Westronic

WS1000 TBOS

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Technical Manual

Technical Manual

Westronic Systems, Inc.
a Mediation Technology company

NOTICE

WESTRONIC makes no warranties about this document. WESTRONIC reserves the right to make hardware and software changes to the product described within this document without prior notice and without obligation to notify any person of such revision or change.

REGULATORY INFORMATION

WARNING: This equipment generates, uses, and can radiate radio frequency energy, and, if not installed and used in accordance with the installation manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A digital device pursuant to Part 15, Subpart J of the FCC rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of the equipment in a residential area is likely to cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

CAUTION: Changes or modifications not expressly approved by Westronic could void the user's authority to operate this equipment.

The FCC label can be found on the right side of the shelf assembly. The label includes the following information:

This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions:

- This device may not cause harmful interference, and
- This device must accept any interference received, including interference that may cause undesired operation.

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Revision History

Rev Level	Issue Date	Reason for Reissue
A	January, 1990	First Release
B	January, 1991	Standardize Document
C	January, 1994	Add TTL Capability
D	April, 1998	Incorporate New Modem
E	November, 1999	Convert Document to FrameMaker Format
F	April, 2000	Error Correction, Remove WS1000 Part Numbers No Longer Available, Remove Appendix A and Place Graphics within Document
G	August, 2001	Convert Document to Word Format, Update Logo
H	July, 2005	Update Adress to New Location

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1 Product Description

1.1 Overview

The WS1000 TBOS Remote complements many operation support systems by providing an economical and flexible means of collecting small to large quantities of discrete alarm and status data, converting them to a simple, easy-to-handle TBOS interface.

The WS1000 can mount in an equipment rack or on a Main Distribution Frame (MDF), so the unit is located as close as possible to the source of discrete interfaces. The result is a large reduction in the amount of wiring required to pick up alarm and status data. This reduction in wiring eliminates the possibility of losing data through disconnected, moved, or cut wiring.

The WS1000 has two serial ports. Serial Port 1 serves as a TBOS host communications interface that can be equipped with an optional 1,200-bps Bell 202T-compatible internal modem, which allows the WS1000 to be located beyond the range of standard RS-422/RS-485 interfaces. If required by a site configuration, serial Port 1 can be equiped with an optional RS-422-to-RS-232 conversion board. Serial Port 2 serves as a TBOS data collection interface, allowing the WS1000 to combine data from other WS1000 TBOS remotes or local TBOS-based Network Elements (NEs).

The WS1000 TBOS units provide a combination of discrete alarm/status inputs and discrete control outputs. The following configurations are available:

- 64 inputs/8 outputs
- 64 inputs/8 outputs/202T modem
- 128 inputs/16 outputs
- 128 inputs/16 outputs/202T modem

The WS1000 unit consists of a standard wire-wrap housing and a plug-in module. This same housing accommodates different WS1000 configurations. The plug-in module is accessible from the front of the WS1000 unit.

The flexibility of the WS1000 allows daisychaining multiple units together to share a single TBOS host interface through a digital or modem connection in the first unit. Combining WS1000 units makes possible the conversion of a maximum 512 discrete inputs and 32 control outputs into a single TBOS interface.

The architecture of the WS1000 makes troubleshooting and repair easy. All of the active WS1000 components reside on one module. Module

front-panel LEDs let you know when the unit has power, is functional, and is receiving/transmitting data on the TBOS ports.

1.2 Applications

The WS1000 TBOS remote collects large quantities of discrete alarm/status inputs and control outputs. The Port 2 serial interface combines data reported by other TBOS-based remote equipment into a single TBOS interface.

When the WS1000 receives a TBOS command from the host on Port 1, it retransmits the command on the Port 2 interface to the monitored equipment. When the WS1000 receives a response from the monitored equipment on the Port 2 interface, it retransmits the response to the host on the Port 1 interface. Thus, WS1000 functions as a repeater/concentrator for other TBOS remote equipment.

Figure 1-1 illustrates a basic configuration of a single WS1000 TBOS remote. When more alarm/controls are required, multiple WS1000s can form a daisychain in an RS-485 mode, allowing a maximum 512 discrete inputs and 32 control outputs.

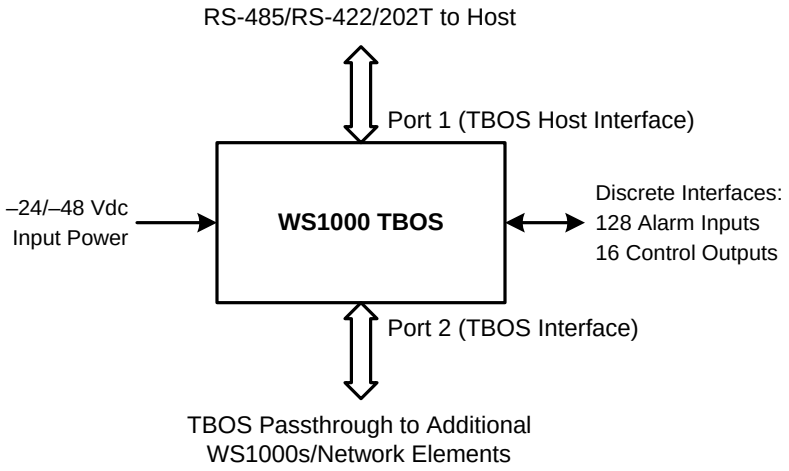


Figure 1-1 WS1000 TBOS Remote Basic Configuration

Figure 1-2 illustrates how to connect multiple WS1000 TBOS remotes together to expand the number of discrete inputs/outputs accessible through a single TBOS connection to the host management system.

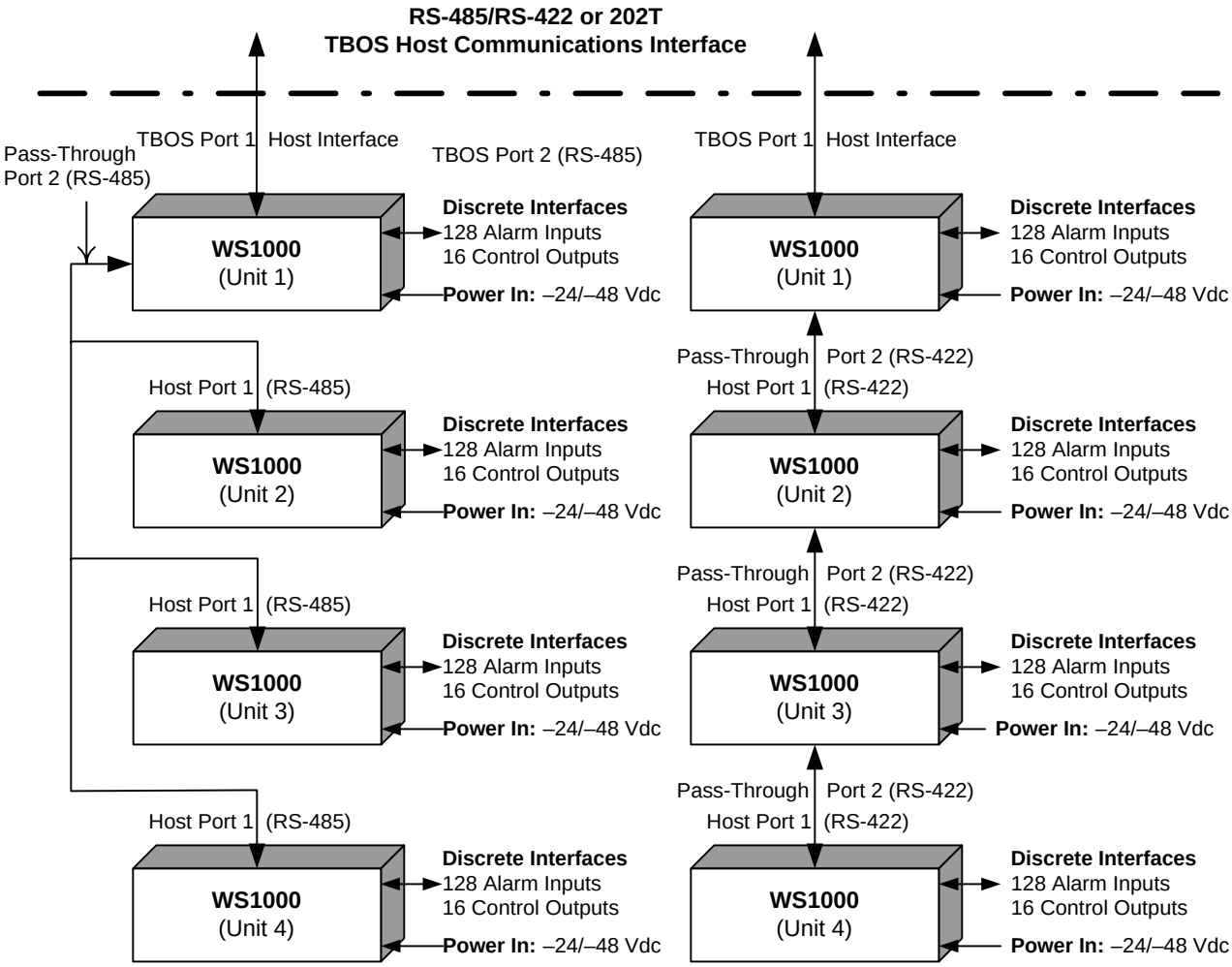


Figure 1-2 WS1000 Discrete Parallel (RS-485) and Serial (RS-422) Expansion

1.3 Front Panel Indicators and Controls

Figure 1-3 shows the WS1000 front panel. The following describes the front-panel indicators.

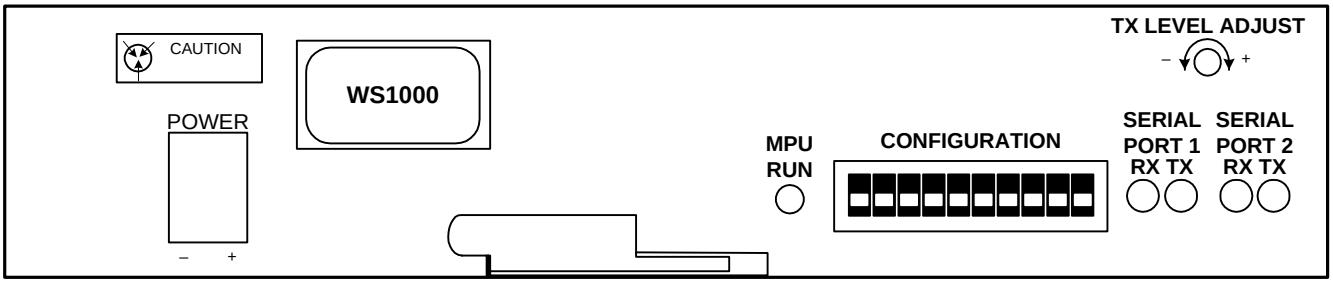


Figure 1-3 WS1000 Remote Front-Panel Fixtures and Indicators

MPU RUN — Microprocessor Run – indicates proper microcomputer initialization and operation. A hardware or software failure has occurred if the **MPU RUN** LED is Off after the unit has powered up.

SERIAL PORT 1 RX — Serial Port 1 Receive – LED momentarily lights for each poll byte received from the host.

SERIAL PORT 1 TX — Serial Port 1 Transmit – LED momentarily lights for each response byte transmitted to the host.

SERIAL PORT 2 RX — Serial Port 2 Receive – LED momentarily lights for each response byte received from downstream units reporting to the host.

SERIAL PORT 2 TX — Serial Port 2 Transmit – LED momentarily lights for each poll byte relayed to downstream units.

The following describes the front-panel controls:

CONFIGURATION — The 10-segment switch sets the following:

- Unit TBOS display number or numbers
- The host/TBOS-collection port interface (RS-422/RS-485)
- The carrier mode if equipped with an internal modem
- The host/TBOS-collection port receive side termination
  - Point-to-point RS-422 links
  - End points of a multipoint RS-485 link

TX LEVEL ADJUST — Adjust the transmit level of the internal modem, if equipped.

1.4 Diagnostics and Configuration

The WS1000 performs internal diagnostics each time it powers up. The front-panel **SERIAL PORT 1 RX** LED lights during the Programmable

Read Only Memory (PROM) test, then the **SERIAL PORT 1 TX** LED lights during the Random Access Memory (RAM) test. The **MPU RUN** LED lights only after all powerup diagnostics have successfully completed.

A Dual-Inline Package (DIP) switch block on the front panel enables WS1000 configuration:

- Three DIP switch segments enable the unit to respond to any of the eight available TBOS displays.
- The two serial ports can operate at 2,400 bps using an RS-422 or RS-485 interface.When the WS1000 has an internal modem, Port 1 automatically configures to 1,200 bps.
- A DIP switch segment establishes automatic or constant modem carrier.
- Two additional switch segments select line terminations for each serial port when the application uses RS-422/RS-485 connections.

Section 2, ***Installation***, contains more information on configuration switch settings.

1.5 Specifications

The following provides detailed information on the electrical, environmental, and mechanical specifications. Included are detailed data for the discrete and serial interfaces.

1.5.1 Electrical and Power

A watchdog/power supply monitor circuit expedites powerup and power down situations and provides automatic initialize reset/restart capability. An external –24/–48 Vdc plug-in connection supplies power for the WS1000, which has its own integral switching power supply for onboard power requirements. The following are WS1000 system electrical specifications:

- Input voltage: nominal –24 Vdc or –48 Vdc (–20 to –60 Vdc)
- Maximum external fusing: 0.5 Amps slow blow (–24 Vdc) or 0.25 Amps slow blow (–48 Vdc)
- Idle power dissipation: 2.7 Watts (no input sense currents, no relays on)

The Westronic WS1000 Power Distribution Panel (PDP) can power several WS1000s (12 maximum) at the same location when necessary.

Table 1-1 lists the maximum module power requirements for the available configurations with all inputs at ground potential.

Table 1-1 Power Ratings for WS1000 Configurations

Equipment Configuration	Power Rating (Watts)
64 inputs/8 outputs	5.5
64 inputs/8 outputs/202T modem	6.0
128 inputs/16 outputs	8.9
128 inputs/16 outputs/202T modem	9.4

1.5.2 Environmental

- Ambient operating temperature range: 0° C to +60° C
- Humidity: < 95% noncondensing.

1.5.3 Mechanical

The WS1000 uses compact mechanical packaging for rack or Main Distribution Frame (MDF) mounting using a metal/plastic enclosure for support. The following details the dimensions, mounting, weight, and connectors.

- Dimensions: 8.0 inches (20.3 cm) wide by 4.0 inches (10.2 cm) high by 5.0 inches (12.7 cm) deep – similar in construction to a traditional front-access wire-wrap distribution block
- Mounting: on an MDF or a 19-inch (48.3 cm) or 23-inch (58.4 cm) rack-mount panel/bar that can hold two units side-by-side (units can also flush-mount on a board or other solid fixture)
- Weight: 4.8 lbs (2.2 kg) maximum
- Connectors:
  - ***Power:*** two-position compression mating plug that accepts #14 AWG through #24 AWG wire (Westronic PN 640-T005, Phoenix Contact PN MSTB-1.5/2-ST-5.08)
  - ***Wire wrap:*** front-panel wire-wrap for discrete I/O and TBOS serial ports. Wire-wrap pins are 0.050 square inches (0.325 square cm) with 0.190 inches (1.235 cm) spacing between pins. Pins accept #24 AWG or #26 AWG wire.

1.5.4 Interfaces

The following describes the discrete and serial interfaces to the WS1000. A 32 by 10 wire-wrap terminal block on the front of the WS1000 provides access to all discrete Input/Output (I/O).

1.5.4.1 Discrete Interfaces

The WS1000 discrete inputs have an internal reference to the negative battery input. Essentially, the inputs are single lines whereby an Off condition exists with the input open or tied to negative (–) battery. An On condition exists when the input is at positive (+) battery (return or ground). If the source is a set of isolated contacts, positive battery (return or ground) connections are available on the WS1000 front for feeding one side of the contacts. Table 1-2 lists the discrete input logic levels.

Table 1-2 Discrete Input Logic Levels

Input Power	Logic Level	Voltage
–24 Vdc	0 (Off) 1 (On)	–15 Vdc through –30 Vdc or Open Circuit –8 Vdc through +5 Vdc
–48 Vdc	0 (Off) 1 (On)	–15 Vdc through –60 Vdc or Open Circuit –8 Vdc through +5 Vdc

Discrete logic outputs use Form A contacts and operate in momentary or latching mode. The mode is defined within the TBOS control command. Each discrete output is a normally open Single-Pole/Single-Throw (SPST) isolated contact with both sides of the connection individually available to the user. To generate a control, the contacts close, presenting a closed loop to the far end. Ground connections are available on the WS1000 front panel as a convenience for applications where one side of the contacts needs a ground.

Discrete Status/Alarm Inputs

- Number of inputs: 64 or 128
- Protection: sustain transient voltages (15 kV maximum)
- Ground: common ground for all inputs
- Current: 1.0 mA for each grounded input

Control Outputs

- Number of outputs: 8 or 16 relay control outputs
- Contact type: SPST normally open (Form A)
- Operation: momentary (300 ms) or latched (based upon TBOS command)
- Contact ratings: 0.5 Amps at 60 Vdc or 0.3 Amps at 110 Vdc; 30 Watts (maximum) switching power

1.5.4.2 Serial Interfaces

The following describes the serial ports: Port 1 (host) and Port 2 (pass-through):

Port 1 (Host Port)

- Protocol: TBOS (eight data-bit characters, odd parity, two stop bits)
- Speed: 2,400 bps
- Physical interface/electrical level: RS-422, RS-485, or 202T modem
- Protection: sustain transient voltages (15 kV maximum)
- Connection: front wire-wrap terminal block (see Section 2, ***Installation***)

Optional Internal Modem (PN 535-T005, Rev A or B)

- Type: 202T/CCITT V.23 compliant; 2-wire or 4-wire; 1,200 bps
- Output power: –10 dBm default (+2.0 dBm maximum)
- Input sensitivity: –36 dBm default (–6 dBm to –48 dBm in 6-dBm steps)
- Connection: front wire-wrap terminal block (see Section 2, ***Installation***)

Optional Internal Modem (PN 535-T016)

- Type: 202T/CCITT V.23 compliant; 2-wire or 4-wire; 1,200 bps
- Output power: –10 dBm default (+2.0 dBm maximum)
- Input sensitivity: automatic select (–6 dBm to –48 dBm with input capable of being blocked during transmit using squelch)
- Connection: front wire-wrap terminal block (see Section 2, ***Installation***)

Port 2 (Pass-Through)

- Protocol: TBOS (eight data-bit characters, odd parity, two stop bits)
- Speed: 2,400 bps
- Physical interface/electrical level: RS-422 or RS-485
- Protection: sustain transient voltage (15 kV maximum)
- Connection: front wire-wrap terminal block (see Section 2, ***Installation***)

WS1000 TBOS Configurations

Table 1-3 lists the currently available WS1000 TBOS units. Each TBOS unit has one host interface port and one pass-through port. The WS1000 common housing part number is 533-T022. The basic configurations are representatively illustrated in Figure 1-4 through Figure 1-7.

Table 1-3 WS1000 TBOS Configurations

Part No	Discrete		Host Intfce
	Inputs	Outputs	
594-T001	64	8	RS-422/RS-485
594-T002	64	8	202T Modem
594-T003	128	16	RS-422/RS-485
594-T004	128	16	202T Modem

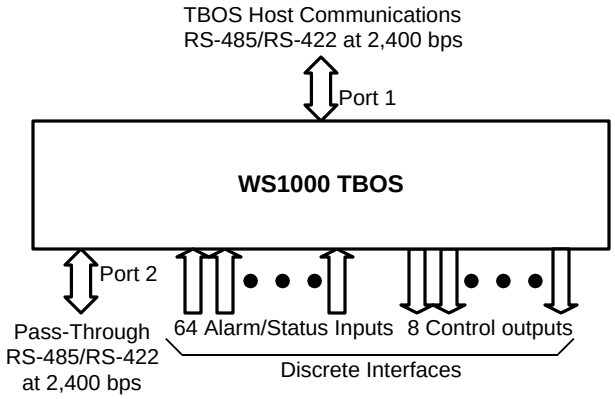


Figure 1-4 Part Number 594-T001

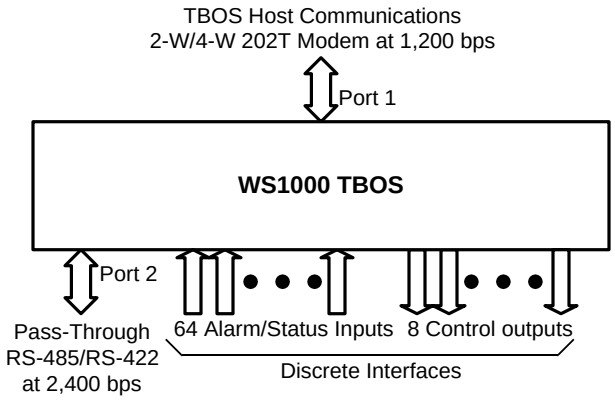


Figure 1-5 Part Number 594-T002

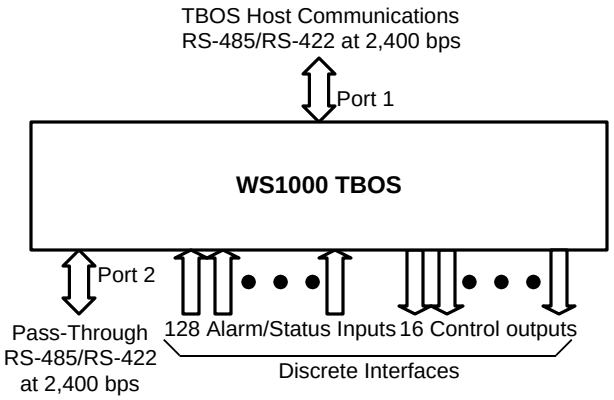


Figure 1-6 Part Number 594-T003

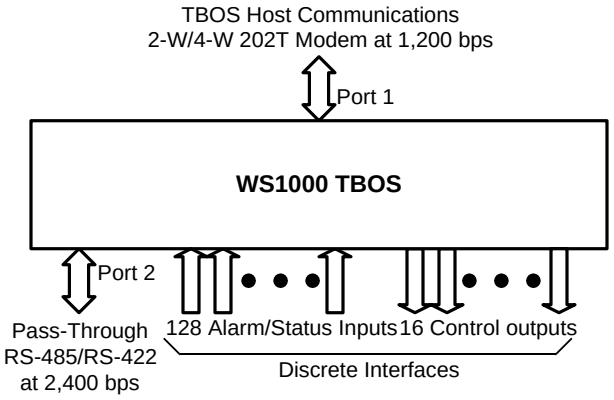


Figure 1-7 Part Number 594-T004

1.6 Other Products from Westronic

The following information briefly describes other Westronic Systems, Inc., products that are available to meet alarm system needs. Call **972-235-5292** to talk with a Westronic representative to learn more about these and other Westronic products.

1.6.1 C1000

The C1000 provides an economical, flexible means of collecting small-to-large quantities (32 – 256 points) of discrete alarm and status data, which it converts into a simple, easily handled TABS or TBOS interface to complement many operation support systems.

Different versions of the C1000 allow communications with a TABS or TBOS host. C1000 can pass through polls for other addresses, permitting C1000 units to form a daisychain for larger configurations and combining telemetry data from C1000s and local NEs into a single channel. In some cases, data is combined through a single modem.

The C1000 requires only one vertical unit (VU) or 1.75 inches in a 19- or 23-inch equipment rack, allowing location as close as possible to the source of discrete interfaces. This results in a large reduction in the wiring required to collect alarm and status data. A reduction in wiring eliminates the possibility of losing data through unknown disconnected, moved, or cut wiring. Serial and discrete interfaces appear through standard DB9/DE9 and 50-pin connectors, making installation and replacement fast and simple.

The C1000 comes equipped with two serial ports: the host and expansion interfaces. The host port serves as a TABS or TBOS host communications interface that can be equipped with an optional 1,200-bps Bell 202T-compatible internal modem to allow locating C1000 beyond the range of standard RS-422/RS-485 interfaces. The expansion port serves as a TABS or TBOS data collection interface. The housing, used with all the different configurations, accommodates a maximum of eight 50-pin discrete interface connectors.

1.6.2 WS2000

The WS2000 product line offers the data collection and reporting capabilities necessary to make small remote telemetry units more flexible and efficient. The WS2000 combines compact design with the power to configure multiple serial and discrete interfaces in virtually any arrangement to best serve the needs of the network. A single-rack-increment high unit (1.75 inches) fits within 19- or 23-inch racks. Other mountings are available.

A WS2000 can have the following equipment combinations:

- 4 or 8 serial ports supporting user-selectable RS-232, RS-422, and RS-485 interfaces at 1,200/ 2,400 bps
- 32 – 512 discrete alarm/status inputs and 8 – 128 discrete control outputs, with expansion capability to 2,048 inputs and 512 outputs in some configurations
- 8 pulse accumulator inputs (optional)
- 8 analog inputs (optional), expandable to 24 analog inputs
- Host port interface at RS-232; RS-422; and RS-485 at 1,200; 2,400; or 9,600 bps (an optional internal modem is available)

To support a broad range of equipment, the WS2000 can incorporate many interface types:

- Asynchronous and synchronous serial
- Discrete inputs and outputs
- Analog and pulse inputs

Some of the many available serial protocol types include:

- WACP[1] (ASCII)
- E-Telemetry (E2A format)
- MCS-11
- TABS
- TBOS

1.6.3 WS3000

The WS3000 is a powerful telemetry unit that combines the most useful functions of discrete and serial alarm collection, mediation, and access with a high-speed processor and large database capacity. The WS3000 is the ideal bridge between today's telemetry networks and the advanced protocols now appearing. With Ethernet asynchronous connectivity and database capacity of 30,000 data points, the WS3000 is the choice of quality telecommunications carriers. The WS3000 features include the following:

- Optional Ethernet interface
- Available solutions for remote alarm monitoring over TL1 ASCII TCP/IP Ethernet, OSI Ethernet, and asynchronous communications
- Data collection using TABS, TBOS, and Teltrac protocols
- 9 serial ports supporting user-selectable RS-232/RS-422/RS-485 interfaces operating from 1,200 – 9,600 bps
- 32 – 512 discrete alarm/status inputs and 8 – 128 discrete control outputs with capability to support a maximum of 30,000 alarm points
- Custom protocols are available on a special assembly basis

[1] Westronic Asynchronous Command Protocol (WACP) replaces Harris Asynchronous Serial Protocol (HASP)

2 Installation

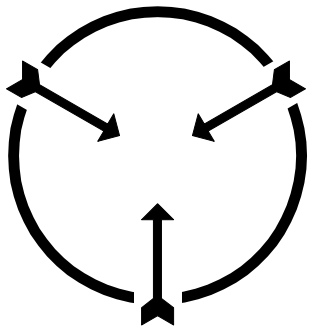
2.1 Overview

This section shows the user how to install and configure the WS1000 hardware, and how to connect the WS1000 to the network. Initial discussion involves considerations/precautions to observe when handling Complimentary Metal-Oxide Semiconductor (CMOS) and N-Channel Metal-Oxide Semiconductor (NMOS) integrated circuits and substituting modules. Following that are installation procedures for mounting the unit, setting option straps for the internal modem and discrete Input/Output (I/O) expansion, and configuring the unit using the front-panel Dual Inline Package (DIP) switches. Concluding this section is the wiring required for the various configuration and options.

2.2 Handling Precautions

WS1000 modules contain CMOS and NMOS integrated circuits, which maximize noise immunity and promote low-power consumption. However, they are also Electro-Static Discharge (ESD) sensitive and, therefore, some possibility exists that they can be damaged because of high static-voltage levels. Although CMOS and NMOS devices are equipped with protection diodes, incorrect handling that allows excessive static energy to enter the devices can still cause device failure. These failures are not readily detected and, in time, can lead to premature device failure.

Become familiar with the ESD procedures that follow. Packaging containing CMOS and NMOS components have a label as shown in Figure 2-1.



Static Sensitive
Maintain Antistatic Protection

Figure 2-1 Electrostatic Discharge (ESD) Logo

CAUTION: Adhering to the following guidelines significantly reduces the possibility of electrostatic damage on CMOS or NMOS components, thus improving system reliability and keeping system downtime to a minimum.

- Before removing or inserting WS1000 modules, always verify that they are not carrying static charges. Always wear a personal grounding device, such as an ESD heel or wrist strap.
- When extracting a WS1000 module, always place it in an antistatic bag or covering for transportation/storage.
- Perform repair work on WS1000 modules on an antistatic work station. All personnel performing repair work must be grounded through wrist straps and antistatic matting at the work station.
- Exercise extreme care when handling CMOS/NMOS components. Do not touch the pins and always place components in antistatic foam for storage and transportation.
- Verify that desoldering tools have static reduction. Some desoldering devices can actually generate large static voltages that damage CMOS and NMOS devices.

The housing and power ground protect the WS1000 plug-in module against 15-kV transients while it is in the housing.

2.3 Module Substitution

Note: Only qualified electronics service personnel should carry out actual WS1000 module repair. Unauthorized repair may void the warranty. When returning a faulty module, describe the suspected problem, fault, or symptom on the documentation that accompanies the module.

The following are general procedures to follow when upgrading a module, replacing a faulty module, or substituting a module as an aid in board diagnostics:

- Turn power off or unplug the front power connector when removing or inserting WS1000 modules. The boards are designed to withstand removal and insertion with power on, but a highly recommended practice is to remove the system power supply when substituting/replacing modules.
- Make sure the substitute module is of the same type (part number) and contains the same switch and option jumper settings. Failure to do so can cause module failure, point displacement because of incorrect board/display address, communication failure with the host, or other related failures.

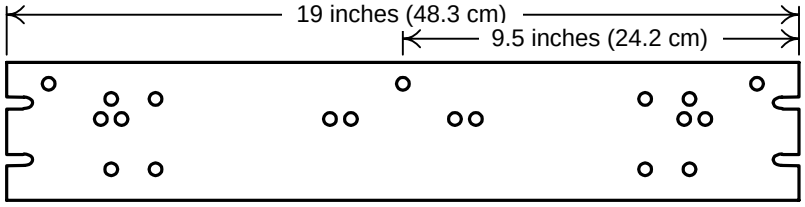
- Make sure that replacement modules mate properly with the connectors at the rear of the housing. Never force a board into position because this can damage rear connectors in the housing or on the module. Determine why the module does not easily plug into position and take appropriate action. To plug a module into position, firmly push with the thumbs on the lower portion of the front panel. To remove a module, simply pull the ejection handle forward until the module snaps free from the housing.

2.4 Installation Procedures

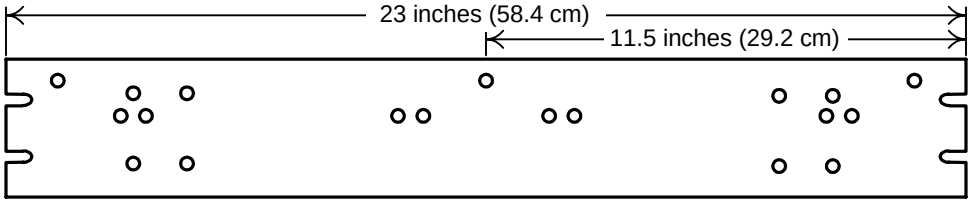
The following describes how to install WS1000 units into a permanent location.

2.4.1 Mounting the Unit

The WS1000 mounts onto a distribution frame or can mount into a 19-inch (48.3 cm) or 23-inch (58.4 cm) equipment rack. You can order the 19-inch and 23-inch rack-mount panels (Figure 2-2) for equipment rack installation. Each WS1000 unit comes with a mounting bracket (Figure 2-3) suitable for use with a rack-mount adapter panel or distribution frame. Figure 2-4 and Figure 2-5 show examples of a rack-mount installation.



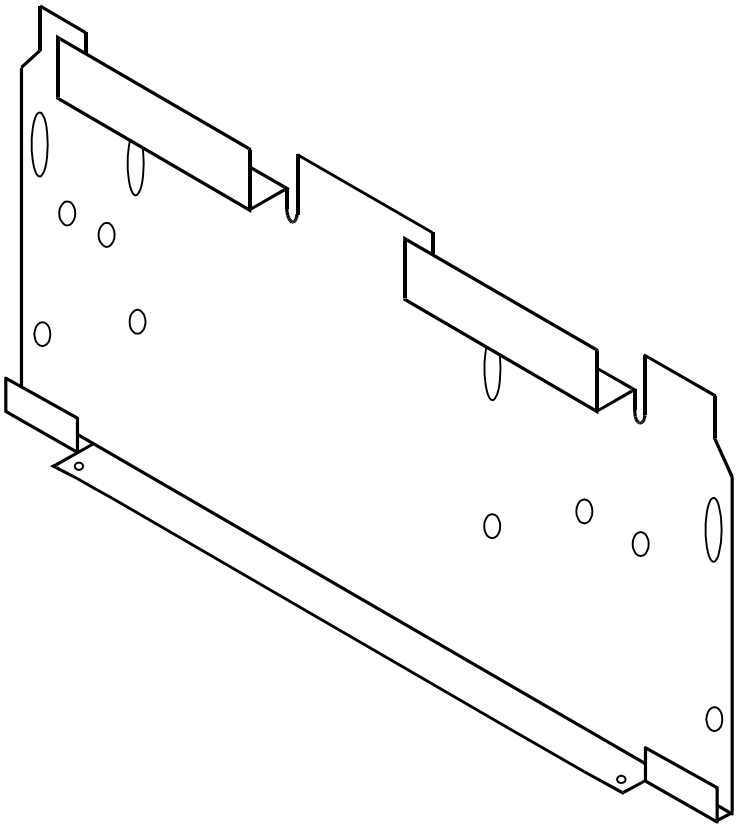
A. 19-Inch Mounting Plate



B. 23-Inch Mounting Plate

Figure 2-2 19- and 23-Inch Rack-Mount Panels

By design, the back edge of the WS1000 unit chassis slides down into the metal right-angle mounting bracket (Figure 2-3) and snaps into place, securing it to the bracket.



See Figure 2-4 for additional details.

Figure 2-3 WS1000 Mounting Bracket

The WS1000 unit requires a minimum of three rack-increment spaces (5.25 inches or 13.3 cm). Use five rack-increment spaces (8.75 inches or 22.2 cm), however, in situations requiring frequent removal of the WS1000 housing after it has been installed. The two extra rack increments (3.5 inches or 8.9 cm) allow the unit to slide up to disengage from the mounting bracket. A maximum of two units can mount side-by-side on any rack-mount panel.

2.4.2 Unit Inspection

Before powerup, remove the WS1000 plug-in module assembly and confirm that the internal modem or expansion boards (if any) are seated properly. The factory has preset all option straps. To verify jumper options, refer to the tables and figures that immediately follow in *Internal Option Straps*.

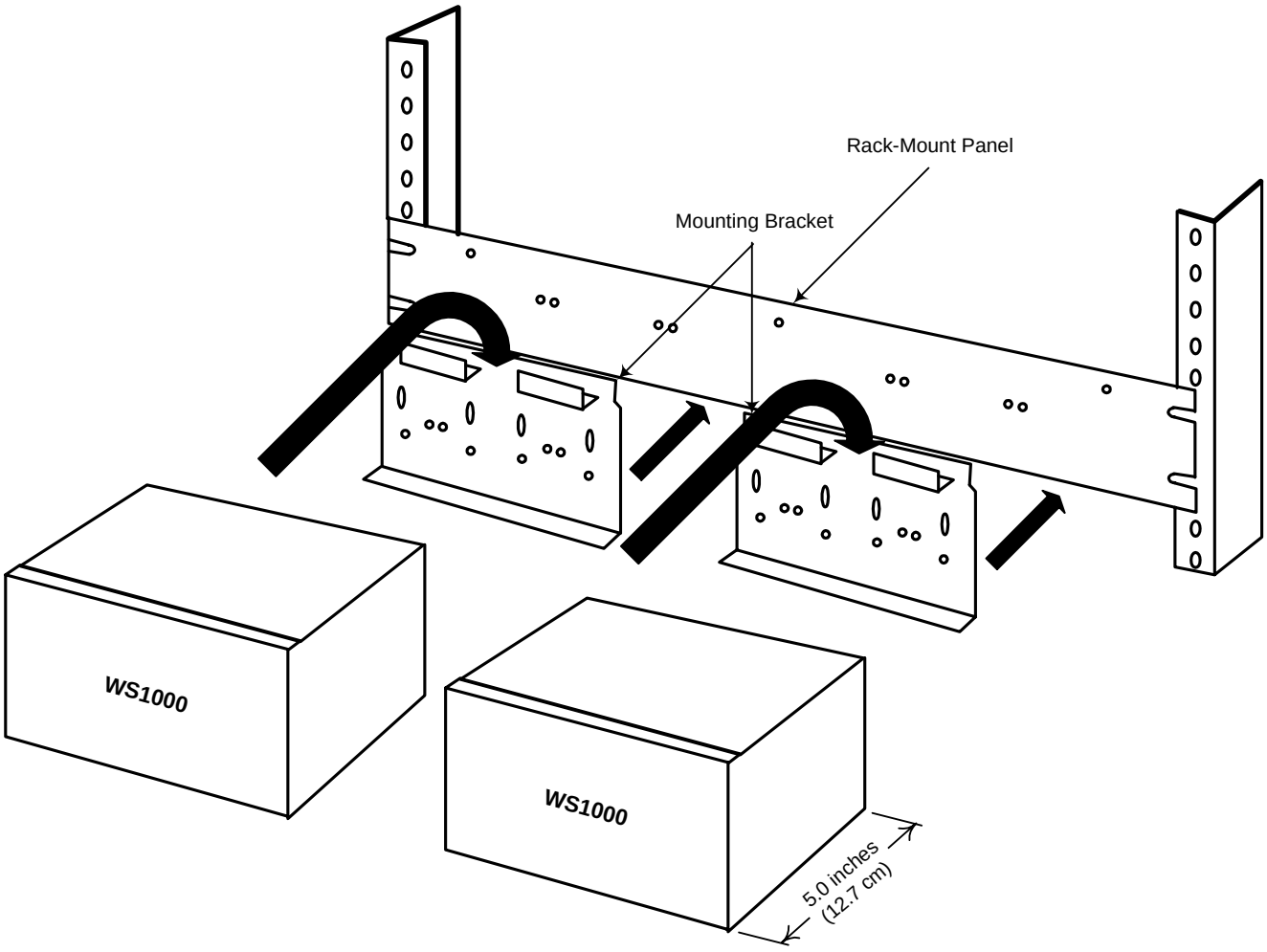


Figure 2-4 WS1000 Rack-Mount Installation

Notes to Figure 2-4***:***

1. Each rack-mount panel comes with screws to attach two mounting brackets to the panel.
2. The mounting brackets can attach directly to the rack-mount panel or to a distribution frame. The bracket has a variety of holes for mounting (also see Figure 2-3). The mounting brackets have no additional mounting hardware; therefore, you must supply mounting hardware appropriate for your distribution frame.
3. A mounting bracket ships with each WS1000 unit. Simply “hook” the WS1000 onto the mounting bracket and set in place on the right-angle lip at the bottom of the mounting bracket.

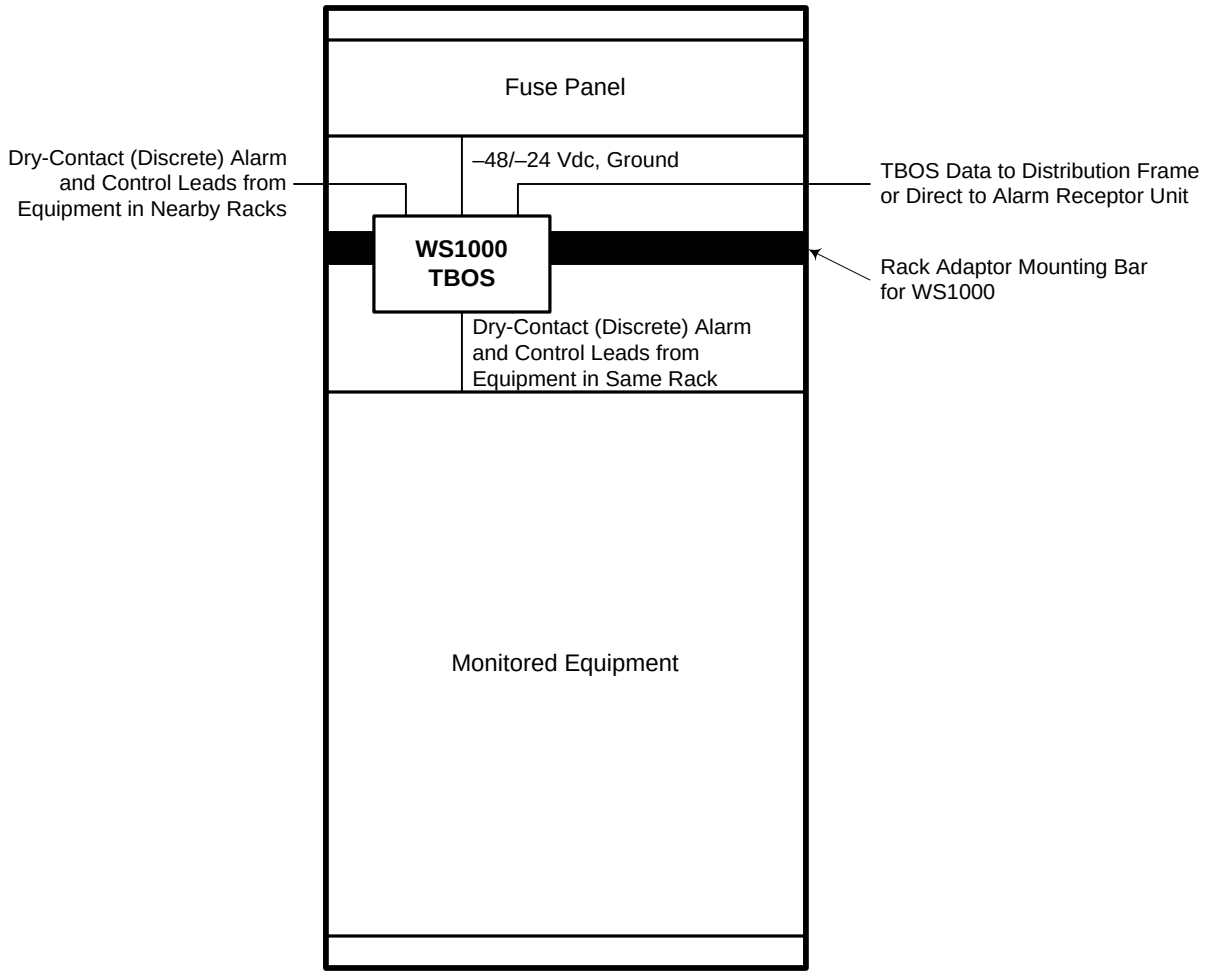


Figure 2-5 WS1000 Mounted in an Equipment Rack

2.4.3 Internal Option Straps

2.4.3.1 Main Board

Configure the WS1000 main board to meet your engineering specifications using the user-selectable option straps. Figure 2-6 shows the board layout with option strap locations and Table 2-1 delineates the factory defaults.

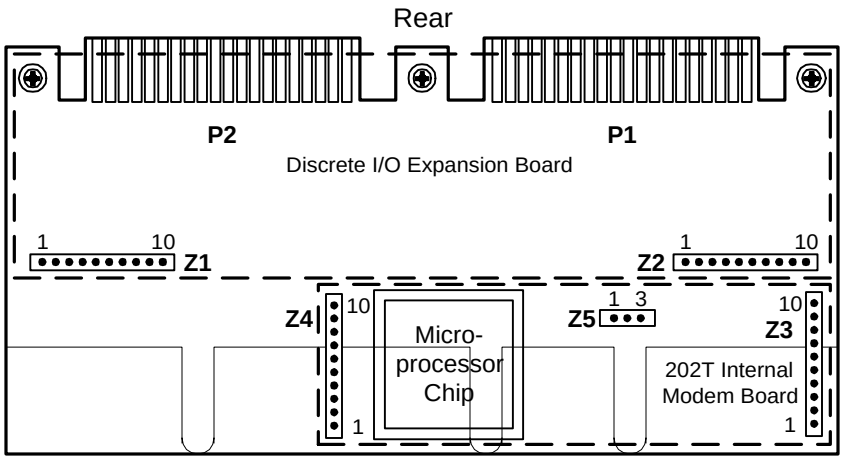


Figure 2-6 WS1000 Main module Option Strap Locations

Table 2-1 Factory Default Strapping for WS1000 Main Board

Jumper	Pins	Function
Z1	1 – 2	Connect strap if discrete I/O expansion board is not installed. Remove strap before installing expansion board.
Z2	–	No strapping
Z3	1 – 2	Connect strap if an internal modem is not installed. Remove strap before installing modem board.
Z4	–	No strapping
Z5 (Note)	2 – 3 1 – 2	Connect to enable the watch-dog timer. Connect to disable the watch-dog timer.

Note: Z5 is present on printed circuit board Revisions 00 and 01 only.

2.4.3.2 **202T Internal Modem** (Optional)

The 202T internal modem comes in two varieties: PN 535-T005 and PN 535-T016. Figure 2-7 shows the modem board physical layout for Part Number 535-T005, Revisions A and B. Figure 2-8 shows the modem board physical layout for Part Number 535-T016.

2.4.3.2.1 **PN 535-T005** (Figure 2-7)

Option straps on Revisions A and B boards determine the communication type and sensitivity settings for the 202T internal modem. Modem sensitivity is set to –36 dBm at the factory. If your application requires a different sensitivity, set it 5 – 10 dBm below the input power level. For example, if the input power level is –17 dBm, set the sensitivity to about –24 dBm. Revision A boards have additional option straps to enable/disable analog and digital loopback connections. Table 2-2 shows option jumper settings for Rev A and B boards.

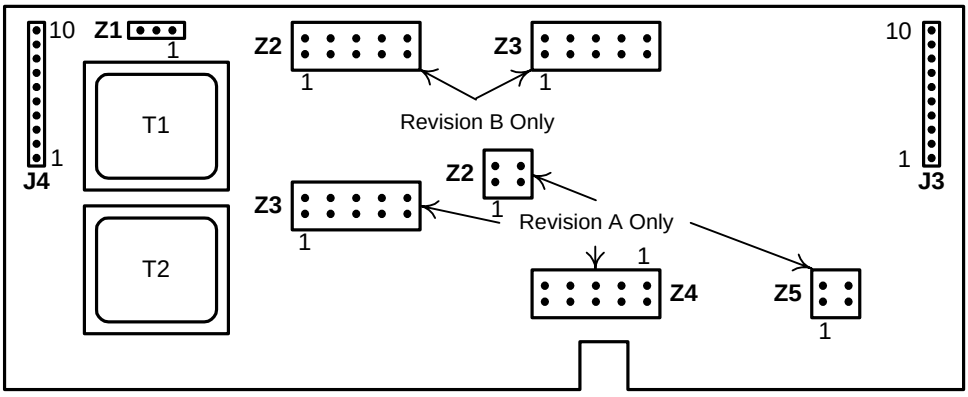


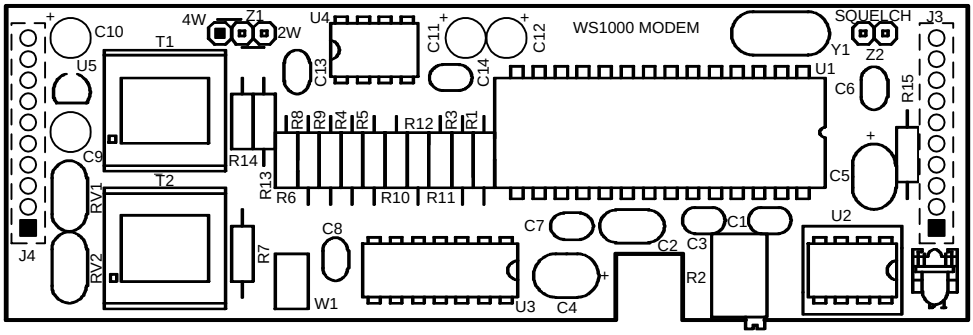
Figure 2-7 PN 535-T005 202T Internal Modem Layout

Table 2-2 PN 535-T005, Rev A/B, 202T Internal Modem Option Settings

Block	Strap Pins	Function
Z1 (Rev A/B)	1-2	2-Wire, Half Duplex
	2-3 (Default)	4-Wire, Full Duplex
Z2 (Rev A)	1-4, 2-3 (Default)	Analog Loopback Disabled
	1-2, 3-4	Analog Loopback Enabled
Z3 (Rev A) Z2 (Rev B)	1-10, 2-9, 3-8, 4-7, 5-6	–6 dBm Receiver Sensitivity
	5-6	–12 dBm Receiver Sensitivity
	4-7	–18 dBm Receiver Sensitivity
	3-8	–24 dBm Receiver Sensitivity
	2-9	–30 dBm Receiver Sensitivity
	1-10 (Default)	–36 dBm Receiver Sensitivity
	None	–42 dBm Receiver Sensitivity
Z4 (Rev A/B) Z3 (Rev B)	1-10, 2-9, 3-8, 5-6	2-Wire, 202T
	1-10, 2-9, 3-8	2-Wire, 202T, Equalized
	1-10, 2-9, 5-6	2-Wire, V.23
	1-10, 2-9	2-Wire, V.23, Equalized
	2-9, 3-8, 5-6 (Default)	4-Wire, 202T
	2-9, 3-8	4-Wire, 202T, Equalized
	2-9, 5-6	4-Wire, V.23
	2-9	4-Wire, V.23, Equalized
	1-10, 2-9, 3-8, 4-7, 5-6	103 Orig
Z4 (Rev A)	1-10, 2-9, 3-8, 4-7	103 Ans
	1-10, 2-9, 4-7, 5-6	V.21 Orig
	1-10, 2-9, 4-7	V.21 Ans
Z5 (Rev A)	1-4, 2-3 (Default)	Digital Loopback Disabled
	1-2, 3-4	Digital Loopback Enabled

2.4.3.2.2 **PN 535-T016** (Figure 2-8)

The second internal modem (PN 535-T016) has only two strapping options: selecting 2-wire or 4-wire operating mode (jumper block Z1) and whether to allow squelch (jumper block Z2) to disable the Rx line while transmitting. Squelch should be enabled (jumper installed) when in 2-wire mode. This model automatically sets the receiver sensitivity. Use Table 2-3, which indicates factory default settings, to configure the modem according to your local engineering requirements.



Notes:

4. The carrier detect LED (shown in lower right corner below J3) lights when the modem detects a carrier. When the modem operates in 2-wire mode, the LED blinks while the modem transmits because it detects its own carrier. The modem detects its own carrier regardless of the squelch jumper option setting (Z2).
5. DIP switch segment 6 must be Down (Automatic Carrier) when in 2-wire mode or in 4-wire mode with squelch enabled.

Figure 2-8 PN 535-T016 Internal Modem Layout

Table 2-3 PN 535-T016 202T Internal Modem Board Option Settings

Jumper	Strap Pins	Function
Z1	1-2 (Default)	4-Wire, Full Duplex
	2-3	2-Wire, Half Duplex
Z2	Installed	Squelch Enabled
	Not Installed (Default)	Squelch Disabled

2.4.3.3 **Discrete I/O Expansion Board** (Optional)

The discrete I/O expansion board has no options to select.

2.4.3.4 **Internal RS-232 Board** (Optional)

Connect Z1 Pins 2 and 3 together for constant carrier (default) or Pins 1 and 2 for switched carrier. The RS-232 board (Figure 2-9) has no other options.

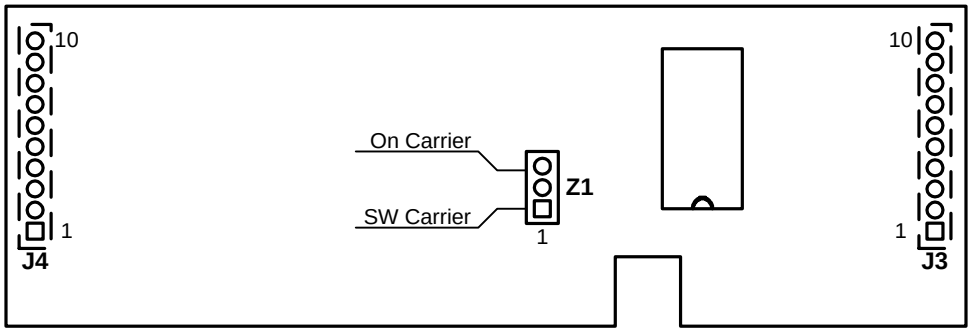


Figure 2-9 RS-232 Module Strap Locations

2.4.4 Installation Wiring

A decal inside the WS1000 front panel shows wiring information and switch settings for the specified WS1000 configuration. Make connections for discrete status inputs, control relay outputs, and serial port I/O on the wire-wrap interfaces. The Ground (GND) pins tie to ground internally. Each pin can hold two wrapped wires.

When connecting more than one WS1000 in an RS-485 mode, make the connection through the wire-wrap terminals on the front of each WS1000 block. Designate one WS1000 to receive information from Port 1 of all other WS1000 units. Because a WS1000 unit can consist of one or two displays (64 or 128 points, respectively), a maximum of eight displays can be bussed in this fashion. Refer to Figure 1-2, Figure 2-5, Figure 2-10, Figure 2-11, Figure 2-12, Figure 2-13, Figure 2-14, and Figure 2-15).

2.4.4.1 Discrete Status Inputs/Control Outputs

The following figures show the wire-wrap connections for the various WS1000 configurations:

- Figure 2-10 shows the pinouts on a WS1000 configured for 64 inputs and 8 outputs, with/without an internal modem.
- Figure 2-11 shows the pinouts for a WS1000 configured for 128 inputs and 16 outputs, with/without an internal modem.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
A	S1	GND	S11	S21	GND	S31	S41	GND	S51	S61	GND	C1	C6	GND			GND			GND			GND			GND			GND	P1 Tx–	M1 TT	GND
B	S2	GND	S12	S22	GND	S32	S42	GND	S52	S62	GND	C1R	C6R	GND			GND			GND			GND			GND			GND	P1 Tx+	M1 TR	GND
C	S3	GND	S13	S23	GND	S33	S43	GND	S53	S63	GND	C2	C7	GND			GND			GND			GND			GND			GND	P1 Rx–	M1 RT	GND
D	S4	GND	S14	S24	GND	S34	S44	GND	S54	S64	GND	C2R	C7R	GND			GND			GND			GND			GND			GND	P1 Rx+	M1 RR	GND
E	S5	GND	S15	S25	GND	S35	S45	GND	S55		GND	C3	C8	GND			GND			GND			GND			GND			GND			GND
F	S6	GND	S16	S26	GND	S36	S46	GND	S56		GND	C3R	C8R	GND			GND			GND			GND			GND			GND			GND
G	S7	GND	S17	S27	GND	S37	S47	GND	S57		GND	C4		GND			GND			GND			GND			GND			GND	P2 Tx–		GND
H	S8	GND	S18	S28	GND	S38	S48	GND	S58		GND	C4R		GND			GND			GND			GND			GND			GND	P2 Tx+		GND
J	S9	GND	S19	S29	GND	S39	S49	GND	S59		GND	C5		GND			GND			GND			GND			GND			GND	P2 Rx–		GND
K	S10	GND	S20	S30	GND	S40	S50	GND	S60		GND	C5R		GND			GND			GND			GND			GND			GND	P2 Rx+		GND

Display 0 (columns 1–13)

Discrete Inputs/Outputs

S#	Status/Alarm Input #
C#	Control Output #
C#R	Control Output # Return
GND	Ground

Digital Port Connections

P#Tx–	Port # Transmit Minus
P#Tx+	Port # Transmit Plus
P#Rx–	Port # Receive Minus
P#Rx+	Port # Receive Plus

202T Modem

M1TT	Port 1 Modem Transmit Tip
M1TR	Port 1 Modem Transmit Ring
M1RT	Port 1 Modem Receive Tip
M1RR	Port 1 Modem Receive Ring

RS-232 Board

M1TT	Transmit
M1TR	Request to Send/ Data Terminal Ready
M1RT	Receive
M1RR	Data Carrier Detect
GND	Ground

Figure 2-10 Front-Panel Wire-Wrap Points for 64-Input/8-Output WS1000

Display 0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A	S1	GND	S11	S21	GND	S31	S41	GND	S51	S61	GND	C1	C6	GND	C11	C16	GND
B	S2	GND	S12	S22	GND	S32	S42	GND	S52	S62	GND	C1R	C6R	GND	C11R	C16R	GND
C	S3	GND	S13	S23	GND	S33	S43	GND	S53	S63	GND	C2	C7	GND	C12		GND
D	S4	GND	S14	S24	GND	S34	S44	GND	S54	S64	GND	C2R	C7R	GND	C12R		GND
E	S5	GND	S15	S25	GND	S35	S45	GND	S55		GND	C3	C8	GND	C13		GND
F	S6	GND	S16	S26	GND	S36	S46	GND	S56		GND	C3R	C8R	GND	C13R		GND
G	S7	GND	S17	S27	GND	S37	S47	GND	S57		GND	C4	C9	GND	C14		GND
H	S8	GND	S18	S28	GND	S38	S48	GND	S58		GND	C4R	C9R	GND	C14R		GND
J	S9	GND	S19	S29	GND	S39	S49	GND	S59		GND	C5	C10	GND	C15		GND
K	S10	GND	S20	S30	GND	S40	S50	GND	S60		GND	C5R	C10R	GND	C15R		GND

Display 1

	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
A	S1	S11	GND	S21	S31	GND	S41	S51	GND	S61		GND	P1 Tx–	M1 TT	GND
B	S2	S12	GND	S22	S32	GND	S42	S52	GND	S62		GND	P1 Tx+	M1 TR	GND
C	S3	S13	GND	S23	S33	GND	S43	S53	GND	S63		GND	P1 Rx–	M1 RT	GND
D	S4	S14	GND	S24	S34	GND	S44	S54	GND	S64		GND	P1 Rx+	M1 RR	GND
E	S5	S15	GND	S25	S35	GND	S45	S55	GND			GND			GND
F	S6	S16	GND	S26	S36	GND	S46	S56	GND			GND			GND
G	S7	S17	GND	S27	S37	GND	S47	S57	GND			GND	P2 Tx–		GND
H	S8	S18	GND	S28	S38	GND	S48	S58	GND			GND	P2 Tx+		GND
J	S9	S19	GND	S29	S39	GND	S49	S59	GND			GND	P2 Rx–		GND
K	S10	S20	GND	S30	S40	GND	S50	S60	GND			GND	P2 Rx+		GND

Discrete Inputs/Outputs

S#	Status/Alarm Input #
C#	Control Output #
C#R	Control Output # Return
GND	Ground

Digital Port Connections

P#Tx–	Port # Transmit Minus
P#Tx+	Port # Transmit Plus
P#Rx–	Port # Receive Minus
P#Rx+	Port # Receive Plus

202T Modem

M1TT	Port 1 Modem Transmit Tip
M1TR	Port 1 Modem Transmit Ring
M1RT	Port 1 Modem Receive Tip
M1RR	Port 1 Modem Receive Ring

RS-232 Board

M1TT	Transmit
M1TR	Request to Send/ Data Terminal Ready
M1RT	Receive
M1RR	Data Carrier Detect
GND	Ground

Figure 2-11 Front-Panel Wire-Wrap Points for 128-Input/16-Output WS1000

2.4.4.2 Serial Ports 1 and 2

The following figures show the serial port connections for various standard configurations:

- External I/O (Figure 2-12)
- Analog host I/O with digital multidrop I/O (Figure 2-13)
- Digital host I/O with digital multidrop I/O (Figure 2-14)

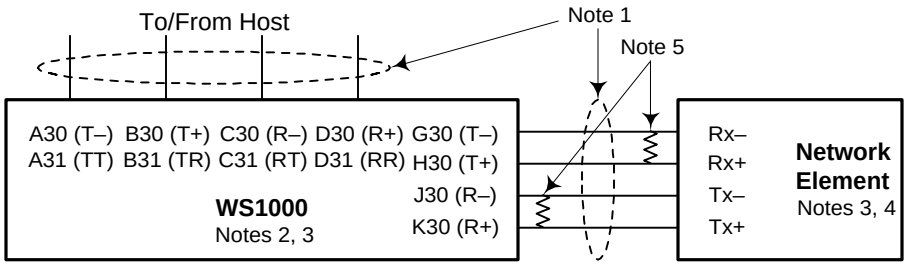


Figure 2-12 WS1000 External Input/Output

Notes:

1. For digital connections, use standard 24/26-AWG, twisted-pair, solid wire for wire-wrap connections between WS1000s and the TBOS host system. Maximum distance is 4,000 feet (1,219 meters) shielded cable or 1,000 feet (305 meters) unshielded cable.
   For analog (modem) connections, use standard 24/26-AWG quad wire between WS1000 and data line facilities.
2. This WS1000 is the initial unit for communicating with a TBOS host. If the TBOS host is collocated with the initial WS1000 (< 4,000 feet or 1,219 meters), use the **digital** I/O pin assignments: **A30**, **B30**, **C30**, and **D30**.
   If the TBOS host is remotely located from the initial WS1000, use the internal modem connection and the **analog** I/O pin assignments: **A31**, **B31**, **C31**, and **D31**.
3. WS1000 and network elements require different display numbers. A WS1000 can have one display (64 points) or two displays (128 points). TBOS can only address a maximum eight displays. Therefore, the network leg from the host can consist of four two-display WS1000s, eight one-display WS1000s, or a combination of one-/two-display WS1000s. The number of network element displays must be considered in the eight-display limit.
4. The network element TBOS connection provides the alarm and control I/O to/from the WS1000.
5. See Table 2-8, *Serial Port Receive Line Terminations*.

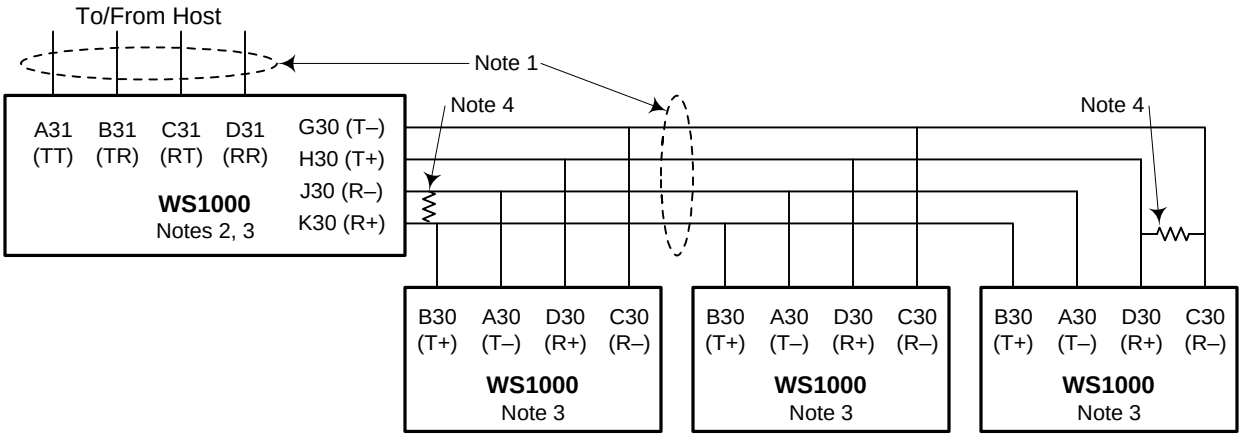


Figure 2-13 Analog I/O to Host with Digital Multidrop I/O

Notes:

6. Use standard 24/26-AWG, twisted-pair, solid wire for wire-wrap connections between WS1000s and the TBOS host system. Maximum distance is 4,000 feet (1,219 meters) shielded cable or 1,000 feet (305 meters) unshielded cable.

7. This WS1000 is the initial unit for communicating with a TBOS host. In this configuration, the TBOS host is remote from the initial WS1000 (> 4,000 feet or 1,219 meters) and requires a modem connection. Use the internal modem connection and the **analog** I/O pin assignments: **A31**, **B31**, **C31**, and **D31**.

8. A WS1000 can have one display (64 points) or two displays (128 points). TBOS can only address a maximum eight displays. Therefore, this configuration has a maximum of four two-display WS1000s, eight one-display WS1000s, or a combination of one-/two-display WS1000s that does not exceed eight displays total.

9. See Table 2-8, *Serial Port Receive Line Terminations*.

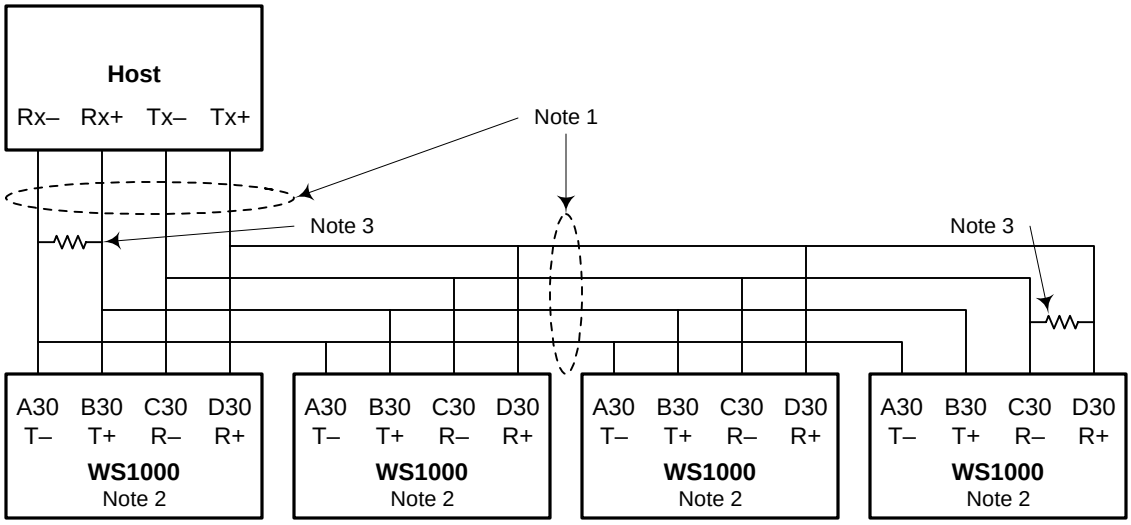


Figure 2-14 Digital I/O to Host with Digital Multidrop I/O

Notes:

10. Use standard 24/26-AWG, twisted-pair, solid wire for wire-wrap connections between WS1000s and the TBOS host system. Maximum distance is 4,000 feet (1,219 meters) shielded cable or 1,000 feet (305 meters) unshielded cable.

11. A WS1000 can have one display (64 points) or two displays (128 points). TBOS can only address a maximum eight displays. Therefore, this configuration has a maximum of four two-display WS1000s, eight one-display WS1000s, or a combination of one-/two-display WS1000s that does not exceed eight displays total.

12. See Table 2-8, *Serial Port Receive Line Terminations*.

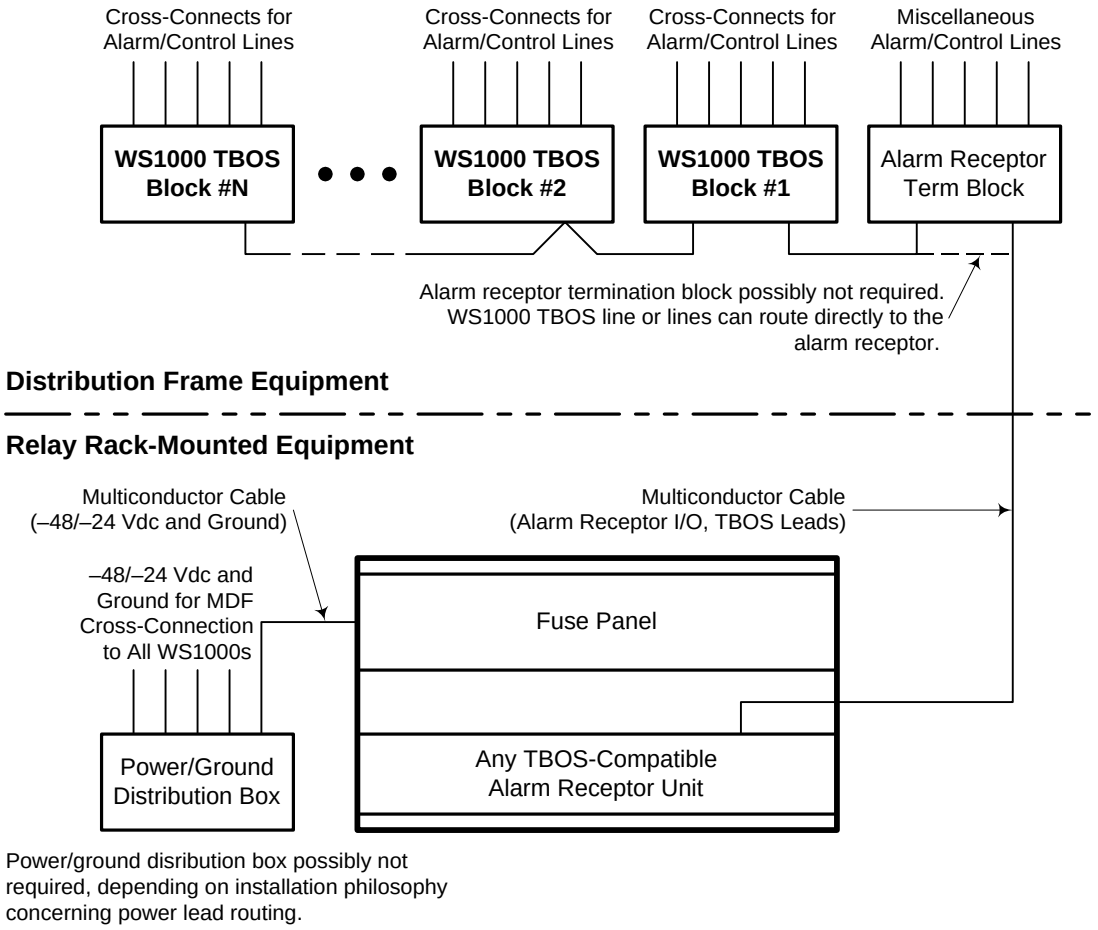


Figure 2-15 WS1000 General Distribution Frame Application

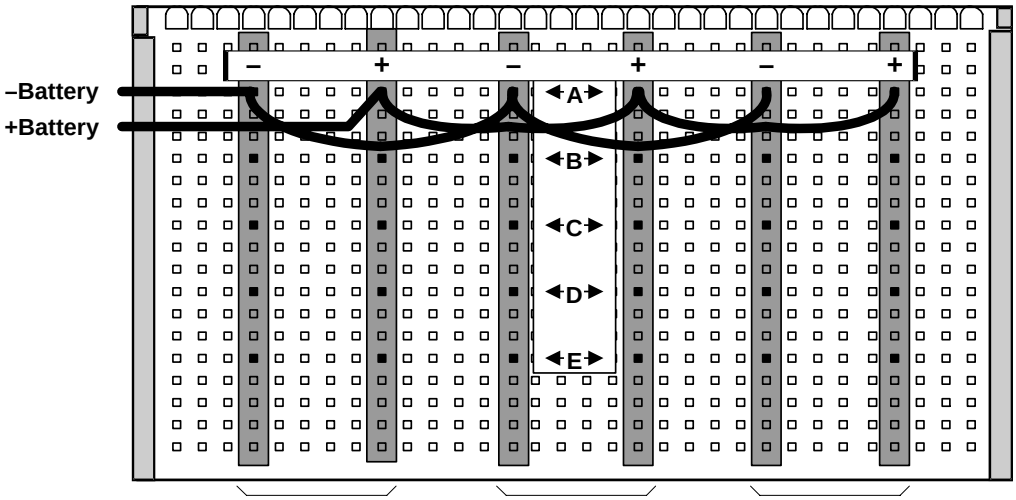
2.4.4.3 WS1000 Input Power Connections

The input power connections provide power from a fuse panel or a power distribution panel, such as the Westronic Power Distribution Block (PDP) shown in Figure 2-16, using #14 – #24 AWG wire for power and ground leads. The PDP allows several WS1000s to be bussed together through a single fuse. The input voltage ranges from –20 Vdc through –60 Vdc for nominal –24/–48 Vdc operation. Remove the slow-blow power fuse before inserting or removing the plug-in power connector on the unit front.

The following apply to the PDP (PN 560-T008):

- The PDP uses wire-wrap pins laid out in columns. All pins in each column connect together on the back of the PDP.
- If input power is applied on Pin A of any column, for example, the remaining pins, such as B – E, of that column become outputs. Total power-feed capacity of a single PDP is 12 WS1000s.

- If more than four WS1000s receive power through the panel, use #14 – #22 AWG solid wire to jumper the top row (for example, Pins A) together, observing column polarity as shown in Figure 2-16.
- Fuse the PDP power input. The input voltage and the number of powered WS1000s determine the fuse value. Use GMT or Type 70 fuses of the value shown in Table 2-4.



Row	WS1000 Nos 1 – 4	WS1000 Nos 5 – 8	WS1000 Nos 9 – 12
B–/B+	1	5	9
C–/C+	2	6	10
D–/D+	3	7	11
E–/E+	4	8	12

Figure 2-16 Westronic Power Distribution Panel

Table 2-4 Power Distribution Panel Fuse Requirements (Slow-Blow)

Number of WS1000s	–48 Vdc	–24 Vdc
1	0.25 A	0.50 A
2	0.50 A	1.00 A
3	0.75 A	1.50 A
4	1.00 A	2.00 A
5	1.25 A	2.50 A
6	1.50 A	3.00 A
7	1.75 A	3.50 A
8	2.00 A	4.00 A
9	2.25 A	4.50 A
10	2.50 A	5.00 A
11	2.75 A	5.50 A
12	3.00 A	6.00 A

Terminate the other end of the power leads from the fuse panel or PDP into the WS1000 power plug as shown in Figure 2-17. The power plug has two screw-compression terminals. After terminating the power leads, reinsert the power plug into its socket in preparation for applying power to the unit.

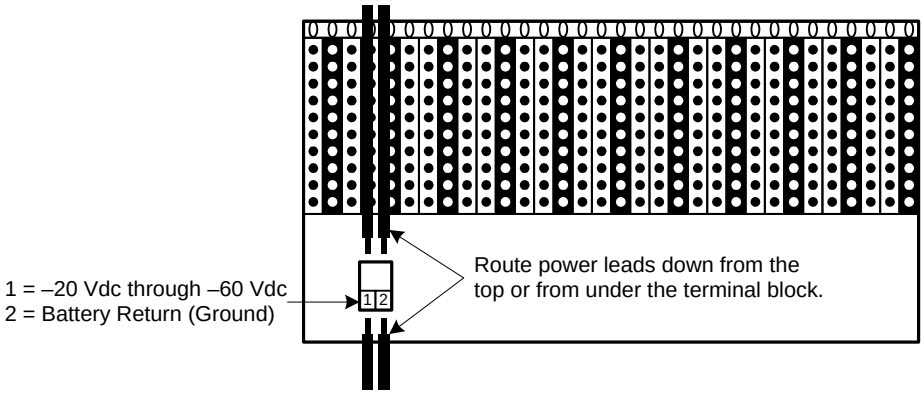


Figure 2-17 WS1000 Power Connections

Note: Each WS1000 plug-in module comes equipped with a mating power plug. To remove the power plug, pull the plug-in module out and, using a pen or scewdriver, push on the backside of the power plug from within the module.

2.4.5 Powering the Unit

Power the WS1000 up by installing the appropriate slow-blow fuse at the fuse panel or the PDP. Fuse requirements for a single WS1000 unit are 0.5 Amps (–24 Vdc) and 0.25 Amps (–48 Vdc). Also see Table 2-4.

After you apply power, the front-panel **MPU RUN** LED lights and remains lit.

The WS1000 is now ready for configuration according to site requirements.

2.5 WS1000 Unit Configuration

Configure each WS1000 unit using the front-panel 10-segment DIP switch (shown in Figure 2-18). Factory default settings for all switch segments is down (Off). The various segments establish the following:

- Display number or numbers
- Host and expansion serial port interface
- Carrier mode (if equipped with an internal modem)
- Host and expansion serial port line terminations

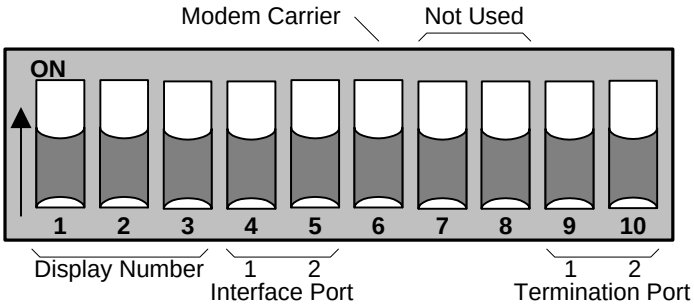


Figure 2-18 WS1000 TBOS Configuration

TBOS Display Number

Each WS1000 can be configured for a particular display. Segments 1 – 3 set the number for the first display (discretes 1 – 64) that the unit responds to on TBOS Port 1. Firmware automatically sets the second display (discretes 65 – 128, if provided) to the next sequential number. Thus, if Segments 1 – 3 establish the first display as Display 2, firmware makes the second display Display 3.

Table 2-5 shows the settings required to set a particular TBOS display number.

Table 2-5 TBOS Display Numbers

Display	1	2	3
1	↓	↓	↓
2	↓	↓	↑
3	↓	↑	↓
4	↓	↑	↑
5	↑	↓	↓
6	↑	↓	↑
7	↑	↑	↓
8	↑	↑	↑

When multiple WS1000 TBOS units are bussed together, you must configure each unit to respond to an unique set of display addresses to prevent multiple units from responding to a single TBOS command.

Serial Port Interface Type

Switch Segments 4 and 5 set the RS interface type for Port 1 (host) and Port 2 (TBOS collection), respectively, as shown in Table 2-6.

Table 2-6 TBOS Serial Port Interface Type

Segment		Function
4 (Note)	↑	RS-485 interface on Port 1
	↓	RS-422 interface on Port 1
5	↑	RS-485 interface on Port 2
	↓	RS-422 interface Port 2

Note: Segment 4 has no effect if the WS1000 has an internal modem.

Carrier Mode

You can set the carrier mode to constant (carrier on) or switched (automatic) on units equipped with an internal 202T modem, as shown in Table 2-7.

Table 2-7 Carrier Mode

Segment		Function
6	↑	Carrier On
	↓	Automatic (switched carrier)

Serial Port Receive Line Termination

Switch Segments 9 and 10 set the receive line terminations for Port 1 (when not equipped with an internal modem) and Port 2, respectively. Specifically, if the unit connects in a point-to-point (RS-422 link) configuration or is the last unit in a multipoint (RS-485) configuration, set the segments to place an 180-Ohm termination across the balanced receive lines (Rx+/Rx–). However, if the unit is somewhere in the middle of a multipoint (RS-485) configuration, set the segments to provide an open termination across the receive lines. See Table 2-8.

Table 2-8 Serial Port Receive Line Terminations

Segment		**Function** (Note 1)
9 (Note 2)	↑	180-Ω termination on Port 1 (Rx+/Rx–)
	↓	Open termination on Port 1 (Rx+/Rx–)
10	↑	180-Ω termination on Port 2 (Rx+/Rx–)
	↓	Open termination Port 2 (Rx+/Rx–)

Notes:

1. The 180-Ω termination is applied across the balanced receive lines in a point-to-point RS-422 link (Figure 2-12) or at the end points of a multipoint RS-485 link (Figure 2-14).
2. Segment 9 sets Port 1 termination only if WS1000 does not have an internal modem.

2.6 Installation Check List

Use the following check list when installing WS1000 hardware:

- Mount the unit
- Verify default strapping:
  - Main board
  - Modem board
- Cable the unit
  - Verify serial port connections (DTE/DCE or DTE/DTE)
  - Verify discrete connections
- Set front-panel DIP Switches in accordance with *WS1000 Unit Configuration* on Page 2-20

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3 Maintenance

3.1 WS1000 Startup Tests

Whenever it powers up, the WS1000 runs a series of diagnostic tests, such as a Random Access Memory (RAM) test and a Programmable Read Only Memory (PROM) checksum test, to verify microprocessor integrity. While the **MPU RUN** LED is Off during startup, the front-panel LEDs for both serial ports help determine failed startup tests.

SERIAL PORT 1 RX LED indicates testing in progress for the PROM checksum while **SERIAL PORT 1 TX** LED indicates testing in progress for RAM integrity. Initially, the appropriate LED lights on each test. If all tests pass, **SERIAL PORT 1 RX** or **TX** LEDs turn Off (provided the serial ports are not terminated) and the **MPU RUN** LED on the unit front lights and remains lit as long as WS1000 has power.

PROM Checksum Failure

SERIAL PORT 1 RX LED remaining lit after the **MPU RUN** LED lights indicates that the actual calculated checksum does not agree with the embedded firmware checksum.

RAM Failure

SERIAL PORT 1 TX LED remaining lit after the **MPU RUN** LED lights indicates a fatal RAM failure (all or part of the RAM bytes are unusable), which in turn causes the MPU to disable unit operation.

Resolving Failures

The RAM and PROM reside within the microprocessor chip on the main board and are not repairable in the field. Remove the main board from the housing and make sure that the microprocessor chip is seated securely in its socket (see Figure 2-6 for chip location). If the chip appears to be securely in place, contact the factory for a Return Material Authorization number (RMA) to begin the repair process.

3.2 WS1000 Serial Port Failures

The unit serial ports communicate using TBOS protocol and require proper RS-422 or RS-485 (4-wire) operation at 2,400 bps. Each unit serial port has a receive and transmit LED to indicate data activity. Because bit 64 of every display reporting to the TBOS host system provides port failure indication, you can use the host system or a maintenance display to check the status for display bit 64:

- When bit 64 is 0 (zero), data activity should be present on the **SERIAL PORT 1 RX** and **TX** LEDs indicating proper reporting operation.
- When bit 64 is 1 and all other bits are 0 (zero), data activity should be present on the **SERIAL PORT 1 RX** LED and possibly some activity on the **SERIAL PORT 1 TX** LED, indicating a port communication problem.

Table 3-1 through Table 3-3 refer to possible error indications derived from the LEDs. Each table has an associated figure to illustrate the connection. Table 3-4 describes the notes listed in the Trouble Notes columns.

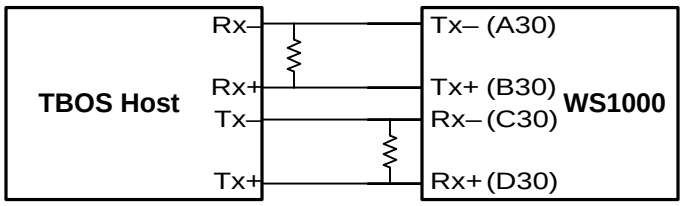

Figure 3-1 Example of a Single WS1000 Connection to a TBOS Host System (RS-422/202T)

Table 3-1 LED Indications on a Single WS1000 Connected to a TBOS Host System (RS-422/202T)

Host Bit 64	MPU RUN LED	LED				Trouble Notes (See **Table 3-4**)
		Port 1 RX	Port 1 TX	Port 2 RX	Port 2 TX	
0	On	Flashing	Flashing	–	–	1
1	Off	No Flash	No Flash	–	–	2
1	On	No Flash	No Flash	–	–	3, 6, 10, 13, 21
1	On	Flashing	No Flash	–	–	3, 6, 9, 10, 13, 21, 22
1	On	Flashing	No Flash	–	–	5, 9, 15, 19, 20

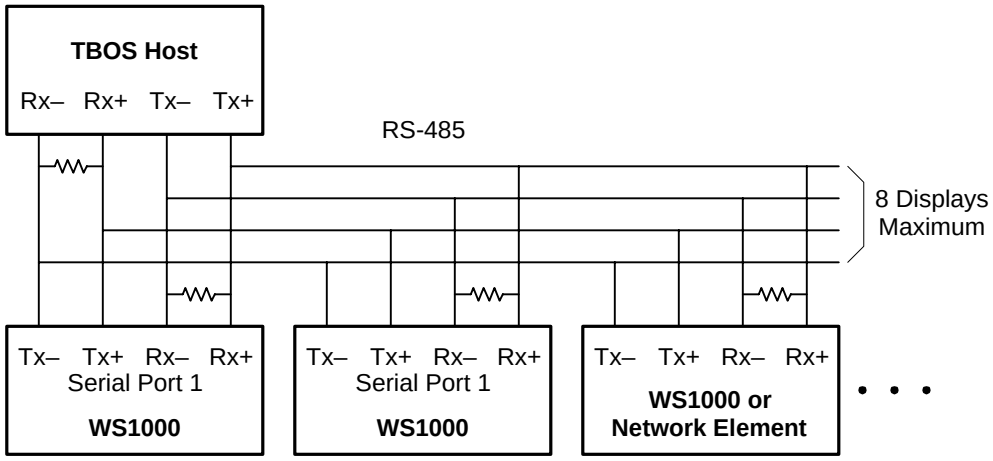

Figure 3-2 Example of Multiple WS1000s Connected to a TBOS Host System (RS-485)

Table 3-2 LED Indications for Multiple WS1000s Connected to a TBOS Host System (RS-485)

Host Bit 64	MPU RUN LED	LED				Trouble Notes (See **Table 3-4**)
		Port 1 RX	Port 1 TX	Port 2 RX	Port 2 TX	
0	On	Flashing	Flashing	–	Flashing	1
1	Off	No Flash	No Flash	–	–	2
1	On	No Flash	No Flash	–	No Flash	3, 6, 10, 13
1	On	Flashing	No Flash	–	Flashing	3, 6, 9,10, 13, 22
1	On	Flashing	Flashing	–	Flashing	5, 9, 15, 19

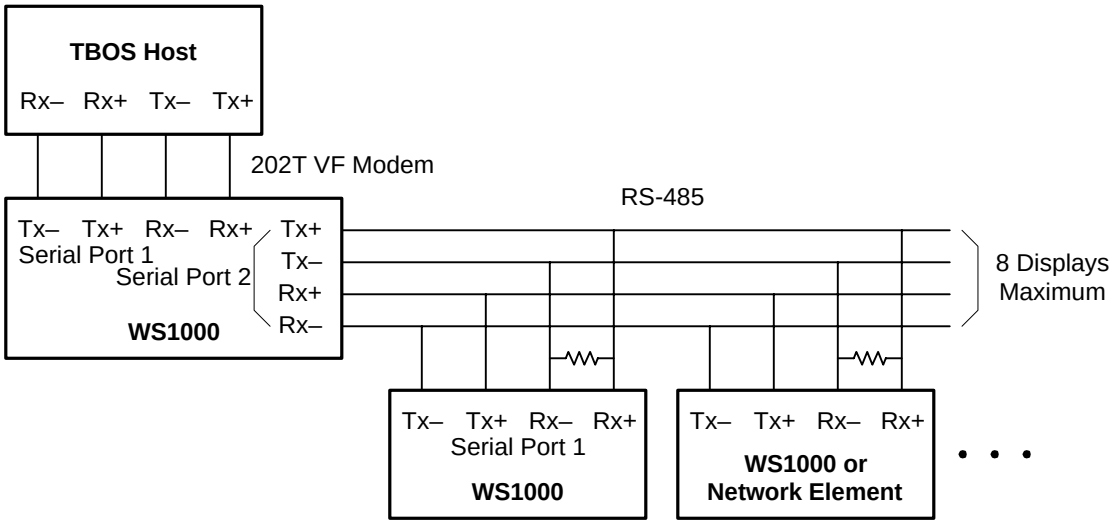

Figure 3-3 Example of Multiple WS1000s/Network Elements Connected to a Single WS1000 (RS-485) With Single WS1000 Connected to a TBOS Host System (202T Modem)

Table 3-3 LED Indications for Multiple WS1000s/Network Elements Connected to a Single WS1000 (RS-485) With a Single WS1000 Connected to a TBOS Host System (202T Modem)

Host Bit 64	MPU RUN LED	LED				Trouble Notes (See **Table 3-4**)
		Port 1 RX	Port 1 TX	Port 2 RX	Port 2 TX	
0	On	Flashing	Flashing	Flashing	Flashing	1
1	Off	No Flash	No Flash	No Flash	No Flash	2
1	On	No Flash	No Flash	No Flash	No Flash	3, 6, 10, 13, 21
1	On	Flashing	Flashing	No Flash	Flashing	4, 5, 9, 11, 15, 19, 20
1	On	Flashing	No Flash	Flashing	Flashing	8, 9, 12, 14, 18
1	On	Flashing	No Flash	No Flash	Flashing	3, 4, 6, 7, 8, 10, 11, 12, 13, 14, 17, 18, 21, 22
1	On	Flashing	Flashing	Flashing	Flashing	5, 8, 9, 12, 14, 17, 18, 19, 20, 22

Trouble Conditions

Use the following table when troubleshooting various configurations of the WS1000.

Table 3-4 WS1000 Probable Trouble Conditions

Note	Description	Check/Fix
1	Normal	N/A
2	**MPU RUN** LED off, no power	Check for blown or missing fuse, open power wire, or reversed ± conditions
3	Reversed serial Port 1 Tx and Rx data lines	Check for crossed connections; swap data lines on serial port if necessary
4	Reversed serial Port 2 Tx and Rx data lines	Check for crossed connections; swap data lines on serial port if necessary
5	Reversed serial Port 1 Tx+ and Tx– data lines	Check for crossed connections; swap data lines on serial port Tx pins if necessary
6	Reversed serial Port 1 Rx+ and RX– data lines	Check for crossed connections; swap data lines on serial port Rx pins if necessary
7	Reversed serial Port 2 Tx+ and Tx– data lines	Check for crossed connections; swap data lines on serial port Tx pins if necessary

Table 3-4 WS1000 Probable Trouble Conditions

Note	Description	Check/Fix
8	Reversed serial Port 2 Rx+ and RX– data lines	Check for crossed connections; swap data lines on serial port Rx pins if necessary
9	Inoperative serial Port 1 transmit driver	Replace WS1000 plug-in module
10	Inoperative serial Port 1 receive circuitry	Replace WS1000 plug-in module
11	Inoperative serial Port 2 transmit driver	Replace WS1000 plug-in module
12	Inoperative serial Port 2 receive circuitry	Replace WS1000 plug-in module
13	DIP segment 9 (serial Port 1 receive termination) in wrong position	Set DIP segment 9 to opposite setting
14	DIP segment 10 (serial Port 2 receive termination) in wrong position	Set DIP segment 10 to opposite setting
15	DIP segment 4 (serial Port 1 RS-422/RS-485) in wrong position	Set DIP segment 4 to opposite setting
16	DIP segment 5 (serial Port 2 RS-422/RS-485) in wrong position	Set DIP segment 5 to opposite setting
17	Inoperative receive circuitry on downstream WS1000/network element	Check downstream WS1000 or network element
18	Inoperative transmit driver on downstream WS1000/network element	Check downstream WS1000 or network element
19	Inoperative receive circuitry on TBOS host system	Check TBOS host system for proper operation
20	202T modem transmit level out of adjustment	Set transmit output of 202T modem to proper level
21	202T modem receive sensitivity out of adjustment	Set receive sensitivity input to proper level
22	DIP segments 1 – 3 (display number) set to wrong number	Set DIP segments 1 – 3 to correct display number

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