Keysight U8001A/U8002A
單一輸出 DC 電源供應器

使用者及
維修指南

KEYSIGHT
TECHNOLOGIES

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KEYSIGHT
TECHNOLOGIES

聲明

手冊零件編號

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印製於馬來西亞

Keysight Technologies
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安全聲明

注意

「注意」標示代表發生危險狀況。如果沒有正確執行或安裝，「注意」會讓您注意操作程序、作法，或告訴您這樣的狀況可能會導致產品毀損或重要資料遺失。除非已經完全了解或進行到所指定的狀況，否則請不要在出現 **「注意」**的狀態下繼續進行。

警告

「警告」通知代表發生危險狀況。如果沒有正確執行或安裝，這個警告會讓您注意操作程序、作法，或告訴您這樣的狀況可能會導致人員受傷或死亡。除非已經完全了解或進行到所指定的狀況，否則請不要在出現 「警告」通知的狀態下繼續進行。

安全符號

下列出現在儀器上與文件中的符號，表示在維持儀器的安全操作時所必須採取的預防措施。

	直流電		關閉 （電源）
	交流電		開啓 （電源）
	直流電與交流電		設備受到 「雙重絕緣」或「強化絕緣」的完整保護。
	三相位交流電		注意，有觸電的風險
	地面 （接地）終端機		注意，危險 （請參考本手冊，取得特定 「警告」或「注意」資訊）。
	保護導體終端		注意，表面過熱
	外框或機箱終端		雙穩按鈕凸出。
	等位能		雙穩按鈕嵌入。

一般安全資訊

在操作、服務與維修本儀器時，務必隨時遵守以下的一般安全預防措施。若未遵守這些預防措施或本手冊中其他地方所述的特定警告，即違反本儀器之設計、製造和用途的安全標準。Keysight Technologies 對於客戶因未遵守這些要求而導致的故障不負任何責任。

警告

- **如果裝置毀損或有問題，請勿繼續使用。**
- **在連接任何線路到裝置之前，請先檢查裝置上的所有標示。**
- **在容易爆炸或有易燃氣體時，請勿操作此裝置。**
- **請勿安裝替代的零件，或對裝置進行任何未經授權的修改。**
- **僅使用製造商提供的電源配接器，避免任何非預期的危險狀況。**

注意

- 請使用裝置隨附的電源線。
- 本手冊範圍未涵蓋的修復或服務，僅可由合格的專業人員執行。

環境狀況

此儀器應在*安裝類別 II、污染等級 2 的區域內，於室內使用*。表 1 顯示一般的環境需求。

表 1　　環境需求

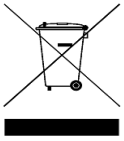
環境狀況	需求
操作溫度	0 °C 至 40 °C （完全額定輸出）
	40 °C 至 55 °C （降低定額輸出）
操作相對濕度 （最大）	最高 95 %
存放溫度	– 20 °C 至 70 °C
高度	最高 2,000 m

注意

Keysight U8001A/U8002A 單一輸出 DC 電源供應器符合下列安全與 EMC 要求：

- IEC 61326:2002 / EN 61326:1997+A1:1998+A3:2003
- CISPR 11:1990 / EN 55011:1990
- 加拿大：ICES-001:2004
- 澳大利亞 / 紐西蘭：AS/NZS CISPR11:2004
- IEC 61010-1:2001/EN 61010-1:2001 （第 2 版）
- 加拿大：CAN/CSA-C22.2 No. 61010-1-04
- 美國：ANSI/UL 61010-1:2004

法規標誌

CE ISM 1-A	CE 標誌是 「歐洲共同體」的註冊商標。貼有此 CE 標誌表示產品符合所有相關的 「歐盟法規指令」。
ICES/NMB-001	ICES/NMB-001 代表此 ISM 設備符合加拿大 ICES-001 的規定。
C US	CSA 標誌是 「加拿大標準協會」的註冊商標。CSA 標誌表示產品通過加拿大市場的檢定，符合適用之加拿大標準。
N10149	C-tick 標誌是澳大利亞 Spectrum Management Agency 的註冊商標。貼有此標誌表示產品符合 1992 年所訂定之「無線通訊法」條款下的 「澳大利亞 EMC 架構」法規。
	本儀器符合 WEEE 指令 (2002/96/EC) 標示需求。此產品黏貼標籤表示您不得將本電機 / 電子產品隨同家庭廢棄物丟棄。

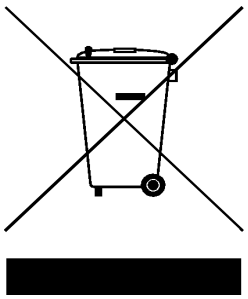
廢棄電子電機設備 (WEEE) 指令 2002/96/EC

本儀器符合 WEEE 指令 (2002/96/EC) 標示需求。此產品黏貼標籤表示您不得將本電機 / 電子產品隨同家庭廢棄物丟棄。

產品類別：

根據 WEEE 指令附錄 1 中所參照之設備類型，本儀器分類為 「監控儀器」產品。

產品的黏貼標籤如下所示：



請勿隨同家庭廢棄物丟棄

若要退回此廢棄儀器，請洽詢您當地最近的 Keysight 營業處，或造訪：

www.keysight.com/environment/product

以取得詳細資訊。

Agilent Technologies	**DECLARATION OF CONFORMITY** According to EN ISO/IEC 17050-1:2004	CE

Manufacturer's Name: Agilent Technologies Microwave Products (M) Sdn. Bhd
Manufacturer's Address: Bayan Lepas Free Industrial Zone,
11900, Bayan Lepas, Penang, Malaysia

Declares under sole responsibility that the product as originally delivered

Product Name: Single Output DC Power Supplies
Models Number: U8001A, U8002A
Product Options: This declaration covers all options of the above product(s)

complies with the essential requirements of the following applicable European Directives, and carries the CE marking accordingly:

Low Voltage Directive (2006/95/EC)
EMC Directive (2004/108/EC)

and conforms with the following product standards:

EMC

Standard	Limit
IEC 61326:2002 / EN 61326:1997+A1:1998+A2:2001+A3:2003	
CISPR 11:1990 / EN55011:1990	Class A Group 1
IEC 61000-4-2:1995 / EN 61000-4-2:1995	4 kV CD, 8 kV AD
IEC 61000-4-3:1995 / EN 61000-4-3:1996	3 V/m, 80-1000 MHz
IEC 61000-4-4:1995 / EN 61000-4-4:1995	0.5 kV signal lines, 1 kV power lines
IEC 61000-4-5:1995 / EN 61000-4-5:1995	0.5 kV line-line, 1 kV line-ground
IEC 61000-4-6:1996 / EN 61000-4-6:1996	3 V, 0.15-80 MHz
IEC 61000-4-11:1994 / EN 61000-4-11:1994	1 cycle / 100%

Canada: ICES-001:2004
Australia/New Zealand: AS/NZS CISPR11:2004

The product was tested in a typical configuration with Agilent Technologies test systems.

Safety IEC 61010-1:2001 / EN 61010-1:2001
Canada: CAN/CSA-C22.2 No. 61010-1-04
USA: ANSI/UL 61010-1:2004

c SP® us
206349

This DoC applies to above-listed products placed on the EU market after:

26-May-2008
Date

Tay Eng Su
Quality Manager

For further information, please contact your local Agilent Technologies sales office, agent or distributor, or Agilent Technologies Deutschland GmbH, Herrenberger Straße 130, 71034 Böblingen, Germany.

Template: A5971-5302-2, Rev. E U8001A DoC Revision 1.0

Product Regulations

EMC

	Performance Criteria
IEC 61326-1:2002 / EN 61326-1:1997+A1:1998+A2:2001+A3:2003	
CISPR 11:1990 / EN 55011:1990 – Group 1 Class A	
IEC 61000-4-2:1995 / EN 61000-4-2:1995 (ESD 4kV CD, 8kV AD)	A
IEC 61000-4-3:1995 / EN 61000-4-3:1996 (3V/m, 80% AM)	A
IEC 61000-4-4:1995 / EN 61000-4-4:1995 (EFT 0.5kV line-line, 1kV line-earth)	A
IEC 61000-4-5:1995 / EN 61000-4-5:1995 (Surge 0.5kV line-line, 1kV line-earth)	A
IEC 61000-4-6:1996 / EN 61000-4-6:1996 (3V, 0.15~80 MHz, 80% AM, power line)	A
IEC 61000-4-11:1994 / EN 61000-4-11:1994 (Dips 1 cycle, 100%)	A
Canada: ICES-001:2004	
Australia/New Zealand: AS/NZS CISPR11:2004	

Safety IEC 61010-1:2001 / EN 61010-1:2001
Canada: CAN/CSA-C22.2 No. 61010-1-04
USA: ANSI/UL 61010-1:2004

Additional Information:
The product herewith complies with the essential requirements of the Low Voltage Directive 2006/95/EC and the EMC Directive 2004/108/EC and carries the CE Marking accordingly (European Union).

[1]Performance Criteria:
A Pass - Normal operation, no effect.
B Pass - Temporary degradation, self recoverable.
C Pass - Temporary degradation, operator intervention required.
D Fail - Not recoverable, component damage.
N/A – Not applicable

Notes:

Regulatory Information for Canada
ICES/NMB-001:2004
This ISM device complies with Canadian ICES-001.
Cet appareil ISM est confomre à la norme NMB-001 du Canada.

Regulatory Information for Australia/New Zealand
This ISM device complies with Australian/New Zealand AS/NZS CISPR11:2004
N10149

本指南內容 ...

本指南提供逐步的安裝與設定指示，讓您慢慢熟悉 Keysight U8001A/U8002A 單一輸出 DC 電源供應器的操作。本指南也包含服務資訊及疑難排解指引，協助您解決開始設定時發生的問題。

1 快速入門

第一章提供初步檢查、輸出檢查、電線電壓轉換及 U8001A/U8002A 單一輸出 DC 電源供應器機架的安裝指示。

2 一般資訊

第二章提供儀器的一般說明、前後端面板概觀、顯示信號器及 U8001A/U8002A 單一輸出 DC 電源供應器的安裝指南。

3 操作與特性

第三章提供操作的詳細說明及 U8001A/U8002A 單一輸出 DC 電源供應器的功能。

4 規格與特性

第四章列出電源供應器的效能規格及設備的其他特性。

5 Service Guide

第五章包含 Keysight U8001A/U8002A 單一輸出 DC 電源供應器的服務資訊，包括保固資訊、一般拆解、疑難排解連線及功能性問題的驗證步驟、詳細的電源供應器校正程序、相關文件及 Keysight 聯絡資訊。

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1
快速入門

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本章內容包括操作前需要注意的檢查，有經驗及無經驗的使用者均可參閱。

初步檢查

下列步驟協助您確認已可使用電源供應器。

1 檢查隨附項目的清單。

請確認您收到電源供應器時，亦已收到下列項目。如果發現缺少任何項目，請聯絡距離您最近的 Keysight Technologies 營業處。

- 電源線
- 校正證明
- Product Reference CD-ROM

2 連接電源線並開啓電源供應器。

電源供應器執行啓動自我測試時，前端面板顯示器將會亮起。同時也會顯示韌體修訂版。如果電源供應器沒有正確開啓，請參閱頁 5。

附註

隨原廠電源供應器附送的電源線，會有適合您所在地區的插頭。電源供應器配備三線接地類型的電源線；第三個導體即為接地線。電源供應器僅在電源線插入適當的插座時才需接地。請勿在沒有足夠機櫃接地連接的情況下，操作電源供應器。

輸出檢查

下列檢查步驟能確保電源供應器從前端面板發展其額定輸出，並正確回應來自前端面板的操作。如需完整效能及驗證測試，請參閱 「Service Guide」。

附註 如果在輸出檢查步驟中偵測到錯誤，則 **ERROR** 信號器就會啓動。請參閱「附錄 A：錯誤碼清單」，以取得詳細資訊。

電壓輸出檢查

下列步驟能確認基本電壓功能沒有加上負載。

1. 開啓電源供應器。

   電源供應器處於啓動 / 重設狀態；已停用輸出 （啓動 「OFF」信號器）。

2. 啓用輸出。

   關閉 「OFF」信號器。注意，顯示器應處於 「電表模式」。「電表模式」意指顯示器會顯示輸出電壓及電流限制。

3. 檢查前端面板電壓計是否正確回應旋鈕控制。
4. 以順時鐘或逆時鐘的方向旋轉旋鈕，以檢查電壓計回應旋鈕控制，且電流計幾乎指向零。
5. 確認電壓可以透過調整旋鈕，從零調整到完全額定值。

附註 開啓電源供應器時，上一次的記憶會顯示在顯示器上。

電流輸出檢查

下列步驟是藉由整個電源供應器輸出的短路，來檢查基本電流功能。

1 開啓電源供應器。

請確認輸出已停用。已開啓 「OFF」信號器。

2 以絕緣測試引線將短路連接整個 (+) 及 (-) 輸出終端。使用大小足以處理最大電流的纜線 （請參考 American Wire Gauge 標準）。

3 啓用輸出。

依據測試引線的電阻，開啓 CV 或 CC 信號器。注意，顯示器應處於 「電表模式」。

4 將電壓限制值調整到 1.0 伏特。

將顯示器設爲 「限制模式」。將電壓限制調整到 1.0 V，確保 CC 操作。會開啓 CC 信號器。要回到 「正常模式」，請再次按下按鍵，或讓顯示器於幾秒鐘之後逾時。

5 將旋鈕設爲電流控制，以檢查前端面板電流計是否正常回應旋鈕控制。

當顯示器處於 「電表模式」時，以順時鐘或逆時鐘的方向旋轉旋鈕 （已關閉 「Limit」信號器）。檢查電流計是否回應旋鈕控制，且電壓計幾乎指向零 （電壓計會顯示測試引線所引起的電壓降）。

6 確認電流可以從零調整到完全額定值。

7 關閉電源供應器，並從輸出終端移除短路。

如果電源供應器沒有開啓

使用下列步驟協助您解決開啓儀器時可能遇到的問題。如需更多協助，請參閱章 5，取得將儀器送回 Keysight Technologies 進行維修的指示。

1 確定電源供應器連接的是交流電源。

首先，確定電源線已穩固地插到電源供應器後端面板的電源插座。同時還需確認您插入電源供應器的電源是帶電的。接著，確定已開啓電源供應器。

2 確定電源線電壓設定。

電源供應器從原廠送出時，會將電線電壓設定爲適合您所在國家 / 地區的值。如果值不正確，請變更電壓設定。設定值爲：100、115 或 230 VAC。

3 確定已安裝正確的電源線保險絲。

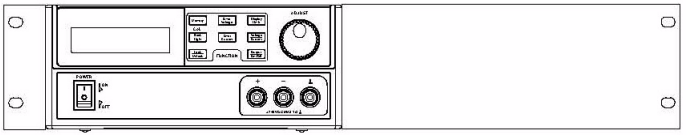
電源供應器從原廠送出時，會針對您所在的國家 / 地區，安裝正確的保險絲。請參閱下表，以替換電源供應器的保險絲。

型號	Keysight 零件編號	零件說明
U8001A	2110-0014 2110-0006	保險絲 4.0 A T （適用於 100 及 115 VAC） 保險絲 2.0 A T （適用於 230 VAC）
U8002A	2110-0722 2110-1425	保險絲 6.25 A T （適用於 100 及 115 VAC） 保險絲 2.8 A T （適用於 230 VAC）

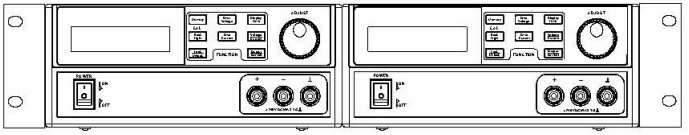
圖 1-1 電線電壓的額定保險絲清單

要在機架安裝儀器

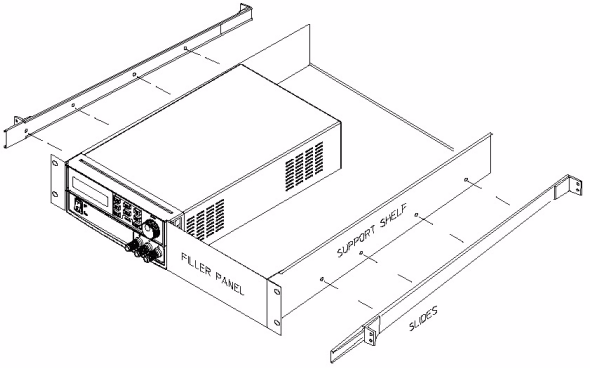
您可以使用三個可用選購套件的其中一個，將電源供應器掛載在標準的 19 吋機櫃中。每個機架安裝套件都包含說明及掛載硬體。



要在機架安裝單一儀器，請訂購配接器套件 5063-9240。



要在機架安裝兩部並排儀器，請訂購相鎖套件 5061-9694 及凸緣套件 5063-9212。請確認在機櫃內使用固定滑軌。



若要在滑動支架上安裝兩部儀器，請訂購支架 5063-9255 及滑動套件 1494-0015。

2
一般資訊

前端面板一覽 8
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安裝 13
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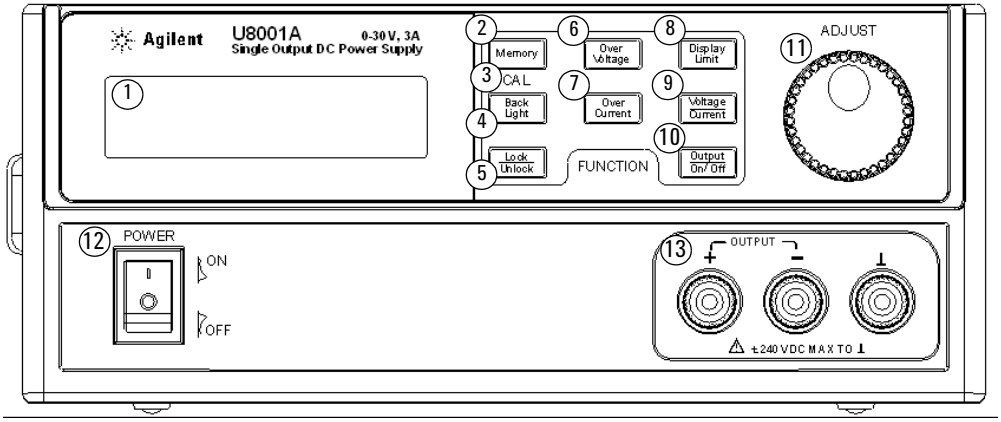
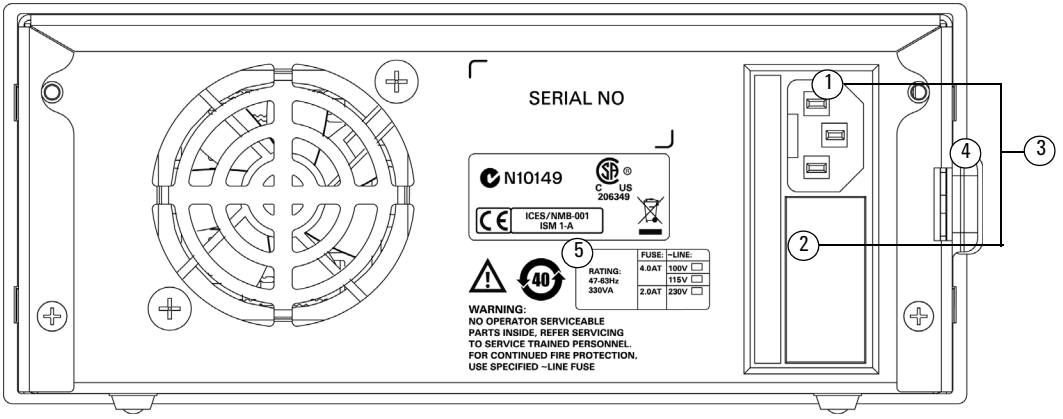
本章提供儀器的一般說明、前端面板概觀、後端面板概觀、顯示器信號器及 U8001A/U8002A 單一輸出 DC 電源供應器的安裝指南。

前端面板一覽



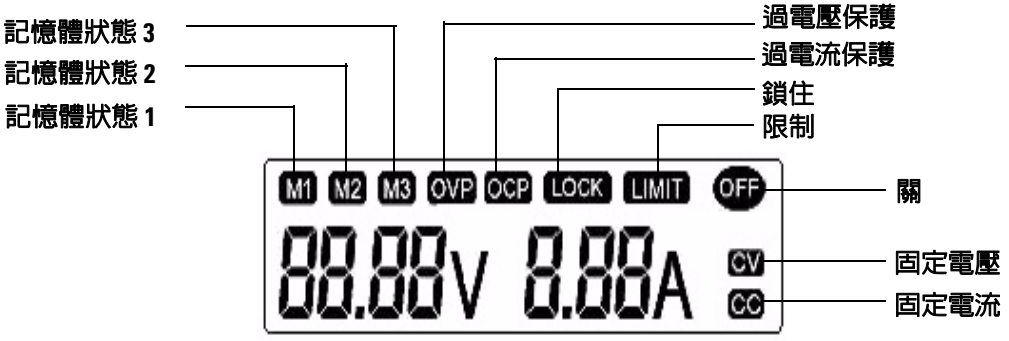
	面板	功能
1	LCD 顯示器	顯示測量。
2	記憶體	設定記憶體、啓用記憶體恢復及記憶體狀態選項 (M1、M2、M3)。
3	CAL	啓用電壓及電流校正。
4	背光	開啓 / 關閉背光。
5	鎖定 / 解除鎖定	啓用及停用前端面板操作。
6	過電壓	啓用及停用過電壓保護功能，設定跳閘電壓，並清除過電壓情況。
7	過電流	啓用及停用過電流保護功能，設定斷路電流，並清除過電流情況。
8	顯示限制	顯示及設定電壓與電流的限制值。
9	電壓 / 電流	選擇旋鈕控制功能，調整電壓與電流。
10	輸出開啓 / 關閉	啓用及停用電源供應器輸出。
11	旋鈕	增加及降低閃爍數字的值。
12	電源開啓 / 關閉	開啓 / 關閉電源
13	接線柱	正、負及接地接線柱，可進行纜線連接。

後端面板一覽



	面板	功能
1	AC 插孔	連接 AC 電源線。
2	電源保險絲座組件	針對不同的國家 / 地區，為電線電壓設定適當的值。
3	電源線模組	結合 AC 插孔與電源保險絲座組件。
4	實體鎖定機制	啓用實體鎖定機制。
5	電線電壓保險絲功率指示器	指出電線電壓及線保險絲功率。

顯示器信號器



信號器	功能
M1 **M2** **M3**	固定記憶體中電源供應器的儲存狀態 當電源供應器處於 「校正模式」時，可用於儲存校正常數。
OVP	啓動信號器時，或是信號器閃爍時過電壓保護電路造成電源供應器關閉的情況下，則會啓用過電壓保護功能。
OCP	啓動信號器時，或信號器閃爍時過電流保護電路造成電源供應器關閉的情況下，則會啓用過電流保護功能。
鎖住	已停用前端面板操作
限制	顯示器顯示電壓及電流的限制值。
關	已停用電源供應器輸出。
CV	信號器閃爍時，電源供應器處於 「固定電壓模式」。
CC	信號器閃爍時，電源供應器處於 「固定電流模式」。

說明

Keysight U8001A/U8002A 單一輸出 DC 電源供應器是輕巧、通用的工作台配件，適合工作台或機架安裝操作。這些電源供應器兼具線性電源供應器效能與高度可用性，讓其成爲電源系統應用的最佳選擇。

操作功能包括：

- 單一輸出
- 固定電壓 (CV) 或固定電流 (CC) 操作
- 過電壓保護 (OVP) 及過電流保護 (OCP)
- 三個儲存位置 (M1 到 M3)，適用於使用者定義的操作狀態
- 鍵台鎖定功能
- 實體鎖定機制

前端面板操作可進行：

- 方便使用的控制功能
- 啓用或停用 OVP 及 OCP
- 設定 OVP 及 OCP 的斷路位準
- 清除 OVP 及 OCP 狀態
- 設定及顯示電壓與電流的限制值
- 操作狀態儲存 / 恢復
- 重新設定電源供應器啓動狀態
- 校正電源供應器
- 啓用或停用輸出

前端面板液晶顯示器 (LCD) 包括：

- 顯示輸出電壓及輸出電流的實際值 （電表模式）
- 或顯示電壓及電流的限制值 （限制模式）
- 從信號器檢查操作狀態

可用前端面板接線柱連接負載纜線，供*工作台*操作。

警告 **機箱中的電源供應輸出浮動超過 ± 240 VDC 時，操作者會有遭到電擊的危險。**

安裝

初始檢查

當您收到電源供應器時，請檢查是否有任何在運送時發生的明顯損壞。如果有發現任何損壞之處，請立即聯絡貨運公司，及距離您最近的 Keysight 營業處。本手冊前面附有保固資訊。

請保留原始包裝，以備將來需將電源供應器送回 Keysight 時使用。如果您將電源供應器送回維修，請附上註明擁有者和型號的標籤。並附上問題的簡短說明。

機械檢查

檢查確認沒有損壞的終端或旋鈕，且機櫃及面板表面完全沒有凹陷及刮傷。確定顯示器沒有刮傷或裂痕。

電氣檢驗

第一章說明快速操作程序，必須確保電源供應器絕對遵循其規格操作。更完整的驗證程序記載於 「Service Guide」 於第 35 頁。

冷卻及位置

冷卻

電源供應器可在 0 °C to 40 °C 溫度範圍內的額定規格下操作。在 40 °C 到 55 °C 的溫度中，電源供應器負載呈不完全額定。風扇從電源供應器的側邊抽出熱氣並由後端排出。使用 Keysight 機架安裝，不會妨礙空氣的流通。

工作台操作

電源供應器安裝的位置，必須在其側面及後端留有足夠空間，讓空氣流通。

清潔

本產品不需清潔。如果想要移除機殼上的灰塵，請使用乾布。

輸出連接

警告 **嘗試將纜線連接到前端輸出終端之前，請確認先關閉電源供應器以避免損壞已連接的電路。**

電壓降

負載纜線必須夠大，以避免因爲纜線妨礙而產生過度電壓降。一般而言，如果纜線大到能夠載入最大的短路電流，而不會過熱，那麼就不會發生過度電壓降。整個負載纜線的電壓降必須限制到小於 2 V。請參閱 American Wire Gauge (AWG) 標準，計算常用 AWG 銅線的電壓降。

3
操作與特性

固定電壓操作 18
固定電流操作 20
記憶體操作 22
編程過電壓保護 24
編程過電流保護 26
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背光操作 29
系統相關操作 30

到目前爲止，您已瞭解如何安裝電源供應器。前一章也向您簡短介紹前端面板按鍵及其功能。本章說明 U8001A/U8002A 單一輸出 DC 電源供應器的操作與特性。

固定電壓操作

下列步驟說明如何執行 「固定電壓 (CV) 操作」。

1 開啓電源供應器。

- 按下 「Power」按鈕以開啓電源供應器。電源供應器即會執行自我測試 （顯示器上不會指出自我測試）。
- 顯示器會開啓所有區段，接著短暫顯示韌體版本。
- 預設會停用輸出。
- 開啓 「OFF」信號器。
- 顯示器顯示 「OFF」

2 將顯示器設爲 「限制模式」。

- 按下 「Display Limit」按鈕，以開啓 「LIMIT」信號器。
- 顯示器會顯示電壓及電流限制值。

附註

按下 「Display Limit」按鈕時，電壓及電流限制值會在顯示器上顯示約五秒的時間。如果沒有偵測到任何活動，則顯示器會回到「電表檢視模式」。

3 調整到想要的輸出電壓。

- 按下 「Voltage/Current」按鈕。看見電壓值的 「V」字閃爍時，請轉動旋鈕，調整到想要的輸出電壓值。

4 調整到想要的電流限制。

- 按下 「Voltage/Current」按鈕。看見目前數值 「A」字閃爍時，請轉動旋鈕，調整到想要的電流限制值。

5 回到 「電表模式」。

- 按下 「Display Limit」按鈕，回到 「電表模式」。會關閉 「LIMIT」信號器。

6 啓用輸出。

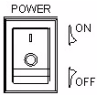
- 按下 「Output On/Off」按鈕，啓用輸出。
- 「OFF」信號器會關閉，「CV」信號器會開啓。
- 現在顯示器即處於 「電表模式」。

附註

確定電源供應器是處於 「固定電壓模式」。確認已開啓固定電壓 (CV) 信號器。如果開啓的是固定電流 (CC) 信號器，請選擇較高的電流限制。

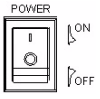
固定電流操作

下列步驟說明如何執行固定電流操作。



1 將接線柱短路。

- 按下 「Power」按鈕以關閉電源供應器。
- 連接正 (+) 與負 (–) 接線柱間的短路電路。



2 開啓電源供應器。

- 按下 「Power」按鈕以開啓電源供應器。電源供應器即會執行自我測試。
- 顯示器會開啓所有區段，接著短暫顯示韌體版本。
- 預設會停用輸出。
- 開啓 「OFF」信號器。

3 將顯示器設爲 「限制模式」。

- 按下 「Display Limit」按鈕，以開啓 「LIMIT」信號器。
- 顯示器會顯示電壓及電流限制值。

附註

按下 「Display Limit」按鈕時，電壓及電流限制值會在顯示器上顯示約五秒的時間。如果沒有偵測到任何活動，則顯示器會回到「電表檢視模式」。

4 調整到想要的電壓限制。

- 按下 「Voltage/Current」按鈕。看見電壓值的 「V」字閃爍時，請轉動旋鈕，調整到想要的電壓限制值。

5 調整到想要的輸出電流。

- 按下 「Voltage/Current」按鈕。看見目前數值 「A」字閃爍時，請轉動旋鈕，調整到想要的輸出電流值。

6 回到 「電表模式」。

- 按下 「Display Limit」按鈕，回到 「電表模式」。會關閉 「LIMIT」信號器。

7 啓用輸出。

- 按下 「Output On/Off」按鈕，啓用輸出。
- 「OFF」信號器會關閉，固定電流 (CC) 信號器會開啓。
- 現在顯示器即處於 「電表模式」。

附註

確定電源供應器是處於 「固定電流模式」。確認已開啓固定電流 (CC) 信號器。如果開啓的是固定電壓 (CC) 信號器，請選擇較高的電壓限制。

記憶體操作

Keysight U8001A/U8002A 單一輸出 DC 電源供應器至多可在固定儲存位置儲存三個操作狀態。儲存功能會*記憶*電壓及電流限制值的設定、OVP* /OCP† 開啓 / 關閉狀態，以及 OVP/OCP 斷路位準。下列步驟說明如何儲存及恢復操作狀態。

儲存操作狀態

1 按下「Memory」按鈕。

- M1 信號器會閃爍。

2 旋轉旋鈕，選擇記憶體位置以儲存操作狀態。

- M1、M2 及 M3 信號器會循環閃爍。

3 再次按下「Memory」按鈕，將操作狀態儲存在選取的記憶體中。

- 顯示器會顯示「donE」。
- 接著會關閉 M1、M2 及 M3 信號器 .

附註 若要取消操作，請將裝置閒置五秒鐘。

* OVP- 過電壓保護

† OCP- 過電流保護

恢復操作狀態

1 按住「Memory」按鈕。

- 會啓動 M1 信號器。
- 會關閉 「LIMIT」信號器。
- 顯示器顯示儲存在 M1 記憶體位置的設定。

2 旋轉旋鈕，以顯示儲存在 M1、M2 及 M3 記憶體位置的設定。

- M1、M2 及 M3 信號器會以循環方式開啓。

3 如果您想要使用顯示的設定作爲目前的操作設定，請按下「Memory」按鈕

- 接著會關閉 M1、M2 及 M3 信號器 .

附註 若要取消操作，請將裝置閒置五秒鐘。

編程過電壓保護

過電壓保護能確保輸出電壓的負載不會超過編程保護層次的值。

下列步驟說明如何啓用與停用過電壓保護 (OVP)、如何設定 OVP 斷路位準，以及如何清除過電壓情況。

設定 OVP 斷路位準及啓用 OVP

1 按下「Over Voltage」按鈕。

- 會關閉「LIMIT」信號器。
- 「OVP」信號器會持續快速閃爍。
- 顯示器會顯示 OVP 值，「V」字持續快速閃爍。

2 轉動旋鈕，調整 OVP 值。

3 再次按下「Over Voltage」按鈕，結束調整，並啓用 OVP。

- 顯示器會顯示「donE」。
- 會啓動「OVP」信號器。

附註 若要取消操作，請將裝置閒置五秒鐘。

停用 OVP

1 按下 「Over Voltage」按鈕，停用 OVP。最後會關閉 「OVP」信號器。

清除過電壓情況

1 啓用輸出時，才會發生 OVP 斷路。發生 OVP 情況時：

- 會停用輸出，並開啓 「OFF」信號器。
- 如果按鍵鎖功能爲啓用，則會將其停用。 「LOCK」信號器會關閉。
- 「OVP」信號器會持續快速閃爍。
- 顯示器會顯示 「TRIP」。

2 若要清除 OVP 斷路情況，請再次按下 「Over Voltage」按鈕。

附註 若 OVP 斷路持續，請降低電壓限制設定，以清除斷路。

編程過電流保護

過電流保護能確保輸出電流的負載不會超過編程保護層次的值。

下列步驟說明如何啓用與停用過電流保護 (OCP)、如何設定 OCP 斷路位準，以及如何清除過電流情況。

設定 OCP 斷路位準及啓用 OCP

1 按下 「Over Current」按鈕。

- 會關閉 「LIMIT」信號器。
- 「OCP」信號器會持續快速閃爍。
- 顯示器會顯示 OCP 值，「A」字持續快速閃爍。

2 轉動旋鈕，調整 OCP 值。

3 再次按下 「Over Current」按鈕，結束調整，並啓用 OCP。

- 顯示器會顯示 「donE」。
- 會啓動 「OCP」信號器。

附註 若要取消操作，請將裝置閒置五秒鐘。

停用 OCP

1 按下 「Over Current」按鈕，停用 OCP。最後會關閉 「OCP」信號器。

清除過電流情況

1 啓用輸出時，才會發生 OCP 斷路。發生 OCP 情況時：

- 會停用輸出，並開啓 「OFF」信號器。
- 如果按鍵鎖功能爲啓用，則會將其停用。 「LOCK」信號器會關閉。
- 「OCP」信號器會持續快速閃爍。
- 顯示器會顯示 「TRIP」。

2 若要清除 OCP 斷路情況，請再次按下 「Over Current」按鈕。

附註 若 OCP 斷路持續，請降低電流限制設定，以清除斷路。

按鍵鎖操作

此操作能鎖住設備旋鈕及所有前端面板按鈕，讓使用者可以確保其偏好設定的安全。

預設會在開機時停用按鍵鎖。

啓用按鍵鎖

1 按下 「Lock/Unlock」按鈕。會開啓 「LOCK」信號器。

2 啓用按鍵鎖功能時，除了 「Lock/Unlock」按鈕外，旋鈕及所有的按鈕都會停用。

停用按鍵鎖

1 按住 「Lock/Unlock」按鈕三秒鐘。

2 按住 「Lock/Unlock」按鈕時，顯示器會顯示 「HOLD」，直到停用按鍵鎖爲止。

3 停用按鍵鎖之後，也會關閉 「LOCK」信號器。

背光操作

此操作是爲 LCD 顯示器提供背光。預設會在開機時啓用背光。

開啓背光

1 按下 「Back Light」按鈕。會開啓背光。

關閉背光

1 按下 「Back Light」按鈕。會關閉背光。

系統相關操作

重設至原廠預設

要將電源供應器裝置重設至原廠預設，請在開機時按住 「Output On/Off」按鈕。

- 關閉 OVP 與 OCP，並將其值設爲最大。
- 清除記憶體儲存位置。
- 電壓及電流限制值設定爲零。
- 校正值不動。

開機自我測試

電源供應器裝置啓動時，會自動進行開機自我測試。此測試確保裝置是可操作的。開機自我測試會檢查快取資料記憶體，並在裝置關閉時檢查電壓及電流輸出。

附註 如果測試失敗，顯示器會顯示 「Err」及錯誤代碼。請參閱 「附錄 A：錯誤碼清單」，以取得詳細資訊。

4
規格與特性

效能規格 32
其他特性 33

本章列出電源供應器的效能規格及設備的其他特性。

效能規格

表 4-1 電子規格

參數	U8001A	U8002A
輸出功率 （於 0 °C 至 40 °C）	0 至 +30 V 0 至 3 A	0 至 +30 V 0 至 5 A
纜線與負載調節	CV：< 0.01% + 2 mV CC：< 0.02% + 2 mA	
漣波與雜訊 （25 °C ± 5 °C）	CV：12 mVp-p，< 1 mVrms； CC：3 mArms	
負載暫態反應時間 （在 15 mV 以內，從全負載到半負載，及從半負載到全負載）	< 50 s	
編程準確性* (25 °C ± 5 °C)	< 0.35% + 20 mV < 0.35% + 20 mA	
回讀準確性* (25 °C ± 5 °C)	< 0.35% + 20 mV < 0.35% + 20 mA	
電表解析度	電壓：10 mV 電流：10 mA	
最大輸出浮動電壓	± 240 VDC	

* 規格是以一小時暖機時間為基礎。

其他特性

表 4-2 其他特性

參數		U8001A	U8002A
溫度係數 （12 個月）		CV：< 100 ppm/ °C	
		CC：< 380 ppm/ °C	CC：<300 ppm/ °C
輸出電壓過衝 （在開啓或關閉交流電期間，如果輸出控制設為少於 1 V）		< 1 V	
電壓編程速度限制在總變化範圍的 1 % 之內			
上升	全負載	150 ms	
	無負載	100 ms	
下降	全負載	30 ms	
	無負載	450 ms	
啓用上次記憶體設定		是	
過電壓保護回應時間		當斷路電壓等於或大於 3 V 時，為 < 1.5 ms，當斷路電壓小於 3 V 時，則為 < 10 msec （發生 OVP 情況後，輸出開始降低的平均時間）	

表 4-3 保護功能

參數	U8001A	U8002A
過電壓保護準確性 ± （輸出百分比 + 偏移）	< 0.5 % + 0.5 V	
過電壓保護可編程範圍	1 V 至 33 V	
過電流保護準確性 ± （輸出百分比 + 偏移）	< 0.5 % + 0.5 A	
過電流保護可編程範圍	1 A 至 3.3 A	1 A 至 5.5 A

表 4-4 交流電輸入規格

參數	U8001A	U8002A
輸入電源選項 （可選取）	110 VAC ± 10%，47 到 63 Hz 115 VAC ± 10%，47 到 63 Hz 230 VAC ± 10%，47 到 63 Hz	
保險絲	外接式，客戶可自行估算	

表 4-5 實體規格

參數	U8001A	U8002A
尺寸 (H x W x L)	88.1 公釐 x 212.3 公釐 x 394.3 公釐	
重量 （公斤）	7.3 公斤	8.3 公斤

5
Service Guide

Equipment Warranty 36
Replacement Parts 38
Troubleshooting 39
Performance Verification and Calibration 43
Voltage Calibration 62
Current Calibration 64

This chapter contains service information for the U8001A/U8002A single output DC power supplies, including warranty information, general diassemble, verification steps to troubleshoot the connectivity and functionality, detailed calibration procedures for your power supply, related documentation and Keysight contacts.

It is advised that you perform the calibration test before you start using the power supply. The step by step calibration procedures are simple and easy to understand. It is meant for both experienced and inexperienced users.

Equipment Warranty

Types of Service Available

If your instrument fails during the warranty period, Keysight Technologies will replace it under the terms of your warranty. After your warranty expires, Keysight offers repair by unit exchange service at competitive prices.

Extended Service Contracts

Many Keysight products are available with optional service contracts that extend the covered period after the standard warranty expires. If you have such a service contract and your instrument fails during the covered period, Keysight Technologies will replace it in accordance with the contract.

Obtaining Repair Service (Worldwide)

To obtain service for your instrument (in-warranty, under service contract, or post-warranty), contact your nearest Keysight Technologies Service Center. They will arrange to have your unit replaced, and can provide warranty or repair cost information where applicable.

To obtain warranty, service, or technical support information you can contact Keysight Technologies at one of the following telephone numbers:

In the United States: (800) 829-4444

In Europe: 31 20 547 2111

In Japan: 0120-421-345

Or use our Web link for information on contacting Keysight worldwide:

www.keysight.com/find/assist

Or contact your Keysight Technologies Representative.

Before shipping your instrument, ask the Keysight Technologies Service Center to provide shipping instructions, including what components to ship. Keysight recommends that you retain the original shipping carton for use in such shipments.

Repackaging for Shipment

If the unit is to be shipped to Keysight for service or repair, be sure to:

- Attach a tag to the unit identifying the owner and indicating the required service or repair. Include the model number and full serial number.
- Place the unit in its original carton with appropriate packaging material for shipping.
- Secure the container with strong tape or metal bands.
- If the original shipping container is not available, place your unit in a container which will ensure at least 4 inches of compressible packaging material around all sides for the instrument. Use static-free packaging materials to avoid additional damage to your unit.

Keysight suggests that you always insure shipments.

Cleaning

No cleaning is required for this product. If you wish to remove dust from the enclosure, use a dry cloth.

Replacement Parts

This section contains information for ordering replacement parts for your instrument. The parts lists are divided into the following sections.

Parts are listed in alphanumeric order according to their reference designators. The parts lists include a brief description of each part with applicable Keysight part number.

To Order Replaceable Parts

You can order replaceable parts from Keysight using the Keysight part number. Note that not all parts listed in this chapter are available as field–replaceable parts. To order replaceable parts from Keysight, do the following:

1. Contact your nearest Keysight Sales Office or Service Center.
2. Identify the parts by the Keysight part number shown in the replaceable parts list.
3. Provide the instrument model number and serial number.

Table 5-6 Replaceable Parts

Part Number	Description
U8001-60002	Front Panel Assembly (U8001)
U8002-60002	Front Panel Assembly (U8002)
U8001-66502	Main PCA (U8001A)
U8002-66502	Main PCA (U8002A)
U8001-80001	Transformer (90 W)
U8002-80001	Transformer (150 W)
2110-0014	Fuse 4.0 A T for 100 Vac and 115 Vac (U8001A)
2110-0006	Fuse 2.0 A T for 230 Vac (U8001A)
2110-0722	Fuse 6.25 A T for 100 Vac and 115 Vac (U8002A)
2110-1425	Fuse 2.8 A T for 230 Vac (U8002A)

Troubleshooting

This section provides a brief check list of common failures. Before troubleshooting or repairing the power supply, make sure that the failure is in the instrument rather than any external connections. Also make sure that the instrument is accurately calibrated.

Unit is Inoperative

- Verify that the ac power cord is connected to the power supply.
- Verify that the front-panel power switch is at "ON" position.
- Verify the power-line voltage setting.
- Verify that the power-line fuse is installed:

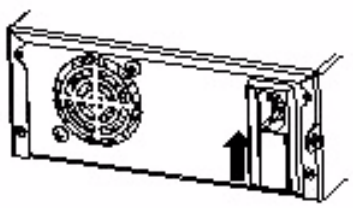
Model	Keysight Part Number	Part Description
U8001A	2110-0014 2110-0006	Fuse 4.0 A T for 100 Vac and 115 Vac Fuse 2.0 A T for 230 Vac
U8002A	2110-0722 2110-1425	Fuse 6.25 A T for 100 Vac and 115 Vac Fuse 2.8 A T for 230 Vac

Line Voltage Conversion

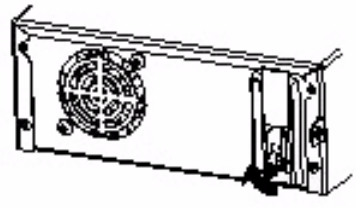
WARNING ***Shock Hazard.*** **Operating personnel must not remove power supply covers. Component replacement and internal adjustment must be made only by qualified service personnel.**

Line voltage conversion is accomplished by adjusting two components: the line voltage selection switch and the power-line fuse on the rear panel.

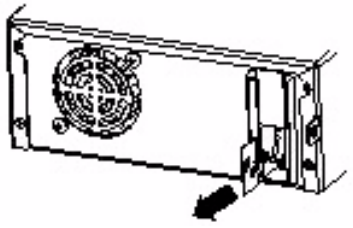
1 Remove the power cord and slide the fuse cover upwards



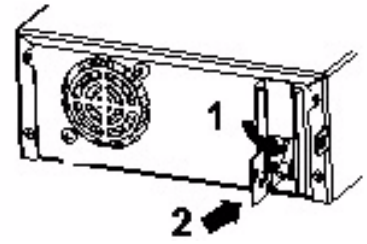
2 Pull the fuse plunger to remove the fuse from the fuse holder

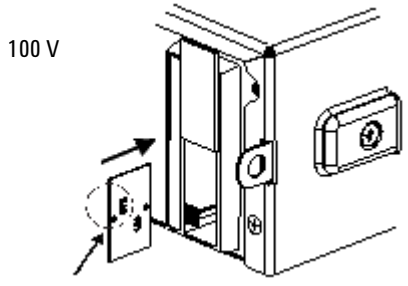


3 Remove the voltage selector PCB using a flat-blade screwdriver.

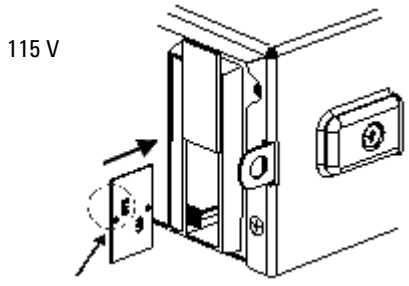


4 Replace the correct fuse and orientate the PCB based on the correct voltage.

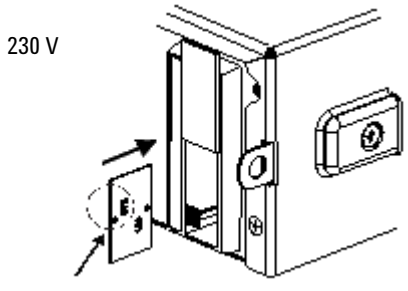




100 indication needs to be in this orientation

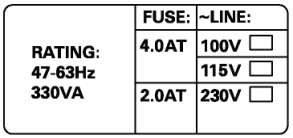


115 indication needs to be in this orientation

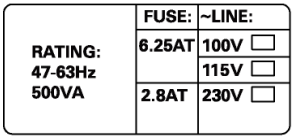


230 indication needs to be in this orientation

Figure 5-2 Orientation of voltage selector AC inlet in different voltage selection



Line Voltage Fuse Rating indicator for U8001A



Line Voltage Fuse Rating indicator for U8002A

NOTE The authorised personnel will mark the fuse rating indicator printed on the rear panel each time the fuse is changed.

Self-Test Procedures

Power-On Self-Test

Each time the power supply is powered on, a set of self-tests are performed. These tests check that the minimum set of logic and measurement hardware are functioning properly.

Unit Fails Self-Test

Verify that the correct power-line voltage setting is selected. Also, ensure that all terminal connections are removed while the self-test is performed. Please refer to 「附錄 A：錯誤碼清單」for list of error codes.

Performance Verification and Calibration

This chapter contains performance verification and calibration procedures. The performance verification procedures allow you to verify that the power supply is operating within its published specifications. The calibration procedures show how to make voltage and current adjustment on the power supply.

Keysight Technologies Calibration Services

When your instrument is due for calibration, contact your local Keysight Service Center for a low-cost recalibration.

Calibration Interval

One year interval is recommended for most applications. Accuracy specifications are warranted only if calibration is made at regular calibration interval. Accuracy specifications are not warranted beyond the one year calibration interval. Keysight does not recommend extending calibration intervals beyond two years for any application. Keysight recommends that complete re-adjustment should always be performed at the calibration interval. This will increase your confidence that the U8001A and U8002A will remain within specification for the next calibration interval. The re-adjustment provides the best long-term stability and accuracy.

Recommended Test Equipment

The test equipment recommended for the calibration and adjustment is listed below. If the exact instrument is not available, substitute the calibration standards of equivalent requirement(s).

Table 5-7 List of Equipment

Equipment	Requirement(s)	Recommended Model	Purpose	Used
Digital Multimeter (DMM)	• 8½ digits resolution	Keysight 3458A	Measures accurate DC voltage	PV* C†

Oscilloscope	• Sensitivity: 1 mV
	• Bandwidth limit: 20 MHz
	• Probe:
	  ◦ 1:1 with RF tip
	  ◦ 10:1 with RF tip for > 50 V
		Keysight DSO8064A or Infiniium equivalent	Displays transient response. Displays ripple and noise waveform.	PV

Differential Amplifier	• Bandwidth > 20 MHz (bandwidth limit : 20 MHz) • AC coupling • Amplifier x10	LeCroy DA1855A	Signal conditioning preamplifiers	PV
RMS Volt Meter	• 20 Hz to 20 MHz	R&S URE3	Measures RMS noise	PV
50 Ω Feed-through Termination		Pomona	Loads termination to match output impedance of the differential amplifier	PV
AC/DC Current Converter		Tektronix TCP305 & Tektronix TCPA300	Converts current to voltage	
Electronic Load	• Voltage range: 30 Vdc • Current range: 5 A • Open and Short switches • Transient On/Off	Keysight 6060B	Measures load and line regulations and transient response time	PV
AC Power Source	• Capable of supplying 90 Vac — 250 Vac	Keysight 6813B	Functions as variable voltage transformer	PV

Table 5-7 List of Equipment

Equipment	Requirement(s)	Recommended Model	Purpose	Used
Resistive Load (R_L)	• 10 Ω/90 W (for U8001A) • 6 Ω/150 W (for U8002A)		Measures ripple and noise	PV
Current Monitoring Resistor (Shunt) ($R_{M)}$	• 0.01 Ω ± 0.1% • TCR less than 20 ppm/°C	ISOTEK Co. Model A-H	Current monitoring resistor	PV C

* PV = Performance Verification

† C = Calibration

Test Consideration

For optimum performance, all procedures should comply with the following recommendations:

- Assure that the calibration ambient temperature is stable and between 20 °C and 30 °C. Ideally the calibration should be performed at 25 °C ±1 °C.
- Assure ambient relative humidity is less than 80%.
- Allow 1 hour warm up period by power on the power supply. During warm up period, set the power supply to maximum programmable voltage and current. Then, enable the output.
- Keep the cables to connect the test setup as short as possible.

Measurement Techniques

Test Setup

Most tests are performed at the front terminals as shown below. Measure the DC voltage directly at the positive (+) and negative (-) terminals on the front panel.

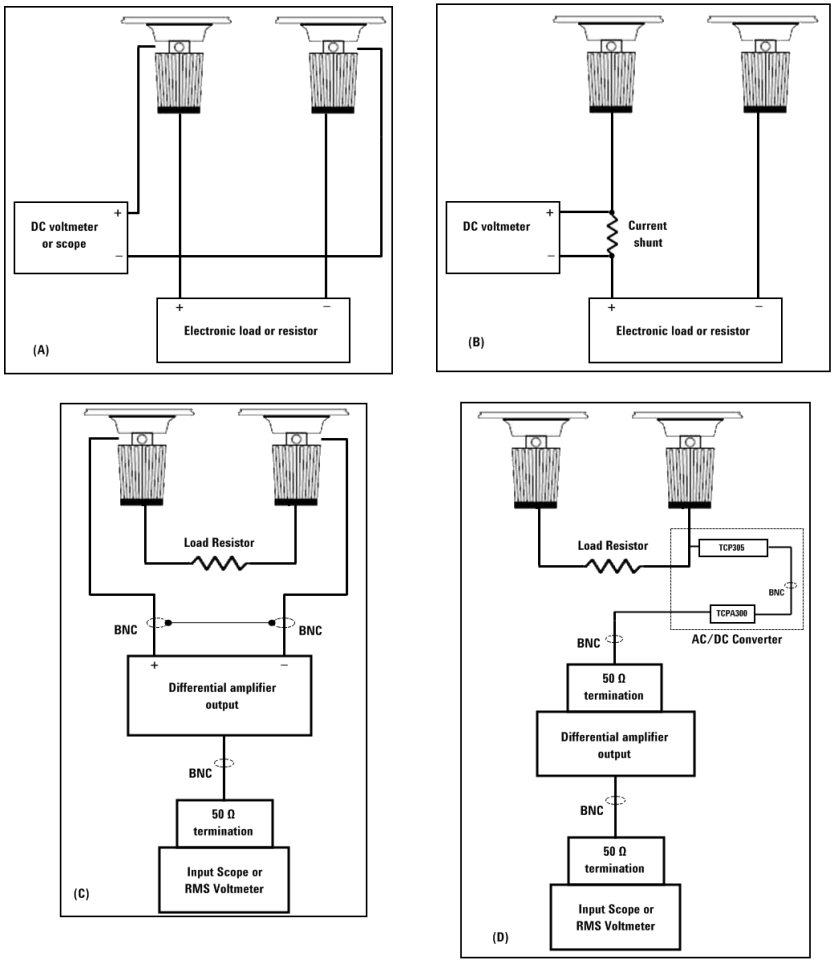


Figure 5-3 Test Setups

Current Monitoring Resistor

To eliminate output current measurement error caused by the voltage drops in the leads and connections, connect the current monitoring resistor (R_M) between the (-) output terminal and the load as a four-terminal device. Connect the current monitoring leads inside the load-lead connections directly at the monitoring points on the resistor element.

General Measurement Techniques

To achieve best results when measuring load regulation, peak to peak voltage, and transient response time of the power supply, measuring devices must be connected through the hole in the neck of the binding post at (A) while the load resistor is plugged into the front of the output terminals at (B). A measurement made across the load includes the impedance of the leads to the load. The impedance of the load leads can easily be several orders of the magnitude greater than the power supply impedance and thus invalidate the measurement. To avoid mutual coupling effects, each measuring device must be connected directly to the output terminals by separate pairs of leads.

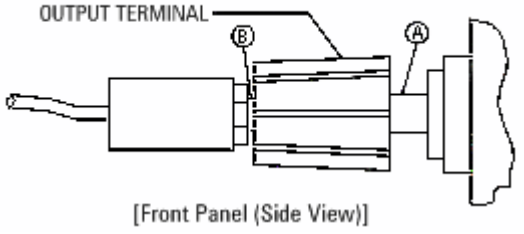


Figure 5-4 General Measurement

Electronic Load

Many of the test procedures require the use of a variable load resistor capable of dissipating the required power. Using a variable load resistor requires that switches should be used to connect, disconnect, and short the load resistor. An electronic load, if available, can be used in place of a variable load resistor and switches. The electronic load is considerably easier to use than load resistors. It eliminates the need for connecting resistors or rheostats in parallel to handle power, it is much more stable than carbon-pile load, and it makes easy work of switching between load conditions as is required for the load regulation and load response tests. Substitution of the electronic load requires minor changes to the test procedures in this chapter.

Constant Voltage (CV) Verification

Voltage Programming and Readback Accuracy

This test is to verify that the voltage programming and readback accuracy are within published specifications.

Procedures:

1. Power off the power supply and connect a DMM between the (+) and (-) terminals of the output to be tested as shown in Figure 5-3(A).
2. Power on the power supply.
3. When the power supply is in limit mode, program the output voltage to 0V and the output current to the maximum programmable value.
4. Enable the output.
5. Wait for a few seconds for the output of the power supply to settle. Make sure that the power supply is in CV mode.
6. Record the voltage reading on the DMM (V_{DMM}). This value should be within the limit of 0 V ± 20 mV.
7. When the power supply is in meter mode, record the voltage reading displayed on the front display of the power supply. This value should be within the limit of V_{DMM} ± 20 mV.
8. Disable the output.
9. When the power supply is in limit mode, program the output voltage to full rated value, i.e. 30 V.
10. Enable the output.
11. Wait for a few seconds for the output of the power supply to settle. Make sure that the power supply is in CV mode.
12. Record the voltage reading on the DMM (V_{DMM}). This value should be within the limit of 30 V ± 0.125 V.
13. When the power supply is in meter mode, record the voltage reading displayed on the front display of the power supply. This value should be within the limit of V_{DMM} ± 0.125 V.

CV Load Effect (Load Regulation)

This test measures the change in the output voltage resulting from a change in the output current from full load to no load or vice versa.

Procedures:

1. Power off the power supply and connect a DMM between the (+) and (-) terminals of the output as shown in Figure 5-3(A).
2. Power on the power supply.
3. When the power supply is in limit mode, program the output voltage to full rated value, i.e. 30 V and output current to the maximum programmable value.
4. Enable the output.
5. Operate the electronic load in constant current mode and set its current to 3 A for U8001A and 5 A for U8002A. Ensure that the power supply is in CV mode. If not, adjust the electronic load so that the current drops slightly until the power supply is in CV mode.
6. Record the reading on the DMM.
7. Within a few seconds after step 6, operate the electronic load in open mode and record the reading on the DMM.
8. Compare the reading obtained in steps 5 and 6. The difference should be within the limit of 5 mV.

CV Source Effect (Line Regulation)

This test measures the change in output voltage that results from a change in AC line voltage from the minimum value to maximum value.

Procedures:

1. Power off the power supply and connect a DMM between the (+) and (-) terminals of the output to be tested as shown in Figure 5-3(A).
2. Connect the AC power line through an AC voltage source. Adjust the AC voltage source to provide nominal input voltage to the power supply.
3. Power on the power supply.
4. When the display is in the limit mode, program the output voltage to full rated value, i.e. 30 V and output current to the maximum programmable value.
5. Enable the output.
6. Operate the electronic load in constant current mode and set its current to 3 A for U8001A and 5 A for U8002A. Ensure that the power supply is in CV mode. If not, adjust the electronic load so that the output current drops slightly until the power supply is in CV mode.
7. Adjust the AC voltage source to low line voltage limit. Record the output reading on the DMM.
8. Within a few seconds after step 7, adjust the AC voltage source to high line voltage limit and record the voltage reading on the DMM.
9. The difference between the DMM readings in steps 7 and 8 should be within the limit of 5 mV.

Line Voltage	Low Line Voltage Limit, V_{ac}	High Line Voltage Limit, V_{ac}
100	90	110
115	104	127
230	207	253

CV Noise

CV noise is specified as the RMS or peak-to-peak output voltage in the frequency range from 20 Hz to 20 MHz.

Procedures:

1. Power off the power supply and connect the output to be tested as shown in Figure 5-3(C) to a differential amplifier and load resistor (10 Ω for U8001A and 6 Ω for U8002A)
2. Power on the power supply.
3. When the display is in the limit mode, program the output voltage to full rated value, i.e. 30 V and output current to the maximum programmable value.
4. Enable the output of the power supply.
5. Make sure that the power supply is in CV mode. If not, adjust the resistive load so that the output current drops slightly until the power supply is in CV mode.
6. Configure the differential amplifier as follow:
   - Set to AC mode (positive and negative) to removes the DC component
   - Set to differential mode
   - Set gain to x10
   - Set attenuation to 1
   - Set low pass filter to 20 MHz bandwidth limit to filter out input signal which contains higher frequency
   - Set to zero precision voltage generator
   - Set input impedance to 1 MΩ
7. Configure the scope as follow:
   - Set time range to 50 ms (20 Hz)
   - Acquires every single sample at the maximum sampling rate and retains only the min and max values in a "sampling region" (50 ms time range)
   - Enable 20 MHz cut off frequency for better high frequency cut-off
   - AC coupling

- Enable Auto-triggering

8 Allow the scope run for a few seconds to generate enough measurement points.

9 Obtain the maximum peak-to-peak voltage measurement as indicated in the scope. Divide this value by 10 to get the CV peak-to-peak noise measurement. The result should not exceed 12 mV_{pp}.

10 Configure the RMS voltmeter as below:

- Set high pass filter to10 Hz
- AC coupling

11 Disconnect the oscilloscope and connect an RMS voltmeter in its place. Do not disconnect the 50 Ω termination. Divide the reading of the RMS voltmeter by 10. The result should not exceed the RMS limits of 1 mV_{RMS}.

Load Transient Response Time

This test measures the time for the output voltage to recover to within 15 mV of nominal output voltage following a load change from full load to half load or vice versa.

Procedures:

1. Power off the power supply and connect the output to be tested as shown in Figure 5-3(A) with an oscilloscope. Operate the electronic load in constant current mode.
2. Power on the power supply.
3. When the display is in the limit mode, program the output voltage to full rated value, i.e. 30 V and output current to the maximum programmable value.
4. Enable the output.
5. Set the electronic load to transient operation mode between one half of the output's full rated value and the output's full rated value at a 1 kHz rate with 50% duty cycle.
6. Set the oscilloscope coupling, internal sync and lock on either the positive or negative load transient.
7. Adjust the oscilloscope to display transients as shown in Figure 5-5. Note that the pulse width (t2 - t1) of the transients at 15 mV from the base line is no more than 50 µs for the output.

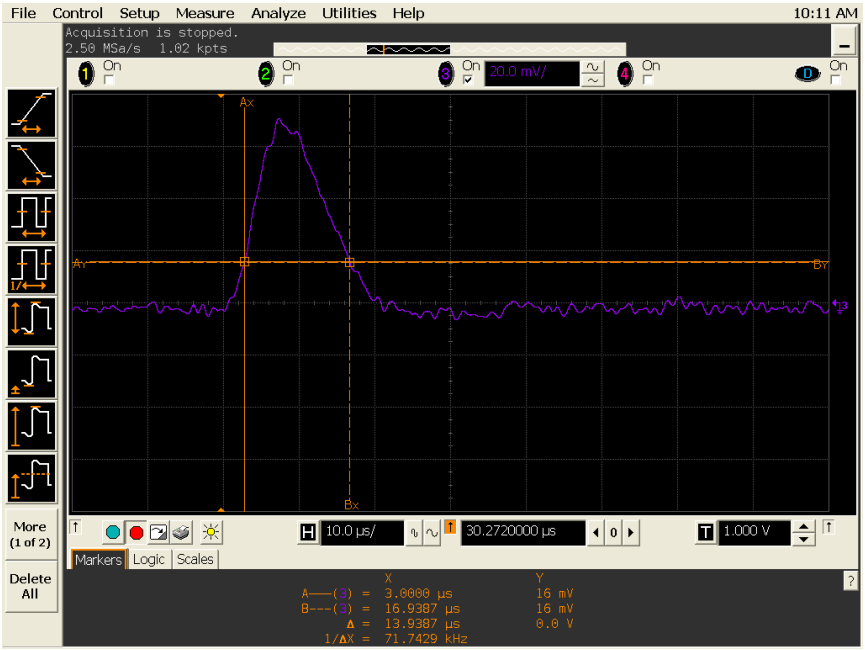


Figure 5-5 Graph of load transient response

Constant Current (CC) Verification

Current Programming and Readback Accuracy

This test is to verify that the current programming and readback accuracy are within published specifications. The accuracy of the current monitoring resistor must be 0.1% or better.

Procedures:

1. Power off the power supply and connect a 0.01 Ω current shunt monitoring resistor (R_M) across the output to be tested and a DMM across the current monitoring resistor (R_M) as shown in Figure 5-3(B).
2. Power on the power supply.
3. When the power supply is in limit mode, program the output voltage to maximum programmable value and the current to 0 A.
4. Enable the output.
5. Wait for a few seconds for the output of the power supply to settle. Make sure that the power supply is in CC mode.
6. Divide the voltage drop (DMM reading) across the current monitoring resistor (R_M) by its resistance to convert to amps and record this value (I_O). This value should be within the limit of 0 A ±20 mA.
7. When the power supply is in meter mode, record the current reading displayed on the front display of the power supply. This value should be within the limit of I_O ±10 mA.
8. Disable the output.
9. When the power supply is in limit mode, program the output current to full rated value, i.e. 3 A for U8001A and 5 A for U8002A.
10. Enable the output.
11. Wait for a few seconds for the output of the power supply to settle. Make sure that the power supply is in CC mode.

12 Divide the voltage drop (DMM reading) across the current monitoring resistor (R_M) by its resistance to convert to amps and record this value (I_O). This value should be within the limit of:

- U8001A: 3 A ±30.5 mA
- U8002A: 5 A ±37.5 mA

13 When the power supply is in meter mode, record the current reading displayed on the front display of the power supply. This value should be within the limit of:

- U8001A: I_O ±30.5 mA
- U8002A: I_O ±37.5 mA

CC Load Effect (Load Regulation)

This test measures the immediate change in output current resulting from a change in the load from full rated output voltage to short circuit.

Procedures:

1. Power off the power supply and connect the output to be tested as shown in Figure 5-3(B) with the DMM connected across the 0.01 Ω current monitoring resistor (R_M).
2. Power on the power supply.
3. When the power supply is in limit mode, program the output voltage to maximum programmable value and output current to full rated value, i.e. 3 A for U8001A and 5A for U8002A.
4. Enable the output.
5. Operate the electronic load in constant voltage mode and set its voltage to 30 V. Ensure that the power supply is in CC mode. If not, adjust the electronic load so that the voltage drops slightly until the power supply is in CC mode.
6. Record the current reading by dividing the voltage reading on the DMM by the resistance of the current monitoring resistor.
7. Within a few seconds after step 6, operate the electronic load in short mode and record the current reading by dividing the voltage reading on the DMM by the resistance of the current monitoring resistor.
8. Compare the reading obtained in steps 6 and 7. The difference should be within the limit of:
   - U8001A: 2.6 mA
   - U8002A: 3 mA

CC Source Effect (Line Regulation)

This test measures the change in output current that results from a change in AC line voltage from the minimum value to the maximum value.

Procedures:

1. Power off the power supply and connect the output to be tested as shown in Figure 5-3(B) with the DMM connected across the current monitoring resistor (R_M).
2. Connect the AC power line through an AC voltage source. Adjust the AC voltage source to provide nominal input voltage to the power supply.
3. Power on the power supply.
4. When the display is in the limit mode, program the output voltage to maximum programmable value and output current to full rated value, i.e. 3 A for U8001A and 5 A for U8002A.
5. Enable the output.
6. Operate the electronic load in constant voltage mode and set its voltage to 30 V. Ensure that the power supply is in CC mode. If not, adjust the electronic load so that the output voltage drops slightly until the power supply is in CC mode.
7. Adjust the AC voltage source to low line voltage limit. Record the output current reading by dividing the voltage reading on the DMM by the resistance of the current monitoring resistor.
8. Within a few seconds after step 7, adjust the AC voltage source to high line voltage limit and record the output current reading by dividing the voltage reading on the DMM by the resistance of the current monitoring resistor.

9 Compare the reading obtained in steps 7 and 8. The difference should be within the limit of:

- U8001A: 2.6 mA
- U8002A: 3 mA

Line Voltage	Low Line Voltage Limit, V_{ac}	High Line Voltage Limit, V_{ac}
100	90	110
115	104	127
230	207	253

CC Noise

CC noise is specified as the RMS output current in a frequency range 20 Hz to 20 MHz with the power supply in constant current operation.

Procedures:

1. Power off the power supply and connect the output to be tested as shown in Figure 5-3(D) to an AC/DC converter and load resistor (10 Ω for U8001A and 6 Ω for U8002A).
2. Power on the power supply.
3. When the display is in the limit mode, program the output voltage to maximum programmable value and output current to full rated value, i.e. 3A for U8001A and 5 A for U8002A.
4. Enable the output.
5. Make sure that the power supply is in CC mode. If not, adjust the resistive load so that the output voltage drops slightly until the power supply is in CC mode.
6. Configure the differential amplifier as follow:
   - Set to AC mode (positive and negative) to removes the DC component
   - Set to differential mode
   - Set gain to x10
   - Set attenuation to 1
   - Set low pass filter to 20 MHz bandwidth limit to filter out input signal which contains higher frequency
   - Set to zero precision voltage generator
   - Set input impedance to 1 MΩ
7. Configure the RMS voltmeter as follow:
   - Set high pass filter to10Hz
   - AC coupling
8. Divide the reading of the RMS voltmeter by 10 and then multiply the result by 5 to get the RMS noise measurement. The result should not exceed the RMS limits of 3 mA_{RMS}.

Voltage Calibration

Before attempting to calibrate the power supply, please ensure that you have disconnected all loads from the power supply and connect a digital voltmeter (DVM) across the output terminals. You will be calibrating for low voltage, middle voltage and high voltage point respectively. Make sure that the power supply is in constant voltage (CV) mode along the voltage calibration.

1 Enter calibration mode.

- In order to enter the calibration mode, hold down the **Memory** button when power on the power supply.
- The output is enabled.
- The calibration will start with voltage calibration mode.
- Display will show "C" blinking.
- The CV annunciator will be turned on.
- Ensure that the power supply is in CV mode. Otherwise, the CC annunciator will fast-blink.

2 Low Voltage Calibration Point.

- Display will show "C" blinking.
- The M1 annunciator will be turned on.
- Use the knob to enter the reading obtained from the DVM.
- Press the "Memory" button to save the changes and move to the next calibration point. You will be able to perform this if the power supply is in CV mode.

3 Middle Voltage Calibration Point.

- Display will show "C" blinking.
- The M2 annunciator will be turned on.
- Use the knob to enter the reading obtained from the DVM.
- Press the "Memory" button to save the changes and move to the next calibration point. You will be able to perform this if the power supply is in CV mode.

4 High Voltage Calibration Point.

- Display will show "C" blinking.
- The M3 annunciator will be turned on.
- Use the knob to enter the reading obtained from the DVM.
- Press the "Memory" button to save the changes voltage calibration is done. You will be able to perform this if the power supply is in CV mode.

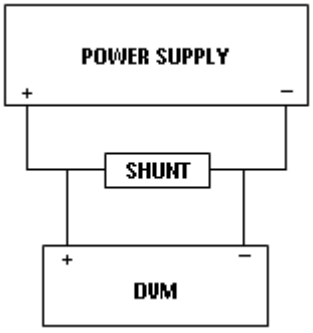
5 Voltage Calibration

- Display will show "donE" for a few seconds and the power supply will enter the current calibration mode.

NOTE If you do not wish to continue with the current calibration, you may now turn off the power supply to exit the calibration mode.

Current Calibration

For current calibration, connect an appropriate shunt 0.01 Ω across the output terminals, and connect a digital voltmeter (DVM) across the shunt resistor. Same as voltage calibration, you will also be calibrating for low current, middle current and high current calibration point respectively. Make sure that the power supply is in constant current (CC) mode along the current calibration.



1 Current Calibration mode

- Display will show "C" blinking.
- The CC annunciator will be turned on.
- Ensure that the power supply is in CC mode. Otherwise the CV annunciator will fast-blink.

2 Low current calibration point.

- Display will show "C" blinking.
- The M1 annunciator will be turned on.
- Use the knob to enter the computed value (DVM reading divided by shunt resistance).
- Press the "Memory" button to save the changes and move to the next calibration point. You will be able to perform this if the power supply is in CC mode.

3 Middle current calibration point.

- Display will show "C" blinking.
- The M2 annunciator will be turned on.

- Use the knob to enter the computed value (DVM reading divided by shunt resistance).

- Press the "Memory" button to save the changes and move to the next calibration point. You will be able to perform this if the power supply is in CC mode.

4 High current calibration point.

- Display will show "C" blinking.
- The M3 annunciator will be turned on.

- Use the knob to enter the computed value (DVM reading divided by shunt resistance).

- Press the "Memory" button to save the changes and the whole calibration process is done. You will be able to perform this if the power supply is in CC mode.

5 Calibration done

- Display will show “donE CAL”
- The output is disabled and the OFF annunciator will be turned on.

6 Reenter calibration mode

- Press the “Memory” button to reenter the calibration mode. The calibration will start with voltage calibration mode.

7 Exit calibration mode

- Turn off the power supply to exit the calibration mode.

8 Toggle between calibration modes

- Along the calibration process, you can toggle between voltage calibration mode and current calibration mode by pressing the "Voltage/Current" button.

附錄

附錄 A：錯誤碼清單 68

KEYSIGHT TECHNOLOGIES

附錄 A：錯誤碼清單

下表包含錯誤碼清單及各代碼的解釋。

操作錯誤

代碼	說明
101	快閃讀 / 寫失敗
102	無效的校正資料
111	溫度太高

校正錯誤

代碼	說明
201	快閃讀 / 寫失敗
211	DAC CV 的校正失敗
212	DAC CC 的校正失敗
213	ADC CV 的校正失敗
214	ADC CC 的校正失敗
215	DAC OV 的校正失敗
216	DAC OC 的校正失敗

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