

BIUT-800

BUS INTERFACE UNIT TESTER

OPERATING MANUAL

First Edition — November 2000

**For use with NEMA TS2-1998
Bus Interface Units**

Rev 1.0

ATSI

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I. General Information

The BIU (Bus Interface Unit) is a key component in a modern NEMA TS2 signal cabinet. The BIU is responsible for converting all the (formerly hardwired) inputs and outputs that need to be controlled and monitored by the controller into reliable, high-speed data packets. These data packets are transmitted to and received from the controller, with appropriate protocol and error checking data at up to ten times per second per BIU. The only link between the BIU and the controller unit is the SDLC bus, which makes checking individual BIUs extremely difficult outside of a fully functional TS2 cabinet. Even then, only cursory testing is possible because built-in TS2 controller diagnostic capabilities are extremely limited. This situation has created the need for a comprehensive, stand-alone tester for the BIU.

The BIUT-800 tester is designed to test TS2 BIUs quickly and easily and determine if they meet the NEMA Standard. The NEMA standard defines how the BIU should function and how it must interface with all the related parts of the TS2 cabinet. The BIUT-800 tester is designed to test exactly to the requirements of the NEMA standard, which should be all that is required of the BIU to provide compatibility between the different makes of equipment. Since there are no options or setup parameters for the BIU, the tester is designed to run only one set of tests that includes all the performance requirements.

The operator simply turns on the power switch, plugs in the BIU to test, enters the make, model, serial number, and begins the test. The tester automatically performs the test sequence, interprets the results, generates the test report and stores the report in the tester's memory. Test reports are saved in the tester's memory by a user assigned name and can be downloaded to a PC or printed on-site with the internal printer.

The tester is housed in a sturdy suitcase-style ABS plastic case which houses the tester, the internal printer, cables, and provides the space for a spare BIU (supplied by the owner). In the lid of the case is a pocket that holds the Operator's Manual and any other paperwork from the factory. We recommend a factory recalibration every two years and the unit should only need an occasional battery replacement (expected 10 year battery life).



Figure 1: BIUT-800 tester with BIU ready for testing

The tester requires 120 V AC, 50/60 Hz power and can be operated in the field or in the shop. The recommended temperature range for operation is 40 deg. F. to 140 deg F.

II. How to Setup for BIU Testing

Upon receiving the new tester, carefully unpack the box by cutting the tape in a way that allows the box to be reused for shipment of the tester back to the factory. After years of shipping test equipment across the continent, we strongly suggest saving the factory shipping box and packaging (foam) for future tester shipments. Your box should contain the following items, all found inside the BIUT-800 enclosure:

1. **BIUT-800 tester**
2. **Internal Impact printer (secured with Velcro to tester)**
3. **Printer ribbon (installed in printer) and roll of paper**
4. **24" SDLC cable w/15-pin connectors**
5. **6' RS232 Serial data cable w/9-pin connectors**
6. **10 inch RS232 Serial printer cable w/ 9 and 25 pin connector**
7. **Operating Manual**
8. **BIUT Interface Software**

The short cord coming out of the tester panel with the two-wire jack is the power for the internal printer. This should be plugged into the appropriate receptacle on the back of the printer. The printer cable should be plugged into the 25-pin port on the back of the printer and into the 9-pin serial port in the side of the tester panel. The 15-pin to 15-pin SDLC cable will need to be attached to the correct ports on the tester and the BIU prior to beginning a test.

Open up the BIUT-800 tester enclosure, and set the power switch (Fig.2) to the "off" position (push down on the side furthest from the dot on the switch). Plug in the power cord to an appropriate (120 VAC/ 3-wire grounded) receptacle and check that the power switch is indeed off (not illuminated).



Figure 2: BIUT-800 tester power switch off

Locate the SDLC cable (Fig. 3), and plug one end of the SDLC cable into the 15-pin D-connector located on the right-hand side of the tester panel (Fig. 4).



Figure 3: SDLC cable (Tester-to-BIU)

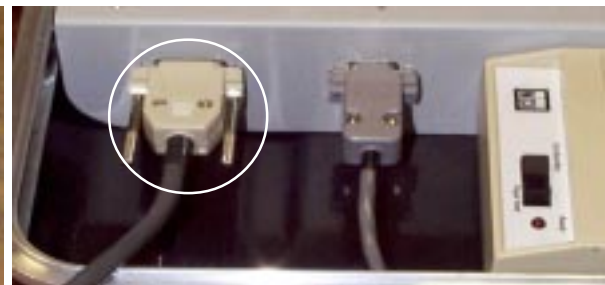


Figure 4: SDLC cable plugged into tester

The tester should be turned on with the power switch shown in Figure 2. Rapidly turning the power off and on again will damage the tester. After turning unit off, wait at least 10 SECONDS before turning it back on. ***Always ensure that the BIU IS NOT inserted in the tester before turning on the power switch.***

Select the BIU to be tested and remove the unit from the cabinet or packaging. Carefully slip the BIU through the card edge guides on the top of the tester panel with the BIU oriented right side up and insert the DIN connector into the mating connector mounted on the top of the tester panel (Fig. 5).

The connectors should mate with only moderate force required. If the connectors are not mating smoothly, remove the BIU and inspect both connectors for bent pins or dirt in the connector. If it seems like it is requiring too much force to get the connectors to mate, try another BIU for comparison. If it seems that the problem is with the tester, call ATSI and discuss the problem with our staff.

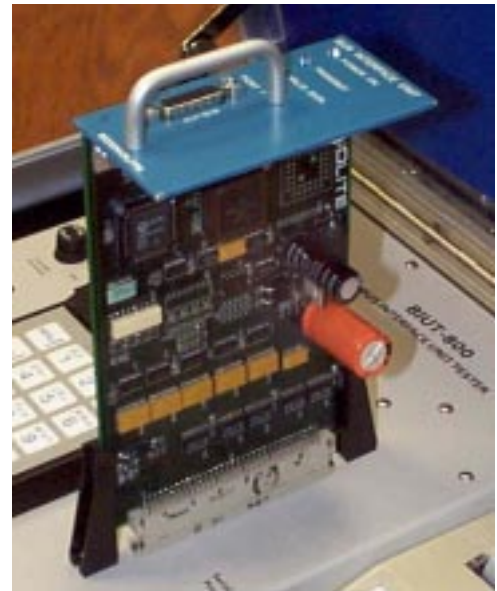


Figure 5: BIU plugged into top panel connector

Caution: Applying excessive force (~40 lb) to the top panel can damage your tester! This type of damage is considered abuse and will not be covered by the warranty.

Once the BIU is seated in the DIN connector, connect the free end of the SDLC cable to the proper 15-pin D connector on the front panel of the BIU (Fig. 6). The BIU is now properly set up in the tester and you are ready to begin the testing process.

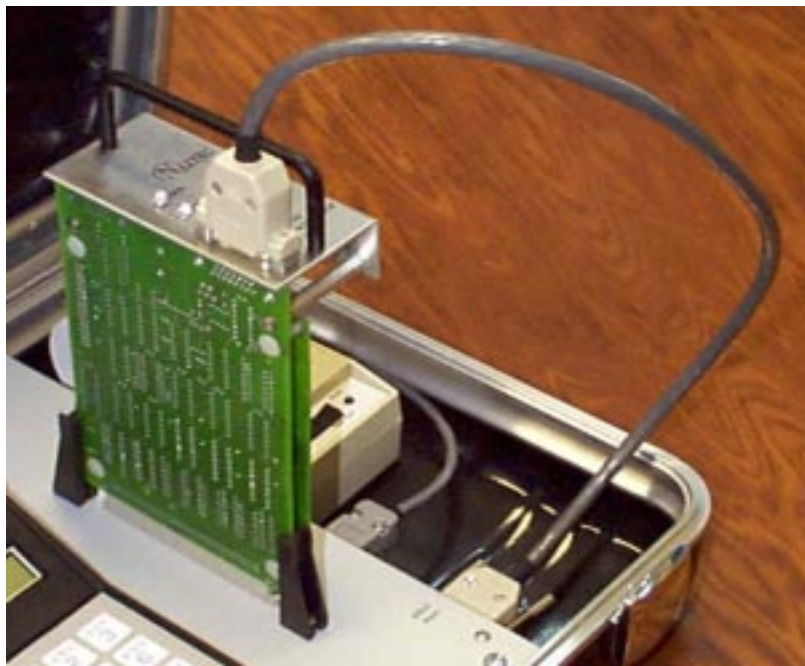


Figure 6: BIU ready for testing

III. Keypad & Display, Start-Up Messages & Responses

To begin this section, the operator should have just turned on the power switch (with no BIU inserted), and the first message should be displayed on the two-line LCD display above the keypad.

The operator uses the BIUT-800 keypad to control tester operations and to input the operator-provided report data. The operator is guided through all operations by messages on a display that identifies the options available at each decision point.

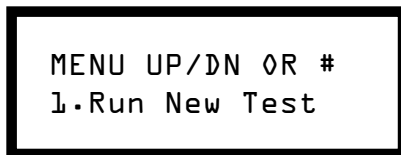
When the tester is first turned on, it presents a series of messages with general information about the tester, including the model number, serial number, and battery status. These messages are not editable, and pass by automatically, ending with the Main Menu selection message on the display (D1).

From this message, you can use the **Menu ↑** or **Menu ↓** keys to scroll through the menu items, or press a numbered key to move directly to one of the following 8 menu items:

1. **Run New Test**
2. **Print Report**
3. **Delete Report**
4. **Set Date/Time**
5. **LCD Contrast**
6. **Set Agency Name**
7. **Printer Configuration**
8. **Tester Info**



Figure 7: BIUT-800 keypad and display



D1: BIUT-800 Main Menu

Before beginning the next section, below are some basic instructions that should help you use the keypad efficiently:

1. To type a Number, simply press the desired numeric key.
2. To type a Letter, press and hold the **Shift** key and then press the desired letter key. You may need to press the letter key two or three times to get the correct letter. For instance, to type in an "L", press and hold the **Shift** key and then press the "JKL / 5" key three times. Release the **Shift** to proceed to the next letter or number.
3. If a mistake was made during entry, use the MARK/BKSPACE to correct the mistake.

To save data entry time, the tester retains the previous entered data. However, the "previous" entry may need modified slightly or changed completely. Below are some additional tips and tricks that will save you time:

1. If the previous entry needs modified slightly, use the **Mark/Backspace** key to delete the appropriate characters and type in the new data. For instance, you are testing ten BIUs and the last three numbers of the serial number differ for each BIU. Instead of typing in the entire serial number each time, press the **Mark/Backspace** three times and only enter the numbers that are different.
2. If the previous entry needs deleted, press and hold the **Shift** key and press the **Mark/Backspace** key to delete the entire entry.
3. Press the **NO/ESC** key to return to the previous menu setting.

The next section will describe how to set up and run a test. Each section following will describe the possible options and features of each of the 8 menu items in numerical order.

IV. Menu Item 1: Run New Tests

The purpose of this menu selection is to begin a new BIU test. The BIUT-800 tester runs the same set of tests every time. The set of tests checks the BIU in each of the eight NEMA-defined addresses. When these tests have been passed, the BIU can be used in any position in the TS2 cabinet.

From the MAIN display, press the **1** key or **Menu ↑** or **Menu ↓** to go to **1. Run New Test** and then press the **Yes/Contin** key. This brings up the next display (D2), which allows the user to select the manufacturer of the BIU that will be tested.



D2: Manufacturer Menu

From this menu, select the BIU manufacturer from the list by pressing the correct number key or **Menu ↑** or **Menu ↓** to go to the desired manufacturer, and then press the **Yes/Contin** key. The manufacturers on the list are as follows:

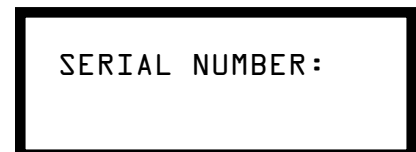
0. Other
1. Naztec
2. Econolite
3. EDI
4. Peek
5. Eagle

This brings up the next display (D3), which allows the user to input the Model number of the BIU that will be tested.



D3: Model Number Input

The first time the tester is used, the default prompt is displayed. Press **Shift** and **Mark/Backspace** to delete the prompt and then enter the Model of the BIU. When the model number is displayed, press the **Yes/Contin** key to record the model number and proceed to the next message. This brings up the next display (D4) that allows the user to input the Serial number of the BIU that will be tested.



D4: Serial Number Input

In a similar fashion to the Model number above, clear the first time prompt and enter the serial number. When the Serial number is displayed, press the **Yes/Contin** key to record the Serial number and proceed to the next message. This brings up the next display (D5), which allows the user to input the Device ID of the BIU being tested.

The remaining user data is filled in a similar fashion as noted above, with the the display prompts shown to the right. After a Comment has been entered, the last prompt is to press the **Yes/Continue** key to begin the test.

This is the ideal point in time to insert the BIU into the card guides and gently guide it into the DIN connector. Prior to this point, the user may have to look around on the BIU to find the Serial number, Inventory number, etc. so it would be better to have the BIU loose. **Inserting the BIU at this time, prior to starting the test, will not damage the tester.**

After the BIU is properly inserted in the tester's card guides and DIN connector, press the **Start/Contin** key to begin the test. During the test, there is no operator input required. The display will give various messages to the user during the test. These are designed to show the user the progress of the tester. If the test needs to be stopped, press and hold the **No/Esc** key to abort the test. *It is important that if the user wants to restart a test, they must not turn the tester's power off and back on. Repeated instances of this can damage the tester.*

Some messages that may be shown will alert the user to setup problems. If the tester finds that SDLC communication has failed in the beginning of the test, the display will post a message to check the SDLC cable, in case the cable was not connected properly. After checking the cable and pressing the "Start/Contin" key, the test will start over after this message. These messages also apply to the BIU as well if the BIU is not inserted properly. If these messages appear repeatedly, the BIU may be damaged and should not be tested.

At the end of the test, the display (D10) will present a summary message indicating how many failures were found. **E**rrs indicate the number of errors; **A** shows how many Alert messages; **W** indicates the Warnings; and **N** identifies the number of Notes issued. (See Appendix A: Test Descriptions, for the different error types) These can be reviewed by printing out or downloading the test report to a PC.

The operator presses **Yes/Contin** to see the next screen, where the option to print the report is given (D11). If **Yes/Contin** is pressed, the display (D12) will prompt for the report type. A Verbose report will provide a more detailed description of the test results.

DEVICE ID:

D5: Device ID Input

TESTED BY:

D6: Tested By Input

LOCATION:

D7: Location Input

COMMENT:

D8: Comment Input

Press Continue
To Start Test.

D9: Begin Test message

Summary:Errs: 12
A: 10 W: 10 N: 1

D10: Test Summary message

Tests Complete
Print Results?

D11: Print Test message

Verbose Report ?
YES/NO

D12: Print Option message

Next, the operator is given the opportunity to save the report. If the operator presses the **Yes/Contn** key, the displayed message (D13) changes to prompt the operator for a test report filename. (*Note: this is the only opportunity to save the test results. ATSI suggests saving all test results that might need further inspection.*)

The filename should be designed to help you find the file later. Try using the cabinet inventory number or some other feature that identifies the location where the BIU is used. Each filename must be unique. If not, the tester will prompt the user for another filename. Keep in mind you are limited to 16 characters.

When the filename is entered via the keypad, press the **Yes/Contn** key, and the file is saved to the memory of the BIUT-800 tester. The display will present a message to this effect, and then revert to the main menu for selection of the next activity.

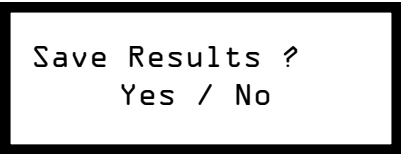
This is the ideal point in time to remove the BIU from the card guides and the DIN connector. Removing the BIU at this time, after the test, will not stress the tester.

V. Menu Item 2: Print Report

The purpose of this menu selection is to print (using the included printer) selected BIU test reports that were previously saved in the memory of the BIUT-800 tester. This function may also be used to download test reports to the user's PC. To download reports using the BIUT Interface software, refer to Section XII, on page 11.

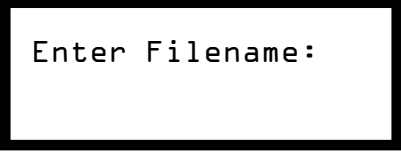
From the MAIN display, press the **2** key or **Menu ↑** or **Menu ↓** to go to **2. Print Report** and then press the **Yes/Contn** key. This brings up the next display (D14), which allows the user to select the report to be printed by date and filename.

Using the **Menu ↑** and **Menu ↓** keys, scroll through the filenames until the desired filename is displayed, then press the **Yes/Contn** key to print the test. A message will appear prompting the user for the type of report to print (see D12). The file will be sent out the serial port to the printer at this point. Pressing **NO/ESC** will return to the Main Menu without printing.



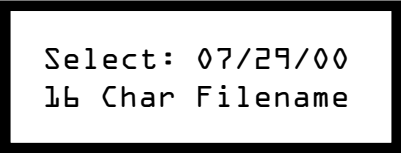
```
Save Results ?
Yes / No
```

D13a: Filename message



```
Enter Filename:
```

D13b: Filename message



```
Select: 07/29/00
16 Char Filename
```

D14: Print Select message

If the user wishes to download the file to a PC, use the 9-pin to 9-pin data transfer cable included with the BIUT-800 tester. The user should utilize a standard communications program of their choice (HyperTerminal comes with Microsoft operating systems) and set the program to receive data from the proper port on their PC with the protocol set to:

19,200 baud, N, 8, 1.

VI. Menu Item 3: Delete Report

The purpose of this menu selection is to delete individual BIU test reports from the memory of the BIUT-800 tester. Refer to Section XII, on page 11 to delete reports using the BIUT Interface Software.

From the MAIN display, press the **3** key or **Menu ↑** or **Menu ↓** to go to **3. Delete Report** and then press the **Yes/Contin** key. This brings up the next display (D15), which allows the user to select the report to be deleted by date and filename.

Using the **Menu ↑** and **Menu ↓** keys, scroll through the filenames until the desired filename is displayed, then press the **Yes/Contin** key to delete the report. A cautionary message (D16) will appear to confirm that you wish to delete a file from memory. Pressing the **Yes/Contin** key will delete the report and send the user back to the file selection menu to delete another report. Press the **NO/ESC** key will return the user to the main menu.

```
Select: 07/29/00
16 Char Filename
```

D15: Delete Select message

```
Delete Report?
My Report Name
```

D16: Delete confirmation message

VII. Menu Item 4: Set Date/Time

The purpose of this menu selection is to set the date and time in the memory of the BIUT-800 tester.

From the MAIN display, press the **4** key or **Menu ↑** or **Menu ↓** to go to **4. Set Date/Time** and then press the **Yes/Contin** key. This brings up the next message (D17) that allows the user to reset the date.

Reset the date, using the numeric keys and press the **Yes/Contin** key when finished. This will display the message allowing the time to be reset in a similar fashion. Press the **Yes/Contin** after setting the time to return to the Main Menu. Pressing the **NO/ESC** key leaves the information unchanged and continues to next item.

```
Change Date?
07/29/00
```

```
Change Time?
15:22
```

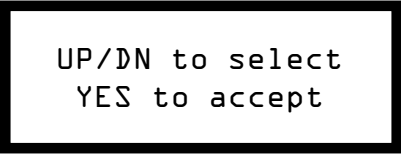
D17: Set Date & Time messages

VIII. Menu Item 5: LCD Contrast

The purpose of this menu selection is to adjust the contrast of the LCD display.

From the MAIN display, press the **5** key or **Menu ↑** or **Menu ↓** to go to **5. LCD Contrast** and then press the **Yes/Contin** key. This brings up the next message (D18) that allows the user to adjust the contrast.

Adjust the contrast of the display by repeatedly pressing (or press and hold) the **Menu ↑** and **Menu ↓** keys. Press the **Yes/Contin** to set contrast level and return to the Main Menu. The contrast setting is now saved as the default power-up contrast. Pressing the **No/Esc** key at any time will revert back to the previous setting and return to the Main Menu.



UP/DN to select
YES to accept

D18: Adjust Contrast message

IX. Menu Item 6: Set Agency Name

The purpose of this menu selection is to set the Agency Name in the memory of the BIUT-800 tester. This Agency Name will appear in the header of every test report. (Note: ATSI presets this for each user.)

From the MAIN display, press the **6** key or **Menu ↑** or **Menu ↓** to go to **6. Set Agency Name** and then press the **Yes/Contin** key. This brings up the next message (D19), which allows the user to reset the Agency Name.

Type in the Agency Name (16 characters, max.), using the alpha keys and press the **Yes/Contin** key when finished. This will store the new Agency Name in memory and return the user to the Main Menu.

Pressing the **NO/ESC** key during entry retrieves the current setting and pressing it a second time will leave the entry unchanged and return to the Main Menu.



AGENCY NAME:
Your Agency

D19: Set Agency Name message

X. Menu Item 7: Printer Configuration

The purpose of this menu selection is to set the communication parameters in the the attached printer to match the parameters in the memory of the BIUT-800 tester.

From the MAIN display, press the **7** key or **Menu ↑** or **Menu ↓** to go to **7. Printer Config** and then press the **Yes/Contin** key. This brings up the next message (D20) and automatically begins the configuration process.

When the configuration process is complete, the ATSI logo should print and the tester will return to the Main Menu.

Note: The installed printer is already pre-configured. Use this option only if you are installing a new printer.

If you are having problems printing, check all cable connections and power. If the printer is still not responding:

1. **Unplug the printer's power cable.**
2. **Wait 10 seconds**
3. **Plug-in the power cable**
4. **Verify the connections of the printer serial cable**
5. **Configure the printer (as shown above)**
6. **Attempt to print a saved test**
7. **Further problem? Contact ATSI**

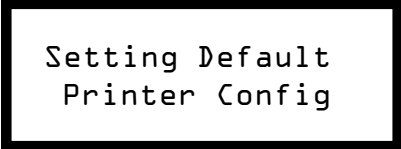
XI. Menu Item 8: Tester Info

The purpose of this menu selection is to display tester information about the BIUT-800 tester.

From the MAIN display, press the **8** key or **Menu ↑** or **Menu ↓** to go to **8. Tester Info** and then press the **Yes/Contin** key. This brings up the next message (D21), which displays the following messages.

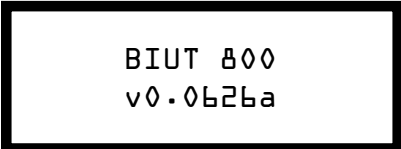
These messages display the tester model number, firmware revision number, tester serial number, and backup battery status to the user. Press the **Yes/Contin** key to cycle through these messages and back to the Main Menu.

Press the **No/Esc** key to return to the Main Menu.

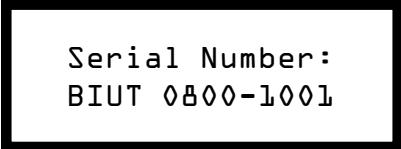


```
Setting Default
Printer Config
```

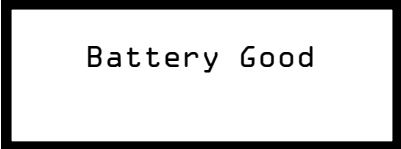
D20: Printer Config message



```
BIUT 800
v0.0626a
```



```
Serial Number:
BIUT 0800-1001
```



```
Battery Good
```

D21: Tester Info messages

XII. BIUT Interface Software

A. AN OVERVIEW

The BIUT Interface software provides you the means to perform miscellaneous functions of the tester. Some of these functions such as firmware upgrades are only available through the software, while printing or deleting a test report can be completed using either the tester or the software.

The software can be used with Windows 95, 98, 98 SE, as well as NT. The following sections will walk you through the installation and basic functions of the application.

B. INSTALLATION

If the "Autorun" feature of your computer's CD-ROM drive is enabled, simply insert the CD into your CD-ROM drive and the installation will automatically begin. If you do not use the "Autorun" feature or it does not automatically start, then click the Start button and select "Run". Type "**D:\GO.exe**" where D: represents the drive letter of your CD. Press the Enter key and follow the onscreen instructions to complete the installation.

C. PREPARING THE TESTER

To prepare the BIUT-800 to communicate with the Interface software you must first disconnect the serial printer cable from the 9-pin connector located on the side of the panel. Now take the supplied six foot female-to-male 9-pin serial cable and connect the male connector to the tester and the female connector to an available serial port on your computer.

D. SOFTWARE FEATURES

There are many features of the Interface Software that will benefit you and your agency. We have made it easy for you to keep track of your test reports, print your test reports, upgrade the firmware of your tester, and even delete test reports saved on the tester.

Appendix A. Test Descriptions

LEVELS OF SEVERITY USED THROUGHOUT THIS APPENDIX

NOTE: This indicates a result that may be within the NEMA TS2 specification, but is worth further investigation as the results were less than perfect. This can help point to intermittent errors, or help find the cause of errors that are seen elsewhere.

WARNING: This indicates a result that is outside of the NEMA TS2 specification, although, it occurs only when: 1) atypical stimuli are applied, or 2) the unit requires additional stimulus to work properly and that stimulus typically occurs. These digressions will typically go unnoticed under normal operating conditions.

ALERT: This indicates a result that is outside the NEMA TS2 specification. These deviations indicate the unit may not function equally well in all cabinets. (This does not indicate that the unit will not work in a particular manufacturer's cabinet, or under certain conditions, but that it does not meet the standard for uniform operation.)

ERROR: This indicates a result that is outside the specification and the particular problem is severe enough that the unit must be taken out of service. Any unit with one defect of this severity will not work properly and may cause other malfunction or damage, and should not be used in any circumstance.

HARDWARE INDEMNITY TESTS

Note: any failure in this set of tests indicates a severe error with the BIU under test, or the tester (BIUT 800) itself. After receiving a printed message, give the message and the BIU to a qualified electrical technician for inspection. Any failure will cause the tester to stop and report the errors found; it should be noted that testing might stop before all errors are found. If the same message(s) occurs for multiple BIU's there may be damage to the tester, contact ATSI immediately for further instruction if this occurs.

[Opto Pins:]

As a safety precaution, isolation of the Opto Common, as well as isolation of the Opto Inputs is tested on start-up. (Standard: TS 2-1998 8.8.5.1 Opto Common and 8.8.5.2 Opto Inputs ¶ 1)

Associated Messages:

```
*ERROR: Opto Voltage Test:  
Opto Com: Write = 0, Read = 1  
Opto 1: Write = 0, Read = 1  
Opto 2: Write = 0, Read = 1  
Opto 3: Write = 0, Read = 1  
Opto 4: Write = 0, Read = 1
```

Comment:

These findings are reported immediately. If there is a problem it is printed out and no further testing is done. Therefore, these results will not be found in any test report. Note: there may be more errors that will remain unreported, testing may stop before all errors are found.

[Input, Output and I/O Pins:]

As a safety precaution, functionality of all input and output pins is tested. The states of the pins are set and internally read back. Typical problems found are associated with pins tied together, pins tied to ground, or pins tied to 24 VDC.

(Standard: TS 2-1998 8.8.4 Outputs, 8.8.5 Inputs, 8.8.5.4 24 Volt Signal Inputs, and 3.3.5.1.3 Inputs)

Associated Messages:

```
*ERROR: I/O 2,           Write = 1, Read = 0
*ERROR: Input 1,        Write = 0, Read = 1
*ERROR: Input 2,        Write = 1, Read = 0
*ERROR: Output 9,       Write = 1, Read = 0
*ERROR: Output 11,      Write = 1, Read = 0
```

Comment:

These findings are reported immediately. If there is a problem it is printed out and no further testing is done.

Note: there may be more errors that will remain unreported; all pins are not tested simultaneously, and therefore testing may stop before all errors are found.

[Line Frequency Reference Pin:]

As a safety precaution, functionality of the Line Frequency Reference pin is assured.

(Standard: TS 2-1998 8.8.5 Inputs, 8.8.5.3 Line Frequency Reference, 8.8.5.4 24 Volt Signal Inputs, and 3.3.5.1.3 Inputs)

Associated Messages:

```
*ERROR: Line Frequency Pin stuck high
*ERROR: Line Frequency Pin stuck low
```

Comment:

Stuck high identifies when the pin cannot be asserted. Stuck low will identify if the pin is tied to ground. This problem is printed out immediately and no further testing is done.

[Self Test:]

Extensive internal diagnostics are performed.

Associated Messages:

```
*ERROR: specific_test    Self Test
internal_reference,     Write = 1, Read = 0
```

Comment:

"specific_test" is replaced with the actual test name. "internal_reference" is replaced with an identifier used by ATSI for diagnostic purposes. These tests are numerous and refer to problems within the tester. The tester should be immediately taken out of service and the error(s) should be reported to ATSI. The tester may have been damaged and could require repair; further, under certain conditions the tester could cause damage to BIU's attempting to be tested.

POWER REQUIREMENTS TESTS**[Inrush Current:]**

24 VDC power is applied to the BIU under test. The current draw is monitored. The tester verifies current does not exceed the maximum 1.25 amperes allowed during the initial inrush.

(Standard: TS 2-1998 8.5 POWER REQUIREMENTS)

Associated Messages:

Inrush Current:	PASS
*ALERT: Inrush Current:	FAIL

Comment:

This failure will cause problems with initial power up or immediately after "hot" insertion. Power supplies with output current protection may fail to power up, or take a longer period of time to reach 24 VDC. This may cause the intersection to go into (or remain in) flash.

[Steady State Current:]

The current draw is monitored. Appropriate frames are sent until the BIU reaches steady state. The tester verifies current does not exceed 200 mA.

(Standard: TS 2-1998 8.5 POWER REQUIREMENTS)

Associated Messages:

Steady State Current:	PASS
*ALERT: Steady State Current:	FAIL

Comment:

This failure may adversely affect the power supply and voltage levels.

INITIALIZATION TESTS**[T&F BIU Address Check:]**

BIU is set to each of the eight Detector and T&F addresses in sequence. Appropriate command frames are sent to each address while valid. The response of the BIU will confirm the proper status.

(Standard: TS 2-1998 8.8.5.4.1 Address Select Inputs.)

Associated Messages:

T&F BIU Address Check:	PASS
1 2	
*ERROR: T&F BIU Address Check:	FAIL
0 3	
*ERROR: T&F Incorrect Response:	FAIL
3	
DET. BIU Address Check:	PASS
11	
*ERROR: DET. BIU Address Check:	FAIL
8 9 10	
*ERROR: DET. Incorrect Response:	FAIL
10	

Comment:

The unit will fail the BIU Address Check if it does not respond to the correct Address. In addition, the unit will receive a T&F Incorrect Response failure if it responds to the incorrect address or if the response is not the proper format. A failure due to an incorrect response will also be listed as an Address Check failure. Units that fail this test should not be put in the field.

[Slow Power Up Test:]

For address 0 (T&F #1), the BIU address is set. The 24 VDC power is applied at a rate no more than 50 V/s without pulling the address lines high by other means. All frames are sent to the BIU to see if it responds to the correct address. No response or an incorrect response is considered a failure.

(Standard: TS 2-1998 8.5.1 Initialization ¶ 1.)

Associated Messages:

Slow Power Up Test:	PASS
*WARNING: Slow Power Up Test:	FAIL

Comment:

This failure will cause problems with initial power up or immediately after "hot" insertion.

[Turn on:]

For each of the following addresses: 0-3, 8-11, the BIU address is set. The 24 VDC power is applied. The states of the output pins are monitored and should be pulled high within 100 ms from application of DC power.

(Standard: TS 2-1998 8.5.1 Initialization ¶ 1.)

Note: BIU's that fail the "Inrush Current" test must be tested in "Cold Turn On" mode. Cold Turn On indicates the 24 VDC is powered up with a slew rate of no faster than 50 V/s. Hot Turn On indicates the 24 VDC is powered up with a slew rate of no faster than 8 V/ms. The slower (Cold Turn On) rate will cause the unit's turn on time to be reported as shorter than under Hot Turn On mode. The limited slew rate causes the Cold Turn On time to start 480 ms after the initial application of power and end when the I/O pins go to and remain in the 24 V state (compare to 3 ms for Hot Turn On).

Associated Messages:

Cold Turn On:	PASS
Hot Turn On:	PASS
*ALERT: Hot Turn On:	FAIL
*T&F #2 Turn On: 206 ms	(0-100 ms)
*ALERT: Cold Turn On:	FAIL
*T&F #4 Turn On: Over 1.5 s	(0-100 ms)

Comment:

Inputs, as well as, I/O and outputs are tested to be at the 24 V state. The verbose report will show all turn on times.

[700 ms Moderate Power Loss:]

With the BIU set to Address 0 (TF #1), a specific pattern of output pins is asserted. The 24 V supply power level is set to 16 V \dagger for 700 ms, then restored. The tester verifies the output pins remain in the current state.

(Standard: TS 2-1998 8.5.1 Initialization ¶ 2-3.)

Associated Messages:

700 ms Moderate Power Loss:	PASS
*ALERT: 700 ms Moderate Power Loss:	FAIL

Comment:

BIU's that fail typically reset all I/O and reinitialize.

[700 ms Harsh Power Loss:]

With the BIU set to Address 0 (TF #1), a specific pattern of output pins is asserted. The 24 V supply power level is set to 0 V \dagger for 700 ms then restored. The tester verifies the output pins remain in the current state.

(Standard: TS 2-1998 8.5.1 Initialization ¶ 2-3.)

Associated Messages:

700 ms Moderate Power Loss:	PASS
*ALERT: 700 ms Moderate Power Loss:	FAIL

Comment:

BIU's that fail typically reset all I/O and reinitialize.

[1.5 s Moderate Power Loss:]

With the BIU set to Address 0 (TF #1), a specific pattern of output pins is asserted. The 24 V supply power level is set to 16 V† for 1500 ms then restored. The tester verifies the output pins are reset to the 24V level upon restoration of power.

(Standard: TS 2-1998 8.5.1 Initialization ¶ 5.)

Associated Messages:

1.5 s Moderate Power Loss: PASS
*ALERT: 1.5 s Moderate Power Loss: FAIL

Comment:

BIU's that fail may actually maintain the current state for longer than 1.5 s before resetting. Some units that fail may not see 16V as below the power loss threshold.

[1.5 s Harsh Power Loss:]

With the BIU set to Address 0 (TF #1), a specific pattern of output pins is asserted. The 24 V supply power level is set to 0 V† for 1500 ms then restored. The tester verifies the output pins are reset to the 24V level upon restoration of power.

(Standard: TS 2-1998 8.5.1 Initialization ¶ 5.)

Associated Messages:

1.5 s Moderate Power Loss: PASS
*ALERT: 1.5 s Moderate Power Loss: FAIL

Comment:

BIU's that fail may actually maintain the current state for longer than 1.5 s before resetting.

†Note: The 1998 TS-2 NEMA Standard in 8.5 POWER REQUIREMENTS specifies: A voltage of 16 VDC or less shall be considered loss of power....

OUTPUT TESTS**[Detector Reset Tests:]**

BIU is set to each of the four detector addresses in sequence. The proper command frame (type 24 to 27) is sent to the BIU. The BIU reset outputs should all be asserted following the receipt of the frame. If necessary, a second frame is sent to negate (set to 24 V level) the resets.

(Standard: TS 2-1998 8.8.4 Outputs.)

Associated Messages:

Detector Reset Tests: PASS
*ALERT: Detector Reset Tests: FAIL
*Det#X: 0101 FAIL
*WARNING:
*Det#X requires a Type 18 T&F
*Output Transfer Frame before
*negating detector reset outputs.
*ALERT:
*Det#X requires Y consecutive
*Type ZZ frames before changing
*detector reset outputs.

Comment:

Each detector card slot pair reset is shown to individually pass (1) or fail (0). Note: X indicates the Detector biu number (1-4), Y shows the number of frames (2 or more), and ZZ shows the frame type number (24-27). Also note that Detector BIU's should not use T&F frames (see TS2-1998, 3.3.1.4.1.9 Type 18 Output Transfer Frame).

[Detector Reset PW:]

The pulse width from the last Detector Reset output test is reported.

(Standard: TS 2-1998 8.8.4 Outputs and 6.5.2.8.6 Signal Recognition and 3.3.5.1.3 Inputs ¶ 1-6.)

Associated Messages:

```
Detector Reset PW:          307 ms ( >= 50 ms)
Detector Reset PW:          > 1 Second
*ALERT: Detector Reset PW:  8 ms   ( >= 50 ms)
```

Comment:

Pulse widths are measured up to 1 second (When the next command frame would normally occur).

[T&F Outputs:]

BIU is set to each of the four T&F addresses in sequence. Tester sends a command frame and an output transfer frame in sequence to set the BIU outputs. The tester checks the output pins to confirm the proper status.

(Standard: TS 2-1998 8.8.4 Outputs ¶ 1-6.)

Associated Messages:

```
T&F Outputs:                PASS
  1
*ERROR: T&F Outputs:        FAIL
*   2 3 4
*ERROR: T&F BIU#3 Outputs Asserted: FAIL
  Match = PASS           X = Don't Care
  OUT1-8  OUT9-15X  I01-8  I09-16
  11111111 1111111X 111111XX XXXXXXXX
*00000001 00000000 10000000 00000000
*ERROR: T&F BIU#3 Outputs Negated: FAIL
  Match = PASS           X = Don't Care
  OUT1-8  OUT9-15X  I01-8  I09-16
  00000000 0000000X 000000XX XXXXXXXX
*11110000 11111110 00000000 00000000
*ALERT:
*T&F #3 Outputs Transfer Before a Type
*18 Output Transfer Frame is Received
*ALERT: T&F Outputs Transfer Before a Type
* 18 Output Transfer Frame is Sent to
* T&F #1 #2 #3 #4
```

Comment:

The terse version of the report indicates which T&F BIU pass or fail. The verbose version of the report gives exact detail of the individual outputs for each BIU. Asserted outputs are set to the 0 V level and Negated outputs are set to the 24 V level. Also note that T&F BIU's must wait for a type 18 frame before transferring outputs (see 3.3.1.4.1.9 Type 18 Output Transfer Frame).

[Load Switch Tests:]

BIU is set to TF #1 and TF #2 addresses in sequence. Tester sends command frames in sequence to drive the load switch in each of the four output states: Off, On, + Half Wave, - Half Wave. The tester checks the output pins to confirm proper operation.

(Standard: TS 2-1998 8.8.4 Outputs ¶ 1-6 and 8.8.5.3 Line Frequency Reference ¶ 1-2)

Associated Messages:

```

Load Switch Tests:          PASS
Load Switch Tests:          FAIL
*ERROR: BIU#X LS#YY Failed  (X = BIU number 1-2, YY = Load Switch number 1 to 24)
Load Switch Tests:          FAIL
*ERROR: BIU#2 LS#9 Failed
    Set Mode = 1, Observed Mode = 3
    Set Mode = 2, Observed Mode = 3
*ALERT:
*Pos&Neg Rectification are Reversed
*on 18 of 48 Load Switches.

```

Comment:

The terse version of the report indicates which load switches pass or fail. The verbose version of the report gives exact detail of the individual outputs for each BIU's load switch that fails. If positive and negative rectification are reversed on all load switches, and the BIU is used in a cabinet with other BIU's that are not reversed, attempts at balancing the load will fail.

[Disable Dim on Line Freq Loss:]

BIU is set to TF #1 and TF #2 addresses in sequence. Tester sends command frames in sequence to drive the load switch in each of the four output states: Off, On, + Half Wave, - Half Wave. The Line Frequency Reference signal is removed from the input, and the BIU is sent another series of frames to test each output state. The tester checks the output pins to confirm proper operation.

(Standard: TS 2-1998 8.8.4 Outputs ¶ 1-6 and 8.8.5.3 Line Frequency Reference last ¶)

Associated Messages:

```

TF#1 Disable Dim on Line Freq Loss:PASS
*ALERT:
*TF#2 Disable Dim on Line Freq Loss: FAIL

```

Comment:

If the BIU does not have a valid signal on the Line Frequency Reference input, the outputs should not be dimmed, but instead turned on full in all cases. Some problems that may arise from a failure will be seen by the monitor and the intersection should be put in flash, other deviations will go unnoticed.

[Output Transfer:]

BIU is set to address 0 (T&F #1). Tester sends a frame to establish the pending state of the output pins. Tester then sends a transfer frame (type 18). The tester monitors the BIU after receipt of the type 18 frame to verify the state of the output pins change state within 20 ms.

(Standard: TS 2-1998 8.8.4 Outputs ¶ 7.)

Associated Messages:

```

Output Transfer:          7.2 ms (0-20 ms)
*ALERT: Output Transfer:  34 ms (0-20 ms)
*ALERT:
*Output Transfer: Timeout Error
*ALERT:
*Output Transfer: Outputs Transfer
*before Type 18 frame is sent.

```

Comment:

The output transfer timeout error may result from ERRORS noted elsewhere in the report.

INPUT TESTS**[T&F Inputs:]**

BIU is set to each of the four T&F addresses in sequence. Tester drives the input pins high and low and sends a command frame for each state to verify the BIU reads the inputs properly.

(Standard: TS 2-1998 8.8.5 Inputs and 8.8.5.4 24 Volt Signal Inputs and 3.3.5.1.3 Inputs ¶ 1-6 and 8.8.5.4.2 Function Inputs)

Associated Messages:

```
T&F 1-4 Inputs:                PASS
*ERROR: T&F Inputs:           FAIL
*1 2 3 4
*ERROR: T&F BIU#1 Inputs Asserted: FAIL
  Match = PASS      X = Don't Care
  I01-8   I09-16   I017-24  IN1-8
  XXXXXXXX XXXXX111 11111111 11111111
*00000000 00000000 00000000 00000000
*ERROR: T&F BIU#1 Inputs Negated: FAIL
  Match = PASS      X = Don't Care
  I01-8   I09-16   I017-24  IN1-8
  XXXXXXXX XXXXX000 00000000 00000000
*00000000 00000000 11110000 11110000
```

Comment:

The terse version of the report indicates which T&F BIU's pass or fail. The verbose version of the report gives exact detail of the individual inputs for each of the BIU's.

[Input Threshold low:]

BIU is set to address 0 (T&F #1) with all pins unasserted (pulled to 24 V). Each input pin is pulled down by the tester below 8 V and the BIU is polled to determine the state of the inputs.

(Standard: TS 2-1998 8.8.5 Inputs and 8.8.5.4 24 Volt Signal Inputs and 3.3.5.1.3 Inputs ¶ 1-6 and 8.8.5.4.2 Function Inputs)

Associated Messages:

```
Input Threshold Low (8V):      PASS
*ALERT: Input Threshold Low (8V): FAIL
```

Comment:

Any unit that fails may report incorrect input states.

[Input Threshold high:]

BIU is set to address 0 (T&F #1) with all pins unasserted (pulled to 24 V). The tester pulls down each input pin above 16 V and the BIU is polled to determine the state of the inputs.

(Standard: TS 2-1998 8.8.5 Inputs and 8.8.5.4 24 Volt Signal Inputs and 3.3.5.1.3 Inputs ¶ 1-6 and 8.8.5.4.2 Function Inputs)

Associated Messages:

```
Input Threshold High (16V):    PASS
*ALERT: Input Threshold High (16V): FAIL
```

Comment:

Any unit that fails may report incorrect input states.

[T&F Input pulse reject:]

BIU is set to address 0 (T&F #1). Tester applies a short (7ms) pulse to the inputs to change their state at various positions in a 100 ms window. The BIU is polled to verify their response.

(Standard: TS 2-1998 8.8.5 Inputs and 8.8.5.4 24 Volt Signal Inputs and 3.3.5.1.3 Inputs ¶ 1-6 and 8.8.5.4.2 Function Inputs)

Associated Messages:

T&F Input Pulse Reject:	PASS
*ALERT: T&F Input Pulse Reject:	FAIL
*Asserted Input Pulse Reject:	FAIL
*Negated Input Pulse Reject:	FAIL

Comment:

Inputs should filter out pulses less than 8 ms in duration (see TS-2 1998 3.3.5.1.3 Inputs).

[Opto Functional Tests:]

BIU is set to addresses 0 through 3 (T&F #1 through 4). A sinewave (8.5 VAC RMS) is applied to each of the opto inputs to change their state. The BIU is polled to verify their status. The pins are tested individually while verifying others remain negated.

(Standard: TS 2-1998 8.8.5 Inputs first ¶)

Associated Messages:

Opto Functional Tests:	PASS
*ERROR: Opto Functional Tests:	FAIL
OPTO 1-4 Assert Negate	
*T&F#1: 0000 0000	FAIL
*T&F#2: 0000 0000	FAIL
*T&F#3: 0000 0100	FAIL
*T&F#4: 1011 0000	FAIL

Comment:

If the status for all inputs was correct it is indicated by PASS. Upon any failure, each opto input is shown as pass (1) or fail (0).

[Opto Pulse Recog:]

BIU set to address 0 (TF #1). DC pulses are applied to the first good Opto pin from Opto Functional Test. For increasing time periods an 11V pulse is applied (from 1 ms through 100 ms). Between each test input, the BIU is polled to see when the input is recognized.

(Standard: TS-2 1998 8.8.5.2 Opto Inputs ¶ 2-6)

Associated Messages:

Opto Pulse Recog:	36 ms	(25-50 ms)
*ALERT: Opto Pulse Recog:	76 ms	(25-50 ms)

Comment:

Errors in timing may result from ERRORS noted elsewhere in the report.

[DC(+)Opto Threshold:]

BIU is set to address 0 (T&F #1). A positive DC voltage signal is applied to the input pin. The amplitude is changed until the input voltage threshold between asserted and negated is found.

(Standard: TS 2-1998 8.8.5.2 Opto Inputs ¶ 2-6)

Associated Messages:

DC(+) Opto Threshold:	5.1 V (3-6 Vrms)
*ALERT: DC+ Opto Threshold:	6.9 V (3-6 Vrms)
*ALERT: DC+ Opto Threshold:	above 12.5 Vrms

Comment:

These results are only useful for cabinets that use 24 VDC logic in conjunction with the opto inputs.

[DC(-)Opto Threshold:]

BIU is set to address 0 (T&F #1). A negative DC voltage signal is applied to the input pin. The amplitude is changed until the input voltage threshold between asserted and negated is found.

(Standard: TS 2-1998 8.8.5.2 Opto Inputs ¶ 2-6)

Associated Messages:

DC(-) Opto Threshold: 5.1 V (3-6 Vrms)
 *ALERT: DC- Opto Threshold: 6.7 V (3-6 Vrms)
 *ALERT: DC+ Opto Threshold: above 12.5 Vrms

Comment:

These results are only useful for cabinets that use 24 VDC logic in conjunction with the opto inputs.

[Sine Wave Opto Threshold:]

BIU is set to address 0 (T&F #1). A sine wave is applied to the pin at 60 Hz. The amplitude is changed until the input voltage threshold between asserted and negated is found. If 8.5 VRMS is not recognized, the tester switches to a full wave rectified signal and tests up to 17.5 VRMS or until recognized.

The above is repeated at different phase angles to the line frequency reference.

(Standard: TS 2-1998 8.8.5.2 Opto Inputs ¶ 2-6)

Associated Messages:

Sine Wave Opto Threshold: PASS
 Sine Wave Opto Threshold: (3-6 Vrms)
 *ALERT: Phase 0 deg: 1.0 Vrms
 *WARNING: Phase 90 deg: 10.0 Vrms +
 *WARNING: Phase 120 deg: Above 17.5 Vrms
 *ALERT: Phase 180 deg: Below 0.1 Vrms
 Phase 240 deg: 3.7 Vrms
 *WARNING: Phase 270 deg: 6.7 Vrms
 +NOTE: Full Wave Rectified Signal Used

Comment:

The + symbol identifies where a full wave rectified sine wave was used. If the Line Frequency Reference input has a valid signal and the opto inputs use the 12 VAC connected through a switch to the opto common and no other modifications have been made to the inputs, then the opto input waveform(s) should be in phase with the Line Frequency Reference input.

[Line Frequency Nominal Impedance:]

BIU set to Address 0 (TF #1). The BIU is powered up and the line frequency signal applied to the input. The input signal is tested for the requisite impedance to 24 VDC, and that the proper rise and fall times are ensured.

(Standard: TS 2-1998 8.8.5.3 Line Frequency Reference ¶ 3-4)

Associated Messages:

Line Frequency Nominal Impedance: PASS
 *ALERT:
 *Line Frequency Nominal Impedance: FAIL
 *Line Freq. Rise Time: 321 us (0-50 us) (example)
 *Line Freq. Fall Time: 123 us (0-50 us) (example)
 *ALERT:
 *Line Frequency Nominal Impedance: FAIL
 *NOTE: Cannot Measure Rise/Fall Times

[Detector Pulse:]

BIU is set to address 8 (DET #1). Pulses of steadily increasing widths are applied to the detector inputs until the input is recognized by the BIU. The tester records the minimum pulse width for recognition.

(Standard: TS 2-1998 8.8.5.4.2 Function Inputs ¶ 1-2)

Associated Messages:

```

Detector Pulse:      880 us  (250-1000 us)
*ALERT:
*Detector Pulse:    1180 us  (250-1000 us)
*ALERT:
*Detector Pulse:    Over 5 ms (250-1000 us)

```

Comment:

Pulse widths are measured up to 5 ms; if over 5 ms a corresponding ALERT should be reported in Detector Call Status.

[Detector Call Status:]

BIU is set to each of the four detector addresses in sequence. Calls are placed and then removed on each of the input pins while the BIU is polled to confirm their status.

(Standard: TS 2-1998 8.8.5.4.2 Function Inputs ¶ 4)

Note: Bit 0 represents a call that is present at the time the frame was generated. Bit 1 represents a change in call status since last time the frame was sent.

Associated Messages:

```

Detector Call Status:          PASS
*ALERT: Detector Call Status:  FAIL
  Call Status Bit 0 (Present)  PASS
  Call Status Bit 1 (Change) DET 1-8 9-16
*DET#1: 00100110 11110111      FAIL
  DET#2: 11111111 11111111      PASS

```

Comment:

If the status for all channels was correct it is indicated by PASS. Upon any failure, each detector channel is shown as pass (1) or fail (0).

[Detector Call Status Time Stamp:]

Calls are placed and then removed on each of the input pins while the BIU is polled to confirm a correct time stamp. This is repeated with the BIU set to each of the four detector addresses in sequence.

(Standard: TS 2-1998 8.8.5.4.2 Function Inputs ¶ 4 and 3.3.1.4.2.6-7 Type 148-151 DR BIU Call Data)

Associated Messages:

```

Detector Call Status Time Stamp:  PASS
*ALERT: Detector Call Status Time Stamp:  FAIL
  Det: Place Call 1-16, Remove Call 1-16
  1: 11111111 11111111 11111111 11111111
  *2: 00000001 00000000 10000000 00000000

```

Comment:

If the time stamp for all channels was correct it is indicated by PASS. Terse reports only show where there are failures; each detector address with at least one error will display each detector channel as pass (1) or fail (0). Verbose reports will show each channel for all detector addresses, if there is at least one error in any address.

[Time Stamp Generator:]

The data from the Detector Call Status Time Stamp test is examined to determine the accuracy of the time stamp generator. The accuracy is calculated for each detector address.

(Standard: TS 2-1998 8.8.5.4.2 Function Inputs ¶ 4 and 3.3.1.4.2.6-7 Type 148-151 DR BIU Call Data)

Associated Messages:

```

Time Stamp Generator:          PASS
*ALERT: Time Stamp Generator:  FAIL
*Det 1: Accurate to           0.06% (0-0.05%)
*Det 2: Accurate to           2.00% (0-0.05%)
*Det 3: Accuracy Cannot Be Measured
Det 4: Accurate to            0.00% (0-0.05%)

```

Comment:

If the time stamp for all channels was correct it is indicated by PASS. Terse reports only show failures. Verbose reports will show all detector addresses, if there are any errors. Failures may be caused by the BIU receiving a large number of calls and failing to increment the counter.

[Detector Channel Status:]

BIU is set to each of the four detector addresses in sequence. Each of the detector inputs is tested with 5 Pulse Width Modulated (PWM) status messages. The test signals are applied concurrently. The BIU is polled to verify that it can interpret the signals correctly (320 tests).

(Standard: TS 2-1998 8.8.5.4.2 Function Inputs ¶ 5)

Associated Messages:

```

Detector Channel Status:      PASS
*ALERT: Detector Channel Status: FAIL
Det BIU#, PWM State: Results
1,1: 11111111 11111111      PASS
1,2: 11111111 11111111      PASS
*1,3: 00000000 00000000      FAIL
*WARNING:
* Detector BIU addresses require Type 18
* T&F output transfer frames for channel
* Status to function properly.
*WARNING:
* Channel status does not switch
* between different error states.

```

Comment:

Each detector channel is shown as pass (1) or fail (0). The first number indicates the detector BIU number, the second is the PWM state tested (channel status), then the 16 bits indicating if the individual channels correctly reported that particular PWM state. Terse reports only show failures.

Note: Detector BIUs should not use T&F Type 18 (see TS2-1998, 3.3.1.4.1.9 Type 18 Output Transfer Frame).

SDLC TESTS**[CRC TEST:]**

BIU set to address 0 (T&F #1). Tester sends 5 command frames with a one-bit error. The BIU should not respond to these test frames. The frames with a CRC error are mixed with valid frames.

(Standard: TS 2-1998 3.3.1.3 Data and Clock Communications Protocol first ¶.)

Associated Messages:

```

CRC Test:                      PASS
*ERROR: CRC Test:              FAIL

```

[Duty Cycle Deviation:]

The BIU SDLC Clock output is examined. The duty cycle is measured and the deviation from 50% is calculated and displayed.

(Standard: TS 2-1998 3.3.1.3 Data and Clock Communications Protocol ¶ 3.)

Associated Messages:

Duty Cycle Deviation: 0.07% (Max 1%)
 *ALERT:
 *Duty Cycle Deviation: 13.00% (Max 1%)
 *ALERT:
 *Duty Cycle Deviation: Timeout Failure

[Frequency Deviation:]

The BIU SDLC Clock output is examined. The frequency is measured and the deviation from 153600 Hz is calculated and displayed.

(Standard: TS 2-1998 3.3.1.3 Data and Clock Communications Protocol ¶ 4.)

Associated Messages:

Frequency Deviation: 0.16% (Max 1%)
 *ALERT:
 *Frequency Deviation: 12.00% (Max 1%)
 *ALERT:
 *Frequency Deviation: Timeout Failure

[Clock Position Dev:]

The BIU SDLC Clock output is examined. The position of the clock edge within the bit cell is measured and the deviation from the midpoint is calculated and displayed.

(Standard: TS 2-1998 3.3.1.3 Data and Clock Communications Protocol ¶ 4.)

Associated Messages:

Clock Position Dev: 0.0% (Max 10%)
 *ALERT:
 *Clock Position Dev: 21.0% (Max 10%)
 *ALERT:
 *Clock Position Dev: Timeout Failure

[Invalid Address Field Data:]

BIU is set to each of the eight Detector and T&F addresses in sequence. Frames are sent with the incorrect address placed in the address field. The BIU should only respond to frames with the corresponding address in the address field.

(Standard: TS 2-1998 3.3.1.3 Data and Clock Communications Protocol ¶ 6b.)

Associated Messages:

Invalid Address Field Data: PASS
 *WARNING: BIU Responds to Frames with
 * Invalid Address Field Data

Comment:

This test simulates an ill-formed frame being sent by the controller unit. A passing message is only shown on a verbose report. Further, if all the invalid frame tests pass and the report type is terse, the following message will be shown:

Invalid Frame Tests: PASS

[Response to Broadcast Frames:]

Frames (10-13 and 20-27) are sent with the address field set to 255 and are therefore considered broadcast frames. Frames 10-13 and 20-23 are all sent within each 100ms window, while frames 24-27 are sent 1 per 100ms window as they would normally appear. For each frame sent the tester watches for a response from the BIU. If the tester receives any response, it is considered an error. The BIU should not respond to broadcast frames. This process is repeated with the BIU set to each of the eight Detector and T&F addresses in sequence. (Standard: TS 2-1998 3.3.1.3 Data and Clock Communications Protocol ¶ 6b.)

Associated Messages:

Response to Broadcast Frames: PASS
 *WARNING: BIU Responds to Broadcast
 * Frames

Comment:

Since there can only be one BIU per address, BIU's that respond to the appropriate address will not generate this error. BIU's that appropriately do not respond will not have any message regarding this test. A passing message is only shown on a verbose report; further, if all the invalid frame tests pass and the report type is terse, the following message will be shown:

Invalid Frame Tests: PASS

[Invalid Control Field Data:]

BIU is set to each of the eight Detector and T&F addresses in sequence. Frames are sent with invalid data placed in the control field. The BIU should not respond. (Standard: TS 2-1998 3.3.1.3 Data and Clock Communications Protocol ¶ 6c.)

Associated Messages:

Invalid Control Field Data: PASS
 *WARNING: BIU Responds to Frames with
 * Invalid Control Field Data

Comment:

This test simulates an ill-formed frame being sent by the controller unit. A passing message is only shown on a verbose report; further, if all the invalid frame tests pass and the report type is terse, the following message will be shown:

Invalid Frame Tests: PASS

[Invalid Information Field Length:]

BIU is set to each of the eight Detector and T&F addresses in sequence. The tester sends frames 10-13 and 20-27 in the sequence they normally occur. The address, control, and frame number fields are all correct, but the number of bytes sent is altered. (e.g. A Type 10 frame usually has 11 bytes sent (excluding CRC) and our tester will only send 5 bytes.) If any response is received, it is considered a failure. Note: the tester does not look for valid data, only for a response. The BIU should not respond. (Standard: TS 2-1998 3.3.1.3 Data and Clock Communications Protocol ¶ 6d and 3.3.1.4 Information Field Formats.)

Associated Messages:

Invalid Information Field Length: PASS
 *WARNING: BIU Responds to Frames with
 *Invalid Information Field Length

Comment:

This test simulates an ill-formed frame being sent by the controller unit. A passing message is only shown on a verbose report; further, if all the invalid frame tests pass and the report type is terse, the following message will be shown:

Invalid Frame Tests: PASS

[Invalid Information Field Data:]

BIU is set to each of the eight Detector and T&F addresses in sequence. Frames with incorrect information field data (i.e. incorrect frame number) are sent. The BIU should not respond.

(Standard: TS 2-1998 3.3.1.4 Information Field Formats.)

Associated Messages:

```
Invalid Information Field Data:    PASS
*WARNING: BIU Responds to Frames with
*Invalid Information Field Data
```

Comment:

This test simulates an ill-formed frame being sent by the controller unit. A passing message is only shown on a verbose report; further, if all the invalid frame tests pass and the report type is terse, the following message will be shown:

```
Invalid Frame Tests:                PASS
```

[Average responses:]

BIU set to address 8 (DET #1). Tester sends command frames to the BIU 100 times over 10 seconds. BIU should respond with the correct frame. This value is shown to help indicate possible intermittent problems from errors in communication.

(Standard: TS 2-1998 3.9.3.1.3 Port 1.)

Associated Messages:

```
*ERROR:
*Average Responses:  12 of 100 (example)
*Consecutive Missed Frames: 7 (example)
```

Comment:

When 2 or more consecutive responses are missed, that number is displayed. It is an error when there are more than 5 consecutive missed frames. It is considered an error when there are less than 50 average responses out of 100.

[Total Response Frames Requested:]

Total number of frames requested throughout this test. These values will vary from test to test.

Associated Messages:

```
Total Response Frames Requested:  5515
```

Comment:

No error messages are generated; the number of frames requiring response throughout the entire test is simply reported.

[Total Response Frames Not Received:]

This indicates the total number of times the BIU did not give a valid response. The BIU could have either given: no response, a response containing an error, or have aborted while sending a response. There are five frames that should not get a response; these are 5 frames that are sent intentionally containing a one bit CRC error. The Response frames not received are shown to help indicate possible intermittent problems from SDLC errors. During normal testing the tester will request the response again or restart a test if necessary.

Associated Messages:

```
Total Response Frames Not Received: 128
- Total CRC Errors:                    35
- SDLC Abort Sequence:                 43
- Nonoctet Aligned Frames:             45
- No Response Received:                 5
```

Comment:

No error messages are generated; the number of SDLC errors received throughout the entire test is simply reported. Ideally there should be 5 frames that should not get a response, there may be more.

Total CRC Errors are response frames the tester receives containing a CRC error. These Messages are not used for test results, the response is requested again, or in some cases, the individual test may be restarted. CRC checking is not done on frames with other SDLC errors.

SDLC Abort Sequence indicates the BIU response started but the BIU aborted transmission before sending the entire frame. This a valid action built into the SDLC protocol.

Nonoctet Aligned Frames shows the received response had an incorrect number of bits. Although a portion of the frame may be correct, it is not used for test results, the response is requested again or the individual test may be restarted.

No Response Received means there was nothing received from the BIU. This should occur when the tester transmits a frame with a CRC error.

Appendix B. Packing the Tester for Shipment

At some point, you may wish to send the tester back to ATSI. It may be for recalibration/recertification, or it may be for repairs. Proper packing will help assure that your tester arrives safely at ATSI.

Successful shipping is mostly a matter of good sense. We can only inspect and test the items that you send to us, so send everything that came with the tester. Make sure you enclose a contact name, phone number, best time to call, fax number, email (if you wish), purchase order number, and a return shipping address that can be serviced by UPS.

Be sure to wrap any cables with foam-wrap or bubble-wrap sufficient to fill the storage well on that side of the enclosure. If you send the printer, remove the paper roll and its support roller, as these will certainly break the plastic support clips on the paper housing during shipment. Keep the paper roll at home; we have plenty of paper at ATSI to test your printer. In this regard, remember that ATSI does not directly warrant the printer, although we will check it out to verify the printer functions properly. The printer manufacturer provides the limited warranty and should be contacted if printer problems are experienced. After removing the paper and roller bar, the printer should be wrapped with foam-wrap or bubble-wrap sufficient to fill the storage well on that side of the enclosure.

When all loose items are securely wrapped and stuffed into the enclosure, then the cover can be closed and the tester placed into a larger cardboard box. It is necessary to select a box and cushioning material that provides at least two inches of cushioning on all sides of the contents of the box. Appropriate cushioning materials are foam-wrap, bubble-wrap, or a good firm filling of foam plastic "peanuts." The packing must protect your tester against shock damage (the second-story drop test) and also puncture damage. Don't use a really flimsy box as the outside container, as it may rupture under impact.

We have opened returned testers which were so poorly packed that the pieces spilled out on the floor. In most damage cases, the carrier is not to blame, and it takes weeks to get them to process a claim. If you fail to pack your tester properly, you may be deprived the use of that tester for weeks, then they will likely deny your claim, even when you pay for extra insurance. An hour spent in careful packing can save many hours of loss of use of your tester.

Appendix C. User Maintenance of the BIUT

The only user maintenance authorized on the BIUT is replacement of the battery or fuse. No other activities or operations on the BIUT are authorized to the owner or any other parties without voiding any factory warranty in effect. The person performing these functions should be a qualified and experienced electronics technician.

The 3V lithium battery's function is to keep the current date and time. Therefore, the only need for opening the tester is if the time and date function is not working properly. The battery is a common battery and can be found at a many retail stores (i.e. Wal Mart, K-Mart, RadioShack, etc.). Use the following list as a cross reference when the need to replace the battery or fuse arises:

3 Volt 1300 mAh Lithium Battery

DL123A (Duracell)
EL123AP (Eveready)
CR123 (RadioShack)

3AG 0.25A 250 Volt Fast Acting Fuse

AGC - 1/4 (Bussman)
ABC - 1/4 (Bussman)
312.250 (Little Fuse)
314.250 (Little Fuse)

Before opening the BIUT, be sure the tester's power cord is not connected to any power receptacle. The power precaution is simply to avoid any possible shock hazard, since line-voltage-bearing nodes will be exposed on the underside of the panel. To make things go easier, remove the BIU and all communications cables.

The two large screwheads along the back edge of the panel, and three matching screwheads along the front edge of the panel must be removed and set aside in a safe place. Grip the panel from both sides and lift it straight up. It should come up easily with no restraints, since all wiring connects only to the panel. Set the panel upside down on some clean soft material (such as clean shop cloths or a towel) so the finish on the topside will not be soiled or scratched. Also be sure to make sure that no unnecessary pressure is being applied to the 2 BIU guides that may cause them to break.

Locate the battery and notice that it is held in place with a retaining clip. Carefully, with not much force, pry one side of the clip away from the battery until it can slide up over the battery allowing the other side to be removed. Remove the old battery and replace it with the new one, being sure to match the polarity figure on the battery holder. Once the battery is in place, reattach the clip and set the panel back in the case, over the panel mounting brackets, and replace the five screws.

Appendix D. Warranty

The BIUT-800 tester is sold with a one-year limited warranty to the original purchaser, as defined by the limited warranty description found on the inside back cover of the operating manual. The Mini-Printer carries a three-month limited warranty from its manufacturer. No other warranties, expressed or implied, apply to the tester or associated components. If it is necessary to return your tester to the factory, please refer to **Appendix B. Packing Your Tester for Shipment**, before giving it to your delivery service.

ATSI will provide to the original purchaser free upgrades to the firmware, via the ATSI website. If any significant changes are incorporated into the production version ATSI will post the update on its website (<http://www.atsi-tester.com>). Updates are included with a calibration, contact ATSI for details. ATSI recommends a 24-month recalibration interval.*

After the first year, ATSI will continue to provide repairs to the tester on a parts-plus-labor basis. A phone call describing the problem may allow ATSI to make a non-binding estimate of repair costs, but the surest approach is to send back the tester for a comprehensive evaluation of the problem and a guaranteed repair estimate. Please refer to **Appendix B** for packing suggestions.

* Note: High use customers (1,000 hours/year) may desire an annual calibration schedule. Contact ATSI for details.