ECAN-240

(Modbus TCP to 2-port CAN Bus Gateway User manual)



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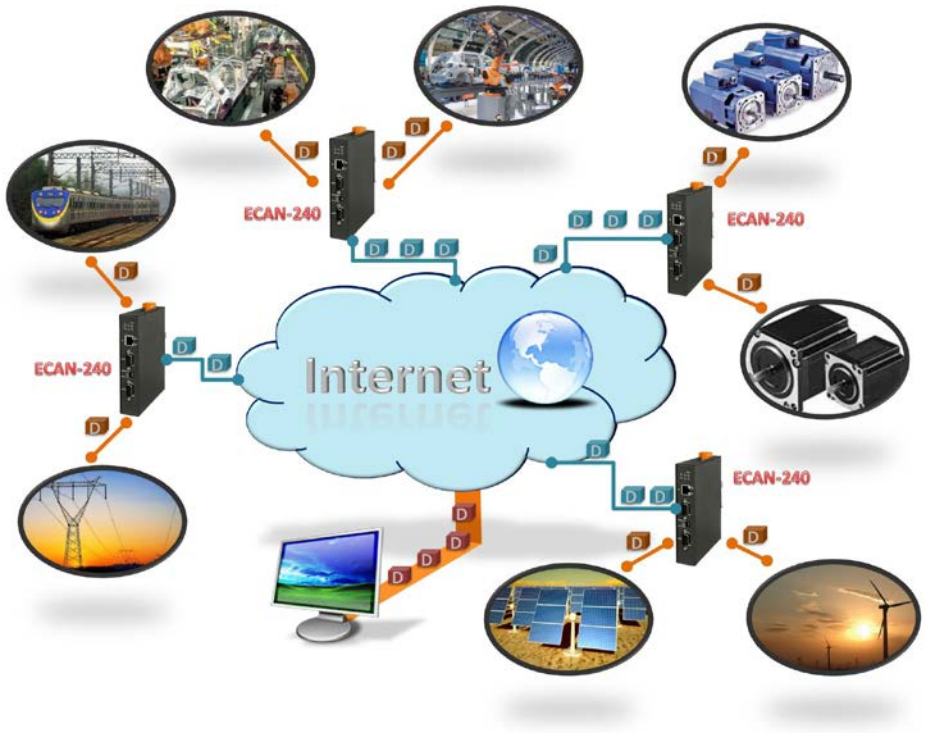
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1. Introduction



The IoT (Internet of Things) has been a much discussed topic in recent years. Using the IoT concept, it is easy to integrate the environment of heterogeneous network and let all of the things into be digitized making life more convenient. In order to provide additional access to IoT applications related to industry based on the CAN bus, ICPDAS has developed a new Ethernet product, the ECAN-240.

The ECAN-240 module is a Modbus TCP to 2-port CAN Bus Gateway. As its functionality, that provides communications via the Ethernet based on the Modbus TCP industrial protocol, meaning that the module can be easily integrated with an industrial network. The ECAN-240 module includes two CAN bus interfaces, meaning that more various CAN applications can be supported, such as a CAN bridge or a CAN message router. The CAN message router function means that the ECAN-240 module can be used to connect to four different CAN networks, ensuring they can communicate with each other. More details related to applications that can be implemented using the ECAN-240 module will be illustrated in sections 4 - 8.

The ECAN-240 module has a fine abilities including anti-jamming and a wide operating temperature meaning that it can be used in harsh environments. The ECAN-240 module provides two rotary switches that are used to select Baud Rate for the CAN bus, which supports 10 kbps to 1 Mbps. The ECAN-240 module contains seven LED indicators, one is used to indicate the status of the power and the others are used to indicate the status of the CAN bus. The ECAN-240 module

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uses the RJ-45 standard communication interface to perform Ethernet transmission. The status of the Ethernet connection can be determined from the built-in indicators on the RJ-45 port. The ECAN-240 module also supports an auto-negotiation function that enables different transmission speeds via the Ethernet. The ECAN-240 module is constructed with a metal-housing that provides a fully ventilated design, meaning that there are no problems with heat radiation.

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1.1. Features

- **Hardware**
  - Supports input voltage 10~30V_{DC}.
  - Fully compatible with the ISO 11898-2 standard.
  - Includes built-in DIP-switch the can be used to enable/disable the terminator resistor.
  - Includes an RJ-45 Ethernet interface with auto-negotiation function.
  - Includes two CAN bus interfaces with 9 pin D-sub connector.
  - Includes two rotary switches for selection of CAN bus Baud Rate.
  - Contains seven LED indicators, one as a power indicator and the others for monitoring CAN bus activity.
  - Contains LED indicator on RJ-45 for Ethernet status.

- **Software**
  - Provides support for the CAN bus ID filter function.
  - Provides support for the CAN bus bridge mode via configuration.
  - Provides support for the CAN bus listen only mode via configuration.
  - Provides support for a range of CAN bus Baud Rate from 10k bps to 1M bps adjustable via the rotary switch.
  - Provides support for the Modbus TCP Client/Server function via configuration.
  - Provides support for TCP/UDP pair connection function via configuration.
  - Provides support for bootloader mode to enable firmware updates.
  - Provides support for web configuration functions.

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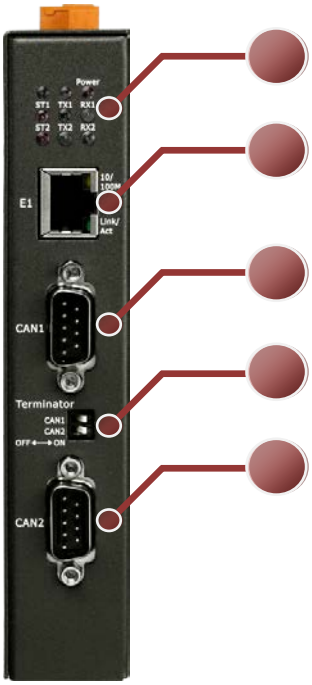
1.2. Specification

Module	ECAN-240
CAN Bus Interface	
Channels	2
Connector	9-pin D-sub male
Baud Rate	10k bps to 1M bps
Terminator Resistor	Built-in 120 ohm terminator resistor, enabled/disabled via DIP-Switch
Isolation	3 kV VDC for DC to DC, 2500 Vrms for photo couple
CAN Bus Specification	ISO 11898-2 CAN 2.0A and CAN 2.0B
Ethernet	
Controller	10/100Base-TX Ethernet Controller (Auto-negotiating, Auto_MDIX)
Connector	RJ-45 with Ethernet indictor
Protocol	Modbus TCP Client/Server, TCP, UDP, HTTP
Socket connections	8 for TCP, 1 for UDP
LED Indicator	
LED (Round)	Power (1), CAN Bus Status (2), CAN Bus Tx (2), CAN Bus Rx (2)
Ethernet LED	Ethernet Status (RJ-45) (2)
Power	
Power Supply	Unregulated +10 ~ +30 VDC
Protection	Reverse polarity protection, Over-voltage brown-out protection
Power Consumption	2W
Mechanical	
Installation	DIN-Rail
Dimension (W x L x H)	106.8mm x 146.8mm x 25.9mm
Environment	
Operating Temperature	-25 to +75°C
Storage Temperature	-30 to +80°C
Relative Humidity	10 to 90% RH, Non-condensing

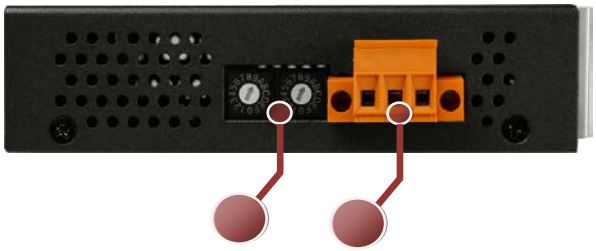
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2. Getting Started

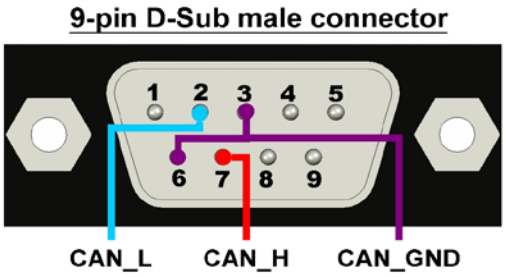
■ **Appearance**



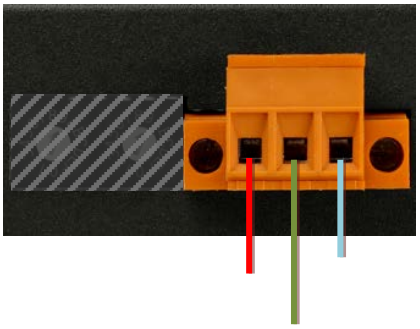
No.	Description
1	LED indicators
2	Ethernet Port with RJ-45 connector
3	CAN1 with 9-pin D-sub male connector
4	Terminator Resistor DIP-switches
5	CAN2 with 9-pin D-sub male connector
6	Power Connector(PWR, GND, F.G.)
7	CAN Bus Baud Rate Rotary Switch



■ **Wire connections and pin assignments**



Pin	Description
1	N/A
2	CAN Low
3	CAN Ground
4	N/A
5	N/A
6	CAN Ground
7	CAN High
8	N/A
9	N/A



Pin	Description
Power	Power, +10~+30VDC
GND	Power Ground
F.G.	Frame Ground

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2.1. LED Indicator

The ECAN-240 module provides seven LED indicators, including indicators for power status and CAN Bus status. The Following is an overview of the purpose and function of each LED indicator together with a description.

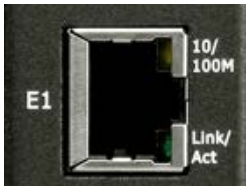


LED Name	LED Status	LED Description
Power (Red)	ON	The power of the module is ON
ST1 (Red)	ON	CAN1 Bus is OFF (***Note**)
	Flashing	An error has occurred on CAN 1(***Note**)
ST2 (Red)	ON	CAN2 Bus is OFF (***Note**)
	Flashing	An error has occurred on CAN 2(***Note**)
TX1 (Green)	Flashing	A CAN message was successfully transmitted on CAN1
TX2 (Green)	Flashing	A CAN message was successfully transmitted on CAN2
RX1 (Green)	Flashing	A CAN message was successfully received on CAN1
RX2 (Green)	Flashing	A CAN message was successfully received on CAN2

***Note**: The CAN Bus will be set to OFF if there are too many faults or if communication is interrupted. In this situation, the ECAN-240 module will automatically restore the Bus and the LED will be turned off.

***Note:** When CAN bus has some errors or CAN software buffer is overflow, the STx indicator will be flashing.

The Ethernet status indicator on ECAN-240 is part of the built-in RJ-45 connector, such as shown in the figure below.

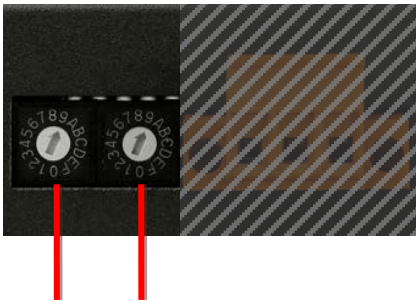


LED Name	LED Status	LED Description
10/100M	ON	100 Mbps
	OFF	10 Mbps or Ethernet disconnected.
Link/Act	Flashing	Communicating

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2.2. Rotary Switch

The ECAN-240 module provides two rotary switches that are used to change CAN Bus Baud Rate for using the built-in configuration functions. The following is an overview of the purpose and function of each rotary switch position together with a description.

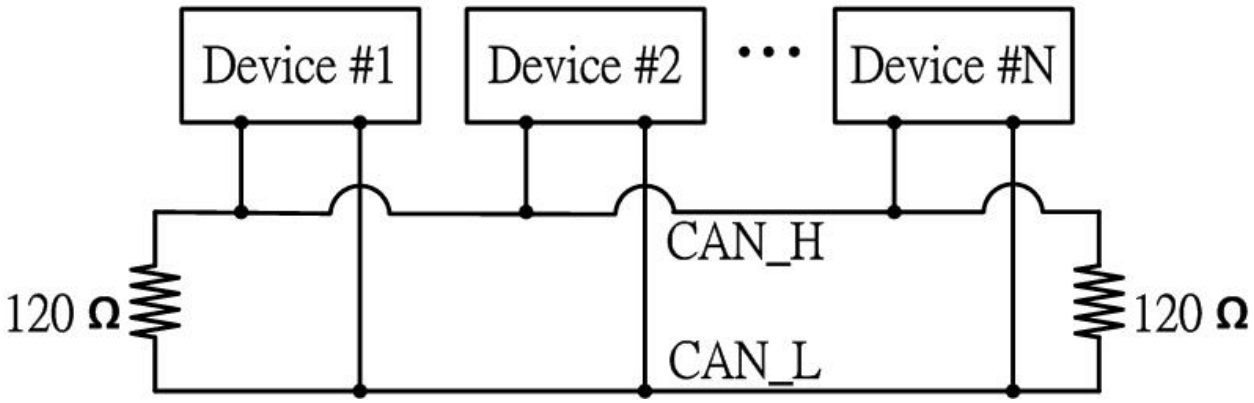


CAN1_SW Value	CAN2_SW Value	Description
0	0	CAN Bus Baud Rate = 10 kbps.
1	1	CAN Bus Baud Rate = 20 kbps.
2	2	CAN Bus Baud Rate = 50 kbps.
3	3	CAN Bus Baud Rate = 80 kbps.
4	4	CAN Bus Baud Rate = 100 kbps.
5	5	CAN Bus Baud Rate = 125 kbps.
6	6	CAN Bus Baud Rate = 250 kbps.
7	7	CAN Bus Baud Rate = 500 kbps.
8	8	CAN Bus Baud Rate = 800 kbps.
9	9	CAN Bus Baud Rate = 1 Mbps.
A	A	User-defined CAN Bus baud rate.
B - E		Reserved.
F	B	Load factory default IP, Mask, Gateway values and not save into EEPROM.
	C	Module self-testing function. Tests the two CAN Buses and the UDP broadcasting function.
	D	Load all factory default values and saves them to the EEPROM.
	E	Reserved.
	F	Bootloader mode.

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2.3. Terminator Resistor

In order to minimize the effects of reflection on the CAN Bus, the bus must be terminated using a terminator resistor at each end. According to the specifications given in ISO 11898-2, each terminator resistor should be 120Ω(or between 108Ω and 132Ω). The bus topology and the positions of these terminator resistors are shown below.



The ECAN-240 module includes two CAN ports and terminator resistors are provided for each CAN port. The terminator resistor can be enabled or disabled via the terminator DIP-switches as illustrated in following figure.



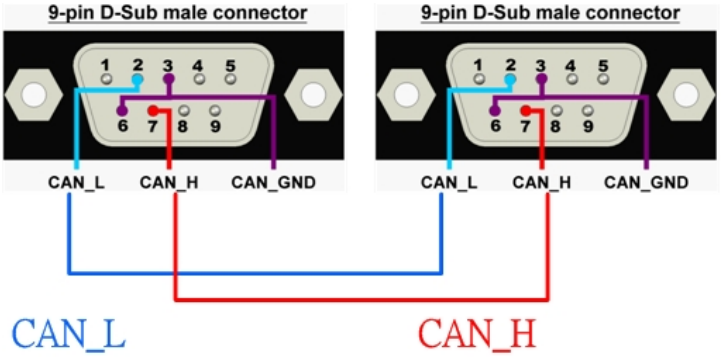
As indicated in the figure, when the DIP-switch is in the OFF position, the terminator resistor function is disabled. Similarly, when the DIP-switch is in the ON position, the terminator resistor function is enabled.

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2.4. Self-Test

Writing a CAN message to CAN1 and reading a CAN message from CAN2 via Modbus Poll Tool.

1. Set the rotary switch vale of CAN1_SW/CAN2_SW to 9/9 position and connect the CAN1 “CAN_H/CAN_L” pins with CAN2 port.



2. Download and install the “Modbus Poll” test program at below link.
   https://www.modbustools.com/download.html

3. Double-click the Modbus Poll shortcut to open.



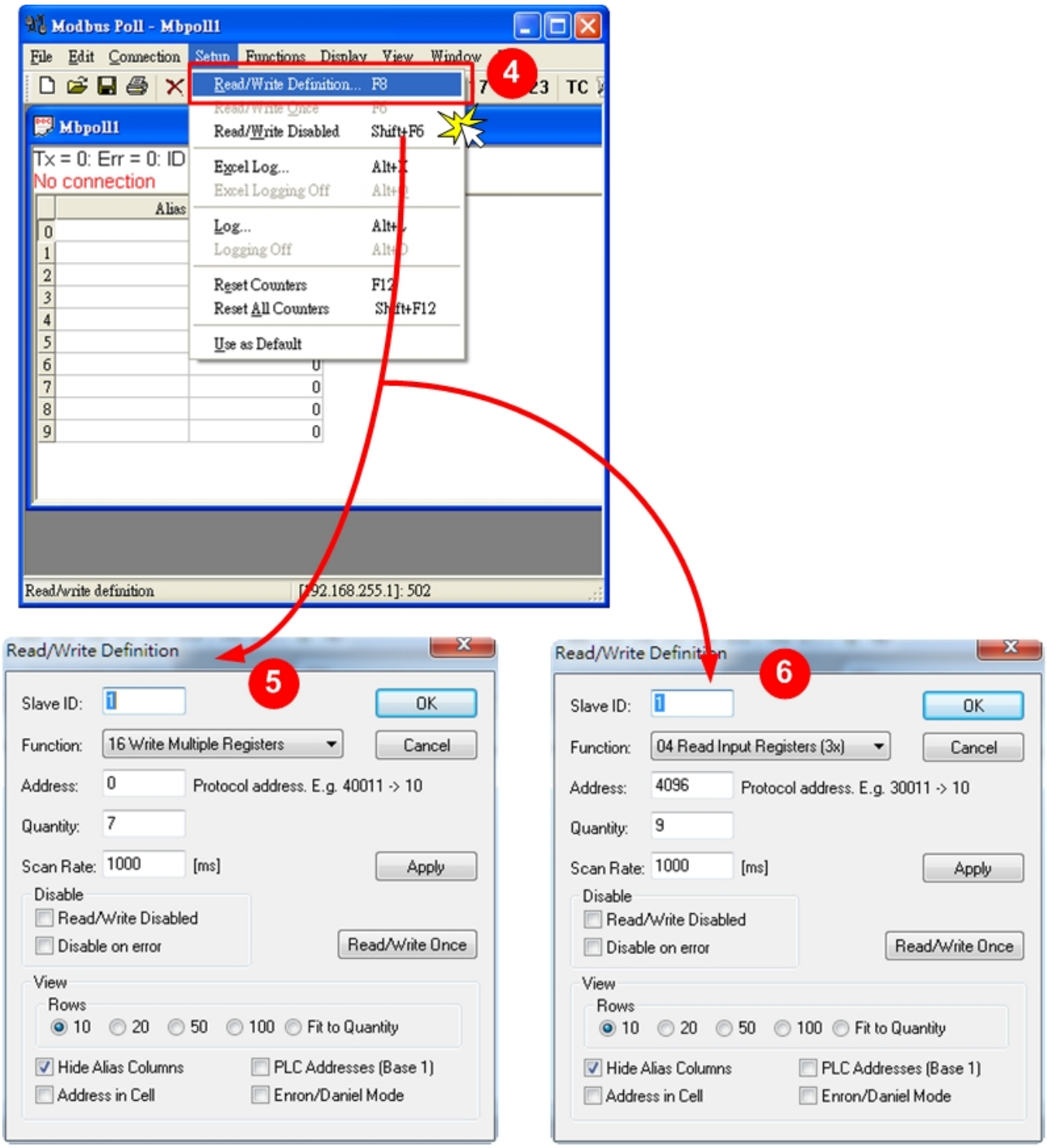
4. Select the “Read/Write Definition…” item from the “Setup” menu to open the “Read/Write Definition” dialog box.

5. Configure the setting for writing a CAN message to “CAN1 Tx Message” address (00000).

6. Configure the setting for reading a CAN message from “CAN2 Rx Message #001” address (04096).

Note: Refer to section 4.1 for Modbus address definition of ECAN-240.

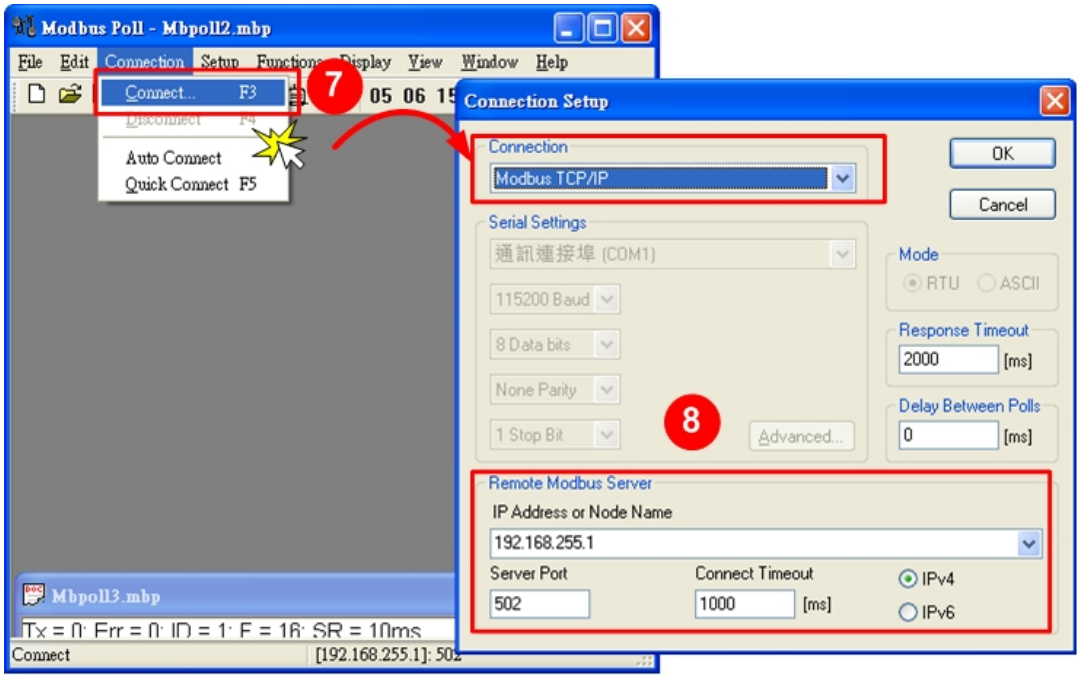
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7. Select the “Connect…”item from the “Connection” menu to open the “Connection Setup” dialog box.

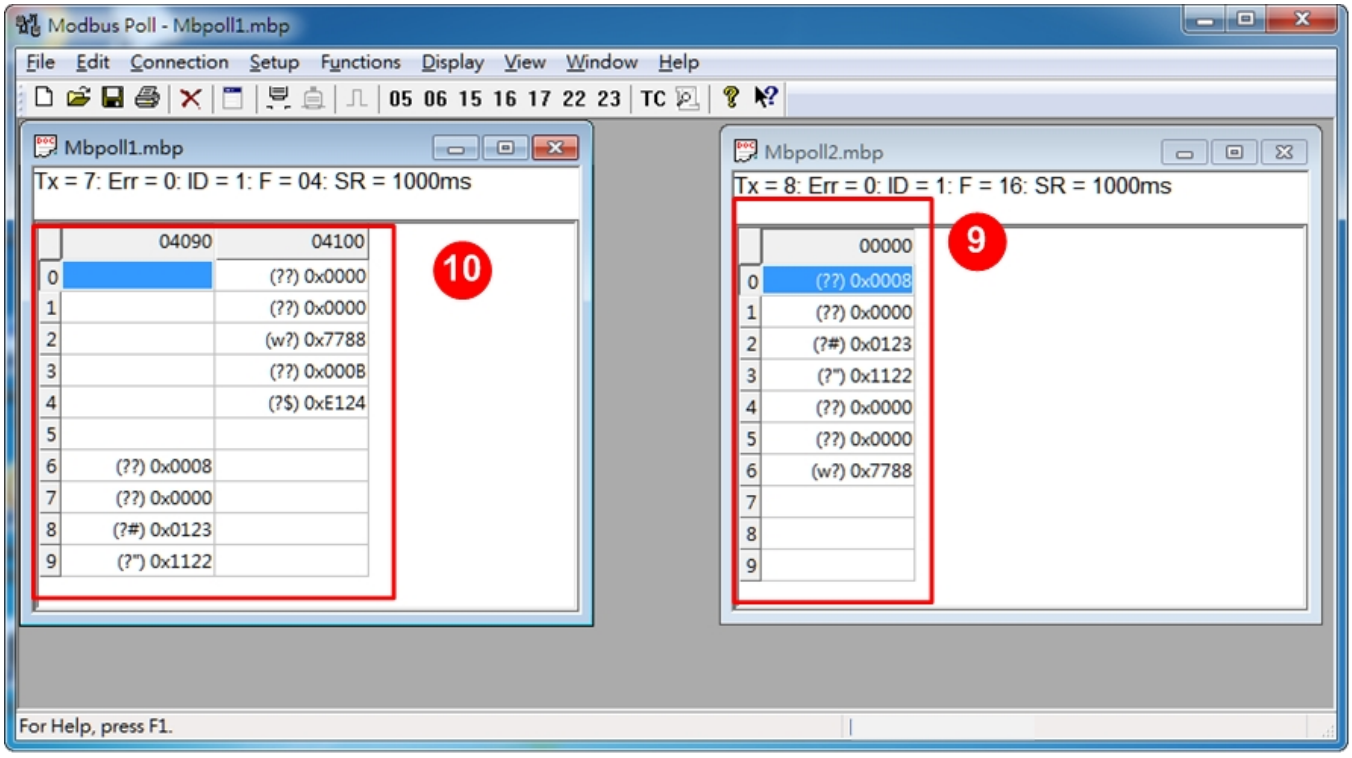
8. Configure the Ipv4 address and TCP port (default: 502) of ECAN-240 click “OK” to connect the ECAN-240 for testing.

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9. Write a CAN message to “CAN1 Tx Message” address (00000)

10. Read a CAN message from “CAN2 Rx Message #001” address (04096).



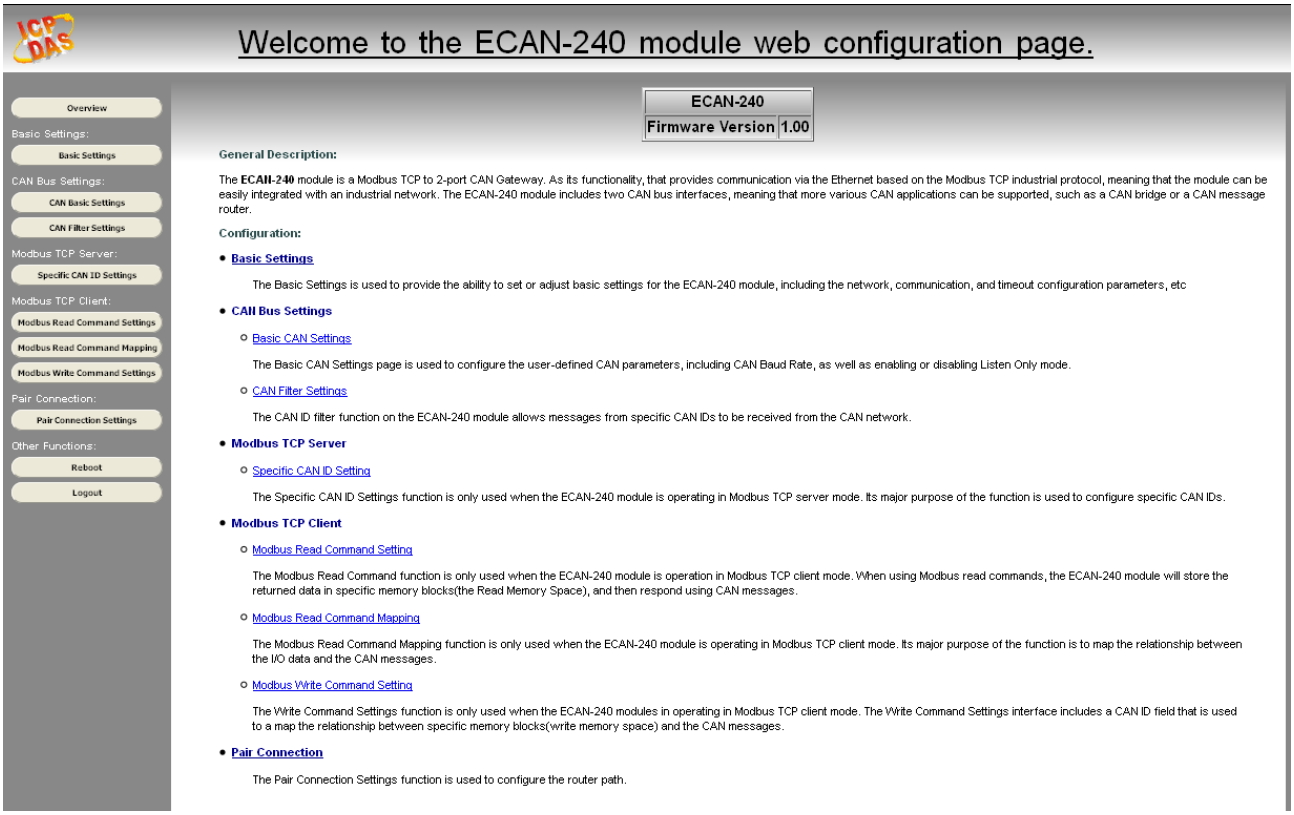
If there is no “Err” count in the request/response messages, the test was successful.

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3. Web Configuration

The configuration for the module parameters or communication commands (in Modbus Client mode only) on the ECAN-240 module can be performed via a standard web browser using the embedded web configuration function. The web configuration functions are divided into several categories and includes basic configuration, CAN Bus configuration, Modbus configuration and pair connection configuration. The following is an overview of the process used to configure the ECAN-240 module via the web.

The figure below is an illustration of the main screen for web configuration. On the left are the function buttons, including Overview, Basic Settings, CAN Basic Settings, CAN Filter Settings, Specific CAN ID Settings (Modbus TCP Server), Read Command Settings (Modbus TCP Client), Read Command Mapping(Modbus TCP Client), Write Command Settings (Modbus TCP Client), Pair Connection, Reboot, and Logout.



Note:

- The browsers are supported, including IE 8, Chrome, Opera, Firefox(recommended).
- The influence of Temporary Internet File on IE 8 will lead to work abnormally during using web configuration function. Thus, please change the setting to “every visit to the page”
- The IE 11 and Microsoft Edge are not supported.

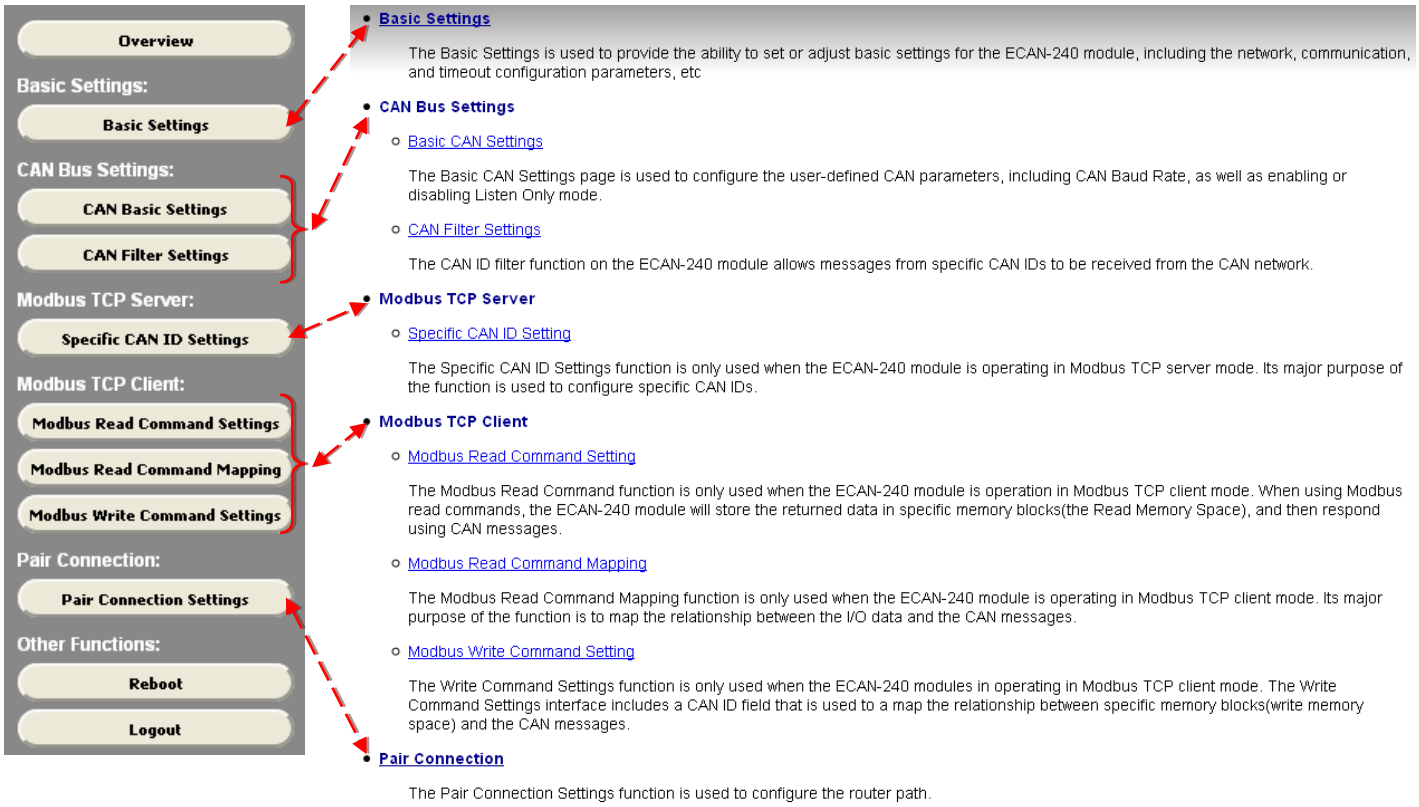
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3.1. Overview

The Overview page shows details of the firmware version currently in use on the ECAN-240 module, as illustrated in the figure below. The Overview page also provides a description of each configuration function. The configuration web page can be accessed using either the function button or the link on Overwrite page.



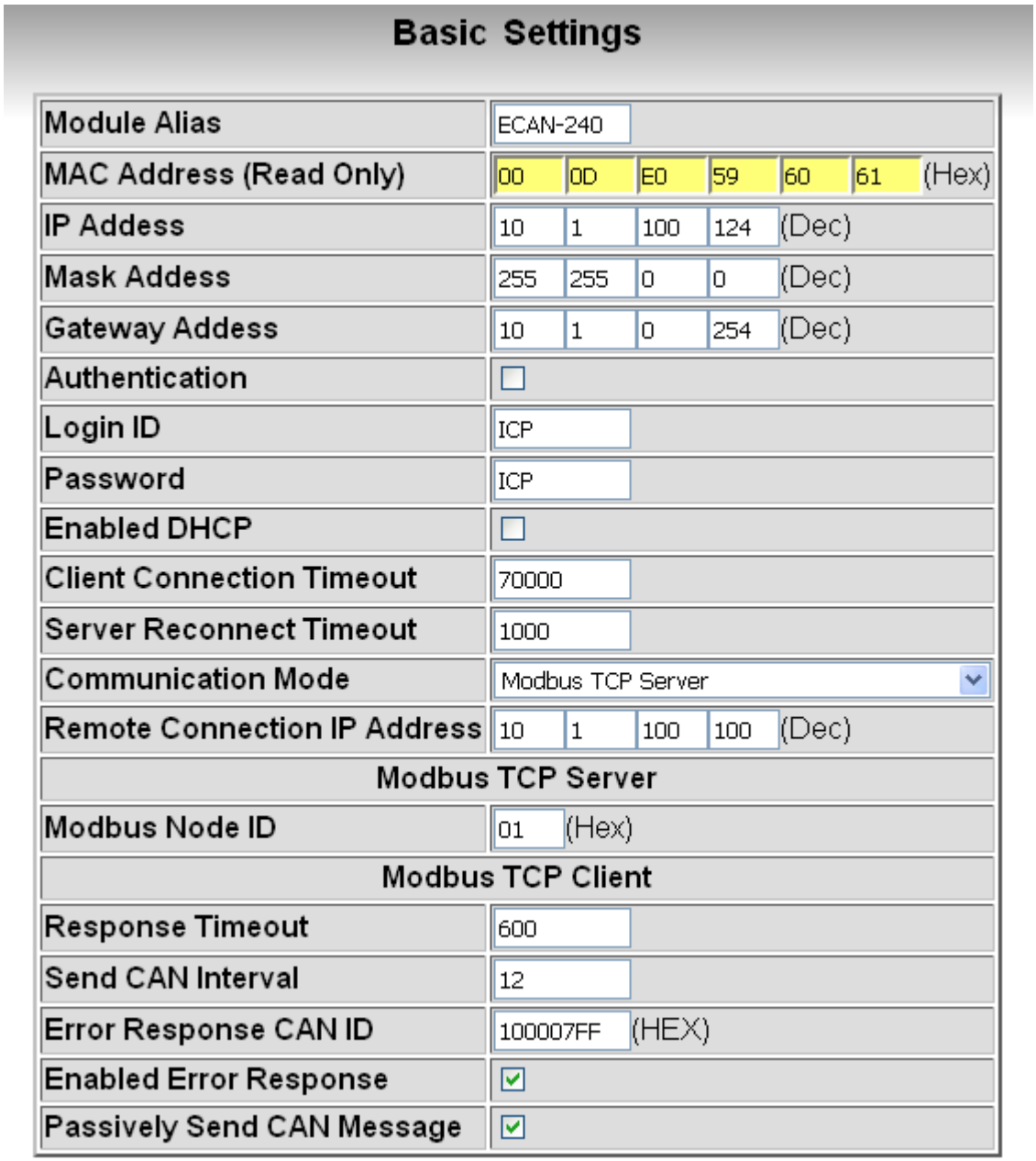
As illustrated below, each button is mapped to a link, meaning that there are two ways to access the configuration page.



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3.2. Basic Settings

The Basic Configuration section provides the ability to set or adjust basic settings for the ECAN-240 module, including the network, communication, and timeout configuration parameters, etc, as illustrated in the figure below.

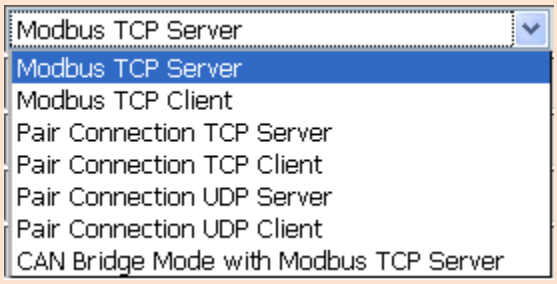


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The following is an overview of the parameters that can be found on the Basic Configuration page together with a description of each.

Parameter	Description
Module Alias	Used to specify recognizable name for the module.
MAC Address	Used to specify the Ethernet MAC address for the module. **Note:** the address is set by the manufacturer by default and cannot be modified.
IP Address	Used to specify the IP address for the module using the IPv4 protocol, and supports class A to E setting. **Note:** The IPv6 protocol is not supported on the ECAN-240 module. The default IP address is **192.168.255.1**.
Mask Address	Used to specify the standard subnet mask for the module. **Note:** The default Mask address is **255.255.0.0**.
Gateway Address	Used to specify the Gateway address for the module. **Note:** The default Gateway address is **192.168.255.2**.
Authentication	Used to specify whether the authentication function is enabled or disabled. If the function is enabled, users attempting to access the web configuration portal will be redirected to the authentication page. Check the checkbox to enable the function. **Note:** If authentication fails, the web configuration function cannot be used.
Login ID	Used to specify the authentication login ID.
Password	Used to specify the authentication password.
Enable DHCP	Used to enable or disable the DHCP function. Check the checkbox to enable the function. **Note** : when using this function, the IP, Mask, Gateway settings will be inactive.
Client Connection Timeout	Used to specify the Client Connection Timeout value. When the ECAN-240 module is set to act as a Server, the value will be used to calculate the timeout value if the Client either malfunctions or if its operation is terminated abnormally. If timeout, the ECAN-240 will be terminated the connection
Server Reconnection Timeout	Used to specify the Server Reconnection Timeout value. When the ECAN-240 module is set to act as a Client, this value will be used to calculate the timeout value and reconnect the server automatically if the Server either malfunctions or if its operation is terminated abnormally .
Communication Mode	Used to specify the communication mode to be used. Seven communication modes are provided on the ECAN-240 module.

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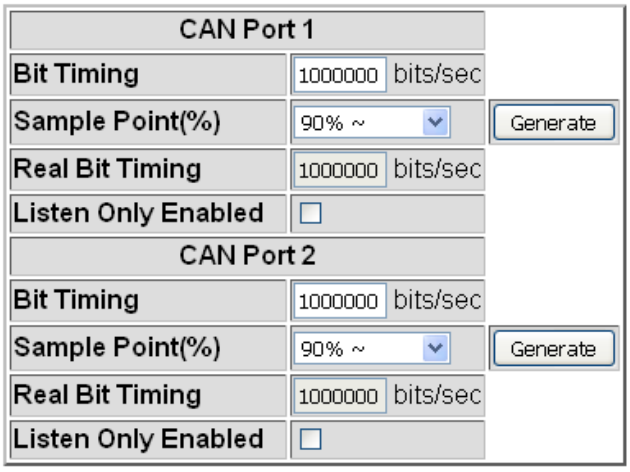
	Details related to the application of each communication mode can be found in Sections 4 to 8. 
Remote Connection IP Address	Used to specify the IP address of a remote device which the ECAN-240 module need to connect. This parameter is used when the ECAN-240 module is acting as a Client.
Modbus Node ID	Used to specify the Modbus Node ID when the ECAN-240 module is acting as a Modbus TCP Server.
Response Timeout	Used to specify a timeout value for Modbus TCP commands. This parameter is used when the ECAN-240 module is operating in Modbus TCP Client mode.
Send CAN Interval	Used to specify the CAN message transmission interval. This parameter is used when the ECAN-240 module is operating in Modbus TCP Client mode.
Error Response CAN ID	Used to specify the CAN ID to be included in a CAN message that is transmitted when the ECAN-240 module receives an error from the Modbus TCP. This function is used when the ECAN-240 module is operating in Modbus TCP Client mode.
Enable Error Response	Used to enable or disable the Error Response function. This function is used in combination with the Error Response CAN ID function and is only used when the ECAN-240 module is operating in Modbus TCP Client mode. Check the checkbox to enable the function.
Passively Send CAN Message	Used to enable or disable the Passively Send CAN Message function. By default, CAN messages are sent actively based on the Send CAN Interval value. This function is only used when the ECAN-240 module is operating in Modbus TCP Client mode. Check the checkbox to enable the function.
Save Basic Configuration	Used to save the basic configuration to the EEPROM. 

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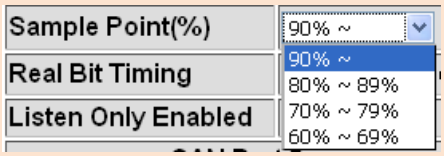
3.3. CAN Bus Settings

3.3.1. Basic CAN Settings

The Basic CAN Settings page is used to configure the user-defined CAN Bus parameters, including CAN Baud Rate, as well as enabling or disabling Listen Only mode.



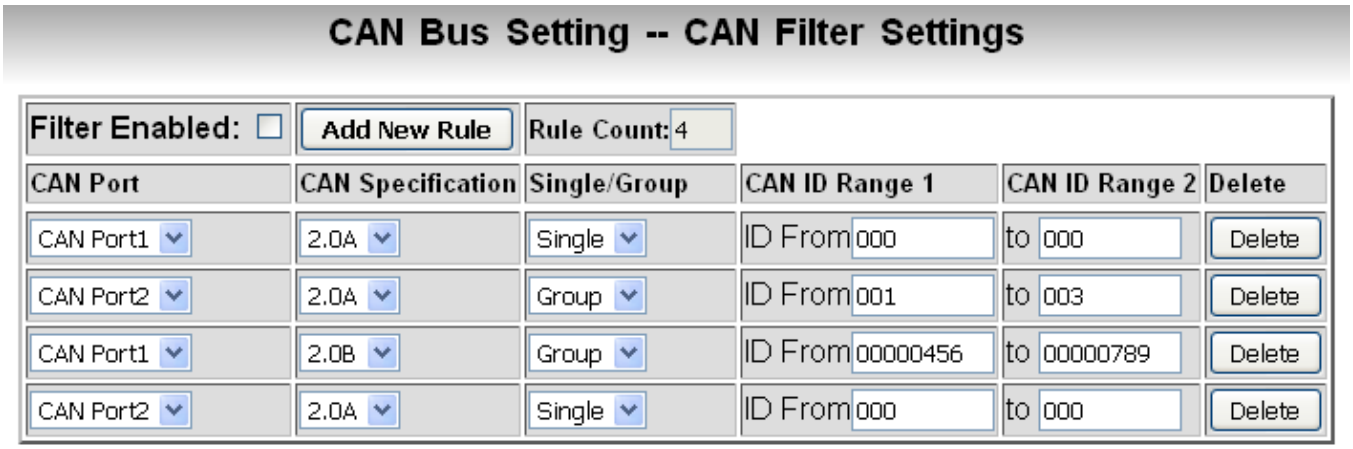
The following is an overview of the parameters that can be found on the Basic CAN Settings page, together with a description of each.

Parameter	Description
Bit Timing Value	Used to specify the bit timing value. It is an optimum value. The ECAN-240 module will use this value to calculate a approximate (actual) bit timing.
Sample Point (%)	Used in the calculation of the CAN Baud Rate. The sample point is located at the specified percentage of the CAN waveform, and defines the error tolerance for the CAN message. Four selection ranges are provided: 
Actual Bit Timing Value	Used to specify the real bit timing value after calculating the bit timing parameters. The ECAN-240 module will use this value to communicate with other CAN devices.
Enable Listen Only Mode	Used to enable or disable Listen Only mode. Check the checkbox to enable the function.
Generate	Used to generate a actual bit timing value. 
Save CAN Configuration	Used to save the CAN configuration to the EEPROM. 

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3.3.2. CAN Filter Settings

The CAN ID filter function on the ECAN-240 module allows messages form specific CAN IDs to be received from the CAN network. Five fields can be configured on the CAN Filter Settings page, including the CAN Port, the CAN Specifications, Single/Group selection, and the CAN ID range. Supports up to 25 CAN ID filter rule settings.



The following is an overview of the parameters that can be found on the CAN Filter Settings page, together with a description of each.

Parameter	Description
Add New Rule	Used to add a new rule to the CAN Filter table
CAN Port	Used to specify a CAN port where the CAN ID is to be filtered.
CAN Specification	Used to specify whether the ID filter is based on either the CAN 2.0A or the CAN 2.0B specification.
Single/Group	Used to specify whether the filter is based on either a Single or a Group ID.
CAN ID Range 1 **CAN ID Range 2**	Used to specify the range of CAN ID values to be filtered. Two fields are used to set the CAN ID value range. • When the Single/Group parameter is set as Single Mode, the values specified in the two range fields will be the same, meaning that a single CAN ID will be filtered. For example, if the **CAN ID Range is set as 0x000 to 0x000**, it means that only messages from CAN ID **0x000** will be received from the CAN network, and all other messages will be blocked by the module. • When the Single/Group parameter is set as Group Mode, the values specified in the two range fields will be the first and last values of a sequential range of CAN IDs. For example, if the **CAN ID Range is set as 0x001 to 0x003**, it means that only messages from CAN IDs in the range of **0x001 to 0x003** will be received from the

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	CAN network, and all other messages will be blocked by the module.
Delete	Used to delete a rule from the CAN Filter table.
Save CAN Configuration	Used to save the CAN filter configuration to the EEPROM. 

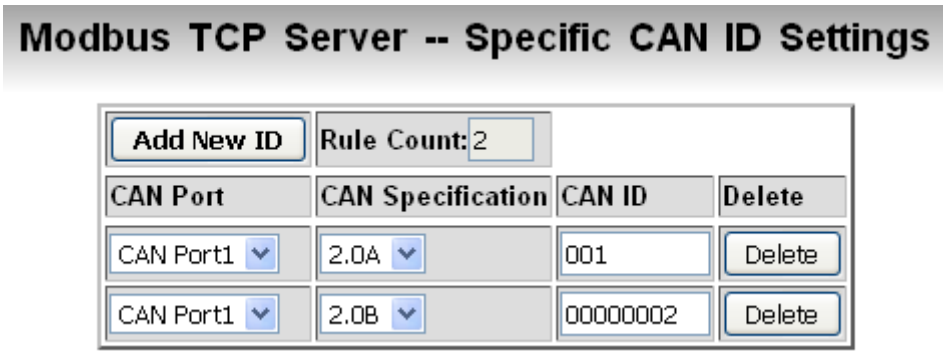
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3.4. Modbus TCP Server

3.4.1. Specific CAN ID Settings

The Specific CAN ID Settings function is only used when the ECAN-240 module is operating in Modbus TCP Server mode. In general, the ECAN-240 module will store the I/O data in a ring buffer when a CAN message is received, and then the Modbus address is used to retrieve the I/O data. If a specific CAN ID table is configured, the ECAN-240 module will identify the CAN ID from the specific CAN ID table and then store the IO data in the relevant buffer after finding the same CAN ID from specific CAN ID table. The CAN message in this specific buffer will be overwritten when received the same CAN ID message.

Note: About the Modbus address table, please refer to the next section.



The following is an overview of the parameters that can be found on the Specific CAN ID Settings page, together with a description of each.

Parameter	Description
Add New ID	Used to add a new CAN ID to the CAN ID table.
CAN Port	Used to specify the CAN port that owns this specific CAN ID.
CAN Specification	Used to specify whether the ID settings are based on the CAN 2.0A or the CAN 2.0B specification.
CAN ID	Used to specify the CAN ID value.
Delete	Used to delete a specific CAN ID from the CAN ID table**.**
Save CAN Configuration	Used to save a specific CAN ID configuration to the EEPROM. 

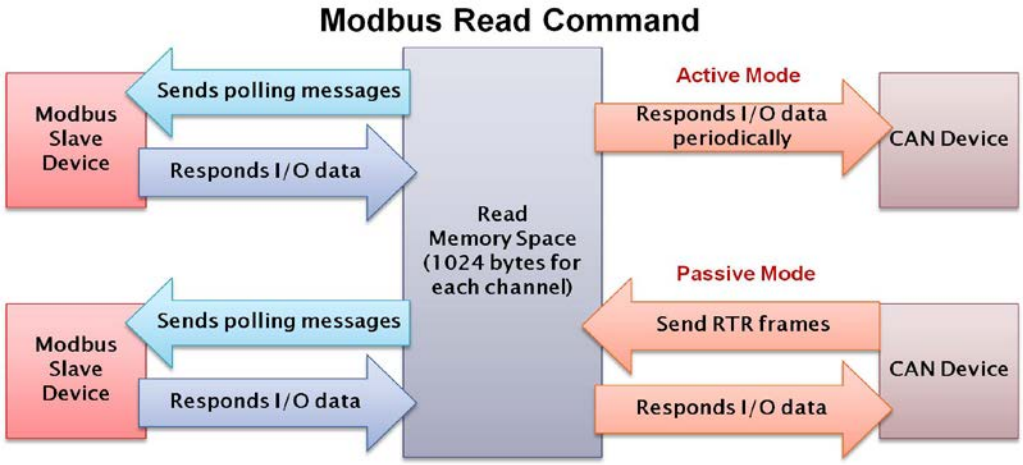
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3.5. Modbus TCP Client

Three kinds of settings for the Modbus TCP Client function are available, including the Read Command Settings, Read Command Mapping, and Write Command Settings, which will be discussed in more detail in section 3.5.1 to 3.5.3 below.

3.5.1. Modbus Read Command Settings

The Modbus Read Command function is only used when the ECAN-240 module is operation in Modbus TCP Client mode. These commands support Modbus Function codes 0x01 to 0x04. When using Modbus Read Command, the ECAN-240 module will store the returned data in specific memory blocks(the Read Memory Space), and then respond using CAN messages, as illustrated in the following figure.



Modbus TCP Client -- Modbus Read Command Settings

Add New Rule | Rule Count: 1

CAN Port	Slave Node ID	Function Code	Start Address (High)	Start Address (Low)	Bit/Word Count (High)	Bit/Word Count (Low)	Delete
1 (Hex)	01 (Hex)	01 (Hex)	00 (Hex)	00 (Hex)	00 (Hex)	00 (Hex)	Delete

The ECAN-240 supports up to 32 Modbus read commands. The following is an overview of the parameters that can be found on the Modbus Read Command Settings page, together with a description of each.

Parameter	Description
Add New Rule	Used to add a new Modbus Read Command rule to the Modbus Read Command list.
CAN Port	Used to specify the CAN port that will be used to send the response with the return value.
Slave Node ID	Used to specify the node ID for the Modbus TCP device.

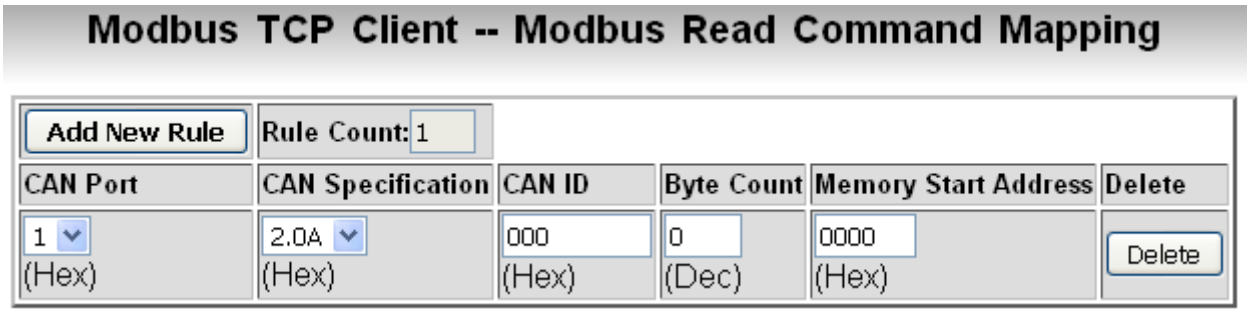
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Function Code	Used to specify the Modbus Function Code. The ECAN-240 module supports function codes 0x01 to 0x04.
Start Address (High)	Used to specify the high byte of the Modbus start address.
Start Address (Low)	Used to specify the low byte of the Modbus start address.
Bit/Word Count (High)	Used to specify the high byte of the Bit/Word count. **Note:** The exact settings for the Bit/Word Count depends on the function code. If the function code is 0x01 or 0x02, this parameter will be set to Bit Count. If the function code is 0x03 or 0x04, it will be set to Word Count.
Bit/Word Count (Low)	Used to specify the low byte of the Bit/Word count. **Note:** The exact settings for the Bit/Word Count depends on the function code. If the function code is 0x01 or 0x02, this parameter will be set to Bit Count. If the function code is 0x03 or 0x04, it will be set to Word Count.
Delete	Used to delete a specific rule from the Modbus Read Command list**.**
Save Modbus TCP Client Configuration	Used to save a specific Modbus Read Command to the Flash memory. 

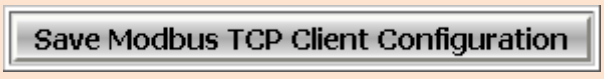
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3.5.2. Modbus Read Command Mapping

The Modbus Read Command Mapping function is only used when the ECAN-240 module is operating in Modbus TCP Client mode. Its major purpose of the function is to map the relationship between the I/O data and the CAN messages. When using the Modbus Read Command Mapping function, the ECAN-240 module will load the I/O data to the CAN data field from the read memory space and then send a CAN message.



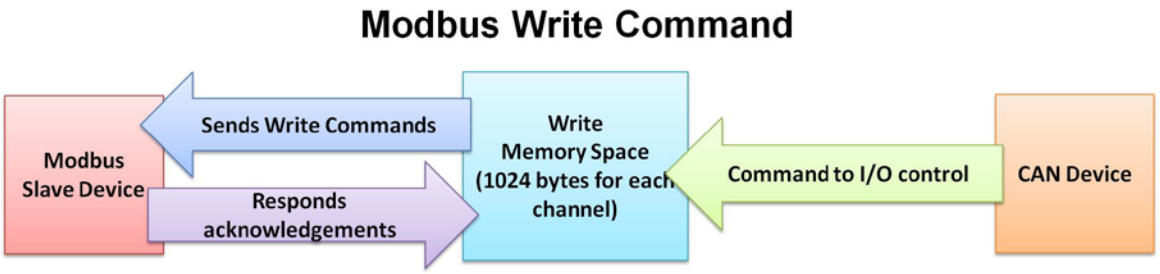
For Modbus read commands, ECAN-240 supports up to 46 CAN read commands.
The following is an overview of the parameters that can be found on the Modbus Read Command Mapping page, together with a description of each.

Parameter	Description
Add New Rule	Used to add a new Read Command Mapping configuration rule to the list.
CAN Port	Used to specify the CAN port that will be used to send the response with the return value.
CAN Specification	Used to specify whether the ID settings are based on the CAN 2.0A or the CAN 2.0B specification.
CAN ID	Used to specify the CAN ID value that will be used to send the response.
Byte Count (High)	Used to specify the length of the I/O data. **Note:** this value cannot be greater than 8 bytes, because the maximum data length for a CAN message is 8 bytes.
Memory Start Address	Used to specify the start address of the read memory space, and is used for I/O data and CAN message mapping.
Delete	Used to delete a specific rule from the Modbus Read Command Mapping configuration list**.**
Save Modbus TCP Client Configuration	Save Modbus Read Command Mapping into Flash. Used to save a specific Read Command Mapping configuration to the flash memory 

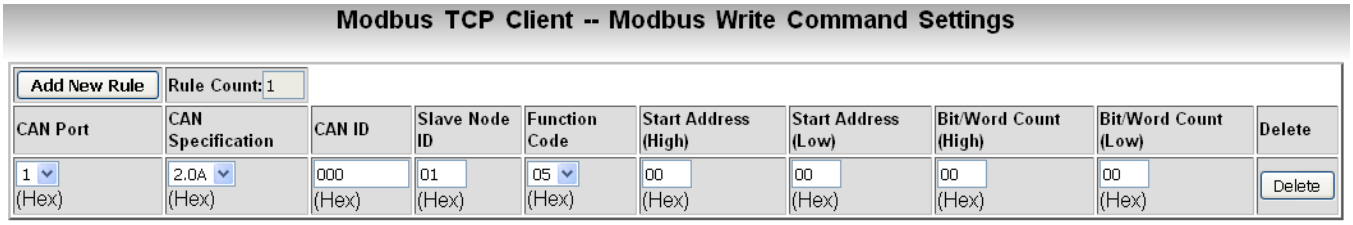
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3.5.3. Modbus Write Command Settings

The Modbus Write Command Settings function is only used when the ECAN-240 modules in operating in Modbus TCP Client mode. These commands support Modbus Function codes 0x05, 0x06, 0x0F, and 0x10. The Modbus Write Command Settings interface includes a CAN ID field that is used to a map the relationship between specific memory blocks(write memory space) and the CAN messages, as illustrated in the following figure.



By using the CAN ID, the ECAN-240 module is able to send a Modbus Write Command containing a variety of data after it receives a CAN message.



The ECAN-240 supports up to 24 Modbus write commands. The following is an overview of the parameters that can be found on the Write Command Settings configuration page, together with a description of each.

Parameter	Description
Add New Rule	Used to add a new Modbus Write Command rule into to the Modbus Write Command list.
CAN Port	Used to specify the CAN port that will be used to receive the CAN data.
CAN Specification	Used to specify whether the ID settings are based on the CAN 2.0A or the CAN 2.0B specification.
CAN ID	Used to specify the CAN message ID that will be used to map the relationship.
Slave Node ID	Used to specify the node ID for the Modbus TCP device.
Function Code	Used to specify the Modbus function code. The ECAN-240 module supports function codes 0x05, 0x06, 0x0F, and 0x10.
Start Address (High)	Used to specify the high byte of the Modbus start address.

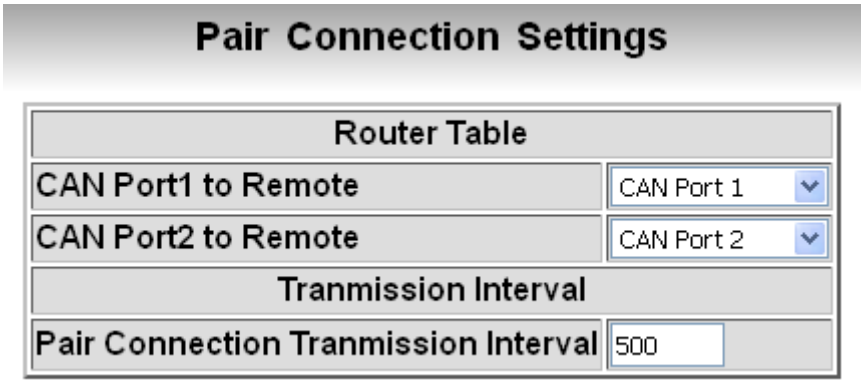
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Start Address (Low)	Used to specify the low byte of the Modbus start address.
Bit/Word Count (High)	Used to specify the high byte of the Bit/Word count. Note: The exact settings for the Bit/Word Count depends on the function code. If the function code is 0x01 or 0x02, this parameter will be set to Bit Count. If the function code is 0x03 or 0x04, it will be set to Word Count.
Bit/Word Count (Low)	Used to specify the low byte of the Bit/Word count. Note: The exact settings for the Bit/Word Count depends on the function code. If the function code is 0x01 or 0x02, this parameter will be set to Bit Count. If the function code is 0x03 or 0x04, it will be set to Word Count.
Delete	Used to delete a specific rule from the Modbus Write Command list.
Save Modbus TCP Client Configuration	Used to save a specific Modbus Write Command to the Flash memory. 

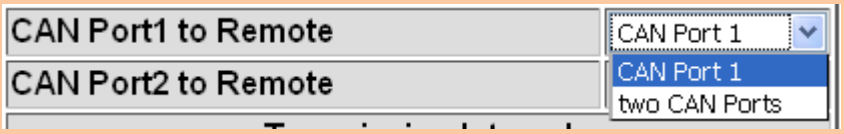
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3.6. Pair Connection Settings

The Pair Connection Settings function is used to configure the router path. As the ECAN-240 module contains two CAN ports, a router table is used to connect two ECAN-240 modules located at different ends of a CAN network. A more detailed illustration of the function will be described in Section 6.



The following is an overview of the parameters that can be found on the Pair Connection Settings page, together with a description of each.

Parameter	Description
CAN Port1 to Remote	Used to specify the remote CAN port that will be connected to CAN port1 on the ECAN-240 module.
CAN Port2 to Remote	Used to specify the remote CAN port that will be connected to CAN port2 on the ECAN-240 module.
	Note: The ECAN-240 module supports two connection methods, one-to-one and one-to-all. For example:  This means that the local CAN port 1 can be connected to either CAN port 1 on the remote device or all CAN ports.
Pair Connection Transmission Interval	Used to specify the transmission interval. **Note:** While the ECAN-240 module received messages from CAN side until 1400 bytes, and then sent via Ethernet. If not enough 1400 bytes, the ECAN-240 will wait for the transmission interval timeout and then send.
Save Pair Connection Configuration	Used to save the Pair Connection configuration to the EEPROM. 

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3.7. Other Functions

- **Reboot**

  Click the Reboot button to reboot the module. After clicking the button, close the browser or the browser tab containing the web configuration page**.**

- **Logout**

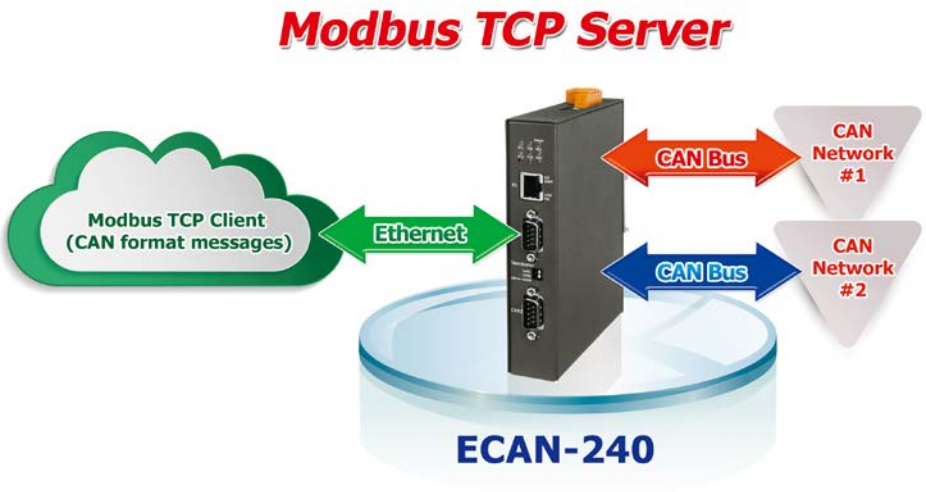
  

  If the Authentication function is enabled, clicking this button will log the user out from the web configuration page.

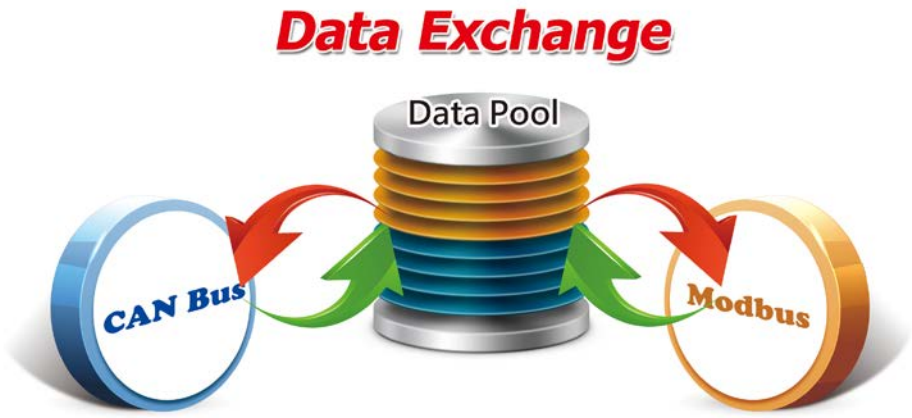
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4. Modbus TCP Server Applications

The Modbus TCP Server function is used to implement communications between a CAN device and a Modbus TCP Client. When the ECAN-240 module is acting as a Modbus TCP Server, the Modbus TCP Client needs to use Modbus commands based on the CAN format in order to access the ECAN-240 module. The ECAN-240 module will then translate these commands into CAN format messages and send them to the CAN networks. Similarly, when a CAN format message is received from the CAN network, the ECAN-240 translates the message into Modbus format, which can then be accessed using a Modbus command.



As illustrated below, the data pool can be considered as a ring buffer that can store up to 200 records. If this maximum is exceeded, the ECAN-240 module will overwrite the oldest record. The ECAN-240 module also provides an additional buffer that can be used to store messages based on specific CAN ID. The maximum is 100 records can be stored. The functionality of this buffer is slightly different in that. The message in this buffer will be overwritten based on the specific CAN ID.



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The ECAN-240 module supports Modbus function codes 0x03, 0x04, 0x06, and 0x10, as indicated in the table below.

Function Code	Function Name	Description
3 (03 Hex)	Read Output Register	Used to read multiple output registers when sending a CAN message.
4 (04 Hex)	Read Input Register	Used to read multiple input registers when receiving a CAN message
6 (06 Hex)	Write Output Register	Used to write single output registers for sending a CAN message
16 (10 Hex)	Write Multiple Registers	Used to write multiple registers for sending a CAN message

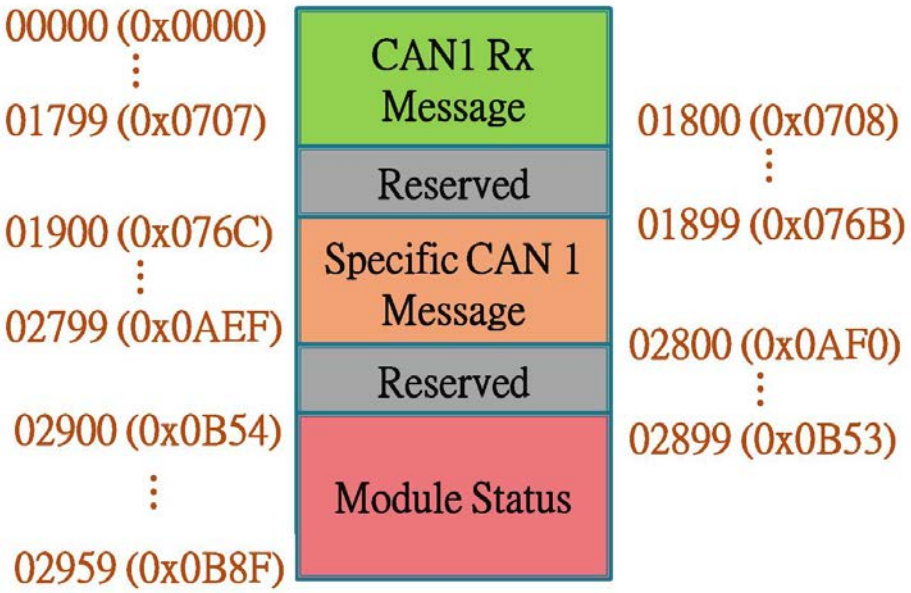
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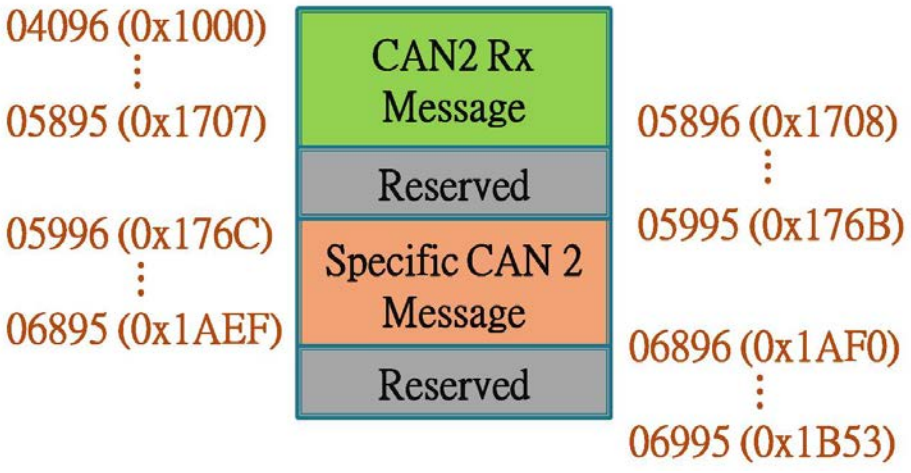
4.1. Modbus Address Mapping

The memory on the ECAN-240 module is divided into two parts, depending on the purpose, and includes the Input Register and the Output Register to match the needs of Modbus TCP Server applications.

4.1.1. Input Register

The major purpose of the Input Register is used for reading CAN messages. Since the ECAN-240 contains two CAN ports, the Input Register is divided to two sections, one for each CAN port. The ECAN-240 module also provides the ability to read the status of the module using Modbus commands. The following figures provide an overview of the address allocation for the Input Register.





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■ **CAN1/CAN2 Rx memory addresses**

Protocol Addresses (Base 0)	PLC Addresses (Base 1)	Word Count	Description
Decimal rule (CAN1)			
00000 ~ 00008	30001 ~ 30009	9	CAN1 Rx Message #001
00009 ~ 00017	30010 ~ 30018	9	CAN1 Rx Message #002
…	…	…	…
01782 ~ 01790	31783 ~ 31791	9	CAN1 Rx Message #199
01791 ~ 01799	31792 ~ 31800	9	CAN1 Rx Message #200
Decimal rule (CAN2)			
04096 ~ 04104	34097 ~ 34105	9	CAN2 Rx Message #001
04105 ~ 04113	34106 ~ 34114	9	CAN2 Rx Message #002
…	…	…	…
05878 ~ 05886	35879 ~ 35887	9	CAN2 Rx Message #199
05887 ~ 05895	35888 ~ 35896	9	CAN2 Rx Message #200

■ **Addresses for specific CAN1/CAN2 Rx messages**

Protocol Addresses (Base 0)	PLC Addresses (Base 1)	Word Count	Description
Decimal rule (CAN1)			
01900 ~ 01908	31901 ~ 31909	9	CAN1 specific Rx Message #001
01909 ~ 01917	31910 ~ 31918	9	CAN1 specific Rx Message #002
…	…	…	…
02781 ~ 02790	32782 ~ 32791	9	CAN1 specific Rx Message #99
02791 ~ 02799	32792 ~ 32800	9	CAN1 specific Rx Message #100
Decimal rule (CAN2)			
05996 ~ 06004	35997 ~ 36005	9	CAN2 specific Rx Message #001
06005 ~ 06013	36006 ~ 36014	9	CAN2 specific Rx Message #002
…	…	…	…
06877 ~ 06886	36878 ~ 36887	9	CAN2 specific Rx Message #99
06887 ~ 06895	36888 ~ 36896	9	CAN2 specific Rx Message #100

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■ Module status addresses

Protocol Addresses (Base 0)	PLC Addresses (Base 1)	Word Count	Description
Decimal rule (CAN1)			
02900	32901	1	CAN1 Rx message count
02901	32902	1	CAN1 Baud Rate configuration
02902 ~ 02903	32902 ~ 32903	2	User-defined Baud Rate configuration for CAN1
02904	32905	1	CAN1 status register
02905	32906	1	CAN1 error count
02906	32907	1	CAN1 overflow
02907	32908	1	CAN2 Rx message count
02908	32909	1	CAN2 Baud Rate configuration
02909 ~ 02910	32910 ~ 32911	2	User-defined Baud Rate configuration for CAN2
02911	32912	1	CAN2 status register
02912	32913	1	CAN2 error count
02913	32914	1	CAN2 overflow
02914	32915	1	Ethernet status
02915	32916	1	Firmware version
02916 ~ 02919	32917 ~ 32920	4	Module Name
02920 ~ 02922	32927 ~ 32923	3	Manufacturer

■ CAN status register

Bit Number	Description
7	Bus Status (0: Bus-On, 1: Bus-Off).
6	Error Status (0: no error, 1: error).
5	Transmit Status (0: idle, 1: transmit).
4	Receive Status (0: idle, 1: receive).
3	Transmit Complete Status (0: incomplete, 1: complete).
2	Transmit Buffer Status (0: locked, 1: released).
1	Data Overrun Status (0: absent, 1: overrun).
0	Receive Buffer Status (0: empty, 1: full).

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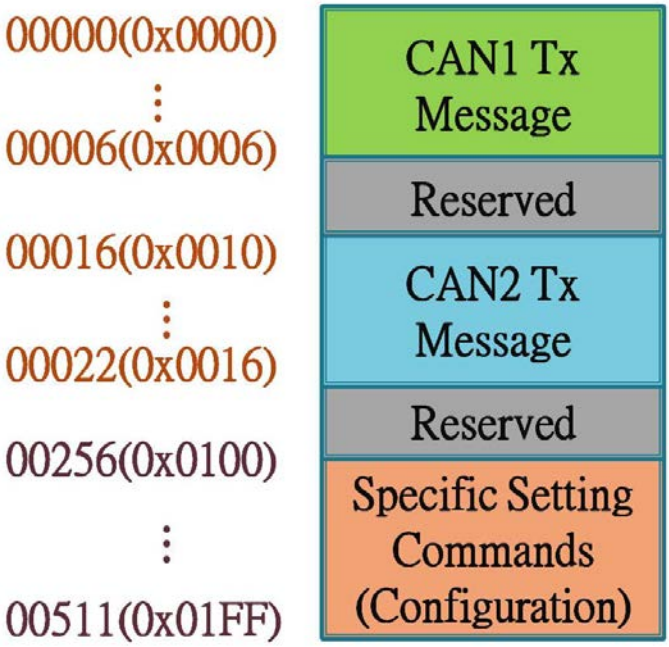
- **Ethernet status**

Bit Number	Description
15	100M Full Duplex (0: non-used, 1: used).
14	100M Half Duplex (0: non-used, 1: used).
13	10M Full Duplex (0: non-used, 1: used).
12	10M Half Duplex (0: non-used, 1: used).
6 - 11	Reserved
5	Auto-negotiation Complete (0: incomplete, 1: complete)
3 – 4	Reserved
2	Link Status (0: Link-Off, 1: Link-On)
0 - 1	Reserved

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4.1.2. Output Register

The major purpose of the output register is for writing CAN messages. Since the ECAN-240 module contains two CAN ports, the Output Register is divided to two sections, one for each CAN port. ECAN-240 also provides the ability to control the module using Modbus commands. The following figures provide an overview of the address allocation for the Output Register.



- **CAN1/CAN2 Tx message addresses**

Protocol Addresses (Base 0)	PLC Addresses (Base 1)	Word Count	Description
Decimal rule (CAN1)			
00000 ~ 00006	40001 ~ 40007	7	CAN1 Tx Message
Decimal rule (CAN2)			
00016 ~ 00022	40017 ~ 40023	7	CAN2 Tx Message

- **Addresses for specific settings commands**

Protocol Addresses (Base 0)	PLC Addresses (Base 1)	Word Count	Description
Decimal rule (CAN1)			
00256 ~ 0257	40257 ~ 40258	2	Modbus Command (Configuration)

The Modbus Command (Configuration) includes the Reboot Module and Reset CAN bus functions.

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- **Reboot Module**

  This function is used to reboot the ECAN-240 module using Modbus command. After sending the request command, the module will respond with a message indicating that the request was successful.

  Request command:

Field Name	Size	Valid Value Range	Example
Hexadecimal rule			
Node ID	1 byte	0x01 to 0xF7	0x01
Function Code	1 byte	0x10	0x10
Start Address	2 bytes	0x0100	0x0100
Word Count	2 bytes	0x0002	0x0002
Byte Count	1 byte	0x04	0x04
Data-1	2 bytes	0x0001	0x0001
Data-2	2 bytes	0x0001	0x0001

  Response:

Field Name	Size	Valid Value Range	Example
Hexadecimal rule			
Node ID	1 byte	0x01 to 0xF7	0x01
Function Code	1 byte	0x10	0x10
Start Address	2 bytes	0x0100	0x0100
Word Count	2 bytes	0x0002	0x0002

- **Reset CAN bus**

  This function is used to reset the CAN bus via a Modbus command. After sending the request command, the module will respond with a message indicating that the request was successful.

  Request command:

Field Name	Size	Valid Value Range	Example
Hexadecimal rule			
Node ID	1 byte	0x01~0xF7	0x01
Function Code	1 byte	0x10	0x10
Start Address	2 bytes	0x0100	0x0100
Word Count	2 bytes	0x0002	0x0002
Byte Count	1 byte	0x04	0x04
Data-1	2 bytes	0x0001	0x0001
Data-2	2 bytes	0x0002	0x0001

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Response:

Field Name	Size	Valid Value Range	Example
Hexadecimal rule			
Node ID	1 byte	0x01 to 0xF7	0x01
Function Code	1 byte	0x10	0x10
Start Address	2 bytes	0x0100	0x0100
Word Count	2 bytes	0x0002	0x0002

Note: This command will clear CAN error status and software buffer overflow status.

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4.2. Structure of CAN message in Modbus commands

In order to enable data exchange between the CAN bus and Modbus, the ECAN-240 module provides CAN data format in a standard Modbus command. The CAN data format in Modbus commands is divided to two parts, Read CAN message format and Write CAN message format.

➢ **Read Command Format:**

Word Number	Description
1	Bit 15: 0 = valid data, 1 = invalid data Bit 6~14: Reserved Bit 5: CAN Specification, 0 = 2.0A, 1 = 2.0B Bit 4: RTR, 0 = No, 1 = Yes Bit s 0 - 3: Data length, value = 0 - 8
2	Most significant two bytes of the CAN identifier. (Big-endian)
3	Least significant two bytes of the CAN identifier. (Big-endian)
4	The Data 1 and Data 2 elements from the CAN data field.
5	The Data 3 and Data 4 elements from the CAN data field.
6	The Data 5 and Data 6 elements from the CAN data field.
7	The Data 7 and Data 8 elements from the CAN data field.
8	Most significant two bytes of the RX timestamp message. (Big-endian)
9	Least significant two bytes of the RX timestamp message. (Big-endian)

➢ **Write Command Format:**

Word Number	Description
1	Bit 6 - 15: Reserved Bit 5: CAN Specification, 0 = CAN 2.0A, 1 = CAN 2.0B Bit 4: RTR, 0 = No, 1 = Yes Bit 0 - 3: Data length, value = 0 - 8
2	Most significant two bytes of the CAN Identifier. (Big-endian)
3	Least significant two bytes of the CAN Identifier. (Big-endian)
4	The Data 1 and Data 2 elements from the CAN data field.
5	The Data 3 and Data 4 elements from the CAN data field.
6	The Data 5 and Data 6 elements from the CAN data field.
7	The Data 7 and Data 8 elements from the CAN data field.

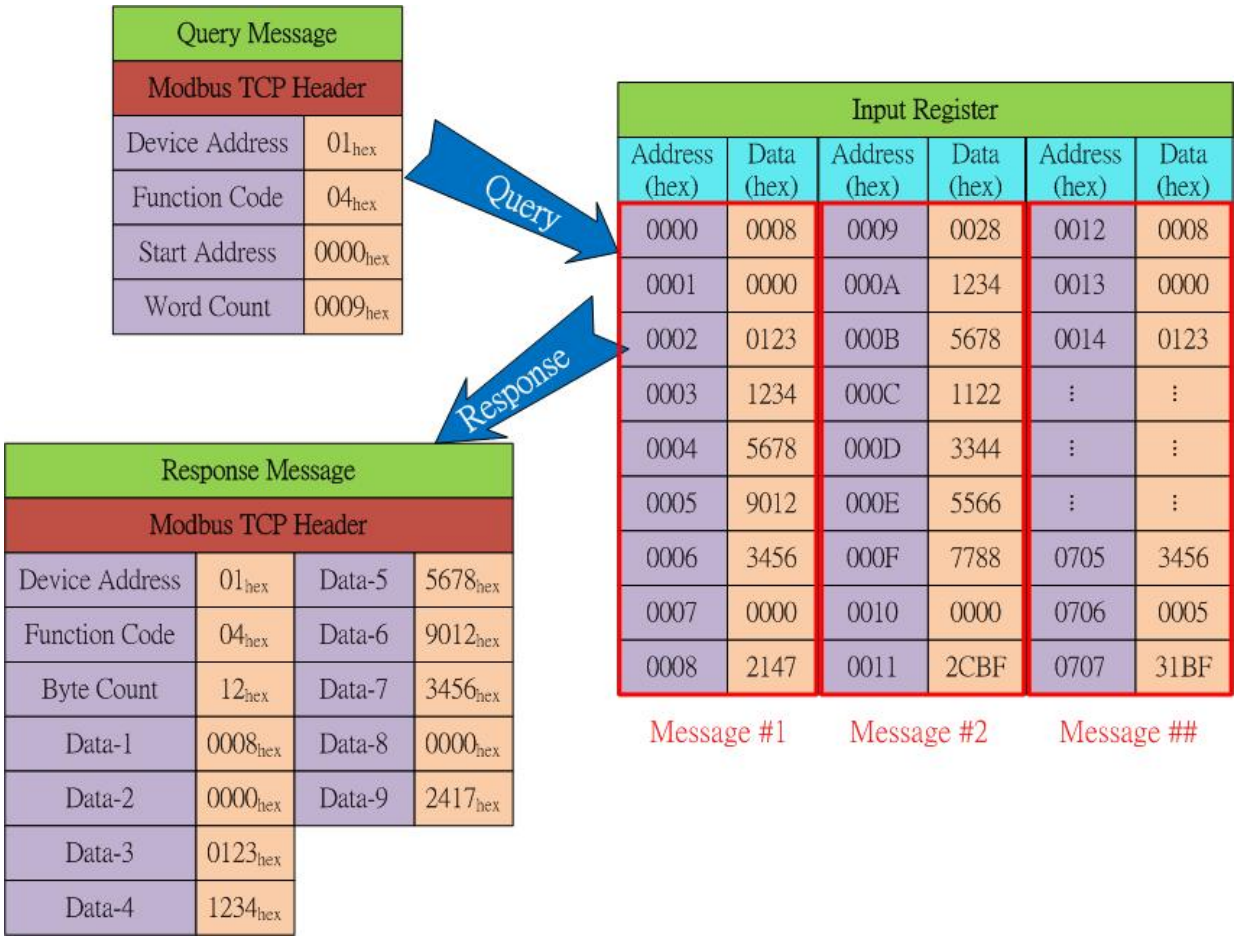
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4.3. Modbus Command Examples

The following is an illustration of how to use Modbus commands to read or write CAN messages and configure the ECAN-240 module.

4.3.1. Reading a CAN message via a Modbus command

Refer to the figure for details of how to use function code 0x04 to read **a single** CAN message.



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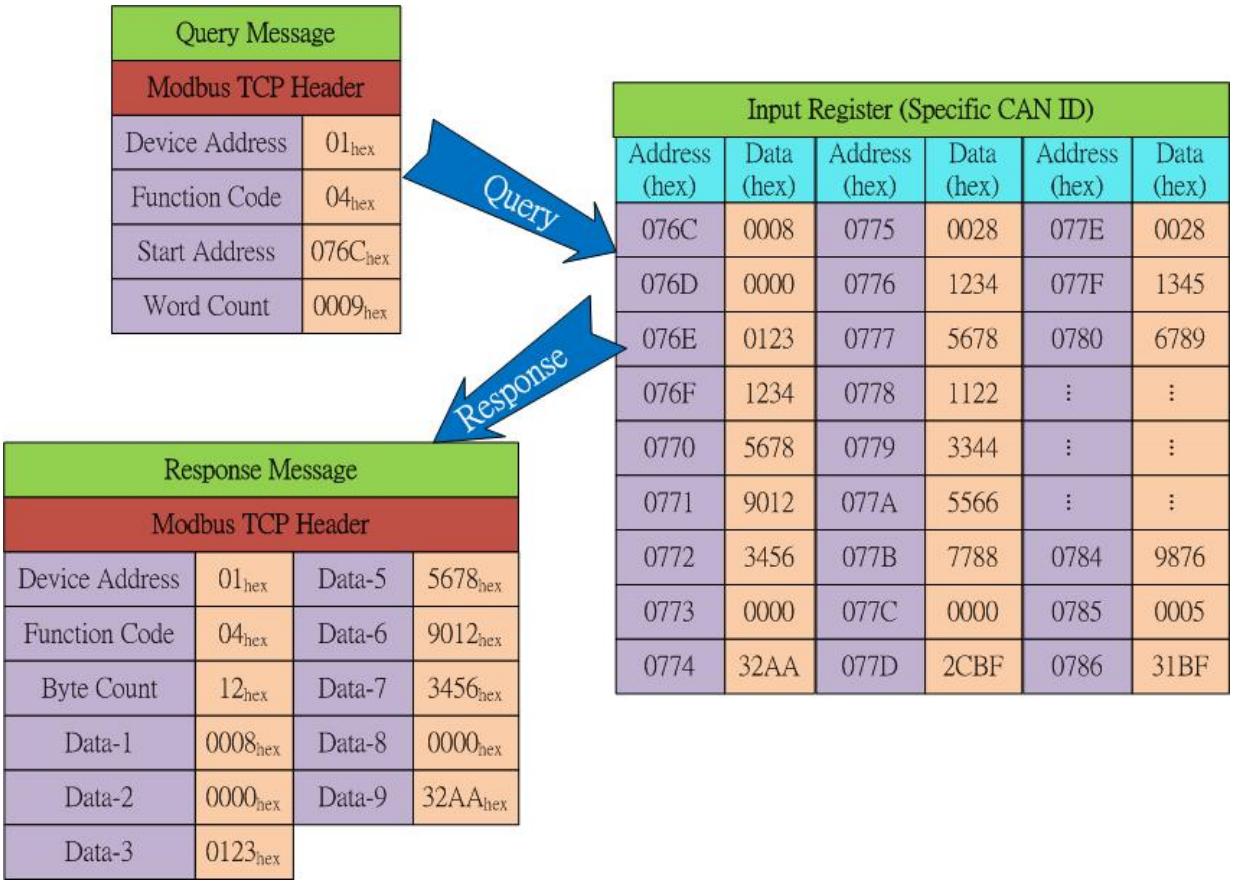
Refer to the figure for details of how to use function code 0x04 to read **two** CAN messages.



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4.3.2. Reading a CAN message containing a specific CAN ID via a Modbus command

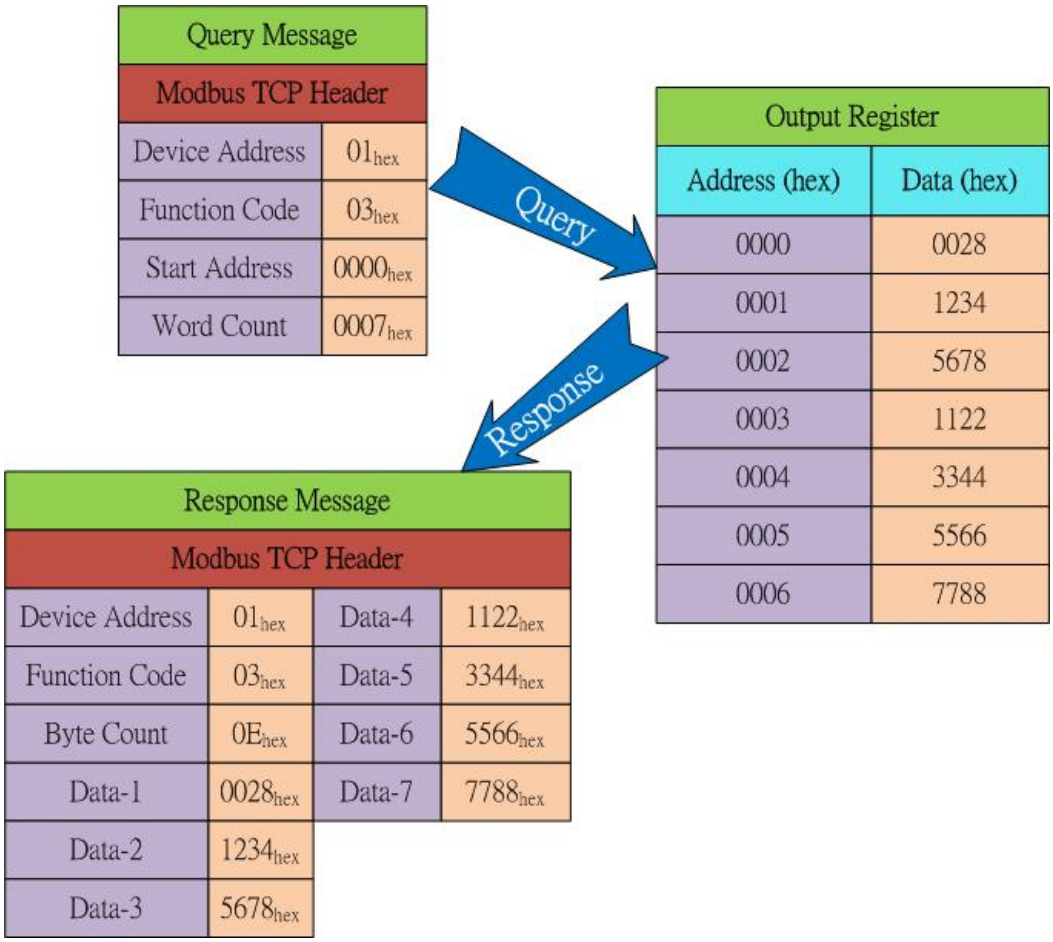
Refer to the figure for details of how to use function code 0x04 to read **a single** CAN message that contains a specific CAN ID.



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4.3.3. Reading a CAN message that has been sent via a Modbus command

Refer to the figure for details of how to use function code 0x03 to read a CAN message that has been sent via a Modbus command.



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4.3.4. Reading the status of a module via a Modbus command

Refer to the figure for details of how to use function code 0x04 to read the status of a module.



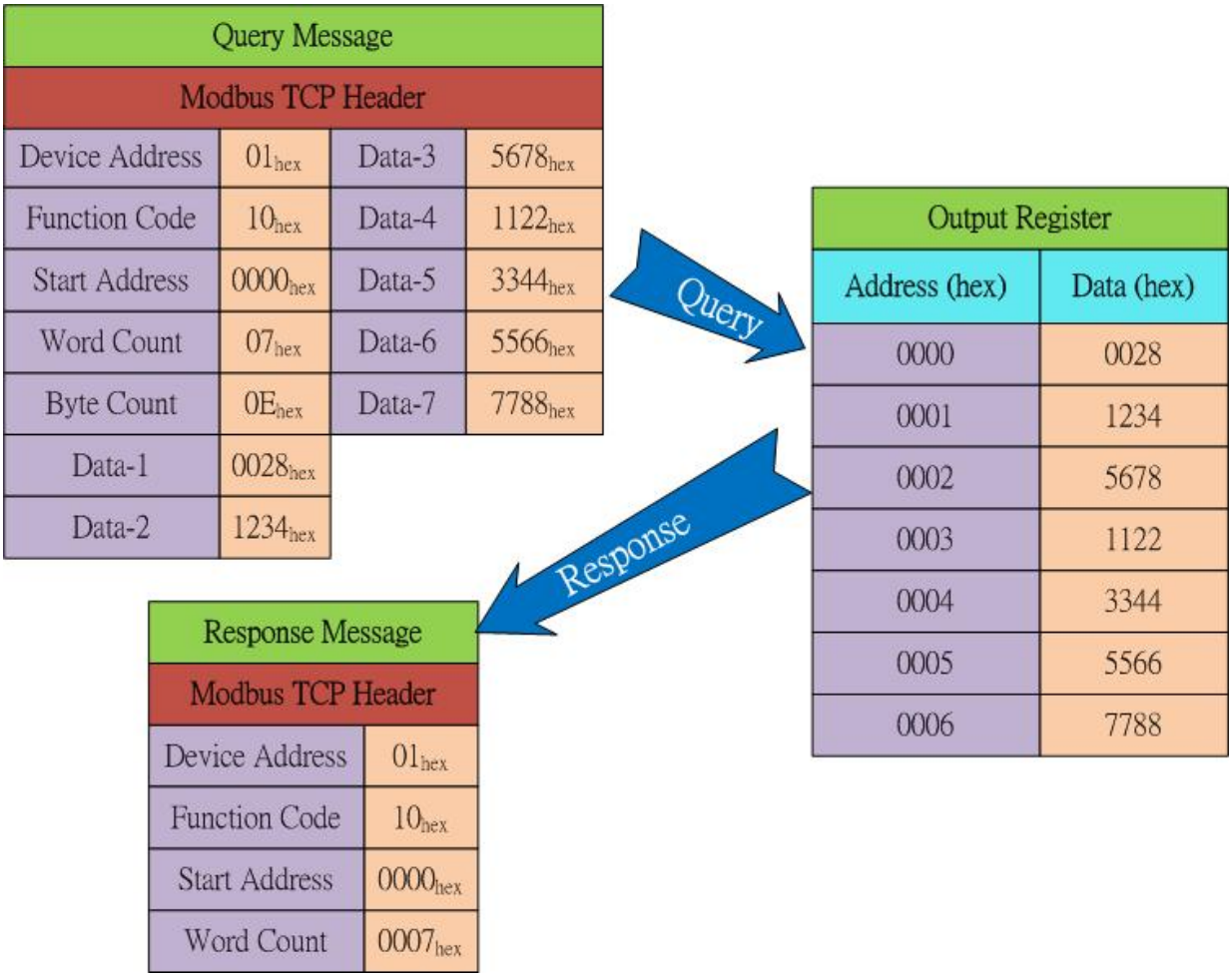
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4.3.5. Writing a CAN message via a Modbus command

There are two ways to write a CAN message, including using function codes 0x06 and 0x10.

- **Using function code 0x10:**

  Refer to figure for details of how to use function code 0x10 to write a CAN message.

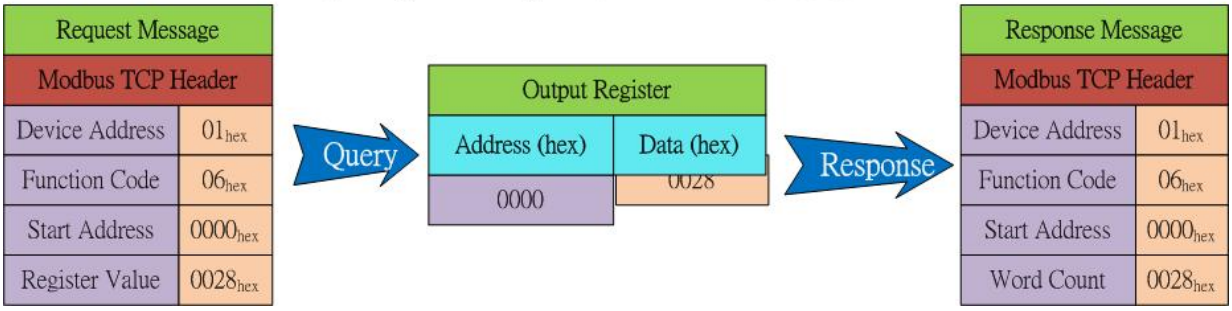


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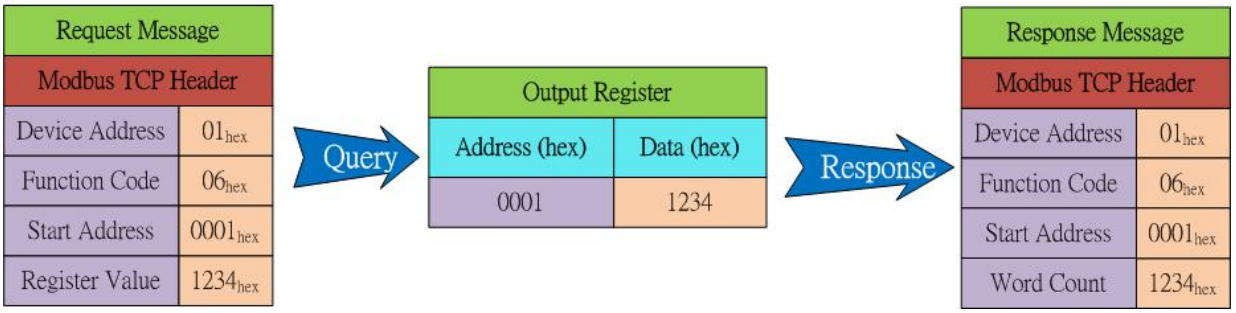
- **Using function code 0x06:**

  The following is a step-by-step illustration of how to send a CAN message via function code 0x06.

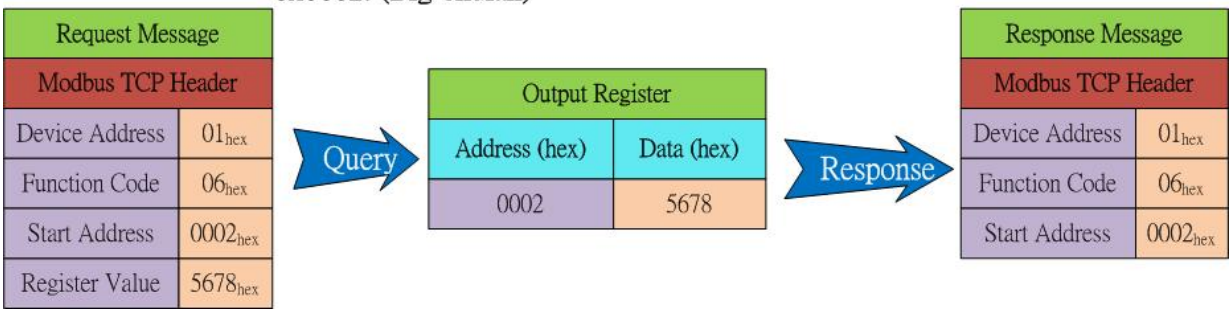
1. Write the CAN specification, RTR, Data Length values to the output register using the Start Address 0x0000.



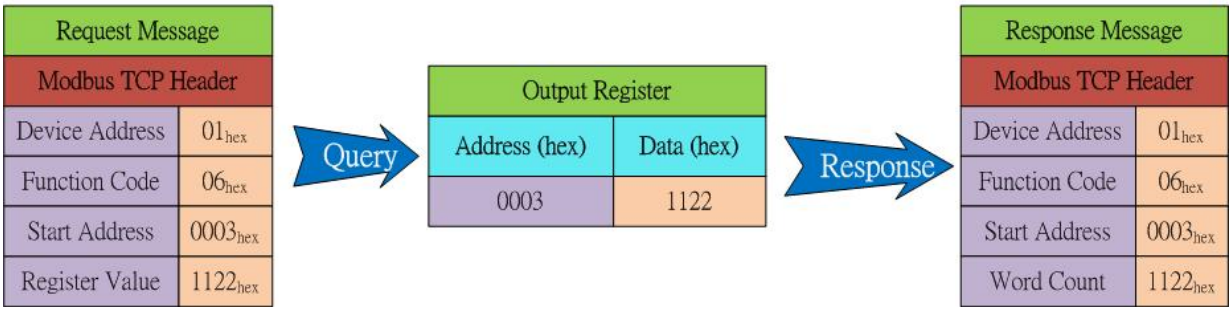
2. Write the most significant two bytes of the CAN identifier to the output register using the Start Address 0x0001. (Big-endian)



3. Write the least significant two bytes of the CAN identifier to the output register using the Start Address 0x0002. (Big-endian)

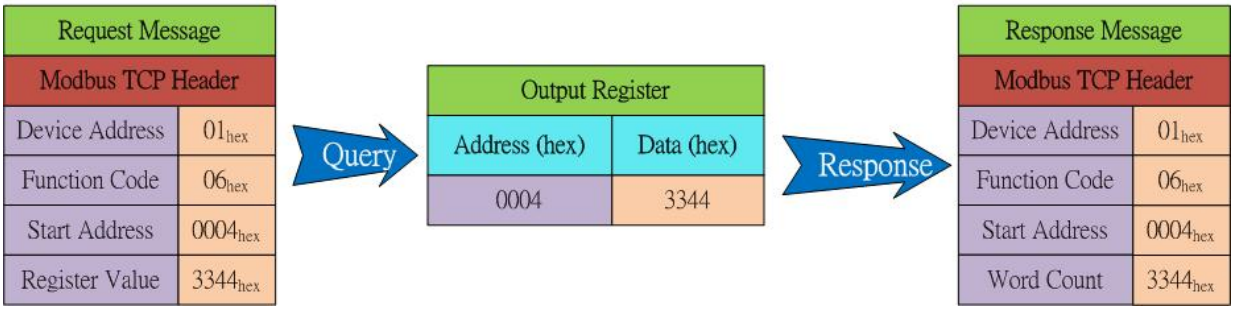


4. Write CAN data1 and data2 to the output register using the Start Address 0x0003.



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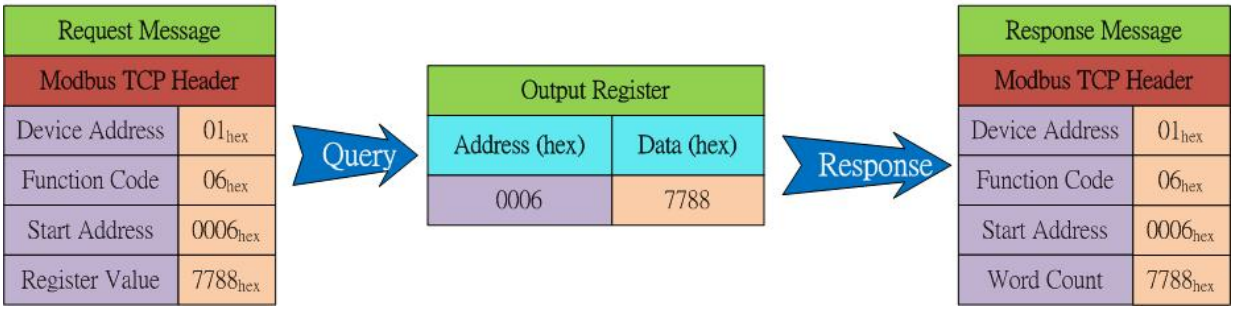
5. Write CAN data3 and data4 to the output register using the Start Address 0x0004.



6. Write CAN data5 and data6 to the output register using the Start Address 0x0005.



7. Write CAN data7 and data8 to the output register using the Start Address 0x0006.

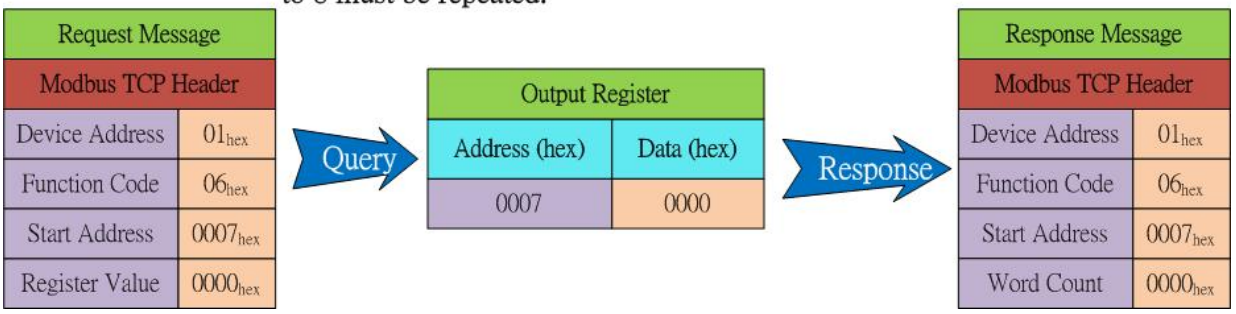


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8. Write the register value To the output register using the Start Address 0x0007. The CAN message will then be transmitted.

If the same CAN message needs to be transmitted, simply use a different value to replace the original one.

If a different CAN message needs to be transmitted, steps 1 to 8 must be repeated.



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4.4. Modbus Exception Codes

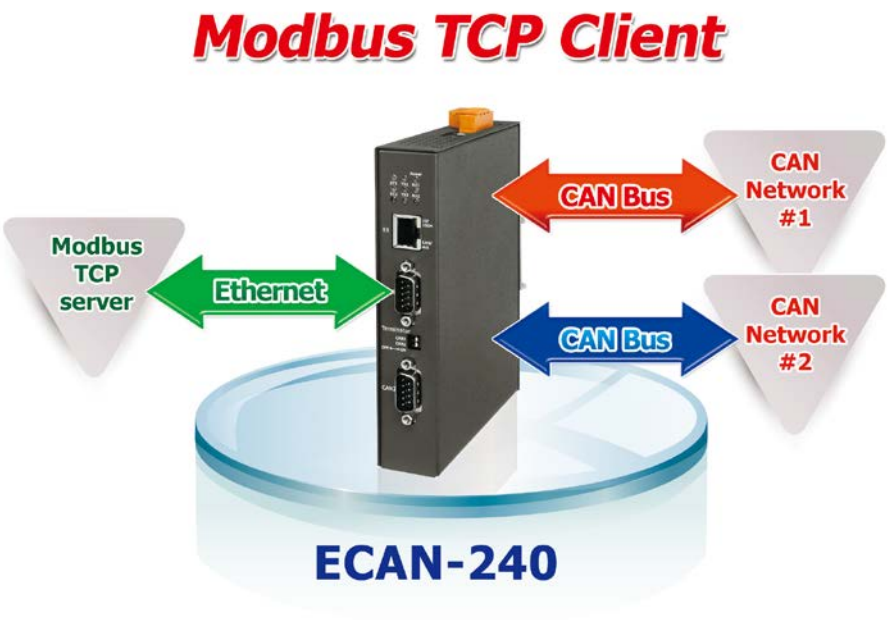
The following is an overview of the Modbus Exception codes that are supported by the ECAN-240 module.

Code	Description	Possible causes & solutions
1	Illegal function	The function code is not supported by the ECAN-240 module.
2	Illegal Data Address	The data address does not exist on the ECAN-240 module.
3	Illegal Data Value	The number of registers or the byte count value is not valid, or no CAN message details are stored in the “Normal CAN Message” field on the ECAN-240 module.
6	Slave Device Busy	A transmission buffer overrun has occurred. The message should be retransmitted at a later time once the status of the module has returned to normal.

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5. Modbus TCP Client Applications

The Modbus TCP Client function is used to implement communications between a CAN Bus and a Modbus TCP Server. When the ECAN-240 module is acting as a Modbus TCP Client, it can access the Modbus TCP Server via the command configuration. When the ECAN-240 module receives I/O data, it will forward it to the remote CAN devices for analysis, control, or other operations. Once configured, the ECAN-240 module is also able to access the Modbus TCP Server via a CAN message.



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5.1. Supported Modbus Function Codes

The Modbus TCP Client function supports Modbus function codes 0x01, 0x02, 0x03, 0x04, 0x05, 0x06, 0x0F, and 0x10, as indicated in the table below.

Modbus Command	Function Code	Function Name	Description
Modbus Read Command	1 (01 Hex)	Read Coil Status	Used to read the status of a coil from a Modbus TCP Server device.
	2 (02 Hex)	Read Input Status	Used to read the status of the input from a Modbus TCP Server device.
	3 (03 Hex)	Read Holding Registers	Used to read Holding Registers from a Modbus TCP Server device.
	4 (04 Hex)	Read Input Registers	Used to read the registers of the input from a Modbus TCP Server device.
Modbus Write Command	5 (05 Hex)	Write Single Coil	Used to write to a single coil on a Modbus TCP Server device.
	6 (06 Hex)	Write Signal Register	Used to write to a single register on a Modbus TCP Server device.
	15 (0F Hex)	Write Multiple Coil	Used to write to multiple coils on a Modbus TCP Server device.
	16 (10 Hex)	Write Multiple Registers	Used to write to multiple registers on a Modbus TCP Server device.

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5.2. Structure of CAN message in Modbus commands

The Modbus read/write command will be mapped to CAN message, so the data length of the Modbus commands must equal or less than CAN data length (8 bytes).

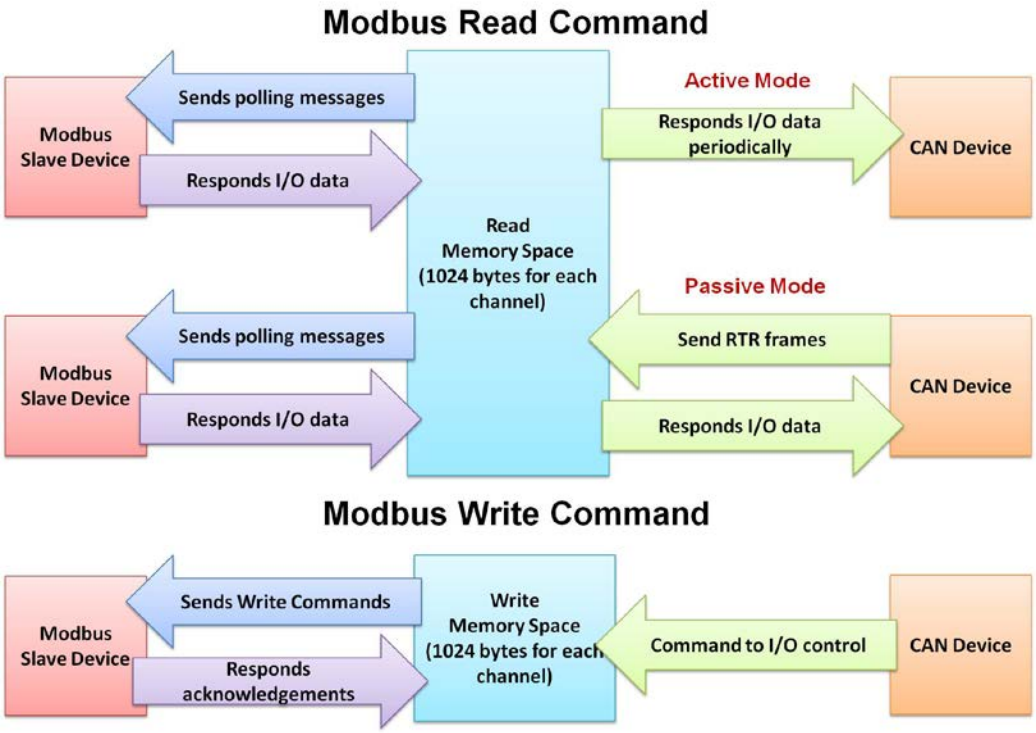
- **Modbus Write Command Data of received CAN messages**

Word Number	Description
1	The Data 1 and Data 2 elements from the CAN data field.
2	The Data 3 and Data 4 elements from the CAN data field.
3	The Data 5 and Data 6 elements from the CAN data field.
4	The Data 7 and Data 8 elements from the CAN data field.

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5.3. I/O Memory Size

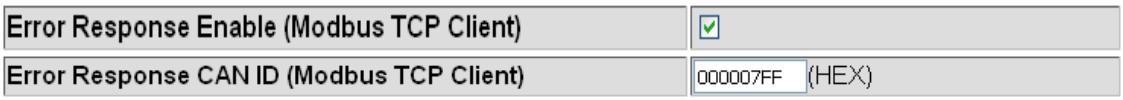
The ECAN-240 module provides a memory block that can be used for data exchange via Modbus TCP Client function. Each CAN port provides a total of 2048 bytes of memory space for transmission and reception, where the available space is 1024 bytes for each. For more information related to the operation of the transmission and reception memory blocks, refer to Sections 3.5.



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5.4. Error Response

The ECAN-240 Module allows error response messages over CAN Bus via error response settings. The Error Response CAN ID is used to specify the CAN ID of the error response messages. Once the error response function is enabled, a CAN message will be returned when the ECAN-240 encounters a Modbus error.



The following describes the format and definition of the CAN error response message.

- **CAN Error Response Message Format**

CAN ID	Length	Byte 0	Bytes 1 - 3	Bytes 4 - 5	Byte 6 - 7
Error Response CAN ID	8	Identifier Code	Reserved	transmission counter	Reserved

- **The "Identifier Code" in Data Byte0 is divided into four types**

Identifier Code	Description
0x00	Reserved
0x01	This code indicates that the current Modbus command has been completely transmitted, but the ECAN-240 module has received the wrong Node ID command.
0x02	This code indicates that the current Modbus command has been completely transmitted, but the ECAN-240 module has not received any response command.
0x03	This code indicates that the current Modbus command has been completely transmitted, but the ECAN-240 module has received a "Modbus Exception" command.

Data Bytes 4 to 5 indicate the "transmission counter" of this error response message. If the Identifier code is 0x03, this counter will be shown in the CAN error response message. Otherwise, these data value will be 0x00.

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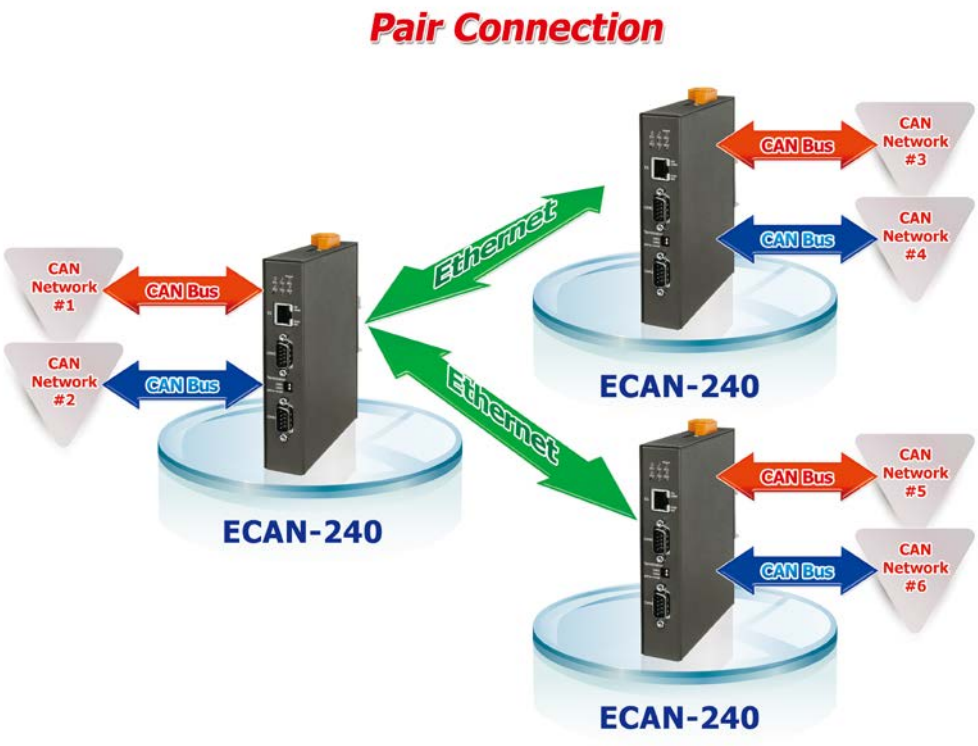
6. Pair Connection Applications

The pair connection function is used to implement communication between two ends of CAN network. CAN Network #1 can communicate with CAN Network #3 or CAN Network #4 using pair connection configuration (for details of the router table, refer to Section 3.6). Similarly, CAN Network #2 can also communicate with CAN Network #3 or CAN Network #4 in the same manner.

The pair connection function on the ECAN-240 module is implemented via either the TCP or the UDP protocol. When using the **TCP protocol**, the application architecture will be one-to-one, as illustrated in the application diagram below.



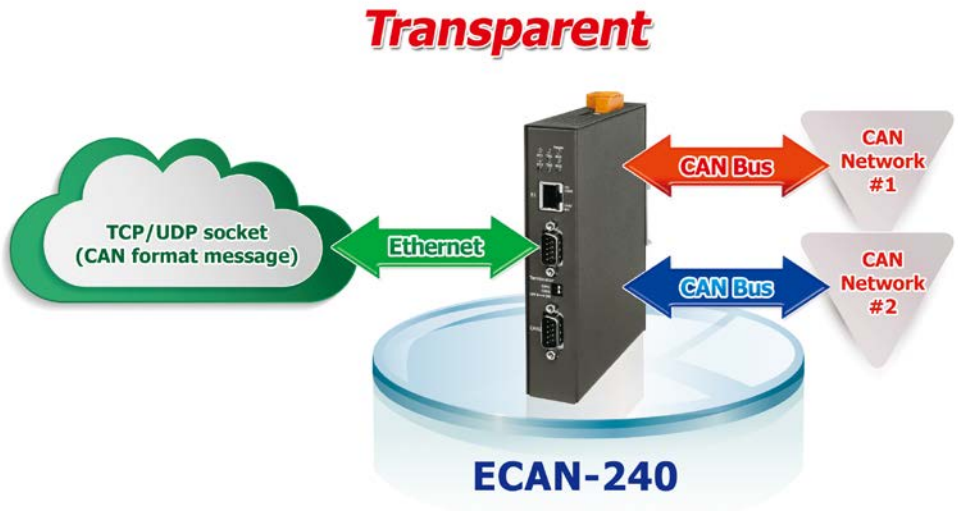
When using the **UDP protocol**, the application architecture will be either one-to-one or one-to-many (UDP broadcast), as illustrated in the application diagram below.

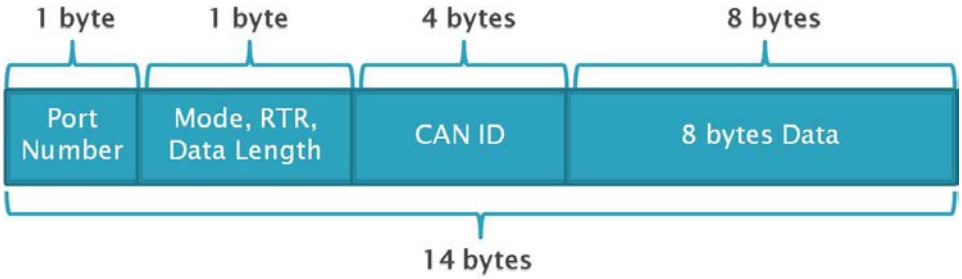


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Note: When using **UDP protocol**, be aware that some routers will block the transmission of UDP packets to the Internet.

The Transparent option is to see as a half-pair connections. The TCP/UDP packet is in CAN format and contains the CAN ID. TCP uses port **10003** and UDP uses port **57540**. This is useful because it allows custom TCP/UDP programs to be developed that can directly access the ECAN-240 module for specific applications.





Byte No.	Description
1	Port No. Port1 = 0x01, Port2 = 0x02
2	Bit 6 - 7: Reserved Bit 5: CAN Specification, 0 = CAN 2.0A, 1 = CAN 2.0B Bit 4: RTR, 0 = No, 1 = Yes Bit 0 - 3: Data length, value = 0 - 8
3 ~ 6	CAN Identifier.
7 ~ 14	Data 1 ~ 8 elements from the CAN data field.

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7. Listen Only Application

The “Listen Only” function is used for listening to CAN Bus communications between two CAN networks. After enabling the “Listen Only” function and rebooting the module, the CAN Bus on the ECAN-240 module will be set to “Listen Only” mode, meaning that the ECAN-240 module will not be able to send any messages to the CAN Bus. On the Ethernet side of the connection, the ECAN-240 module acts as a Modbus TCP Server and can be accessed using Modbus TCP commands.

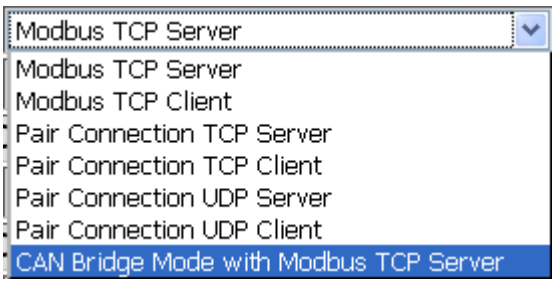


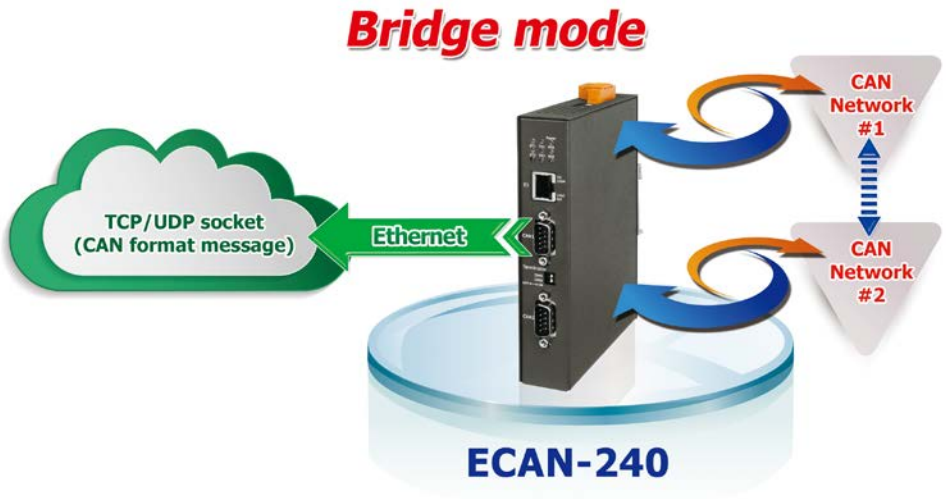


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8. Bridge Mode Applications

Bridge Mode is a special function that allows two CAN networks to communicate with each other via the ECAN-240 protocols. At this time, the ECAN-240 module acts as a Modbus TCP Server and CAN messages can be transmitted between two CAN modules using Modbus TCP commands.





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Appendix A Firmware Update

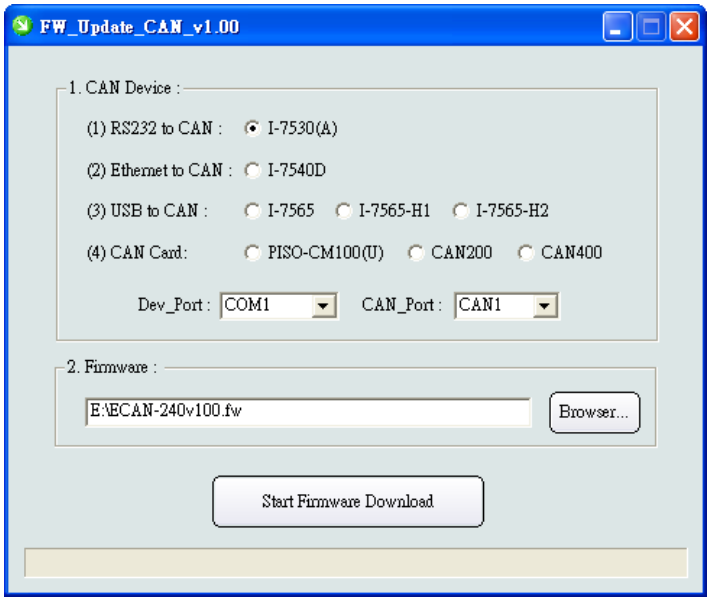
The firmware on the ECAN-240 module can be updated via CAN devices produced by ICP DAS. The latest firmware file (“*.fw”) and the latest version of the Firmware Update utility, FW_Update_CAN_vX.XX.exe (where X denotes the utility version), are available from the Web link below. A notification will not be sent when a new version is released.

https://www.icpdas.com/tw/download/show.php?num=3953&model=ECAN-240

Follow the process described below to update the firmware for the ECAN-240 module using the ICP DAS Firmware Update utility.

Step 1: Move the two rotary switches to the 0xF position (Bootloader mode) and reboot the module. Once the ECAN-240 module has rebooted, all the LEDs on the module will be flashing.

Step 2: Run the Firmware Update utility, FW_Update_CAN_vX.XX.exe (where X denotes the utility version).



[1] CAN devices:

The firmware on the ECAN-240 module can be updated by using ICP DAS CAN products indicated below and Firmware Update utility.

(1) RS232 to CAN : I-7530(A).

(2) Ethernet to CAN: I-7540D.

(3) USB to CAN: I-7565, I-7565-H1, and I-7565-H2.

(4) CAN Card: PISO-CM100(U), PISO-/PCM-/PEX-CAN200 and CAN400.

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Before updating the firmware, the following parameters needs to be set on the utility.

(1) Select the CAN hardware device.

(2) Set the Dev_Port or Board_ID (for CAN cards only).

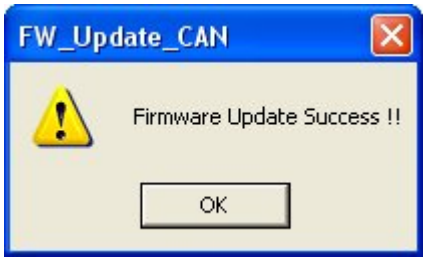
(3) Set the CAN_Port number.

(4) Connect to CAN Port 1 of the ECAN-240 module.

[2] Download the Firmware:

(1) Click the "**Browser…**" button to select the location of the firmware file. The name of the firmware file will be ECAN-240_vXXX.fw (where X denotes the firmware version).

(2) Click the "**Start Firmware Download**" button to being the firmware update process. While the firmware is being updated, a progress bar will be displayed in the utility to indicate the status of the update process. Once the firmware has been successfully updated, a notification will be displayed.



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