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INTRODUCTION

Welcome

Welcome to Maple Systems' STEP1 Standard Terminal Emulation Protocol, a powerful terminal emulation protocol for use with Maple Systems' Operator Interface Terminals (OITs) in industrial applications.

About Your Documentation

The documentation for the STEP1 Protocol and your OIT consists of:

- *STEP1 Protocol Operation Manual* (shipped with STEPware-100) — Covers the general operation and features of the OIT when using the STEP1 Protocol, implementation of the features using STEPware-100, and installation requirements unique to the STEP1 Protocol.
- *OIT Installation Manual* (shipped with each OIT) — Covers the installation requirements of your specific OIT. Each OIT has a manual written specifically to its unique specifications.
- STEPware-100 On-line Help — Covers the operation of STEPware-100.

Conventions

You will find the following typographic conventions throughout this manual.

This	Represents
bold	Characters that you must type exactly as they appear. For example, if you are directed to type a:setup , you should type all the bold characters exactly as they are printed.
<i>italic</i>	Place holders for information you must provide. For example, if you are directed to type <i>filename</i> , you should type the actual name for a file instead of the word shown in italic type.
ALL CAPITALS	Directory names, file names, key names, and acronyms.
SMALL CAPS	Non-printable ASCII control characters.
KEY1+KEY2	A plus sign (+) between key names means to press and hold down the first key while you press the second key.
KEY1, KEY2	A comma (,) between key names means to press and release the keys one after the other.

OIT Models Supported

The STEP1 Protocol supports the following OIT models:

- MAP320D-240B
- MAP340D-240F
- MAP460D-240B
- OIT3160-A00
- OIT3165-A00
- OIT3175-A00
- OIT3185-A00
- OIT3200-B00
- OIT3250-B00
- OIT3600-B00
- OIT4160-A00
- OIT4165-A00
- OIT4175-A00
- OIT4185-A00
- OIT4400-B00
- OIT4450-B00
- OIT5400-B00

Previous models, such as the MAP320**B**-240B or OIT3200-**A**00, are not supported.

Operational Overview

The STEP1 Protocol allows the OIT Family and MAP Family Operator Interface Terminals to provide the human-machine interface between an operator and an ASCII compatible computer or host controller. Any controller that is capable of sending and receiving ASCII characters through a serial port can potentially communicate to an OIT Family or MAP Family Operator Interface Terminal using the STEP1 Protocol.

The STEP1 Protocol allows the OIT to receive and send simple ASCII character strings. The OIT accepts:

- printable ASCII characters — which immediately display on the OIT
- non-printable ASCII control characters (Control Codes) — which directly affect the OIT's display
- and special ASCII character combinations (Control Commands).

Control Commands cause the OIT to:

- modify the OIT's configuration parameters
- display one of up to 500 predefined messages
- sound the OIT's internal buzzer
- sound the OIT's external buzzer (OIT3250, OIT4450, and OIT5400 only)
- turn the OIT's LEDs on or off (OIT3250, OIT4450, and OIT5400 only)
- or print to a serial printer (OIT3250, OIT4450, and OIT5400 only).

The OIT can be programmed to send ASCII characters or predefined ASCII strings to the host controller and the OIT's display. Each of the OIT's function keys can be programmed with two strings of up to 40 ASCII characters (including ASCII control characters). This allows each function key to simulate an on/off or momentary switch. The OIT's other keys send individual ASCII characters.

All supported OIT models are configured for use with the STEP1 Protocol using the STEPware-100 configuration software. STEPware-100 is Windows-based configuration software that allows you to setup all configurable OIT options (including configuration parameters, predefined messages, and predefined ASCII strings) and download them to the OIT. Many of the OIT's configuration parameters can also be modified during operation using the Control Commands.

CHAPTER 1

Getting Started

The Getting Started chapter walks you through all the steps required to setup your OIT:

- What You Will Need
- Installing STEPware-100
- STEPware-100 Tutorial
- Downloading a STEPware-100 Project to Your OIT
- Verifying Your OIT is Operational
- Connecting Your OIT to the Host Controller

What You Will Need

The table, below, lists the items you will need to configure and operate your OIT.

	OIT3160A/ OIT4160A	OIT3100 and OIT4100 Series, except 3160A/4160A	MAP460/ OIT3600	All Other Models
Configuration Software	STEPware-100	STEPware-100	STEPware-100	STEPware-100
Configuration Cable (OIT to PC)	7431-0049	7431-0096	7431-0048	7431-0049
Personal Computer ¹	User Provided	User Provided	User Provided	User Provided
Power Cable	6030-0009	6030-0009	Not Required	7431-0050A
1/2 Amp, 24 VDC Power Supply ²	User Provided	User Provided	User Provided	User Provided
Host Controller	User Provided	User Provided	User Provided	User Provided
Communication Cable (OIT to Host Controller)	User Provided	User Provided	User Provided	User Provided

¹ Computer requirements include at least a 486SX/33MHz PC, 4MB RAM, 4MB available hard disk space, VGA video controller, Microsoft Windows 3.1, and one available RS-232 serial port.

² The MAP340, OIT4400, and OIT4450 require a fast start power supply.

Installing STEPware-100

To install STEPware-100:

1. Start Windows. If any applications are running, close them before continuing.
2. Place the STEPware-100 Setup Disk into your 3.5-inch floppy drive.
3. Windows 3.x: In Program Manager, from the File menu, choose Run.
Windows95 and NT4.0: From the Task Bar, choose Start, then Run.

4. Type **a:\setup** (substitute **b** for **a** if your 3.5-inch drive is configured as the b drive).
5. Choose the OK button.
6. Follow the instructions on your screen.

NOTE: When installation of STEPware-100 is complete, your PC must be restarted before STEPware-100 will operate correctly.

STEPware-100 Tutorial

Create a Basic STEPware-100 Project

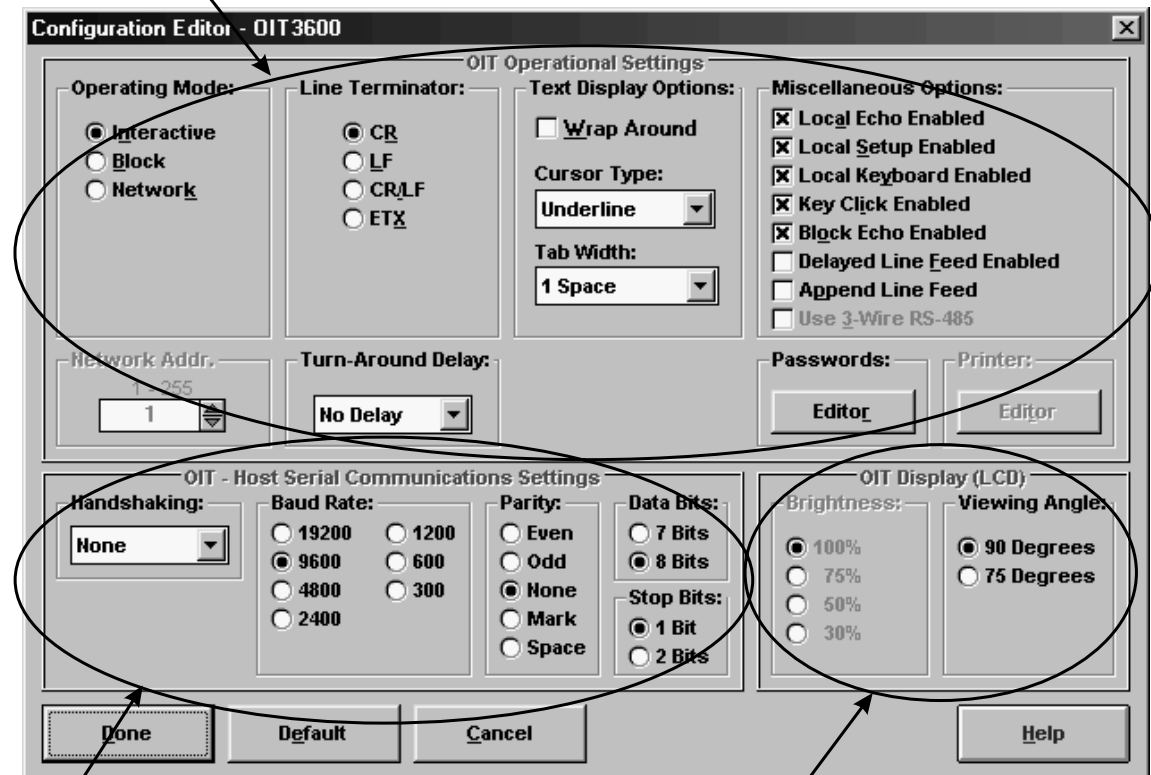
This step walks you through the creation of a basic STEPware-100 project named SAMPLE.SWR. Once downloaded to the OIT, this basic configuration allows the OIT to receive and display data sent from the host controller, and to send data entered from the OIT's keypad back to the host controller.

1. Start STEPware-100.
2. From the File menu, choose New. The New Project dialog box appears.
3. In the OIT Model drop down list box, select the appropriate OIT model.

NOTE: It is important to select the correct OIT model. STEPware can not transfer a project from one OIT to another.

4. Choose the Start New Project button. The Configuration Editor dialog box appears.

OIT Operational Settings



OIT to Host Communications Settings

OIT Display Settings

- The Configuration Editor is used to specify the OIT's operating parameters. Refer to Chapter 2: OIT Configuration for more information. When finished setting the OIT's operating parameters, choose the Done button to return to the STEPware-100 main screen.

NOTE: The sample communication session in the "Verifying Your OIT is Operational" section later in this chapter is written to communicate to your PC. If you want to run the sample communication session, you should accept the default OIT - Host Serial Communications Settings instead of setting them to match your host controller.

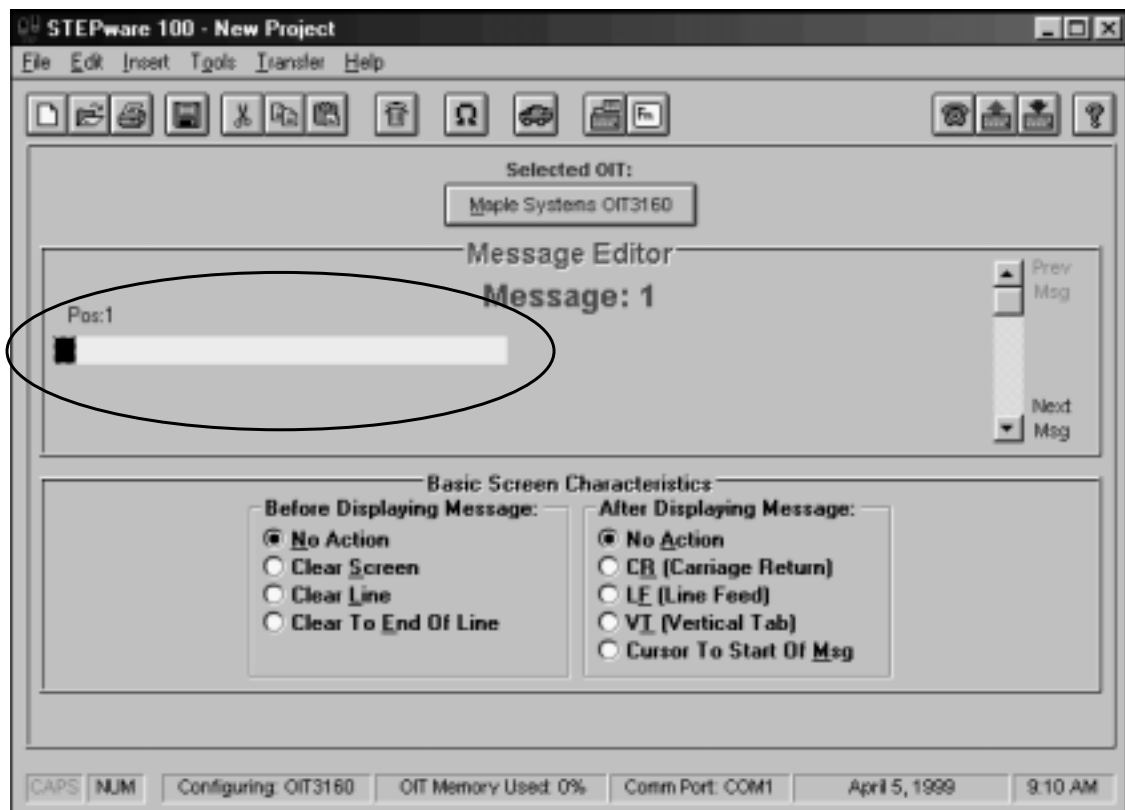
- From the File menu, choose Save As. The Save As dialog box appears.
- In the File Name text box, type **sample.swr**.
- Choose the OK button to save the project and return to the STEPware-100 main screen.

Add Two Predefined Messages

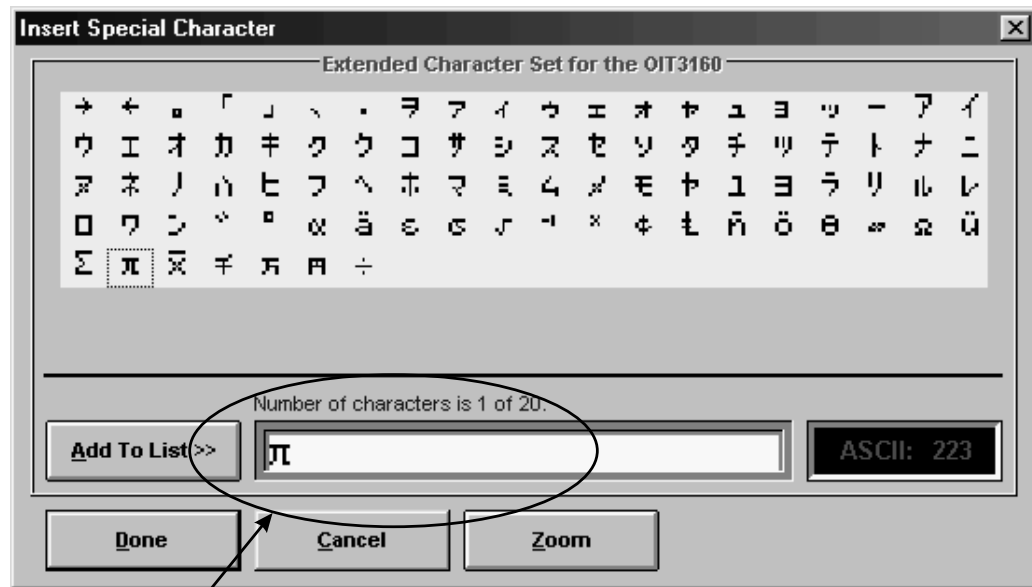
The OIT stores up to 500 predefined messages. Whenever the host controller requests a predefined message using the Display Message control command, the OIT displays the requested message starting at the current cursor position.

This step walks you through the creation of two predefined messages.

- In the Message Editor, type **Messages can include**.



- Press PAGE DOWN to go to the next message.
- Press F2 to open the Insert Special Characters dialog box.
- The Insert Special Character dialog box allows you to insert special characters into your predefined messages. Using the arrow keys, select any special character.
- Choose the Add To List button. The selected special character displays in the text box next to the Add To List button.



The special characters displayed here are inserted into the message when you choose the Done button.

6. Choose the Done button to return to the STEPware-100 main screen. The special character displayed in the text box next to the Add To List button displays in the Message Editor.
7. In the Message Editor, following the special character you just inserted, type a space and then type **characters**.
8. From the File menu, choose Save.

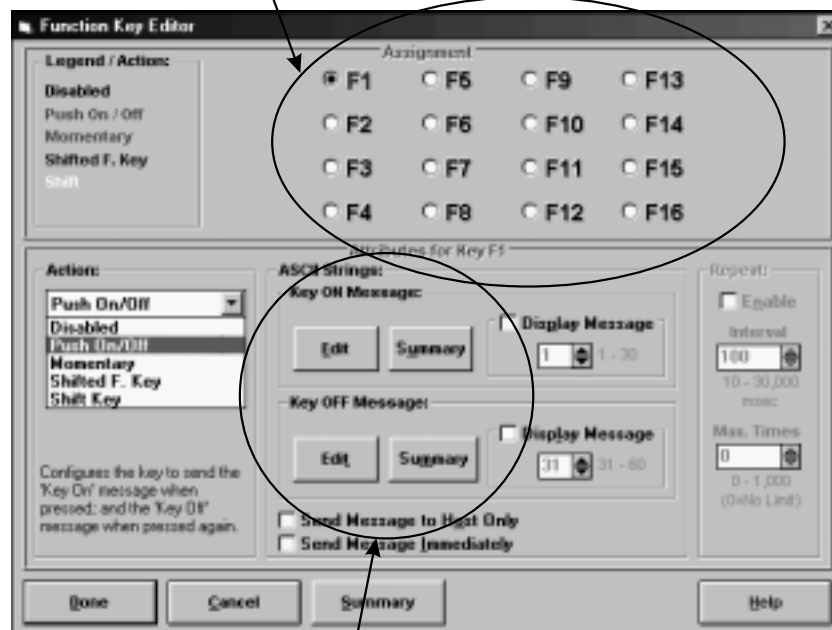
Configure a Push-on/Push-off Function Key

Each of the OIT's function keys can be configured to send two ASCII strings to the host controller; each a maximum of 40 characters. One ASCII string is sent to the host controller whenever the function key simulates an "on" state, the other whenever the function key simulates an "off" state. The predefined ASCII strings can contain any ASCII character from 0 to 255.

This step walks you through the configuration of Function Key 1 as a push-on/push-off function key that sends the predefined ASCII string "on CR LF" when simulating an "on" state, and the predefined ASCII string "off CR LF" when simulating an "off" state. The predefined ASCII strings are sent to the host controller and to the OIT's display.

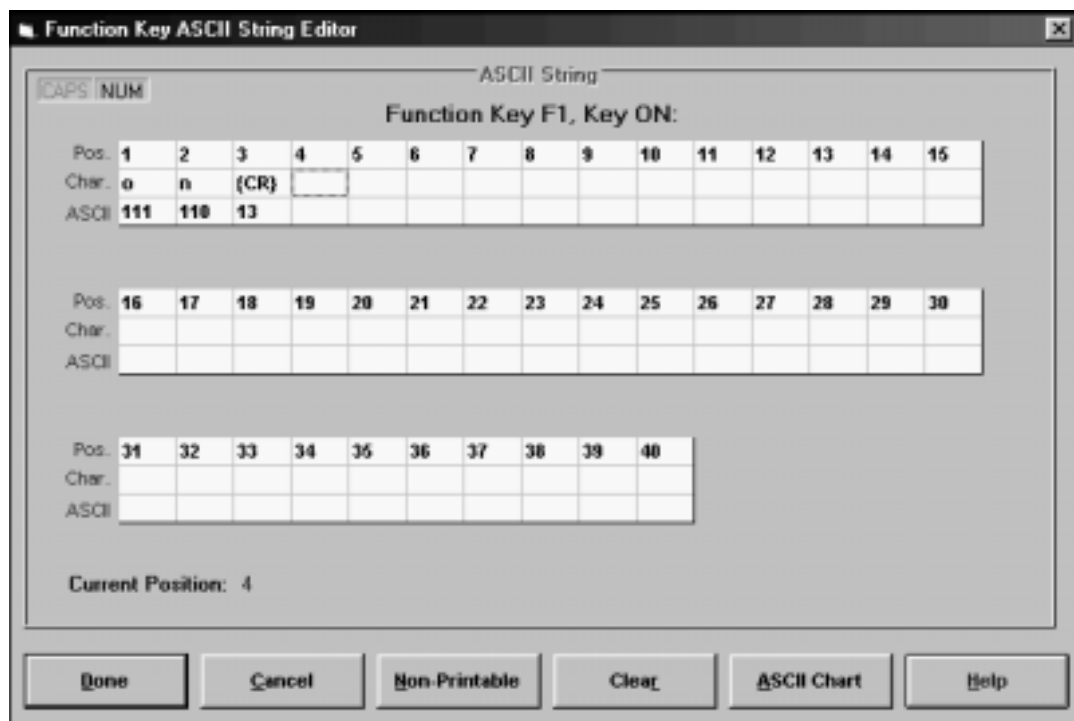
1. Press F5 to display the Function Key Editor dialog box.
2. In the Assignment group box, select the F1 option button to configure Function Key 1.
3. In the Action drop down list box, select Push On/Off.

Select a function key to configure.



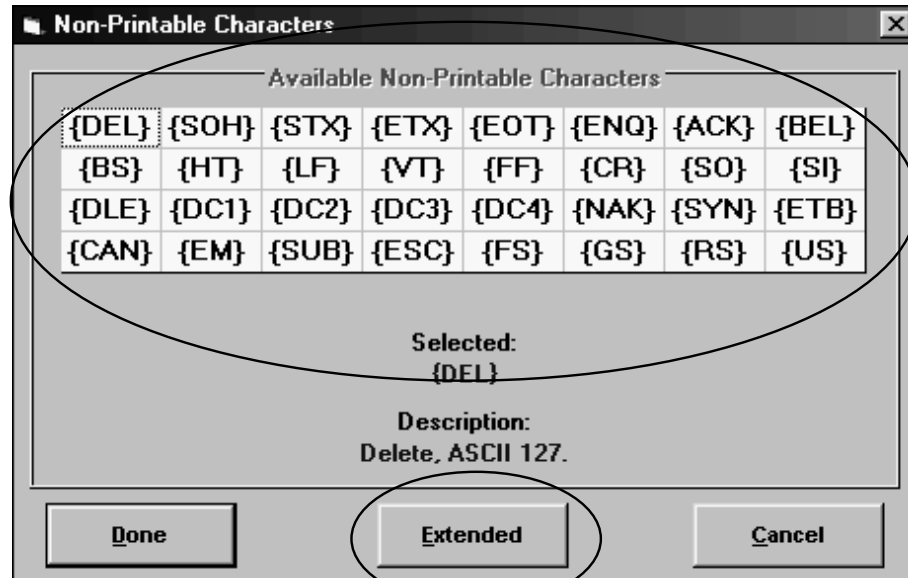
Choose the Edit buttons to configure the "on" and "off" predefined ASCII strings.

4. In the Key ON Message group box, choose the Edit button to display the Function Key ASCII String Editor dialog box.
5. In Pos. 1, type o.
6. In Pos. 2, type n.



7. In Pos. 3:
 - choose the Non-Printable button and the Non-Printable Characters dialog box appears
 - select {CR}
 - then choose the Done button to return to the Function Key ASCII String Editor dialog box.

Place one of these non-printable characters in your predefined ASCII string by selecting the character with your mouse and then choosing the Done button.



Choose the Extended button to select ASCII characters 128 to 255.

NOTE: To enter an ASCII character from 128 to 255, choose the Extended button in the Non-Printable Characters dialog box, type the ASCII code, and then choose the OK button.

8. In Pos. 4:
 - double click Pos. 4 and the Non-Printable Characters dialog box appears
 - double click {LF} to select LF and return to the Function Key ASCII String Editor dialog box.
9. Choose the Done button to return to the Function Key Editor dialog box.
10. In the Key OFF Message group box, choose the Edit button to display the Function Key ASCII String Editor dialog box.
11. In Pos. 1, type **o**.
12. In Pos. 2, type **f**.
13. In Pos. 3, type **f**.
14. In Pos. 4:
 - double click Pos. 4 and the Non-Printable Characters dialog box appears
 - double click {CR} to select CR and return to the Function Key ASCII String Editor dialog box.
15. In Pos. 5:
 - double click Pos. 5 and the Non-Printable Characters dialog box appears
 - double click {LF} to select LF and return to the Function Key ASCII String Editor dialog box.
16. Choose the Done button to return to the Function Key Editor dialog box.

Configure a Momentary Function Key

Momentary function keys can be configured to repeat the predefined ASCII string while the function key is pressed. The time interval between transmissions of the ASCII string can be set between 10 msec and 30 sec. In addition a maximum limit can be set, 1 to 1000, after which the function key is no longer recognized until it is released and pressed again.

This step walks you through the configuration of Function Key 2 as a momentary function key that sends the predefined ASCII string “up CR LF” every 200 milliseconds until the function key is released or the predefined ASCII string has been sent 10 times, whichever is shorter. The predefined ASCII string is only sent to the host controller.

1. If you are not already in the Function Key Editor, press F5.
2. In the Assignment group box, select the F2 option button to configure Function Key 2.
3. In the Action drop down list box, select Momentary.
4. In the Key ON Message group box, choose the Edit button. The Function Key ASCII String Editor dialog box appears.
5. In Pos. 1, type **u**.
6. In Pos. 2, type **p**.
7. In Pos. 3:
 - double click Pos. 3 and the Non-Printable Characters dialog box appears
 - double click {CR} to select CR and return to the Function Key ASCII String Editor dialog box.
8. In Pos. 4:
 - double click Pos. 4 and the Non-Printable Characters dialog box appears
 - double click {LF} to select LF and return to the Function Key ASCII String Editor dialog box.
9. Choose the Done button to return to the Function Key Editor dialog box.
10. In the ASCII Strings group box, select the Send Message To Host Only check box. This stops the predefined ASCII strings assigned to Function Key 2 from displaying on the OIT.
11. In the Repeat group box:
 - select the Enable check box
 - type 200 into the Interval text box to select a 200 msec interval
 - then type 10 into the Max. Times text box.

Configure a Shifted Function Key

This step walks you through the configuration of Function Key 3 as a shifted function key. The function key sends the predefined ASCII string “normal CR LF” whenever the SHIFT key is not held down while this function key is pressed. It sends the predefined ASCII string “shifted CR LF” whenever the function key is pressed while the SHIFT key is held down. The SHIFT key is another function key that has been configured as a SHIFT key.

The predefined ASCII strings are sent to the host controller and to the OIT’s display.

1. If you are not already in the Function Key Editor, press F5.
2. In the Assignment group box, select the F3 option button to configure Function Key 3.
3. In the Action drop down list box, select Shifted F. Key.
4. In the Key ON Message (Unshifted) group box, choose the Edit button. The Function Key ASCII String Editor dialog box appears.
5. Type the ASCII string “normal”.

6. In Pos. 7:
 - double click Pos. 7 and the Non-Printable Characters dialog box appears
 - double-click {CR} to select CR and return to the Function Key ASCII String Editor dialog box.
7. In Pos. 8:
 - double click Pos. 8 and the Non-Printable Characters dialog box appears
 - double-click {LF} to select LF and return to the Function Key ASCII String Editor dialog box.
8. Choose the Done button to return to the Function Key Editor dialog box.
9. In the Key OFF Message (Shifted) group box, choose the Edit button. The Function Key ASCII String Editor dialog box appears.
10. Type the ASCII string “shifted”.
11. In Pos. 7:
 - double click Pos. 7 and the Non-Printable Characters dialog box appears
 - double-click {CR} to select CR and return to the Function Key ASCII String Editor dialog box.
12. In Pos. 8:
 - double click Pos. 8 and the Non-Printable Characters dialog box appears
 - double-click {LF} to select LF and return to the Function Key ASCII String Editor dialog box.
13. Choose the Done button to return to the Function Key Editor dialog box.

Configure a SHIFT Function Key

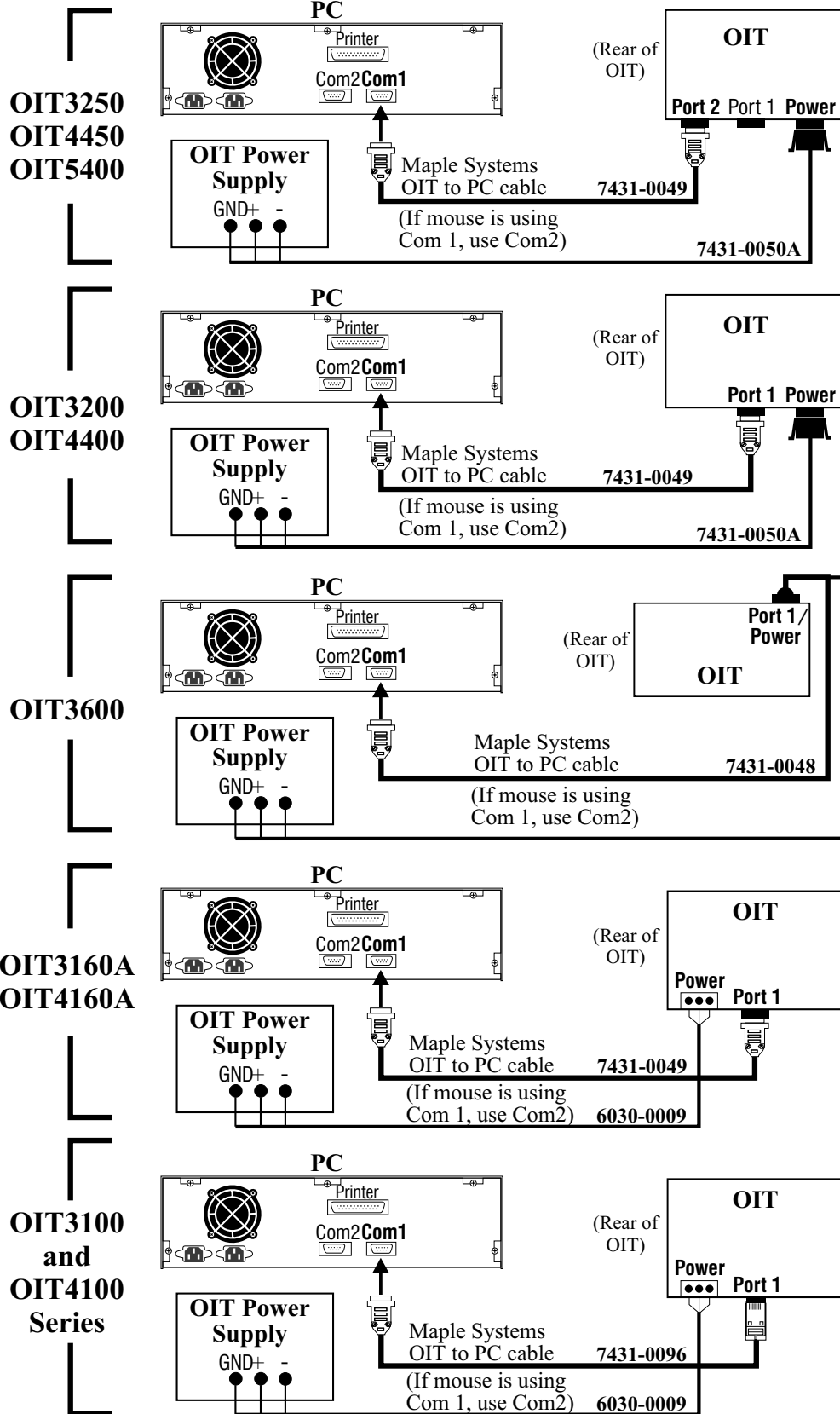
This step walks you through the configuration of Function Key 4 as a SHIFT function key. The function key can then be used with shifted function keys to send the alternate or “shifted” ASCII string to the host. When the SHIFT function key is not pressed, any shifted function key will send its normal or “unshifted” ASCII string to the host. If the SHIFT key is held down, the shifted function key will send the “shifted” ASCII string.

1. If you are not already in the Function Key Editor, press F5.
2. In the Assignment group box, select the F4 option button to configure Function Key 4.
3. In the Action drop down list box, select Shift Key.
4. Choose the Done button to return to the STEPware-100 main screen.
5. From the File menu, choose Save.

You have now successfully created a STEPware-100 project named SAMPLE.SWR that includes two messages, one push-on/push-off function key, one momentary function key, one shifted function key, and one SHIFT key. To download SAMPLE.SWR to your OIT and then run a sample operating session using Windows Terminal, follow the steps in the Downloading a STEPware-100 Project to Your OIT and the Verifying Your OIT is Operational sections.

Downloading a STEPware-100 Project to Your OIT

Connect OIT to PC and Power Supply



Place OIT in Download/Upload Mode

New OIT

NOTE: If using an OIT3160 or OIT4160, refer to the Existing OIT section below.

NOTE: If using an OIT3165/4165, OIT3175/4175 or OIT3185/4185, refer to Appendix D for the setup keyboard layout.

If the OIT has never been configured, the following message appears when power is applied to the OIT:

OIT Model	Message
OIT3100 and OIT4100 Series	OIT not Configured! Press Key for Dnload
All other models	***System is not Configured*** Press Any Key to Enter Download Mode

Pressing any key on the OIT causes the OIT to enter download/upload mode. The following message appears:

OIT Model	Message
OIT3100 and OIT4100 Series	**Download Mode** Please load Project!
All other models	***Computer Communications Mode*** Computer Will Reset OIT When Done...

Existing OIT

If your OIT has already been configured, follow these steps to place it in download/upload mode:

1. While applying power to the OIT, press and hold the following key on the OIT while the “Initializing” message appears:

OIT Model	Key
OIT3100 and OIT4100 Series	CLEAR
All other models	SETUP

2. The following message should appear:

OIT Model	Message
OIT3100 and OIT4100 Series	Parameters? MODIFY
All other models	Configuration Parameters? MODIFY

3. Next, press the [ENTER] key to display the following message:

OIT Model	Message
OIT3100 and OIT4100 Series	Password?
All other models	Enter Setup Password?

4. Type the setup password and then press the [ENTER] key on the OIT. If there is no setup password, just press the [ENTER] key. The following message appears:

OIT Model	Message
OIT3100 and OIT4100 Series	Down/Upload Mode? Y
All other models	Download/Upload computer? YES

5. Press the [ENTER] key to display the message:

OIT Model	Message
OIT3100 and OIT4100 Series	Ready for Transfer to/from STEPware!
All other models	Ready for Transfer to/from STEPware! Computer will reset OIT when done...

The OIT is now in download/upload mode waiting for instructions from the STEPware-100 configuration software.

If You Have Trouble Entering Configuration Mode

1. If the **Initializing** message is followed by **Terminal Now Ready!**, the OIT did not enter Configuration mode and you need to repeat step 1.
2. If the **OIT Brightness**, **Disp View Angle**, or **Baud Rate** message displays instead of **Parameters?**, Local Setup Access has been disabled. You will need to enable Local Setup Access by connecting the OIT to a host controller and having the host controller send the Keyboard Control control command to the OIT. Refer to Appendix A: Control Commands for more information. Please refer to Appendix F: Troubleshooting for more tips on entering configuration mode.
3. If the OIT's display remains blank and you hear a steady beeping, the OIT does not contain a complete project and is waiting in download mode for STEPware-100 to download a project. Since the OIT is already in download mode, you should proceed to the next step, Transfer Project.

Transfer Project

When you receive your OIT from the factory, it does not contain any information on how it is to operate. Therefore, the first time you download a project to the OIT you must also download the Operational Software. Downloading the Operational Software takes approximately three minutes to complete. Sending only the project file reduces the download time to approximately 30 seconds.

To download a STEPware-100 project to the OIT:

1. Start STEPware-100 and open your project.

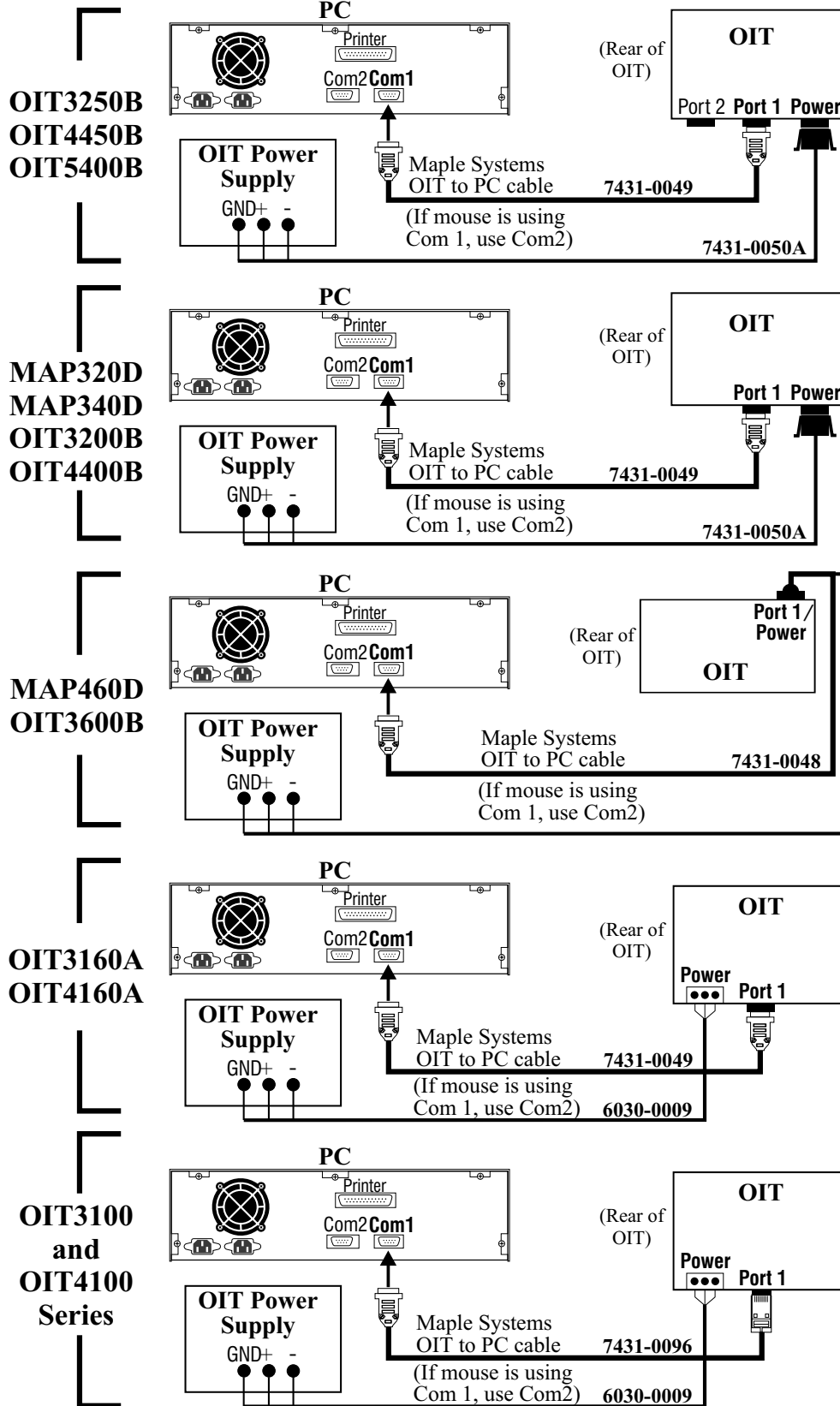
NOTE: The OIT must be in Download/Upload mode to accept a project from STEPware-100.

2. From the Transfer menu, choose Send to OIT. The STEPware 100 - Send To OIT dialog box appears.
3. Choose the Options button. The Communication Options dialog box appears.
4. If the OIT has not been previously downloaded to, in the Download Only group box, select the Project and OIT Operational Software option button.
5. If the OIT already contains the OIT Operational Software, in the Download Only group box, select the Project Only option button.
6. If you want to keep unauthorized users from reading the project in the OIT, in the Download Only group box, select the Enable? check box.
7. In the Upload & Download group box, select the COM port option button that corresponds to the COM port the OIT is connected to.
8. Choose the Done button to return to the STEPware 100 - Send To OIT dialog box.
9. Choose the OK button to start the transfer.

When the transfer is complete, the OIT restarts. The OIT is now ready to communicate with the host controller.

Verifying Your OIT is Operational

Connect OIT to PC and Power Supply



Setup PC's Terminal Emulation Program

1. Start your terminal emulation program.
2. Verify settings:
 - Baud Rate = 9600
 - Data Bits = 8
 - Stop Bits = 1
 - Parity = None
 - Handshaking (Flow control) = None
 - Terminal Emulation = VT-100 or equivalent
 - Local Echo = Enabled

Sample Communications Session

Before executing this sample communications session, you should have completed:

- STEPware-100 Tutorial (create SAMPLE.SWR)
- Downloading a STEPware-100 Project to Your OIT (download SAMPLE.SWR).

You should also have completed the previous two steps in this section:

- Connect OIT to PC and Power Supply
- Setup PC's Terminal Emulation Program.

When you are ready to begin, apply power to the OIT and then follow the instructions listed in the Action column of the table, below.

NOTE: Keys listed in parenthesis are the commands necessary to enter the specified control code using Windows Terminal. Your terminal emulation program, may be different.

Action	Result
PC: hello LF(CTRL+J)	OIT: Displays "hello" starting at the cursor's current position and moves the cursor to column 1 of the next line.
PC: ESC(CTRL+[]) m 1 CR(CTRL+m)	OIT: Displays predefined message #1.
PC: LF(CTRL+J)	OIT: Moves the cursor to the next line. If the cursor was already on the last line, the lines are scrolled up one line.
PC: ESC(CTRL+[]) m 2 CR(CTRL+m)	OIT: Displays predefined message #2.
PC: FF(CTRL+L)	OIT: Clears the display and moves the cursor to column 1, line 1.
OIT: Press and release Function Key 1	OIT: Displays "on\$\$" because the push-on/push-off function key's ON message was configured to send the ASCII string "o n CR LF". PC: Receives the ASCII string "o n CR LF".
OIT: Press and hold Function Key 2 for a few seconds	OIT: Displays nothing because the momentary function key was configured to send the ASCII string to the host only. PC: Receives the ASCII string "u p CR LF" every 200 milliseconds until either the ASCII string is received 10 times or Function Key 2 is released.
OIT: Press and release Function Key 1	OIT: Displays "off\$\$" because the push-on/push-off function key's OFF message was configured to send the ASCII string "o f CR LF". PC: Receives the ASCII string "o f f CR LF".
OIT: Press and hold down Function Key 4. Press and release Function Key 3. Release Function Key 4.	OIT: Displays "shifted\$\$" because the shifted Function Keys ON (shift) message was configured to send the ASCII string "shift CF LF". PC: Receives the ASCII "shift CR LF".

Connecting Your OIT to the Host Controller

The information in this section is supplemental to the information in your OIT Installation Manual. **Please read this section and your OIT Installation Manual before installing your OIT.**

RS-232 (Interactive & Block modes)

Interactive and Block modes support the 3-wire RS-232 configuration with TXD, RXD, and signal common. The cable requires an overall shield to protect against electrical noise. Xon and Xoff can be used for communication handshaking.

3-Wire RS-232			
Host Controller	OIT Terminal Block (MAP460D, OIT3600)	OIT Port 1 (OIT3100 and OIT4100 Series)	OIT Port 1 (all other models)
TXD	Pin 9 — RXD	Pin 6 — RXD	Pin 2 — RXD
RXD	Pin 10 — TXD	Pin 5 — TXD	Pin 3 — TXD
signal ground	Pin 8 — return	Pin 4 — return	Pin 5 — return

RS-422/485 (Interactive & Block modes)

Interactive and Block modes support the 3-wire and 5-wire RS-422/485 configurations. The 3-wire configuration has both transmit and receive on the same pair of wires plus a signal common. The 5-wire configuration has differential signal pairs for transmit and receive plus a signal common. In both configurations the signal pairs must be twisted and surrounded by an overall shield.

3-Wire RS-422/485			
Host Controller	OIT Terminal Block (MAP460D, OIT3600)	OIT Port 1 (OIT3100 and OIT4100 Series)	OIT Port 1 (all other models)
TXD+ & RXD+	Pins 4 & 6 — RXD+ & TXD+	Pins 1 & 8 — RXD+ & TXD+	Pins 4 & 9 — RXD+ & TXD+
TXD- & RXD-	Pins 5 & 7 — RXD- & TXD-	Pins 2 & 7 — RXD- & TXD-	Pins 1 & 6 — RXD- & TXD-
signal ground	Pin 8 — return	Pin 4 — return	Pin 5 — return

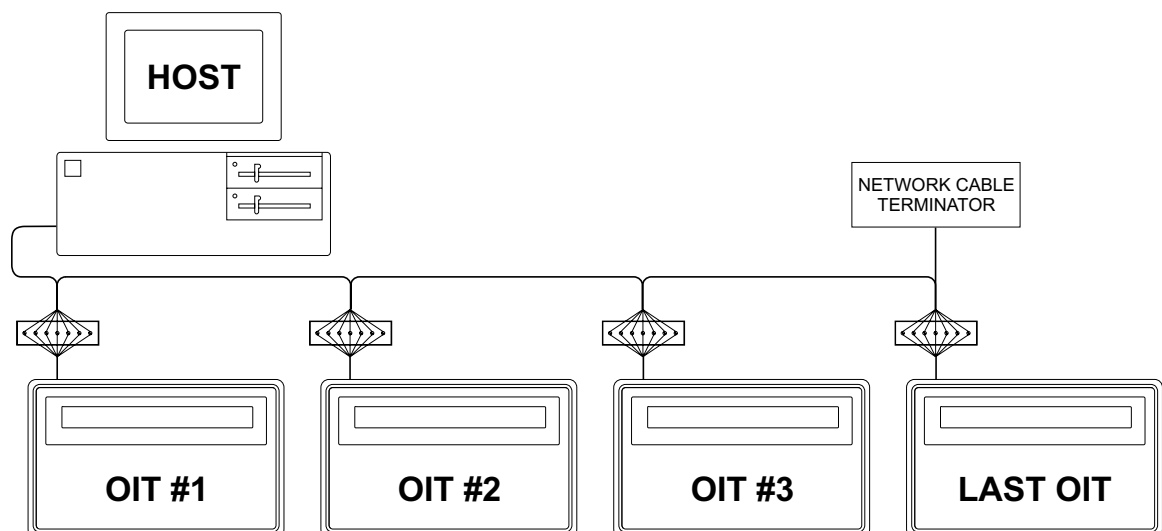
5-Wire RS-422/485			
Host Controller	OIT Terminal Block (MAP460D, OIT3600)	OIT Port 1 (OIT3100 and OIT4100 Series)	OIT Port 1 (all other models)
TXD+	Pin 4 — RXD+	Pin 8 — RXD+	Pin 4 — RXD+
TXD-	Pin 5 — RXD-	Pin 7 — RXD-	Pin 1 — RXD-
RXD+	Pin 6 — TXD+	Pin 1 — TXD+	Pin 9 — TXD+
RXD-	Pin 7 — TXD-	Pin 2 — TXD-	Pin 6 — TXD-
signal ground	Pin 8 — return	Pin 4 — return	Pin 5 — return

RS-422/485 (Network mode)

Network mode supports the 3-wire and 5-wire RS-422/485 configurations. The 3-wire configuration has both transmit and receive on the same pair of wires plus a signal common. The 5-wire configuration has differential signal pairs for transmit and receive plus a signal common. In both configurations the signal pairs must be twisted and surrounded by an overall shield.

5-wire RS-422/485 supports full-duplex communications; which means that the host controller can transmit data to the OITs and receive data from the OITs at the same time. 3-wire RS-422/485 only supports half-duplex communications; which means that the host controller cannot transmit and receive data at the same time. Although 3-wire RS-422/485 installations may be less costly than 5-wire installations, the increased complexity in programming the host controller for 3-wire RS-422/485 may increase development time.

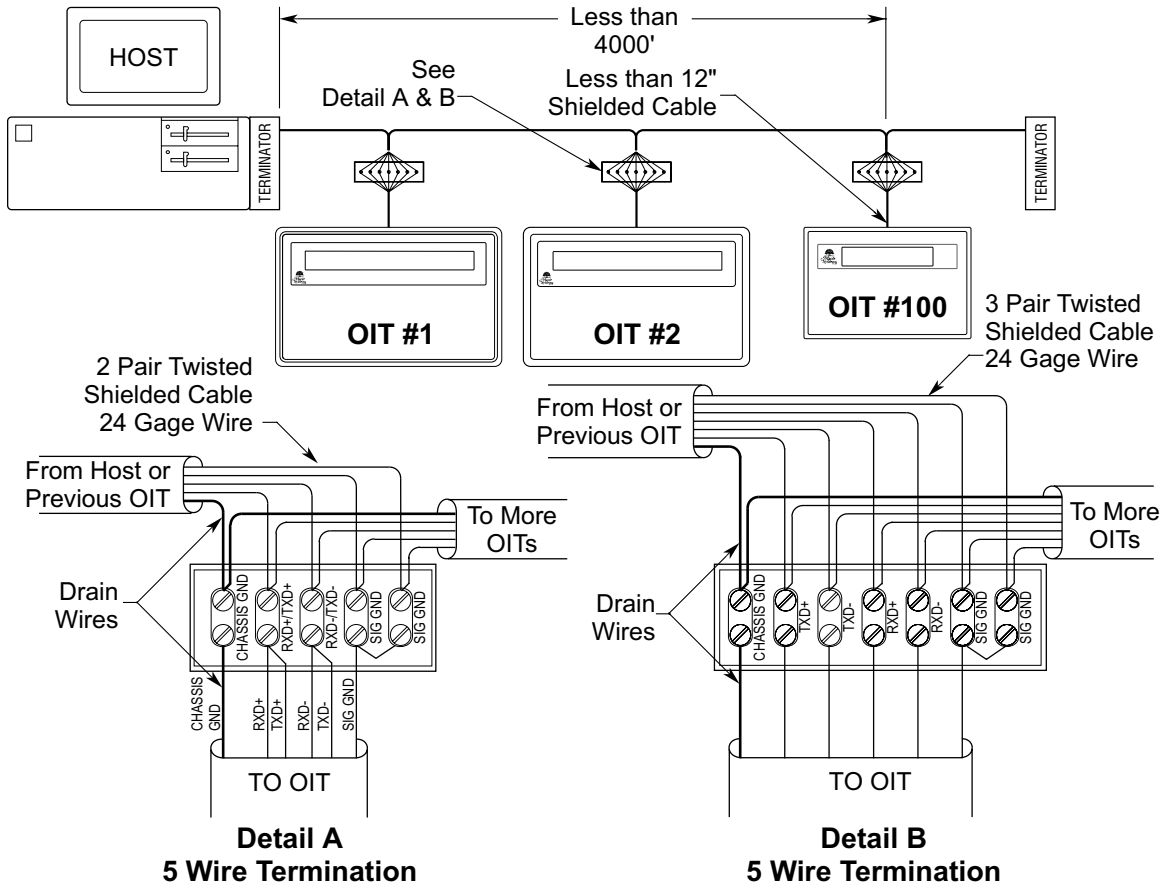
There are several different forms of communications networks. Maple Systems' OITs utilize the multidrop format. The host controller, located at one of the network ends, is connected to the OITs via a continuous com-link. Each OIT is connected to the network by locally tapping into the com-link with short stub cables. The end of the com-link must be properly terminated to reduce noise pickup and interference. The total length of the com-link, from the host controller to the network cable terminator, can be up to 4,000 feet.



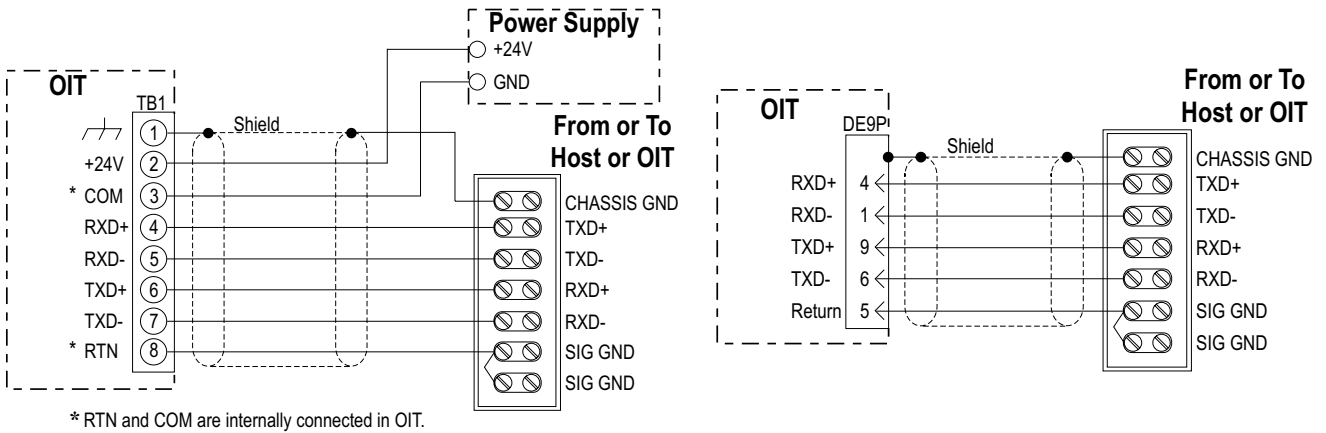
OIT Jumper

All of the OITs, except the OIT3100 and OIT4100 Series, have a jumper that must be moved when connecting the OIT to a network. Refer to the Set Jumper for Specific Protocol section in the OIT Installation Manual.

OIT Connection

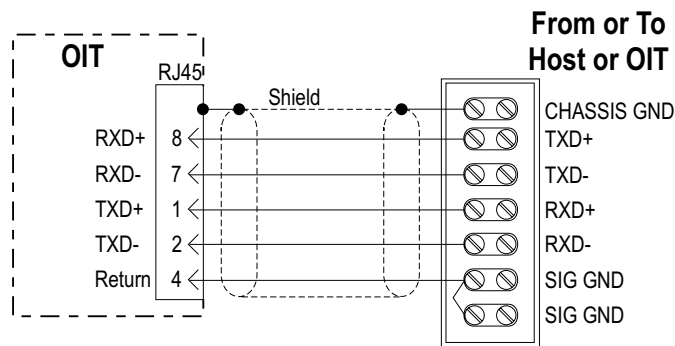


5-Wire RS-422/485 (Network mode)



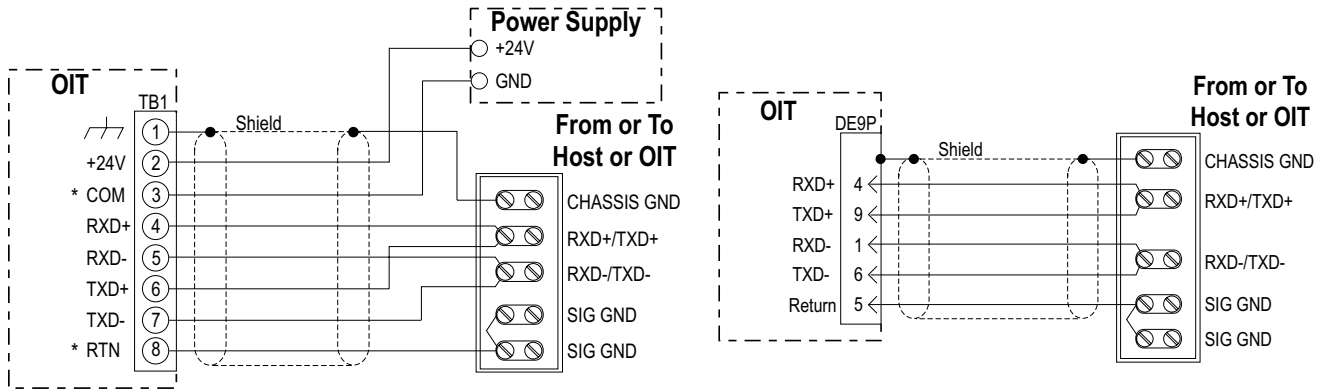
5-Wire RS-422/485 (MAP460D & OIT3600)

5-Wire RS-422/485 (all other models)

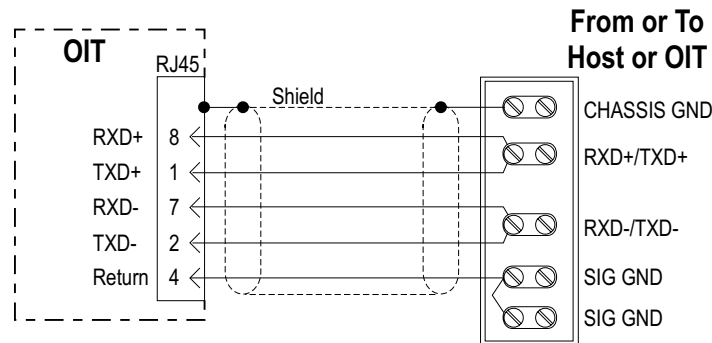


5-Wire RS-422/485 (OIT3100 and OIT4100 Series, except OIT3160/4160)

3-Wire RS-422/485 (Network mode)



* RTN and COM are internally connected in OIT.



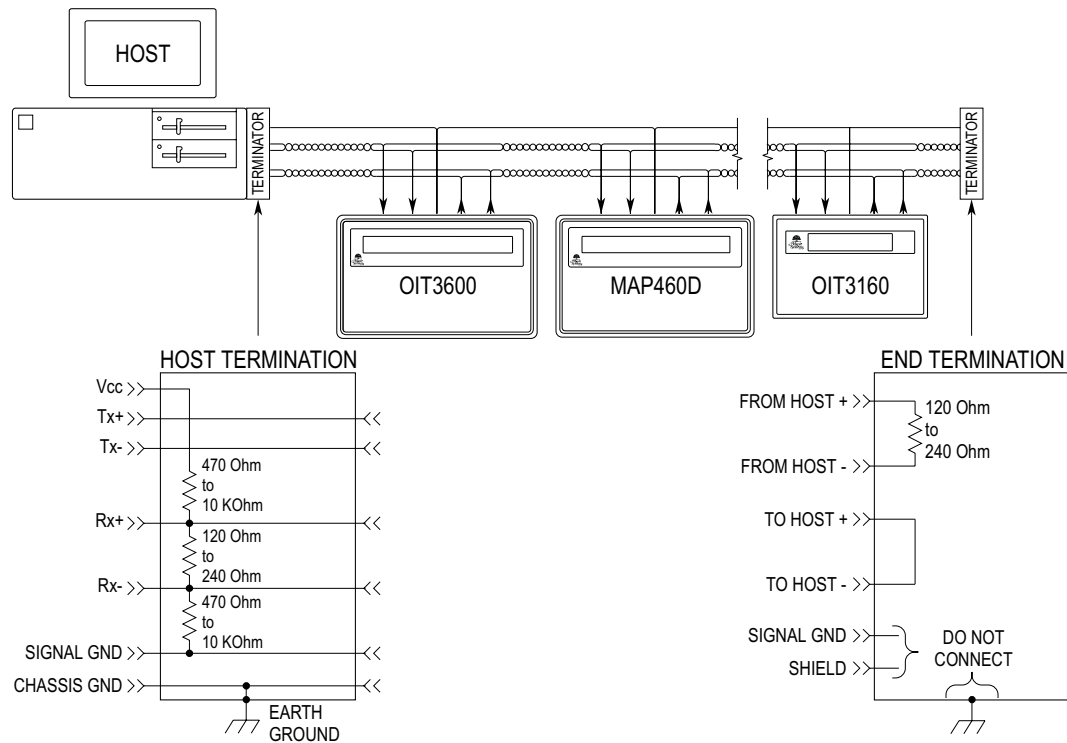
3-wire RS422/485 (OIT3100 and OIT4100 Series, except OIT3160/4160)

If you decide to use 3-wire RS-422/485, the following limitations apply:

1. The host controller must disable or tri-state its RS-485 transmitter when it is not sending data to the OITs on the network. To simplify programming, the host should disable or tri-state its RS-485 receiver whenever transmitting.
2. The ability to stay logged on to a particular OIT by sending the command terminator instead of the line terminator is not available in this mode. Therefore, each command sent from the host controller should end with the appropriate line terminator.
3. If the host controller sends a command that requires a response from the OIT, the host controller must wait for a response from the OIT before sending another command. Otherwise, a situation can occur in which the OIT and the host controller attempt to transmit at the same time causing unpredictable results.
4. The ASCII strings sent by the OIT's function keys should not include any control characters which the other OITs on the network could misinterpret, such as the line terminator or command terminator.

Network Termination

The com-link cable must be properly terminated to reduce the amount of interference and noise pickup from the surrounding environment. This is accomplished by using a termination circuit at both ends of the network cable. The following figure shows a typical termination circuit. The host termination is only needed if the host controller's RS-422/485 adapter does not contain any built-in terminator circuitry. The end termination must be done at the extreme end of the com-link cable.

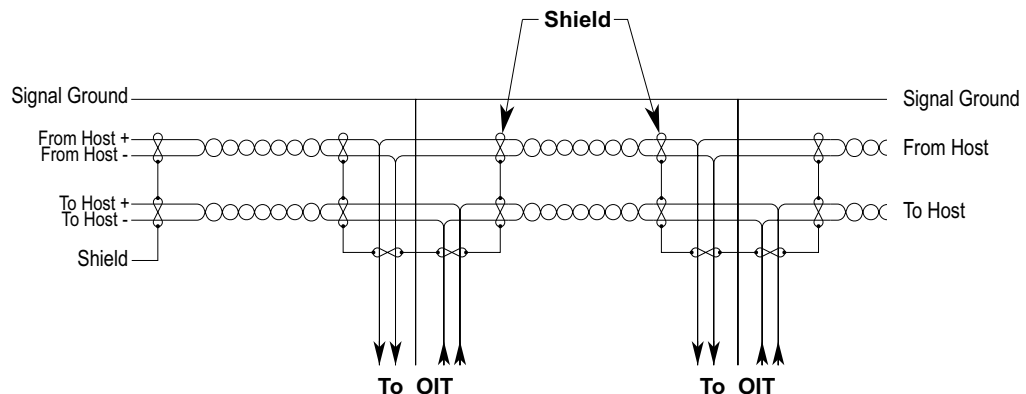


Network Grounding

To communicate properly, serious attention must be paid to the grounding scheme of the devices connected to the com-link. Improper grounding, improper termination, and faulty shielding of the com-link are the most common causes of system failure in a multidrop network.

The cable shield must not be used as the signal ground.

It is tempting to try and reduce the cost of 5-wire cabling by using a 4-wire cable with the shield used as the signal ground. **DON'T DO IT.** The initial cost savings are always exceeded by the maintenance costs once the system is operating under field conditions. It is often necessary to completely replace the network com-link with the proper cable (5-wire plus shield) to eliminate noise problems in the system.



The signal ground must not be connected to the chassis or earth ground.

The chassis or earth ground is intended as a safety ground for power supplies, EMI filters, voltage spike protection circuits, 120 VAC neutral returns, and all manner of AC and DC driven devices. As a result, the chassis or earth ground can carry large voltage potentials and currents. Connecting the signal ground to chassis or earth ground can damage the devices connected to the com-link.

CHAPTER 2

OIT Configuration

Your OIT must be configured using the STEPware-100 configuration software before it can communicate with your host controller. Refer to Chapter 1: Getting Started for instructions on creating and downloading a STEPware-100 project. After your OIT is configured, some of the OIT's operating parameters can be changed from the OIT's keyboard when the OIT is in Configuration mode. In addition, several Control Commands allow the host controller to dynamically change some of the OIT's operating parameters. This chapter explains Configuration mode and the OIT's operating parameters.

Configuration Mode

Configuration mode allows the OIT to communicate with a computer using the STEPware-100 configuration software. It also provides the ability to make quick changes to the operation of the OIT without using STEPware-100. Configuration mode can only be accessed when power is being applied to the OIT.

NOTE: If using an OIT3165/4165, OIT3175/4175 or OIT3185/4185, refer to Appendix D for the setup keyboard layout.

To place a previously configured OIT into Configuration mode:

1. While applying power to the OIT, press and hold the OIT's SETUP or CLEAR key while the following messages appear: `Initializing`, `Configuration mode!`, and `Parameters? MODIFY`.

Notes:

1. To exit configuration mode, press the OIT's CLEAR key.
2. If the `Initializing` message is followed by `Terminal Now Ready!`, the OIT did not enter Configuration mode and you need to repeat step 1.
3. If the OIT `Brightness`, `Disp View Angle`, or `Baud Rate` message displays instead of `Parameters?`, Local Setup Access has been disabled. You will need to enable Local Setup Access by connecting the OIT to a host controller and having the host controller send the Keyboard Control command to the OIT. Refer to Appendix A: Control Commands for more information. Please refer to Appendix F: Troubleshooting for more tips on entering configuration mode.
4. If the OIT's display remains blank and you hear a steady beeping, the OIT does not contain a complete project and is waiting in download mode for STEPware-100 to download a project. Refer to Chapter 1: Getting Started for instructions on creating and downloading a STEPware-100 project.

2. At **Parameters?**, press the OIT's TOGGLE key to alternate between MODIFY and VIEW, then press the OIT's ENTER key to accept and continue.

Option	Description	Result
MODIFY	Allows you to enter Download/Upload mode or modify the OIT's current operating parameters.	Displays Password? (refer to step 3) NOTE: You must start entering your password or press the OIT's ENTER key within 5 seconds, or the OIT exits Configuration mode.
VIEW	Displays the OIT's current operating parameters.	Displays the first operating parameter (refer to step 5).

3. At **Password?**, type the setup password and then press the OIT's ENTER key. If there is no setup password, just press the OIT's ENTER key. **Down/Upload mode? Y** displays.
4. At **Down/Upload mode?**, press the OIT's TOGGLE key to alternate between Y and N, then press the OIT's ENTER key to accept and continue.

Option	Description	Result
Y	Allows you to enter Download/Upload mode for communication with STEPware-100.	Displays: Ready for Transfer to/from STEPware! Refer to Chapter 1: Getting Started for instructions on creating and downloading a STEPware-100 project.
N	Displays the OIT's current operating parameters.	Displays the first operating parameter (refer to step 5).

5. The following Level 1 menus appear in order. If you select YES at a Level 1 menu, the corresponding Level 2 menus appear. If you select NO at a Level 1 menu, the next Level 1 menu appears. At any menu, press the OIT's TOGGLE key to alternate between the options.

Level 1 Menus	Level 2 Menus	Options
OIT Brightness: (MAP340D, OIT4100 Series, OIT4400, OIT4450)		30%, 50%, 75%, 100%
Disp View Angle: (MAP460D, OIT3100 Series, OIT3600)		75d, 90d
Modify communication parameters?	Baud Rate: Parity: Data Length: Stop Bits:	300, 600, 1200, 2400, 4800, 9600, 19200 NONE, ODD, EVEN, MARK, SPACE 7, 8 1, 2
Modify operating parameters?	Op Mode: Handshake: Line Term: Append LF: Local Echo: Block Echo: Turn Delay: Delayed LF: RS485 3 Wire: Network Address:	INTERACTIVE, BLOCK, NETWORK NONE, XON/XOFF, RTS/CTS, BOTH CR, LF, CR/LF, ETX ENABLED, DISABLED ENABLED, DISABLED ENABLED, DISABLED NONE, 50 MSEC, 100 MSEC, 250 MSEC NO, YES NO, YES 1 to 255
Modify display/keyboard parameters?	Tab Width: Cursor: Wrap Around: Key board: KeyClick: Setup Access: Setup Password	1 SPACE, 4 SPACES, 8 SPACES UNDERLINE, NONE ENABLED, DISABLED ENABLED, DISABLED ENABLED, DISABLED NO, YES 5 numbers in any combination
Setup correct?		YES — saves changes and exits Configuration mode. NO — returns to Down/Upload mode? (refer to step 4).

Operating Parameters

The STEP1 protocol has many operating parameters which determine how the OIT communicates to the host controller. These operating parameters can be configured using the STEPware-100 configuration software or the OIT's Configuration mode, or by sending Control Commands from the host controller. Each operating parameter is described in detail below.

OIT Display Brightness or Viewing Angle Setting

Some OIT models with LCD displays have adjustable viewing angles of 75° and 90°. A viewing angle of 75° means that the LCD provides the sharpest contrast when viewed from a point slightly below the display. An angle of 90° means that the sharpest contrast occurs when the LCD is viewed from a point perpendicular to the face of the display.

OIT models with VFD displays have adjustable brightness levels of 30%, 50%, 75%, and 100%.

To modify this parameter using **STEPware-100**:

1. Open the Configuration Editor.
2. In the OIT Display (LCD) group box, select the desired Brightness or Viewing Angle from the option buttons.

To modify this parameter in **Configuration mode**:

1. At OIT Brightness, or Disp View Angle, select the desired Brightness or Viewing Angle. Refer to the Configuration Mode section in this chapter for more information.

To modify this parameter from the **host controller**:

1. Use the Set LCD Viewing Angle or Brightness Level control command. Refer to Appendix A: Control Commands for more information.

Baud Rate Setting

This parameter determines the baud rate that the OIT uses to communicate to the host controller. Options are 300, 600, 1200, 2400, 4800, 9600, and 19200 baud. When the OIT is in Configuration mode, 9600 baud is used to communicate to STEPware-100 regardless of how this setting has been configured.

To modify this parameter using **STEPware-100**:

1. Open the Configuration Editor.
2. In the OIT - Host Serial Communications Settings group box, select the desired baud rate from the Baud Rate option buttons.

To modify this parameter in **Configuration mode**:

1. At **Baud Rate**, use the OIT's TOGGLE key to select the desired baud rate. Refer to the Configuration Mode section in this chapter for more information.

To modify this parameter from the **host controller**:

1. Use the Set Communications Parameters control command. Refer to Appendix A: Control Commands for more information.

Parity Setting

This parameter determines the parity that the OIT uses to communicate to the host controller. Options are Even, Odd, None, Mark, Space. When the OIT is in Configuration mode, no parity is used to communicate to STEPware-100 regardless of how this setting has been configured.

To modify this parameter using STEPware-100:

1. Open the Configuration Editor.
2. In the OIT - Host Serial Communications Settings group box, select the desired parity from the Parity option buttons.

To modify this parameter in Configuration mode:

1. At **Parity**, use the OIT's TOGGLE key to select the desired parity. Refer to the Configuration Mode section in this chapter for more information.

To modify this parameter from the host controller:

1. Use the Set Communications Parameters control command. Refer to Appendix A: Control Commands for more information.

Data Bits Setting

This parameter determines the number of data bits that the OIT uses to communicate to the host controller. Options are 7 Bits or 8 Bits. When the OIT is in Configuration mode, 8 data bits are used to communicate to STEPware-100 regardless of how this setting has been configured.

To modify this parameter using STEPware-100:

1. Open the Configuration Editor.
2. In the OIT - Host Serial Communications Settings group box, select the desired number of data bits from the Data Bits option buttons.

To modify this parameter in Configuration mode:

1. At **Data Length**, use the OIT's TOGGLE key to select the desired number of data bits. Refer to the Configuration Mode section in this chapter for more information.

To modify this parameter from the host controller:

1. Use the Set Communications Parameters control command. Refer to Appendix A: Control Commands for more information.

Stop Bits Setting

This parameter determines the number of stop bits that the OIT uses to communicate to the host controller. Options are 1 Bit or 2 Bits. When the OIT is in Configuration mode, one stop bit is used to communicate to STEPware-100 regardless of how this setting has been configured.

To modify this parameter using STEPware-100:

1. Open the Configuration Editor.
2. In the OIT - Host Serial Communications Settings group box, select the desired number of stop bits from the Stop Bits option buttons.

To modify this parameter in **Configuration mode**:

1. At **Stop Bits**, use the OIT's TOGGLE key to select the desired number of stop bits. Refer to the Configuration Mode section in this chapter for more information.

To modify this parameter from the **host controller**:

1. Use the Set Communications Parameters control command. Refer to Appendix A: Control Commands for more information.

Handshaking Setting

This parameter determines the type of handshaking that is used between the OIT and the host controller. Handshaking allows the host controller to regulate when the OIT sends information; preventing the OIT from overwriting the host controller's serial buffer or vice versa. Options are software handshaking (Xon/Xoff), hardware handshaking (RTS/CTS), both, or none. When the OIT is in Configuration mode, no handshaking is used to communicate to STEPware-100 regardless of how this setting has been configured.

To modify this parameter using **STEPware-100**:

1. Open the Configuration Editor.
2. In the OIT - Host Serial Communications Settings group box, select the desired handshaking in the Handshaking list box.

To modify this parameter in **Configuration mode**:

1. At **Handshake**, use the OIT's TOGGLE key to select the desired handshaking. Refer to the Configuration Mode section in this chapter for more information.

To modify this parameter from the **host controller**:

1. Use the Enable Handshaking control command. Refer to Appendix A: Control Commands for more information.

Software Handshaking

Software handshaking, which uses the Xon/Xoff format, is available only in Interactive mode. The following rules apply:

1. When the host controller sends an XOFF control code (hexadecimal 13), the OIT halts transmission of any data to the host controller until the host controller sends an XON control code (hexadecimal 11). While transmission is halted, each OIT keypress continues to be displayed on the OIT but no data is transmitted to the host controller. Instead, each character is temporarily stored in an 8 byte 'Handshake' buffer. When the handshake buffer is full, each OIT keypress causes the OIT to sound a warning beep. The data continues to be displayed on the OIT but is not stored in the Handshake buffer. Therefore, the host controller does not receive any data that is entered when the handshake buffer is full.
2. When the host controller sends the XON control code, the OIT sends the contents of the Handshake buffer to the host controller before proceeding normally.
3. The OIT has the option of sending the XOFF control code to the host controller if the host controller is sending data to the OIT faster than the OIT can process it. When the OIT sends the XOFF control code to the host controller, the OIT ignores any further transmissions from the host controller until the OIT sends the XON control code. The OIT has an internal buffer size of 200 characters. When the OIT's buffer contains 170 characters, the OIT sends the XOFF control code. The OIT sends the XON control code when the buffer is empty (the time required to empty the buffer varies according to the baud rate but is approximately 150 msec.).

Hardware Handshaking

Hardware handshaking, which uses the CTS/RTS format, is available only in Interactive and Block modes. The following rules apply:

1. OITs with two serial ports must not have a programming cable connected to the second port.
2. OITs with serial printer output capability cannot use the serial printer.
3. When the host controller deasserts the CTS line, the OIT halts transmission of any data to the host controller until the CTS line is reasserted. While transmission is halted, each OIT keypress continues to be displayed on the OIT but no data is transmitted to the host controller. Instead, each character is temporarily stored in an 8 byte 'Handshake' buffer. When the handshake buffer is full, each OIT keypress causes the OIT to sound a warning beep. The data continues to be displayed on the OIT but is not stored in the Handshake buffer. Therefore, the host controller does not receive any data that is entered when the handshake buffer is full.
4. When the host controller reasserts the CTS line, the OIT sends the contents of the Handshake buffer to the host controller before proceeding normally.
5. The OIT has the option of deasserting the RTS line if the host controller is sending data to the OIT faster than the OIT can process it. When the OIT deasserts the RTS line, the OIT ignores any further transmissions from the host controller until the OIT reasserts the RTS line. The OIT has an internal buffer size of 200 characters. When the OIT's buffer contains 170 characters, the OIT deasserts the RTS line. The OIT reasserts the RTS line when the buffer is empty (the time required to empty the buffer varies according to the baud rate but is approximately 150 msec.).

No Handshaking

This setting disables any software or hardware handshaking. Although this is the easiest to use, it is possible for the OIT to overwrite the host controller's serial buffer, or vice versa.

Operating Mode Setting

This parameter determines whether the OIT operates in Interactive, Block, or Network mode. Refer to Chapter 3: Operating Modes for more information.

To modify this parameter using **STEPware-100**:

1. Open the Configuration Editor.
2. In the OIT Operational Settings group box, select the desired operating mode from the Operating Mode option buttons.

To modify this parameter in **Configuration mode**:

1. At **Op Mode**, use the OIT's TOGGLE key to select the desired operating mode. Refer to the Configuration Mode section in this chapter for more information.

To modify this parameter from the **host controller**:

1. Use the Set Operating Mode control command. Refer to Appendix A: Control Commands for more information.

Line Terminator Setting

This parameter determines which ASCII control character is used for the line terminator. Options are CR, LF, CR/LF, or ETX. The line terminator performs different functions in Interactive, Block, and Network modes.

In all three modes, the line terminator is sent to the host controller when the OIT responds to a control command and when the OIT's ENTER key is pressed.

In Interactive mode, if local echo is enabled when the OIT's ENTER key is pressed, the line terminator is also sent to the OIT's display.

In Block or Network mode, if block echo is enabled when the OIT's ENTER key is pressed, the line terminator is also sent to the OIT's display.

In Network mode, the line terminator is used to indicate that the host controller has finished communicating to a particular OIT. The line terminator, therefore, notifies the other terminals that the next two bytes received from the host controller indicate which OIT the host controller wants to talk to.

Refer to Chapter 3: Operating Modes for more information on the use of the line terminator in Interactive, Block, and Network modes.

To modify this parameter using **STEPware-100**:

1. Open the Configuration Editor.
2. In the OIT Operational Settings group box, select the desired line terminator from the Line Terminator option buttons.

To modify this parameter in **Configuration mode**:

1. At **Line Term:**, use the OIT's TOGGLE key to select the desired line terminator. Refer to the Configuration Mode section in this chapter for more information.

To modify this parameter from the **host controller**:

1. Use the Set Line Terminator control command. Refer to Appendix A: Control Commands for more information.

Append Linefeed Setting

This parameter determines whether a linefeed LF control character (0x0A) will be appended to any carriage return CR control character (0x0D) that is sent to the OIT from the host controller. If enabled, this will cause the cursor of the OIT display to move down to the next line of the display when a CR is received from the host. This feature is useful when using controllers which can send ASCII strings followed by a CR control character but are unable to append the LF control character to any ASCII string sent. Without sending a LF control character, the host is forced to display characters on the OIT screen on one line of the display only. This feature allows any host that is unable to send the LF control character to use all of the lines of the OIT display.

To modify this parameter using **STEPware-100**:

1. Open the Configuration Editor.
2. In the OIT Operational Settings group box, select the Append Line Feed check box.

To modify this parameter in **Configuration mode**:

1. At **Append LF:**, use the OIT's TOGGLE key to enable or disable the Append Line Feed feature. Refer to the Configuration Mode section in this chapter for more information.

To modify this parameter from the **host controller**:

1. This feature cannot be changed from the host controller.

Local Echo Setting

This parameter determines whether local echo is used when the OIT is operating in Interactive mode. If enabled, each character sent to the host controller from an OIT keypress is also sent to the OIT's display.

To modify this parameter using **STEPware-100**:

1. Open the Configuration Editor.
2. In the OIT Operational Settings group box, select the Local Echo Enabled check box.

To modify this parameter in **Configuration mode**:

1. At **Local Echo:**, use the OIT's TOGGLE key to enable or disable local echo. Refer to the Configuration Mode section in this chapter for more information.

To modify this parameter from the **host controller**:

1. Use the Display Format Control control command. Refer to Appendix A: Control Commands for more information.

Block Echo Setting

This parameter determines whether block echo is used when the OIT is operating in Block or Network mode. If enabled, each character sent to the host controller from an OIT keypress is also sent to the OIT's display. If disabled, asterisks are sent to the OIT's display in place of the characters.

To modify this parameter using **STEPware-100**:

1. Open the Configuration Editor.
2. In the OIT Operational Settings group box, select the Block Echo Enabled check box.

To modify this parameter in **Configuration mode**:

1. At **Block Echo:**, use the OIT's TOGGLE key to enable or disable block echo. Refer to the Configuration Mode section in this chapter for more information.

To modify this parameter from the **host controller**:

1. Use the Display Format Control control command. Refer to Appendix A: Control Commands for more information.

Turn-Around Delay Setting

This parameter determines the amount of time the OIT waits to respond after receiving a command from the host controller. Options are No Delay, 50 msec, 100 msec, or 250 msec. Be sure to pick a turnaround delay that allows the host controller enough time to prepare for the OIT's response.

To modify this parameter using **STEPware-100**:

1. Open the Configuration Editor.
2. In the OIT Operational Settings group box, select the desired turn-around delay in the Turn-Around Delay list box.

To modify this parameter in **Configuration mode**:

1. At **Turn Delay**, use the OIT's TOGGLE key to select the desired turnaround delay. Refer to the Configuration Mode section in this chapter for more information.

To modify this parameter from the **host controller**:

1. Use the Set Turn-Around Delay control command. Refer to Appendix A: Control Commands for more information.

Delayed Linefeed Setting

This parameter determines whether the OIT executes an LF control code (hexadecimal 0A) immediately or when the next character is received. If enabled, the OIT does not execute an LF control code received from the host controller until the next character is received. If disabled, the OIT immediately executes the LF control code. This parameter is used most often with host controllers that automatically append an LF control code to each data transmission.

To modify this parameter using **STEPware-100**:

1. Open the Configuration Editor.
2. In the OIT Operational Settings group box, select the Delayed LineFeed Enabled check box.

To modify this parameter in **Configuration mode**:

1. At **Delayed LF**, use the OIT's TOGGLE key to enable or disable delayed linefeed. Refer to the Configuration Mode section in this chapter for more information.

To modify this parameter from the **host controller**:

1. Use the Display and Cursor Format Control control command. Refer to Appendix A: Control Commands for more information.

Use 3-Wire RS-485 Setting

This parameter determines whether the OIT disables the RS-485 receiver when the OIT transmits data to the host controller. If the OIT is wired to the host controller using 3-wire RS-485 half duplex communications, then this option must be enabled for the OIT to operate properly. Conversely, if the OIT is wired to the host controller using 5-wire RS-485 full duplex communications, this setting must be disabled to allow the host controller to send a command to the OIT while waiting for a response from a prior command.

To modify this parameter using **STEPware-100**:

1. Open the Configuration Editor.
2. In the OIT Operational Settings group box, select the Use 3-Wire RS-485 check box.

To modify this parameter in **Configuration mode**:

1. At **RS485 3 Wire**, use the OIT's TOGGLE key to enable or disable 3-Wire RS-485. Refer to the Configuration Mode section in this chapter for more information.

Network Address Setting

This parameter determines the network address used by the host controller to communicate with this OIT when in Network mode. Options are 1 to 255.

To modify this parameter using **STEPware-100**:

1. Open the Configuration Editor.
2. In the OIT Operational Settings group box, enter the desired network address in the Network Addr. text box.

To modify this parameter in **Configuration mode**:

1. At **Network Address**:, use the OIT's TOGGLE key to select the desired network address. Refer to the Configuration Mode section in this chapter for more information.

To modify this parameter from the **host controller**:

1. Use the Set Operating Mode control command. Refer to Appendix A: Control Commands for more information.

Tab Width Setting

This parameter determines how many spaces the OIT moves the cursor when the HT control code (hexadecimal 09) is received from the host controller. Options are 1 Space, 4 Spaces, and 8 Spaces.

To modify this parameter using **STEPware-100**:

1. Open the Configuration Editor.
2. In the OIT Operational Settings group box, select the desired tab width in the Tab Width list box.

To modify this parameter in **Configuration mode**:

1. At **Tab Width**:, use the OIT's TOGGLE key to select the desired tab width. Refer to the Configuration Mode section in this chapter for more information.

To modify this parameter from the **host controller**:

1. Use the Set Tab Character Width control command. Refer to Appendix A: Control Commands for more information.

Cursor Type Setting

This parameter determines the type of cursor used in the OIT's display. Options are No Cursor and Underline.

To modify this parameter using **STEPware-100**:

1. Open the Configuration Editor.
2. In the OIT Operational Settings group box, select the desired cursor type in the Cursor Type list box.

To modify this parameter in **Configuration mode**:

1. At **Cursor**:, use the OIT's TOGGLE key to select the desired cursor type. Refer to the Configuration Mode section in this chapter for more information.

To modify this parameter from the host controller:

1. Use the Display and Cursor Format Control control command. Refer to Appendix A: Control Commands for more information.

Wrap Around Setting

This parameter determines whether the OIT will use ‘word wrapping’ when displaying characters on the OIT screen. If disabled, any characters received from the host or from the keyboard of the OIT are displayed on the OIT screen at the location of the cursor. If the cursor is on the last column of a line, then the incoming character overwrites any character that is currently displayed on the last column and the cursor does not move.

If the wrap around feature is enabled, then the cursor will drop down to the beginning of the next line when it reaches the end of the current line.

Note: The OIT does not support the wrap around feature when the operating mode is in Block or Network mode and the character to be displayed comes from a keypress on the OIT.

To modify this parameter using STEPware-100:

1. Open the Configuration Editor.
2. In the OIT Operational Settings group box, select the Wrap Around check box.

To modify this parameter in Configuration mode:

1. At WrapAround:, use the OIT’s TOGGLE key to enable or disable the Wrap Around feature. Refer to the Configuration Mode section in this chapter for more information.

To modify this parameter from the host controller:

1. This feature cannot be changed from the host controller.

Local Keyboard Setting

This parameter determines whether the OIT’s keyboard is enabled.

To modify this parameter using STEPware-100:

1. Open the Configuration Editor.
2. In the OIT Operational Settings group box, select the Local Keyboard Enabled check box.

To modify this parameter in Configuration mode:

1. At Keyboard:, use the OIT’s TOGGLE key to enable or disable the local keyboard. Refer to the Configuration Mode section in this chapter for more information.

To modify this parameter from the host controller:

1. Use the Keyboard Control control command. Refer to Appendix A: Control Commands for more information.

Key Click Setting

This parameter determines whether an audible key click occurs whenever a key is pressed on the OIT's keyboard.

To modify this parameter using STEPware-100:

1. Open the Configuration Editor.
2. In the OIT Operational Settings group box, select the Key Click Enabled check box.

To modify this parameter in Configuration mode:

1. At **KeyClick**, use the OIT's TOGGLE key to enable or disable the local keyboard. Refer to the Configuration Mode section in this chapter for more information.

To modify this parameter from the host controller:

1. Use the Keyboard Control control command. Refer to Appendix A: Control Commands for more information.

Local Setup Setting

This parameter determines whether the OIT allows you to access Configuration mode. If this parameter is disabled, you will not be able to enter Configuration mode. Since you must enter Configuration mode to reprogram the OIT, you will not be able to reprogram the OIT until the host controller sends a Keyboard Control control command enabling local setup again.

To modify this parameter using STEPware-100:

1. Open the Configuration Editor.
2. In the OIT Operational Settings group box, select the Local Setup Enabled check box.

To modify this parameter in Configuration mode:

1. At **Setup Access**, use the OIT's TOGGLE key to enable or disable local setup. Refer to the Configuration Mode section in this chapter for more information.

To modify this parameter from the host controller:

1. Use the Keyboard Control control command. Refer to Appendix A: Control Commands for more information.

Passwords Setting

This parameter determines the five-digit numeric password used to restrict entry into Configuration mode. Configuration mode is used to change the OIT's operating parameters or to download/upload a project to/from STEPware-100.

When attempting to enter Configuration mode, the OIT prompts you to enter the Setup Password. If the default setting of "00000" has not been changed, you simply press the OIT's ENTER key to access Configuration mode. If the setup password has been changed, you must enter the correct five-digit numeric password to access Configuration mode.

NOTE: If you forget your password, call Maple Systems Technical Support department at 425-486-4477 for help accessing Configuration mode.

To modify this parameter using **STEPware-100**:

1. Open the Configuration Editor.
2. In the OIT Operational Settings group box, choose the Editor button to open the Password Editor dialog box.
3. In the Setup text box, enter a five-digit numeric password.
4. Choose the Done button.

To modify this parameter in **Configuration mode**:

1. At **Setup Password**, use the OIT's numeric keys to enter a five-digit numeric password. Refer to the Configuration Mode section in this chapter for more information.

Printer Settings

Refer to Chapter 7: Printer for more information.

CHAPTER 3

Operating Modes

Your OIT can be programmed to operate in one of three operating modes: Interactive, Block, or Network. These modes affect how the OIT sends data to and receives data from the host controller. This chapter explains the differences between the three operating modes. Refer to Chapter 2: OIT Configuration for information on how to change the operating mode.

Interactive Mode

In Interactive mode, the OIT immediately sends data to the host controller. For example, pressing the OIT's 1 key sends the ASCII character 1 to the host controller and pressing a function key sends the predefined ASCII string. Interactive mode is most often used in applications that require simple one-key responses from the OIT.

If local echo mode is enabled, any ASCII characters sent to the host controller are also displayed on the OIT. When the cursor reaches the end of the current display line, additional characters overwrite the character in the last column.

The following table lists the behavior of each OIT key in Interactive mode.

NOTE: Some keys are not available on all OIT models.

OIT Key	Data Sent to Host	Local Echo Mode Operation
0 to 9	0 to 9	Displays 0 to 9
Help (±)	-	Displays -
Toggle (.)	.	Displays .
Page Up ()	*	Displays *
Page Down ()	+	Displays +
Last Msg	(Displays (
Next Msg)	Displays)
Clear	FF	Clears the display and moves the cursor to the first position of the top line.
Delete	DEL	Deletes the character to the left of the cursor and moves the cursor one position left. If the cursor is on the first position of a line, this key has no affect. If the cursor is on the last position of a line and a character is displayed there, the character is deleted and the cursor remains on the last position of the line.

OIT Key	Data Sent to Host	Local Echo Mode Operation
Enter	Line Terminator (ETX, CR, LF, or CR/LF)	If the line terminator is ETX, this key has no affect. If the line terminator is CR, the cursor moves to the first column of the current line. If the line terminator is LF or CR/LF, the cursor moves to the first column of the next line. If the cursor is on Line #2 when an LF or CR/LF is received, any characters on Line #2 move to Line #1.
Function Keys & Screen Dependent Function Keys	Predefined ASCII String	Displays the predefined ASCII string. If the predefined ASCII string contains control characters, they are displayed as \$. When the cursor reaches the end of the current display line, additional characters overwrite the character in the last column.

Block Mode

In Block mode, when the OIT operator presses a key, the OIT sends the data to the OIT's display and stores the data in the Keyboard Input Buffer. If the cursor reaches the end of the display line, the OIT sounds an error beep and stops accepting data. Storing data in the Keyboard Input Buffer, allows the OIT operator to see the data on the OIT's display and make changes before sending the data to the host controller. When the OIT operator presses the OIT's ENTER key, the contents of the Keyboard Input Buffer are immediately sent to the host controller along with the line terminator.

Any attempt by the host controller to write to the OIT's display, clears the Keyboard Input Buffer. Therefore, the host controller should determine if the OIT operator is in the process of entering data before writing to the OIT's display. The Request Keyboard Buffer Status control command is available for this purpose. If the host controller does need to write to the OIT's display while the OIT operator is inputting data, the host controller can set up a display variable on the OIT's display using the Create Display Variable control command. Writing to a display variable allows the host controller to display time-critical data while still allowing the OIT operator to enter data. Refer to Appendix A: Control Commands for more information on the Request Keyboard Buffer Status and Create Display Variable control commands.

The following table lists the behavior of each OIT key in Block mode.

NOTE: Some keys are not available on all OIT models.

OIT Key	Operation
0 to 9	Sends 0 to 9 to the Keyboard Input Buffer and the OIT's display.
Help (±)	Sends - to the Keyboard Input Buffer and the OIT's display.
Toggle (.)	Sends . to the Keyboard Input Buffer and the OIT's display.
Page Up ()	Sends * to the Keyboard Input Buffer and the OIT's display.
Page Down ()	Sends + to the Keyboard Input Buffer and the OIT's display.
Last Msg	Sends (to the Keyboard Input Buffer and the OIT's display.
Next Msg	Sends) to the Keyboard Input Buffer and the OIT's display.
Clear	Clears the contents of the Keyboard Input Buffer, moves the cursor to the original data entry starting position, and clears all characters to the right of the cursor.

OIT Key	Operation
Delete	Deletes the last character entered into the Keyboard Input Buffer, deletes the character to the left of the cursor and moves the cursor one position left. If the cursor is at the original data entry starting position, this key has no affect. If the cursor is on the last position of a line and a character is displayed there, the character is deleted and the cursor remains on the last position of the line.
Enter	Sends the contents of the Keyboard Input Buffer immediately to the host controller along with the line terminator. Moves the cursor to the original data entry starting position.
F1 to F16 and SDF1 to SDF5	Sends the predefined ASCII string to the Keyboard Input Buffer and the OIT's display. Predefined ASCII strings are sent to the OIT's display regardless of the Send Message to Host Only setting. If the Send Message Immediately setting is checked, then the predefined ASCII string is sent immediately to the host not the Keyboard Input Buffer. Therefore, the ENTER key does not need to be pressed to send the string to the host. If the predefined ASCII string contains control characters, they are displayed as a \$. If the predefined ASCII string is longer than the number of character spaces available for data entry, only the characters that fit on the OIT's display are sent to the Keyboard Input Buffer and an error beep sounds to indicate buffer overflow. Function keys configured as momentary send both the "on" and "off" ASCII strings. However, the "on" ASCII string is only sent once regardless of the repeat settings.

Network Mode

If multiple OITs are connected to one host controller, then the OITs must be configured to operate in Network mode. The host controller, which operates as the network master and polls the OITs for responses, must initiate all communications. To prevent all of the OITs on the network from responding at the same time, an addressed message scheme is used for the network protocol.

Sending Data to the OITs

To communicate with a particular OIT, the host controller sends that OIT's network address in hexadecimal as two ASCII characters. This is called "logging on" to the OIT. The host controller can then communicate with that OIT, the same as in Block mode. The host controller must send a line terminator to "log off" or close communications with that OIT before addressing another OIT.

The line terminator alerts all OITs on the network that a new communication session is about to begin, and that the next two characters sent will be an OIT's network address. Each OIT on the network compares the network address sent by the host controller with its own network address. If they match, the OIT responds to any characters sent by the host controller. If they do not match, the OIT monitors the data stream for the next line terminator sent.

Since the line terminator is used by the host controller to "log off" or close communications with one OIT before starting to talk to another, if the host controller wants to remain logged on to the current OIT, the host controller must send the command terminator (STX) with control commands, instead of the line terminator. After the host controller sends a command that ends with the command terminator, further commands or data sent to the current OIT do not have to include the OIT's network address. It is important to note that the OIT always includes its network address and a line terminator when responding to the host controller.

When using Network mode, always follow these rules:

1. Every OIT on the network must be assigned a unique network address.
2. Every OIT on the network must be programmed to use the same line terminator.
3. Always have the host controller send a line terminator immediately before sending an OIT network address. There are two reasons for this:
 - If one of the OITs on the network suddenly loses power and reinitializes, it will not know what “state” the communications session is in. Therefore, it will not respond to the host controller until the host controller sends a line terminator.
 - If any other characters are present on the data line between the time that the host controller sends the line terminator and the network address, the OIT that the host controller is attempting to communicate to may not “log on” because the OIT thinks that the host controller is logged on to another OIT.

Receiving Data from the OITs

When the host controller sends data that requires a response from the OIT, the OIT immediately responds (unless turnaround delay is used). The OIT responds by sending its hexadecimal network address as two ASCII characters followed by the requested data and the line terminator. Each command that requests data is answered separately by the OIT.

As in Block mode, any OIT keypad input is sent to the OIT’s display and the Keyboard Input Buffer. However, once the OIT’s ENTER key is pressed, the contents of the Keyboard Input Buffer are transferred to the Keyboard Output Buffer and the OIT no longer accepts keypad input until the host controller either polls or clears the OIT’s Keyboard Output Buffer. If an attempt is made to enter additional data, the OIT sounds an error beep. If a function key is pressed that has the Send Message Immediately setting enabled, then the output is sent directly to the Keyboard Output Buffer along with any other contents of the Keyboard Input Buffer, just as though the operator had pressed the ENTER key. The OIT will no longer accept keypad input until the host controller either polls or clears the OIT’s Keyboard Output Buffer. If an attempt is made to enter additional data, the OIT sounds an error beep.

Refer to Appendix A: Control Commands for information on the Clear Output Buffer and Poll OIT Buffer control commands.

Sending the Same Data to all OITs

The host controller can send an identical message to all of the OITs on the network by using the global broadcast address of “00”. The OITs do not transmit any data to the host controller when the global address is used; this prevents the OITs from corrupting each other’s messages by trying to talk at the same time. After sending a global broadcast, before the host controller can begin a session with one particular OIT, the host controller must send the line terminator to “log off” all of the OITs on the network.

Network Addressing

The addressing range allowed for networked OITs is from 1 to 255. This implies that up to 255 OITs can be connected to one network. However, the actual number will likely be less, and is due to the loading characteristics of the network connection. Factors such as baud rate, impedance and capacitive loading of the communications line, line impedance of the RS-485 drivers, and total number of OITs on the network all affect performance. If network performance becomes degraded, you may need network boosters or repeaters to increase the number of OITs on the network. For more information on sources for network boosters or repeaters, contact Maple Systems Technical Support at 425-486-4477.

Sample Network Session

Below is a sample session showing a host controller communicating with three OITs on a multidrop network. The OITs have network addresses of 1, 30, and 100. The line terminator is set to ETX.

NOTE: Spaces are shown for clarity only and should not be used.

Source	Message	Description
Host	00 ESC m 25 ETX	The host controller sends a global command telling all terminals to display Message #25. Notice that the host controller ended with a line terminator. This “logs off” all of the OITs.
Host	01 ESC e HELLO! STX	The host controller sends an echo command as a “log on” to OIT #1. Notice that the host controller ends with a command terminator instead of a line terminator. This allows the host controller to continue communicating with OIT #1 without having to send another network address.
OIT #1	01 HELLO! ETX	OIT #1 responds with its network address, the characters received from the host controller, and a line terminator.
Host	ESC ? STX	The host controller requests the keyboard status of OIT #1. Notice that the host controller does not specify a network address, since the host controller has not sent a line terminator yet.
OIT #1	01 0 ETX	OIT #1 responds that no characters are currently stored in the Keyboard Input Buffer and ends with a line terminator.
Host	ESC e BYE! ETX	The host controller sends an echo command as a “log off” to OIT #1. Notice that the host controller ended with a line terminator. Now the other OITs will listen for a new network address.
OIT #1	01 BYE! ETX	OIT #1 responds with its network address, the characters received from the host controller, and a line terminator.
Host	1E ESC w 5 ETX	The host controller “logs on” to OIT #30 and creates a five character display variable at the current cursor position. Notice that the host controller ended with a line terminator to “log off” OIT #30.
Host	64 ESC p STX	The host controller “logs on” to OIT #100 and polls the Keyboard Output Buffer contents.
OIT #100	64 <i>data from F3 keypress</i> ETX	OIT #100 responds with its network address, the contents of the Keyboard Output Buffer (which happens to contain the ASCII string sent when the F3 key was pressed), and the line terminator.
Host	ESC r ETX	The host controller asks OIT #100 to resend the last transmission.
OIT #100	64 <i>data from F3 keypress</i> ETX	OIT #100 resends the last transmission and ends with the line terminator.

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CHAPTER 4

Using the OIT's Display

The OIT displays data input from the OIT's keypad, data sent from the host controller, and data stored in predefined messages. When a printable ASCII character is sent to the OIT's display, it is displayed at the OIT cursor's current location (unless the host controller is writing to a display variable). The cursor is then advanced one column to the right on the current display line. If the cursor is on the last column of the line, it does not move, (unless the wrap around feature is enabled).

The host controller can send control commands and control codes which move the cursor to different locations on the screen, clear the screen, perform a line feed, create a display variable, scroll the screen, etc.

Extended Character Set

In addition to the standard printable ASCII characters, each OIT model has an extended character set which can be displayed. Refer to Appendix C: Extended Character Sets for a list of the extended characters available on your OIT and the ASCII codes the host controller should send to display them.

To insert an extended character into a predefined message:

1. Start STEPware-100.
2. Open a project that has been configured for your OIT.
3. Display the message you want to insert the extended character into.
4. Position the cursor in the message where you want to insert the extended character.
5. Press F2 to open the Insert Special Character dialog box.
6. Using the arrow keys, select the special character.
7. Choose the Add To List button. The selected special character displays in the text box next to the Add To List button.
8. Choose the Done button to return to the STEPware-100 main screen. The special character displayed in the text box next to the Add To List button displays in the Message Editor.

Displaying Text from the OIT's Keypad

In Interactive mode, to display text from the OIT's keypad, local echo must be enabled. Refer to Chapter 2: OIT Configuration for more information on enabling local echo.

In Interactive mode (with local echo enabled), Block mode, or Network mode, any ASCII characters sent to the host controller or Keyboard Input Buffer by pressing keys on the OIT's keypad, are also sent to the OIT cursor's current location in the OIT's display. When the cursor reaches the end of the current display line:

- in Interactive mode, additional characters overwrite the character in the last column, unless the word-wrap feature is enabled. If word-wrap is enabled, the cursor moves to the next line of the display.
- in Block or Network mode, the OIT sounds an error beep and stops accepting keypad input.

In Network mode, once the OIT's ENTER key is pressed, the OIT no longer accepts keypad input until the host controller either polls or clears the OIT's Keyboard Input Buffer. If an attempt is made to enter additional data, the OIT sounds an error beep. Refer to Appendix A: Control Commands for information on the Clear Output Buffer and Poll OIT Buffer control commands.

Some of the OIT's keys behave differently in Interactive mode than they do in Block and Network modes. The following table lists the behavior of each OIT key in Interactive, Block, and Network modes.

NOTE: Some keys are not available on all OIT models.

OIT Key	Interactive Mode	Block & Network Modes
0 to 9	Displays 0 to 9	Displays 0 to 9
Help (\pm)	Displays -	Displays -
Toggle (.)	Displays .	Displays .
Page Up ()	Displays *	Displays *
Page Down ()	Displays +	Displays +
Last Msg	Displays (Displays (
Next Msg	Displays)	Displays)
Clear	Clears the display and moves the cursor to the first position of the top line.	Moves the cursor to the original data entry starting position and clears all characters to the right of the cursor.
Delete	Deletes the character to the left of the cursor and moves the cursor one position left. If the cursor is on the last position of a line and a character is displayed there, the character is deleted and the cursor remains on the last position of the line. If the cursor is on the first position of a line, this key has no affect unless word wrap is enabled. With word wrap enabled, the character in the last position of the line above is deleted and the cursor moves to that position.	Deletes the character to the left of the cursor and moves the cursor one position left. If the cursor is at the original data entry starting position, this key has no affect. If the cursor is on the last position of a line and a character is displayed there, the character is deleted and the cursor remains on the last position of the line.
Enter	If the line terminator is ETX, this key has no affect. If the line terminator is CR, the cursor moves to the first column of the current line. If the line terminator is LF or CR/LF, the cursor moves to the first column of the next line. If the cursor is on Line #2 when an LF or CR/LF is received, any characters on Line #2 move to Line #1.	Moves the cursor to the original data entry starting position.

OIT Key	Interactive Mode	Block & Network Modes
Function Keys & Screen Dependent Function Keys	Displays the predefined ASCII string or, if the Display Message feature is enabled, the predefined message. If the predefined ASCII string contains control characters, they are displayed as \$. When the cursor reaches the end of the current display line, additional characters overwrite the character in the last column unless the word wrap feature is enabled, in which case, the cursor drops to the next line of the display.	Displays the predefined ASCII string or, if the Display Message feature is enabled, the predefined message. If the predefined ASCII string contains control characters, they are displayed as \$. If the predefined ASCII string is longer than the remainder of the line on the OIT's display, only the characters that fit are displayed.

Displaying Text from the Host Controller

The host controller can send data to the OIT's display by simply sending printable ASCII characters or by sending control commands and control codes.

Printable ASCII characters are immediately displayed at the OIT cursor's current location. The cursor is then advanced one position to the right on the current display line. When the cursor reaches the end of the current display line, additional characters overwrite the character in the last column and the cursor does not move, unless the word wrap feature is enabled, in which case, the cursor drops to the next line of the display.

In addition to the standard printable ASCII characters, the host controller can also display characters from the OIT's extended character set. Refer to Appendix C: Extended Character Sets for a list of the extended characters available on your OIT and the ASCII codes the host controller should send to display them.

The host controller can control the location of data on the OIT's display by sending control commands and control codes. For example, to move the OIT's cursor down to the next line, the host controller sends the LF control code (hexadecimal 0A). To move the OIT's cursor to Line #2 Column #10, the host controller sends the Set Cursor Position control command (**ESC x 10 2 terminator**). Refer to Appendix A: Control Commands and Appendix B: Control Codes for a complete description of the available control commands and control codes.

The OIT continuously monitors the host controller for data. Therefore, the host controller can send data to the OIT at any time. The OIT uses a 200 byte internal storage buffer for incoming data from the host controller. This buffer can fill up if the host controller sends data faster than the OIT processes it. If this occurs, use software or hardware handshaking to control the rate of data transfer. Refer to Chapter 2: OIT Configuration for information on software and hardware handshaking.

Using a Display Variable

One display variable can be defined at any time on the OIT's display using the Create Display Variable control command. A display variable allows the host controller to set aside a portion of the OIT's display for specific data. When writing to the display variable using the Write Display Variable control command, the host controller does not have to worry about where the OIT's cursor is positioned or whether the OIT operator is in the middle of entering data. One typical use for display variables is to set aside a location for displaying time-critical data such as error messages. Following is information

on creating, writing to, and deleting display variables. Refer to Appendix A: Control Commands and Appendix B: Control Codes for more information.

To create a display variable:

1. Have the host controller position the OIT's cursor in the location where you want to start the display variable.
2. Have the host controller send the Create Display Variable control command (`ESC w length terminator`). The area allocated for the display variable is cleared, starting at the OIT cursor's current location, and the OIT's cursor is placed to the right of the display variable.

To write to a display variable:

1. Have the host controller send the Write Display Variable control command (`ESC v text terminator`). The new text overwrites the existing contents of the display variable. If the text sent is longer than the display variable, the excess characters are ignored.

NOTE: If the new text is shorter than the existing text, the part of the existing text that is longer than the new text will still be visible in the OIT's display.

To delete a display variable:

1. Have the host controller send the FF control code.

NOTE: The FF control code clears the entire display not just the display variable.

Displaying Text from Predefined Messages

In some applications, the OIT may be required to display many messages to the OIT operator concerning the state of the control system. If these messages are always the same, they can be stored in the OIT and displayed whenever the host controller requests them. The OIT has the ability to store up to 500 predefined messages. Each predefined message can be as long as the number of characters per line on the OIT and can contain printable ASCII characters and characters from the extended character set.

To display a predefined message, the host controller sends the Display Message control command (`ESC m message# terminator`). When the OIT receives the Display Message control command, the requested message displays at the OIT cursor's current location. If the message is longer than the number of character spaces remaining on the current display line, the message is truncated, unless word wrap is enabled.

For example, the OIT programmer configured Message #25 to read "**This is a message text string!**". The following message is displayed on the OIT (notice the location of the cursor in Line #2):

```
This is the first line of the display
Cursor is here: _
```

When the host controller requests Message #25 by sending the Display Message control command (`ESC m 25 terminator`), Message #25 is displayed starting at the OIT cursor's current position in Line #2:

```
This is the first line of the display
Cursor is here: This is a message text s!
```

Notice that part of Message #25 has been truncated with the last character of the message located in the last position of Line #2. Refer to Appendix A: Control Commands for more information on the Display Message control command.

Optional Settings for Predefined Messages

Each predefined message can be configured with optional controls which the OIT will perform either before or after a message is displayed on the OIT screen. These controls are provided to minimize the amount of commands that must be sent from the host in order to format the OIT display screen.

Controls used before displaying the message: Each predefined message can be tagged with one of the following controls. These controls are performed on the OIT before the message is displayed:

- No Action - selecting this option means that nothing is done to the OIT display before the predefined message is displayed.
- Clear Screen - the OIT clears the entire screen and homes the cursor.
- Clear Line - the OIT clears the entire line that the cursor is located on and moves the cursor to the beginning of the line.
- Clear to End of Line - the OIT clears the entire line starting at the current position of the cursor.

Controls used after displaying the message: Each predefined message can be tagged with one of the following controls. These controls are performed on the OIT display after the message is displayed:

- No Action - selecting this option means nothing is done to the OIT display after the predefined message is displayed.
- CR (Carriage Return) - the OIT moves the cursor to the beginning of the line that the cursor is on after the message is displayed.
- LF (Line Feed) - the OIT moves the cursor to the beginning of the next line after the message is displayed.
- VT (Vertical Tab) - the OIT performs a 'reverse line feed' by moving the cursor to the beginning of previous line after the message is displayed.
- Cursor to Start of Msg - the OIT moves the cursor to the first character of the message that was just displayed.

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CHAPTER 5

Using the OIT's Function Keys

The OIT's function keys provide the ability to create a predefined string of characters called 'ASCII Strings' that can be sent to the host controller whenever the function key is used. Each function key can also be programmed to display the ASCII Strings on the OIT screen or to display some predefined message. Each function key can be configured to perform in a specific manner, such as simulating a push on/off switch or as a momentary switch. This allows maximum flexibility when designing the function keys.

General Features

Each function key can be individually programmed with the following features. Please note that some of the features may or may not be available to the function key depending upon what type of 'action' the function key is to perform.

Function Key Action

Each function key can be programmed to perform a specific 'action' that characterizes how the key is to operate. Once the 'action' of the function key is selected, the function key behaves differently when pressed or released, according to the following:

- Disabled - if the function key is disabled, then it will not do anything when the key is pressed or released. This allows you to 'remove' function keys from the OIT keyboard that are not needed.
- Push On/Off - this action enables the function key to simulate a push on/off mechanical switch. The function key has two states- the ON state and the OFF state. Whenever the function key is pressed, it will alternate between the two states.
- Momentary - this action enables the function key to simulate a momentary or pushbutton mechanical switch. The function key has two states- the ON state and the OFF state. When the function key is pressed and held down, the ON state is active. When the function key is released, the OFF state is active.
- Shifted Function Key - this action, when used with a function key that is configured as a SHIFT key, allows the function key to behave much like a key on a typewriter or computer keyboard. When the function key is pressed without the SHIFT key, the 'unshift' or ON state is active. When the function key is pressed with the SHIFT key, the 'shift' or OFF state is active.
- SHIFT key - this action configures the function key to behave as a SHIFT key that allows Shifted Function Keys as described above to work. Whenever the SHIFT key is held down, the secondary action of any Shifted Function key will be active if that key is then pressed.
- DELETE key - this action allows the function key to behave as a Delete key, enabling the OIT operator to delete characters on the OIT display. This action is only available on OIT models that do not have a predefined DELETE key, (such as the OIT3100 and OIT4100 Series). The DELETE key will behave differently according to the operating mode used. Refer to Chapter 3: Operating Modes for more information.

- ENTER key - this action allows the function key to behave as an ENTER key, enabling the OIT operator to send a line terminator to the host and perform other actions when the OIT is in Block or Network mode. This action is only available on OIT models that do not have a predefined ENTER key, (such as the OIT3100 and OIT4100 Series). The ENTER key will behave differently according to the operating mode used. Refer to Chapter 3: Operating Modes for more information.
- CLEAR key - this action allows the function key to behave as a CLEAR key, enabling the OIT operator to send a line terminator to the host and perform other actions when the OIT is in Block or Network mode. This action is only available on OIT models that do not have a predefined ENTER key, (such as the OIT3100 and OIT4100 Series). The ENTER key will behave differently according to the operating mode used. Refer to Chapter 3: Operating Modes for more information.

Function Key ASCII Strings

Two ASCII text strings can be created and assigned to each function key. Two strings provide the function key with the ability to simulate a momentary or on/off switch or provide two selections when the function key is configured as a shifted function key. Each string can contain up to 40 ASCII characters including control characters. The two ASCII strings are referred to as the Key ON (Unshifted) Message and the Key OFF (Shifted) Message. These strings are sent to the host according to what action the function key is configured as (see above). These strings are also sent to the OIT display if the following conditions are met:

- Interactive Mode:
 1. Local Echo option is enabled
 2. Send Message to Host Only option is disabled
 3. Display Message option is not used
- Block or Network Mode:
 1. Block Echo is enabled
 2. Display Message option is not used

Displaying Predefined Messages using Function Keys

The predefined messages that are created on the main screen of the STEPware-100 configuration software are stored in the OIT and can be displayed on the OIT screen either through a control command call from the host computer (refer to Appendix A: Control Commands) or by configuring the function keys to display the message. Although the OIT can store up to 500 messages, each function key is limited to displaying Messages #1-60.

The feature allows the OIT operator to send an ASCII string to the host while displaying one of the predefined messages on the OIT that may describe the action just taken. This feature is particularly useful when the ASCII string sent to the host is a command that is not displayable on the OIT screen (because it contains mostly control characters that cannot be represented on the OIT screen). For instance, a command is sent from one of the function keys to stop a motor: ESC 1E S 0 CR. Instead of displaying the command sent to the host, (which doesn't mean anything to the OIT operator), a message is displayed on the OIT screen which says, "**Motor has been stopped!**". This helps provide the OIT operator with confirmation that the key he has pressed has performed an action.

Each state of the function key can be configured to send a predefined message to the OIT screen. This allows a different message to be displayed depending upon the action of the key, (i.e. momentary, push on/off, etc.). For each function key, the OIT programmer has the option of selecting Message#1-30 for the ON state (Key ON Message) and Message#31-60 for the OFF state (Key OFF Message). When using this feature, the ASCII string configured to be sent to the host is not sent to the OIT display. Instead, the predefined message is sent.

This feature is also useful for function keys that are configured as momentary with the Repeat Key feature enabled. Normally, if the Repeat Key feature is enabled, then pressing and holding down the momentary function key will cause the ASCII String to be sent to the host and the display (if local echo is enabled) at the repeat key rate. If the OIT programmer wants something to be displayed on the OIT screen when this function key is pressed, but he doesn't want the text string to be repeated every time another ASCII String is sent to the host, then he simply programs the repeat key to display a predefined message. This message will only be displayed once, when the key is first pressed.

Note that when the OIT is operating in NETWORK mode, the function keys cannot use this feature. Also, the predefined message option is only available in BLOCK mode if the **Send Immediately** feature is enabled.

Send Message to Host Only

If a function key is configured with this option enabled, then when the OIT is operating in Interactive mode, the ASCII string that is sent to the host is not displayed on the OIT screen even though the local echo feature is enabled. This allows a function key to send a command to the host without causing any other action to occur on the OIT.

Note that this feature is not available when the OIT is operating in BLOCK or NETWORK modes.

Send Message Immediately

If the OIT is in BLOCK or NETWORK modes, all ASCII string data sent to the host from function keys are normally stored into the Keyboard Input Buffer. This allows the OIT operator to view and edit the ASCII string data on the OIT screen before it is sent to the host. The data is not sent to the host until the ENTER key is pressed on the OIT.

If this feature is enabled for a function key, then the ASCII string data is sent directly to the host when the function key is used. The ENTER key is not required. This allows the OIT to operate in BLOCK or NETWORK mode for data entry without sacrificing immediate commands that are sent from function keys.

Function Keys as Push-on/Push-off Switches

When a push-on/push-off function key is pressed, the Key ON Message is sent to the host controller. When pressed again, the Key OFF Message is sent. If you want the push-on/push-off function key to send the same ASCII string every time it is pressed, you need to configure the Key OFF Message to be the same as the Key ON Message.

Configuring a Push-on/Push-off Function Key

1. In STEPware-100, press F5 to open the Function Key Editor dialog box.

2. In the Assignment group box, select the appropriate option button.
3. In the Action drop down list box, select Push On/Off.
4. In the Key ON Message group box, choose the Edit button to display the Function Key ASCII String Editor dialog box.
5. Enter your ASCII string in the Char. row of the table.
 - To enter printable ASCII characters, just press the appropriate key on the PC's keyboard.
 - To enter non-printable ASCII characters, either double click in the Char. row or choose the Non-Printable button to display the Non-Printable Characters dialog box. Select a non-printable character by double clicking on one of the available non-printable characters. If you do not see the non-printable character you wanted, pressing the Extended button will display a dialog box that allows you to enter ASCII character codes from 128 to 255.
6. Choose the Done button to return to the Function Key Editor dialog box.
7. If you want to program a Key OFF Message, repeat steps 4 through 6 using the Edit button in the Key OFF Message group box.
8. Select the other options as described in the General Features section.

Function Keys as Momentary Switches

When a momentary function key is pressed, the Key ON Message is sent to the host controller. When released, the Key OFF Message is sent. If you want the Key ON Message sent continuously until the function key is released, you need to enable the Repeat feature. The Repeat feature includes the following options:

- Interval — allows you to set the time interval, 10 msec to 30 sec, between transmissions of the Key ON Message.
- Max. Times — allows you to set the maximum number of times, 0 to 1,000, that the Key ON Message is resent. Once this limit is reached, the function key is no longer recognized until it is released and pressed again. A value of 0 allows the Key ON Message to be sent continuously as long as the function key is pressed.

NOTE: The Repeat feature is not supported in Block and Network modes since both have limited buffers which would be quickly overridden.

NOTE: If local echo is enabled in Interactive mode, the Key ON Message is sent to the OIT's display. If you are using the Repeat feature, the OIT's display can fill quickly. To keep the Key ON and Key OFF Messages from displaying, you need to select the Send Message To Host Only option when configuring each function key.

Configuring a Momentary Function Key

1. In STEPware-100, press F5 to open the Function Key Editor dialog box.
2. In the Assignment group box, select the appropriate option button.
3. In the Action drop down list box, select Momentary.
4. In the Key ON Message group box, choose the Edit button to display the Function Key ASCII String Editor dialog box.
5. Enter your ASCII string in the Char. row of the table.
 - To enter printable ASCII characters, just press the appropriate key on the PC's keyboard.
 - To enter non-printable ASCII characters, either double click in the Char. row or choose the Non-Printable button to display the Non-Printable Characters dialog box. Select a non-printable character by double clicking on one of the available non-printable characters. If you do not see the non-printable character you wanted, pressing the Extended button will display a dialog box that allows you to enter ASCII character codes from 128 to 255.

6. Choose the Done button to return to the Function Key Editor dialog box.
7. If you want to program a Key OFF Message, repeat steps 4 through 6 using the Edit button in the Key OFF Message group box.
8. If you want to use the Repeat feature, in the Repeat group box, select the Enable check box and then set the Interval and Max. Times.
9. Select the other options as described in the General Features section.

Shifted Function Keys

Each shifted function key has two states: normal and shifted. The function key is always in the normal state unless a SHIFT key is being pressed. In the normal state, when the function key is pressed, the Key ON (or Unshifted) Message is sent to the host controller. If a SHIFT key is being pressed, the function key goes into the shifted state. In the shifted state, when the function key is pressed, the Key OFF (or Shifted) Message is sent to the host controller.

Configuring a Shifted Function Key

1. In STEPware-100, press F5 to open the Function Key Editor dialog box.
2. In the Assignment group box, select the function key.
3. In the Action group box, select the appropriate option button- Shifted F. Key.
4. In the Key ON ((Unshifted) Message group box, choose the Edit button to display the Function Key ASCII String Editor dialog box.
5. Enter your ASCII string in the Char. row of the table.
6. Choose the Done button to return to the Function Key Editor dialog box.
7. To program a Key OFF (Shifted) Message, repeat steps 4 through 6 using the Edit button in the Key OFF Message group box.
8. Select the other options as described in the General Features section.

Disabling a Function Key

If your application does not require all of the OIT's function keys, the unused function keys can be disabled so that no action occurs when the key is pressed. When you create a new project using STEPware-100 the function keys default to disabled.

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CHAPTER 6

LED and Printer Operation

Using the OIT's LEDs

Some of the OIT models which support the STEP1 protocol have LEDs which can be activated by control commands sent from the host controller. These LEDs can be split into three categories:

- Function Key LEDs — located next to each function key. Each function key LED is referenced according to the function key it is next to. For example, the LED next to Function Key #7 is Function Key LED #7.
- Status LEDs — a row of eight LEDs. On the OIT3250 each status LED is labeled with a number, 1 through 8. The OIT4450 and OIT5400 have a slide-in legend that lets you customize the label for each status LED.
- System LEDs — four LEDs with predefined labels: MESSAGE, ALARM, RUN, and PRINT. The labels define the function of each system LED when the OIT is operating with one of Maple Systems' PLC (programmable logic controller) protocols included in the OITware-200 configuration software. Since the STEP1 protocol allows you to use these LEDs for any purpose, the labels assigned to each system LED do not necessarily indicate their function.

None of these LEDs are used by the OIT. Therefore, you can define the function of each LED. The host controller causes the LEDs to turn on, turn off, or blink using the following control commands:

- Function Key LED control command (`ESC X functionLED# mode terminator`)
- Status LED control command (`ESC Y statusLED# mode terminator`)
- System LED control command (`ESC Z systemLED# mode terminator`).

Refer to Appendix A: Control Commands for more information on the control commands.

Using a Serial Printer

Some of the OIT models which support the STEP1 protocol have a second serial port that can be used to attach a serial printer. When a serial printer is attached to the OIT, the host controller can send the contents of the OIT's display or a string of ASCII characters, both printable and control, to the printer using the following control commands:

- Print Screen control command (`ESC O terminator`)
- Print Text control command (`ESC P text terminator`).

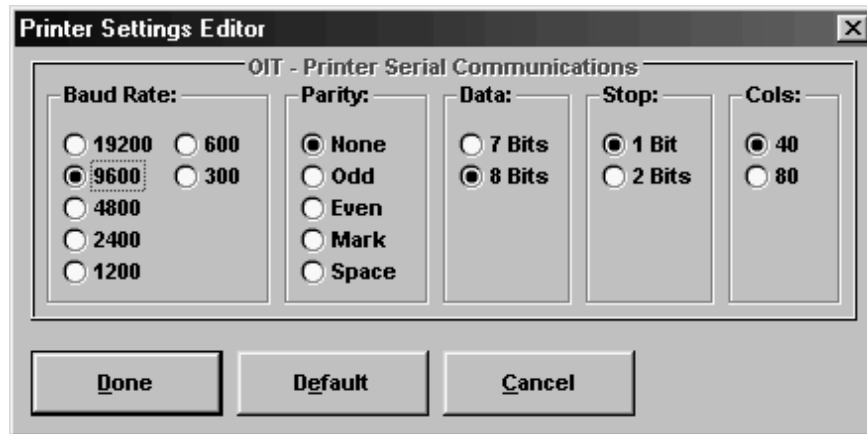
Refer to Appendix A: Control Commands for more information.

The attached serial printer will treat certain ASCII control characters as formatting requests (refer to the printer's manual). By embedding these ASCII control characters into the text sent with the Print Text control command, you can format the printed output.

Refer to the OIT's Installation Manual for information on wiring.

To configure your STEPware-100 project for use with your printer:

1. Start STEPware-100.
2. Open your project.
3. Press F4 to open the Configuration Editor.
4. From the Printer group box, choose the Editor button to open the Printer Settings Editor dialog box.



5. From the Baud Rate group box, select the option button to match your printer's baud rate setting.
6. From the Parity group box, select the option button to match your printer's parity setting.
7. From the Data group box, select the option button to match your printer's data bit setting.
8. From the Stop group box, select the option button to match your printer's stop bit setting.
9. From the Cols group box, select the option button to match the width of your printer. If you printer is wider than 80 columns, you will only be able to use the first 80 columns.
10. Choose the Done button to return to the Configuration Editor.
11. Choose the Done button to return to the STEPware-100 main screen.

APPENDIX A

Control Commands

Control commands are multiple ASCII characters, starting with the command initiator (ESC control character) and ending with the command terminator (STX control character) or line terminator. These commands allow the host controller to request and send information to the OIT. Control commands are always sent by the host controller to the OIT.

The first letter after the command initiator is the command letter. The command letter determines which action the OIT performs. Following is any necessary or optional command data. The command data is always in ASCII format, meaning that all command data must be printable ASCII characters.

The following rules must be adhered to when the host controller sends a control command:

- Each control command must begin with the command initiator (ESC control character).
- Each control command must end with either the command terminator (STX control character) or line terminator.
- Except for the command initiator, the command terminator, and the line terminator, all other characters sent by the host controller must be printable ASCII characters.

If the control command requires a response from the OIT, the OIT immediately responds with any requested data and the line terminator.

Terminators

There are two types of terminators used in control commands: the command terminator and the line terminator. The *command terminator* is the STX control character and is used to indicate the end of a control command. The *line terminator* is programmable and can be CR, LF, CR/LF, or ETX. The line terminator is used by the host controller to indicate the end of a control command or to “log off” an OIT when operating in Network mode (refer to Chapter 3: Operating Modes).

Notation Conventions

This section uses the following type styles to define control command syntax:

SMALL CAPS	Used for non-printable ASCII control characters. Control characters are sent to the OIT using decimal or hexadecimal notation or by sending a BASIC CHR\$ command. The control characters can also be generated from the keyboard of a computer when using a terminal emulation program. The table, below, lists the control characters recognized by the OIT when sent by the host controller.
bold	Used for literal portions of the syntax that must be used exactly as shown (including upper/lower case).
<i>italics</i>	Used for variables that specify the type of data to include.

Note: Spaces are shown between the segments of the control command for clarity only. Spaces should not actually be sent. For example, ESC **A** *text terminator* should be sent as

ESC**A***textterminator*.

Control Character	Decimal Notation	Hexadecimal Notation	BASIC Command	Terminal Keyboard Keypresses
ESC	27	1B	CHR\$(27)	CTRL [
STX	2	02	CHR\$(2)	CTRL B
CR	13	0D	CHR\$(13)	CTRL M
LF	10	0A	CHR\$(10)	CTRL J
ETX	3	03	CHR\$(3)	CTRL C

Control Command Format

initiator commandletter commanddata terminator

initiator = ESC

command letter = printable ASCII character a, b, c, d, e, f, g, k, m, o, p, r, t, u, v, w,x, y, z, B, H, K, L, M, O, P, T, X, Y, Z, ?, {, }

command data = any data required by the specified command

terminator = command terminator STX
or line terminator CR, LF, CR/LF, OR ETX

Command Response Format

commanddata lineterminator

command data = any data required by the specified command

line terminator = CR, LF, CR/LF, OR ETX

Configuration Control Commands

Set LCD Viewing Angle or Brightness Level Command

ESC **a** *bias/brightness terminator*

bias: 0 = 90°, 1 = 75°

or *brightness*: 0 = 30%, 1 = 50%, 2 = 75%, 3 = 100%

Response: none

Description: Allows the host controller to control the viewing angle of the LCD or the display brightness of the VFD.

Example: PRINT CHR(27); "a0"; CHR(2)

Save Configuration Parameters Command

ESC **b** *terminator*

Response: none

Description: Saves the OIT's current setup permanently into the Flash PROM.

The saved parameters become the defaults used at power-up.

Example: PRINT CHR(27); "b"; CHR(2)

Request Configuration Data Command

ESC **c** *terminator*

Response: *class version revision serial terminator*

class: 1 = OIT3160, 2 = OIT4160, 3 = OIT3600, 4 = OIT3200
5 = OIT3250, 6 = OIT4400, 7 = OIT4450, 8 = OIT5400,
9 = MAP460D, A = MAP320D, B = MAP340D, C =
MAP450D, D = OIT3165/4165, E = OIT3175/4175, F = OIT3175/4185

version: Two digits for the firmware version.

revision: Two digits for the firmware revision level.

serial: 0 = RS-232, 1 = RS-422/485, 2 = both active

Description: Returns six ASCII digits representing the OIT's current product model, version, revision, and serial interface type.

Example: PRINT CHR(27); "c"; CHR(2)

Display and Cursor Format Control Command

ESC **d 00** *cursor delayedLF terminator*

cursor: 0 = no change, 1 = disable cursor, 2 = enable cursor

delayed LF: 0 = no change, 1 = disable delayed LF, 2 = enable delayed LF

Response: none

Description: Allows the host controller to disable or enable the OIT's cursor or delayed line feed. Anytime a LF character is received by the OIT, the delayed line feed feature causes the cursor to remain in its current position until the next displayable character is received. The Set Cursor Position control command cancels the delayed line feed feature.

Example: PRINT CHR(27); "d0021"; CHR(2)

Display Format Control Command

ESC **f blockecho 0 localecho terminator**

block echo: 0 = no change

1 = disable block echo (replace characters sent to the display with *s)

2 = enable block echo

local echo: 0 = no change, 1 = disable local echo, 2 = enable local echo

Response: none

Description: Allows the host controller to control block echo during Block mode and local echo during Interactive mode. When block echo is disabled, characters sent to the display during Block mode are replaced with *s. When local echo is disabled, characters are not sent to the display during Interactive mode.

Example: PRINT CHR(27); "f201"; CHR(2)

Keyboard Control Command

ESC **k enable 00** *click setup terminator*

enable: 0 = no change, 1 = off (disable keyboard entry), 2 = on

click: 0 = no change, 1 = off (disable audible click), 2 = on

setup: 0 = no change, 1 = off (disable local setup), 2 = on

Response: none

Description: Allows the host controller to control the OIT's keyboard operation.

Example: PRINT CHR(27); "k20020"; CHR(2)

Set Turn-Around Delay Command

ESC **t** *delay terminator*

delay: 0 = none, 1 = 50 milliseconds, 2 = 100 milliseconds, 3 = 250 milliseconds

Response: none

Description: Allows the host controller to change the delay between the time the OIT receives a command requesting data and the OIT's response.

Example: PRINT CHR(27); "t0"; CHR(2)

Set Tab Character Width Command

ESC **z** *width terminator*

width: 0 = no change, 1 = 1 character, 2 = 4 character, 3 = 8 character

Response: none

Description: Allows the host controller to set the width of each "tab stop" used by the HT control code.

Example: PRINT CHR(27); "z2"; CHR(2)

Set Communications Parameters Command

ESC **B** *baud parity databits terminator*

baud: 0 = no change, 1 = 300 baud, 2 = 600 baud, 3 = 1200 baud,
4 = 2400 baud, 5 = 4800 baud, 6 = 9600 baud, 7 = 19200 baud

parity: 0 = no change, 1 = space, 2 = mark, 3 = even, 4 = odd, 5 = none

data bits: 0 = no change, 1 = 7 data bits (1 stop bit if parity, 2 if no parity),
2 = 8 data bits & 1 stop bit

Response: none

Description: Allows the host controller to change the OIT's baud rate, parity, and data bits.

Example: PRINT CHR(27); "B652"; CHR(2)

Enable Handshaking Command

ESC **H** *handshaking terminator*

handshaking: 0 = all handshaking disabled

1 = software handshaking (XON/XOFF) enabled (Interactive mode)

2 = hardware handshaking (RTS/CTS) enabled (Interactive and Block modes)

3 = software and hardware handshaking enabled (Interactive mode)

Response: none

Description: Allows the host controller to enable or disable serial handshaking.

Example: PRINT CHR(27); "H0"; CHR(2)

Set Operating Mode Command

ESC **M** *mode address terminator*

mode: 0 = no change, 1 = interactive, 2 = block, 3 = network

address: 01 to FF (ASCII hexadecimal)

Response: none

Description: Allows the host controller to change the OIT's operating mode and network address.

Example: PRINT CHR(27); "1"; CHR(2)

Set Line Terminator Command

ESC **T** *lineterminator terminator*

line terminator: 0 = ETX, 1 = CR, 2 = LF, 3 = CR/LF

Response: none

Description: Allows the host controller to change the line terminator.

Example: PRINT CHR(27); "T1"; CHR(2)

General Purpose Control Commands

Echo Back Text Command

ESC **e** *text terminator*

Response: *text terminator*

Description: Causes the OIT to echo back the ASCII characters sent (up to 40 characters). Each character is stored by the OIT until the terminator is received, at which time the entire string is sent back to the host controller.

Example: PRINT CHR(27); "eHello!"; CHR(2)

Sound Bell Command

ESC **g** *seconds terminator*

seconds: 0 = turn bell off, 1 to 60 = sound bell for n seconds

Response: none

Description: Allows the host controller to sound the OIT's transducer.

Example: PRINT CHR(27); "g3"; CHR(2)

Display Message Command

ESC **m** *message# terminator*

message#: 0 = clear screen and return cursor to first position of first line
1 to 500 = predefined message to display

Response: none

Description: Displays a predefined text string starting at the current cursor position.

If the text string is longer than the remaining line, only the first part of the string is displayed. The text string is displayed until the OIT operator presses the Clear key or the host controller calls message #0 to clear the screen.

Example: PRINT CHR(27); "m2"; CHR(2)

Clear Output Buffer Command

ESC **o** *terminator*

Response: none

Description: Clears the contents of the OIT's Keyboard Input Buffer and Keyboard Output Buffer when the OIT is in Block or Network modes.

Example: PRINT CHR(27); "o"; CHR(2)

Poll OIT Buffer Command

ESC **p** terminator

Response: contents terminator

contents: OIT's Keyboard Output Buffer contents

Description: Allows the host controller to retrieve the contents of the Keyboard Output Buffer when in Network mode.

Example: PRINT CHR(27); "p"; CHR(2)

Retransmit Last Keyboard Buffer Command

ESC **r** terminator

Response: contents terminator

contents: OIT's Keyboard Output Buffer contents

Description: Allows the host controller to retrieve the previous contents of the Keyboard Output Buffer when in Block or Network modes. If the buffer is empty, only a line terminator is returned to the host controller.

Example: PRINT CHR(27); "r"; CHR(2)

Function Key Control Command

ESC **K** functionkey# enable **00** terminator

function key#: 0 = all function keys, 1 to 16 = corresponding function key

enable: 0 = no change, 1 = disable, 2 = enable

Response: none

Description: Allows the host controller to disable and then enable function keys.

Example: PRINT CHR(27); "K0100"; CHR(2)

Screen Function Key Control Command

ESC **L** SDFkey# enable **00** terminator

SDF key#: 0 = all screen dependent function keys

1 to 5 = corresponding screen dependent function key

enable: 0 = no change, 1 = disable, 2 = enable

Response: none

Description: Allows the host controller to disable and then enable screen dependent function keys.

Example: PRINT CHR(27); "L1200"; CHR(2)

Print Screen Command

ESC **O** terminator

Response: none

Description: Prints the current contents of the display, including blank lines, to a serial printer attached to the OIT's second serial port (OIT3250, OIT4450, and OIT5400 only).

Example: PRINT CHR(27); "O"; CHR(2)

Print Text Command

ESC **P** *text terminator*

text: up to 40 ASCII characters (printable or control)

Response: none

Description: Allows the host controller to send ASCII characters to a serial printer attached to the OIT's second serial port (OIT3250, OIT4450, and OIT5400 only).

Example: PRINT CHR(27); "PPrint this text!"; CHR(2)

Function Key LED Command

ESC **X** *functionLED# mode terminator*

functionLED#: 00 = all LEDs, 01 to 16 = function key LED#

mode: 0 = off, 1 = on, 2 = blink

Response: none

Description: Allows the host controller to control the OIT's function key LEDs (OIT3250, OIT4450, and OIT5400 only).

Example: PRINT CHR(27); "X022"; CHR(2)

Status LED Command

ESC **Y** *statusLED# mode terminator*

status LED#: 0 = all LEDs, 1 to 8 = status LED#

mode: 0 = off, 1 = on, 2 = blink

Response: none

Description: Allows the host controller to control the OIT's status LEDs (OIT3250, OIT4450, and OIT5400 only).

Example: PRINT CHR(27); "Y31"; CHR(2)

System LED Command

ESC **Z** *systemLED# mode terminator*

system LED#: 0 = all LEDs, 1 = run LED, 2 = print LED, 3 = alarm LED, 4 = message LED

mode: 0 = off, 1 = on, 2 = blink

Response: none

Description: Allows the host controller to control the OIT's system LEDs (OIT3250, OIT4450, and OIT5400 only).

Example: PRINT CHR(27); "Z00"; CHR(2)

Request Keyboard Buffer Status Command

ESC **?** *terminator*

Response: *status terminator*

status: 0 = buffer empty

1 = keyboard input in progress (Block and Network modes)

2 = entire message buffered, waiting for Poll OIT Buffer control command (Network mode)

Description: Allows the host controller to determine the status of the OIT's Keyboard Input Buffer.

Example: PRINT CHR(27); "?"; CHR(2)

Enable Block Mode Command

ESC { *start end fill terminator*

start: 00 to 39. Starting cursor column number. 00 defaults to the position of the cursor at the time the command is received.

end: 00 to 39. Ending cursor column number. 00 defaults to the end of the current line at the time the command is received.

fill: SPACE to ~. Fill character used to replace any characters affected by the Clear Output Buffer command or the DEL and CAN control codes. If not specified, the ASCII space character is used.

Response: none

Description: Allows the host controller to dynamically change from Interactive to Block mode. The optional start, end, and fill parameters limit the input to a specific area of the display (up to 40 characters). This command can be used in Network mode.

Example: PRINT CHR(27); "{1520"; CHR(2)

Disable Block Mode Command

ESC } *enable terminator*

enable: 0 = no change, 1 = off (disable keyboard entry), 2 = on

Response: none

Description: After sending the Enable Block Mode command, the Disable Block Mode command allows the host controller to return the OIT to Interactive mode, clears the OIT's Keyboard Output Buffer, and enables or disables the keyboard. If the OIT was in Network mode when the Enable Block Mode command was received, then the block input field is cleared without changing the operating mode.

Example: PRINT CHR(27); "}2"; CHR(2)

Display Control Commands

Read Display Variable Command

ESC u *terminator*

Response: *text terminator*

text: ASCII characters currently in the display variable

Description: Allows the host controller to retrieve the contents of a display variable.

Example: PRINT CHR(27); "u"; CHR(2)

Write Display Variable Command

ESC v *text terminator*

text: ASCII characters to be written to the display variable

Response: none

Description: Allows the host controller to change the contents of a display variable.

The old contents of the display variable are not erased until a new character overwrites the old character. If the text is longer than the display variable, the excess characters are ignored.

Example: PRINT CHR(27); "V12345"; CHR(2)

Create Display Variable Command

ESC **w** *length terminator*
length: 1 to 40, defaults to 4 if not specified

Response: none

Description: Allows the host controller to create a display variable at the current cursor position. The area allocated for the display variable is cleared and the cursor is placed to the right of the field. When the host controller writes to the display variable using the Write Display Variable control command, the display variable is updated accordingly.

Example: PRINT CHR(27); "W10"; CHR(2)

Set Cursor Position Command

ESC **x** *column line terminator*
column: 0 = no change, 1 to 40 = specified column#
line: 0 = no change, 1 = line #1, 2 = line #2

Response: none

Description: Allows the host controller to move the cursor without affecting the display contents.

Example: PRINT CHR(27); "x32"; CHR(2)

Read Cursor Position Command

ESC **y** *terminator*
Response: *column line terminator*
column: 01 to 40 = cursor's current column#
line: 1 = line #1, 2 = line #2

Description: Allows the host controller to determine the cursor's current position.

Example: PRINT CHR(27); "y"; CHR(2)

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APPENDIX B

Control Codes

Control codes are non-printable ASCII control characters sent from the host controller to the OIT which cause the OIT to perform specific functions.

Control Codes	Decimal Notation	Hexadecimal Notation	Description
ENQ	5	05	Returns six ASCII digits representing the OIT's current product model, version, revision, and serial interface type.
BEL	7	07	Sounds a 1/2 second warning beep.
BS	8	08	Moves the cursor one character position to the left on the current display line. The BS is non-destructive meaning that no characters are removed from the display. If the cursor is at the beginning of the line, the BS is ignored.
HT	9	09	Moves the cursor to the beginning of the next tab field. If the cursor is at the end of the current display line, the HT is ignored. The default tab width of 1 can be changed using the STEPware-100 configuration software or the Set Tab Character Width control command.
LF	10	0A	Moves the cursor to the same column of the next display line. If the cursor is on line #1, the cursor moves to line #2 without disturbing the contents of either line. If the cursor is on the last line, all lines move up one line clearing the last line for new input. Display variables are automatically scrolled as well.
VT	11	0B	Moves the cursor to the beginning of the previous display line. If the cursor is on line #2 or lower, the cursor moves to the beginning of the previous line without disturbing the contents of any line. If the cursor is on the top line, all lines scroll down one line clearing the top line for new input. Display variables are automatically scrolled as well.
FF	12	0C	Clears the entire display and moves the cursor to the beginning of line #1.
CR	13	0D	Moves the cursor to the beginning of the current display line without disturbing the contents of the line.
XON	17	11	Resumes OIT transmission previously halted by an XOFF.
XOFF	19	13	Halts OIT transmission.
CAN	24	18	Erases the characters from the cursor to the end of the current display line.

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APPENDIX C

Extended Character Sets

The following tables list the extended character set for each OIT model. If the OIT receives one of the listed ASCII Codes from the host controller, it displays the corresponding extended character.

MAP460D, OIT3100 Series, OIT3600, OIT4100 Series

Extended Character	ASCII Code
→	126
←	127
□	161
「	162
」	163
ゝ	164
・	165
ヲ	166
ア	167
イ	168
ウ	169
エ	170
オ	171
カ	172
キ	173
ク	174
ツ	175
ー	176
ア	177
イ	178
ウ	179
エ	180
オ	181
カ	182
キ	183
ク	184
コ	186
サ	187
シ	188

Extended Character	ASCII Code
ヌ	189
セ	190
ソ	191
タ	192
チ	193
ツ	194
テ	195
ト	196
ナ	197
ニ	198
ヌ	199
ネ	200
ノ	201
ハ	202
ヒ	203
フ	204
ヘ	205
ホ	206
マ	207
ミ	208
ム	209
メ	210
モ	211
カ	212
キ	213
ク	214
コ	215
リ	216
ル	217

Extended Character	ASCII Code
レ	218
ロ	219
ワ	220
ン	221
々	222
□	223
α	224
ä	225
ε	227
ϵ	229
∫	232
∫	233
※	235
Φ	236
も	237
ñ	238
ö	239
θ	242
※	243
Ω	244
ü	245
Σ	246
π	247
⊗	248
千	250
万	251
円	252
÷	253

MAP320D, OIT3200, OIT3250

Extended Character	ASCII Code
→	126
←	127
□	161
┌	162
└	163
√	164
▪	165
☞	166
↗	167
イ	168
ウ	169
エ	170
オ	171
カ	172
キ	173
ヨ	174
ツ	175
ー	176
ア	177
ウ	178
エ	180
オ	181
カ	182
キ	183
ケ	184
コ	186
サ	187
シ	188
ス	189
セ	190
ソ	191

Extended Character	ASCII Code
タ	192
チ	193
ツ	194
テ	195
ト	196
ナ	197
ニ	198
ヌ	199
ネ	200
ノ	201
ハ	202
ヒ	203
フ	204
ヘ	205
ホ	206
マ	207
ミ	208
ム	209
メ	210
モ	211
ヤ	212
ユ	213
ヨ	214
ラ	215
リ	216
ル	217
レ	218
ロ	219
ワ	220
ン	221
ッ	222

Extended Character	ASCII Code
□	223
⊗	224
⊙	225
⊚	226
⊛	227
⊜	228
⊝	229
⊞	230
⊟	231
⊠	232
⊡	233
⊢	234
⊣	235
⊤	236
⊥	237
⊦	238
⊧	239
⊨	240
⊩	241
⊪	242
⊫	243
⊬	244
⊭	245
⊮	246
⊯	247
⊰	248
⊱	250
⊲	251
⊳	252
⊴	253
⊵	254

MAP340D, OIT4400, OIT4450

Ext. Char.	Code
~	126
,	127
f	128
"	129
...	130
†	131
‡	132
^	133
‰	134
Š	135
<	136
Œ	137
'	138
'	139
"	140
"	141
•	142
—	143
—	144
~	145
™	146
Š	147
>	148
œ	149
ÿ	150
j	152
¢	153
£	154
¤	155
¥	156
↵	157
§	158
¨	159
©	161
ª	162
«	163
¬	164
¶	165
®	166

Ext. Char.	Code
-	167
°	168
±	169
²	170
³	171
´	172
µ	174
¶	175
·	176
¸	177
¹	178
º	179
»	180
¼	181
½	182
¾	183
¿	184
À	185
Á	186
Â	187
Ã	188
Ä	189
Å	190
Æ	191
Ç	192
È	193
É	194
Ê	195
Ë	196
Ì	197
Í	198
Î	199
Ï	200
Ð	201
Ñ	202
Ò	203
Ó	204
Ô	205
Õ	206

Ext. Char.	Code
Ö	207
×	208
Ø	209
Ù	210
Ú	211
Û	212
Ü	213
Ý	214
Þ	216
ß	217
à	218
á	219
â	220
ã	221
ä	222
å	223
æ	224
ç	225
è	226
é	227
ê	228
ë	229
ì	230
í	231
î	232
ï	233
ö	234
ñ	235
ò	236
ó	237
ô	238
õ	239
ö	240
÷	241
ø	242
ù	244
ú	245
û	246
ü	252

OIT5400

Ext. Char.	Code
˘	126
Ɔ	128
ü	129
é	130
â	131
ä	132
à	133
ä	134
ç	135
é	136
ë	137

Ext. Char.	Code
è	138
ï	139
î	140
ì	141
Ë	142
À	143
É	144
Æ	145
Œ	146
ô	147
ö	148

Ext. Char.	Code
ò	149
û	150
ù	151
ö	153
ü	154
ϕ	155
£	156
¥	157
℔	158
ƒ	159

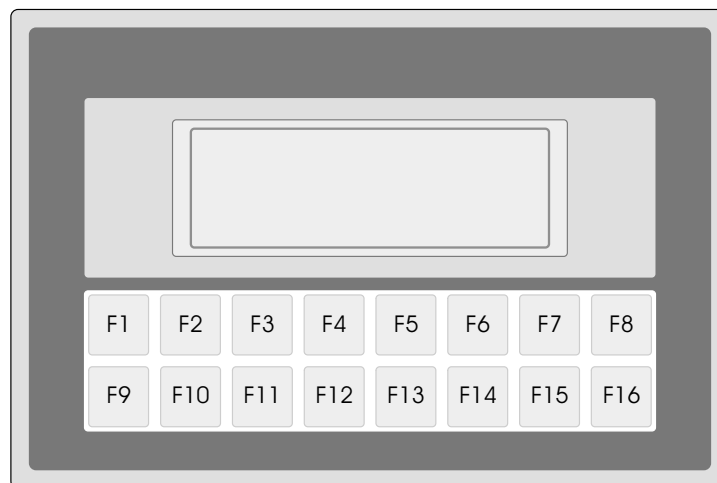
APPENDIX D

Keyboard Layouts: OIT3165/4165, OIT3175/4175 and OIT3185/4185

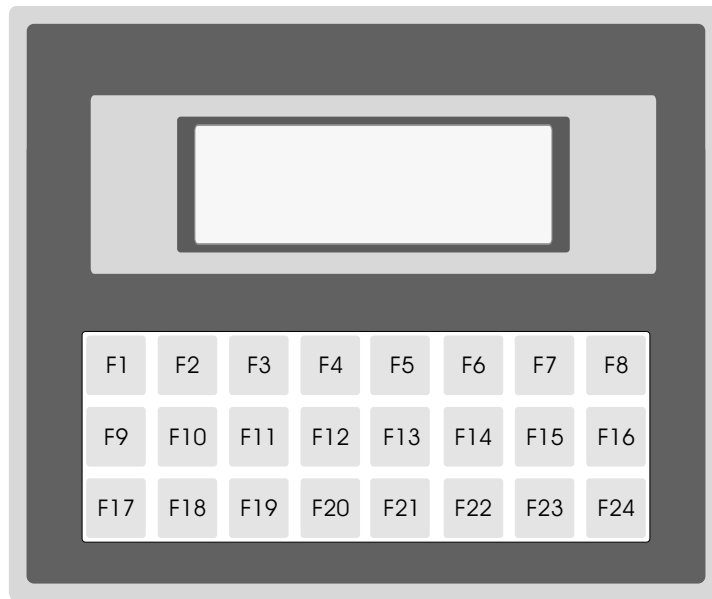
The keyboards of the OIT3165/4165, OIT3175/4175 and OIT3185/4185 differ from the other Maple Systems OIT models in that these keyboards are composed entirely of function keys which can be configured by the OIT programmer, (refer to Chapter 5: Using the OIT's Function Keys). These keyboards have relegendable key inserts which allow the OIT operator to label each function key. The templates below show how each key is referenced when using the STEPware-100 configuration software:



OIT3165/4165



OIT3175/4175



OIT3185/4185

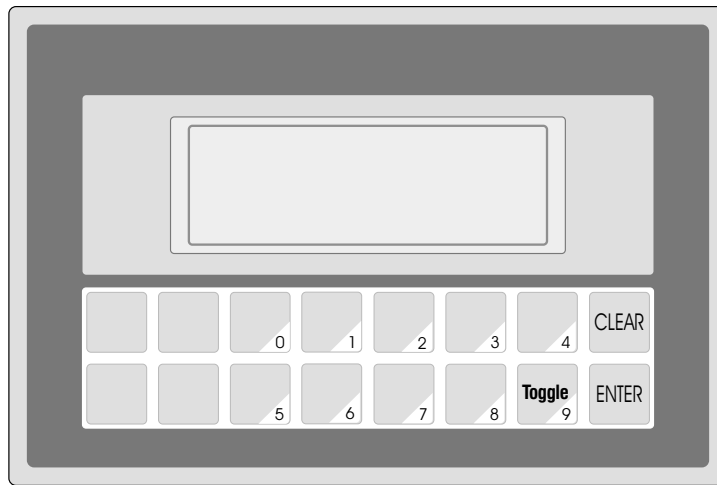
The keyboard that is created using the STEPware-100 configuration software becomes active only after the OIT has finished it’s initialization routines when power is applied to the unit. Therefore, the user-defined keyboard becomes active only after the OIT has displayed “Initializing” then “Terminal Now Ready!!”.

Between the time when power is first applied to the OIT and the time that the user-defined keyboard becomes active, the OIT uses an alternate ‘setup’ keyboard which allows the OIT programmer to gain access to the Setup menus. The ‘setup’ keyboard will remain in effect while the OIT is in setup mode, until the OIT is reinitialized.

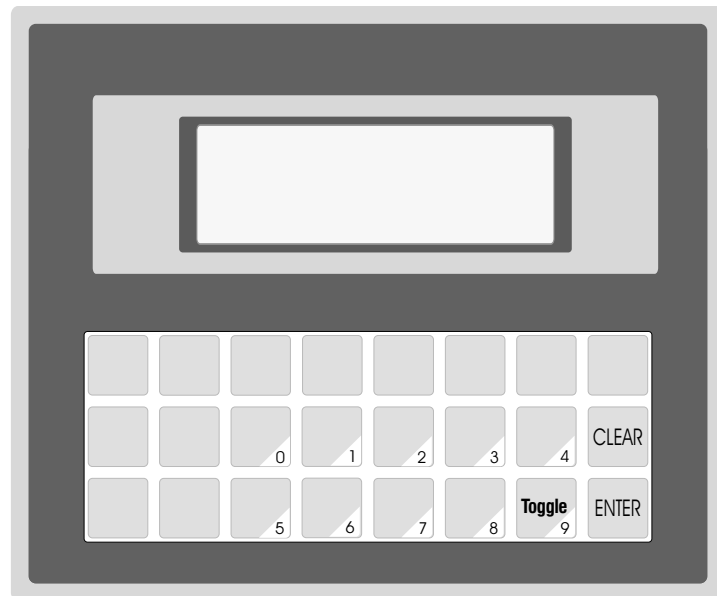
The templates below show how each key is defined when in setup mode:



OIT3165/4165



OIT3175/4175



OIT3185/OIT4185

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APPENDIX E

Slide-in Legend Templates

Some of the OIT Family Operator Interface Terminals contain clear windows that allow you to insert your own legends to customize the text, colors and graphics of certain keys. In some models you can also add your own logo or model identification. These legends can be inexpensively made and are environmentally sealed when installed.

The slide-in legends can be made on any non-glossy stock between 0.004 inches [0.1 mm] and 0.008 inches [0.2 mm] thick by using either of the following methods:

- Photocopy a blank legend and hand illustrate. Refer to the “Blank Legends for Photocopying” section.
- Use the dimensions to create a computer generated legend. Refer to the “Dimensions for Computer Generated Legends” section.
- Use our Legend Generator Software to create a computer generated legend. Available for our website at www.maple-systems.com/tech.htm

Refer to the Installation Manual shipped with your OIT for instructions on installing the slide-in legends.

Blank Legends for Photocopying

The blank legends on the following pages can be photocopied and hand illustrated to create custom slide-in legends.

When photocopying:

- Use only non-glossy stock which is 0.004 - 0.008 inches [0.1 - 0.2 mm] thick.
- Check photocopy accuracy with the printed check dimension.

When illustrating (OIT3165, OIT3175, OIT3185, OIT4165, OIT4175, and OIT4185):

- Use the tick marks to locate the switch centers. Refer to the dimension in the “Dimensions for Computer Generated Legends” section if unsure.

NOTE: Pressing the center of the switch is critical for switch actuation.

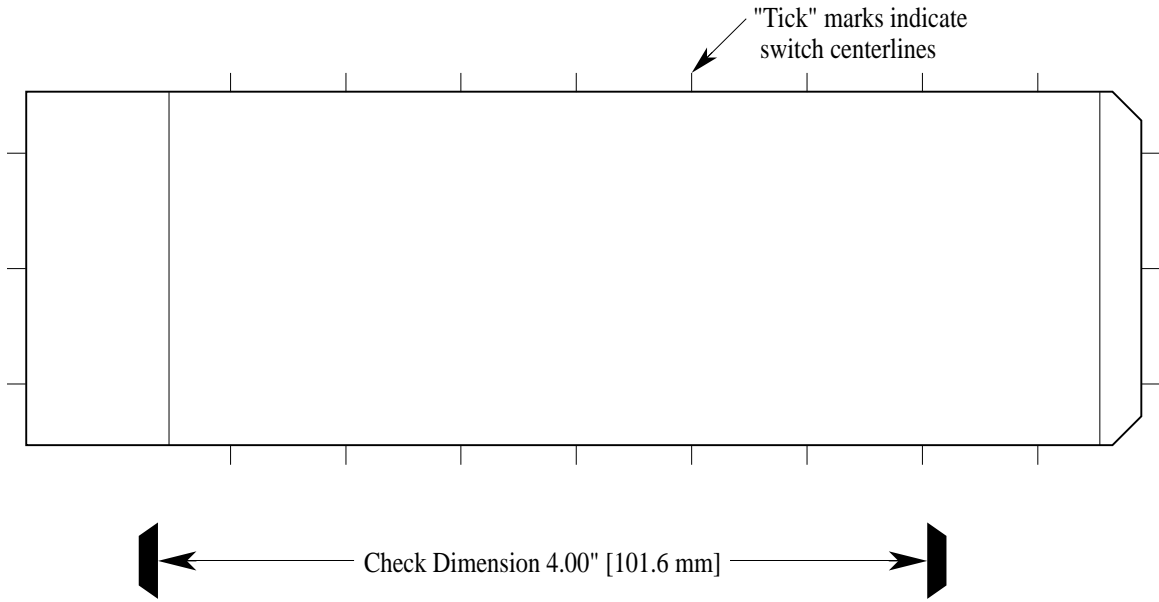
- Recommended key size is 0.500 inches [12.7 mm] square.
- Background colors should extend to the solid lines.
- All text and graphics should be 0.070 inches [1.8 mm] within the solid lines.

NOTE: Do not affix anything to the legend using glue, tape, stickers, etc.

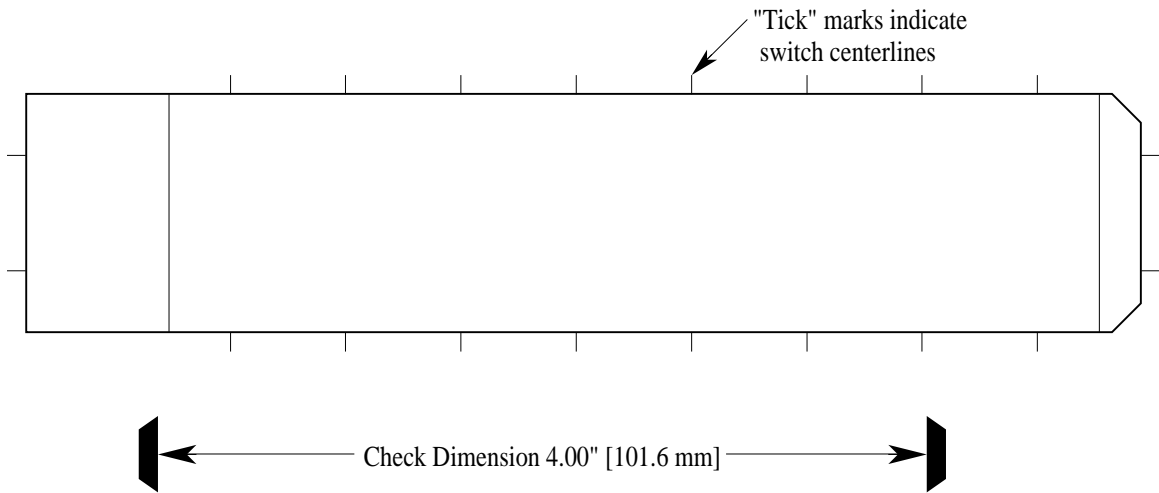
When illustrating (all models except OIT3165, OIT3175, OIT3185, OIT4165, OIT4175, and OIT4185):

- Background colors should extend to the solid lines.
- The tick marks define the edge of the viewable area. Keep all text and graphics within the tick marks.

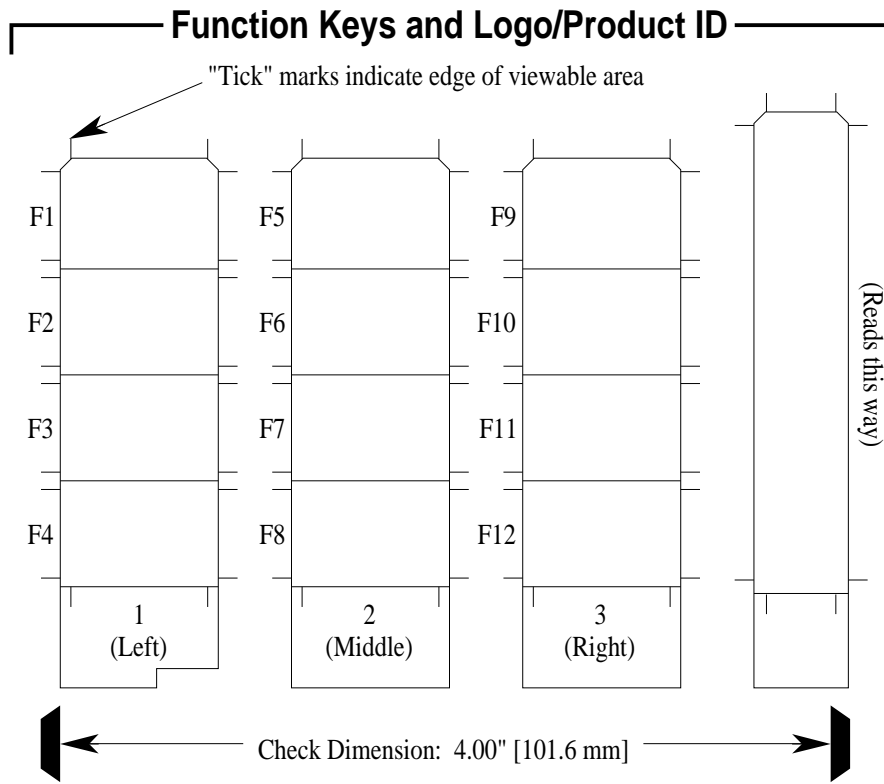
OIT3165A, OIT3185A, OIT4165A, and OIT4185A Legend



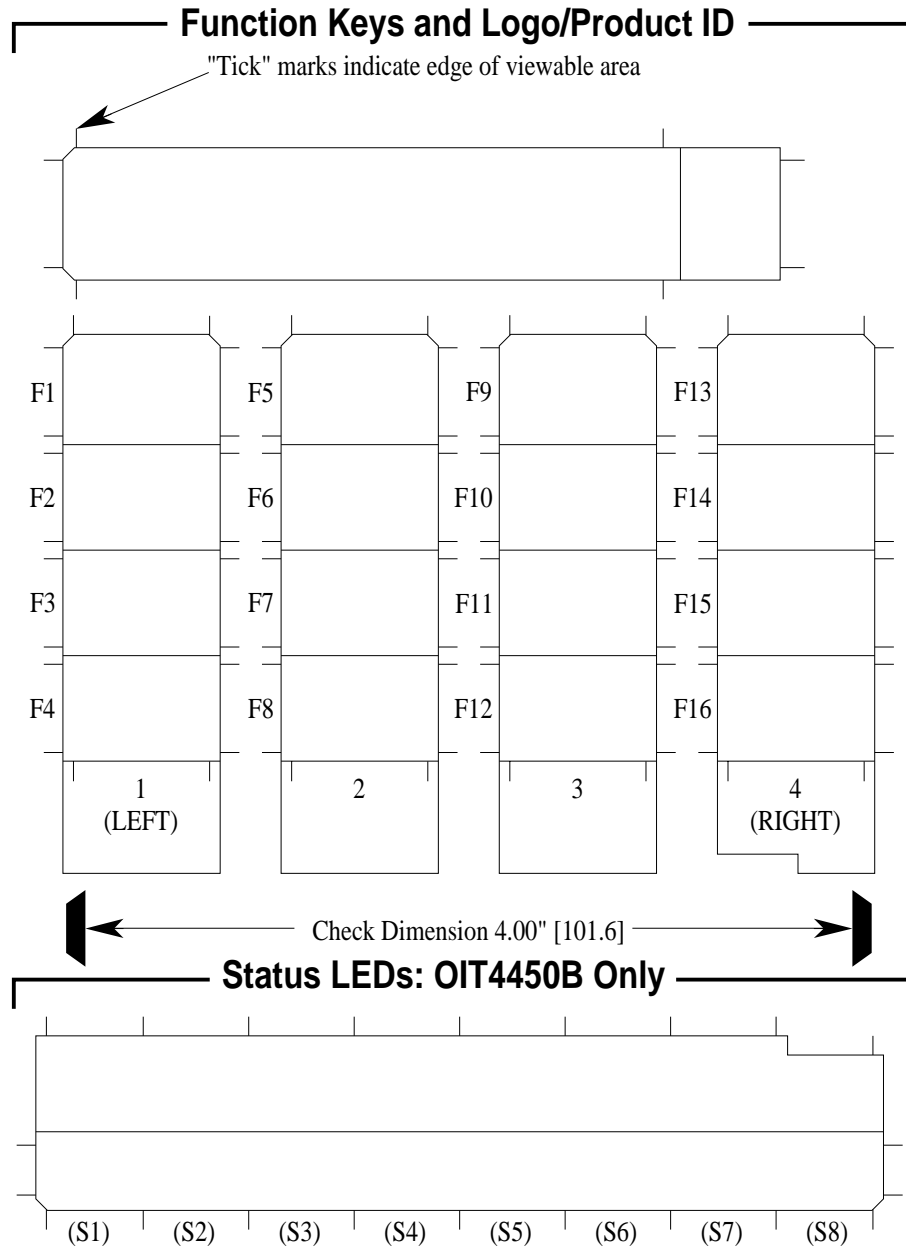
OIT3175A and OIT4175A Legend



OIT3200B and OIT3250B Legends

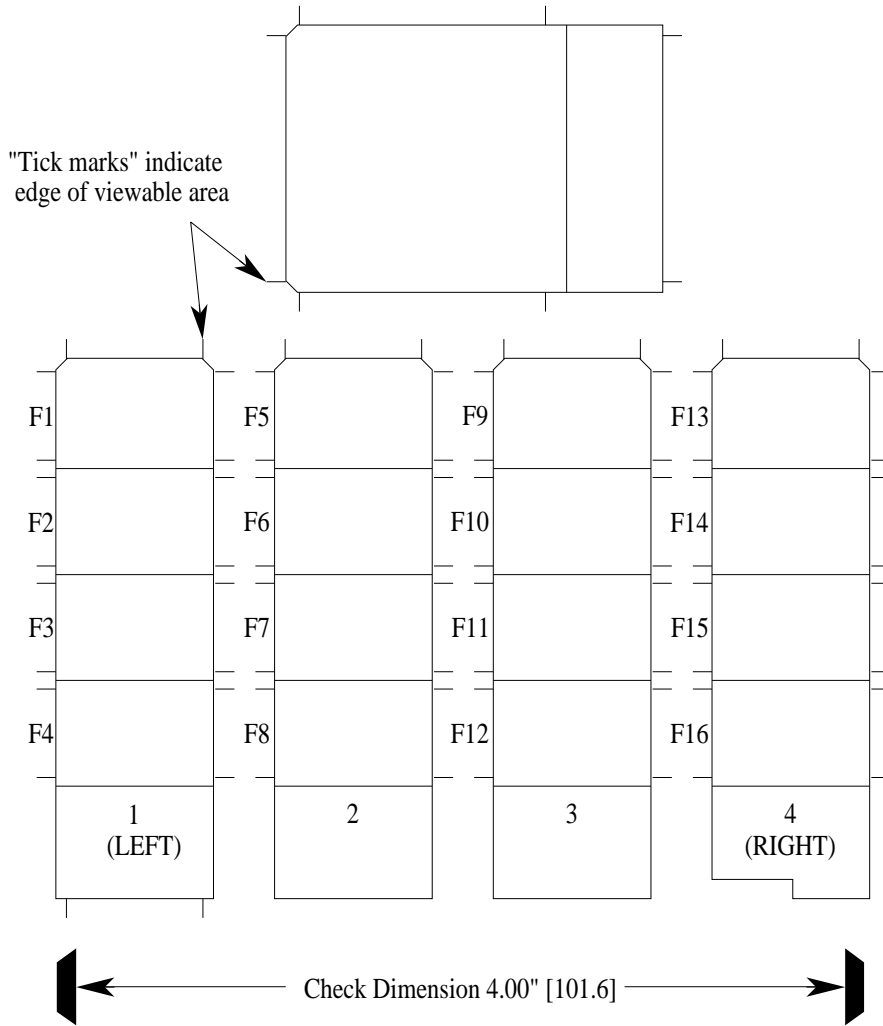


OIT4400B and OIT4450B Legends

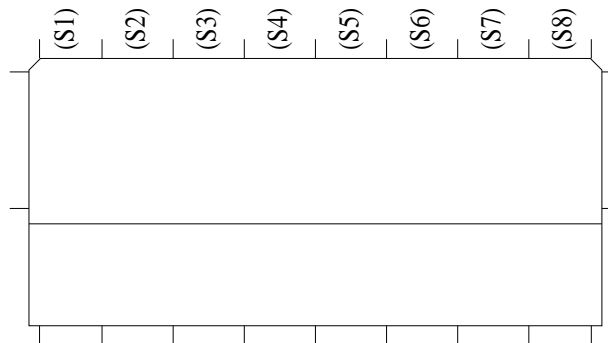


OIT5400B Legends

Function Keys and Logo/Product ID



Status LEDs



Dimensions for Computer Generated Legends

The dimensions on the following pages can be used to create legends using a computer graphics program.

When creating (OIT3165, OIT3175, OIT3185, OIT4165, OIT4175 and OIT4185):

- Dimensions are in inches [mm].
- Recommended key size is 0.500 inches [12.7 mm] square.

NOTE: Pressing the center of the switch is critical for switch actuation.

- Background colors should extend to the upper and lower edges of the legend and to the 2 vertical lines marked "BACKGROUND."
- All text and graphics should be within the dashed rectangle.

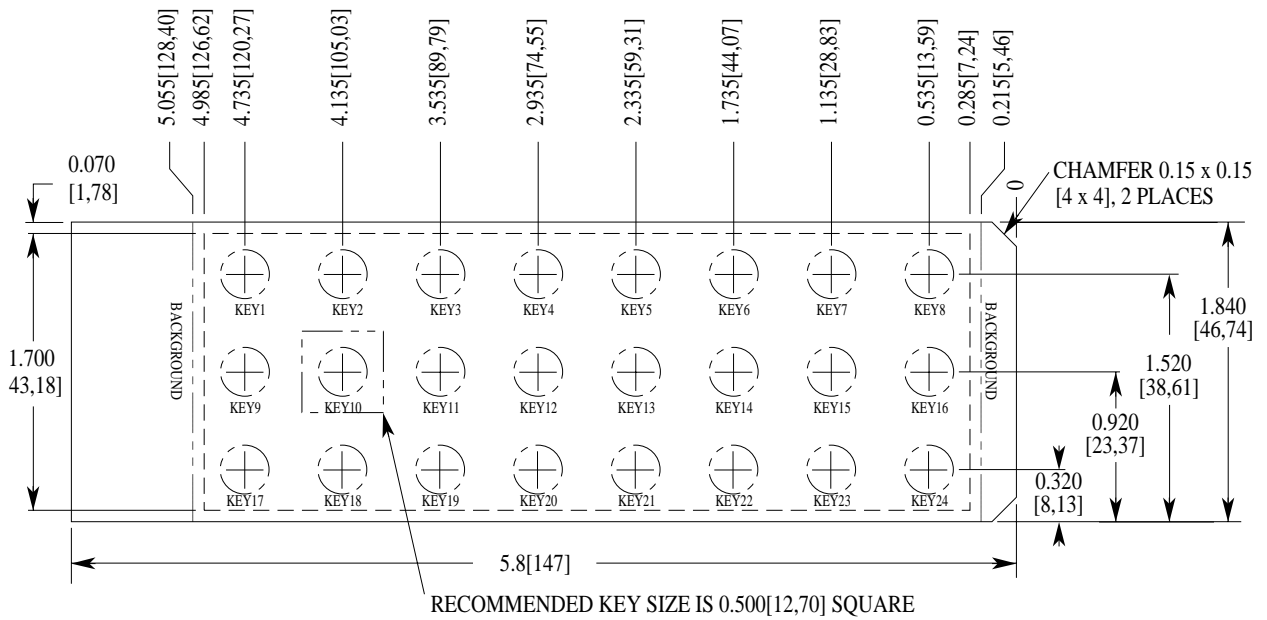
When creating (all models except OIT3165, OIT3175, OIT3185, OIT4165, OIT4175 and OIT4185):

- Dimensions are in inches [mm].
- Background colors should extend to the solid lines.
- All text and graphics should be within the dashed rectangles.

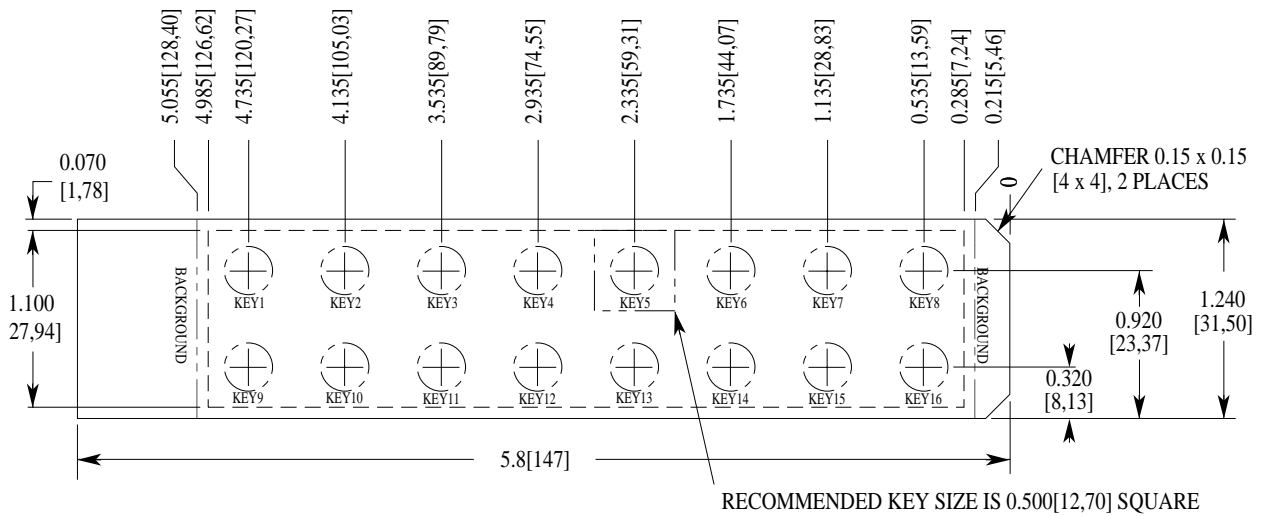
When printing:

- Use only non-glossy stock which is 0.004 - 0.008 inches [0.1 - 0.2 mm] thick.
- Check printing accuracy.

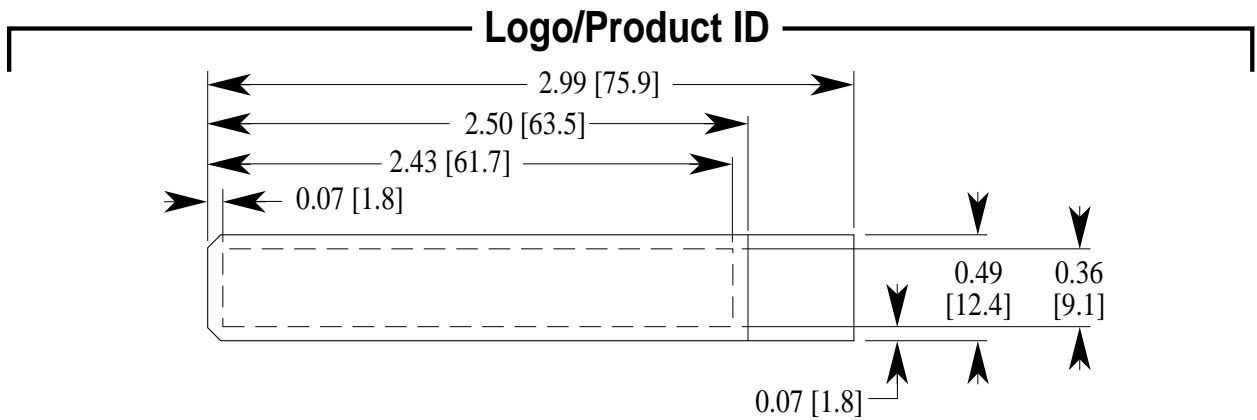
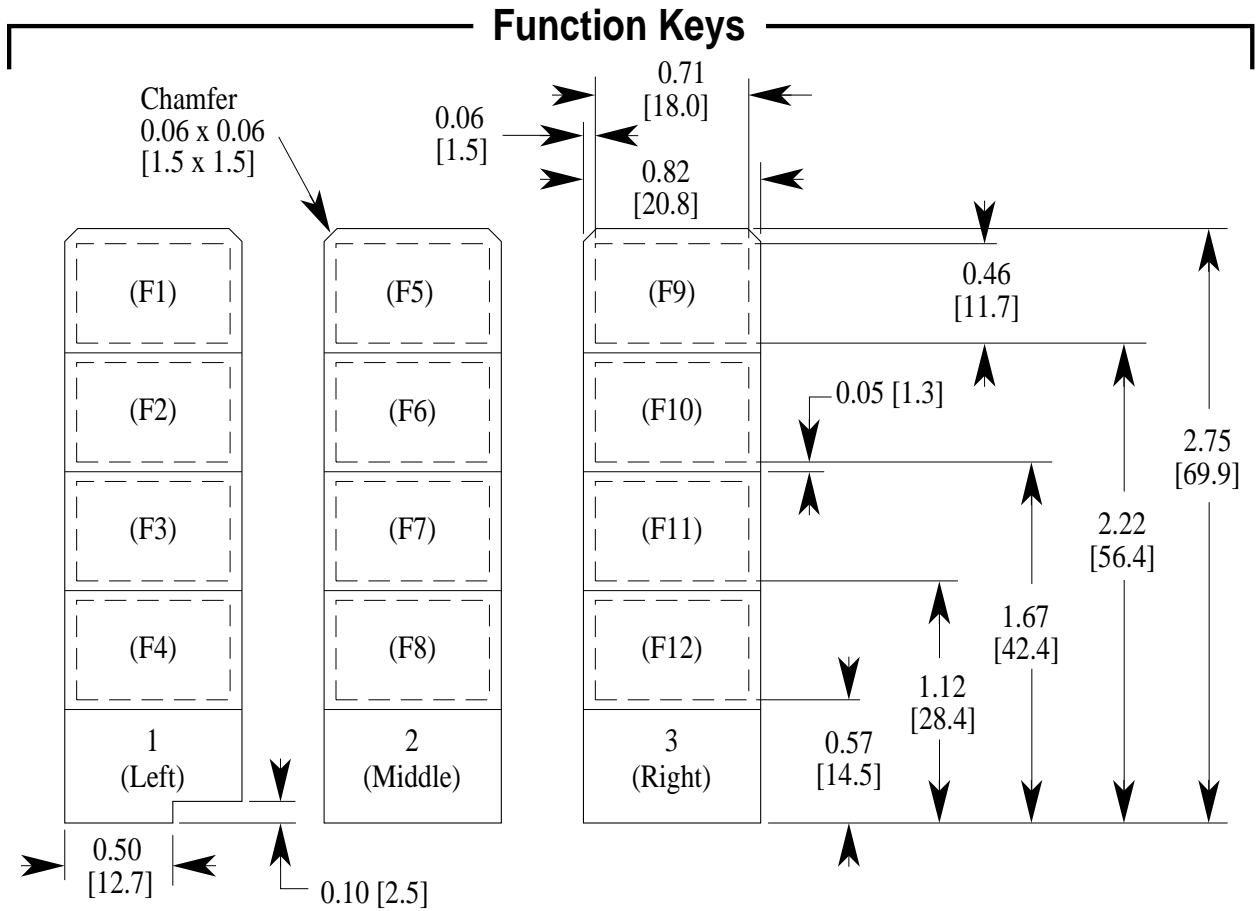
OIT3165A, OIT3185A, OIT4165A, and OIT4185A Legend



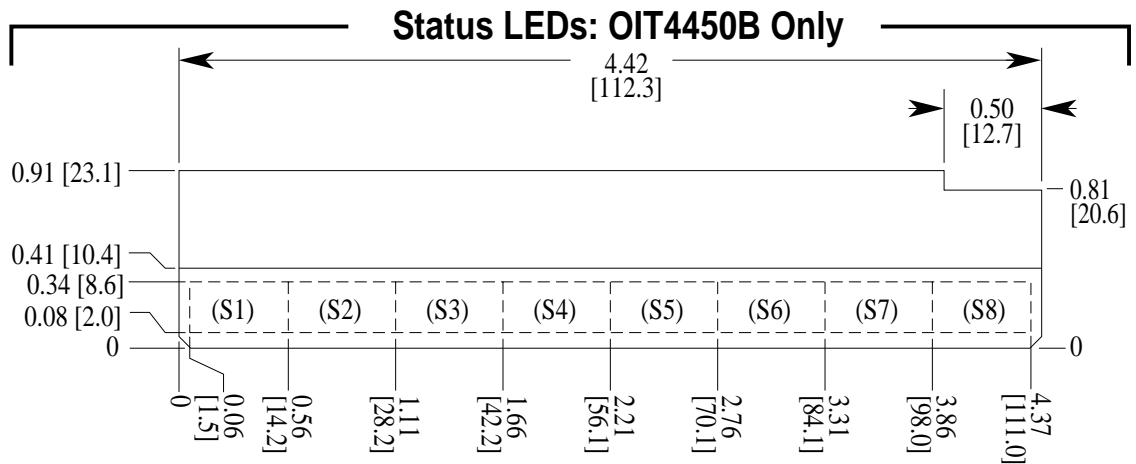
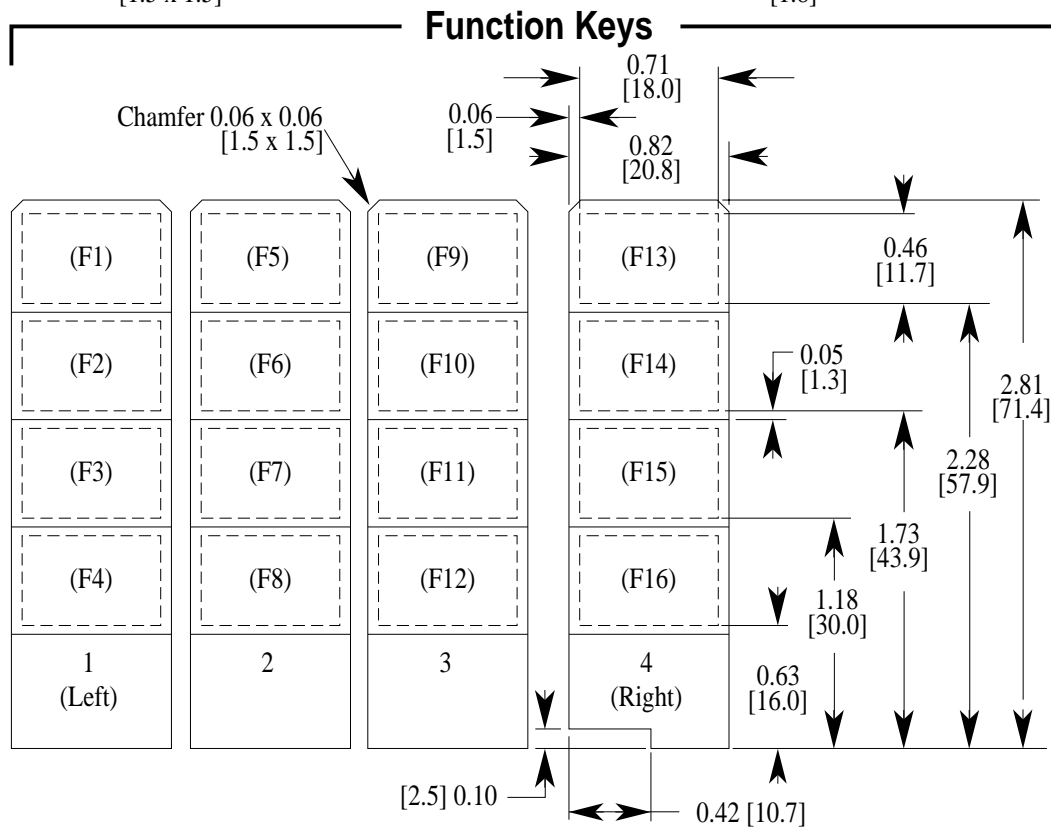
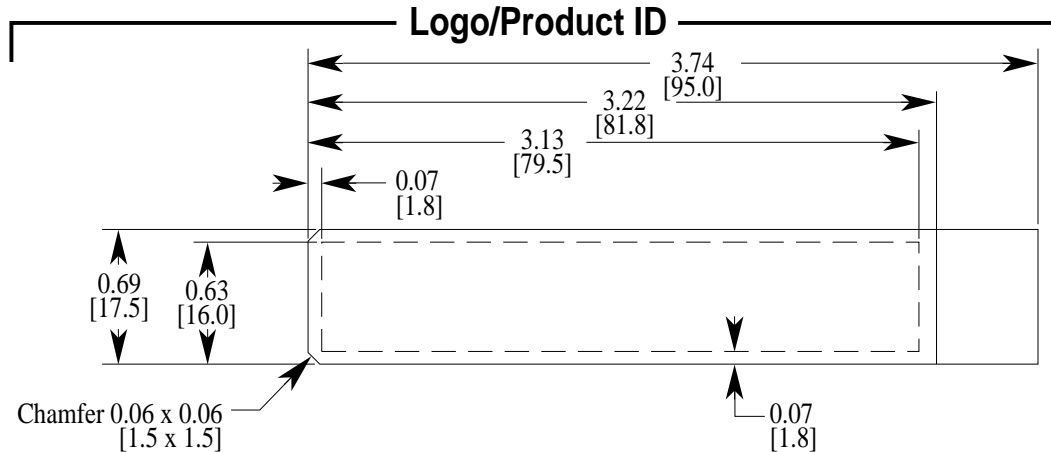
OIT3175A and OIT4175A Legend



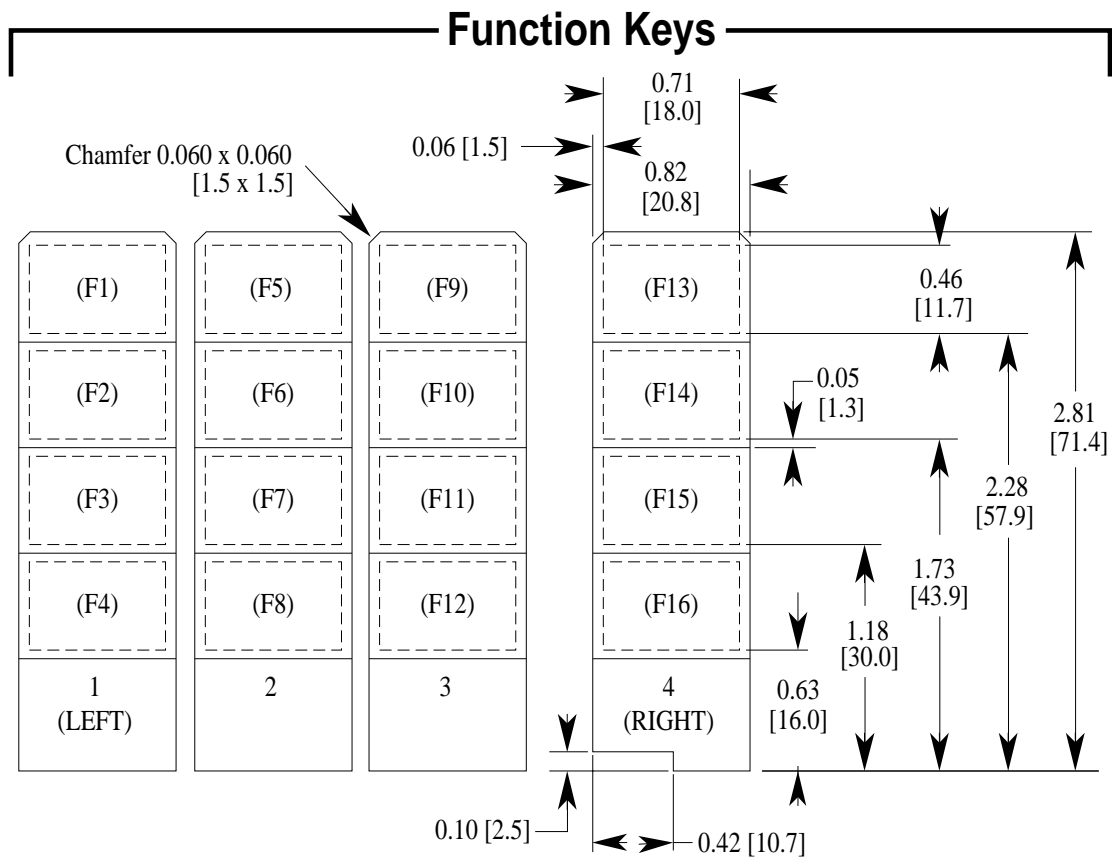
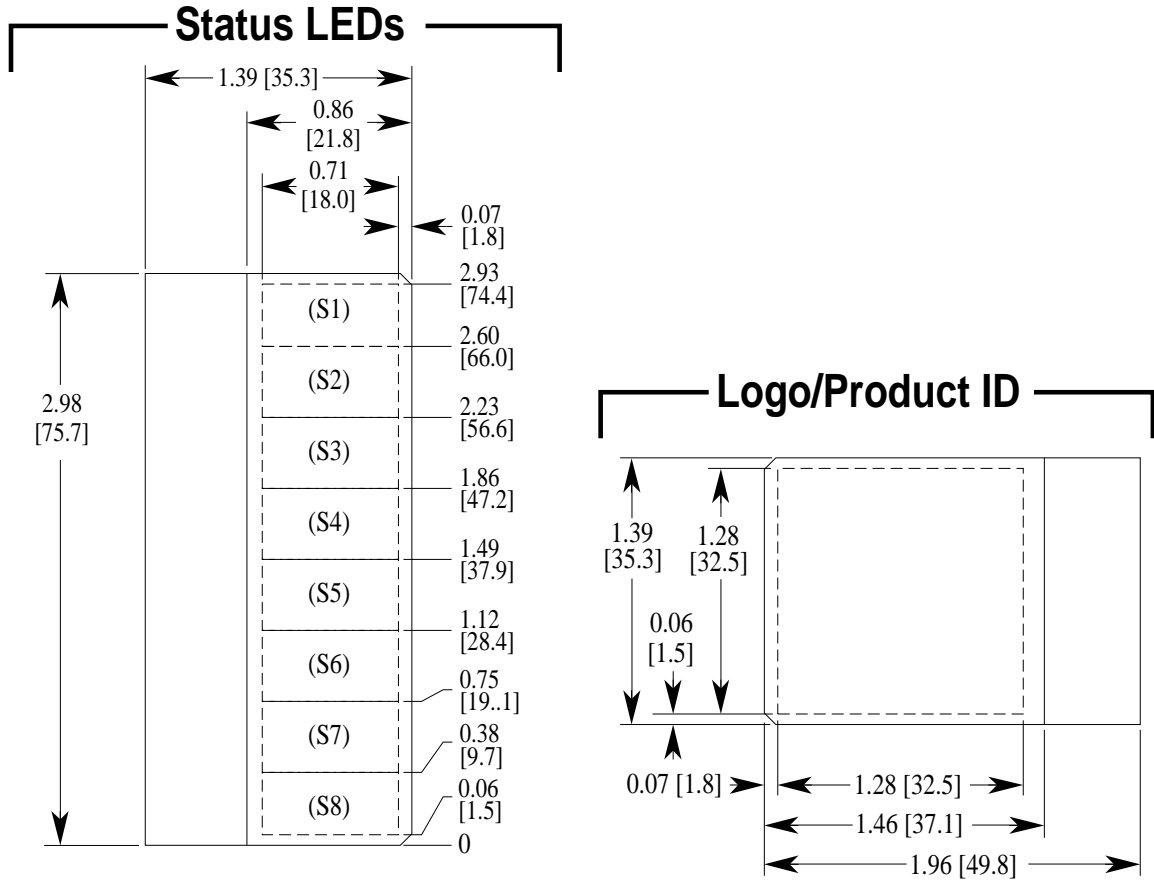
OIT3200B and OIT3250B Legends



OIT4400B and OIT4450B Legends



OIT5400B Legends



APPENDIX F

Troubleshooting

“System DLL’s Missing or Corrupt” Message Displays During STEPware-100 Installation

The “System DLL’s Missing or Corrupt” message can be caused by the following:

- A missing or full \TEMP directory. If you do not have a \TEMP directory, create one. If your \TEMP directory is full, delete some of the files.
- A missing or corrupt VER.DLL and/or DDEML.DLL file. These files are normally provided with Windows and are usually located in the \WINDOWS\SYSTEM directory. If either of these files is missing or has a size of 0, re-install the file(s) from your Windows Setup disks.
- *WindowsNT*: Two VER.DLL and/or DDEML.DLL files; with one copy in the \SYSTEM directory and one copy in the \SYSTEM32 directory. If either of these files is present in both directories, delete the file(s) in the \SYSTEM directory.

When Power is Applied the OIT’s Display is Blank and the OIT Beeps

This indicates that the OIT does not contain a complete project and that the OIT is in download mode waiting for STEPware-100 to download a project. Refer to Chapter 1: Getting Started for instructions on creating and downloading a STEPware-100 project.

The OIT Will Not Enter Configuration Mode

If, instead of displaying `Parameters? MODIFY`, the OIT displays `Brightness?`, `Disp View Angle?` or `Baud Rate?`, Local Setup Access has been disabled. You will need to enable Local Setup Access by connecting the OIT to a host controller and having the host controller send the Keyboard Control control command to the OIT. Refer to Appendix A: Control Commands for more information.

If, for some reason, you cannot reenable the Local Setup Access using the Keyboard Control command, perform the following:

- for OIT3175/4175 models:
 1. Press and hold down the CLEAR or ENTER key while the OIT is initializing, until the **Disp View Angle** or **OIT Brightness** message is displayed.
 2. Press the ENTER key to display **Baud Rate** message.
 3. Press the F1 key.
 4. Press the F2 key.
 5. Press the F9 key.
 6. Wait for a few seconds. The OIT will reinitialize, allowing you to enter Local Setup by holding down the CLEAR or ENTER key.

- for OIT3165/4165, OIT3175/4175 and OIT3185/4185 models:
 1. While pressing and holding down the CLEAR or ENTER key, cycle power to the OIT. Continue pressing until the **Disp View Angle** or **OIT Brightness** message is displayed, then release.
 2. Press the ENTER key to display **Baud Rate** message.
 3. Press the F1 key.
 4. Press the F2 key.
 5. Press the F3 key.
 6. Wait for a few seconds. The OIT will reinitialize, allowing you to enter Local Setup by holding down the CLEAR or ENTER key.
 7. Refer to Chapter 2, OIT Configuration and follow instructions.
- for OIT3200/3250 and OIT5400 models:
 1. While pressing and holding down the CLEAR or ENTER key, cycle power to the OIT. Continue pressing until the **Baud Rate** message is displayed, then release.
 2. Press the F1 key.
 3. Press the F2 key.
 4. Press the F3 key.
 5. Wait for a few seconds. The OIT will reinitialize, allowing you to enter Local Setup by holding down the CLEAR or ENTER key.
 6. Refer to Chapter 2, OIT Configuration and follow instructions.
- for OIT4400/4450 models:
 1. While pressing and holding down the CLEAR or ENTER key, cycle power to the OIT. Continue pressing until the **OIT Brightness** message is displayed, then release.
 2. Press the ENTER key to display **Baud Rate** message.
 3. Press the F1 key.
 4. Press the F2 key.
 5. Press the F3 key.
 6. Wait for a few seconds. The OIT will reinitialize, allowing you to enter Local Setup by holding down the CLEAR or ENTER key.
 7. Refer to Chapter 2, OIT Configuration and follow instructions.
- for OIT3600 model:
 1. While pressing and holding down the CLEAR or ENTER key, cycle power to the OIT. Continue pressing until the **Display viewing angle** message is displayed, then release.
 2. Press the ENTER key to display **Baud Rate** message.
 3. Press the F1 key.
 4. Press the F2 key.
 5. Press the F3 key.
 6. Wait for a few seconds. The OIT will reinitialize, allowing you to enter Local Setup by holding down the CLEAR or ENTER key.
 7. Refer to Chapter 2, OIT Configuration and follow instructions.
- for MAP320/340/460 model:
 1. Press and hold down the CLEAR or ENTER key while the OIT is initializing, until the **Display viewing angle** message is displayed.
 2. Press the ENTER key to display **Baud Rate** message.

3. Press the F1 key.
4. Press the F4 key.
5. Press the F7 key.
6. Wait for a few seconds. The OIT will reinitialize, allowing you to enter Local Setup by holding down the CLEAR or ENTER key.
7. Refer to Chapter 2, OIT Configuration and follow instructions.

The OIT's Keypad is Not Responding As Expected

Many operating parameters affect the operation of the OIT's keypad. Therefore, if a key is not operating as expected, consider the following:

- The operating mode (i.e. Interactive, Block, or Network) can change how the key operates. Refer to Chapter 3: Operation Modes for more information.
- Is local echo enabled? For OITs operating in Interactive mode, this option determines whether characters sent to the host from the OIT's keypad are also sent to the OIT's display.
- Is block echo enabled? For OITs operating in Block or Network mode, this option determines whether a character or an asterisk is displayed on the OIT's display when a key is pressed.
- Which line terminator is the OIT using? This parameter determines which character is sent when the OIT's ENTER key is pressed.
- Is the local keyboard option enabled? If the local keyboard parameter is disabled, then the OIT's keypad will not function except to allow the OIT operator to enter Configuration mode during initialization of the OIT.
- Is the keyclick option enabled? By default, all of the keys on the OIT respond with a keyclick sound whenever the keys are pressed. However, this feature can be disabled to allow the keys to be silent.

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Index

!			
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