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CT-5321 Modbus Serial Port Module

1 Module Description

The Modbus serial port module supports 1 channel RS485/RS232 /RS422 (optional), supports Modbus RTU/ASCII protocol, and supports master, slave and free transparent transmission mode.

The serial Module **CT-5321** could be applied with the adapter modules, so it could convert Modbus into other protocols such as Modbus TCP, Profinet, EtherCAT, EtherNet/IP, etc. When the module is used, serial port parameters and Modbus instructions should be configured in IO Config software.

Devices with RS485/RS232/RS422 interface, which support modbus-RTU /ASCII, could be applied with **CT-5321** to realize interconnection with upper PLC or upper computers. **CT-5321** could be applied with devices such as: PLC, DCS, remote IO, VFD, motor start protection device, intelligent high and low voltage electrical apparatus, power measurement device, intelligent field measurement equipment and instruments, etc.

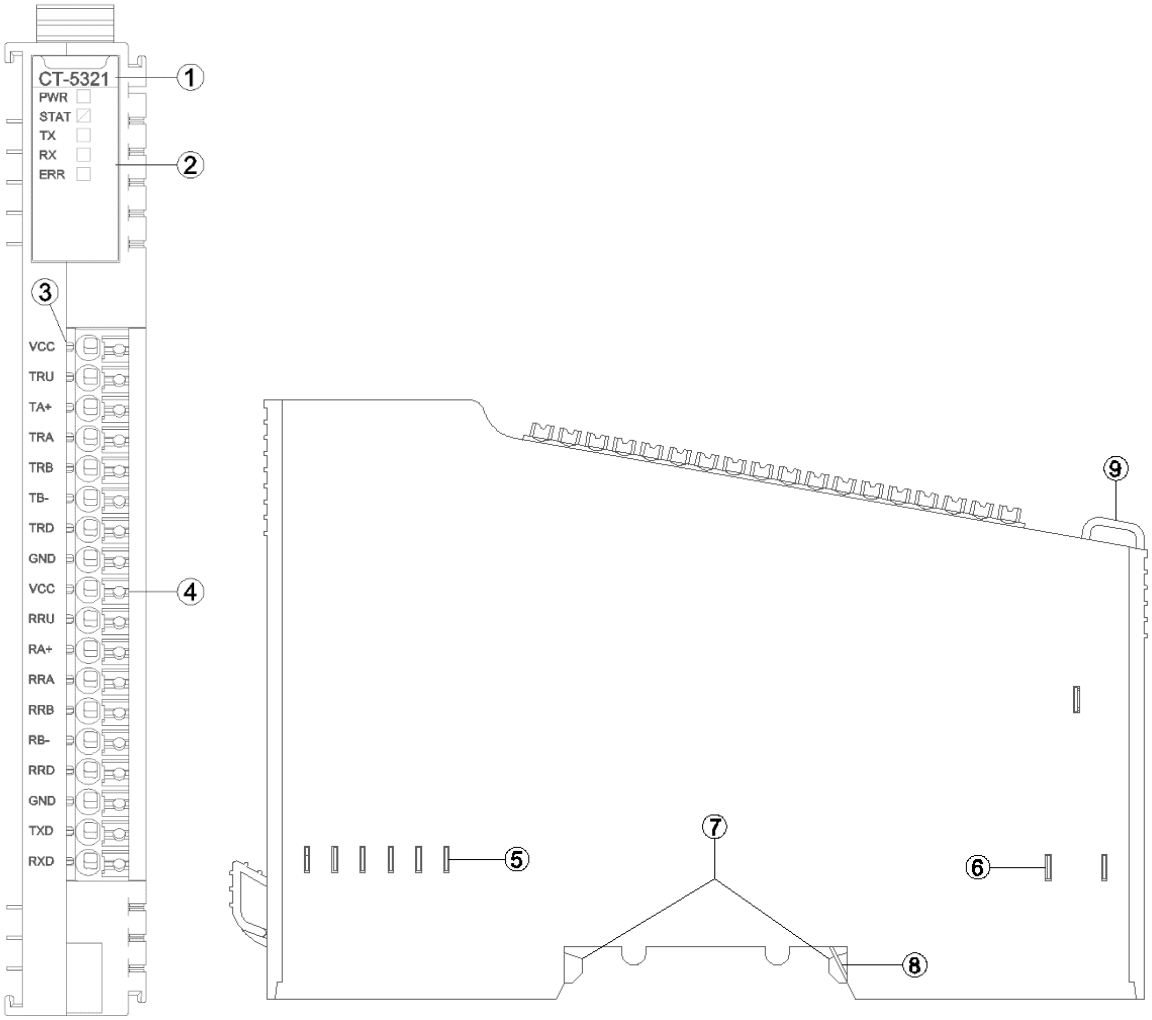
2 Technical Parameters

General parameters	
Power	Max.500mA@5.0Vdc
Isolation	I/O to internal bus: opto-couple isolation (3KVrms)
Field Power	Nominal:24Vdc, Range:22-28Vdc
Wiring	I/O Wiring：Max.1.5mm²(AWG 16)
Mounting Type	35mmDIN-Rail
Size	115*14*75mm
Weight	65g
Environment Specification	
Operational Temperature	-40~85℃
Operational Humidity	5%~95% RH(No Condensation)
Protection Class	IP20
Serial Port Parameters	

M/S/F:Channel Number	1Channel
M/S/F:Interface	RS485/RS232/RS422
M/S:Protocol	Modbus RTU/ASCII
M/S/F:Working Mode	Modbus Master, Slave, Transparent Transmission
M/S/F:Baud Rate	300bps-500Kbps
M/S/F:Data Bit	Bit 7, Bit 8
M/S/F:Parity Checking	None, Odd, Even
M/S/F:Stop Bit	Bit1, Bit2
M/S/F: Character Interval	1.5t-200t
F: Byte Order Conversion	Prohibit, 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	Prohibit, Enable
M: Module Control Mode	Level trigger (continuously valid), rising edge trigger (single valid)
M: Power on Event Output	Prohibit, Enable
S:Slave ID	Customized，default：1
S:Response Time	Customized，default：50

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 Hardware Interface



① Module Type

② State indicator

③ N/A

④ Wiring Terminal and identification

⑤ Internal Bus

⑥ Field Power

⑦ Buckle

⑧ Grounding Resilient Sheet

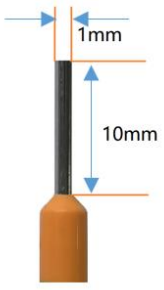
⑨ Fixed Wiring Harness

3.1 Wiring Terminal

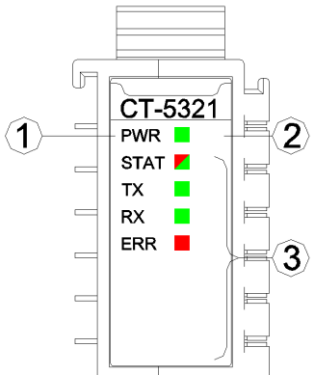
<table>
<tr><th>Terminal</th><th>RS485</th><th>RS422</th><th>RS232</th></tr>
<tr><td>VCC</td><td rowspan="2">4.7K Pull up resistance short connection</td><td rowspan="2">4.7K Pull up resistance short connection (TX)</td><td rowspan="14"></td></tr>
<tr><td>TRU</td></tr>
<tr><td>TA+</td><td>A+</td><td>TX+</td></tr>
<tr><td>TRA</td><td rowspan="2">120R Terminal resistance short connection</td><td rowspan="2">120R Terminal resistance short connection (TX)</td></tr>
<tr><td>TRB</td></tr>
<tr><td>TB-</td><td>B-</td><td>TX-</td></tr>
<tr><td>TRD</td><td rowspan="2">4.7KPull down resistance short connection</td><td rowspan="2">4.7K Pull down resistance short connection (TX)</td></tr>
<tr><td>GND</td></tr>
<tr><td>VCC</td><td rowspan="8"></td><td rowspan="2">4.7K Pull up resistance short connection (RX)</td></tr>
<tr><td>RRU</td></tr>
<tr><td>RA+</td><td>RX+</td></tr>
<tr><td>RRA</td><td rowspan="2">120R Terminal resistance short connection (RX)</td></tr>
<tr><td>RRB</td></tr>
<tr><td>RB-</td><td>RX-</td></tr>
<tr><td>RRD</td><td rowspan="2">4.7K Pull down resistance short connection (RX)</td></tr>
<tr><td>GND</td><td>GND</td><td>GND</td></tr>
<tr><td>TXD</td><td rowspan="2"></td><td rowspan="2"></td><td>TXD</td></tr>
<tr><td>RXD</td><td>RXD</td></tr>
</table>

It is recommended to use cables with cores smaller than 1mm ².

The cold-pressed terminal parameters are as follows:

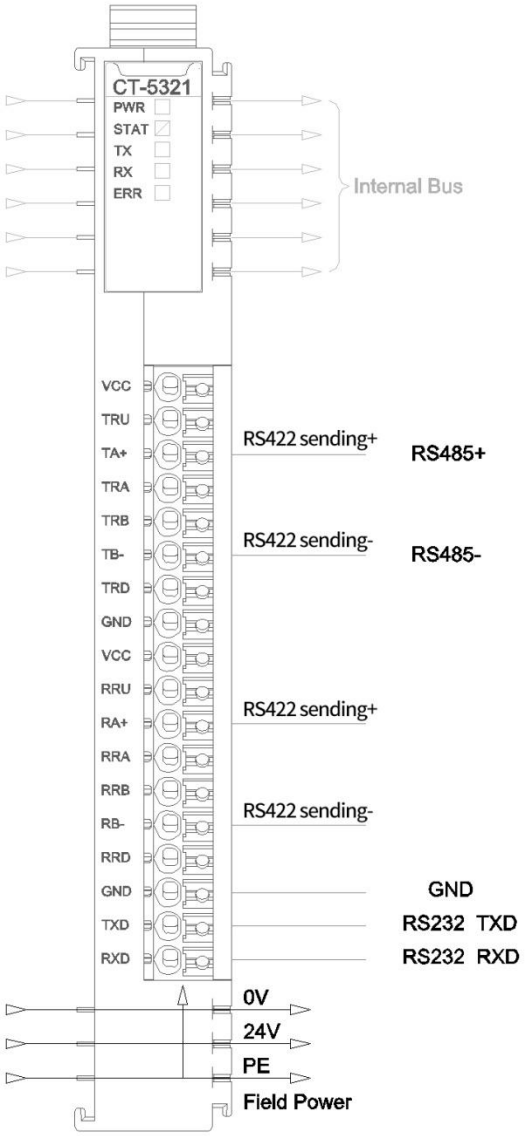


3.2 LED Indicator State



PW power indicator(Green)	Definition
ON	The system power supply is normal.
OFF	The system power supply is failure.
STAT Module State Indicator(Red/Green)	Definition
Double Flash (RED)	Module Exception has been soft-restarted
ON (GREEN)	Operational Mode
Green Single Flash	Stop mode
Flash(2.5Hz) (RED/GREEN)	Upgrading mode
Flash(10Hz) (RED/GREEN)	Firmware Update
TX Serial Port Sending Indicator	Definition
OFF	No data sending
Flash	Serial port data sending
RX Serial Port receiving Indicator	Definition
OFF	No data receiving
Flash	Serial port data receiving
ERR Running Indicator	Definition
OFF	Configuration normal, communication normal
Single Flash	Communication abnormal
Cycle Flash	Configuration error

4 Wiring


CT-5321
PWR
STAT
TX
RX
ERR
Internal Bus
VCC
TRU
TA+
TRA
TRB
TB-
TRD
GND
VCC
RRU
RA+
RRA
RRB
RB-
RRD
GND
TXD
RXD
RS422 sending+
RS485+
RS422 sending-
RS485-
RS422 sending+
RS422 sending-
GND
RS232 TXD
RS232 RXD
0V
24V
PE
Field Power

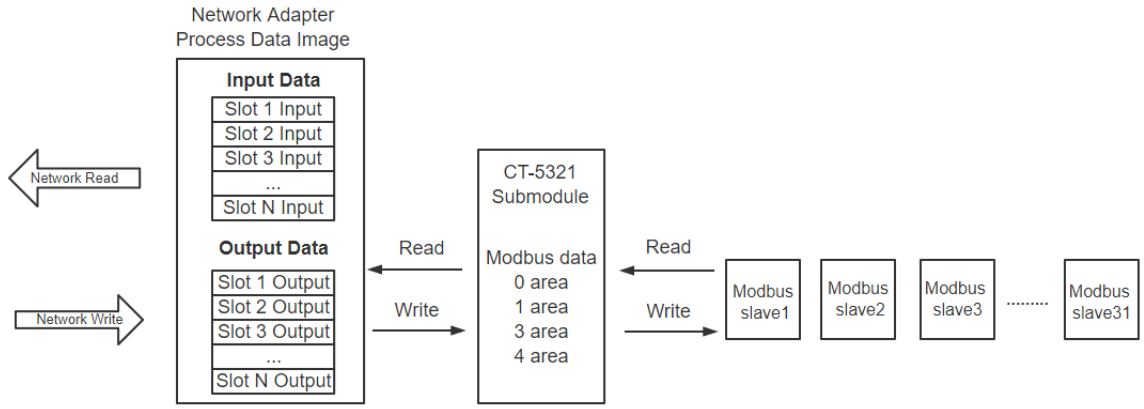
5 Process data definition

5.1 Module process data definition

CT-5321, the module itself has no input or 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 CT-5321 in real time through the internal bus.Its data mapping model is shown as the figure below:



6 Configuration parameters definition

6.1 CT-5321 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						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		Byte Swap	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				First Output on Power-Up	Module Control Mode	Module Control Enable	Output Mode	Fault Action for Read Command
Byte 16	Slave ID							
Byte 17	Response Delay(ms)							
Byte 18								

M/S/F：Gateway Mode : Module working mode（default：Modbus Master）

0：Modbus Master

1：Modbus Slave

2：Free port communication mode

M/S/F：Baudrate Selection（default：standard baud rate）

0：Standard baud rate

1：Customized baud rate

M/S/F：Standard BaudRate（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: 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(default：Bit 8)

0：Bit 7

1：Bit 8

M/S/F：Parity Bits(default：None)

0：None

1：Odd

2：Even

M/S/F：Stop Bits(default：Bit 1)

0：Bit 1

1：Bit 2

M/S:Serial Mode (default：RTU)

0：RTU

1：ASCll

F:Btye Swap (default：disabled)

0：Disabled

1：Enable

M/S/F:Char Pitch： 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 (ms): 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 (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: 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: 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 triggers (data changes)

M: Module Control Enable: 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: disabled)

0: disabled

1: enable

M: Module Control Mode. This value is valid only in module control enabled mode. (Default: Level triggered)

0: Level trigger (effective continuously)

1: Rising edge trigger (single trigger)

M: First Output on Power-on. (Default: enabled)

0: disabled

1: enable

S: Slave ID: 1-247 could be set.This parameter is only valid in slave mode.

S: Respond Delay (MS): 0~65535 is optional, default 50.

6.2 CT-5321 Parameter definitions for submodules

6.2.1 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 (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 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.

6.2.2 Submodules 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 state modules

F : Input and output data modules all support 1~512words optionally

Definition of process data for control and state modules

IO module data direction	Data Name	Variable Name	Data Type	Byte Offset
Input Data	Output control word - feedback	Control_Word_Feedback	uint16_t	0
	Send frame byte length-	Send_Data_Len_Feedback	uint16_t	2

	feedback			
	Serial State	COM_Status	uint16_t	4
	Received Error frame count	Error_Counter	uint16_t	6
	Total received data frame count	Received_Counter	uint16_t	8
	The current received frame byte length	Received_Data_Len	uint16_t	10
Output Data	Output control word	Control_Word	uint16_t	0
	Send frame byte length	Send_Data_Len	uint16_t	2

Variable Definition：

Variable Name	Bit15-6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Control_Word	Reserved	Received Counter Reset	Error Counter Reset	Timeout Error Reset	Parity Error Reset	Done Reset	Trigger
Send_Data_Len	Send_Data_Len						
COM_Status	Reserved			Timeout Error	Parity Error	Done	Busy
Error_Counter	Error_Counter						
Received_Counter	Received_Counter						
Received_Data_Len	Received_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 answering 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.

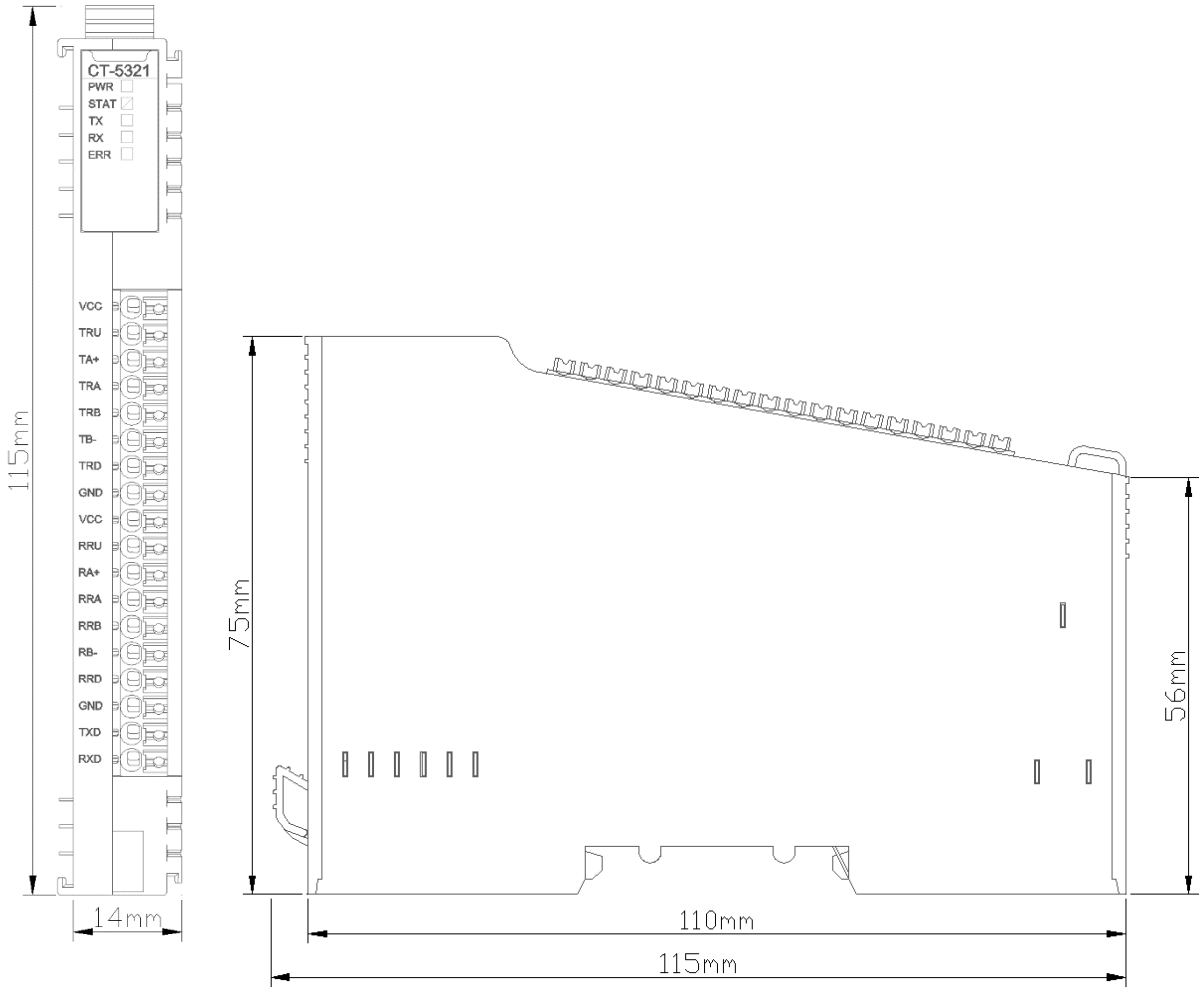
When Error_Counter_Reset is in rise edge, Error_Counter value will be reset.

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.

A Dimension drawing