600-DIO Test Procedure (*20-0117-20)*

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)**

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

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

STEP 1. TEST MATERIALS & REQUIREMENTS

PART	INSTRUCTION

A **This test must use current flash version 5.04 (DIO600_504_release.s28)**

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

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 600 Test Jig:** with 12 VDC power supplied
5) **Factory-designated CPU board:** for I2C Data Bus validation

OTHER ITEMS

6) **Serial Number Stickers**
7) **QC Stamp**
8) **CE Stickers**
9) **Factory-designated Baseline DIO:** marked/flagged used for visual inspection

<< advance to Part-C of the setup >>

C Setting up the Factory Test station:

1) **connect the RS-232 Serial Cable** to front of Factory Test Station (or bench)
2) **power-up Factory Test Station (controller box)**
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 **'4'** and **<enter>**

LOADING INITIAL FLASH

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) quickly **navigate** to **C: > Factory Test > S28 files > 600 > 600 DIO > DIO600_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 loose time browsing.

NOTE: Part C must be done when …
- the flash version initially changes

The memory sector that stores flash code for the ***daughter boards*** *does not get overwritten when you load flash for testing 600-series daughter boards.*

SECTION-2: VISUAL INSPECTIONS

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

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!**

PART	INSTRUCTION

A. ORIENTATION OF COMPONENTS:

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

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

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

PURPOSE: This section covers the following:

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

STIPULATIONS

- 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

A **Connect the Test Jig to the Factory Bench:**

1. **TURN POWER OFF ON THE BENCH**
2. **connect power wires** (observing polarity) to the Red & Black lugs on front of bench.

B **Install the 'designated test CPU' into the LEFT SIDE Test Jig:**

1. Seat the **'designated CPU'** on the left side of Jig, align pins ~ OR ~ use +12vdc cable
2. connect the ***16-pin I2C Ribbon Cable*** **to J8** (this will be used later)
3. secure the hasp *as appropriate*

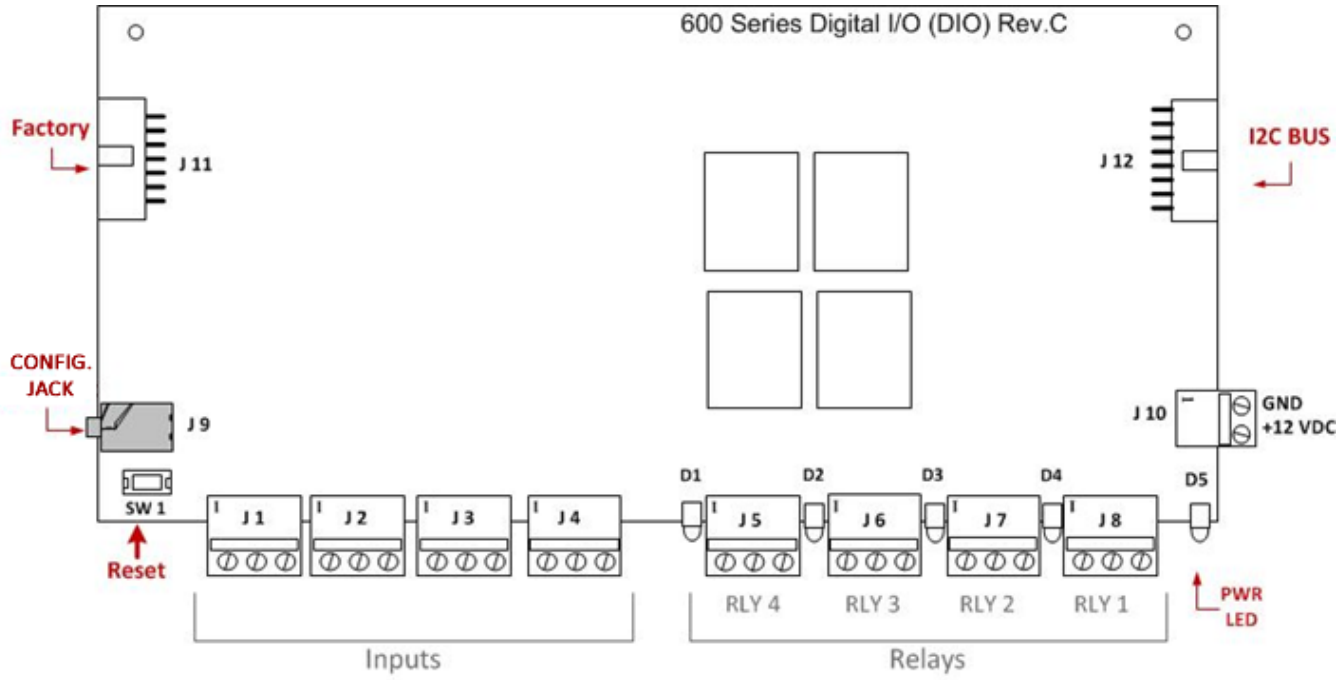
STEP-3 continued …

C **Install the 'target DIO' into RIGHT SIDE of the Test Jig:**

1. Slide the **target DIO** into upright position on the right side of Jig,
2. Plug the **12vdc power** cable into **DIO J10**.
3. Connect the ***14-pin Factory Ribbon Cable*** to the **target DIO (J11)**
4. Connect ***RS-232 Cable*** to **Factory Test Bench**

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

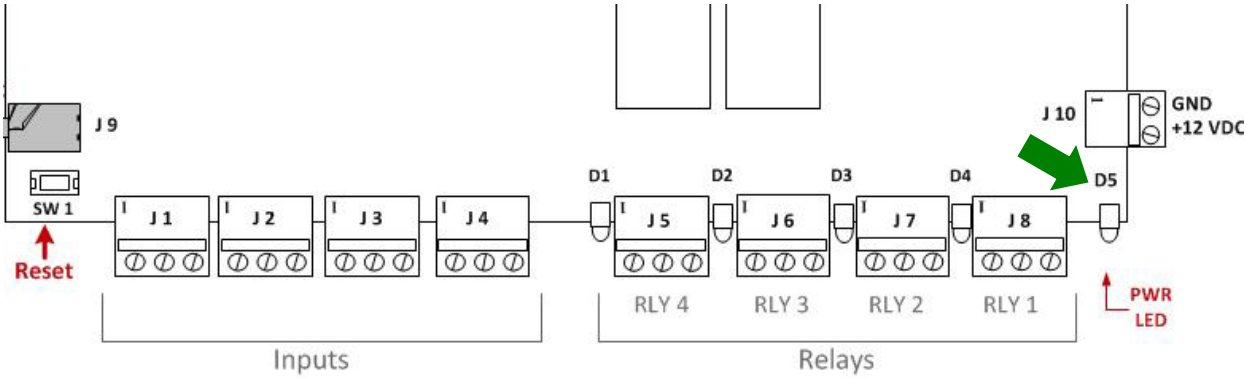
The board will be oriented in the upright position when placed on the Test Jig.



STEP 4. VERIFY BOARD POWER:

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

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



STEP 5. RUN THE DIO BOARD TEST:

A **SET UP FOR BOARD TEST AS FOLLOWS:**

- the Factory ***14-pin Ribbon Cable*** should be connected to the **DIO (J11)**
- the ***RS-232 Serial Cable*** should be connected to **Bench**
- **HyperTerminal should be open**: *Com Port settings should use: 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:** **Test Routine runs a series of automated tests pauses at Step 10.**

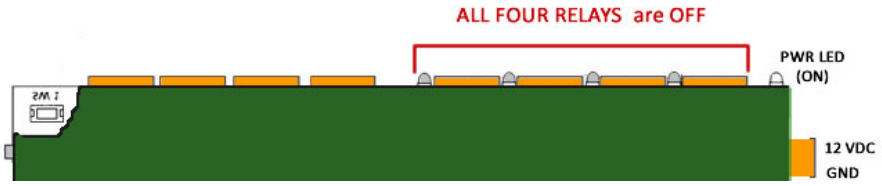
```
  test skipped, no CS8900A on this board.
Running Test 6 - Test on board DIP switches.
  test skipped, no switches on this board.
Running Test 7 - Test interface to 85C30.
  test skipped, no 85C30 on this board.
Running Test 8 - Test Flash memory.
  test skipped, no FLASH chip on this board.
Running Test 9 - 600 DPI/ 635 DPI / SAC loop back test.
  test skipped, not a DPI or SAC.
Running Test 10 - 600 DIO relay test.
  Hit the space bar to indicate correct relay state;
  or any other key to stop test, indicating failure.
    Are all relays off?.
```

See next page to continue the test.

STEP 6. RELAY TEST: an interactive test of the output relays.

A the PC will prompt you to ensure all relays are OFF (D1 THRU D4)

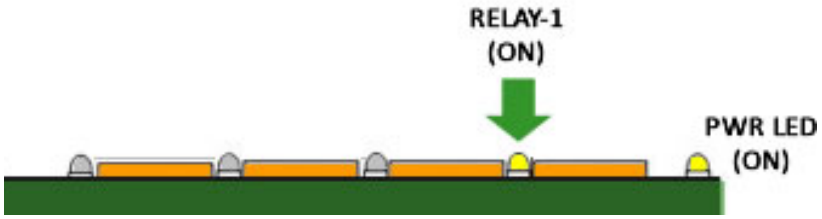
✓**VERIFY:** **that all relay LEDs (D1-D4) turn OFF.**



B **This part tests that each relay turns "ON" one-by-one:**

- **Press the <space bar>**

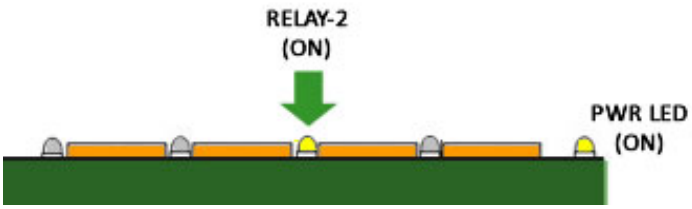
✓**VERIFY:** **ONLY RELAY-1 turns ON.**



C

- **Press the <space bar>**

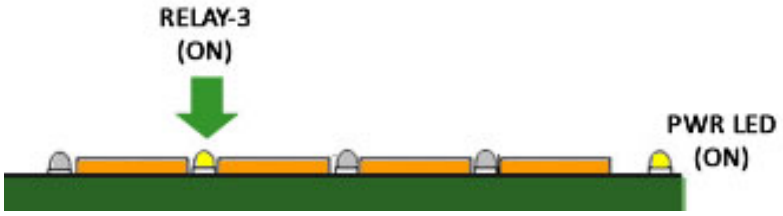
✓**VERIFY:** **ONLY RELAY-2 turns ON.**



D

- **Press the <space bar>**

✓**VERIFY:** **ONLY** **RELAY-3 turns ON.**



E

- **Press the <space bar>**

✓**VERIFY:** **ONLY** **RELAY-4 turns ON.**

F

- **Press the <space bar>**

✓**VERIFY:** **ALL relays turn OFF and ALL Tests Complete.**

```
    Is relay 3 on?
    Is relay 4 on?
  test 10 passed.
Running Test 11 - 600 DIO input test.
  0=125  1=178  2=178  3=178  4=178  5=178  6=178  7=178
  0=175  1=121  2=178  3=178  4=178  5=178  6=178  7=178
  0=178  1=177  2=122  3=178  4=178  5=177  6=178  7=178
  0=178  1=177  2=178  3=122  4=178  5=177  6=178  7=178
  0=178  1=177  2=178  3=177  4=122  5=178  6=178  7=178
  0=178  1=177  2=178  3=177  4=178  5=122  6=178  7=178
  0=178  1=177  2=178  3=178  4=178  5=178  6=122  7=178
  0=178  1=177  2=178  3=177  4=178  5=178  6=178  7=122
  test 11 passed.
Running Test 12 - Test 600/635 CPUs inputs: tamper/ac fail/
  test skipped, not a 600/635 CPU.
Running Test 13 - DSI RS-232 and RS-485 loop back tests.
  test skipped, not a 600 DSI.
All tests completed.
test 600 DIO>
```

NOTE: Once the relays are all OFF, the factory test will continue running the automated test of the DIO.

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

A Start the programming mode:

1. type "**program**" and press <**Enter**>
2. 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)

```
test 600 DIO> program
Enter Target's serial number: (max is 16777215)
12345678
02300001
You are about to program the TARGET board as a

    600-Digital I/O Module, Version 4.77

Do you wish to proceed? (yes/no)
yes
```

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

~ the Flash file will load to the board

✓**VERIFY:** that flash and **completes successfully**.

```
yes
  Setting the FLASH frequency divider register
  Setting the FLASH protection register
  Mass erasing the FLASH memory
  Programming the FLASH memory
    0x00C500
  Programming the FLASH memory - complete
Verifying Target FLASH
All bytes matched
  Writing Configuration Data
  Setting the FLASH frequency divider register
  Setting the FLASH protection register
  Erasing the configuration area FLASH memory
  Program the configuration data
    0x00FC00
  Configuration programming - complete
test 600 DIO>
```

STEP 8. Validating I2C BUS and Board Settings 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 ribbon cable*** from the ***target DIO*** **(J-2)**.
2) Connect the ***16-pin I2C-Buss ribbon cable*** to the **CPU (J-8)** and the **target DIO (J12)**.
3) Swap the **RS-232 cable** to the **CPU J4**

B **reset SW-1 on the CPU**– *the PC prompt will change to "login:"*
type "install" and press <enter>

```
G.....
GCS Boot Loader - Version 4.77

login: install
```

C **reset SW-1** on the **DIO** and notice the **CPU's XMIT LED flickers once**

✓**VERIFY:** **the CPU's LED (D5) flickers once when the DIO is RESET**. *This indicates that the DIO is attempting to communicate with the CPU. You may reset the DIO again if needed to induce the flicker.*

D **type "boards" and press <Enter>**

(It may take a minute for daughter boards to display; re-issue 'boards' command as needed).

✓**VERIFY:** the boards command returns the correct information…

1) **both boards are displayed** (CPU and DIO)
2) **DIO serial number** is correct (entered during Step-7)
3) **DIO board flash version** is correct (see step 1A)
4) **DIO board ID = 34**

```
> boards
Ref   Type       Serial #   Version  Boot   Pos  Status
  0   635-CPU    03000088    4.77    4.77    1
  1   DIO        02300001    4.77    4.77   34   NORMAL
```

STEP 9. FINISH BOARD: finish prepping the board for stocking.

A **Remove the TARGET DIO from the QC Test Jig:**

1. **Turn OFF power to the test Bench**
2. **Disconnect 2-PIN power cable** from the DIO
3. **Disconnect the *I2C Ribbon Cable***
4. **Remove the DIO** from the Test Jig

B **Affix the board stickers:**

1. QC Stamp
2. Serial Number sticker
3. CE sticker
4. verify contents of attached Ziploc bag :

1	2-pin orange connector (power)
8	3-pin orange connectors

C **RETURN TO BEGINNING OF PROCEDURE TO CONTINUE TESTING NEXT BOARD**

D **When finished testing all boards, store the factory-designated baseline board in the pocket of the Primary Test Procedure.**

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
1/15/2014	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. 2. Repaired header to display the document rev number	C. Roberts