

# 635-CPU Test Procedure (20-0635-30)

## *Factory Test Procedure*



### ***UPDATE DOCUMENT BEFORE RUNNING TESTS ...***

**IMPORTANT:** Every time the flash version changes, **Step-1a** in this procedure must be updated, reprinted, laminated and replaced in all the binder sets used by manufacturing.

The information on printer setup is on the inside cover.

## INSTRUCTIONS TO UPDATE THE FLASH & REPLACE PAGE



**Do the following steps to update the document:**

1. Open the document file in MS Word
2. Open the **DOCUMENT PROPERTIES** for editing
3. In the **Category** field, update the flash version (**no dot** - e.g. 477)
4. In the **Keywords** field, update the flash version (**with dot**- e.g. 4.77)
5. Click **OK** to save properties.
6. Go to Section-1 Part A (p. 3): **place cursor in the flash field & press F9 key**; the version field should update to the correct version.
7. On same line, **place cursor on the file name version and press F9 key** to update the file name version number.
8. Press **<Ctrl + S>** to save the entire file.
9. Press **<Ctrl+P>** to open the print properties:
  - » set **Printer** = 'EXCELSIOR\Copier'
  - » set **Page Range** = '3 - 4'
  - » set number of **Copies** = '3'
  - » click the **PROPERTIES** button
  - » set **Duplex** = "Open to the Left"
  - » set **Color** = "color" (IF DESIRED)
  - » *make sure staple is 'off'*
  - » click **OK** to send to printer
10. Laminate the pages and punch holes
11. Replace the page in all the binders (1 & 2 factory manager copies)

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**IMPORTANT:** *If steps/ instructions are changed or updated, the document revision should be incremented (revision number is found in the in the Comments field of the Properties screen).*

- Do NOT increment the revision number when updating the flash code version– the flash version is expected to change.
- Increment the revision number to the **left of the decimal** (i.e. change 4.0 to 5.0) if an instruction, test or diagram is changed, added or removed.
- Increment the number to the **right of the decimal** (i.e. change 4.0 to 4.1) If a correcting a typo/spelling error –OR- a modification to existing text or diagram is made to clarify the existing instruction.
- After changing the revision number, open the header on page1 and update the field by pressing the F9 key when the cursor is on the rev number field.

## SECTION-1: SET UP OF FACTORY TEST ENVIRONMENT

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PURPOSE: This section designates the correct flash, prepares the test environment / loads flash to the factory test station.

### STEP 1. TEST MATERIALS & REQUIREMENTS

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PART	INSTRUCTION
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**A** This test must use current flash version [5.04](#) (CPU635\_504\_release.s28)

<< This step must be updated when the *flash version and file name* changes >>

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**B** List of Materials:

#### TEST BENCH

- 1) Test PC: with *HyperTerminal* and *IE Explorer* installed
- 2) Factory Test Bench/Station: loaded with correct Flash— according to [Step-1A](#).
- 3) Cable set:
  - » RS-232 Serial cable,
  - » 14-pin ribbon cable,
  - » 16-pin I2C ribbon cable,
- 4) Factory 635 Test Jig: with 12 VDC power supplied
- 5) Factory-designated daughter board (DSI): for I2C Data Bus validation

#### OTHER ITEMS

- 6) Serial Number Stickers [with MAC Address](#) (printed by Mark/engineering dept.)
- 7) Battery Slips: with correct flash version – according to [Step-1A](#).
- 8) QC Stamp
- 9) CE Stickers
- 10) Factory-designated Baseline CPU: marked/flagged used for visual inspection
- 11) Volt meter - for checking DC voltage

<< advance to Part C of the setup >>

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**C Setting up the Factory Test station:**

- 1) connect the **RS-232 Serial Cable** to front of Factory Test Station (bench/controller)
- 2) **power-up Factory Test Station** (or controller)
- 3) open **HyperTerminal** session using the following connection settings
  - a. **Baud** = 57600;
  - b. **Bits** = 8; **Stop Bit** = 1;
  - c. **Parity** = None; and **Flow Control** = None
- 4) Type the following commands into the HyperTerminal window:
  - » press <enter>
  - » type 'select' and <enter> (the select command returns a menu list of boards)
  - » type '8' and <enter> - to choose 635 CPU test environment

**LOADING CPU FLASH INTO FACTORY TEST STATION**

- 5) type "load" and press <Enter> key (Note: a countdown will begin "CCC..." )
- 6) select **Transfer > Send File** from the HyperTerminal menu
- 7) click [**Browse**] button
- 8) click [**My Computer**] button
- 9) navigate to **C: > Factory Test > S28 files > 635 > 635 CPU > CPU635\_nnn\_release.s28**  
(where 'n' represents the correct flash version being loaded, according to [Step-1A](#))
- 10) click [**Open**] button
- 11) choose '1K XMODEM'
- 12) click [**Send**] button - to begin the transfer of flash code to the Factory Test Station.

**NOTE: if HyperTerminal times out 'CCC...' before the transfer begins, simply repeat steps 6 thru 12.**

The file transfer should start on the second attempt, because you are now pointed to the correct folder location and won't lose time browsing.

**NOTE:** Part C must be done when ...

- ▶ the flash version initially changes
- ▶ or the factory test station is changing over from having tested 635 CPUs.

The memory sector that stores 635 CPU code is overwritten when 600 CPU flash is loaded.

## SECTION-2: VISUAL INSPECTIONS

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PURPOSE: This describes the inspections done when comparing the *target CPU* to the *baseline CPU*.

### STEP 2. VISUAL INSPECTION OF TARGET BOARD

**PASS ACTION:** if the board passes ALL checks, advance to next Step.

**FAIL ACTION:** if a board fails ANY checks, take the appropriate actions to repair the board before proceeding with Factory Tests.

**WARNING:** Do not apply power to a failed board until the repairs are done!

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PART	INSTRUCTION
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**A. ORIENTATION OF COMPONENTS:**

Perform the visual inspection by comparing the *target CPU* to the *baseline CPU*.

✓ **VERIFY:** all 'marked' components are correctly oriented on the *target CPU*

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**B. INSPECTION OF BOARD AND SOLDER:**

(Inspect the front and back of the board)

✓ **VERIFY:** there are no obvious solder bridges or cold solder connections

✓ **VERIFY:** there is no obvious damage to the board

✓ **VERIFY:** that parts are not broken, pulled-up, or improperly installed

## SECTION-3: FACTORY TEST & PROGRAMMING

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PURPOSE: This section covers the following:

- » executes manual & automated tests on the CPU
- » loads flash and programs factory default settings on the CPU

### STIPULATIONS

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- ▶ STEP-1 (Setup) MUST be completed before running step-3
- ▶ STEP-2 (visual inspection) MUST be completed before running step-3
- ▶ ALL instructions and tests MUST be performed in sequential order
- ▶ DO not abbreviate, modify or skip any steps
- ▶ DO NOT interrupt power to the board during testing
- ▶ a failed board must be retested starting from Step-2 after it has been corrected/repaired

### STEP 3. SET-UP the FACTORY TEST JIG:

PART	INSTRUCTION
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<b>A</b>	<b>Connect the Test Jig to the Factory Bench:</b>
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	<b>1. TURN POWER OFF ON THE BENCH</b>
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- |  |  |
|--|--|
|  | 2. connect power wires (observing polarity) to the Red & Black lugs on front of bench. |
|--|--|
- 

<b>B</b>	<b>Install the 'designated DSI' :</b>
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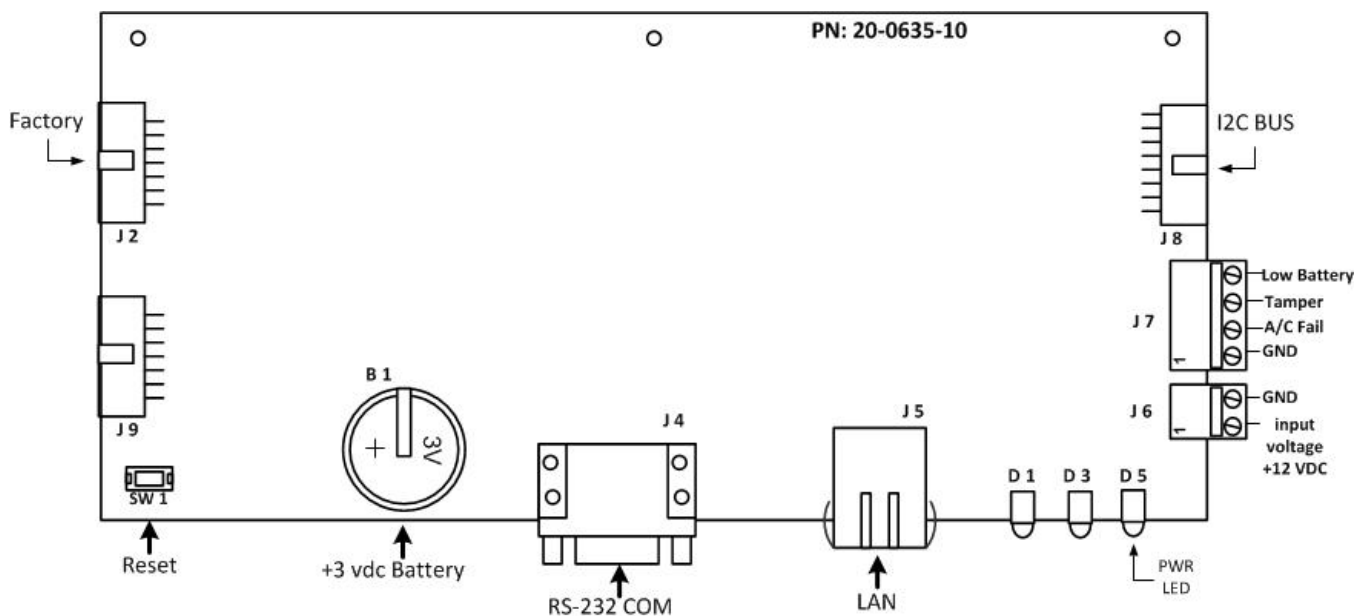
- |  |  |
|--|--|
|  | » seat the 'designated DSI' on the right side of Jig; in the upright position. |
|  | » connect the <i>I2CRibbon Cable</i> to J13                                    |
|  | » connect power cable to the <i>2-pin connector</i> to the DSI board           |
-

**STEP 3 continued...****C Install the 'target CPU' into the LEFT SIDE Test Jig:**

- 1) Install the 'target CPU' on the left side of Jig, connect 12vdc power
- 2) Connect the *4-pin input plug* to J7
- 3) Secure the safety hasp during testing as needed
- 4) Connect the *14-pin Factory Ribbon Cable* to the target DPI (J2)
- 5) Connect *RS-232 Cable* to Factory

**Reference Diagram:** Use this diagram to help locate the connections.

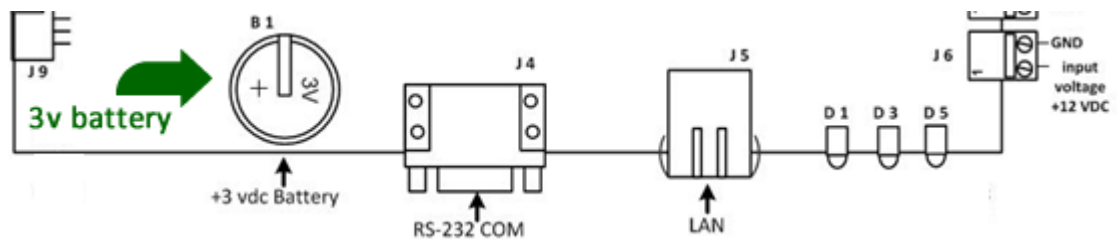
*The board will be oriented in this same position when placed on the Test Jig.*



**STEP 4. TEST CPU POWER & BATTERY STRENGTH:**

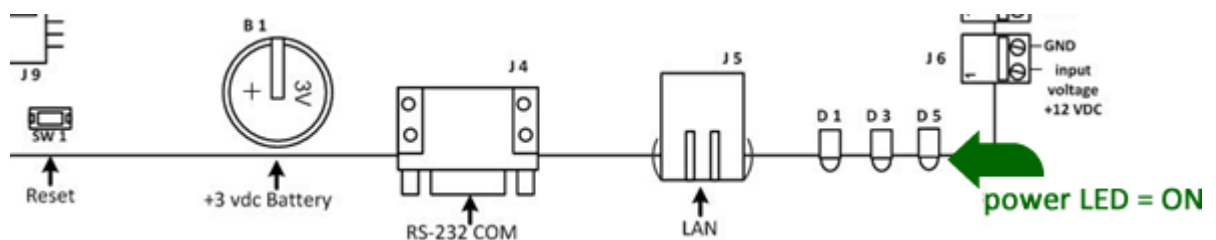
- A**
1. Set the **volt/ohm meter** to read Volts DC.
  2. Connect the negative meter lead to the ground-lug on the *Test Bench*
  3. Touch the positive lead to the Battery (B1).

✓ **VERIFY:** the meter reads at least +3 VDC for the Battery (B1)



- B** Turn ON Power to the Test Bench *at* the toggle switch.

✓ **VERIFY:** the Power LED (D5) is ON/solid.





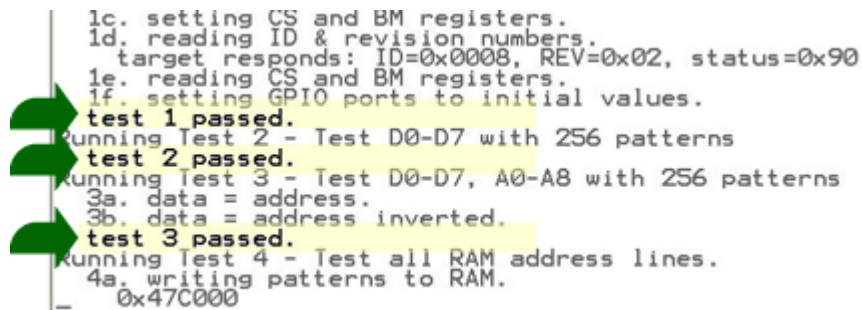
**STEP 5. RUN THE CPU FACTORY TEST:****A SET UP FOR BOARD TEST AS FOLLOWS:**

- » Factory **14-pin Ribbon Cable** should be connected to the **CPU (J-2)**.
- » the **RS-232 Serial Cable** should be connected to **Bench**
- » **HyperTerminal should be open:** Com Port settings are already set: 57600Baud; 8-Bits; No Parity; 1-Stop Bit; No Flow Control
- » **Caps Locks should be OFF** - all HyperTerminal commands are all lower-case.

**B** Press <Enter> key to get the command-line prompt to appear.

**C** type "run" and press <Enter>

✓ **VERIFY:** the Test Routine runs normally – each step passes



```
1c. setting CS and BM registers.
1d. reading ID & revision numbers.
    target responds: ID=0x0008, REV=0x02, status=0x90
1e. reading CS and BM registers.
1f. setting GPIO ports to initial values.
test 1 passed.
Running Test 2 - Test D0-D7 with 256 patterns
test 2 passed.
Running Test 3 - Test D0-D7, A0-A8 with 256 patterns
3a. data = address.
3b. data = address inverted.
test 3 passed.
Running Test 4 - Test all RAM address lines.
4a. writing patterns to RAM.
- 0x47C000
```

- ✓ The PC will pause at the CPU INPUT test.  
*See next page to continue the manual test of inputs.*

**STEP 6. TEST BOARD INPUTS:** This step manually exercises the target CPU inputs.

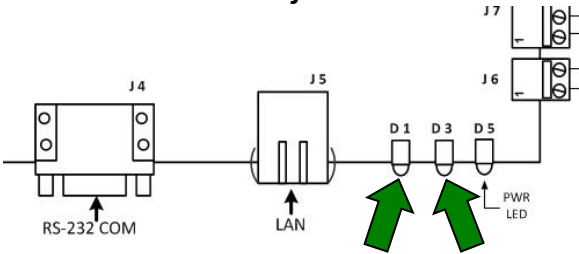
**A** Press each *input button* while you compare expected results (using the table below).

*The input push-buttons are located on the left side Test Jig.*

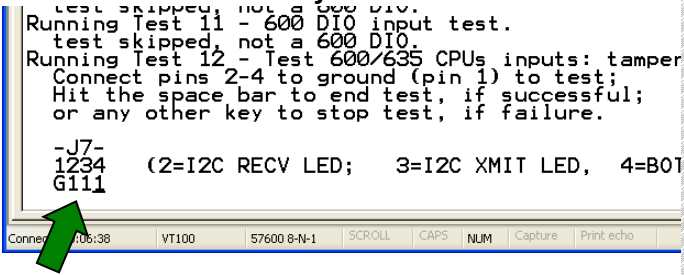
**✓ VERIFY:** the LEDs should come ON and the PC prompt changes as expected.

INPUT BUTTON STATE	D1 & D3 LED STATE	PC prompt
<i>Default: no inputs pushed</i>	<i>both LEDs = OFF</i>	<i>"G000"</i>
<b>PRESS INPUT 1 (A/C FAIL)</b>	only D1= ON	"G100"
<b>PRESS INPUT 2 (TAMPER)</b>	only D3= ON	"G010"
<b>PRESS INPUT 3 (LOW BATTERY)</b>	both D1 & D3= ON	"G001"
<i>Note: the D5 Power LED should remain ON/solid throughout the test</i>		

Location of D1 & D3



Location of PC indicator



**STEP 7. PROGRAMMING THE TARGET BOARD:** this step covers configuring the Serial Number and loading the .S28 Flash file to the target CPU.

**A Start the programming mode:**

1. Press the <space bar> to continue
2. type “program” and press <Enter>
3. Type in the **8-digit serial #** and press <Enter>.

**NOTE:** The serial number printed on the sticker may not show the leading zero, but it must be entered.

✓ **VERIFY:** that flash version is correct (according to Step-1A)

```
All tests completed.
test 635 CPU> program
Enter Target's serial number: (max is 16777215)
12345678
03000021
You are about to program the TARGET board as a
635-Control Module, Version X.XX
Do you wish to proceed? (yes/no)
yes
```

**B** type “yes” and press <Enter> Flash file loads to the target CPU

✓ **VERIFY:** that flash saves successfully.

```
programming bootloader
verifying bootloader
programming bootloader succeeded
programming application
verifying application
programming was successful
Writing Configuration Data
Setting the (on board) FLASH frequency divider register
Setting the (on board) FLASH protection register
Mass erasing the (on board) FLASH memory
Programming the (on board) FLASH on board memory - first 256 bytes
Values were successfully saved, serial number has been set.
Programming the (on board) FLASH on board memory - configuration values
Values were successfully saved, configuration values are set..
test 635 CPU>
```

**STEP 8. VALIDATING TARGET BOARD via HyperTerminal:** This step confirms the serial number and flash Version are correct, validates the RS-232 and I2C ports are working and that daughter boards can be detected.

**A. Connect the test cables as follows:**

- 1) Disconnect the *factory test ribbon cable* from the *target CPU* Factory port (J-2).
- 2) Connect the **I2C-bus Ribbon Cable** to the *target CPU* (J-8) and to DSI board.
- 3) Swap the **Serial Cable** to *target CPU* (J4)
- 4) Connect the **J-5 LAN connection** to the *target CPU* (J-5) LAN port.

**B. Cold start the target CPU:**

- » press and hold RESET (SW1) for 10 seconds.
- » Also RESET the DSI

**C. type “boards” and press <Enter>**

*(It may take a minute for daughter boards to display; re-issue ‘boards’ command if needed).*

✓ **VERIFY:** the ‘boards’ command returns the correct information...

- 1) Both boards are displayed, CPU and DSI
  - » re-enter the ‘boards’ command as needed
- 2) CPU serial number matches value entered during Step-7
- 3) CPU flash version matches the flash version loaded in **Step-1A**

```

test 635 DPI> boards
Ref    Type      Serial #    Version    Boot    Pos    Status
0      635-CPU    0300NNNN   X.XX       X.XX    1      NORMAL
1      DSI        0200NNNN   X.XX       X.XX    1
  
```

Both boards appear

correct serial #

correct flash #

**STEP 9. VALIDATE BOARD via Web Page:** This step validates that the CPU's LAN port is working, the embedded web page is ON, and the CPU clock is working/set.

- A** Open or Refresh the **Internet Explorer** (desktop shortcut)
- » The browser should find the **IP Address** of the CPU
  - » Press <F5> if you did not close the browser after the last board

✓**CHECK:** check the following:

- 1) click [Set Date/Time] button and verify that the time is live
- 2) verify serial number matches the value programmed during Step-7
- 3) verify flash version matches the value shown in Step-1A
- 4) verify daughter board appears on the buss

Model Number:	635
Local Date/Time:	11:36:13 07/31/2012 <span>Set Date/Time</span>
Unit No:	001
Cluster No:	001
Serial Number:	030NNNN
Software Version:	X.XX
CPU Number is:	1
Extended Card Mode:	No
Number of Users:	0
Unacknowledged Logs:	6

	Server IP	Server Port	Local Port
0	Not Used		
1	Not Used		
2	Not Used		
3	Not Used		

Attached Boards						
Serial#	Board#	Status	Board Type	Version	Using CPU	Flash Update
2400628	5	NORMAL	DSI			

**STEP 10. FINISH BOARD:** finish prepping the board for stocking.

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**A Remove the 635 CPU from the QC Test Jig as follows:**

1. Turn OFF bench power switch
2. Disconnect **IC2 Ribbon Cable**
3. Disconnect **RS-232 Serial Cable**
4. Disconnect **LAN cable**
5. Disconnect **power and input cables** to the **target CPU**
6. Remove the CPU from the Test Jig

**B Add board stickers:**

1. QC Stamp
2. CE sticker
3. Serial Number sticker with MAC address
4. Insert the **Battery Slip** under the B1 battery clip.
5. verify contents of attached Ziploc bag :

1	2-pin orange connector (power)
1	4-pin orange connector (inputs)

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**C RETURN TO START OF THIS PROCEDURE AND CONTINUE TESTING NEXT BOARD:**

- 
- D** When finished testing all boards, store the **factory-designated baseline board** in the pocket of the Primary Test Procedure.
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## TERMS & REQUIREMENTS *used in this procedure:*

**Baseline CPU** a ***factory-designated DPI*** that is used as a comparison during the visual inspection of the target DPI (i.e. when validating correct orientation of specific surface components, quality of soldering and component attachment, or board condition).

! The **baseline CPU** **MUST** be the ***factory-designated board*** that...

- a. is the **same model and revision** as the **target DPI**.
- b. and **has passed all factory testing** itself.
- c. and **has the appropriate surface components flagged** for cross reference.

**Designated Test DSI** the daughter board that is installed in the ***Test Jig*** to assist with validating the I2C Data Buss.

! The **designated DSI** is a **permanent part of the test kit**

! It **MUST** be tagged in a way that makes it easily identifiable - so it doesn't get mixed with boards going into stock.

**Factory Test Station** Is the *small circuit board* that attaches to the Factory port (J2) on the ***source CPU*** which is mounted on the back of test bench. The FTS uses a *14-pin ribbon cable* to attaches to the Factory port (J2) on the ***target CPU*** during testing & programming.

**Source CPU** is the CPU (on the back of the test bench) that is used to perform the 'run' test and load flash to the target CPU. The ***source CPU*** stores the ***factory test program*** and the ***current flash code*** in its memory.

**Target CPU** The ***target CPU*** is the board being tested and programmed.

**Test Bench** is the ***entire test bench*** (fixture) used to perform the factory tests (including the ***source CPU*** and ***Factory Test Station board*** which are mounted on the back of the bench ).

**Test Jig** the ***test receptacle (including wiring harness)*** that holds the ***target CPU*** during testing. The jig connects to the Factory Test Bench for power and other data connections.

DO NOT PRINT OR POST THIS PAGE IN THE FACTORY TEST BINDERS

Revision History Table

DATE OF REVISION	REVISION DESCRIPTION	UPDATED BY
1/14/2014	Updated flash version from 4.77 to 5.04	C. Roberts
1/17/2014	Added the Revision History Table	C. Roberts
1/17/2014	1. Revised and clarified the Print Instructions on page 2 to include the steps to manually update the flash version field in case the field doesn't auto-update when sent to printer.	C. Roberts