I-7540D(M)-MTCP Ethernet/Modbus TCP/Modbus RTU to CAN Converter

User's Manual

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1. Introduction

"Embedded Internet" and "Embedded Ethernet" are hot topics today. Nowadays the Ethernet protocol becomes the de-facto standard for local area network. Via Internet, connectivity is occurring everywhere, from home appliances to vending machines to testing equipment to UPS…etc. Using Ethernet for network in industrial area is appealing because the required cabling is already installed. The I-7540D(M)-MTCP from ICP DAS is a solution that enables CAN networks to be coupled together over the Internet/Ethernet, whereby remote monitoring and control is possible. The I-7540D(M)-MTCP controls networked communication and makes a transparent CAN-based application interface available to the user.

The I-7540D(M)-MTCP has supported a major function, convert Modbus TCP and Modbus RTU to CAN. It allows a Modbus TCP/RTU master to communicate with CAN devices on a CAN network. Furthermore, the I-7540D(M)-MTCP also supports a transparent, protocol-independent transfer of the CAN messages (pair-connection), thus allowing its implementation into a wide range of possible applications.

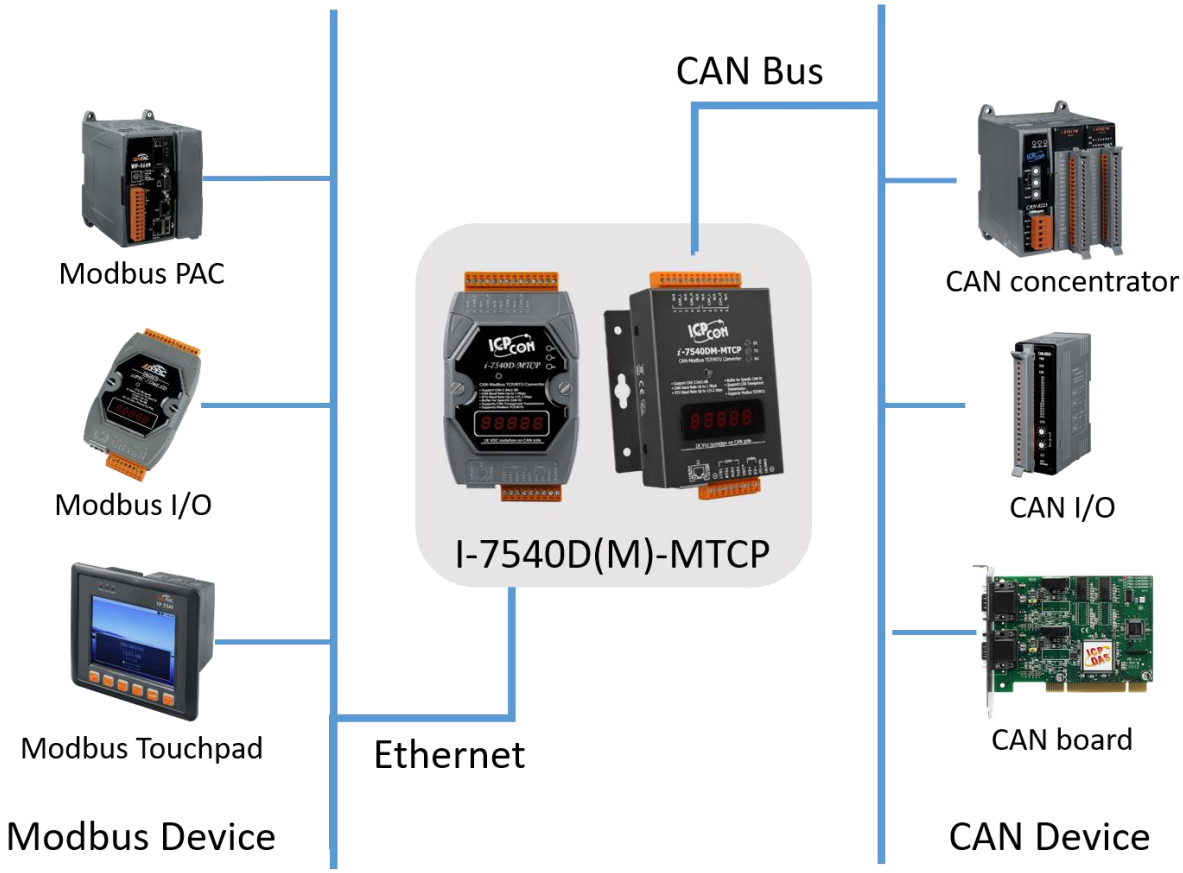


Figure1-1: Application of I-7540D(M)-MTCP Modbus TCP mode

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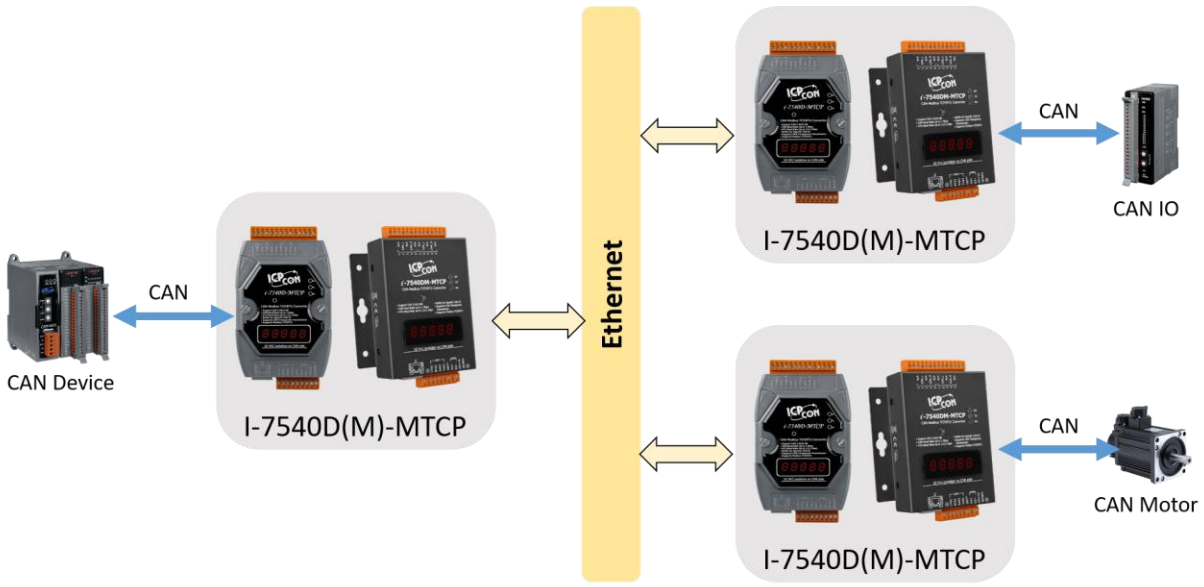


Figure1-2: Application of I-7540D(M)-MTCP Pair Connection

1.1 Features

- RDC 80186-80 Embedded CPU, or compatible
- Ethernet Protocol, TCP,UDP, IP, ICMP, ARP, HTTP
- COM driver support interrupt & 1K QUEUE Input & Output buffer
- Provide 200 CAN frames buffer in CAN to Modbus Mode
- NXP 82C 250 CAN Transceiver
- Support both CAN specification 2.0A and 2.0B
- Max transmission speed up to 1M bps for CAN and 115.2kbps for RS-232 & RS-485
- Max transmission distance of CAN over 1000m (follow CAN specification)
- 7-segment LED display to Module IP, RS-232 baud rate, CAN configuration…
- CAN Error/Tx/Rx LED indicator
- Software configurable CAN and RS-232 communication parameters
- Firmware updated from COM1 or Ethernet port
- Support Web Configuration
- Support maximum 24 Ethernet clients connection
- Support function code 0x03/0x04/0x10 of Modbus TCP/RTU command for reading and writing CAN message
- Provide the transparent communication between the CAN devices via Ethernet
- Support 30 specific CAN IDs in the Modbus TCP/RTU m

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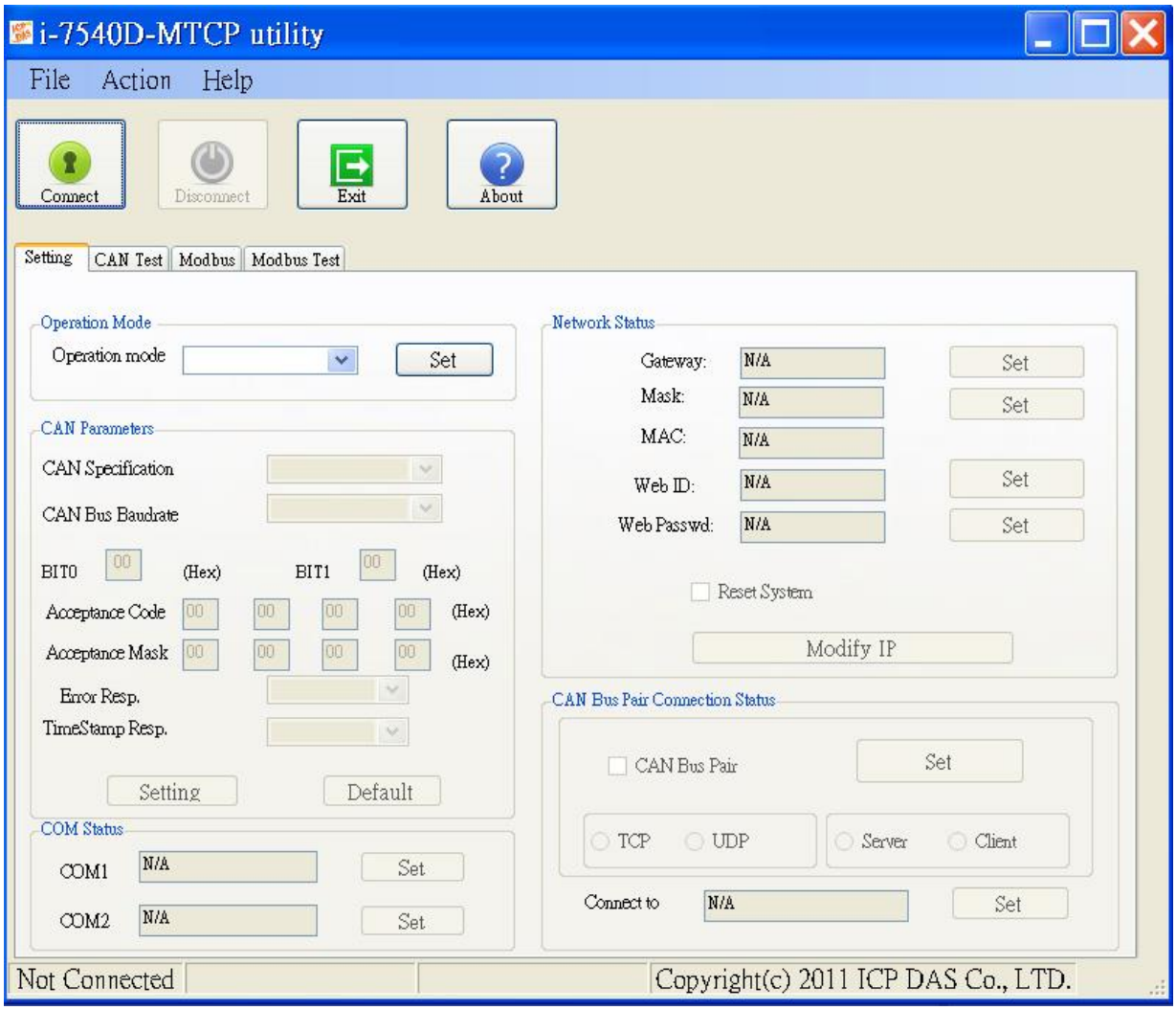
1.2 Specifications

Communication Interface	
COM1	RS-232 (TXD, RXD, RTS, CTS, GND)
COM2	RS-485 (D2+, D2-)
CAN	One CAN port with two CAN bus connector interfaces (CAN_H, CAN_L)
Ethernet Port	10/100 Base-TX Ethernet Controller (Auto-negotiating, Auto_MDIX, LED indicator)
COM Port Formats	
Data bit	7, 8
Parity	Even, Odd, None
Stop bit	1
Baud-rate	115.2Kbps max.
CAN Port Formats	
CAN Controller	NXP SJA1000T with 16 MHz clock
Isolated	1000 VDC for DC-to-DC 2500 Vrms for photo-coupler
Baud-rate	1Mbps max.
Mechanism	
Dimensions	123 x 72 x 33 mm (L x W x H)
Operating Environment	
Operating Temperature	-25°C to +75°C
Storage Temperature	-40°C to +80°C
Power	
Protection	Power reverse polarity protection
Frame Ground for ESD Protection	Yes
Required Supply Voltage	+10 to +30VDC (non-regulated)
Power consumption	2.5W

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1.3 I-7540D(M)-MTCP Software Utility tool

- Communication mode setting
- CAN bus Baud Rate configuration;
- CAN acceptance filter configuration;
- CAN 2.0A or 2.0B specific selection;
- Setting the IP, Gateway and Mask of the network status;
- Setting the Web ID and password
- RS-232/RS-485 baud rate and data bit setting;
- CAN bus pair connection parameters configuration.
- Provides a quick testing function for transmitting/receiving CAN messages;
- Modbus Specific ID Setting
- Provides a quick testing function for Modbus TCP/Modbus RTU command



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1.4 Applications

- Factory Automation
- Building Automation
- Home Automation
- Control system
- Monitor system
- Vehicle Automation



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2. Hardware



I-7540D-MTCP



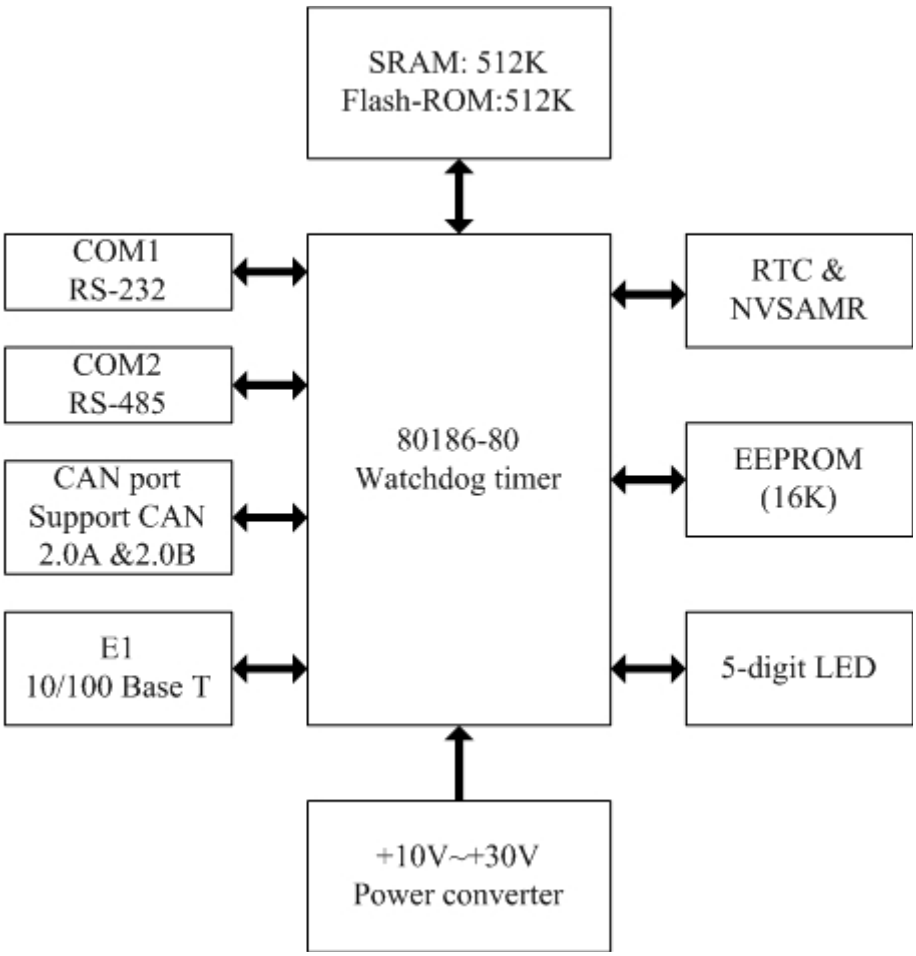
I-7540DM-MTCP

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2.1 Block Diagram

Figure 2-1 is a block diagram illustrating the functions on the I-7540D(M)-MTCP module. It has the 2500Vrms and 1000V DC-to-DC isolation in the CAN interface side.

Figure 2-1: Block diagram of I-7540D(M)-MTCP



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2.2 Pin Assignment

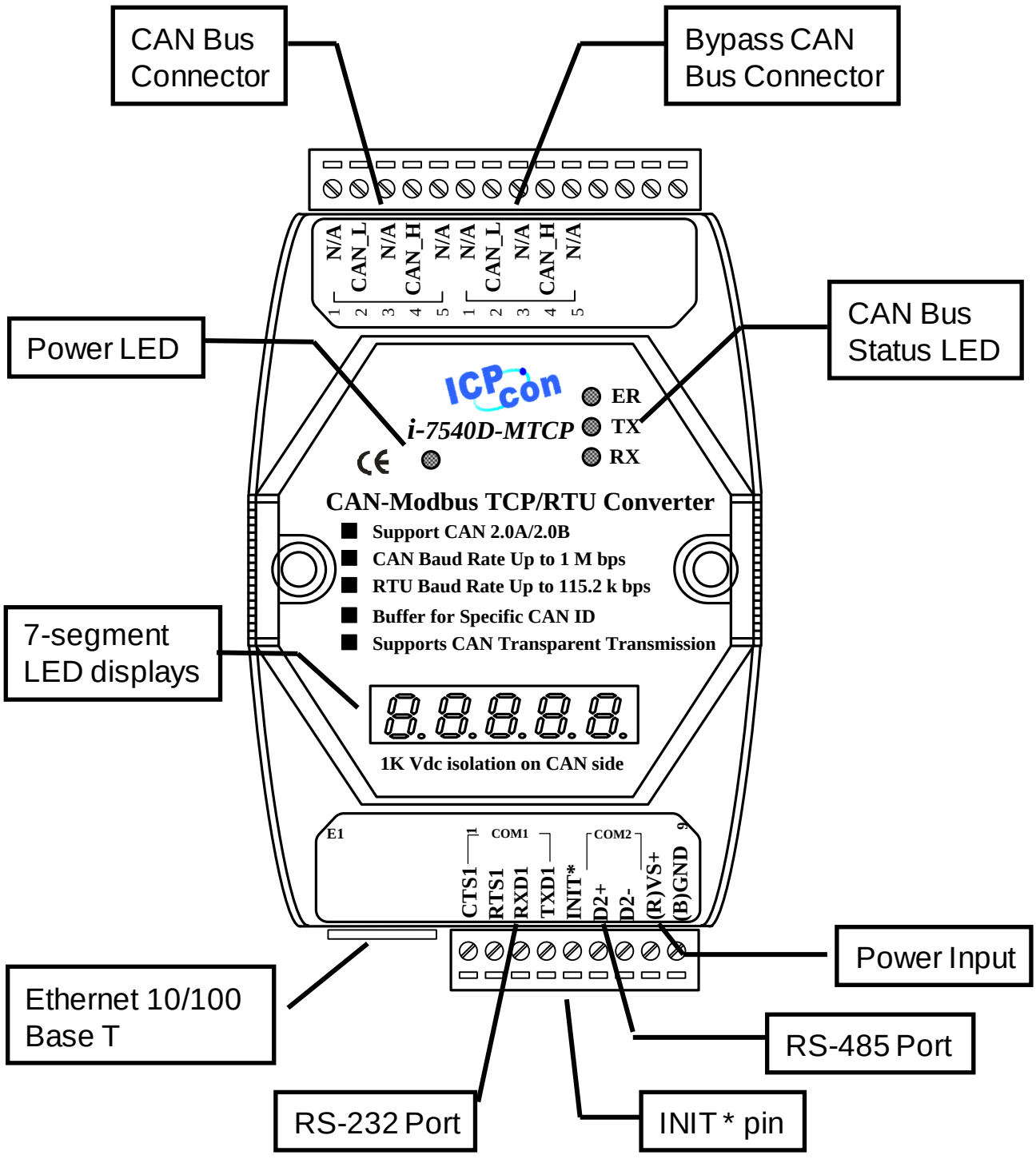


Figure 2-2: Pin assignment on the I-7540D(M)-MTCP

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2.2.1 RS-232 & RS-485 & Power supply Interface

The I-7540D(M)-MTCP provides one RS-232 interface and one RS-485 interface with hardware flow control. The GND-signal of COM1 RS-232 is shared with power GND pin (pin-9). The pin assignment is shown in table 2-1.

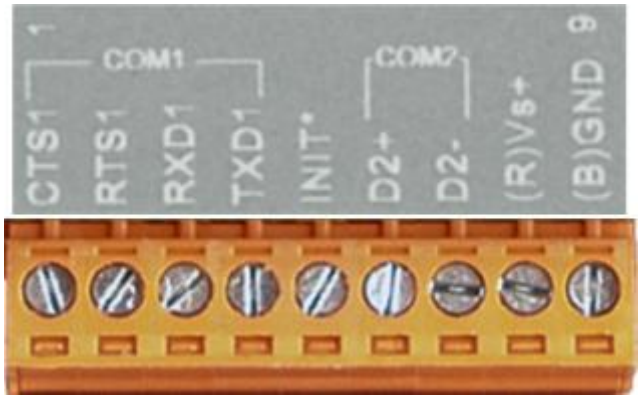


Table 2-1: COM Connector Pin Assignment

Pin	Name	Description
1	CTS1	CTS pin of COM1 (RS-232)
2	RTS1	RTS pin of COM1 (RS-232)
3	RXD1	RXD pin of COM1 (RS-232)
4	TXD1	TXD pin of COM1 (RS-232)
5	INIT*	Initial pin for enable/disable AUTOEXEC.BAT
6	D2+	Data+ pin of COM2 (RS-485)
7	D2-	Data- pin of COM2 (RS-485)
8	VS+	V+ of power supply (+10V to +30V DC unregulated)
9	GND	GND of power supply

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2.2.2 Connect to CAN Bus

In order to provide an easy CAN bus wiring, the I-7540D(M)-MTCP supplies one CAN port with two CAN bus connector interfaces. About the connecter position and pin description are shown as figure 2-3 and table 2-2.

Figure 2-3: CAN bus Connector

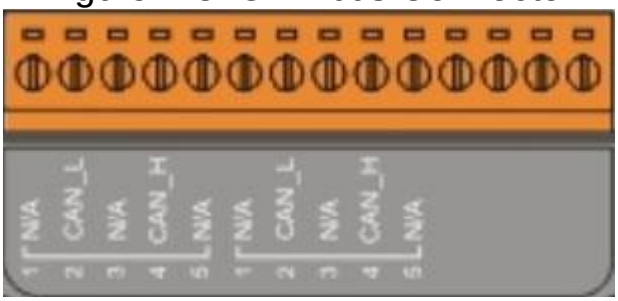
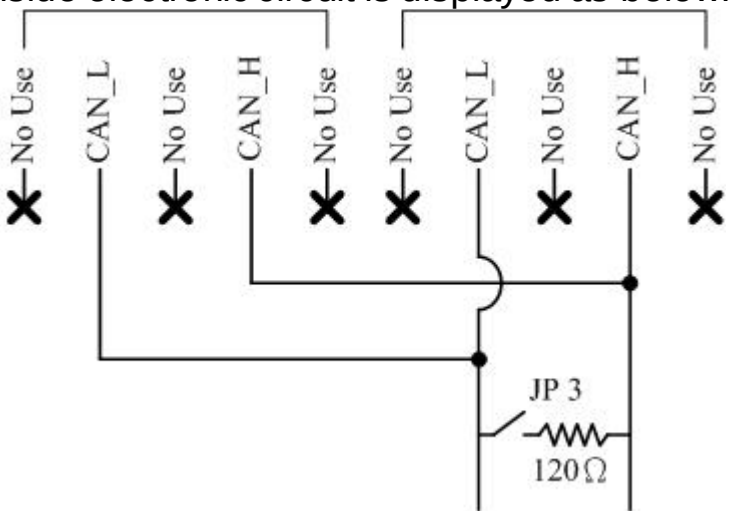


Table 2-2: CAN bus Connector Pin Assignment

Pin No.	Signal	Description
1	N/A	Not Connected
2	CAN_L	CAN_L bus line (dominant low)
3	N/A	Not Connected
4	CAN_H	CAN_L bus line (dominant high)
5	N/A	Not Connected

Note that the bypass CAN bus connector is not another CAN channel. It is designed for connecting to another CAN device conveniently. The structure of the inside electronic circuit is displayed as below.



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2.2.3 Ethernet Connect

The Ethernet (10/100 Base-TX) signals are routed to an RJ45 socket for easy connection using a standard CAT 3 or CAT 5 network cable. On power on of the I-7540D(M)-MTCP, it will auto-negotiate the network speed and connection.

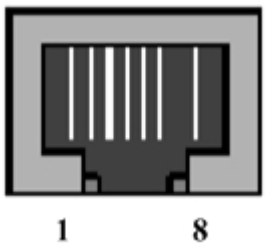


Table 2-3: Ethernet Connector Pin Assignment

Pin	Name	Description
1	TX+	Transmit Data +
2	TX+	Transmit Data -
3	RX+	Receive Data +
4	N.C.	Not Connected
5	N.C.	Not Connected
6	RX-	Receive Data -
7	N.C.	Not Connected
8	N.C.	Not Connected

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2.3 Terminator resistor settings

In order to minimize reflection effects on the CAN bus line, the CAN bus lines have to be terminated at both ends by two terminal resistances. Based on the ISO 11898-2 spec, each terminal resistance is 120Ω (or between 108Ω~132Ω). The length related resistance should have 70 mΩ/m. Users should check the resistances of their CAN bus, before they install a new CAN network as figure 2-4.

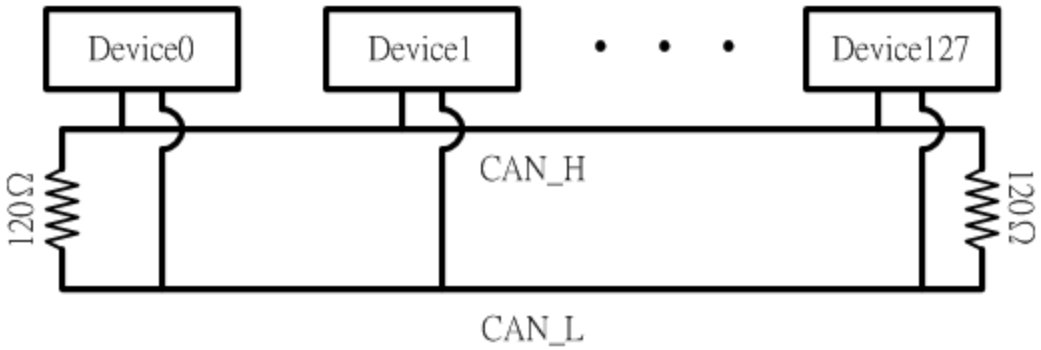


Figure 2-4**:** Terminator resistor

Moreover, to minimize the voltage drop on long distance, the terminal resistance should be higher than the value defined in the ISO 11898-2. Table 2-4 may be used as a reference.

Table 2-4: Relation between bus cable and length

Bus Length (meter)	**Bus Cable Parameters**		**Terminal Resistance (Ω)**
	Length Related Resistance (mΩ/m)	**Cross Section (Type)**	
0~40	70	0.25(23AWG)~ 0.34mm2(22AWG)	124 (0.1%)
40~300	< 60	0.34(22AWG)~ 0.6mm2(20AWG)	127 (0.1%)
300~600	< 40	0.5~0.6mm2 (20AWG)	150~300
600~1K	< 20	0.75~0.8mm2 (18AWG)	150~300

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Therefore, the I-7540D(M)-MTCP module supplies a jumper for users to connect the terminator resistor or not. If users want to use this terminator resistor, please open the I-7540D(M)-MTCP cover and use the JP3 jumper to activate the 120Ω terminator resistor built in the system, as in the figure 2-5. Note that the default setting is active. And about the JP3 jumper setting, please refer the table 2-5.

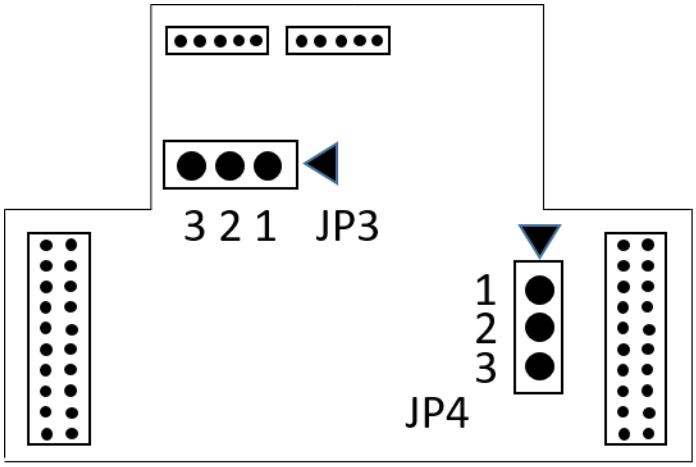
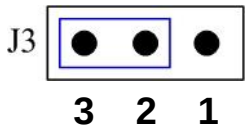
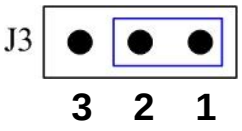


Figure 2-5**:** XC100 I/O expansion board LAYOUT

Table 2-5： **JP3** Jumper Selection

Apply the termination resistor (120Ω)	**Don't apply the termination resistor**
	

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2.4 LED Indication

The I-7540D(M)-MTCP provides the Converter function between the Ethernet port and the RS-232 & RS485 & CAN port. It can handle both 11-bits and 29-bits ID format according to whether it is a CAN 2.0A or 2.0B. It also provides some LEDs to indicate to users what situation the I-7540D(M)-MTCP is in.

2.4.1 Power LED

There is a red indicator-LED in the I-7540D(M)-MTCP to indicate the firmware status.

The default shipping of I-7540D(M)-MTCP will be firmware inside, so the red indicator-LED of I-7540D(M)-MTCP will be ON 0.5 second then OFF 0.5 second periodically.

2.4.2 CAN bus indicator LED

The I-7540D(M)-MTCP includes three single-color LED displays to indicate the status of module, network and I/O device. They are ER LED (it is red), TX LED (it is green), and RX LED (it is red). The Indicators assist maintenance personnel in quickly identifying a problem unit. The LED test is to be performed at power–up. When the CAN communication events occur, these indicators will be triggered to glitter with different conditions.

- ER LED

This LED provides device status and indicates whether or not the device is operating properly. Table 2-6 shows the conditions of ER status. Therefore, when the device is operated normally, the ER-LED must be turned off. If this led flashing red, users can use the “99S” command, in section 4.5, to read the status of the I-7540D(M)-MTCP.

Table 2-8 RX led conditions

Condition	Description
Off	Device is normal; no error occurs
Red	Device has unrecoverable fault
Flashing Red	Device has recoverable fault. To recover: Reset device or perform error recovery

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- TX LED

This LED indicates the status of message transmitted. Table 2-7 shows the conditions of TX status. Therefore, when the device transmits messages to the CAN bus, the TX-LED is normally flashing green.

Table 2-7 TX led conditions

Condition	**Description**
Off	No data is being transmitted to the CAN side
Flashing green	Data are transmitting to the CAN side
Solid green	Transmit data error

- RX LED

This LED indicates the status of message received. Table 2-8 shows the conditions for RX status. Therefore, when the device receives CAN messages, the RX-LED would be flashed.

Table 2-8 RX led conditions

Condition	**Description**
Off	No data is being received
Flashing Red	Data is being received
Solid Red	Receive error messages

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2.4.3 5-digits 7-Segment LED Displays

The 5-digits 7-SEG LED will show as figure 2-6.

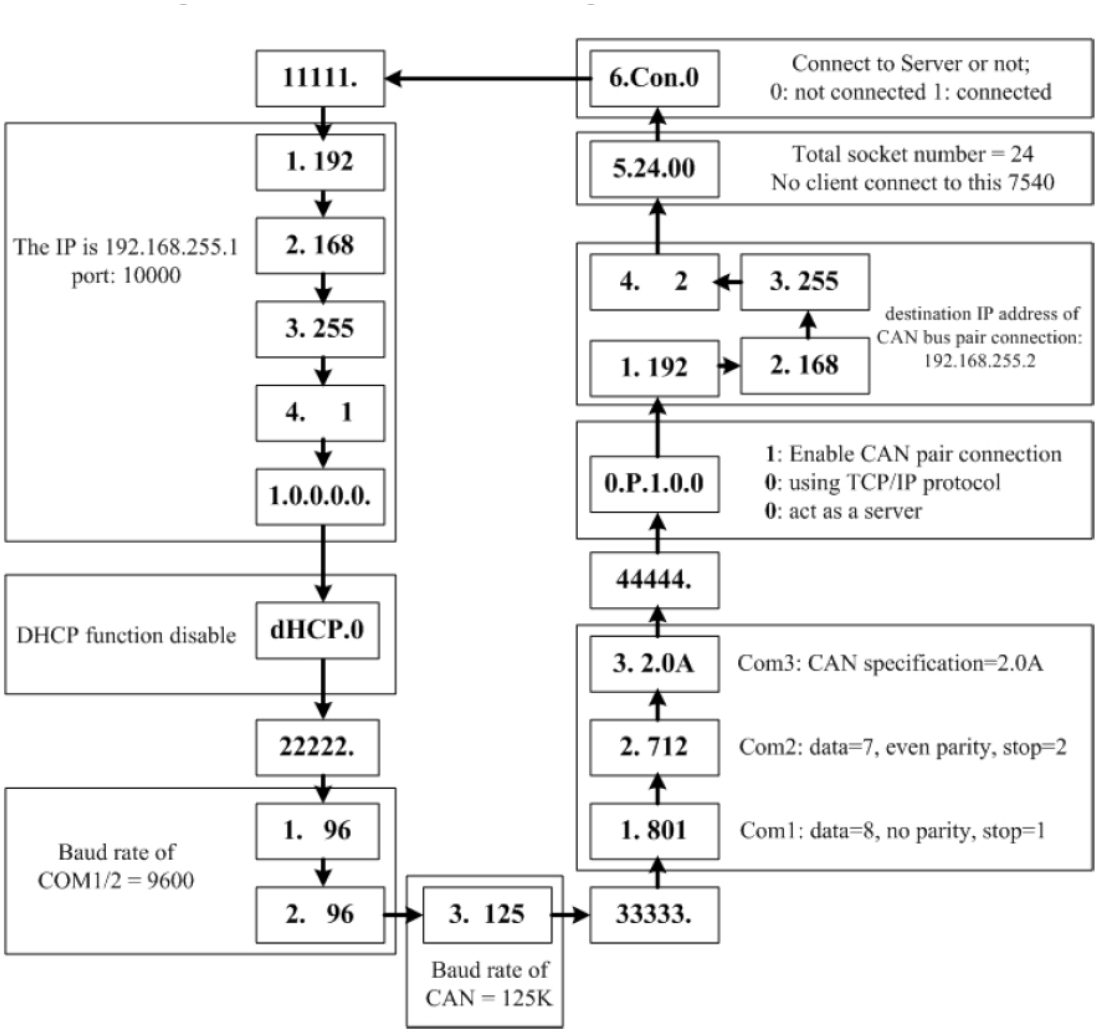


Figure 2-6 7-SEG LED Displays

The important information of I-7540D(M)-MTCP can be divided as follows:

- Group-ID 11111: IP information of this I-7540D(M)-MTCP
- Group-ID 22222: baud rate of all ports
- Group-ID 33333: configuration of all ports
- Group-ID 44444: CAN bus pair connection information and client-connected information of this I-7540D(M)-MTCP

The IP information format of I-7540D(M)-MTCP is given as follows:

- Group-ID of 5-digit LED: 11111.
- LED-1: indicator, can be 1 or 2 or 3 or 4
- LED-2~5: IP

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The LED will show Group-ID first, and then show its IP as the above diagram indicates. If users change IP, the value shown will change immediately. The default shipping IP = 192.168.255.1the LED-show sequence is given as above diagram.

The DHCP function formats are given as follows:

- dHCP.0DHCP→ function disable
- dHCP.1DHCP→ function enable and get an IP
- dHCP.2DHCP→ function enable but not get an IP, using default setting
- If the DHCP function is enable, the I-7540D(M)-MTCP will get it's IP from the DHCP server. Otherwise, it will use the IP in the EEPROM.

The baud-rate format of COM ports are given as follows:

- Group-ID of 5-digit LED: 22222.
- LED-1: COM port number
- LED-2~5: value of (baud/100)

The baud-rate format of CAN port is given as follows:

- LED-1: CAN port number
- LED-2~5: value of (baud/1000)

The COM port and CAN port number are shown in LED-1 and their baud rate is shown in the LED-2~5. The COM port baud rate=(value of LED-2~5)*100. Therefore, shown-value=1. 96 means baud rate of COM1=9600bps; shown-value=2.1152 means baud rate of COM2= 115200bps. It's the same as the CAN port baud rate. The CAN port baud rate=(value of LED-2~5)*1000. Therefore, shown-value=3. 10 means baud rate of CAN=10kbps; shown-value=3.1000 means baud rate of CAN= 1Mbps. All baud rate of I-7540D(M)-MTCP's port will be shown one by one.

The configuration of COM ports are given as follows:

- Group-ID of 5-digit LED: 33333.
- LED-1: COM port number
- LED-3: data bit, 7 or 8
- LED-4: parity bit, 0=no parity, 1=even parity, 2=odd parity
- LED-5: stop bit, 1 or 2

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The configuration of CAN port is given as follows:

- LED-1: CAN port number
- LED-2~5: CAN specification (2.0A or 2.0B)

The connection-client and CAN bus pair connection information are given as follows:
Group-ID of 5-digit LED: 44444.

- LED-1: indicator, can be 0 or 1 or 2 or 3 or 4 or 5.

Indicator 0:

- LED-2: 'P' for CAN bus pair connection
- LED-3: "Enable CAN pair" parameter, 0: Enable, 1: Disable
- LED-4: "TCP or UDP" parameter, 0: TCP, 1: UDP.
- LED-5: "Server or Client" parameter, 0: act as a server, 1: act as a client

Indicator 1 or 2 or 3 or 4:
The CAN bus pair destination IP information format of I-7540D(M)-MTCP is given as follows:

- LED-2~5: IP

The LED will show Group-ID first, and then show its IP as the above diagram indicates. If users change can bus pair destination IP and reset the system, the value shown will change. The default shipping IP = 192.168.255.2 → the LED-show sequence is given as above diagram.

Indicator 5:

- LED-2/3: numbers of free sockets are available, default 24.
- LED-4/5: numbers of sockets are used by clients, default 0.

If any one client connects to this I-7540D(M)-MTCP, free-sockets will be decreased and used-sockets will be increased. If the free-sockets number is reduced to 0, then no extra client can link to this I-7540D(M)-MTCP. The default number of free-sockets is 24. Therefore, the I-7540D(M)-MTCP allows 24 clients link to it.

Indicator 6:

- LED-2~4: "Con." for connect to server or not

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- LED-5: 0: not connect to server; 1: already connect to server.

3. Software Utility

We support some software utilities for users to set and test the status of the I-7540D(M)-MTCP.

1. I-7540D-MTCP Utility
   The I-7540D-MTCP Utility tool can be used to configure the operation condition between the CAN and Ethernet communications. Also it can be used to transmit or receive a CAN message for simple testing of the module's functions.

2. MiniOS7 Utility
   MiniOS7 Utility is a tool for configuring, uploading files to all products embedded with ICPDAS MiniOS7.

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3.1 I-7540D-MTCP Utility

The I-7540D-MTCP Utility tool can be used to configure the operation condition between the CAN and Ethernet communications. Also it can be used to transmit or receive a CAN message for simple testing of the module's functions. To start the "I-7540D-MTCP Utility", please install the I-7540D-MTCP Utility setup file and run the I-7540D-MTCP.exe file. The screenshot of the startup screen for this Utility is given in the below figure. Connect the I-7540D(M)-MTCP's Ethernet port with the PC's Ethernet port via a standard CAT 3 or CAT 5 network cable. Then the user can connect the CAN interface into the CAN network based on the CAN specifications. For further information related to this, please refer to section 2.2.2 and 2.2.3 of this manual on how to make a hardware connection.

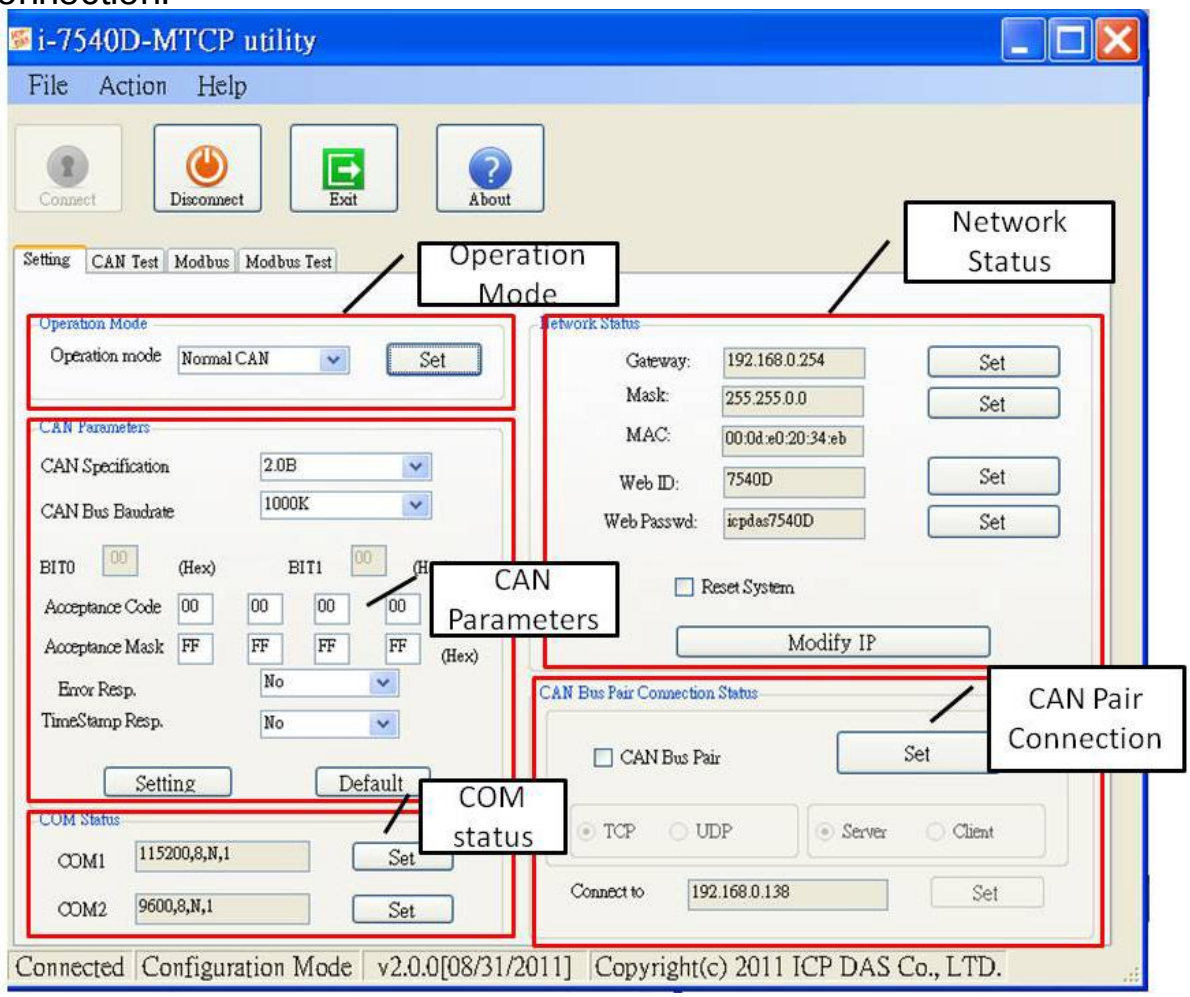


Figure 3-1: I-7540D-MTCP Utility

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3.1.1 Install I-7540D-MTCP Utility

Install I-7540D-MTCP Utility

Step1: Download the I-7540D-MTCP Utility setup file from the web site
http://www.icpdas.com/products/Remote_IO/can_bus/I-7540.htm
Or the CD-ROM disk following the path of
Fieldbus_CD:\\CAN\Converter\I-7540D\Utility

Step 2: Execute the setup.exe file to install I-7540D-MTCP Utility.

Step 3: A "Welcome" window pops up to prompt user to begin the installation. See figure 3-2.

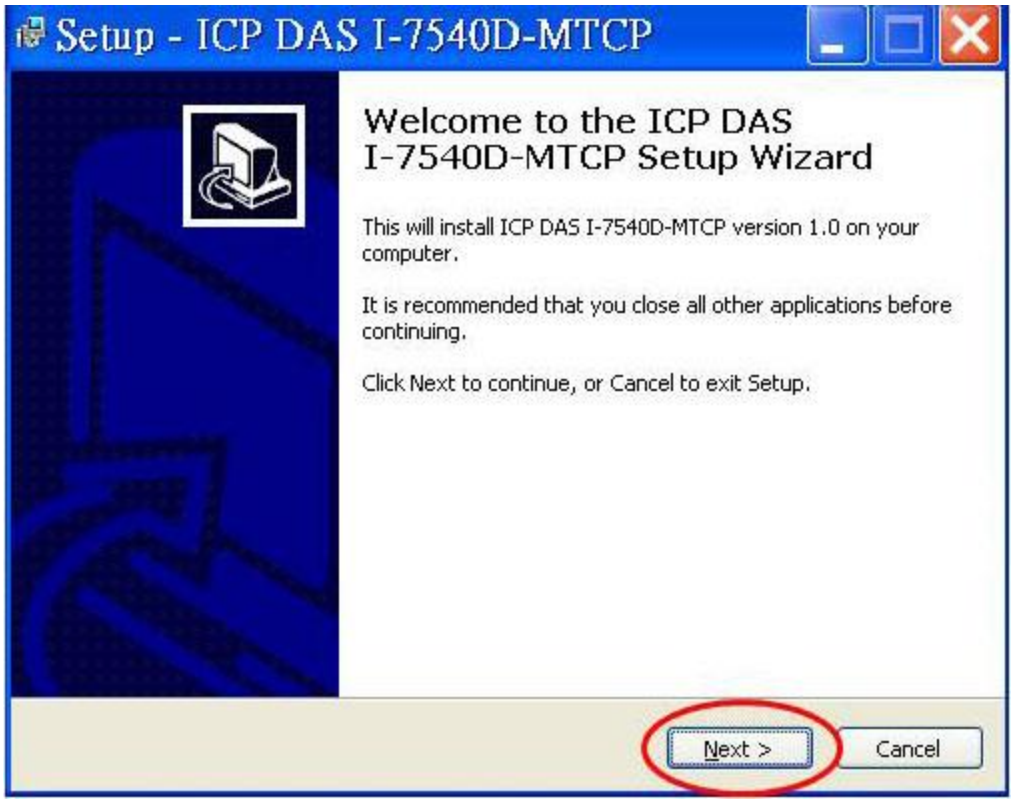


Figure 3-2: Welcome dialog

Step 4: Click the "Next" button and a "Select Destination Location" window will pop up for deciding the installation path.

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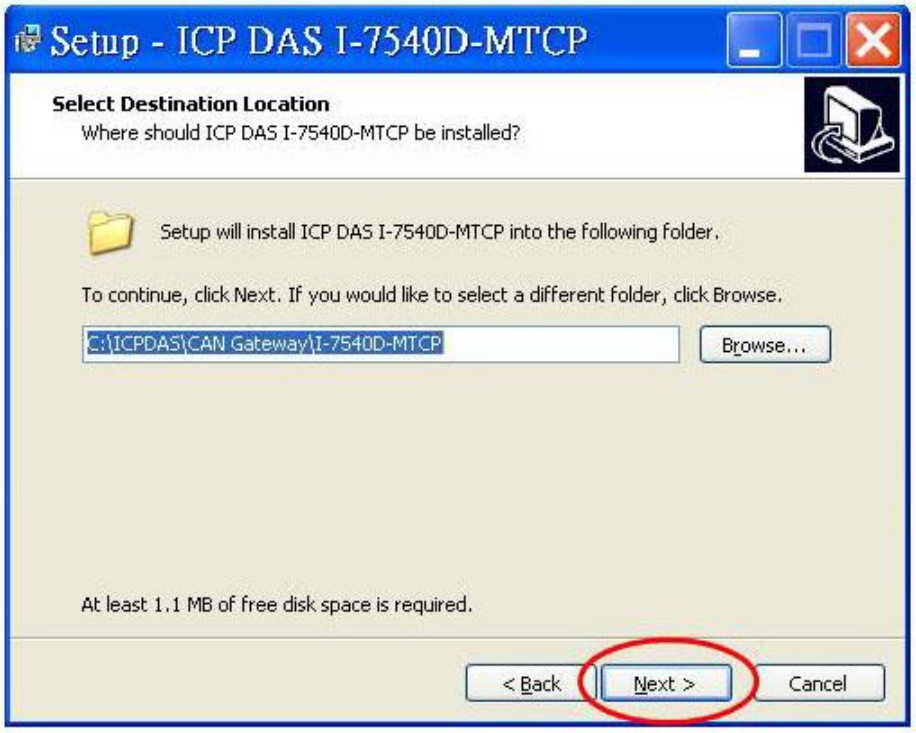


Figure 3-3: “Select Destination Location” dialog

Step 5: Click “Next” button and a “Ready to Install the Program” window will pop up to prompt user that the wizard is ready to begin the installation See figure 3-4.

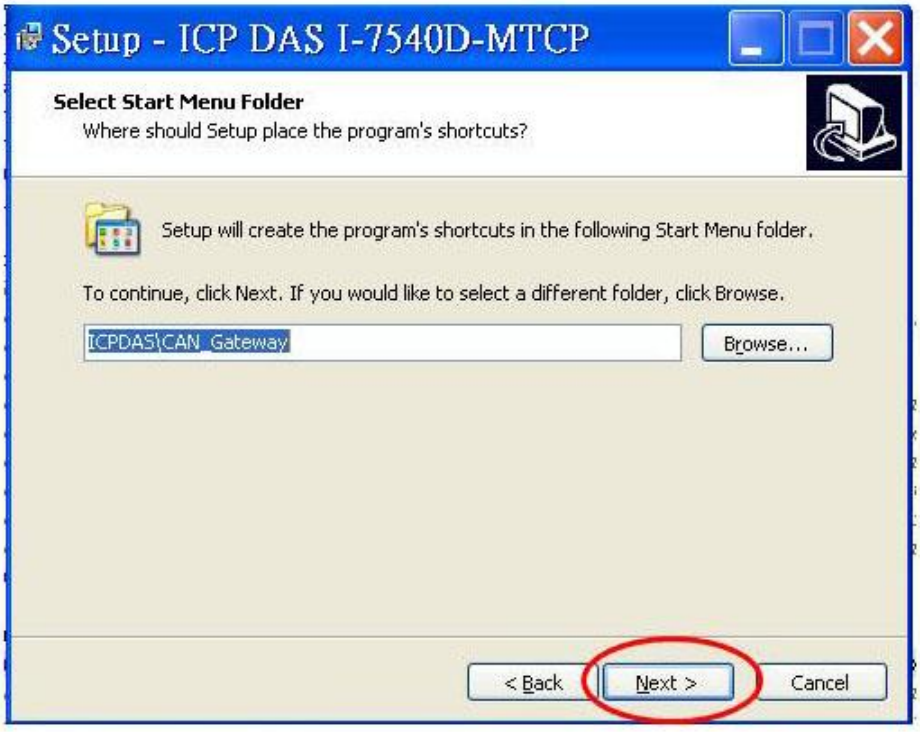


Figure 3-4: “Ready to Install the Program” dialog

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Step 6: Click “Install” button and start to install the I-7540D-MTCP Utility to the system. After finishing the process, a “Complete” window will pop up to prompt users that the successful completion of the installation. And click “Finish” button to exit. See figure 3-5.

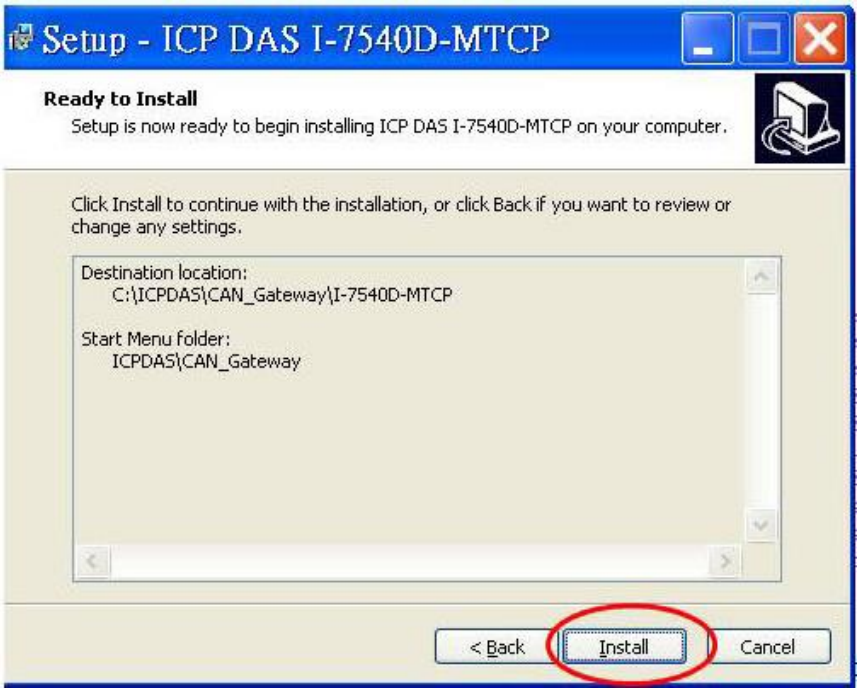


Figure 3-5: “Ready to Install” dialog

Step 7: After finishing the installation of the I-7540D-MTCP Utility, users can find it as shown in figure 3-6.

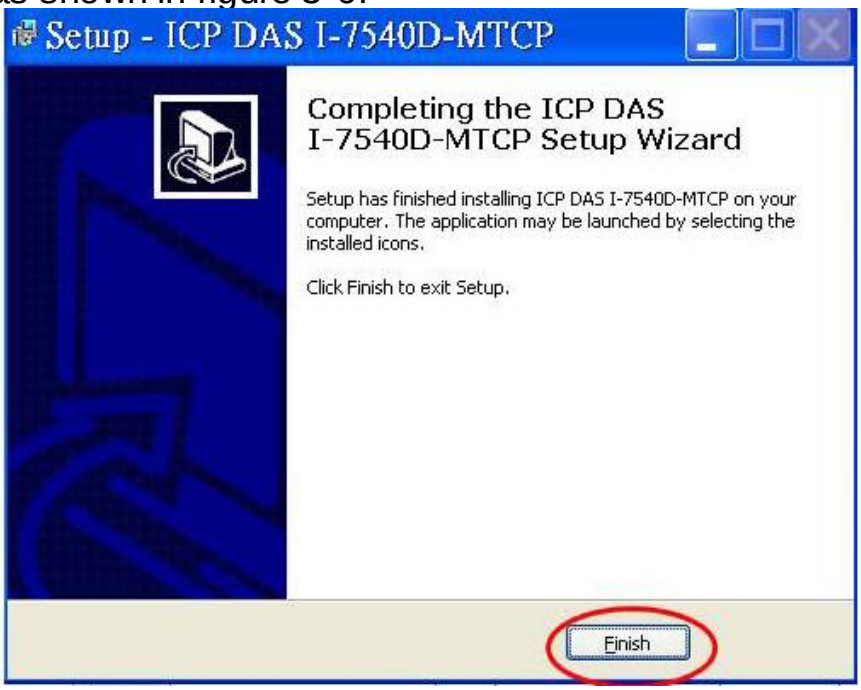


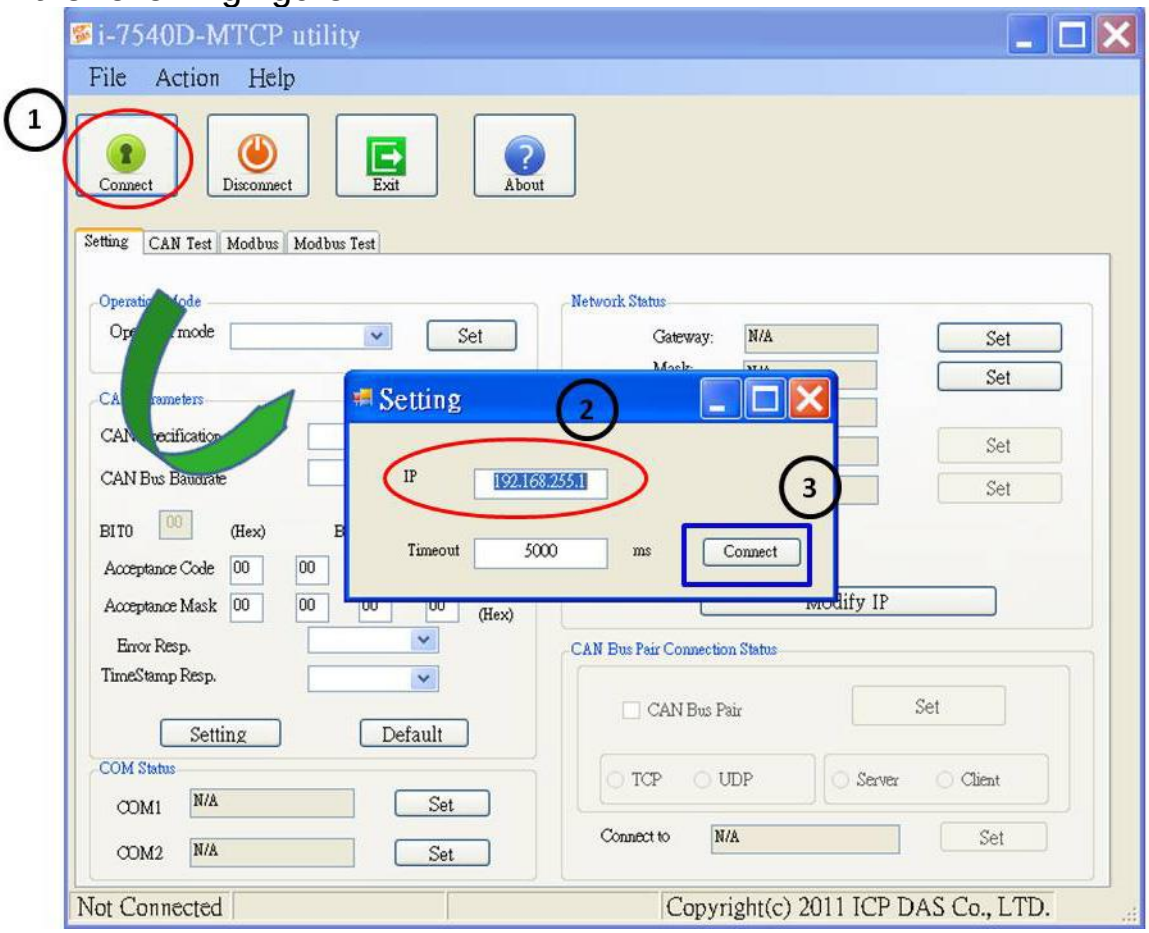
Figure 3-6: “Successful Completion of the Installation” dialog

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3.1.2 How to configure the module parameters

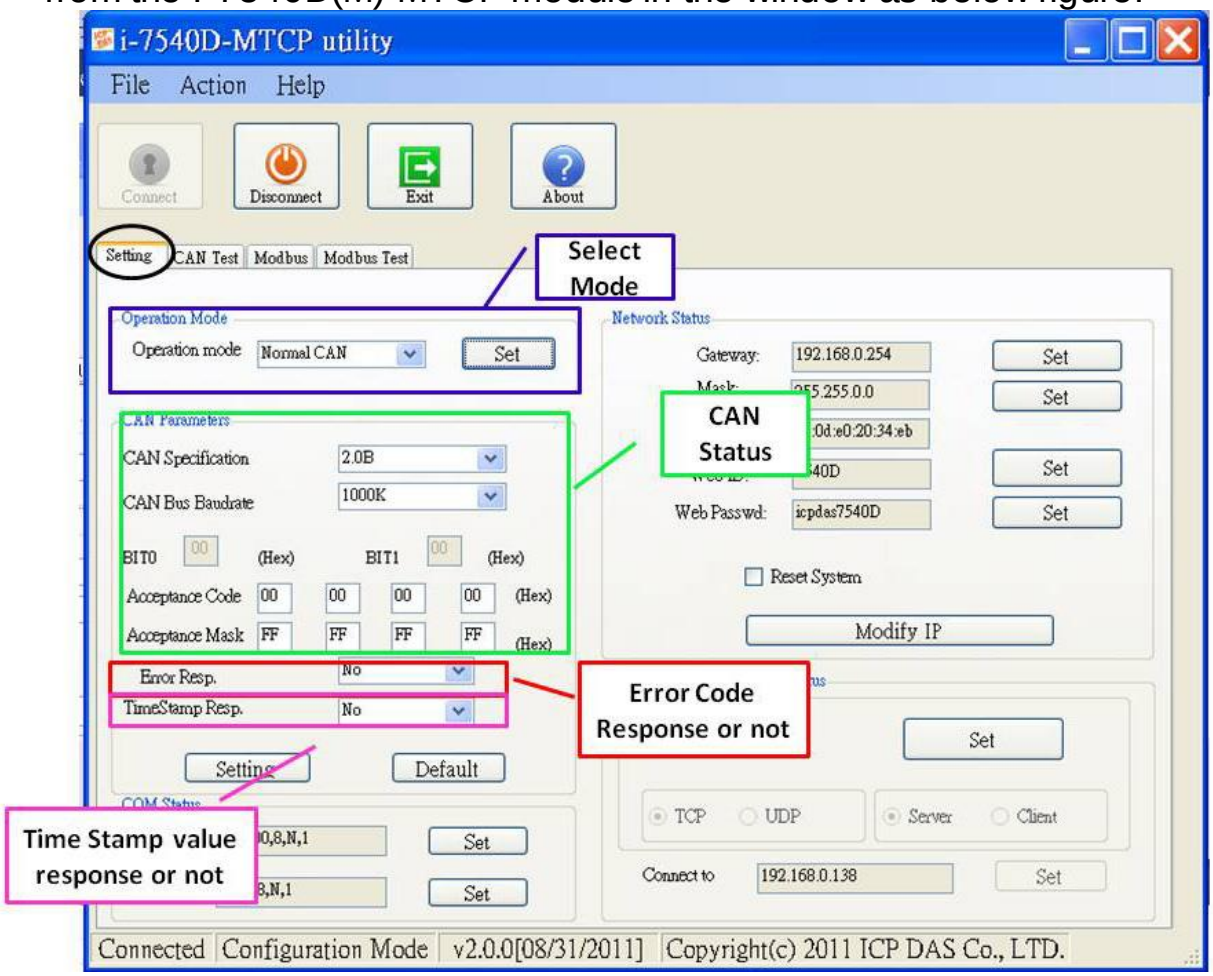
The following procedure will guide you on how to configure the communication parameters for the CAN and Ethernet interface. The configuration steps are depicted as below:

1. Connect the power source (the 10~30 DC volts) into the I-7540D(M)-MTCP module.
2. The I-7540D(M)-MTCP module's Power LED will flash approximately once per second. And the 5-digits 7-segment LED will scroll to display some messages, please refer to section 2.4.3. That means the I-7540D(M)-MTCP module is working normally.
3. The user must run the I-7540D-MTCP Utility software after they have made a wire connection between the PC and the I-7540D(M)-MTCP via the network cable
4. Click the "Connect" icon on the I-7540D-MTCP Utility tool bar. The setting frame will be popped up. Key-in the IP of the I-7540D(M)-MTCP and press the "Connect" button in order to connect with it. As shown in the following figure.



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5. Then the I-7540D(M)-MTCP configuration window will be brought out. The I-7540D-MTCP Utility will show the communication information from the I-7540D(M)-MTCP module in the window as below figure.



6. Choose the “Settings” tab to open the configuration window for the CAN and the Network status parameters of the I-7540D(M)-MTCP. Once users have finished changing the CAN parameter settings, please click the “Setting” button, on the “CAN Parameters” frame, to store the communication parameters into the EEPROM on the I-7540D(M)-MTCP.

Note: If users click the “Defaults” icon, all of the CAN communication parameters in the I-7540D(M)-MTCP will be set to the default values, which are:

CAN Specification = 2.0B
CAN bus Baud rate = 1Mbps
BTR0 = 00, BTR1 = 00
Acceptance Code = 00 00 00 00
Acceptance Mask = FF FF FF FF
Error Response = No

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Timestamp Response = No

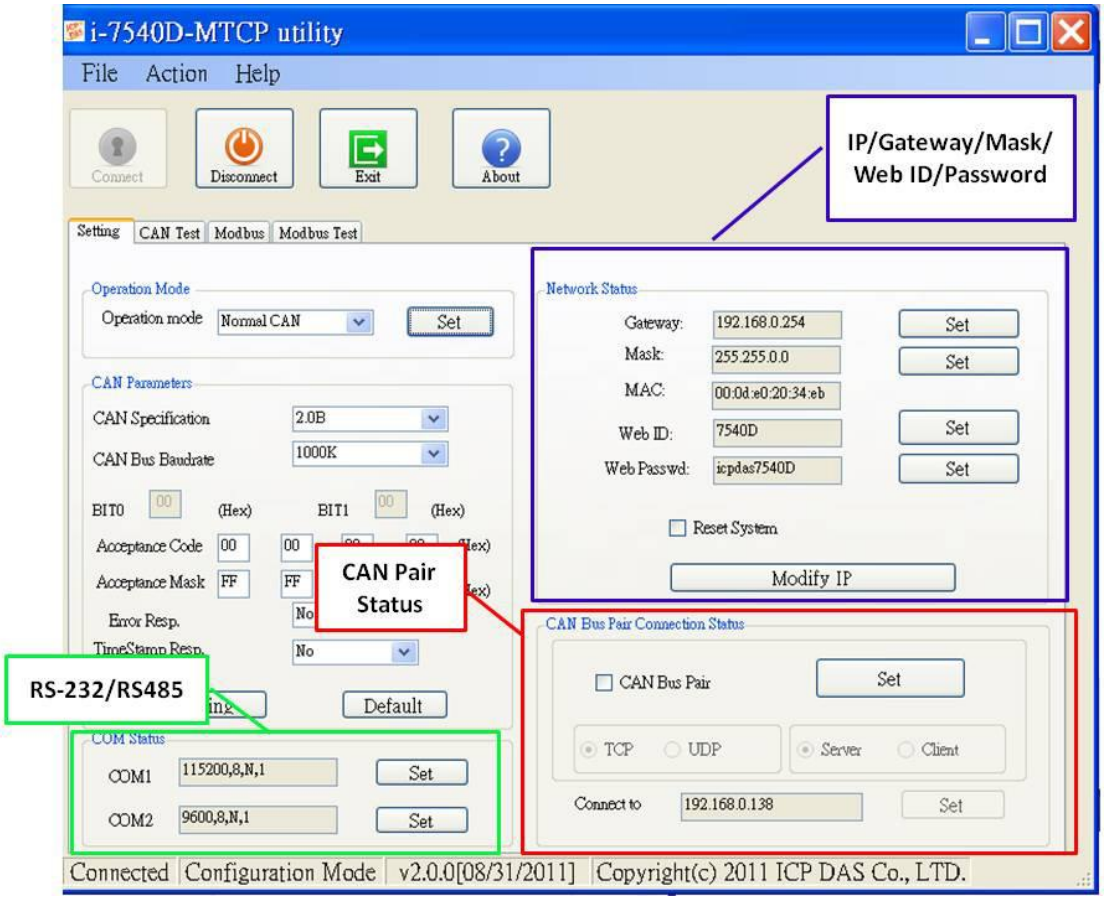
7. The “Network Status” frame displayed the IP, Gateway, Mask and MAC address of the I-7540D(M)-MTCP. Users can change these network parameters by click the “Set” button and “Modify IP” button. And the “Reset System” checkbox is used to reset the system of I-7540D(M)-MTCP.

Note: After modify the network status of the I-7540D(M)-MTCP, the setting value will become effective after resetting the system.

8. The “COM Status” frame showed the parameters of RS-232 and RS485 ports. User also can modify it by click the “Set” button.

9. The “CAN Bus Pair Connection Status” frame showed the parameters of CAN pair connection.

Note: After modify the CAN bus pair connection status of the I-7540D(M)-MTCP, the setting value will become effective after resetting the system.



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3.1.3 Connect How to set the Bus Timing Registers

BTR0, BTR1: Set the special user-defined baud rate.

Users can set arbitrary baud with these parameters. But users need to have the background of SJA1000 CAN controller and 82C251 CAN transceiver, and calculate the values of BT0 and BT1 by themselves (The clock frequency of CAN controller is 16MHz.).

3.1.4 Connect to the How to set the Acceptance Code and Mask

Acceptance Code (AccCode): The CAN ID bits that you want to get.
Acceptance Mask (AccMask): The CAN ID bits that you want to filter.

The AccCode is used for deciding what kind of ID the CAN controller will accept. The AccMask is used for deciding which bit of ID will need to check with AccCode. If the bit of AccMask is set to 0, it means that the bit in the same position of ID need to be checked, and that ID bit value needs to match the bit of AccCode in the same position.

For 11-bit ID Message:

AccCode and AccMask	Bit Position	Filter Target
AccCode[0] and AccMask[0]	bit7~bit0	bit10 ~ bit3 of ID
AccCode[1] and AccMask[1]	bit7~bit5	bit2 ~ bit0 of ID
AccCode[1] and AccMask[1]	bit4	RTR
AccCode[1] and AccMask[1]	bit3~bit0	No use
AccCode[2] and AccMask[2]	bit7~bit0	bit7 ~ bit0 of 1st byte data
AccCode[3] and AccMask[3]	bit7~bit0	bit7 ~ bit0 of 2nd byte data

For 29-bit ID Message:

AccCode and AccMask	Bit Position	Filter Target
AccCode[0] and AccMask[0]	bit7~bit0	bit28 ~ bit21 of ID
AccCode[1] and AccMask[1]	bit7~bit0	bit20 ~ bit13 of ID
AccCode[2] and AccMask[2]	bit7~bit0	bit12 ~ bit5 of ID
AccCode[3] and AccMask[3]	bit7~bit3	bit4 ~ bit0 of ID
AccCode[3] and AccMask[3]	bit2	RTR
AccCode[3] and AccMask[3]	bit1~bit0	No use

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For example (In 29 bit ID message):

AccCode :	00h	00h	00h	00h
AccMask :	FFh	FFh	FFh	FFh
ID bit	bit28~bit21	bit20~bit13	bit12~bit5	bit4~bit0
Accepted ID:	xxxx xxxx	xxxx xxxx	xxxx xxxx	101x x

The accepted ID range is as following list.

ID Byte	Byte 3 (h)		Byte 2 (h)		Byte 1 (h)		Byte 0 (h)	
	High	Low	High	Low	High	Low	High	Low
Accepted value	0 1	X	X	X	X	X	1 3 5 7 9 B D F	4 5 6 7

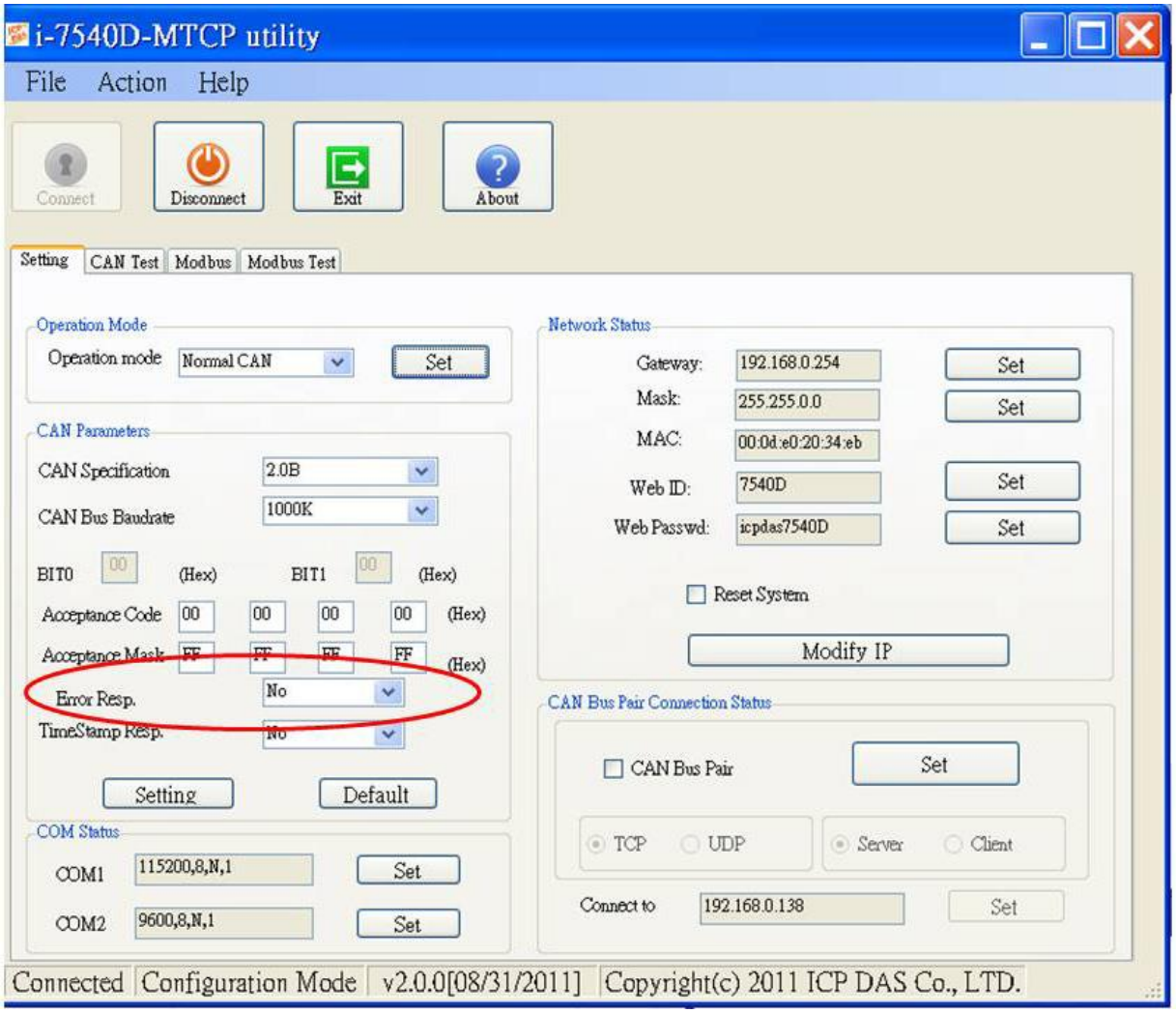
(Note: The mark “x” means don’t care. And the mark “h” behind the value means hex format.)

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3.1.5 Enable Error Response

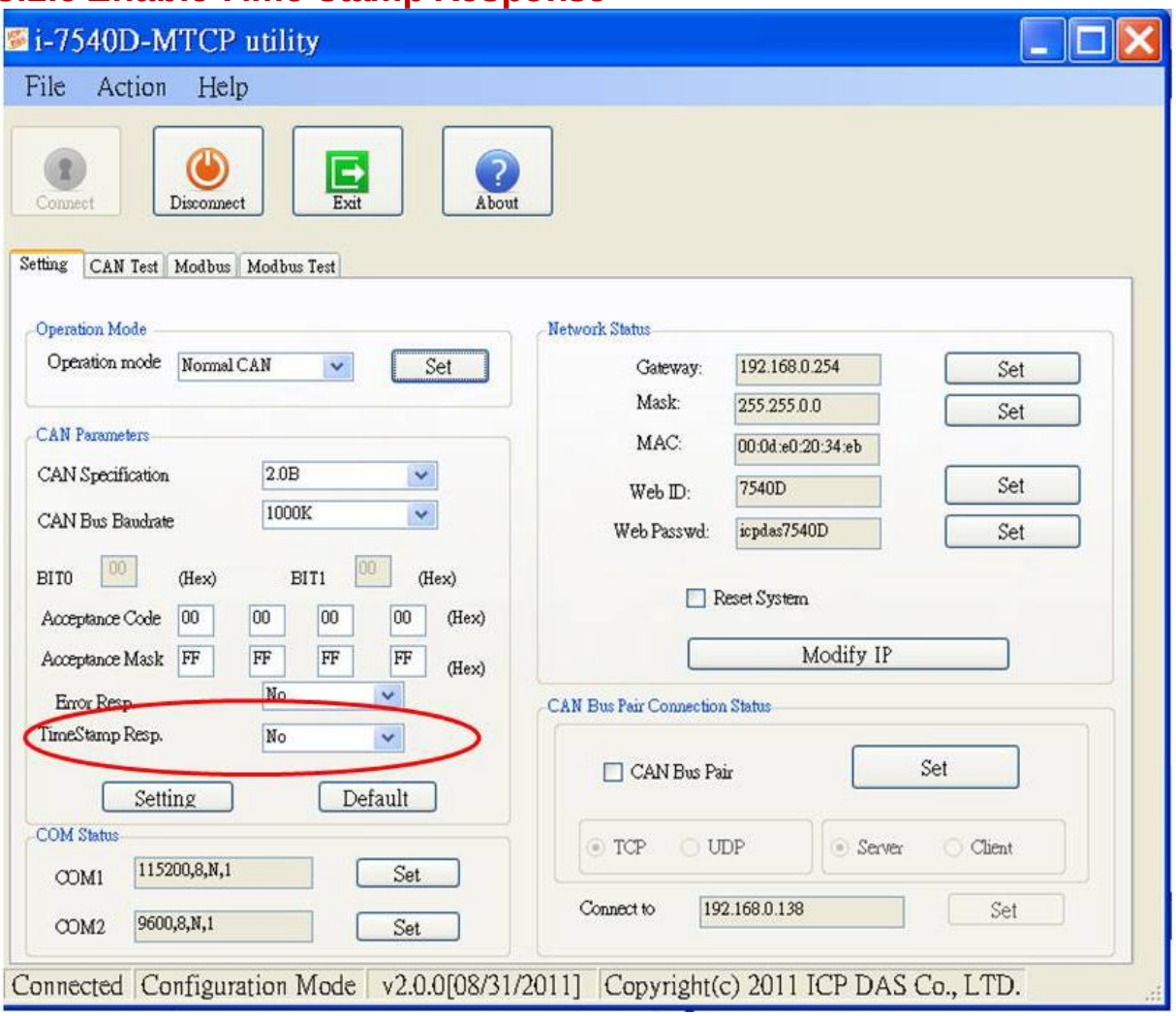
When the I-7540D(M)-MTCP receives a command that it doesn't accept, it will response syntax and/or communication error information to the host. These general error codes are shown in below table.

AsciiToHex (Error code)	Description
1	The head character of the command string is invalid.
2	The length of the command string is invalid.
3	The value of CAN identifier is invalid.
4	The value of CAN data length is invalid.
5	Reserved



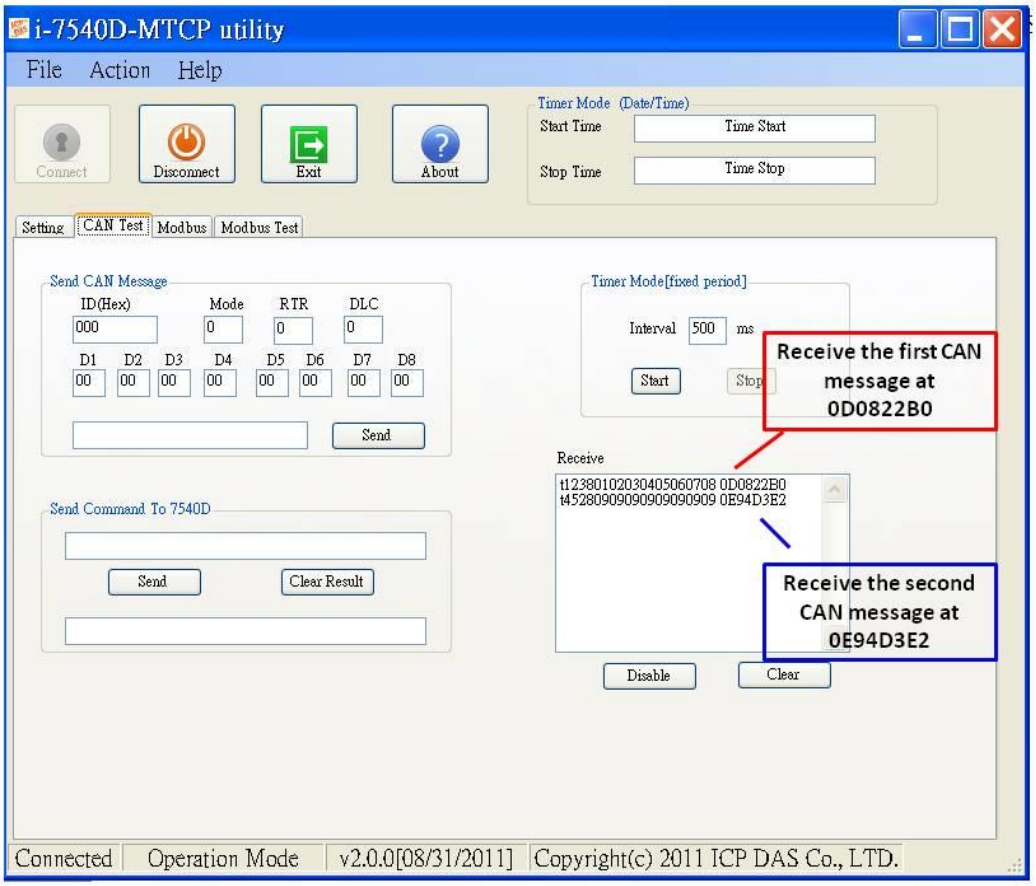
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3.1.6 Enable Time-stamp Response



When the time-stamp response is enabled, the I-7540D(M)-MTCP will send CAN message with its time-tick vale, hexadecimal eight ASCII chars for a unit of microsecond, to the host as it receive a CAN message.
For example:

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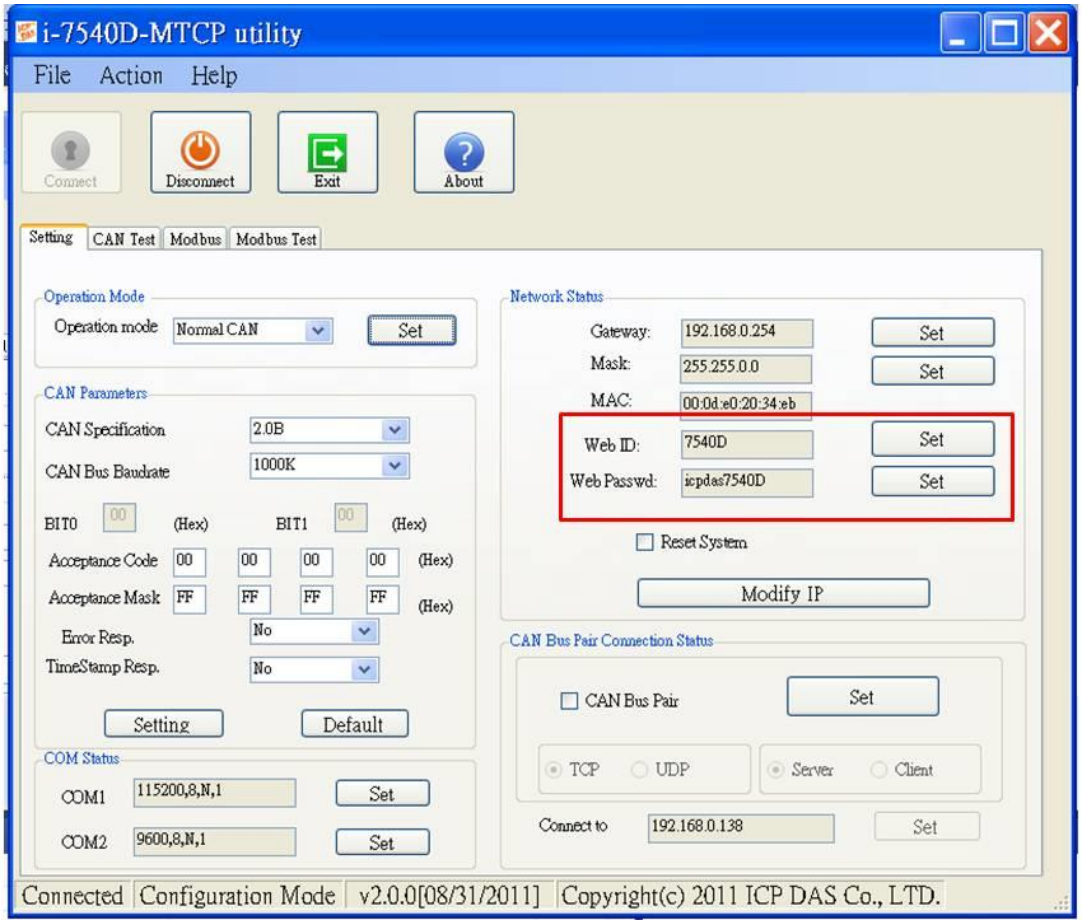
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3.1.7 How to change web ID/PASSWORD configuration

The I-7540D(M)-MTCP module has a built-in web server that allows user to easily configure the module from a remote location using a regular web browser.

When users want to modify the configuration of I-7540D(M)-MTCP via Setup web page, they need to fill these two fields, ID and PASSWORD, with correct values. Or they can view the configuration of I-7540D(M)-MTCP, and can't modify the configuration.

If users want to change the ID and PASSWORD, they need to modify these two parameters by using Utility tool. The default setting of ID is "7540D", and default PASSWORD is "icpdas7540D".



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3.1.8 How to test the module transmission performance

The following procedure will guide you to learning how to transmit/receive CAN messages to/from other devices/PCs by using the I-7540D(M)-MTCP converter.

1. Connect the I-7540D(M)-MTCP's CAN port into the CAN network, which must at least have one CAN device on the network.

2. Supply the 10~30 volts DC source into the I-7540D(M)-MTCP module through the power terminal.

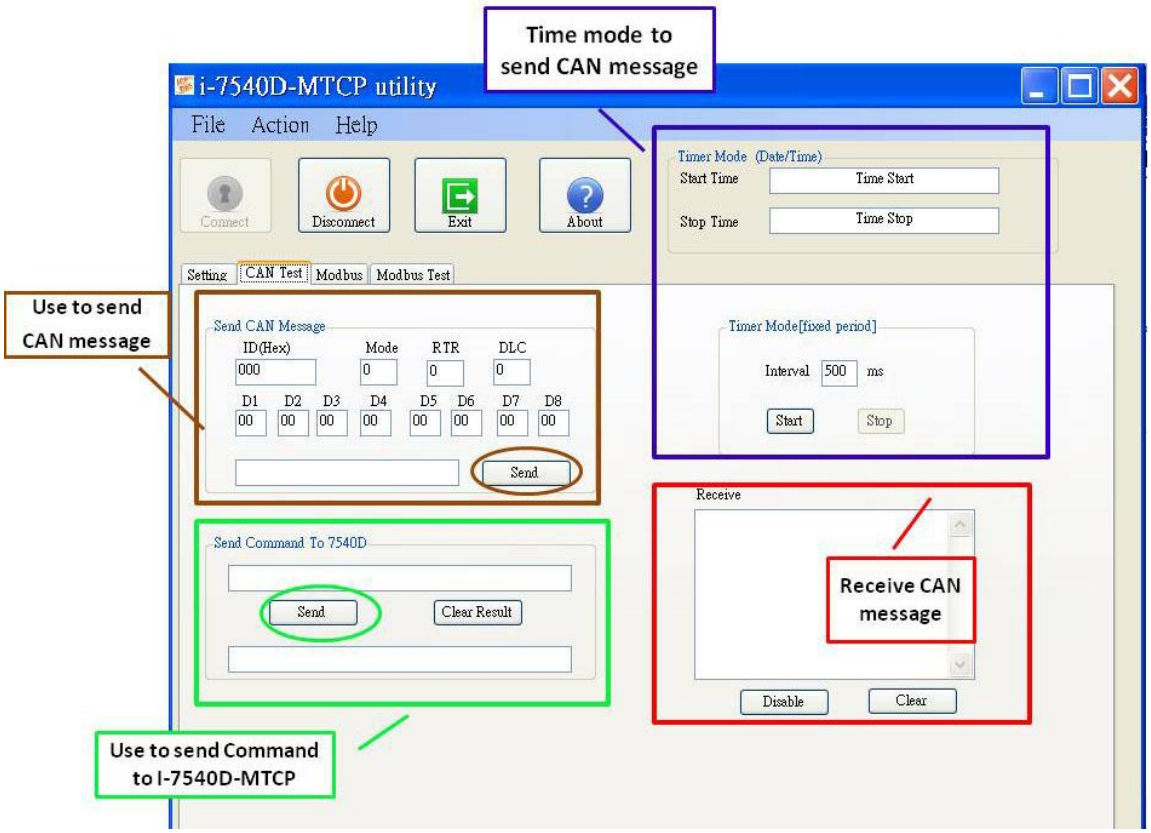
3. The I-7540D(M)-MTCP module's Power LED will flash approximately once per second. And the 5-digits 7-segment LED will scroll to display some messages. That means the I-7540D(M)-MTCP is working in the operation mode.

4. Run the I-7540D-MTCP Utility software after they have made a wire connection between the PC and the I-7540D(M)-MTCP via the network cable

5. Click the "Connect" icon on the I-7540D-MTCP Utility tool bar. The setting frame will be popped up. Key-in the IP of the I-7540D(M)-MTCP and press the "Connect" button in order to connect with it. As shown in the following figure.

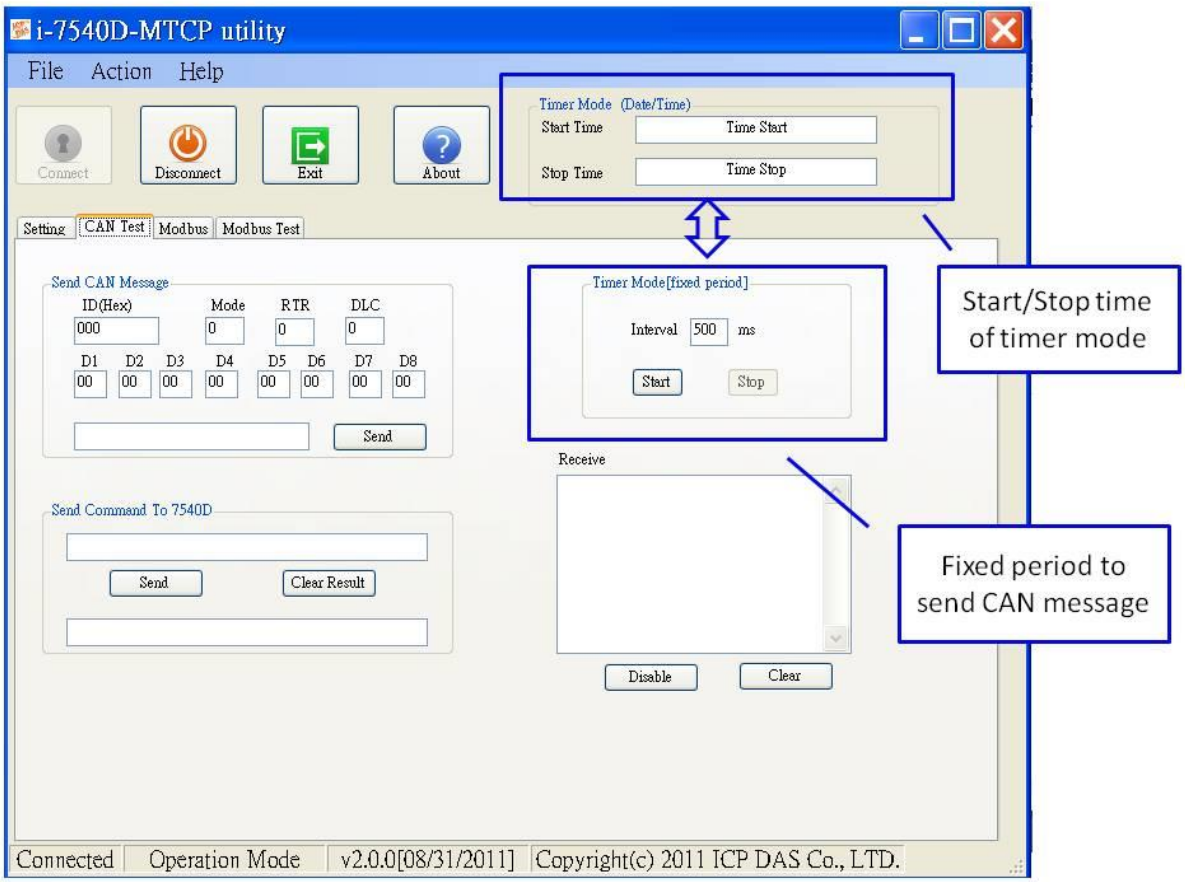
6. Select the "CAN Test" tab in order to test the function of transmission and reception via the I-7540D(M)-MTCP module. In "Send CAN Message" frame, user can send the necessary CAN message to Ethernet port 10003 of I-7540D(M)-MTCP. Then I-7540D(M)-MTCP will transfer and transmit this message to CAN bus. In the "Send Command to I-7540D-MTCP" frame, users can send command to I-7540D(M)-MTCP for getting or setting the status or parameters of I-7540D(M)-MTCP.

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7. Users also can use the timer mode to send CAN message in fixed period. And the start/stop time would be displayed in Date/Time format. And when receiving correct CAN message, these CAN message will be displayed on the “Receive” box.

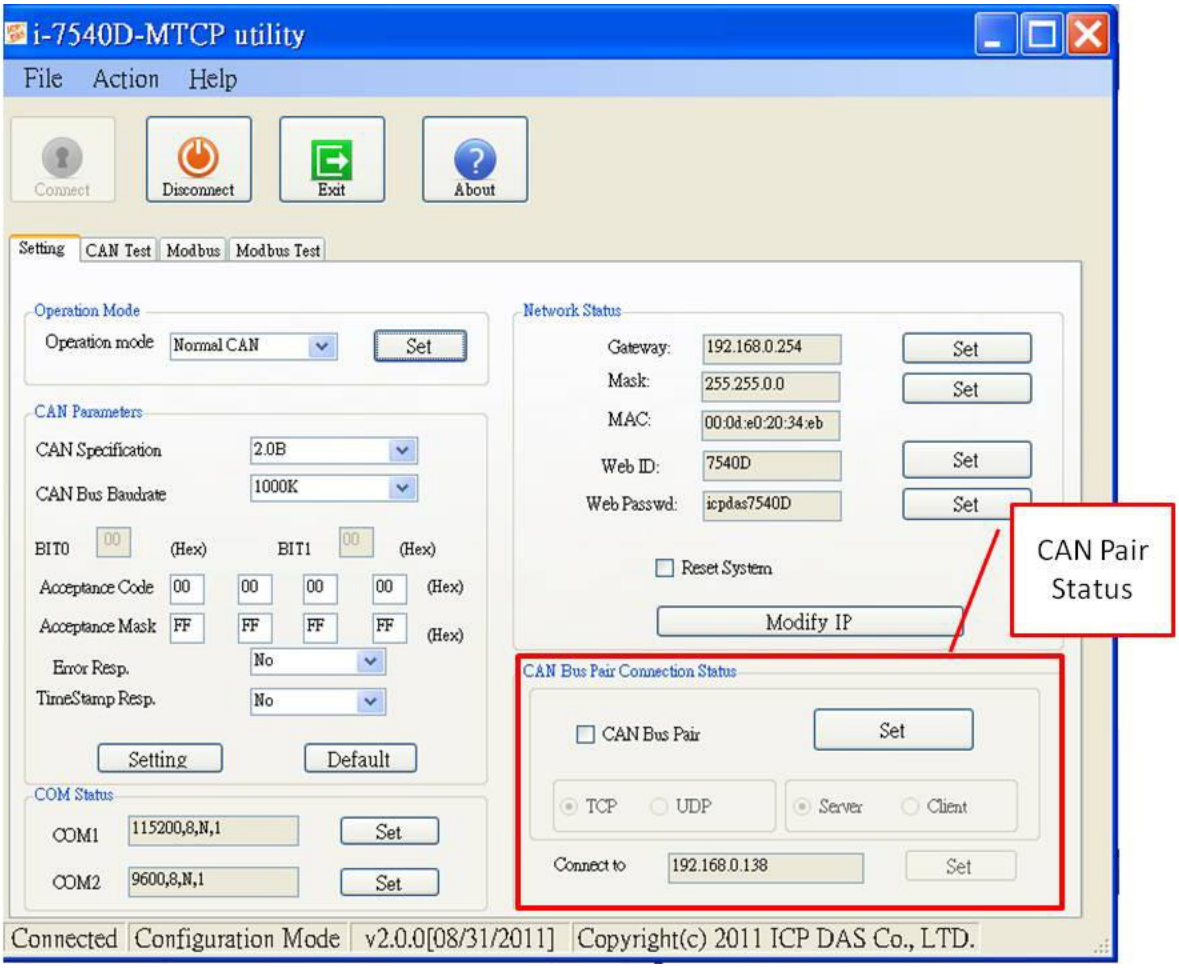
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3.1.9 How to use CAN Bus Pair Connection

The I-7540D(M)-MTCP supports CAN bus pair connection UDP/TCP function. CAN bus pair connection will use UDP method (port: 57540) or TCP method (port: 10003). User can refer the following application to use this function.



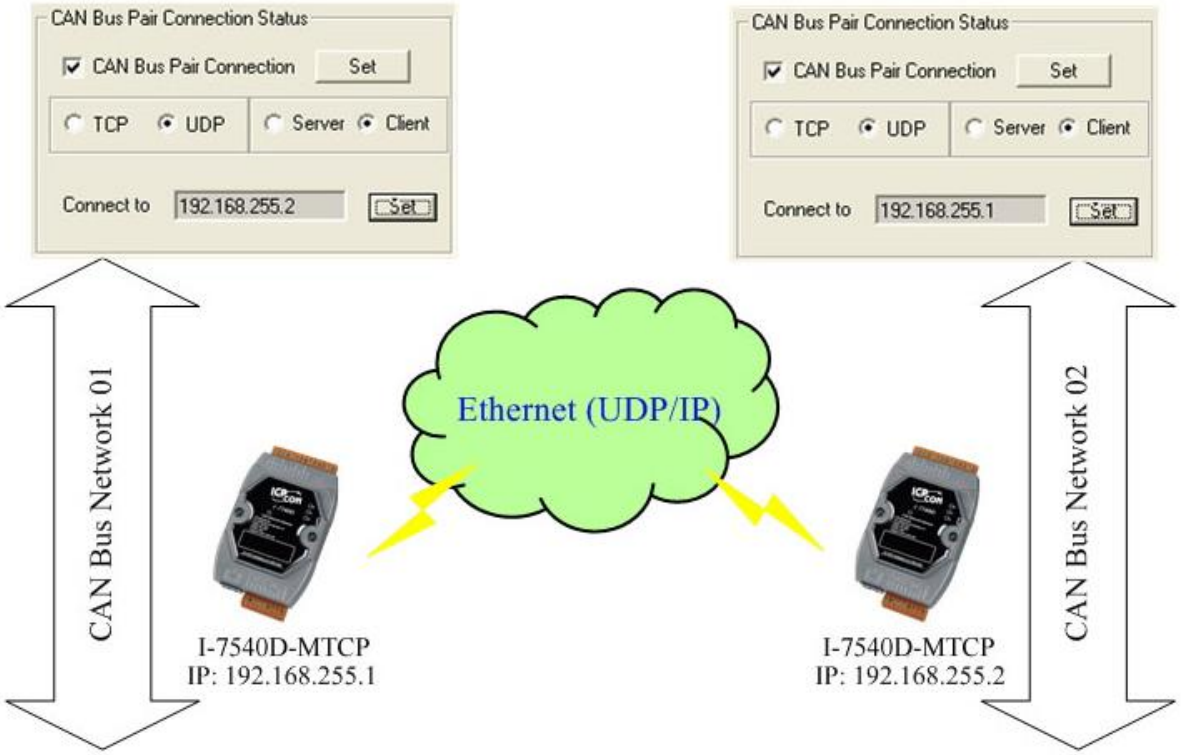
Note:

After setting “Enable CAN Bus Pair Connection”, all data send to this I-7540D(M)-MTCP via Ethernet port 10003 will become no effective.

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Application 01: one-to-one communication

After setting “CAN Bus Pair connection Status” of the two I-7540D(M)-MTCP and re-start the system of them, CAN messages between “CAN Network 01” and “CAN Network 02” can be exchanged by UDP/IP protocol through Ethernet network.

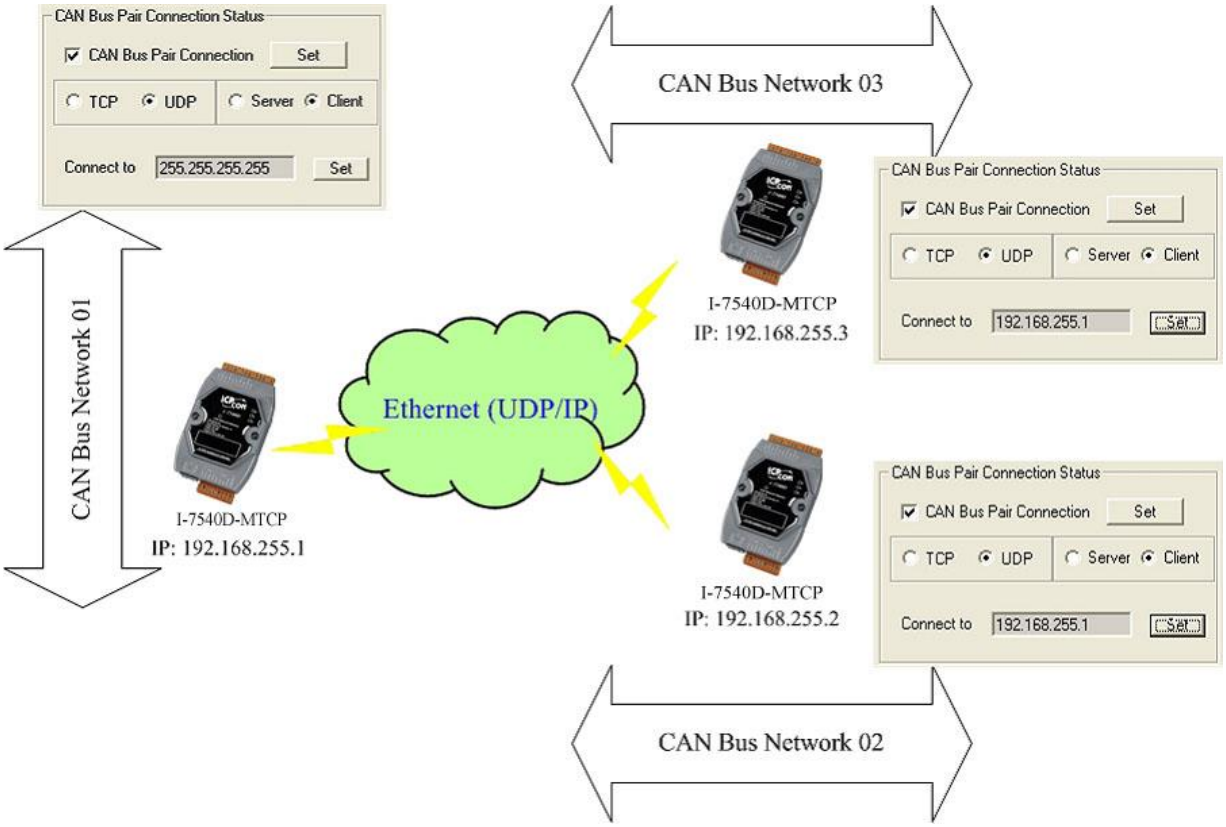


Note:

When setting to use UDP method, the “Server/Client” parameters will be no effective.

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Application 02: one-to-many communication (broadcast)



1. After setting “CAN Bus Pair connection Status” of these I-7540D(M)-MTCP and re-start the system of them, CAN messages on “CAN Network 01” will be sent to “CAN Network 02“ and “CAN Network 03“ by using UDP/IP protocol via Ethernet network.

2. All CAN message on “CAN Network 02“ will sent to “CAN Network 01“ by using UDP/IP protocol via Ethernet network.

3. All CAN message on “CAN Network 03“ will sent to “CAN Network 01“by using UDP/IP protocol via Ethernet network.

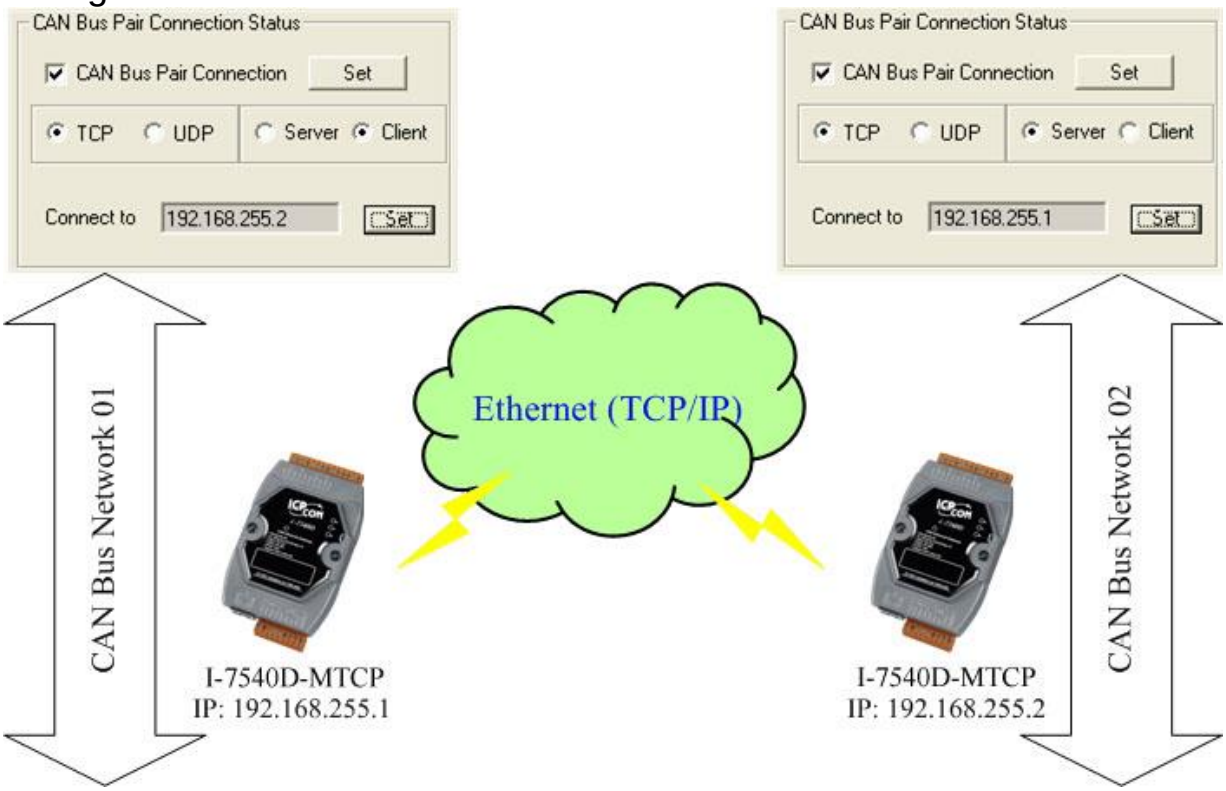
4. By using this broadcast method, users need to know how to set the network mask of the I-7540D(M)-MTCP.

Note:
When setting to use UDP method, the “Server/Client” parameters will be no effective.

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Application 03: One acts as a server, the other acts as a client.

After setting “CAN Bus Pair connection Status” of the two I-7540D(M)-MTCP and re-start the system of them, CAN messages between CAN Network 01 and CAN Network 02 can be exchanged by TCP/IP protocol through Ethernet network.



Note:

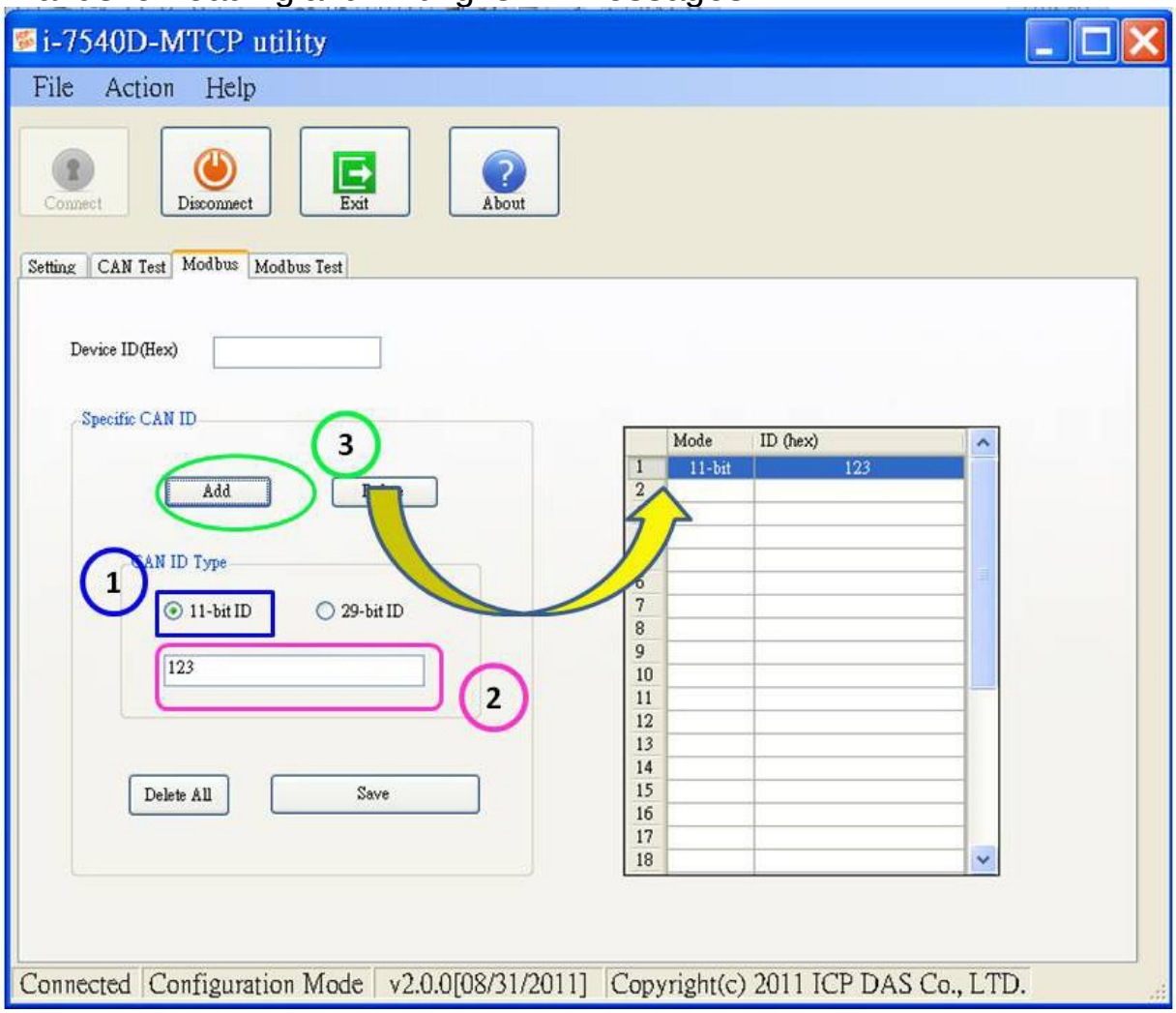
When setting to act as a TCP server, the “Connect to (Destination IP)” will be no effective.

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3.1.10 How to set specific CAN ID table

When users select the “Modbus TCP” or “Modbus RTU” mode, the functions, “Device ID” and “Specific CAN ID”, are useful. In the “Specific CAN ID” field, users can set maximum thirty CAN IDs which indicate the corresponding CAN messages to be stored in the specific Modbus Input Register respectively. In the Modbus Input Register, the register range of the “Specific CAN ID” occupies the section from 0x0E10 to 0x102C. Each CAN ID will use 18 Modbus input registers.

In Modbus TCP/ RTU mode, users need to communicate the I-7540D(M)-MTCP with Modbus TCP/RTU command. The I-7540D(M)-MTCP only supports function code 0x03/0x04/0x10 of Modbus TCP/RTU commands for reading and writing CAN messages.



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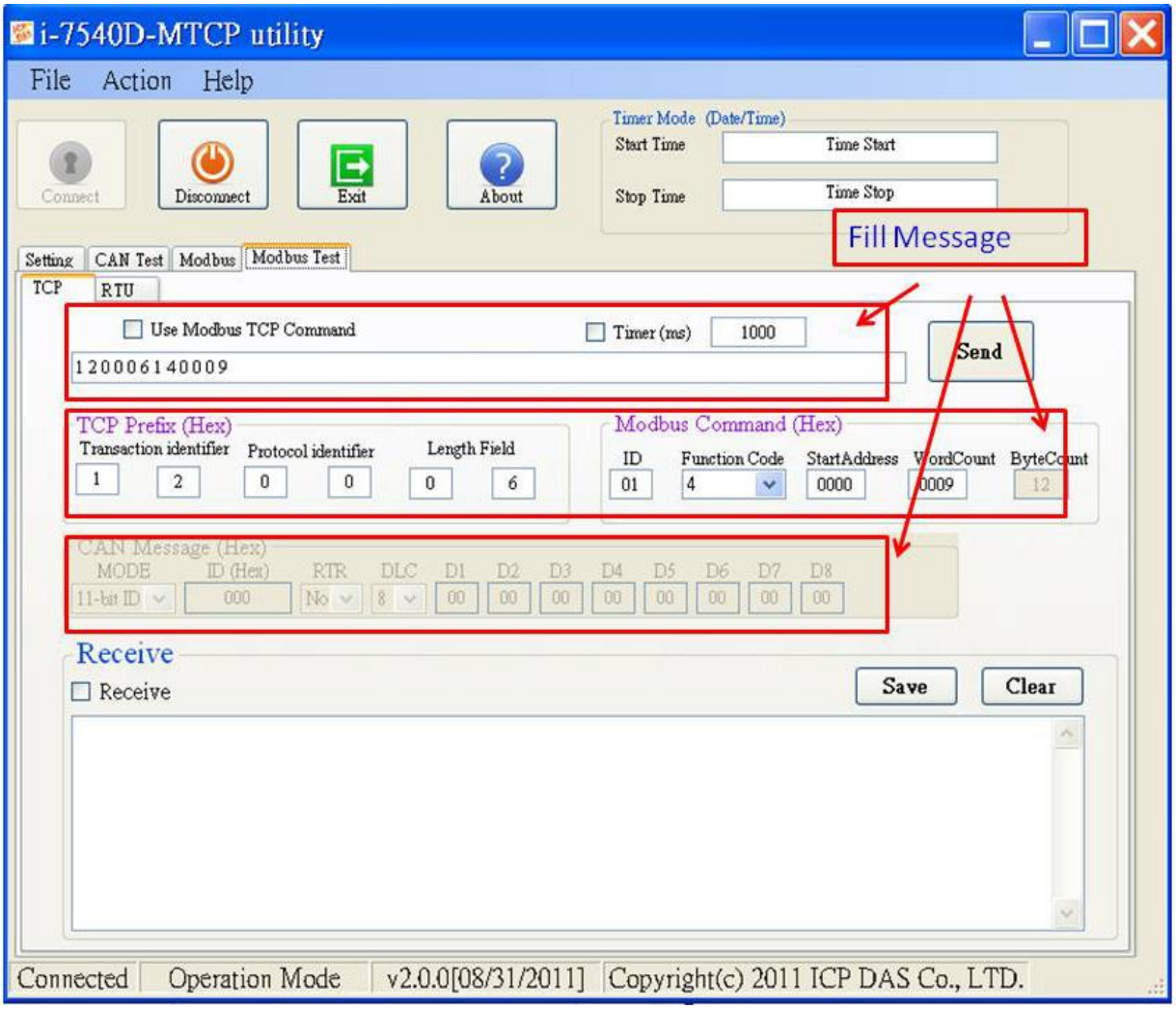
3.1.11 How to test Modbus TCP mode

In this mode, there are two methods for users to send command to the I-7540D(M)-MTCP. The screenshot of the Utility is shown below:

Through the first method **(check "Use Modbus TCP Command")** users can use the function code 0x03/0x04/0x10 of Modbus TCP commands for reading and writing CAN message. The second method **(uncheck "Use Modbus TCP Command")** requires users to understand the Modbus TCP protocol. Then key-in the correct Modbus TCP command in the text box. Both of the methods require users to click the "Send" button to transmit the command to the I-7540D(M)-MTCP module. When checking the "Timer(ms)", the Utility will transmit the command periodically.

If the "Receive" is checked, the messages sent from the I-7540D(M)-MTCP will automatically be received and displayed in the "Receive" text box. Besides, users can click the "Clear" button to remove the messages on the text box. In addition, users can click the "Save" button to save the messages in the "Receive" text box into the "I-7540D-MTCP_MT_yyyyMMddmmss.txt " file. The indication of the file name is described below.

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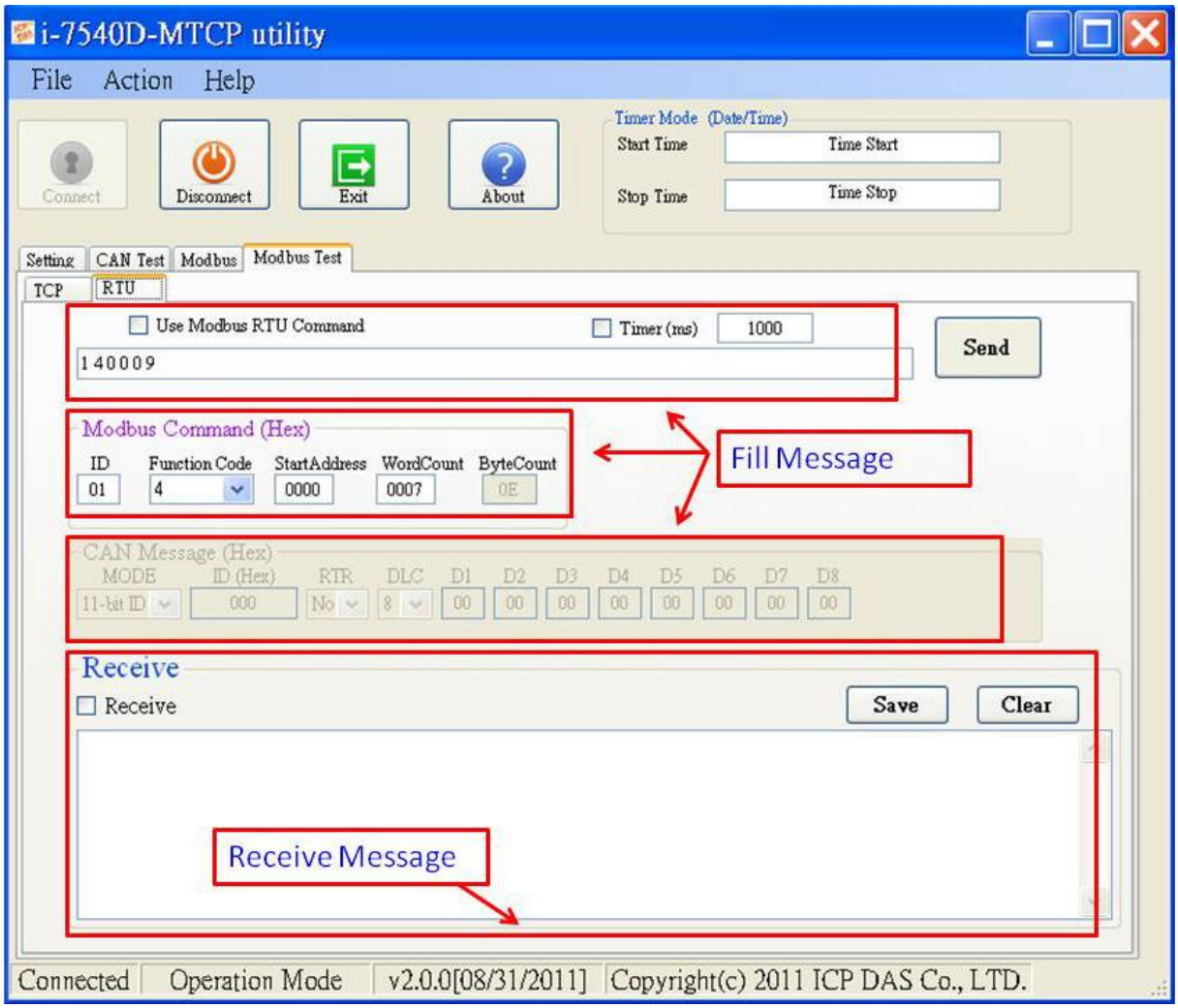
3.1.12 How to test Modbus RTU mode

In this mode, there are two methods for users to send command to the I-7540D(M)-MTCP. The screenshot of the Utility is shown below:

Through the first method **(check "Use Modbus RTU Command")** users can use the function code 0x03/0x04/0x10 of Modbus RTU commands for reading and writing CAN message. The second method **(uncheck "Use Modbus RTU Command")** requires users to understand the Modbus RTU protocol. Then key-in the correct Modbus RTU command in the text box. Both of the methods require users to click the "Send" button to transmit the command to the I-7540D(M)-MTCP module. When checking the "Timer(ms)", the Utility will transmit the command periodically.

If the "Receive" is checked, the messages sent from the I-7540D(M)-MTCP will automatically be received and displayed in the "Receive" text box. Besides, users can click the "Clear" button to remove the messages on the text box. In addition, users can click the "Save" button to save the messages in the "Receive" text box into the "I-7540D-MTCP_MR_yyyyMMddmmss.txt " file. The indication of the file name is described below.

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3.2 MiniOS7 Utility

MiniOS7 Utility is a tool for configuring, uploading files to all products embedded with ICPDAS MiniOS7. And it provides some PC diagnostic tools which can help users to diagnose the status of the I-7540D(M)-MTCP and other controllers.

Supported connection ways

- COM Port Connection
- Ethernet UDP & TCP Connection

Maintenance

- Upload file(s)
- Update MiniOS7 image
- Delete file(s)

Configure

- Date & Time
- IP Address
- COM port

Check

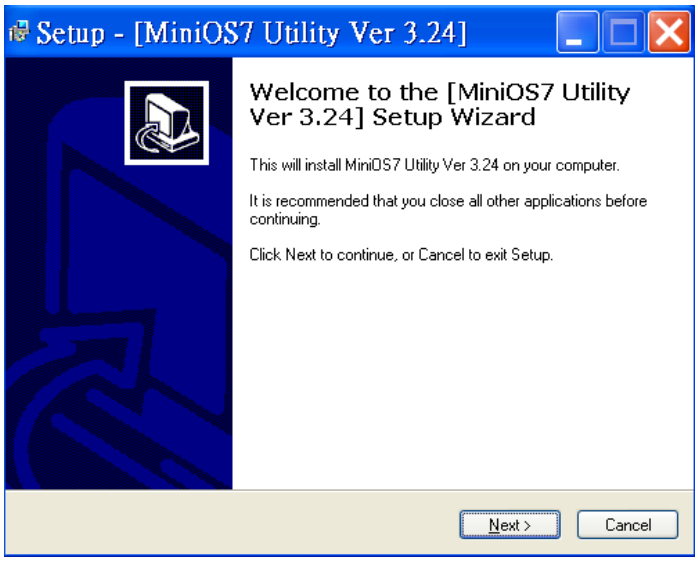
- Product information

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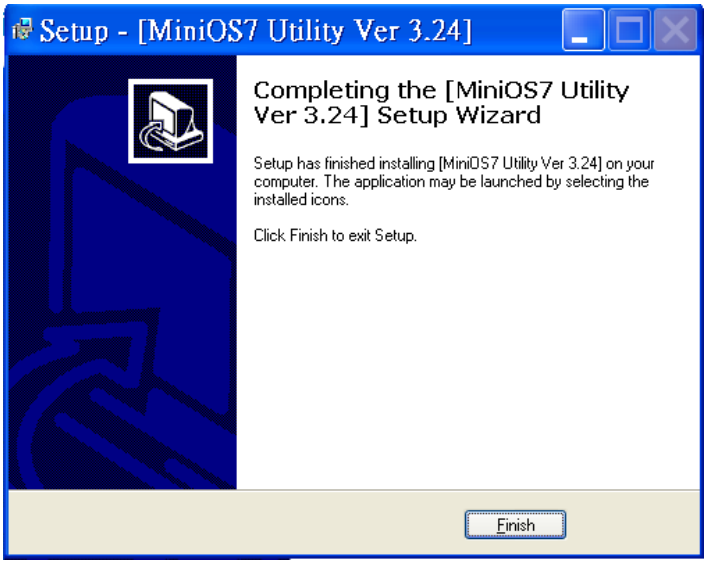
3.2.1 Install the MiniOS7 Utility

Step 1:
The installation software can be obtained from the following location. 8000cd:\\Napdos\MiniOS7\utility\MiniOS7_utility\ or http://ftp.icpdas.com/pub/cd/8000cd/napdos/minios7/utility/minios7_utility/

Step 2:
Go to where you downloaded the file, and double-click on the installation file in Windows to execute it.



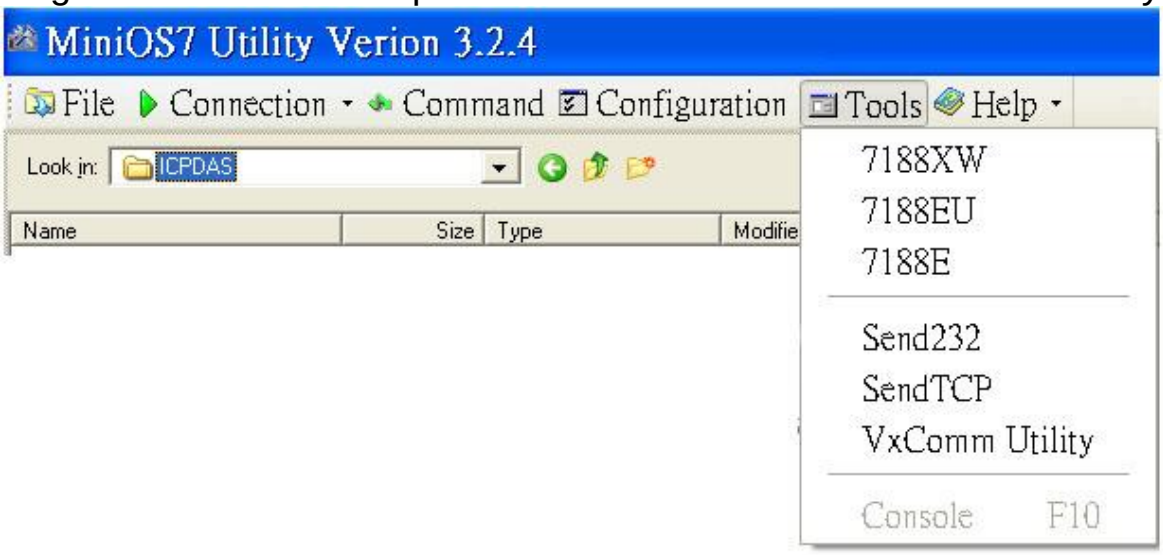
Step 3:
To finish the installation of the MiniOS7 Utility, click the Finish button to exit the setup process.



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3.2.2 PC Diagnostic tools

The MiniOS7 Utility provides serial PC diagnostic tools. These PC diagnostic tools can be opened from the Tools menu of MiniOS7 Utility.



The PC Diagnostic tools include:

- 7188XW:

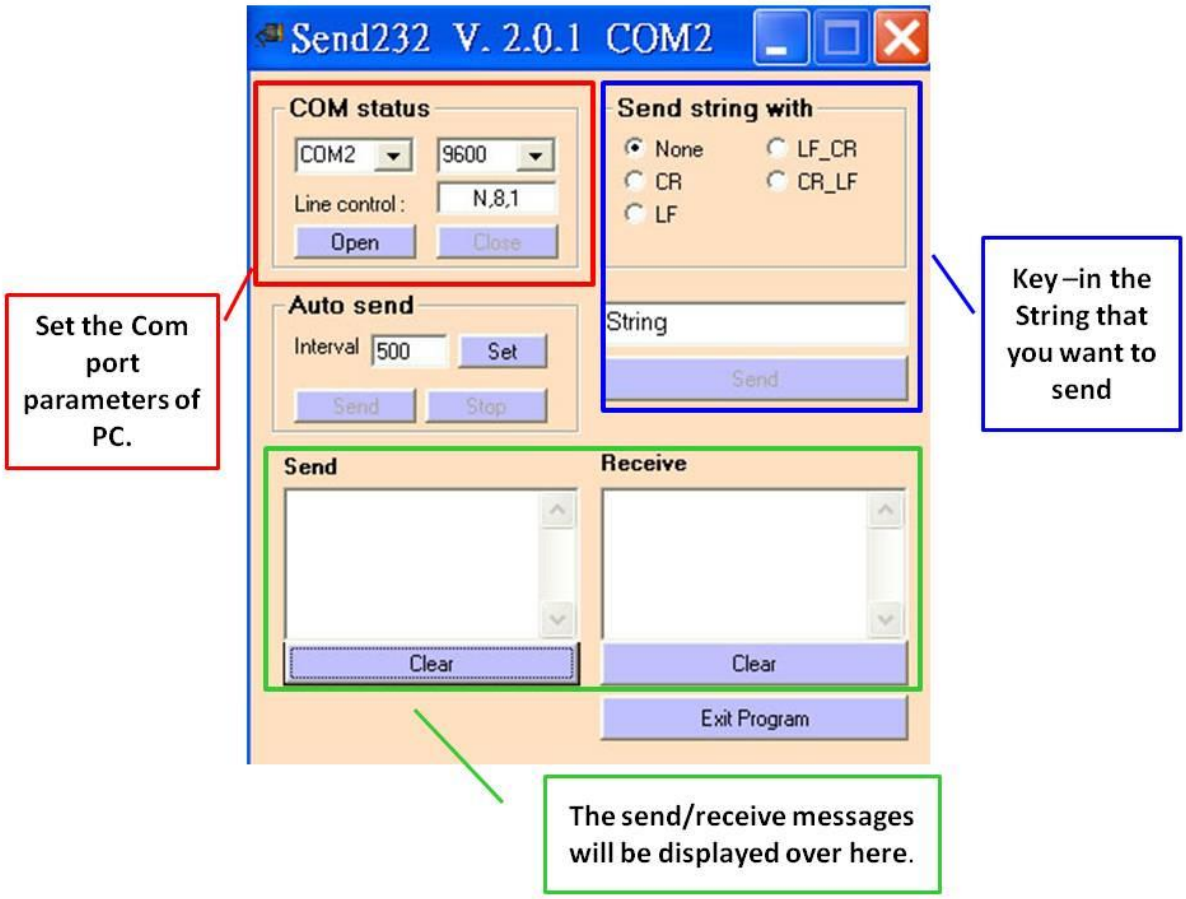
7188XW is the PC side utility for modules using the ICPDAS MiniOS7. It is the Win32 version of 7188x.exe. For 7188x.exe just can use the standard COMPORT(RS-232) of PC,ButonWin32systems

(WIN95/98/ME/NT/2K/XP) also have RS-232 port use PCMCIA or USB interface, 7188x.exe can not use these devices, so need the program 7188xw.exe. Using RS-232 ports of PC link to the modules using MiniOS7.7188xw.exe in basically is a terminal program. It sends out the data that user key-in to COM port, and show the data received from COM port on the screen of PC. The main function for 7188xw.exe is to DOWNLOAD files to the MiniOS7 system.

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- Send232:

Send232 uses serial port (RS-232) interface to communicate with devices. And it can be used to test the Virtual COM technology.

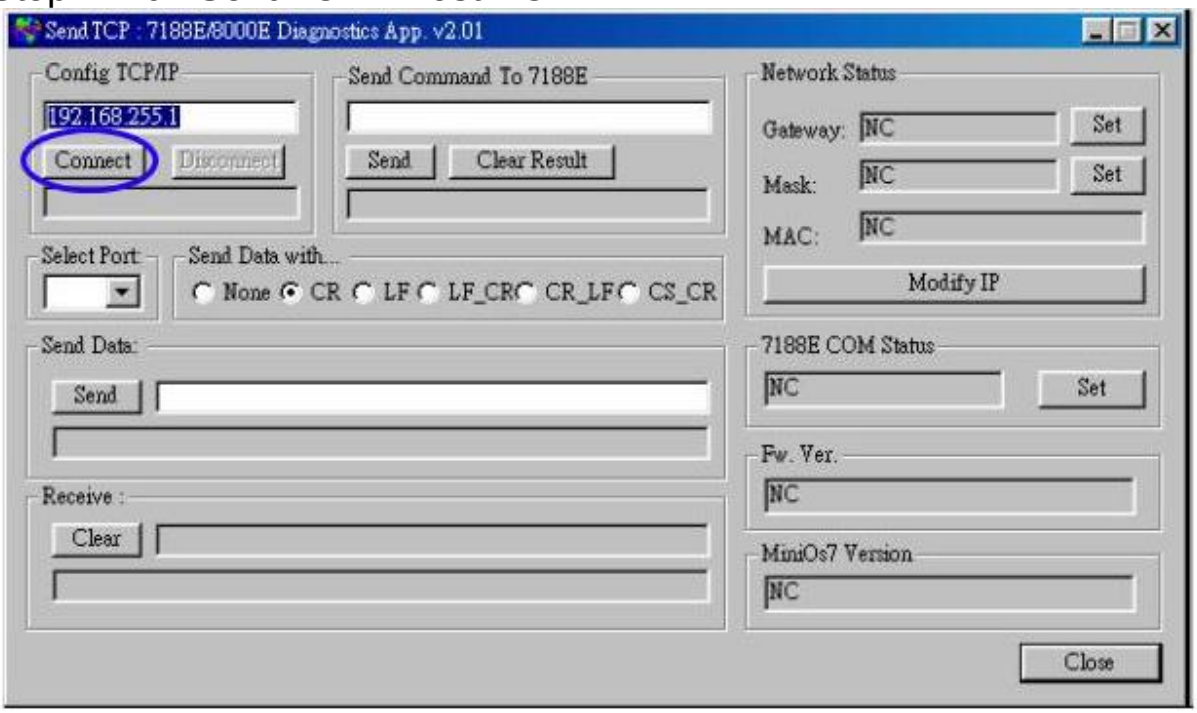


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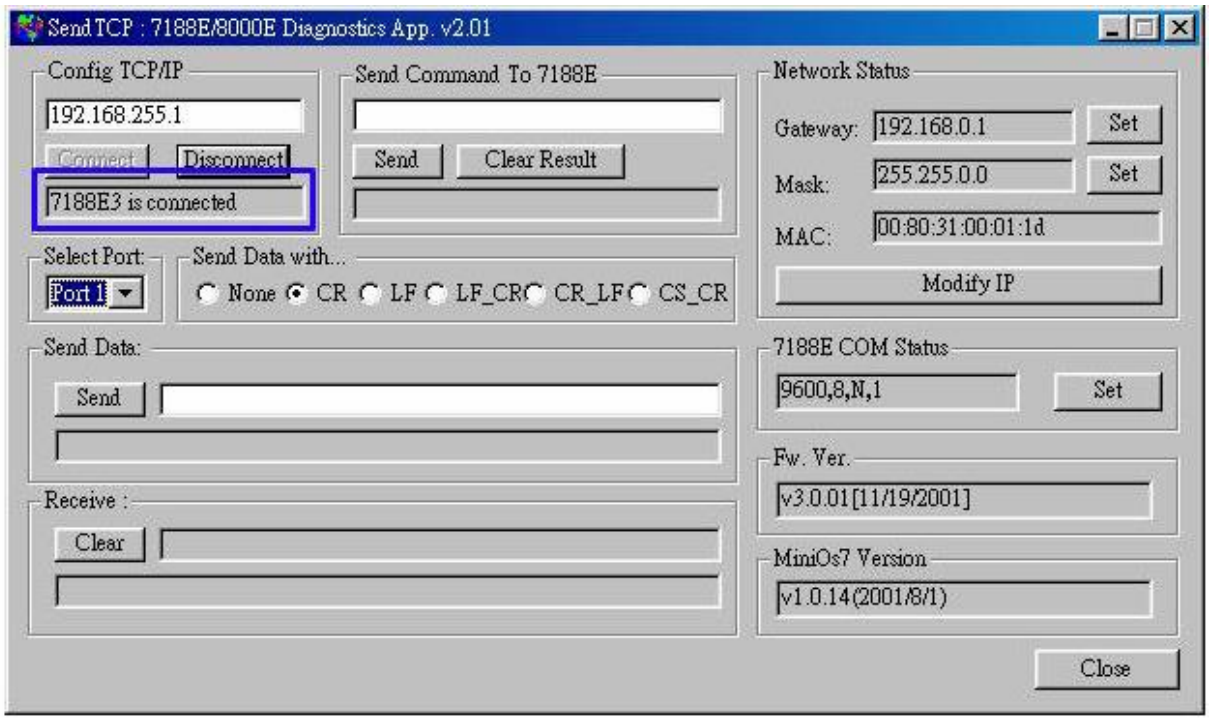
- SendTCP:

SendTCP uses TCP protocol to communicate with the 7188E/8000E/7540D/I-7540D(M)-MTCP and other devices from Ethernet.

Step 1: Run SendTCP in host-PC.

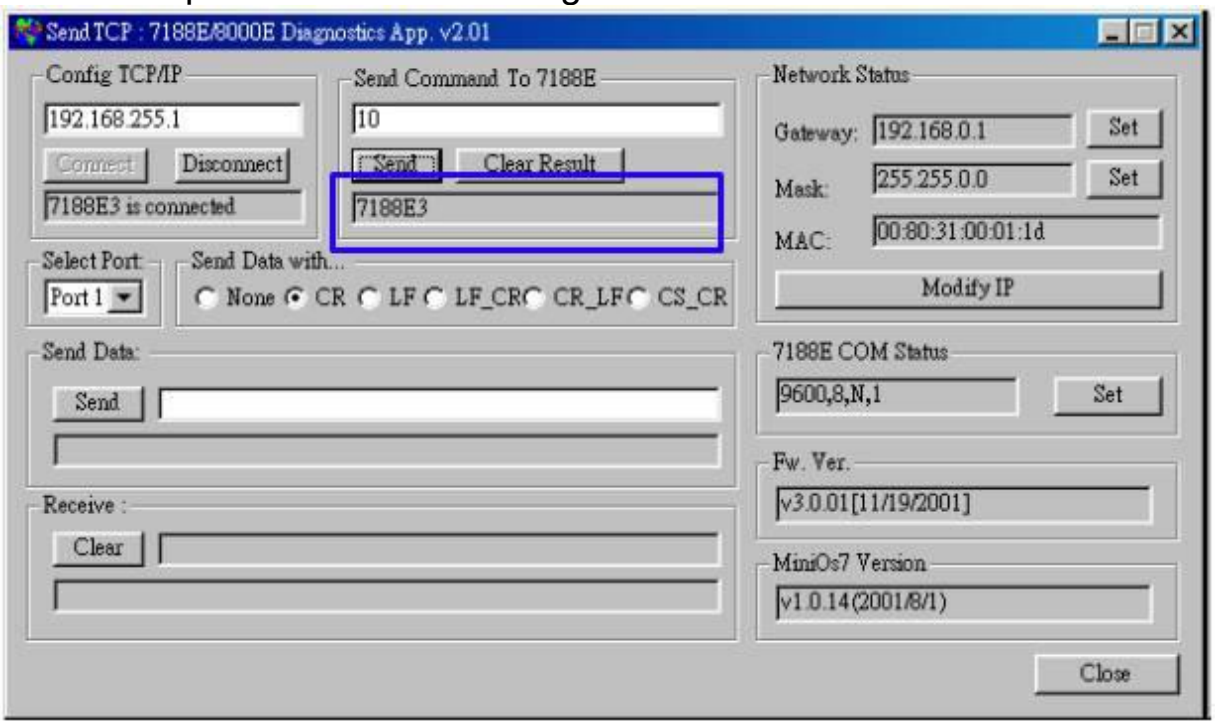


Step 2: Input the IP of I-7540D(M)-MTCP and press the "**Connect**" button to connect with I-7540D(M)-MTCP. And then it will display "7188E3 is connected".

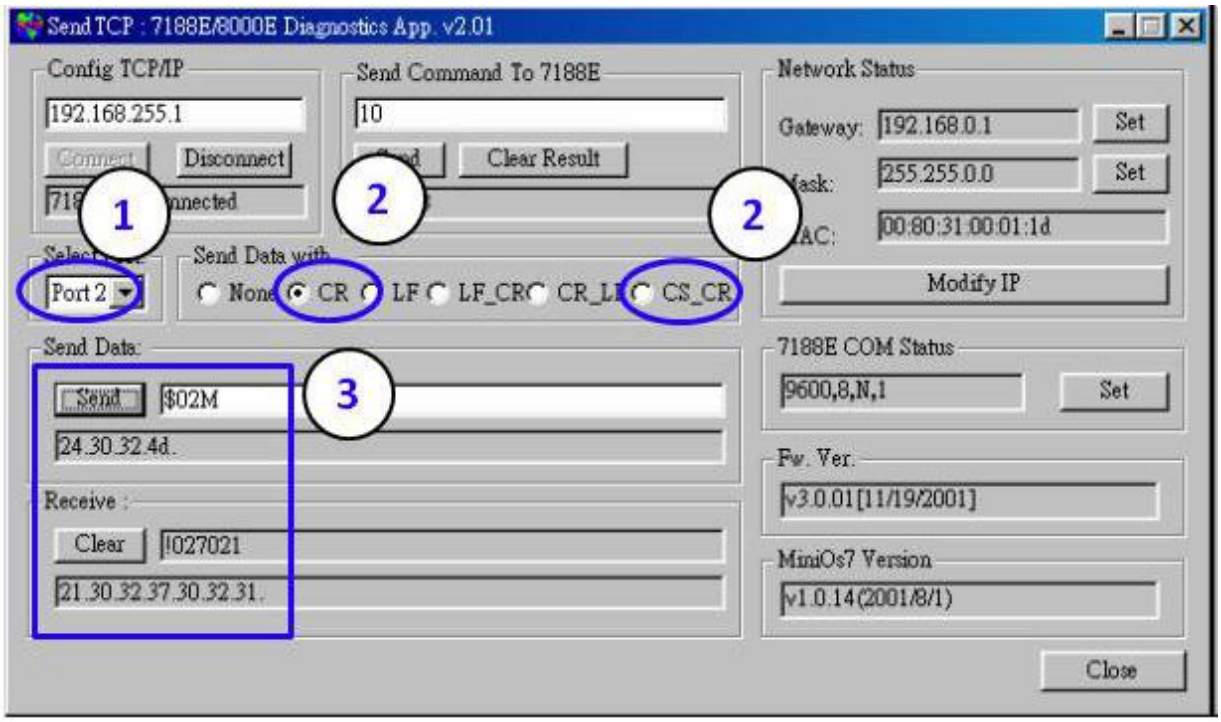


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Step 3: Send command “10” to the I-7540D(M)-MTCP. And it will response “7188E3 message.

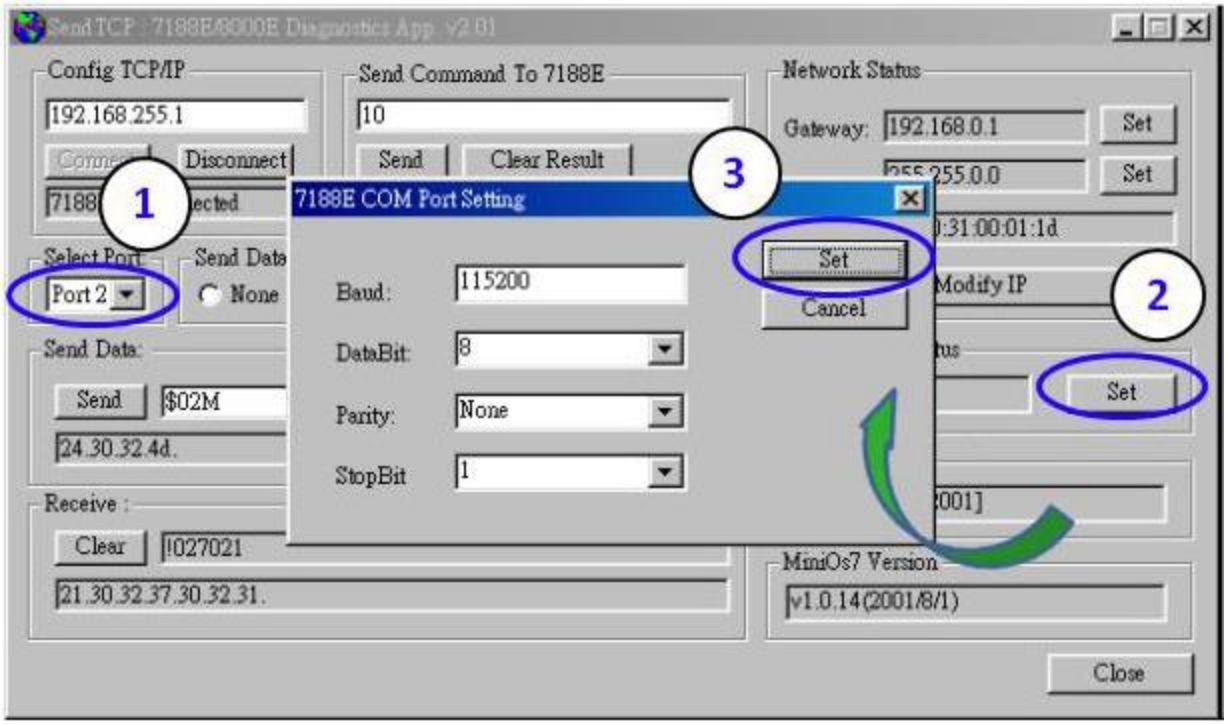


Step 4: Select “**Port 2**” and “**CR**”. Then send “**$02M**” to read 7000 module’s ID which is connected to I-7540D(M)-MTCP’s COM2. If you enable 7000 module’s checksum function, select “**CS_CR**”. The “**CS_CR**” option will add two checksum bytes, then adds “**CR”**.



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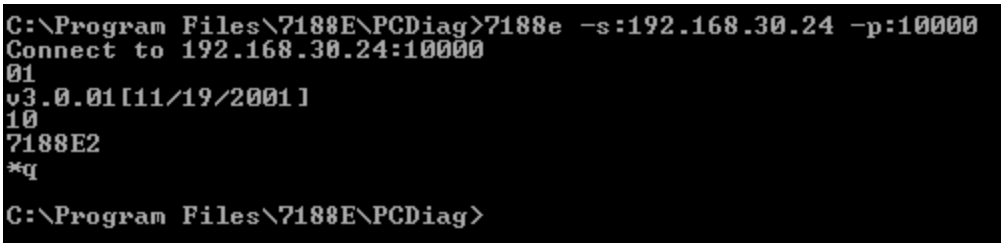
Step 5: If you want to change the 7540D(M)-MTCP's COM ports settings, click "**Set**" to change them. The 7540D(M)-MTCP's COM port that you want to configure is specified by "**Select Port**" combo list. Port 2 means you want to configure the 7188E's COM2.



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- 7188E:
  Command-prompt mode program, used to send data to specific machines using TCP protocol.

  Usage:
  7188e [-S:IP] [-P:Port]: Connect to a device by using TCP protocol.
  ***Q**: Quit program and disconnect.



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4. Support Command List

For easy application, we provide 4 command strings to allow users to send specific commands from I-7540D(M)-MTCP's Ethernet port10003 to CAN bus. And receiving response message form CAN bus. Also, we provide several commands for I-7540D(M)-MTCP's Ethernet port10000 to set and get the status of 7540D(M)-MTCP. It can cover most applications of different requests. The general formats of the I-7540D(M)-MTCP's commands are given below:

Port 10003 Command Format: <Command><CR>

<Command> : The commands of the I-7540D(M)-MTCP.

<CR> : All commands from this port must end with the character "<CR>" (The ASCII value is 13).

The 4 command formats are given in the following table. More detailed information related to the each command will be described in the following sub sections.

Table 4-1: Command list table (port 10003)

Command	Description
tIIILDD…<CR>	Send or receive a standard data frame.
TIIIL<CR>	Send or receive a standard remote frame.
eIIIIIIIILDD…<CR>	Send or receive an extended data frame.
EIIIIIIIIL<CR>	Send or receive an extended remote frame.

Note: The I-7540D(M)-MTCP's COM3 (CAN port) can only accept these 4 commands.

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Port 10000 Command Format: 99<Command>

99 : Specific command for getting or setting the status of the I-7540D(M)-MTCP

Table 4-2: Command list table (port 10000)

Command	Description
S	Read the status value of I-7540D
C	Clear CAN error flag and FIFO
RA	Reboot the I-7540D module.
#P01	Read the RS-232 configuration
#P02	Read the RS-485 configuration
#P1	Read the CAN configuration
#P1B	Read the BTR0 and BTR1 configuration
$P0105BBDSP	Change the RS-232 configuration
$P0205BBDSP	Change the RS-485 configuration
$P114PBCC…MM…ET	Change the CAN configuration
$P1B04TTRR	Change the BTR0 and BTR1 configuration
#PWID	Read Web ID configuration
#PWPW	Read Web Password configuration
$PWIDLLxxxxx…	Change Web ID configuration
$PWPWLLxxxxx…	Change Web Password configuration
#PPC	Read CAN Pair Connection configuration
#PPIP	Read CAN Pair Destination IP
$PPCLLABC	Change CAN Pair Connection configuration
$PPIPxxx…	Change CAN Pair Destination IP

Note:

1. More detailed information related to of the each command will be described in the following sub sections.
2. The #P1B and $P1B04TTRR commands just can be used on the firmware version v1.04 or later.
3. The #PWID, #PWPW, $PWIDLLxxxxx…, $PWPWLLxxxxx…, commands just can be used on the firmware version v1.05 or later.
4. The #PPC, #PPIP, $PPCLLABC, $PPIPxxx…commands just can be used on the firmware version v1.06 or later.

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4.1 tIIILDD…<CR>

Description: Send or receive a standard CAN data frame.

- **Syntax: tIIILDD…<CR>**

t	Represent a standard (2.0A) data frame.
III	11 bits Identifier (000~7FF)
L	Data length (0~8)
DD…	Input data frame value according to the data length (00~FF)

- **Response:** Valid command: No response
  Invalid command: ?<Error Code><CR>
- **Note:** It is necessary to enable the "Error Response" function in the I-7540D-MTCP Utility, in order to receive Syntax and/or communication error information at the host PC.

- **Example:**
  Command: t03F6112233445566<CR>
  Send a CAN message with a standard data frame. ID=03F, DLC=6, data1=11, data2=22, data3=33, data4=44, data5=55 and data6=66.

Note: This command can only be accepted by I-7540D(M)-MTCP's port 10003

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4.2 TIIIL<CR>

Description: Send or receive a standard CAN remote frame.

- **Syntax: TIIIL<CR>**

  T Represents a standard (2.0A) remote frame.
  III 11 bits Identifier (000~7FF)
  L Data length (0~8)

- **Response:** Valid command: No response
  Invalid command: ?<Error Code><CR>

- **Note:** It is necessary to enable the "Error Response" function in the I-7540D-MTCP Utility, in order to receive Syntax and/or communication error information at the host PC.

- **Example:**
  Command: T2E88<CR>
  Send a CAN message with a standard remote frame.
  ID=2E8, DLC=8.

Note: This command can only be accepted by I-7540D(M)-MTCP's port 10003

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4.3 eIIIIIIIILDD…<CR>

Description: Send or receive an extended CAN data frame.

- **Syntax: eIIIIIIIILDD…<CR>**

e	Stands for the extended (2.0B) data frame.
IIIIIIII	29 bits Identifier (00000000~1FFFFFFF)
L	Data length (0~8)
DD…	Input data frame value according to the data length (00~FF)

- **Response:**

  Valid command: No response

  Invalid command: ?<Error Code><CR>

- **Note:**

  It is necessary to enable the "Error Response" function in the I-7540D-MTCP Utility, in order to receive Syntax and/or communication error information at the host PC.

.

- **Example:**

  Command: e123456785112233445 5<CR>

  Send a CAN message with an extended data frame. ID=12345678, DLC=5, data1=11, data2=22, data3=33, data4=44 and data5=55.

Note: This command can only be accepted by I-7540D(M)-MTCP's port 10003

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4.4 EIIIIIIIIL<CR>

Description: Send or receive an extended CAN remote frame.

- **Syntax: EIIIIIIIIL<CR>**

E	Stands for the extended (2.0B) CAN remote frame.
IIIIIIII	29 bits Identifier (00000000~1FFFFFFF)
L	Data length (0~8)

- **Response:**

  Valid command: No response

  Invalid command: ?<Error Code><CR>

- **Note:**

  It is necessary to enable the “Error Response” function in the I-7540D Utility, in order to receive Syntax and/or communication error information at the host PC.

- **Example:**

  Command: E010156786<CR>

  Send a CAN message with an extended remote frame.

  ID=01015678, DLC=6.

Note: This command can only be accepted by I-7540D(M)-MTCP’s port 10003

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4.5 99S

Description: Read the I-7540D CAN Baud Rate and error flag message.

- **Syntax: 99S**

  99S Command character

- **Response:**

  Valid Command: !CFFTTRRO<CR>

  Invalid command: ?<Error Code><CR>

  ! Delimiter for valid command

  C current baud rate setting of CAN

  FF CAN status register

  TT CAN transmit error counter

  RR CAN receive error counter

  O CAN or RS-232/485/422 FIFO Overflow flag

- **Note:** Furthermore, all response results are shown in the ASCII format. Users need to make an ASCII to hex format transformation in order to understand what the meaning is based on the 4-2, 4-3, 4-4 tables

Table 4-3: CAN baud rate list

AsciiToHex(**C**)	Description
0	10K baud rate of CAN
1	20K baud rate of CAN
2	50K baud rate of CAN
3	100K baud rate of CAN
4	125K baud rate of CAN
5	250K baud rate of CAN
6	500K baud rate of CAN
7	800K baud rate of CAN
8	1000K baud rate of CAN
9	User defined

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Table 4-4: CAN status register list

AsciiToHex(**FF**)	Name	Value	Function
Bit 7 (MSB)	Bus Status	1	Bus-off; the SJA100 is not involved in bus activities
		0	Bus-on; the SJA1000 is involved in bus activities
Bit 6	Error Status	1	Error; at least one of the error counter has reached or exceeded the CPU warning limit
		0	Ok; both error counters are below the warning limit
Bit 5	Transmit Status	1	Transmit; the SJA1000 is transmitting a message
		0	Idle; no transmit message is in progress
Bit 4	Receive Status	1	Receive; the SJA1000 is receiving a message
		0	Idle; no receive message is in progress
Bit 3	Transmission Complete Status	1	Complete; the previously requested transmission is not yet completed
		0	Incomplete; the previously requested transmission is not yet complement
Bit2	Transmit Buffer Status	1	Released; the CPU may write a message into the transmit buffer
		0	Locked; a message is waiting for transmission or is already in process
Bit 1	Data Overrun Status	1	Overrun; a message was lost
		0	Absent; no data overrun has occurred
Bit 0 (LSB)	Receive Buffer Status	1	Full; one or more messages are available in the RXFIFO
		0	Empty; no message is available

Table 4-5: CAN Error flag list

AsciiToHex(O)	Description
Bit 3 =1	CAN Transmit Error
Bit 2 =1	CAN Receive Error
Bit 1 =1	CAN FIFO Overflow
Bit 0 =1	Initial CAN Chip Error

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- **Example:**

  Command: 99S

  Receive: !40C00000<CR>

  Obtain some current information on the I-7540D(M)-MTCP module. The response will show the following results: CAN baud rate=125K, CAN status register= transmission complete and transmit buffer is released, CAN transmit error counter=0, CAN receive error counter=0 and CAN FIFO = normal.

Note: This command can only be accepted by I-7540D(M)-MTCP's port 10000

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4.6 99C

Description: Clear the CAN error flag and FIFO on the module.

- **Syntax: 99C**

  99C Command character

- **Response:**
  Valid Command: No response.
  Invalid command: ERROR

- **Note:** After sending this command, the CAN receive and transmit FIFO will be clear. The error counter of reception and transmission will be set to zero. And the TX and RX LEDs will turn OFF.

- **Example:**
  Command: 99C

Note: This command can only be accepted by I-7540D(M)-MTCP's port 10000

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4.7 99RA

Description: Reboot the I-7540D(M)-MTCP module. Users can use this command to reboot the module in order to allow it to work in order again.

- **Syntax: 99RA**

  99RA Command character

- **Response:**

  Valid Command: Reboot the I-7540D(M)-MTCP module.

  Invalid command: ERROR

- **Example:**

  Command: 99RA

  The I-7540D(M)-MTCP module will reboot after it had received this command.

Note: This command can only be accepted by I-7540D(M)-MTCP's port 10000

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4.8 99#P01

Description: Read the RS-232 configuration

- **Syntax: 99#P01**

  99#P01 Command character

- **Response:**

  Valid Command: 061BBDSP

  Invalid command: ERROR

  061 Delimiter for valid command

  BB RS-232 Baud rate

  D Data bit

  0 = 7 bits data formation

  1 = 8 bits data formation

  S Stop bit

  0 = 1 stop bit

  1 = 2 stop bits

  P Parity bits

  0 = None

  1 = Even

  2 = Odd

  RS-232 Baud rate list

BB	Description
00	110 bps baud rate of RS-232
01	150 bps baud rate of RS-232
02	300 bps baud rate of RS-232
03	600 bps baud rate of RS-232
04	1200 bps baud rate of RS-232
05	2400 bps baud rate of RS-232
06	4800 bps baud rate of RS-232
07	9600 bps baud rate of RS-232
08	19200 bps baud rate of RS-232
09	38400 bps baud rate of RS-232
0A	57600 bps baud rate of RS-232
0B	115200 bps baud rate of RS-232

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- **Example:**

  Command: 99#P01
  Response: 0610B100
  The response will show the following results: RS-232 baud rate=115.2K bps, data bits=8, stop bits=1, none parity.

Note: This command can only be accepted by I-7540D(M)-MTCP's port 10000

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4.9 99#P02

Description: Read the RS-485 configuration.

- **Syntax: 99#P02**

  99#P02 Command character

- **Response:**

  Valid Command: 062BBDSP
  Invalid command: ERROR

  062 Delimiter for valid command
  BB RS-485 Baud rate
  D Data bit
  0 = 7 bits data formation
  1 = 8 bits data formation
  S Stop bit
  0 = 1 stop bit
  1 = 2 stop bits
  P Parity bits
  0 = None
  1 = Even
  2 = Odd

RS-485 Baud rate list

BB	Description
00	110 bps baud rate of RS-485
01	150 bps baud rate of RS-485
02	300 bps baud rate of RS-485
03	600 bps baud rate of RS-485
04	1200 bps baud rate of RS-485
05	2400 bps baud rate of RS-485
06	4800 bps baud rate of RS-485
07	9600 bps baud rate of RS-485
08	19200 bps baud rate of RS-485
09	38400 bps baud rate of RS-485
0A	57600 bps baud rate of RS-485
0B	115200 bps baud rate of RS-485

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- **Example:**
  Command: 99#P02
  Response: 06207111
  The response will show the following results: RS-485 baud rate=9600 bps, data bits=8, stop bits=2, even parity.

Note: This command can only be accepted by I-7540D(M)-MTCP's port 10000

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4.10 99#P1

Description: Read the CAN configuration.

- **Syntax: 99#P1**

99#P1	Command character

- **Response:**

Valid Command: 14PBCCCCCCCCMMMMMMMMET
Invalid command: ERROR

14	Delimiter for valid command
P	CAN specification 0 = 2.0A 1 = 2.0B
B	CAN Baud rate
CCCCCCCC	32 bits Acceptance Code Register (00000000~FFFFFFFF)
MMMMMMMM	32 bits Acceptance Mask Register (00000000~FFFFFFFF)
E	Error response or not 0 = Disable 1 = Enable
T	Timestamp response or not 0 = Disable 1 = Enable

CAN Baud rate list

B	Description
0	10K baud rate of CAN
1	20K baud rate of CAN
2	50K baud rate of CAN
3	100K baud rate of CAN
4	125K baud rate of CAN
5	250K baud rate of CAN
6	500K baud rate of CAN
7	800K baud rate of CAN
8	1000K baud rate of CAN
9	User Defined

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- **Example:**
  Command: 99#P1
  Response: 140400000000FFFFFFFF00
  The response will show the following results: CAN specification=2.0A, CAB baud rate=125Kbps, acceptance code register=00000000, acceptance mask register=FFFFFFFF, disable error response, disable timestamp.

Note: This command can only be accepted by I-7540D(M)-MTCP's port 10000

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99#P1B

Description: Read the CAN Bus Timing Register

- **Syntax: 99#P1B**

  99#P1B Command character

- **Response:**

  Valid Command: 06PBTTRR

  Invalid command: ERROR

  06 Delimiter for valid command
  P CAN specification
  0 = 2.0A
  1 = 2.0B
  B CAN Baud rate
  TT CAN Bus Timing Register 1 (00~FF)
  RR CAN Bus Timing Register 1 (00~FF)

CAN Baud rate list

B	Description
0	10K baud rate of CAN
1	20K baud rate of CAN
2	50K baud rate of CAN
3	100K baud rate of CAN
4	125K baud rate of CAN
5	250K baud rate of CAN
6	500K baud rate of CAN
7	800K baud rate of CAN
8	10K baud rate of CAN
9	User defined

- **Example:**

  Command: 99#P1B
  Response: 06090014
  The response will show the following results: CAN specification = 2.0A, CAN baud rate = User defined, BTR0=00, BTR1=14.

Note: This command can only be accepted by I-7540D(M)-MTCP's port 10000

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4.11 99$P0105BBDSP

Description: Change the RS-232 configuration of the I-7540D(M)-MTCP.

- **Syntax: 99#P0105BBDSP**

99#P0105 Command character
BB RS-232 Baud rate
D Data bit
0 = 7 bits data formation
1 = 8 bits data formation
S Stop bit
0 = 1 stop bit
1 = 2 stop bits
P Parity bits
0 = None
1 = Even
2 = Odd

RS-232 Baud rate list

BB	Description
00	110 bps baud rate of RS-232
01	150 bps baud rate of RS-232
02	300 bps baud rate of RS-232
03	600 bps baud rate of RS-232
04	1200 bps baud rate of RS-232
05	2400 bps baud rate of RS-232
06	4800 bps baud rate of RS-232
07	9600 bps baud rate of RS-232
08	19200 bps baud rate of RS-232
09	38400 bps baud rate of RS-232
0A	57600 bps baud rate of RS-232
0B	115200 bps baud rate of RS-232

- **Response:**

Valid Command: OK
Invalid command: ERROR

- **Example:**

Command: 99#P01050B100
Response: OK
Set the setting of RS-232 baud rate= 115.2Kbps, data bits=8, stop

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bit=1, none parity bit into the I-7540D(M)-MTCP and the I-7540D(M)-MTCP response “OK” command to mean that the configuration of RS-232 has been changed.

Note: This command can only be accepted by I-7540D(M)-MTCP’s port 10000

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4.12 99$P0205BBDSP

Description: Change the RS-485 configuration of the I-7540D(M)-MTCP.

- **Syntax: 99#P0205BBDSP**

99#P0205 Command character
BB RS-485 Baud rate
D Data bit
0 = 7 bits data formation
1 = 8 bits data formation
S Stop bit
0 = 1 stop bit
1 = 2 stop bits
P Parity bits
0 = None
1 = Even
2 = Odd

RS-485 Baud rate list

BB	Description
00	110 bps baud rate of RS-485
01	150 bps baud rate of RS-485
02	300 bps baud rate of RS-485
03	600 bps baud rate of RS-485
04	1200 bps baud rate of RS-485
05	2400 bps baud rate of RS-485
06	4800 bps baud rate of RS-485
07	9600 bps baud rate of RS-485
08	19200 bps baud rate of RS-485
09	38400 bps baud rate of RS-485
0A	57600 bps baud rate of RS-485
0B	115200 bps baud rate of RS-485

- **Response:**

Valid Command: OK
Invalid command: ERROR

- **Example:**

Command: 99#P02050B100
Response: OK
Set the setting of RS-485 baud rate= 115.2Kbps, data bits=8, stop

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bit=1, none parity bit into the I-7540D(M)-MTCP and the I-7540D(M)-MTCP response “OK” command to mean that the configuration of RS-485 has been changed.

Note: This command can only be accepted by I-7540D(M)-MTCP’s port 10000

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4.13 99$P114PBCC…MM…ET

Description: Change the CAN configuration of the I-7540D(M)-MTCP

- **Syntax: 99#P114PBCC…MM…ET**

99#P114	Command character
P	CAN specification 0 = 2.0A 1 = 2.0B
B	CAN Baud rate
CCCCCCCC	32 bits Acceptance Code Register (00000000~FFFFFFFF)
MMMMMMMM	32 bits Acceptance Mask Register (00000000~FFFFFFFF)
E	Error response or not 0 = Disable 1 = Enable
T	Timestamp response or not 0 = Disable 1 = Enable

CAN Baud rate list

B	Description
0	10K baud rate of CAN
1	20K baud rate of CAN
2	50K baud rate of CAN
3	100K baud rate of CAN
4	125K baud rate of CAN
5	250K baud rate of CAN
6	500K baud rate of CAN
7	800K baud rate of CAN
8	10K baud rate of CAN
9	User defined

- **Response:**

  Valid Command: OK
  Invalid command: ERROR

- **Example:**

  Command: 99#P1140400000000FFFFFFFF00
  Response: OK

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Set the setting of CAN specification=2.0A, CAN baud rate= 125 Kbps, acceptance code=00000000, acceptance mask=FFFFFFFF, disable error response, disable timestamp response into the I-7540D and the 7540D response “OK” command to mean that the configuration of CAN has been changed.

Note: This command can only be accepted by I-7540D(M)-MTCP’s port 10000

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4.14 99$P1B04TTRR

Description: Change the CAN Bus Timing Register of the I-7540D(M)-MTCP

- **Syntax: 99#P1B04TTRR**

99#P1B04	Command character
TT	Bus Timing Register 0 (00~FF)
RR	Bus Timing Register 1 (00~FF)

- **Response:**

  Valid Command: OK
  Invalid command: ERROR

Note:

1. **This command can only be accepted by I-7540D(M)-MTCP's port 10000**
2. **Users need to have the background of SJA1000 CAN controller and 82C251 CAN transceiver, and calculate the values of BT0 and BT1 by themselves (The clock frequency of CAN controller is 16MHz.).**

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4.15 99#PWID

Description: Read the Wed ID configuration

- **Syntax: 99#PWID**

  99#PWID Command character

- **Response:**

  Valid Command: LLxxxxx…
  Invalid command: ERROR

  LL Web ID Length, in hexadecimal format.
  xxxxx… Web ID saved in the EEPROM, the default Web ID setting is “I7540D”

- **Example:**

  Command: 99#PWID
  Response: 057540D
  Read the Web ID setting of the I-7540D(M)-MTCP, and the I-7540D(M)-MTCP responses the Web ID setting is “7540D”.

Note: This command can only be accepted by I-7540D(M)-MTCP’s port 10000.

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4.16 99#PWPW

Description: Read the Wed Password configuration

- **Syntax: 99#PWPW**

  99#PWPW Command character

- **Response:**

  Valid Command: LLxxxxx…
  Invalid command: ERROR

  LL Web ID Length, in hexadecimal format.
  xxxxx… Web ID saved in the EEPROM, the default Web ID setting is “I7540D”

- **Example:**

  Command: 99#PWPW
  Response: 0Bicpdas7540D
  Read the Web password setting of the I-7540D(M)-MTCP, and the I-7540D(M)-MTCP responses the Web password setting is “icpdas7540D”.

Note: This command can only be accepted by I-7540D(M)-MTCP’s port 10000.

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4.17 99$PWIDLLxxxxx…

Description: Change the Wed ID configuration.

- **Syntax: 99#PWIDLLxxxxx…**

99#PWID	Command character
LL	Web ID data Length, in hexadecimal format.
xxxxx…	Web ID data, at most 30 ASCII characters.

- **Response:**

  Valid Command: OK
  Invalid command: ERROR

- **Example:**

  Command: 99#PWID047540
  Response: OK
  Change the Web ID data setting of the I-7540D(M)-MTCP to "7540" and the I-7540D(M)-MTCP responses "OK" command to mean that the configuration of Web ID data has been changed.

Note: This command can only be accepted by I-7540D(M)-MTCP's port 10000.

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4.18 99$PWPWLLxxxxx…

Description: Change the Wed password configuration.

- **Syntax: 99#P02**

99#PWPW	Command character
LL	Web password data Length, in hexadecimal format.
xxxxx…	Web password data that you want to configure. At most 30 ASCII characters.

- **Response:**

  Valid Command: OK
  Invalid command: ERROR

- **Example:**

  Command: 99#PWPW0512345
  Response: OK
  Change the Web password data setting of the I-7540D(M)-MTCP to “12345” and the I-7540D(M)-MTCP responses “OK” command to mean that the configuration of Web ID data has been changed.
  .

Note: This command can only be accepted by I-7540D(M)-MTCP’s port 10000.

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4.19 99#PPC

Description: Read the CAN bus pair connection configuration. Here support three parameters, “enable can pair”, “TCP or UDP” and “Server or Client”

- **Syntax: 99#PPC**

  99#PPC Command character

- **Response:**

  Valid Command: LLABC
  Invalid command: ERROR

  LL number of parameters
  A Enable CAN bus pair connection flag,
  0: Disable, 1: Enable
  B Using TCP or UDP connection; 0: TCP, 1: UDP
  C Act as a server or client; 0: server, 1: client

- **Example:**

  Command: 99#PPC
  Response: 03100
  Read the CAN bus pair connection configuration of the I-7540D(M)-MTCP, and the I-7540D(M)-MTCP responses that enable can bus pair connection and act as a TCP server.

Note: This command can only be accepted by I-7540D(M)-MTCP’s port 10000.

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4.20 99#PPIP

Description: Read the destination IP of CAN bus pair connection.

- **Syntax: 99#PPIP**

  99#PPIP Command character

- **Response:**

  Valid Command: xxx.xxx.xxx.xxx
  Invalid command: ERROR

  xxx.xxx.xxx.xxx Destination IP Address.

- **Example:**

  Command: 99#PPIP
  Response: 192.168.255.2
  Read the CAN bus pair connection destination IP of the I-7540D(M)-MTCP, and the I-7540D(M)-MTCP responses that destination IP address is “192.168.255.2”.

Note: This command can only be accepted by I-7540D(M)-MTCP’s port 10000.

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4.21 99$PPCLLABC

Description: Change the CAN bus pair connection configuration. After setting successfully, all parameters will take effective after system restart.

- **Syntax: 99#PPCLLABC**

99#PPC	Command character
LL	number of parameters, here fix to “03”
A	Enable CAN bus pair connection flag, 0: Disable, 1: Enable
B	Using TCP or UDP connection; 0: TCP, 1: UDP
C	Act as a server or client; 0: server, 1: client

Note:

1. When **A**=0, **B** and **C** take no effective
2. When using UDP connection (**B**=1), **C** take no effective
3. When acting as a TCP client or using UDP method, users need to set the destination IP address (section 4.23), so that the I-7540D(M)-MTCP can work correctly.

- **Response:**

Valid Command: OK
Invalid command: ERROR

- **Example:**

Command: 99#PPC03101
Response: OK
Change the CAN bus pair connection configuration of the I-7540D(M)-MTCP to “enable CAN bus pair connection” and act as a TCP client.
.

Note: This command can only be accepted by I-7540D(M)-MTCP’s port 10000.

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4.22 99$PPIPxxx…

Description: Change the CAN bus pair connection destination IP address. After setting successfully, all parameters will take effective after system re-start

- **Syntax: 99#PPIPxxx…**

99#PPIP	Command character
xxx…	IP address, iii/ppp/III/PPP: 3 digits number

Note:

This IP address is effective when enable CAN bus pair connection and acting as TCP client or using UDP connection method.

- **Response:**

Valid Command: OK
Invalid command: ERROR

- **Example:**

Command: 99#PPIP192168255002
Response: OK
Change the CAN bus pair connection destination IP of the I-7540D(M)-MTCP.

Note: This command can only be accepted by I-7540D(M)-MTCP's port 10000.

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4.23 General Error code for commands from port 10003

Table 4-6: Error code table

AsciiToHex (Error code)	Description
1	The head character of the command string is invalid.
2	The length of the command string is invalid.
3	The value of CAN identifier is invalid.
4	The value of CAN data length is invalid.
5	Reserved

5. Modbus TCP Slave Mode

5.1 Supported Modbus Functions

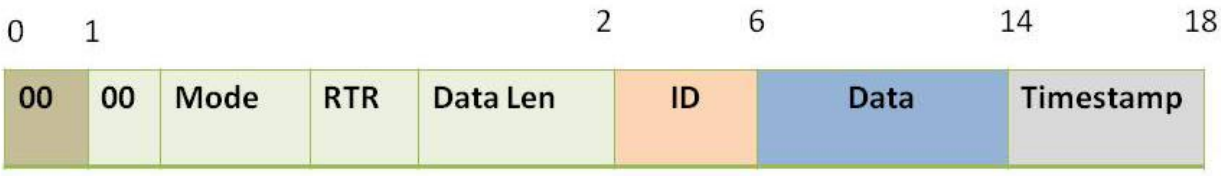
The Modbus function codes supported by the I-7540D(M)-MTCP are shown in the following table.

Table 5-1: Supported Modbus Function Codes

Function Code	Function Name	Description
3 (03 Hex)	Reading Output Register	Read multiple registers (4x) for a sent CAN messages
4 (04 Hex)	Reading Input Register	Read multiple input registers (3x) for reading CAN messages
16 (10 Hex)	Preset Multiple Registers	Write multiple registers (4x) for sending a CAN message

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5.2 Comparison table of CAN message to Modbus message



Byte 1: 00
Byte 2: bit 0~3: Data Length
bit 4: RTR
bit 5: Mode
bit 6~7: 0

Byte 3~6: CAN ID
Byte 7~14: Data
Byte 15~16: Timestamp

Figure 5-1: CAN message Format of I-7540D(M)-MTCP Modbus mode.

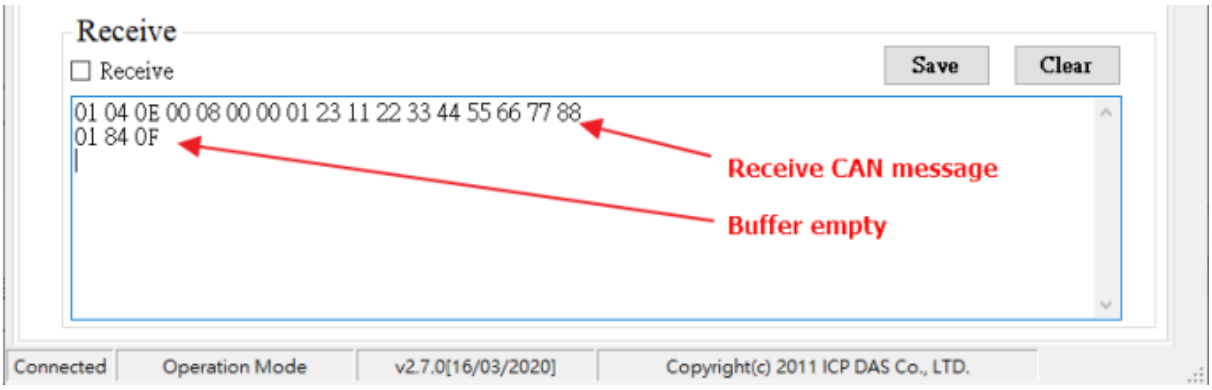


Figure 5-2: CAN message returned by I-7540D(M)-MTCP Modbus mode

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5.3 Modbus TCP Address

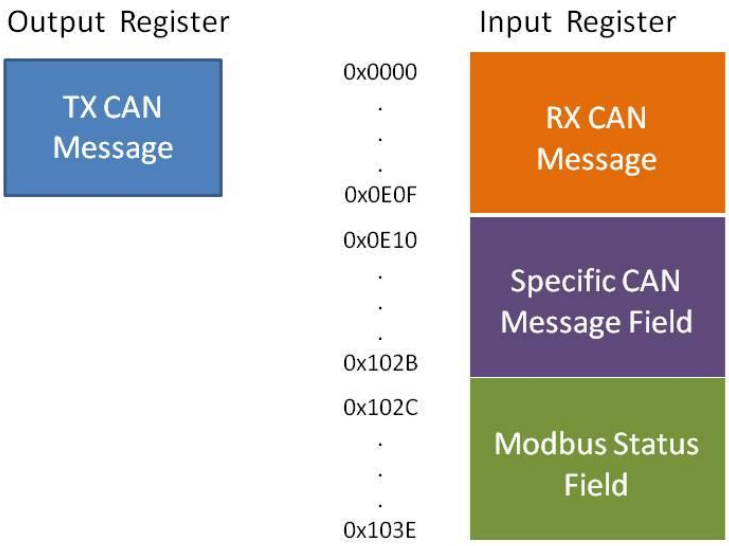


Figure 5-3: The address definition of Input Register and Output Register of the I-7540D(M)-MTCP.

5.3.1 Normal CAN Message Field:

The address range is 0x0000~0x0E0F, which is in the form of a Ring buffer.

A CAN message field will occupy the address space of 9 Words and can store up to 200 CAN messages. If more than 200 messages are exceeded, they will be overwritten.

When reading this field message, the Start Address of the Modbus command is always 0 (as shown in Figure 5-4). Each time I-7540D-MTCP is read, the following messages will be automatically moved forward.

The Modbus location arrangement details of the "Normal CAN message" field are described in Table 5-2.

Modbus Address	Word Count	Description
0x0000 ~ 0x0011	9	RX CAN Message #001
0x0012 ~ 0x0023	9	RX CAN Message #002
…	…	…
0x0DEC ~ 0x0DFD	9	RX CAN Message #199
0x0DFE ~ 0x0E0F	9	RX CAN Message #200

Table5-2: Modbus address arrangement of “Normal CAN Message” field.

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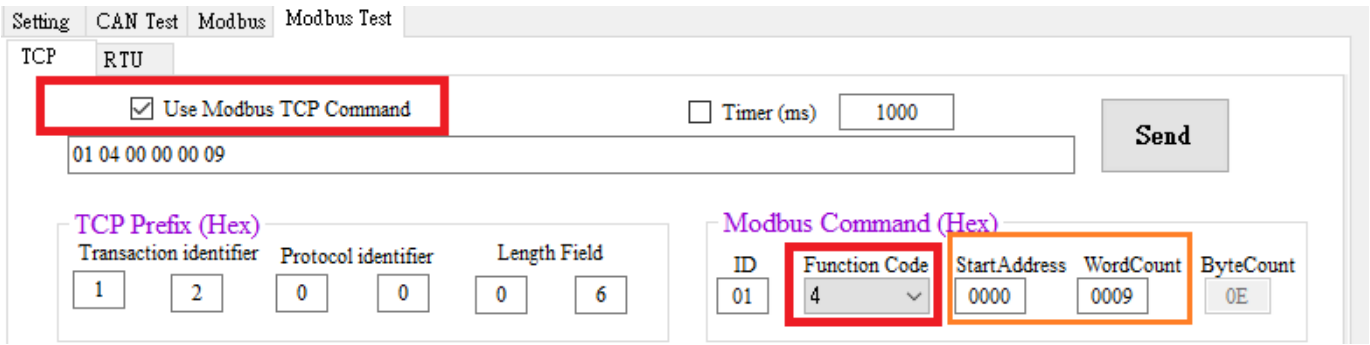
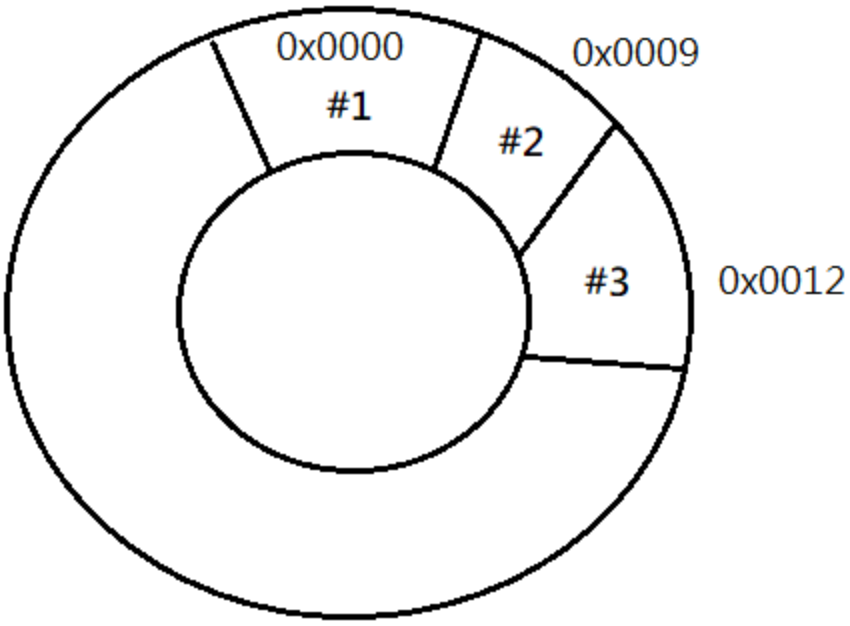
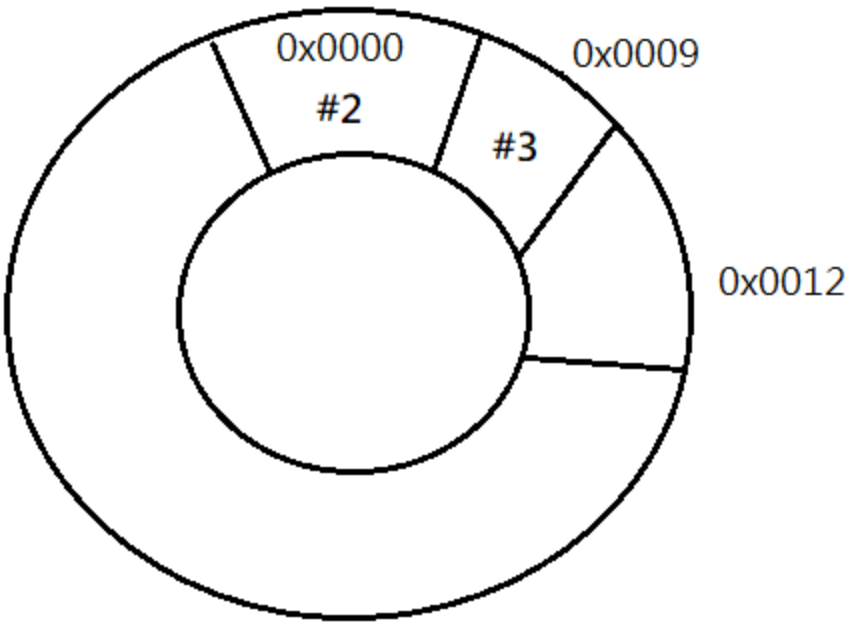


Figure 5-4: Use Utility to read standard CAN messages

Example 1:
I-7540D-MTCP receives CAN message #1 . CAN message #2 . CAN message #3 in sequence

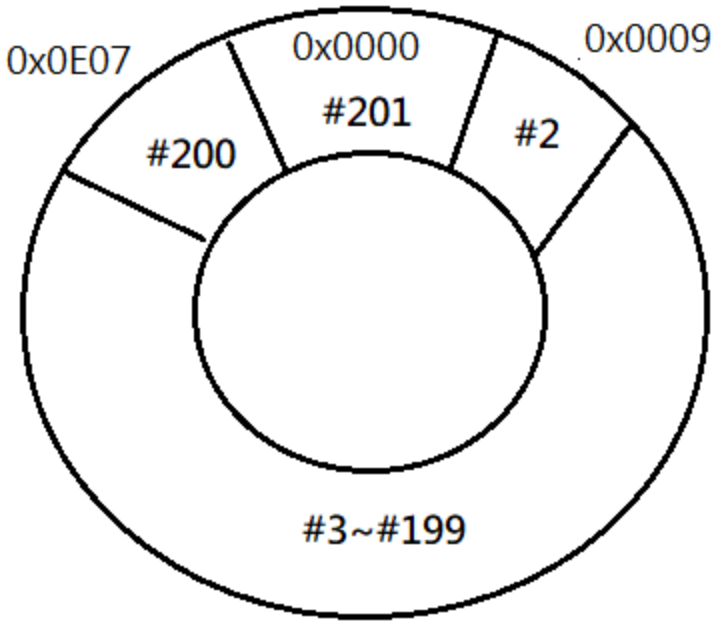


After the user reads a message (the read message is CAN message #1):

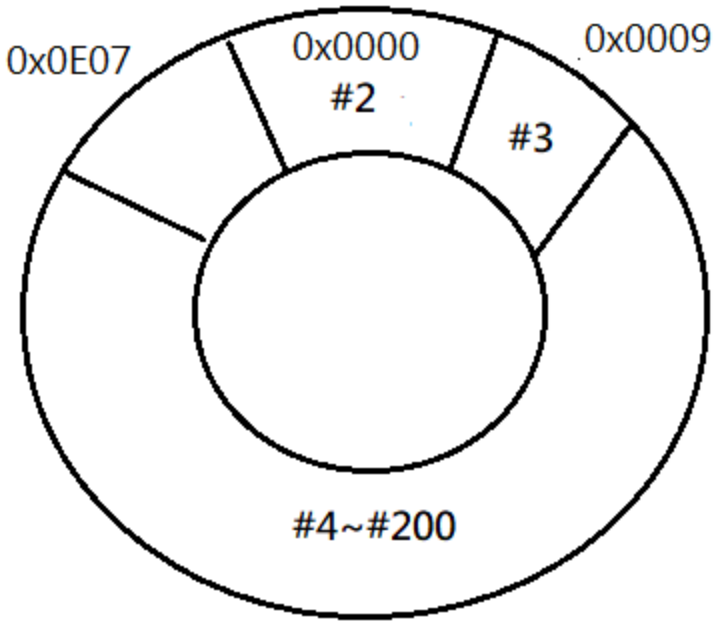


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Example 2:
I-7540D-MTCP receives CAN message #1. CAN message #2...CAN message #201 in sequence. If no message is read in the middle,



After the user reads a message (the read message is CAN message #201):



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5.3.2 Specific CAN Message Field:

Up to 30 CAN IDs can be stored. When the CAN message ID received by I-7540D(M)-MTCP is the set ID, I-7540D(M)-MTCP will put this CAN message into the corresponding CAN message field. scratchpad.

The information in this field will always be the latest information for this ID, and no old information records will be left.
Each CAN message will occupy 9 words of address space. The range of this field is listed in Table 5-3 below.

Before Firmware Version V2.7:

Modbus Address	Word Count	Description
0x0E10~0x0F21	9	Specific RX CAN Message #01
…	…	…
0x0FFF~0x1010	9	Specific RX CAN Message #29
0x101A~0x102B	9	Specific RX CAN Message #30

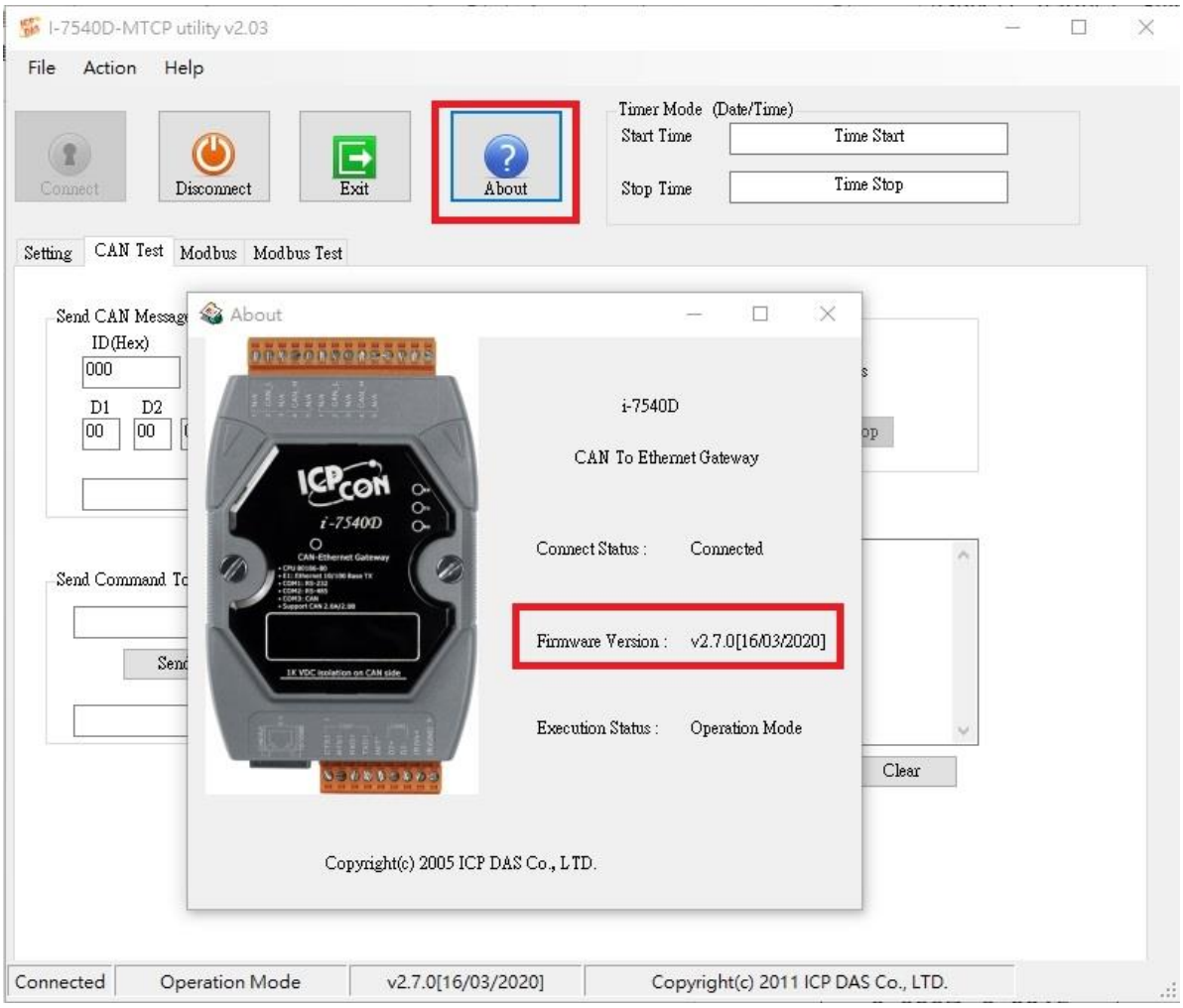
After Firmware Version V2.7:

Modbus Address	Word Count	Description
0x0708~0x0710	9	Specific RX CAN Message #01
…	…	…
0x0804~0x080C	9	Specific RX CAN Message #29
0x080D~0x0815	9	Specific RX CAN Message #30

Table5-3: Modbus address of “Specific CAN Message” field.

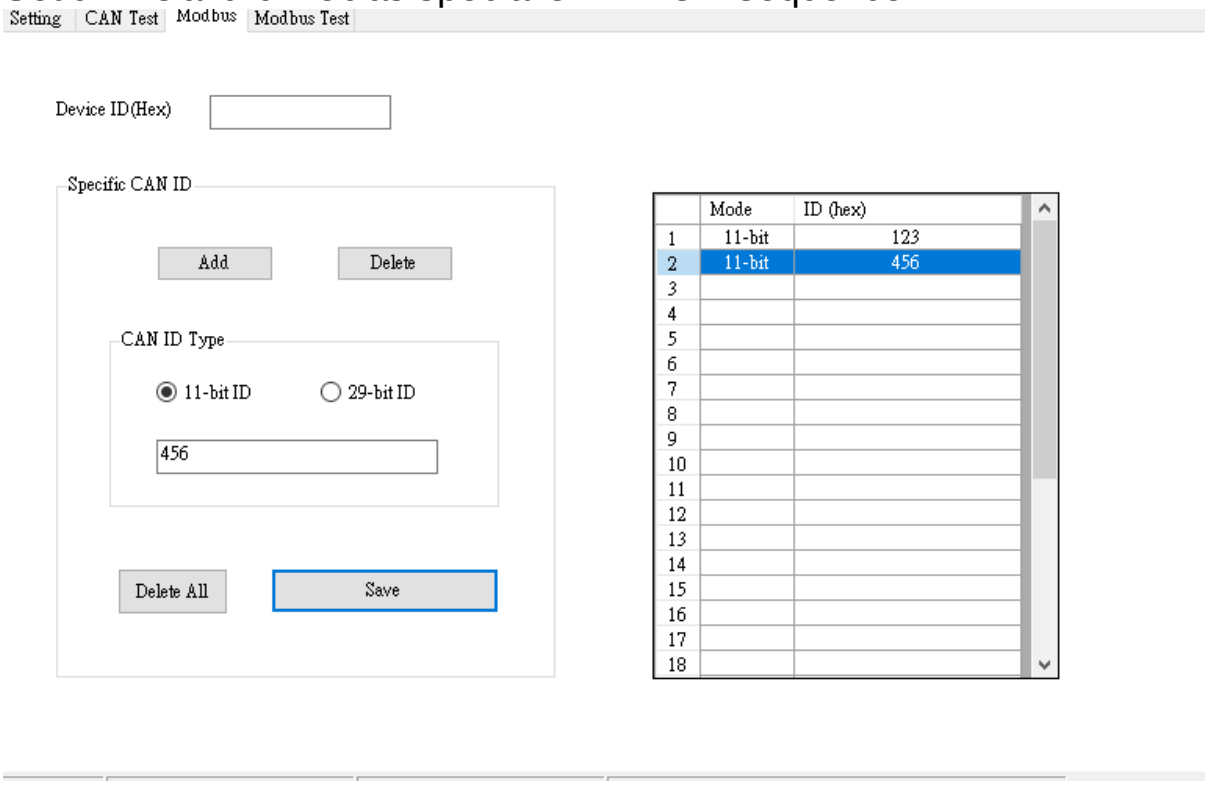
Remarks: The firmware version can be viewed after connecting to the Utility and clicking About, as shown in the figure below

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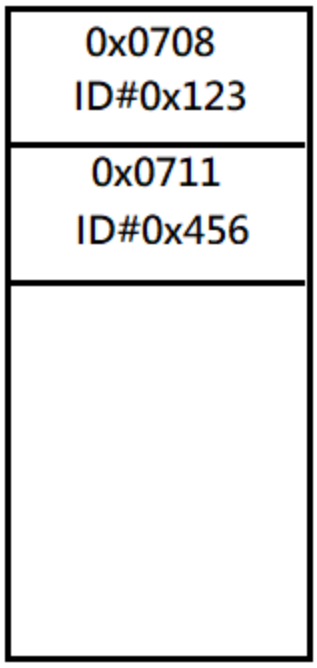
Example:

Set 0x123 and 0x456 as special CAN IDs in sequence

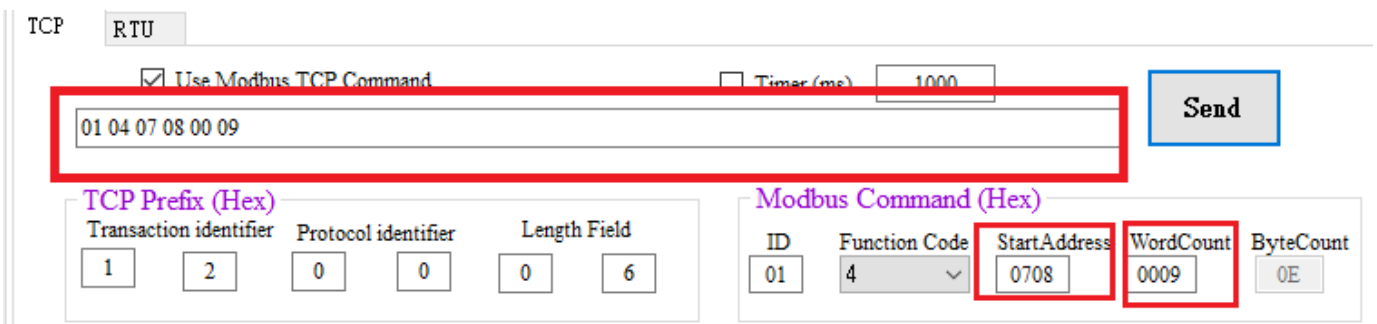


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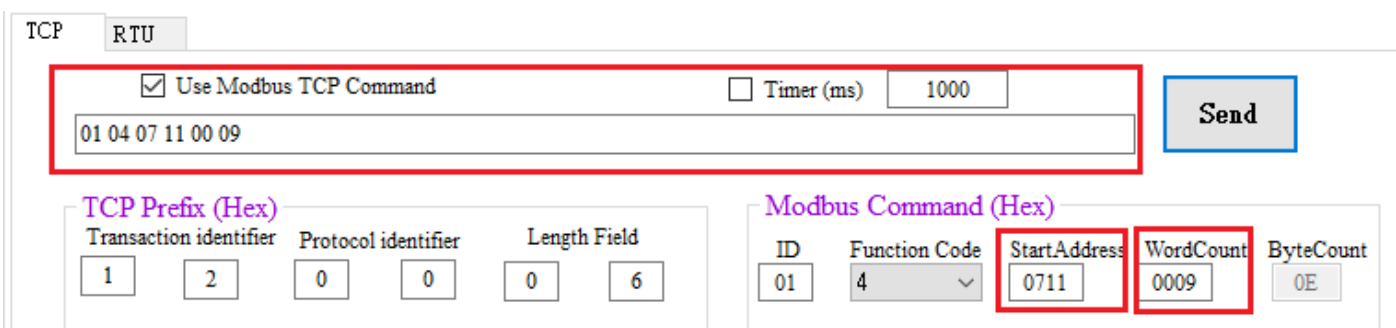
When I-7540D-MTCP receives the message with ID 0x123.0x456, it will store the message at the location of 0x0708. 0x0711



When reading the ID 0x123 message, you need to change the Start Address of the Modbus command to 0x0708



When reading the ID 0x456 message, you need to change the Start Address of the Modbus command to 0x0711



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5.3.3 Module Status Field:

The I-7540D(M)-MTCP's status information is defined in the following address. Users can use the Modbus RTU command (function code 04_{hex}) to read these information from the "Module Status" field.

Modbus Address	Byte Count	Description
0x102C	1	current baud rate setting of CAN
0x102D	1	CAN status register
0x102E	1	CAN transmit error counter
0x102F	1	CAN receive error counter
0x1030	1	CAN or RS-232/485/422 FIFO Overflow flag
0x1031~0x103E	13	No used

Table5-4: Modbus address of "Modbus Status" field.

Note: The meaning of the register values can refer to section 4.5.

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6.Modbus TCP Master

Compared to Chapter 5, this chapter will introduce the Modbus TCP master function of I-7540D(M)-MTCP. With this function, the I-7540D(M)-MTCP can act as a Modbus master (TCP Client). In the following sections, this chapter will provide detailed instructions on how to configure and operate this function.

6.1Supported Function Codes

The Modbus master function supports Modbus function codes: 0x01, 0x02, 0x03, 0x04, 0x05, 0x06, 0x0F, and 0x10. The following table provides a detailed description:

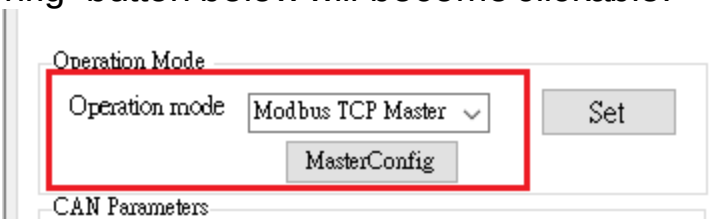
Table 6-1: Supported Modbus Function Codes

Modbus command	Function Code	Function Name	Description
Modbus **Read** command	1 (01 Hex)	Read Coil Status	Read Coil Status from slave device.
	2 (02 Hex)	Read Input Status	Read Input Status from slave device.
	3 (03 Hex)	Read AO Holding Registers	Read AO Holding Registers from slave device.
	4 (04 Hex)	Read AI Registers	Read AI Registers from slave device.
Modbus **Write** command	5 (05 Hex)	Write Single Coil	Write Single Coil from slave device.
	6 (06 Hex)	Write Signal Register	Write Single Register from slave device.
	15 (0F Hex)	Write Multiple Coil	Write Multiple Coil from slave device.
	16 (10 Hex)	Write Multiple Registers	Write Multiple Registers from slave device.

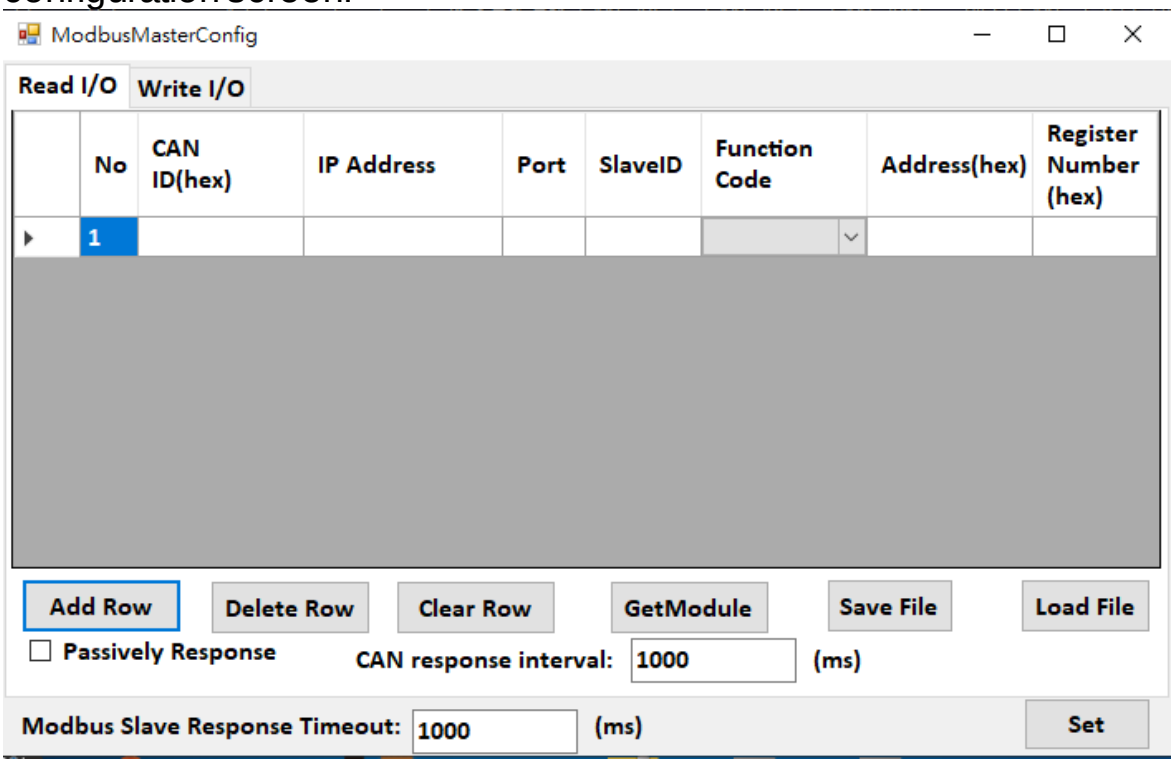
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6.2Configuration and Operation

When selecting "Modbus TCP Master" as the operation mode in the Utility, the "Master Config" button below will become clickable.



After clicking the "Master Config" button, you will enter the following configuration screen:



The functions of each button are as follows:

- "Add Row" button: Adds a new row to the configuration table.(Up to 20 rows can be added)
- "Delete Row" button: Deletes a selected row from the configuration table.
- "Clear Row" button: Clears all fields in the configuration table.
- "GetModule" button: Reads the current configuration values from the module.
- "Save File" button: Saves the configuration values displayed on the screen as a .ini file.
- "Load File" button: Loads the configuration values from a previously saved .ini file into the configuration table.
- "Set" button: Sends the configured values to the I-7540D(M)-MTCP module.

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The functions of each field are as follows:

- "CAN ID (hex)": Specifies the CAN message ID used to respond to Modbus IO data from the Modbus slave via the CAN bus. Please enter the value in hex format.

- "IP Address": Specifies the IP address of the Modbus TCP slave to connect to.

- "Port": Specifies the port number of the Modbus TCP slave to connect to.

- "Slave ID": Specifies the Modbus ID of the Modbus TCP slave. Please enter the value in hex format.

- "Function Code": Specifies the Modbus function code to use. See table 6-1 for details.

- "Address (hex)": Specifies the starting address of the register to read/write from/to the Modbus TCP slave. Please enter the value in hex format.

- "Register Number (hex)": Specifies the number of registers to read/write from/to the Modbus TCP slave. Please enter the value in hex format.

- "Modbus Slave Response Timeout": Specifies the timeout period for receiving a response from the Modbus TCP slave. The unit is milliseconds.(Minimum:400ms)

- "Passively Response" (only available for ReadI/O): If selected, the I-7540D(M)-MTCP's CAN port will not actively send the read IO message. The user must send an RTR message with the corresponding ID to receive the CAN message.

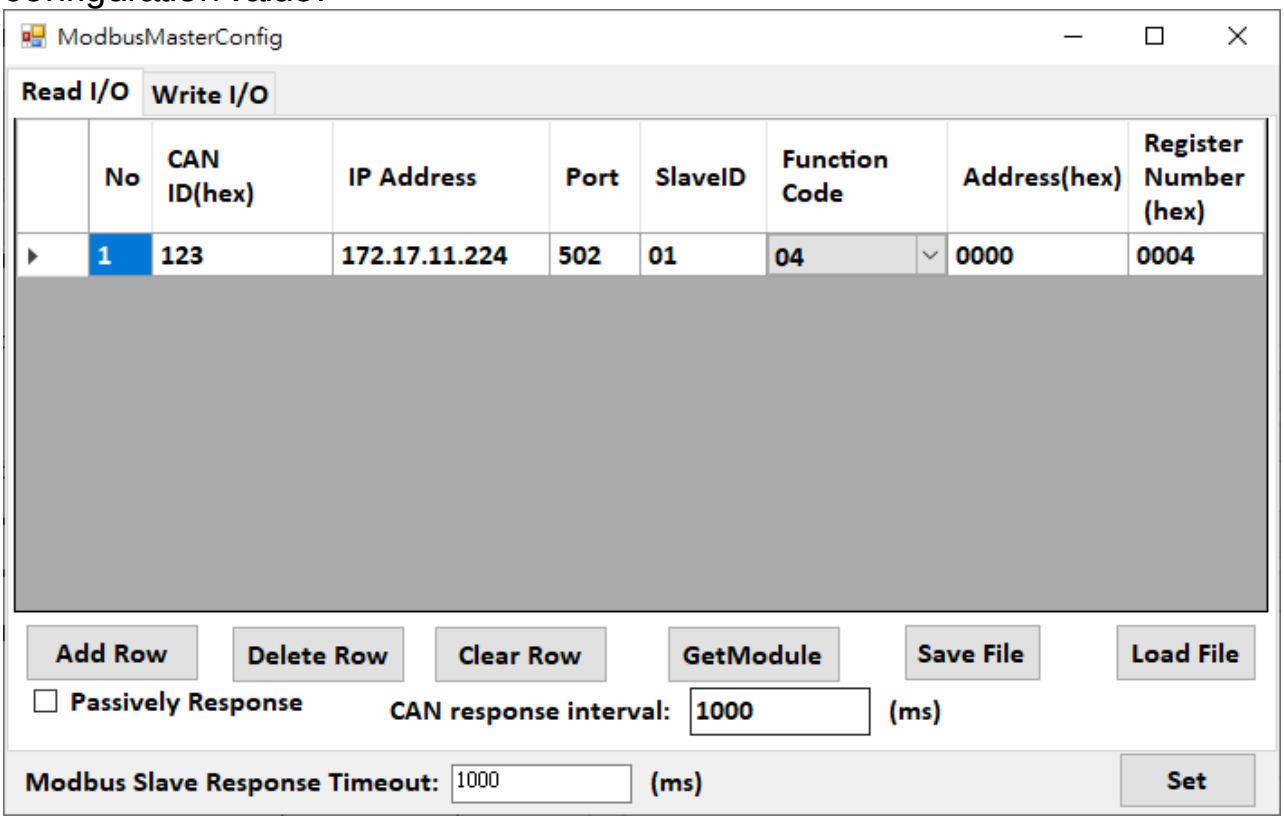
- "CAN Response interval" (only available for ReadI/O): Specifies the interval time for actively sending CAN messages. The unit is milliseconds. (This field needs to be set only when "Passively Response" is not selected.)

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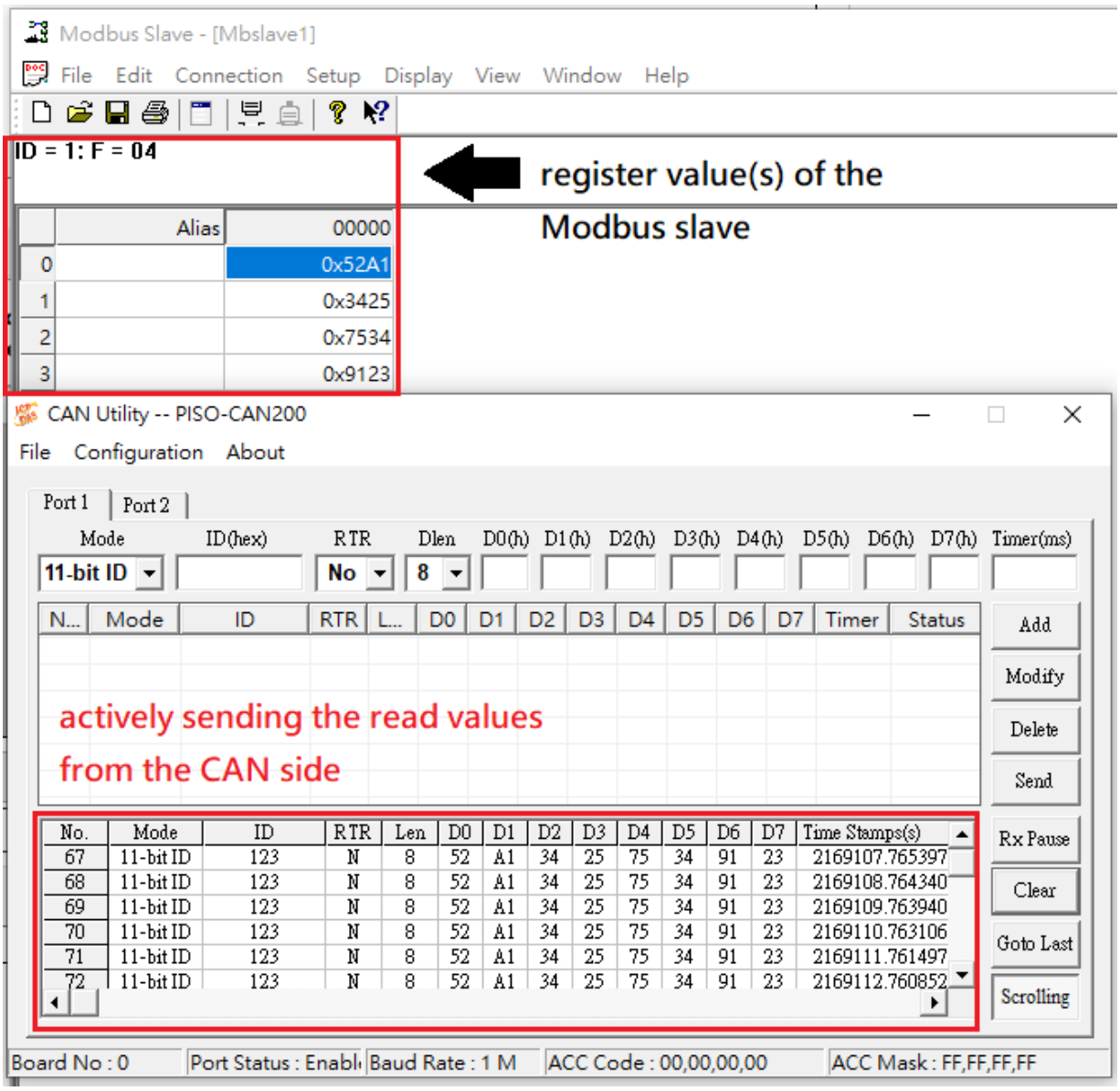
6.3Example

(1)Read I/O:

configuration value:

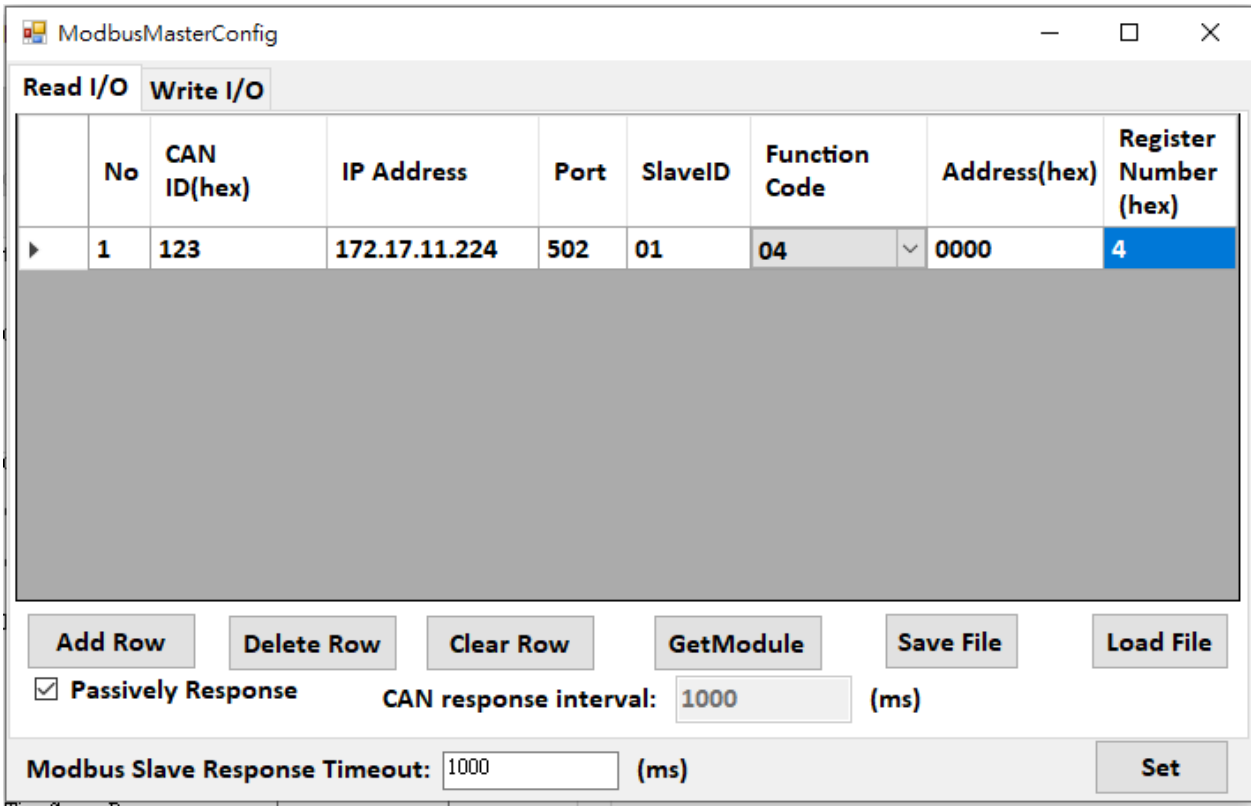


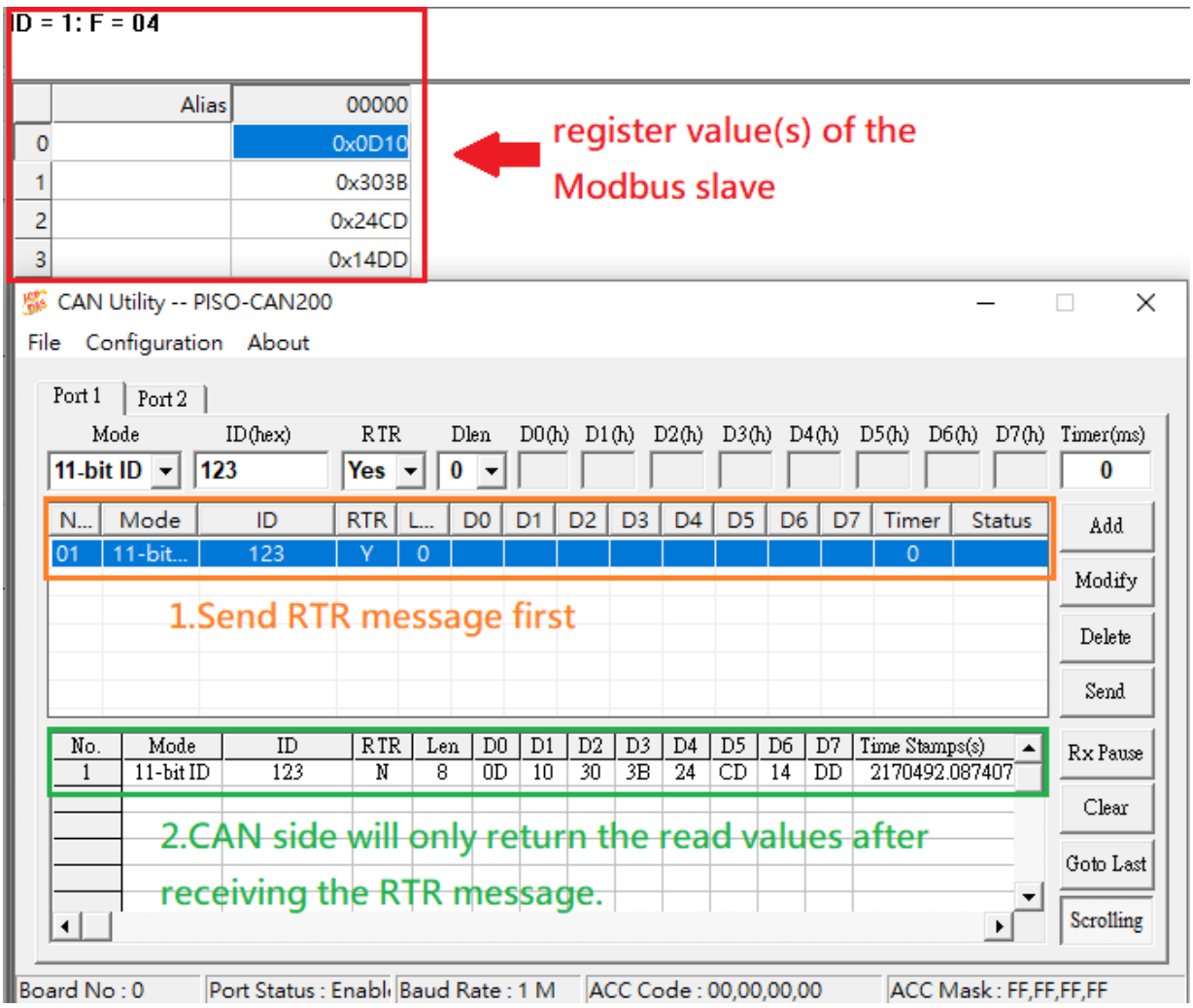
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(2)Read I/O + Passively Response:
configuration value:

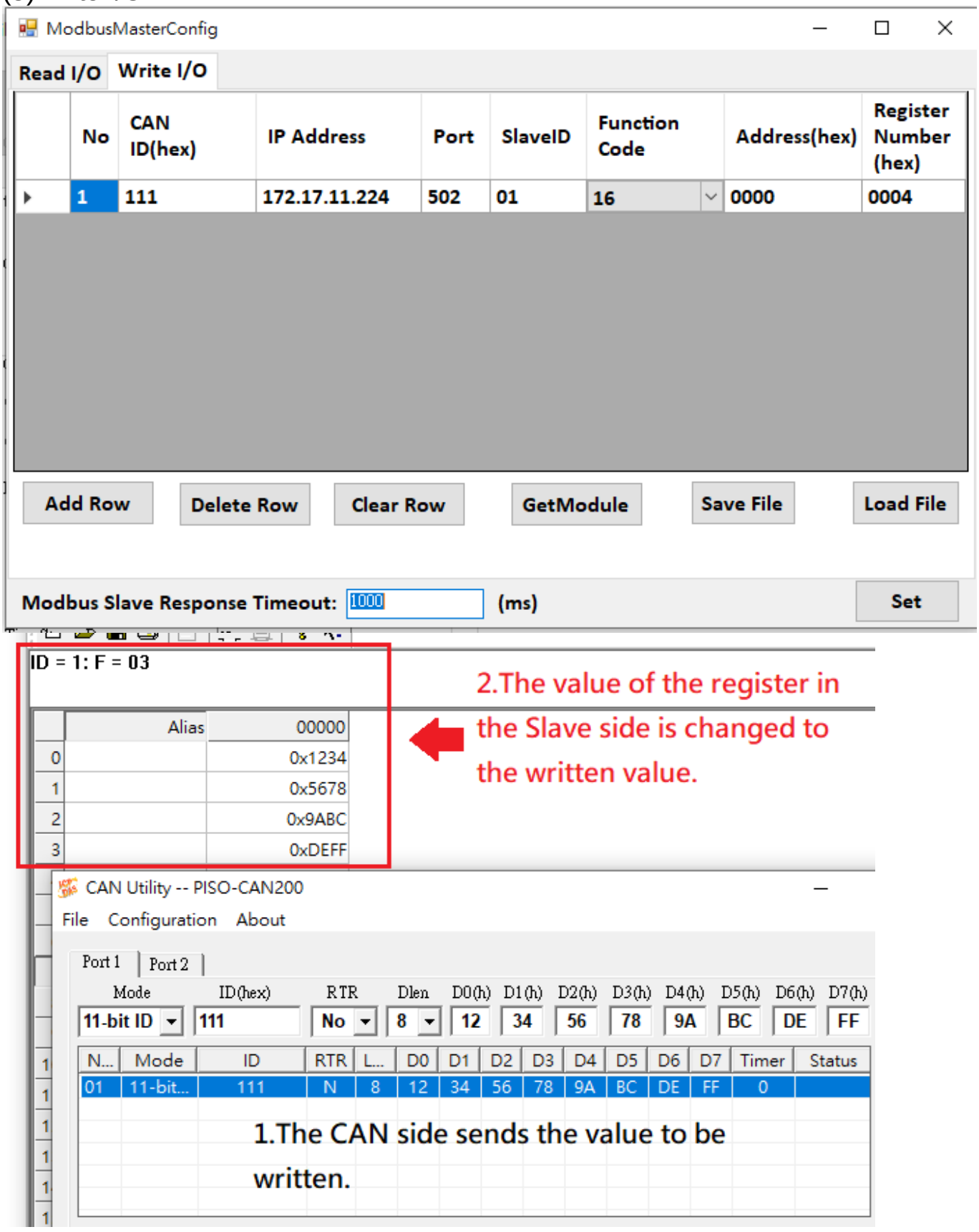
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(3)Write I/O:



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7.More example pictures

The following uses Modbus TCP as an example. The usage of Modbus commands for Modbus RTU and Modbus TCP are the same.

7.1Using Modbus TCP command to get a CAN Message

When the I-7540D(M)-MTCP is set to the Modbus TCP mode, each CAN message (except the CAN message whose CAN IDs are defined in the Specific CAN Message field) received from the CAN network will be stored into the “Normal CAN Message” field.

Users can use the Modbus TCP command (function code 04_{hex}) to read the CAN message from the “Normal CAN Message” field (refer to table 5-2). The start address of each command must be set to 0000_{hex} and the data length field must be 9 (with Timestamp) because one CAN message uses 9 address space. After reading the registers by the Modbus command, the content of the registers of the read CAN message is covered by the unread CAN message which will be read next.

Example:
Use Modbus TCP command (function code 04_{hex}) to read one CAN message:

Query Message	
Transaction ID	0102_{hex}
Protocol ID	0000_{hex}
Length Field	0006_{hex}
Device Address	01_{hex}
Function Code	04_{hex}
Start Address	0000_{hex}
Word Count	0007_{hex}

Query

Response

Response Message			
Device Address	01_{hex}	Data-3	0123_{hex}
Function Code	04_{hex}	Data-4	0102_{hex}
Byte Count	$0E_{hex}$	Data-5	0304_{hex}
Data-1	0008_{hex}	Data-6	0506_{hex}
Data-2	0000_{hex}	Data-7	0708_{hex}

Input Register (Normal CAN Message Field)					
Address (Hex)	Data (Hex)	Address (Hex)	Data (Hex)	Address (Hex)	Data (Hex)
0000	0008	0009	0008	0012	0008
0001	0000	000A	0000	0013	0000
0002	0123	000B	0123	0014	0133
0003	0102	000C	0102	0015	0506
0004	0304	000D	0102	0016	0102
0005	0506	000E	0102	0017	0102
0006	0708	000F	0708	0018	0708
0007	Timestamp	0010	Timestamp	0019	Timestamp
0008	Timestamp	0011	Timestamp	001A	Timestamp

Message #1 Message #2 Message #3

Figure 7-1: Use the Modbus TCP command to read one CAN message.

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7.2 Using Modbus TCP command to Send a CAN Message

If users need to send CAN messages via the Modbus TCP commands, users need to send the Modbus TCP command with the “TX CAN message“ format to the Output Register of the I-7540D(M)-MTCP. Then the I-7540D(M)-MTCP will transfer this command to a CAN message format and send it to the buffer of the CAN controller. The CAN controller will send the CAN message automatically which the CAN bus is idle.

Users can use Modbus TCP commands (function code 10_{hex}) to transmit a CAN message by writing the Output Register of the I-7540D(M)-MTCP . The start address of the Modbus TCP command is always 0000_{hex}, and the Word count and Byte count are always 07_{hex} and $0E_{hex}$ respectively.

Example:
Use the Modbus TCP command (function code 10_{hex}) to transmit a CAN message to the CAN network:

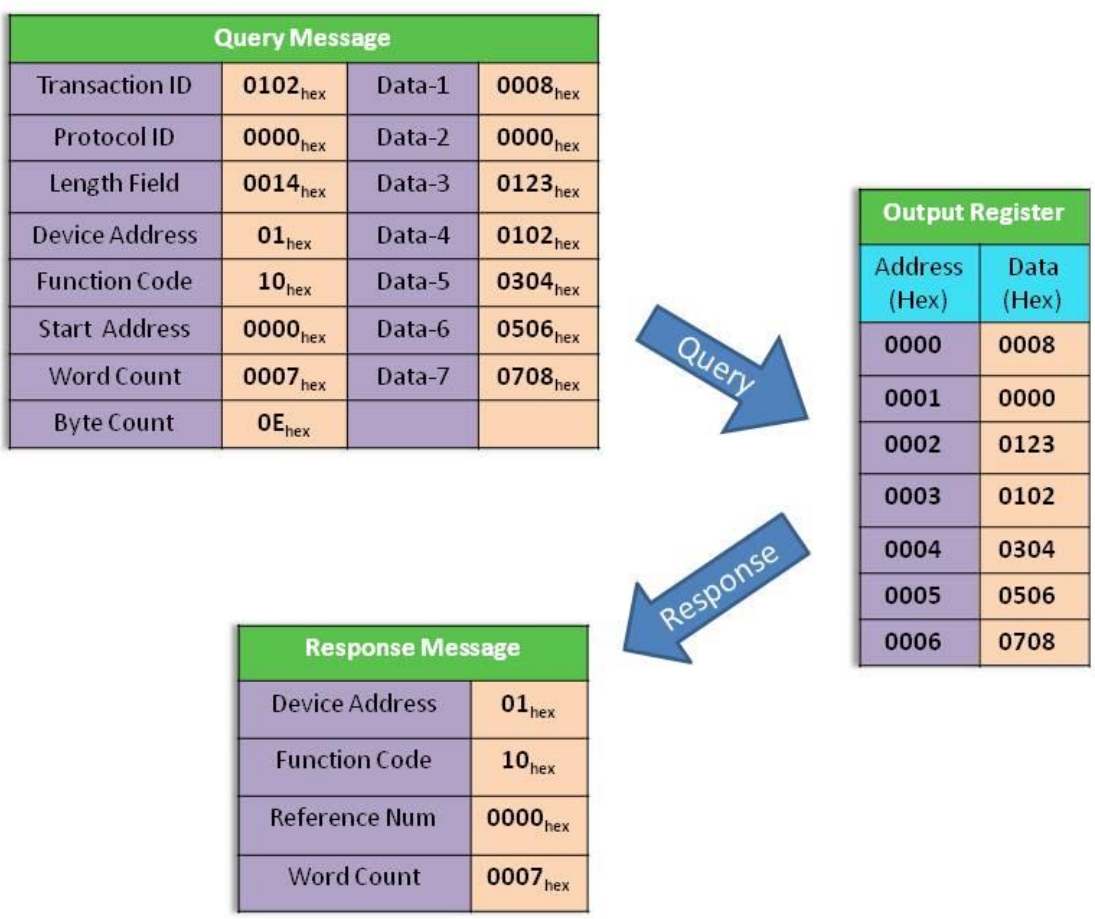


Figure 7-2: Use Modbus TCP command to transmit a CAN message.

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Users can use the Modbus TCP command with function code 03_{hex} to read the transmitted CAN message. The start address of the command is always 0000_{hex}, and the data length field must be set to 0007_{hex}.

Example:
Use the Modbus TCP command (function code 03_{hex}) to read the transmitted CAN message format from the Output Register:

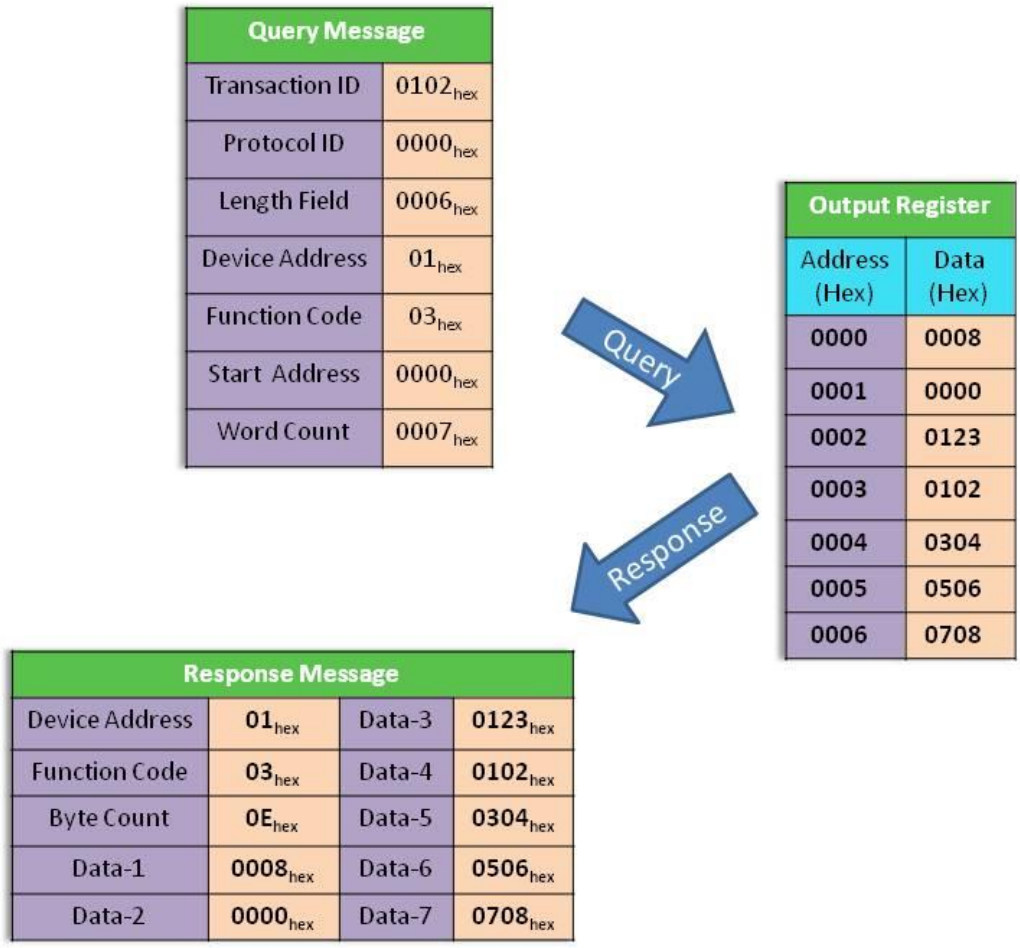


Figure 7-3: Use the Modbus TCP command (function code 03_{hex}) to read the transmitted CAN message format.

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7.3 Using Modbus TCP command to get a Specific CAN Message

I-7540D(M)-MTCP supports the "Specific CAN Message" field. When receiving a CAN message whose CAN ID is defined in a specific CAN message through the Utility tool, I-7540D(M)-MTCP will save this CAN message into the "Specific CAN Message" field.

Users can use Modbus TCP command (function code 04hex) to directly read CAN messages from this area. It is used to obtain important CAN messages immediately. If the starting position of a specific CAN message field is defined, the starting address of the command must be the same, and the data length must be 9.

Example:

Use the Modbus TCP command (function code 04_{hex}) to read the specific CAN message from the "Specific CAN Message" field:



Figure 7-4: Use the Modbus TCP command to read specific CAN message.

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