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T1K–MODBUS Base Controller Specifications

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— T1K–MODBUS Base Controller Specifications
— Setting the DIP Switches
— Setting the Rotary Address Switches
— MODBUS Port Pin–out and Wiring
— RJ12 Serial Port Pin–out and Wiring

T1K–MODBUS Base Controller Specifications

General	
Operating Temperature	32° F to 131° F (0° C to 55° C)
Storage Temperature	–4° F to 158° F (–20° C to 70° C)
Ambient Humidity	30% – 95% relative humidity (non–condensing)
Voltage Withstand	1500VAC, 1 minute (15–pin connector internal)
Insulation Resistance	500VDC, 10MΩ
Vibration Resistance	MIL STD 810C, Method 514.2
Shock Resistance	MIL STD 810C, Method 516.2
Noise Immunity	NEMA (ICS3–304) Impulse noise 1µs, 1000V FCC class A RFI (145MHz, 435MHz 10W, 10cm)
Atmosphere	No corrosive gases Environmental Pollution Level is 2.
Size	1.89”Wx3.15”Hx3.26”D (48Wx80Hx83D)mm
Weight	6.0 oz. (170 g)

MODBUS Port Specifications	
Connector	15–pin female D–shell connector
Connection Port Type	RS232C, RS–422/485
Protocol	MODBUS RTU
Station Number	1 to F7h (247) Rotary Switch Setting
Number of I/O Points	Inputs: 1024; Outputs: 1024
Baud Rate (bps)	300, 600, 1200, 2400, 4800, 9600, 19200, 38400 (Dip Switch 1–3 selectable)
Communication Data	8 Bit (Fixed)
Start Bit	1 Bit (Fixed)
Stop Bit	1 Bit (Default), 2 Bit Selectable with Dip Switch 4 ON (Option Mode) Use T1K–MODBUS Setup Tool
Parity Bit	ODD (Default) / EVEN / NONE; Selectable with Dip SW 4 ON (Option Mode) Use T1K–MODBUS Setup Tool
Communication Timeout	500ms, 1s (Default), 2.5s, 5s, 10s, 25s, 60s Selectable with Dip SW 4 ON (Option Mode) Use T1K–MODBUS Setup Tool
RTS On / RTS Off Delay Time	0 (Default) / 2 / 5 / 10 /50 /100 / 500 ms Selectable with Dip SW 4 ON (Option Mode) Use T1K–MODBUS Setup Tool
Communication Status Indicators	RUN, ERR, TX, RX
Module Status Indicators	PWR, DIAG

RJ12 Serial Port Specifications	
Connector	6–pin female modular (RJ12 phone jack)
Connection Port Type	RS232C
Protocol	MODBUS RTU; Use to configure the MODBUS port using the T1K–MODBUS Setup Tool. Also use for firmware upgrades.
Station Number	1 (Fixed)
Baud Rate	9600bps, 19200bps (Dip Switch 6 selectable)
Communication Data	8 Bit (Fixed)
Start Bit	1 Bit (Fixed)
Stop Bit	1 Bit (Fixed)
Parity Bit	ODD (Fixed)

Base Controller I/O Specifications	
Number of I/O Points (max.)	Discrete: Inputs: 1024, Outputs: 1024 Analog: Inputs 64 Channels, Outputs 64 Channels
Number of Slots	1 to 31
Self–Diagnostics	Watchdog Timer, Memory Check
I/O Module Type Supported	Discrete Input, Discrete Output Analog Input, Analog Output
Hot Swap	Yes
Internal Power Consumption	250mA @ 5VDC
Allowable External Power Drop	to 0V for 10ms max.

Status Indicators

The status indicator LEDs on the Base Controller's front panel have specific functions which can help in programming and troubleshooting.

Indicator	Status	Description
PWR (Green)	ON	Power good
RX (Green)	ON	Data is being received by the Base Controller
	OFF	No data is being received by the Base Controller
TX (Green)	ON	Data is being transmitted by the Base Controller
	OFF	No data is being transmitted by the Base Controller
RUN (Green)	ON	Starting communication to Master Module
	OFF	LED will turn OFF 1 second after failing to communicate with master module
ERR	ON	Communication error
	Flashing at 1 sec intervals	ERR LED will begin flashing after the master stops communicating with the Base Controller. The Communication Time–out period can be set using the T1K–MODBUS Setup Tool.
DIAG	ON	I/O system error
	OFF	I/O sytem good

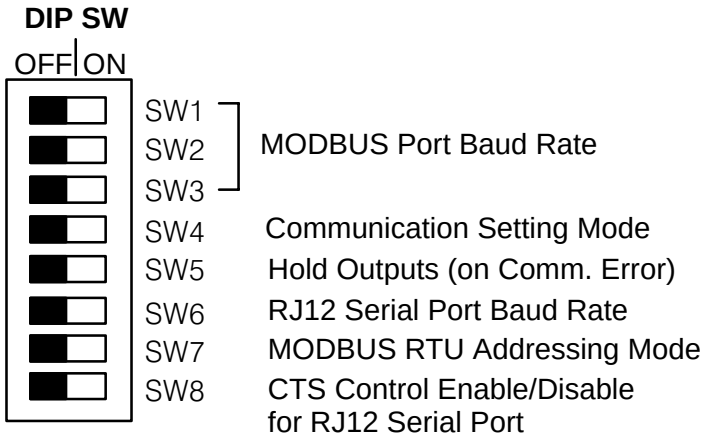
Setting the DIP Switches

DIP Switch Settings

The T1K–MODBUS controller has an eight position DIP Switch which controls baud rates, addressing modes, the state of the outputs in an error condition, etc. The DIP Switch is located on the side of the unit, opposite the power supply.

Note: Be sure to look closely at the DIP Switch default settings below.

The DIP Switch is on this side.



Factory Default Settings Shown (all OFF)

DIP Switches 1–3 select the MODBUS port baud rate.

SW 1–3 MODBUS Port Baud Rate			
Baud Rate	**SW 1**	**SW2**	**SW3**
300 bps	OFF	OFF	OFF
600 bps	ON	OFF	OFF
1200 bps	OFF	ON	OFF
2400 bps	ON	ON	OFF
4800 bps	OFF	OFF	ON
9600 bps	ON	OFF	ON
19200 bps	OFF	ON	ON
38400 bps	ON	ON	ON

The Communications Setting mode, **DIP Switch 4**, enables some of the MODBUS port communication parameters to be user set using the T1K–MODBUS Set Up Tool. The following tables describe the default and option modes.

SW 4 Communication Setting Mode	
OFF	Default Mode
ON	Option Mode

Default Mode:
The following table lists the MODBUS port default settings when **DIP Switch 4 is in the OFF position.**

SW 4 OFF	MODBUS Port / Default Mode
Item	**Default Setting**
Communication Data	8 Bit
Start Bit	1 Bit
Stop Bit	1 Bit
Parity Bit	ODD
Communication Timeout	1s
RTS ON Delay Time	0ms
RTS OFF Delay Time	0ms

Option Mode:
The following items are user selectable using the T1K–MODBUS Set Up Tool* when **DIP Switch 4 is in the ON position**.

SW 4 ON	MODBUS Port / Option Mode
Item	**Default Setting**
Communication Data	8 Bit (Fixed)
Start Bit	1 Bit (Fixed)
Stop Bit*	1 Bit / 2 Bit
Parity Bit*	ODD / EVEN / NONE
Communication Timeout*	500ms, 1s, 2.5s, 5s, 10s, 25s, 60s
RTS ON Delay Time*	0ms, 2ms, 5ms, 10ms, 20ms, 50ms, 100ms, 500ms
RTS OFF Delay Time*	0ms, 2ms, 5ms, 10ms, 20ms, 50ms, 100ms, 500ms

The Hold Outputs DIP Switch 5 determines the slave outputs' response to a communications failure. If DIP switch 5 is in the ON position, the outputs in that slave unit will hold their last state when a communication error occurs. If OFF, the outputs in that slave unit will turn off in response to a communications error.

SW 5 Hold Outputs	
OFF	Turn OFF
ON	Hold Last State

WARNING: Selecting "HOLD LAST STATE" means that outputs in that slave will not be under program control in the event of a communications failure. Consider the consequences to process operation carefully before selecting this mode.

DIP Switch 6 selects the baud rate for the RJ12 serial port. All other serial port communication parameters are fixed. The port defaults are listed in the specifications tables in the beginning of this chapter.

SW 6 RJ12 Serial Port Baud Rate	
OFF	9600 bps
ON	19200 bps

DIP Switch 7 selects the T1K–MODBUS addressing mode. Select the **OFF position** if the T1K–MODBUS is to be used with a MODBUS master that operates in the 584/984 addressing mode. Select the **ON position** if the T1K–MODBUS is to be used with a ***Direct***Logic PLC CPU operating as the MODBUS master. The modes are discussed in Chapter 3.

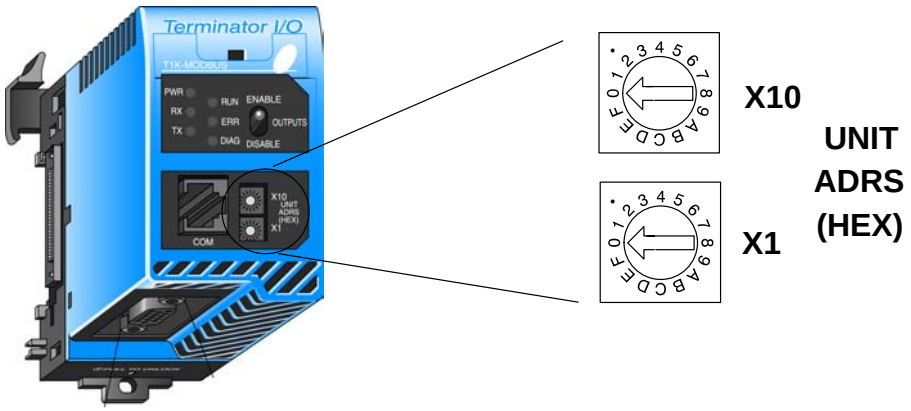
SW 7 MODBUS RTU Addressing Mode	
OFF	584/984 MODBUS Slave
ON	***Direct***Logic PLC MODBUS Slave

DIP Switch 8 either enables or disables the CTS pin on the RJ12 serial port. Place the switch in the **ON position** if the connected serial device requires RTS/CTS control. Otherwise place the switch in the **OFF position** if only 3–wire communication (TX, RX, GND) is required.

SW 8 CTS for RJ12 Serial Port	
OFF	Disable
ON	Enable

Setting the Rotary Address Switches

The T1K–MODBUS unit address is set by the two rotary switches on the front of the unit. Addresses are in hexadecimal format with valid address from 00 to F7, which is equivalent to 0 to 247 decimal. The addresses do not have to be sequential, but each station address must be unique.
The top rotary switch is used to set the most significant digit of the HEX address. The lower switch is used to set the least significant digit in the HEX address.



Converting HEX Addresses to Decimal

Eventhough the T1K–MODBUS unit address is set in HEX, it's not difficult to calculate the equivalent decimal address used by the MODBUS protocol.
To calculate the equivalent HEX address:
1) Divide the decimal address desired by 16. This provides the X10 HEX digit.
2) The remainder will be a number less than 16, resulting in a HEX number between 0–F. The remainder provides the X1 HEX digit. Two examples are given below.

0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	HEX Format
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Decimal format

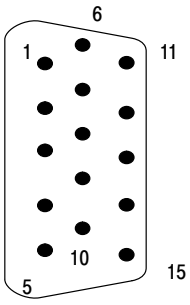
60 decimal

60 ÷ 16 = 3 with remainder of 12 = C So 60 decimal = 3C HEX

24 decimal

24 ÷ 16 = 1 with remainder of 8 = 8 So 24 decimal = 18 HEX

MODBUS Port Pin–out and Wiring

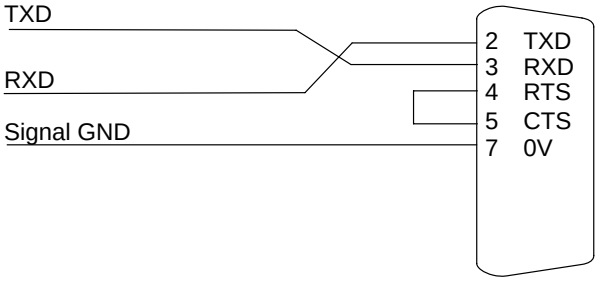


15-pin Female
D Connector

MODBUS Port Pin Descriptions		
1	5V	5 VDC
2	TXD2	Transmit Data (RS232C)
3	RXD2	Receive Data (RS232C)
4	RTS2	Ready to Send (RS–232C)
5	CTS2	Clear to Send (RS–232C)
6	RXD2–	Receive Data – (RS–422)
7	0V	Logic Ground
8	0V	Logic Ground
9	TXD2+	Transmit Data + (RS–422)
10	TXD2 –	Transmit Data – (RS–422)
11	RTS2 +	Request to Send + (RS–422)
12	RTS2 –	Request to Send – (RS–422)
13	RXD2 +	Receive Data + (RS–422)
14	CTS2 +	Clear to Send + (RS422)
15	CTS2 –	Clear to Send – (RS–422)

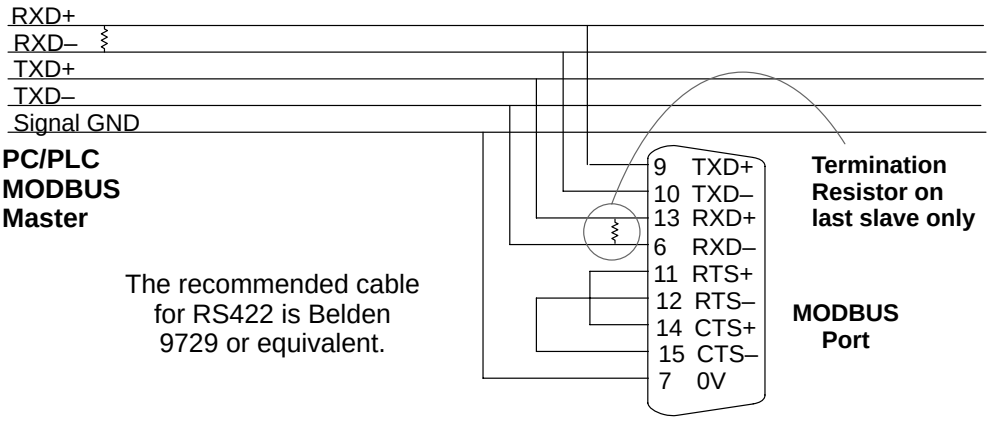
RS–232C Point-to-point DTE Device

PC/PLC MODBUS Master



MODBUS Port

RS–422 Network



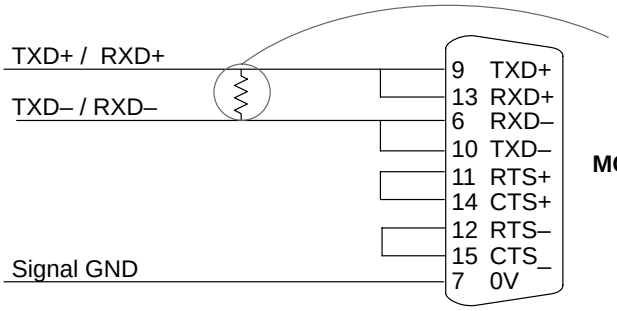
PC/PLC MODBUS Master

Termination Resistor on last slave only

MODBUS Port

The recommended cable for RS422 is Belden 9729 or equivalent.

RS–485 Network



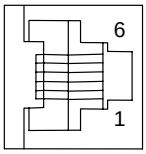
PC/PLC MODBUS Master

Termination Resistor on last slave only

MODBUS Port

RJ12 Serial Port Pin–out and Wiring

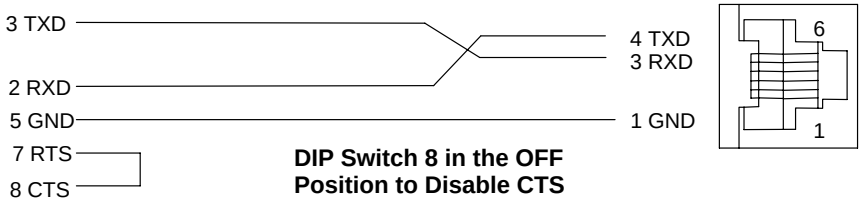
The Base Controller's MODBUS port can be configured using the T1K–MODBUS Setup Tool via the RJ12 serial port. The "Using the T1K–MODBUS Setup Tool" chapter later in this manual discusses using the Setup Tool. The RJ12 port is also used to upgrade the firmware in the base controller.



6-pin Female
Modular Connector

RJ12 Serial Port Pin Descriptions		
1	0V	Power (–) connection (GND)
2	5V	Power (+) connection
3	RXD	Receive Data (RS232C)
4	TXD	Transmit Data (RS232C
5	RTS	Request to Send
6	CTS	Clear to Send

Use D2–DSCBL to connect PC to RJ12 Serial Port



DIP Switch 8 in the OFF Position to Disable CTS