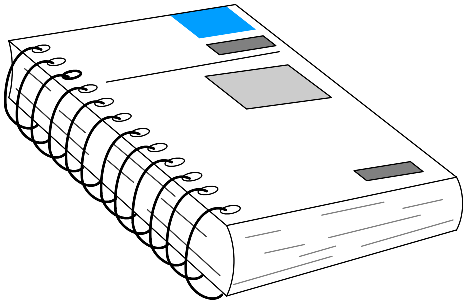
Introduction

In This Chapter. . . .

Manual Overview

The Purpose of this Manual

This manual describes the installation and operation of the Terminator I/O MODBUS Base Controller (T1K–MODBUS).



Supplemental Manuals

The following manuals are essential to the proper use of your Terminator I/O MODBUS Base Controller.

- Terminator Installation and I/O Manual part number **T1K–INST–M**

  This manual contains very important information, including a complete I/O Module Memory Map. The Memory Map is crucial in designing and implementing a Terminator I/O system.
- The PLC User Manual (if PLC is used as master).
- The MODBUS Master manual (if other than PLC is used as master).

Who Should Read this Manual

If you have a working knowledge of MODBUS networks, and the PLC or PC which you are using, this manual will help you configure and install your T1K–MODBUS Base Controller.

Technical Support

We strive to make our manuals the best in the industry and rely on your feedback in reaching our goal. If you cannot find the solution to your particular application, or, if for any reason you need additional technical assistance, please call us at

770–844–4200.

Our technical support team is glad to work with you in answering your questions. They are available **weekdays from 9:00 a.m. to 6:00 p.m. Eastern Time**. We also encourage you to visit our website where you can find technical and nontechnical information about our products and our company.

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Manual Layout The contents of this user manual are as follows:

Chapter	Title	What's covered
1	**Introduction**	introduces MODBUS and describes both the Terminator I/O System and the T1K–MODBUS Base Controller
2	**T1K–MODBUS Specifications**	provides module specifications, dip switch settings, port pin–outs and wiring information.
3	**MODBUS RTU Functions and Addressing Modes**	provides MODBUS RTU functions supported and use with DirectLogic PLCs, or MODBUS 584/984 modes.
4	**Using T1K–MODBUS Setup Tool**	explains how to configure the MODBUS port using the Setup Tool.

Appendices Additional reference information for the T1K–MODBUS is available in the following appendices.

Appendix	Title	What's covered
A	**I/O Module Hot Swap**	explains the T1K–MODBUS I/O module Hot Swap feature and the Enable/Disable Outputs switch.
B	**Analog Output Module Configuration**	uses a memory map to explain how to configure an analog output module.

Symbols Used

The "note pad" icon in the left–hand margin indicates a **special note**.

The "exclamation mark" icon in the left-hand margin indicates a **warning** or **caution**. These are very important because the information may help you prevent serious personal injury or equipment damage.

The "light bulb" icon in the left-hand margin indicates a **tip** or **shortcut**.

Introduction to MODBUS

MODBUS RTU (Remote Terminal Unit) Protocol is a messaging structure used to establish master–slave communications between intelligent devices. When a MODBUS master sends a message to a MODBUS slave, the message contains the address of the slave, the function, the data and a check sum. The slave's response message contains fields confirming the master's request, any data requested and an error–checking field.

A typical MODBUS RTU frame consists of the following fields:

ADDRESS	FUNCTION	DATA	CHECKSUM

The **address field** of a message contains 8 bits. Valid slave addresses are in the range of 0– 247 decimal. The individual slave devices are set in the range of 1 – 247 decimal (address 0 is the broadcast to all slaves address). The master specifies a slave by placing the slave address in the address field of the message. When the slave responds, it places its own address in the address field to identify to the master which slave is responding.

The **function code field** of a message contains 8 bits. Valid function codes are in the range of 1 – 255 decimal. The function code instructs the slave what kind of action to take. Some examples are to read the status of a group of discrete inputs; to read the data in a group of registers; to write to an output coil or a group of registers; or to read the diagnostic status of a slave.

When a slave responds to the master, it uses the function code field to indicate either a normal response or that some type of error has occurred. For a normal response, the slave echoes the original function code. In an error condition, the slave echoes the original function code with its MSB set to a logic 1.

The **data field** is constructed using sets of two hexadecimal digits in the range of 00 to FF. According to the network's serial transmission mode, these digits can be made of a pair of ASCII characters or from one RTU character.

The data field also contains additional information that the slave uses to execute the action defined by the function code. This can include internal addresses, quantity of items to be handled, etc.

The data field of a response from a slave to a master contains the data requested if no error occurs. If an error occurs, the field contains an exception code that the master uses to determine the next action to be taken. The data field can be nonexistent in certain types of messages.

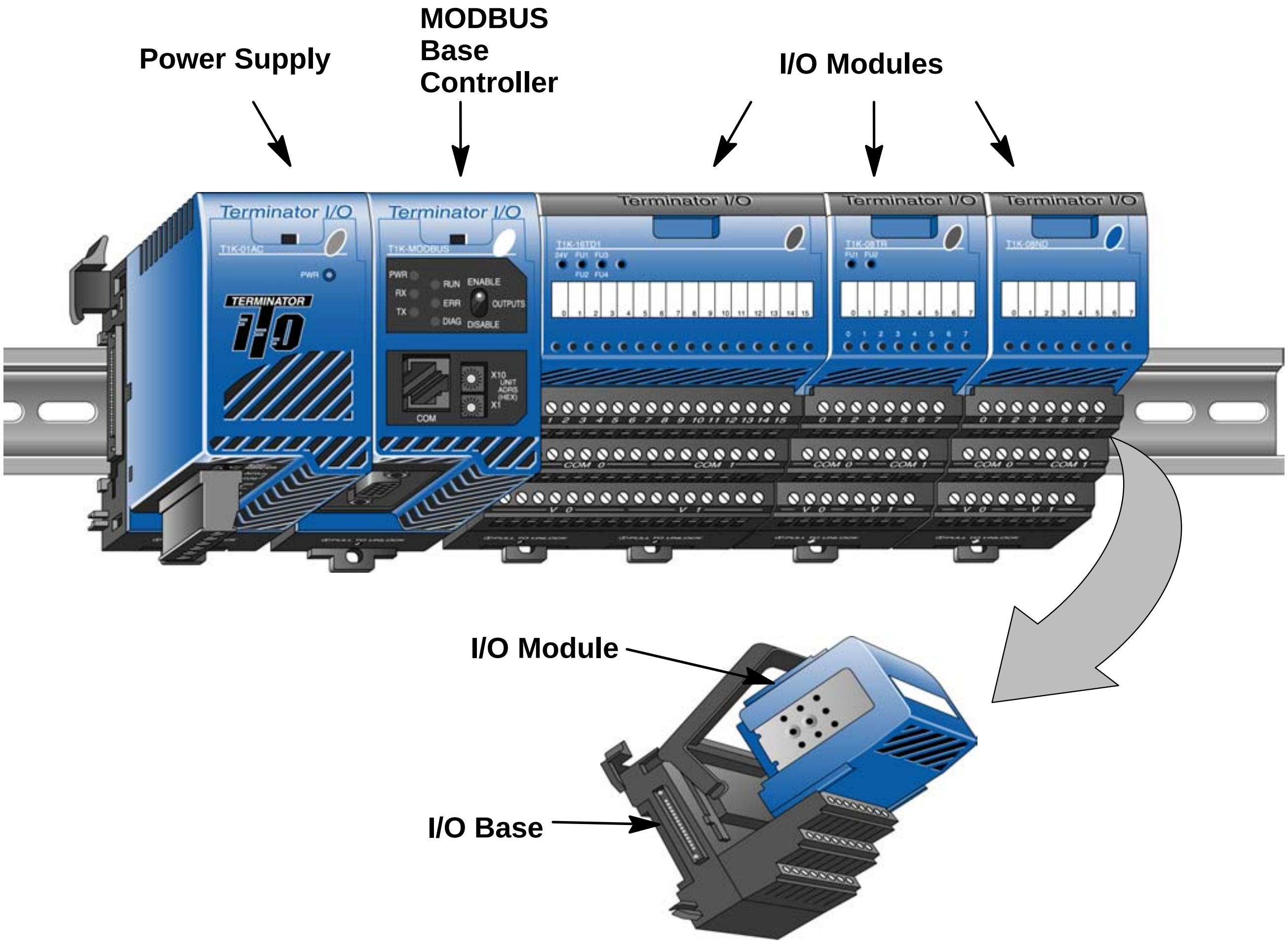
The **checksum field** is used for error checking. Standard MODBUS serial networks use two types of error checking.

Parity checking (even or odd) totals the number of logical 1 bits in the data field and sets the parity bit to a 0 or 1 representing an odd or even total of logical 1 bits. *Cyclical Redundancy Check* (CRC) checks the entire message and is applied regardless of any parity check method used. The CRC field consists of two bytes, creating a 16 bit binary value. The CRC is calculated in the transmitting device and is recalculated and compared by the receiving device.

Both the character check and the message frame check are generated in the master device and applied to the message before transmission. The slave device checks each character and the entire message frame during receipt.

Terminator I/O System

Terminator I/O is a modular system which combines the functions of terminal blocks and I/O modules for distributed I/O. Each Terminator I/O system has the following components: a Power Supply, a Base Controller, and one or more I/O Modules and I/O bases.



T1K–MODBUS Base Controller

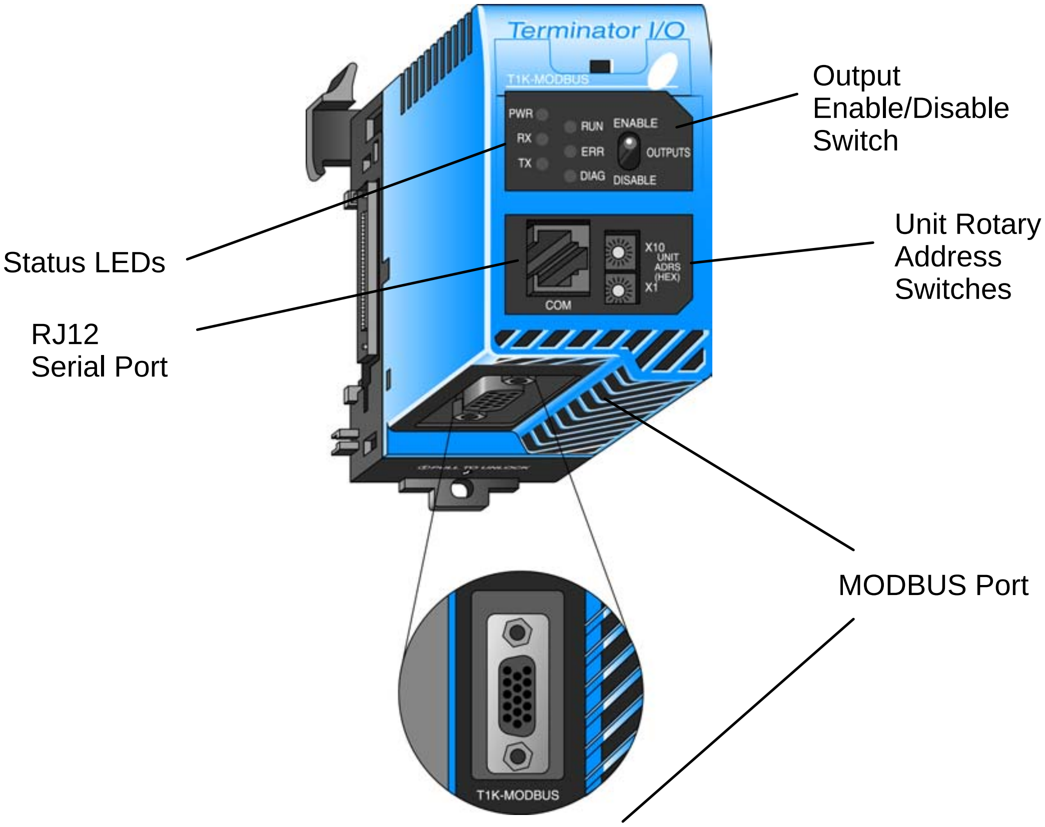
The T1K–MODBUS Base Controller is a slave module that functions as a controller for Terminator I/O on a MODBUS network.

Note: It is recommended to use the T1K–MODBUS Base Controller in a “scan based” (polled) control system rather than in an “event–driven” control system. As a slave, the Base Controller does not have the ability to report an error condition to the MODBUS network master. Thus, polling a slave on a regular basis will detect a slave error condition promptly, whereas an event–driven control system will not detect a slave error condition until the next event is addressed to a slave in error.

MODBUS Base Controller Features

The Base Controller has the following features:

- Status LEDs
- MODBUS Port
- Serial Port (RJ12)
- Unit Address Switches
- Output Enable/Disable Switch
- DIP Switch (located on right side of unit)


Terminator I/O
T1K-MODBUS
PWR
RX
TX
RUN
ERR
DIAG
ENABLE
OUTPUTS
DISABLE
COM
X10
UNIT ADRS (HEX)
X1
T1K-MODBUS
Output Enable/Disable Switch
Unit Rotary Address Switches
Status LEDs
RJ12 Serial Port
MODBUS Port