tET/tPET DIO Series User Manual

Version 1.5, Jan 2012

Service and usage information for

tET-P6
tPET-P6

tET-C4
tPET-C4

tET-A4
tPET-A4

tET-P2C2
tPET-P2C2

tET-P2A2
tPET-P2A2

tET-P2POR2
tPET-P2POR2

tET-P2R2
tPET-P2R2

Warranty

All products manufactured by ICP DAS are under warranty regarding defective materials for a period of one year, beginning from the date of delivery to the original purchaser.

Warning

ICP DAS assumes no liability for any damage resulting from the use of this product. ICP DAS reserves the right to change this manual at any time without notice. The information furnished by ICP DAS is believed to be accurate and reliable. However, no responsibility is assumed by ICP DAS for its use, nor for any infringements of patents or other rights of third parties resulting from its use.

Copyright

Trademarks

Names are used for identification only and may be registered trademarks of their respective companies.

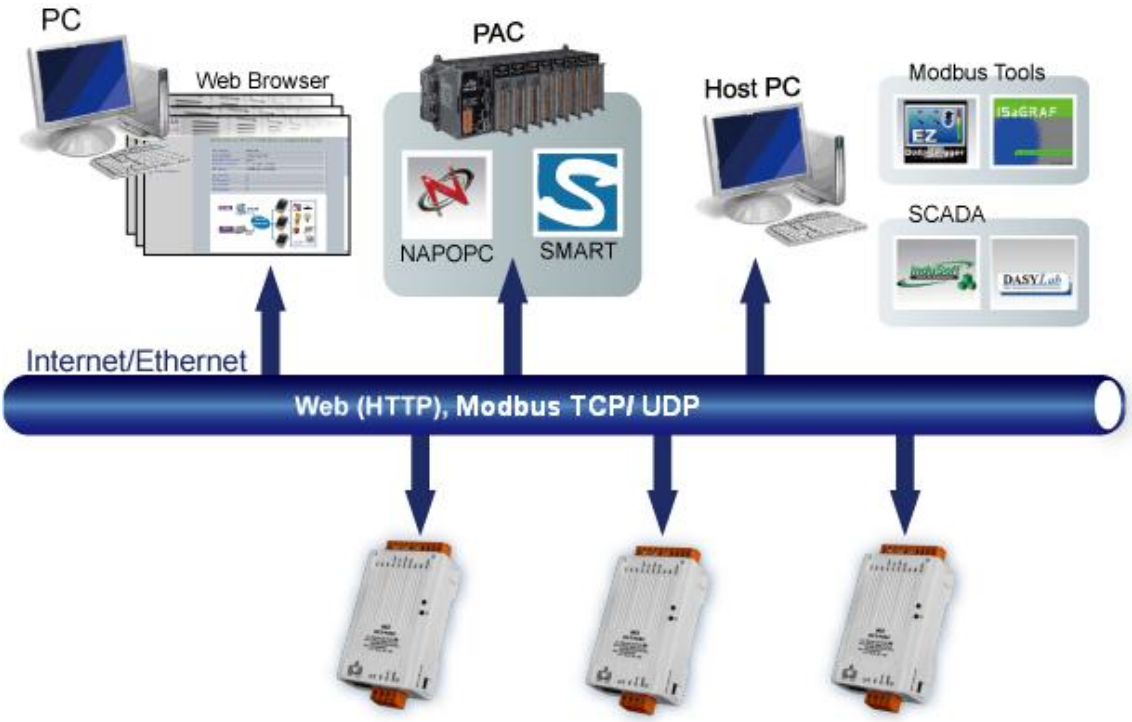
Contact US

If you have any questions, please feel free to contact us and we will respond within 2 working days.

Email: service@icpdas.com , service.icpdas@gmail.com

Table of Contents

1. Introduction



Providing networking ability and various digital I/O functions, the tET/tPET series are IP-based Ethernet I/O monitoring and control modules. The module can be remotely controlled through a 10/100 M Ethernet network by using Modbus TCP/UDP protocol. Modbus has become a de facto standard communications protocol in industry, and is now the most commonly available means of connecting industrial electronic devices. This makes the tET/tPET series perfect integration with the HMI, SCADA, PLC and other software systems.

1.1. Product Information

1.1.1 tET/tPET DIO Series Modules

The tET/tPET series Ethernet I/O modules support various I/O types, like photo-isolated digital input, relay contact, PhotoMOS relay, and open-collector output, etc. The Table below gives a description of each model.

Type	Model	Description
DC Digital Input	tET-P6	Tiny Ethernet module with 6-ch DI
	tPET-P6	Tiny Ethernet module with PoE and 6-ch DI
DC Digital Output	tET-C4	Tiny Ethernet module with 4-ch DO (NPN, Sink)
	tET-A4	Tiny Ethernet module with 4-ch DO (PNP, Source)
	tPET-C4	Tiny Ethernet module with PoE and 4-ch DO (NPN, Sink)
	tPET-A4	Tiny Ethernet module with PoE and 4-ch DO (PNP, Source)
DC Digital Input and Output	tET-P2C2	Tiny Ethernet module with 2-ch DI and 2-ch DO (NPN, Sink)
	tET-P2A2	Tiny Ethernet module with 2-ch DI and 2-ch DO (PNP, Source)
	tPET-P2C2	Tiny Ethernet module with PoE, 2-ch DI and 2-ch DO (NPN, Sink)
	tPET-P2A2	Tiny Ethernet module with PoE, 2-ch DI and 2-ch DO (PNP, Source)
Power Relay Output	tET-P2R2	Tiny Ethernet module with 2-ch DI and 2-ch Form A power relay
	tPET-P2R2	Tiny Ethernet module with PoE, 2-ch DI and 2-ch Form A power relay
PhotoMOS Relay Output	tET-P2POR2	Tiny Ethernet module with 2-ch DI and 2-ch Form A PhotoMOS relay
	tPET-P2POR2	Tiny Ethernet module with PoE, 2-ch DI and 2-ch Form A PhotoMOS relay

1.1.2 tET/tPET Series Selection Guide

Model		Bus	Protocol	I/O Specification		
Ethernet	PoE			Isolation	DI	DO
tET-P6	**tPET-P6**	Ethernet 10/100 M	Modbus TCP	Yes	6-ch (Sink/Source)	-
tET-C4	**tPET-C4**			Yes	-	4-ch (NPN, Sink)
tET-A4	**tPET-A4**			Yes	-	4-ch (PNP, Source)
tET-P2C2	**tPET-P2C2**			Yes	2-ch (Sink/Source)	2-ch (NPN, Sink)
tET-P2A2	**tPET-P2A2**			Yes	2-ch (Sink/Source)	2-ch (PNP, Source)
tET-P2POR2	**tPET-P2POR2**			Yes	2-ch (Sink/Source)	2-ch Form A PhotoMos Relay
tET-P2R2	**tPET-P2R2**			Yes	2-ch (Sink/Source)	2-ch Form A Relay

1.1.3 tET/tPET Comparison

The tPET series features true IEEE 802.3af-compliant (classification, Class 1) Power over Ethernet (PoE) functions. Now, not only is data carried through an Ethernet cable, but power is also provided. This feature makes installation of tPET series modules a piece of cake. Imagine no more unnecessary wires with only an Ethernet cable needed to take care of everything in the field.

The tET/tPET series also features a built-in web server that allows basic configuration, I/O monitoring and I/O control to be performed by simply using a web browser meaning that remote control of your modules is as easy as surfing the Internet. The tET/tPET series also supports the Modbus TCP/UDP protocols that enable perfect integration with SCADA software.

Industrial PoE Solutions

When using PoE devices such as the tPET series, you are able to select the ICP DAS “PoE” switch, the “NS-205PSE”, as the power source. The NS-205PSE automatically detects any connected devices, whether they are PoE devices or not. This mechanism ensures that the NS-205PSE will work with both PoE and non-PoE devices simultaneously.

When acting as a power source for PoE devices, the NS-205PSE requires a power input ranging from +46 to +55 V_{DC}.

More information about the tET/tPET series

The tET series module only through removable terminal block to supply power. The removable terminal block will accept external power input from +12 to +48 VDC.

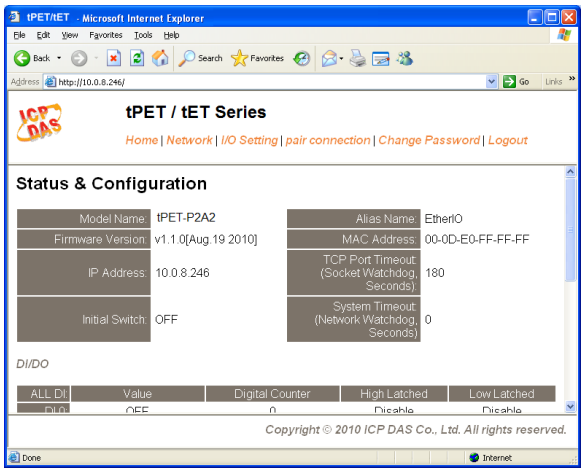
The tPET series module contains two ways to supply power. The first is through the Ethernet via a PoE switch; the second is through removable terminal block via an external power source. The external power supply should be in the range from +12 to 48 VDC. The reason for including the second method is to provide a redundant power input feature. There is an LED included on the tPET series module that indicates whether the power is being supplied by the PoE switch or not.

	tPET	PETL-7000	PET-7000
CPU	**32-bit ARM**		80186
Ethernet	10/100 M, PoE		
Modbus TCP/UDP	Yes		
Web Configuration	Yes		
Web HMI	Simplified		**Yes**
Multi-client	Yes (Max. Connections: 5)		**Yes (Max. Connections: 12)**
IP Filter	Yes (white list)		
Latched DI	Yes		
DI as counter	**32-bit, 3.5 kHz**		32-bit, 500 Hz
Frequency Measurement	**Yes (3.5 kHz Max.)**		-
I/O pair-connection	**Yes (Poll/Push Mode)**		Yes (Poll Mode)
PWM	**Yes (100 Hz Max.)**		-
Dual-Watchdog	Yes (CPU, host)		Yes (Module, host)
ESD Protection	+/- 4 kV		
Surge Protection	-	**+/- 0.5 kV**	
Form Factor	**Tiny Size**	Palm Size	
Remarks	**Cost-effective**		-
Note: tET = tPET without PoE.			

1.2 Features

➢ Built-in Web Server

Each tET/tPET series module contains a built-in web server that allows users to easily configure, monitor and control the module from a remote location using a web browser.



➢ Modbus Protocol

The Modbus TCP/UDP slave function on the Ethernet port can be used to provide data to remote SCADA software.

➢ Built-in Multi-function I/O

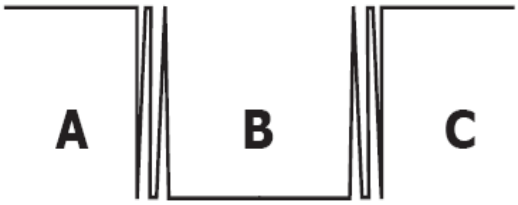
■ All Digital Output modules provide:

- A ***Power-on value*** (On boot up, the DO status is set to the Power-on value)
- A ***Safe value*** (If Modbus TCP communication is lost for a certain period, the DO status will be set to the user-defined safe value)
- ***PWM function:*** The DOs on the tET/tPET series provide PWM (pulse generation) function. Uses can set different frequency (50 or 100 Hz Max.) and duty cycle for each digital output channel. In addition, the two DO channels can work independently or simultaneously. “High Duty Cycle” describes the proportion of 'on' time to the regular interval or 'period' of time; And “Low Duty Cycle” corresponds to 'off' status. It is unnecessary to keep switching the ON/OFF from remote controller. The tET/tPET series product reduces the complexity of the control system and enhances the timing accuracy.

- All Digital Input modules provide:

  - ***DI channels that can also be used as 32-bit high speed (3.5 kHz) counters.***

  - ***High/Low latched status:*** The modules provide commands to read the latched high digital input and latched low digital input status. Following is an example to show the usefulness of the latched digital input. When we want to read the key stroke of a key switch connected to the digital input channel of a module, the input signal of the key stroke is a pulse signal as shown in the following figure.



If we just use the read digital input status command to read the signal and we cannot send the command during the B period due to some reasons, then we will lose the key stroke information. However, with the read latched digital input command, we can still get the key stroke information even we are not able to send command in B period.

  - ***Frequency Measurement:*** The tET/tPET series module also provides the function of the frequency measurement; it gets the DI count in a certain time and calculates the frequency. Rather than polling by the remote host, our module can count out the frequency directly, reduce the communication delay caused by two ends and also increase the accuracy of frequency measurement. In order to applying for more applications, this module provides 3 scan modes and 4 moving average methods for user to select the best way in their applications.

➢ All-in-one Module

Various I/O components are mixed with multiple channels in a single module, which provides the most cost effective I/O usage and enhances the performance of I/O operations.

➢ Automatic MDI/MDI-X Crossover for Plug-and-play

The RJ-45 port supports automatic MDI/MDI-x that can automatically detect the type of connection to the Ethernet device without requiring special straight or crossover cables.

➢ Built-in Dual Watchdog

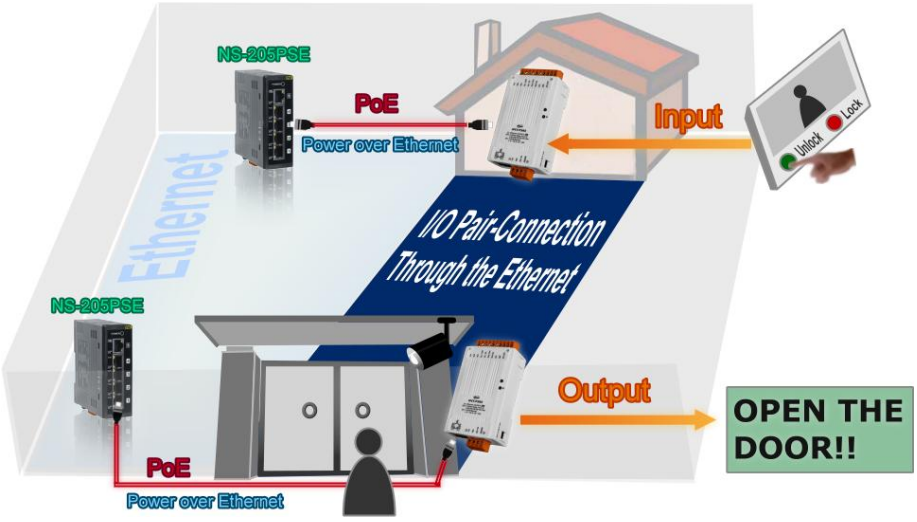
The Dual Watchdog consists of a CPU Watchdog (for hardware functions) and a Host Watchdog (for software functions).

The ***CPU Watchdog*** automatically resets it-self when the built-in firmware runs abnormally.

The ***Host Watchdog*** set the digital output with predefined safe-value when there is no communication between the module and host (PC or PLC) over a period of time (Watchdog timeout).

➢ I/O Pair-Connection

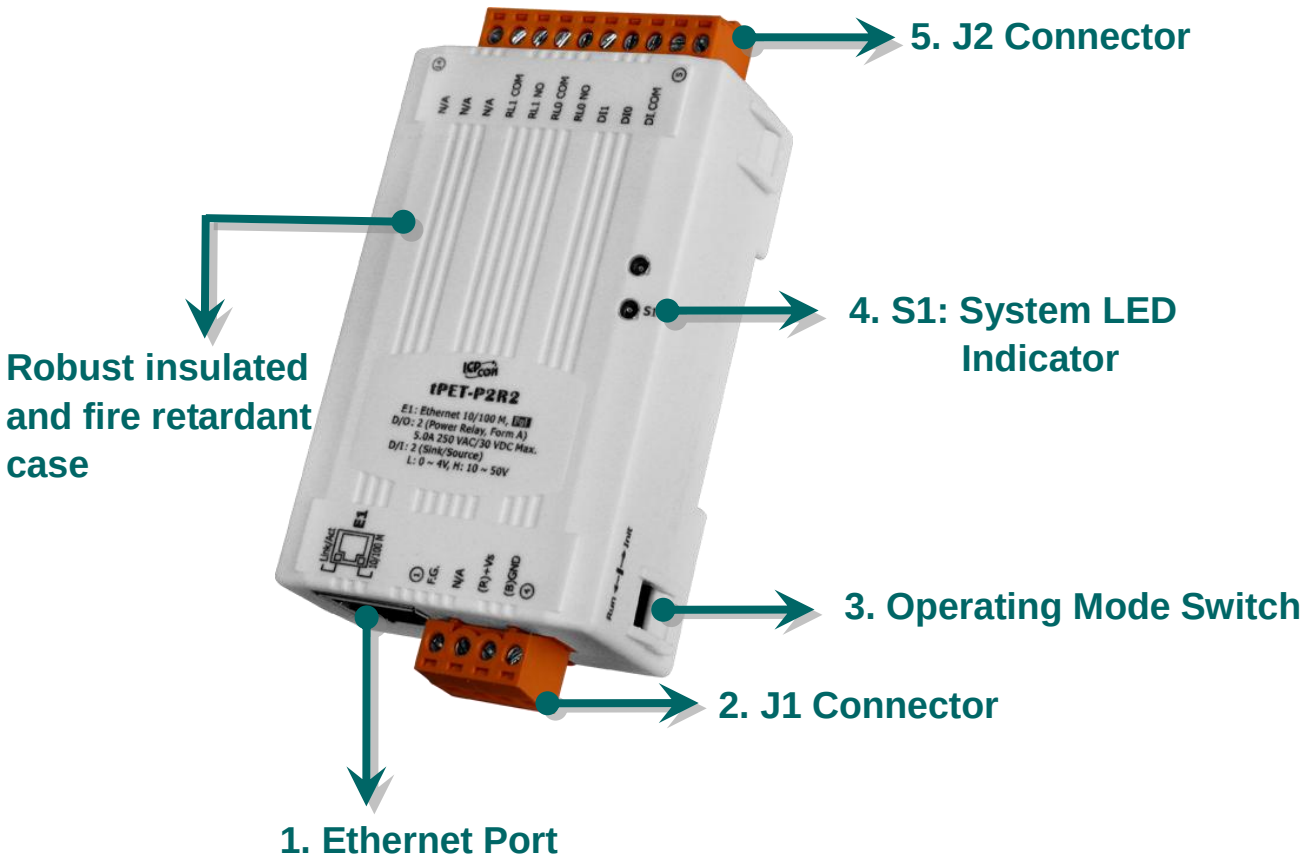
This function is used to create a DI to DO pair through the Ethernet. Once the configuration is completed, the tET/tPET series module can continuously poll the status of a remote DI device using the Modbus TCP protocol, and then write to local DO channels in the background.



2 Hardware Information

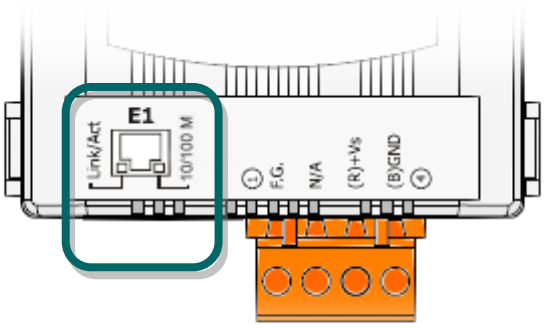
2.1 Front Panel

Here is a brief overview of the tET/tPET series module components and a description.



➢ 1. Ethernet Port

The tET/tPET series modules are equipped with a RJ-45 jack that is used as the 10/100 Base-TX Ethernet port and features networking capability. When an Ethernet link is detected and an Ethernet packet is received, the **Link/Act LED (Green)** indicator and **10/100 M LED (Yellow)** indicator will be illuminated.
Note: The Ethernet port supports PoE (Power-over-Ethernet) functional for tPET series only.

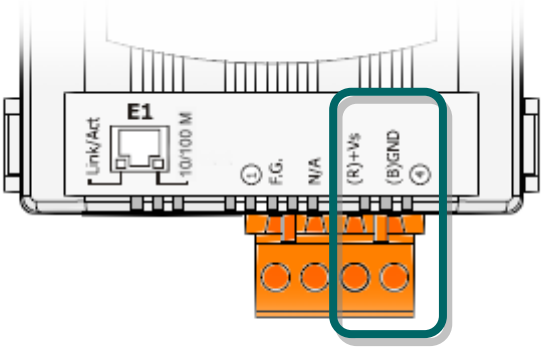


➢ 2. J1 Connector

J1 connector depends on the type of the tET/tPET series module.
For more detailed information regarding the pin assignments for the J1 Connector, please refer to Section 2.3. “Pin Assignments”

DC Power Input

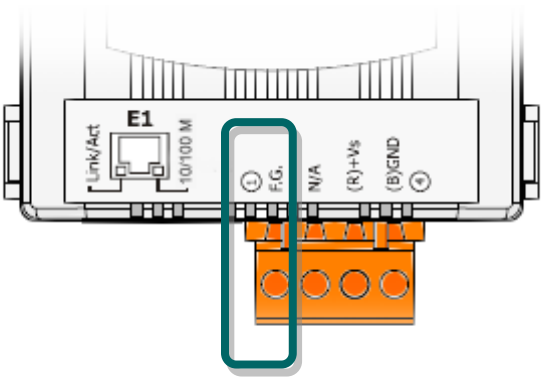
The definition of Pin 3 and Pin 4 applies to all types of tET/tPET series module for used as the power supply.



Pin	Name	Function
3	+Vs	+12 ~ +48 VDC power input
4	GND	Ground connection

Frame Ground

Electronic circuits are constantly vulnerable to Electrostatic Discharge (ESD), which become worse in a continental climate area. tET/tPET series modules feature a new design for the frame ground, which provides a path for bypassing ESD, resulting in an enhanced ESD protection capability and ensuring that the module is more reliable.



Pin	Name	Function
1	F.G.	Frame Ground

➢ 3. Operating Mode Switch

Init mode: Configuration mode
Run mode: Firmware running mode

In the tET/tPET series, the operating mode Switch is in the Run position by default. When updating the tET/tPET firmware, the switch needs to be moved from the Run position to the Init position. The Switch must be returned to the Run position after the update is complete.

➢ 4. S1: System LED Indicator

Once power is supplied to the tET/tPET, the system LED indicator will be illuminated as follows:

Function	System LED Behavior
Running Firmware	ON (Red)
Network ready	Flashing per 3 seconds (Red)
Serial Port Busy	Flashing per 0.2 seconds (Red)
PoE (for tPET only)	ON (Green)

Note: The PoE LED (Green) indicator for tPET series only.

➢ 5. J2 Connector

J2 connector depends on the type of the tET/tPET series module.
For more detailed information regarding the pin assignments for the J2 Connector, please refer to Section 2.3. “Pin Assignments”

2.2 Specifications

2.2.1 System Specifications

Moduls	tET Series	tPET Series
System		
CPU	32-bit MCU	
Dual Watchdog	Yes	
Communication		
Ethernet Port	10/100 Base-TX, 8-Pin RJ-45 x1, (Auto-negotiating, Auto-MDI/MDIX, LED indicator)	
	-	PoE (IEEE 802.3af, Class 1)
LED Display		
S1	-	PoE indicator (Green)
	System indicator (Red)	
E1	Link/Act indicator (Green)	
	10/100 M indicator (Yellow)	
Mechanical		
Dimensions	52 mm x 27 mm x 98 mm	
Installation	DIN-Rail mounting	
Environment		
Operating Temperature	-25 ˚C ~ +75 ˚C	
Storage Temperature	-30 ˚C ~ +80 ˚C	
Humidity	10 ~ 90 % RH, non-condensing	
Power Requirements		
Power Input	-	PoE: IEEE 802.3af, Class 1
	Terminal block: +12 ~ 48 V_{DC} (non-regulated)	
Power Consumption	0.04 A @ 24 V_{DC} for tET-P2R2	0.03 A @ 48 V_{DC} for tPET-P2R2

2.2.2 I/O Specifications

2.2.2.1 tET-P6, tPET-P6

Models	tET-P6/tPET-P6
Digital Input	
Input Channels	6
Input Type (Device)	Wet Contact (Sink, Source)
On Voltage Level	+10 V_{DC} ~ +50 V_{DC}
Off Voltage Level	+4 V_{DC} max.
Input Impedance	10 k Ohm
Counters	Max. Count: 4,294,967,285 (32 bits)
	Max. Input Frequency: 3.5 kHz (without filter)
	Min. Pulse Width: 0.15 ms
Frequency Measurement	1 ~ 3.5 kHz in Mode “1000 ms” (+/-1 Hz error)
	10 ~ 3.5 kHz in Mode “100 ms“ (+/-10 Hz error)
	0.01 ~1 Hz in Mode “Single-pulse“ (+/- 0.01 Hz error)
Overvoltage Protection	+70 V_{DC}
Isolation	3750 Vrms

2.2.2.2 tET-C4, tPET-C4, tET-A4, tPET-A4

Models	tET-C4/tPET-C4	tET-A4/tPET-A4
Digital Output		
Output Channels	4	
Output Type (Module)	Sink, Open Collector (NPN)	Source, Open Collector (PNP)
Output Voltage	+5 V_{DC} ~ +30 V_{DC}	+10 V_{DC} ~ +40 V_{DC}
Max. Load Current	100 mA/channel at 25 °C Direct drive power relay module	650 mA/channel at 25 °C
PWM	100 Hz Max. The unit of duty cycle is 1 ms, and the resolution is about 5 ms. (High/Low duty cucle range = 5 ~ 65,535 ms)	
Over-Voltage	+60 V_{DC}	+48 V_{DC}
Short Circuit Protection	-	Yes
Output Isolation	3750 Vrms	

2.2.2.3 tET-P2C2, tPET-P2C2, tET-P2A2, tPET-P2A2

Models	tET-P2C2/tPET-P2C2	tET-P2A2/tPET-P2A2
Digital Input		
Input Channels	2	
Input Type (Device)	Wet Contact (Sink, Source)	
On Voltage Level	+10 V_{DC} ~ +50 V_{DC}	
Off Voltage Level	+4 V_{DC} max.	
Input Impedance	10 k Ohm	
Counters	Max. Count: 4,294,967,285 (32 bits)	
	Max. Input Frequency: 3.5 kHz (without filter)	
	Min. Pulse Width: 0.15 ms	
Frequency Measurement	1 ~ 3.5 kHz in Mode “1000 ms” (+/-1 Hz error)	
	10 ~ 3.5 kHz in Mode “100 ms“ (+/-10 Hz error)	
	0.01 ~1 Hz in Mode “Single-pulse“ (+/- 0.01 Hz error)	
Overvoltage Protection	+70 V_{DC}	
Isolation	3750 Vrms	
Digital Output		
Output Channels	2	
Output Type (Module)	Sink, Open Collector (NPN)	Source, Open Collector (PNP)
Output Voltage	+5 V_{DC} ~ +30 V_{DC}	+10 V_{DC} ~ +40 V_{DC}
Max. Load Current	100 mA/channel at 25 °C Direct drive power relay module	650 mA/channel at 25 °C
PWM	100 Hz Max. The unit of duty cycle is 1 ms, and the resolution is about 5 ms. (High/Low duty cycle range = 5 ~ 65,535 ms)	
Over-Voltage	+60 V_{DC}	+48 V_{DC}
Short Circuit Protection	-	Yes
Output Isolation	3750 Vrms	

2.2.2.4 tET-P2POR2, tPET-P2POR2

Models	tET-P2POR2/tPET-P2POR2
Digital Input	
Input Channels	2
Input Type (Device)	Wet Contact (Sink, Source)
On Voltage Level	+10 V_{DC} ~ +50 V_{DC}
Off Voltage Level	+4 V_{DC} max.
Input Impedance	10 k Ohm
Counters	Max. Count: 4,294,967,285 (32 bits)
	Max. Input Frequency: 3.5 kHz (without filter)
	Min. Pulse Width: 0.15 ms
Frequency Measurement	1 ~ 3.5 kHz in Mode “1000 ms”, (+/-1 Hz error)
	10 ~ 3.5 kHz in Mode “100 ms“, (+/-10 Hz error)
	0.01 ~1 Hz in Mode “Single-pulse“, (+/- 0.01 Hz error)
Overvoltage Protection	+70 V_{DC}
Isolation	3750 Vrms
Relay Output	
Output Channels	2
Output Type (Module)	PhotoMOS Relay, Form A
Load Voltage	60 V_{DC}/ V_{AC}
Load Current	60 V/1.0 A (Operating Temperature -25°C ~ -40°C)
	60 V/0.8 A (Operating Temperature +40°C ~ +60°C)
	60 V/0.7 A (Operating Temperature +60°C ~ +75°C)
PWM	50 Hz max. The unit of duty cycle is 1 ms, and the resolution is about 10 ms. (High/Low duty cycle range = 10 ~ 65,535 ms)
Turn ON Time	1.3 ms (Typical)
Turn Off Time	0.1 ms (Typical)
Output Isolation	3000 Vrms

Note: Because the characteristic of relay, t(P)ET-P2POR2/t(P)ET-P2R2 series (the module with relay) are not suitable to use PWM for a long time.

2.2.2.5 tET-P2R2, tPET-P2R2

Models		tET-P2R2/tPET-P2R2
Digital Input		
Input Channels		2
Input Type (Device)		Wet Contact (Sink, Source)
On Voltage Level		+10 V_{DC} ~ +50 V_{DC}
Off Voltage Level		+4 V_{DC} max.
Input Impedance		10 k Ohm
Counters		Max. Count: 4,294,967,285 (32 bits)
		Max. Input Frequency: 3.5 kHz (without filter)
		Min. Pulse Width: 0.15 ms
Frequency Measurement		1 ~ 3.5 kHz in Mode “1000 ms” (+/-1 Hz error)
		10 ~ 3.5 kHz in Mode “100 ms“ (+/-10 Hz error)
		0.01 ~1 Hz in Mode “Single-pulse“ (+/- 0.01 Hz error)
Overvoltage Protection		+70 V_{DC}
Isolation		3750 Vrms
Relay Output		
Output Channels		2
Output Type (Module)		Power Relay, Form A (SPST N.O.)
Output Voltage Range		250 V_{AC}/30 V_{DC}
Max. Load Current		5.0 A/channel at 25 °C
Operate Time		6 ms
Release Time		3 ms
PWM		50 Hz max. The unit of duty cycle is 1 ms, and the resolution is about 10 ms. (High/Low duty cycle range = 10 ~ 65,535 ms)
Electrical Life (Resistive load)	VED	5 A 250 V_{AC} 30,000 ops (10 ops/minute) at 75 °C
		5 A 30 V_{DC} 70,000 ops (10 ops/minute) at 75 °C
	UL	5 A 250 V_{AC}/30 V_{DC} 6,000 ops
		3 A 250 V_{AC}/30 V_{DC} 100,000 ops
Mechanical Life		20,000,000 ops. At no load (300 ops./ minute)
Output Isolation		3000 Vrms

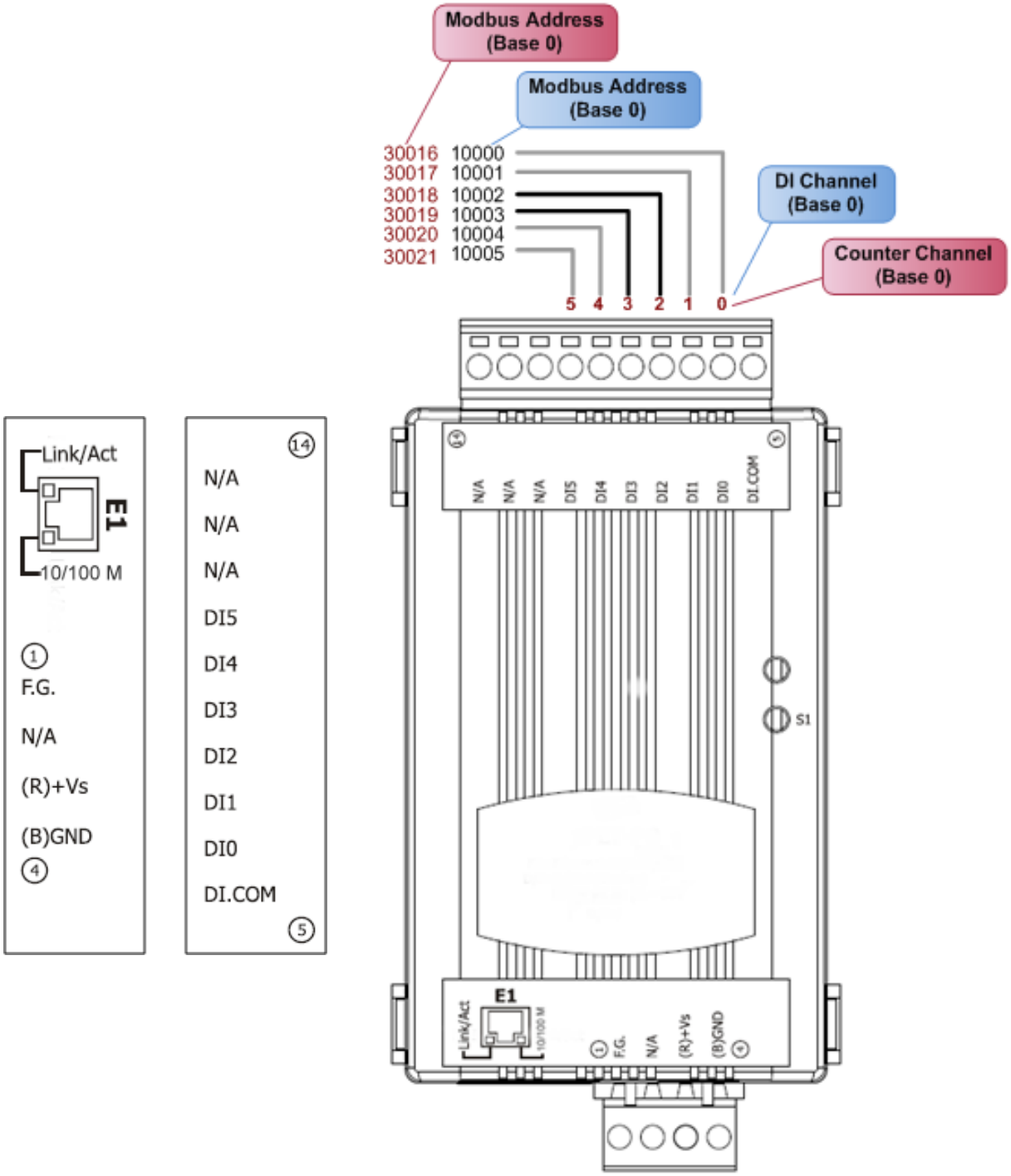
Note: Because the characteristic of relay, t(P)ET-P2POR2/t(P)ET-P2R2 series (the module with relay) are not suitable to use PWM for a long time.

2.3 Pin Assignments

2.3.1 tET-P6, tPET-P6

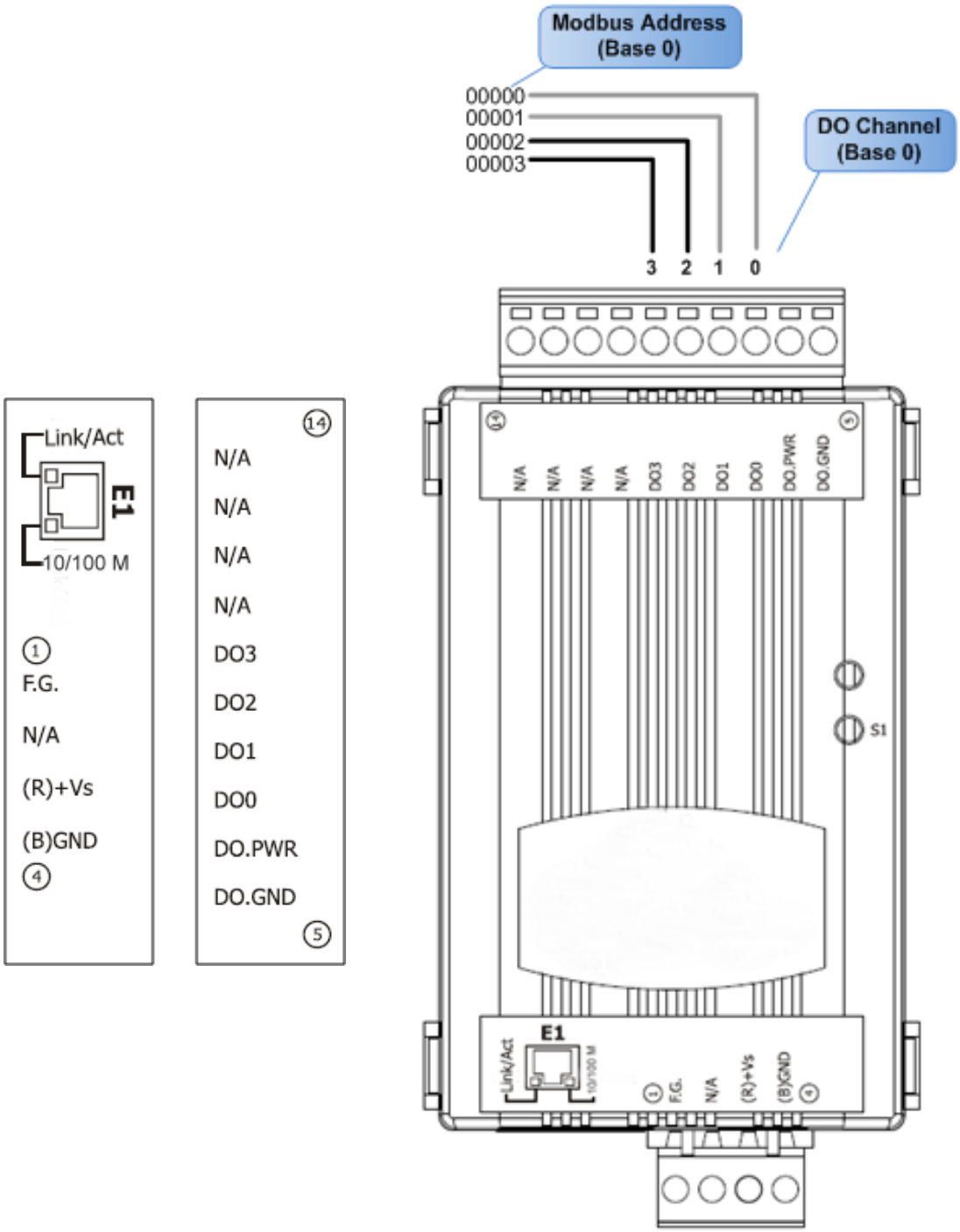
: I/O Address Mapping

: Counter Address Mapping



2.3.2 tET-C4, tPET-C4, tET-A4, tPET-A4

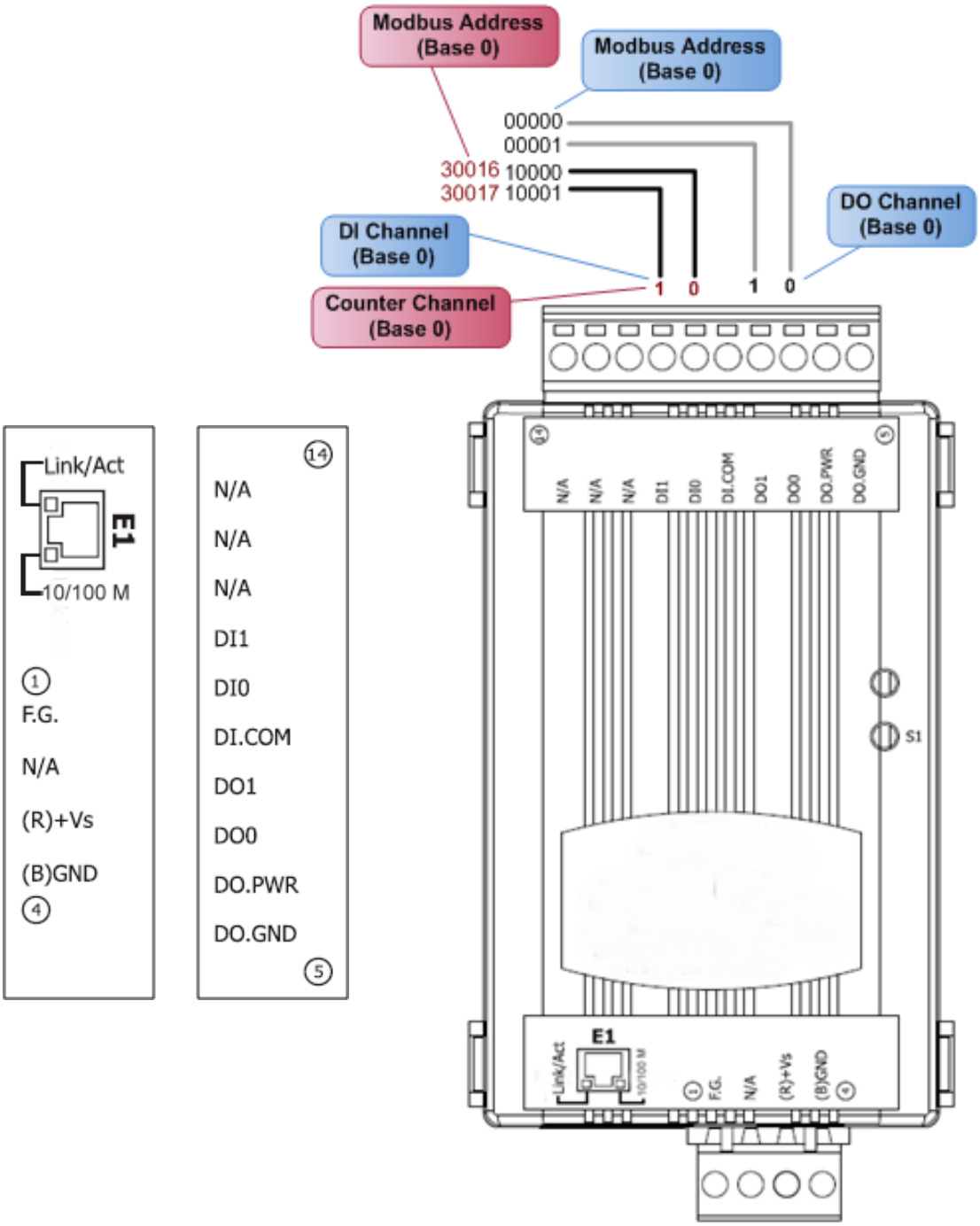
: I/O Address Mapping



2.3.3 tET-P2C2, tPET-P2C2, tET-P2A2, tPET-P2A2

: I/O Address Mapping

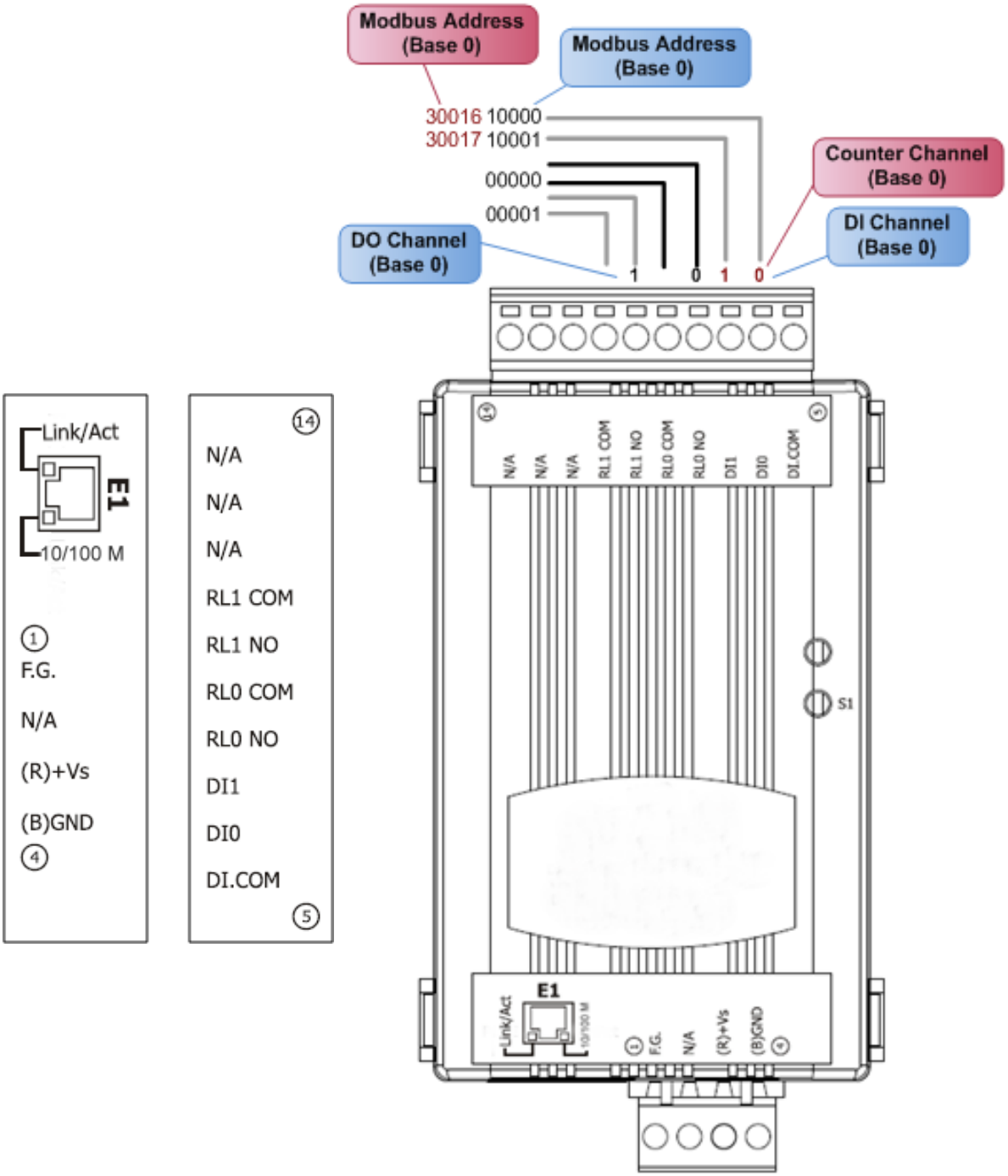
: Counter Address Mapping



2.3.4 tET-P2POR2, tPET-P2POR2, tET-P2R2, tPET-P2R2

: I/O Address Mapping

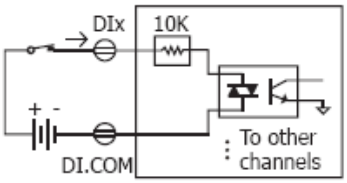
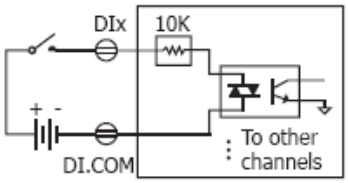
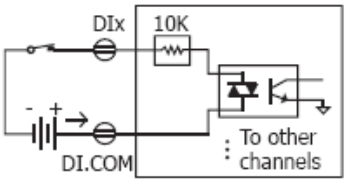
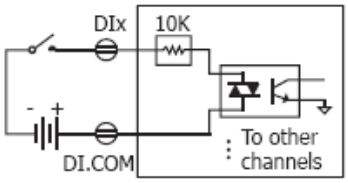
: Counter Address Mapping



2.4 Wiring Connections

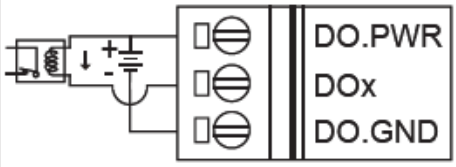
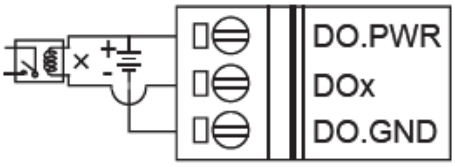
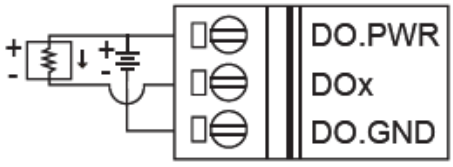
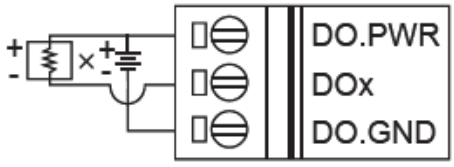
2.4.1 Input Wiring

➢ **tET-P6, tPET-P6, tET-P2C2, tPET-P2C2, tET-P2A2, tPET-P2A2, tET-P2POR2, tPET-P2POR2, tET-P2R2, tPET-P2R2:**

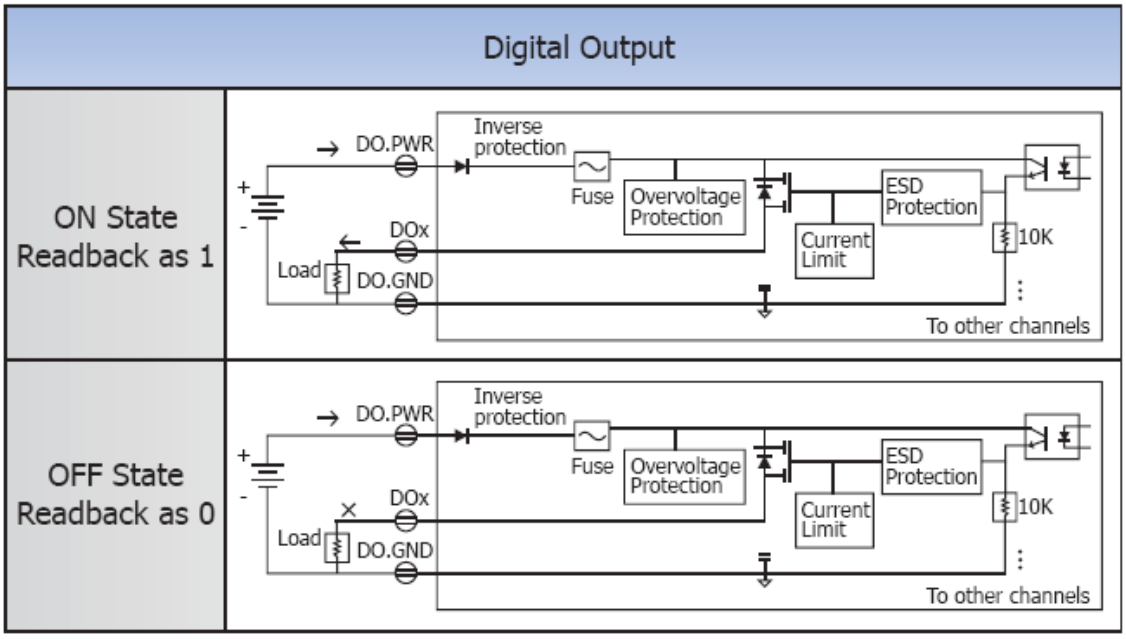
Digital Input	Readback as 1	Readback as 0
Sink	+10 ~ +50 VDC	OPEN or <4 VDC
		
Source	+10 ~ +50 VDC	OPEN or <4 VDC
		

2.4.2 Output Wiring

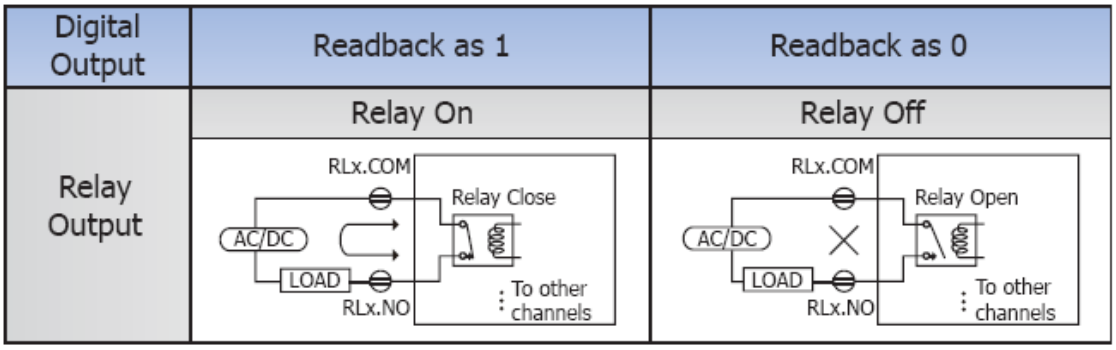
➢ **tET-C4, tPET-C4, tET-P2C2, tPET-P2C2:**

Output Type	Readback as 1	Readback as 0
Drive Relay	Relay ON	Relay Off
		
Resistance Load		
		

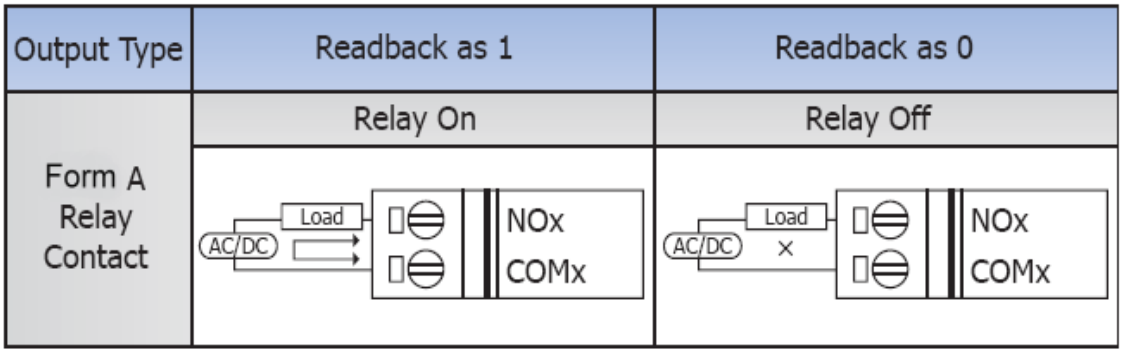
➢ tET-A4, tPET-A4, tET-P2A2, tPET-P2A2:



➢ tET-P2R2, tPET-P2R2:

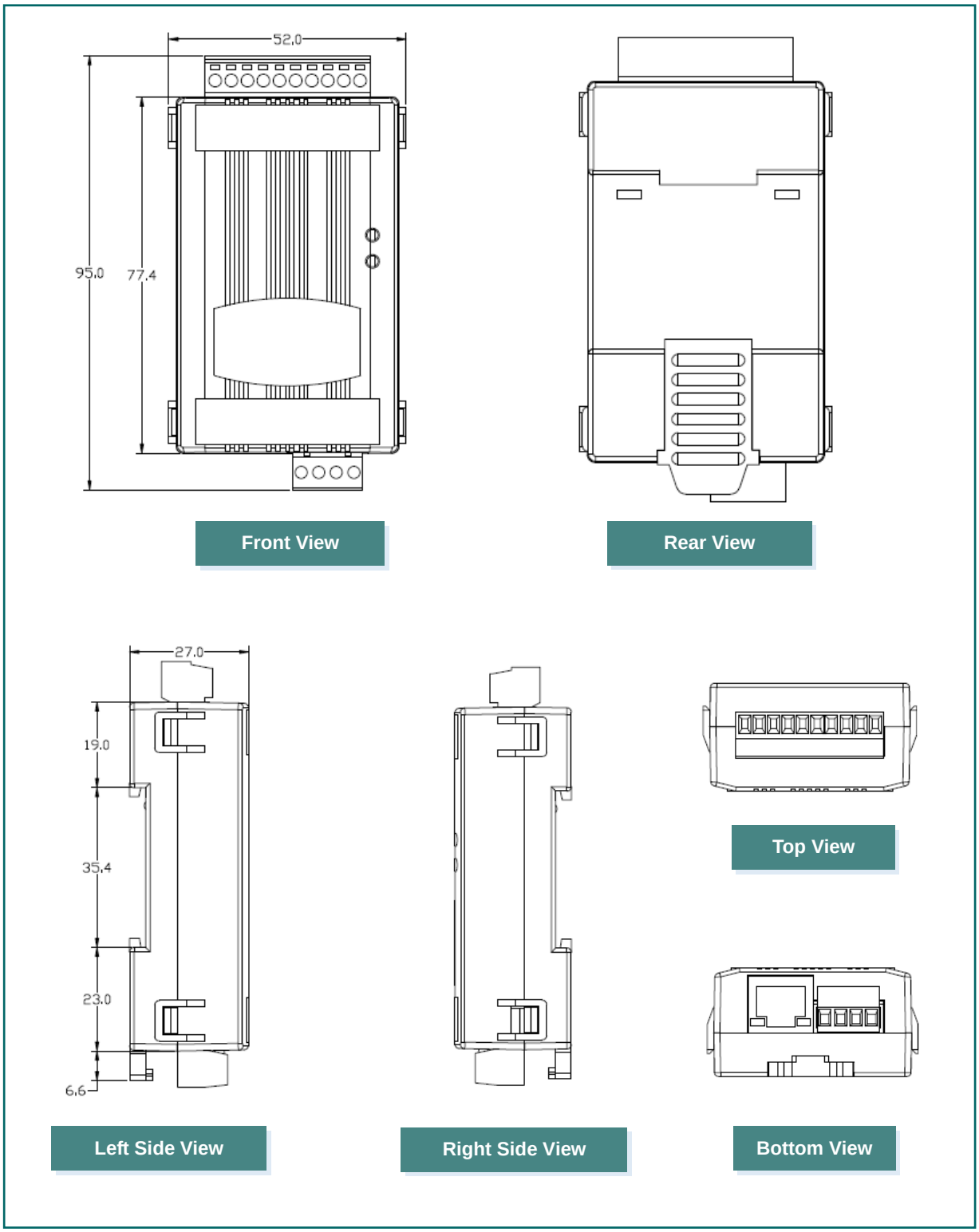


➢ tET-P2POR2, tPET-P2POR2:



2.5 Dimensions

All dimensions are in millimeters.



3 Getting Started

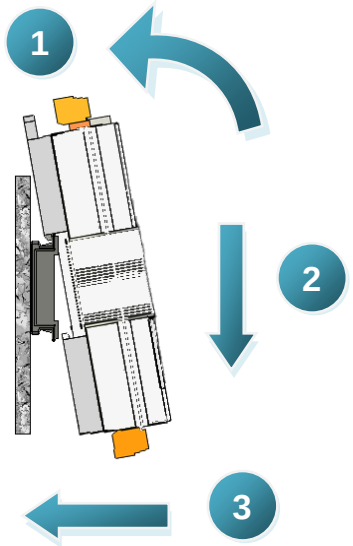
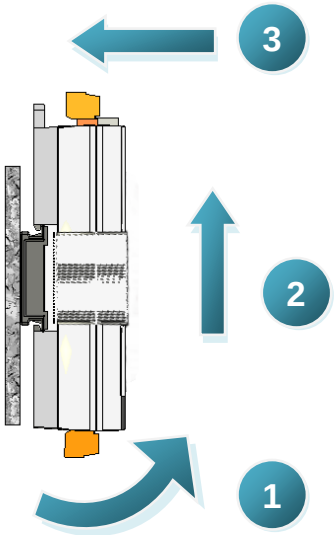
This chapter provides a basic overview of how to install, configure and operate your tET/tPET series module.

3.1 Mounting the Module

The tET/tPET series module can be mounted by attaching the bottom of the chassis to a DIN-Rail, the wall or if can be piggybacked to another module.

➢ DIN-Rail mounting

The tET/tPET series module contains simple rail clips to enable if to be reliably mounted on a standard 35 mm DIN rail.

Mounting on a DIN-Rail	Dismounting from a DIN-Rail
	

3.2 Configuring the Boot Mode

All tET/tPET series modules have two operating modes that can be selected using the switch mechanism incorporated on the chassis.

➢ Init Mode

Init Mode should only be selected when updating the firmware or troubleshooting.

Init

Run

➢ Run Mode

Run Mode is the default operating mode and the mode that should be selected most of the time.

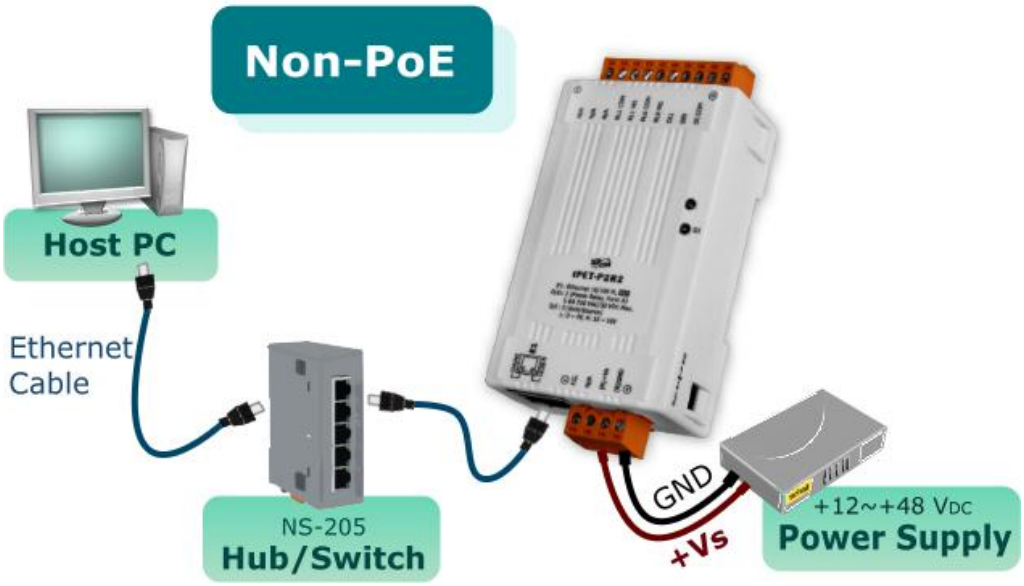
Init

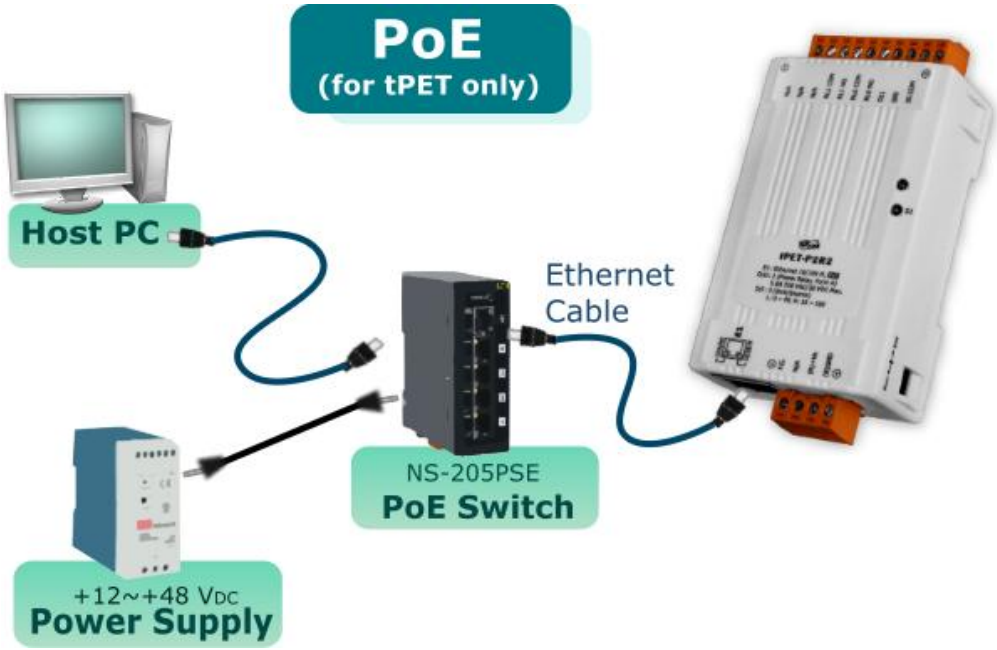
Run

Note:
Be sure to return the switch to the Normal position after any firmware update is complete.

3.3 Connecting to Network, PC and Power

All tET/tPET series modules are equipped with an RJ-45 Ethernet port to allow connection to an Ethernet hub/switch or PC.





3.4 Using eSearch Utility to assign a new IP

The eSearch Utility is a useful tool that provides a quick and easy method of configuring the Ethernet settings for tET/tPET series modules from a PC.

Step 1: Get the eSearch Utility tool

The eSearch Utility can be obtained either from the companion CD or from our FTP site:

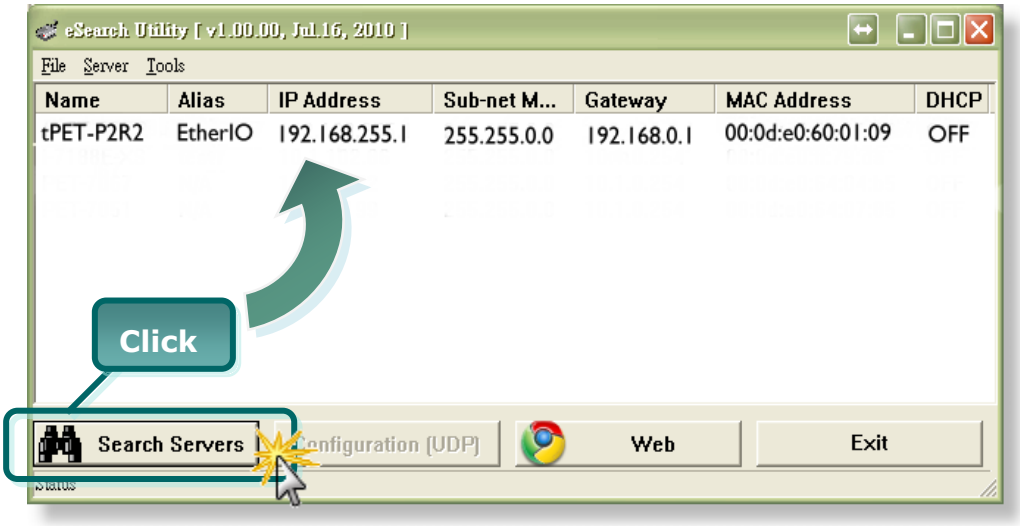
CD:\Napdos\Software\eSearch\

http://ftp.icpdas.com/pub/cd/tinymodules/napdos/software/esearch/

Step 2: Run the eSearch Utility

Double-click the eSearch Utility.

Step 3: Click the "Search Servers" button to search for your tET/tPET module

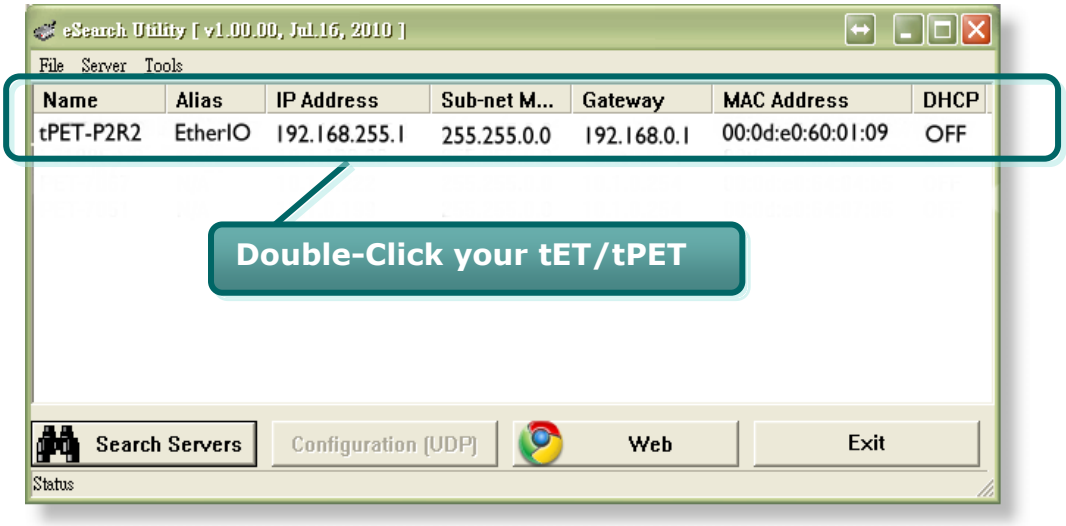


Step 4: Double-Click your tET/tPET to configure the settings.

tET/tPET series modules are IP-based devices that may not be suitable for your network using a default IP address. Therefore, you must first assign a new IP address to the tET/tPET module depending on your network settings.

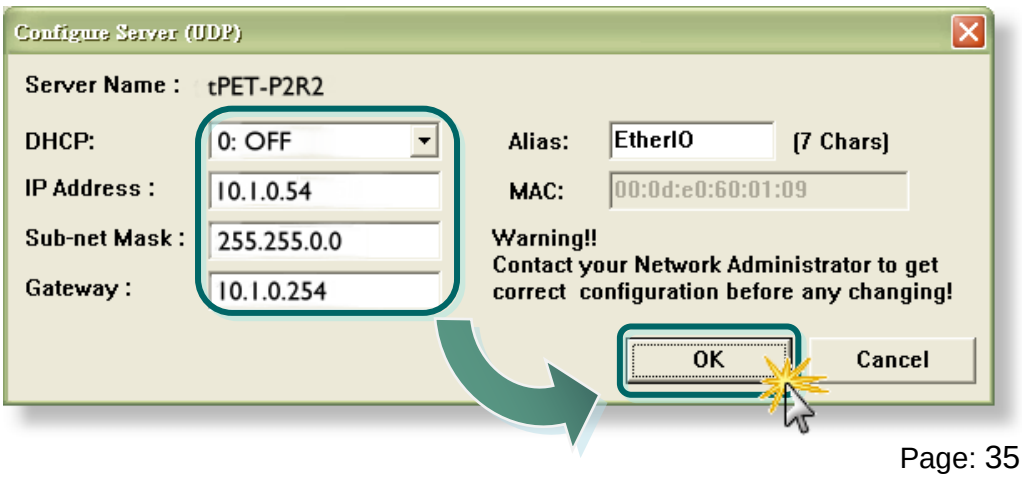
The factory default IP settings are as follows:

Item	Default
IP Address	192.168.255.1
Subnet Mask	255.255.0.0
Gateway	192.168.0.1



Step 5: Assign a new IP address and then click the "OK" button

Contact your Network Administrator to obtain the correct network configuration. Modify the network settings and then click the "**OK**" button. The tET/tPET series module will use the new settings immediately.



4 Web Configuration

All tET/tPET series modules contain an advanced web configuration system that provides I/O accessibility to the tET/tPET module via a web browser.

Logging in to the tET/tPET Web Server

You can login to the tET/tPET web server from any computer that has Internet access capability.

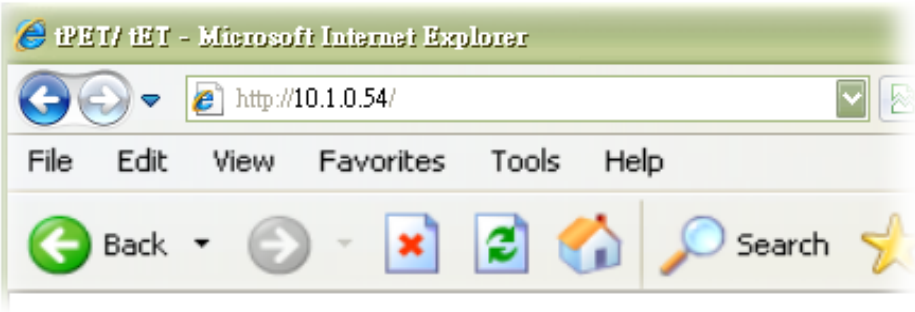
Step 1: Open a browser

For example, Mozilla Firefox, Google Chrome and Internet Explorer are reliable and popular internet browsers that can be used to configure tET/tPET series modules.

If using IE, please disable its cache to avoid browser accessing error. The detail settings steps refer to “Appendix: A”.

Step 2: Enter the URL address of the tET/tPET

Make sure you have correctly configured the network settings of the tET/tPET module, or refer to Section 3.4 “Using eSearch Utility to Assign a New IP”.



Step 3: Enter the Password

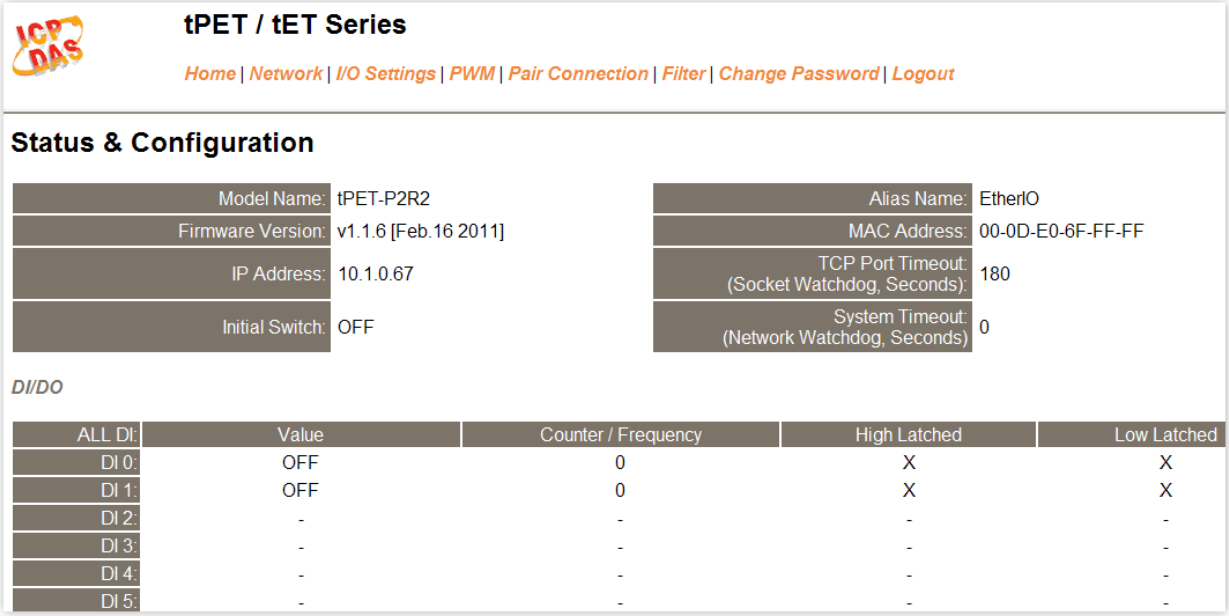
After entering the IP address, the login dialog page will prompt you to enter a password.

The factory default password is as follows:

Item	Default
Login password	**Admin**

Step 4: Login to the tET/tPET web server

After logging into the tET/tPET web server, the main page will be displayed.



4.1 Home page

The Home tab links to the main page, which is divided in to three parts.

The first part of the page provides basic information about the tET/tPET hardware and software.

Status & Configuration

Model Name:	tPET-P2A2	Alias Name:	EtherIO
Firmware Version:	v1.1.5 [Dec.21 2010]	MAC Address:	00-0D-E0-60-01-09
IP Address:	10.1.0.54	TCP Port Timeout: (Socket Watchdog, Seconds):	180
Initial Switch:	OFF	System Timeout: (Network Watchdog, Seconds)	0

The second part provides information about the status of the I/O.

DI/DO

ALL DI:	Value	Digital Counter	High Latched	Low Latched
DI 0:	OFF	0	X	X
DI 1:	OFF	0	X	X
DI 2:	-	-	-	-
DI 3:	-	-	-	-
DI 4:	-	-	-	-
DI 5:	-	-	-	-
DI 6:	-	-	-	-
DI 7:	-	-	-	-
DI 8:	-	-	-	-
DI 9:	-	-	-	-
DI 10:	-	-	-	-
DI 11:	-	-	-	-

DO7	-	DO6	-	DO5	-	DO4	-	DO3	-	DO2	-	DO1	OFF	DO0	OFF

The third part provides the status of the I/O pair-connections.

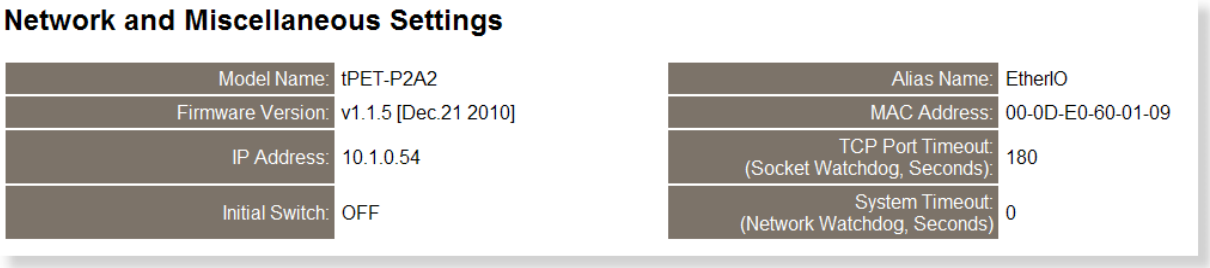
Current port settings:

Pair-Connection Settings	Port 1
Server Mode:	Server
Remote Server IP:	Disabled
Remote TCP Port:	Disabled

4.2 Network Settings

4.2.1 Network and Miscellaneous Settings

Check the Model name and the software information



Network and Miscellaneous Settings

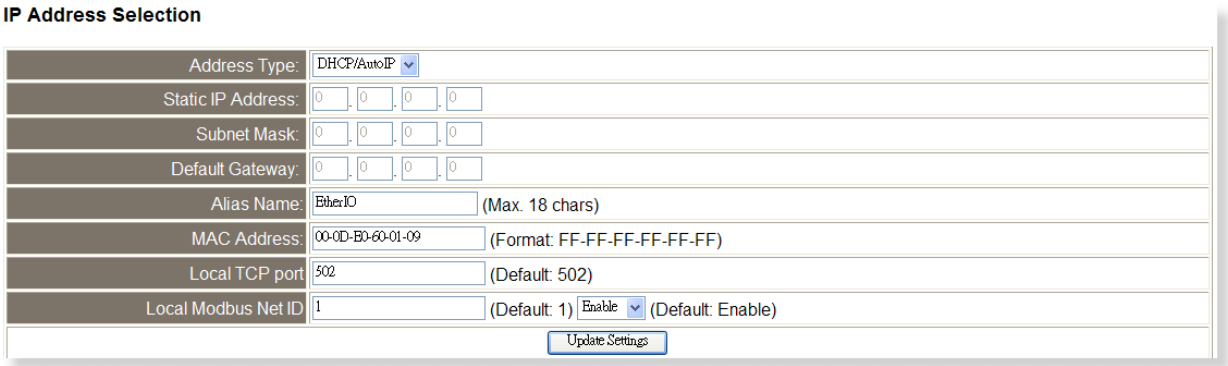
Model Name:	tPET-P2A2	Alias Name:	EtherIO
Firmware Version:	v1.1.5 [Dec.21 2010]	MAC Address:	00-0D-E0-60-01-09
IP Address:	10.1.0.54	TCP Port Timeout: (Socket Watchdog, Seconds):	180
Initial Switch:	OFF	System Timeout: (Network Watchdog, Seconds)	0

The software information includes the following data items:

Model Name, Firmware version, IP Address, Initial Switch, Alias Name, MAC Address, TCP Port Timeout and System Timeout.

After updating the tET/tPET firmware, you can check the tET/tPET software version information from this page.

4.2.2 IP Address Selection



IP Address Selection

Address Type:	DHCP/AutoIP
Static IP Address:	0 . 0 . 0 . 0
Subnet Mask:	0 . 0 . 0 . 0
Default Gateway:	0 . 0 . 0 . 0
Alias Name:	EtherIO (Max. 18 chars)
MAC Address:	00-0D-E0-60-01-09 (Format: FF-FF-FF-FF-FF-FF)
Local TCP port	502 (Default: 502)
Local Modbus Net ID	1 (Default: 1) Enable (Default: Enable)

Update Settings

■ Item Descriptions:

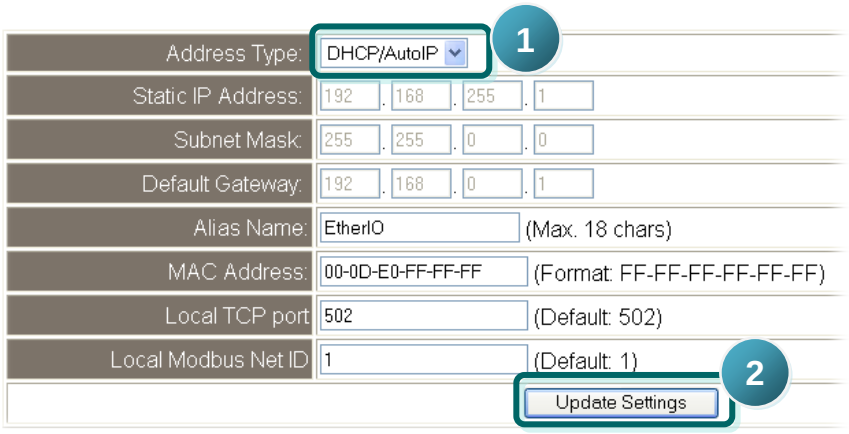
Item	Description
Address Type	**Static IP:** If you don't have a DHCP server in your network, you can configure the network settings manually. Please refer to the section "4.2.2.2 Manually Configuration"
	DHCP/AutoIP: Dynamic Host Configuration Protocol (DHCP) is a network application protocol that automatically assigns an IP address to each device. Please refer to the section "4.2.2.1 Dynamic Configuration"
Static IP Address	Each tET/tPET on the network must have a unique IP address. This item used to assign specific IP address.
Subnet Mask	The subnet mask indicates which portion of the IP address is used to identify the local network or subnet.
Default Gateway	A gateway (or router) is a system that is used to connect an individual network with one or more additional networks.
Alias Name	Each tET/tPET can be allocated a unique alias name so that it can be identified the network.
MAC Address	The User-defined MAC address.
Local TCP port	Default is 502
Local Modbus Net ID	Default is 1
Update Settings	Click this button to save the new settings to the tET/tPET.

4.2.2.1 Dynamic Configuration

Dynamic configuration is very easy to perform. If you have a DHCP server, a network address can be configured dynamically using the following steps:

Step 1: Select **"DHCP/ AutoIP"** as the address type

Step 2: Click the **"Update Settings"** button to finish the configuration



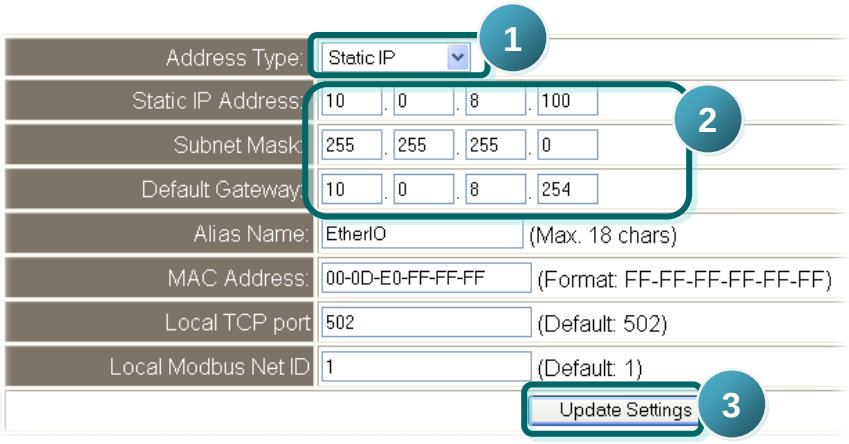
4.2.2.2 Manual Configuration

When using manual configuration, you have to assign all the network settings in the following manner:

Step 1: Select the **"Static IP"** as the address type

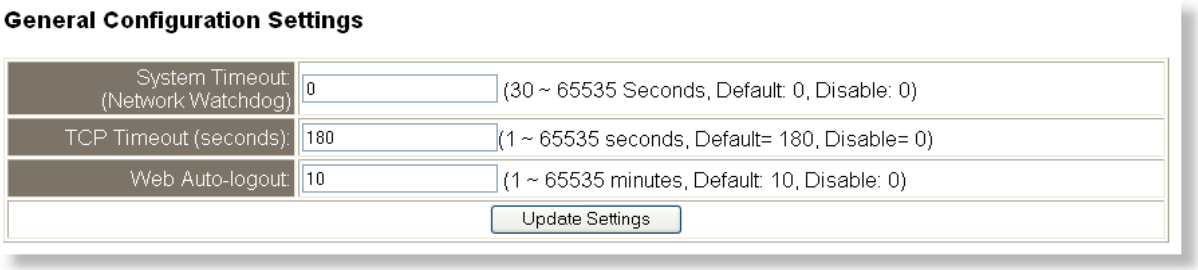
Step 2: Enter the appropriate **network settings**

Step 3: Click the **"Update Settings"** button to finish configuration



4.2.3 General Configuration Settings

The General Configuration Settings provides the following functions:



■ Item Descriptions:

Item	Description
System Timeout (Network Watchdog)	If no network communication occurs for a certain period, the system will be rebooted based on the configured system timeout value.
TCP Timeout (Seconds)	If Modbus TCP communication is lost for a certain period, the system will cut off the connection.
Web Auto-logout	If there is no action for a certain period in the web server, user account will be logout.
Update Settings	Click this button to save the new settings to the tET/tPET.

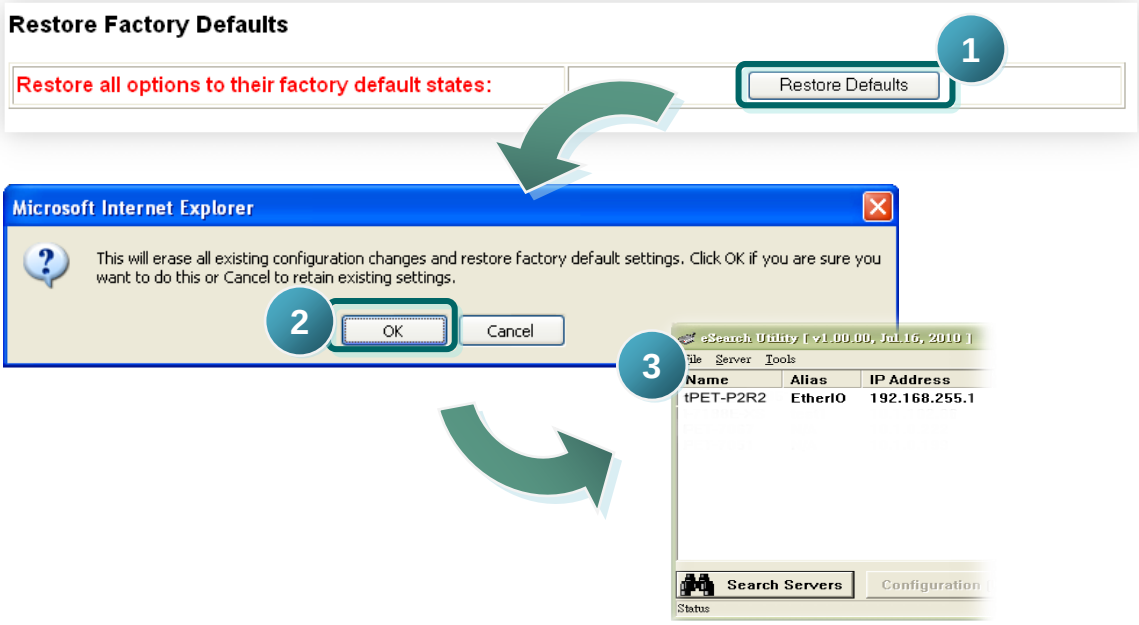
4.2.4 Restore Factory Defaults

To reset the settings to their factory default, follow these steps:

Step 1: Click the **"Restore Defaults"** button to reset the configuration.

Step 2: Click the **"OK"** button in the message dialog box.

Step 3: Check whether the tET/tPET module is reset to factory default settings for use with the eSearch Utility. Refer to the Section 3.4 Using eSearch Utility to assign a new IP".

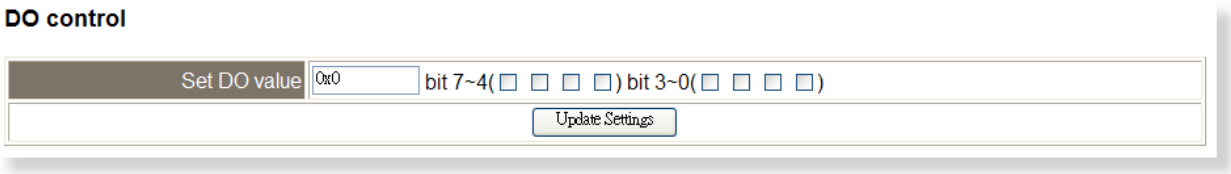


■ The table below lists the factory default settings:

Data Item	Factory Default Settings
Network Settings	
IP	192.168.255.1
Gateway	192.168.0.1
Mask	255.255.0.0
DHCP	Disabled
Basic Settings	
Module Name	Depends on the module name
Alias Name	EtherIO

4.3 I/O Settings

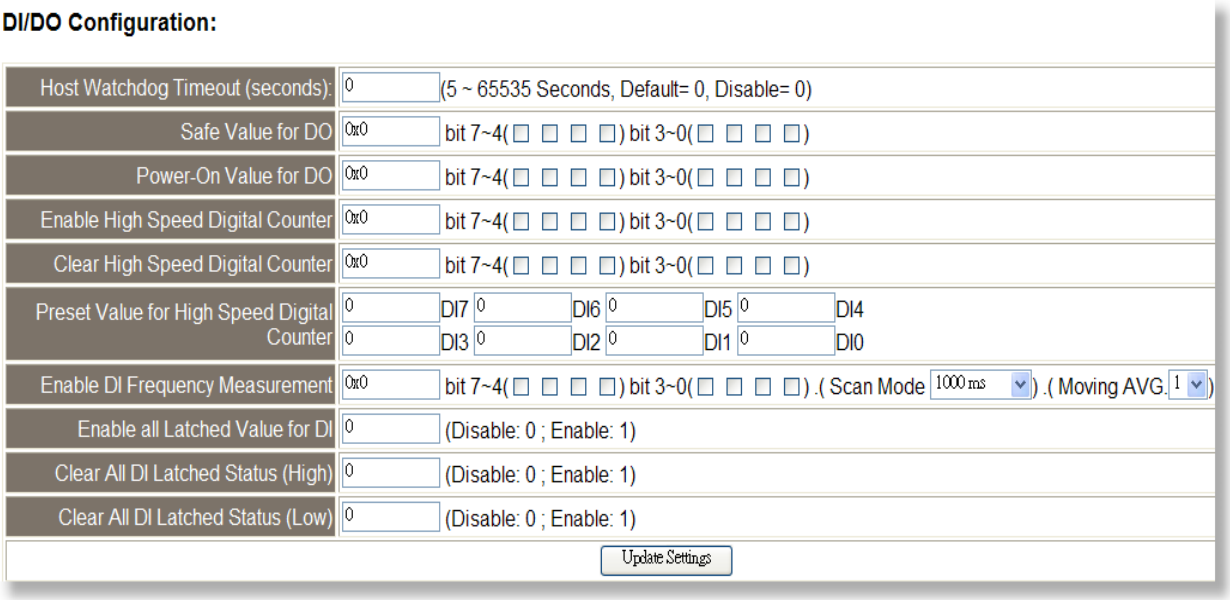
4.3.1 DO Control



■ Item Descriptions:

Item	Description
Set DO value	User can set certain value to DO manually
Update Settings	Click this button to save the new settings to the tET/tPET.

4.3.2 DI/DO configuration

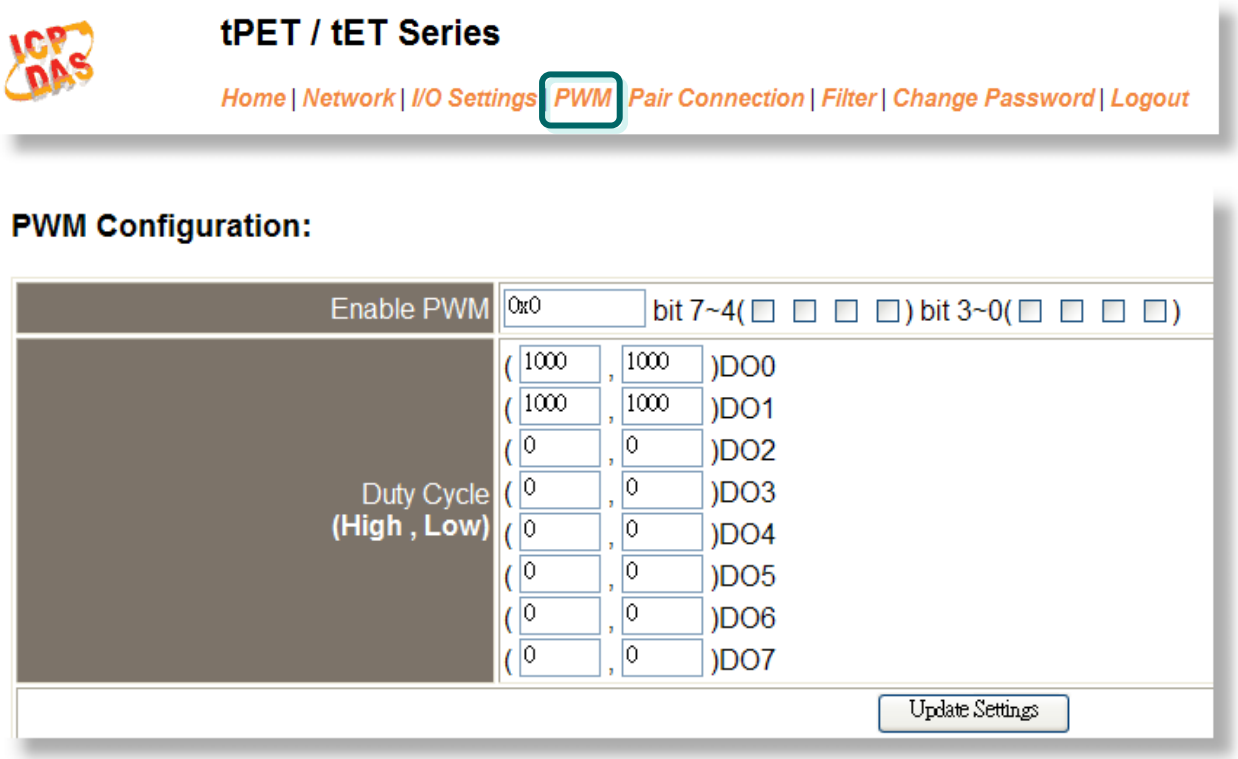


■ Item Descriptions:

Item	Description
Host Watchdog Timeout (Seconds)	If Modbus TCP communication is lost for a certain period, the safe value will be set.
Safe Value for DO	If Modbus TCP communication is lost for a certain period, the DO status will be set to the user defined safe value.
Power-On value for DO	On boot up, the DO status is set to the Power-on value.
Enable high speed digital counter	Set the counters to enable.
Clear high speed digital counter	Clear the all values of all counters.
Preset value for high speed digital counter	Sets the default values for the counters.
Enable DI frequency measurement	Set the frequency measurement to enable.
	Scan Mode: 1000 ms ==> 1 ~ 3.5 kHz, (+/- 1 Hz error) 100 ms ==> 10 ~ 3.5 kHz, (+/- 10 Hz error) Single-pulse ==> 0.01 ~ 1 Hz, (+/- 0.01 Hz error) Moving Average: 1 ==> No Average 2 ==> The average of 2 continuous sample values 4 ==> The average of 4 continuous sample values 8 ==> The average of 8 continuous sample values
Enable all latched value for DI	Set the latched status to enable.
Clear all DI latched status (high)	Clear the high latched status of all counters.
Clear all DI latched status (low)	Clear the low latched status of all counters.
Update Settings	Click this button to save the new settings to the tET/tPET.

4.4 PWM Setting

4.4.1 PWM Configuration



■ Item Descriptions:

Item	Description	Default
Enable PWM	Set the PWM to enable.	0
Duty Cycle	These are 2 parameters each DO channel. The first parameter is the high pulse width, while the second word is the low pulse width. The unit is 1 ms, and the resolution is about 5 ms.(5~65535 ms)	1000 (ms)

Note: Because the characteristic of relay, t(P)ET-P2POR2/t(P)ET-P2R2 series (the module with relay) are not suitable to use PWM for a long time.

4.5 Pair-Connection

4.5.1 Settings

The I/O pair-connection function is a particular feature of tET/tPET series modules that can enable a pair of DI-to-DO connections via the Modbus TCP (Ethernet).

Settings:

I/O Pair-Connection Settings	Current	Updated
Pair Mode:	Disabled	Disable
Remote Server IP:	Disabled	10 . 1 . 120 . 53
Remote TCP Port:	Disabled	502 (Default: 502)
Connection Timeout:	5000	5000 (Default: 5000 ms)
Reconnect Interval:	10000	10000 (Default: 10000 ms)
Remote Net ID:	1	1 (Default: 1)
Scan Time:	1000	1000 (Default: 1000 ms)
Remote DI to Local DO	Current	Updated (Poll Mode)
Local DO Address:	0	0 (Default: 0)
Remote DI Address:	0	0 (Default: 0)
Remote DI Count:	0	0 (For Local DO)
Local DI to Remote DO	Current	Updated (Push Mode) TCP
Local DI Address:	0	0 (Default: 0)
Remote DO Address:	0	0 (Default: 0)
Local DI Count:	0	0 (For Remote DO)
Force Update Time:	60	60 (Default: 60 s)

Submit

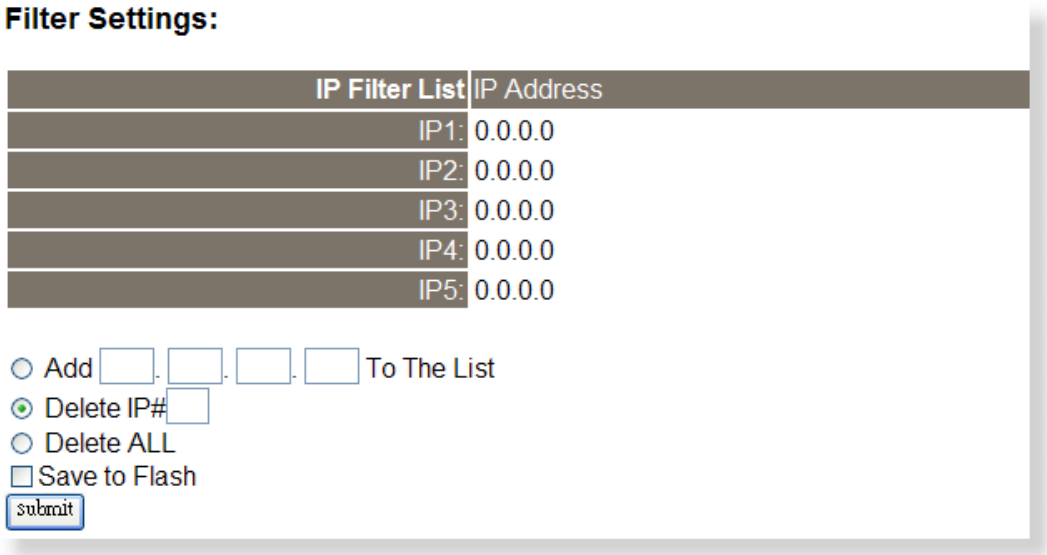
■ Item Descriptions:

Item	Description	Default
I/O Pair-Connection Settings		
Pair Mode	Enable/Disable the I/O pair-connection Range: -	Disabled
Remote Server IP	The IP address of the remote device Range:-	0
Remote TCP Port	The Port number of the remote device Range: 0~65535	502
Connection Timeout	The maximum time period before abandoning an attempt to establish a connection Range: 1000~42949672965 ms	5000
Reconnect Interval	The interval time of reconnect	10000 ms
Remote Net ID	Modbus Net ID of remote device Range: 1~247	1
Scan Time	The Time period required to establish communication Range: 1000~42949672965 ms	1000
Remote DI to Local DO (Poll mode)		
Local DO Address	The DO base address of the local DO register that will be mapped to the remote DI device. Range: Depends on the type of tET/tPET module	0
Remote DI Address	The DI base address of the Remote DI device that will be mapped to the local DO register Range: Depends on the type of remote device	0
Remote DI count	The DI count that is mapped from the base address Range: 1~255	0
Local DI to Remote DO (Push Mode)		
Mode	TCP/UDP	TCP
Local DI Address	The DI base address of local DI register that will be mapped to the remote DO device. Range: Depend on the tET/tPET	0
Remote DO Address	The DO base address of the Remote DO device that will be mapped to the local DI register Range: Depends on the type of remote device	0
Local DI count	The DI count that is mapped from the base address Range: 1~255	0
Force Update Time	The interval time to force pushing	60 s

4.6 Filter

4.6.1 Filter Settings

This filter settings page is used to query or edit IP filter list. The IP filter list restricts the access of packets based on the IP header. If one or more IP address are saved into the IP filter table, only clients whose IP is specified in the IP filter list can access the tET/tPET series module.

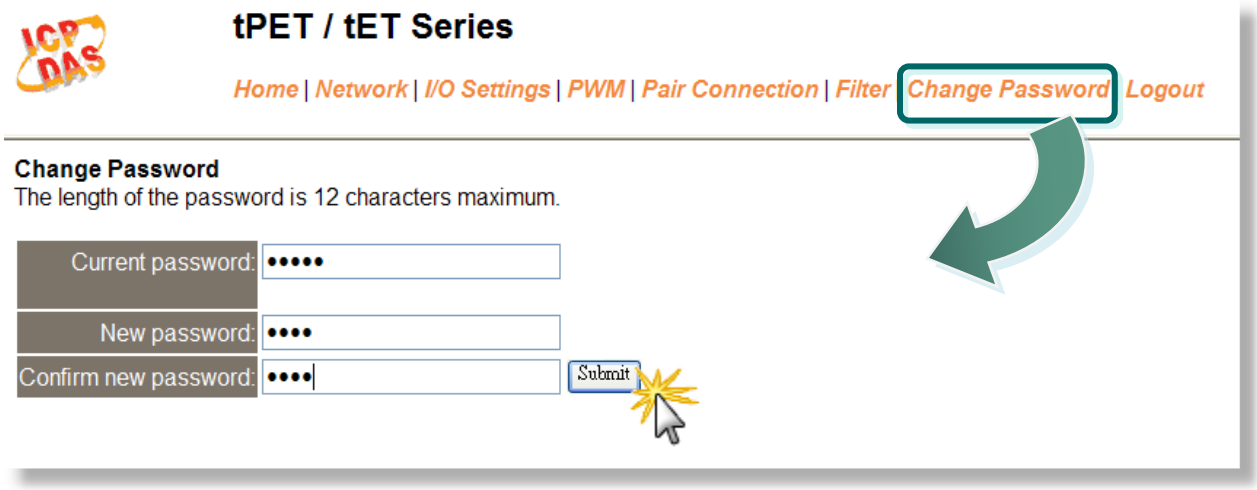


■ Item Descriptions:

Item	Description
Add “IP” to the list	Adds an IP address to the IP filter list
Delete IP # “number”	Deletes IP# from the IP filter list
Delete All	Deletes all items from the IP filter list
Save to Flash	Save a new IP filter list to the Flash.
Submit	Click this button to save the new settings to the tET/tPET.

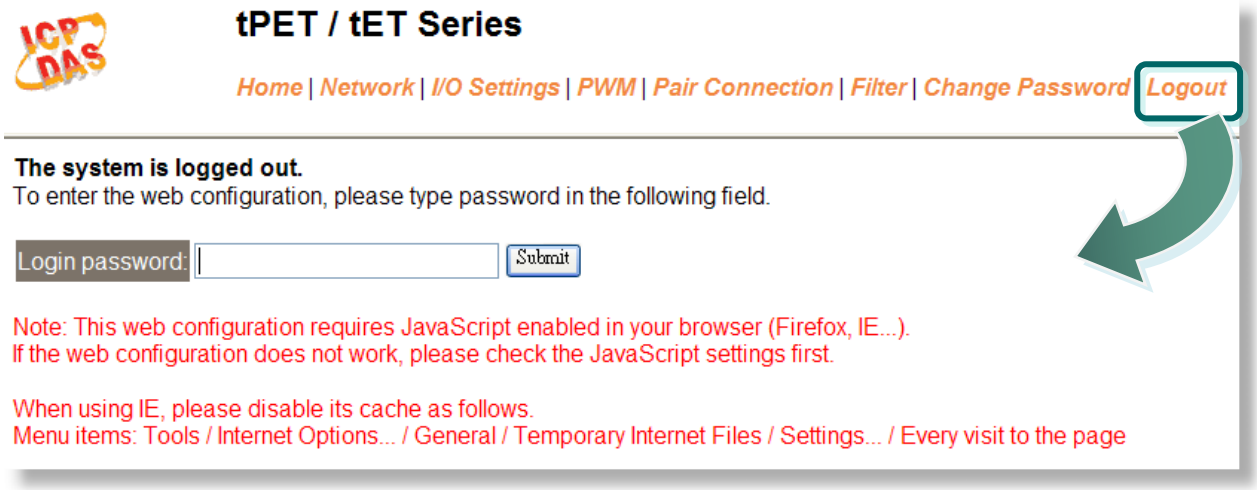
4.7 Change Password

To change a password, first enter the old password (default is **Admin**) in the **"Current password"** field and then enters a new password in the **"New password"** field. Re-enter the new password in the **"Confirm new password"** field, and then click the "**Submit**" button to update your password.



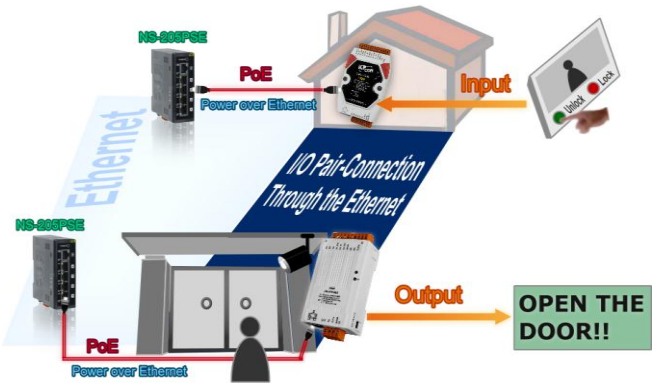
4.8 Logout

Click the **"Logout"** tab to log out from the system and return to the login page.



5 I/O Pair-Connection Applications

The tET/tPET series module can be used to create DI to DO pair-connect through the Ethernet. Once the configuration is completed, the modules can poll the status of the local DI channels and then use the Modbus/TCP protocol to continuously write to a remote DO device in the background. It's useful when connecting digital I/O devices that do not themselves have Ethernet capability.

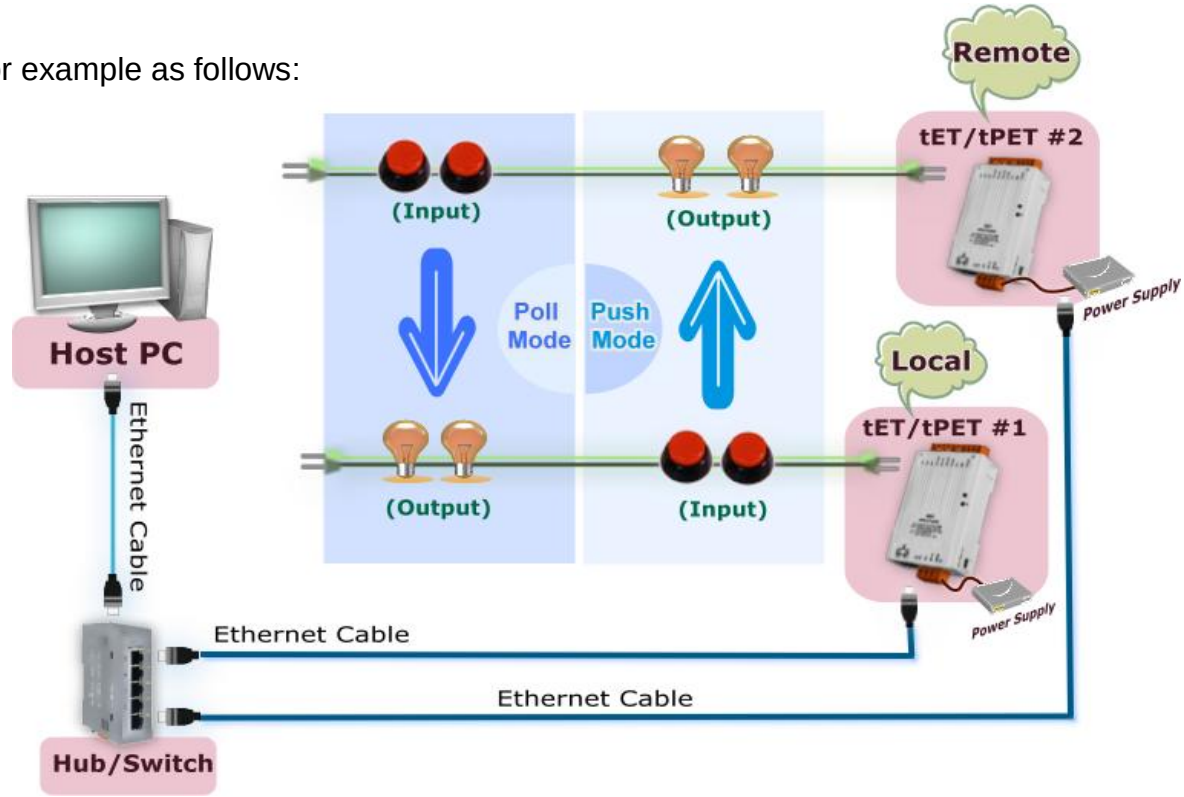


Please refer to the following steps to set I/O pair-connection function:

Step 1: Connecting to a network, PC and Power

Confirm that the tET/tPET modules are functioning correctly. Refer to Section 3. Getting Started for more details.

For example as follows:



Step 2: Configuring Ethernet Settings

Contact your Network Administrator to obtain a correct and functioning network configuration (**such as IP/Mask/Gateway details)** for tET/tPET series modules. Please also refer to Section 3.4 Using eSearch Utility to assign a new IP.

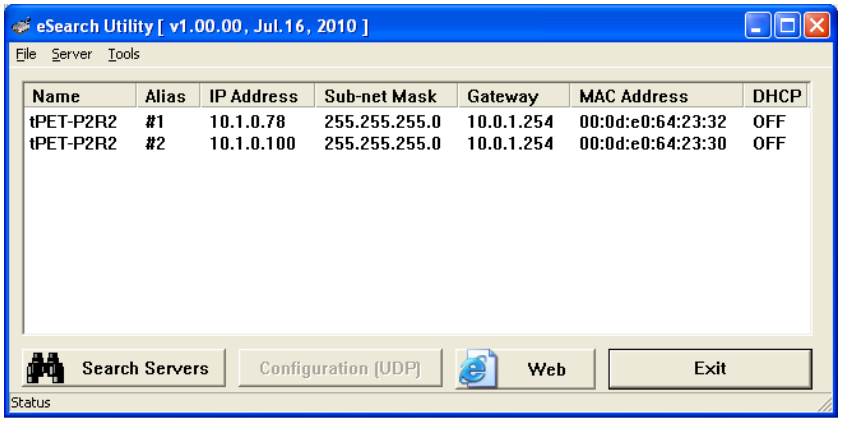


Figure 5-1

Step 3: Configuring I/O Pair-Connection on Web Server

■ Push Mode

1 Select your **tET/tPET #1** and click "**Web**" button on the eSearch Utility to launch the browser program for connecting to the web server.

2 Enter the password (**default: Admin**) in the Login password field, and then click the **"Submit"** button to enter the configuration page.

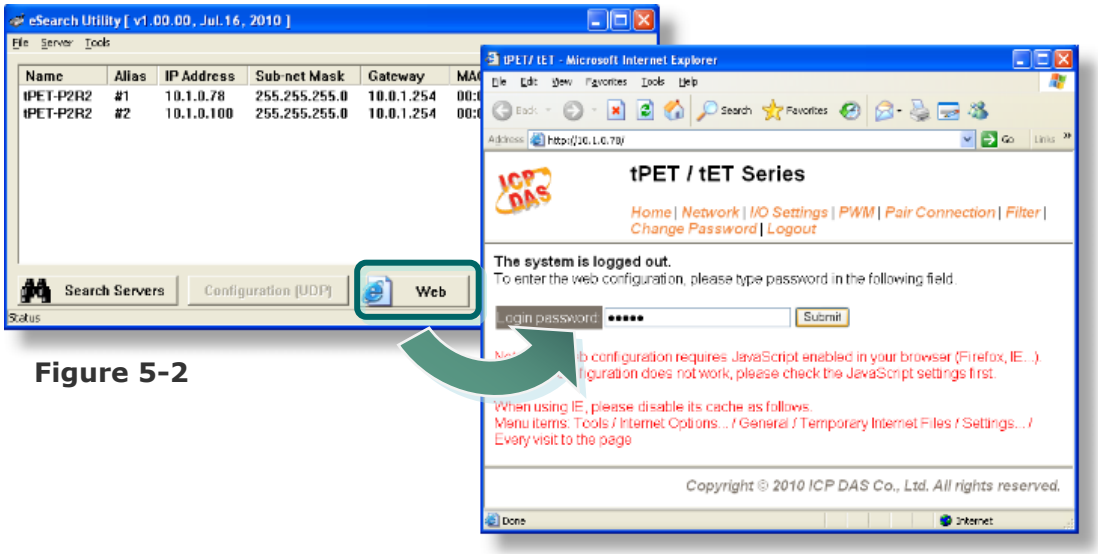


Figure 5-2

3 Click the **"Pair Connection"** link to enter the settings page.

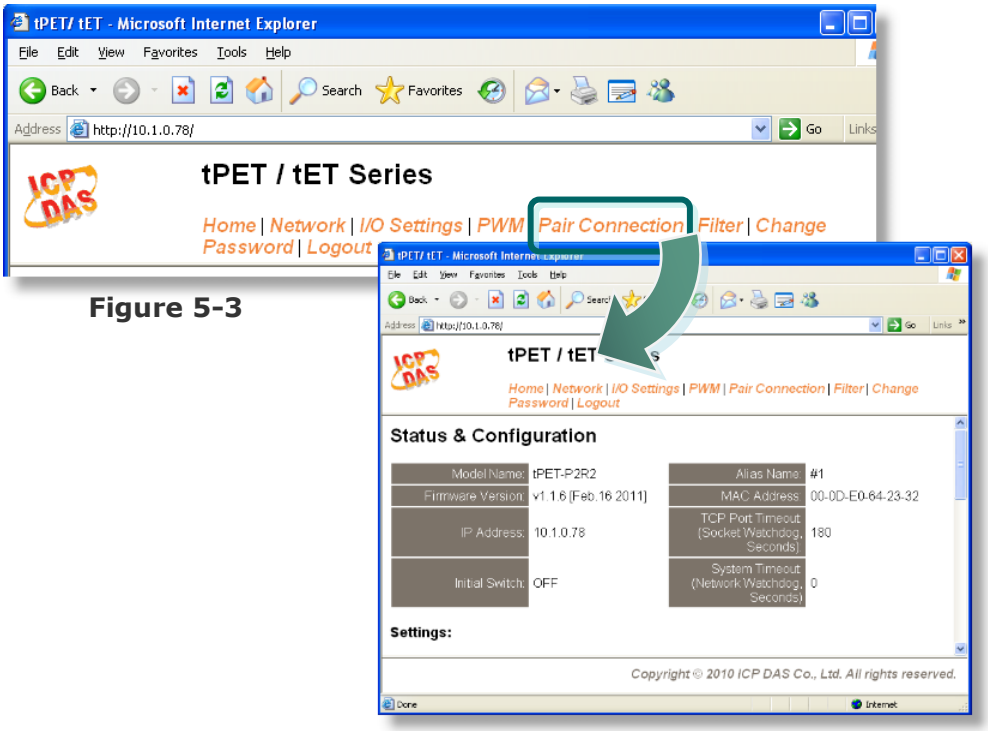


Figure 5-3

4 Select the "**Enable**" option from the "**Pair Mode**" drop down options.

5 Type the **IP address of the tET/tPET #2** in "**Remote Server IP**" field.

6 Type the **TCP Port of the tET/tPET #2** in "**Remote TCP Port**" field.

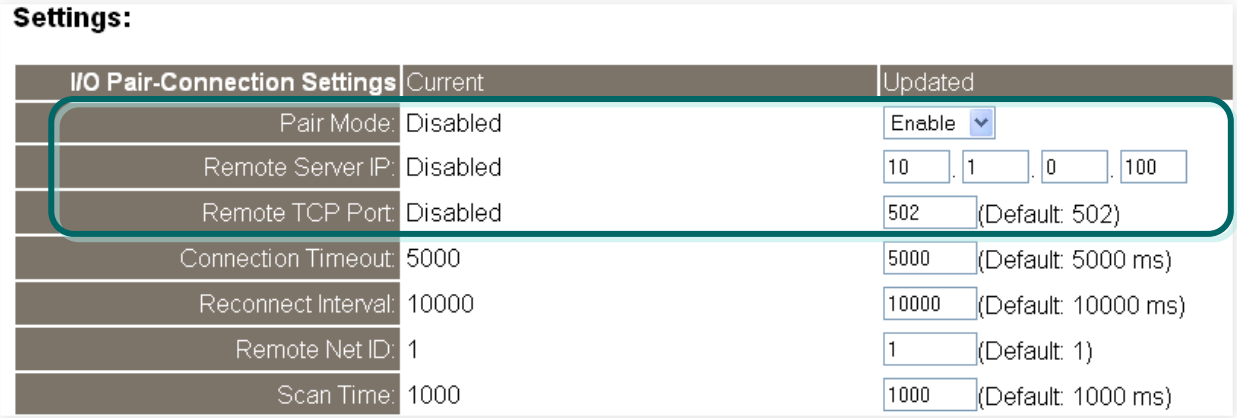


Figure 5-4

7 Type a **DI Count number for the tET/tPET #1** in the "**Local DI Count**" field.
*For example, we set **"2"** in the **"Local DI Count"** field. This means the **DI x2 of tET/tPET #1** are mapped to **DO x2 of tET/tPET #2**.*

8 Click the "**Submit**" button to complete the configuration.

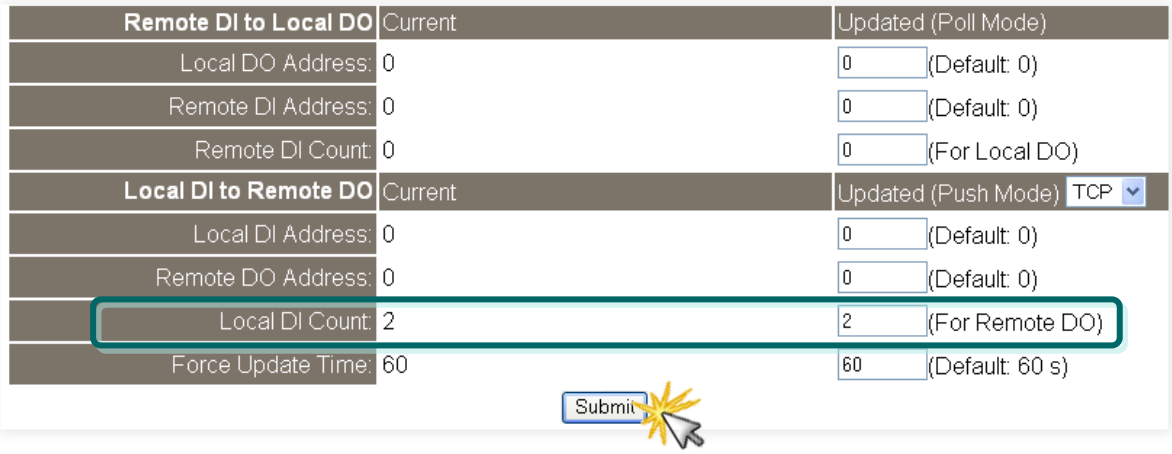


Figure 5-5

■ Poll Mode

1 Select your **tET/tPET #1** and click "**Web**" button on the eSearch Utility to launch the browser program for connecting to the web server.

2 Enter the password (**default: Admin**) in the Login password field, and then click the **"Submit"** button to enter the configuration page.

3 Click the **"Pair Connection**" link to enter the settings page.

4 Select the "**Enable**" option from the "**Pair Mode**" drop down options.

5 Type the **IP address of the tET/tPET #2** in "**Remote Server IP**" field.

6 Type the **TCP Port of the tET/tPET #2** in "**Remote TCP Port**" field.

(Refer to **Figures 5-2~5-4** for illustrations of how to perform the above steps.)

7 Type a **DI Count number for the tET/tPET #2** in the "**Remote DI Count**" field.
*For example, we set **"2"** in the **"Remote DI Count"** field. This means the **DI x2 of tET/tPET #2** are mapped to **DO x2 of tET/tPET #1**.*

8 Click the "**Submit**" button to complete the configuration.

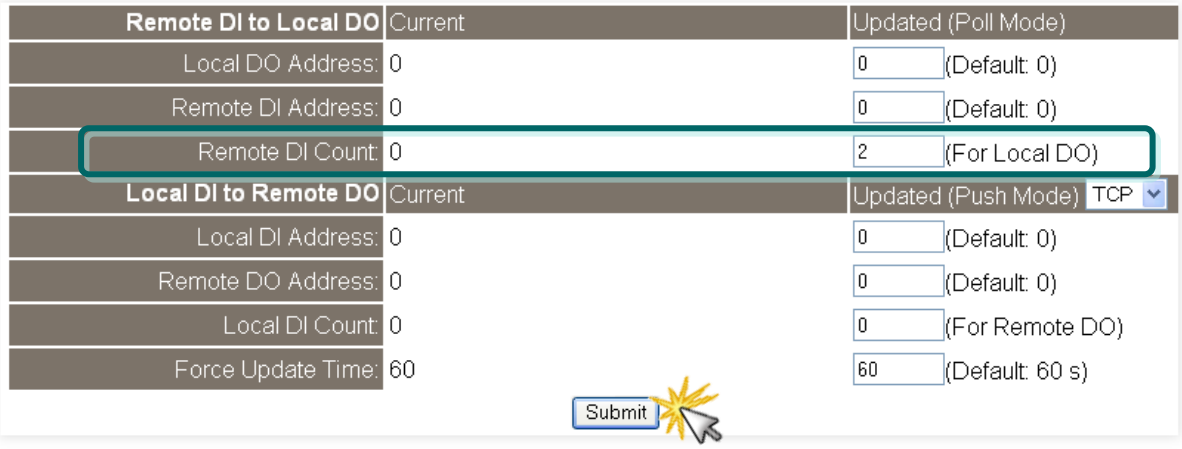
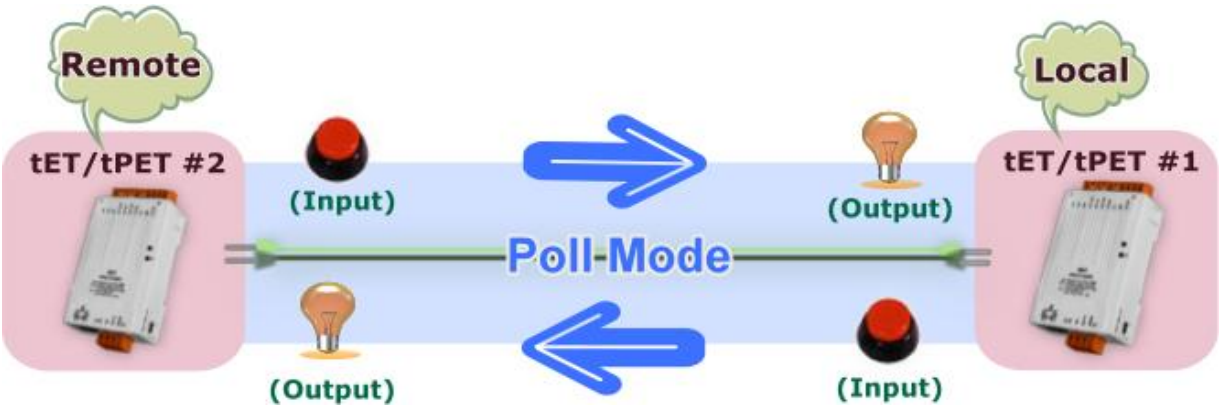


Figure 5-6

5.1 Two Ethernet I/O Modules for Poll Mode (One to One)



Step 1: Configuring I/O Pair-Connection on tET/tPET #1

1 Select your **tET/tPET #1** and click "**Web**" button on the eSearch Utility to launch the browser program for connecting to the web server.

2 Enter the password (**default: Admin**) in the Login password field, and then click the **"Submit"** button to enter the configuration page.

3 Click the **"Pair Connection**" link to enter the settings page.

4 Select the "**Enable**" option from the "**Pair Mode**" drop down options.

5 Type the **IP address of the tET/tPET #2** in "**Remote Server IP**" field.

6 Type the **TCP Port of the tET/tPET #2** in "**Remote TCP Port**" field.

(Refer to **Figures 5-2~5-4** for illustrations of how to perform the above steps.)

7 Type a **DI Count number for the tET/tPET #2** in the "**Remote DI Count**" field.
*For example, we set **"1"** in the **"Remote DI Count"** field. This means the **DI x1 of tET/tPET #2** are mapped to **DO x1 of tET/tPET #1**.*

8 Click the "**Submit**" button to complete the configuration.

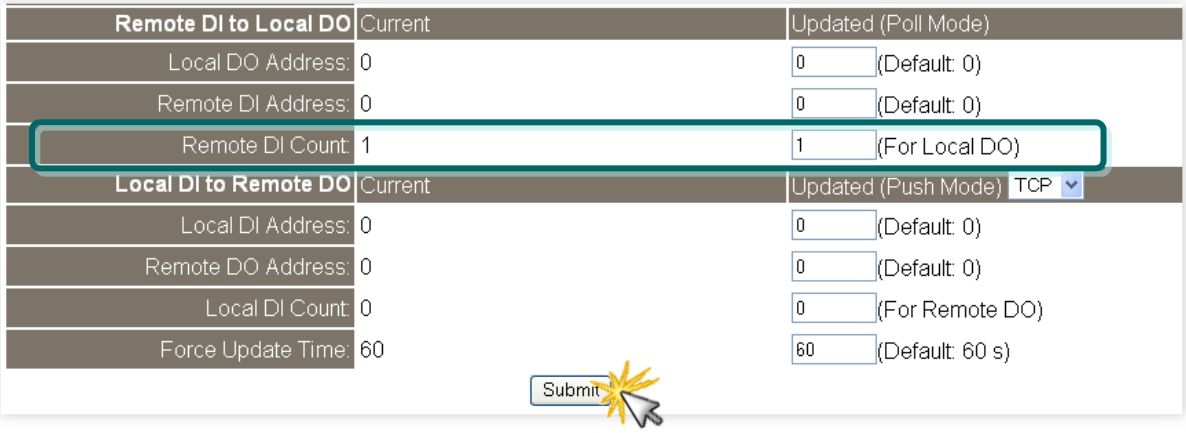


Figure 5-7

Step 2: Configuring I/O Pair-Connection on tET/tPET #2

1 Select your **tET/tPET #2** and click "**Web**" button on the eSearch Utility to launch the browser program for connecting to the web server.

2 Enter the password (**default: Admin**) in the Login password field, and then click the **"Submit"** button to enter the configuration page.

3 Click the **"Pair Connection**" link to enter the settings page.

4 Select the "**Enable**" option from the "**Pair Mode**" drop down options.

5 Type the **IP address of the tET/tPET #1** in "**Remote Server IP**" field.

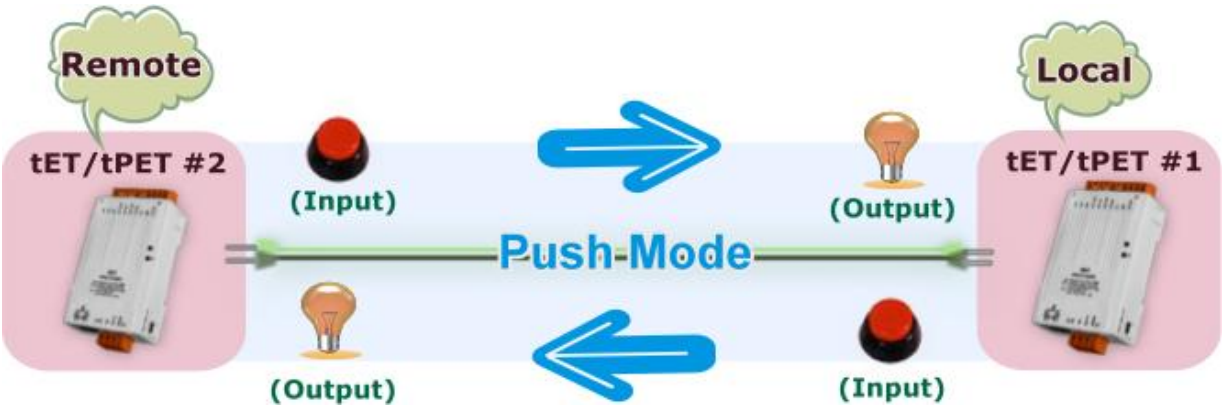
6 Type the **TCP Port of the tET/tPET #1** in "**Remote TCP Port**" field.

(Refer to **Figures 5-2~5-4** for illustrations of how to perform the above steps.)

7 Type a **DI Count number for the tET/tPET #1** in the "**Remote DI Count**" field.
*For example, we set **"1"** in the **"Remote DI Count"** field. This means the **DI x1 of tET/tPET #1** are mapped to **DO x1 of tET/tPET #2,** Refer to **Figures 5-7** for illustrations.*

8 Click the "**Submit**" button to complete the configuration.

5.2 Two Ethernet I/O Modules for Push Mode (One to One)



Step 1: Configuring I/O Pair-Connection on tET/tPET #1

1 Select your **tET/tPET #1** and click "**Web**" button on the eSearch Utility to launch the browser program for connecting to the web server.

2 Enter the password (**default: Admin**) in the Login password field, and then click the **"Submit"** button to enter the configuration page.

3 Click the **"Pair Connection**" link to enter the settings page.

4 Select the "**Enable**" option from the "**Pair Mode**" drop down options.

5 Type the **IP address of the tET/tPET #2** in "**Remote Server IP**" field.

6 Type the **TCP Port of the tET/tPET #2** in "**Remote TCP Port**" field.

(Refer to **Figures 5-2~5-4** for illustrations of how to perform the above steps.)

7 Type a **DI Count number for the tET/tPET #1** in the "**Local DI Count**" field.
*For example, we set **"1"** in the **"Local DI Count"** field. This means the **DI x1 of tET/tPET #1** are mapped to **DO x1 of tET/tPET #2**.*

8 Click the "**Submit**" button to complete the configuration.

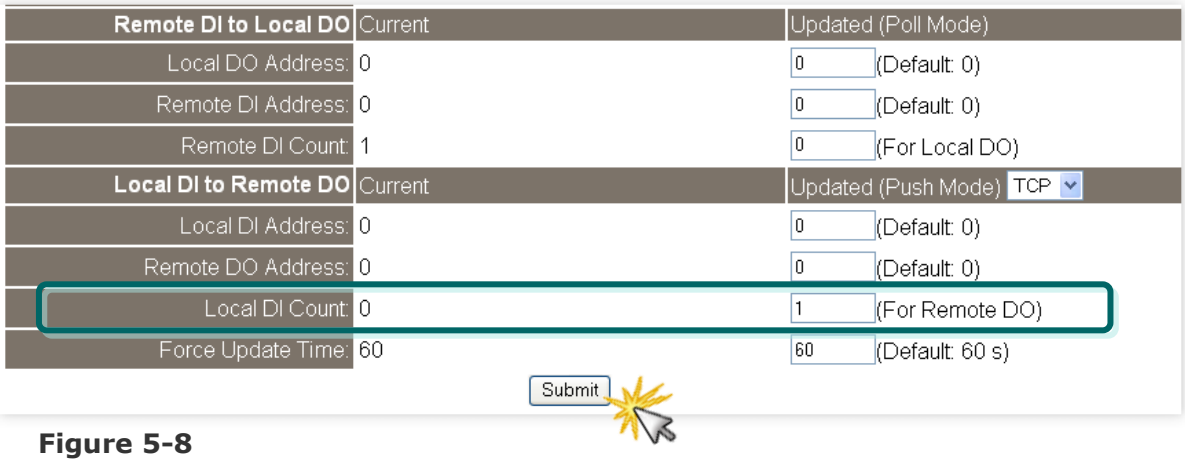


Figure 5-8

Step 2: Configuring I/O Pair-Connection on tET/tPET #2

1 Select your **tET/tPET #2** and click "**Web**" button on the eSearch Utility to launch the browser program for connecting to the web server.

2 Enter the password (**default: Admin**) in the Login password field, and then click the **"Submit"** button to enter the configuration page.

3 Click the **"Pair Connection**" link to enter the settings page.

4 Select the "**Enable**" option from the "**Pair Mode**" drop down options.

5 Type the **IP address of the tET/tPET #1** in "**Remote Server IP**" field.

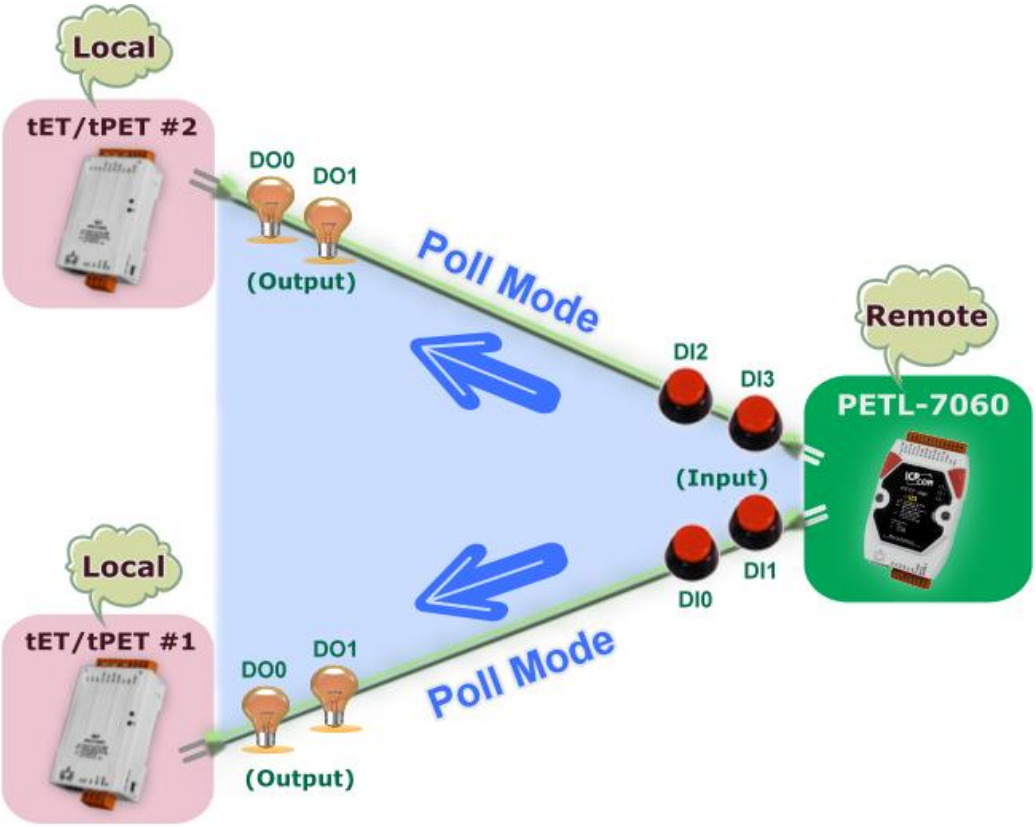
6 Type the **TCP Port of the tET/tPET #1** in "**Remote TCP Port**" field.

(Refer to **Figures 5-2~5-4** for illustrations of how to perform the above steps.)

7 Type a **DI Count number for the tET/tPET #2** in the "**Local DI Count**" field.
*For example, we set **"1"** in the **"Loacl DI Count"** field. This means the **DI x1 of tET/tPET #2** are mapped to **DO x1 of tET/tPET #1,** refer to **Figures 5-8** for illustrations.*

8 Click the "**Submit**" button to complete the configuration.

5.3 Multi Ethernet I/O Modules for Poll Mode (Multi to One)



Step 1: Configuring I/O Pair-Connection on tET/tPET #1

1 Configuring Ethernet settings for tET/tPET #1, tET/tPET #2 and PETL-7060. Please also refer to Section 3.4 Using eSearch Utility to assign a new IP.

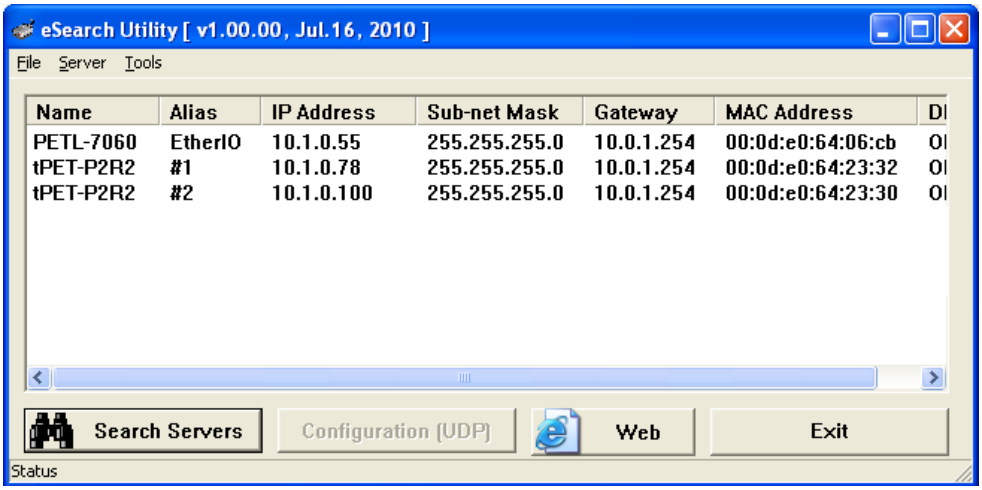


Figure 5-9

2 Select your **tET/tPET #1** and click "**Web**" button on the eSearch Utility to launch the browser program for connecting to the web server.

3 Enter the password (**default: Admin**) in the Login password field, and then click the **"Submit"** button to enter the configuration page.

4 Click the **"Pair Connection**" link to enter the settings page.

(Refer to **Figures 5-2~5-3** for illustrations of how to perform the above steps.)

5 Select the "**Enable**" option from the "**Pair Mode**" drop down options.

6 Type the **IP address of the PETL-7060** in "**Remote Server IP**" field.

7 Type the **TCP Port of the PETL-7060** in "**Remote TCP Port**" field.

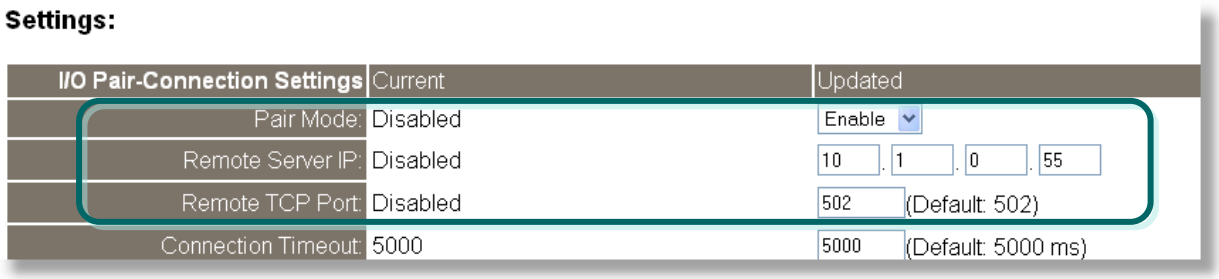


Figure 5-10

8 Type a **DI Address for the PETL-7060** in the "**Remote DI Address**" field.
*For example, we set **"0"** in the **"Remote DI Address"** field. This means the **DI address from DI0 to DI1 of PETL-7060** are mapped to **DO x2 of tET/tPET #1**.*

9 Type a **DI Count number for the PETL-7060** in the "**Remote DI Count**" field.
*For example, we set **"2"** in the **"Remote DI Count"** field. This means the **DI x2 of PETL-7060** are mapped to **DO x2 of tET/tPET #1**.*

10 Click the "**Submit**" button to complete the configuration.

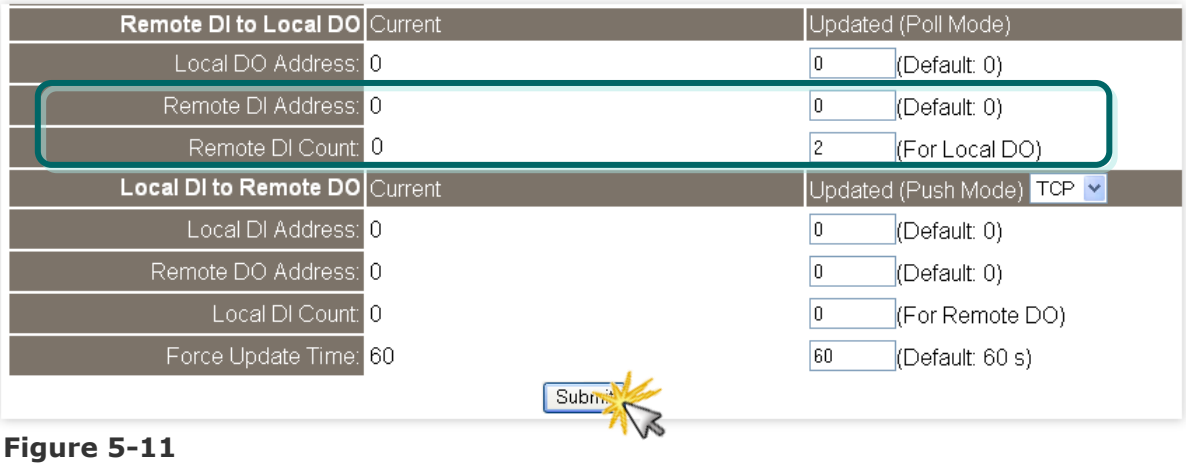


Figure 5-11

Step 2: Configuring I/O Pair-Connection on tET/tPET #2

1 Select your **tET/tPET #2** and click "**Web**" button on the eSearch Utility to launch the browser program for connecting to the web server.

2 Enter the password (**default: Admin**) in the Login password field, and then click the **"Submit"** button to enter the configuration page.

3 Click the **"Pair Connection**" link to enter the settings page.

4 Select the "**Enable**" option from the "**Pair Mode**" drop down options.

5 Type the **IP address of the PETL-7060** in "**Remote Server IP**" field.

6 Type the **TCP Port of the PETL-7060** in "**Remote TCP Port**" field.

(Refer to **Figures 5-2~5-3 and Figures 5-9~5-10** for illustrations of how to perform the above steps.)

7 Type a **DI Address for the PETL-7060** in the "**Remote DI Address**" field.
*For example, we set **"2"** in the **"Remote DI Address"** field. This means the **DI address from DI2 to DI3 of PETL-7060** are mapped to **DO x2 of tET/tPET #2**.*

8 Type a **DI Count number for the PETL-7060** in the "**Remote DI Count**" field.
*For example, we set **"2"** in the **"Remote DI Count"** field. This means the **DI x2 of PETL-7060** are mapped to **DO x2 of tET/tPET #2**.*

9 Click the "**Submit**" button to complete the configuration.

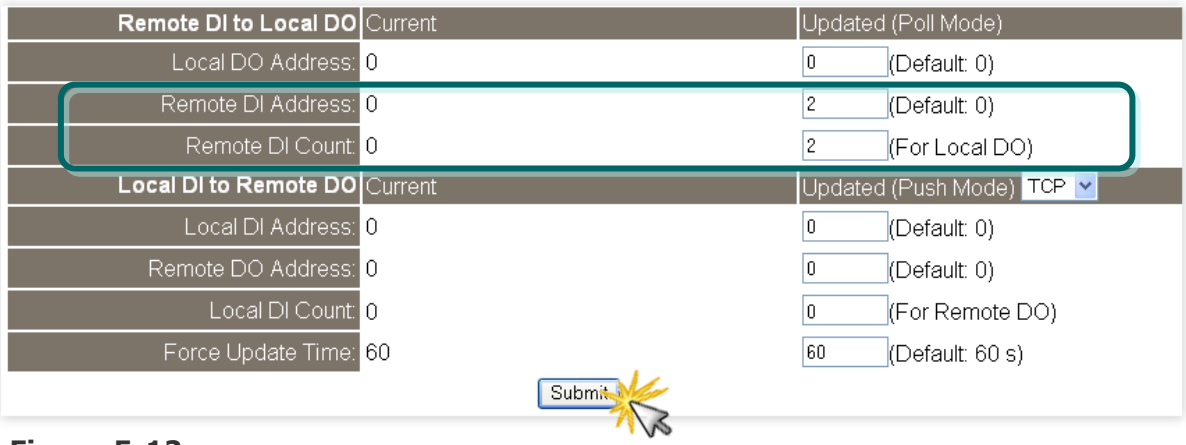
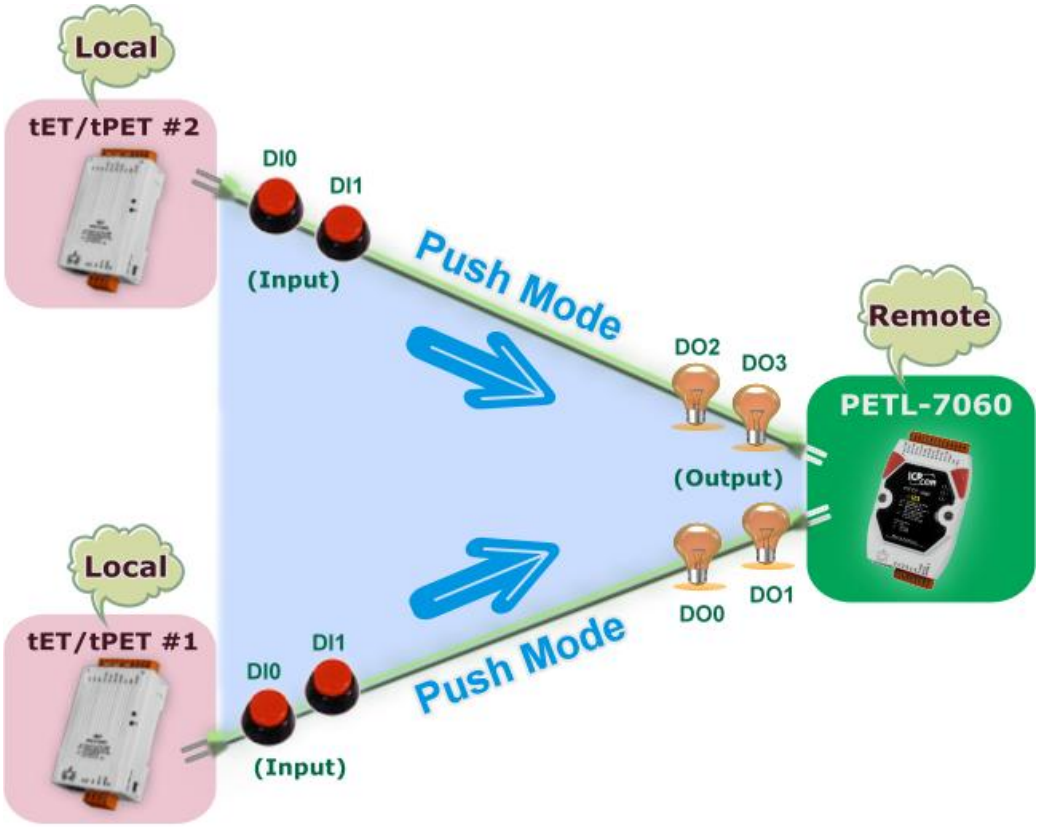


Figure 5-12

5.4 Multi Ethernet I/O Modules for Push Mode (Multi to One)



Step 1: Configuring I/O Pair-Connection on tET/tPET #1

1 Configuring Ethernet settings for tET/tPET #1, tET/tPET #2 and PETL-7060.

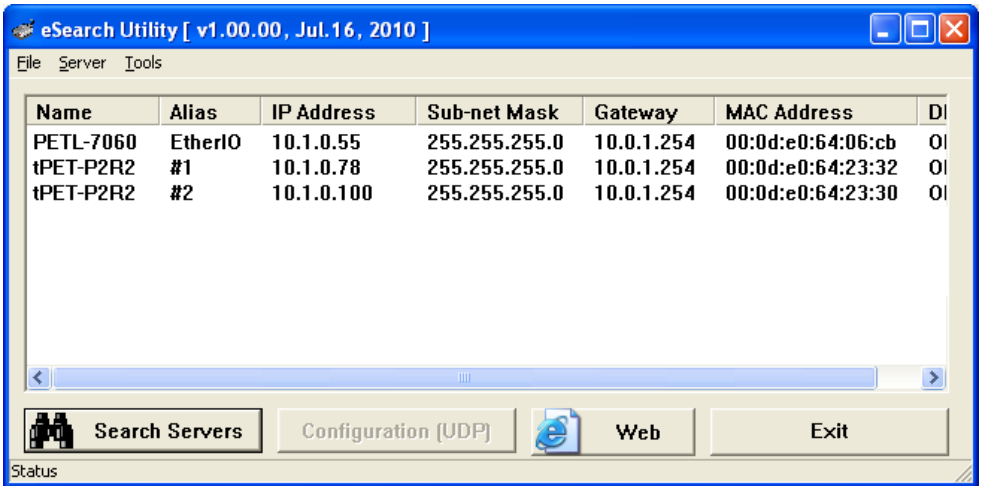


Figure 5-13

2 Select your **tET/tPET #1** and click "**Web**" button on the eSearch Utility to launch the browser program for connecting to the web server.

3 Enter the password (**default: Admin**) in the Login password field, and then click the **"Submit"** button to enter the configuration page.

4 Click the **"Pair Connection**" link to enter the settings page.

(Refer to **Figures 5-2~5-3** for illustrations of how to perform the above steps.)

5 Select the "**Enable**" option from the "**Pair Mode**" drop down options.

6 Type the **IP address of the PETL-7060** in "**Remote Server IP**" field.

7 Type the **TCP Port of the PETL-7060** in "**Remote TCP Port**" field.

Settings:

I/O Pair-Connection Settings	Current	Updated
Pair Mode:	Disabled	Enable
Remote Server IP:	Disabled	10 . 1 . 0 . 55
Remote TCP Port:	Disabled	502 (Default: 502)
Connection Timeout:	5000	5000 (Default: 5000 ms)

Figure 5-14

8 Type a **DO Address for the PETL-7060** in the "**Remote DO Address**" field.
*For example, we set **"0"** in the **"Remote DO Address"** field. This means the **DO address from DO0 to DO1 of PETL-7060** are mapped to **DI x2 of tET/tPET #1**.*

9 Type a **DI Count number for the tET/tPET #1** in the "**Local DI Count**" field.
*For example, we set **"2"** in the **"Local DI Count"** field. This means the **DI x2 of tET/tPET #1** are mapped to **DO x2 of PETL-7060**.*

10 Click the "**Submit**" button to complete the configuration.

Remote DI to Local DO	Current	Updated (Poll Mode)
Local DO Address:	0	0 (Default: 0)
Remote DI Address:	0	0 (Default: 0)
Remote DI Count:	0	0 (For Local DO)
Local DI to Remote DO	Current	Updated (Push Mode) TCP
Local DI Address:	0	0 (Default: 0)
Remote DO Address:	0	0 (Default: 0)
Local DI Count:	0	2 (For Remote DO)
Force Update Time:	60	60 (Default: 60 s)

Submit

Figure 5-15

Step 2: Configuring I/O Pair-Connection on tET/tPET #2

1 Select your **tET/tPET #2** and click "**Web**" button on the eSearch Utility to launch the browser program for connecting to the web server.

2 Enter the password (**default: Admin**) in the Login password field, and then click the **"Submit"** button to enter the configuration page.

3 Click the **"Pair Connection**" link to enter the settings page.

4 Select the "**Enable**" option from the "**Pair Mode**" drop down options.

5 Type the **IP address of the PETL-7060** in "**Remote Server IP**" field.

6 Type the **TCP Port of the PETL-7060** in "**Remote TCP Port**" field.

(Refer to **Figures 5-2~5-3 and Figures 5-13~5-14** for illustrations of how to perform the above steps.)

7 Type a **DO Address for the PETL-7060** in the "**Remote DO Address**" field.
*For example, we set **"2"** in the **"Remote DO Address"** field. This means the **DO address from DO2 to DO3 of PETL-7060** are mapped to **DI x2 of tET/tPET #2**.*

8 Type a **DI Count number for the tET/tPET #2** in the "**Local DI Count**" field.
*For example, we set **"2"** in the **"Local DI Count"** field. This means the **DI x2 of tET/tPET #2** are mapped to **DO x2 of PETL-7060**.*

9 Click the "**Submit**" button to complete the configuration.

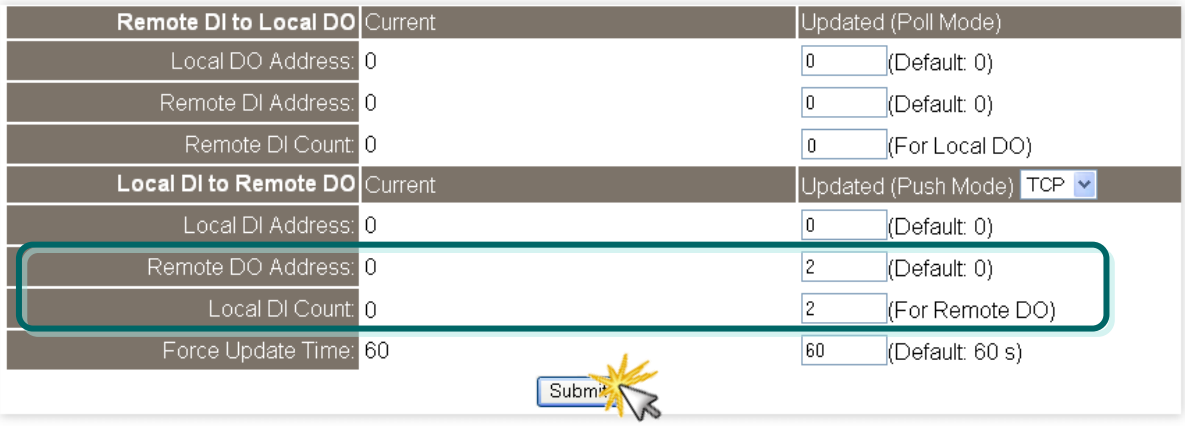
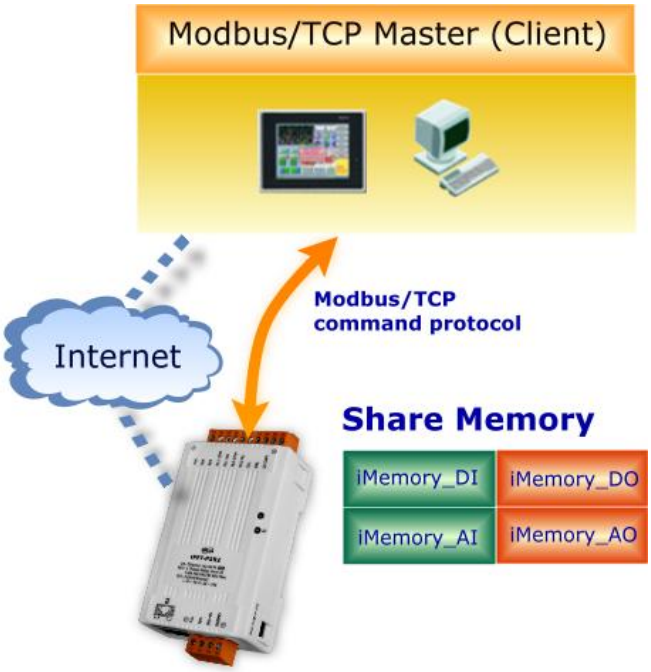


Figure 5-16

6 Modbus Information

The tET/tPET series is an IP-based Modbus I/O device that allows you to remotely control DI/DO terminals via an Ethernet. It uses a master-slave communication technique in which only one device (the master) can initiate a transaction (called queries), while other devices (slaves) respond the requested data to the master, or by taking the action requested in the query.



Most SCADA (Supervisor Control And Data Acquisition) and HMI software can easily integrate serial devices, such as Citect, ICONICS, iFIX, InduSoft, Intouch, Entivity Studio, Entivity Live, Entivity VLC, Trace Mode, Wizcon, Wonderware, etc. via the Modbus protocol.

You can also develop a Modbus/TCP master application with any programming language, such as VB, C# and so on.
We provide Modbus SDK for developing Modbus applications on PC.

For the relevant demo programs and SDK can be obtained from the following locations:

VB Demo：http://ftp.icpdas.com/pub/cd/6000cd/napdos/et7000/demo/pc_client/

.Net demo and SDK：http://ftp.icpdas.com/pub/cd/8000cd/napdos/modbus/nmodbus/

9.1 What is Modbus TCP/IP?

Modbus is a communication protocol developed by Modicon in 1979. You can also visit http://www.modbus.org to find more valuable information.

The Different versions of Modbus used today include Modbus RTU (based on serial communication interfaces such as RS485 and RS232), Modbus ASCII and Modbus TCP, which is the Modbus RTU protocol embedded into TCP packets.

Modbus TCP is an internet protocol. The protocol embeds a Modbus frame into a TCP frame so that a connection oriented approach is obtained, thereby making it reliable. The master queries the slave and the slave responds with the reply. The protocol is open and, hence, highly scalable.

9.2 Modbus Message Structure

Modbus devices communicate using a master-slave (client-server) technique in which only one device (the master/client) can initiate transactions (called queries). The other devices (slaves/servers) respond by supplying the requested data to the master, or by taking the action requested in the query.

A query from a master will consist of a slave address (or broadcast address), a function code defining the requested action, any required data, and an error checking field. A response from a slave consists of fields confirming the action taken, any data to be returned, and an error checking field.

Modbus/TCP Message Structure

Byte 00~05	Byte 06~11
6-byte header	**RTU Data**

Leading 6 bytes of Modbus/TCP protocol:

Byte 00	Byte 01	Byte 02	Byte 03	Byte 04	Byte 05
Transaction identifier		Protocol identifier		Length field (upper byte)	Length field (lower byte)

Transaction identifier = Assigned by Modbus/TCP master (client)

Protocol identifier = 0

Length field (upper byte) = 0 (since all messages are smaller than 256)

Length field (lower byte) = Number of following RTU data bytes

RTU Data Structure

Byte 06	Byte 07	Byte 08-09	Byte 10-11
Net ID (Station number)	Function Code	Data Field	
		Reference number (Address Mapping)	Number of points

Net ID specifies the address of the receiver (Modbus/TCP slave).

Function Code specifies the message type.

Data Field is the data block.

■ Net ID (Station Number)

The first byte in the Modbus structure of the Modbus RTU is the receiver's address. The Valid addresses are in the range of 0 to 247. Addresses 0 is used for broadcast, while addresses 1 to 247 are given to individual Modbus devices.

■ Function Code

The second byte in the frame structure of the Modbus RTU is the function code. The function code describes what the slave is required to do. Valid function codes are between 1 and 255. The slave uses the same function code as the request to answer it. Only when an error occurs in the system will the highest bit of the function code be set to '1'. Hence the master will know whether the message has been transmitted correctly or not.

Section	Code	Function	Reference (Address)
6.2.1	**01 (0x01)**	Read Coils status (Readback DOs)	0xxxx
6.2.2	**02 (0x02)**	Read Input Status (Read DIs)	1xxxx
6.2.3	**03 (0x03)**	Read Holding Registers (Readback AOs)	4xxxx
6.2.4	**04 (0x04)**	Read Input Registers (Read AIs)	3xxxx
6.2.5	**05 (0x05)**	Force Single Coil (Write DO)	0xxxx
6.2.6	**06 (0x06)**	Preset Single Register (Write AO)	4xxxx
6.2.7	**15 (0x0F)**	Force Multiple Coils (Write DOs)	0xxxx
6.2.8	**16 (0x10)**	Preset Multiple Registers (Write AOs)	4xxxx

■ Data

Data is transmitted in 8-, 16- and 32-bit format. The data of 16-bit registers is transmitted in high-byte first (For example: 0x0A0B ==> 0x0A, 0x0B). The data of 32-bit registers is transmitted as two 16-bit registers, and is low-word first. (For example: 0x0A0B0C0D ==> 0x0C, 0x0D, 0x0A, 0x0B.)

9.2.1 01 (0x01) Read Coils Status (Readback DOs)

This function code is used to read the current coils status or the current digital output readback value.

[Request]

Byte	Description	Size	Value
00	Net ID (Station number)	1 Byte	1~247
01	Function code	1 Byte	0x01
02-03	Starting DO address	2 Bytes	Refer to Modbus Address Table for tET/tPET series. (Sec. 6.3 Modbus Register Map) Byte 02 = high byte Byte 03 = low byte
04-05	Number of points (channels)	2 Bytes	Byte 04 = high byte Byte 05 = low byte

[Response]

Byte	Description	Size	Value
00	Net ID (Station number)	1 Byte	1-247
01	Function code	1 Byte	0x01
02	Byte Count	1 Byte	Byte count of response (n = (Points+7)/8)
03	Data	n Byte	n= 1; Byte 03 = data bit 7~0 n= 2; Byte 04 = data bit 15~8 ..... n= m; Byte m+2 = data bit (8m-1)~ 8(m-1)

[Error Response]

Byte	Description	Size	Value
00	Net ID (Station number)	1 Byte	1-247
01	Function code	1 Byte	0x81
02	Exception code	1 Byte	Refer to Modbus Standard Specification for more details

■ *For example: function 01 (0x01), Readback DOs*

	[Leading 6 bytes]	[Request]
Command:	01 02 00 00 00 06	01 01 00 00 00 02

	[Leading 6 bytes]	[Response]
Response:	01 02 00 00 00 04	01 01 01 03

Reads digital output value

Descriptions as follows:

Command:

[Leading 6 bytes]
Byte 00-03: 01 02 00 00 (Message number)
Byte 04-05: 00 06 (Number of remaining bytes in this frame)

[Request]
Byte 00 : 01 (Net ID)
Byte 01 : 01 (Function Code)
Byte 02-03: 00 00 (Starting DO address)
Byte 04-05: 00 02 (Number of points)

Response:

[Leading 6 bytes]
Byte 00-03: 01 02 00 00 (Message number)
Byte 04-05: 00 04 (Number of remaining bytes in this frame)

[Response]
Byte 00: 01 (Net ID)
Byte 01: 01 (Function Code)
Byte 02: 01 (Byte count of response)
Byte 03: 03 (DO1~DO0 Value)

9.2.2 02 (0x02) Read Input Status (Read DIs)

This function code is used to read the current digital input value.

[Request]

Byte	Description	Size	Value
00	Net ID (Station number)	1 Byte	1-247
01	Function code	1 Byte	0x02
02-03	Starting DI address	2 Bytes	Refer to Modbus Address table for tET/tPET series. (Sec. 6.3 Modbus Register Map) Byte 02 = high byte Byte 03 = low byte
04-05	Number of points (channels)	2 Bytes	Byte 04 = high byte Byte 05 = low byte

[Response]

Byte	Description	Size	Value
00	Net ID (Station number)	1 Byte	1-247
01	Function code	1 Byte	0x02
02	Byte Count	1 Byte	Byte count of response (n =(Points+7)/8)
03	Data	n Byte	n= 1; Byte 03 = data bit 7~0 n= 2; Byte 04 = data bit 15~8 ..... n= m; Byte m+2 = data bit (8m-1)~ 8(m-1)

[Error Response]

Byte	Description	Size	Value
00	Net ID (Station number)	1 Byte	1-247
01	Function code	1 Byte	0x82
02	Exception code	1 Byte	Refer to Modbus Standard Specification for more details

■ *For example: function 02 (0x02), Read DIs*

	[Leading 6 bytes]	[Request]
Command:	01 02 00 00 00 06	01 02 00 00 00 02

	[Leading 6 bytes]	[Response]
Response:	01 02 00 00 00 04	01 02 01 03

Reads digital input value

Descriptions as follows:

Command:

[Leading 6 bytes]
Byte 00-03: 01 02 00 00 (Message number)
Byte 04-05: 00 06 (Number of remaining bytes in this frame)

[Request]
Byte 00 : 01 (Net ID)
Byte 01 : 02 (Function Code)
Byte 02-03: 00 00 (Starting DI address)
Byte 04-05: 00 02 (Number of points)

Response:

[Leading 6 bytes]
Byte 00-03: 01 02 00 00 (Message number)
Byte 04-05: 00 04 (Number of remaining bytes in this frame)

[Response]
Byte 00: 01 (Net ID)
Byte 01: 02 (Function Code)
Byte 02: 01 (Byte count of response)
Byte 03: 03 (DI1~DI0 Value)

9.2.3 03 (0x03) Read Holding Registers (Readback AOs)

This function code is used to readback the holding registers or the analog output value. These registers are also used to store the preset value of digital counter, host watch dog timer, module name and TCP timeout, etc.

[Request]

Byte	Description	Size	Value
00	Net ID (Station number)	1 Byte	1-247
01	Function code	1 Byte	0x03
02-03	Starting AO address	2 Bytes	Refer to Modbus Address Table for tET/tPET series. (Sec. 6.3 Modbus Register Map) Byte 02 = high byte Byte 03 = low byte
04-05	Number of 16-bit registers (channels)	2 Bytes	Word count Byte 04 = high byte Byte 05 = low byte

[Response]

Byte	Description	Size	Value
00	Net ID (Station number)	1 Byte	1-247
01	Function code	1 Byte	0x03
02	Byte Count	1 Byte	Byte count of response (n = Points x 2 Bytes)
03~	Register values	n Bytes	Register values n= 2; Byte 03 = high byte Byte 04 = low byte ..... n= m; Byte 03 = high byte Byte 04 = low byte ..... Byte m+1 = high byte Byte m+2 = low byte

[Error Response]

Byte	Description	Size	Value
00	Net ID (Station number)	1 Byte	1-247
01	Function code	1 Byte	0x83
02	Exception code	1 Byte	Refer to Modbus Standard Specification for more details

■ *For example: function 03 (0x03), Readback AOs*

	[Leading 6 bytes]	[Request]
Command:	01 02 00 00 00 06	01 03 01 03 00 02

	[Leading 6 bytes]	[Response]
Response:	01 02 00 00 00 07	01 03 04 50 32 41 32

Reads module's name for tPET-P2A2

Descriptions as follows:

Command:

[Leading 6 bytes]
Byte 00-03: 01 02 00 00 (Message number)
Byte 04-05: 00 06 (Number of remaining bytes in this frame)

[Request]
Byte 00 : 01 (Net ID)
Byte 01 : 03 (Function Code)
Byte 02-03: 01 03 (Starting AO Address)
Byte 04-05: 00 02 (Number of 16-bit registers)

Response:

[Leading 6 bytes]
Byte 00-03: 01 02 00 00 (Message number)
Byte 04-05: 00 07 (Number of remaining bytes in this frame)

[Response]
Byte 00: 01 (Net ID)
Byte 01: 03 (Function Code)
Byte 02: 04 (Byte count of response)
Byte 03-04: 50 32 (Low word of module name: ASCII "0x50, 0x32" represent to character "P", "2")
Byte 05-06: 41 32 (High word of module name: ASCII "0x41, 0x32" represent to character "A", "2")

9.2.4 04 (0x04) Read Input Registers (Read AIs)

This function code is used to read the input registers or the current analog input value. These registers are also used to store the current value of digital counter, number of DI channels and number of DO channels, etc.

[Request]

Byte	Description	Size	Value
00	Net ID (Station number)	1 Byte	1-247
01	Function code	1 Byte	0x04
02-03	Starting AI address	2 Bytes	Refer to Modbus Address Table for tET/tPET series. (Sec. 6.3 Modbus Register Map) Byte 02 = high byte Byte 03 = low byte
04-05	Number of 16-bit registers (channels)	2 Bytes	Word count Byte 04 = high byte Byte 05 = low byte

[Response]

Byte	Description	Size	Value
00	Net ID (Station number)	1 Byte	1-247
01	Function code	1 Byte	0x04
02	Byte Count	1 Byte	Byte count of response (n = Points x 2 Bytes)
03~	Register values	n Byte	Register values n= 2; Byte 03 = high byte Byte 04 = low byte ..... n= m; Byte 03 = high byte Byte 04 = low byte ..... Byte m+1 = high byte Byte m+2 = low byte

[Error Response]

Byte	Description	Size	Value
00	Net ID (Station number)	1 Byte	1-247
01	Function code	1 Byte	0x84
02	Exception code	1 Byte	Refer to Modbus Standard Specification for more details

■ *For example: function 04 (0x04), Read AIs*

	[Leading 6 bytes]	[Request]
Command:	01 02 00 00 00 06	01 04 00 64 00 01

	[Leading 6 bytes]	[Response]
Response:	01 02 00 00 00 05	01 04 02 00 02

Reads number of DI channels for tPET-P2A2

Descriptions as follows:

Command:

[Leading 6 bytes]
Byte 00-03: 01 02 00 00 (Message number)
Byte 04-05: 00 06 (Number of remaining bytes in this frame)

[Request]
Byte 00 : 01 (Net ID)
Byte 01 : 04 (Function Code)
Byte 02-03: 00 64 (Starting AI Address)
Byte 04-05: 00 01 (Number of 16-bit registers)

Response:

[Leading 6 bytes]
Byte 00-03: 01 02 00 00 (Message number)
Byte 04-05: 00 05 (Number of remaining bytes in this frame)

[Response]
Byte 00: 01 (Net ID)
Byte 01: 04 (Function Code)
Byte 02: 02 (Byte count of response)
Byte 03-04: 00 02 (Number of DI channels of tPET-P2A2)

9.2.5 05 (0x05) Force Single Coil (Write DO)

This function code is used to set a single coil status or a single digital output value.

[Request]

Byte	Description	Size	Value
00	Net ID (Station number)	1 Byte	1-247
01	Function code	1 Byte	0x05
02-03	DO Address	2 Bytes	Refer to Modbus Address Table for tET/tPET series. (Sec. 6.3 Modbus Register Map) Byte 02 = high byte Byte 03 = low byte
04-05	Output value	2 Bytes	0xFF 00 set the output to ON. 0x00 00 set the output to OFF. All other values are illegal and will not affect the coil. Byte 04 = high byte Byte 05 = low byte

[Response]

Byte	Description	Size	Value
00	Net ID (Station number)	1 Byte	1-247
01	Function code	1 Byte	0x05
02-03	DO Address	2 Bytes	The value is the same as Byte 02-03 of the Request
04-05	Output value	2 Bytes	The value is the same as Byte 04-05 of the Request

[Error Response]

Byte	Description	Size	Value
00	Net ID (Station number)	1 Byte	1-247
01	Function code	1 Byte	0x85
02	Exception code	1 Byte	Refer to Modbus Standard Specification for more details

■ *For example: function 05 (0x05), Write DO*

	[Leading 6 bytes]	[Request]
Command:	01 02 00 00 00 06	01 05 00 01 FF 00

	[Leading 6 bytes]	[Response]
Response:	01 02 00 00 00 06	01 05 00 01 FF 00

Sets the DO1 to ON

Descriptions as follows:

Command:

[Leading 6 bytes]
Byte 00-03: 01 02 00 00 (Message number)
Byte 04-05: 00 06 (Number of remaining bytes in this frame)

[Request]
Byte 00 : 01 (Net ID)
Byte 01 : 05 (Function Code)
Byte 02-03: 00 01 (DO address)
Byte 04-05: FF 00 (Set the output to ON)

Response:

[Leading 6 bytes]
Byte 00-03: 01 02 00 00 (Message number)
Byte 04-05: 00 06 (Number of remaining bytes in this frame)

[Response]
Byte 00 : 01 (Net ID)
Byte 01 : 05 (Function Code)
Byte 02-03: 00 01 (DO address)
Byte 04-05: FF 00 (Set the output to ON)

9.2.6 06 (0x06) Preset Single Register (Write AO)

This function code is used to set one of the holding registers that are used to store the configuration value of the module.

[Request]

Byte	Description	Size	Value
00	Net ID (Station number)	1 Byte	1-247
01	Function code	1 Byte	0x06
02-03	AO Address	2 Bytes	Refer to Modbus Address Table for tET/tPET series. (Sec. 6.3 Modbus Register Map) Byte 02 = high byte Byte 03 = low byte
04-05	Register value	2 Bytes	Register value Byte 04 = high byte Byte 05 = low byte

[Response]

Byte	Description	Size	Value
00	Net ID (Station number)	1 Byte	1-247
01	Function code	1 Byte	0x06
02-03	AO Address	2 Bytes	The value is the same as Byte 02-03 of the Request
04-05	Register value	2 Bytes	The value is the same as Byte 04-05 of the Request

[Error Response]

Byte	Description	Size	Value
00	Net ID (Station number)	1 Byte	1-247
01	Function code	1 Byte	0x86
02	Exception code	1 Byte	Refer to Modbus Standard Specification for more details

■ *For example: function 06 (0x06), Write AO*

	[Leading 6 bytes]	[Request]
Command:	01 02 00 00 00 06	01 06 01 08 00 3C

	[Leading 6 bytes]	[Response]
Response:	01 02 00 00 00 06	01 06 01 08 00 3C

Sets the system timeout to 60 seconds

Descriptions as follows:

Command:

[Leading 6 bytes]
Byte 00-03: 01 02 00 00 (Message number)
Byte 04-05: 00 06 (Number of remaining bytes in this frame)

[Request]
Byte 00 : 01 (Net ID)
Byte 01 : 06 (Function Code)
Byte 02-03: 01 08 (AO Address)
Byte 04-05: 00 3C (Set the 60 seconds)

Response:

[Leading 6 bytes]
Byte 00-03: 01 02 00 00 (Message number)
Byte 04-05: 00 06 (Number of remaining bytes in this frame)

[Response]
Byte 00 : 01 (Net ID)
Byte 01 : 06 (Function Code)
Byte 02-03: 01 08 (AO Address)
Byte 04-05: 00 3C (Set the 60 seconds)

9.2.7 15 (0x0F) Force Multiple Coils (Write DOs)

This function code is used to set multiple coils status or write multiple digital output value.

[Request]

Byte	Description	Size	Value
00	Net ID (Station number)	1 Byte	1-247
01	Function code	1 Byte	0x0F
02-03	Starting DO address	2 Bytes	Refer to Modbus Address Table for tET/tPET series. (Sec. 6.3 Modbus Register Map) Byte 02 = high byte Byte 03 = low byte
04-05	Number of output channels (Points)	2 Bytes	Byte 04 = high byte Byte 05 = low byte
06	Byte count	1 Byte	n = (Points +7)/8
07	Output value	n Byte	A bit corresponds to a channel. Value 1 for a bit denotes the channel is ON, while the value 0 is OFF. n= 1; Byte 07 = data bit 7 ~ 0 n= 2; Byte 08 = data bit 15 ~ 8 ..... n= m; Byte m+6 = data bit (8m-1)~ 8(m-1)

[Response]

Byte	Description	Size	Value
00	Net ID (Station number)	1 Byte	1-247
01	Function code	1 Byte	0x0F
02-03	Starting DO address	2 Bytes	The value is the same as Byte 02-03 of the Request
04-05	Number of output channels (Points)	2 Bytes	The value is the same as Byte 04-05 of the Request

[Error Response]

Byte	Description	Size	Value
00	Net ID (Station number)	1 Byte	1-247
01	Function code	1 Byte	0x8F
02	Exception code	1 Byte	Refer to Modbus Standard Specification for more details

■ *For example: function 15 (0x0F), Write DOs*

	[Leading 6 bytes]	[Request]
Command:	01 02 00 00 00 08	01 0F 01 0B 00 02 01 03

	[Leading 6 bytes]	[Response]
Response:	01 02 00 00 00 06	01 0F 01 0B 00 02

Sets Safe value (DO0-DO1)

Descriptions as follows:

Command:

[Leading 6 bytes]
Byte 00-03: 01 02 00 00 (Message number)
Byte 04-05: 00 08 (Number of remaining bytes in this frame)

[Request]
Byte 00 : 01 (Net ID)
Byte 01 : 0F (Function Code)
Byte 02-03: 01 0B (Starting DO address)
Byte 04-05: 00 02 (Number of output channels)
Byte 06 : 01 (Byte count)
Byte 07 : 03 (Output value)

Response:

[Leading 6 bytes]
Byte 00-03: 01 02 00 00 (Message number)
Byte 04-05: 00 06 (Number of remaining bytes in this frame)

[Response]
Byte 00 : 01 (Net ID)
Byte 01 : 0F (Function Code)
Byte 02-03: 01 0B (Starting DO address)
Byte 04-05: 00 02 (Number of input channels)

9.2.8 16 (0x10) Preset Multiple Registers (Write AOs)

This function code is used to set multiple holding registers that are used to store the configuration value of the module.

[Request]

Byte	Description	Size	Value
00	Net ID (Station number)	1 Byte	1-247
01	Function code	1 Byte	0x10
02-03	Starting AO address	2 Bytes	Refer to Modbus Address Table for tET/tPET series. (Sec. 6.3 Modbus Register Map) Byte 02 = high byte Byte 03 = low byte
04-05	Number of 16-bit registers (channels)	2 Bytes	Word count Byte 04 = high byte Byte 05 = low byte
06	Byte Count	1 Byte	Byte count of the following data (n =Points x 2 Bytes)
07	Register values	n Bytes	Register values n= 2; Byte 03 = high byte Byte 04 = low byte ..... n= m; Byte 03 = high byte Byte 04 = low byte ..... Byte m+1 = high byte Byte m+2 = low byte

[Response]

Byte	Description	Size	Value
00	Net ID (Station number)	1 Byte	1-247
01	Function code	1 Byte	0x10
02-03	Starting AO address	2 Byte	The value is the same as Byte 02-03 of the Request
04-05	Number of 16-bit registers (channels)	2 Byte	The value is the same as Byte 04-05 of the Request

[Error Response]

Byte	Description	Size	Value
00	Net ID (Station number)	1 Byte	1-247
01	Function code	1 Byte	0x90
02	Exception code	1 Byte	Refer to Modbus Standard Specification for more details

■ *For example: function 16 (0x10), Write AOs*

	[Leading 6 bytes]	[Request]
Command:	01 02 00 00 00 0B	01 10 00 32 00 01 02 03 E8 00 00

	[Leading 6 bytes]	[Response]
Response:	01 02 00 00 00 06	01 10 00 32 00 01

Sets Preset value for digital counter

Descriptions as follows:

Command:

[Leading 6 bytes]
Byte 00-03: 01 02 00 00 (Message number)
Byte 04-05: 00 0B (Number of remaining bytes in this frame)

[Request]
Byte 00 : 01 (Net ID)
Byte 01 : 10 (Function Code)
Byte 02-03: 00 32 (Starting AO Address)
Byte 04-05: 00 01 (Number of 16-bit registers)
Byte 06 : 02 (Byte count)
Byte 07-10: 03 E8 00 00 (Preset value for digital counter)

Response:

[Leading 6 bytes]
Byte 00-03: 01 02 00 00 (Message number)
Byte 04-05: 00 06 (Number of remaining bytes in this frame)

[Response]
Byte 00 : 01 (Net ID)
Byte 01 : 10 (Function Code)
Byte 02-03: 00 32 (Starting AO Address)
Byte 04-05: 00 01 (Word Count)

■ Data Field

The data field of messages sent between a master and a slave contains additional information about the action to be taken by the master or any information requested by the slave. If the master does not require this information, the data field can be empty.

Reference (Address)	Description
0xxxx	**Read/Write Discrete Outputs or Coils.** A 0x reference address is used to output device data to a digital output channel.
1xxxx	**Read Discrete Inputs.** The ON/OFF status of a 1x reference address is controlled by the corresponding digital input channel.
3xxxx	**Read Input Registers.** A 3x reference register contains a 16-bit number received from an external source, e.g. an analog signal.
4xxxx	**Read/Write Output or Holding Registers.** A 4x register is used to store 16 bits of numerical data (binary or decimal), or to send the data from the CPU to an output channel.

For more detail of Address Mapping (Reference number), refer to 6.3 Modbus Register Map.

9.3 Modbus Register Map

Data is transmitted in 8-, 16- and 32-bit format. The data of 16-bit registers is transmitted in high-byte first (For example: 0x0A0B ==> 0x0A, 0x0B). The data of 32-bit registers is transmitted as two 16-bit registers, and is low-word first. (For example: 0x0A0B0C0D ==> 0x0C, 0x0D, 0x0A, 0x0B.)

9.3.1 Common Functions

- **0xxxx: DO address (base 0)**

Begin address	Points	Description	Bits per Point	Range	Access Type
127 (0x7F)	1	Recovers all web default settings	1	1 = recover	W (Pulse)
128 (0x80)	1	Default ID settings	1	1 = recover	W (Pulse)
133 (0x85)	1	Reboots the tET/tPET module	1	1 = reboot	W (Pulse)
Remarks	"**W**": Write				

- **3xxxx: AI address (base 0)**

Begin address	Points	Description	Bits per Point	Range	Access Type
151 (0x97)	1	Firmware version	16	123 denotes that the version=1.2.3	R
158 (0x9E)	1	Modbus communication status	16	0 = No Error 1 = Timeout	R
160 (0xA0)	1	Pair-Connection status	16	0 = Normal 1 = Timeout 2 = Disconnected	R
Remarks	"**R**": Read				

- **4xxxx: AO address (base 0)**

Begin address	Points	Description	Bits per Point	Range	Access Type
255 (0xFF)	1	CPU reset status	16	1 = at Power-on 2 = by the WDT 3 = by the reset command	R/W
257 (0x101)	1	Set host watch dog timer	16	<5: Disabled 5~65535: Enabled (units: seconds) (Default=0) When the tET/tPET module loses communication with host PC for more than the period defined in the WDT settings, DO channels will revert to their safe values and the host WDT events counter will increase by one.	R/W/F
258 (0x102)	1	Host WDT events	16	Denotes how many host WDT events have occurred since the last CPU reset	R/W
259 (0x103)	1	Module name	16	Module name	R
263 (0x107)	1	Set TCP timeout	16	<5: Disabled 5~65535: Enabled (units: second) (default=0)	R/W/F
264 (0x108)	1	Set System timeout	16	<30: Disabled 30~65535: Enabled (unit: second) (default=0)	R/W/F
Remarks	"**R**": Read; "**W**": Write; "**F**": Setting is recorded in flash as default.				

9.3.2 Specific Functions

The nDI and nDO parameters of each model used in the following Modbus address tables are shown as follows:

Model name		Number of DO channels **(nDO)**	Number of DI channels **(nDI)**
tET series	tPET series		
tET-P6	tPET-P6	0	6
tET-C4	tPET-C4	4	0
tET-A4	tPET-A4	4	0
tET-P2C2	tPET-P2C2	2	2
tET-P2A2	tPET-P2A2	2	2
tET-P2POR2	tPET-P2POR2	2	2
tET-P2R2	tPET-P2R2	2	2

- **0xxxx: DO address (base 0)**

Begin address	Points	Description	Bits per Point	Range	Access Type
0 (0x00)	1~nDO	Digital Output	1	0 = Off 1 = On	R/W
32 (0x20)	1	Clear all DI latched status (high)	1	1 = Clear	W
33 (0x21)	1	Clear all DI latched status (low)	1	1 = Clear	W
34 (0x22)	1~nDI	Clear high speed digital counter	1	1 = Clear	W
60 (0x3C)	1	Save specific data to Flash (The access type of some register are labeled by "**E**")	1	1 = Clear	W
100 (0x64)	1~nDO	Enable DO PWM	1	0 = Off 1 = On (Default= 0)	R/W
150 (0x96)	1	Enable all DI latched status (high/low)	1	0 = Disable 1 = Enable (Default= 0)	R/W/F
151 (0x97)	1~nDI	Enable high speed digital counter	1	0 = Disable 1 = Enable (Default= 0)	R/W/F
190 (0xBE)	1~nDI	Enable DI frequency measurement	1	0 = Disable 1 = Enable (Default= 0)	R/W/F
235 (0xEB)	1~nDO	Power-on value for DO	1	0 = Off 1 = On (Default= 0)	R/W/F

267 (0x10B)	1~nDO	Safe value for DO	1	0 = Off 1 = On (Default= 0)	R/W/F
Remarks	"**R**": Read; "**W**": Write; "**F**": Setting is recorded in flash as default. "**E**": After writing DO[60] register, the data will be stored in flash.				

Note: Because the characteristic of relay, t(P)ET-P2POR2/t(P)ET-P2R2 series (the module with relay) are not suitable to use PWM for a long time.

• 1xxxx: DI address (base 0)

Begin address	Points	Description	Bits per Point	Range	Access Type
0 (0x00)	1~nDI	Digital Input status	1	0 = Off 1 = On	R
32 (0x20)	1~nDI	Digital latched status (high)	1	0 = no 1 = latched	R
64 (0x40)	1~nDI	Digital latched status (low)	1	0 = no 1 = latched	R
Remarks	"**R**": Read				

• 3xxxx: AI address (base 0)

Begin address	Points	Description	Bits per Point	**Value**	Access Type
16 (0x10)	1~nDI	Value of digital counter	32	0~4294967296	R
100 (0x64)	1	Number of DI channels	16	nDI	R
110 (0x6E)	1	Number of DO channels	16	nDO	R
121 (0x79)	1	Number of high-speed counters	16	nDI	R
Remarks	"**R**": Read				

Note: Each 32-bit point occupies two 16-bit registers, and has address offset 2. The second point is at begin-address +2, and so on.

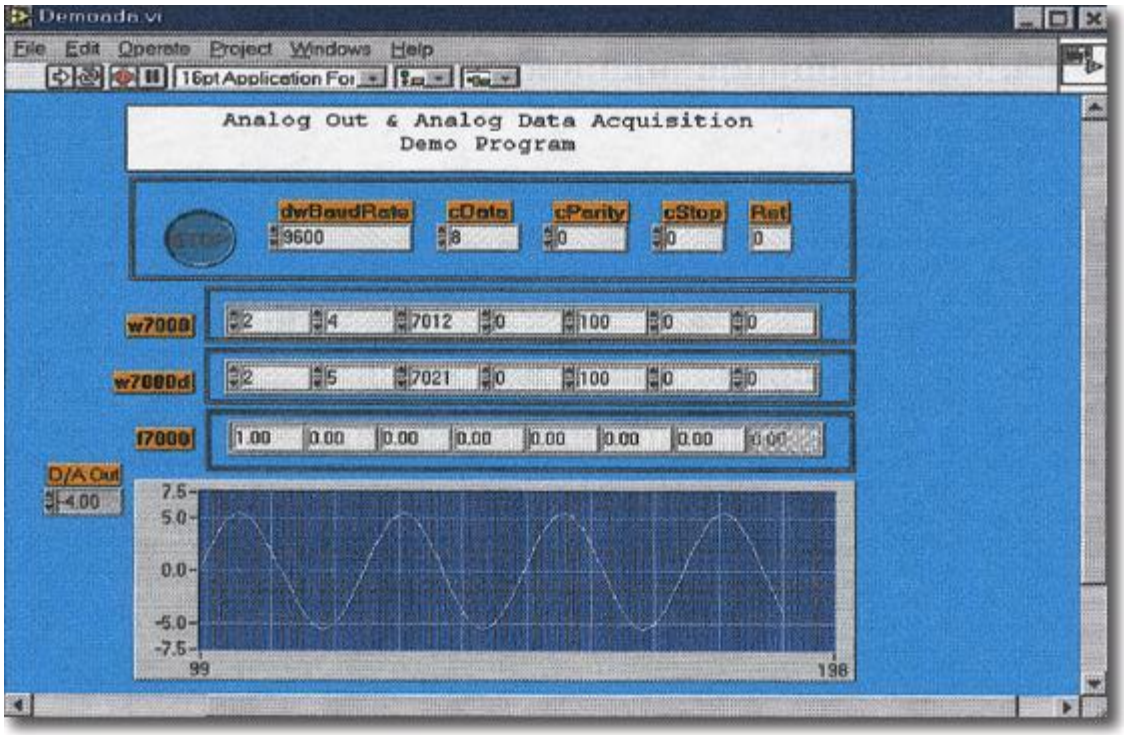
• 4xxxx: AO address (base 0)

Begin address	Points	Description	Bits per Point	Range	Access Type
50 (0x32)	1~nDI	Preset value for the high speed digital counter	32	0~4294967296	R/W/E
100 (0x64)	1~nDO	Duty cycle of DO PWM The first word (16-bit register) is the high pluse width, while the second word is the low pluse width. The unit is 1 ms, and the resolution is about 10 ms.	32	0~65535; 0~65535;	R/W/E
150 (0x64)	1~nDO	Scan mode	16	1000 = 1000 ms 100 = 100 ms 2000 = Single pulse	R/W/F
200 (0x64)	1~nDO	Moving average	16	1=No average 2=Average 2 values 4= Average 4 values 8= Average 8 values	R/W/F
268 (0x10C)	1~nDO	Min-Switching Time for DO	16	1~65535 second	R/W/F
284 (0x11C)	1~nDO	Auto-off Time for DO	16	1~65535 second	R/W/F
Remarks	"**R**": Read; "**W**": Write; "**F**": Setting is recorded in flash as default. "**E**": After writing DO[60] register, the data will be stored in flash.				

Note: Each 32-bit point occupies two 16-bit registers, and has address offset 2. The second point is at begin-address +2, and so on.

10 Related Tools

10.1 LabVIEW



LabVIEW is the best way to acquire, analyze, and present data. LabVIEW delivers a graphical development environment that can be used to quickly build data acquisition quickly, instrumentation and control systems, boosting productivity and saving development time. With LabVIEW, it is possible to quickly create user interfaces that enable interactive control of software systems. To specify your system functionality, simply assemble block diagram – a natural design notation for scientists and engineers.

The document for linking LabVIEW to the tET/tPET using the Modbus protocol is located at:

CD:\NAPDOS\tPET\Document\Application\LabVIEW\

http://ftp.icpdas.com/pub/cd/tinymodules/napdos/tPET/document/application/labVIEW/

10.2 OPC Server

OPC (OLE for Process Control) is the first standard resulting from the collaboration of a number of leading worldwide automation suppliers working in cooperation with Microsoft. Originally based on Microsoft's OLE COM (Component Object Model) and DCOM (Distributed Component Object Model) technologies, the specification defines a standard set of objects, interfaces and methods for use in process control and manufacturing automation applications to facilitate interoperability.

There are many different mechanisms provided by various vendors that allow access to a variety of devices via specific applications. However, if an OPC server is provided for the device, other applications will also be able to access the device via the OPC interface.

10.3 SCADA

SCADA stands for Supervisor Control and Data Acquisition and is a PC-based production automation and control system.

SCADA is widely used in many fields, e.g. power generation, water systems, the oil industry, and the chemical, and automobile industry. Different fields require different functions, but they all have the same common features:

- ✓ Graphical interface
- ✓ Process mimicking
- ✓ Real time and historic trend data
- ✓ Alarm system
- ✓ Data acquisition and recording
- ✓ Data analysis
- ✓ Report generator

➢ Accessing the tET/tPET module

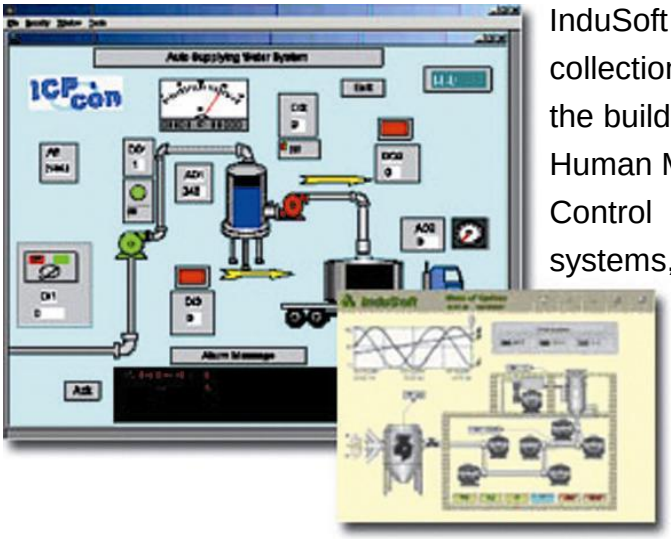
SCADA software is able to access tET/tPET devices using the Modbus communication protocol without the need for other software drivers.

➢ Popular SCADA software

Some of the more popular SCADA software includes Citect, ICONICS, iFIX, InduSoft, Intouch, Entivity Studio, Entivity Live, Entivity VLC, Trace Mode, Wizcon, Wonderware ... etc

In the following sections, three popular brands of SCADA software are introduced, together with detailed instructions of how to use them to communicate with tET/tPET series modules using the Modbus TCP protocol.

10.3.1 InduSoft



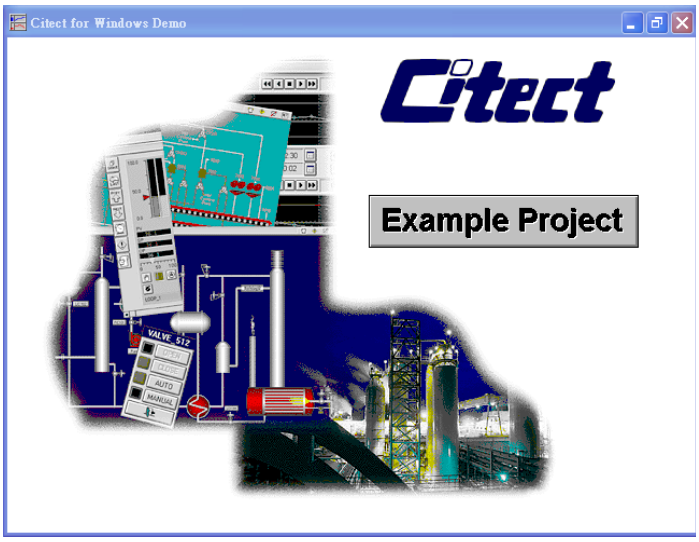
InduSoft Web Studio is a powerful, integrated collection of automation tools that includes all the building blocks needed to develop modern Human Machine Interfaces (HMI), Supervisory Control and Data Acquisition (SCADA) systems, and embedded instrumentation and control applications. InduSoft Web Studio's application runs in native Windows NT, 2000, XP, CE and CE .NET environments and conforms to industry standards such as Microsoft .NET, OPC, DDE, ODBC, XML, and ActiveX.

The document describing how to link InduSoft to the tET/tPET series module using the Modbus protocol is located at:

CD:\NAPDOS\tPET\Document\Application\InduSoft\

http://ftp.icpdas.com/pub/cd/tinymodules/napdos/tPET/document/application/indusoft/

10.3.2 Citect



CitectSCADA is a fully integrated Human Machine Interface (HMI) / SCADA solution that enables users to increase return on assets by delivering a highly scalable, reliable control and monitoring system. Easy-to-use configuration tools and powerful features enable the rapid development and deployment of solutions for applications of any size.

The document describing how to link Citect to the tET/tPET module using the Modbus protocol is located on

CD:\NAPDOS\tPET\Document\Application\Citect\
http://ftp.icpdas.com/pub/cd/tinymodules/napdos/tPET/document/application/citect/

10.3.3 iFix

The document describing how to link iFix to the tET/tPET series module using the Modbus protocol is located at:

CD:\NAPDOS\tPET\Document\Application\iFix\

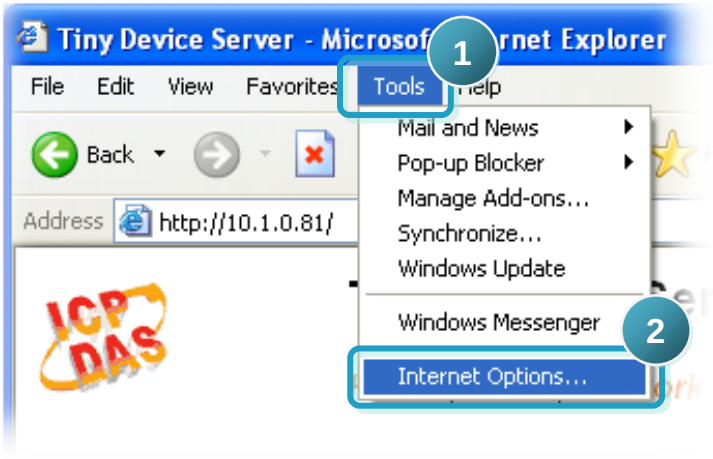
http://ftp.icpdas.com/pub/cd/tinymodules/napdos/tPET/document/application/ifix/

Appendix

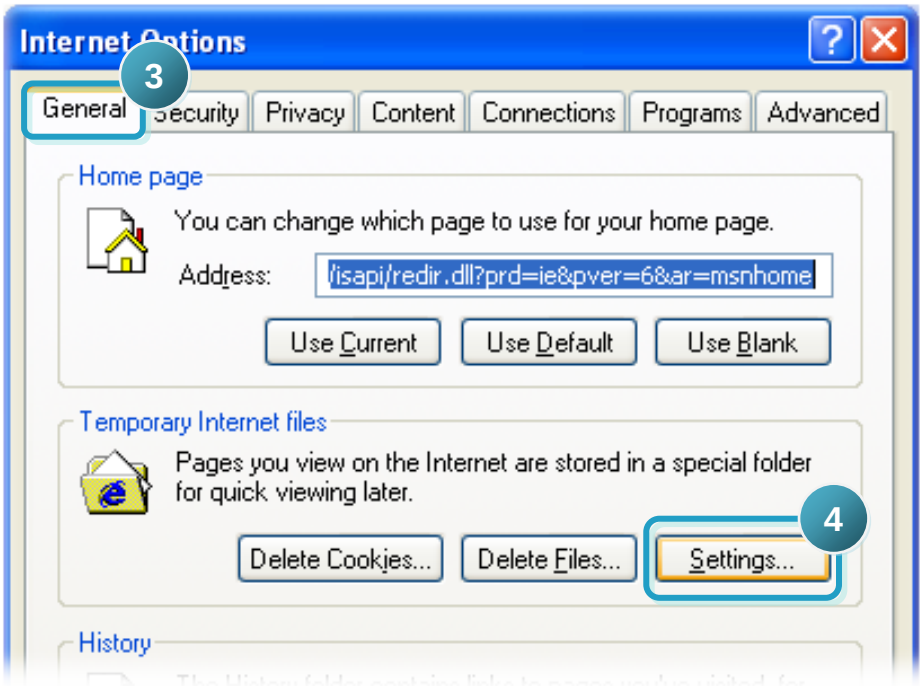
A. How to avoid browser access error that causes a blank page to be displayed when using IE.

Disable the IE cache in the following manner:

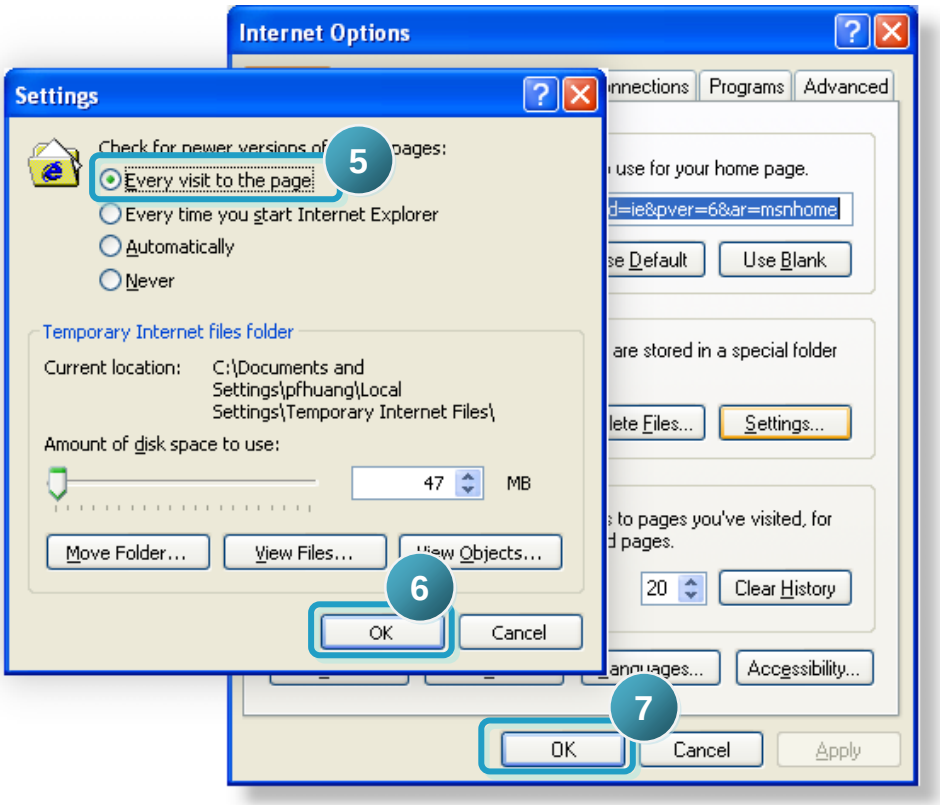
Step 1: Click **"Tools"** >> "**Internet Options...**".



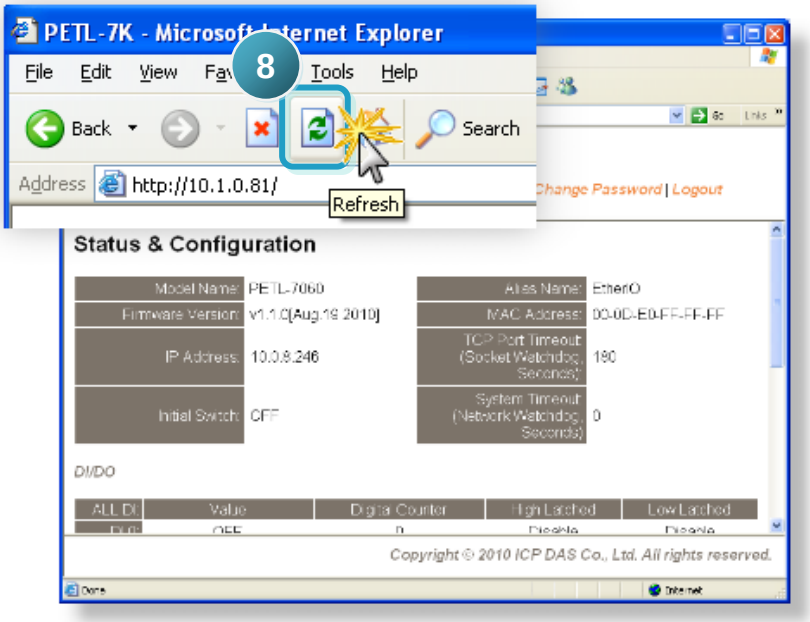
Step 2: Click the "**General**" tab and then click the "**Settings...**" button in the Temporary Internet files frame of the Internet Options dialog.



Step 3: Click the "**Every visit to the page**" option and then click the "**OK**" button in both Settings dialog and Internet Options dialog.



Step 4: Click the "**Refresh**" button to press F5 on your keyboard to refresh the tET/tPET web server, or re-open IE.



B. Firmware Updates via the Ethernet

Introduction

The tET/tPET supports firmware updates across an Ethernet network via the BOOTP/TFTP protocol. The tET/tPET module (network client) uses the BOOTP protocol to obtain an IP address from the eflash.exe utility program (configuration server), and then uses the TFTP protocol to transfer the firmware image from the eflash.exe (server) to the tET/tPET (client) module.

The code (in the boot loader) used to update the firmware image is not part of the firmware itself. Thus, users can update the firmware even if the built-in version is corrupted or does not exist. If the firmware update fails, the update procedures simply need to be run again.

The tET/tPET module has a built-in flash protection feature that prohibits any modification to the firmware in the flash. Before updating the firmware, the "**Init Switch**" must be set to the "**Init**" state and then power-on reset is performed on the tET/tPET to disable the flash protection. Since the flash becomes writable, the firmware can be remotely updated via the Ethernet network.

Mode	Flash Protection	**Firmware Update**	Configuration
Initial	No	**Yes**	Factory
Run	**Yes**	No	User-Defined

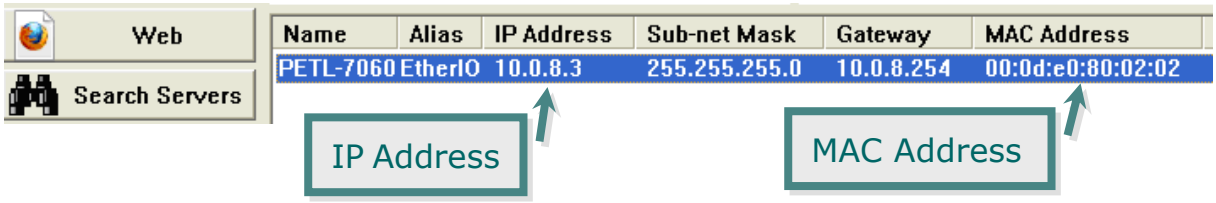
Notes:

1. Ensure that the network settings of your computer are correctly configured or the update procedures via the Ethernet network may not work properly.
2. The eflash.exe program may not start correctly if there is another TFTP server running on the same computer.
3. RFC-951 defines the BOOTP (Bootstrap Protocol, uses UDP Ports 67 and 68).
4. RFC-1350 defines the TFTP (Trivial File Transfer Protocol, uses UDP Port 69).

Procedure for updating Firmware via the Ethernet

1. Connect the tET/tPET module to the same HUB or the same sub-network as your PC. Do not connect it to either a router or the Internet as if may cause the update to fail.

2. Run the eSearch Utility to search for the tET/tPET module and take not of its IP and MAC addresses.



If the above IP address does not work correctly (for example, it does not respond to a ping command), contact your network administrator to obtain a valid IP address for the tET/tPET module.

3. Create an "**update.bat**" file in the firmware folder (for example, C:\ETL7K). Enter the following eflash.exe command strings in the file.

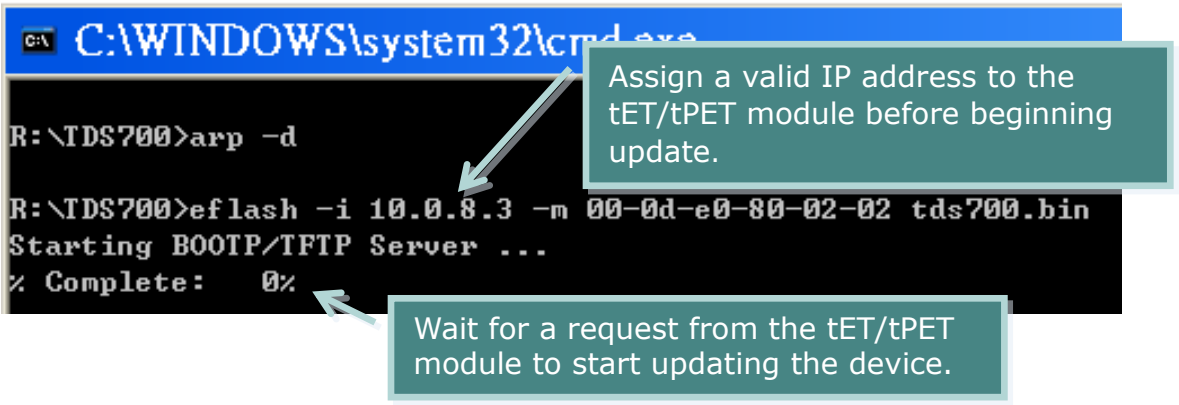
```
eflash –i [IP address] –m [MAC address] [Firmware Name]
pause
```

The "**pause**" command ensures that the DOS box remains open so that you can then check the result and press "**Enter**" to close it later.

For example, of assign the IP address 10.0.8.3 to the tET/tPET module that has a MAC of address of 00.0d.e0:80:02:02. The IP address assigned to the tET/tPET module can be the same as that assigned by the DHCP (since it works), or if can be another valid IP address that is in the same sub-network and is not in conflict with other devices.

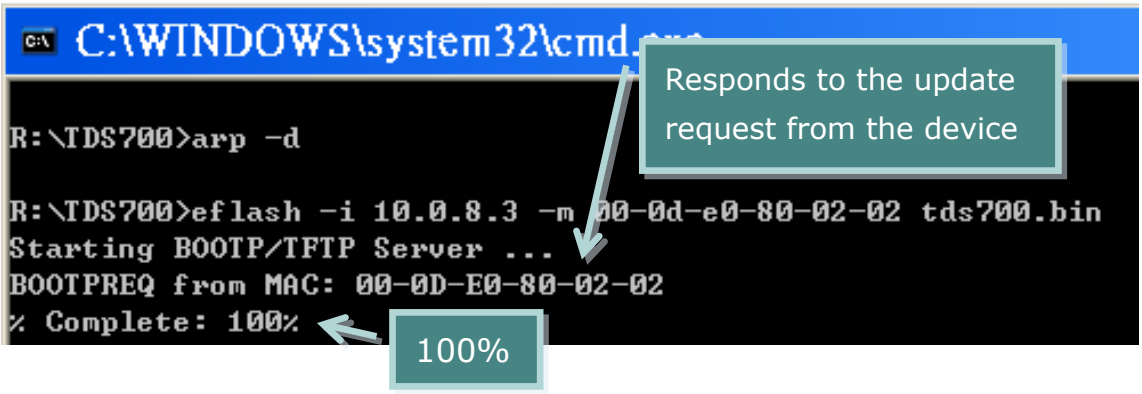
```
eflash -i 10.0.8.3 -m 00-0d-e0-80-02-02 ETL7K.dat
pause
```

4. Double-click the **update.bat** file you just created above on a Windows 2000/XP/2003 system to begin waiting for an update request from the tET/tPET series module.



5. Set the "**Init Switch**" of the tET/tPET module to the in "**Init**" position.

6. Reboot the tET/tPET module in init mode to initial the update request.



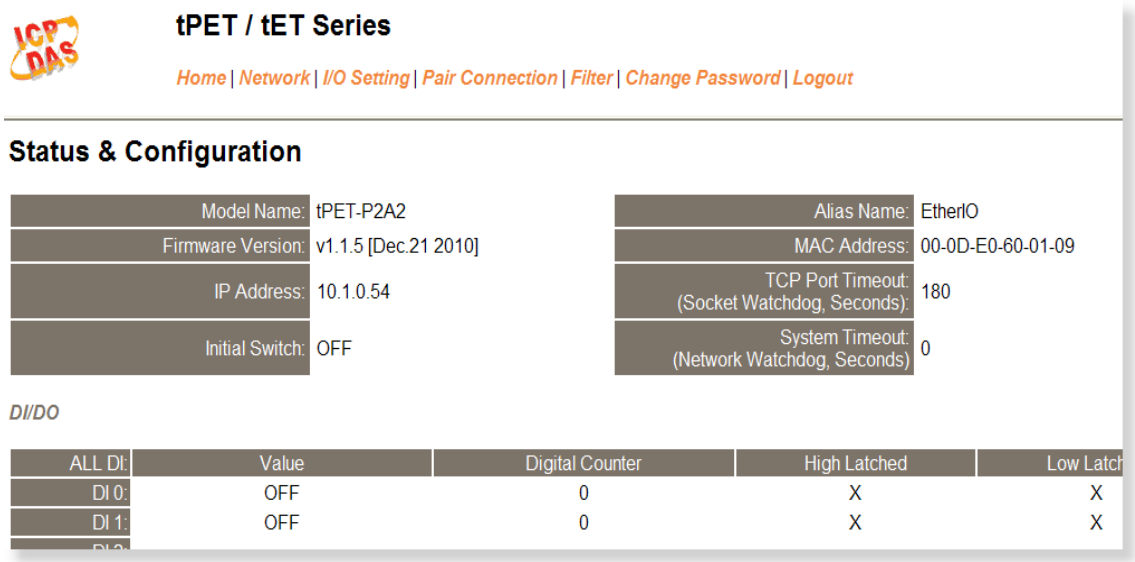
7. Set the "**Init Switch**" to the "**Run**" position once the update is finished, when the complete rate shows "**100%**".

8. Reboot the tET/tPET module so that if is running in normal mode.

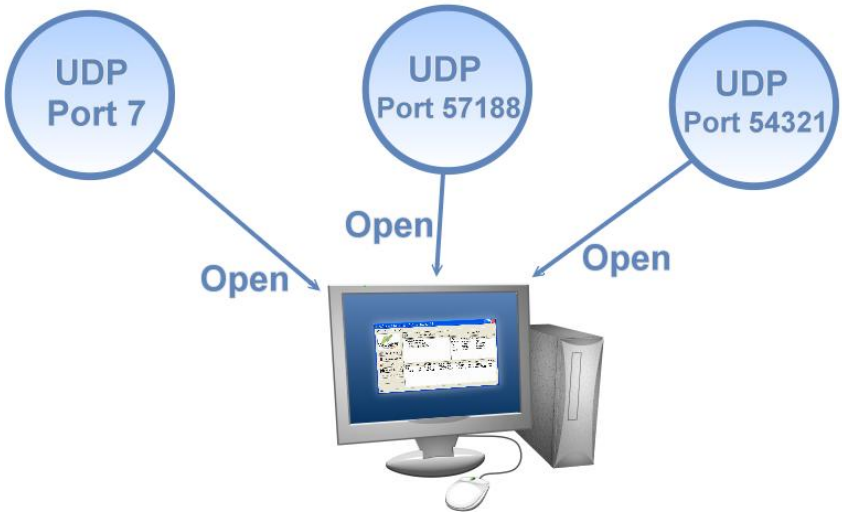
9. Run the eSearch Utility to search for the tET/tPET module again to check that it is now working.

If any problem causes the firmware not to work, for example, the module cannot be found by searching or the system LED is always off, download a new firmware image from our website and then update the module again.

10. Log in to the web configuration for the tET/tPET module to check the firmware version/date (the default password is **"Admin"**).



C. Why cannot computer ping or search the tET/tPET series module?



The computer can make a communication with the module through some specific ports. Please confirm with your network administrator that UDP Port 7, Port 57188 and Port 54321 can't be denying by network device.

About the detailed information of TCP/UDP port refers to following table:

- **TCP Port:**

Port Number	Description
80	HTTP (HyperText Transport Protocol)
502	Modbus Data Port

- **UDP Port:**

Port Number	Description
7	Echo (Ping)
57188	Request of UDP search
54321	Response of UDP search