connect the interface	10PIN terminal
Station Address	Dial code setting (1-127)
Process Data	Input Max. 328 Byte Output Max. 328 Byte
Configuration Interface	Type-C
Transmission Rate	10 kbit/s, 20 kbit/s, 50 kbit/s, 100 kbit/s, 125 kbit/s, 250 kbit/s, 500 kbit/s, 800 kbit/s, 1000 kbit/s

3 Hardware Interface



3.1 System Power & Network Interface

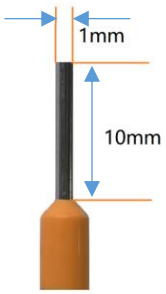
The device wiring adpots 10 Pin screw terminals and its Pin definition is as below:

CANopen interface pin definition

Pin	Definition	Description
1	GND	CAN Signal Grounded
2	L	CAN_L signal bus line
3	H	CAN_H signal bus line
4	PE	CAN Protecting Earthing
5	GND	Signal Grounded
6	NC	Empty
7	NC	Empty
8	PE	Ground terminal (Protect Earthing)
9	0V	Power input negative
10	24V	Power input positive

It is recommended to use cables with cores greater smaller than 1mm.

The cold-pressed terminal parameters are as follows:



3.2 Reset button

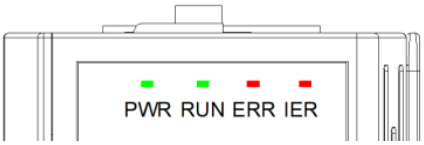
Reset: Press down the “RESET” button for 5 seconds, all parameters of the module will be restored to the default values.

3.3 Configuration Interface

Config

Config: configured ports, it is standard Type-C interface for configuring device parameters and firmware upgrades.

3.4 LED Indicator



PWR Power State (GREEN)	Definition
ON	System Power Normal
OFF	System Power Failure
RUN Network State (GREEN)	Definition
OFF	CANopen communication is established
Flash	CANopen communication is not established or disconnected
ERR Network Error (RED)	Definition
OFF	Not used
Flash	Not used
IER bus Error (RED)	Definition
OFF	IO communication normal
Flash	IO communication failure

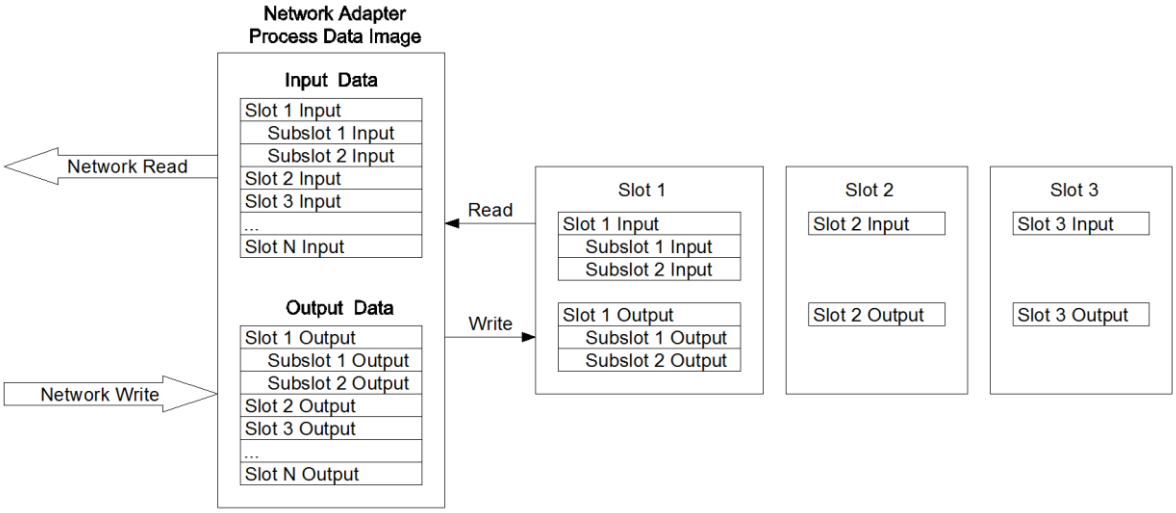
4 Process data definition

4.1 COMM board process data definition

CANopen COMM board itself has no input-output process data.

4.2 IO module process data mapping

The COMM board reads and writes input and output process data of IO module in real time through the internal bus, and its data mapping model is shown as follow:



Input and output data of the IO module are mapped to objects 6000, 6200, 6401, 6411 based on data types. TPDO and RPDO both support variable PDO mapping.

5 Configuration parameter definition

Configuration Parameter				
No.	Description			
Byte 0	Reserved	Fault Action for Output	Fault Action for Input	Source of Configuration Data
Byte 1	CAN BaudRate			
Byte 2	CANopen Slave Address			
Byte 3	Reserved		Auto Start	Auto Generate PDO COB-ID
Byte 4	OLED Display Time			
Byte 5 ... Byte 19	Reserved			

Data description:

Source of Configuration Data: Parameter configuration mode (Default: 0)

0: Configured software configuration is valid

1: Fieldbus controller configuration is valid

Fault Action for Input: Input data handling mode when IO occurs fault (Default: 0)

0: Hold Last Input Value

1: Clear Input Value

Fault Action for Output: Output data handling mode when IO occurs fault (Default: 1)

0: Hold Last Output Value

1: Clear Output Value

CANopen Slave Address: CANopen slave device number (read only, default: 1)

CAN BaudRate: CAN bus baud rate Settings (default: 2)

0: 1 MBit/sec

1: 800 kBit/sec

2: 500 kBit/sec

3: 250 kBit/sec

4: 125 kBit/sec

5: 100 kBit/sec

6: 50 kBit/sec

7: 20 kBit/sec

8: 10 kBit/sec

Auto Generate PDO COB-ID: PDO identifiers can be automatically assigned, the Enable and the Disable is optional. After the PDO identifier is enabled, the PDO identifier could be automatically assigned to the I/O module. After the PDO identifier is disabled, only 4 predefined PDO are available, and more PDO need to be set by the CANOPEN master. It is disabled by default.

Auto Start: The slave is automatically started. Enable and disable is optional. After this function is enabled, the site will proactively send a PDO message and uploads the message when there is data. It is disabled by default.

6 LCD display Interface:

B32 OLED display:

First page

Second page

Note: The module information displays are total of 2 pages. The first line of each page displays the slave station model. The first page mainly displays the module name and the channel status of the corresponding module. The second page displays the software version information and error code.

B64 OLED display:

First page

Second page

Note: The module information displays are total of 2 pages. The first line of each page displays the slave station model and types of slave station, The first page mainly displays the module name and the channel status of the corresponding module. The second page displays the software version information, some configuration parameters of the slave station and error code.

BN-8031: Modbus-TCP COMM Board

1 The COMM Board Overview

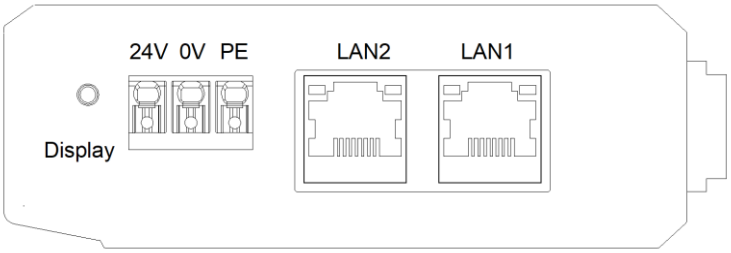
BN-8031 Modbus-TCP COMM board supports standard Modbus-TCP server communication, and the Ethernet supports the cascading function of dual network port switches. The device supports the simultaneous access of 5 clients. It supports 01/02/03/04/05/06/15/16 function code and Modbus application of watchdog. The sum of process data input and output is up to 8192 bytes and it supports 4 extended I/O modules. The module carries diagnostic function and it could monitor the communication status of the I/O module in real time. It also supports input and output fault processing and network fault detection.

2 Technical parameters

COMM Board Hardware Parameter	
System Power	Power: 19.2～28.8VDC (Nominal: 24VDC) Protection: Reverse Protection, Overcurrent Protection
Power Consumption	70mA@24Vdc
IO module supported	4pcs
Wiring diameter	Max.1.5mm² (AWG 16)
Environment Parameter	
Operation Temperature	-30~75℃
Operation Humidity	5%-95% (No Condensation)
IP Grade	IP20
Modbus TCP Parameter	
Network Protocol	Modbus TCP
Process Data Area	Sum of input and output: Max 8192 Byte
Diagnostic Function	Supported
Number of client connections	5 Clients
TCP Keeplive	Supported
Modbus Watchdog	Supported (Default: Enable, 30 Seconds)
Function Code	01/02/03/04/05/06/15/16
Network Interface	2*RJ45
Connection Rate	10/100Mbps, MDI/MIDX, Full-Duplex
IP Address	Set via IO Config software

3 Hardware Interface

3.1 System Power & Network Interface



1, The system power module wiring adopts 3Pin 3.5mm spacing spring terminals. The terminal definitions are as follows:

No.	Marking	Definition
1	PE	Protecting Earthing Terminal
2	0V	Power Input -
3	24V	Power Input +

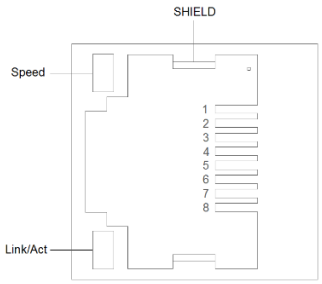
2, Modbus-TCP network Interface

LAN1/LAN2 supports switch cascading function, 10Mbps/100Mbps rate adaption, MDI/MID-X auto crossover.

Speed: Network speed LED (Green)

ON: 100Mbps

OFF: 10Mbps



Link/Act: Link state LED, Active state LED (Orange)

ON: Link UP

OFF: Link DOWN

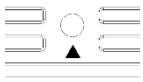
Flash: Active

SHIELD: RJ45 Shield Interface

RJ45 Pin definition

Pin	Definition	Description
1	TD+	Sending +
2	TD-	Sending -
3	RD+	Receiving +
4	--	--
5	--	--
6	RD-	Receiving -
7	--	--
8	--	--

3.2 Reset button



Reset

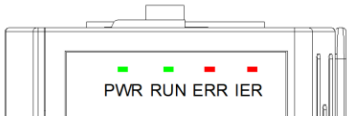
Reset: Module reset button, long press the button for more than 5 seconds and all module parameters will be restored to default values.

3.3 Configuration Interface

Config

Config: Configuration port, standard Type-C port, it could be used to configure device parameters and upgrade firmware.

3.4 LED indicator



PWR: Power State (GREEN)	Definition
ON	System Power Normal
OFF	System Power Failure
RUN: Network Running State (GREEN)	Definition
FLASH	Modbus data exchange
OFF	No Modbus data exchange
ERR: Network Error (RED)	Definition
FLASH	Network cable not connected
OFF	Network cable already connected
IER: Bus Error (RED)	Definition
FLASH	Modules are incorrectly connected to the COMM board
OFF	All modules are correctly connected to the COMM board

3.5 Terminal definition

Module wiring adopts 3Pin 3.5mm spacing spring wiring terminals, which are defined as follows:

No.	Marking	Definition
1	PE	Protecting Earthing Terminal
2	V-	Power Input -
3	V+	Power Input +

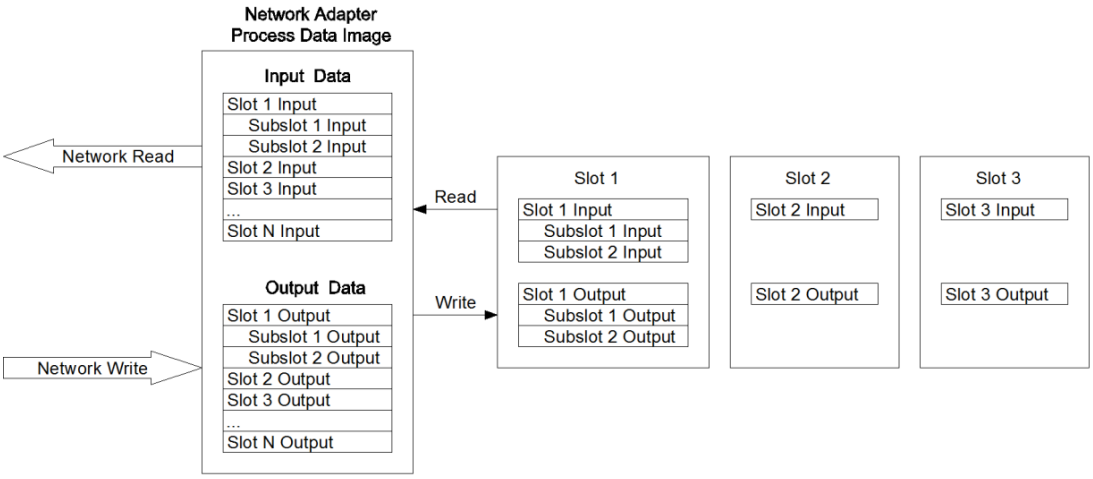
4 Process data definition

4.1 COMM board process data definition

Modbus-TCP COMM board itself has no input-output process data.

4.2 IO module process data mapping

The COMM board reads and writes input and output process data of IO module in real time through the internal bus, and its data mapping model is shown as follow:



Modbus address mapping table varies according to module combination, and detailed address mapping table could be viewed through IO Config – the configuration software.

5 Configuration parameter definition

Configuration Parameter								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved	Modbus Disconnected Detection	Linkdown Detection	Sniffer Port	Port Mirroring	Fault Action for Output	Fault Action for Input	Source of Config Data
Byte 1	MAC Address [0]							
Byte 2	MAC Address [1]							
Byte 3	MAC Address [2]							
Byte 4	MAC Address [3]							
Byte 5	MAC Address [4]							
Byte 6	MAC Address [5]							
Byte 7	IP Address [0]							
Byte 8	IP Address [1]							
Byte 9	IP Address [2]							
Byte 10	IP Address [3]							
Byte 11	Net Mask [0]							
Byte 12	Net Mask [1]							
Byte 13	Net Mask [2]							
Byte 14	Net Mask [3]							
Byte 15	Net Gateway [0]							
Byte 16	Net Gateway [1]							
Byte 17	Net Gateway [2]							
Byte 18	Net Gateway [3]							
Byte 19 Byte 20	Modbus Port							
Byte 21	Reserved							Watchdog
Byte 22 Byte 23	Watchdog Time (s)							
Byte 24	OLED Display Time							
Byte 25 ... Byte 39	Reserved							

Data description:

Source of Config Data: Parameter configuration mode (Default: 0)

0: Software Configuration

1: Field bus Configuration

Fault Action for Input: Input fault handling mode, when IO module is offline, the COMM board will process IO module input data according to this mode.

(Default: 0)

0: Hold Last Input Value

1: Clear Input Value

Fault Action for Output: Output fault handling mode, when IO module is offline, the COMM board will process IO module output data according to this mode. (Default: 0)

0: Hold Last Output Value

1: Clear Output Value

Port Mirroring: The port mirroring function could mirror the message of COMM board network data to LAN1 or LAN2 for output. (Default: 0)

0: Disable

1: Enable

Sniffer Port: Mirror port, which is used to monitor COMM board network message data when port mirror function is enabled. (Default: 0)

0: LAN1

1: LAN2

Linkdown Detection: enables or disables network fault Detection. This parameter is optional.

Linkdown Detection: Network fault detection, Enable/Disable is Optional. This function is enabled by default.

Modbus Disconnected Detection: Modbus communication fault detection, Enable/Disable is Optional. This function is enabled by default.

MAC Address: MAC address, read-only property.

IP Address: COMM board IP address

Net Mask: Sub network mask

Net Gateway: Gateway address.

Modbus Port: Modbus-tcp Server port number. (Default: 502)

Watchdog: Modbus watchdog. (Default: 1)

0: Disable

1: Enable

Watchdog Time (s): Modbus application watchdog period, when the watchdog is enabled, if there is no Modbus data exchange on the TCP connection in this period, the TCP connection will be disconnected (other TCP connections with data exchange will be remained normally). (Default: 30)

OLED Display Time: OLED LCD display time (S), the LCD will be steady on when the time is set to 0.

6 System diagnostic area

System diagnostic area is divided into two parts.

The first part: "State input" storage area, address 0x2000 ~ 0x2068, a total of 105 Word.

No.	Storage Type	Description	Storage Capacity	Address Range	Read-write
1	3 Area	System diagnosis - Status input	105 Word	0x2000~0x2068	RO

Modbus client monitors the address area 0x2000~0x2068 by calling Modbus 04 function code to obtain the current working status and error code of the adapter and IO module, the data format is shown as below:

No.	Modbus Address (Decimalism)	Address (Hexadecimal)	Data Name	Description
1	8192	0x2000	Reset Mode	Reset Reason
2	8193	0x2001	Reserve	
3	8194	0x2002	Reserve	
4	8195	0x2003	Running time - Second	
5	8196	0x2004	Running time - Minute	
6	8197	0x2005	Running time - Hour	
7	8198	0x2006	Running time - Day	
8	8199	0x2007	MAC	Current Device MAC
9	8200	0x2008		
10	8201	0x2009		
11	8202	0x200A	IP	Current Device IP
12	8203	0x200B		
13	8204	0x200C	MASK	Current Device MASK
14	8205	0x200D		
15	8206	0x200E	GATEWAY	Current Device GATEWAY
16	8207	0x200F		
17	8208	0x2010	DI-size	Discrete quantity input area data size
18	8209	0x2011	DO-size	Coil output area data size
19	8210	0x2012	AI-size	Input register area data size
20	8211	0x2013	AO-size	Holding register area data size
21	8212	0x2014	Config-Client-IP	Configure interface client IP
22	8213	0x2015		

23	8214	0x2016	Config-Client-Port	Configure interface client port
24	8215	0x2017	Modbus-Client-Number	Connected Modbus client number
25	8216	0x2018	Modbus-Client-1-IP	Client 1-IP
26	8217	0x2019		
27	8218	0x201A	Modbus-Client-1-Port	Client 1-Port
28	8219	0x201B	Modbus-Client-2-IP	Client 2-IP
29	8220	0x201C		
30	8221	0x201D	Modbus-Client-2-Port	Client 2-Port
31	8222	0x201E	Modbus-Client-3-IP	Client 3-IP
32	8223	0x201F		
33	8224	0x2020	Modbus-Client-3-Port	Client 3-Port
34	8225	0x2021	Modbus-Client-4-IP	Client 4-IP
35	8226	0x2022		
36	8227	0x2023	Modbus-Client-4-Port	Client 4-Port
37	8228	0x2024	Modbus-Client-5-IP	Client 5-IP
38	8229	0x2025		
39	8230	0x2026	Modbus-Client-5-Port	Client 5-Port
40	8231	0x2027	Module_Error [0]	Module 0 error code
41	8232	0x2028		
42	8233	0x2029	Module_Error [1]	Module 1 error code
43	8234	0x202A		
44	8235	0x202B	Module_Error [2]	Module 2 error code
45	8236	0x202C		
46	8237	0x202D	Module_Error [3]	Module 3 error code
47	8238	0x202E		
48	8239	0x202F	Module_Error [4]	Module 4 error code
49	8240	0x2030		

*Reset state Register 38193 address data format is shown as below:

Address offset	Address name	Description	Power on default value
Bit 0	Power_On_Reset	Power on reset tag	0/1
Bit 1-3	Reserved	Reserved	0
Bit 4	External_Reset	External Reset tag	0/1
Bit 5	Reserved	Reserved	0
Bit 6	Soft_Reset_Request	Soft Reset tag	0
Bit 7	Reserved	Reserved	0
Bit 8	HardFault	Hard Fault Reset	0
Bit 9	StackOver	Stack Over Reset	0
Bit 10	MemoryOver	Memory Over Reset	0
Bit 11-15	Reserved	\Reserved	0

The second part: "Control Output" storage area, address 0x2000, a total of 1 Word.

No.	Storage Type	Description	Storage Capacity	Address Range	Read-write
1	4 Area	System diagnosis - Control output	1 Word	0x2000	RW

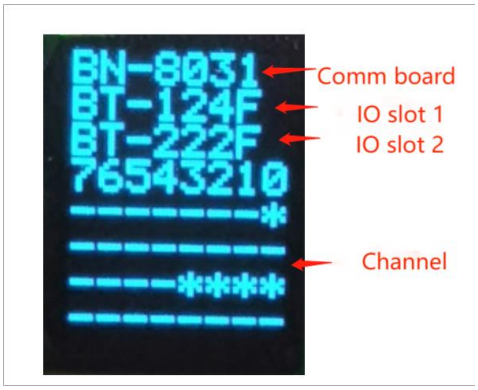
The Modbus client controls the address 0x2000 by calling Modbus 06/16 function code to implement block reset or port mirroring control.

Register 408193 address data format is shown as below:

Address offset	Address Name	Description	Value range	Default value
Bit 0	Restart	0->1 Rising edge triggering system reset	0-1	0
Bit 1	Port_Mirror	Port mirroring function enable 0: disabled 1: enable	0-1	0: disabled
Bit 2	Sniffer_Port	Mirror port selection 0: LAN1 1: LAN2	0-1	0: LAN1
Bit 3-15	Reserved	Reserved	0	0

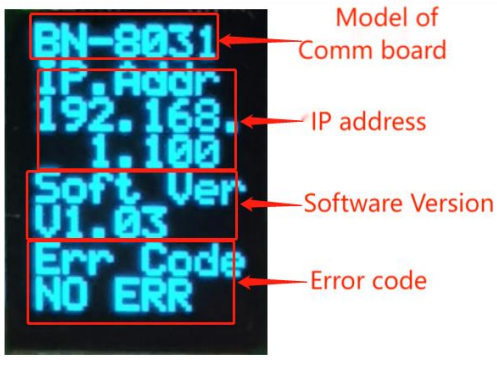
7 LCD display interface

The initial LCD screen is as follows, which displays the COMM board model, slot module model, and channel information (The "*" is displayed for channels with input and output values, and the "-" is displayed for channels without input and output values).



If an I/O module in a slot is empty, "NULL" will be displayed in the corresponding slot:

Press the LCD button to switch to the LCD interface of the COMM board, which displays the module model, IP address, software version, and module fault.



BN-8031-6V Modbus-TCP 8DI/8DO COMM Board

1 The COMM Board Overview

BN-8031-6V supports standard Modbus-TCP server communication, and the Ethernet supports the cascading function of dual network port switches. The device supports the simultaneous access of 5 clients. It supports 01/02/03/04/05/06/15/16 function code and Modbus application of watchdog. The sum of process data input and output is up to 8192 bytes and it supports 3 extended I/O modules. The module supports 8 channels of digital input which is low level valid (source type) and it could be connected to NPN sensor. The module supports 8 channels of digital output which is low level valid (sink type) and it could be connected to NPN sensor. The module carries diagnostic function and it could monitor the communication status of the I/O module in real time. It also supports input and output fault processing and network fault detection.

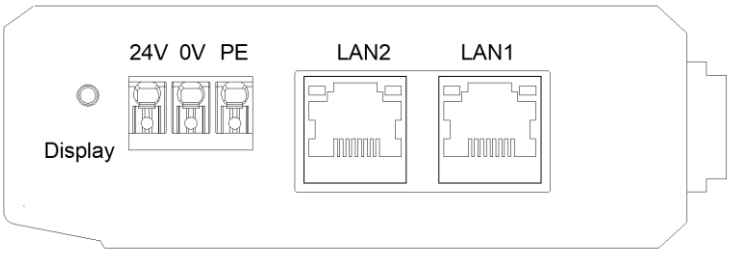
2 Technical parameters

General Parameters	
System Power	Power: 19.2～28.8VDC (Nominal: 24VDC) Protection: Reverse Protection, Overcurrent Protection
Power Consumption	Max.：70mA@24Vdc
Isolation	The isolation voltage between field power and PE: AC 500V The isolation voltage between I/O channel and PE: AC 500V The isolation voltage among ethernet port, system power, PE and I/O channel: AC 500V
Wiring	Max.：1.0mm² (AWG 17) Min.：0.2mm² (AWG 24)
Mounting Type	35mm DIN-Rail
Size	114*27.5*84mm
Weight	140g
Environment Specification	
Operation Temperature	-30~75℃
Operation Humidity	5%-95% (No Condensation)
Ingress Protection Rating	IP20
Vibration Resistance	Comply with IEC 61131-2 and EC 60068-2-6
Impact resistance	Comply with IEC 61131-2 and IEC 60068-2-27

EMC Performance	Comply with IEC 61131-2 and IEC 61000-4
Modbus TCP Parameters	
Network Protocol	Modbus TCP
Process Data Area	Sum of input and output: Max 8192 Byte
Diagnostic Function	Supports
Number of client connections	5 Clients
TCP Keeplive	Supports
Modbus Watchdog	Supports (Default: Enable, 30 Seconds)
Function Code	01/02/03/04/05/06/15/16
Network Interface	2*RJ45
Connection Rate	10/100Mbps, MDI/MIDX, Full-Duplex
8DI Parameters	
Channel Number	8-channel
Input Type	Standard IEC 61131-2 Type 1 source input
Turn-on Voltage	-15Vdc to -13Vdc (common terminal:24Vdc)
Turn-off Voltage	0Vdc to -5Vdc (common terminal:24Vdc)
Turn-on Current	Min. 3mA
Input Impedance	>5.2kΩ
Input Delay	OFF to ON: Max. 3ms ON to OFF: Max. 2ms
Filter Time	Default:10ms
Sample Frequency	500Hz
8DO Parameters	
Field Power	Power：19.2~28.8VDC（nominal:24VDC）
Channel Number	8-channel
Rated Current	Single-channel current：Max. 1A Module current：Max. 4A/8 channel
Leakage Current	Max.5uA
Output Impedance	Typical:180 mΩ
Output Delay	OFF to ON: Max. 360us ON to OFF: Max. 600us
Protection Function	Over-temperature shutdown: Typical: 175℃ Overcurrent protection：Typical: 8A Short-circuit protection：Supports

3 Hardware Interface

3.1 System power and Network Interface



1、The system power module wiring adopts 3Pin 3.5mm spacing spring terminals. The terminal definitions are as follows:

No.	Marking	Definition
1	PE	Protecting Earthing Terminal
2	0V	Power Input -
3	24V	Power Input +

2、Modbus TCP network Interface

LAN1/LAN2 supports switch function, 10Mbps and 100Mbps data rates, MDI/MID-X auto crossover.

Speed: Pending, Unused

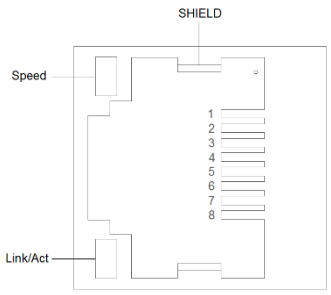
Link/Act: Link state LED, Active state LED (Orange)

ON: Link UP

OFF: Link DOWN

Flash: Active

SHIELD: RJ45 Shield Interface

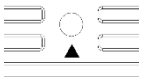


RJ45 Pin definition

Pin	Definition	Description
1	TD+	Sending+
2	TD-	Sending -
3	RD+	Receiving+
4	--	--
5	--	--
6	RD-	Receiving -

7	--	--
8	--	--

3.2 Reset button



Reset

Reset: Module reset button, long press the button for more than 5 seconds and all module parameters will be restored to default values.

3.3 LCD

When the device is powered on normally, the LCD screen could view the model of the communication board and the model of the extended IO module.

When upgrading the module, the LCD interface enters the IAP upgrade mode.

There are large and small LCD screens. When the communication board is configured with 0~1 extended IO modules, use a small LCD screen; When the communication board is configured with 2~3 expansion IO modules, a large LCD screen is used. Although they are different in size, they have the same display function.

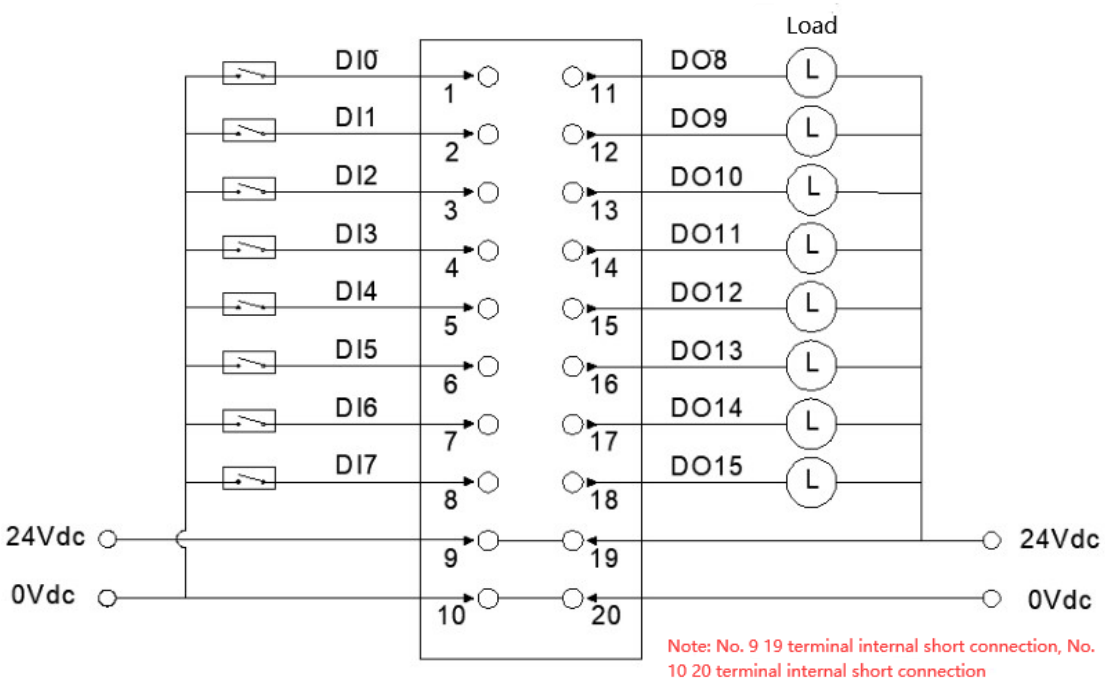
Note: One slot of the communication board is a fixed bit, which is used for the 8-channel digital input and output of the communication board, and a maximum of 3 expansion I/O modules are supported.

3.4 LED Indicators

PWR: Power State (GREEN)	Definition
ON	System Power Normal
OFF	System Power Failure
RUN: Network Running State (GREEN)	Definition
Flash (Varies with the data exchange rate)	Modbus data exchange
OFF	No Modbus data exchange
ON	Modbus TCP establish at least 1 connection
Quick Flash(10Hz)	Invalid MAC address (all 0)
Flash (4 times)	Configure the software lighting test

ERR: Network Error (RED)	Definition
Slow Flash(2.5Hz)	Network cable not connected
OFF	Network cable already connected
IER: Bus Error (RED)	Definition
Flash（1 Hz）	Modules are incorrectly connected to the COMM board
OFF	All modules are correctly connected to the COMM board

3.5 Terminal definition



Module wiring adopts 20Pin 3.5mm spacing spring wiring terminals, which are defined as follows:

Definition	No.	Marking	Marking	No	Definition
Input Signal	1	DI0	DO8	11	Output Signal
	2	DI1	DO9	12	
	3	DI2	DO10	13	
	4	DI3	DO11	14	
	5	DI4	DO12	15	
	6	DI5	DO13	16	
	7	DI6	DO14	17	
	8	DI7	DO15	18	
Power	9	24V	24V	19	Power
	10	0V	0V	20	

4 Process data definition

4.1 COMM board process data definition

The process data of 8DI and 8DO is placed on sub-slot 0 belonging to the slot 0 of the communication board.

The process data of 8DI accounts for 1 byte, and the process data of each channel accounts for 1 bit.

<8DI Input Status> Process data definitions

Input Data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	DI Ch#7	DI Ch#6	DI Ch#5	DI Ch#4	DI Ch#3	DI Ch#2	DI Ch#1	DI Ch#0

Data Description:

DI Ch#(0-7)：When the corresponding channel input signal is valid (low level valid), this bit is forced to 1，and when the input is invalid, this bit is forced to 0.

0：Input signal invalid

1：Input signal valid

The process data of 8DO occupies 1 byte, and the process data of each channel occupies 1 bit.

<8DO output Status> Process data definitions

Output Data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	DO Ch#7	DO Ch#6	DO Ch#5	DO Ch#4	DO Ch#3	DO Ch#2	DO Ch#1	DO Ch#0

Data Description:

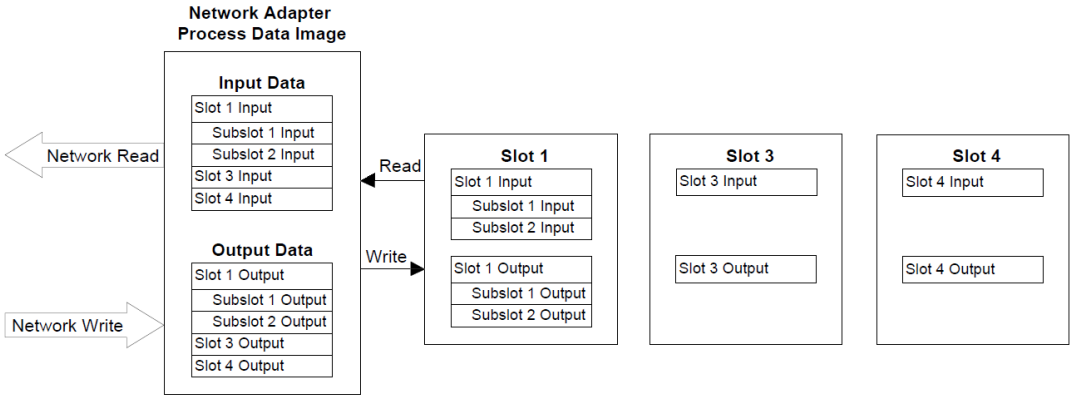
DO Ch#(0-7)：When the bit is 1, the output signal of the corresponding channel is valid (low level valid), and when it is 0, the output is invalid.

0：Output signal invalid

1：Output signal valid

4.2 IO module process data mapping

The COMM board reads and writes input and output process data of IO module in real time through the internal bus, and its data mapping model is shown as follow:



5 Configuration parameter definition

The configuration parameters of 8DI and 8DO are placed on sub-slot 0 belonging to the slot 0 of the communication board. All configuration parameters of the communication board are defined as follows：

Configure Parameters								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Byte Swap	Modbus Disconnected Detection	Linkdown Detection	Reserved		Fault Action Out	Fault Action In	Config Source
Byte 1	MAC Address							
Byte 2								
Byte 3								
Byte 4								
Byte 5								
Byte 6								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 7	IP Address							
Byte 8								
Byte 9								
Byte 10								
Byte 11	Net Mask							
Byte 12								
Byte 13								
Byte 14								
Byte 15	Net Gateway							
Byte 16								
Byte 17								
Byte 18								
Byte 19	Modbus Port							
Byte 20								
Byte 21	Reserved							Watchdog
Byte 22	Watchdog Time							
Byte 23								
Byte 24	OLED Display Time							
Byte 25	Input Filtering Time							
Byte 26								

Byte 27	Reserved	Input Holding Time
Byte 28 ... Byte 42	Reserved	

Data description:

Config Source: Parameter configuration mode (Default: 0)

0: Software Configuration

Fault Action for Input: Input fault handling mode, when IO module is offline, the COMM board will process IO module input data according to this mode. (Default: 0)

0: Hold Last Input Value

1: Clear Input Value

Fault Action for Output: Output fault handling mode, when IO module is offline, the COMM board will process IO module output data according to this mode. (Default: 0)

0: Hold Last Output Value

1: Clear Output Value

Linkdown Detection: Network fault detection, enable or disable. (Default: Enable)

0：Disable

1：Enable

Modbus Disconnected Detection: Modbus communication fault detection, enable or disable. (Default: Enable)

MAC Address: MAC Address, read-only property.

IP Address: IP Address, read-only property

Net Mask: Subnet mask.

Net Gateway: Gateway address.

Modbus Port: Modbus-TCP Server port number. (Default: 502)

Watchdog: Modbus watchdog. (Default: Enable)

0：Disable

1：Enable

Watchdog Time(s)：Modbus Watchdog time (s), when the watchdog is enabled, if there is no Modbus data exchange on the Modbus TCP connection during this time period, the Modbus TCP connection will be disconnected. When the watchdog is disabled, the Modbus TCP connection will not be disconnected if there is no Modbus data exchange on the Modbus TCP connection during the time period. (Default: 30)

The minimum value is set to 20, which is greater than the maximum error time of Keep Alive for Modbus TCP connections, ensuring that socket resources are released normally when the network is abnormal.

Modbus TCP the maximum client is 5.

OLED Display Time(min): OLED Display Time(min)，When set to 0, the LCD screen is always on.

Input Filtering Time(ms): The input filtering time of the channel (ms). (Default: 10)

Input Holding Time(ms): The signal input hold time of the channel (ms). (Default: 0)

0：Disable

1：200ms

2：500ms

3：1000ms

4：1500ms

5：2000ms

6：3000ms

7：5000ms

6 System diagnostic area

System diagnostic area is divided into two parts.

The first part:

"State input" storage area, address 0x2000 ~ 0x2030, a total of 49 Words.

No.	Storage Type	Description	Storage Capacity	Address Range	Read-write
1	3 Area	System diagnosis - Status input	49 Word	0x2000~0x2030	RO

No. 1

Modbus client monitors the address area 0x2000~0x2068 by calling Modbus 04 function code to obtain the current working status and error code of the adapter and IO module, the data format is shown as below.

No.	Modbus Address (Decimalism)	Address (Hexadecimal)	Data Name	Description
1	8192	0x2000	Reset_Mode	Reset Reason
2	8193	0x2001	Reserve	
3	8194	0x2002	Reserve	
4	8195	0x2003	Running time - Second	
5	8196	0x2004	Running time - Minute	
6	8197	0x2005	Running time - Hour	
7	8198	0x2006	Running time - Day	
8	8199	0x2007	MAC	Current Device MAC
9	8200	0x2008		
10	8201	0x2009		
11	8202	0x200A	IP	Current Device IP
12	8203	0x200B		
13	8204	0x200C	MASK	Current Device MASK
14	8205	0x200D		
15	8206	0x200E	GATEWAY	Current Device GATEWAY
16	8207	0x200F		
17	8208	0x2010	DI-size	Discrete quantity input area data size

18	8209	0x2011	DO-size	Coil output area data size
19	8210	0x2012	AI-size	Input register area data size
20	8211	0x2013	AO-size	Holding register area data size
21	8212	0x2014	Config-Client-IP	Configure interface client IP
22	8213	0x2015		
23	8214	0x2016	Config-Client-Port	Configure interface client port
24	8215	0x2017	Modbus-Client-Number	Connected Modbus client number
25	8216	0x2018	Modbus-Client-1-IP	Client 1-IP
26	8217	0x2019		
27	8218	0x201A	Modbus-Client-1-Port	Client 1-Port
28	8219	0x201B	Modbus-Client-2-IP	Client 2-IP
29	8220	0x201C		
30	8221	0x201D	Modbus-Client-2-Port	Client 2-Port
31	8222	0x201E	Modbus-Client-3-IP	Client 3-IP
32	8223	0x201F		
33	8224	0x2020	Modbus-Client-3-Port	Client 3-Port
34	8225	0x2021	Modbus-Client-4-IP	Client 4-IP
35	8226	0x2022		
36	8227	0x2023	Modbus-Client-4-Port	Client 4-Port
37	8228	0x2024	Modbus-Client-5-IP	Client 5-IP
38	8229	0x2025		
39	8230	0x2026	Modbus-Client-5-Port	Client 5-Port
40	8231	0x2027	Module_Error [0]	Module 0 error code
41	8232	0x2028		
42	8233	0x2029	Module_Error [1]	Module 1 error code
43	8234	0x202A		
44	8235	0x202B	Module_Error [2]	Module 2 error code
45	8236	0x202C		
46	8237	0x202D	Module_Error [3]	Module 3 error code
47	8238	0x202E		
48	8239	0x202F	Module_Error [4]	Module 4 error code
49	8240	0x2030		

*Reset state Register 0x2000 address data format is shown as below:

Address offset	Address name	Description	Power on default value

Bit 0	Power_On_Reset	Power on reset tag	1
Bit 1	nRESET pin Reset	nRESET Pin reset	1
Bit 2	Wactchdog Reset	Wactchdog Reset	0
Bit 3	Low Voltage Reset	Low Voltage Reset	0
Bit 4	Brown-out Reset	Brown-out Reset	0
Bit 5	MCU Reset	MCU Reset	0
Bit 6	HRESET Reset	HRESET Reset	1
Bit 7	CPU Reset	CPU Reset	0
Bit 8	CPU Lockup Rese	CPU Lockup Rese	0
Bit 9	HardFault	Hard Fault Reset	0
Bit 10	StackOver	Stack Over Reset	0
Bit 11	MemoryOver	Memory Over Reset	0
Bit 12-15	Reserved	Reserved	0

The second part:

"**Control Output**" Storage area, address 0x2000, a total of 1 word.

"**Status input**" Storage area, address 0x2800-0x2830, a total of 49 words.

No.	Storage Type	Description	Storage Capacity	Address Range	Read-write
1	4 Area	System diagnosis - Control Output	1 word	0x2000	RW
2	4 Area	System diagnosis - Status input	49 Word	0x2800~0x2830	RW

No. 1

The Modbus client controls the address 0x2000 by calling the Modbus 06/16 function code to realize the communication board reset or port mirroring control function.

The register 0x2000 address data format is as follows：

Address offset	Address Name	Description	Value range	Default value
Bit 0	Restart	0->1 Rising edge triggering system reset	0-1	0
Bit 1	Port_Mirror	Port mirroring function enable	0-1	0: disabled

		0: disabled 1: enable		
Bit 2	Sniffer_Port	Mirror port selection 0: LAN1 1: LAN2	0-1	0: LAN1
Bit 3-15	Reserved	Reserved	0	0

No. 2

Modbus client monitors the address area 0x2800~0x2830 by calling Modbus 03 function code to obtain the current working status and error code of the adapter and IO module, the data format is shown as below:

No.	Modbus Address (Decimalism)	Address (Hexadecimal)	Data Name	Description
1	8192	0x2000	Reset Mode	Reset Reason
2	8193	0x2001	Reserve	
3	8194	0x2002	Reserve	
4	8195	0x2003	Running time - Second	
5	8196	0x2004	Running time - Minute	
6	8197	0x2005	Running time - Hour	
7	8198	0x2006	Running time - Day	
8	8199	0x2007	MAC	Current Device MAC
9	8200	0x2008		
10	8201	0x2009		
11	8202	0x200A	IP	Current Device IP
12	8203	0x200B		
13	8204	0x200C	MASK	Current Device MASK
14	8205	0x200D		
15	8206	0x200E	GATEWAY	Current Device GATEWAY
16	8207	0x200F		
17	8208	0x2010	DI-size	Discrete quantity input area data size
18	8209	0x2011	DO-size	Coil output area data size
19	8210	0x2012	AI-size	Input register area data size
20	8211	0x2013	AO-size	Holding register area data size

21	8212	0x2014	Config-Client-IP	Configure interface client IP
22	8213	0x2015		
23	8214	0x2016	Config-Client-Port	Configure interface client port
24	8215	0x2017	Modbus-Client-Number	Connected Modbus client number
25	8216	0x2018	Modbus-Client-1-IP	Client 1-IP
26	8217	0x2019		
27	8218	0x201A	Modbus-Client-1-Port	Client 1-Port
28	8219	0x201B	Modbus-Client-2-IP	Client 2-IP
29	8220	0x201C		
30	8221	0x201D	Modbus-Client-2-Port	Client 2-Port
31	8222	0x201E	Modbus-Client-3-IP	Client 3-IP
32	8223	0x201F		
33	8224	0x2020	Modbus-Client-3-Port	Client 3-Port
34	8225	0x2021	Modbus-Client-4-IP	Client 4-IP
35	8226	0x2022		
36	8227	0x2023	Modbus-Client-4-Port	Client 4-Port
37	8228	0x2024	Modbus-Client-5-IP	Client 5-IP
38	8229	0x2025		
39	8230	0x2026	Modbus-Client-5-Port	Client 5-Port
40	8231	0x2027	Module_Error [0]	Module 0 error code
41	8232	0x2028		
42	8233	0x2029	Module_Error [1]	Module 1 error code
43	8234	0x202A		
44	8235	0x202B	Module_Error [2]	Module 2 error code
45	8236	0x202C		
46	8237	0x202D	Module_Error [3]	Module 3 error code
47	8238	0x202E		
48	8239	0x202F	Module_Error [4]	Module 4 error code
49	8240	0x2030		

*Reset state Register 38193 address data format is shown as below:

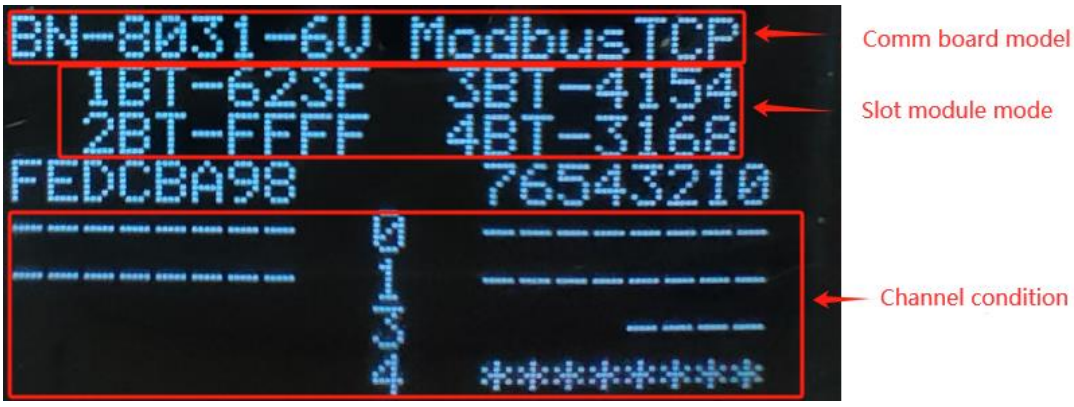
Address offset	Address name	Description	Power on default value
Bit 0	Power_On_Reset	Power on reset tag	1
Bit 1	nRESET pin Reset	nRESET Pin reset	1
Bit 2	Wactchdog Reset	Wactchdog Reset	0
Bit 3	Low Voltage Reset	Low Voltage Reset	0
Bit 4	Brown-out Reset	Brown-out Reset	0
Bit 5	MCU Reset	MCU Reset	0

Bit 6	HRESET Reset	HRESET Reset	1
Bit 7	CPU Reset	CPU Reset	0
Bit 8	CPU Lockup Rese	CPU Lockup Rese	0
Bit 9	HardFault	Hard Fault Reset	0
Bit 10	StackOver	Stack Over Reset	0
Bit 11	MemoryOver	Memory Over Reset	0
Bit 12-15	Reserved	Reserved	0

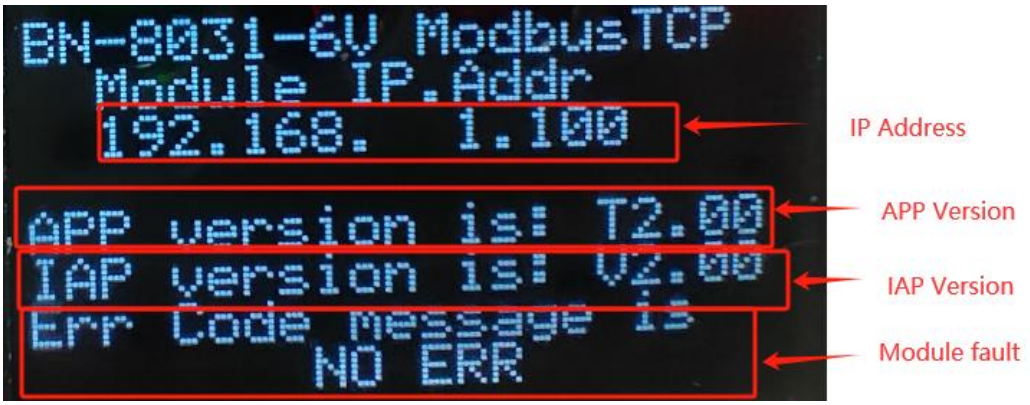
7 LCD display interface

The following describes how to configure 2~3 expansion I/O modules on a communication board.

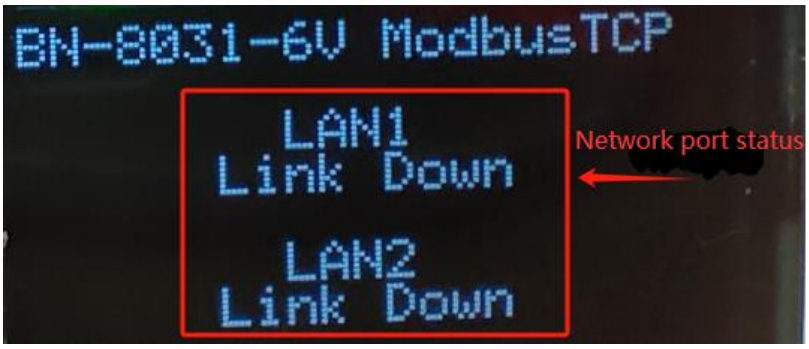
The initial LCD screen is as follows, which displays the COMM board model, slot module model, and channel information (The “*” is displayed for channels with input and output values, and the “-” is displayed for channels without input and output values).



Press the LCD display button to switch to the LCD interface of the communication board, which could display the communication board model, IP address, IAP version, APP version and fault status.

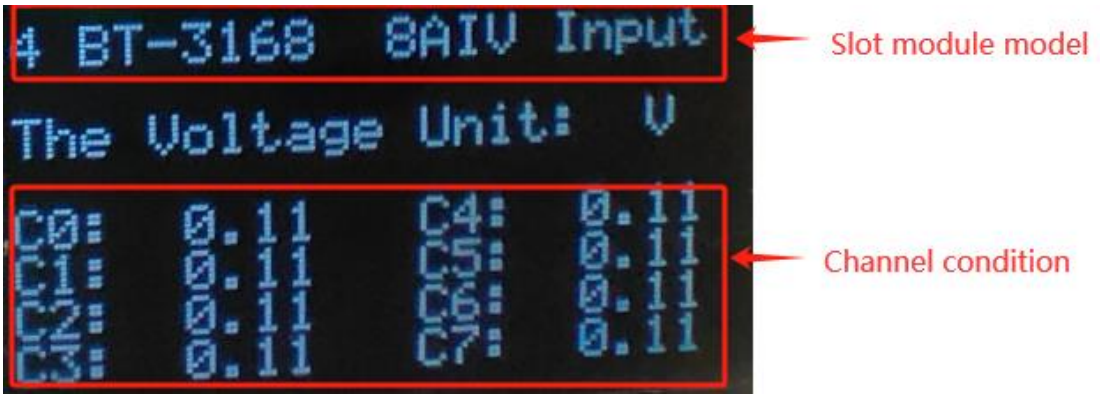


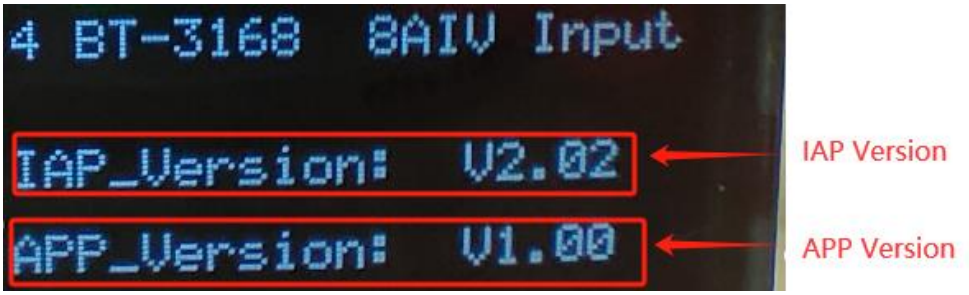
Press the LCD button to switch to the network port status interface, which could display the network port connection status and network rate.



Press the LCD display button to switch to the input and output interface of the fixed slot, and the 8-channel input and output status of the communication board could be displayed (the channel has input and output value channels display "*", and the non-input and output channels display "-").

Press the LCD button to switch to the working status interface of the extended IO module, which could display the module model, input and output status, IAP version and APP version.





BN-8031-68S Modbus-TCP /4DI/4AI COMM Board

1 The COMM Board Overview

BN-8031-68S supports standard Modbus-TCP server communication, and the Ethernet supports the cascading function of dual network port switches. The device supports the simultaneous access of 5 clients. It supports 01/02/03/04/05/06/15/16 function code and Modbus application of watchdog. The sum of process data input and output is up to 8192 bytes. The device supports 4-channel current signal acquisition and could be configured for 0-20mA and 4-20mA current signal acquisition. The device supports 4-channel digital input, supports source and sink input. The input high level (sink) is valid, it could be connected to PNP sensor, and the input low level (source) is valid, it could be connected to NPN sensor. The Modbus serial port supports 1 channel RS485 and supports Modbus RTU/ASCII master protocol. The module carries diagnostic function and it could monitor the communication status of the I/O module in real time. It also supports input and output fault processing and network fault detection.

2 Technical parameters

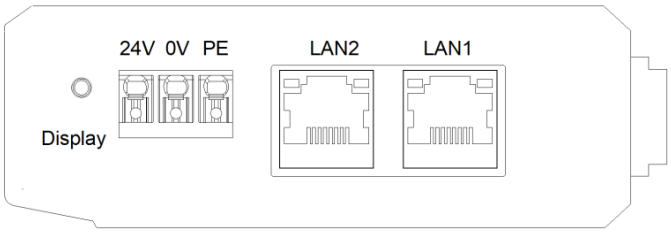
COMM Board Hardware Parameters	
System Power	Power: 19.2～28.8VDC (Nominal: 24VDC)
Power Consumption	Max.：50mA@24Vdc
Wiring	Max.1.0mm² (AWG 17) Min:0.2mm²(AWG 24)
Mounting Type	35mm DIN-Rail
Size	114*27.5*84mm
Weight	140g
Environment Specification	
Operation Temperature	-30~60℃
Operation Humidity	5%-95% (No Condensation)
Ingress Protection Rating	IP20
Vibration Resistance	Comply with IEC 61131-2 and EC 60068-2-6
Impact resistance	Comply with IEC 61131-2 and IEC 60068-2-27

EMC Performance	Comply with IEC 61131-2 and IEC 61000-4
Modbus Master Parameters	
Channel Number	1 channel
Interface	RS485
Protocol	Modbus RTU/ASCII
Working Mode	Modbus Master
Baud Rate	300bps-500Kbps
Modbus Watchdog	supports(Default: Enable，30 Seconds)
Data Bits	7、8
Parity Checking	None, Even, ODD
Stop Bit	1、2
Character Interval	1.5t-200t
Response Timeout	Custom, Default: 1000
Delay Between Polls	Custom, Default: 100
Action for Read Command	Keep the last entered value or zeroing out the input value
Data Output Mode	Polling or Event triggered (the data changes)
Module Control Enable	Enable or Disable
Module Control Mode	Level trigger (effective continuously) and rising edge trigger (single trigger)
First Output on Power-on	Enable or Disable
4DI Parameters	
Channel Number	4 -channel
Input Type	Standard IEC 61131-2 Type 1 source or sink input
Turn-on Voltage	High Input: Min.11Vdc to Max.30Vdc (Common Terminal: 0Vdc) Low Input: Min.0Vdc to Max.13Vdc (Common Terminal: 24Vdc)
Turn-off Voltage	High Input: Max.5Vdc (Common Terminal: 0Vdc) Low Input: Min.19Vdc (Common Terminal: 24Vdc)
Turn-on Current	High Input: 11VDC 2.126mA (Common Terminal: 0Vdc) Low Input: 13VDC 2.137mA (Common Terminal: 24Vdc)
Input Impedance	>5.2kΩ
Input Delay	OFF to ON：Max.3ms ON to OFF: Max.3ms
Filter Time	Default:10ms
Sample Frequency	500Hz
4AI Parameters	
Channel Number	4 -channel
Input Current Range	0~20mA、4~20mA
Resolution ratio	24 Bit

Acquisition precision	±0.3% full range，@25℃
	±0.5% full range，@-20~70℃
Sampling Resistance	100Ω
Sampling rate	20ms/4 channels
Data format	16-bit signed integer

3 Hardware Interface

3.1 System power and Network Interface

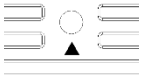


The system power module wiring adopts 3Pin 3.5mm spacing spring terminals.

The terminal definitions are as follows:

No.	Marking	Definition
1	PE	Protecting Earthing Terminal
2	0V	Power Input -
3	24V	Power Input +

3.2 Reset button



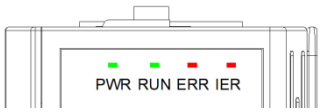
Reset：Module reset button, long press the button for more than 5 seconds and all module parameters will be restored to default values.

3.3 LCD

When the device is powered on normally, the LCD screen could view the model of the communication board and the model of the extended IO module.

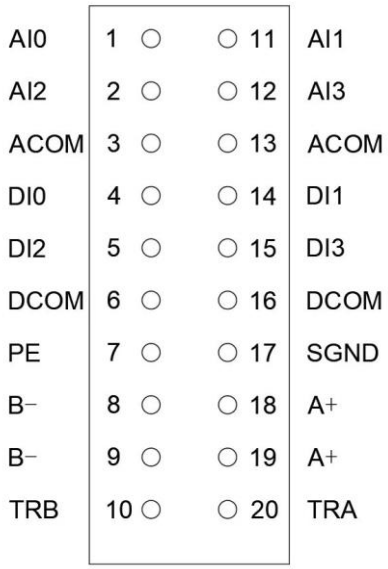
When upgrading the module, the LCD interface enters the IAP upgrade mode.

3.4 LED Indicators



PWR: Power State (GREEN)	Definition
ON	System Power Normal
OFF	System Power Failure
RUN: Network Running State (GREEN)	Definition
Flash	Modbus data exchange
OFF	No Modbus data exchange
ERR: Network Error (RED))	Definition
Flash	Network cable not connected
OFF	Network cable already connected
IER: Bus Error (RED)	Definition
Flash	Modules are incorrectly connected to the COMM board
OFF	All modules are correctly connected to the COMM board

3.5 Terminal definition



Module wiring adopts 20Pin 3.5mm spacing spring wiring terminals, which are defined as follows:

Definition	Marking	No.	No.	Marking	Definition
AI Input CH0	AI0	1	11	AI1	AI Input CH1

AI Input CH2	AI2	2	12	AI3	AI Input CH3
Common Terminal	ACOM	3	13	ACOM	Common Terminal
DI Input CH0	DI0	4	14	DI1	DI Input CH1
DI Input CH2	DI2	5	15	DI3	DI Input CH3
Common Terminal	DCOM	6	16	DCOM	Common Terminal
GND	PE	7	17	SGND	GND
RS485	B-	8	18	A+	RS485
	B-	9	19	A+	
	TRB	10	20	TRA	

Note:

Pins 8 and 9 are internally shorted, and pins 18 and 19 are internally shorted；

Use the internal terminal resistance of the module: Short-circuit terminals 9 and 10, and terminals 19 and 20；

Connect external terminal resistors: terminals 8 and 18, or terminals 9 and 19, with a resistor；

Use internal pull-up resistors within the module: Short circuit terminals 19 and 20；

Use the internal pull-down resistors within the module: Short circuit terminals 9 and 10.

4 Process data definition

4.1 COMM board process data definition

The process data of 8DI and 8DO is placed on sub-slot 0 of slot 0 of the communication board.

<4DI Input Status> Process data definitions

Input Data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	NULL	NULL	NULL	NULL	DO Ch#3	DO Ch#2	DO Ch#1	DO Ch#0

Data Description:

DI Ch#(0-3)：When the corresponding channel input signal is valid, this bit is forced to 1，and when the input is invalid, this bit is forced to 0.

0：Input signal invalid

1：Input signal valid

<4AI Input Status> Process data definitions

Input Data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Analog Input Data (CH 0)							
Byte 1								
Byte 2	Analog Input Data (CH 1)							
Byte 3								
Byte 4	Analog Input Data (CH 2)							
Byte 5								
Byte 6	Analog Input Data (CH 3)							
Byte 7								

Data Description:

Analog Input Data (CH0-3)：Analog signal Input value of corresponding channel.

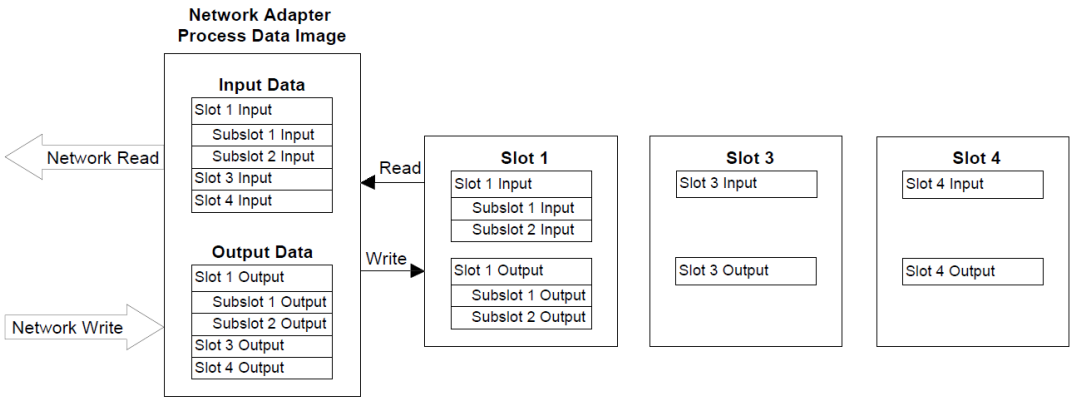
Analog Input Data				
Current(0-20mA)	Current 4-20mA)	Decimal	Hexadecimal	Range
>23.515	>22.810	32767	7FFF	Overflow
>23.515	>22.810	32765	7FFD	ACD 芯片故障

23.515	22.81	32511	7EFF	Exceed the range
.	.	.	.	
.	.	.	.	
20.0007	20.0005	27649	6C01	
20	20	27648	6C00	Rated range
.	.	.	.	
.	.	.	.	
0	4	0	0000	
<0.0	3.9995	-1	FFFF	Below the range
	.	.	.	
	.	.	.	
	1.1852	-4864	ED00	
	<1.1852	-32767	7FFF	Channel disabled
	<1.1852	-32768	8000	Underflow

Note: The ADC chip failure process data is 32765，disabling channel process data uploading values is -32767.

4.2 Extended IO module process data mapping

The COMM board reads and writes input and output process data of IO module in real time through the internal bus, and its data mapping model is shown as follow:



5 Configuration parameter definition

<Adapter> Configuration parameter definitions

Configure parameters								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Byte Swap	Modbus Disconnected Detection	Linkdown Detection	Reserved		Fault Action for Output	Reserved	Source of Config Data
Byte 1	MAC Address[0]							
Byte 2	MAC Address[1]							
Byte 3	MAC Address[2]							
Byte 4	MAC Address[3]							
Byte 5	MAC Address[4]							
Byte 6	MAC Address[5]							
Byte 7	IP Address[0]							
Byte 8	IP Address[1]							
Byte 9	IP Address[2]							
Byte 10	IP Address[3]							
Byte 11	Net Mask[0]							
Byte 12	Net Mask[1]							
Byte 13	Net Mask[2]							
Byte 14	Net Mask[3]							
Byte 15	Net Gateway[0]							
Byte 16	Net Gateway[1]							
Byte 17	Net Gateway[2]							
Byte 18	Net Gateway[3]							
Byte 19	Modbus Port							
Byte 20								
Byte 21	Reserved							Watchdog
Byte 22	Watchdog Time(s)							
Byte 23	OLED Display Time							

Data Description:

Source of Config Data: Parameter configuration mode (Default: 0)

0: Software Configuration

Fault Action for Output: Output fault handling mode, when IO module is offline,

the COMM board will process IO module output data according to this mode. (Default: 0)

0: Hold Last Output Value

1: Clear Output Value

Linkdown Detection: Network fault detection, enable or disable. (Default: Enable)

Modbus Disconnected Detection： Modbus communication fault detection, enable or disable. (Default: Enable)

Byte Swap: Byte swap (mapping of the digital region to the analog region), enable or disable. (Default: Enable)

MAC Address: MAC Address, read-only property.

IP Address**:** COMM Board IP address.

Net Mask**:** Subnet mask.

Net Gateway**:** Gateway address.

Modbus Port: Modbus-TCP Server port number. (Default: 502)

Watchdog: Modbus watchdog. (Default: Enable)

0**:** Disable

1**:** Enable

Watchdog Time(s): Modbus Watchdog times, when the watchdog is enabled, if there is no Modbus data exchange on the TCP connection during this time period, the TCP connection will be disconnected (other TCP connections with data exchange will be maintained normally). (Default: 30)

OLED Display Time: OLED Display Time(min)，When set to 0, the LCD screen is always on.. (Default: 1)

<Modbus Master> Configuration parameter definitions

Configure parameters								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved					BaudRate Select	Gateway Mode	
Byte 1	Standard BaudRate							
Byte 2								
Byte 3								
Byte 4								
Byte 5	Custom BaudRate							
Byte 6								
Byte 7								
Byte 8								
Byte 9	Reserved		Serial Mode	Stop Bits		Parity Bits		Data Bits
Byte 10	Char Pitch							
Byte 11	Response Timeout (ms)							
Byte 12								
Byte 13	Delay Between Polls (ms)							
Byte 14								
Byte 15	Reserved			First Output on Power-Up	Module Control Mode	Module Control Enable	Output Mode	Fault Action for Read Command

Data Description:

Gateway Mode: Module working mode. (Default: Modbus master)

0：Modbus master

BaudRate Select: Baud rate selection. (Default: Standard baud rate)

0：Standard baud rate

1：Custom baud rate

Standard BaudRate: Standard baud rate（Default: 9600bps）

0：300bps

1：600bps

2：1200bps

3：2400bps

4：4800bps

5：9600bps

6：14400bps

7：19200bps

8：38400bps

9：57600bps

10：115200bps

11：128000bps

12：230400bps

13：256000bps

14：384000bps

15：500000bps

Custom BaudRate: Custom baud rate: 300-500000bps could be set. (Default: 9600)

Note: A small number of customers' devices are non-standard baud rate, which can be customized.

Data Bits: Data bits. (Default: 8 bits)

0: 7 bits

1: 8 bits

Parity Bits: Parity bits. (Default: Non)

0: Non

1: Eve

2: ODD

Stop Bits: Stop bits. (Default: 1 bit)

0: 1 bit

1: 2 bits

Serial Mode: Serial mode. (Default: RTU)

0: RTU

1: ASCII

Char Pitch: Char pitch: indicates the interval detection time when receiving a packet. (t is the time it takes for a single char to be transmitted, which is related to the baud rate）(Default: 5 chars)

0: 1.5 chars

1: 3.5 chars

2: 5 chars

3: 10 chars

4: 20 chars

5: 50 chars

6: 100 chars

7: 200 chars

Response Timeout: Response timeout (ms): the time it takes for the slave to respond after the master sends the command. 1~65535 could be set. (Default: 1000)

Delay Between Polls: Delay between polls (ms), the interval between Modbus commands being sent (The delay between receiving the slave response packet and sending the next command),0~65535 could be set. (Default:100)

Fault Action for Read Command: Fault action for read command: data processing mode when data read from the slave station times out. (Default: Keep the last entered value)

0: Keep the last entered value

1: Zeroing out the input value is optional

Output Mode: Data output mode. In “polling mode”, Modbus periodically sends write packets. In "event triggered" mode, write commands are sent only when

the Modbus output data changes. (Default: Polling)

0: Polling)

1: Event triggered (the data changes)

Module Control Enable: Module control enable. When need to control the read and write commands of the Modbus, select the enable mode to control the read and write commands of the Modbus by controlling the value of the “Module Control Output”.

(Default: Disable)

0: Disable

1: Enable

Module Control Mode: Module control mode. This value is valid only in module control enable mode. (Default: level triggered)

0: Level trigger (effective continuously)

1: Rising edge trigger (single trigger)

First Output on Power-on: Output on power-on. (Default: Enable)

0: Disable

1: Enable

<Modbus Master> Submodules in master mode

M: Diagnostic module

M: Reading coil (0xxxx), it supports 8~128bits optionally

M: Reading discrete input (1xxxx), it supports 8~128bits optionally

M: Reading input register (3xxxx), it supports 1~16words optionally

M: Reading hold register (4xxxx), it supports 1~16words optionally

M: Writing coil (0xxxx), it supports single coil and 8~128bits optionally

M: Writing hold register (4xxxx), it supports single register and 1~16words optionally

M：Diagnostic module: it includes module status input, module error code input, module control output, and polling time input. The drop-down menu commands need to be added to the first 8 lines of the slot.

1.Module state input: there are 8~48 channels available. The module state could monitor the working state of each data slot. When a data slot fails, the corresponding state bit will be set to 1, and it would be reset automatically after failure recovery.

2.Module error code input: there are 8~48 channels available. When the data slot fails, the error code module could display the function code of the error channel and the detailed error code. According to the error code, the user can judge the cause of the fault, and then take the corresponding adjustment method. See "Modbus Error Code Table" for a detailed description.

3. Module control output: there are 8~48 channels available. The read/write channel for output control of the command is valid when the parameter (M: module control) under the serial port is in enabled mode.

4. Polling time input: Polling time is used for monitoring serial ports.

Modbus Error code table

Error Code	Fault description	Troubleshooting method

0x00	Working properly	N/A
0x01	Illegal function code	The device does not support the current function code, please refer to the slave manual to select the corresponding function code module
0x02	Illegal data address	If the device data exceeds its address range, refer to the slave manual to modify the data starting address or data length
0x03	Illegal data value	Data length error, data length beyond the Max. allowed value 125(Word) or 2000(Bit), modify the length
0x04	Data processing error	Check that if the range of data values meets the slave requirements
0x05	Application layer length mismatch	Increase the receive character pitch and check the communication parameter Settings
0x06	Protocol ID error	Check the sending end message
0x07	Cache address error	Device internal error
0x08	Bit offset error	Device internal error
0x09	The slave ID number does not match	Increase timeout time, check hardware connection state, and check communication parameter Settings
0x0A	CRC Error	CRC error, check communication line
0x0B	LRC Error	LRC error, check communication line
0x0C	Answer function codes do not match	Check the hardware connection state
0x0D	Answer addresses do not match	Check the hardware connection state
0x0E	The length of the reply data does not match	Check the hardware connection state
0x0F	Communication timeout	Increase timeout time, check hardware connection state, and check communication parameter Settings
0x10	ASCII mode starting character Error	':' Colon starting character Error
0x11	ASCII mode terminator character Error	CR/LF Carriage return terminator character Error
0x12	ASCII mode non-character data	The data contains non-hexadecimal ASCII codes
0x13	ASCII mode character error	Slave answering length error

<4DI Input Status> Configuration parameter definitions

Configuration parameters								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Input Filtering Time(ms)							
Byte 1								
Byte 2	Reserved					Input Holding Time(ms)		

Data Description:

Input Filtering Time(ms): The input filtering time of the channel, in ms. (Default:10)

Input Holding Time(ms): The signal input hold time of the channel in ms. (Default:0)

0: Disable

1: 200ms

2: 500ms

3: 1000ms

4: 1500ms

5: 2000ms

6: 3000ms

7: 5000ms

<4AI Input Status> Configuration parameter definitions

Configuration parameters								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved							16Bit Data Format
Byte 1	Reserved				Channel Enable Ch#3	Channel Enable Ch#2	Channel Enable Ch#1	Channel Enable Ch#0
Byte 2	Reserved				Current Type Ch#3	Current Type Ch#2	Current Type Ch#1	Current Type Ch#0
Byte 3	Ch#0 Filter Level							

Byte 4	Ch#1 Filter Level
Byte 5	Ch#2 Filter Level
Byte 6	Ch#3 Filter Level

Data Description:

16Bit Data Format: Analog data storage format. (default: 0)

0：A-B

1：B-A

Channel Enable Ch#(0-3): Channel enabled. (default: 1)

0：Disable

1：Enable

Current Type Ch#(0-3): The type of input signal. (default: 1)

0：0-20mA

1：4-20mA

Filter Level Ch#(0-3): Filtering level.(default: 1)

0: level 0

1: level 1

2: level 2

3: level 3

4: level 4

5: level 5

6: level 6

7: level 7

8: level 8

9: level 9

10: level 10

6 System diagnostic area

System diagnostic area is divided into two parts.

The first part:

"State input" storage area, address 0x2000 ~ 0x2030, a total of 49 Word.

No.	Storage Type	Description	Storage Capacity	Address Range	Read-write
1	3 Area	System diagnosis - Status input	49 Word	0x2000~0x2030	RO

No. 1

Modbus client monitors the address area 0x2000~0x2068 by calling Modbus 04 function code to obtain the current working status and error code of the adapter and IO module, the data format is shown as below:

No.	Modbus Address (Decimalism)	Address (Hexadecimal)	Data Name	Description
1	8192	0x2000	Reset_Mode	Reset Reason
2	8193	0x2001	Reserve	
3	8194	0x2002	Reserve	
4	8195	0x2003	Running time - Second	
5	8196	0x2004	Running time - Minute	
6	8197	0x2005	Running time - Hour	
7	8198	0x2006	Running time - Day	
8	8199	0x2007	MAC	Current Device MAC
9	8200	0x2008		
10	8201	0x2009		
11	8202	0x200A	IP	Current Device IP
12	8203	0x200B		
13	8204	0x200C	MASK	Current Device MASK
14	8205	0x200D		
15	8206	0x200E	GATEWAY	Current Device GATEWAY
16	8207	0x200F		
17	8208	0x2010	DI-size	Discrete quantity input area data size
18	8209	0x2011	DO-size	Coil output area data size

19	8210	0x2012	AI-size	Input register area data size
20	8211	0x2013	AO-size	Holding register area data size
21	8212	0x2014	Config-Client-IP	Configure interface client IP
22	8213	0x2015		
23	8214	0x2016	Config-Client-Port	Configure interface client port
24	8215	0x2017	Modbus-Client-Number	Connected Modbus client number
25	8216	0x2018	Modbus-Client-1-IP	Client 1-IP
26	8217	0x2019		
27	8218	0x201A	Modbus-Client-1-Port	Client 1-Port
28	8219	0x201B	Modbus-Client-2-IP	Client 2-IP
29	8220	0x201C		
30	8221	0x201D	Modbus-Client-2-Port	Client 2-Port
31	8222	0x201E	Modbus-Client-3-IP	Client 3-IP
32	8223	0x201F		
33	8224	0x2020	Modbus-Client-3-Port	Client 3-Port
34	8225	0x2021	Modbus-Client-4-IP	Client 4-IP
35	8226	0x2022		
36	8227	0x2023	Modbus-Client-4-Port	Client 4-Port
37	8228	0x2024	Modbus-Client-5-IP	Client 5-IP
38	8229	0x2025		
39	8230	0x2026	Modbus-Client-5-Port	Client 5-Port
40	8231	0x2027	Module_Error [0]	Module 0 error code
41	8232	0x2028		
42	8233	0x2029	Module_Error [1]	Module 1 error code
43	8234	0x202A		
44	8235	0x202B	Module_Error [2]	Module 2 error code
45	8236	0x202C		
46	8237	0x202D	Module_Error [3]	Module 3 error code
47	8238	0x202E		
48	8239	0x202F	Module_Error [4]	Module 4 error code
49	8240	0x2030		

*Reset state Register 0x2000 address data format is shown as below:

Address offset	Address name	Description	Power on default value
Bit 0	Power_On_Reset	Power on reset tag	1

Bit 1	nRESET pin Reset	nRESET Pin reset	1
Bit 2	Wactchdog Reset	Wactchdog Reset	0
Bit 3	Low Voltage Reset	Low Voltage Reset	0
Bit 4	Brown-out Reset	Brown-out Reset	0
Bit 5	MCU Reset	MCU Reset	0
Bit 6	HRESET Reset	HRESET Reset	1
Bit 7	CPU Reset	CPU Reset	0
Bit 8	CPU Lockup Rese	CPU Lockup Rese	0
Bit 9	HardFault	Hard Fault Reset	0
Bit 10	StackOver	Stack Over Reset	0
Bit 11	MemoryOver	Memory Over Reset	0
Bit 12-15	Reserved	Reserved	0

The second part:

"**Control Output**" Storage area, address 0x2000, a total of 1 word。

"**Status input**" Storage area, address 0x2800-0x2830, a total of 49 word.

No.	Storage Type	Description	Storage Capacity	Address Range	Read-write
1	4 Area	System diagnosis - Control Output	1 word	0x2000	RW
2	4 Area	System diagnosis - Status input	49 Word	0x2800~0x2830	RW

No. 1

The Modbus client controls the address 0x2000 by calling the Modbus 06/16 function code to realize the communication board reset or port mirroring control function.

The register 0x2000 address data format is as follows：

Address offset	Address Name	Description	Value range	Default value
Bit 0	Restart	0->1 Rising edge triggering system reset	0-1	0
Bit 1	Port_Mirror	Port mirroring function enable 0: disabled 1: enable	0-1	0: disabled
Bit 2	Sniffer_Port	Mirror port selection 0: LAN1 1: LAN2	0-1	0: LAN1
Bit 3-15	Reserved	Reserved	0	0

No. 2

Modbus client monitors the address area 0x2800~0x2830 by calling Modbus 03 function code to obtain the current working status and error code of the adapter and IO module, the data format is shown as below:

No.	Modbus Address (Decimalism)	Address (Hexadecimal)	Data Name	Description

1	8192	0x2000	Reset Mode	Reset Reason
2	8193	0x2001	Reserve	
3	8194	0x2002	Reserve	
4	8195	0x2003	Running time - Second	
5	8196	0x2004	Running time - Minute	
6	8197	0x2005	Running time - Hour	
7	8198	0x2006	Running time - Day	
8	8199	0x2007	MAC	Current Device MAC
9	8200	0x2008		
10	8201	0x2009		
11	8202	0x200A	IP	Current Device IP
12	8203	0x200B		
13	8204	0x200C	MASK	Current Device MASK
14	8205	0x200D		
15	8206	0x200E	GATEWAY	Current Device GATEWAY
16	8207	0x200F		
17	8208	0x2010	DI-size	Discrete quantity input area data size
18	8209	0x2011	DO-size	Coil output area data size
19	8210	0x2012	AI-size	Input register area data size
20	8211	0x2013	AO-size	Holding register area data size
21	8212	0x2014	Config-Client-IP	Configure interface client IP
22	8213	0x2015		
23	8214	0x2016	Config-Client-Port	Configure interface client port
24	8215	0x2017	Modbus-Client-Number	Connected Modbus client number
25	8216	0x2018	Modbus-Client-1-IP	Client 1-IP
26	8217	0x2019		
27	8218	0x201A	Modbus-Client-1-Port	Client 1-Port
28	8219	0x201B	Modbus-Client-2-IP	Client 2-IP
29	8220	0x201C		
30	8221	0x201D	Modbus-Client-2-Port	Client 2-Port
31	8222	0x201E	Modbus-Client-3-IP	Client 3-IP
32	8223	0x201F		
33	8224	0x2020	Modbus-Client-3-Port	Client 3-Port
34	8225	0x2021	Modbus-Client-4-IP	Client 4-IP
35	8226	0x2022		
36	8227	0x2023	Modbus-Client-4-Port	Client 4-Port

37	8228	0x2024	Modbus-Client-5-IP	Client 5-IP
38	8229	0x2025		
39	8230	0x2026	Modbus-Client-5-Port	Client 5-Port
40	8231	0x2027	Module_Error [0]	Module 0 error code
41	8232	0x2028		
42	8233	0x2029	Module_Error [1]	Module 1 error code
43	8234	0x202A		
44	8235	0x202B	Module_Error [2]	Module 2 error code
45	8236	0x202C		
46	8237	0x202D	Module_Error [3]	Module 3 error code
47	8238	0x202E		
48	8239	0x202F	Module_Error [4]	Module 4 error code
49	8240	0x2030		

*Reset state Register 38193 address data format is shown as below:

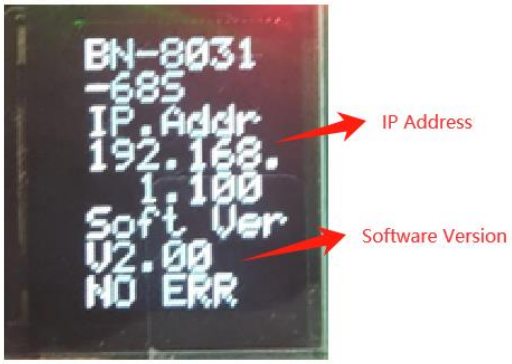
Address offset	Address name	Description	Power on default value
Bit 0	Power_On_Reset	Power on reset tag	1
Bit 1	nRESET pin Reset	nRESET Pin reset	1
Bit 2	Wactchdog Reset	Wactchdog Reset	0
Bit 3	Low Voltage Reset	Low Voltage Reset	0
Bit 4	Brown-out Reset	Brown-out Reset	0
Bit 5	MCU Reset	MCU Reset	0
Bit 6	HRESET Reset	HRESET Reset	1
Bit 7	CPU Reset	CPU Reset	0
Bit 8	CPU Lockup Rese	CPU Lockup Rese	0
Bit 9	HardFault	Hard Fault Reset	0
Bit 10	StackOver	Stack Over Reset	0
Bit 11	MemoryOver	Memory Over Reset	0
Bit 12-15	Reserved	Reserved	0

7 LCD display interface

The initial LCD screen is as follows, which displays the COMM board model, slot module model, and channel information (The “*” is displayed for channels with input and output values, and the “-” is displayed for channels without input and output values).

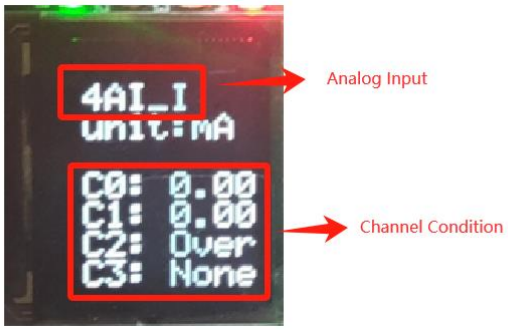
Page 1：Among them, "BN-8031-68S" is the product name. "0-7" is the channel number. "----", the upper row is the 4DI channel input state, and when there is input, it is "*". "----", the upper row is the channel input status of 4AI, and the input is "*" when there is input.

Page 2：“IP. Addr. 192.168.1.100" is the IP address of the product. "Soft Ver V2.00" is the software version of the product. "NO ERR" means that the product is faulty, and there is no fault at this time.

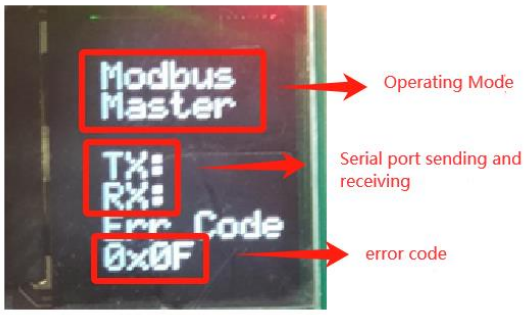


Page 3："4DI" is a four-channel digital input. "0-7" is the channel number. "----" is the channel input status of 4DI, and "*" when there is input.

Page 4：The "4AI_I" is a four-channel analog current input. "unit:mA" is in mA. “C0 ... C3" channel input value, "Over" out of measurement range, "None" channel prohibited.



Page 5：It takes effect after the master submodule is configured. Among them, "Modbus Master" is currently in the master mode. "TX:" serial port transmission status, "TX: *" will be displayed when normal transmission. "RX:" serial port receiving status, "RX: *" will be displayed when receiving normally. "Err Code" is the current error state. The "0x0F" error code, 0x0F is a timeout error, and the specific error is referred to the Modbus error code table.



BN-8032: Profinet COMM Board

1 The COMM board overview

The BN-8032 Profinet COMM board supports standard Profinet IO Device Communication. The COMM board MRP media redundancy, and it could realize ring network redundancy. And it supports RT/IRT real-time and synchronous communication mode, with its RT real-time communication minimum period of 1ms and IRT synchronous communication minimum period of 250us.The COMM board supports a max input of 1440 bytes, a max output of 1440 bytes, and the number of the extended IO modules it supports is 4.

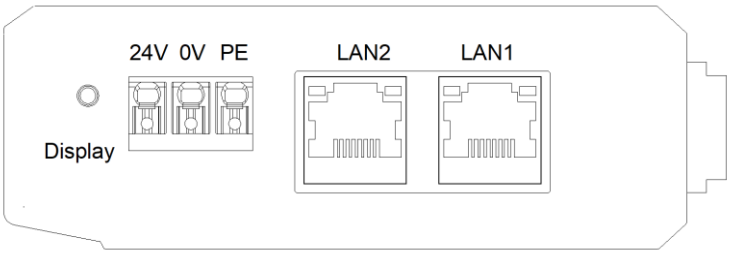
2 Technical parameters

COMM Board Hardware Parameter	
System Power	Power: 19.2～28.8VDC (Nominal: 24VDC) Protection: Reverse Protection
Power Consumption	100mA@24Vdc
IO module supported	4pcs
Wiring diameter	Max.1.5mm² (AWG 16)
Environment Parameter	
Operation Temperature	-30~75℃
Operation Humidity	5%-95% (No Condensation)
IP Grade	IP20
Profinet Parameter	
Network Protocol	Profinet IO Device
Process Data Area	Input Max 1440 Bytes, Output Max 1440 Bytes
RT	Supported, Min. period is 1ms s
IRT	Supported, Min.250us, Min. period is 1ms s 250us
MRP	Supported
MRPD	Not supported
Network Interface	2*RJ45
Speed	10/100Mbps, MDI/MIDX, Full-Duplex
Profinet Device Name	Profinet Monitor Modifies the device name

Notice: The COMM board does not support the MRPD (Media Redundancy for Planned Duplication) function, so the MRP and IRT functions cannot be used simultaneously.

3 Hardware Interface

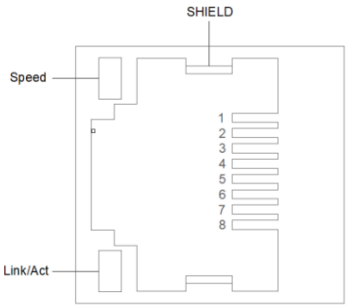
3.1Network Interface



1. The system power module wiring adopts 3Pin 3.5mm spacing spring terminals. The terminal definitions are as follows:

No.	Marking	Definition
1	PE	Protecting Earthing Terminal
2	V-	Power Input -
3	V+	Power Input +

2. PORT1 and PORT2 are both Profinet communication port, and support switch function with 10Mbps and 100Mbps data rates, MDI/MID-X auto crossover.



Speed: Network Speed LED (Green)

ON: 100Mbps

OFF: 10Mbps

Link/Act: Link state LED, Active state LED (Orange

ON: Link UP

OFF: Link DOWN

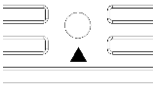
Flash: Active

SHIELD: RJ45 Shield Interface

RJ45 Pin definition

Pin	Definition	Description
1	TD+	Sending +
2	TD-	Sending -
3	RD+	Receiving +
4	--	--
5	--	--
6	RD-	Receiving -
7	--	--
8	--	--

3.2 Reset button



Reset

Reset: Module reset button, long press the button for more than 5 seconds and all module parameters will be restored to default values.

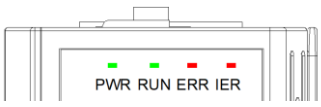
3.3 Configuration Interface

Config

Config: Configuration port, standard Type-C port, it could be used to configure device parameters and upgrade firmware.

Description: device parameters can be set in Profinet IO controller configuration software.

3.4 LED Indicators



PWR: Power State (GREEN)	Definition
ON	System Power Normal
OFF	System Power Failure
RUN: Network Running State (GREEN)	Definition
OFF	Working improperly
ON	Working properly
FLASH	LED light on test

Quick Flash (10Hz)	System error, topology structure error
ERR: Network Error (RED)	Definition
ON	Port1 and Port2 Link-Down
FLASH	System Offline
OFF	System Online
Quick Flash (10Hz)	MAC Address Illegal
IER: Bus Error (RED)	Definition
FLASH	Modules are incorrectly connected to the COMM board
OFF	All modules are correctly connected to the COMM board

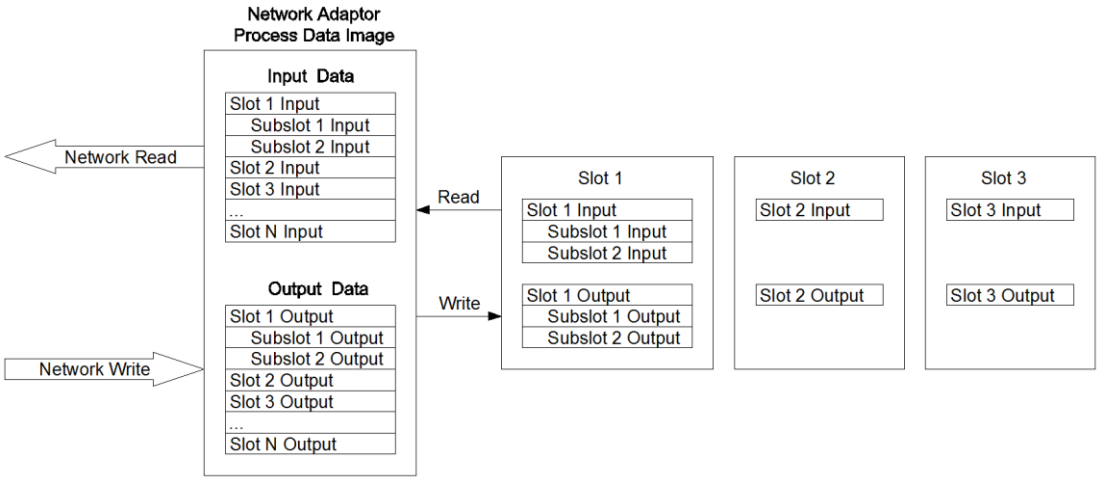
4 Process data definition

4.1 COMM board process data definition

Profinet COMM board itself has no input-output process data.

4.2 IO module process data mapping

The COMM board reads and writes input and output process data of IO module in real time through the internal bus, and its data mapping model is shown as follow:



The max number of input bytes of the Profinet COMM board is 1440 bytes, and the max number of output bytes is 1440 bytes.

5 Configuration parameter definition

Configuration Parameter								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved					Fault Action for Output	Fault Action for Input	Source of Config Data
Byte 1	OLED Display Time							
Byte 2 ... Byte 16	Reserved							
Byte 17	MAC Address [0]							
Byte 18	MAC Address [1]							
Byte 19	MAC Address [2]							
Byte 20	MAC Address [3]							
Byte 21	MAC Address [4]							
Byte 22	MAC Address [5]							
Byte 23	IP Address [0]							
Byte 24	IP Address [1]							
Byte 25	IP Address [2]							
Byte 26	IP Address [3]							
Byte 27	Net Mask [0]							
Byte 28	Net Mask [1]							
Byte 29	Net Mask [2]							
Byte 30	Net Mask [3]							
Byte 31	Net Gateway [0]							
Byte 32	Net Gateway [1]							
Byte 33	Net Gateway [2]							
Byte 34	Net Gateway [3]							
Byte 35 ... Byte 99	Profinet Device Name							

Data description:

Source of Config Data: Parameter configuration mode (Default: 1)

0: Software Configuration

1: Field bus Configuration

Fault Action for Input: Input fault handling mode, when IO module is offline, the COMM board will process IO module input data according to this mode. (Default: 0)

0: Hold Last Input Value

1: Clear Input Value

Fault Action for Output: Output fault handling mode, when IO module is offline, the COMM board will process IO module output data according to this mode. (Default: 0)

0: Hold Last Output Value

1: Clear Output Value

OLED Display Time: OLED LCD display time (S), the LCD will be steady on when the time is set to 0

MAC Address: MAC address, read-only property

IP Address: IP Address, read-only property

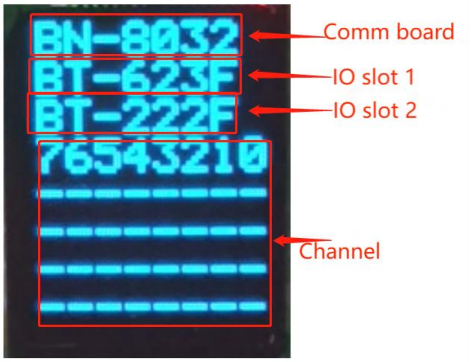
Net Mask: Sub network mask, read-only property

Net Gateway: Gateway address, read-only property

Profinet Device Name: Profinet device name, read-only property

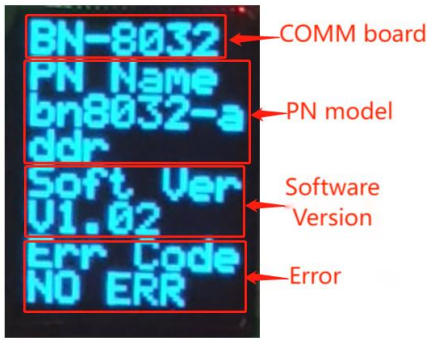
6 LCD display interface

The initial LCD screen is as follows, which displays the COMM board model, slot module model, and channel information (The "*" is displayed for channels with input and output values, and the "-" is displayed for channels without input and output values).



If an I/O module in a slot is empty, "NULL" will be displayed in the corresponding slot:

Press the LCD button to switch to the LCD interface of the COMM board, which displays the module model, IP address, software version, and module fault.



BN-8032-L: Profinet COMM Board

1 The COMM board overview

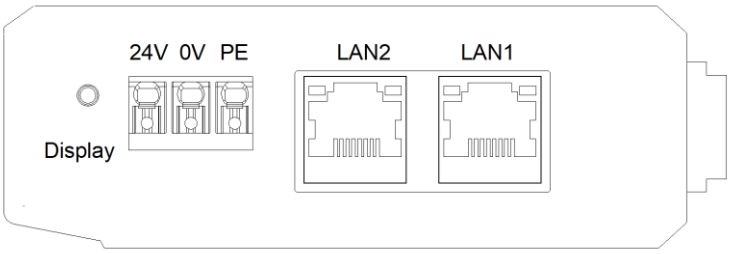
The BN-8032-L Profinet COMM board supports standard Profinet IO Device Communication. The COMM board doesn't support MRP media redundancy, but it Supports RT real-time communication mode, the minimum period of RT real-time communication is 1ms. The COMM board supports a max input of 1440 bytes, a max output of 1440 bytes, and the number of the extended IO modules it supports is 4.

2 Technical parameters

COMM Board Hardware Parameter	
System Power	Power: 19.2～28.8VDC (Nominal: 24VDC) Protection: Reverse Protection
Power Consumption	100mA@24Vdc
IO module supported	Max: 4pcs (B32 support 2pcs, B64 support 4pcs)
Wiring diameter	Max.1.5mm² (AWG 16)
Environment Parameter	
Operation Temperature	-30~75℃
Operation Humidity	5%-95% (No Condensation)
IP Grade	IP20
Profinet Parameter	
Network Protocol	Profinet IO Device
Process Data Area	Input Max 1440 Bytes, Output Max 1440 Bytes
RT	Supported, Min. period is 1ms
IRT	Not supported
MRP	Not supported
MRPD	Not supported
Network Interface	2*RJ45
Speed	10/100Mbps, MDI/MIDX, Full-Duplex
Profinet Device Name	Profinet Monitor Modifies the device name

3 Hardware Interface

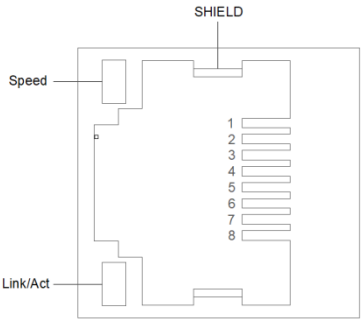
3.1 Network Interface



1. The system power module wiring adopts 3Pin 3.5mm spacing spring terminals. The terminal definitions are as follows:

No.	Marking	Definition
1	PE	Protecting Earthing Terminal
2	V-	Power Input -
3	V+	Power Input +

2. PORT1 and PORT2 are both Profinet communication port, and support switch function with 10Mbps and 100Mbps data rates, MDI/MID-X auto crossover.



Speed: Network Speed LED (Green)

ON: 100Mbps

OFF: 10Mbps

Link/Act: Link state LED, Active state LED (Orange)

ON: Link UP

OFF: Link DOWN

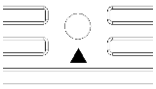
Flash: Active

SHIELD: RJ45 Shield Interface

RJ45 Pin definition

Pin	Definition	Description
1	TD+	Sending +
2	TD-	Sending -
3	RD+	Receiving +
4	--	--
5	--	--
6	RD-	Receiving -
7	--	--
8	--	--

3.2 Reset button



Reset

Reset: Module reset button, long press the button for more than 5 seconds and all module parameters will be restored to default values.

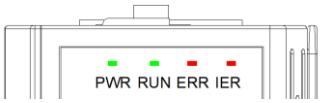
3.3 Configuration Interface

Config

Config: Configuration port, standard Type-C port, it could be used to configure device parameters and upgrade firmware.

Description: device parameters can be set in Profinet IO controller configuration software.

3.4 LED Indicators



PWR: Power State (GREEN)	Definition
ON	System Power Normal
OFF	System Power Failure
RUN: Network Running State (GREEN)	Definition
OFF	Working improperly
ON	Working properly
FLASH	LED light on test
Quick Flash (10Hz)	System error, topology structure error
ERR: Network Error (RED)	Definition
ON	Port1 and Port2 Link-Down
FLASH	System Offline
OFF	System Online
Quick Flash (10Hz)	MAC Address Illegal
IER: Bus Error (RED)	Definition
FLASH	Modules are incorrectly connected to the COMM board
OFF	All modules are correctly connected to the COMM board

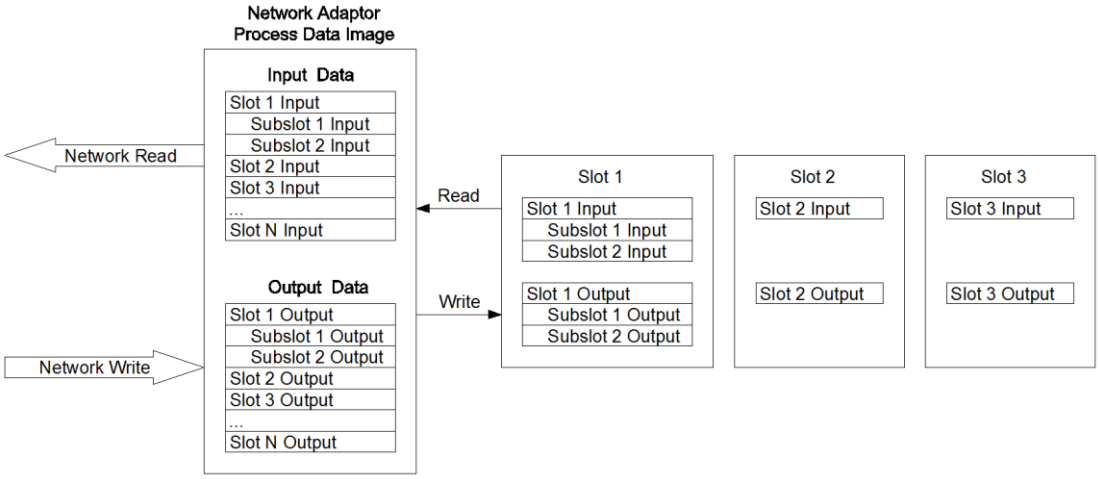
4 Process data definition

4.1 COMM board process data definition

Profinet COMM board itself has no input-output process data.

4.2 IO module process data mapping

The COMM board reads and writes input and output process data of IO module in real time through the internal bus, and its data mapping model is shown as follow:



The max number of input bytes of the Profinet COMM board is 1440 bytes, and the max number of output bytes is 1440 bytes.

5 Configuration parameter definition

Configuration Parameter								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved					Fault Action for Output	Fault Action for Input	Source of Config Data
Byte 1	OLED Display Time							
Byte 2 ... Byte 16	Reserved							
Byte 17	MAC Address [0]							
Byte 18	MAC Address [1]							
Byte 19	MAC Address [2]							
Byte 20	MAC Address [3]							
Byte 21	MAC Address [4]							
Byte 22	MAC Address [5]							
Byte 23	IP Address [0]							
Byte 24	IP Address [1]							
Byte 25	IP Address [2]							
Byte 26	IP Address [3]							
Byte 27	Net Mask [0]							
Byte 28	Net Mask [1]							
Byte 29	Net Mask [2]							
Byte 30	Net Mask [3]							
Byte 31	Net Gateway [0]							
Byte 32	Net Gateway [1]							
Byte 33	Net Gateway [2]							
Byte 34	Net Gateway [3]							
Byte 35 ... Byte 99	Profinet Device Name							

Data description:

Source of Config Data: Parameter configuration mode (Default: 1)

0: Software Configuration

1: Field bus Configuration

Fault Action for Input: Input fault handling mode, when IO module is offline, the COMM board will process IO module input data according to this mode. (Default: 0)

0: Hold Last Input Value

1: Clear Input Value

Fault Action for Output: Output fault handling mode, when IO module is offline, the COMM board will process IO module output data according to this mode. (Default: 1)

0: Hold Last Output Value

1: Clear Output Value

OLED Display Time: OLED LCD display time (S), the LCD will be steady on when the time is set to 0

MAC Address: MAC address, read-only property

IP Address: IP Address, read-only property

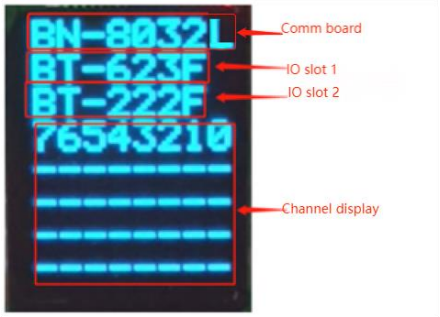
Net Mask: Sub network mask, read-only property

Net Gateway: Gateway address, read-only property

Profinet Device Name: Profinet device name, read-only property

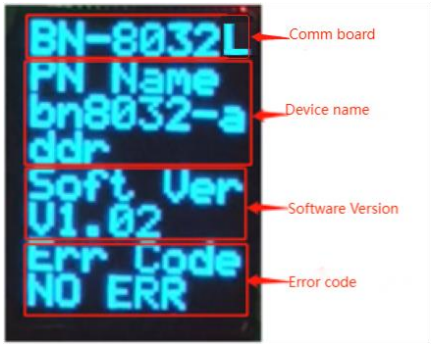
6 LCD display interface

The initial LCD screen is as follows, which displays the COMM board model, slot module model, and channel information (The "*" is displayed for channels with input and output values, and the "-" is displayed for channels without input and output values).



If an I/O module in a slot is empty, "NULL" will be displayed in the corresponding slot:

Press the LCD button to switch to the LCD interface of the COMM board, which displays the module model, IP address, software version, and module fault.



BN-8033: EtherCAT COMM Board

1 The COMM board overview

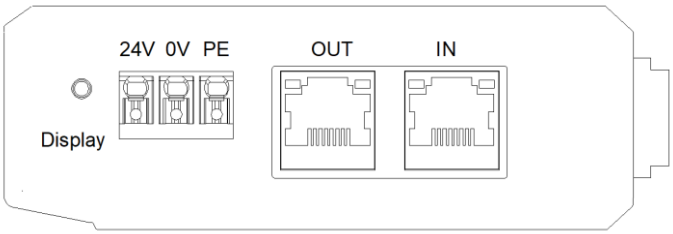
The BN-8033 EtherCAT I/O module supports standard EtherCAT protocol access. The COMM board supports a max input of 1024 bytes and a max output of 1024 bytes, and the number of the extended IO modules it supports is 4.

2 Technical parameters

COMM Board Hardware Parameter	
System Power	Power: 19.2～28.8VDC (Nominal: 24VDC) Protection: Reverse Protection
Power Consumption	100mA@24Vdc
IO module supported	4pcs
Wiring diameter	Max.1.5mm² (AWG 16)
Environment Parameter	
Operation Temperature	-30~75℃
Operation Humidity	5%-95% (No Condensation)
IP Grade	IP20
EtherCAT Parameter	
Network Protocol	EtherCAT
Process Data Area	Max input of 1024 bytes and a max output of 1024 bytes
Network Interface	2*RJ45
Connection Rate	10/100Mbps, MDI/MIDX, Full-Duplex

3 Hardware Interface

3.1 Network Interface



1. The system power module wiring adopts 3Pin 3.5mm spacing spring terminals. The terminal definitions are as follows:

No.	Marking	Definition
1	PE	Protecting Earthing Terminal
2	0V	Power Input -
3	24V	Power Input +

2. EtherCAT network interface

IN is the EtherCAT input port and OUT is the EtherCAT output port, 10Mbps/100Mbps rate adaption.

Speed: Network speed LED (Green)

ON: 100Mbps

OFF: 10Mbps

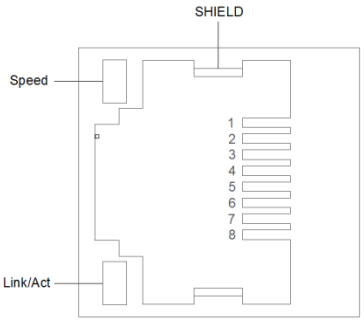
Link/Act: Link state LED, Active state LED (Orange)

ON: Link UP

OFF: Link DOWN

Flash: Active

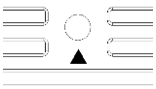
SHIELD: RJ45 Shield Interface



RJ45 Pin definition

Pin	Definition	Description
1	TD+	Sending +
2	TD-	Sending -
3	RD+	Receiving +
4	--	--
5	--	--
6	RD-	Receiving -
7	--	--
8	--	--

3.2 Reset button



Reset

Reset: Module reset button, long press the button for more than 5 seconds and all module parameters will be restored to default values.

3.3 Configuration Interface

Config

Config: Configuration port, standard Type-C port, it could be used to configure device parameters and upgrade firmware.

3.4 LED indicator

PWR: Power State (GREEN)	Definition
ON	System Power Normal
OFF	System Power Failure
RUN: Network Running State (GREEN)	Definition
FLASH	Operating
OFF	Initializing
Quick Flash (10Hz)	Starting or in BootStrap state
Slow Flash (2.5Hz)	In pre-operational state
Single Flash	In safe running state
ERR: Network Error (RED)	Definition
OFF	No error
ON	Application control failed
Quick Flash (10Hz)	Startup errors
Slow Flash (2.5Hz)	Invalid configuration
Single Flash	Local error, unrequested state switch
Double Flash	Watchdog error
IER: Bus Error (RED)	Definition
FLASH	Modules are incorrectly connected to the COMM board
OFF	All modules are correctly connected to the COMM board

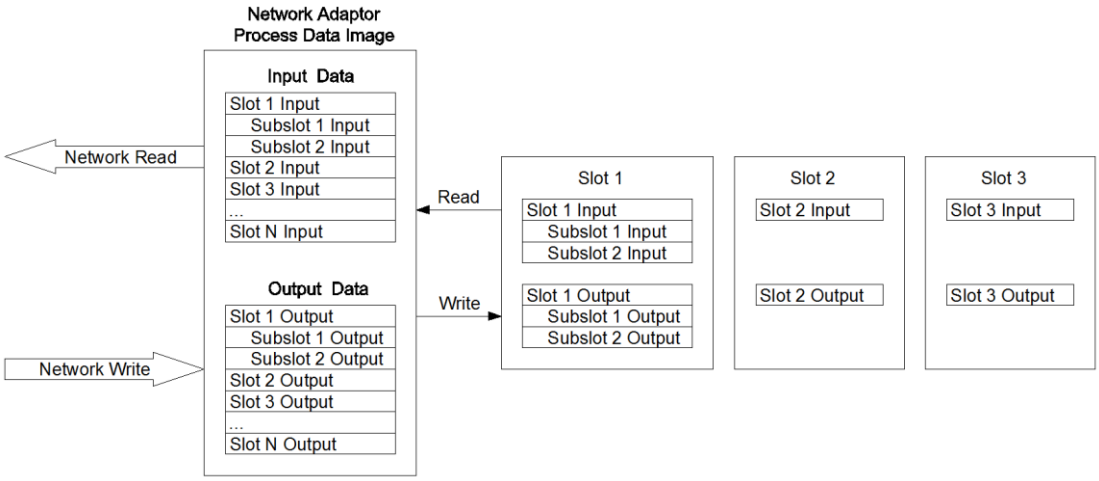
4 Process data definition

4.1 COMM board process data definition

EtherCAT COMM board itself has no input-output process data.

4.2 IO module process data mapping

The COMM board reads and writes input and output process data of IO module in real time through the internal bus, and its data mapping model is shown as follow:



EtherCAT COMM board supports max input bytes of 1024 bytes and a max output bytes of 1024 bytes.

5 Configuration Parameter Definition

Configuration Parameter								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved					Fault Action for Output	Fault Action for Input	Source of Config Data
Byte 1 … Byte 2	Station Alias							
Byte 3	OLED Display Time							
Byte 4 … Byte 18	Reserved							

Data description

Source of Config Data: Parameter configuration mode (Default: 0)

0: Software Configuration

1: Field bus Configuration

Fault Action for Input: Input fault handling mode, when IO module is offline, the COMM board will process IO module input data according to this mode. (Default: 0)

0: Hold Last Input Value

1: Clear Input Value

Fault Action for Output: Output fault handling mode, when IO module is offline, the COMM board will process IO module output data according to this mode. (Default: 0)

0: Hold Last Output Value

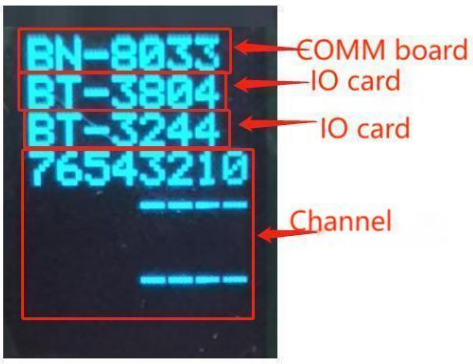
1: Clear Output Value

Station Alias: Alias name of the station

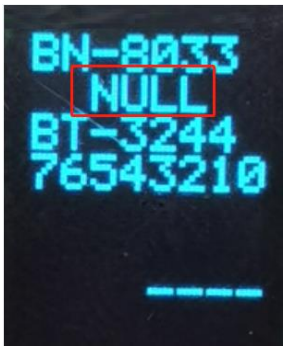
OLED Display Time: OLED LCD display time (S), the LCD will be steady on when the time is set to 0.

6 LCD display interface

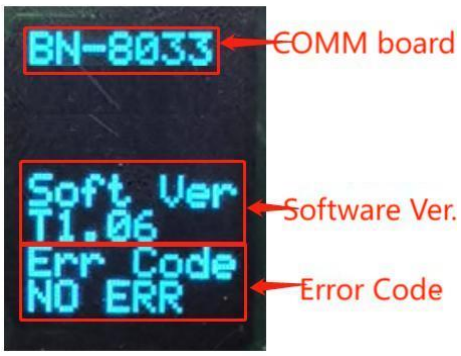
The initial LCD screen is as follows, which displays the COMM board model, slot module model, and channel information (The "*" is displayed for channels with input and output values, and the "-" is displayed for channels without input and output values).



If an I/O module in a slot is empty, "NULL" will be displayed in the corresponding slot:



Press the LCD button to switch to the LCD interface of the COMM board, which displays the module model, IP address, software version, and module fault.



BN-8034: Ethernet/IP COMM Board

1 The COMM board overview

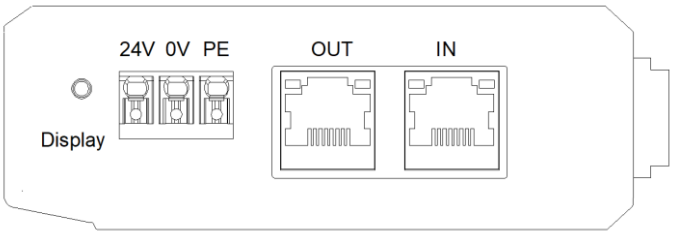
The BN-8034 Ethernet/IP I/O module supports standard Ethernet/IP protocol access. The COMM board supports a max input of 504 bytes and a max output of 504 bytes. The number of extended I/O modules supported is 4.

2 Technical parameters

COMM Board Hardware Parameter	
System Power	Power: 19.2～28.8VDC (Nominal: 24VDC) Protection: Reverse Protection
Power Consumption	100mA@24Vdc
IO module supported	4pcs
Wiring diameter	Max.1.5mm² (AWG 16)
Environment Parameter	
Operation Temperature	-30~75℃
Operation Humidity	5%~95% RH (No Condensation)
IP Grade	IP20
Ethernet/IP Parameter	
Network Protocol	Ethernet/IP
Max input length	504 Bytes per assembly instance
Max output length	504 Bytes per assembly instance
Max no. of explicit message connections	10
Max no. of implicit message connections	5
Max no. of CIP connections	10
Network Interface	2*RJ45
Speed	10/100Mbps, MDI/MIDX, Full-Duplex

3 Hardware Interface

3.1 Network Interface

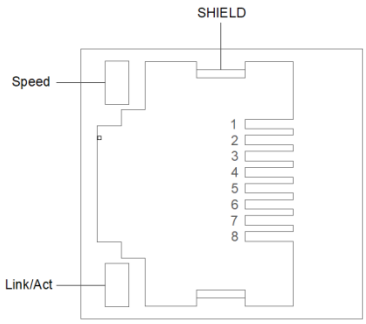


1, The system power module wiring adopts 3Pin 3.5mm spacing spring terminals. The terminal definitions are as follows:

No.	Marking	Definition
1	PE	Protecting Earthing Terminal
2	0V	Power Input -
3	24V	Power Input +

2, Ethernet/IP network interface

LAN1/LAN2 are the Ethernet/IP Ethernet port, 10M/100M self- adaptive rate.



Speed: Network Speed LED Indicator (Green)

ON: 100M

OFF: 10M

Link/Act: Link State, Active State (Orange)

ON: Link UP

OFF: Link DOWN

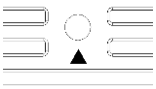
Flash: Active

SHIELD: RJ45 Shield Interface

RJ45 Pin definition

Pin	Definition	Description
1	TD+	Sending +
2	TD-	Sending -
3	RD+	Receiving +
4	--	--
5	--	--
6	RD-	Receiving -
7	--	--
8	--	--

3.2 Reset button



Reset

Reset: Module reset button, long press the button for more than 5 seconds and all module parameters will be restored to default values.

3.3 Configuration Interface

Config

Config: Configuration port, standard Type-C port, it could be used to configure device parameters and upgrade firmware.

3.4 LED indicator

Note: If RUN and ERR are off at the same time, and the network cable is not connected. If RUN and ERR are flashing alternately and it is for power-on self-check.

PWR: Power State (GREEN)	Definition
ON	System Power Normal
OFF	System Power Failure
RUN: Network Running State (GREEN)	Definition
ON	Connection established. The IP address is configured. At least one CIP connection has been established. The master connection has not timed out
FLASH	The connection is not established. The IP address is configured, the CIP connection is not established, and the master connection has not timed out
ERR: Network Error (RED)	Definition
ON	Duplicate IP address. The IP address is already occupied.
FLASH	The connection timed out. After the IP address is configured, the master connection timed out
IER: Bus Error (RED)	Definition
FLASH	Modules are incorrectly connected to the COMM board
OFF	All modules are correctly connected to the COMM board

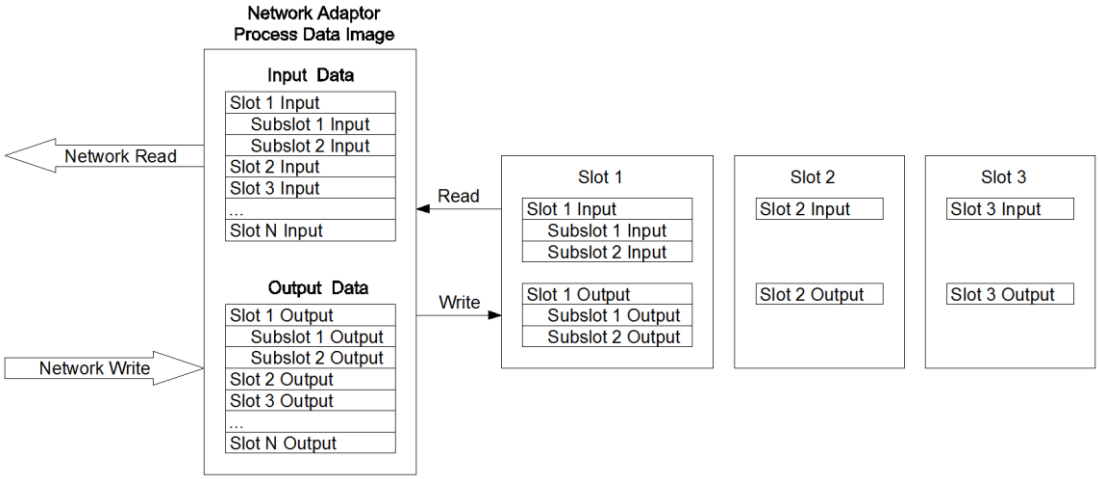
4 Process data definition

4.1 COMM board process data definition

Ethernet/IP COMM board itself has no input-output process data.

4.2 IO module process data mapping

The COMM board reads and writes input and output process data of IO module in real time through the internal bus, and its data mapping model is shown as follow:



Ethernet/IP network adapter max input bytes is 1024 bytes and max output bytes is 1024 bytes.

5 Configuration parameter definition

Configuration Parameter								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved			O-->T Transfer Format	T-->O Transfer Format	Fault Action for Output	Fault Action for Input	Source of Config Data
Byte 1	MAC Address [0]							
Byte 2	MAC Address [1]							
Byte 3	MAC Address [2]							
Byte 4	MAC Address [3]							
Byte 5	MAC Address [4]							
Byte 6	MAC Address [5]							
Byte 7	IP Address [0]							
Byte 8	IP Address [1]							
Byte 9	IP Address [2]							
Byte 10	IP Address [3]							
Byte 11	Net Mask [0]							
Byte 12	Net Mask [1]							
Byte 13	Net Mask [2]							
Byte 14	Net Mask [3]							
Byte 15	Net Gateway [0]							
Byte 16	Net Gateway [1]							
Byte 17	Net Gateway [2]							
Byte 18	Net Gateway [3]							
Byte 19	T-->O Size (Bytes)							
Byte 20								
Byte 21	O-->T Size (Bytes)							
Byte 22								
Byte 23	OLED Display Time							
Byte 24 … Byte 38	Reserved							

Data description:

Source of Config Data: Parameter configuration mode (Default: 0)

0: Software Configuration

1: Field bus Configuration

Fault Action for Input: Input fault handling mode, when IO module is offline, the COMM board will process IO module input data according to this mode. (Default: 0)

0: Hold Last Input Value

1: Clear Input Value

Fault Action for Output: Output fault handling mode, when IO module is offline, the COMM board will process IO module output data according to this mode. (Default: 0)

0: Hold Last Output Value

1: Clear Output Value

T-->O Transfer Format: T-->O input conversion Format, read-only.

O-->T Transfer Format: O-->T Output conversion Format, read-only.

MAC Address: MAC address, read-only property.

IP Address: COMM board IP address

Net Mask: Sub network mask

Net Gateway: Gateway address.

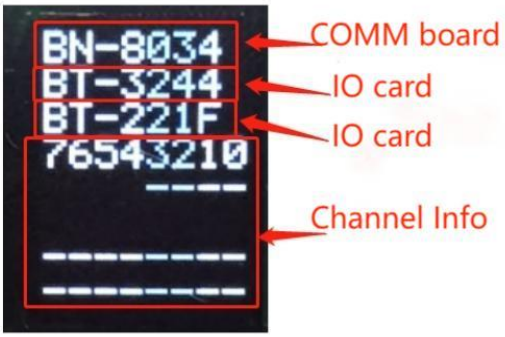
T-- >O Size (Bytes): T-- >O length size (Bytes), read-only.

O-->T Size (Bytes): O-->T length size (Bytes), read-only.

OLED Display Time: OLED LCD display time (S), the LCD will be steady on when the time is set to 0.

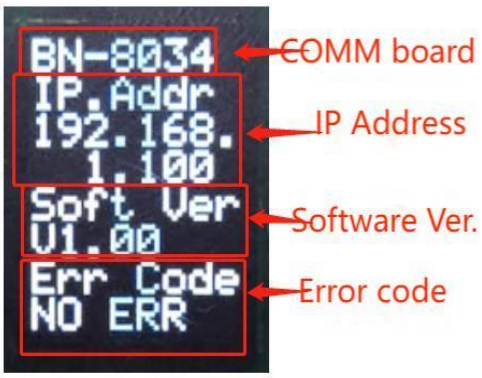
6 LCD display interface

The initial LCD screen is as follows, which displays the COMM board model, slot module model, and channel information (The "*" is displayed for channels with input and output values, and the "-" is displayed for channels without input and output values).



If an I/O module in a slot is empty, "NULL" will be displayed in the corresponding slot:

Press the LCD button to switch to the LCD interface of the COMM board, which displays the module model, IP address, software version, and module fault.



3 Extended IO module

BT-124F: 16-channel digital input / 24VDC /Sink/Source dual direction, the input high&low level is valid

1 Module features

◆ the module supports 16 channels digital input, supports sink type & source type input. The input high level (sink type) is valid and the module it could be connected to PNP sensor while the input low level (source type) is valid, and the module it could be connected to NPN sensor.

◆ the module can collect digital output signal of field equipment (dry contact or active output).

◆ the module can be accessed to 2-wire or 3-wire digital sensor.

◆ the internal bus and field input of the module adopts opto-isolator.

◆ the module supports the input signal holding function, and the holding time can be set.

◆ by adding counting sub-module, the counting function is valid.

◆ each input channel of the module supports a 32-bit counter with the counting frequency <200Hz.

◆ the module can be set the digital signal input filtering time and the byte transmission order of the counter.

◆ each channel of the module could be set the counting mode and counting direction independently.

◆ the module supports LCD display of basic module information and channel indicating display parameters

2 Technical parameters

General parameters	
Power Consumption	Max.60mA@5.0Vdc
Isolation	I/O to internal bus: opto-couple isolation (3KVrms)
Field Power	Nominal: 24Vdc, Range: 19.2～28.8Vdc
Wiring	I/O wiring: Max 1mm² (AWG 18)
Environment Specification	
Operational Temperature	-30~75℃
Operational Humidity	5%-95% (No Condensation)
Protection Class	IP20
Input parameters	
Channel Number	16 channels digital input, supports sink type & source type input
Turn-on voltage	High input: Min.10Vdc to Max.28Vdc (common terminal: 0Vdc) Low input: Min.0Vdc to Max.14Vdc (common terminal: 24Vdc)
Turn-off Voltage	High input: Max.5Vdc (common terminal: 0Vdc) Low input: Min.19Vdc (common terminal: 24Vdc)
Turn-on current	Max.15mA/channel@28V
Input impedance	>7.5kΩ
Input delay	OFF to ON: Max.2ms ON to OFF: Max.2ms
Filter time	Default 10ms
Sample frequency	500Hz
Counter frequency	<200Hz

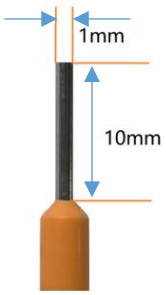
3 Terminal definition

Module wiring adopts 20Pin 3.5mm spacing spring wiring terminals, which are defined as follows:

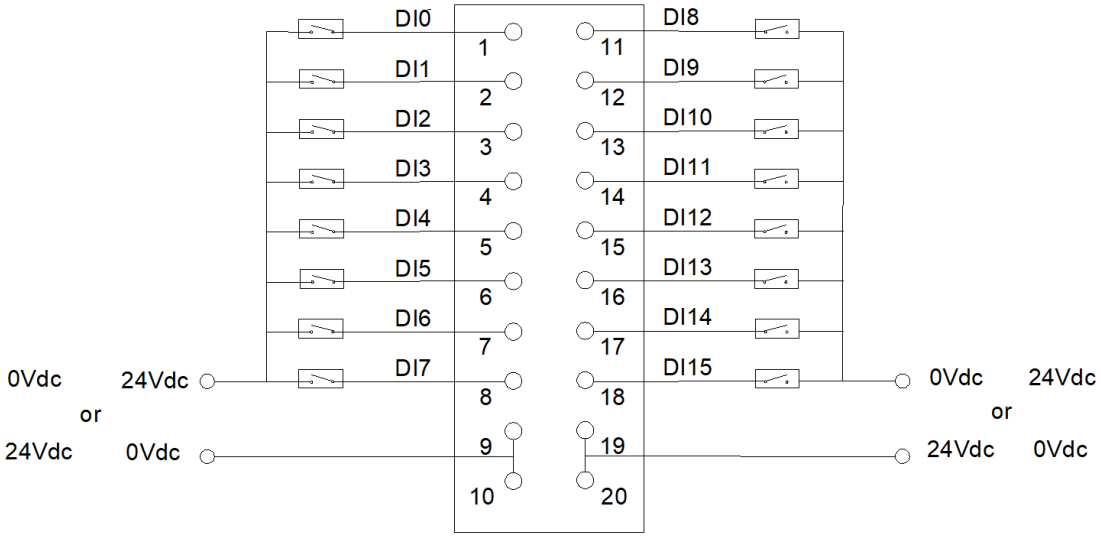
Description	Terminal Number	Symbol	Symbol	Terminal Number	Description
Signal input	1	DI0	DI8	11	Signal input
	2	DI1	DI9	12	
	3	DI2	DI10	13	
	4	DI3	DI11	14	
	5	DI4	DI12	15	
	6	DI5	DI13	16	
	7	DI6	DI14	17	
	8	DI7	DI15	18	
Common terminal	9	24V or 0V	24V or 0V	19	Common terminal
	10			20	

It is recommended to use cables with cores smaller than 1mm².

The cold-pressed terminal parameters are as follows:



4 Wiring



Note: Terminals 9 and 10 are internally short-circuited.
Terminals 19 and 20 are internally short-circuited.

5 Process data definition

<16DI Input Status> Submodule process data definition

Input data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	DI Ch#7	DI Ch#6	DI Ch#5	DI Ch#4	DI Ch#3	DI Ch#2	DI Ch#1	DI Ch#0
Byte 1	DI Ch#15	DI Ch#14	DI Ch#13	DI Ch#12	DI Ch#11	DI Ch#10	DI Ch#9	DI Ch#8

Data description:

DI Ch# (0-15): When the corresponding channel input signal is valid, the bit is 1, and when the input is invalid, it is 0.

0: Input signal invalid

1: Input signal valid

<16DI Counter Submodule> Submodule process data definition:

Input data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Counter Value Ch#0							
Byte 1								
Byte 2								
Byte 3								
Byte 4	Counter Value Ch#1							
Byte 5								
Byte 6								
Byte 7								
Byte 8	Counter Value Ch#2							
Byte 9								
Byte 10								
Byte 11								
Byte 12	Counter Value Ch#3							
Byte 13								
Byte 14								
Byte 15								
Byte 16	Counter Value Ch#4							
Byte 17								
Byte 18								
Byte 19								
Byte 20	Counter Value Ch#5							
Byte 21								
Byte 22								
Byte 23								
Byte 24	Counter Value Ch#6							
Byte 25								
Byte 26								

Byte 27	
Byte 28	Counter Value Ch#7
Byte 29	
Byte 30	
Byte 31	
Byte 32	Counter Value Ch#8
Byte 33	
Byte 34	
Byte 35	
Byte 36	Counter Value Ch#9
Byte 37	
Byte 38	
Byte 39	
Byte 40	Counter Value Ch#10
Byte 41	
Byte 42	
Byte 43	
Byte 44	Counter Value Ch#11
Byte 45	
Byte 46	
Byte 47	
Byte 48	Counter Value Ch#12
Byte 49	
Byte 50	
Byte 51	
Byte 52	Counter Value Ch#13
Byte 53	
Byte 54	
Byte 55	
Byte 56	Counter Value Ch#14
Byte 57	
Byte 58	
Byte 59	
Byte 60	Counter Value Ch#15
Byte 61	
Byte 62	
Byte 63	

Output data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Counter Reset Ch#7	Counter Reset Ch#6	Counter Reset Ch#5	Counter Reset Ch#4	Counter Reset Ch#3	Counter Reset Ch#2	Counter Reset Ch#1	Counter Reset Ch#0
Byte 1	Counter Reset Ch#15	Counter Reset Ch#14	Counter Reset Ch#13	Counter Reset Ch#12	Counter Reset Ch#11	Counter Reset Ch#10	Counter Reset Ch#9	Counter Reset Ch#8

Data description:

Counter Value Ch# (0-15): Count value, 32-bit unsigned integer, automatically zeroing after overflow.

Counter Reset Ch# (0-15): When the data bit changes from 0 to 1 (rising edge), the input counter of the corresponding channel is cleared.

Note: the max counting frequency of the input channel is 200Hz. When the input signal exceeds this frequency, the counting result may be inconsistent with the actual value.

6 Configuration parameter definition

<16DI Input Status> Submodule configuration parameter definition

Configuration parameters								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Input Filtering Time (ms)							
Byte 1								
Byte 2	Reserved					Input Holding Time (ms)		

Data description:

Input Filtering Time (ms): Input filter time of Channel (ms) (Default: 10)

Input Holding Time (ms): Signal input holding time of Channel (ms) (Default: 0)

0: Disable

1: 200ms

2: 500ms

3: 1000ms

4: 1500ms

5: 2000ms

6: 3000ms

7: 5000ms

<16DI Counter Submodule> Submodule configuration parameter definition

Configuration parameters								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved				Storage Enable	Storage Function	32Bit Data Format	
Byte 1	Count Mode Ch#3		Count Mode Ch#2		Count Mode Ch#1		Count Mode Ch#0	
Byte 2	Count Mode Ch#7		Count Mode Ch#6		Count Mode Ch#5		Count Mode Ch#4	
Byte 3	Count Mode Ch#11		Count Mode Ch#10		Count Mode Ch#9		Count Mode Ch#8	
Byte 4	Count Mode Ch#15		Count Mode Ch#14		Count Mode Ch#13		Count Mode Ch#12	
Byte 5	Count Direction Ch#7	Count Direction Ch#6	Count Direction Ch#5	Count Direction Ch#4	Count Direction Ch#3	Count Direction Ch#2	Count Direction Ch#1	Count Direction Ch#0

Byte 6	Count Direction Ch#15	Count Direction Ch#14	Count Direction Ch#13	Count Direction Ch#12	Count Direction Ch#11	Count Direction Ch#10	Count Direction Ch#9	Count Direction Ch#8

Data description:

32Bit Data Format: Byte transfer order of Channel count value (Default: 0)

0: AB-CD

1: BA-DC

2: CD-AB

3: DC-BA

Storage Function: Storage Function is supported or not, read only attribute, and this value is the actual value of the module when uploading device parameters.

0: storage is not supported

1: storage is supported

Storage Enable: Storage enable, when the Storage Function enables, the IO module will save the count value in real time to non-volatile memory, and load the last saved count value on the next power on. (Default: 1)

0: Disabled

1: Enable

Count Mode Ch# (0-15): Count mode of the input channel. (Default: 0)

0: rising edge count

1: falling edge count

2: double edge count

Count Direction Ch# (0-15): The counting direction of the input channel. (Default: 0)

0: count up

1: count down

7 LCD display interface

Page1 **Page2**

Note: The module information display is with a total of 2 pages, the page 1 mainly displays channel status, information tips, and module type information. The page 2 mainly displays software version information.

Page 1: Display channel status and module type

Number 1 displays the slot number (**1**) of the module.

Number 2 displays the module name (**BT-124F**).

Number 3 displays the module type (**16DI, Src or Sink**).

Number 4 displays the channel input display tips. If it displays tips, and this would be indication to the corresponding channels, whereas there is no input and the display will be "**-**". The display will be from right to left, and the high-order byte will be displayed in the front, the low-order byte will be displayed in the back.

1. For example, if all 16 channels have input, and **Number 4** will be displayed as:

76543210

FEDCBA98

2. If there is no input for 16 channels, and **Number 4** will be displayed as:

----

3. If the COMM board is connected with the master first and then disconnected (the disconnected time exceeds the watchdog time), and **Number 4** will be displayed as:

__fault_

__fault_

Page 2: Display software version information.

Number 1 displays the slot number (**1**) of the module.

Number 2 displays module name (**BT-124F**).

Number 3 displays the IAP version information for the module (**V1.02**).

Number 4 displays the APP version information for this module (**V1.02**).

BT-222F: 16-channel / digital output / 24VDC / source, the output high level is valid

1 Module features

◆ the module supports 16 channels digital output, and the output voltage is 24VDC and the output high level is valid.

◆ the module can drive field equipment. (relay, solenoid valve, etc.)

◆ the internal bus of the module and field output are using opto-coupler.

◆ the module has the functions of thermal shutdown and overcurrent protection.

◆ the module supports short circuit protection and overload protection warning functions to corresponding channels.

◆ the module supports LCD display of basic module information and channel indicator display parameters.

◆ the module supports the fault output processing function when the application layer is disconnected.

2 Technical parameters

General Parameters	
Power	Max.175mA@5.0Vdc
Isolation	I/O to internal bus: opto-couple isolation (3KVrms)
Field Power	Nominal: 24Vdc, Range: 19.2～28.8Vdc
Wiring	I/O wiring: Max 1mm² (AWG 18)
Environment Specification	
Operational Temperature	-30~75℃
Operational Humidity	5%-95% (No Condensation)
Protection Class	IP20
Output Parameters	
Channel Number	16 channel source type output
Rated Current	Single-channel: 700mA Multi-channel: 500mA
Leakage Current	Max: 5uA
Output Impedance	<120mΩ
Output Delay	OFF to ON: Max.100us ON to OFF: Max.100us
Protection	Overtemperature shutdown: typical value is 130℃ Overcurrent protection: typical value 1.3A Short circuit protection: support

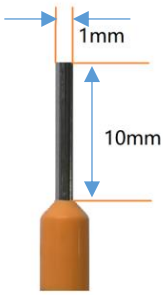
3 Terminal definition

Module wiring adopts 20Pin 3.5mm spacing spring wiring terminals, which are defined as follows:

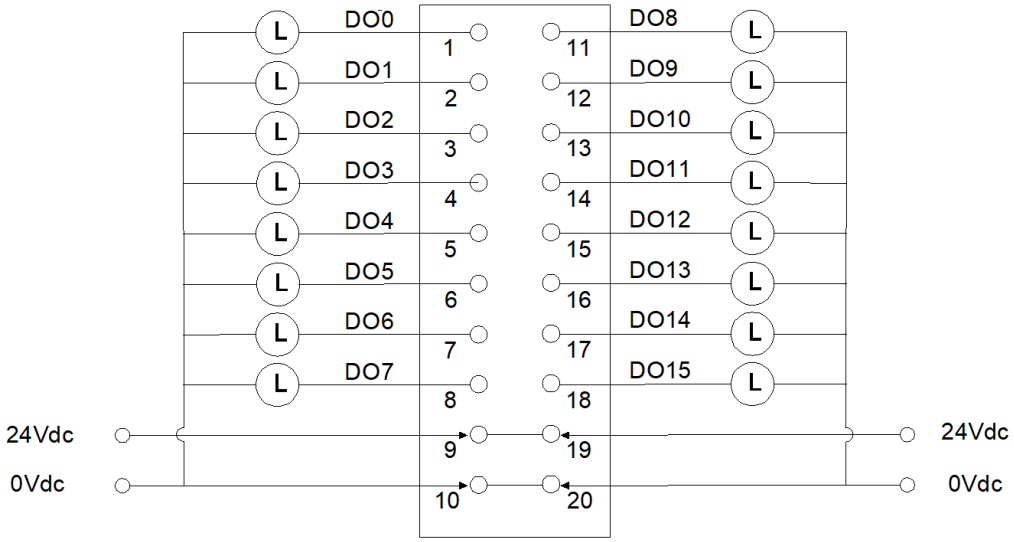
Description	Terminal Number	Symbol	Symbol	Terminal Number	Description
Signal output	1	DO0	DO8	11	Signal output
	2	DO1	DO9	12	
	3	DO2	DO10	13	
	4	DO3	DO11	14	
	5	DO4	DO12	15	
	6	DO5	DO13	16	
	7	DO6	DO14	17	
	8	DO7	DO15	18	
Power	9	24V	24V	19	Power
	10	0V	0V	20	

It is recommended to use cables with cores smaller than 1mm².

The cold-pressed terminal parameters are as follows:



4 Wiring



Note: Terminals 9 and 19 are internally short-circuited.
Terminals 10 and 20 are internally short-circuited.

5 Process data definition

Output data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	DO Ch#7	DO Ch#6	DO Ch#5	DO Ch#4	DO Ch#3	DO Ch#2	DO Ch#1	DO Ch#0
Byte 1	DO Ch#15	DO Ch#14	DO Ch#13	DO Ch#12	DO Ch#11	DO Ch#10	DO Ch#9	DO Ch#8

Data declaration:

DO Ch# (0-15): when this bit is 1, the corresponding channel output signal is valid, the output is high level, and the output is invalid when it is 0.

0: Output signal is invalid

1: Output signal is valid

6 Configuration parameter definition

Configuration parameters								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Fault Action for Output Ch#7	Fault Action for Output Ch#6	Fault Action for Output Ch#5	Fault Action for Output Ch#4	Fault Action for Output Ch#3	Fault Action for Output Ch#2	Fault Action for Output Ch#1	Fault Action for Output Ch#0
Byte 1	Fault Action for Output Ch#15	Fault Action for Output Ch#14	Fault Action for Output Ch#13	Fault Action for Output Ch#12	Fault Action for Output Ch#11	Fault Action for Output Ch#10	Fault Action for Output Ch#9	Fault Action for Output Ch#8
Byte 2	Fault Value for Output Ch#7	Fault Value for Output Ch#6	Fault Value for Output Ch#5	Fault Value for Output Ch#4	Fault Value for Output Ch#3	Fault Value for Output Ch#2	Fault Value for Output Ch#1	Fault Value for Output Ch#0
Byte 3	Fault Value for Output Ch#15	Fault Value for Output Ch#14	Fault Value for Output Ch#13	Fault Value for Output Ch#12	Fault Value for Output Ch#11	Fault Value for Output Ch#10	Fault Value for Output Ch#9	Fault Value for Output Ch#8

Data description:

Fault Action for Output Ch# (0-15): Fault Output mode. When the IO module detects an internal bus exception and fails to communicate with the adapter. And the module will turn to offline mode, so the output data is processed in this way. (default: 0)

0: keep the last time output State.

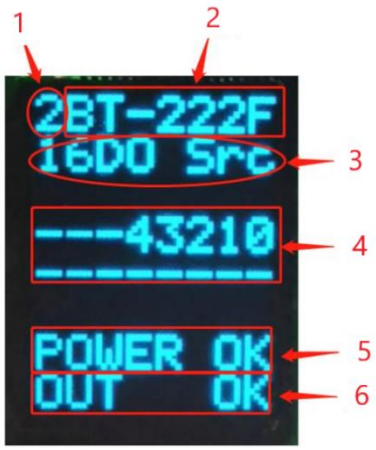
1: output fault value.

Fault Value for Output Ch# (0-15): when the Fault Output mode is 1, this bit sets the Fault Output Value, and this setting value will be outputted when the internal bus of IO module is offline. (default: 0)

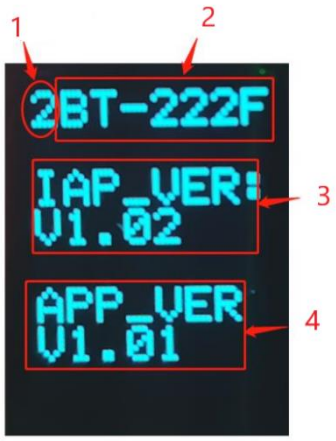
0: Output low level.

1: Output high level.

7 LCD display interface



Page1



Page2

Note: The module information display is 2 pages in total, the first number on the first row of each page indicates the slot location of the module, and the module model is displayed behind. The page 1 mainly displays channel status, information tips, and module type information, and the page 2 mainly displays software version information.

Page 1: Display channel status and module type

Number 1 displays the slot number (**2**) of the module.

Number 2 displays the module name (**BT-124F**).

Number 3 displays the module type (**16DO, Src**)

Number 4 displays the channel output display tips. If it displays tips, and this would be indication to the corresponding channels, whereas there is no output and the display will be "**-**". The display will be from right to left.

1. For example, if all 16 channels have output, and **Number 4** will be displayed as:

76543210

FEDCBA98

2. If there is no output for 16 channels, and **Number 4** will be displayed as:

----

3. If the COMM board is connected with the master first and then disconnected, and the application layer is disconnected, and after the fault output has been processed. Then **Number 4** will be displayed as:

__fault_

__fault_

4. **Number 5** displays the onsite power supply of the module. "POWER OK" is displayed if onsite power supply is connected. "NO 24Vdc" is displayed if onsite power supply is not connected.

5. **Number 6** displays the output state of the channel, and it is not displayed if the output is normal. If the channel is overloaded, or the output is faulty, and the LCD will be displayed as "H Temper", so the corresponding channel indicator will be displayed as **"^"**.

6. For example, it is displayed as below when the second channel output is overloaded.

765432^0

FEDCBA98

Page 2: Display software version information.

Number 1 displays the slot number (**2**) of the module.

Number 2 displays module name (**BT-222F**).

Number 3 displays the IAP version information for the module (**V1.02**).

Number 4 displays the APP version information for this module (**V1.01**).

BT-221F: 16-channel / digital output / 24VDC / sink, the output low level is valid

1 Module features

◆ the module supports 16 channels digital output; the output voltage is 0V and the output low level is valid.

◆ the module can drive field equipment (relay, solenoid valve, etc.).

◆ the internal bus and field output of the module both adopt electromagnetic isolation.

◆ the module has the function of thermal shutdown and over current protection.

◆ the module supports the short circuit warning function to the corresponding channel.

◆ the module supports the fault output processing function when the application layer is disconnected.

2 Technical parameters

General Parameters	
Power	Max.140mA@5.0Vdc
Isolation	I/O to internal bus: opto-couple isolation (3KVrms)
Field Power	Nominal: 24Vdc, Range: 19.2～28.8Vdc
Wiring	I/O wiring: Max 1mm² (AWG 18)
Environment Specification	
Operational Temperature	-30~75℃
Operational Humidity	5%-95% (No Condensation)
Protection Class	IP20
Output parameters	
Channel Number	16 channel sink type output
Rated Current	Single channel output: Max.500mA Simultaneously output: Max.300mA
Leakage Current	Max: 30uA
RDSON	Typical value: 1.5Ω
Output Delay	OFF to ON: Max.100us ON to OFF: Max.100us
Protection	Overtemperature shutdown: typical value is 160℃ Overcurrent protection: typical value 620mA Short circuit protection: supported

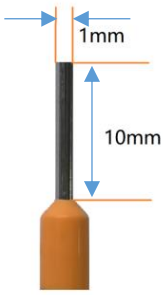
3 Terminal definition

Module wiring adopts 20Pin 3.5mm spacing spring wiring terminals, which are defined as follows:

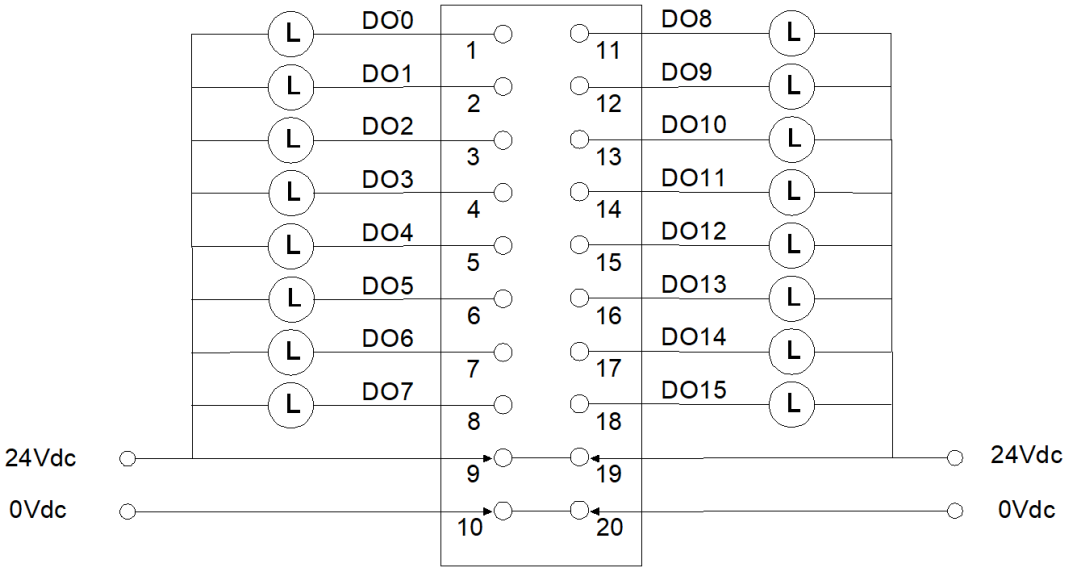
Description	Terminal Number	Symbol	Symbol	Terminal Number	Description
Signal output	1	DO0	DO8	11	Signal output
	2	DO1	DO9	12	
	3	DO2	DO10	13	
	4	DO3	DO11	14	
	5	DO4	DO12	15	
	6	DO5	DO13	16	
	7	DO6	DO14	17	
	8	DO7	DO15	18	
Power	9	24V	24V	19	Power
	10	0V	0V	20	

It is recommended to use cables with cores smaller than 1mm².

The cold-pressed terminal parameters are as follows:



4 Wiring



Note: Terminals 9 and 19 are internally short-circuited.
Terminals 10 and 20 are internally short-circuited.

5 Process data definition

Output data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	DO Ch#7	DO Ch#6	DO Ch#5	DO Ch#4	DO Ch#3	DO Ch#2	DO Ch#1	DO Ch#0
Byte 1	DO Ch#15	DO Ch#14	DO Ch#13	DO Ch#12	DO Ch#11	DO Ch#10	DO Ch#9	DO Ch#8

Data declaration:

DO Ch# (0-15): when this bit is 1, the corresponding channel output signal is valid, the output is low level, and the output is invalid when it is 0.

0: Output signal is invalid

1: Output signal is valid

6 Configuration parameter definitions

Configuration parameters								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Fault Action for Output Ch#7	Fault Action for Output Ch#6	Fault Action for Output Ch#5	Fault Action for Output Ch#4	Fault Action for Output Ch#3	Fault Action for Output Ch#2	Fault Action for Output Ch#1	Fault Action for Output Ch#0
Byte 1	Fault Action for Output Ch#15	Fault Action for Output Ch#14	Fault Action for Output Ch#13	Fault Action for Output Ch#12	Fault Action for Output Ch#11	Fault Action for Output Ch#10	Fault Action for Output Ch#9	Fault Action for Output Ch#8
Byte 2	Fault Value for Output Ch#7	Fault Value for Output Ch#6	Fault Value for Output Ch#5	Fault Value for Output Ch#4	Fault Value for Output Ch#3	Fault Value for Output Ch#2	Fault Value for Output Ch#1	Fault Value for Output Ch#0
Byte 3	Fault Value for Output Ch#15	Fault Value for Output Ch#14	Fault Value for Output Ch#13	Fault Value for Output Ch#12	Fault Value for Output Ch#11	Fault Value for Output Ch#10	Fault Value for Output Ch#9	Fault Value for Output Ch#8

Data description:

Fault Action for Output Ch# (0-15): Fault Output mode. When the IO module detects an internal bus exception and fails to communicate with the adapter. And the module will turn to offline mode, so the output data is processed in this way. (default: 0)

0: keep the last time output State.

1: output fault value.

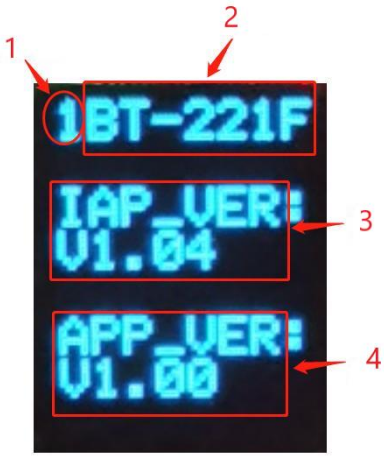
Fault Value for Output Ch# (0-15): when the Fault Output mode is 1, this bit sets the Fault Output Value, and this setting value will be outputted when the internal bus of IO module is offline. (default: 0)

0: Output low level.

1: Output high level.

7 LCD display interface

Page1



Page2

Note: The module information display is 2 pages in total, the first number on the first row of each page indicates the slot location of the module, and the module model is displayed behind. Page 1 mainly displays channel status, information tips, and module type information, and Page 2 mainly displays software version information.

Page 1: Display channel status and module type

Number 1 displays the slot number (**1**) of the module.

Number 2 displays the module name (**BT-221F**).

Number 3 displays the module type (**16DO, Sin**).

Number 4 displays the channel input display tips. If it displays tips, and this would be indication to the corresponding channels, whereas there is no input and the display will be "**-**". The display will be from right to left.

1. For example, if all 16 channels have output, and **Number 4** will be displayed as:

76543210

FEDCBA98

2. If there is no output for 16 channels, and **Number 4** will be displayed as:

----

3. If the COMM board is connected with the master first and then disconnected, and the application layer is disconnected, and after the fault output has been processed. Then **Number 4** will be displayed as:

__fault_

__fault_

Row 8 shows the output state of the channel, and it is not displayed if the output is normal. And if the channel is overcurrent short circuited, or the output is faulty, and the LED will be displayed as **"CH Short"**, so the corresponding channel indicator is displayed as **"^"**. For example, if the second channel output is overloaded and it will be displayed as:

765432^0

FEDCBA98

Page 2: Display software version information.

Number 1 displays the slot number (**1**) of the module.

Number 2 displays module name (**BT-221F**).

Number 3 displays the IAP version information for the module (**V1.04**).

Number 4 displays the APP version information for this module (**V1.00**).

BT-3158: 8-channel / voltage input / 0-5VDC/ 0-10VDC/±5VDC/±10VDC, 12bits

1 Module features

◆ the module supports 8 channels of voltage signal input

◆ the module could collect signal of 0~5VDC, 0~10VDC, ±5VDC, ±10VDC, with a 12-bit resolution.

◆ the module input signal is a single ended common grounding input

◆ the filtering time could be set.

◆ the module supports LCD display of basic module information and channel indicator display parameters

2 Technical parameters

General Parameters	
Power	Max.100mA@5.0Vdc
Isolation	I/O to internal bus: opto-couple isolation (3KVrms)
Wiring	I/O wiring: Max 1mm² (AWG 18)
Environment Specification	
Operational Temperature	-30~75℃
Operational Humidity	5%-95% (No Condensation)
Protection Class	IP20
Input parameters	
Channel Number	8 channel voltage input
LED Indicator	0~5VDC, 0~10VDC, ±5VDC, ±10VDC
Resolution	12Bits
Accuracy	±0.3%@25℃ ±0.5@-30~75℃
Sample Rate	2ms/8 channels
Import Impedance	1MΩ
Common Terminal	Common Grounding Input
Data format	16 - bit signed integer

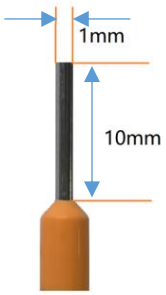
3 Terminal definition

Module wiring adopts 20Pin 3.5mm spacing spring wiring terminals, which are defined as follows:

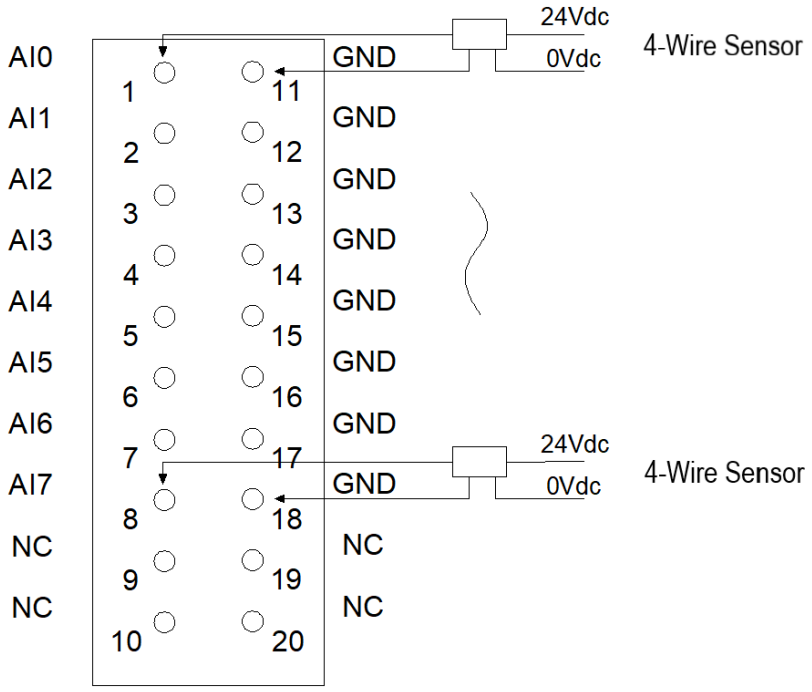
Description	Terminal Number	Symbol	Symbol	Terminal Number	Description
Signal input	1	AI0	GND	11	Signal input
	2	AI1	GND	12	
	3	AI2	GND	13	
	4	AI3	GND	14	
	5	AI4	GND	15	
	6	AI5	GND	16	
	7	AI6	GND	17	
	8	AI7	GND	18	
N/A	9	NC	NC	19	N/A
	10	NC	NC	20	

It is recommended to use cables with cores smaller than 1mm².

The cold-pressed terminal parameters are as follows:



4 Wiring


AI0
AI1
AI2
AI3
AI4
AI5
AI6
AI7
NC
NC
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
GND
GND
GND
GND
GND
GND
GND
GND
NC
NC
24Vdc
0Vdc
4-Wire Sensor
24Vdc
0Vdc
4-Wire Sensor

5 Process data definition

Input data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Analog Input Data (CH 0)							
Byte 1								
Byte 2	Analog Input Data (CH 1)							
Byte 3								
Byte 4	Analog Input Data (CH 2)							
Byte 5								
Byte 6	Analog Input Data (CH 3)							
Byte 7								
Byte 8	Analog Input Data (CH 4)							
Byte 9								
Byte 10	Analog Input Data (CH 5)							
Byte 11								
Byte 12	Analog Input Data (CH 6)							
Byte 13								
Byte 14	Analog Input Data (CH 7)							
Byte 15								

Data description:

Analog Input Data (CH0-7): Voltage input data value

Process data definition (8AI)					
Voltage (0-5V)	Voltage (0-10V)	Voltage (±5V)	Voltage (±10V)	Decimal	Hex
5	10	5	10	4095	0x0FFF
.	.	.	.	.	.
.	.	.	.	.	.
2.5	5	2.5	5	2047	0x07FF
.	.	.	.	.	.
.	.	.	.	.	.
0	0	0	0	0	0x0000
/	/	.	.	.	.
/	/	.	.	.	.
/	/	-2.5	-5	-2047	0xF801
/	/	.	.	.	.
/	/	.	.	.	.
/	/	-5	-10	-4095	0xF001

6 Configuration parameters definition

Configuration Parameters								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved							16Bit Data Format
Byte 1	Voltage Type (CH 3)		Voltage Type (CH 2)		Voltage Type (CH 1)		Voltage Type (CH 0)	
Byte 2	Voltage Type (CH 7)		Voltage Type (CH 6)		Voltage Type (CH 5)		Voltage Type (CH 4)	
Byte 3	Filtering Time (CH0)							
Byte 4								
Byte 5	Filtering Time (CH1)							
Byte 6								
Byte 7	Filtering Time (CH2)							
Byte 8								
Byte 9	Filtering Time (CH3)							
Byte 10								
Byte 11	Filtering Time (CH4)							
Byte 12								
Byte 13	Filtering Time (CH5)							
Byte 14								
Byte 15	Filtering Time (CH6)							
Byte 16								
Byte 17	Filtering Time (CH7)							
Byte 18								

Data description:

16Bit Data Format: Sequence of 16-bit data byte transmission (Default: 0)

0: A_B

1: B_A

Voltage Type (CH 0-7): Input voltage type (Default: 2)

0: 0~5Vdc

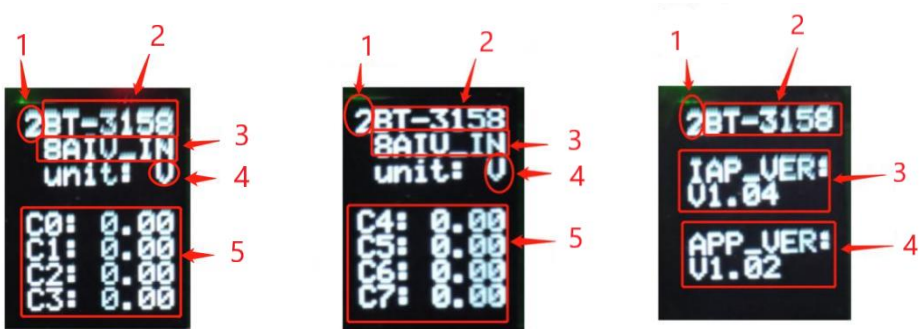
1: -5~5Vdc

2: 0~10Vdc

3: -10~10Vdc

Filtering Time (CH0-CH7): The input filtering time of the channel, unit ms. (default value: 10)

7 LCD display interface



Page1 **Page2** **Page3**

Note: The module information display is 3 pages in total, the page 1 and 2 mainly display channel status, information tips, and module type information, the page 3 mainly displays software version information.

Number 1 of each page displays the slot number (**2**) of the module.

Number 2 displays the module name (**BT-3158**).

Page 1 and 2: channel status and module type information

Number 3 displays the type of module;

Number 4 displays the units of voltage;

Number 5 displays values for the voltage acquisition size.

1. If the COMM board is connected with the master first and then disconnected (the disconnected time exceeds the watchdog time), and voltage display row will be displayed as:

__fault_

Page 3: Display software version information

Number 1 displays the slot number (**2**) of the module.

Number 2 displays module name (**BT-3158**).

Number 3 displays the IAP version information for the module (**V1.04**).

Number 4 displays the APP version information for this module (**V1.02**).

BT-3168: 8-channel / voltage input 0~5VDC/0~10VDC/±5VDC/±10VDC, 15bit/16bit

1 Module features

◆ the module supports 8 channels of voltage signal input

◆ the module could collect signal of 0~5VDC, 0~10VDC, ±5VDC, ±10VDC, with 15bits or 16 bits resolution.

◆ the module input signal is a single ended common grounding input

◆ the filtering time could be set.

◆ the module supports LCD display of basic module information and channel indicator display parameters

2 Technical parameters

General Parameters	
Power	Max.100mA@5.0Vdc
Isolation	I/O to internal bus: opto-couple isolation (3KVrms)
Wiring	I/O wiring: Max 1mm² (AWG 18)
Environment Specification	
Operational Temperature	-30~75℃
Operational Humidity	5%-95% (No Condensation)
Protection Class	IP20
Input parameters	
Channel Number	8 channel voltage input
LED Indicator	0~5VDC, 0~10VDC, ±5VDC, ±10VDC
Resolution	15/16Bits
Accuracy	±0.3%@25℃ ±0.5@-30~75℃
Sample Rate	1ms/8 channels
Import Impedance	1MΩ
Common Terminal	Common Grounding Input
Data format	16 bits signed integer

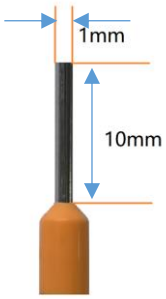
3 Terminal definition

Module wiring adopts 20Pin 3.5mm spacing spring wiring terminals, which are defined as follows:

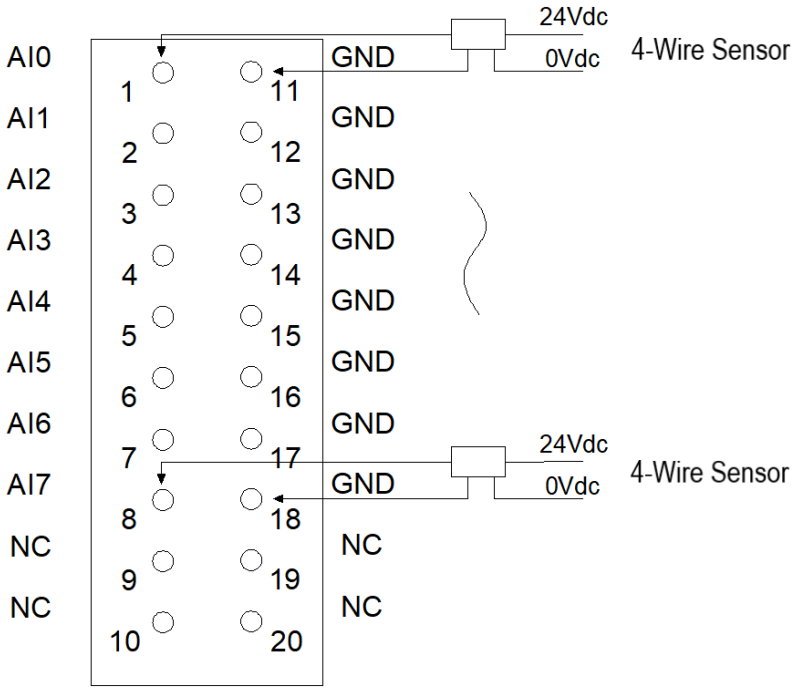
Description	Terminal Number	Symbol	Symbol	Terminal Number	Description
Signal input	1	AI0	GND	11	Signal input
	2	AI1	GND	12	
	3	AI2	GND	13	
	4	AI3	GND	14	
	5	AI4	GND	15	
	6	AI5	GND	16	
	7	AI6	GND	17	
	8	AI7	GND	18	
N/A	9	NC	NC	19	N/A
	10	NC	NC	20	

It is recommended to use cables with cores smaller than 1mm².

The cold-pressed terminal parameters are as follows:



4 Wiring


AI0
AI1
AI2
AI3
AI4
AI5
AI6
AI7
NC
NC
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
GND
GND
GND
GND
GND
GND
GND
GND
NC
NC
24Vdc
0Vdc
4-Wire Sensor
24Vdc
0Vdc
4-Wire Sensor

5 Process data definition

Input data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Analog Input Data (CH 0)							
Byte 1								
Byte 2	Analog Input Data (CH 1)							
Byte 3								
Byte 4	Analog Input Data (CH 2)							
Byte 5								
Byte 6	Analog Input Data (CH 3)							
Byte 7								
Byte 8	Analog Input Data (CH 4)							
Byte 9								
Byte 10	Analog Input Data (CH 5)							
Byte 11								
Byte 12	Analog Input Data (CH 6)							
Byte 13								
Byte 14	Analog Input Data (CH 7)							
Byte 15								

Data description:

(Standard Mode) Analog Input Data (CH0-7): Voltage input data value

Process data definition (8AI)					
Voltage (0-5V)	Voltage (0-10V)	Voltage (±5V)	Voltage (±10V)	Decimal	Hex
5	10	5	10	27648	0x6C00
.	.	.	.	.	.
.	.	.	.	.	.
2.5	5	2.5	5	13824	0x3600
.	.	.	.	.	.
.	.	.	.	.	.
0	0	0	0	0	0x0000
/	/	.	.	.	.
/	/	.	.	.	.
/	/	-2.5	-5	-13824	0xCA00
/	/	.	.	.	.
/	/	.	.	.	.
/	/	-5	-10	-27648	0x9400

(Special Mode) Analog Input Data (CH0-7): Voltage input data value

Process data definition (8AI)					
Voltage (0-5V)	Voltage (0-10V)	Voltage (±5V)	Voltage (±10V)	Decimal	Hex
5	10	5	10	32767	0x7FFF
.	.	.	.	.	.
.	.	.	.	.	.
2.5	5	2.5	5	16383	0x3FFF
.	.	.	.	.	.
.	.	.	.	.	.
0	0	0	0	0	0x0000
/	/	.	.	.	.
/	/	.	.	.	.
/	/	-2.5	-5	-16384	0xC000
/	/	.	.	.	.
/	/	.	.	.	.
/	/	-5	-10	-32768	0x8000

6 Configuration parameters definition

Configuration Parameters								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved						Range_ Mode	16Bit Data Format
Byte 1	Voltage Type (CH 1)				Voltage Type (CH 0)			
Byte 2	Voltage Type (CH 3)				Voltage Type (CH 2)			
Byte 3	Voltage Type (CH 5)				Voltage Type (CH 4)			
Byte 4	Voltage Type (CH 7)				Voltage Type (CH 6)			
Byte 5	Filtering Time (CH0)							
Byte 6								
Byte 7	Filtering Time (CH1)							
Byte 8								
Byte 9	Filtering Time (CH2)							
Byte 10								
Byte 11	Filtering Time (CH3)							
Byte 12								
Byte 13	Filtering Time (CH4)							
Byte 14								
Byte 15	Filtering Time (CH5)							
Byte 16								
Byte 17	Filtering Time (CH6)							
Byte 18								
Byte 19	Filtering Time (CH7)							
Byte 20								
Byte 21 … Byte 29	Reserved							

Data description:

16Bit Data Format: Sequence of 16-bit data byte transmission (Default: 0)

0: A_B

1: B_A

Range_Mode: process data mode (Default: standard mode)

Standard mode: Siemens process data definition is the same

Special mode: Hardware maximum range

Voltage Type (CH 0-7): Input voltage type (Default: 2)

0: 0~5Vdc

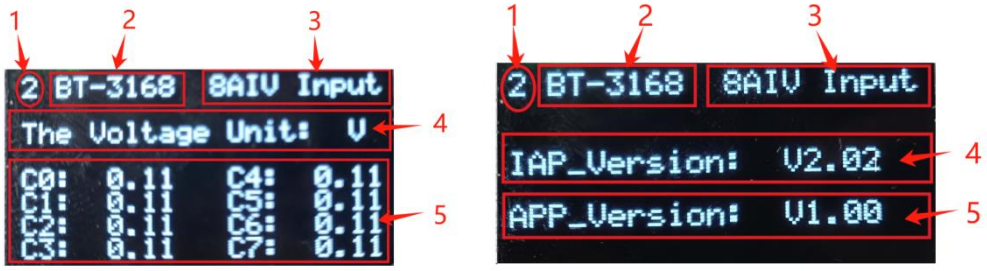
1: -5~5Vdc

2: 0~10Vdc

3: -10~10Vdc

Filtering Time (CH0-CH7): The input filtering time of the channel, unit ms (default value: 10)

7 LCD display interface



Page1 **page2**

Note: The module information display is 2 pages in total, the page 1 mainly displays channel status, information tips, and module type information, the page 2 mainly displays software version information.

Number 1 of each page displays the slot number (**2**) of the module.

Number 2 displays the module name (**BT-3168**).

Page 1: channel status and module type information

Number 3 displays the type of module.

Number 4 displays the units of voltage.

Number 5 displays values for the voltage acquisition size.

1. If the COMM board is connected with the master first and then disconnected (the disconnected time exceeds the watchdog time), and voltage display row will be displayed as:

__fault_

Page 2: Display software version information

Number 1 displays the slot number (**2**) of the module.

Number 2 displays module name (**BT-3168**).

Number 3 displays the IAP version information for the module (**V1.04**).

Number 4 displays the APP version information for this module (**V1.02**).

BT-3238: 8-channel / current input /0&4-20mA, 15-bits, single ended

1 Module features

◆ the module supports 8-channel current signal acquisition.

◆ the module can be configured for 0-20mA or 4-20mA current signal acquisition.

◆ the module supports 2-wire (non-loop output, external power supply is required) or 4-wire current sensor input.

◆ the internal bus of the module and field input adopts magnetic insulation.

◆ the module input channel could be connected to the field active analog signal current output sensor.

◆ the module channel equips with TVS overvoltage protection.

◆ the module supports separately disabling specific channels to improve the acquisition speed.

◆ the module supports LCD display of basic module information and channel indicator display parameters.

2 Technical parameters

General Parameters	
Power	Max.65mA@5.0Vdc
Isolation	I/O to internal bus: magnetic isolation (2.5KVrms) Power isolation: DC-DC
Wiring	I/O wiring: Max.1mm² (AWG 18)
Environment Specification	
Operational Temperature	-30~75℃
Operational Humidity	5%-95% (No Condensation)
Protection Class	IP20
Input parameters	
Channel Number	8 channels
Input range	0~20mA, 4~20mA
Resolution ratio	15 Bits
Acquisition precision	±0.3% full range, @25℃
	±0.5% full range, @-20~70℃
Sampling Resistance	100Ω
Sampling rate	35ms/8 channels
Data format	16-bit signed integer

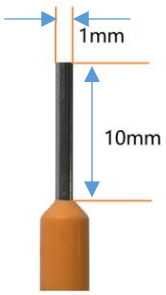
3 Terminal definition

Module wiring adopts 20Pin 3.5mm spacing spring wiring terminals, which are defined as follows:

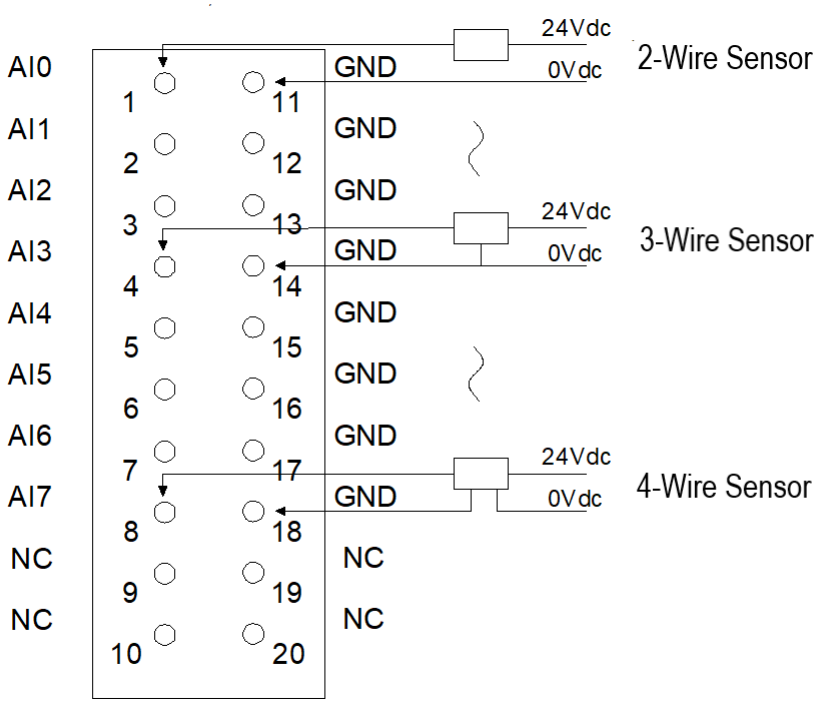
Description	Terminal Number	Symbol	Symbol	Terminal Number	Description
Signal input	1	AI0	GND	11	Signal input
	2	AI1	GND	12	
	3	AI2	GND	13	
	4	AI3	GND	14	
	5	AI4	GND	15	
	6	AI5	GND	16	
	7	AI6	GND	17	
	8	AI7	GND	18	
N/A	9	NC	NC	19	N/A
	10	NC	NC	20	

It is recommended to use cables with cores smaller than 1mm².

The cold-pressed terminal parameters are as follows:



4 Wiring


AI0
AI1
AI2
AI3
AI4
AI5
AI6
AI7
NC
NC
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
GND
GND
GND
GND
GND
GND
GND
GND
NC
NC
24Vdc
0Vdc
2-Wire Sensor
24Vdc
0Vdc
3-Wire Sensor
24Vdc
0Vdc
4-Wire Sensor

5 Process data definition

Input Data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Analog Input Data (CH 0)							
Byte 1								
Byte 2	Analog Input Data (CH 1)							
Byte 3								
Byte 4	Analog Input Data (CH 2)							
Byte 5								
Byte 6	Analog Input Data (CH 3)							
Byte 7								
Byte 8	Analog Input Data (CH 4)							
Byte 9								
Byte 10	Analog Input Data (CH 5)							
Byte 11								
Byte 12	Analog Input Data (CH 6)							
Byte 13								
Byte 14	Analog Input Data (CH 7)							
Byte 15								

Data description:

Analog Input Data (CH0-7): Analog signal Input value of corresponding channel.

Analog Input Data (BT-3238)				
Current (0-20mA)	Current (4-20mA)	Decimal	Hexadecimal	Range
>23.52 mA	>22.81 mA	32767	7FFF	Overflow
23.52 mA	22.81 mA	32511	7EFF	Exceed the range
		27649	6C01	
20 mA	20 mA	27648	6C00	Rated range
.	.	.	.	
15 mA	16 mA	20736	5100	
.	.	.	.	
723.4 nA	4Ma+578.7nA	1	1	
0 mA	4 mA	0	0	
		-1	FFFF	Below the range
-3.52 mA	1.185 mA	-4864	ED00	
<-3.52 mA	<1.185 mA	-32768	8000	Underflow

Note: Disabling channel process data uploading value is -32767.

6 Configuration parameter definition

Configuration parameters								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved							16Bit Data Format
Byte 1	Current Type Ch#3		Current Type Ch#2		Current Type Ch#1		Current Type Ch#0	
Byte 2	Current Type Ch#7		Current Type Ch#6		Current Type Ch#5		Current Type Ch#4	

Data description:

16Bit Data Format: Analog data storage format. (default: 0)

0: A-B

1: B-A

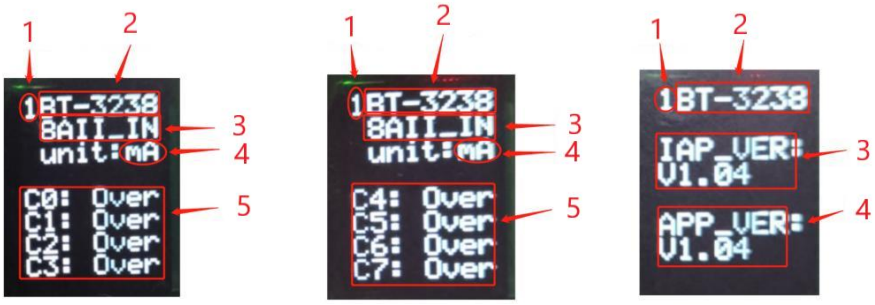
Current Type Ch# (0-7): Type of input signal. (default: 1)

0: NONE (disabling channel)

1: 0-20mA

2: 4-20mA

7 LCD display interface



Page1 **Page2** **Page3**

Note: The module information display is 3 pages in total, the page 1 and 2 mainly display channel status, information tips, and module type information, the page 3 mainly displays software version information.

Number 1 of each page displays the slot number (**1**) of the module.

Number 2 of each page displays the module name (**BT-3238**).

Page 1 and 2: channel status and module type information

Number 3 displays the type of module.

Number 4 displays the units of current.

Number 5 is displayed as the collected current magnitude.

1. If the collected current magnitude is not in the corresponding range, and when it occurs overflows and underflows, then the current will be displayed as:

"Over"

2. When the channel is disabled, the channel display will be changed from original current into

"None"

3. If the COMM board is connected with the master first and then disconnected (the disconnected time exceeds the watchdog time), current display row will be displayed as:

__fault_

Page 3: Display software version information.

Number 1 displays the slot number (**1**) of the module.

Number 2 displays module name (**BT-3238**).

Number 3 displays the IAP version information for the module (**V1.04**).

Number 4 displays the APP version information for this module (**V1.04**).

BT-3244: 4-channel / current input / 0&4-20mA, ±20mA, 15 bits, Single-ended bipolar

1 Module features

◆ the module supports 4-channel current signal acquisition.

◆ the module can be configured for 0-20mA, 4-20mA and ±20mA current signal acquisition.

◆ the module supports 2-wire (non-loop output, external power supply is required) current sensor input.

◆ the internal bus of the module and field input adopts magnetic insulation.

◆ the module input channel could be connected to the field active analog signal current output sensor.

◆ the module channel equips with TVS overvoltage protection.

◆ the module supports separately disabling specific channels to improve the acquisition speed.

◆ the module supports LCD display of basic module information and channel indicator display parameters.

2 Technical parameters

General Parameters	
Power	Max.65mA@5.0Vdc
Isolation	I/O to internal bus: magnetic isolation (2.5KVrms) Power isolation: DC-DC
Wiring	I/O wiring: Max.1mm² (AWG 18)
Installation	35mm DIN-Rail
Environment Specification	
Operational Temperature	-30~75℃
Operational Humidity	5%-95% (No Condensation)
Protection Class	IP20
Input parameters	
Channel Number	4 channels
Input range	0~20mA, 4~20mA and ±20mA
Resolution ratio	15 Bits
Acquisition precision	±0.3% full range, @25℃
	±0.5% full range, @-20~70℃
Sampling Resistance	100Ω
Sampling rate	17ms/4 channels
Data format	16-bit signed integer

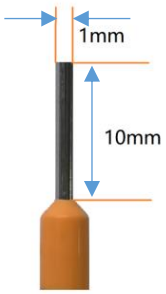
3 Terminal definition

Module wiring adopts 20Pin 3.5mm spacing spring wiring terminals, which are defined as follows:

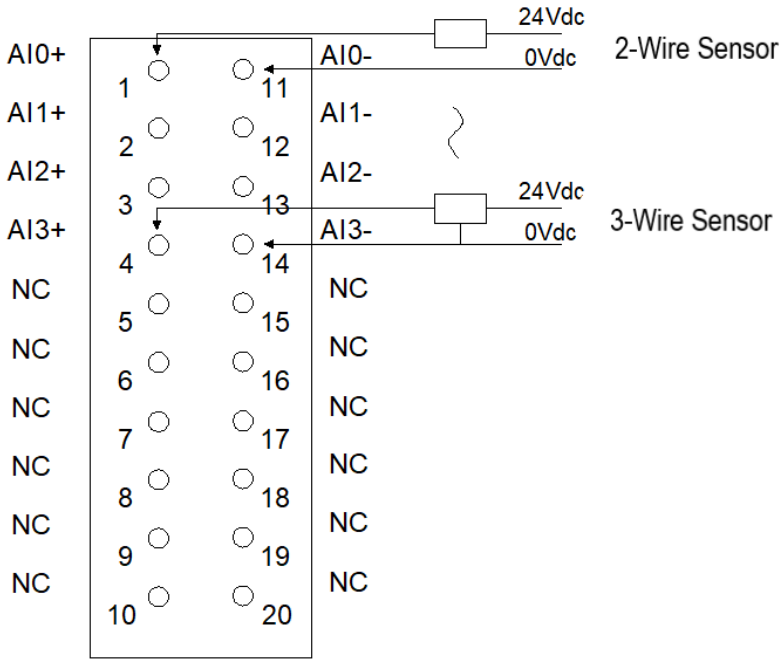
Description	Terminal Number	Symbol	Symbol	Terminal Number	Description
Signal input	1	AI0+	AI0-	11	Signal input
	2	AI1+	AI1-	12	
	3	AI2+	AI2-	13	
	4	AI3+	AI3-	14	
N/A	5	NC	NC	15	N/A
	6	NC	NC	16	
	7	NC	NC	17	
	8	NC	NC	18	
	9	NC	NC	19	
	10	NC	NC	20	

It is recommended to use cables with cores smaller than 1mm².

The cold-pressed terminal parameters are as follows:



4 Wiring


AI0+
AI1+
AI2+
AI3+
NC
NC
NC
NC
NC
NC
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
AI0-
AI1-
AI2-
AI3-
NC
NC
NC
NC
NC
NC
24Vdc
0Vdc
2-Wire Sensor
24Vdc
0Vdc
3-Wire Sensor

5 Process data definition

Input Data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Analog Input Data (CH 0)							
Byte 1								
Byte 2	Analog Input Data (CH 1)							
Byte 3								
Byte 4	Analog Input Data (CH 2)							
Byte 5								
Byte 6	Analog Input Data (CH 3)							
Byte 7								

Data description:

Analog Input Data (CH0-3): Analog signal Input value of corresponding channel.

Analog Input Data (BT-3244) (±20mA)			
Current (±20mA)	Decimal	Hexadecima	Range
>23.52 mA	32767	7FFF	Overflow
23.52 mA	32511	7EFF	Exceed the range
	27649	6C01	
20 mA	27648	6C00	Rated range
15 mA	20736	5100	
723.4 nA	1	1	
0 mA	0	0	
	-1	FFFF	
.	.	.	
-15 mA	-20736	AF00	
.	.	.	
-20 mA	-27648	9400	
	-27649	93FF	Below the range
-23.52 mA	-32512	8100	
<-23.52 mA	-32768	8000	Underflow

Note: Disabling channel process data uploading value is -32767.

Analog Input Data (BT-3244) (0-20mA/4-20mA)				
Current (0-20mA)	Current (4-20mA)	Decimal	Hexadecimal	Range
>23.52 mA	>22.81 mA	32767	7FFF	Overflow
23.52 mA	22.81 mA	32511	7EFF	Exceed the range
		27649	6C01	
20 mA	20 mA	27648	6C00	Rated range
15 mA	16 mA	20736	5100	
723.4 nA	4mA+578.7nA	1	1	
0 mA	4 mA	0	0	
		-1	FFFF	Below the range
-3.52 mA	1.185 mA	-4864	ED00	
<-3.52 mA	<1.185 mA	-32768	8000	Underflow

Note: Disabling channel process data uploading value is -32767.

6 Configuration parameter definition

Configuration parameters								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved							16Bit Data Format
Byte 1	Current Type Ch#3		Current Type Ch#2		Current Type Ch#1		Current Type Ch#0	

Data description:

16Bit Data Format: Analog data storage format. (default: 0)

0: A-B

1: B-A

Current Type Ch# (0-7): Type of input signal. (default: 1)

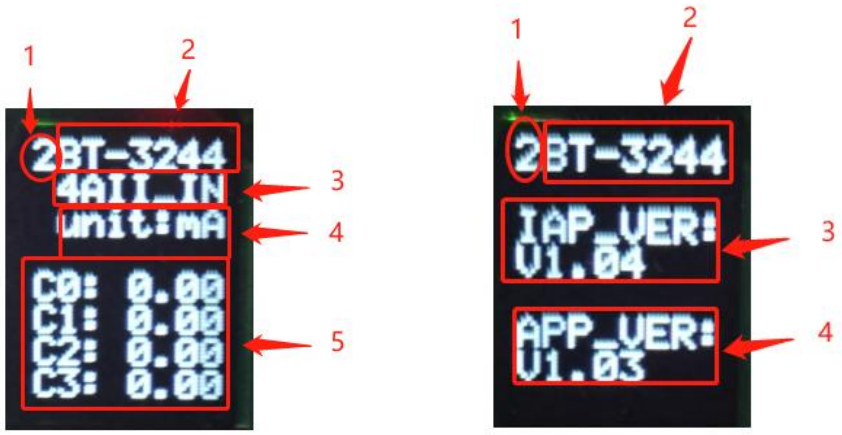
0: NONE (disabling channel)

1: 0-20mA

2: 4-20mA

3: -20-20mA

7 LCD display interface



Page1 **Page2**

Note: The module information display is 2 pages in total, the number 1 on the row 1 of each page indicates the slot location of the module, the module model is displayed behind, the page 1 mainly displays channel status, information tips, and module type information, the page 2 mainly displays software version information.

Page 1: channel status and module type information

Number 3 shows the type of module;

Number 4 shows the units of current;

Number 5, from row 5 to row 8, the channels are displayed as the collected current magnitude.

1.If the collected current magnitude is not in the corresponding range, and when it occurs overflows and underflows, then the current will be displayed as:

"Over"

2.When the channel is disabled, the channel display will be changed from original current into

"None".

3.If the COMM board is connected with the master first and then disconnected (the disconnected time exceeds the watchdog time), **current** display row will be

displayed as:

__fault_

Page 2: Display software version information.

Number 1 and 2 display the slot number (**2**) of the module and the module model name (**BT-3244**).

Number 3 displays the IAP version information for the module (**V1.04**)

Number 4 displays the APP version information for this module (**V1.03**)

BT-3714: 4-channel / RTD input / PT100 / 15bits / Temperature acquisition module

1 Module features

◆ the module supports 4-channel RTD thermal resistance (PT100) temperature acquisition.

◆ the module could be connected to a 2-wire or 3-wire PT100 temperature sensor.

◆ the internal bus of the module and field input adopts magnetic isolation.

◆ 15-bit ADC resolution ratio.

◆ the module supports separately disabling specific channels to improve the acquisition speed.

◆ the module supports LCD display of basic module information and channel indicator display parameters.

2 Technical parameters

General Parameters	
Power	Max.35mA@5.0Vdc
Isolation	I/O to internal bus: magnetic isolation (2.5KVrms)
Wiring	I/O wiring: Max.1mm² (AWG 18)
Environment Specification	
Operational Temperature	-30~75℃
Operational Humidity	5%~95% RH (No Condensation)
Protection Class	IP20
Input parameters	
Channel Number	4 channels
Resolution Ratio	15 Bit
Sensor Type	PT100
Measurement Range	-240~880℃
Measurement Accuracy	0.5℃
Switching Rate	320ms/4 channels
Data format	16-bit signed integer
Diagnostic Function	-32767: channel disabling 32766: open circuit, disconnection (or no sensor is connected) -32766: short-circuit condition 32767: temperature overflowing -32768: temperature underflowing

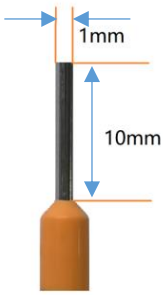
3 Terminal definition

Module wiring adopts 20Pin 3.5mm spacing spring wiring terminals, which are defined as follows:

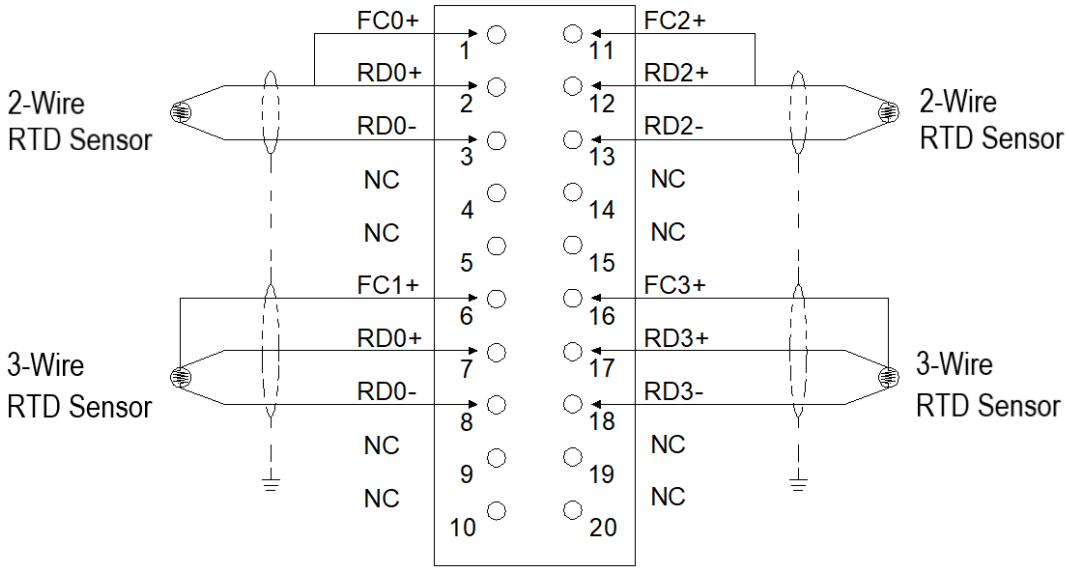
Description	Terminal Number	Symbol	Symbol	Terminal Number	Description
Signal input	1	FC0+	FC2+	11	Signal input
	2	RD0+	RD2+	12	
	3	RD0-	RD2-	13	
N/A	4	NC	NC	14	N/A
	5	NC	NC	15	
Signal input	6	FC1+	FC3+	16	Signal input
	7	RD1+	RD3+	17	
	8	RD1-	RD3-	18	
N/A	9	NC	NC	19	N/A
	10	NC	NC	20	

It is recommended to use cables with cores smaller than 1mm².

The cold-pressed terminal parameters are as follows:



4 Wiring


FC0+
RD0+
RD0-
NC
NC
FC1+
RD0+
RD0-
NC
NC
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
FC2+
RD2+
RD2-
NC
NC
FC3+
RD3+
RD3-
NC
NC
2-Wire
RTD Sensor
2-Wire
RTD Sensor
3-Wire
RTD Sensor
3-Wire
RTD Sensor

5 Process data definition

Input Data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Analog Input Data (CH 0)							
Byte 1								
Byte 2	Analog Input Data (CH 1)							
Byte 3								
Byte 4	Analog Input Data (CH 2)							
Byte 5								
Byte 6	Analog Input Data (CH 3)							
Byte 7								

Data description:

Analog Input Data (CH0-3): Analog channel input data values.

Process Data Definition			
Temperature	Decimal	Hex	Location
>880.0	32767	7FFF	Overflow
880.0	8800	2260	Exceeds the upper limit
.	.	.	
.	.	.	
850.1	8501	2135	
850.0	8500	2134	Rated range
.	.	.	
.	.	.	
-200.0	-2000	F830	
-200.1	-2001	F82F	Exceeds the lower limit
.	.	.	
.	.	.	
-240.0	-2400	F6A0	
<-240.0	-32768	8000	Underflow

Note: The upload process data is 32766 when the module is not connected with the sensor or offline. And the upload process data is -32367 when the channel is disabled, while the upload process data is -32766 when the sensor is short-circuited.

6 Configuration parameters definition

Configuration Parameter								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved	CH3_Enable	CH2_Enable	CH1_Enable	CH0_Enable	Temperature_Unit		16Bit Data Format

Data description:

16Bit Data Format: Sequence of 16-bit data byte transmission (default: 0)

0: A_B

1: B_A

Temperature_Unit: Thermal resistance temperature unit (default: 0)

0: Temp_Unit_C (Degrees Celsius)

1: Temp_Unit_F (Fahrenheit Degree)

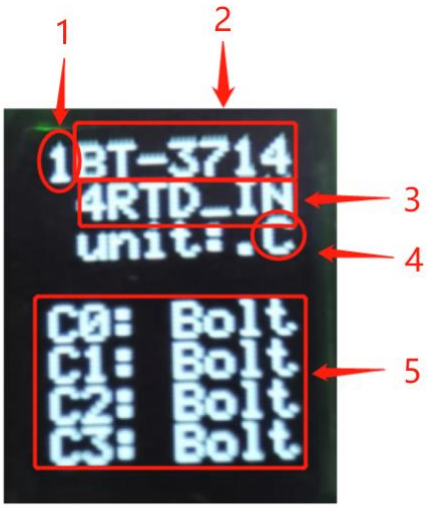
2: Temp_Unit_K (Kelvin Degree)

CH_Enable: Thermal resistance temperature unit (default: 1)

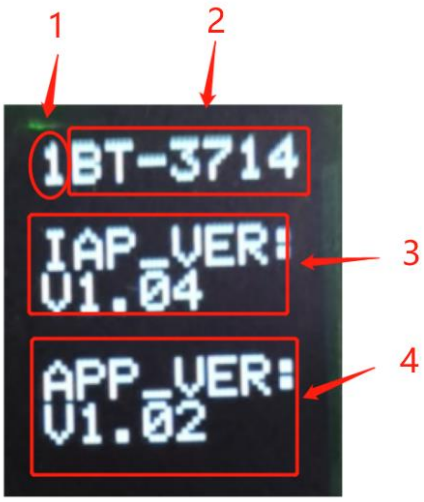
0: Disable (channel disabling)

1: Enable (channel enabling)

7 LCD display interface



Page1



Page2

Note: The module information display is 2 pages in total, the first number on the first row of each page indicates the slot location of the module, the module model is displayed behind, the page 1 mainly displays channel status, information tips, and module type information, the page 2 mainly displays software version information.

Page 1: channel status and module type information

Number 3 shows the type of module;

Number 4 shows the units of temperature;

Number 5 are displayed as the temperature values of the 4 channels.

1. When a Short circuit occurs in a certain channel, it will be displayed as **"Short"**;

2. When the sensor is not connected, it will be displayed as **"Bolt"**;

3. When the temperature overflows or underflows, it will be displayed as **"Over"**.

4. When the channel is disabled, the channel display will be changed from original current into **"None"**.

5. If the COMM board is connected with the master first and then disconnected (the disconnected time exceeds the watchdog time), temperature value display

row will be displayed as:

__fault_

Page 2: Display software version information.

Number 1 displays the slot number (**1**) of the module.

Number 2 displays the module model name (**BT-3714**).

Number 3 displays the IAP version information for the module (**V1.04**)

Number 4 displays the APP version information for this module (**V1.02**)

BT-3724: 4-channel / RTD input / PT1000 / 15bits / Temperature acquisition module

1 Module features

◆ the module supports 4-channel RTD thermal resistance (PT1000) temperature acquisition.

◆ the module could be connected to a 2-wire or 3-wire PT1000 temperature sensor.

◆ the internal bus of the module and field input adopts magnetic isolation.

◆ 15-bit ADC resolution ratio.

◆ the module supports separately disabling specific channels to improve the acquisition speed.

◆ the module supports LCD display of basic module information and channel indicator display parameters.

2 Technical parameters

General Parameters	
Power	Max.35mA@5.0Vdc
Isolation	I/O to internal bus: magnetic isolation (2.5KVrms)
Wiring	I/O wiring: Max.1mm² (AWG 18)
Environment Specification	
Operational Temperature	-30~75℃
Operational Humidity	5%~95% RH (No Condensation)
Protection Class	IP20
Input parameters	
Channel Number	4 channels
Resolution Ratio	15 Bits
Sensor Type	PT1000
Measurement Range	-240~880℃
Measurement Accuracy	0.5℃
Switching Rate	320ms/4 channels
Diagnostic Function	-32767: channel disabling 32766: open circuit, disconnection (or no sensor is connected) -32766: short-circuit condition 32767: temperature overflowing -32768: temperature underflowing

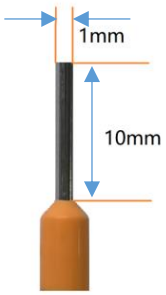
3 Terminal definition

Module wiring adopts 20Pin 3.5mm spacing spring wiring terminals, which are defined as follows:

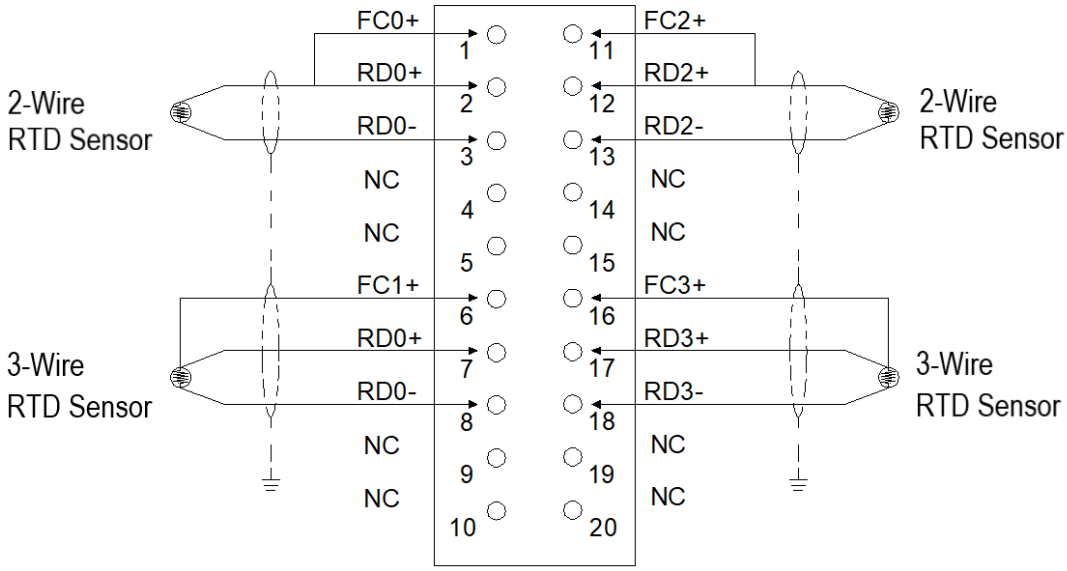
Description	Terminal Number	Symbol	Symbol	Terminal Number	Description
Signal input	1	FC0+	FC2+	11	Signal input
	2	RD0+	RD2+	12	
	3	RD0-	RD2-	13	
N/A	4	NC	NC	14	N/A
	5	NC	NC	15	
Signal input	6	FC1+	FC3+	16	Signal input
	7	RD1+	RD3+	17	
	8	RD1-	RD3-	18	
N/A	9	NC	NC	19	N/A
	10	NC	NC	20	

It is recommended to use cables with cores smaller than 1mm².

The cold-pressed terminal parameters are as follows:



4 Wiring


FC0+
RD0+
RD0-
NC
NC
FC1+
RD0+
RD0-
NC
NC
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
FC2+
RD2+
RD2-
NC
NC
FC3+
RD3+
RD3-
NC
NC
2-Wire
RTD Sensor
3-Wire
RTD Sensor
2-Wire
RTD Sensor
3-Wire
RTD Sensor

5 Process data definition

Input Data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Analog Input Data (CH 0)							
Byte 1								
Byte 2	Analog Input Data (CH 1)							
Byte 3								
Byte 4	Analog Input Data (CH 2)							
Byte 5								
Byte 6	Analog Input Data (CH 3)							
Byte 7								

Data description:

Analog Input Data (CH0-3): Analog channel input data values.

Process Data Definition			
Temperature	Decimal	Hex	Location
>880.0	32767	7FFF	Overflow
880.0	8800	2260	Exceeds the upper limit
.	.	.	
.	.	.	
850.1	8501	2135	
850.0	8500	2134	Rated range
.	.	.	
.	.	.	
-200.0	-2000	F830	
-200.1	-2001	F82F	Exceeds the lower limit
.	.	.	
.	.	.	
-240.0	-2400	F6A0	
<-240.0	-32768	8000	Underflow

Note: The upload process data is 32766 when the module is not connected with the sensor or offline. And the upload process data is -32367 when the channel is disabled, while the upload process data is -32766 when the sensor is short-circuited.

6 Configuration parameters definition

Configuration Parameter								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved	CH3_Enable	CH2_Enable	CH1_Enable	CH0_Enable	Temperature_Unit		16Bit Data Format

Data description:

16Bit Data Format: Sequence of 16-bit data byte transmission (default: 0)

0: A_B

1: B_A

Temperature_Unit: Thermal resistance temperature unit (default: 0)

0: Temp_Unit_C (Degrees Celsius)

1: Temp_Unit_F (Fahrenheit Degree)

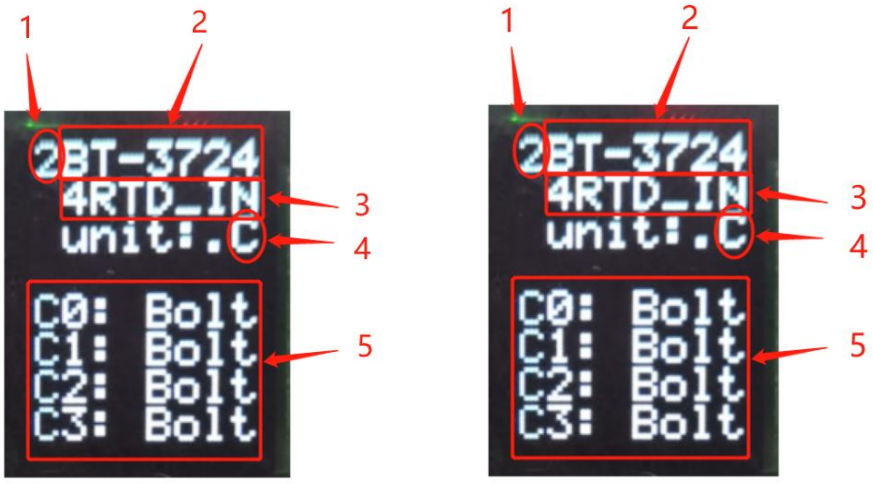
2: Temp_Unit_K (Kelvin Degree)

CH_Enable: Thermal resistance temperature unit (default: 1)

0: Disable (channel disabling)

1: Enable (channel enabling)

7 LCD display interface



Page1 **Page2**

Note: The module information display is 2 pages in total, the first number on the first row of each page indicates the slot location of the module, the module model is displayed behind, the page 1 mainly displays channel status, information tips, and module type information, the page 2 mainly displays software version information.

Page 1: channel status and module type information

Number 3 shows the type of module;

Number 4 shows the units of temperature;

Number 5, the channels are displayed as the temperature values of the 4 channels.

1. When a Short circuit occurs in a certain channel, it will be displayed as **"Short"**;

2. When the sensor is not connected, it will be displayed as **"Bolt"**;

3. When the temperature overflows or underflows, it will be displayed as **"Over"**.

4. When the channel is disabled, the channel display will be changed from original current into **"None"**.

5. If the COMM board is connected with the master first and then disconnected

(the disconnected time exceeds the watchdog time), temperature value display row will be displayed as:

__fault_

Page 2: Display software version information.

Number 1 displays the slot number (**2**) of the module.

Number 2 displays the module model name (**BT-3724**).

Number 3 displays the IAP version information for the module (**V1.04**)

Number 4 displays the APP version information for this module (**V1.01**)

BT-3804: 4-channel / analog input / TC / 24bits / Thermocouple temperature acquisition module

1 Module features

◆ the module supports 4-channel thermocouple signal acquisition.

◆ the module supports 9 kinds of conventional thermocouple temperature measurement type.

◆ the internal bus of the module and field input adopts magnetic isolation.

◆ The module input channel supports TVS overvoltage protection.

◆ 24-bit ADC resolution (Σ-δ type).

◆ the module supports separately disabling specific channels to improve the acquisition speed.

◆ the module supports LCD display of basic module information and channel indicator display parameters.

2 Technical parameters

General Parameters		
Power		Max.50mA@5.0Vdc
Isolation		I/O to internal bus: magnetic isolation (2.5KVrms)
Wiring		I/O wiring: Max.1mm² (AWG 18)
Environment Specification		
Operational Temperature		-30~75℃
Operational Humidity		5%~95% RH (No Condensation)
Protection Class		IP20
Input parameters		
Channel Number		4 Channels
Sensor Type		J / K/ E / T / S / R / B / N / C type thermocouples
Acquisition Accuracy		±0.3% Full Scale, @25℃ ±0.5% Full Scale, @-40~85℃
Sampling Rate		70ms/4 channels
Measuring Range ℃	J Type	-210~1200℃
	K Type	-270~1370℃
	E Type	-270~1000℃
	T Type	-270~400℃
	S Type	-50~1760℃
	R Type	-50~1760℃
	B Type	0~1820℃
	N Type	-270~1300℃
	C Type	0~2320℃
Data Format		16-Bit Signed Integer (Integer)
Diagnostic Function		-32767: No thermocouple model selected (that is, the channel is disabled) 32766: open circuit disconnection 32767: Temperature overflow -32768: Temperature underflow

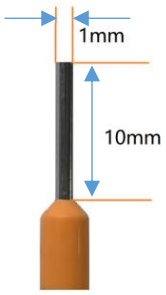
3 Terminal definition

Module wiring adopts 20Pin 3.5mm spacing spring wiring terminals, which are defined as follows:

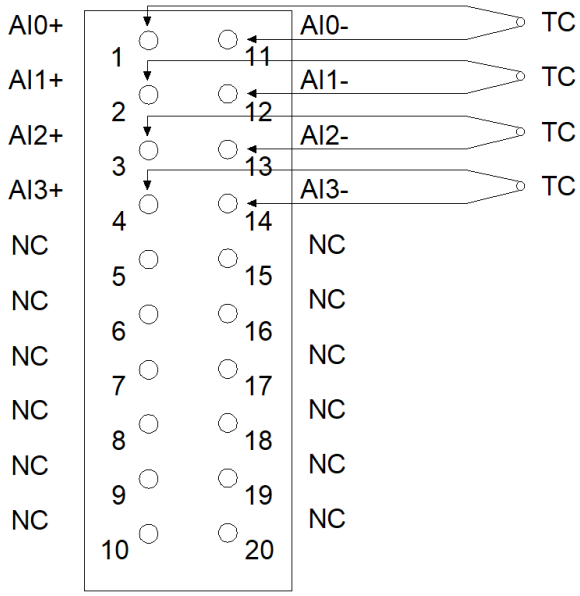
Description	Terminal Number	Symbol	Symbol	Terminal Number	Description
Signal input	1	AI0	GND	11	Signal input
	2	AI1	GND	12	
	3	AI2	GND	13	
	4	AI3	GND	14	
N/A	5	NC	NC	15	N/A
	6	NC	NC	16	
	7	NC	NC	17	
	8	NC	NC	18	
	9	NC	NC	19	
	10	NC	NC	20	

It is recommended to use cables with cores smaller than 1mm².

The cold-pressed terminal parameters are as follows:



4 Wiring


AI0+
AI1+
AI2+
AI3+
NC
NC
NC
NC
NC
NC
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
AI0-
AI1-
AI2-
AI3-
NC
NC
NC
NC
NC
NC
TC
TC
TC
TC

5 Process data definition

Input Data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Analog Input Data (CH 0)							
Byte 1								
Byte 2	Analog Input Data (CH 1)							
Byte 3								
Byte 4	Analog Input Data (CH 2)							
Byte 5								
Byte 6	Analog Input Data (CH 3)							
Byte 7								

Data description:

Analog Input Data (CH0-3): The current temperature acquisition value of the corresponding channel

Process Data Definition - J Type			
Temperature	Decimal	Hex	Location
>1360.0	32767	7FFF	Overflow
1360.0	13600	3520	Exceeds the upper limit
.	.	.	
.	.	.	
1200.1	12001	2EE1	
1200.0	12000	2EE0	Rated range
.	.	.	
.	.	.	
-210.0	-2100	F7CC	
<-210.0	-32768	8000	Underflow

Process Data Definition - K Type			
Temperature	Decimal	Hex	Location
>1622.0	32767	7FFF	Overflow
1622.0	16220	3F5C	Exceeds the upper limit
.	.	.	
.	.	.	
1372.1	13721	3599	
1372.0	13720	3598	Rated range
.	.	.	
.	.	.	
-270.0	-2700	F574	
<-270.0	-32768	8000	Underflow

Process Data Definition – E Type			
Temperature	Decimal	Hex	Location
>1200.0	32767	7FFF	Overflow
1200.0	12000	2EE0	Exceeds the upper limit
.	.	.	
.	.	.	
1000.1	10001	2711	
1000.0	10000	2710	Rated range
.	.	.	
.	.	.	
-270.0	-2700	F574	
<-270.0	-32768	8000	Underflow

Process Data Definition –T Type			
Temperature	Decimal	Hex	Location
>540.0	32767	7FFF	Overflow
540.0	5400	1518	Exceeds the upper limit
.	.	.	
.	.	.	
400.1	4001	FA1	
400.0	4000	FA0	Rated range
.	.	.	
.	.	.	
-270.0	-2700	F574	
<-270.0	-32768	8000	Underflow

Process Data Definition –S Type			
Temperature	Decimal	Hex	Location
>1850.0	32767	7FFF	Overflow
1850.0	18500	4844	Exceeds the upper limit
.	.	.	
.	.	.	
1769.1	17691	451B	
1769.0	17690	451A	Rated range
.	.	.	
.	.	.	
-50.0	-500	FE0C	
-50.1	-501	FE0B	

.	.	.	Exceeds the lower limit
.	.	.	
-170.0	-1700	F95C	
<-170.0	-32768	8000	Underflow

Process Data Definition – R Type			
Temperature	Decimal	Hex	Location
>2019.0	32767	7FFF	Overflow
2019.0	20190	4EDE	Exceeds the upper limit
.	.	.	
.	.	.	
1769.1	17691	451B	
1769.0	17690	451A	Rated range
.	.	.	
.	.	.	
-50.0	-500	FE0C	
-50.1	-501	FE0B	Exceeds the lower limit
.	.	.	
.	.	.	
-170.0	-1700	F95C	
<-170.0	-32768	8000	Underflow

Process Data Definition - B Type			
Temperature	Decimal	Hex	Location
>2070.0	32767	7FFF	Overflow
2070.0	20700	50DC	Exceeds the upper limit
.	.	.	
.	.	.	
1820.1	18201	4719	
1820.0	18200	4718	Rated range
.	.	.	
.	.	.	
0.0	0		
<0.0	-32768	8000	Underflow

Process Data Definition – N Type			
Temperature	Decimal	Hex	Location
>1550.0	32767	7FFF	Overflow
1550.0	15500	3C8C	

.	.	.	Exceeds the upper limit
.	.	.	
1300.1	13001	32C9	
1300.0	13000	32C8	Rated range
.	.	.	
.	.	.	
-270.0	-2700	F574	
<-270.0	-32768	8000	Underflow

Process Data Definition – C Type			
Temperature	Decimal	Hex	Location
>2320.0	32767	7FFF	Overflow
2320.0	23200	5AA0	Rated range
.	.	.	
.	.	.	
0.0	0		
<0.0	-32768	8000	下 Underflow

Note: All thermocouples are fault upload values. The process data uploaded with the thermocouple type not selected status (that is, the channel is disabled) is -32767, the process data uploaded with the thermocouple not connected status is 32766, the process data uploaded with the temperature of overflowing status is 32767, and the process data uploaded with the temperature of underflowing status is -32768.

6 Configuration parameters definition

Configuration Parameter								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved					Temperature_Unit		16Bit Data Format
Byte 1	TC Input Type (CH 1)				TC Input Type (CH 0)			
Byte 1	TC Input Type (CH 3)				TC Input Type (CH 2)			

Data description:

16Bit Data Format: Big-endian and little-endian format of data upload: (default: 0)

0: A_B

1: B_A

Temperature_Unit: Thermocouple temperature unit (default: 0)

0: Temp_Unit_C (Degrees Celsius)

1: Temp_Unit_F (Fahrenheit Degree)

2: Temp_Unit_K (Kelvin Degree)

TC Input Type (CH 0-3): Sensor type of the channel: (default: 0)

0: Channel is disabled

1: J Type

2: K Type

3: E Type

4: T Type

5: S Type

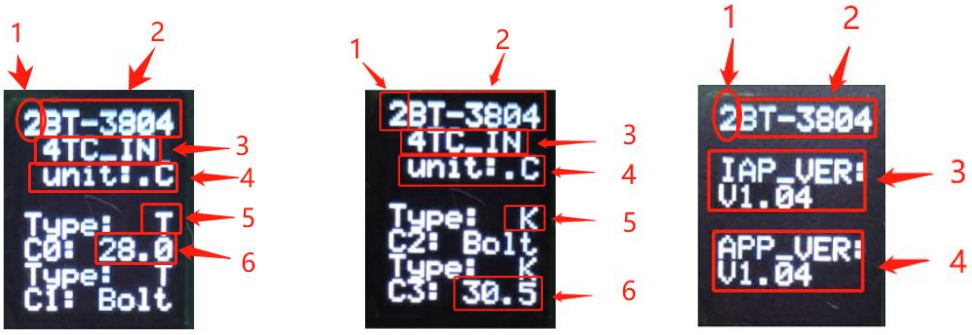
6: R Type

7: B Type

8: N Type

9: C Type

7 LCD display interface



Page1 **Page2** **Page3**

Note: The module information display is 3 pages in total, the first number on the first row of each page indicates the slot location of the module, the module model is displayed behind, the first and second pages mainly display channel status, information tips, and module type information, the third page mainly displays software version information.

Page 1 and 2: channel status and module type information

Number 3 shows the type of module;

Number 4 shows the units of temperature;

Number 5 show the thermocouple type, it will not be displayed if the thermocouple type is not selected;

Number 6 show the magnitude of the temperature value.

1. When the temperature value channel displays **"Bolt"**, it indicates that the channel is not connected to the thermocouple, or the thermocouple is in open circuit status.

2. When the channel displays **"None"**, it indicates that the thermocouple type is not selected for the channel (that is, the channel is disabled).

3. If the COMM board is connected with the master first and then disconnected (the disconnected time exceeds the watchdog time), temperature value display row will be displayed as:

__fault_

Page 3: Display software version information.

Number 1 displays the slot number (**2**) of the module.

Number 2 displays the module model name (**BT-3804**).

Number 3 displays the IAP version information for the module (**V1.04**)

Number 4 displays the APP version information for this module (**V1.04**)

BT-4154: 4-channel / Voltage Output 0~5VDC/0~10VDC/±5VDC/±10VDC, 15 bits /16 bits

1 Module features

◆ the module supports 4 channels voltage signal output.

◆ output range: 0~5VDC/0~10VDC/±5VDC/±10VDC, 15bit/16bit resolution.

◆ module output signal is single - ended common - grounded output.

◆ the module supports the channel overcurrent and over temperature protection warning function to the corresponding channel.

◆ the module supports LCD display of basic module information and channel indicator display parameters.

2 Technical parameters

General parameters	
Power	Max.160mA@5.0Vdc
Isolation	I/O to internal bus: magnetic isolation (3KVrms)
Wiring	I/O wiring: Max.1mm² (AWG 18)
Environment Specification	
Operational Temperature	-30~75℃
Operational Humidity	5%~95% RH (No Condensation)
Protection Class	IP20
Output Parameter	
Channel Number	4 Channels voltage output
Output Voltage Range	0~5VDC, 0~10VDC, ±5VDC, ±10VDC
Load Resistance	Max.5kΩ
Resolution	15bits/16bits (the output mode is settable)
Acquisition Accuracy	±0.1% (Full Scale) @25℃ ±0.3 (Full Scale) @-40~85℃
Switching Rate	1ms/all channels
Diagnose	Overtemperature/overcurrent status monitoring
Protection Current	20mA.
Common Port	Common grounded output

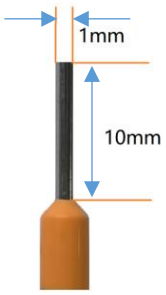
3 Terminal definition

Module wiring adopts 20Pin 3.5mm spacing spring wiring terminals, which are defined as follows:

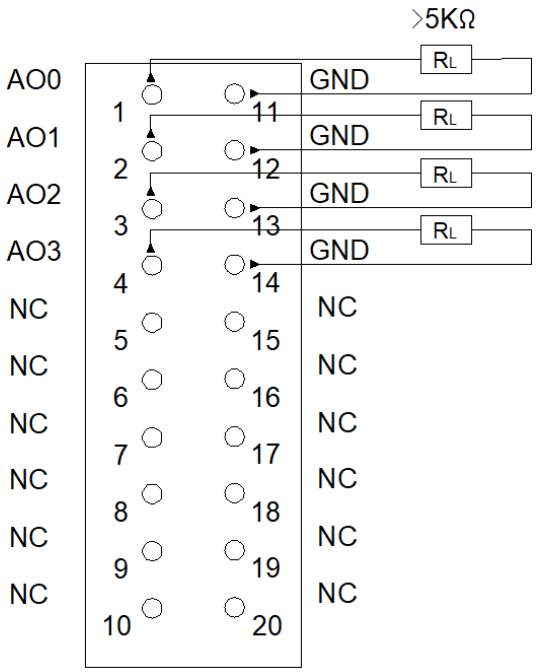
Description	Terminal Number	Symbol	Symbol	Terminal Number	Description
Signal output	1	AO0	GND	11	Signal output
	2	AO1	GND	12	
	3	AO2	GND	13	
	4	AO3	GND	14	
N/A	5	NC	NC	15	N/A
	6	NC	NC	16	
	7	NC	NC	17	
	8	NC	NC	18	
	9	NC	NC	19	
	10	NC	NC	20	

It is recommended to use cables with cores smaller than 1mm².

The cold-pressed terminal parameters are as follows:



4 Wiring


>5KΩ
RL
RL
RL
RL
AO0
AO1
AO2
AO3
NC
NC
NC
NC
NC
NC
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
GND
GND
GND
GND
NC
NC
NC
NC
NC
NC

5 Process data definition

Input Data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved			Over temperature	Overcurrent (CH3)	Overcurrent (CH2)	Overcurrent (CH1)	Overcurrent (CH0)
Output Data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Analog Output Data (CH 0)							
Byte 1								
Byte 2	Analog Output Data (CH 1)							
Byte 3								
Byte 4	Analog Output Data (CH 2)							
Byte 5								
Byte 6	Analog Output Data (CH 3)							
Byte 7								

5.1 Process Data Definition (standard mode)

Data description:

Analog Output Data (CH0-4): voltage output value

Unipolarity 0-5V/0-10V output value

Voltage (0-5V)	Voltage (0-10V)	Decimal	Hex
5	10	27648	0x6C00
.	.	.	.
.	.	.	.
2.5	5	13824	0x3600
.	.	.	.
.	.	.	.
0	0	0	0x0000

Bipolar ±5V/±10V Output value

Voltage (±5V)	Voltage (±10V)	Decimal	Hex
5	10	27648	0x6C00
.	.	.	.
.	.	.	.
2.5	5	13824	0x3600
.	.	.	.
.	.	.	.
0	0	0	0x0000
.	.	.	.
.	.	.	.
-2.5	-5	-13824	0xCA00
.	.	.	.
.	.	.	.
-5	-10	-27648	0x9400

5.2 Process Data Definition (special mode)

Data description:

Analog Output Data (CH0-4): voltage output value

Unipolarity 0-5V/0-10V output value

Voltage (0-5V)	Voltage (0-10V)	Decimal	Hex
5	10	65535	0xFFFF
.	.	.	.
.	.	.	.
2.5	5	32767	0x7FFF
.	.	.	.
.	.	.	.
0	0	0	0x0000

Bipolar ±5V/±10V Output value

Voltage (±5V)	Voltage (±10V)	Decimal	Hex
5	10	32767	0x7FFF
.	.	.	.
.	.	.	.
2.5	5	16383	0x3FFF
.	.	.	.
.	.	.	.
0	0	0	0x0000
.	.	.	.
.	.	.	.
-2.5	-5	-16384	0xC000
.	.	.	.
.	.	.	.
-5	-10	-32768	0x8000

6 Configuration parameters definition

Configuration Parameter								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved						Range_ Mode	16Bit Data Format
Byte 1	Voltage Type (CH 1)				Voltage Type (CH 0)			
Byte 2	Voltage Type (CH 3)				Voltage Type (CH 2)			

Data description:

16Bit Data Format: 16 bits data byte transmission sequence (default value: A_B)

A_B: Big-endian format transmission

B_A: Little-endian format transmission

Range_Mode: Process data mode (default: standard mode)

Standard mode: same with Siemens process data definition

Special mode: max range of hardware

Voltage Type (CH 0-3): Output voltage type (default value: 0~10Vdc)

Disable: Output disabling

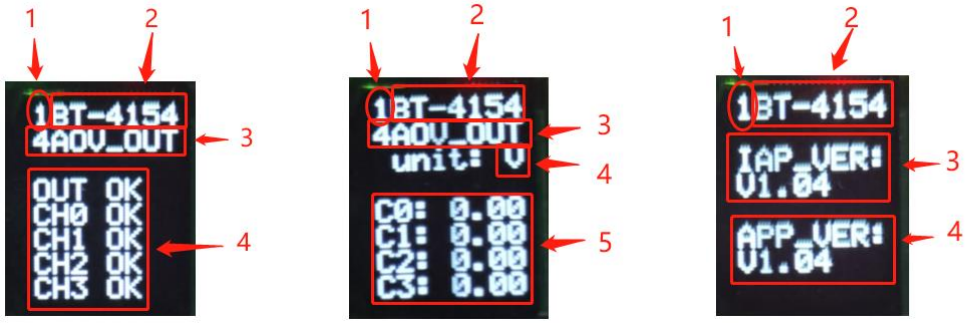
0~5Vdc: 0~5V Direct-current output

0~10Vdc: 0~10V Direct-current output

-5~5Vdc: -5~5V Direct-current output

-10~10Vdc: -10~10V Direct-current output

7 LCD display interface



Page1 **Page2** **Page3**

Note: The module information display is 3 pages in total, the first number on the first row of each page indicates the slot location of the module, the module model is displayed behind, the first pages mainly display channel status, the second page mainly displays the current magnitude value of channel output, information tips, and module type information, the third page mainly displays software version information.

Page 1: channel status and module type information

Number 3 shows the type of module;

Number 4 displayed as **"OUT OK"** when the output status is normal, and it will be displayed as **"H Temper"** when overtemperature occurs.

Each channel is displayed as **" CH- OK "** when there is no output but in normal status, and the channels will be displayed as **" CH- ERRO "** when over current occurs.

Page 2: channel output current value, information tips, and module type information

Number 3 shows the type of module;

Number 4 shows the units of voltage;

Number 5 show the voltage output value (converted from the process data, not the actual value, may be slightly different from the actual output)

Page 3: Display software version information.

Number 1 displays the slot number (**1**) of the module.

Number 2 displays the module model name (**BT-4154**).

Number 3 displays the IAP version information for the module (**V1.04**)

Number 4 displays the APP version information for this module (**V1.04**)

BT-4234: 4-channel / analog output /0&4-20mA/15-bit/16-bit/ single ended

1 Module features

◆ 0-20mA or 4-20mA, the two output ranges can be set.

◆ the module internal bus and field output adopts magnetic insulation.

◆ single-terminal grounded together output mode.

◆ the module supports the channel open circuit overload warning function to the corresponding channel.

◆ the module supports LCD display of basic module information and channel indicator display parameters.

2 Technical parameters

General parameters	
Power	Max.25mA@5.0Vdc
IO bus isolation	I/O to internal bus: magnetic isolation (2.5KVrms)
Field Power	Nominal: 24Vdc, Range: 19.2～28.8Vdc
Wiring	I/O wiring: Max.1mm² (AWG 18)
Environment Specification	
Operational Temperature	-30~75℃
Operational Humidity	5%-95% RH (No Condensation)
Protection Class	IP20
Output parameters	
Channel Number	4 channels
Resolution Ratio	15Bits/16Bits
Output Range	0~20mA/4~20mA
Output Precision	>0.3%
Diagnostic Function	Disconnection or overload, field power supply error
he common terminal	0V grounded together, channels are not isolated
Switching Rate	2ms/all channels
Load	Max.1KΩ

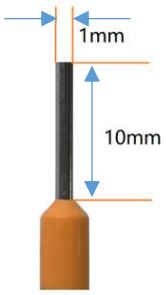
3 Terminal definition

Module wiring adopts 20Pin 3.5mm spacing spring wiring terminals, which are defined as follows:

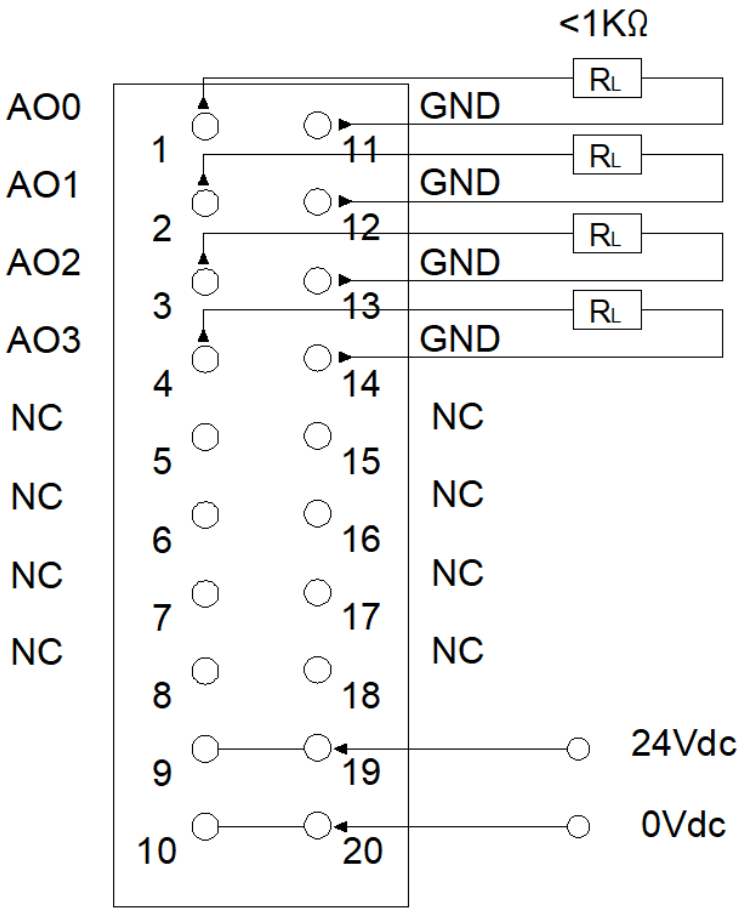
Description	Terminal Number	Symbol	Symbol	Terminal Number	Description
Signal output	1	AO0	GND	11	Signal output
	2	AO1	GND	12	
	3	AO2	GND	13	
	4	AO3	GND	14	
N/A	5	NC	NC	15	N/A
	6	NC	NC	16	
	7	NC	NC	17	
	8	NC	NC	18	
Power	9	24Vdc	24Vdc	19	Power
	10	0Vdc	0Vdc	20	

It is recommended to use cables with cores smaller than 1mm².

The cold-pressed terminal parameters are as follows:



4 Wiring



Note: Terminals 9 and 19 are internally short-circuited.
Terminals 10 and 20 are internally short-circuited.

5 Progress data definition

Input data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved		Field Power Error (CH0-3)	DAC Communication Error (CH0-3)	Output Opening or Overload (CH3)	Output Opening or Overload (CH2)	Output Opening or Overload (CH1)	Output Opening or Overload (CH0)
Output data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Analog Output Data (CH 0)							
Byte 1								
Byte 2	Analog Output Data (CH 1)							
Byte 3								
Byte 4	Analog Output Data (CH 2)							
Byte 5								
Byte 6	Analog Output Data (CH 3)							
Byte 7								

Data description:

Output Opening or Overload (CH0-3): Current output diagnostic State, when the corresponding Output channel is open circuit or overloaded, this bit is set to 1, and it will be automatically cleared when the load returns to normal.

0: load is normal

1: openload or overload

DAC Communication Error (CH0-3): DAC converter Communication is Error. This Error will occur when the field power supply is disconnected or the DAC and isolator are damaged.

0: DAC communication is normal

1: DAC conversion failed

Field Power Error (CH0-3): This Error will occur when the Field Power is not powered on.

0: field power access is normal

1: field power access is failure

Analog Output Data (CH0-3): Analog Output value, 16-bit unsigned integer.

5.1 Process Data Definition (standard mode)

Analog Output Data (BT-4234)			
Current (0-20mA)	Decimal	Hex	Range
21mA	32767	7FFF	Overflow
	29031	7167	
21mA	29030	7166	Exceeds the upper limit
20mA+723.4nA	27649	6C01	
20mA	27648	6C00	Rated range
15mA	20736	5100	
723.4nA	1	1	
0 mA	0	0	
0 mA	-1	FFFF	Underflow
	-32768	8000	

Analog Output Data (BT-4234)			
Current (4-20mA)	Decimal	Hex	Range
21mA	32767	7FFF	Overflow
	29377	72C1	
21mA	29376	72C0	Exceeds the upper limit
20mA+578.7nA	27649	6C01	
20 mA	27648	6C00	Rated range
16 mA	19008	4A40	
4mA +578.7nA	1	1	
4mA	0	0	
3.9995mA	-1	FFFF	Exceeds the lower limit
3.6mA	-692	FD4C	
3.6mA	--693	FD4B	Underflow
	-32768	8000	

5.2 Process Data Definition (special mode)

Analog Output Data (BT-4234)			
Current (0-20mA)	Current (4-20mA)	Decimal 16bits	Hex 16bits
20 mA	20 mA	65535	0xFFFF
.	.	.	.
.	.	.	.
.	.	.	.
10 mA	12 mA	32767	0x7FFF
.	.	.	.
.	.	.	.
.	.	.	.
0 mA	4 mA	0	0x0000

6 Configuration parameter definition

Configuration parameter								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved						Range_Mode	16Bit Data Format
Byte 1	Reserved				Current Type CH3	Current Type CH2	Current Type CH1	Current Type CH0

Data description:

16Bit Data Format: Analog data storage format. **(**Default: 0)

0: A-B

1: B-A

Range_Mode: Process data mode (default: standard mode)

Standard mode: same with Siemens process data definition

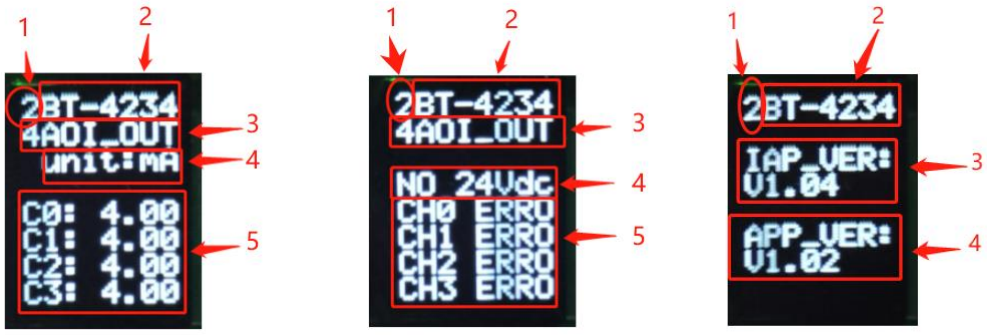
Special mode: max range of hardware

Current Type (CH0-3): Type of output current. (Default: 1)

0: 0-20mA

1: 4-20mA

7 LCD display interface



Page1 **Page2** **Page3**

Note: The module information display is 3 pages in total, the first number on the first row of each page indicates the slot location of the module, the module model is displayed behind, page 1 and 2 mainly display channel status, information tips, and module type information, page 3 mainly displays software version information.

Page 1: channel status and module type information

Number 3 shows the type of module;

Number 4 shows the units of voltage;

Number 5 show the voltage output value (converted from the process data, not the actual value, may be slightly different from the actual output, the value also will be displayed when the site power is not connected)

Page 2: channel output voltage value, information tips, and module type information

Number 3 shows the type of module;

Number 4 shows **"NO 24Vdc"**, and it indicates that the I/O terminal is connected to 24Vdc power supply. And if **"POWER OK"** is displayed in the terminal power supply, it indicates that the I/O terminal does not have 24Vdc power supply;

Number 5, the channels show **"CH- ERRO"**, and it indicates that the channel is open circuit, overloaded, or not connected to field power. If **"CH- OK"** is

displayed on the channel, and it indicates that the channel is correct.

Page 3: Display software version information.

Number 1 and 2 display the slot number (**2**) of the module and the module model name (**BT-4234**).

Number 3 displays the IAP version information for the module (**V1.04**)

Number 4 displays the APP version information for this module (**V1.02**)

BT-5102: 2-channel Encoder input/5VDC

1 Module features

◆ the module supports two channels of encoder input.

◆ each encoder channel supports A/B incremental encoder or pulse-directional encoder input.

◆ each encoder channel supports orthogonal A/B signal input, input voltage 5V, and it supports source and sink input.

◆ the incremental encoder mode supports x1/ x2 / x4 frequency multiplication to be selectable.

◆ the pulse - direction mode supports nondirectional signal, pulse input only.

◆ each encoder channel supports 1 digital input signal with an input voltage of 5Vdc or 24Vdc.

◆ each encoder channel supports 1 digital output signal with an output voltage of 24Vdc.

◆ each encoder channel supports 1 way of 5V power output, which can be connected to the encoder for power supply.

◆ the module internal bus and field input adopt magnetic isolation.

◆ the module carries 16 LED indicators.

◆ the maximum input frequency of the encoder supported by the module is 1.5MHz.

◆ the module supports measurement function; it could detect the load speed or input signal frequency.

2 Technical parameters

General Parameters	
Power	Max.60mA@5.0Vdc
Isolation	I/O to internal bus: magnetic isolation (3KVrms).
Filed Power	Nominal: 24Vdc, input range: 19.2～28.8Vdc
Wiring	I/O wiring: MAX. 1.5 mm² (AWG 16).
Mounting Type	35mm DIN-Rail
Size	115*14*75mm
Weight	65g
Environment Specification	
Operational Temperature	-30~75℃
Operational Humidity	5%-95% (No Condensing)
Ingress Protection Rating	IP20
Input Parameters	
Channel Number	2-Channel encoder
Encoder Signal Voltage Range	ABZ input standard 5Vdc, range ± 10%
Encoder Input Impedance	Internal pull-up or pull-down resistance 4.7K
Encoder Filtering Time	Could be set, the default is 0.5 us
Encoder Count Frequency	<1.5MHz
Encoder Frequency Multiplication Mode	x1/x2/x4
Encoder Measurement Function	Load speed or input signal frequency measurement
DI Turn-On Voltage	Min.5Vdc To Max.28Vdc
DI Turn-Off Voltage	Max.2.7Vdc
DI Turn-On Current	Max.5mA/Channel @28V
DI Input Impedance	>10.0kΩ
DI Input Delay	OFF to ON: Max.3ms ON to OFF: Max.2ms
DO Output Voltage	5V, Range ± 10%.
DO Output Current	Max.500mA
DO Output Sink Current	Max.5uA

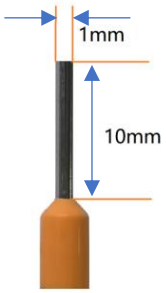
3 Terminal definition

Module wiring adopts 20Pin 3.5mm spacing spring wiring terminals, which are defined as follows:

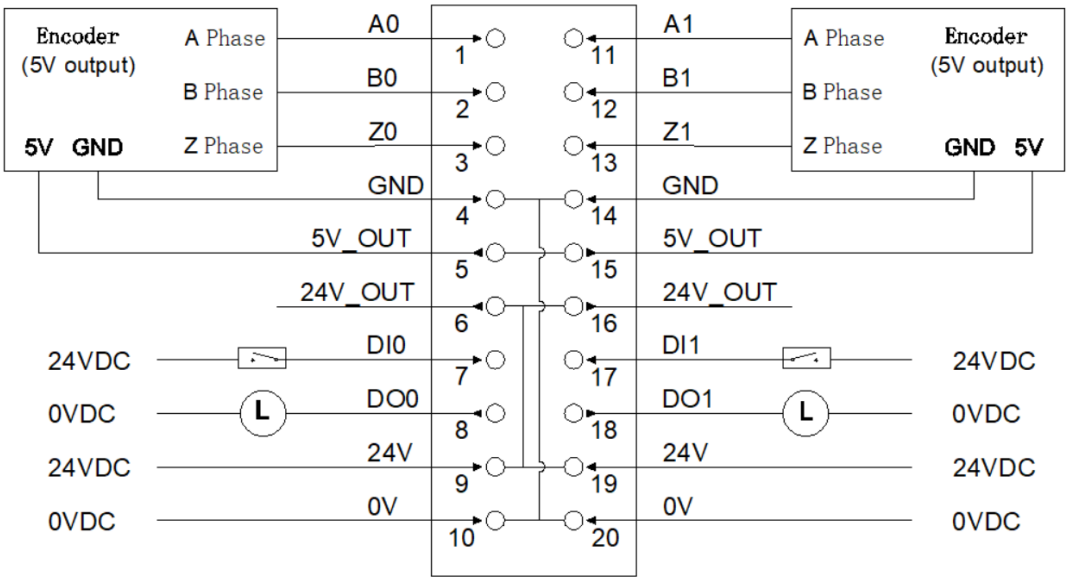
Illustrate	Terminal Number	Symbol	Symbol	Terminal Number	Description
External Encoder 0	1	A0	A1	11	External encoder 1
	2	B0	B1	12	
	3	Z0	Z1	13	
Encoder Powered	4	GND	GND	14	Encoder powered
	5	5V	5V	15	
	6	24V	24V	16	
DI Input	7	DI0	DI1	17	DI Input
DO Output	8	D00	D01	18	DO Output
Externally Powered 24VDC	9	24V	24V	19	Externally powered 24VDC
Externally Powered 0VDC	10	0V	0V	20	Externally powered 0VDC

It is recommended to use cables with cores smaller than 1mm².

The cold-pressed terminal parameters are as follows:



4 Wiring


Encoder
(5V output)
A Phase
B Phase
Z Phase
5V GND
A0
B0
Z0
GND
5V_OUT
24V_OUT
DI0
DO0
24V
0V
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
A1
B1
Z1
GND
5V_OUT
24V_OUT
DI1
DO1
24V
0V
A Phase
B Phase
Z Phase
Encoder
(5V output)
GND 5V
24VDC
0VDC
24VDC
0VDC
L
L
24VDC
0VDC
24VDC
0VDC

5 Process data definition

< 2 Analog Input (5V Encoder) > Submodule process data definition

Enter the data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Counter DOWN Ch#0	Counter UP Ch#0	Counter Underflow Ch#0	Counter Overflow Ch#0	DI Ch#0	Z Ch#0	B Ch#0	A Ch#0
Byte 1	Reserved							
Byte 2	Counter DOWN Ch#1	Counter UP Ch#1	Counter Underflow Ch#1	Counter Overflow Ch#1	DI Ch#1	Z Ch#1	B Ch#1	A Ch#1
Byte 3	Reserved							
Byte 4	Counter value Ch#0							
Byte 5								
Byte 6								
Byte 7								
Byte 8	Capture value Ch#0							
Byte 9								
Byte 10								
Byte 11								
Byte 12	Measurements 1 Ch#0							
Byte 13								
Byte 14								
Byte 15								
Byte 16	Measurements 2 Ch#0							
Byte 17								
Byte 18								
Byte 19								
Byte 20	Counter value Ch#1							
Byte 21								
Byte 22								
Byte 23								
Byte 24	Capture value Ch#1							
Byte 25								
Byte 26								
Byte 27								
Byte 28	Measurements 1 Ch#1							
Byte 29								
Byte 30								
Byte 31								
Byte 32	Measurements 2 Ch#1							
Byte 33								
Byte 34								
Byte 35								

Output data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved						Counter Set Trigger Ch#0	DO Ch#0
Byte 1	Reserved							
Byte 2	Reserved						Counter Set Trigger Ch#1	DO Ch#1
Byte 3	Reserved							
Byte 4	Set Value for Counter Ch#0							
Byte 5								
Byte 6								
Byte 7								
Byte 8	Set Value for Counter Ch#1							
Byte 9								
Byte 10								
Byte 11								

Data description:

Input data definition:

A/B/Z Ch# (0-1): The position is 1 when the corresponding channel A/B/Z input signal is valid, and 0 when the input is invalid.

DI Ch# (0-1): Digital input signal status.

Counter Overflow Ch# (0-1): Counter overflowed flag bit.

Counter Underflow Ch# (0-1): Counter underflowed flag bit.

Counter UP: Encoder positive rotation, counter up counting sign.

Counter DOWN: Encoder contrarotation, counter down count flag.

Counter Value Ch# (0-1): Pulse count value, 32 - bit signed integer, automatically clear after overflow.

Capture value Ch# (0-1): Pulse capture value, 32-bit signed integer, and when DI is set to capture, the pulse count value will be captured to the capture value at the selected edge.

Measurements 1 Ch# (0-1): Measurement value 1, the measurement value will be output according to the measurement value type selected by the user (view the configuration parameter section of the module for optional

measurement value).

Measurements 2 Ch# (0-1): Measurement value 2, the measurement value will be output according to the measurement value type selected by the user (view the configuration parameter section of the module for optional measurement value).

Output data definition:

DO Ch# (0-1): Digital output channel control.

Counter Set Trigger CH# (0-1): Counter set trigger bit, rising edge trigger counter set, the output value **Set Value for Counter** will be updated to **Counter Value**, this function can be used to set the initial value of the counter.

Set Value for Counter Ch# (0-1): Counter set value.

6 Configuration parameter definition

<2 Analog Input (5V Encoder) > Submodule configuration parameter definition

Configure parameters								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved				Storage Function	16Bit Data Format	32Bit Data Format	
Byte 1	Reserved					Work Mode Ch#0		
Byte 2	Reserved						Frequency Multiplication Ch#0	
Byte 3	Reserved			Filtering Time Ch#0				
Byte 4	Reserved							Counter Storage Ch#0
Byte 5	Reserved						Encode Output Signal Type Ch#0	
Byte 6	Reserved							DI0 Function Selection Ch#0
Byte 7	Reserved						Capture Mode Ch#0	
Byte 8 ... Byte 17	Reserved							
Byte 18	Reserved					Speed Measurement Time Ch#0		
Byte 19	Reserved		Measurements 2 Type Ch#0			Measurements 1 Type Ch#0		
Byte 20	Encoder Resolution Ch#0							
Byte 21								
Byte 22	Transmission Ratio Active Ch#0							
Byte 23								
Byte 24	Transmission Ratio Slave Ch#0							
Byte 25								
Byte 26 ... Byte 33	Reserved							
Byte 34	Reserved					Work Mode Ch#1		
Byte 35	Reserved						Frequency Multiplication Ch#1	
Byte 36	Reserved			Filtering Time Ch#1				
Byte 37	Reserved							Counter Storage

			Ch#1
Byte 38	Reserved		Encode Output Signal Type Ch#1
Byte 39	Reserved		DI Function Selection Ch#1
Byte 40	Reserved		Capture Mode Ch#1
Byte 41 ... Byte 50	Reserved		
Byte 51	Reserved		Speed Measurement Time Ch#1
Byte 52	Reserved	Measurements 2 Type Ch#1	Measurements 1 Type Ch#1
Byte 53	Encoder Resolution Ch#1		
Byte 54			
Byte 55	Transmission Ratio Active Ch#1		
Byte 56			
Byte 57	Transmission Ratio Slave Ch#1		
Byte 58			
Byte 59 ... Byte 66	Reserved		

Data description:

32Bit Data Format: The byte transfer order of a channel count value. (Default: 0).

0: AB-CD

1: BA-DC

2: CD-AB

3: DC-BA

16Bit Data Format: Byte transfer order of channel state. (Default: 0).

0: A-B

1: B-A

Storage Function: whether the storage function is supported, read-only attribute, this value is the actual value of the module when uploading device parameters.

0: Storage is not supported

1: Storage is supported

Work Mode Ch# (0-1): the encoder working mode. (Default: 0).

0: Incremental encoder mode.

1: Counting direction mode.

2: Count up mode.

3: Count down mode.

Frequency Multiplication Ch# (0-1): Frequency multiplication number (available only in incremental encoder mode), according to this mode it could output pulse count value. (Default: 2).

0: frequency multiplication 1

1: frequency multiplication 2

2: frequency multiplication 4

Filtering Time Ch# (0-1): Encoder input filter time (default: 5).

0: No filtering

1: 0.1uS

...

5: 0.5 uS

...

31: 3.1 uS

Counter Storage Ch# (0-1): Enable storage. When the storage function is enabled, the IO module will save the count value to the non-volatile memory in real time, and load the last saved count value at the next power-on. (Default: 1).

0: Disable

1: Enable

Encoder Output Signal Type Ch# (0-1): Encoder output type (default: 0).

0: Source

1: Sink

2: Push-pull

DI Function Selection Ch# (0-1): DI0 or DI1 function selection (default: 0).

0: Normal DI function

1: Pulse capture function

Capture Mode Ch# (0-1): Capture mode (default: 0).

0: Rising edge capture

1: Falling edge capture

2: Double edge capture

Speed Measurement Time Ch# (0-1): Speed measurement period (default: 6).

0: 10mS

1: 20mS

2: 50mS

3: 100mS

4: 200mS

5: 500mS

6: 1000mS

7: 2000mS

Measurements 1 Type Ch# (0-1): Measure value 1 Type selection (default: 0).

0: No measurement

1: Load speed

2: Pulse frequency

Measurements 2 Type Ch# (0-1): Measure value 2 Type selection (default: 0).

0: No measurement

1: Load speed

2: Pulse frequency

Encoder Resolution Ch# (0-1): Encoder resolution (default: 1).

Value range: 1-65535

Transmission Ratio Active Ch# (0-1): transmission ratio (main) (Default: 1).

Value range: 1-65535

Transmission Ratio Slave Ch# (0-1): Transmission Ratio (Slave) (Default: 1).

Value range: 1-65535

7 LCD display interface

32 channel LCD display:

Page 1 **Page 2** **Page 3**

Note: The module information display is a total of 3 pages. The page 1 mainly displays the channel status, information prompt, and its module type and other information, the page 2 mainly displays the count value of the two encoder channels, and the page 3 displays the software version information.

Number 1 of each page displays the slot number (**2**) of the module.

Number 2 of each page displays the module name (**BT-5102**).

Number 3 of the page 1 and 2 displays the type of module (**2Encoder**).

The page 1 displays information such as channel status and its module type

Number 3 displays the type of module (**2Encoder**).

Number 4 displays the channel output display prompt, there is a display corresponding to indicate the corresponding channel, and when there is no state, it is displayed as **"-**" from right to left

1. For example:

DUOIZBA1

DUOIZBA2

'1' indicates the encoder channel number, 'A' indicates that phase A status input is valid, 'B' indicates that phase B status input is valid, 'Z' indicates that phase Z status input is valid, 'I' indicates DI input status high, and 'O' Indicates that the

DO output state is high, 'U' indicates that the encoder is rotated in the forward direction, and 'D' indicates that the encoder is rotated in the opposite direction.

2. For example, when there is no state, it will be displayed as:

-------1

-------2

From right to left, the channel number, phase A state input signal is invalid, phase B state input signal is invalid, phase Z state input signal is invalid, DI input state is invalid, DO output state is invalid, encoder is stationary or reversed, encoder is stationary or forward.

3. After joining the communication board and connecting with the master station and then disconnecting, the application layer is disconnected, and after the fault output is executed, the status display of these two lines is as follows:

__fault_

__fault_

Row 7 shows the field power supply of the module. "POWER OK" is displayed when there is a field power supply, and "NO 24Vdc" is displayed when the field power supply is not connected

Page 2: Displays information such as the encoder channel count value and its module type

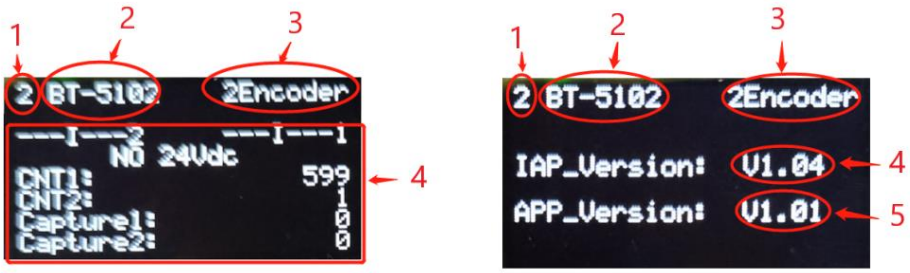
Number 4 displays the count values of the two encoders, respectively.

Page 3: Displays software version information

Number 3 displays the IAP version information (**V1.04**) of the module.

Number 4 displays the APP version information (**V1.01**) of the module.

64 channel LCD display:



Page 1 **Page 2**

Note: The module information display is a total of 2 pages. The page 1 mainly displays the channel status, information prompt, the count value of the two encoder channels, and the module type and other information, and page 2 mainly displays the software version information.

Number 1 of each page displays the slot number (2) of the module.

Number 2 of each page displays the module name (BT-5102).

Number 3 of each page displays the type of module (2Encoder).

Page 1: Information such as channel status and its module type

Number 4 shows the channel status.

1. For example:

DUOIZBA2 DUOIZBA1

'1' indicates the encoder channel number, 'A' indicates that phase A status input is valid, 'B' indicates that phase B status input is valid, 'Z' indicates that phase Z status input is valid, 'I' indicates DI input status high, and 'O' Indicates that the DO output state is high, 'U' indicates forward rotation, and 'D' indicates reverse rotation.

2. For example, when there is no state, it will be displayed as:

-------2 -------1

From right to left, the channel number, phase A state input signal is invalid, phase B state input signal is invalid, phase Z state input signal is invalid, DI input state is invalid, DO output state is invalid, encoder is stationary or reversed,

encoder is stationary or forward.

3. After the communication board is connected to the master station and then disconnected (the disconnection time exceeds the watchdog time), the channel display line is displayed as:

__fault_ __fault_

Row 4 shows the field power supply for the module. "POWER OK" is displayed when there is a field power supply, and "NO 24Vdc" is displayed when the field power supply is not connected

Row 5 through 8 show the count and capture values for the two encoder channels.

Page 2: Displays software version information

Number 4 displays the IAP version information (V1.04) of the module.

Number 5 displays the APP version information (V1.01) of the module.

BT-5112: 2-channel Encoder input/24VDC

1 Module features

◆ The module supports a total of 2 channels of encoder input.

◆ Each encoder channel supports A/B incremental encoder or pulse-directional encoder input.

◆ Each encoder channel supports orthogonal A/B signal input, input voltage 24V, support source and sink input.

◆ Incremental encoder mode supports x1/x2/x4 frequency multiplication mode.

◆ Pulse-direction mode supports no direction signal, only pulse input.

◆ Each encoder channel supports 1 digital signal input, and the input voltage is 5Vdc or 24Vdc.

◆ Each encoder channel supports 1 digital output signal, and the output voltage is 24Vdc.

◆ Each encoder channel comes with 1 channel 5V power supply and 24V power conversion output, which can be connected to the encoder for power supply.

◆ The internal bus and field input of the module are magnetically isolated.

◆ The module supports the basic information of the LCD display module and its channel indication display parameters

◆ The maximum input frequency of the encoder supported by the module is 1.5MHz.

◆ The module supports the measurement function, which can detect the load speed or input signal frequency.

2 Technical parameters

General Parameters	
Power	Max.60mA@5.0Vdc
Isolation	I/O to Internal Bus: Magnetically Isolated (3KVrms)
Filed Power	Nominal: 24Vdc, range: 19.2～28.8Vdc
Wiring	I/O wiring: Max.1.5mm² (AWG 16)
Mounting Type:	35mm DIN-Rail
Size	115*14*75mm
Weight	65g
Environment Specification	
Operational Temperature	-30~75℃
Operational Humidity	5%-95% no condensation
Ingress Protection Rating	IP20
Input Parameters	
Channel number	2-channel encoder
Encoder signal voltage range	ABZ input standard 24Vdc, range ± 10%
Encoder input impedance	Internal pull-up or pull-down resistance 4.7K
Encoder filtering time	Could be set, the default value is 0.5us
Encoder count frequency	<0.5MHz
Encoder frequency multiplication mode	x1/x2/x4
Encoder measurement function	Load speed or input signal frequency measurement
DI turn-on voltage	Min.5Vdc to Max.28Vdc
DI turn-off voltage	Max.2.7Vdc
DI turn-on current	Max.5mA/channel @28V
DI input impedance	>10.0kΩ
DI input delay	OFF to ON: Max.3ms ON to OFF: Max.2ms
DO output voltage	24V, range ± 10%.
DO output current	Max.500mA
DO output sink current	Max.5uA

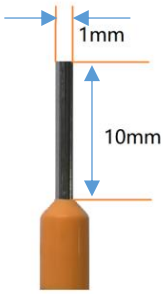
3 Terminal definition

Module wiring adopts 20Pin 3.5mm spacing spring wiring terminals, which are defined as follows:

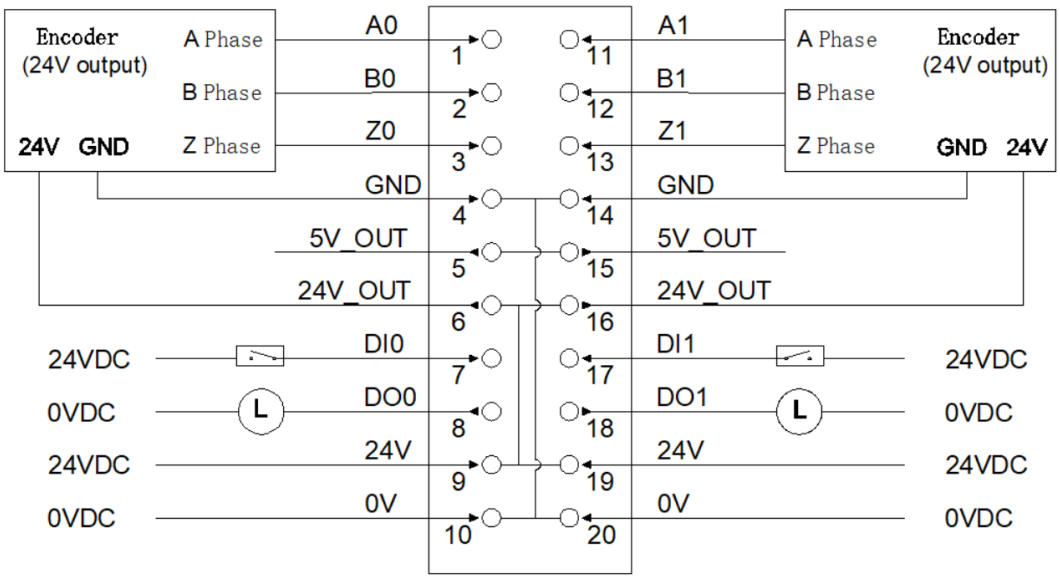
illustrate	Terminal serial number	symbol	symbol	Terminal serial number	illustrate
External encoder 0	1	A0	A1	11	External encoder 1
	2	B0	B1	12	
	3	Z0	Z1	13	
Encoder powered	4	GND	GND	14	Encoder powered
	5	5V	5V	15	
	6	24V	24V	16	
DI input	7	DI0	DI1	17	DI input
DO output	8	D00	D01	18	DO output
Externally powered 24VDC	9	24V	24V	19	Externally powered 24VDC
Externally powered 0VDC	10	0V	0V	20	Externally powered 0VDC

It is recommended to use cables with cores smaller than 1mm².

The cold-pressed terminal parameters are as follows:



4 Wiring


Encoder
(24V output)
A Phase
B Phase
Z Phase
24V GND
A0
B0
Z0
GND
5V_OUT
24V_OUT
DI0
DO0
24V
0V
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
A1
B1
Z1
GND
5V_OUT
24V_OUT
DI1
DO1
24V
0V
A Phase
B Phase
Z Phase
Encoder
(24V output)
GND 24V
24VDC
0VDC
24VDC
0VDC
L
L
24VDC
0VDC
24VDC
0VDC

5 Process data definition

< 2 Analog Input (24V Encoder) > Submodule process data definitions

input data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Counter DOWN Ch#0	Counter UP Ch#0	Counter Underflow Ch#0	Counter Overflow Ch#0	DI Ch#0	Z Ch#0	B Ch#0	A Ch#0
Byte 1	Reserved							
Byte 2	Counter DOWN Ch#1	Counter UP Ch#1	Counter Underflow Ch#1	Counter Overflow Ch#1	DI Ch#1	Z Ch#1	B Ch#1	A Ch#1
Byte 3	Reserved							
Byte 4	Counter value Ch#0							
Byte 5								
Byte 6								
Byte 7								
Byte 8	Capture value Ch#0							
Byte 9								
Byte 10								
Byte 11								
Byte 12	Measurements 1 Ch#0							
Byte 13								
Byte 14								
Byte 15								
Byte 16	Measurements 2 Ch#0							
Byte 17								
Byte 18								
Byte 19								
Byte 20	Counter value Ch#1							
Byte 21								
Byte 22								
Byte 23								
Byte 24	Capture value Ch#1							
Byte 25								

Byte 26	
Byte 27	
Byte 28	Measurements 1 Ch#1
Byte 29	
Byte 30	
Byte 31	
Byte 32	Measurements 2 Ch#1
Byte 33	
Byte 34	
Byte 35	

Output data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved						Counter Set Trigger Ch#0	DO Ch#0
Byte 1	Reserved							
Byte 2	Reserved						Counter Set Trigger Ch#1	DO Ch#1
Byte 3	Reserved							
Byte 4	Set Value for Counter Ch#0							
Byte 5								
Byte 6								
Byte 7								
Byte 8	Set Value for Counter Ch#1							
Byte 9								
Byte 10								
Byte 11								

Data Description:

Input Data Definition:

A/B/Z Ch# (0-1): The position is 1 when the corresponding channel A/B/Z input signal is valid, and 0 when the input is invalid.

DI Ch# (0-1): Digital input signal status.

Counter Overflow Ch# (0-1): Counter overflowed flag bit.

Counter Underflow Ch# (0-1): Counter underflows flag bit.

Counter UP: Encoder positive rotation, counter up counting sign.

Counter DOWN: Encoder contrarotation, counter down count flag.

Counter Value Ch# (0-1): Pulse count value, 32 - bit signed integer, automatically clear after overflow**.**

Capture value Ch# (0-1): Pulse capture value, 32-bit signed integer, and when DI is set to capture, the pulse count value will be captured to the capture value at the selected edge.

Measurements 1 Ch# (0-1): Measurement value 1, the measurement value will be output according to the measurement value type selected by the user (view the configuration parameter section of the module for optional measurement value).

Measurements 2 Ch# (0-1): Measurement value 2, the measurement value will be output according to the measurement value type selected by the user (view the configuration parameter section of the module for optional measurement value).

Output Data Definition:

DO Ch# (0-1): Digital output channel control.

Counter Set Trigger CH# (0-1): Counter set trigger bit, rising edge trigger counter set, the output value **Set Value for Counter** will be updated to **Counter Value**, this function can be used to set the initial value of the counter.

Set Value for Counter Ch# (0-1): The counter set value.

6 Configuration parameter definition

<2 Analog Input (24V Encoder) > Submodule configuration parameter definition

Configure parameters								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved				Storage Function	16Bit Data Format	32Bit Data Format	
Byte 1	Reserved					Work Mode Ch#0		
Byte 2	Reserved						Frequency Multiplication Ch#0	
Byte 3	Reserved			Filtering Time Ch#0				
Byte 4	Reserved							Counter Storage Ch#0
Byte 5	Reserved						Encode Output Signal Type Ch#0	
Byte 6	Reserved							DI0 Function Selection Ch#0
Byte 7	Reserved						Capture Mode Ch#0	
Byte 8 ... Byte 17	Reserved							
Byte 18	Reserved					Speed Measurement Time Ch#0		
Byte 19	Reserved		Measurements 2 Type Ch#0			Measurements 1 Type Ch#0		
Byte 20	Encoder Resolution Ch#0							
Byte 21								
Byte 22	Transmission Ratio Active Ch#0							
Byte 23								
Byte 24	Transmission Ratio Slave Ch#0							
Byte 25								
Byte 26 ... Byte 33	Reserved							
Byte 34	Reserved					Work Mode Ch#1		
Byte 35	Reserved						Frequency Multiplication Ch#1	
Byte 36	Reserved			Filtering Time Ch#1				
Byte 37	Reserved							Counter Storage

			Ch#1
Byte 38	Reserved		Encode Output Signal Type Ch#1
Byte 39	Reserved		DI1 Function Selection Ch#1
Byte 40	Reserved		Capture Mode Ch#1
Byte 41 ... Byte 50	Reserved		
Byte 51	Reserved		Speed Measurement Time Ch#1
Byte 52	Reserved	Measurements 2 Type Ch#1	Measurements 1 Type Ch#1
Byte 53	Encoder Resolution Ch#1		
Byte 54			
Byte 55	Transmission Ratio Active Ch#1		
Byte 56			
Byte 57	Transmission Ratio Slave Ch#1		
Byte 58			
Byte 59 ... Byte 66	Reserved		

Data Description:

32Bit Data Format: Byte transfer order of channel state. (Default: 0).

0: AB-CD

1: BA-DC

2: CD-AB

3: DC-BA

16Bit Data Format: Byte transfer order of channel state. (Default: 0).

0: A-B

1: B-A

Storage Function: whether the storage function is supported, read-only attribute, this value is the actual value of the module when uploading device parameters.

0: Storage is not supported

1: Storage is supported

Work Mode Ch# (0-1): Working mode of encoder. (Default: 0).

0: Incremental encoder mode.

1: Count direction mode.

2: Count up mode.

3: Count down mode.

Frequency Multiplication Ch# (0-1): Frequency multiplication number (available only in incremental encoder mode), according to this mode it could output pulse count value. (Default: 2).

0: frequency multiplication 1

1: frequency multiplication 2

2: frequency multiplication 4

Filtering Time Ch# (0-1): Encoder input filter time (default: 5).

0: No filtering

1: 0.1uS

...

5: 0.5 uS

...

31: 3.1 uS

Counter Storage Ch# (0-1): Enable storage. When the storage function is enabled, the IO module will save the count value to the non-volatile memory in real time, and load the last saved count value at the next power-on. (Default: 1).

0: Disable

1: Enable

Encoder Output Signal Type Ch# (0-1): Encoder output type (default: 0).

0: Source

1: Sink

2: Push-pull

DI Function Selection Ch# (0-1): DI0 or DI1 function selection (default value: 0).

0: Normal DI function

1: Pulse capture function

Capture Mode Ch# (0-1): Capture mode (default: 0).

0: Rising edge capture

1: Falling edge capture

2: Double edge capture

Speed Measurement Time Ch# (0-1): Speed measurement period (Default: 6).

0: 10mS

1: 20mS

2: 50mS

3: 100mS

4: 200mS

5: 500mS

6: 1000mS

7: 2000mS

Measurements 1 Type Ch# (0-1): Measure value 1 Type selection (default: 0).

0: No measurement

1: Load speed

2: Pulse frequency

Measurements 2 Type Ch# (0-1): Measure value 2 Type selection (default: 0).

0: No measurement

1: Load speed

2: Pulse frequency

Encoder Resolution Ch# (0-1): Encoder resolution (default: 1).

Value range: 1-65535

Transmission Ratio Active Ch# (0-1): Transmission Ratio (main) (Default: 1).

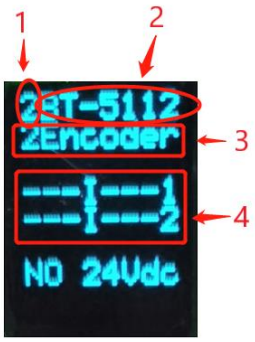
Value range: 1-65535

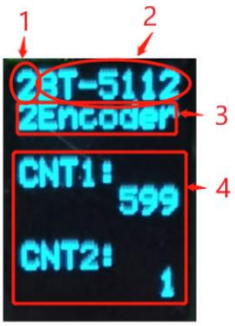
Transmission Ratio Slave Ch# (0-1): Transmission Ratio (Slave) (Default: 1).

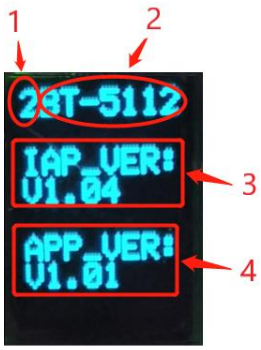
Value range: 1-65535

7 LCD display interface

32 channel LCD display:







Page 1 **Page 2** **Page 3**

Note: The module information display is a total of 3 pages. The first page mainly displays the channel status, information prompt, and its module type and other information, the second page mainly displays the count value of the two encoder channels, and the third page displays the software version information.

Number 1 of each page displays the slot number (**2**) of the module.

Number 2 of each page displays the module name (**BT-5102**).

Number 3 of the 1st and the 2nd displays the type of module (**2Encoder**).

The page 1 displays information such as channel status and its module type

Number 4 displays the channel output display prompt, there is a display corresponding to indicate the corresponding channel, and when there is no state, it is displayed as "-" from right to left

1. For example:

DUOIZBA1

DUOIZBA2

'1' indicates the encoder channel number, 'A' indicates that phase A status input is valid, 'B' indicates that phase B status input is valid, 'Z' indicates that phase Z status input is valid, 'I' indicates DI input status high, and 'O' Indicates that the

DO output state is high, 'U' indicates that the encoder is rotated in the forward direction, and 'D' indicates that the encoder is rotated in the opposite direction.

2. For example, when there is no state, it will be displayed as:

-------1

-------2

From right to left, the channel number, phase A state input signal is invalid, phase B state input signal is invalid, phase Z state input signal is invalid, D I input state is invalid, DO output state is invalid, encoder is stationary or reversed, encoder is stationary or forward.

3. After joining the communication board and connecting with the master station and then disconnecting, the application layer is disconnected, and after the fault output is executed, the status display of these two lines is as follows:

__fault_

__fault_

Line 7 shows the field power supply of the module. "POWER OK" is displayed when there is a field power supply, and "NO 24Vdc" is displayed when the field power supply is not connected

Page 2: Displays information such as the encoder channel count value and its module type

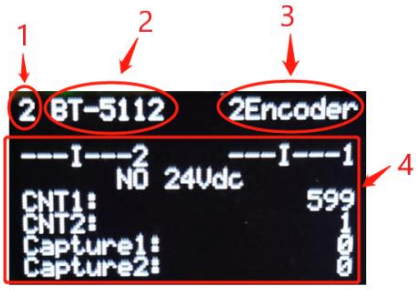
Number 4 show the count values of the two encoders, respectively.

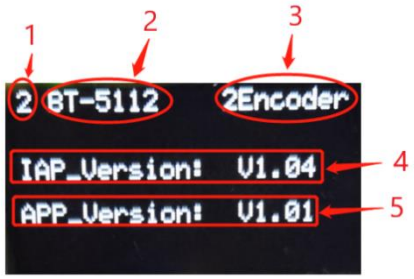
Page 3: Displays software version information

Number 3 show the IAP version information (**V1.04**) of the module.

Number 4 show the APP version information (**V1.01**) of the module.

64 channel LCD display:





Page 1 **Page 2**

Note: The module information display is a total of 2 pages. The first page mainly displays the channel status, information prompt, the count value of the two encoder channels, and the module type and other information, and the second page mainly displays the software version information.

Number 1 of each page displays the slot number (**2**) of the module.

Number 2 of each page displays the module name (**BT-5112**).

Number 3 of each page displays the type of module (**2Encoder**).

Page 1: Information such as channel status and its module type

Number 4 displays the channel status.

1. For example:

DUOIZBA2 DUOIZBA1

'1' indicates the encoder channel number, 'A' indicates that phase A status input is valid, 'B' indicates that phase B status input is valid, 'Z' indicates that phase Z status input is valid, 'I' indicates DI input status high, and 'O' Indicates that the DO output state is high, 'U' indicates forward rotation, and 'D' indicates reverse rotation.

2. For example, when there is no state, it will be displayed as:

-------2 -------1

From right to left, the channel number, phase A state input signal is invalid, phase B state input signal is invalid, phase Z state input signal is invalid, DI

input state is invalid, DO output state is invalid, encoder is stationary or reversed, encoder is stationary or forward.

3. After the communication board is connected to the master station and then disconnected (the disconnection time exceeds the watchdog time), the channel display line is displayed as:

__fault_ __fault_

Row 4 shows the field power supply for the module. "POWER OK" is displayed when there is a field power supply, and "NO 24Vdc" is displayed when the field power supply is not connected

Row 5 through 8 show the count and capture values for the two encoder channels.

Page 2: Displays software version information

Number 4 displays the IAP version information (**V1.04**) of the module.

Number 5 displays the APP version information (**V1.01**) of the module.

BT-5121: 1 channel Encoder SSI input

1 Module features

◆ The module supports 1 channel SSI encoder input.

◆Each encoder channel supports SSI absolute encoder signal input.

◆Each encoder channel supports 4 digital signal with an input voltage of 24Vdc and support for sink and source inputs. The 4 channels share a common terminal.

◆Each encoder channel supports 1 digital output signal with an output voltage of 24Vdc.

◆The module internal bus and field input adopt magnetic isolation.

◆The module supports the maximum clock frequency of 2MHz.

◆ The module supports basic information and channel indication display parameters of the LCD display module

◆The encoder reading interval time could be set.

◆The data bit length and the start and end bits positions could be set.

2 Technical parameters

General Parameters	
Power	Max.60mA@5.0Vdc
Isolation	I/O to internal bus: magnetic isolation (3KVrms)
Field Power	Nominal: 24Vdc, Range: 19.2～28.8Vdc
Wiring	Max.1.5mm² (AWG 16)
Mounting Type	35mm DIN-Rail
Size	115*14*75mm
Weight	65g
Environment Specification	
Operational Temperature	-30~75℃
Operational Humidity	5%-95% (No Condensation)
Ingress Protection Rating	IP20
Input Parameters	
Channel Number	1-channel encoder
Encoder signal type	Differential signal, 5V
Data frame length	10-40 bit
Position value length	Maximum of 32 bit
Position value format	Supports gray code or binary
Location value LSB/MSB	Settable
SSI encoder clock frequency	≤2MHz
DI turn-on voltage	Min.5Vdc to Max.28Vdc
DI turn-off voltage	Max.2.7Vdc
DI turn-on current	Max.5mA/channel@28V
DI input impedance	>10.0kΩ
DI input delay	OFF to ON: Max.3ms ON to OFF: Max.2ms
DO output voltage	5V, range ±10%
DO output current	Max.500mA
DO output sink current	Max.5uA

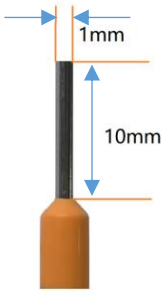
3 Terminal definition

The module wiring adopts 20Pin 3.5mm spacing spring wiring terminals, which are defined as follows:

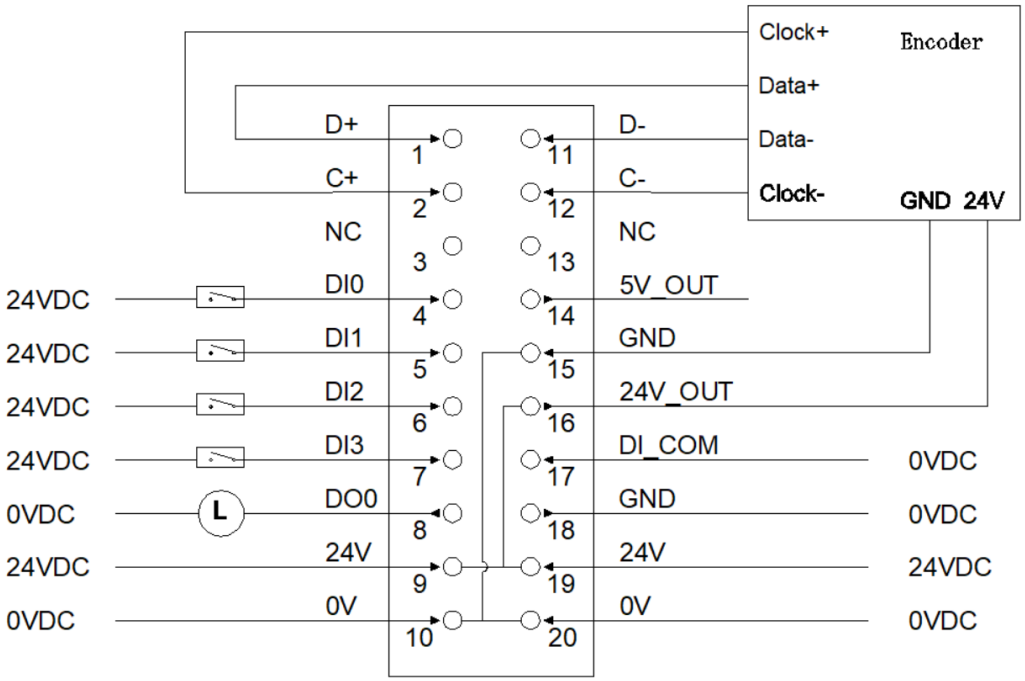
illustrate	Terminal serial number	symbol	symbol	Terminal serial number	illustrate
External encoder	1	D+	D-	11	External encoder
	2	C+	C-	12	
	3			13	
DI input CH0	4	DI0	5V	14	Encoder power supply
DI input CH1	5	DI1	GND	15	
DI input CH2	6	DI2	24V	16	
DI input CH3	7	DI3	DI_COM	17	DI input common terminal
DO output	8	DO0	GND	18	DO output 0V terminal
External power supply 24VDC	9	24V	24V	19	External power supply 24VDC
External power supply 0VDC	10	0V	0V	20	External power supply 0VDC

It is recommended to use cables with cores smaller than $1mm^2$

The cold_pressed terminal parameters are as follows:



4 Wiring


Clock+
Data+
Data-
Clock-
Encoder
GND 24V
D+
C+
NC
DI0
DI1
DI2
DI3
DO0
24V
0V
D-
C-
NC
5V_OUT
GND
24V_OUT
DI_COM
GND
24V
0V
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
24VDC
24VDC
24VDC
24VDC
0VDC
24VDC
0VDC
L
0VDC
0VDC
24VDC
0VDC

5 Process data definition

< 2 Analog Input (SSI Encoder) >Submodule process data definition

Input Data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved	Encoder Count DOWN Ch#0	Encoder Count UP Ch#0	DI3 Ch#0	DI2 Ch#0	DI1 Ch#0	DI0 Ch#0	Data Line Status Ch#0
Byte 1	Reserved							
Byte 2	Counter value Ch#0							
Byte 3								
Byte 4								
Byte 5								
Byte 6	Capture value Ch#0							
Byte 7								
Byte 8								
Byte 9								
Output Data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved							DO Ch#0
Byte 1	Reserved							

Data Description:

Data Line Status Ch# (0): Indicates the idle status of the Data line of the corresponding channel (Normally, idle data is high level. If the value is 0, it indicates that the input signal polarity is reversed, and the polarity of the input signal line needs to be switched).

0: Data line level is low when idle

1: Data line level is high when idle

DI (0-3) Ch# (0): The position is 1 when the corresponding channel input signal is valid, and 0 when the input is invalid.

0: Input signal invalid

1: Input signal valid

Encoder Count UP Ch# (0): The encoder counts up and in positive rotation

Encoder Count DOWN Ch# (0): The encoder counts down and in contrarotation

Counter Value Ch# (0): Pulse count value, 32-bit signed integer, automatically

clear after overflow.

Capture value Ch# (0): Pulse capture value, 32-bit signed integer. When DI is set to capture function, the pulse count value will be captured into the pulse capture value at the selected edge.

DO Ch# (0): The position is 1 when the corresponding channel output signal is valid, and 0 when the output is invalid.

0: Output signal invalid

1: Output signal valid

6 Configuration parameter definition

<2 Analog Input (SSI Encoder)>Submodule configuration parameters definition

configuration parameter								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved				16Bit Data Format	16Bit Data Format	32Bit Data Format	
Byte 1	Reserved		Frame Bit Length Ch#0					
Byte 2	Reserved				SSI CLK Frequency Ch#0			
Byte 3 Byte 4	SSI Interval Time Ch#0							
Byte 5	Reserved							Gray Conversion Ch#0
Byte 6	Reserved		LSB Bit of Position Value Ch#0					
Byte 7	Reserved		MSB Bit of Position Value Ch#0					
Byte 8	Reserved							Counter Storage Ch#0
Byte 9	Reserved							DI0 Function Selection Ch#0
Byte 10	Reserved						Capture Mode Ch#0	
Byte 11 … Byte 30	Reserved							

Data Description:

32Bit Data Format: Byte transfer order of channel count values. (Default value: 0)

0: AB-CD

1: BA-DC

2: CD-AB

3: DC-BA

16Bit Data Format: Byte transfer order of channel status. (Default value: 0)

0: A-B

1: B-A

Storage Function: Storage function supported or not supported, read-only attribute. The value is the actual value of the module when uploading device parameters.

0: Storage not supported

1: Storage supported

Frame Bit Length Ch# (0): Encoder SSI frame length. (Default value: 13) Value range: 10-40.

SSI CLK Frequency Ch# (0): The clock frequency when data is read. (Default value: 0)

0: 125KHz

1: 250KHz

2: 500KH

3: 1.0MHz

4: 1.5MHz

5: 2.0MHz

SSI Interval Time Ch# (0): The interval time (unit: 100us) can be set within the range of 1 to 65535. (Default 10)

Gray Conversion Ch# (0): Gray code conversion enable (default: 1)

0: prohibit

1: enable

LSB Bit of Position Ch# (0): LSB bit number of the position value, with a value range of 0~39 (default value: 0)

MSB Bit of Position Ch# (0): The MSB bit number of position value. The value range is 1-40 (default value: 12)

Counter Storage Ch# (0): Enable storage. When the storage function is enabled, the IO module will save the count value to the non-volatile memory in real time, and load the last saved count value at the next power-on. (Default: 1)

0: Disable

1: Enable

DI0 Function Selection Ch# (0): DI0 function selection (Default: 0)

0: Normal DI function

1: Pulse capture function

Capture Mode Ch# (0): Capture mode (Default: 0)

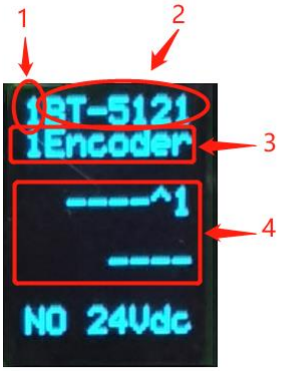
0: Rising edge capture

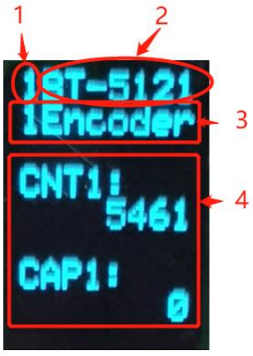
1: Falling edge capture

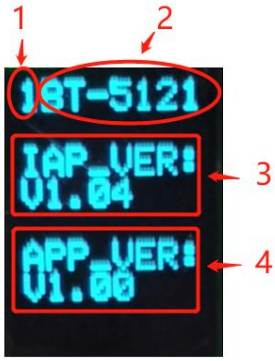
2: Double edge capture

7 LCD display interface

32 channel LCD display:







Page1 (32 channel) **Page2 (32 channel)** **Page3 (32 channel)**

Note: The module information is displayed on a total of 3 pages. The first digit on the row 1 of each page represents the slot number of the module, followed by the module model.

The page 1 mainly displays channel status, information prompts, and module type information.

The page 2 mainly displays the count value and capture value of the encoder channel.

The page 3 displays software version information.

Page 1: Display channel status and module type information

Number 1 and 2 display the slot number (**1**) where the module is located and the module model name (**BT-5121**).

Number 3 displays the type of the module (**1Encoder**)

Number 4 is the channel display prompt, which indicates the corresponding channel. When there is no status, it is displayed as "-" from right to left

1. For example, when there is a status displayed:

DUOI^1

'1' represents the encoder channel number, '^' represents the high level of data input when idle, 'I' represents the high level of DI0 input state, 'O' represents

the high level of DO output state, 'U' represents the forward rotation of the encoder, and 'D' represents the forward rotation of the encoder.

2. For example, when there is no state, it is displayed as:

-----1

From right to left, it represents the channel number, indicating that when idle, the data input is at a high level. The DI0 input state is invalid, the DO output state is invalid, the encoder is stationary or reverse, and the encoder is stationary or forward.

Row 6 contains four DI input states:

All four channels have inputs displayed as “ 3210”

All four channels show no input as “ ----”

After joining the communication board and disconnecting from the main station, the application layer disconnects. After executing the fault output, the status display in the 4th and 6th lines is as follows:

__fault_

__fault_

Row 8 displays the field power supply situation of the module. The field power supply is displayed as connected “POWER OK”, When not connected to the field power supply, the display is “NO 24Vdc”

Page 2: Display encoder channel count values and module type information

Number 4 respectively display the count value and capture value of the encoder.

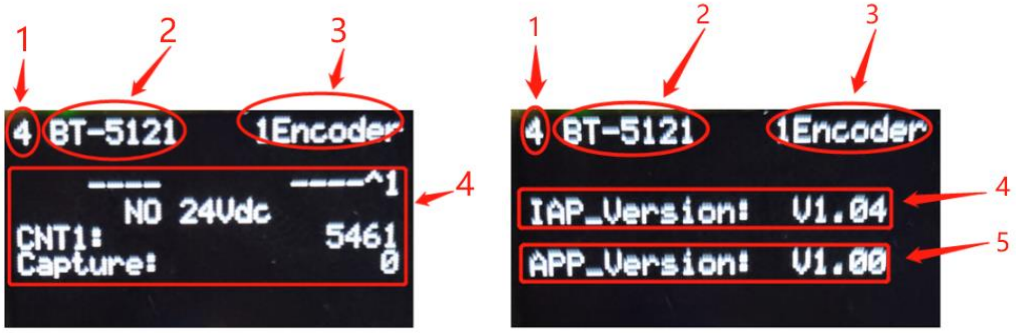
Page 3: Display software version information

Number 1 and 2 display the slot number (**1**) where the module is located and its module model name (**BT-5121**)

Number 3 displays the IAP version information of the module (**V1.04**)

Number 4 displays the APP version information of the module (**V1.00**)

64 channel LCD display:



Page1 (64 channel LED) **Page1 (64 channel LED)**

Explanation: The module information is displayed on a total of 2 pages. The first digit on the row 1 of each page represents the slot number of the module, followed by the module model and type. The page 1 mainly displays channel status, information prompts, capture values of the count values of the two encoder channels, and module type information. The page 2 mainly displays software version information.

Page 1: Channel status and module type information

Row 1 displays the slot, model, and type of the module

Number 4 displays the channel status

1. For example, when there is a status displayed:

3210 DUOI^1

'1' represents the encoder channel number, '^' represents the high level of data input when idle, 'I' represents the high level of DI0 input state, 'O' represents the high level of DO output state, 'U' represents the forward rotation of the encoder, and 'D' represents the forward rotation of the encoder. Moving further to the left, "3210" indicates that four DIs have inputs

2. For example, display when there is no status:

---- -----1

From right to left, it represents the channel number, indicating that when idle,

the data input is at a high level. The DI input state is invalid, the DO output state is invalid, the encoder is stationary or reverse, and the encoder is stationary or forward. Moving further to the left, "----" indicates that 4 DIs have no input.

3. After joining the communication board and disconnecting from the main station, the application layer disconnects. After executing the fault output, the status display line shows:

__fault_ __fault_

Row 4 displays the field power supply situation of the module. The field power supply is displayed as connected “POWER OK”, When not connected to the field power supply, the display is “NO 24Vdc”

The count and capture values displayed from lines 5 to 6.

Page 2: Display software version information

Row 1 displays the slot number (4) where the module is located, its module model name (BT-5121), and its module type (1Encoder)

Number 4 displays the IAP version information of the module (V1.04)

Number 5 displays the APP version information of the module (V1.00)

BT-5141: 1 channel orthogonal/pulse encoder input/5V differential

1 Module features

◆The module supports 1 channel of encoder input.

◆Each encoder channel supports A/B incremental encoder or pulse direction encoder input.

◆Each encoder channel supports orthogonal A/B differential signal input, with a voltage output range of 0-5V.

◆The incremental encoder mode supports x1/x2/x4 frequency multiplication mode.

◆The pulse direction mode supports nondirectional signal, only pulse input.

◆Each encoder channel supports 4 digital signal inputs, with an input voltage of 24Vdc and support for sink and source inputs. The 4 channels share a common terminal.

◆Each encoder channel supports one digital output signal with an output voltage of 24Vdc.

◆The internal bus and field inputs of the module are isolated by optocouplers.

◆ The module supports basic information and channel indication display parameters of the LCD display module

◆The maximum input frequency of the encoder supported by the module is 10MHz.

◆The module supports measurement function and can detect load speed or input signal frequency.

2 Technical parameters

General Parameters	
Power	Max.60mA@5.0Vdc
Isolation	I/O to internal bus: magnetic isolation (3KVrms)
Field Power	Nominal: 24Vdc, Range: 19.2～28.8Vdc
Wiring	Max.1.5mm² (AWG 16)
Mounting Type	35mm DIN-Rail
Size	115*14*75mm
Weight	65g
Environment Specification	
Operational Temperature	-30~75℃
Operational Humidity	5%-95% (No Condensation)
Ingress Protection Rating	IP20
Input Parameters	
Channel Number	1-channel encoder
Encoder signal type	Differential input, voltage output range of 0-5V
Encoder filtering time	Default 0.5us
Encoder count frequency	<10MHz
Encoder frequency multiplication mode	x1/x2/x4
Encoder measurement function	Load speed or input signal frequency measurement
DI turn-on voltage	Min.5Vdc to Max.28Vdc
DI turn-off voltage	Max.2.7Vdc
DI turn-on current	Max.5mA/ channel @28V
DI input impedance	>10.0kΩ
DI input delay	OFF to ON: Max.3ms ON to OFF: Max.2ms
DO output voltage	5V, range ±10%
DO output current	Max.500mA
DO output sink current	Max.5uA

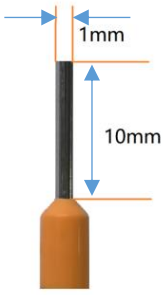
3 Terminal definition

The module wiring adopts 20Pin 3.5mm spacing spring wiring terminals, which are defined as follows:

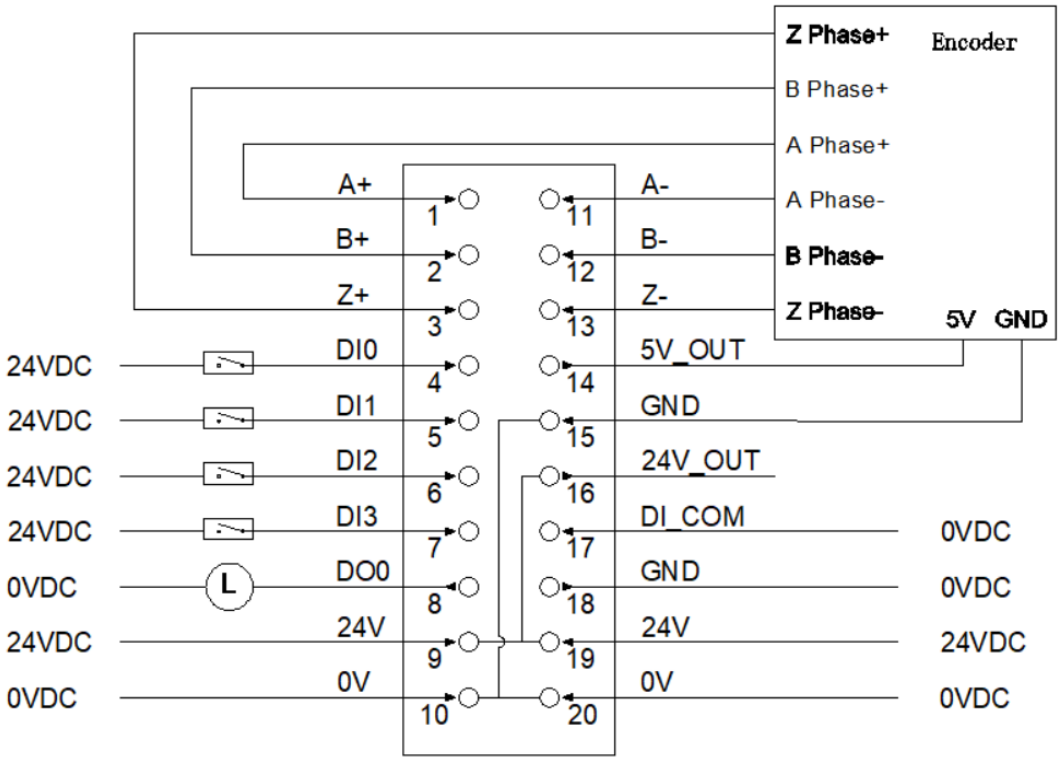
illustrate	Terminal serial number	symbol	symbol	Terminal serial number	illustrate
External encoder	1	A+	A-	11	External encoder
	2	B+	B-	12	
	3	Z-	Z-	13	
DI input CH0	4	DI0	5V	14	Encoder power supply
DI input CH1	5	DI1	GND	15	
DI input CH2	6	DI2	24V	16	
DI input CH3	7	DI3	DI_COM	17	DI input common terminal
DO output	8	DO0	GND	18	DO output 0V terminal
External power supply 24VDC	9	24V	24V	19	External power supply 24VDC
External power supply 0VDC	10	0V	0V	20	External power supply 0VDC

It is recommended to use cables wire cores smaller than 1mm².

The cold pressed terminal parameters are as follows:



4 Writing


Z Phase+
Encoder
B Phase+
A Phase+
A Phase-
B Phase-
Z Phase-
5V GND
A+
B+
Z+
DI0
DI1
DI2
DI3
DO0
24V
0V
A-
B-
Z-
5V_OUT
GND
24V_OUT
DI_COM
GND
24V
0V
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
24VDC
24VDC
24VDC
24VDC
0VDC
24VDC
0VDC
L
0VDC
0VDC
24VDC
0VDC

5 Progress data definition

< 2 Analog Input (Encoder) >Submodule process data definition

Input Data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Counter Overflow Ch#0	DI3 Ch#0	DI2 Ch#0	DI1 Ch#0	DI0 Ch#0	Z Ch#0	B Ch#0	A Ch#0
Byte 1	Reserved					Counter DOWN Ch#0	Counter UP Ch#0	Counter Underflow Ch#0
Byte 2	Counter value Ch#0							
Byte 3								
Byte 4								
Byte 5								
Byte 6	Capture value Ch#0							
Byte 7								
Byte 8								
Byte 9								
Byte 10	Measurements 1 Ch#0							
Byte 11								
Byte 12								
Byte 13								
Byte 14	Measurements 2 Ch#0							
Byte 15								
Byte 16								
Byte 17								
Output Data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved						Counter Set Trigger Ch#0	DO Ch#0
Byte 1	Reserved							
Byte 2	Set Value for Counter Ch#0							
Byte 3								
Byte 4								
Byte 5								

Data Description:

Input data definition:

A/B/Z Ch# (0): The position is 1 when the corresponding channel A/B/Z input signal is valid, and 0 when the input is invalid.

DI (0-3) Ch# (0): Digital input signal status.

Counter Overflow Ch# (0): Counter overflow flag bit.

Counter Underflow Ch# (0): Counter underflow flag bit.

Counter UP: Encoder positive rotation, counter up counting sign.

Counter DOWN: Encoder contrarotation, counter down count flag.

Counter Value Ch# (0): Pulse count value, 32-bit signed integer, automatically clear after overflow.

Capture value Ch# (0): Pulse capture value, a 32-bit signed integer. When DI is set to capture, the pulse count value will be captured to the pulse capture value at the selected edge.

Measurements 1 Ch# (0): Measurement value 1, the measurement value will be output according to the measurement value type selected by the user (view the configuration parameter section of the module for optional measurement value)

Measurements 2 Ch# (0-1): Measurement value 2, the measurement value will be output according to the measurement value type selected by the user (view the configuration parameter section of the module for optional measurement value)

Output data definition:

DO Ch# (0): Digital output channel control.

Counter Set Trigger CH# (0): Counter set trigger bit, rising edge trigger counter set, the output value **Set Value for Counter** will be updated to **Counter Value**, this function can be used to set the initial value of the counter.

Set Value for Counter Ch# (0): Counter set value.

6 Configuration parameter definition

<2 Analog Input (Encoder) >submodule configuration parameters definition

configuration parameter								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved				Storage Function	16Bit Data Format	32Bit Data Format	
Byte 1	Reserved					Work Mode Ch#0		
Byte 2	Reserved						Frequency Multiplication Ch#0	
Byte 3	Reserved			Filtering Time Ch#0				
Byte 4	Reserved							Counter Storage Ch#0
Byte 5	Reserved							DI0 Function Selection Ch#0
Byte 6	Reserved						Capture Mode Ch#0	
Byte 7 … Byte 16	Reserved							
Byte 17	Reserved					Speed Measurement Time Ch#0		
Byte 18	Reserved		Measurements 2 Type Ch#0			Measurements 1 Type Ch#0		
Byte 19	Encoder Resolution Ch#0							
Byte 20								
Byte 21	Transmission Ratio Active Ch#0							
Byte 22								
Byte 23	Transmission Ratio Slave Ch#0							
Byte 24								
Byte 25 … Byte 32	Reserved							

Data Description:

32Bit Data Format: The byte transfer order of channel count values. (Default value: 0)

0: AB-CD

1: BA-DC

2: CD-AB

3: DC-BA

16Bit Data Format: Byte transfer order of channel status. (Default value: 0)

0: A-B

1: B-A

Storage Function: Storage function support or not, read-only properties, the value is the actual value of the module when uploading device parameters.

0: Storage not supported

1: Support storage

Work Mode Ch# (0): Encoder working mode. (Default value: 0)

0: Incremental encoder mode.

1: Counting direction mode.

2: Count up mode.

3: Countdown mode.

Frequency Multiplication Ch# (0): Frequency Multiplication Ch# (0-1): Frequency multiplication number (available only in incremental encoder mode), according to this mode it could output pulse count value. (Default: 2)

0: frequency multiplication 1

1: frequency multiplication 2

2: frequency multiplication 4

Filtering Time Ch# (0): Encoder input filtering time (default value: 5)

0: Unfiltered

1: 0.1uS

…

5: 0.5 uS

…

31: 3.1 uS

Counter Storage Ch# (0): Enabled storage, when the storage function is enabled, the IO module will save the count value to the non-volatile memory in

real time, and load the last saved count value at the next power on. (Default value: 1)

0: Disable

1: Enable

DI0 Function Selection Ch# (0): DI0 function selection (default value: 0)

0: Normal DI function

1: Pulse capture function

Capture Mode Ch# (0): Capture mode (default: 0)

0: Rising edge capture

1: Falling edge capture

2: Double edge capture

Speed Measurement Time Ch# (0): Speed measurement period (default value: 6)

0: 10mS

1: 20mS

2: 50mS

3: 100mS

4: 200mS

5: 500mS

6: 1000mS

7: 2000mS

Measurements 1 Type Ch# (0): Measurement value 1 type selection (default value: 0)

0: No measured value

1: Load speed

2: Pulse frequency

Measurements 2 Type Ch# (0): Measurement value 2 type selection (default value: 0)

0: No measured value

1: Load speed

2: Pulse frequency

Encoder Resolution Ch# (0): Encoder resolution (default value: 1)

Value range: 1-65535

Transmission Ratio Active Ch# (0): Transmission ratio (primary) (default value: 1)

Value range: 1-65535

Transmission Ratio Slave Ch# (0): Transmission ratio (primary) (default value: 1)

Value range: 1-65535

7 LCD display interface

Page 1 **Page 2** **Page 3**

Note: The module information is displayed on a total of 3 pages. The first digit on the first line of each page represents the slot number of the module, followed by the module model.

Page 1 mainly displays channel status, information prompts, and module type information.

Page 2 mainly displays the count value and capture value of the encoder channel

Page 3 displays software version information.

Page 1: Display channel status and module type information

Number 1 and 2 display the slot number (**1**) where the module is located and its module model name (**BT-5141**).

Number 3 displays the type of the module (**1Encoder**)

Number 4 displays the channel output display prompt, with corresponding indications indicating the corresponding channel. When there is no status, it is displayed as "-" from right to left.

1. For example: DUOIZBA1

'1' represents the encoder channel number, 'A' represents the A-phase state input valid, 'B' represents the B-phase state input valid, 'Z' represents the Z-phase state input valid, 'I' represents the DI0 input state high level, 'O'

represents the DO output state high level, 'U' represents the encoder forward rotation, and 'D' represents the encoder reverse rotation.

2. For example, when there is no state, it is displayed as:

-------1

Represented from right to left in sequence, channel number, invalid input signal for A-phase state, invalid input signal for B-phase state, invalid input signal for Z-phase state, invalid input state for DI0, invalid output state for DO, encoder stationary or reverse, encoder stationary or forward.

Row 6 contains four DI input states:

All four channels have inputs displayed as “ 3210”

All four channels show no input as “ ----”

3. After joining the communication board and disconnecting from the main station, the application layer disconnects. After executing the fault output, the status display in the 4th and 6th lines is as follows:

__fault_

__fault_

Row 8 displays the field power supply situation of the module. The field power supply is displayed as connected “POWER OK”, When not connected to the field power supply, the display is “NO 24Vdc”

Page 2: Display encoder channel count values and module type information

Number 4 respectively displays the count value and capture value of the encoder.

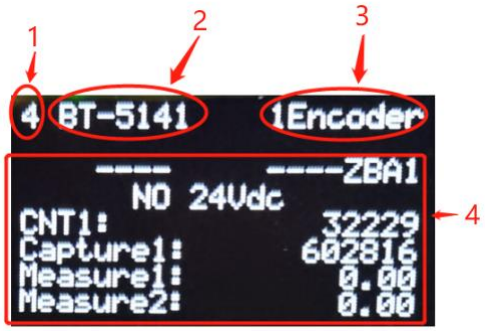
Page 3: Display software version information

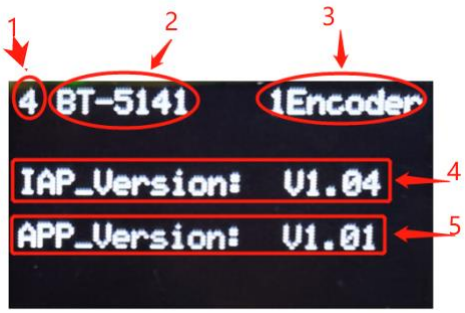
Number 1 and 2 display the slot number (**1**) where the module is located and its module model name (**BT-5141**)

Number 3 displays the IAP version information of the module (**V1.04**)

Number 4 displays the APP version information of the module (**V1.01**)

64 channel LCD display:





Page 1 (64 channel) **Page2 (64channel)**

Explanation: The module information is displayed on a total of 2 pages. The first digit on the first line of each page represents the slot number of the module, followed by the module model. The first page mainly displays channel status, information prompts, and module type information, while the second page mainly displays software version information.

Page 1: Channel status and module type information

Row 1 displays the slot, model, and type of the module

Number 3 displays the channel status

1. For example, when there is a status displayed:

3210 DUOIZBA1

'1' represents the encoder channel number, 'A' represents the A-phase state input valid, 'B' represents the B-phase state input valid, 'Z' represents the Z-phase state input valid, 'I' represents the DI0 input state high level, 'O' represents the DO output state high level, 'U' represents the encoder forward rotation, and 'D' represents the encoder reverse rotation. Moving further to the left, "3210" indicates that four DIs have inputs.

2. For example, when there is no status, it displays:

---- -------1

Represented from right to left in sequence, channel number, invalid input signal for A-phase state, invalid input signal for B-phase state, invalid input signal for

Z-phase state, invalid input state for DI0, invalid output state for DO, encoder stationary or reverse, encoder stationary or forward. Moving further to the left, "--" indicates that 4 DIs have no input.

3.Row 4 displays the field power supply situation of the module. When the field power supply is connected, it is displayed as "POWER OK". When the field power supply is not connected, it is displayed as "NO 24Vdc"

The count and capture values displayed in lines 5 to 8, along with their two measured values.

Page 3: Display software version information

Row 1 displays the slot number (4) where the module is located, its module model name (BT-5141), and its module type (1Encoder)

Number 4 displays the IAP version information of the module (V1.04)

Number 5 displays the APP version information of the module (V1.01)

BT-5312 2-Channel Modbus Serial Port Module

1 Module features:

◆ The module supports 2 channels of RS485, and the two channels of serial ports work independently.

◆ The module supports Modbus RTU/ASCII protocol, and supports master, slave, and freed-mode.

◆ The module has built-in termination and bias resistors, which could be enabled by short-circuiting the external terminals.

◆ When using the module, need to configure the serial port parameters and Modbus instructions in the IO Config software.

◆ When used in conjunction with the adapter module, the Modbus protocol could be converted to other protocols，such as：Modbus TCP、Profinet、EtherCAT and EtherNet/IP, etc.

◆ RS485 interface devices that support Modbus-RTU/ASCII protocol could use this product to realize interconnection with the upper PLC or the upper computer.

◆ The maximum number of supported submodules is 39.

2 Technical Parameters

General Parameters	
Power	Nominal voltage：24VDC Input range：19.2~28.8VDC protection：Anti-reverse polarity protection
Isolation	The isolation voltage between the serial channel and the system power AC 500V The isolation voltage between the serial channel and the PE AC500V Isolation between serial ports AC500V
Wiring	Max: 1.0mm² (AWG 18) Min: 0.2mm² (AWG 24)
Weight	30g
Environment Specification	
Operating Temperature	-30℃~60℃
Relative Humidity	5~95% (No Condensation)
Ingress Protection Rating	IP20
Vibration Resistance	Comply with IEC 61131-2 and EC 60068-2-6
Impact resistance	Comply with IEC 61131-2 and IEC 60068-2-27
EMC Performance	Comply with IEC 61131-2 and IEC 61000-4
Serial Port Parameters	
M/S/F: Channel Number	2 Channels
M/S/F: Interface	RS485
M/S: Protocol	Modbus RTU/ASCII
M/S/F: Working Mode	Modbus Master, Slave, Transparent Transmission
M/S/F: Baud Rate	300bps-500Kbps
Wiring： M/S/F: Interface	20 Pin Terminal Blocks
M/S/F: Data Bit	Bit 7, Bit 8
M/S/F: Parity Checking	N/A, Odd, Even
M/S/F: Stop Bit	Bit1, Bit2
M/S/F: Character Interval	1.5t-200t
F: Byte Order Conversion	Disable, Enable
M/F: Response Timeout	Customized，default：1000
M/F: Polling Timeout	Customized，default：100
M: Read Data Processing Mode	Hold the last input value, clear the input value

M: Data Output Mode	Polling, event triggering (data changes)
M: Module Control Enable	Disable, Enable
M: Module Control Mode	Level trigger (continuously valid), rising edge trigger (single valid)
M: Power on Event Output	Disable, Enable
S: Slave ID	Customized，default：1
S: Response Time	Customized，default：50
Maximum bus length	1200m（RS485，2400 baud rate）
Termination and bias resistors	Enabled by shorting the external terminals
The number of supported submodules	39

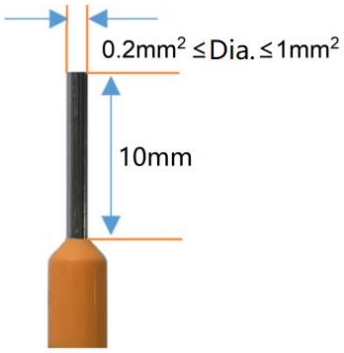
Note: M represents the valid parameters of master mode, S represents the valid parameters of slave mode, and F represents the valid parameters of free transparent transmission mode.

3 Terminal Block Definition

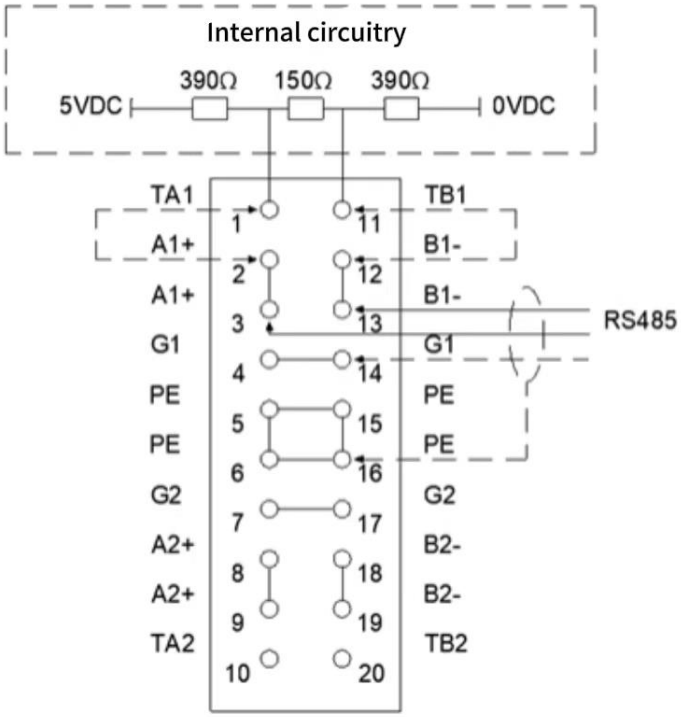
The module wiring adopts 20Pin 3.5mm pitch spring terminal blocks, and the terminals are defined as follows：

illustrate	Pin ordinal	sign	sign	Pin ordinal	illustrate
Pull-up resistor	1	TA1	TB1	11	Pull-down resistors
Serial port 1 (A+)	2	A1+	B1-	12	Serial port 1 (B-)
	3	A1+	B1-	13	
GND (Serial port 1)	4	GND	GND	14	GND (Serial port 1)
PE	5	PE	PE	15	PE
	6	PE	PE	16	
GND (Serial port 2)	7	GND	GND	17	GND (Serial port 2)
Serial port 2 (A+)	8	A2+	B2-	18	Serial port 2 (B-)
	9	A2+	B2-	19	
Pull-up resistor	10	TA2	TB2	20	Pull-down resistors

When the cold-pressed terminal is terminated, it should be terminated and viewed in strict accordance with the corresponding termination specifications or requirements, and terminated according to the corresponding node serial number. The conductor needs to be made of copper wire with a core greater than 0.2mm² and less than 1mm². The parameters of the crimped terminal are as follows：



4 Wiring Diagram



Note 1:

Pin 2, 3 are internally shorted. Pin 12, 13 are internally shorted. Pin 4, 14 are internally shorted. Pin 5, 6, 15, 16 are internally shorted. Pin 7, 17 are internally shorted. Pin 8, 9 are internally shorted, and the pin 18, 19 are internally shorted. The wiring method of serial port 2 is referenced from serial port 1.

Note 2:

1、Connect an external termination resistor between terminal 2 and 12, or terminal 3 and 13；

2、Use the internal terminal resistance of the module: Short-circuit terminal 1 and 2, terminal 11 and 12；

3、Use the internal pull-up resistors within the module: Short circuit terminals 1 and 2；

4、Use the internal pull-down resistors within the module: Short circuit terminals 11 and 12；

5、The wiring for Serial Port 2 is similar to that of Serial Port 1；

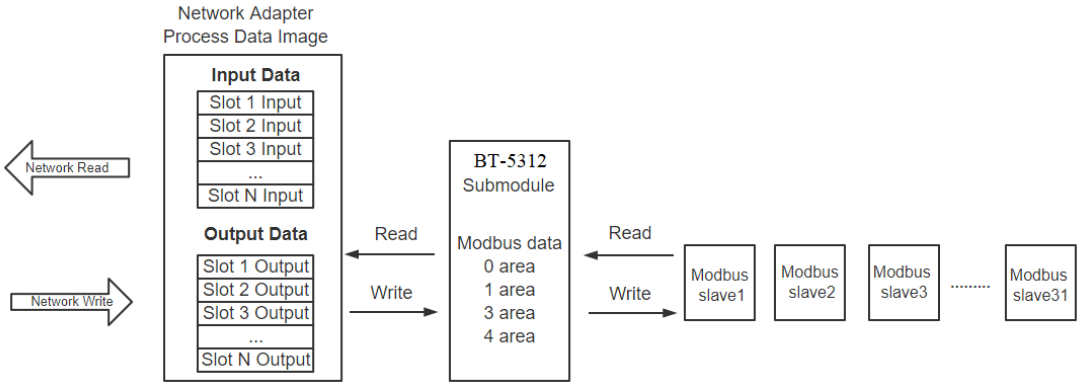
5 Process data definitions

5.1 Module process data definitions

The BT-5312 module has no input and output process data.

5.2 Submodule process data mapping

The network adapter reads and writes the input and output process data of the sub-module of BT-5312 in real time through the internal bus. Its data mapping model is shown as the figure below:



6 Configuration parameter definitions

6.1 BT-5312 Configuration parameter definitions

Configure Parameters								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved					BaudRate Select#0	Gateway Mode#0	
Byte 1	Standard BaudRate#0							
Byte 2								
Byte 3								
Byte 4								
Byte 5	Custom BaudRate#0							
Byte 6								
Byte 7								
Byte 8								
Byte 9	Reserved	Byte Swap#0	Serial Mode#0	Stop Bits#0		Parity Bits#0		Data Bits#0
Byte 10	Char Pitch#0							
Byte 11	Response Timeout(ms) #0							
Byte 12								
Byte 13	Delay Between Polls(ms) #0							
Byte 14								
Byte 15	Reserved			First Output on Power-Up#0	Module Control Mode#0	Module Control Enable#0	Output Mode#0	Fault ACtion for Read Command#0
Byte 16	Slave ID#0							
Byte 17	Response Delay(ms) #0							
Byte 18								
Byte 19	Reserved							
Byte 20	Reserved							
Byte 21	Reserved							
Byte 22	Reserved							
Byte 23	Reserved					BaudRate Select#1	Gateway Mode#1	
Byte 24	Standard BaudRate#1							
Byte 25								
Byte 26								
Byte 27								
Byte 28	Custom BaudRate#1							
Byte 29								
Byte 30								
Byte 31								
Byte 32	Reserved	Byte Swap#1	Serial Mode#1	Stop Bits#1		Parity Bits#1		Data Bits#1
Byte 33	Char Pitch#1							

Byte 34 Byte 35	Response Timeout(ms) #1					
Byte 36 Byte 37	Delay Between Polls(ms) #1					
Byte 38	Reserved	First Output on Power-Up#1	Module Control Mode#1	Module Control Enable#1	Output Mode#1	Fault ACtion for Read Command#1
Byte 39	Slave ID#1					
Byte 40 Byte 41	Response Delay(ms) #1					
Byte 42	Reserved					
Byte 43	Reserved					
Byte 44	Reserved					
Byte 45	Reserved					

Data Description：

M/S/F：Gateway Mode Ch#(0-1)：Module working mode（Default：Modbus Master）

0：Modbus Master

1：Modbus Slave

2：Freed-mode

M/S/F：BaudRate Select Ch#(0-1):Baud rate selection：（Default：Standard baud rate）

0：Standard baud rate

1：Customized baud rate

M/S/F：Standard BaudRate Ch#(0-1):Standard baud rate（Default：9600bps）

0：300bps

1：600bps

2：1200bps

3：2400bps

4：4800bps

5：9600bps

6：14400bps

7：19200bps

8：38400bps

9：57600bps

10：115200bps

11：128000bps

12：230400bps

13：256000bps

14：384000bps

15：500000bps

M/S/F :Custom BaudRate Ch#(0-1): 300-500000bps could be set,default: 9600.Note:The devices of a few customers are with non-standard Baud rate, and it could be customized.

M/S/F：Data Bits Ch#(0-1) (default：Bit 8)

0：Bit 7

1：Bit 8

M/S/F：Parity Bits Ch#(0-1)：(default：N/A)

0：N/A

1：Odd

2：Even

M/S/F：Stop Bits Ch#(0-1)： (default：Bit 1)

0：Bit 1

1：Bit 2

M/S: Serial Mode Ch#(0-1):Serial mode.(default：RTU)

0：RTU

1：ASCII

F: Btye Swap Ch#(0-1):Endian-order conversion. (default：disable)

0：Disable

1：Enable

M/S/F:Char Pitch Ch#(0-1)：Character spacing: Frame interval detection time

when receiving a message (T is the transmission time of a single character and is related to the baud rate）. (default：5 CH)

0：1.5 CH

1：3.5 CH

2：5 CH

3：10 CH

4：20 CH

5：50 CH

6：100 CH

7：200 CH

M/F: Response Timeout Ch#(0-1): The time that the master sends a command and waits for a response from the slave.1~65535 could be set, the default is 1000.

M/F:Delay Between Polls Ch#(0-1): Polling delay (ms)： The interval time between Modbus commands (the delay between receiving the slave response message and sending the next command), 0~65535 could be set, default 100.

M: Fault ACtion for Read Command Ch#(0-1): The way the data is processed after the timeout of the slave read data. (Default: Hold last input value)

0：Hold the last input value

1：Clearing input value optional

M: Output Mode Ch#(0-1):Data output mode. The Modbus periodically sending write messages under "polling mode". In "event triggered" mode, write commands are sent only when the Modbus output data changes.(Default: polling)

0：Polling

1：Event Triggering (Data Changes)

M: Module Control Enable Ch#(0-1):Module control enables. When it is necessary to control the read and write commands of Modbus, it could select

enabling mode and control the read and write commands of Modbus by controlling the value of "module control output". (Default: disable)

0：Disable

1：Enable

M: Module Control Mode Ch# (0-1): Module control mode. This value is valid only in module control enabled mode. (Default：Level triggered)

0：Level triggered（effective continuously）

1：Rising edge triggering（Single trigger）

M: First Output on Power-on Ch# (0-1): Power-on event output. (Default：Enable)

0：Disable

1：Enable

S:Slave ID Ch#(0-1): Slave address：1-247 could be set. This parameter is only valid in slave mode.

S: Respond Delay Ch#(0-1): Response delay(ms)：0~65535 is optional，default 50.

6.2 BT-5312 Parameter Definition of The Submodule

6.2.1 Submodule in Master Mode

M: Diagnostic module

M: Reading coil (0xxxx), it supports 8~128bits optionally

M: Reading discrete input (1xxxx), it supports 8~128bits optionally

M: Reading input register (3xxxx), it supports 1~16words optionally

M: Reading hold register (4xxxx), it supports 1~16words optionally

M: Writing coil (0 xxxx), it supports single coil and 8~128bits optionally

M: Writing hold register (4xxxx), it supports single register and 1~16words optionally

M: Diagnostic module, it includes module status input, module error code input, module control output, and polling time input. The drop-down menu commands need to be added to the first 8 lines of the slot.

1. Module state input: there are 8~48 channels available. The module state could monitor the working state of each data slot. When a data slot fails, the corresponding state bit will be set to 1, and it would be reset automatically after failure recovery.

2. Module error code input: there are 8~48 channels available. When the data slot fails, the error code module could display the function code of the error channel and the detailed error code. According to the error code, the user could judge the cause of the fault, and then take the corresponding adjustment method. See "Modbus Error Code Table" for a detailed description.

3. Module control output: there are 8~48 channels available. The read/write channel for output control of the command is valid when the parameter (M: module control) under the serial port is in enabled mode.

4. Polling time input: Polling time is used for monitoring serial ports.

6.2.2 Submodule in Slave Mode

S: Diagnostic module

S: Reading coil (0xxxx)，it supports 1~1024Bytes optionally

S: Reading hold register (4xxxx), it supports 1~512words optionally

S: Writing coil (0xxxx), it supports 1~1024Bytes optionally

S: Writing discrete input (1xxxx), it supports 8~1024Bytes optionally

S: Writing input register (3xxxx), it supports 1~512words optionally

S: Writing hold register (4xxxx), it supports 1~512words optionally

S: Diagnostic module

The module could monitor the communication failure by entering the state in slave. Please see the following table to check the failure.

Modbus Error Code Table		
Error Code	Fault description	Troubleshooting method
0x00	Working properly	N/A
0x01	Illegal function code	The device does not support the current function code, please refer to the slave manual to select the corresponding function code module
0x02	Illegal data address	If the device data exceeds its address range, refer to the slave manual to modify the data starting address or data length
0x03	Illegal data value	Data length error, data length beyond the Max. allowed value 125(Word) or 2000(Bit), modify the length
0x04	Data processing error	Check that if the range of data values meets the slave requirements
0x05	Application layer length mismatch	Increase the receive character pitch and check the communication parameter Settings
0x06	Protocol ID error	Check the sending end message
0x07	Cache address error	Device internal error
0x08	Bit offset error	Device internal error
0x09	The slave ID number does not match	Increase timeout time, check hardware connection state, and check communication parameter Settings
0x0A	CRC Error	CRC error, check communication line
0x0B	LRC Error	LRC error, check communication line
0x0C	Answer function codes do not match	Check the hardware connection state
0x0D	Answer addresses do not match	Check the hardware connection state

0x0E	The length of the reply data does not match	Check the hardware connection state
0x0F	Communication timeout	Increase timeout time, check hardware connection state, and check communication parameter Settings
0x10	ASCII mode starting character Error	':' Colon starting character Error
0x11	ASCII mode terminator character Error	CR/LF Carriage return terminator character Error
0x12	ASCII mode non-character data	The data contains non-hexadecimal ASCII codes
0x13	ASCII mode character error	Slave answering length error

6.2.3 Submodule in free transparent transmission mode

F：Control and status modules

F：The input and output data modules all support 1~512words for optional

Process data definition for control and status modules：

I/O module data direction	The name of the data	The name of the variable	data type	Byte offset
Enter the data	Output control word - feedback	Control_Word_FeedbACk	uint16_t	0
	Send Frame Byte Length - Feedback	Send_Data_Len_FeedbACk	uint16_t	2
	Serial port status	COM_Status	uint16_t	4
	Received error frame count	Error_Counter	uint16_t	6
	Received total data frame count	Received_Counter	uint16_t	8
	The byte length of the current received frame	Received_Data_Len	uint16_t	10
Output data	Outputs control words	Control_Word	uint16_t	0
	The length of the bytes of the sending frame	Send_Data_Len	uint16_t	2

Variable definitions：

Variable Name	Bit 15-7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Control_Word_Feedback	Reseverd	Input Data Reset	Received Reset	Error Reset	Timeout Reset	Parity Reset	Done Reset	Trigger
Send_Data_Len_Feddback	Send Data Len							
COM_Status	Reseverd				Timeout Error	Parity Error	Done	Busy
Error_Counter	Error Counter							
Received_Counter	Received Counter							
Received_Data_Len	Received Data Len							
Control_Word	Reseverd	Input Data Reset	Received Reset	Error Reset	Timeout Reset	Parity Reset	Done Reset	Trigger
Send_Data_Len	Send Data Len							

Input data description：

1.Control_Word_Feedback is the feedback value of Control_Word, which will be updated to the control word feedback after the output control word is refresh to the module

2.Send_Data_Len_Feedback is the feedback value of Send_Data_Len. After the length of sending frame bytes is refreshed to the module, it will be updated to the length feedback of sending frame bytes.

3.In the response mode, when the serial ports are sending data, the Busy bit is set to 1.

3.1 When the serial port receives the reply within the timeout period, the Busy bit will be reset, and Done will be completed at position 1 and Received_Counter will calculate the value plus 1. If there is a parity error in the received frame, and Parity_Error will be set to 1, while Error_Counter will count plus 1. Received_Data_Len holds the number of bytes of the currently received frame.

3.2 When the serial port does not receive a reply within the timeout period, the Busy bit will be reset, and the Done will be completed at position 1. At the same time, Timeout_Error will be set as 1, and the Error_Counter will be added as 1, so the Received_Data_Len value will be reset.

4. In the active report mode, when slave received the data packet, and the Received_Counter will count as a value plus 1. If there is a parity error in the received frame, the Parity_Error bit will be set to 1, while the Error_Counter will count plus 1.

Description of output data:

1.When Received_Counter_Reset is in rise edge, the Received_Counter value will be reset.

When Error_Counter_Reset is in rise edge, Error_Counter value will be reset.

When Timeout_Error_Reset s in rise edge, Timeout_Error will be reset.

When Parity_Error_Reset is in rise edge, Parity_Error will be reset.

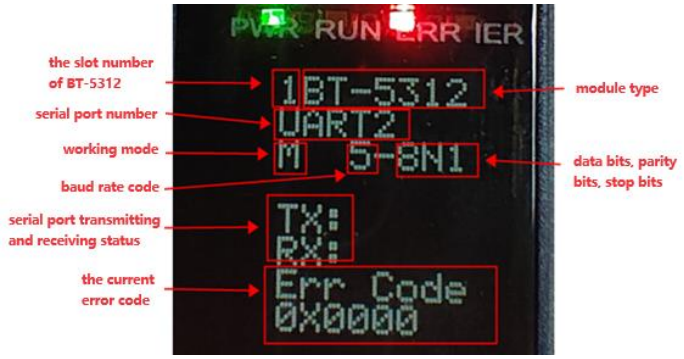
When Done_Reset is in rise edge, Done will be reset.

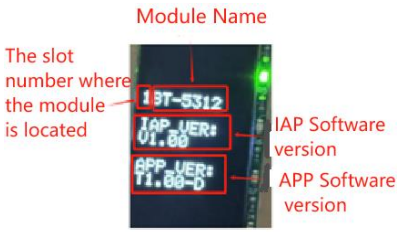
2. In the active report mode, the Trigger bit is invalid and the Send_Data_Len is invalid.

3. In master-slave response mode, when Trigger is in rise edge, and it will Trigger serial port to send data for one time, and the serial port will send data packets according to the data length of Send_Data_Len and wait for the replying processing.

7 LCD Display Interface

Page 1（32-channel LCD display） **Page 2（32-channel LCD display）**





Page 3（32-channel LCD display） **Page 4（32-channel LCD display）**

Illustrate： There are 4 pages of information about the BT-5312 to display on LCD.

Page 1：Displays information such as the module name

Line 1 shows the network adapter;

Line 2 shows the name of the IO module;

Pages 2 and 3：Displays information such as serial port status and error code

Line 1 shows the slot number and type of BT-5312;

Line 2 shows the serial port number. UART1: serial port 1, UART2: serial port 2

Line 3 shows the working mode, baud rate code, data bit, check bit, stop bit. F: Free mode. M: master station mode. S: slave station mode. The baud rate code "5" indicates a baud rate of 9600bps. "8N1" indicates 8 data bits with no parity and 1

stop bit.

Lines 4 to 5 show the sending and receiving status of the serial port，“TX：”serial port transmitting status，"TX: *" will be displayed when sending normally;"RX:" serial port receiving status, "RX: *" will be displayed when receiving normally;

Lines 6 to 7 show the current error code (there is no error code when BT-5312 works in free mode), and "Err Code" is the current error status.

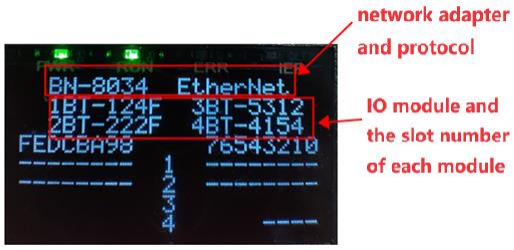
Page 4: Displays SoftwareVersion Information

Line 1 shows the slot number of the module and module name;

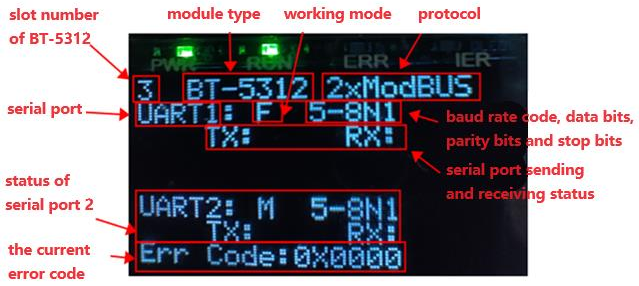
Lines 2 to 3 show the IAP version information of the module;

Lines 4 to 5 show the APP version information of the module;

64-Channel LCD Display：



Page 1（64-channel LCD）



Page 2（64-channel LCD）

Page 3（64-channel LCD）

Illustrate: There are 3 pages of information about the BT-5312 to display on LCD.

Page 1：The network adapter and module model are displayed

Line 1 shows the protocol and type of network adapter;

Lines 2 to 3 show the module type and the corresponding slot number;

Page 2：Displays software version information

Line 1 shows the slot number in which the module is located, module type, working mode and its protocol;

Lines 2 and 5 are both show serial port number, the working mode, baud rate code, data bit, check bit, stop bit. UART1: Serial port 1, UART2: Serial port 2; F: Free mode. M: master station mode. S: slave station mode. The baud rate code "5" indicates a baud rate of 9600bps. "8N1" indicates 8 data bits with no parity and 1 stop bit.

Lines 3 and 6 are both show the sending and receiving status of the serial port，“TX:” serial port sending status, it will be displayed when it is sent normally“TX: *”; “RX:” serial port receive status, it will be displayed when it is received normally “RX: *”;

Lines 4 and 7 are both show the current error code (there is no error code when BT-5312 works in free mode), “Err Code” indicates the current error status;

Page 3: Displays software version information

Line 1 shows the slot number of the module, the module type, and its protocol.

Line 2 shows the IAP version of BT-5312;

Line 3 shows the APP version of BT-5312;

BT-623F: 8-channel / digital input /24VDC/ sink / source, 8 channel / digital output/24VDC/ source, 24VDC

1 Module features

◆ the module supports 8-channel digital input, and supports source type and sink type two-way input. The input voltage is 0V/24VDC. The input high level (sink type) is valid and the module it could be connected to PNP sensor while the input low level (source type) is valid, and the module it could be connected to NPN sensor.

◆ the module supports 8-channel digital output, output high level is valid, and the output voltage is 24VDC.

◆ the module input channel can collect digital output signal of field equipment. (dry contact or active output).

◆ the module input channel can be connected to the 2-wire or 3-wire digital sensor.

◆ the module input channel supports 32-bit counter for each channel, the counting frequency < 200Hz.

◆ the input channel of the module can set the digital signal input filtering time and the byte transfer order of the counter.

◆ the input channel of the module can set the counting mode and counting direction independently.

◆ the module output channel can drive field equipment. (relay, solenoid valve, etc.)

◆ the output channel of the module is equipped with short circuit, thermal shutdown and overvoltage protection functions.

◆ the module internal bus and field input and output , using Optocoupler isolation.

◆ the module supports LCD display of basic module information and channel indicator display parameters.

◆ the module supports the fault output processing function when the application layer is disconnected.

◆DO output overload protection warning function to the corresponding channel.

2 Technical parameters

General Parameters	
Power	Max.45mA@5.0Vdc
Isolation	I/O to internal bus: opto-coupler isolation (3KVrms)
Field Power	Nominal: 24Vdc, Range: 19.2～28.8Vdc
Wiring	I/O wiring: Max.1mm² (AWG 18)
Weight	14g
Size	74*42*10mm
Environment Specification	
Channel Number	8-channel
Turn on Voltage	High input: Min.10Vdc to Max.28Vdc (Common: 0Vdc) Low input: Min.0Vdc to Max.14Vdc (Common: 24Vdc)
Turn off Voltage	High input: Max.5Vdc (Common: 0Vdc) Low input: Min.19Vdc (Common: 24Vdc)
Open Current	Max.15mA/ channel @28V
Input Impedance	>1.8kΩ
Input Delay	OFF to ON: Max.3ms ON to OFF: Max.2ms
Filtering Time	Default: 10ms
Sampling Frequency	500Hz
Count Frequency	<200Hz
Output Parameters	
Channel Number	8-channel
Rated Current	Typical value: 1.5A
Leakage Current	Max value: 7uA
Output Impedance	<0.2Ω
Output Delay	OFF to ON: Max 200us ON to OFF: Max 100us
Protection Function	Protection current: typical value 4.7A Temperature protection: typical value 165℃ Short circuit protection support

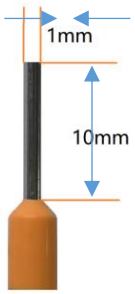
3 Terminal definition

Module wiring adopts 20Pin 3.5mm spacing spring wiring terminals, which are defined as follows:

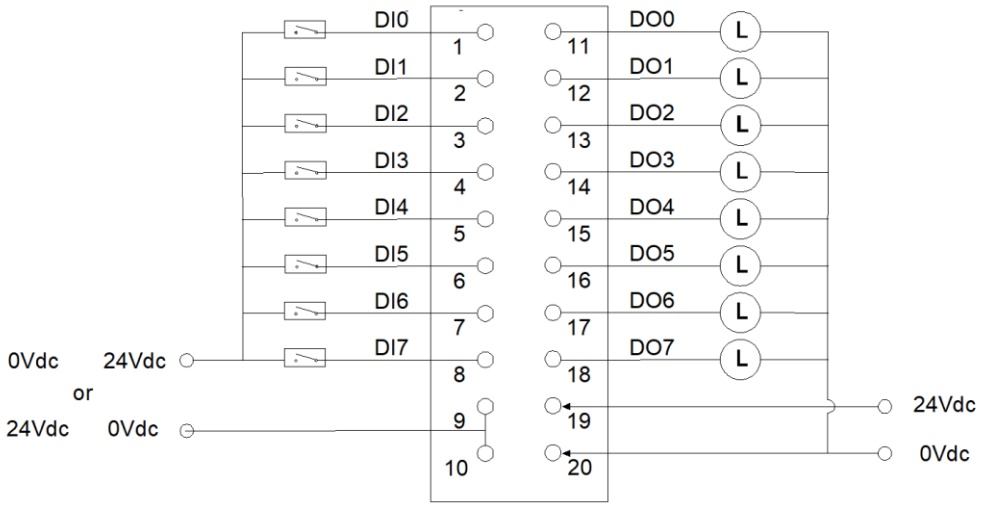
Description	Terminal Number	Symbol	Symbol	Terminal Number	Description
Signal input	1	DI0	DO0	11	Signal output
	2	DI1	DO1	12	
	3	DI2	DO2	13	
	4	DI3	DO3	14	
	5	DI4	DO4	15	
	6	DI5	DO5	16	
	7	DI6	DO6	17	
	8	DI7	DO7	18	
Common terminal	9	24V or 0V	24V	19	Common terminal
	10		0V	20	

It is recommended to use cables with cores smaller than 1mm².

The cold-pressed terminal parameters are as follows:



4 Wiring



Note: Terminals 9 and 10 are internally short-circuited.

5 Process data definition

<8DI8DO Input Output Status> Submodule process data definition

Input data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	DI Ch#7	DI Ch#6	DI Ch#5	DI Ch#4	DI Ch#3	DI Ch#2	DI Ch#1	DI Ch#0
Output data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	DO Ch#7	DO Ch#6	DO Ch#5	DO Ch#4	DO Ch#3	DO Ch#2	DO Ch#1	DO Ch#0

<8DI Counter Submodule > Counter submodule process data definition

Input data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Counter Value Ch#0							
Byte 1								
Byte 2								
Byte 3								
Byte 4	Counter Value Ch#1							
Byte 5								
Byte 6								
Byte 7								
Byte 8	Counter Value Ch#2							
Byte 9								
Byte 10								
Byte 11								
Byte 12	Counter Value Ch#3							
Byte 13								
Byte 14								
Byte 15								
Byte 16	Counter Value Ch#4							
Byte 17								
Byte 18								
Byte 19								
Byte 20	Counter Value Ch#5							
Byte 21								
Byte 22								
Byte 23								
Byte 24	Counter Value Ch#6							

Byte 25								
Byte 26								
Byte 27								
Byte 28	Counter Value Ch#7							
Byte 29								
Byte 30								
Byte 31								
Output data								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Counter Reset Ch#7	Counter Reset Ch#6	Counter Reset Ch#5	Counter Reset Ch#4	Counter Reset Ch#3	Counter Reset Ch#2	Counter Reset Ch#1	Counter Reset Ch#0

Data description:

DI CH# (0-7): when the corresponding channel input signal is valid, this bit will be set as 1, and it will be set as 0 when the input signal is invalid.

0: the input signal is invalid

1: the input signal is valid

Counter Value Ch# (0-7): 8-channel 32-bit counter, unsigned integer, automatically zeroing after overflow.

DO CH# (0-7): when this bit is set as 1, and the corresponding channel output signal is valid, and this is high level valid.

0: the output signal is invalid

1: the output signal is valid

Counter Reset Ch# (0-7): when the data bit changes from 0 to 1 (rising edge), the input counter of the corresponding channel will be cleared.

Note: the max counting frequency of the input channel is 200Hz. When the input signal exceeds this frequency, the counting result may be inconsistent with the actual value.

6 Configuration parameter definition

<8DI8DO Input Output Status > Submodule configuration parameter definition

Configuration parameter								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Input Filtering Time							
Byte 1								
Byte 2	Reserved					Input Holding Time (ms)		
Byte 3	Fault Action for Output Ch#7	Fault Action for Output Ch#6	Fault Action for Output Ch#5	Fault Action for Output Ch#4	Fault Action for Output Ch#3	Fault Action for Output Ch#2	Fault Action for Output Ch#1	Fault Action for Output Ch#0
Byte 4	Fault Value for Output Ch#7	Fault Value for Output Ch#6	Fault Value for Output Ch#5	Fault Value for Output Ch#4	Fault Value for Output Ch#3	Fault Value for Output Ch#2	Fault Value for Output Ch#1	Fault Value for Output Ch#0

Data description:

Input Filtering Time (ms): Channel input filtering time, unit: ms. (Default: 10)

Input Holding Time (ms): Channel input signal holding time, unit: ms. (Default: 0)

0: Disable

1: 200ms

2: 500ms

3: 1000ms

4: 1500ms

5: 2000ms

6: 3000ms

7: 5000ms

Fault Action for Output Ch# (0-7): Fault Output mode. When the IO module detects an internal bus exception and fails to communicate with the COMM board, the module enters offline mode, and the output data will be processed in this way. (default: 0)

0: keep the last time output.

1: output fault value. output configured output value.

Fault Value for Output Ch# (0-7): When the fault output mode is 1, the bit sets the fault output value, which is output when the IO module internal bus is offline. (default: 0)

0: output low level.

1: output high level.

<8DI Counter Submodule> Submodule configuration parameter definition

Configuration parameter								
Bit No	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Reserved				Storage Enable	Storage Function	32Bit Data Format	
Byte 1	Count Mode Ch#3		Count Mode Ch#2		Count Mode Ch#1		Count Mode Ch#0	
Byte 2	Count Mode Ch#7		Count Mode Ch#6		Count Mode Ch#5		Count Mode Ch#4	
Byte 3	Count Direction Ch#7	Count Direction Ch#6	Count Direction Ch#5	Count Direction Ch#4	Count Direction Ch#3	Count Direction Ch#2	Count Direction Ch#1	Count Direction Ch#0

Data description:

32Bit Data Format: Byte transmission order of channel count values **(**default: 0).

0: AB-CD

1: BA-DC

2: CD-AB

3: DC-BA

Storage Function: Storage Function is supported or not, read only attribute, and this value is the actual value of the module when uploading device parameters.

0: storage is not supported

1: storage is supported

Storage Enable: Storage enable, when the Storage Function enables, the IO module will save the count value in real time to non-volatile memory, and load the last saved count value when it is powered on next time. (default: 1)

0: Disabled

1: Enable

Count Mode Ch# (0-7): Input channel count mode. (default: 0)

0: Rising edge count

1: Falling edge count

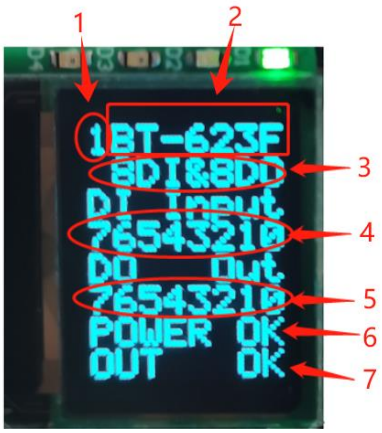
2: Double edge count

Count Direction Ch# (0-7): Counting direction of the input channel. (default: 0)

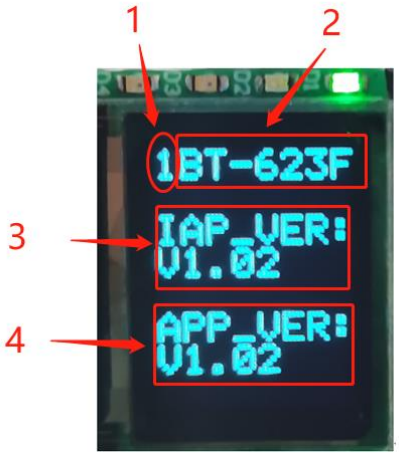
0: Count up

1: Count down

7 LCD display interface



Page1



Page2

Note: The module information display is 2 pages in total, the first number on the first row of each page indicates the slot location (**1**) of the module, the module model is displayed behind (**BT623F**), the page 1 mainly displays channel status, information tips, and module type information, the page 2 mainly displays software version information.

Page 1: channel status and module type information

Number 1 and 2 show the 32-bit slot location (**1**) of the module, the module model is displayed behind (**BT623F**);

Number 3 shows the module type **8DI&8DO**;

Number 4 and 5 display the channel input and output prompts;

8DI: Row 3 and row 4

Row 3 and row 4 show the 8DI input display prompt. If there is a display and it will be corresponding to the indicated channel. And it will be displayed as "-" from right to left when there is no input.

1. For example, if all 8 channels have input, and row 4 shows:

   76543210

2. If all 8 channels have no input and it will be displayed as:

   ----

3. After the COMM board is connected to the master and then disconnected,

the application layer is disconnected, and this row will be displayed as follows:

__fault_

8DO: Row 5 and row 6

Row 5 and row 6 show the 8DO output display prompt. If there is a display and it will be corresponding to the indicated channel. And it will be displayed as "-" from right to left when there is no output.

1. For example, if all 8 channels have output, and row 6 shows:

76543210

2. If all 8 channels have no output and it will be displayed as:

----

3. After the COMM board is connected to the master and then disconnected, the application layer is disconnected, and after the fault output is performed, this row will be displayed as follows:

__fault_

Row 7 shows the site power supply of the module. If the site power supply is connected to the module and row7 will be displayed as "POWER OK". And if the site power supply is not connected to the module and it will be displayed as "NO 24Vdc".

Row 8 shows the channel output. The normal output is displayed as "OUT OK". If the channel is overloaded or when the output is faulty, the output is displayed as "H Temper" and the corresponding channel is displayed as "^". Suppose if the second channel output is overloaded, and it will be displayed as:

765432^0

Page 2: Display software version information.

Number 1 and 2 display the slot number (**1**) of the module and the module model name (**BT-623F**).

Number 3 display the IAP version information for the module (**V1.02**)

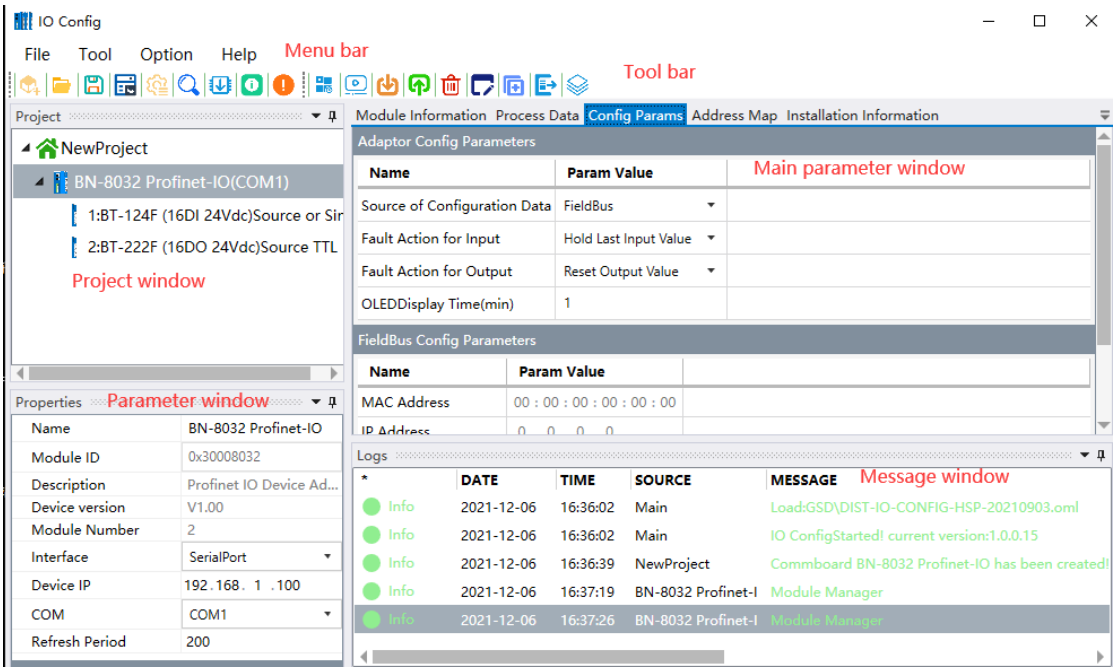
Number 4 display the APP version information for this module (**V1.02**)

4 IO-Config configuration software

Note:

1. When uploading, downloading and monitoring modules, all COMM board modules support serial port uploading, downloading and data monitoring. Only MODBUS TCP supports uploading, downloading, and monitoring over both serial ports and network ports. Serial port Type-C USB data cable must have the function of data transmission and power supply, because some mobile phone charging lines only have power supply function, but do not support data transmission, so they cannot be used for uploading and downloading module parameters.
2. For the digital input module (DI), there is the concept of a submodule. Usually, the configuration of the DI module only adopts a number of channels digital Bool signal. The sub-module is used to store the input count and clear count of each channel.
3. Shortcut keys: Ctrl+C can copy the I/O module, Ctrl+V can paste the I/O module, Delete can Delete the I/O module, Ctrl+S can save the configuration project, Ctrl+M can export the address table, and F1 can enter the HELP document to view THE I/O technical parameters.

4.1 Software Interface



Menu bar: IO Config software menu

Tool bar: common user menus

Project window: tree structure displays the currently active projects

Properties: It displays the specific parameters of the current item. COMM board module (module name, module number, module description, device version, number of modules, interface selection, device IP address, serial port number, and online refresh interval), IO module (module name, module number, module description, and number of submodules)

Module information: major windows

Basic information: It could be viewed the module name, module number, hardware version, software version, module description, current consumption, and device manufacturer.

Process data: It can be used to monitor channel data online.

Config Parameters: module configurable parameters.

Address Map: address occupied by the I/O module

Installation Information: it could be viewed module description, current

consumption, module size, residual current, and product picture.

Logs: displays real-time operation information, including operation logs about creating projects, uploading, downloading, and modifying configuration parameters

Tool bar

Menu common shortcut icon

Icon	Name	Menu	Description
	New Project	File-Project-New Project	Create a new project
	Open project	File-Project-Open Project	Open the saved project files
	Save ALL	File - Project - Save ALL	Save current project
	Save As	File - Project - Save As	Save the current project as the new project
	Config	Option- Config	Configure the software language, software interface color, and device library description file path
	Search Device	Tool-Search Device	A new pop-up window, used for MODBUS communication search devices
	Device Update	Tool-Device Update	A new pop-up window, used for COMM board and IO module firmware upgrade
	About	Help-About	It could be viewed ODOT company info. and the configured software version
	Help Document	Help-Help Document	A new pop-up window, it could check IOConfig user manual
	Hardware manual	Help-hardware manual	A new pop-up window, it could check all IO module hardware manual.
	About Exceptions	Help-About Exceptions	A new pop-up window, warning of abnormal Exi. WIN7 sp1/XP system and below version please install Microsoft patch.

COMM board common shortcut icon

Icon	Name	Menu	Description
	Module Manager	COMM board- Module Manager	Add the IO module manager
	Online	COMM board -Online	COMM board and IO module online monitoring.

	Download Params	COMM board- Download IO Params	Download all params of the modules
	Upload Params	COMM board- Upload IO Params	Upload all params of the modules
	Delete	COMM board - Delete	Delete the current COMM board module
	Rename	COMM board - Rename	Rename the COMM board module
	Copy	COMM board - Copy	Copy the COMM board and extended IO module
	Export Map	COMM board - Export address map	Export the address mapping of COMM board module and extended IO module
	Export Document	COMM board – Export the document	Export all information about COMM board modules and I/O modules, including the address table, module parameters, size diagram, and module list.

4.2 Configured software using

4.2.1 Function brief introduction

Model selection

View the hardware manuals of the COMM board module (BN modules) and IO module (BT modules)

Create new project, save project, and open the original project.

Adding the BN&BT module and view the module parameters.

Modify BN&BT module parameters.

Address mapping table, data address of BT modules.

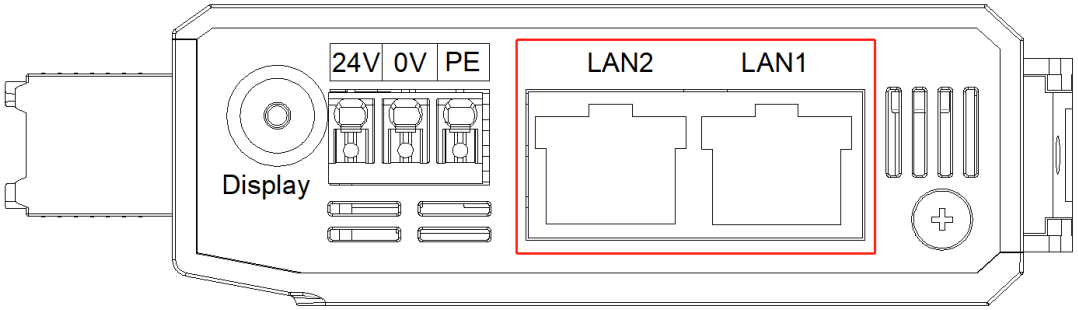
BT modules online test.

Data export, BN&BT address table, engineering documentation.

Firmware upgrading.

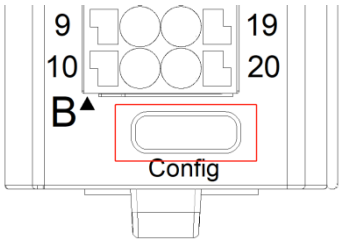
4.2.2 COMM interface

RJ45 Port



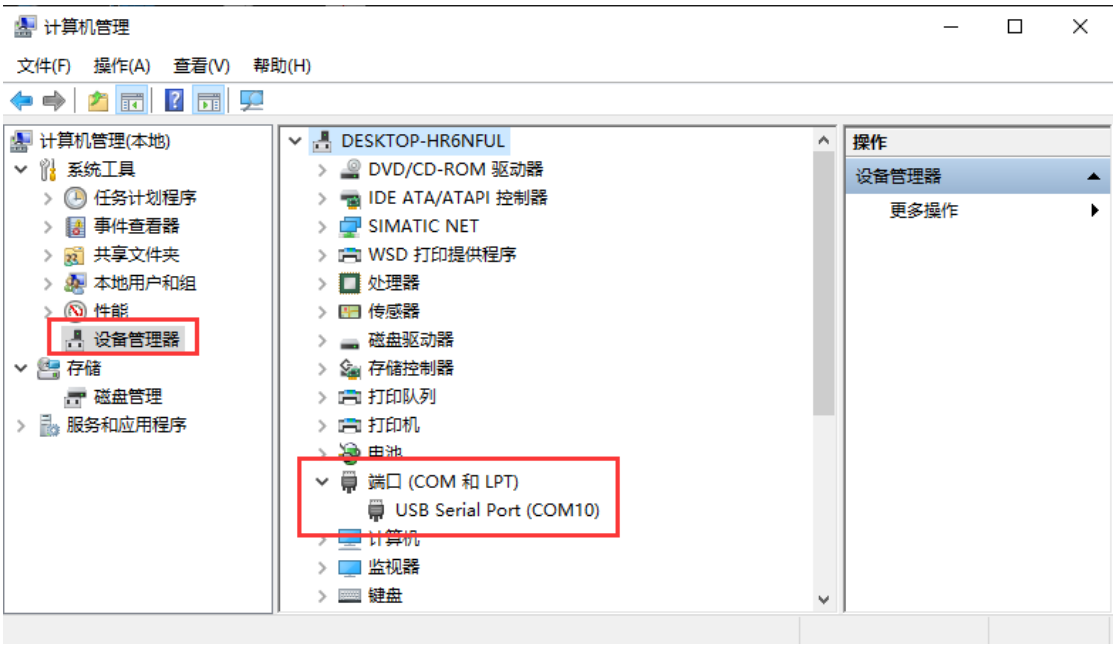
Only when the COMM board module is BN-8031, it can use the RJ45 port for communication: search for BN-8031, modify BN&BT module parameters, test BT module data online, and upgrade firmware.

Serial Port



When using serial port for communication, the serial port Type-C USB cable must support for transmitting data and power supply. Some mobile phone charging cables only have power supply function, but do not support data transmission, so they cannot be used for uploading and downloading module parameters.

After the type-C USB cable is connected to the computer and COMM board, and the computer will automatically install the driver. After the driver is installed, the serial port number will pop up in the device manager of the computer.

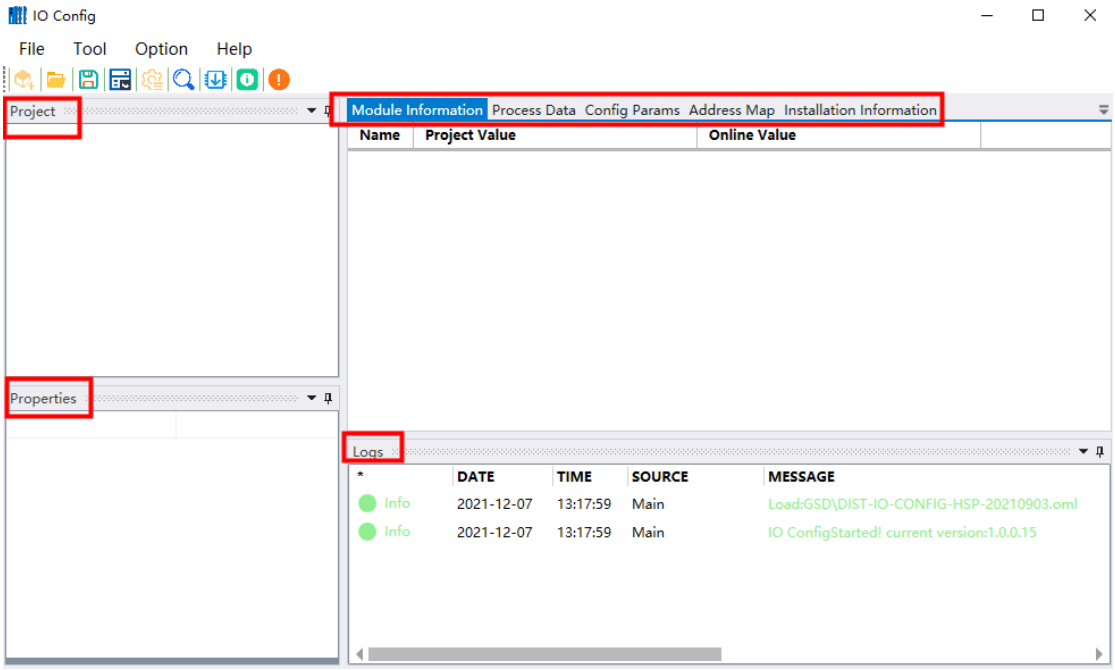


4.2.3 Module selection

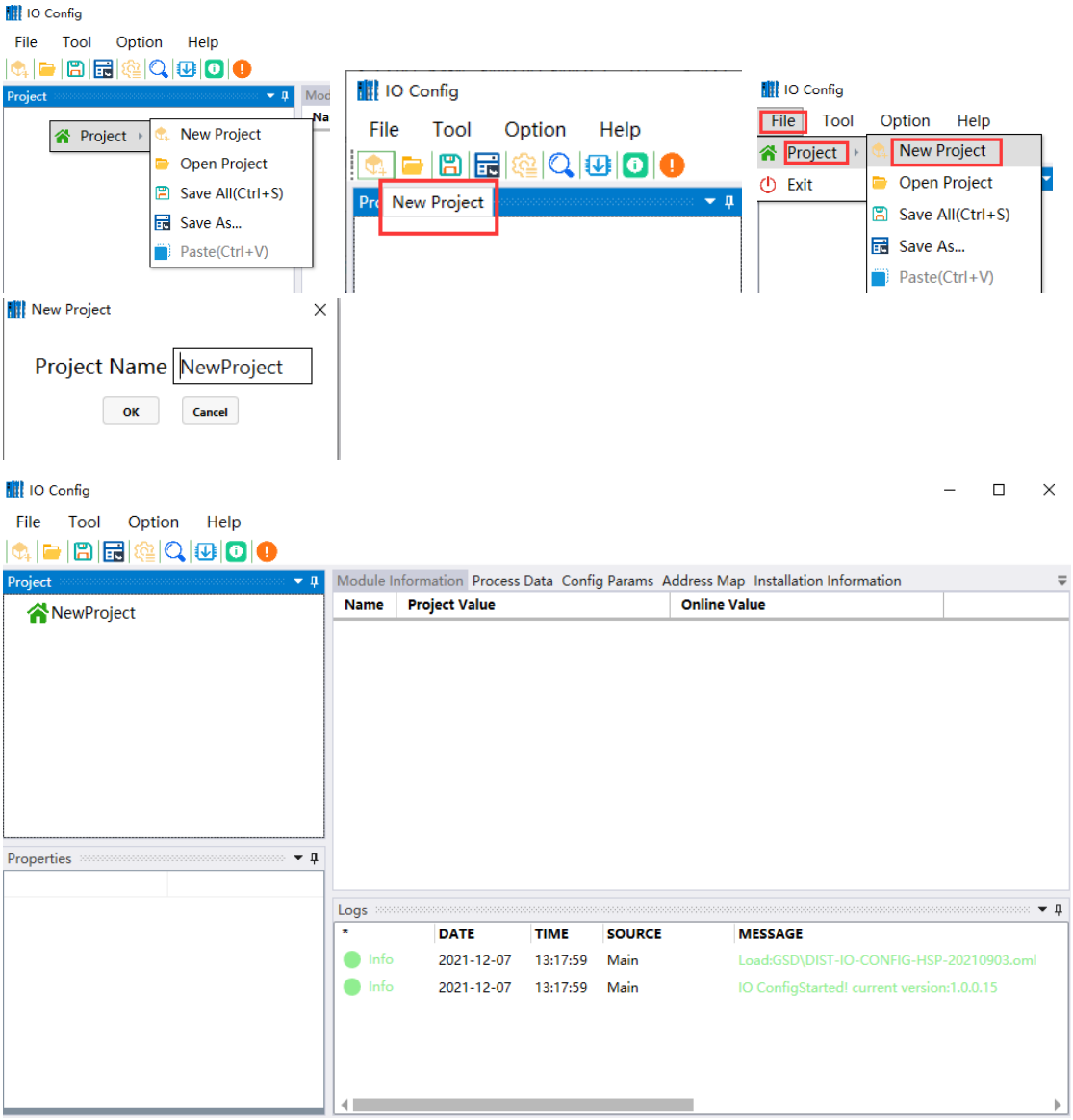
Before module selection, it can press F1 shortcut key to open IO hardware manual and view information of all modules, which is convenient for module selection and users to have a more comprehensive understanding of module information.

The customer uses the IOConfig software to select modules to determine whether additional power modules are required for the I/O module. It could also determine whether to add a power module based on the internal bus power supply current of the COMM board module and the power consumption of the I/O module. And it could Export BN&BT module files for purchasing, drawing and so on.

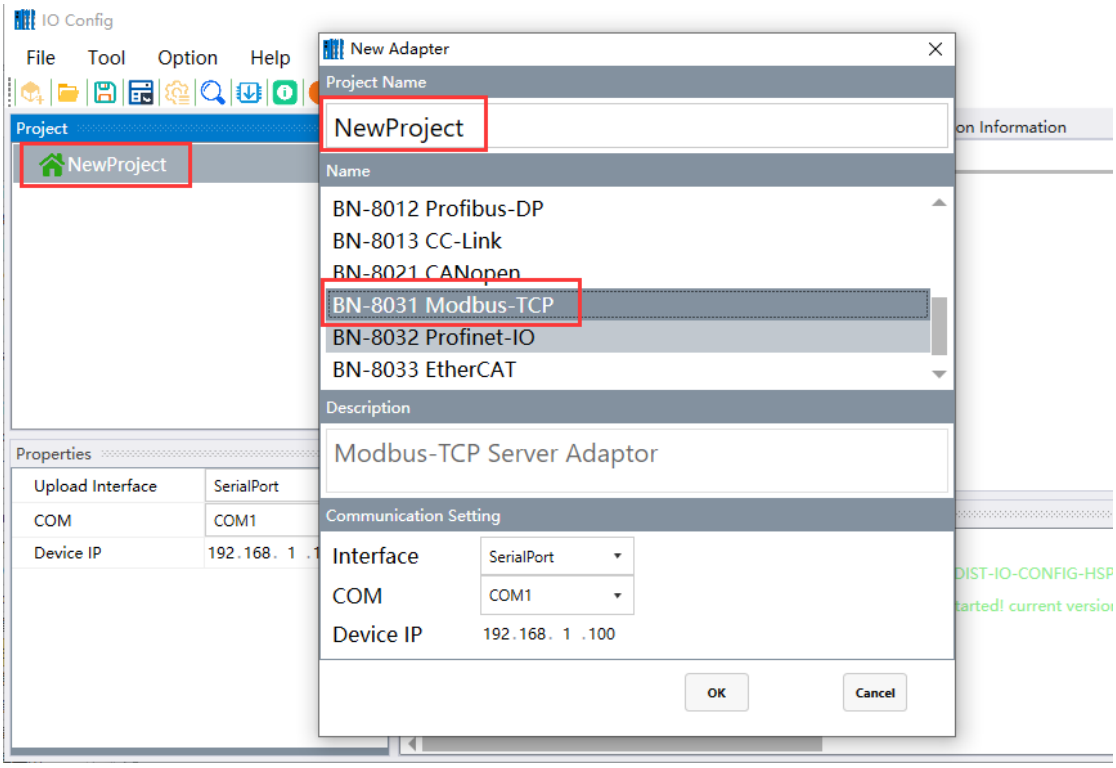
Double-click the IOConfig shortcut icon to display the initial software configuration page.



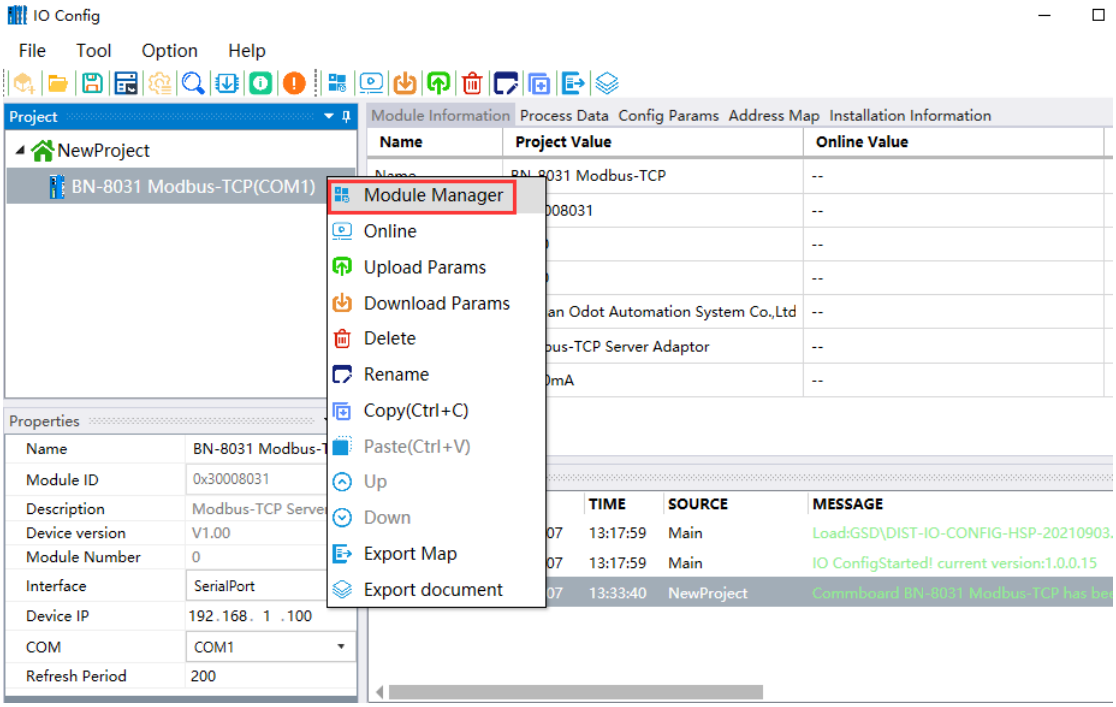
Create a project, click in the project directory bar, right - Project - New Project or click shortcut key or menu bar File - Project - New Project, manually enter the project name.

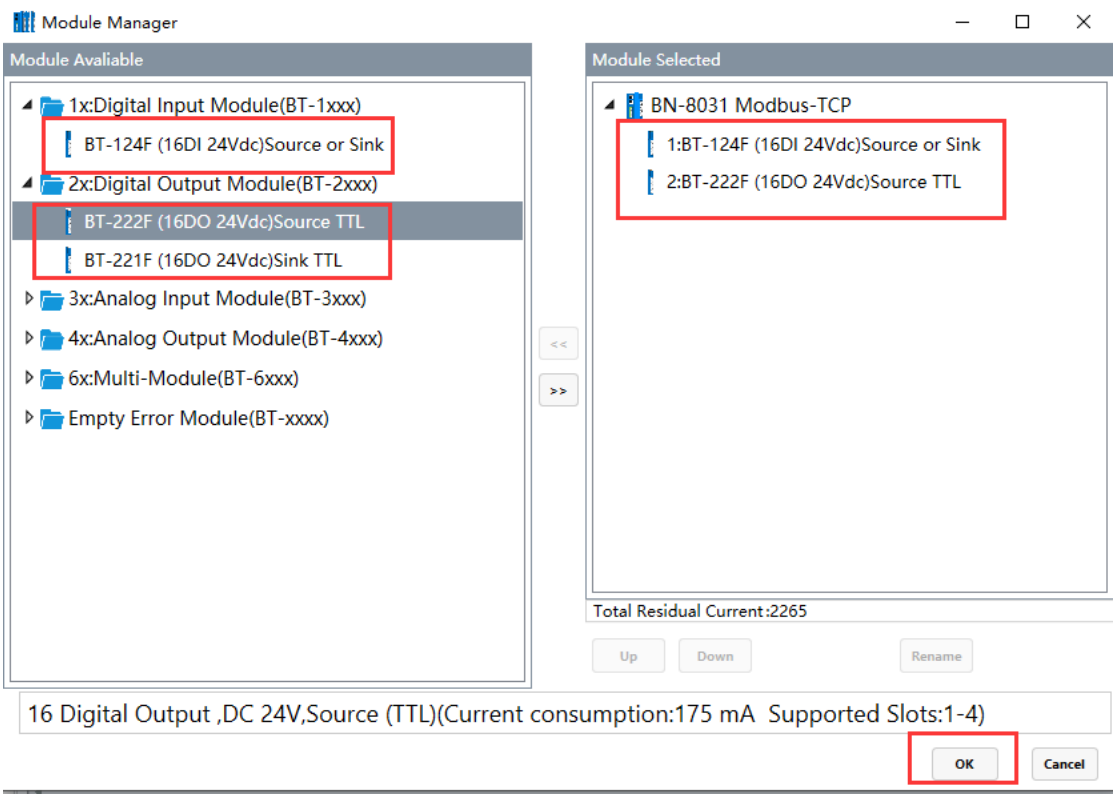


Right-click project-New adapter in the project directory bar, select BN-8031 in the popup interface, select serial port for the interface, select serial port number COM1, and click OK.

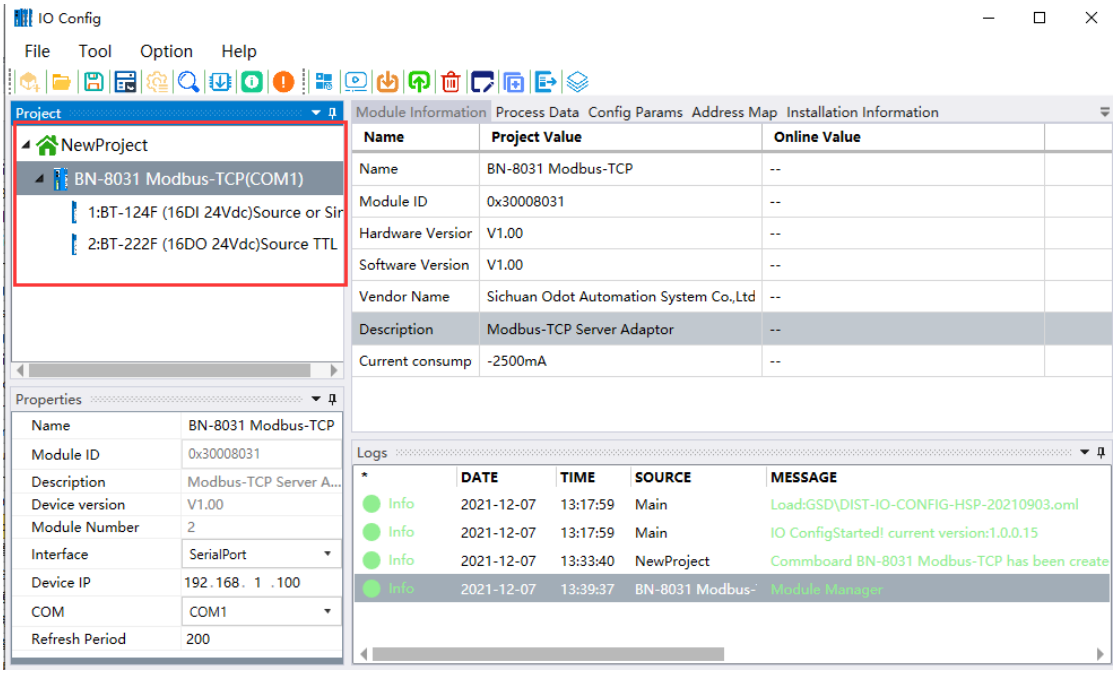


Select BN-8031 COMM board in the project bar, right-click BN-8031, click Module Manager, in the pop-up dialog box, and select the IO module. Click OK.





After adding the I/O modules and it could click OK to automatically generate I/O modules in the project bar.



4.2.4 View and modify BN&BT configuration parameters

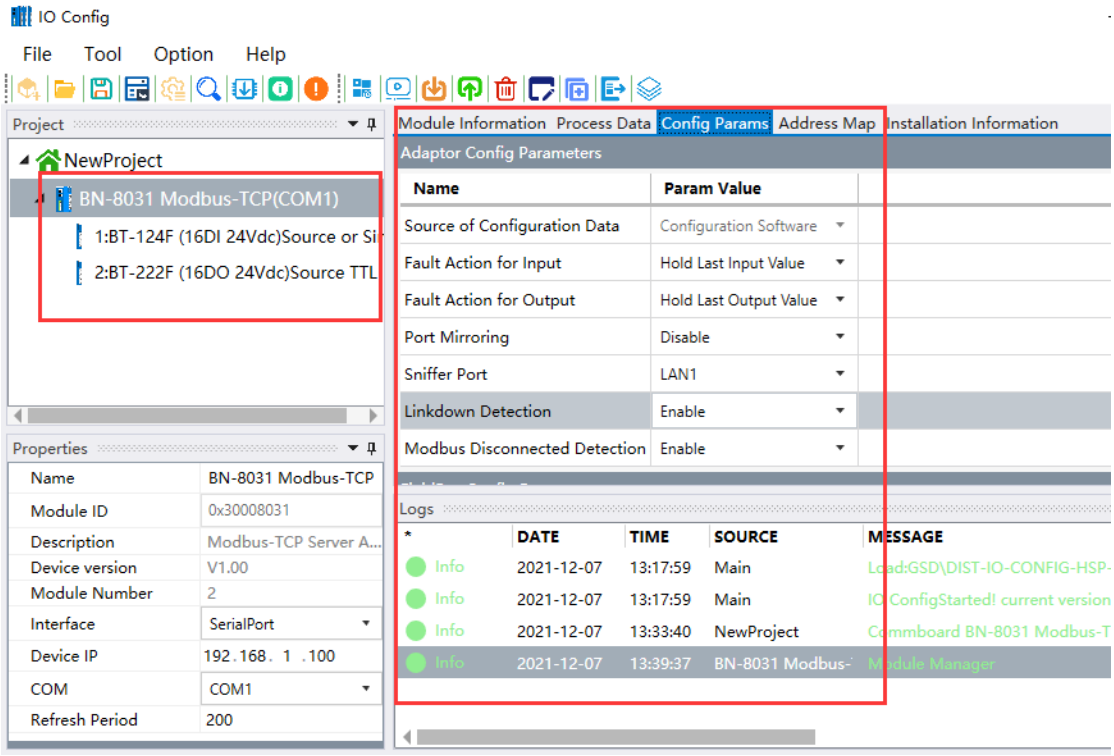
It could create a new project and add different COMM board and IO modules. And it could Config Params to view the default parameters of the BN&BT modules.

The modification parameters of COMM board for Modbus TCP, Modbus RTU, CANopen and Ethernet/IP, it must use the IOConfig software.

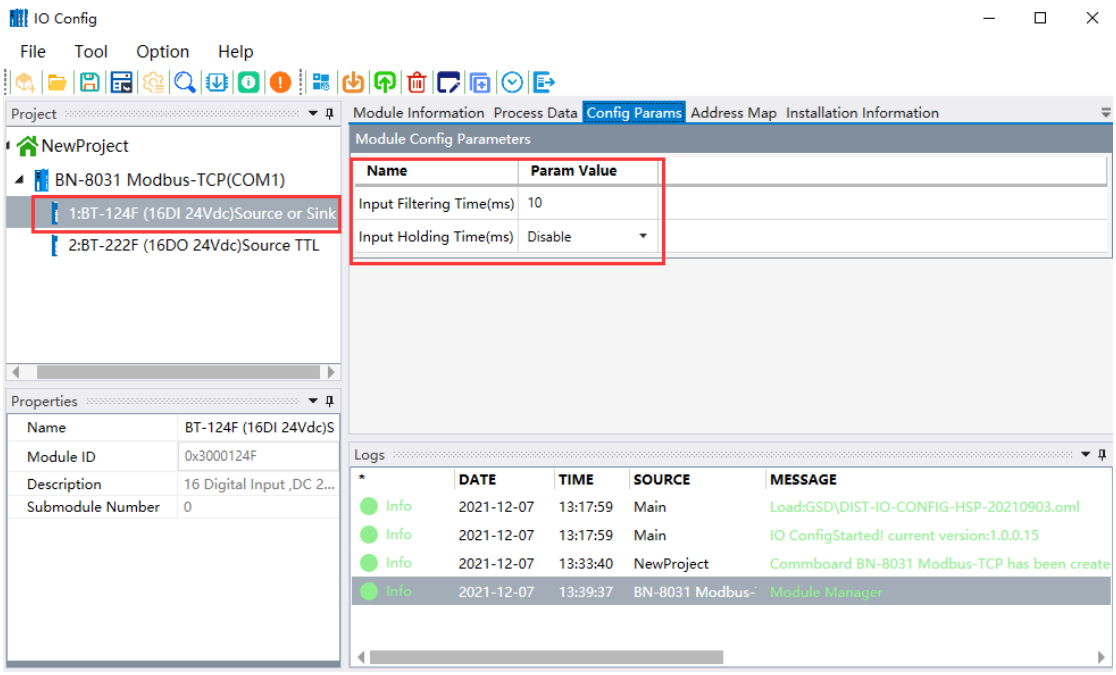
The modification parameters of Profinet, EtherCAT and Profibus DP COMM board can be directly set on the third-party configuration interface without using IOConfig software.

IO module configuration parameters can be modified in the IOConfig software. After modifying IO module parameters, right-click the COMM board module to download the configuration.

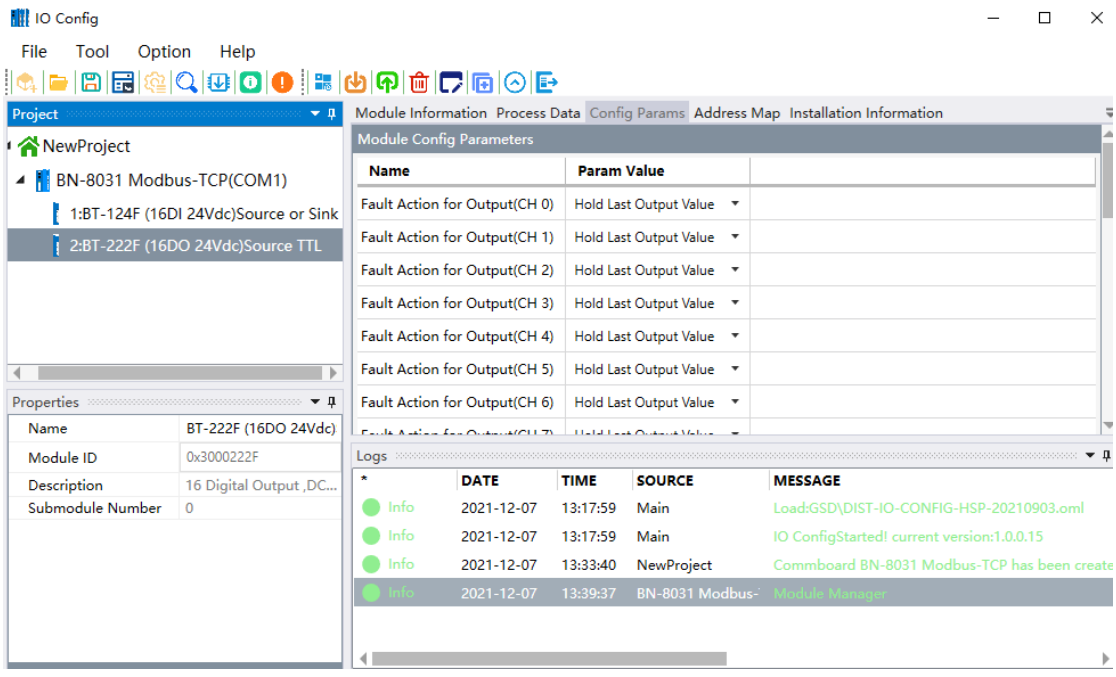
Modbus TCP (BN-8031) Config Params Interface:



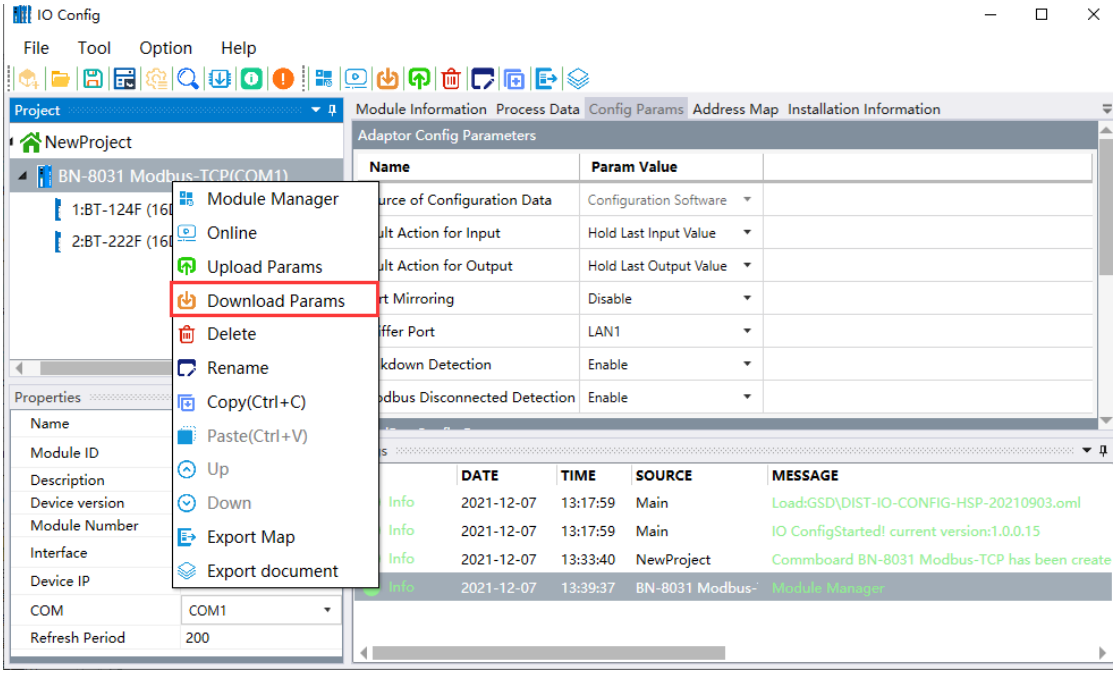
BT-124F Config Params



BT-222F Config Params



After parameter modification, it could right-click COMM board module - download Params in the project directory bar. It could modify the configuration parameters of the COMM board and IO module.



After all parameters are modified, it needs to select the COMM board module and use Ctrl+S to save the configuration project file.