

VT-IO-DAM0444 Industrial I/O Converter



User Manual

V1.5

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Revision History:

No.	Description	Date
V1.0	First release.	Dec. 25, 2023
V1.1	Added description on the offset calibration and gain calibration of AI channels; Modified description of the DI nodes.	Jan. 18, 2024
V1.2	Added description on the conversion between the decimal register address and the hex Modbus register address.	Feb. 28, 2024
V1.3	Modified the function of register 40016; Added the 'factory reset' feature to 40016.	Apr. 9, 2024
V1.4	Updated the example digits in Section 4.2.	May 20, 2026
V1.5	1. Updated the calculation formula for the AI values in Section 3.6 and deleted Section 3.7 (AI calibration). 2. Added the following register addresses: 40019, 40020, 40800. 3. Deleted the following register addresses: 100, 104, 10300, 10304. 4. Updated the description of the following addresses: 200, 204, 41001. 5. Updated the application examples in chapter 4.	Sep 22, 2026

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Foreword

Thank you for purchasing the VT-IO-DAM0444 industrial I/O Converter (“the Module” or “the Product”). This manual intends to provide guidance and assistance necessary on setting up, operating or maintaining the Product. Please read this manual and make sure you understand the structure and functionality of the Product before putting it into use.

Intended Users

This manual is intended for:

- Industrial automation engineers
- Technical support engineers
- Other users

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Disclaimer

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It is our practice to change part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the Product may be changed without notice.

Technical Support and Assistance

Should you have any question about the Product that is not covered in this manual, contact your sales representative for solution. Please contain the following information in your question:

- Product name and PO number;
- Complete description of the problem;
- Error message you received, if any.

Vantron Technology, Inc.

Address: 48434 Milmont Drive, Fremont, CA 94538

Tel: (650) 422-3128

Email: sales@vantrontech.com

Regulatory Information

The Product is designed to comply with:

- CE
- FCC
- ISED

Please refer to the Appendix for Regulatory Compliance Statement.

Symbology

This manual uses the following signs to prompt users to pay special attention to relevant information.

	Caution for latent damage to system or harm to personnel
	Attention to important information or regulations

General Safety Instructions

The Product is supposed be installed by knowledgeable, skilled persons familiar with local and/or international electrical codes and regulations. For your safety and prevention of damage to the Product and other equipment connected to it, please read and observe carefully the following safety instructions prior to installation and operation. Keep this manual well for future reference.

- Do not disassemble or otherwise modify the Product. Such action may cause heat generation, ignition, electronic shock, or other damages including human injury, and may void your warranty.
- Keep the Product away from heat source, such as heater, heat dissipater, or engine casing.
- Do not insert foreign materials into any opening of the Product as it may cause the Product to malfunction or burn out.
- To ensure proper functioning and prevent overheating of the Product, do not cover or block the ventilation holes of the Product.
- Follow the installation instructions with the installation tools provided or recommended.
- The use or placement of the operation tools shall comply with the code of practice of such tools to avoid short circuit of the Product.
- Cut off the power before inspection of the Product to avoid human injury or product damage.

Precautions for Power Cables and Accessories

-  Use proper power source only. Make sure the supply voltage falls within the specified range. The Product is designed to use 12V DC. Always check whether the Product is DC powered before applying power.
-  Place the cables properly at places without extrusion hazards.
-  Use only approved antenna(s). Non-approved antenna(s) may produce spurious or excessive RF transmitting power which may violate FCC limits.
-  Cleaning instructions:
 - Power off before cleaning the Product
 - Do not use spray detergent
 - Clean with a damp cloth
 - Do not try to clean exposed electronic components unless with a dust collector
-  Power off and contact Vantron technical support engineer in case of the following faults:
 - The Product is damaged
 - The temperature is excessively high
 - Fault is still not solved after troubleshooting according to this manual
-  Do not use in combustible and explosive environment:
 - Keep away from combustible and explosive environment
 - Keep away from all energized circuits
 - Unauthorized removal of the enclosure from the device is not allowed
 - Do not replace components unless the power cable is unplugged
 - In some cases, the device may still have residual voltage even if the power cable is unplugged. Therefore, it is a must to remove and fully discharge the device before replacement of the components.

CHAPTER 1 INTRODUCTION

1.1 Product Overview

The VT-IO-DAM0444 industrial I/O converter is equipped with multiple digital input (DI), digital output (DO), and analog input (AI) channels, providing versatile connectivity options for industrial applications. It is specifically designed to efficiently convert both digital and analog signals into RS485 bus signals, enabling seamless uplink data transmission through serial communication protocols like Modbus RTU. With the converter, edge data from PLCs and sensors in the industrial field can be effortlessly transferred to a range of industrial devices, including gateways, routers, and industrial DTUs.

The VT-IO-DAM0444 is constructed with a compact and rugged design, ensuring durability and reliability in harsh industrial environments. Additionally, its flexible installation options enhance its adaptability to various industrial setups.

1.2 Unpacking

The Product has been carefully packed with special attention to quality. However, should you find any component damaged or missing, please contact your sales representative in due time.

Standard accessories:

- VT-IO-DAM0444 industrial I/O converter
- 1 × DI terminal connector
- 1 × DO terminal connector
- 1 × AI terminal connector
- 1 × DC power connector
- 1 × Qualified certificate

Optional accessories:

- 1 × 12V 1A power adapter
- 1 × Power cord
- 1 × Debug cable

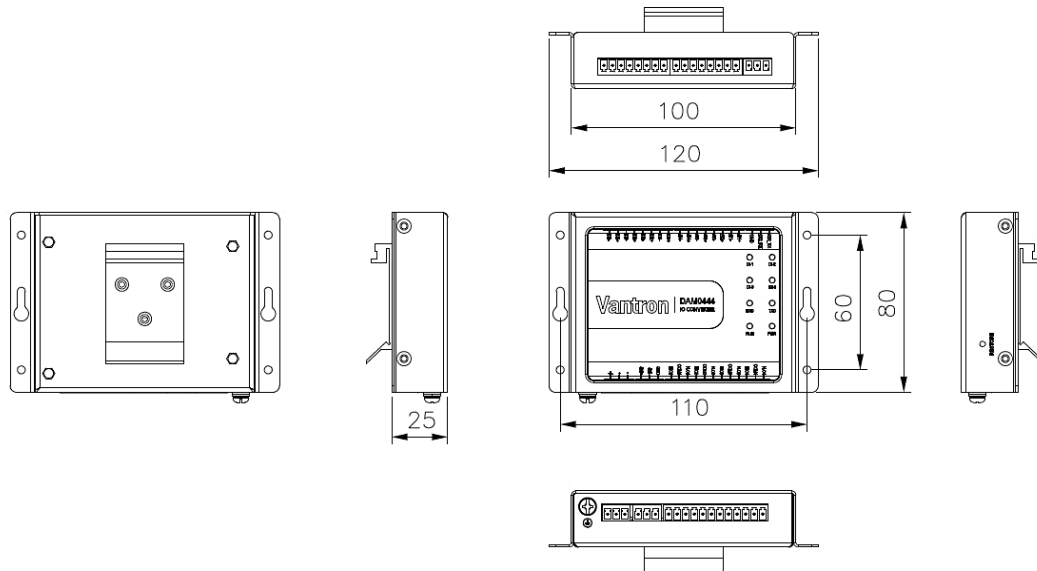
 *Actual accessories might vary slightly from the list above as the customer order might be different from the standard configuration options.*

1.3 Specifications

VT-IO-DAM0444		
System	MCU	STM32F030C8T6
	Memory	8KB
	Storage	64KB
I/O	Serial port	1 × RS232 for device configuration & debugging (115200, 8N1) 1 × RS485 for data communication
	AI	4 × AI (Measurement signal: 4~20mA; Accuracy: 3‰; Resolution: 12-bit; Impedance: 240 Ω)
	DI	4 × DI (Wet contact; Frequency: 1kHz)
	DO	4 × DO (Contact capacity: 30V/500mA)
System Control	LED indicator	1 × Power LED
		1 × System status indicator
		4 × DI channel indicator
		2 × RS485 working indicator (RXD & TXD)
Mechanical	Button	1 × Restore button (1~3s: Restart the device; > 3s: Factory reset)
	Enclosure	Metal
	Dimensions	120mm × 80mm × 25mm (Including the mounting brackets)
	Installation	Wall mounting, DIN rail mounting
Power	Input	12V DC
		1 × Power terminal (3-pin, 3.81mm)
	Consumption	< 5W (load)
Software	Uplink protocol	Modbus RTU
	OS	RTOS
Environment Condition	Temperature	Operating: -40°C ~ +85°C
		Storage: -40°C ~ +85°C
	Humidity	Operating: 5%-95% RH (Non-condensing)
	EMC level	EMC Level 3
	Certification	FCC, IC, CE

1.4 Mechanical Dimensions

- 120mm × 80mm × 25mm (Including mounting brackets)



1.5 Power Supply

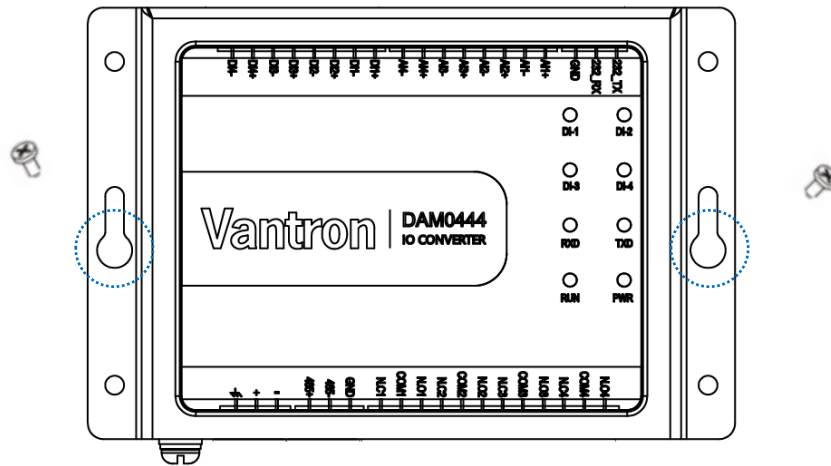
The VT-IO-DAM0444 is designed to work with 12VDC power input via the power terminal on the front of the device.

CHAPTER 2 HARDWARE DESCRIPTION

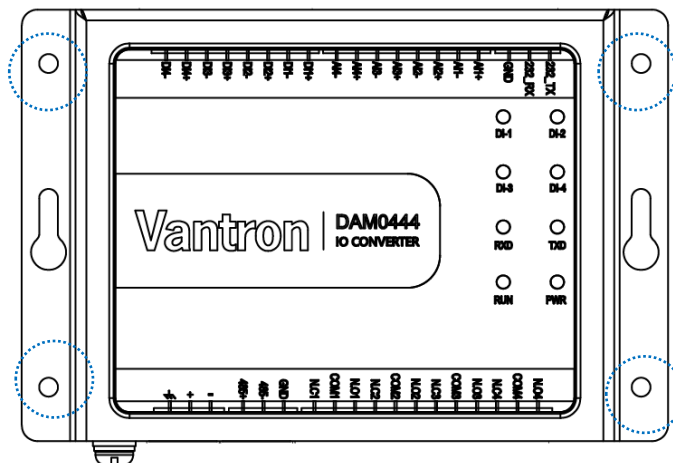
2.1 Device Installation

2.1.1 Wall Mount

1. Position the device on a desired place, for instance, a wall or a desktop.
2. Use screws (M4×6 / M4×8 recommended) to fasten the device on the wall or desktop.

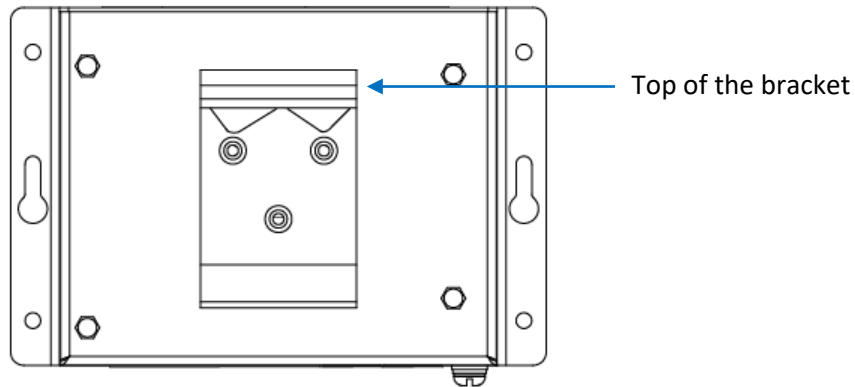


3. Further secure the device using another four screws that fit the small round holes if needed.

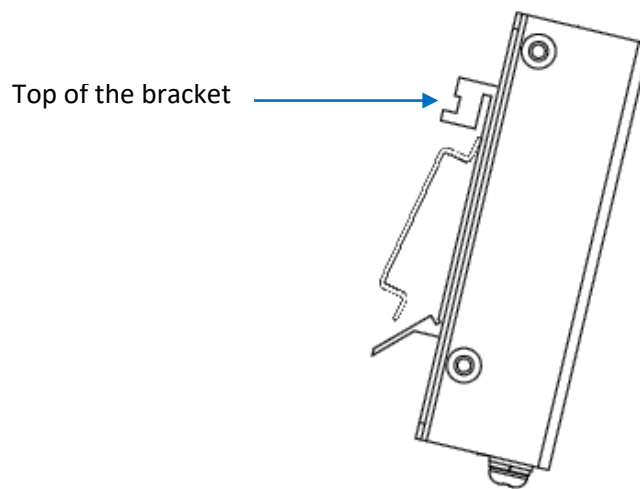


2.1.2 DIN Rail Mount

1. Hold the device uprightly with the DIN rail bracket on the bottom of the device facing the DIN rail.

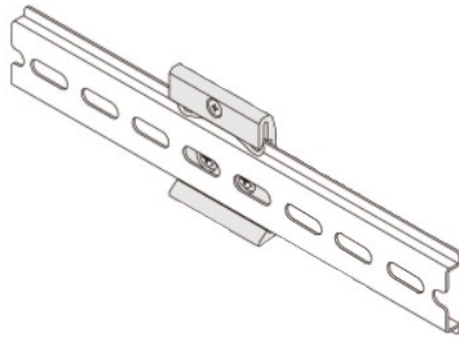


2. Fit one side of the DIN rail to the clamp at the top of the DIN rail bracket, behind the triangle fixer.



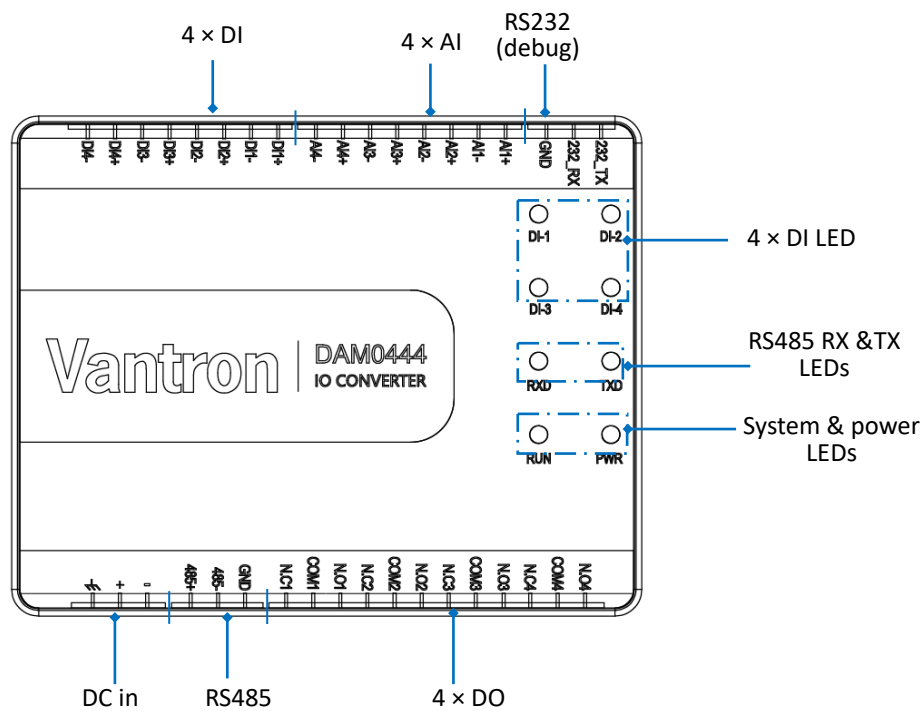
3. Push the device down to compress the bracket.

- Release the device when there is enough space for the other side of the DIN rail to fit in the downside of the DIN rail bracket.



- Gently swing the device to make sure it is fastened on the DIN rail.

2.2 Module Layout

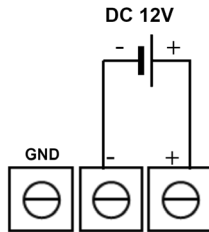


2.3 I/O Parameters

I/O	Parameter	Description
DI	Channel	4
	Type	Wet contact
	Input mode	Level + pulse counter
	Digital filter time interval	6 sampling loops
	Collection frequency	1kHz
AI	Channel	4
	Measurement signal	4~20mA
	Accuracy	3‰
	Collection frequency	250Hz
	Resolution	12-bit
	Isolation	350V DC
	Impedance	240Ω
	Input mode	Differential input
DO	Channel	4
	Contact	Form C relay
	Contact capacity	30V/500mA
	Output mode	Level + pulse
Uplink serial port	Serial mode	RS485
	Channel	1
	Max. baud rate	115200
	Protocol	Modbus RTU

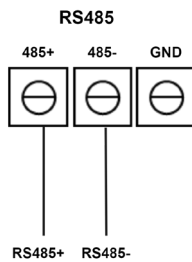
2.4 Wiring

2.4.1 Power Supply



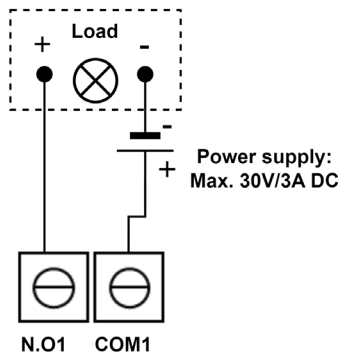
Note: The GND pin may connect to the common ground reference point.

2.4.2 RS485 Connector

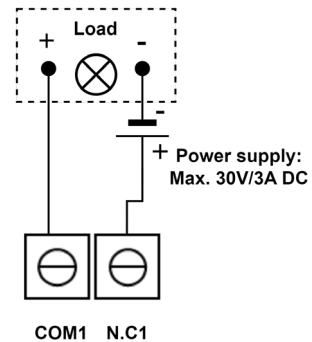


Note: The GND pin may connect to the common ground reference point.

2.4.3 DO (DO1 for illustration)

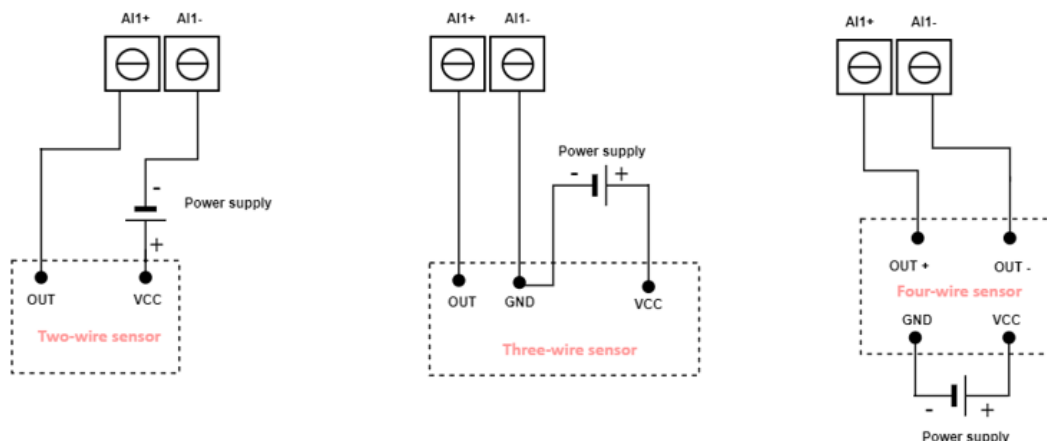


Normally open control



Normally closed control

2.4.4 AI (AI1 for illustration)



2.5 DI

Contact	Wiring	DI Value
Wet contact	DI- to GND, DI+ to high level	1
	DI- to GND, DI+ to low level	0

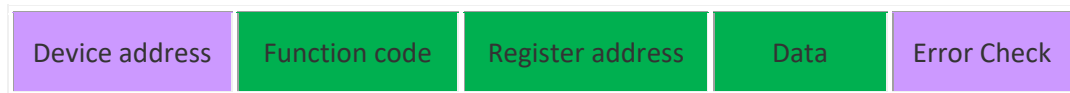
2.6 LED Indicators

LED	Function	Description
DI-x	Digital input indication	On: Digital input active
		Off: Digital input inactive
RXD	RS485 receive data	Solid: RS485 connection fault
		Blinking: Receiving data
		Off: No data transmission
TXD	RS485 transmit data	Blinking: Sending data
		Off: No data transmission
PWR	Power indication	Solid: The device is powered on
		Off: The device is unpowered on or there is a power failure
RUN	System status indication	Solid: System abnormality
		Blinking
		1s interval: Normal operation
		Fast, 50ms interval: Device bootup
		Off: System abnormality

CHAPTER 3 SOFTWARE CONFIGURATION

The VT-IO-DAM0444 supports Modbus RTU, a widely used communication protocol in industrial automation, enabling seamless data exchange between master and slave devices. The VT-IO-DAM0444 is the **slave** device in the communication process.

In Modbus RTU, the PDU (Protocol Data Unit) is a crucial part of the communication frame used to exchange data between the master and slave devices. A typical PDU includes the following components.



The device address field is the specific slave register address. The function code field tells the addressed slave, the VT-IO-DAM0444, what function to perform. The register address field specifies the starting point of the register in the slave's memory. Additional data field carries the necessary data to execute the request. The error check field provides a method for the slave to validate the integrity of the message.

3.1 Modbus Function Codes

The following sections explain the common function codes used in Modbus RTU communication.

3.1.1 Coil

3.1.1.1 Function 01 (0x01): read coils

This function code reads the ON/OFF status of discrete coils (1-2000) in the device. The coil status response message is packed as one coil per bit of the data field. Status is indicated as: 1 is the value ON, and 0 is the value OFF.

Request PDU

Function code	1 byte	0x01
Starting address	2 bytes	0x0000-0xFFFF
Quantity of coils	2 bytes	1-2000

Response PDU

Function code	1 byte	0x01
Byte count	1 byte	N*
Coil status	N bytes	

N* = Quantity of outputs/8. If the remainder is not 0, N=N+1.

Example of a request to read discrete outputs 20-38:

Request		Response	
Field name	Hexadecimal	Field name	Hexadecimal
Function code	01	Function code	01
Starting address Hi	00	Byte count	03
Starting address Lo	13	Output status 27-20	CD
Quantity of outputs Hi	00	Output status 35-28	6B
Quantity of outputs Lo	13	Output status 38-36	05

3.1.1.2 Function 05 (0x05): write a single coil

This function code writes a single coil to either ON or OFF. A value of FF 00 hex requests the coil to be ON. A value of 00 00 requests it to be OFF. All other values are illegal and will not affect the coil.

Request PDU

Function code	1 byte	0x05
Starting address	2 bytes	0x0000-0xFFFF
Output value	2 bytes	0x0000 or 0xFF00

Response PDU

Function code	1 byte	0x05
Starting address	2 bytes	0x0000-0xFFFF
Output value	2 bytes	0x0000 or 0xFF00

Example of a request to write coil 173 ON:

Request		Response	
Field name	Hexadecimal	Field	Hexadecimal
Function code	05	Function code	05
Output address Hi	00	Output address Hi	00
Output address Lo	AC	Output address Lo	AC
Output value Hi	FF	Output value Hi	FF
Output value Lo	00	Output value Lo	00

3.1.1.3 Function 15 (0x0F): write multiple coils

This function code writes each coil in a sequence of coils to either ON or OFF. A logical 1 in a bit position of the field requests the corresponding coils to be ON. A logical 0 requests it to be OFF.

Request PDU

Function code	1 byte	0x0F
Starting address	2 bytes	0x0000-0xFFFF
Quantity of outputs	2 bytes	0x0001-0x07B0
Byte count	1 byte	N*
Output value	N* bytes	

N* = Quantity of outputs/8. If the remainder is not 0, N=N+1.

Response PDU

Function code	1 byte	0x0F
Starting address	2 bytes	0x0000-0xFFFF
Quantity of outputs	2 bytes	0x0001-0x07B0

Example of a request to write ten coils starting at coil 20:

Request		Response	
Field name	Hexadecimal	Field name	Hexadecimal
Function code	0F	Function code	0F
Starting address Hi	00	Starting address Hi	00
Starting address Lo	13	Starting address Lo	13
Quantity of outputs Hi	00	Quantity of outputs Hi	00
Quantity of outputs Lo	0A	Quantity of outputs Lo	0A
Byte count	02		
Output value Hi	CD		
Output value Lo	01		

3.1.2 Discrete Inputs

Function 02 (0x02): read discrete inputs

This function code reads the ON/OFF status of discrete inputs (1-2000) in the slave. The input status response message is packed as one input per bit of the data field. Status is indicated as: 1 is the value ON, and 0 is the value OFF.

Request PDU

Function code	1 byte	0x02
Starting address	2 bytes	0x0000-0xFFFF
Quantity of inputs	2 bytes	1-2000

Response PDU

Function code	1 byte	0x02
Byte count	1 byte	N*
Input status	N* bytes	

N* = Quantity of outputs/8. If the remainder is not 0, N=N+1.

Example of a request to read discrete inputs 197-218:

Request		Response	
Field name	Hexadecimal	Field name	Hexadecimal
Function code	02	Function code	02
Starting address Hi	00	Byte count	03
Starting address Lo	C4	Input status 204-197	AC
Quantity of inputs Hi	00	Input status 212-205	DB
Quantity of inputs Lo	16	Input status 218-213	35

3.1.3 Holding Registers

3.1.3.1 Function 03 (0x03): read holding registers

This function code reads the binary contents of holding registers (1-125) in the slave.

Request PDU

Function code	1 byte	0x03
Starting address	2 bytes	0x0000-0xFFFF
Quantity of registers	2 bytes	0x0001-0x007D

Response PDU

Function code	1 byte	0x03
Byte count	1 byte	2 x N*
Register value	N* x 2 bytes	

N* = Quantity of input registers.

Example of a request to read registers 108-110:

Request		Response	
Field name	Hexadecimal	Field name	Hexadecimal
Function code	03	Function code	03
Starting address Hi	00	Byte count	06
Starting address Lo	6B	Register value Hi (108)	02
Quantity of registers Hi	00	Register value Lo (108)	2B
Quantity of registers Lo	03	Register value Hi (109)	00
		Register value Lo (109)	00
		Register value Hi (110)	00
		Register value Lo (110)	64

3.1.3.2 Function 06 (0x06): write a single register

This function code writes a value into a single holding register.

Request PDU

Function code	1 byte	0x06
Register address	2 bytes	0x0000-0xFFFF
Register value	2 bytes	0x0001-0x00FF

Response PDU

Function code	1 byte	0x06
Register address	2 bytes	0x0000-0xFFFF
Register value	2 bytes	0x0001-0x00FF

Example of a request to write 00 03 hex into register 2:

Request		Response	
Field name	Hexadecimal	Field name	Hexadecimal
Function code	06	Function code	06
Register address Hi	00	Register address Hi	00
Register address Lo	01	Register address Lo	01
Register value Hi	00	Register value Hi	00
Register value Lo	03	Register value Lo	03

3.1.3.3 Function 16 (0x10): write multiple registers

This function code writes values into a sequence of holding registers (1-120).

Request PDU

Function code	1 byte	0x10
Starting address	2 bytes	0x0000-0xFFFF
Quantity of registers	2 bytes	0x0001-0x0078
Byte count	1 byte	2 x N*
Value of registers	N* x 2 bytes	

N* = Quantity of input registers.

Response PDU

Function code	1 byte	0x10
Starting address	2 bytes	0x0000-0xFFFF
Quantity of registers	2 bytes	1-120

Example of a request to write 00 0A and 01 02 hex into two registers starting at 2:

Request		Response	
Field name	Hexadecimal	Field name	Hexadecimal
Function code	10	Function code	10
Starting address Hi	00	Starting address Hi	00
Starting address Lo	01	Starting address Lo	01
Quantity of registers Hi	00	Quantity of registers Hi	00
Quantity of registers Lo	02	Quantity of registers Lo	02

3.2 Device Function Codes

The VT-IO-DAM0444 uses the following public function codes for its DI, DO, and AI channels in relation to the corresponding registers.

Unit	Register Type	Register Add. (Decimal)	Function Code	
Single bit (bit)	Coil status: DO	00001-09999 Read/Write (R/W)	0x01	Read coils
			0x05	Write a single coil
			0x0F	Write multiple coils
	Discrete input status: DI	10001-19999 Read only (R)	0x02	Read discrete inputs
16-bit (word)	Holding register: AI/AO	40001-49999 Read/Write (R/W)	0x03	Read holding registers
			0x06	Write a single register
			0x10	Write multiple registers

3.3 Register Addresses

The register address field specifies the starting point of the register in the slave's memory.

The registers involved in the input and output channels of the VT-IO-DAM0444 are defined as follows to realize specific functions.

Register Add. (Decimal)	Count	Register Content	Action	Description	Function Code
40001	1	Hardware version	R		0x03
40002	1	Software version	R	For example, in version 1.0, high byte for the main version, low byte for the subversion.	0x03
40003	10	Device name	R/W	Max. 20 bytes, including '\0'. Write 0x5A01 to the write protection register to modify the field.	0x03, 0x10
40013	1	Device address	R/W	1~255 (1 by default). 0 is the broadcast address. Write 0x5A01 to the write protection register to modify the field.	0x03, 0x06, 0x10

Register Add. (Decimal)	Count	Register Content	Action	Description	Function Code
40014	1	Baud rate value	R/W	See Table-1 for the register value corresponding to the baud rate. The default value is 3, indicating the baud rate is 9600.	0x03, 0x06, 0x10
40015	1	Parity value	R/W	See Table-2 for the register value corresponding to the. The default value is 'None'.	0x03, 0x06, 0x10
40016	1	Factory reset	W	Write 0xA55A to factory reset device configurations.	0x06
40017	1	AI configuration reset	W	Write 0xA55B to reset AI configurations, including input type, sampling rate, filter, calibration parameters.	0x06
40018	1	Device restart	W	Write 0x5254 to restart the system.	0x06
40019	1	Write protection	W	Write 0x5A01 to unlock write protection for 10 seconds , after which the device will resume write protection.	0x06
40020	16	Device serial number	R/W	Write 0x5A01 to the write protection register to unlock it for modifying the device serial number.	0x03, 0x10

Table-1 Register Value for the Baud Rate

Register Value (Hexadecimal)	Baud Rate
0x0000	1200
0x0001	2400
0x0002	4800
0x0003	9600
0x0004	19200
0x0005	38400
0x0006	57600
0x0007	115200

Note:

1. When matching the baud rate, the communication address may be 0 or the address of the VT-IO-DAM0444. When using address 0, the read operation must target the baud rate setup register (40014), with a register count of 1.
2. The register can be modified when using address 0. Write **0x5A01** to the write protection register to modify the field. The bus does not respond upon modification, as the device switches to the new baud rate.

Table-2 Register Value for the Parity

Register Value (Hexadecimal)	Parity
0x0000	None
0x0001	Odd
0x0002	Even

Note: Write **0x5A01** to the write protection register to modify the field.

Register Add. (Decimal)	Count	Register Content	Action	Description	Function Code
200	4	Real-time status of DO1-D04	R/W	Value range: 0x0000 - 0x0001. A write operation changes the current DO status; a read operation returns the current status.	0x01, 0x05, 0x0F
204	4	Power-on status of DO1-D04	R/W	Value range: 0x0000 - 0x0001. The DO power-on status updates to the set value upon the next device startup. A read operation returns the power-on status.	0x01, 0x05, 0x0F
10200	4	Real-time level of D11-DI4	R	Value range: 0x0000 - 0x0001.	0x02
40300	4	Positive pulse status of DI1- DI4	R/W	Value range: 0x0000 - 0x0001. 0 indicates no effective positive pulse, 1 indicates the existence of effective positive pulses; writing 0 clears the status.	0x03, 0x06, 0x10
40304	4	Negative pulse status of DI1- DI4	R/W	Value range: 0x0000 - 0x0001. 0 indicates no effective negative pulse, 1 indicates the existence of effective negative pulses; writing 0 clears the status.	0x03, 0x06, 0x10
40308	4	Positive pulse counter of DI1- DI4	R/W	Value range: 0x0000 - 0xFFFF. Any value can be written, and the counting starts from the written value.	0x03, 0x06, 0x10
40312	4	Negative pulse counter of DI1- DI4	R/W	Value range: 0x0000 - 0xFFFF. Any value can be written, and the counting starts from the written value.	0x03, 0x06, 0x10
40316	4	Count of level changes for DI1-DI4	R/W	Value range: 0x0000 - 0xFFFF. Any value can be written, and counting starts from the written value.	0x03, 0x06, 0x10

Register Add. (Decimal)	Count	Register Content	Action	Description	Function Code
40320	4	Filter parameters of DI1-DI4	R/W	The signal must be maintained for several sampling cycles to be confirmed. The default value is 0x6, indicating that 6 sampling cycles are required. The range is 0x1-0xFFFF. Writing 0 will return a failure result.	0x03, 0x06, 0x10
40324	1	Clearing of DI1-DI4	R/W	Set the clear mode after reading: Automatic clear: bit value = 1 (default mode); manual clear: bit value = 0. Only applicable for registers 40300, 40304, 40308, 40312, 40316.	0x03, 0x06, 0x10
40325	4	Working mode of DO1-DO4	R/W	0 for level mode; 1 for pulse mode.	0x03, 0x06, 0x10
40329	4	Pulse width of DO1-DO4	R/W	Value range: 50 (ms) – 65535 (ms).	0x03, 0x06, 0x10
40600	8	Engineering units of AI1-AI4	R	Engineering unit value (4-byte float) of the measured signal of the analog channels.	0x03
40700	4	Raw value of AI1-AI4	R	Raw value (2-byte unsigned int) of the measured signal of the analog channels.	0x03
40800	8	Analog calibration index of AI1-AI4	W	Ratio of the nominal value to the sampled value for the analog channels.	0x10
41001	1	Filter parameters of AI1-AI4	R/W	Valid value: 1-16, default 10.	0x03, 0x06, 0x10
41002	1	Sampling range of AI1-AI4	R/W	Defined values: 0, 1, 2. 0: 0-20 mA; 1: 4-20 mA; 2: 0-10 V. Default: 1. Note: This device supports only the 4-20 mA range.	0x03, 0x06, 0x10

Note:

When the register count is greater than 1, the corresponding channels **increment sequentially** from the starting address. For example, to read or write the real-time status of **DO3**, set the register address to **202**.

The register address in the table indicates the PLC register address. In actual Modbus communication, the register addresses shall be converted as follows for proper communication:

Range 00001-09999: Modbus register address = PLC register address

Range 10000-19999: Modbus register address = PLC register address - 10000

Range 40000-49999: Modbus register address = PLC register address - 40000

For example:

The PLC register address for AI sampling range is 41002, which, when converted to the Modbus register address, would be $41002 - 40000 = 1002$ (in hexadecimal: 0x03EA).

3.4 DI Control

3.4.1 DI Collection

Wiring of the pins for data collection: DI- to ground, DI+ to high level, and the DI node value is 1; DI- to ground, DI+ to low level, and the DI node value is 0.

The level signal register addresses for DI1 to DI4 are 10200-10203, and the function code for reading DI status is 0x02.

3.4.2 DI Pulse

- DI pulse status: When DI- is connected to low level and DI+ is connected to high level, the value of corresponding positive pulse status register is set to 1. When DI+ is connected to low level, the value of corresponding negative pulse register is set to 1. Writing a value of 0 clears the detected pulse status.
- DI pulse counter: Represents the number of positive/negative pulse changes detected. An initial value can be written, and the counting starts from this initial value to a maximum of 65535. After reaching the maximum value, the counting will restart from 0.
- Level change count: Represents the sum of the number of level changes. An initial value can be written, and the counting starts from this initial value to a maximum of 65535. After reaching the maximum value, the counting will restart from 0.

3.4.3 DI Clearing

- When set to automatic clearing, the values of DI positive/negative pulse counter and DI level change count will be automatically cleared after each reading.
- When set to manual clearing, the values will not be cleared after each reading. Only when 0 is manually input will the values be cleared.

3.4.4 Filter Parameter

The input signal is validated after consistently maintaining multiple sampling cycles. By default, the value is set to 0x6, indicating that 6 sampling cycles are necessary to validate the switch input. The acceptable value range is from 0 to 20.

3.5 DO Control

3.5.1 Real-time Status

The real-time status register controls the corresponding relay action. Writing 0 will connect the COM and N.C pins, while writing 1 will connect the COM and N.O pins.

The status register addresses for DO1 to DO4 are 200-203. Function code 0x01 is for reading the DO status, 0x05 is for writing the status of a single DO, 0x0F is for writing the status of multiple DO channels simultaneously.

3.5.2 Power-on Status

The power-on status refers to the relay status when the device is powered on without receiving external control commands. Writing 0 indicates that COM and N.C pins are connected when the device is powered on, while writing 1 indicates that COM and N.O pins are connected.

3.5.3 Working Mode

DO operating mode can be set to either level mode or pulse mode.

- Level mode: The relay's on/off state can only be changed through commands.
- Pulse mode: The relay will automatically switch from N.O and COM connection to N.C and COM connection within a specified time period. The time period can be set with the pulse width within the range of 50-65535 milliseconds.

3.6 AI Control

The device features 4-channel differential analog input, with **4-20mA** measurement signal supported.

The engineering units register addresses are 40600-40607, with 4-byte float. Function code 0x03 is used for reading the engineering units.

The raw value register addresses are 40700-40703, with 2-byte unsigned integers. Function code 0x03 is used to read the raw values. The actual current value can be calculated from the raw readings using the following formula:

For the 4-20 mA measurement range:

$$\text{Current (mA)} = (\text{AI raw value} + 1024) / 256$$

3.6.1 Filter Parameter

The filter parameter is set be the average value of multiple data points gathered a single collection. The default data point is configured to 0x4, and the acceptable value range is from 1 to 16.

3.6.2 Sampling Range

The device supports only the 4-20 mA AI measurement signal, denoted by 1.

Defined values: 0 = 0-20 mA, 1 = 4-20 mA, 2 = 0-10 V.

CHAPTER 4 APPLICATION EXAMPLES

4.1 Read DI Status (0x02)

This example demonstrates reading 2 channels (DI1–DI2) simultaneously. Assume the Modbus slave address of the VT-IO-DAM0444 is 1. The command frame is shown below:

0x 010200C800027835

Command breakdown:

01	02	00C8	0002	7835
Slave address	Function code	Starting register add.	Inputs count	CRC checksum
1 byte, device RS485 address	1 byte, 0x02: Read discrete inputs	2 bytes, start address for reading	2 bytes, number of discrete inputs to read	2 bytes, CRC16

Assume DI1 is closed and DI2 is open; the following response can be expected:

0x 010201016048

Response breakdown:

01	02	01	01	6048
Slave address	Function code	Data byte count	Input data	CRC checksum
1 byte, device RS485 address	1 byte, 0x02: Read discrete inputs	1 byte	1 bit represents one DI channel. 1 = closed, 0 = open	2 bytes, CRC16 value

4.2 Read AI Analog Values

4.2.1 Read AI Engineering Unit Registers (0x03)

Assume the Modbus slave address of the VT-IO-DAM0444 is 1.

1. Command to query the input current value of AI1:

0x 0103025800024460

Command breakdown:

01	03	0258	0002	4460
Slave address	Function code	Starting register add.	Register count	CRC checksum
1 byte, device RS485 address	1 byte, 0x03: Read holding registers	2 bytes, start address for reading	2 bytes, number of registers to read	2 bytes, CRC16 value

Assume a 10 mA current signal is connected to AI1; the following response can be expected:

0x 010304412002326F70

Response breakdown:

01	03	04	41200232	6F70
Slave address	Function code	Data byte count	Payload data	CRC checksum
1 byte, device RS485 address	1 byte, 0x03: Read holding registers	1 byte	4 bytes	2 bytes, CRC16 value

Hex value 41 20 02 32 converts to a floating-point value of ~10 mA.

2. Command to query the input current value of AI1-AI4:

0x 010302580008C467

Expected response:

0x 010310412002320000000000000000000000000007151

Response breakdown:

01	03	10	41200232000000000000000000000000	7151
Slave address	Function code	Data byte count	Payload data	CRC checksum
1 byte (device RS485 address)	1 byte, 0x03: Read holding registers	1 byte	Each AI channel occupies 4 bytes. 41200232 — Current value of AI1 00000000 — Current value of AI2 00000000 — Current value of AI3 00000000 — Current value of AI4	2 bytes, CRC16 value

Convert the above hex data to floating-point values to get the actual current readings.

4.2.2 Read AI Raw Value Registers (0x03)

Calculated current and AI raw ADC value relationship (4–20 mA sampling range):

$$\text{Current (mA)} = (\text{AI raw value} + 1024) / 256$$

Assume the Modbus slave address of the VT-IO-DAM0444 is 1.

1. Command to query the raw value of AI1:

0x 010302BC00014456

Command breakdown:

01	03	02BC	0001	4456
Slave address	Function code	Starting register add.	Register count	CRC checksum
1 byte, device RS485 address	1 byte, 0x03: Read holding registers	2 bytes, start address for reading	2 bytes, number of registers to read	2 bytes, CRC16 value

Assume a 10 mA current signal is connected to AI1; the following response can be expected:

0x 01030205FFFB54

Response breakdown:

01	03	02	05FF	FB54
Slave address	Function code	Data byte count	Payload data	CRC checksum
1 byte, device RS485 address	1 byte, 0x03: Read holding registers	1 byte	2-byte raw ADC value	2 bytes, CRC16 value

Hex value 05FF converts to decimal **1535**. Calculated current = $(1535 + 1024) / 256 = 9.996$ mA. Minor deviation exists versus the actual input value, caused by integer rounding in the formula. This error can be avoided by reading the AI engineering unit registers.

2. Command to query the raw value of AI1-AI4:

0x 010302BC00048455

Expected response:

0x 01030805FF0000000000005AE7

Response breakdown:

01	03	08	05FF000000000000	5AE7
Slave address	Function code	Data byte count	Payload data	CRC checksum
1 byte, device RS485 address	1 byte, 0x03: Read holding registers	1 byte	05FF — Raw ADC value of AI1 0000 — Raw ADC value of AI2 0000 — Raw ADC value of AI3 0000 — Raw ADC value of AI4	2 bytes, CRC16 value

4.3 Write a Positive Pulse Count to a Single DI (0x06)

You may write any preset value to the DI pulse count register. The following example writes 65535 to DI1.

Assume the VT-IO-DAM0444 slave address is 1, the command to write 65535 is as follows:

0x 01060134FFFFC848

Command breakdown:

01	06	0134	FFFF	C848
Slave address	Function code	Starting register add.	Register data	CRC checksum
1 byte, device RS485 address	1 byte, 0x06: Write a single holding register	2 bytes, target register address for writing	2 bytes, every 2 bytes represent one DI channel	2 bytes, CRC16 value

If the command executes successfully, the device echoes the same frame as the response:

0x 01060134FFFFC848

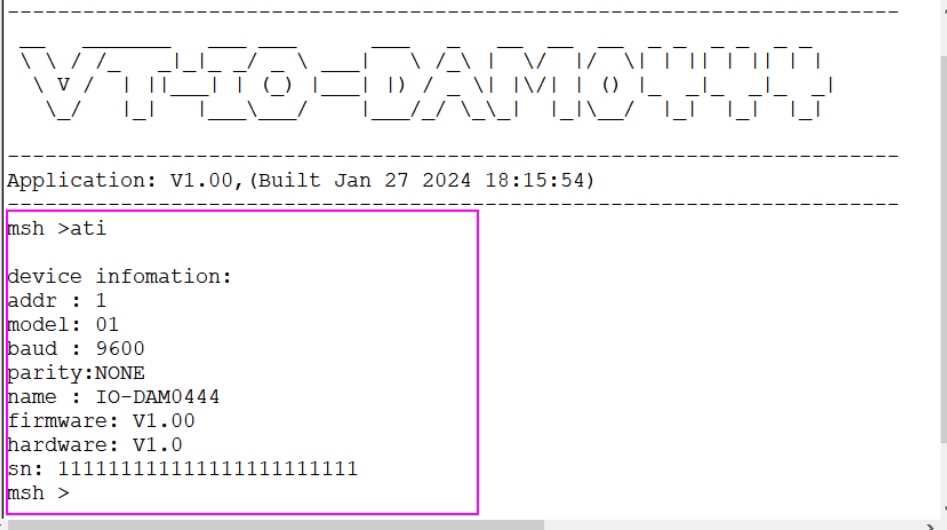
Response breakdown:

01	06	0134	FFFF	C848
Slave address	Function code	Starting register add.	Register data	CRC checksum
1 byte, device RS485 address	1 byte, 0x06: Write a single holding register	2 bytes, target register address for writing	2 bytes, every 2 bytes represent one DI channel	2 bytes, CRC16 value

4.4 Query Device Information

In case the product label of the VT-IO-DAM0444 is missing, there are two ways to access the device information and serial port parameters.

Method I— Sending an `ati` command via the RS232 debug port:



```

-----
VT-IO-DAM0444
-----
Application: V1.00, (Built Jan 27 2024 18:15:54)
-----
msh >ati

device infomation:
addr : 1
model: 01
baud : 9600
parity:NONE
name : IO-DAM0444
firmware: V1.00
hardware: V1.0
sn: 1111111111111111111111111111
msh >

```

Method II— Commands via RS485 serial port:

For installation sites with limited wiring capability, the RS485 serial port can be used to send Modbus commands to determine the device address and serial port parameters.

You can set the device address to 0 (broadcast address) to read the baud rate register (40014). If the value returned in the response matches the actual baud rate of the serial communication, the slave address and serial parameters of the device are confirmed.

Command to query the baud rate code:

0x 0003000E0001E418

Command breakdown:

00	03	000E	0001	E418
Slave address	Function code	Starting register add.	Register count	CRC checksum
1 byte, broadcast address	1 byte, 0x03: Read a holding register	2 bytes, start address for reading	2 bytes, number of registers to read	2 bytes, CRC16 value

Assume the serial parameters of the VT-IO-DAM0444 are 1200 baud, no parity, the following response can be expected:

0x 0103020000B844

Command breakdown:

01	03	02	0000	B844
Slave address	Function code	Data byte count	Payload data	CRC checksum
1 byte, actual slave address of the device	1 byte, 0x03: Read holding registers	1 byte	2 bytes (baud rate)	2 bytes, CRC16

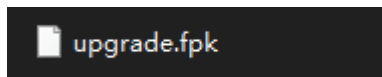
Please refer to **Table-1 Register Value for the Baud Rate** included in Section 3.3 for the baud rate of the device.

CHAPTER 5 DEVICE UPGRADE

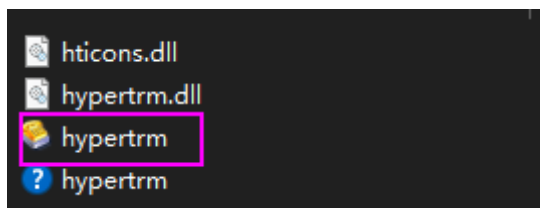
Device upgrade is intended to be carried out via the RS232 debug port on the device in Windows environment.

The upgrade file is a .fpk file included in the \SW\Firmware\Upgrade directory of the release package and the upgrade tool is located in the \SW\Tools\upgrade tool\HyperTerminal directory of the package.

Upgrade file:

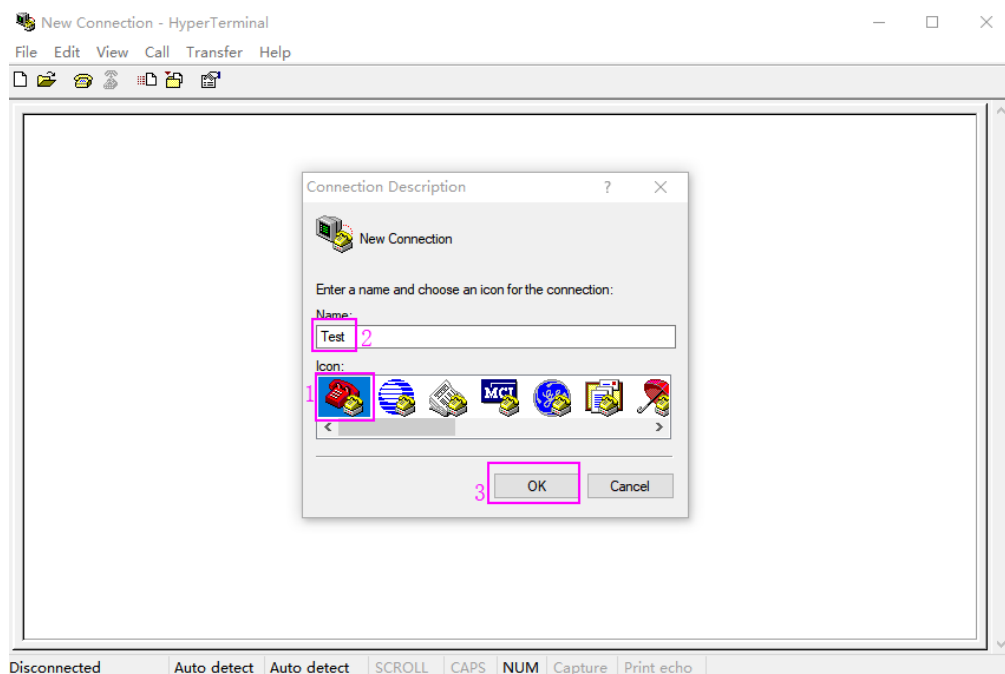


Upgrade tool:



5.1 Create a Connection

1. Select an icon.
2. Set a name for the connection.
3. Click **OK** to confirm the action.

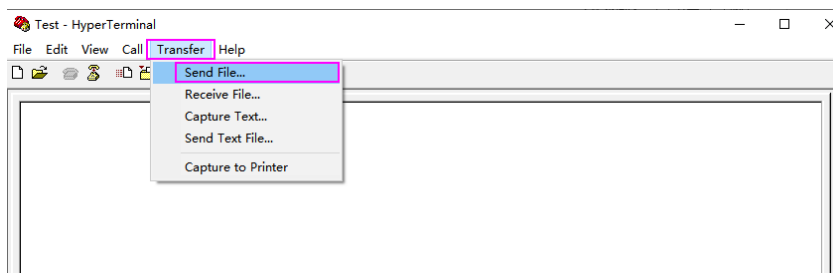


5.2 Configure the Port

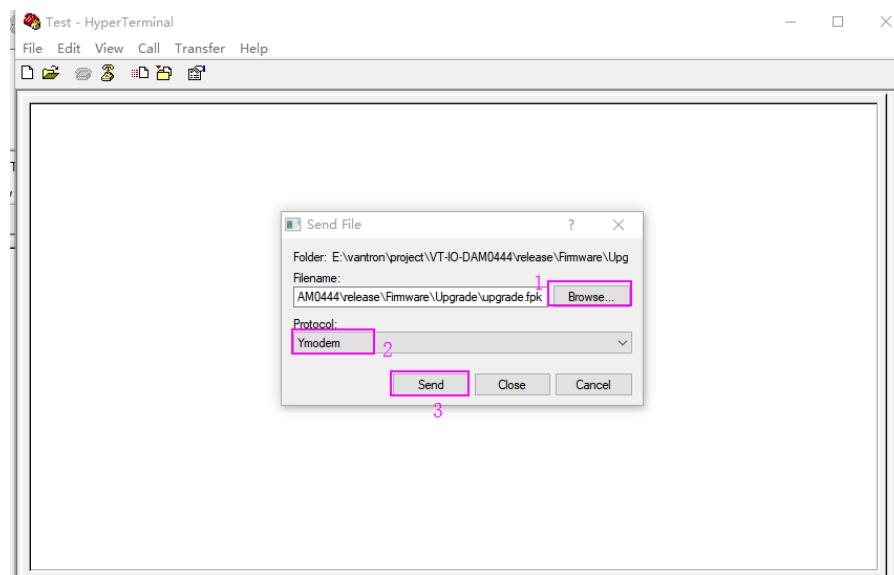
1. Select the device name of the RS232 port mapped in the Windows system.
2. Confirm your selection.
3. Configure the parameters of the RS232 port.

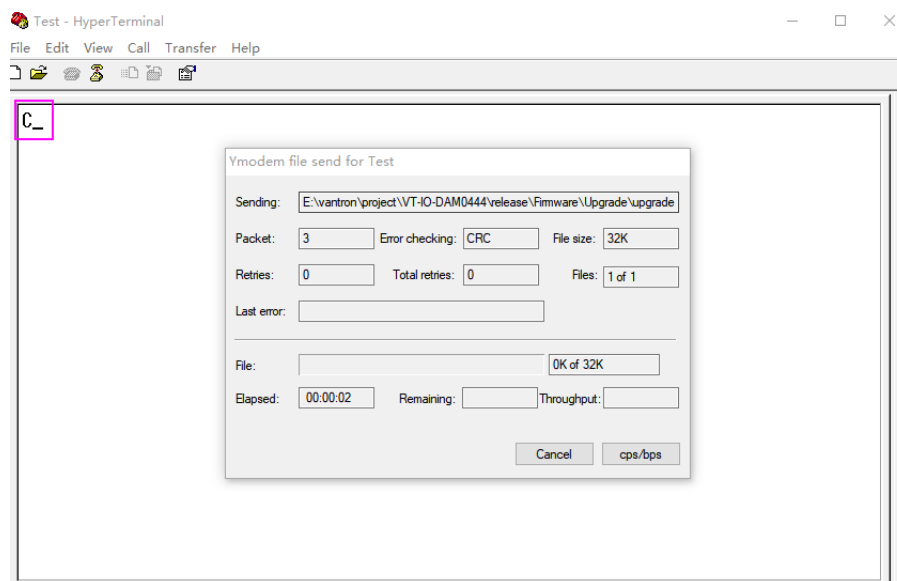
115200, 8N1

5.3 Add the Upgrade File



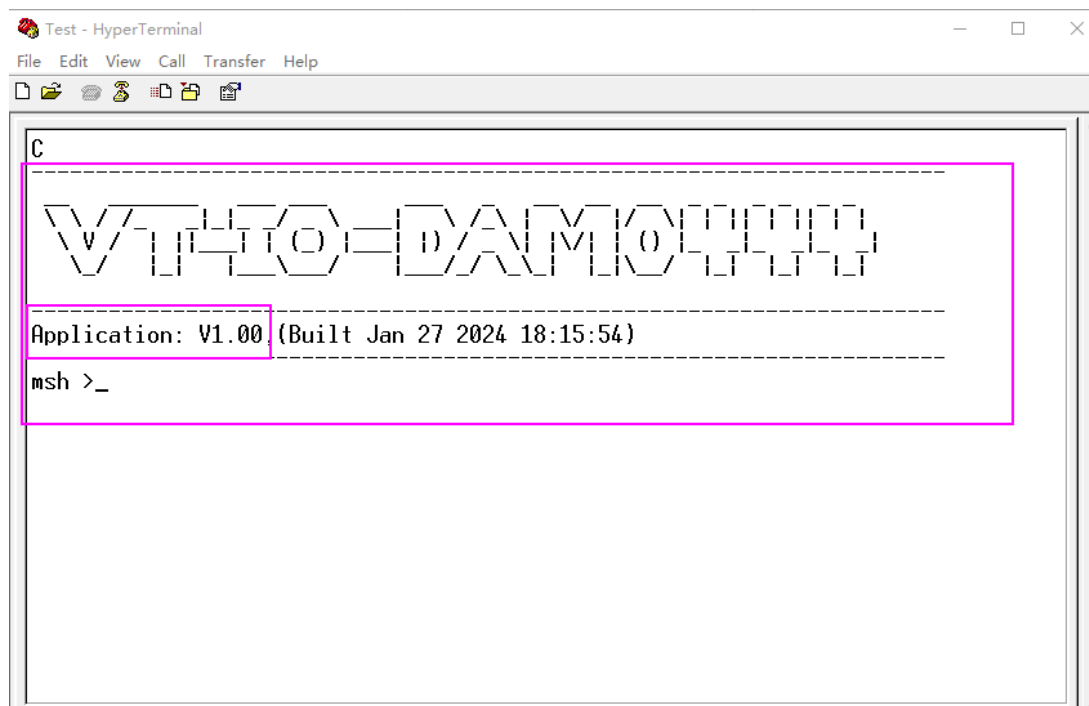
1. After navigating to **Transfer > Send File**, click **Browse** to locate the upgrade file;
2. Select the **Ymodem** protocol;
3. Before clicking the **Send** button, press the **Restore** button on the device until a capitalized **C** is shown on the terminal.





5.4 Complete the Upgrade

Once the upgrade finishes, the firmware version will be shown on the terminal as follows.



CHAPTER 6 DISPOSAL AND WARRANTY

6.1 Disposal

When the device comes to end of life, you are suggested to properly dispose of the device for the sake of the environment and safety.

Before you dispose of the device, please back up your data and erase it from the device.

It is recommended that the device is disassembled prior to disposal in conformity with local regulations. Please ensure that the abandoned batteries are disposed of according to local regulations on waste disposal. Do not throw batteries into fire or put in common waste canister as they are explosive. Products or product packages labeled with the sign of “explosive” should not be disposed of like household waste but delivered to specialized electrical & electronic waste recycling/disposal center.

Proper disposal of this sort of waste helps avoid harm and adverse effect upon surroundings and people’s health. Please contact local organizations or recycling/disposal center for more recycling/disposal methods of related products.

6.2 Warranty

Product warranty

VANTRON warrants to its CUSTOMER that the Product manufactured by VANTRON, or its subcontractors will conform strictly to the mutually agreed specifications and be free from defects in workmanship and materials (except that which is furnished by the CUSTOMER) upon shipment from VANTRON. VANTRON's obligation under this warranty is limited to replacing or repairing at its option of the Product which shall, within **24 months** after shipment, effective from invoice date, be returned to VANTRON's factory with transportation fee paid by the CUSTOMER and which shall, after examination, be disclosed to VANTRON's reasonable satisfaction to be thus defective. VANTRON shall bear the transportation fee for the shipment of the Product to the CUSTOMER.

Out-of-Warranty Repair

VANTRON will furnish the repair services for the Product which are out-of-warranty at VANTRON's then-prevailing rates for such services. At customer's request, VANTRON will provide components to the CUSTOMER for non-warranty repair. VANTRON will provide this service as long as the components are available in the market; and the CUSTOMER is requested to place a purchase order up front. Parts repaired will have an extended warranty of 3 months.

Returned Products

Any Product found to be defective and covered under warranty pursuant to Clause above, shall be returned to VANTRON only upon the CUSTOMER's receipt of and with reference to a VANTRON supplied Returned Materials Authorization (RMA) number. VANTRON shall supply a RMA, when required within three (3) working days of request by the CUSTOMER. VANTRON shall submit a new invoice to the CUSTOMER upon shipping of the returned products to the CUSTOMER. Prior to the return of any products by the CUSTOMER due to rejection or warranty defect, the CUSTOMER shall afford VANTRON the opportunity to inspect such products at the CUSTOMER's location and no Product so inspected shall be returned to VANTRON unless the cause for the rejection or defect is determined to be the responsibility of VANTRON. VANTRON shall in turn provide the CUSTOMER turnaround shipment on defective Product within **fourteen (14) working days** upon its receipt at VANTRON. If such turnaround cannot be provided by VANTRON due to causes beyond the control of VANTRON, VANTRON shall document such instances and notify the CUSTOMER immediately.

Appendix Regulatory Compliance Statement

FCC Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

Note: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate this equipment.

RF Radiation Exposure Statement:

1. This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator and your body.
2. The device has been evaluated to meet general RF exposure requirement.

ISED Statement

This device complies with ISED's licence-exempt RSSs. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be chosen so that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Le présent appareil est conforme aux CNR d'ISED applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

1. Le dispositif ne doit pas produire de brouillage préjudiciable, et
2. Ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radio électrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.