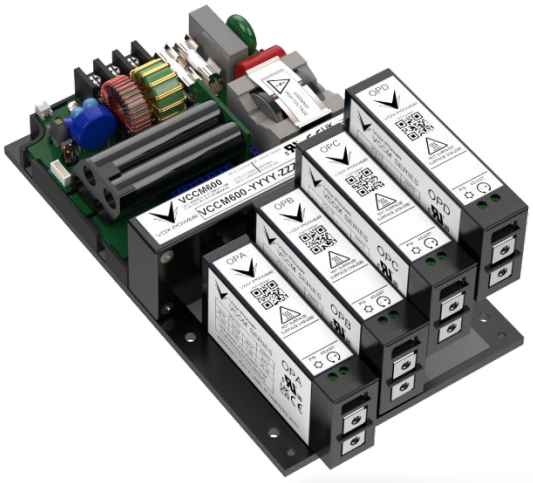
VCCM600 Series

USER MANUAL

AC/DC Conduction Cooled Configurable PSU



600W
Powerful

4" x 7" x 1.61"
Small

Fan-less
Silent

Flexibility meets reliability - modular & fan-less

The VCCM600 series user manual has been prepared by our design team to assist qualified engineers in correctly designing in the VCCM600 product into their application to achieve the best reliability and performance possible.

VCCM600 Series Overview

The VCCM600 series of conduction cooled configurable power platform delivers a silent 600 Watts and up to 750 Watts of peak power for 5 seconds in a rugged 4" x 7" package and is the ultimate power solution for applications where reliability or audible noise are of concern. The product combines the advantages of a modular power supply with the high reliability of a fan-less architecture. Depending on your application, the VCCM600 can be configured as a conduction, convection or forced air cooled solution and this versatility allows the unit to be seamlessly integrated across a vast range of applications, which makes it perfect for standardising your power platform. Designed with highest reliability and versatility in mind, the VCCM600 is suitable for applications ranging from the most controlled environments to the harshest conditions. Each configured modular solution can accommodate up to 4 isolated DC output modules which utilize 100% SMT components for increased reliability. Standard features include full output voltage adjust range, externally controllable voltage and current and series & paralleling of outputs. The unique design approach and heat dissipation techniques allows the unit to be mounted in virtually any orientation giving system designers even more flexibility. The series is approved to latest safety and EMC standards and features market leading specifications and design in application support.

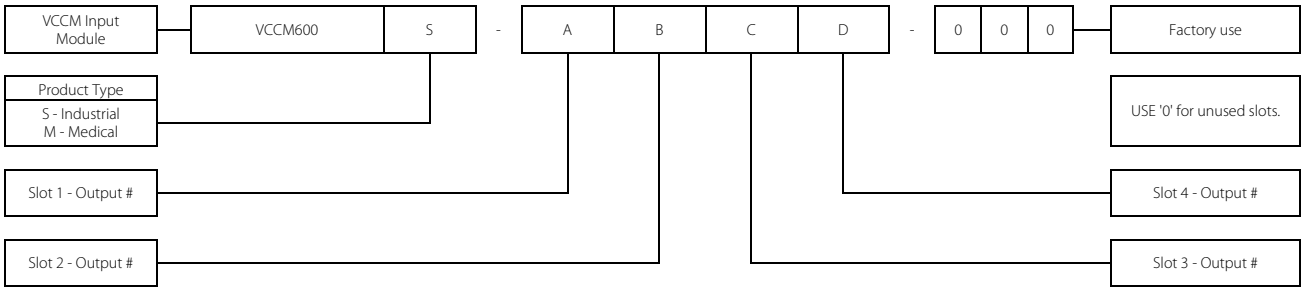
Contents

Part Numbers and Ordering Information

INPUT MODULES	
Input Module	Details
VCCM600S	600 Watt Input Module with ITE Approvals (UL/IEC60950 Edition 2 & UL/IEC62368 Edition 2)
VCCM600M	600 Watt Input Module with Medical Approvals (UL/IEC60601-1 Edition 3.1 + UL/IEC60601-1-2 Edition 4 EMC)

OUTPUT MODULES							
Module	Nominal voltage	Rated current	Rated Power	Adjustment range	Load regulation	Line regulation	OVP
OP 0	Unused slots						
OP A	5V	25A	125W	1.5V-7.5V	±50mV	±0.1%Vnom	9V
OP B	12V	15A	150W	4.5V-15V	±100mV	±0.1%Vnom	18V
OP C	24V	7.5A	150W	9V-30V	±150mV	±0.1%Vnom	36V
OP D	48V	3.5A	150W	18V-58V	±300mV	±0.1%Vnom	66V

PART NUMBERING SYSTEM



Contact your Distributor or Vox Power for special configuration requirements. The factory may allocate a 3-digit suffix to identify such requirements.

Installation Notes

The instructions in this manual and all warning labels on the product must be followed carefully.

PRODUCT USE

Vox Power Ltd products are not intended for use in connection with life support systems, human implantations, nuclear facilities or systems, aircraft, spacecraft, military or naval missile, ground support or control equipment used for the purpose of guidance navigation or direction of any aircraft, spacecraft or military or naval missile or any other application where product failure could lead to loss of life or catastrophic property damage. The user will hold Vox Power Ltd harmless from any loss, cost or damage resulting from its breach of these provisions.

INSTALLATION

This power supply has been designed in accordance with the relevant safety requirements of IEC/EN/UL/CSA 62368-1, IEC/EN/UL/CSA 60950-1, IEC/EN/UL/CSA 60601-1, Low voltage Directive LVD 2014/35/EU and EMC directive EMC 2014/30/EU.

The power supply is considered a component power supply and must be installed within an end equipment by qualified personnel. The end equipment must provide a controlled environment which restricts access to any unauthorised personnel. Equipment and system manufacturers must protect operators and service personnel against unintentional contact with hazardous terminals.

HAZARDS

Risk of electric shock

This power supply contains dangerous voltages.
Appropriate protections must be implemented.

Hot Surface

The external surfaces of this power supply may become hot during and after use.
Appropriate protections must be implemented.

If series and/or parallel combinations of outputs exceed safe voltage and/or energy levels, the final equipment manufacturer must provide appropriate protection for both users and service personnel.

SYSTEM LABELING

A label that is clearly visible to service personnel must be placed on the final equipment, which warns that surfaces of the power supply may be hot and should not be touched when the product is operating.

Where the incoming wiring earth is intended for connection as the main protective earth conductor and where the terminals for such a connection is not supplied on a component or subassembly, the user shall add an appropriate label displaying a protective earth symbol in accordance with IEC60417-5019 (2006-08) directly adjacent to the terminal.

All labels should be durable and legible and should withstand the 15 second rub test as per UL60950-1 section 1.7.15.

FUSING

This power supply has internal dual pole fusing. One fuse in each line. **Fuses are not replaceable.**
DC operation is not covered by safety approvals. Contact Vox Power for details.

DE-RATINGS

Ambient Temperature	The input module power must be de-rated by 2.5%/°C above 50°C up to a maximum ambient temperature of 70°C.
Baseplate Temperature	The output module power and current must be de-rated by 2.5%/°C above 85°C up to a maximum baseplate temperature of 105°C.
Input Voltage	The input module power must be de-rated by 5W/V_{RMS} below120 V_{RMS} (e.g. 600W @ 120 V_{RMS}, 450W @ 90 V_{RMS}) **Note that the mains supply voltage tolerance must be included when calculating the derating. E.g. 100V nominal mains with -15% tolerance must be derated to 85V rating.**

Remember to take the appropriate de-rating into consideration before specifying any power supply for an application. If in any doubt, please contact Vox Power directly or your local Vox Power representative.

SERVICING

This power supply contains no user serviceable parts. Repairs must be carried out by authorised personnel only. Contact Vox Power Ltd for further information.

COOLING

For proper operation of the power supply, the user must ensure sufficient cooling to maintain all component temperatures within specifications. A thorough review of the user manual should be carried out for details of thermal performance.

END OF LIFE DISPOSAL

This power supply may contain components that require special disposal. At end of life, ensure that the unit is disposed of according to local regulations.

OTHER

- To prolong the life of the unit, use in a dust free environment.
- If units are damaged during transit, contact your sales agent or Vox Power and DO NOT apply power to the unit.
- Always use adequately sized cables and ensure good crimp connections. Use cable supports to minimise stress on connectors.
- Avoid excessive shock or vibration.

GENERAL INSTALLATION PARAMETERS

- Equipment class: I
- Pollution degree: 2
- Flammability rating: 94V-2
- RoHS compliance: 2011/65/EU & 2015/863/EU
- Installation category: II
- Material group: IIIb (Indoor use only)
- IP rating: IP10

Installationshinweise

Die Anweisungen in dieser Anleitung und alle Warnhinweise auf dem Produkt sind sorgfältig zu befolgen.

PRODUKTVERWENDUNG

Produkte von Vox Power Ltd sind nicht vorgesehen für den Gebrauch in Zusammenhang mit Lebenserhaltungssystemen, menschliche Implantaten, Nuklearanlagen oder -systemen, Flugzeugen, Raumfahrzeugen, militärischen Lenkflugkörpern, boden- oder steuerungstechnischem Gerät für den Einsatz zum Zwecke der Navigation oder Lenkung von Flugzeugen, Raumfahrzeugen oder Lenkflugkörpern oder sonstigen Anwendungen, bei denen ein Produktversagen zum Tode oder zu katastrophalen Schäden führen kann. Der Anwender wird Vox Power Ltd von jeglichen Verlusten, Kosten oder Schäden schadlos halten, die auf die Verletzung dieser Bestimmungen zurückzuführen sind.

INSTALLATION

Diese Netzteil entspricht in Auslegung und Konstruktion den einschlägigen Sicherheitsanforderungen gemäß DIN EN IEC 62368-1, DIN EN IEC 60950-1, DIN EN IEC 60601-1, Niederspannungsrichtlinie 2014/35/EU und EMV-Richtlinie 2014/30/EU.
Das Netzteil wird als Einbaunetzteil betrachtet und muss daher von einer Elektrofachkraft in ein Endgerät eingebaut werden. Das Endgerät muss eine geschützte Umgebung/Umhäusung aufweisen, die den Zugang für unbefugte Personen beschränkt. Geräte- und Anlagenhersteller müssen Bedien- und Wartungspersonal vor unbeabsichtigtem Kontakt der gefährlichen Anschlüsse schützen.

GEFAHREN

Gefahr durch elektrischen Schlag
In diesem Netzteil können gefährliche Spannungen anliegen.
Es sind geeignete Schutzmaßnahmen vorzusehen.

Heiße Fläche
Die äußeren Flächen dieses Netzteils können beim und nach dem Gebrauch heiß werden.
Es sind geeignete Schutzmaßnahmen vorzusehen.

Überschreiten in Reihe oder parallel geschaltete Ausgangskombinationen sichere Spannungs- und/oder Energiepegel, hat der Endgerätehersteller für den angemessenen Schutz für Anwender und Wartungspersonal zu sorgen.

SYSTEMKENNZEICHNUNG

Das Endgerät ist mit einem gut für das Wartungspersonal sichtbaren Aufkleber (o. ä.) zu versehen, der davor warnt, dass die Netzteiloberflächen im Betrieb heiß sein könnten und nicht berührt werden sollten.
Ist die eingehende Erdleitung für den Anschluss als Hauptschutzleiter vorgesehen und es sind auf Baugruppen- oder Bauteilebene keine Anschlüsse für einen solchen Anschluss vorhanden, hat der Anwender in unmittelbarer Nähe des Anschlusses einen geeigneten Aufkleber mit dem Symbol Schutzerde gemäß IEC 60417-5019 (2006-08) anzubringen.
Alle Aufkleber müssen dauerhaft und lesbar sein und die 15-Sekunden-Reibprüfung gemäß UL60950-1 Abschnitt 1.7.15 bestehen.

SICHERUNG

Dieses Netzteil ist mit einer doppelten internen Sicherung ausgestattet. Eine Sicherung in jedem Leiter. **Sicherungen sind nicht auswechselbar.**
Der Betrieb an Gleichspannung ist nicht Bestandteil der Sicherheitszulassungen. Bei Fragen bitte an Vox Power wenden.

DERATING (Reduzierung von Maximalwerten)

Umgebungstemperatur	Die Leistung des Eingangsmoduls ist oberhalb 50 °C um 2,5 % je Grad Celsius zu reduzieren. Dies gilt bis zur Höchstumgebungstemperatur 70 °C.
Grundplattentemperatur	Leistung und Strom des Ausgangsmoduls sind oberhalb 85 °C um 2,5 % je Grad Celsius zu reduzieren. Dies gilt bis zur maximalen Grundplattentemperatur 105 °C.
Eingangsspannung	Die Leistung des Eingangsmoduls muss unterhalb von 120 V_{RMS} um 5W/V_{RMS} reduziert werden (Z. B. 600 W bei 120 V_{RMS}, 450 W bei 90 V_{RMS}) **Es ist zu beachten, dass die Toleranz der Netzspannung bei der Berechnung des Deratings berücksichtigt werden muss. Z. B. muss die Nennspannung bei einem 100-V-Netz mit -15 % Toleranz auf 85 V reduziert werden.**

Berücksichtigen bei der Bemessung und Spezifikation jedes Netzteils stets ein entsprechendes Derating. Bei Fragen bitte direkt an Vox Power oder an Ihre zuständige Vertretung für Vox Power wenden.

INSTANDHALTUNG

Reparaturen sind ausschließlich durch befugte Personen durchzuführen. Bei Informationsbedarf bitte an Vox Power Ltd wenden.

KÜHLUNG

Für den ordnungsgemäßen Betrieb des Netzteils muss der Anwender für ausreichende Kühlung sorgen, um alle Bauteiltemperaturen innerhalb der angegebenen Werte zu halten. Lesen Sie sich bitte sorgfältig die Abschnitte bzw. Daten mit Bezug auf das Temperaturverhalten im Gerätehandbuch durch.

ENTSORGUNG

Dieses Netzteil kann Komponenten enthalten, die gesondert entsorgt werden müssen. Bei der Entsorgung des Gerätes sind die jeweils gültigen Vorschriften zu beachten.

SONSTIGES

- Zur Optimierung der Lebensdauer sollte das Gerät in einer staubfreien Umgebung betrieben werden.
- Bei Transportschäden das GERÄT NICHT ANSCHLIESSEN ODER IN BETRIEB NEHMEN. Wenden Sie sich bitte an Ihre Handelsvertretung oder an Vox Power.
- Verwenden Sie stets Kabel mit ausreichenden Querschnitten und achten Sie auf gute Crimpanschlüsse. Verwenden Sie Kabelhalter, um die Steckverbinder möglichst wenig zu beanspruchen.
- Vermeiden Sie übermäßige Stoß- oder Schwingbeanspruchungen.

ALLGEMEINE INSTALLATIONSPARAMETER

- Geräteklasse I
- Verschmutzungsgrad 2
- Entflammbarkeit UL 94V-2
- RoHS-Konformität 2011/65/EU & 2015/863/EU
- Überspannungskategorie II
- Isolierstoffgruppe IIIb (nur Innenbereich)
- Schutzart IP10

Instrucciones de instalación

Las instrucciones de este manual y las etiquetas de advertencia del producto se deben seguir estrictamente.

USO DEL PRODUCTO

Los productos de Vox Power Ltd no están destinados a su conexión a sistemas de soporte vital, implantaciones en personas, instalaciones o sistemas nucleares, aviones, vehículos espaciales, misiles militares o navales, equipamiento de soporte o control terrestre utilizado para guiar la navegación o la dirección de aviones, vehículos espaciales o misiles militares o navales o cualquier otra aplicación en las que una avería del producto pudiera provocar la pérdida de vidas o daños catastróficos en propiedades. El usuario eximirá a Vox Power Ltd de cualquier pérdida, coste o daño resultante del incumplimiento de estas condiciones.

INSTALACIÓN

Esta fuente de alimentación se ha diseñado en conformidad con los requisitos de seguridad correspondientes de IEC/EN/UL/CSA 62368-1, IEC/EN/UL/CSA 60950-1, IEC/EN/UL/CSA 60601-1, Directiva de Baja Tensión LVD 2014/35/EU y Directiva EMC 2014/30/EU.

La fuente de alimentación se considera un componente que debe ser instalado en un equipo final por personal cualificado. El equipo final debe proporcionar un entorno controlado que limite el acceso al personal no autorizado. Los fabricantes de los equipos y los sistemas deben proteger a los operarios y al personal de mantenimiento frente al contacto accidental con terminales peligrosos.

PELIGROS

Riesgo de descarga eléctrica
Esta fuente de alimentación contiene tensiones peligrosas.
Se deben aplicar las protecciones apropiadas.

Superficies calientes
Las superficies externas de esta fuente de alimentación se pueden calentar durante y después de su uso.
Se deben aplicar las protecciones apropiadas.

Si las combinaciones en serie y/o paralelo de las salidas superan los niveles de tensión y/o energía de seguridad, el fabricante del equipo final debe proporcionar la protección apropiada a los usuarios y al personal de mantenimiento.

ETIQUETADO DEL SISTEMA

Se debe colocar una etiqueta sobre el equipo final de manera que sea claramente visible para el personal de mantenimiento. Esta etiqueta advertirá que las superficies de la fuente de alimentación pueden estar calientes y no se deberían tocar cuando el producto está en funcionamiento.

Cuando la entrada de la toma de tierra esté destinada a la conexión como conductor a tierra de protección principal y los terminales para esta conexión no hayan sido suministrados en un componente o subsistema, el usuario añadirá una etiqueta apropiada que indique un símbolo de toma de tierra de protección en conformidad con IEC60417-5019 (2006-08) y la colocará al lado del terminal.

Todas las etiquetas deben ser resistentes y legibles, y deben superar la prueba de rasgado durante 15 segundos de UL60950-1 sección 1.7.15.

FUSIBLES

Esta fuente de alimentación tiene fusibles internos de dos polos, un fusible en cada línea. **Los fusibles no son sustituibles.**
El funcionamiento con CC no queda cubierto por las homologaciones de seguridad. Contacte con Vox Power para más información.

REAJUSTE DE ESPECIFICACIONES

Temperatura ambiente	La potencia del módulo de entrada se debe reducir un 2,5%/°C por encima de 50°C hasta una temperatura ambiente máxima de 70°C.
Temperatura de la placa base	La potencia y la corriente del módulo de salida se deben reducir un 2,5%/°C por encima de 85°C hasta una temperatura máxima de la placa base de 105°C.
Tensión de entrada	La potencia del módulo de entrada se debe reducir en 5W/V_{RMS} por debajo de 120 V_{RMS} (p.ej., 600W a 120 V_{RMS}, 450W a 90 V_{RMS}) **Obsérvese que hay que tener en cuenta la tolerancia de la tensión de alimentación de la red al calcular la reducción. Por ejemplo, una tensión nominal de 100V con una tolerancia del -15% se debe reducir a 85V.**

Recuerde que es necesario reajustar las especificaciones antes de escoger una fuente de alimentación para una determinada aplicación. Si tiene alguna duda, contacte con Vox Power directamente o a través de un representante de la empresa.

REPARACIONES

Esta fuente de alimentación no contiene piezas reparables. Las reparaciones deben ser efectuadas únicamente por personal autorizado. Contacte con Vox Power Ltd para más información.

REFRIGERACIÓN

Para que el funcionamiento de la fuente de alimentación sea adecuado, el usuario debe asegurarse de que la refrigeración sea suficiente para mantener las temperaturas de todos los componentes dentro de sus especificaciones. Revise el manual de usuario para más información.

ELIMINACIÓN AL FINAL DE LA VIDA ÚTIL

Esta fuente de alimentación puede contener componentes que requieren un tratamiento especial al desecharlos. Asegúrese de cumplir la normativa correspondiente cuando finalice la vida útil de la unidad.

OTROS

- Para prolongar la vida útil de la unidad utilícela en un entorno libre de polvo.
- Si las unidades sufren daños durante su traslado, contacte con su representante comercial o con Vox Power y NO alimente la unidad.
- Use siempre los cables del diámetro adecuado y comprueba que conexiones tienen el engarce correcto. Utilice soporte para el cable para minimizar el esfuerzo en los conectores.
- Evite fuertes choques o vibraciones.

PARÁMETROS GENERALES DE INSTALACIÓN

- Clase del equipo: I
- Grado de contaminación: 2
- Grado de inflamabilidad: 94V-2
- Conformidad con RoHS: 2011/65/EU & 2015/863/EU
- Categoría de instalación: II
- Grupo de material: IIIb (para uso solo en interiores)
- Grado de IP: IP10

Remarques relatives à l'installation

Les instructions de ce manuel et les étiquettes d'avertissement présentes sur le produit doivent être respectées scrupuleusement.

UTILISATION DU PRODUIT

Les produits Vox Power Ltd ne sont pas destinés à être utilisés dans des systèmes de survie, des implants chirurgicaux, des installations ou systèmes nucléaires, des aéronefs, des engins spatiaux, des missiles militaires ou navals, des équipements de soutien au sol ou de commande utilisés à des fins de guidage, de navigation ou d'orientation d'aéronef, d'engin spatial ou de missile militaire ou naval, ni dans toute autre application dans laquelle une défaillance du produit pourrait entraîner une perte de vie humaine ou des dommages matériels catastrophiques. L'utilisateur ne saurait tenir responsable Vox Power Ltd de toute perte financière, coût ou dommage résultant du non-respect de ces termes.

INSTALLATION

Cette alimentation est conçue conformément aux exigences de sécurité applicables des normes IEC/EN/UL/CSA 62368-1, IEC/EN/UL/CSA 60950-1, IEC/EN/UL/CSA 60601-1, de la directive basse tension LVD 2014/35/EU et de la directive CEM 2014/30/EU.

L'alimentation est considérée comme un composant de puissance, et doit être installée dans l'équipement final par du personnel qualifié. L'équipement final doit fournir un environnement contrôlé qui restreint l'accès à toute personne non autorisée. Les fabricants d'équipements et de systèmes doivent protéger les opérateurs et le personnel de service contre tout contact involontaire avec les bornes présentant un danger.

DANGERS

Risque de choc électrique

Cette alimentation contient des tensions dangereuses.

Des protections appropriées doivent être mises en place.

Surfaces chaudes

Les surfaces externes de cette alimentation peuvent devenir très chaudes pendant et après l'utilisation.

Des protections appropriées doivent être mises en place.

Si la combinaison en série et/ou en parallèle de sorties multiples amène à dépasser les niveaux de tension et/ou d'énergie sûrs, le fabricant de l'équipement final doit fournir une protection appropriée aux utilisateurs et au personnel de maintenance.

ÉTIQUETAGE DU SYSTÈME

Une étiquette bien visible du personnel de maintenance doit être apposée sur l'équipement final, pour avertir que certaines surfaces de l'alimentation peuvent être chaudes et ne doivent pas être touchées lorsque l'équipement fonctionne.

Lorsque le conducteur de terre du câblage entrant est destiné à être connecté en tant que conducteur principal de protection et que la borne de connexion ne se trouve pas sur un composant ou un sous-ensemble, l'utilisateur doit apposer une étiquette appropriée affichant un symbole de protection conformément à la norme CEI60417-5019 (2006-08) à proximité directe de la borne.

Toutes les étiquettes doivent être durables et lisibles, et résister au test de frottement de 15 secondes conformément à la section 1.7.15 de la norme UL60950-1.

FUSIBLE DE PROTECTION

Cette alimentation dispose d'un fusible bipolaire interne. Un fusible dans chaque ligne. **Les fusibles ne sont pas remplaçables**

Le fonctionnement en courant continu n'est pas couvert par les homologations de sécurité. Contactez Vox Power pour plus de détails.

DÉCLASSEMENT

Température ambiante	La puissance du module d'entrée doit être déclassée de 2,5 %/°C au-delà de 50°C jusqu'à une température ambiante maximale de 70°C.
Température de l'embase	La puissance et le courant du module de sortie doivent être réduits de 2,5 %/°C au-dessus de 85°C jusqu'à une température maximale de l'embase de 105°C.
Tension d'entrée	La puissance du module d'entrée doit être réduite de 5 W/ V_{RMS} en dessous de 120 V_{RMS} (par exemple 600 W à 120 V_{RMS}, 450 W à 90 V_{RMS}). **Notez que la tolérance de tension d'alimentation secteur doit être incluse lors du calcul du derating. Par exemple. Le secteur nominal de 100 V avec une tolérance de -15 % doit être réduit à 85 V.**

N'oubliez pas de tenir compte du déclassement approprié avant de spécifier une alimentation pour une application. En cas de doute, veuillez contacter directement Vox Power ou votre représentant local Vox Power.

MAINTENANCE

Cette alimentation ne contient aucun composant réparable par l'utilisateur. Les réparations ne doivent être effectuées que par du personnel autorisé. Contactez Vox Power Ltd pour plus d'informations.

REFROIDISSEMENT

Pour un fonctionnement correct de l'alimentation, l'utilisateur doit assurer un refroidissement suffisant pour maintenir la température de tous les composants dans les limites des spécifications. Lire le manuel d'utilisation attentivement pour les détails de performance thermique.

ÉLIMINATION EN FIN DE VIE

Cette alimentation peut contenir des composants nécessitant une procédure d'élimination particulière. En fin de vie, assurez-vous que l'appareil est éliminé conformément aux réglementations locales.

AUTRE

- Pour prolonger la durée de vie de l'appareil, utilisez-le dans un environnement non-poussiéreux.
- Si l'unité a été endommagée durant son transport, contactez votre représentant commercial ou Vox Power, et NE mettez PAS l'unité sous tension.
- Utilisez toujours des câbles de diamètre adéquat et assurez-vous que les connexions soient bien serties et bien serrées. Utilisez des supports de câbles pour minimiser les contraintes sur les connecteurs.
- Évitez les chocs et les vibrations excessives.

PARAMÈTRES D'INSTALLATION GÉNÉRAUX

- Classe d'équipement I
- Degré de pollution 2
- Indice d'inflammabilité 94V-2
- Conformité RoHS 2011/65/EU & 2015/863/EU
- Catégorie d'installation II
- Groupe de matériaux IIIb (intérieur uniquement)
- Indice IP IP10

Note per l'installazione

Seguire scrupolosamente le istruzioni del presente manuale e le indicazioni di tutte le etichette di avvertenza presenti sul prodotto.

USO DEL PRODOTTO

I prodotti Vox Power Ltd non sono previsti per l'uso in relazione a sistemi di supporto delle funzioni vitali, impianti su esseri umani, impianti o centrali nucleari, aeroplani, veicoli spaziali, missili navali o per usi militari, apparecchiature di controllo o supporto di sistemi terrestri impiegati per la guida o l'orientamento di qualsiasi aerodina, missili navali oppure per usi militari o veicoli spaziali o qualunque altra applicazione in cui un guasto al prodotto potrebbe comportare la perdita di vite o danni catastrofici alle cose. L'utilizzatore manleverà e terrà indenne Vox Power Ltd da qualsiasi perdita, costo o danno risultante dalla violazione di queste disposizioni.

INSTALLAZIONE

Questo alimentatore è stato progettato in conformità ai requisiti relativi alla sicurezza specificati nelle seguenti norme e direttive: IEC/EN/UL/CSA 62368-1, IEC/EN/UL/CSA 60950-1, IEC/EN/UL/CSA 60601-1, Direttiva 2014/35/UE "bassa tensione" e Direttiva 2014/30/UE relativa alla compatibilità elettromagnetica.
L'alimentatore è considerato un componente di un'apparecchiatura finale e deve essere installato nella stessa da personale qualificato. Tale apparecchiatura deve assicurare un ambiente controllato che limiti l'accesso a personale non autorizzato. I produttori di apparecchiature e sistemi devono proteggere gli operatori e il personale di manutenzione contro il contatto non intenzionale con terminali pericolosi.

RISCHI

Rischio di folgorazione
In questo alimentatore sono presenti alte tensioni. Attuare misure di protezione appropriate.

Superfici ad alta temperatura
Le superfici esterne di questo alimentatore possono raggiungere temperature elevate durante e dopo l'uso. Attuare misure di protezione appropriate.

Se combinazioni in serie e/o in parallelo delle uscite superano livelli sicuri di tensione e/o energia, il produttore dell'apparecchiatura finale deve garantire una protezione adatta sia per gli utilizzatori che per il personale di manutenzione.

ETICHETTATURA DELL'IMPIANTO

Sull'apparecchiatura finale deve essere apposta un'etichetta, chiaramente visibile dal personale di manutenzione, avvisante che le superfici dell'alimentatore possono raggiungere temperature elevate e non devono essere toccate mentre il prodotto è in funzione.
Nel caso in cui il cavo di terra in ingresso sia concepito per la connessione come principale conduttore di protezione al potenziale di terra e i terminali per tale connessione non siano forniti su un componente o un gruppo secondario, direttamente accanto al terminale l'utilizzatore deve aggiungere un'appropriata etichetta che mostri un simbolo di terra di protezione in conformità alla norma IEC60417-5019 (2006-08).
Tutte le etichette devono essere durevoli e leggibili e devono superare la prova di strofinamento di 15 secondi a norma UL60950-1 sezione 1.7.15.

FUSIBILI

Questo alimentatore è dotato di fusibili bipolari interni, un fusibile in ciascuna linea. **I fusibili non possono essere sostituiti.**
Il funzionamento in CC non ricade nell'ambito delle approvazioni di sicurezza. Per maggiori informazioni contattare Vox Power.

DERATING

Temperatura ambiente	La potenza del modulo d'ingresso deve ridursi del 2,5%/°C oltre 50 °C fino a una temperatura ambiente max di 70 °C.
Temperatura della piastra base	La corrente e la potenza del modulo di uscita devono ridursi del 2,5%/°C oltre 85 °C fino a una temperatura massima della piastra base di 105 °C.
Tensione d'ingresso	La potenza del modulo d'ingresso deve ridursi di 5 W/Veff sotto 120 Veff (per es., 600 W a 120 Veff, 450 W a 90 Veff) **Tenere presente che quando si calcola la riduzione di tensione / potenza occorre includere la tolleranza sulla tensione della rete di alimentazione. Per es., 100 V nominali per la tensione di rete con tolleranza pari a -15% devono essere ridotti a un valore nominale di 85 V.**

Prendere in considerazione l'appropriato derating prima di specificare un eventuale alimentatore per un'applicazione. In caso di dubbi, contattare direttamente Vox Power o il rappresentante locale Vox Power.

RIPARAZIONI

Questo alimentatore non contiene parti su cui l'utilizzatore possa intervenire. Eventuali riparazioni devono essere eseguite esclusivamente da personale autorizzato. Per ulteriori informazioni contattare Vox Power Ltd.

RAFFREDDAMENTO

Ai fini del corretto funzionamento dell'alimentatore, l'utilizzatore deve garantire un raffreddamento sufficiente a mantenere le temperature di tutti i componenti entro le specifiche. Leggere con attenzione il manuale per l'uso per informazioni dettagliate sulle prestazioni termiche.

SMALTIMENTO A FINE VITA

Questo alimentatore potrebbe contenere componenti che richiedono uno smaltimento speciale. Al termine della sua durata, accertarsi che venga smaltito in conformità alle norme di legge.

ALTRE INDICAZIONI

- Per prolungare la durata del dispositivo, impiegarlo in un ambiente privo di polvere.
- Se un dispositivo viene danneggiato durante il trasporto, contattare l'agente di vendita locale o Vox Power e NON accenderlo.
- Usare sempre cavi di sezione adeguata e accertarsi che le connessioni siano salde. Usare pressacavo per ridurre al minimo le sollecitazioni sui connettori.
- Evitare urti o vibrazioni di livello eccessivo.

PARAMETRI DI INSTALLAZIONE GENERALI

- Classe apparecchiatura: I
- Grado d'inquinamento: 2
- Grado d'infiammabilità: 94V-2
- Conformità RoHS: 2011/65/EU & 2015/863/EU
- Categoria di installazione: II
- Gruppo materiali: IIIb (solo per l'uso in locali chiusi)
- Grado di protezione involucro: IP10

Informações sobre a instalação

As instruções neste manual e em todas as etiquetas de aviso afixadas no produto devem ser cuidadosamente observadas

UTILIZAÇÃO DO PRODUTO

Os produtos da Vox Power Ltd não se destinam a ser utilizados em sistemas de suporte de vida, sistemas para implantação no corpo humano, instalações ou sistemas nucleares, aeronaves, naves espaciais, mísseis militares ou navais, equipamento de suporte no solo ou de controlo para fins de guiamento de navegação ou orientação de aeronaves, naves espaciais ou mísseis militares ou navais ou quaisquer outras aplicações onde a falha do produto possa conduzir à perda de vidas ou a danos materiais catastróficos. O utilizar deve isentar a Vox Power Ltd de quaisquer perdas, custos ou danos decorrentes da violação destas disposições.

INSTALAÇÃO

Esta fonte de alimentação foi desenvolvida e construída de acordo com os requisitos de segurança relevantes das normas IEC / EN / UL / CSA 62368-1, IEC / EN / UL / CSA 60950-1, IEC / EN / UL / CSA 60601-1, Directiva de Baixa Tensão 2014/35 / EU e Directiva de Compatibilidade Electromagnética 2014/30 / EU.
A fonte de alimentação é considerada um componente de alimentação e deve ser instalada no equipamento final por pessoal qualificado. O equipamento final deve assegurar um ambiente controlado que restrinja o seu acesso a pessoal não autorizado. Os fabricantes dos equipamentos e sistemas devem proteger os operadores e o pessoal de manutenção contra os contactos não intencionais com terminais perigosos.

RISCOS

Risco de choque eléctrico
Esta fonte de alimentação contém correntes eléctricas perigosas.
Por isso, devem ser utilizadas protecções apropriadas.

Superfície quente
As superfícies exteriores desta fonte de alimentação podem ficar quentes durante e após a sua utilização.
Por isso, devem ser utilizadas protecções apropriadas.

Se as montagens em série e/ou paralelo das saídas excederem os níveis de tensão e/ou energia de segurança, o fabricante do equipamento final deve fornecer protecção adequada para os utilizadores e técnicos de manutenção.

ETIQUETAS AFIXADAS

Deve ser afixado no equipamento final uma etiqueta claramente visível para o pessoal de manutenção, avisando que as superfícies da fonte de alimentação podem estar quentes e não devem ser tocadas quando o produto estiver em funcionamento.
Quando o condutor de terra de entrada se destinar a ser a ligação principal da terra de protecção e se os terminais para tal conexão não forem fornecidos como componente ou subconjunto único, o utilizador deve afixar uma etiqueta adicional directamente adjacente ao terminal com um símbolo de terra de protecção de acordo com a norma IEC60417-5019 (2006-08) .
Todas as etiquetas devem ser duráveis e legíveis e devem resistir ao ensaio de abrasão durante 15 segundos, conforme a norma UL60950-1, parágrafo 1.7.15.

FUSÍVEIS

Esta fonte de alimentação está equipada com dois fusíveis bipolares internos. Um fusível em cada condutor. **Os fusíveis não são substituíveis.**
O funcionamento com corrente DC não está coberto pelas aprovações de segurança. Contactar a Vox Power para mais informações.

REDUÇÃO DOS VALORES NOMINAIS

Temperatura Ambiente	A potência do módulo de entrada deve ser reduzida 2,5%/° C acima de 50 °C, até uma temperatura ambiente máxima de 70 °C.
Temperatura de Referência	A potência do módulo de saída deve ser reduzida 2,5%/° C acima de 85 °C, até uma temperatura ambiente máxima de 105 °C.
Tensão de Entrada	O modulo de entrada deve ter uma potência de 5 W/V_{RMS} abaixo de V_{RMS} (por exemplo, 600 W a 120 V_{RMS}, 450 W a 90 V_{RMS}) **Ter em atenção de que a tolerância da tensão de alimentação deve ser incluída no cálculo da redução de capacidade. Por exemplo, uma tensão de alimentação nominal de 100 V com -15% de tolerância deve ser reduzida para uma capacidade de 85 V.**

Não esquecer de ter em consideração a redução apropriada, antes de especificar a fonte de alimentação para uma aplicação. Em caso de dúvida, contactar directamente com a Vox Power ou um dos seus Distribuidores.

SERVIÇO E MANUTENÇÃO

Esta fonte de alimentação não contém peças cuja manutenção possa ser feita pelo utilizador. As reparações devem ser realizadas apenas por pessoal autorizado. Para mais informações, contactar a Vox Power Ltd.

ARREFECIMENTO

Para o funcionamento adequado da fonte de alimentação, o utilizador deve assegurar um arrefecimento suficiente para manter as temperaturas de todos os componentes dentro dos parâmetros especificados. Analisar completamente o Manual de Utilização, para obter informações sobre o desempenho térmico.

ELIMINAÇÃO FINAL DO PRODUTO

Esta fonte de alimentação pode conter componentes que exijam uma eliminação final especial. No final da sua vida útil, a fonte de alimentação deve ser eliminada de acordo com os regulamentos locais em vigor aplicáveis.

OUTRAS INSTRUÇÕES

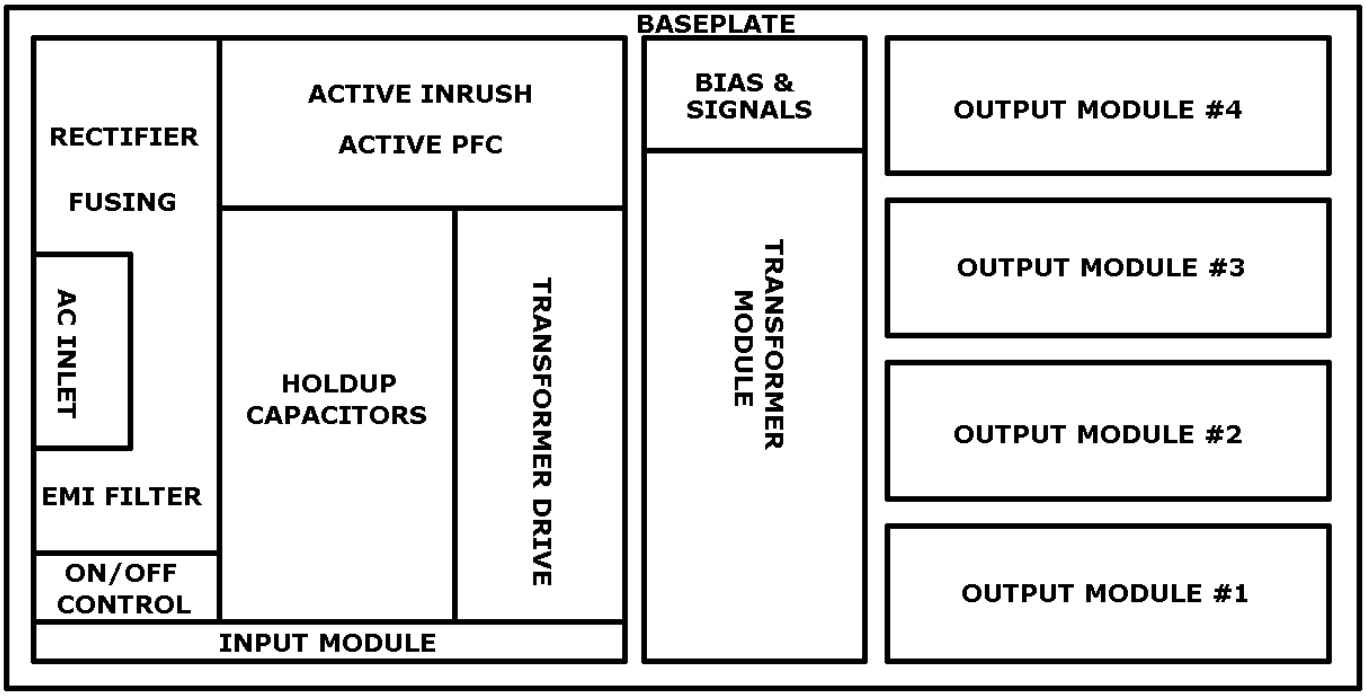
- Para prolongar a vida útil do equipamento, utilizá-lo em ambientes sem poeiras.
- Em caso de danificação do equipamento durante o transporte, contactar o responsável pelo fornecimento ou a Vox Power e NÃO energizar o equipamento.
- Usar sempre cabos de calibre adequado e com boas ligações por cravagem. Suportar devidamente as cablagens, para minimizar as tensões nos conectores.
- Evitar choques ou vibrações excessivas.

PARÂMETROS GERAIS DA INSTALAÇÃO

- Classe de equipamento I
- Nível de poluição 2
- Classe de inflamabilidade 94V-2
- Certificação RoHS (materiais perigosos) 2011/65/EU & 2015/863/EU
- Categoria da instalação II
- Grupo de materiais IIIb (apenas para utilização interior)
- Classe de protecção IP10

Theory of Operation

The diagram below outlines the topology and major internal components of a fully assembled VCCM600 configurable power supply. Four output slots are provided and can be populated by any combination of *output modules*. The remaining components in the block diagram are housed in the *input* and *transformer modules*.



The *input module* is responsible for receiving the AC mains line voltage and converting it to an appropriate DC voltage whilst providing protection from AC line disturbances and preventing excessive EMI emissions and current harmonics. The integrated EMI filter attenuates high frequency current emissions to levels below EN55032 class B. It also provides dual pole fusing, one fuse in each conductor and protection from line disturbances as outlined in EN61000.

Inrush current is controlled by a resistive element upon initial connection to the AC line. Once the internal capacitances have been charged, the resistive element is bypassed to reduce losses.

Active Power Factor Correction (PFC) is used to ensure an accurate input current waveform with extremely low harmonic content, exceeding the requirements of EN61000. This stage also provides active input current limiting which prevents overloading of the input stage while maintaining high power factor.

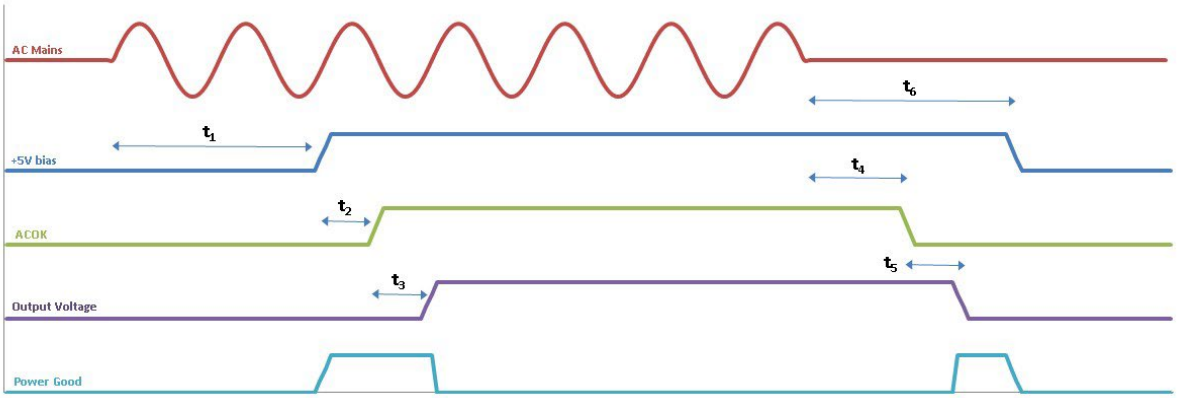
The output of the PFC stage charges the hold-up electrolytic capacitors which store enough energy to allow the VCCM600 configured product to continue operating during minor line disturbances. Long lifetime and high temperature capacitors are used which ensures extended lifetime and product reliability.

A highly efficient zero voltage switching circuit is used to drive the isolated transformer from the hold-up capacitors. The output modules connect to the transformer secondary and provide safe isolated power to a high performance synchronous rectifier power converter. This power converter is controlled using the latest analog control technology to produce superior output performance in a miniature size.

Input Module Operation

Startup & Shut Down

The VCCM input module operates from a universal input voltage range and starts automatically upon application of adequate AC mains voltage (>84Vrms). After a short delay, the global 5V bias supply starts and the ACOK signal goes high to indicate that the mains voltage is present and input stage is operating correctly. Once the ACOK signal is high, the output modules turn on and deliver power to the application loads. The power good signals will indicate that the output voltages are within specification. The diagram below shows the normal start up/shut down sequence and gives typical timings.



Typical timing values at 120Vac 600W 25°C: t_1φ ≈500 ms, t_2φ ≈170 ms, t_3φ ≈1500 ms, t_4φ ≥15 ms, t_5φ ≥5ms (minimum), t_6φ ≥100 ms

When the AC mains voltage is removed, the internal hold-up capacitors will supply power to the load for typically 20 ms (t_4+t_5) at maximum power. The ACOK signal will go low at least 5ms before the output voltages fall below the power good threshold level. This allows the application to prepare for the impending loss of power. The 5V bias supply will remain on for typically 100ms, after the output modules have turned off.

*Output modules that are adjusted above nominal voltage, will have reduced ACOK warning time.

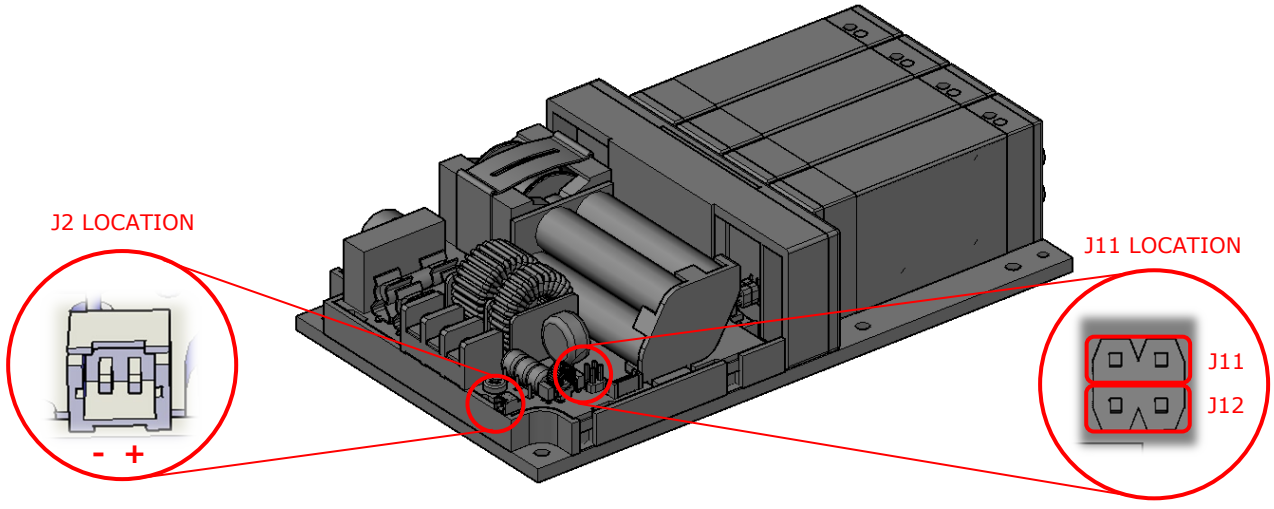
Standby control

The unit may be completely shut down by shorting (<10Ω) the terminals of J2. The unit will restart once the short is released.
The control uses transformer coupled pluses to detect the short and is fully isolated to 2xMOPP. The voltage present on J2 ranges from +3.3V to -0.8V with a peak current of 15mA. In active mode, the control is pulsed every 1.3mS while in standby mode the control is pulsed every 400mS. A signal MOSFET or switch may be used to activate this control.
This shutdown will not generate the ACOK warning signal.
The maximum cable capacitance supported by this control is 220pF.

Programmable start-up state

The start-up and standby control logic can be inverted by shorting J11 with a jumper. The functionality is shown in the table below.

J11	J2	Operational mode	Comments
Open	Open	NORMAL	Default. Unit will start into NORMAL mode
Open	Closed	STANDBY	<1W power consumption
Closed	Open	STANDBY	Unit will start into STANDBY mode. <1W power consumption
Closed	Closed	NORMAL	



Note - J12 is reserved for internal use. Do not short J12

Hold-up
For short line distubances (<20ms), the output voltages will not be affected*. However, the ACOK signal may still go low to warn that there is an impending loss of output power. The ACOK signal will return to the high state once the unit has recovered from the disturbance.

*Output modules that are adjusted above the hold-up voltage (as detailed in their respective datasheets), may experience a dip in voltage.

No Load Power/Standby Power Consumption

The no-load power consumption of the VCCM600 series PSU is extremely low when compared to similar configurable power supplies. With the output modules enabled the unit typically only requires less than 15W with no output load. To reduce the no-load power further the outputs can be disabled using the inhibit pins. With the outputs disabled the unit typically requires less than 10W. When the unit is in the standby (latched off) state, the power consumption is less than 1W.

Peak Power capability

The input module can provide a peak output power of up to 750W for a period of up to 5 seconds, provided the input current remains below the over current protection threshold. Peaks of power lower than 750W can be supported for longer times provided the excess watt-seconds are equivalent. For example, 750W peak for 5 seconds is an excess power of 150W*5s = 750Ws. 650W can be supported for 750Ws/50W = 15s. When using peak power capability, the user must ensure the average power remains within ratings. Note that input module de-ratings apply to both rated power and peak power.

Input Module Protections

Over current protection (OCP)

The input module is protected from excessive input current by means of an over current protection circuit which limits the input current to approximately 7Arms. If the OCP threshold is exceeded the unit may shut down and attempt to automatically restart. This shutdown will generate the usual ACOK warning.

Under voltage protection (UVP) & Brown-Out Protection (BOP)

The input module is protected from excessively low input voltages by under voltage and brown out protection circuits that senses the input line voltage. The under-voltage protection circuit maintains the unit in standby mode until the input voltage rises above the UVP threshold as detailed in the datasheet. Once the unit is active, the brown out protection monitors the input voltage and shuts down the unit when input voltage goes below approximately 60Vrms. This shutdown will generate the usual ACOK warning. The unit will restart once the input voltage increases above the UVP threshold.

Over Temperature Protection (OTP)

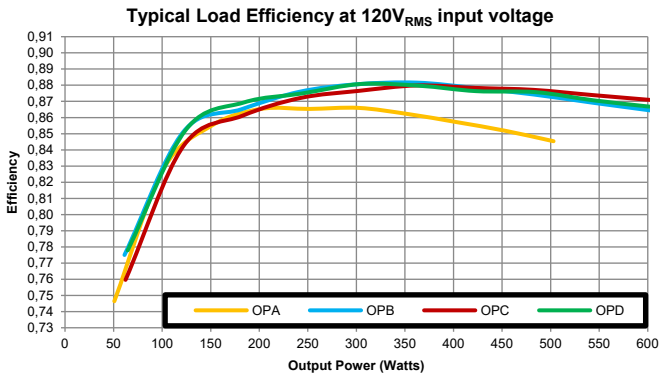
The input module is protected from excessive temperatures by means of various internal temperature sensors. If temperature thresholds are exceeded the entire unit may latch off, with no ACOK warning. To re-enable the unit, it must be allowed to cool, then either disconnect the AC mains for approximately 20 seconds, or toggle the standby control on J2.

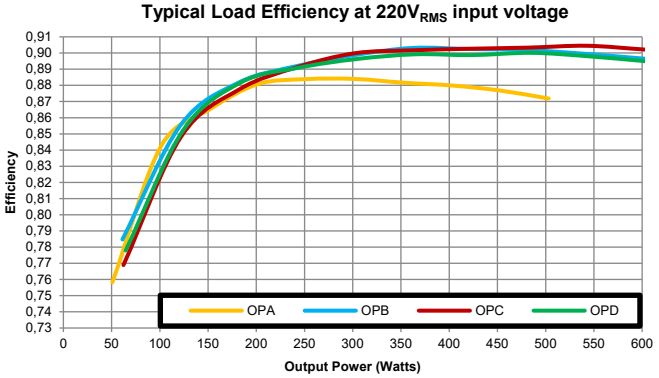
Over Power Protection (OPP)

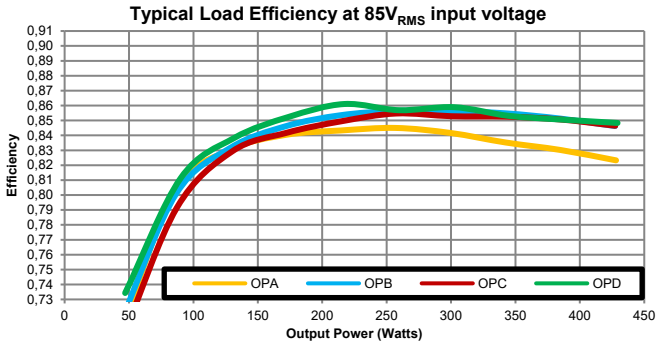
The input module is protected from excessive power by means of an over power protection circuit. Should the rated power be exceeded the unit will shut down and attempt to recover automatically. This shutdown will not generate the usual ACOK warning.

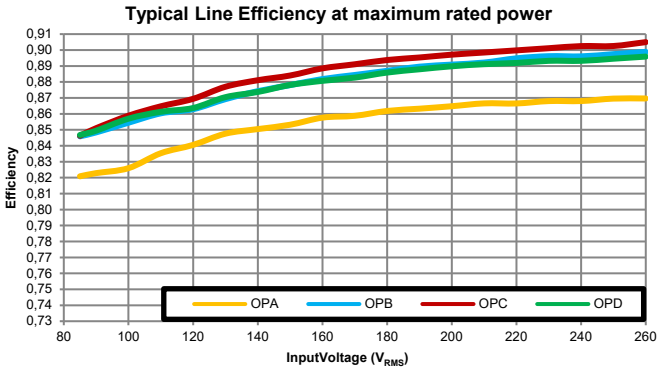
Efficiency Performance

The efficiency of the configured VCCM600 product is dependent on parameters such as input line voltage, load level and on the combination of output modules. The plots below show typical efficiencies of a VCCM600 product fitted with all modules A, B, C or D. The plots cover the full load and line voltage range. All modules are adjusted to nominal voltages and are equally loaded.









An estimate of the overall efficiency for any configured system may be obtained from these graphs.

Power Ratings

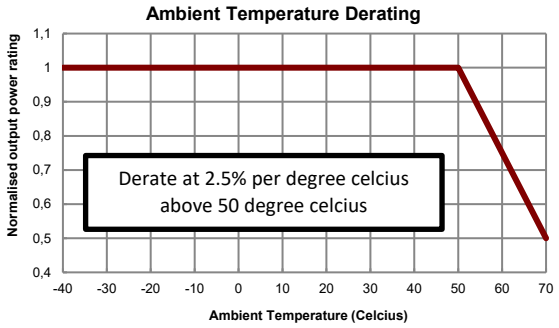
VCCM600 series products must always be operated within stated operating limits. Equipment manufacturers and other users must take the appropriate de-rating into account when specifying a unit for the intended application. If in doubt, contact your sales representative or Vox Power for assistance.

There are three main de-ratings for the VCCM600 series of configurable power supplies when used in a conduction cooled application,

1. Ambient air temperature (1)

Ambient air temperature de-ratings apply to the input module rated and peak power only. (3)

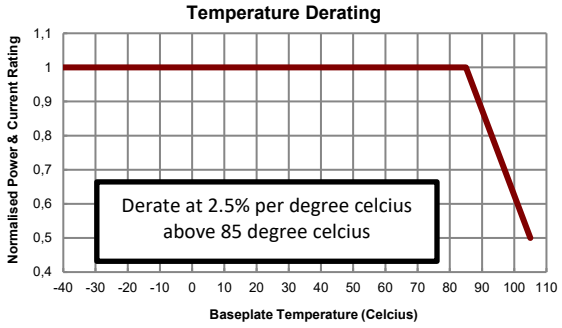
The input module must be de-rated by 2.5% per degree Celsius above 50°C, up to a maximum of 70°C.



2. Baseplate temperature (2)

Baseplate temperature de-ratings apply to output module rated power, peak power and rated current, and bias supply power.

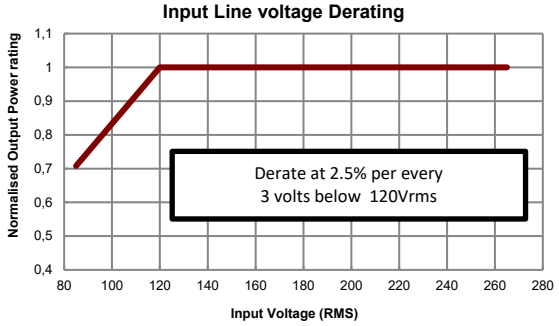
The output module parameters must be de-rated by 2.5% per degree Celsius above 85°C, up to a maximum of 105°C.



3. Input line voltage

Input line voltage de-ratings apply to the rated power and peak power for both the input module and output module. (3)

All parameters must be de-rated by 2.5% for every 3 volts below 120Vrms, down to a minimum of 85Vrms.



Notes:

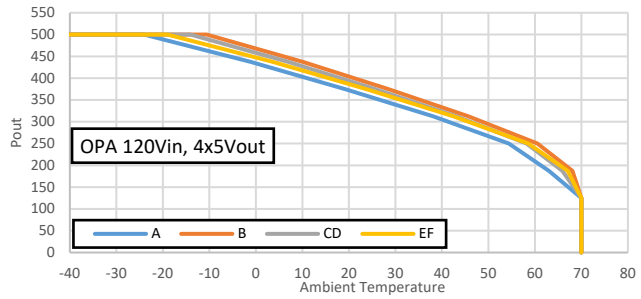
1. Ambient air temperature is the air temperature immediately surrounding the PSU.
2. Baseplate temperature is measured at baseplate temperature sensing location TS1.
3. A normalized value of 1 is equivalent to 100%.
4. **Input line voltage deratings are cumulative with temperature deratings.**

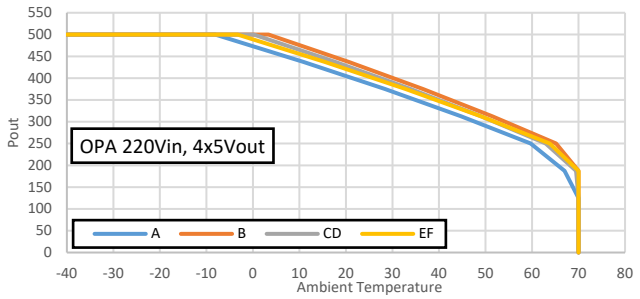
Examples of power ratings calculation for various input voltages, ambient temperatures and baseplate temperatures							
	1	**2**	**3**	**4**	**5**	**6**	**7**
V_{IN} (V_{RMS})	120	85	85	120	120	100	120
Normalised V_{IN} Rating [A]	1	0.708	0.708	1	1	0.833	1
$T_{AMBIENT}$ (^{0}C)	70	50	70	50	60	60	50
Normalised $T_{AMBIENT}$ Rating [B]	0.5	1	0.5	1	0.75	0.75	1
T_{BASE} (^{0}C)	85	85	85	95	105	95	105
Normalised T_{BASE} Rating [C]	1	1	1	0.75	0.5	0.75	0.5
Normalised Total input rating [A*B = D]	0.5	0.708	0.354	1	0.75	0.624	1
Normalised Total output rating [A*C = E]	1	0.708	0.708	0.75	0.5	0.624	0.5
Input module $P_{RATED/PEAK}$ [600W/750W*D]	300/375	424.8/531	212.4/265.5	600/750	450/562.5	374.4/468	600/750
Bias supply power [5W*C]	5	5	5	3.75	2.5	3.75	2.5
OPA $P_{RATED/PEAK}$ [125W/187.5W*E]	125/187.5	88.5/132.75	88.5/132.75	93.75/140.625	62.5/93.75	78/117	62.5/93.75
OPA I_{RATED} [25A*C]	25	25	25	18.75	12.5	18.75	12.5
OPB $P_{RATED/PEAK}$ [150W/225W*E]	150/225	106.2/159.3	106.2/159.3	112.5/168.75	75/112.5	93.6/140.4	75/112.5
OPB I_{RATED} [15A*C]	15	15	15	11.25	7.5	11.25	7.5
OPC $P_{RATED/PEAK}$ [150W/225W*E]	150/225	106.2/159.3	106.2/159.3	112.5/168.75	75/112.5	93.6/140.4	75/112.5
OPC I_{RATED} [7.5A*C]	7.5	7.5	7.5	5.625	3.75	5.625	3.75
OPD $P_{RATED/PEAK}$ [150W/217.5W*E]	150/217.5	106.2/154	106.2/154	112.5/163.125	75/108.75	93.6/135.72	75/108.75
OPD I_{RATED} [3.75A*C]	3.75	3.75	3.75	2.8125	1.875	2.8125	1.875

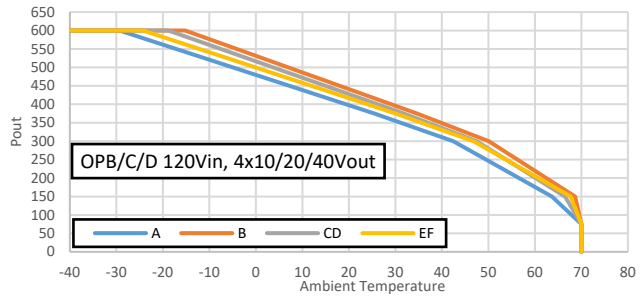
System Cooling

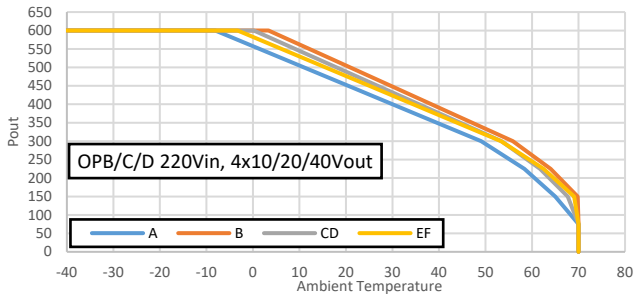
The power ratings shown in the previous section are for conduction cooling, however the unit may be operated with forced air cooling, convection cooling or combinations of all three. To assist in specifying the product for these applications, the typical thermal performance has been characterised under controlled conditions. The ratings achieved are based on maintaining the baseplate temperature within the conduction cooled ratings specified on page 9.

CONVECTION PERFORMANCE
Natural Convection, No Heatsink, Free Air, Mounting Orientations A/B/C/D/E/F

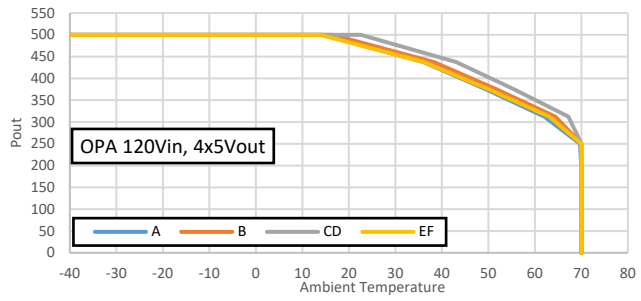


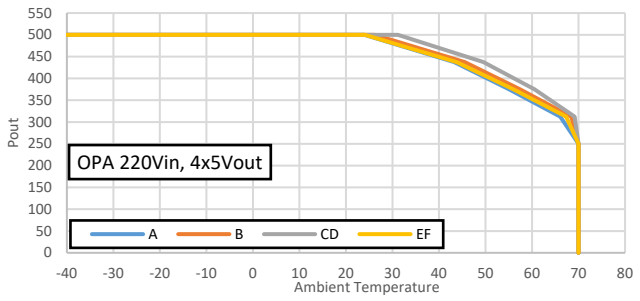


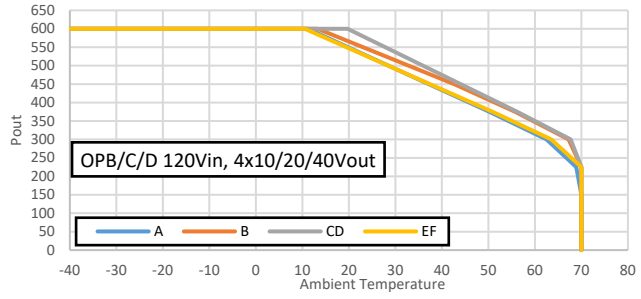


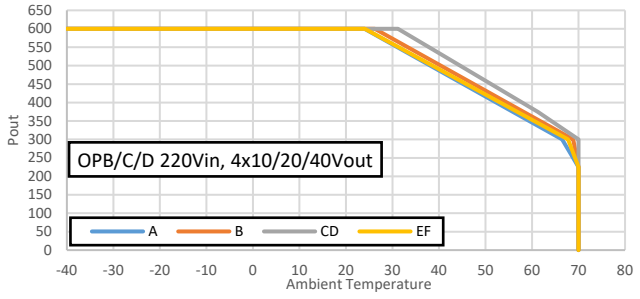


CONVECTION PERFORMANCE WITH HEATSINK [1]
Natural Convection, With Heatsink, Free Air, Mounting Orientations A/B/C/D/E/F

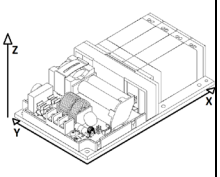
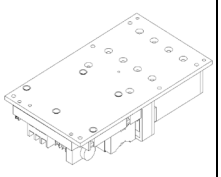
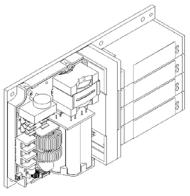
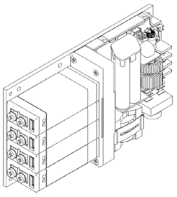
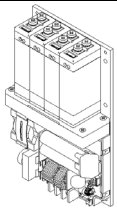
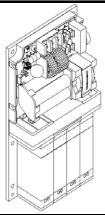








Orientation definitions

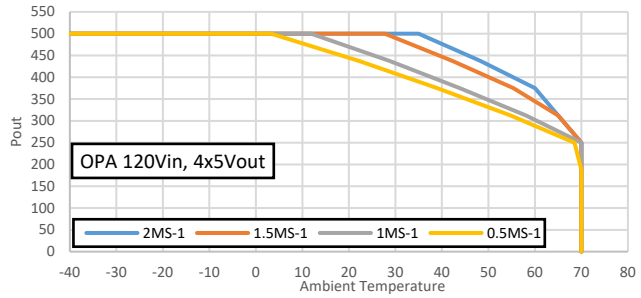
A	B	C	D	E	F
					

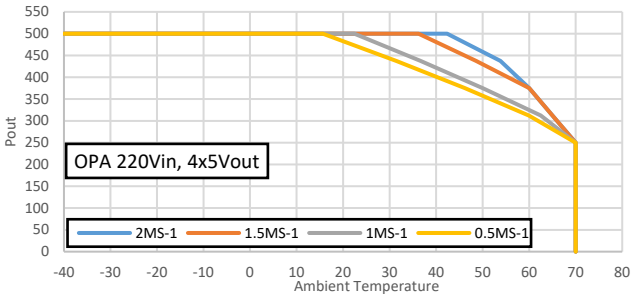
Notes

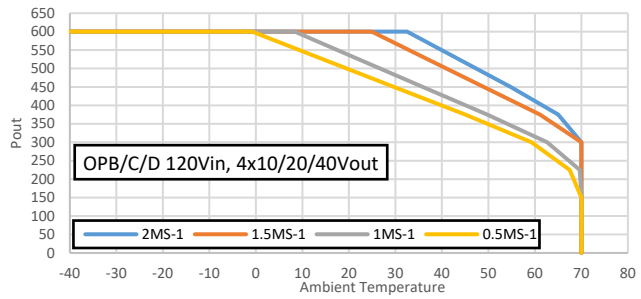
1. Standard Vox heatsinks type 1 and type 2 used. Type 1 used for mounting orientations A, B, E and F. Type 2 used for mounting orientations A, B, C and D.

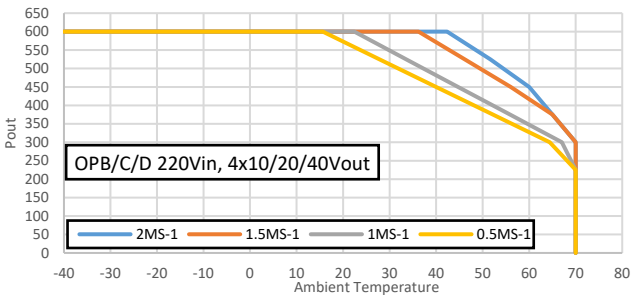
FORCED AIR PERFORMANCE

No Heatsink, Air Direction X or Y at $2MS^{-1}/1.5MS^{-1}/1MS^{-1}/0.5MS^{-1}$



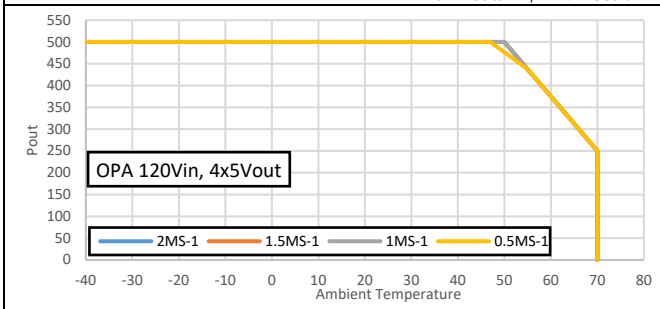


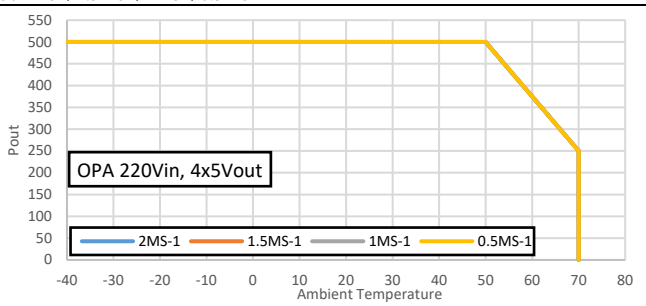


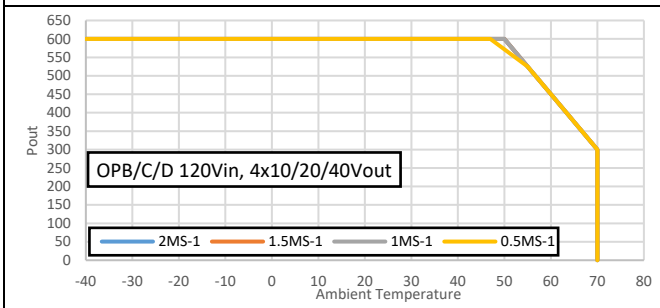


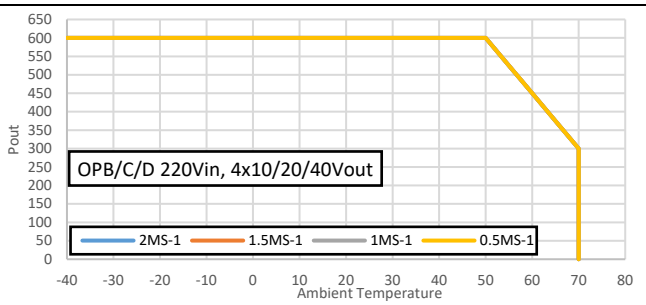
FORCED AIR PERFORMANCE WITH HEATSINK [2]

With Heatsink, Air Direction X or Y at $2MS^{-1}/1.5MS^{-1}/1MS^{-1}/0.5MS^{-1}$



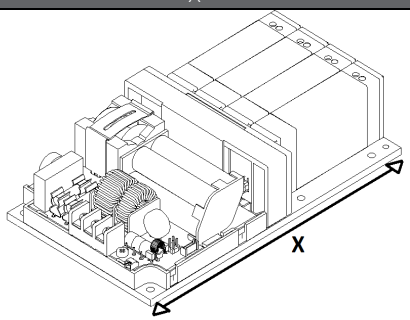




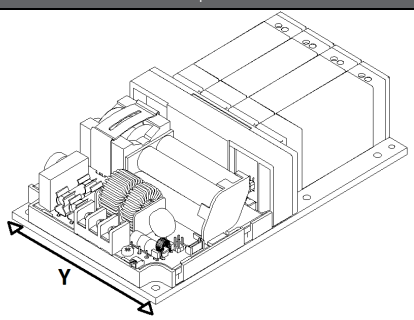


Airflow definitions

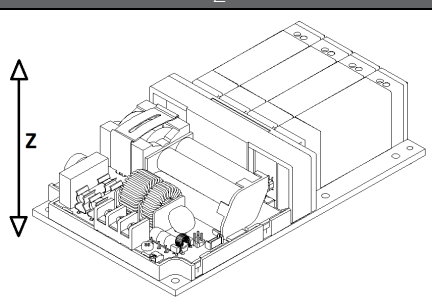
X



Y



Z



Notes

1. Each $0.5MS^{-1}$ is approximately 100LFM. Eg. $2MS^{-1} \approx 400LFM$, $1.5MS^{-1} \approx 300LFM$ etc.
2. Standard Vox heatsinks type 1 and type 2 used. Type 1 used for airflow direction X. Type 2 used for airflow direction Y.

The ratings provided above are for guidance only and all VCCM600 configured solutions must be evaluated in the end application to ensure the conditions set out in the power ratings section are met.

Specifying the VCCM600 product for convection or forced air cooling

To specify a VCCM600 series product for an end application, the required output power, minimum input line voltage, maximum ambient, mounting orientation and air flow rate (if applicable) should be determined. Check the requirements against the closest characteristic plot from the tables above to ensure ratings can be achieved. Be conservative when specifying the product as convection and forced air cooling can be highly dependent on the end application enclosure and power supply mounting. The estimated performance must be verified in the end application and temperatures may exceed predicted levels. It is also important to note that ambient temperature refers to the ambient temperature immediately surrounding the PSU. If the PSU is mounted within an enclosure the enclosure ambient temperature is likely to be higher than the external air ambient temperature.

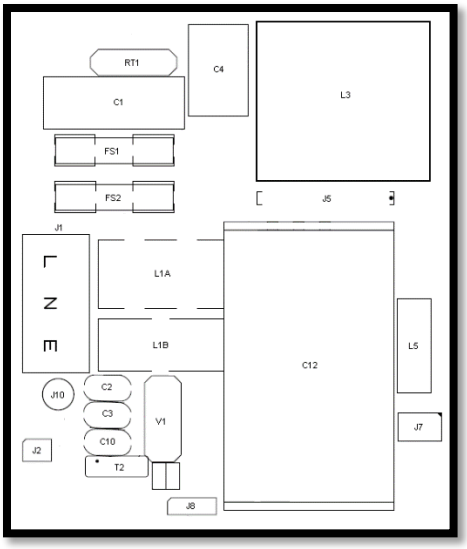
Evaluating the VCCM600 product in the end application

To ensure the product is operating within its ratings in the end application the following procedure should be performed during the design stage.

1. Install a thermocouple in position TS1 of the product. (See Mechanical dimensions and mounting for details.) The thermocouple wire should exit on the top side between slots 2 and 3. The bottom side should be flush for heatsink mounting if necessary. Glue should be used to hold the thermocouple in place.
2. Setup the application in worst case conditions, considering Input line voltage, Output power, ambient temperature, airflow and cooling restrictions.
3. Power the system and monitor the baseplate temperature until it reaches steady state.
4. Ensure that under worst case conditions, the baseplate temperature cannot exceed the rated temperature as outlined in the power ratings section of this manual.

Protective covers in the end application

If a cover is placed over the primary components, then the following **component temperatures must be measured** to ensure they are below the recommended temperatures.

Description	Reference	Recommended temperature	Maximum allowed temperature	Drawing
Fuse	FS1, FS2	100°C	125°C	
Electrolytic capacitors	C12	85°C	105°C	
Inductors	L1, L2, L3, L5	105°C	130°C	
Other capacitors	C1, C4	90°C	110°C	
Operation of components above the recommended temperatures will result in reduced lifetime of the unit and invalidate the warranty.				

If excessive temperatures are measured during this evaluation, then one or more of the following remedies may improve thermal performance.

- Increase heatsink size
- Increase airflow rate
- Improve air intake & outlet
- Reduce power requirement

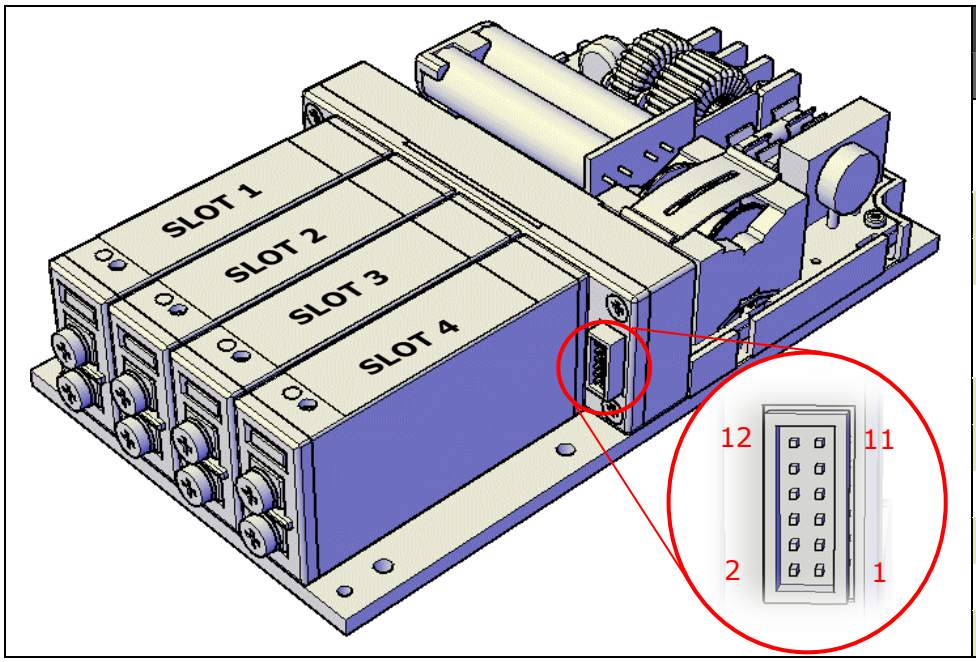
Using the internal temperature sensor to control external application cooling

An internal temperature sensor T_{SNS} is available on J3 pin 9 (See page 14 for details). The output voltage of this sensor gives a measurement of the internal transformer temperature and can be used to control external cooling systems or to provide a warning of impending over temperature protection.
The internal temperature (T_{SNS}) should never exceed 120^{0}C (2.74V), however, system reliability will be maximised if the PSU temperature is maintained as low as possible in any given application.

Signalling

Global Signals

To reduce cabling in the end system, all major input and output signals and the global 5V bias supply are wired to a single signals circuit that is accessed through connector J3 on the transformer module as shown in the diagram below.



J3 – Global Signals		
Pin	Name	Description
1	PG4	Slot 4 Power Good
2	INH4	Slot 4 Inhibit
3	PG3	Slot 3 Power Good
4	INH3	Slot 3 Inhibit
5	PG2	Slot 2 Power Good
6	INH2	Slot 2 Inhibit
7	PG1	Slot 1 Power Good
8	INH1	Slot 1 Inhibit
9	T_{SNS}	Temperature sense
10	ACOK	AC mains signal
11	+5V	5V Bias supply
12	COM	Common

All the signals are referenced to the bias supply common rail (COM) and external control and/or monitoring circuits can be easily powered and interfaced to the PSU through this connector. The entire signals circuit is fully medically isolated and can be considered a SELV output. The table below lists the isolation voltages.

Signals isolation voltages		
Signals to Input	4000	V_{AC}
Signals to Chassis	500	V_{DC}
Signals to Output	500	V_{DC}

Bias Supply (+5V [Power])

The VCCM600 series has one isolated bias supply located on the transformer module (J3) beside slot 4. The output side bias supply generates 5V and is rated up to 1A. The supply is available whenever the AC mains voltage is connected and the input module is operating correctly. A shutdown through the standby control on J2 or any of the following abnormal conditions will disable the 5V bias supply:

- Over temperature of any part of the unit
- Over voltage on any output module
- Internal over current (device failure)

AC Mains Signal (ACOK [Output])

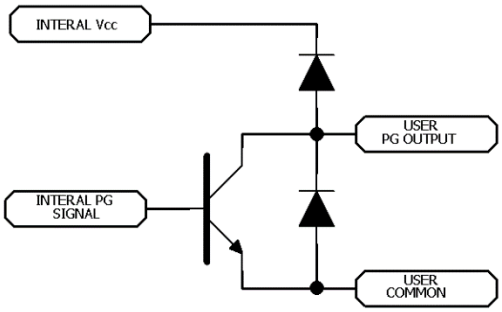
An ACOK signal is provided to indicate to the user that the AC mains voltage is applied and the input module is operating correctly. The output signal is driven from an internal operational amplifier. Under normal operating conditions this signal gives a warning of 5ms before the output voltage falls below the power good threshold. A shutdown through the standby control on J2 or any of the following abnormal conditions may cause the unit to turn off without the minimum 5mS ACOK warning:

- Over temperature of any part of the unit
- Over voltage on any output module
- Internal over current (device failure)

*Output modules that are adjusted above nominal voltage, will have reduced ACOK warning time.

Power Good Signals (PG1-PG4 [Output])

Each output module provides a power good (PG) signal to indicate when the output voltage is above approximately 90% of the pre-set voltage for that module. Each PG signal on an output module is internally connected through an opto-isolator to the signals circuit, which provides and open collector output, as shown.

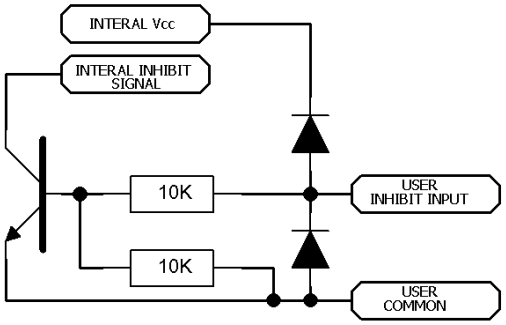


The LED on the front of each module gives a visual confirmation of the PG status.

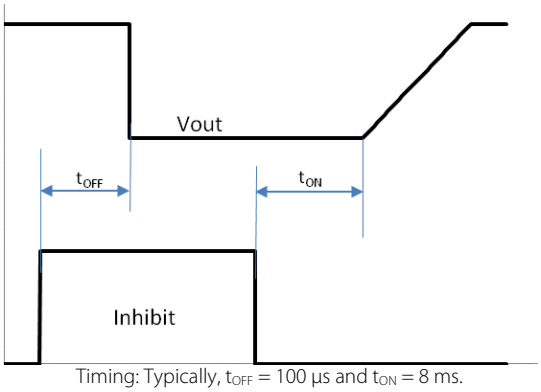
Note that remote adjustments of the output voltage using the $V_{CONTROL}$ and $I_{CONTROL}$ pins do not change the PG signal threshold. The PG threshold is always approximately 90% of the voltage set with the manual potentiometer.

Output Inhibits (INH1-INH4 [Input])

The signals circuit provides an inhibit input to disable each output module individually. Each inhibit input is internally connected through an opto-isolator to the respective output modules. The basic internal electrical circuit and timing diagrams are shown below.



Internal circuit



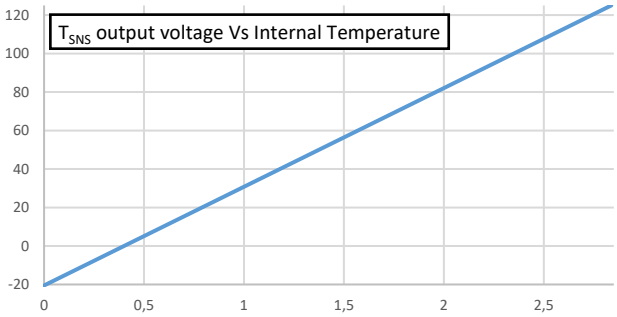
Timing: Typically, t_{OFF} = 100 µs and t_{ON} = 8 ms.

Internal Temperature sensor (T_{SNS} [Output])

An internal temperature sensor is embedded in the transformer module. The output voltage of this sensor gives a measurement of the internal transformer temperature and can be used to control external cooling systems or to provide a warning of impending over temperature protection. The sensor output voltage is related to temperature as follows,

$$V = 0.4 + 0.0195*T$$

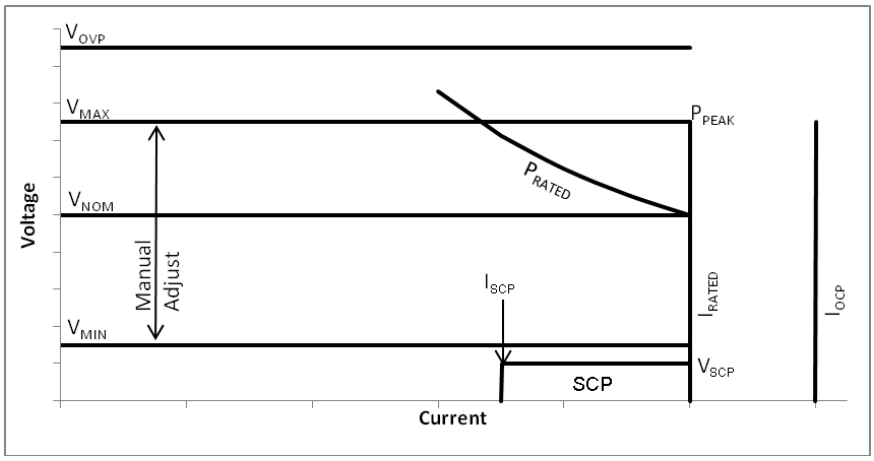
The sensor will accurately measure temperatures in the range -10^{0}C to +125^{0}C.
The internal temperature should never exceed 120^{0}C (2.74V)



Output Module Operation (A, B, C & D)

Power Profile

The power profile diagram below is a voltage/current plot that together with the associated table provides details of the main features of the currently available output modules.



Parameter	OPA	OPB	OPC	OPD
V_{NOM} (V)	5	12	24	48
V_{MIN} (V)	1.5	4.5	9	18
V_{MAX} (V)	7.5	15	30	58
V_{OVP} (V)	9.5	17	32	66
I_{RATED} (A)	25	15	7.5	3.75
I_{OCP} (A)	27.5	16.5	8.25	4.125
V_{SCP} (V)	1	2	3.5	3.5
I_{SCP} (A)	22	13.2	6.6	3.3
P_{RATED} (W)	125	150	150	150
P_{PEAK} (W)	187.5	225	225	217.5

Output Voltage Adjustment

Each output can be adjusted within the range as described in the table above or in the datasheet. Voltage adjustment can be achieved by two methods;

1. **Manual potentiometer adjustment**

Using the manual adjust potentiometer (located beside the "Power Good" indicator on the top of each output module), the preset output voltage (V_{SET}) of each output module is adjustable over the entire range of V_{MIN} to V_{MAX} as specified in the power profile table above. A clockwise rotation of the potentiometer results in an increase of the output voltage while an anti-clockwise rotation results in a decrease of the output voltage.

2. **Remote Voltage Programming**

Using remote voltage programming, the output voltage may be adjusted beyond the V_{MIN} and V_{MAX} range specified in the power profile table above. However, certain precautions must be taken to ensure correct operation. Please see the "Advanced output module features" section for more details.

Over Voltage Protection (OVP)

In the event of an output module fault, the modules are protected against excessive output voltages. This is implemented as a fixed voltage threshold V_{OVP}, in the table above. If the output voltage exceeds this threshold, all outputs will be disabled temporarily. If the fault persists after 20mS the entire unit will be latched off, otherwise the outputs will auto recover. To resume operation of a latched unit, disconnect the AC input voltage for 5 seconds or toggle the standby control on J2. Note that no warning is given on the AC_OK signal for faults of this type.

Over Current & Short Circuit Protection (OCP & SCP)

For increased safety and reliability all output modules in the VCCM series have over current and short circuit protection. The over current threshold is typically set at 115% of the rated current and has a constant current, straight line characteristic that reduces the output voltage as the load resistance decreases. If the output voltages falls below the short circuit voltage threshold (V_{SCP}) the module enters short circuit protection mode. In this mode the output module uses a hiccup scheme to reduce system losses and potential damage. When in this mode, the output will be enabled for approximately 3% of the time, disabled for 97% and will attempt to restart at approximately 125 ms intervals. The module remains in this state until the short circuit condition is removed, at which point normal operation resumes.

Reverse Current Protection (RCP)

The standard output modules use synchronous rectification in the output stages to achieve high efficiency and as a result the outputs can both source and sink current. The sink current is internally limited to approximately -6% of the maximum rated current. However, in applications where the output modules are connected to external power sources such as batteries or other power supplies certain precautions must be observed to prevent damage to the unit.

The outputs should never be directly connected to to external power sources without some form of reverse current protection such as an external diode or controlled mosfet. If protection is not used, large reverse currents which will ultimately result in damage to the unit will occur, especially when the AC mains is disconnected.

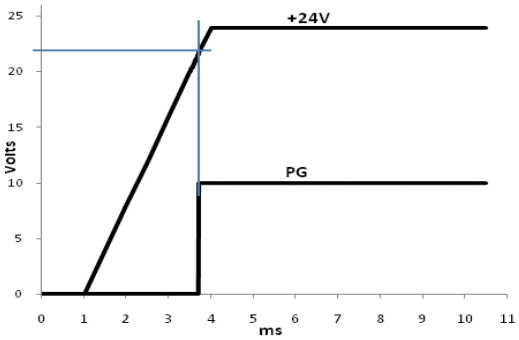
Additionally, when connecting output modules to large motors or other stored energy devices that can generate significant back EMF, external protections must be employed to prevent the back EMF from damaging the output module.

Output Module Average and Peak Power

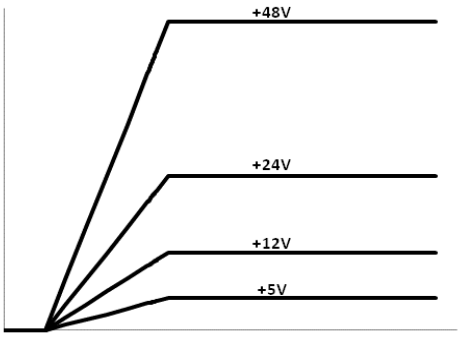
All modules have an average and peak power rating. The average power of each unit must at all times remain below it's specified limit. However, each output can deliver up to 150% of it's average power rating for a maximum of 5 seconds at 50% duty cycle, subject to the current limit not being exceeded and subject to the overall average power drawn being less than the specified average power rating (including any input derating due to temperature or line voltage). The available peak power is a function of the output voltage and maximum current for each module. Full peak power is only possible when the output voltage is adjusted to V_{MAX} and the maximum current is drawn from the module. Note that both average and peak power ratings are subject to the same temperature derating as the input module (derate by 2.5% per °C above 50°C), but are not subject to any line derating.

Start-up & Shut Down

All outputs are designed to have a regulated monotonic start-up with a rise time of approximately 3ms as shown in the diagram right. The power good signal will not assert until the voltage exceeds the power good threshold (≈90%).



Where multiple output modules are used, the default start up scheme is ratio-metric with all outputs starting at the same time as shown in the diagram right. External control circuits may be used to implement tracking or sequenced start up if necessary.



The outputs are not designed to start into pre-biased loads and may discharge any externally capacitance before beginning to ramp the output voltage up in the normal way.

At shutdown, the outputs enter a high impedance state. Where no external load is present it may take some time for the voltage to decay. When driving inductive loads, care must be taken to limit the voltage at the output terminals to prevent damage to the unit.

Synchronisation

All output modules in the same product are synchronised. The typical operating frequency is 260kHz and paralleled or series connected units will not produce ripple beat frequencies.

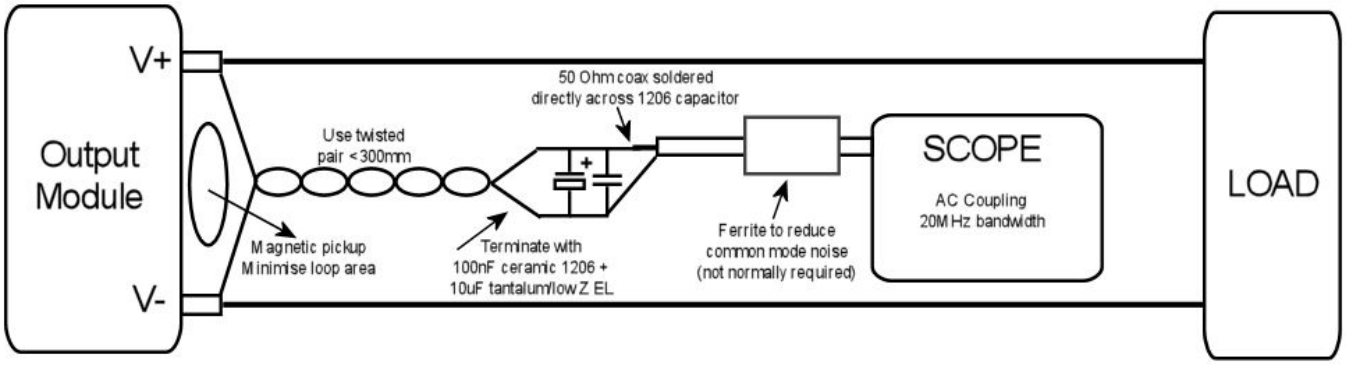
External capacitance

All outputs can support a large external capacitance as detailed in the table shown.
The capacitances specified ensure monotonic start-up with rated load applied.
Larger capacitances can be applied for lower load currents.

OP	C_{EXT_MAX}
A	12mF
B	4mF
C	1mF
D	500uF

Ripple and Noise

The ripple and noise figures stated in the datasheet are defined based on a standard measuring method. To obtain the same results the same test setup must be used and care must be taken to eliminate any parasitic noise pickup. The diagram below shows details of the setup and sources of noise pickup.



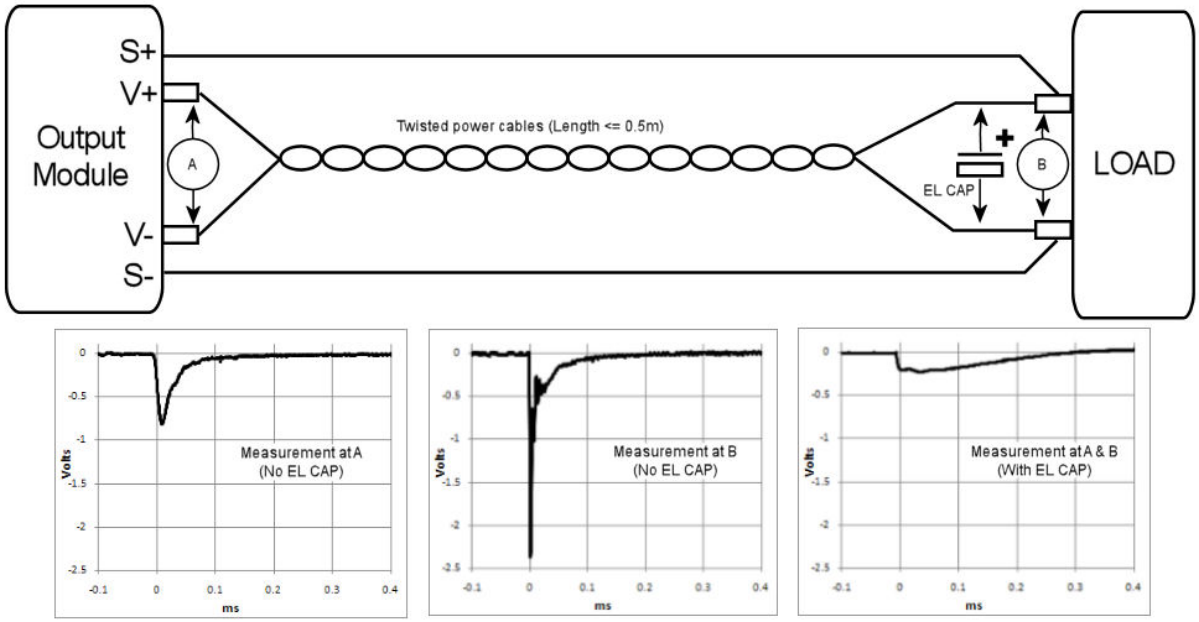
Over Temperature Protection (OTP)

Each output module is protected against excessive temperatures. In the event of an internal temperature exceeding safe levels the output module will shut off. If the temperature reduces the output module will automatically recover. Should the temperature continue to rise a second over temperature circuit will shut down the input module and all outputs. To resume operation of the unit, disconnect the AC input voltage for 20 seconds then reconnect. If all temperatures are within specifications the unit will restart. Note that no warning is given on the AC_OK signal for faults of this type.

Transient Response

The VCCM output modules have been especially designed to have high reliability. To achieve this all electrolytic capacitors have been eliminated from the design. As a result of this, high dynamic load transients can cause relatively high voltage deviations at the output and although the outputs have a very high loop bandwidth with typical recovery times of less than 100µs, the voltage deviations may still be excessive for some applications.

An example application is detailed in the diagram below and shows typical responses at the terminals of the output module and at the load. Notice that the voltage deviation due to cable inductance exceeds the module response and hence a capacitor located at the module terminals will have little effect at the load. The optimum solution is to locate a low impedance electrolytic capacitor at the load which will eliminate the inductive cable drop and reduce the typical voltage deviation at the module.



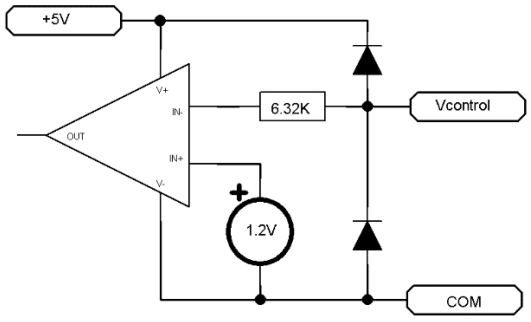
Advanced Output Module Features

Remote Voltage Programming (External Voltage Control)

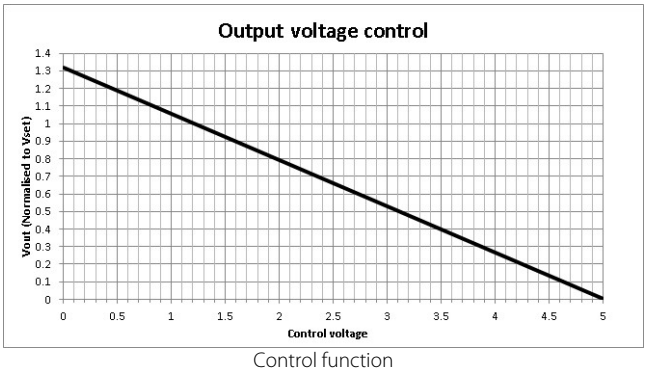
The output voltage of the module can be adjusted using an external voltage source connected between the COM and $V_{CONTROL}$ pins on the signals connector J4 as shown below.

In this configuration the output voltage will follow the typical equation below,

$V_O = V_{SET}((5-V_{CONTROL}) / 3.8)$, where V_{SET} is the manual preset voltage of the module.



Equivalent internal circuit



Control function

The output voltage can be controlled from 0% to 131.5% of the preset voltage using this control method. However, care must be taken to ensure the output voltage does not exceeed the OVP level, as this will trigger OVP protection.

Remote adjustment of the output voltage using the $V_{CONTROL}$ pin does not affect the preset power good threshold. Hence, remotely adjusting the output voltage below 0.9*Vset will cause the power good signal to go low.

Where tight voltage adjustment tolerances are required, it is recommended to use external circuitry to provide closed loop control of the $V_{CONTROL}$ pin.

SELV Precautions

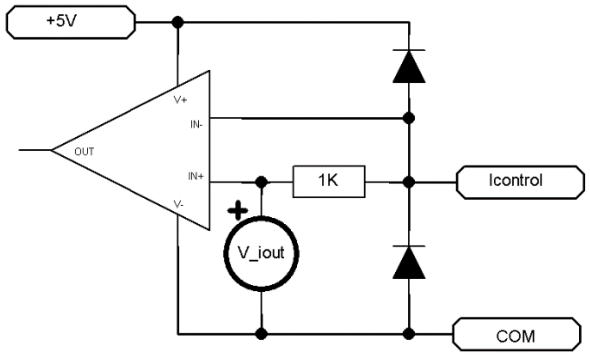
OPD modules with a preset voltage above 45VDC can exceed the SELV (Safety Extra Low Voltage) limit of 60VDC under two conditions.

1. Normal use adjustment using $V_{CONTROL}$ pin.
2. Single fault short of $V_{CONTROL}$ pin to COM pin (or equivalent).

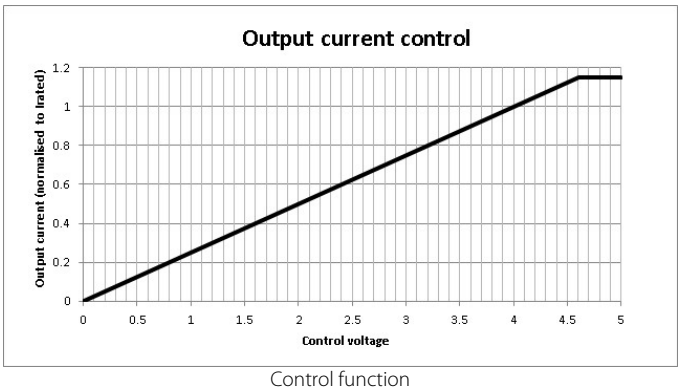
The end user should verify compliance to SELV and/or safety requirements in the application if the OPD module is used with a preset voltage above 45VDC.

Remote Current Programming (External Voltage Control)

The output current limit of the module can be reduced using an external voltage source connected between the COM and $I_{CONTROL}$ pins on the signals connector as shown below. In practice this also means that the output can be used as a modulated or constant current source.



Equivalent internal circuit



Control function

In the diagram above, Vi_out is an internal voltage source that is proportional to the internal inductor current and approximates the equation,

$V_{I\_OUT} = 4*I_{OUT}/I_{RATED}$, where Irated is the maximum rated current for the module.

In this configuration the output current limit will approximate the following equation,

$I_{LIMIT} = I_{RATED}*V_{CTRL}/4$, where I_{RATED} is the maximum rated current for the module.

It is not possible to increase the maximum current limit of the module, and control voltages exceeding 4.6V will have no effect on the current limit.

When using an output module as a modulated current source, the output voltage should be manually adjusted to the maximum that will be required by the application and this will be the upper voltage limit. Once the load is connected, the output current can then be modulated by applying a control voltage as described above.

Note that the power-good threshold level is fixed and defined by the manually preset voltage. Hence, while the output module is limiting or modulating the output current the PG signal may go low.

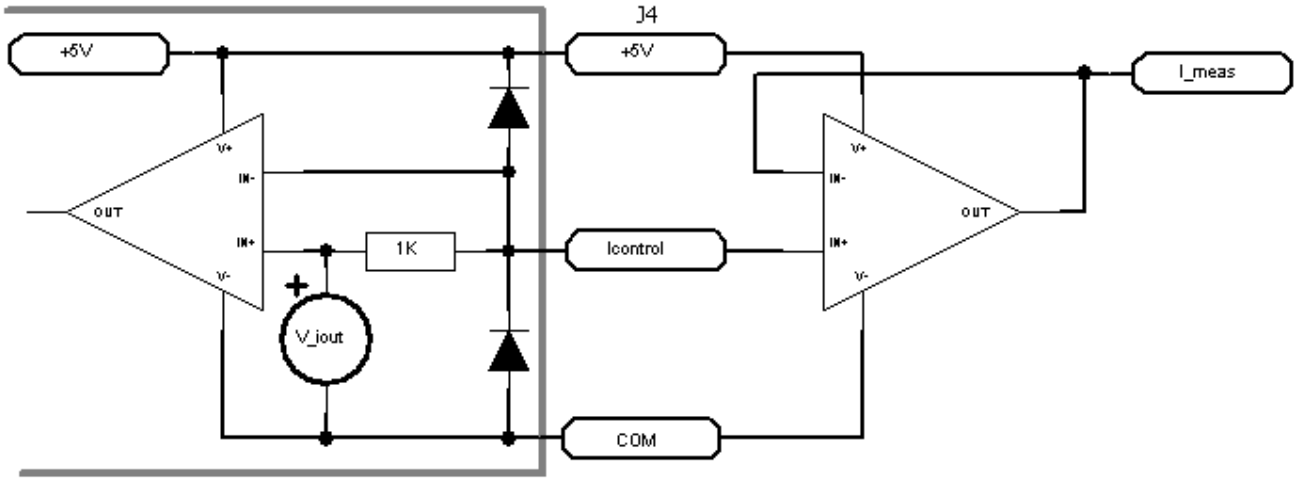
Where tight current adjustment tolerances are required, it is recommended to use external circuitry to provide closed loop control of the $I_{CONTROL}$ pin.

Output Current Measurement

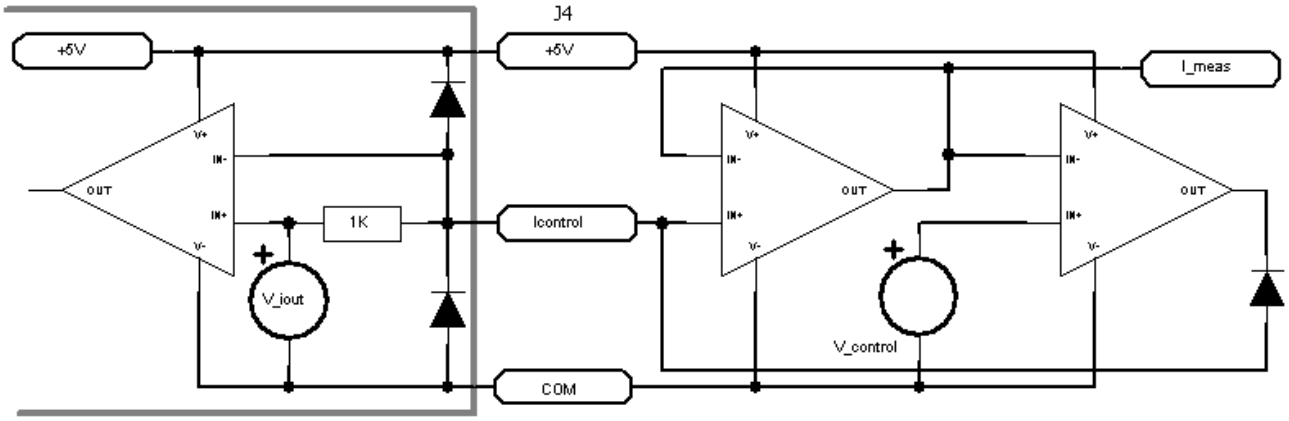
The output current of the module can be measured using the $I_{CONTROL}$ signal. If this pin is not loaded its output voltage will follow the typical equation,

$V_{I\_OUT} = 4*I_{OUT}/I_{RATED}$, where I_{RATED} is the maximum rated current for the module.

Note that the $I_{CONTROL}$ output voltage is representative of the internal inductor current not the actual load current. However, this will only have an influence during dynamic events. It is recommended to add an external buffer amplifier (as shown below) when using the $I_{CONTROL}$ signal to measure the output current as loading the $I_{CONTROL}$ signal, even with microamps can cause the current limit to be reduced. If it is required to measure the output current and adjust the output current limit simultaneously, this can be achieved by using a clamp circuit instead of a voltage source to adjust the current limit, while continuing to use an amplifier to measure the output current. An example circuit is shown below. In this case $V_{CONTROL}$ will control the current limit while the buffered $I_{CONTROL}$ signal will provide a measurement of the output current.



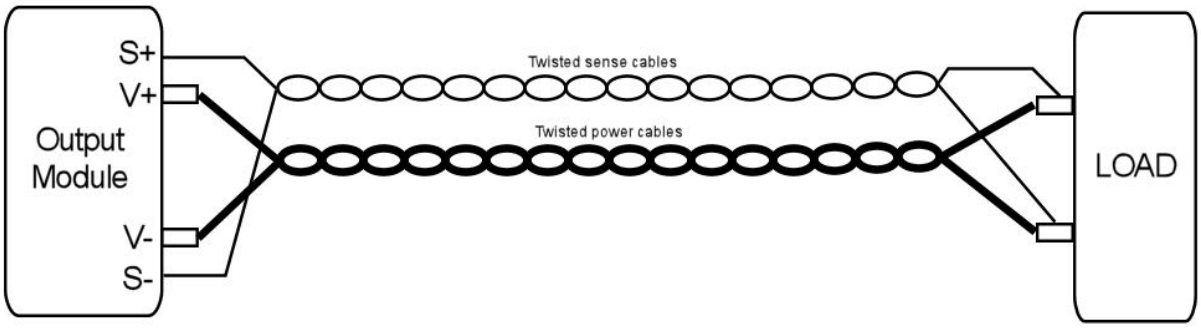
Measuring output current



Measuring & controlling output current

Remote Sensing

Remote sensing is available on all output modules and can be used to compensate for a voltage drop in the power leads connecting the power supply to the load. To implement remote sensing connect the positive sense pin (S+, connector J4.2) to the positive side of the remote load and the negative sense pin (S-, connector J4.1) to the negative side of the remote load. The voltage will be regulated at the points where the sense cables are connected.



Active protection against damaged power cables or accidental power cable removal is provided and prevents damage to the unit in each case. An internal circuit measures the voltage between S+ to V+ and S- to V-, when this voltage exceeds the thresholds specified in the datasheet, the output voltage is reduced to benign levels. During system design, care must be taken to ensure power cables have a sufficiently low voltage drop (<0.5V) at maximum load current to ensure this protection does not activate unintentionally.

In systems where remote sensing is not used, the output voltage at the power terminals will be slightly higher than that at the sense terminals. This voltage difference is termed, "open sense offset" and occurs due to internal bias currents in the sensing circuit. Factory set units are set with the sense cables connected unless otherwise specified.

Local Bias Supply

A local non-isolated +5V bias supply is provided on each output module (+5 V on J4.6, referenced to COM on J4.3). This supply is intended to power interface circuits for monitoring and controlling the output modules. The output can supply up to 10mA maximum. Exceeding this can damage the unit.

Also, as COM is connected to an internal voltage that is **NOT** equivalent to S- or V-, particular attention must be given to grounding issues when interfacing COM to any control circuit in the application. Connecting COM to S- or V- may result in damage to the unit.

Series Connected Outputs

VCCM output modules of the same type can be series connected to achieve higher output voltages. Links for series connecting modules are available directly from Vox Power or our local representatives.

The following instructions must be followed for output modules configured in this manner.

WARNING!

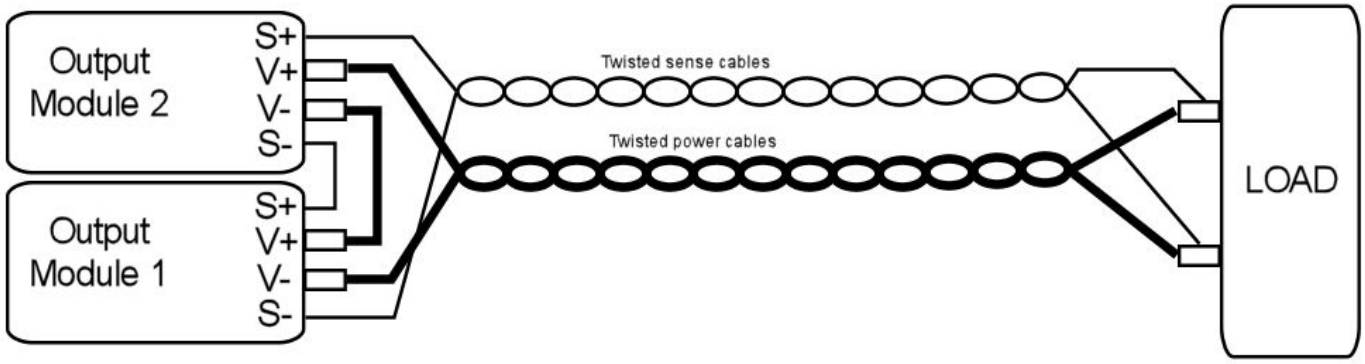
- Energy and Voltage hazards may arise when individual modules are series connected. See the Safety section for more details.
- When modules are connected in series, their inhibit lines (J3), if used, should be paralleled.
- Inhibiting series connected modules individually may cause damage

Isolation to Ground

Care must be taken not to exceed the output module isolation to chassis ground when series connecting modules. Each output module is rated for 500 Volts maximum between each output terminal and chassis ground. Exceeding this voltage may damage the module.

Remote Sensing

For series connected modules, remote sensing is achieved by connecting the upper most positive sense terminal (S+) and the lower most negative sense terminal (S-) from the series of modules to their respective load regulation points. All inner sense terminals in the series must be daisy chained i.e. S+ to S- from the first module in the series to the last module in the series. An example of two series connected modules is shown below.



Series Connected Remote Voltage/Current Control

Remote voltage and/or current control is possible with series connected modules using the advanced $V_{CONTROL}$ and $I_{CONTROL}$ functions described earlier. However, individual control of each module can be complex as the various control terminals are referenced to the positive output of the preceding module and require the use of multiple isolated control voltages to attain control over the full voltage range. Please contact Vox Power or your distributor for assistance if remote voltage or current control is required for series connected modules.

SELV Precautions

Where series combinations of output modules exceed 60V, the output can no longer be considered SELV (Safety Extra Low Voltage) and hence the final equipment manufacturer must provide suitable protection for both users and service personnel.

External capacitance

When large external capacitances are connected to series connected outputs, the maximum input power can be exceeded at start-up and the unit can latch off. Consider sequencing output start-up to prevent exceeding the input power limit when charging large external capacitances.

Parallel Connected Outputs

VCCM output modules of the same type can be paralleled within the same product to achieve higher output currents. Links for paralleling modules are available directly from Vox Power or our local representatives.

The following instructions must be followed for output modules configured in this manner.

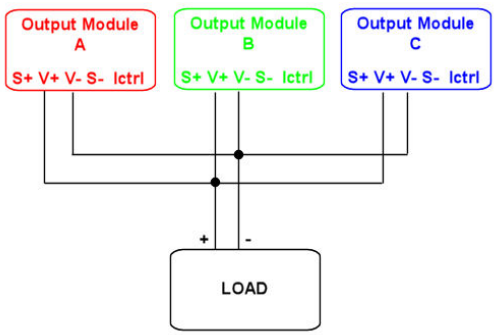
WARNING!

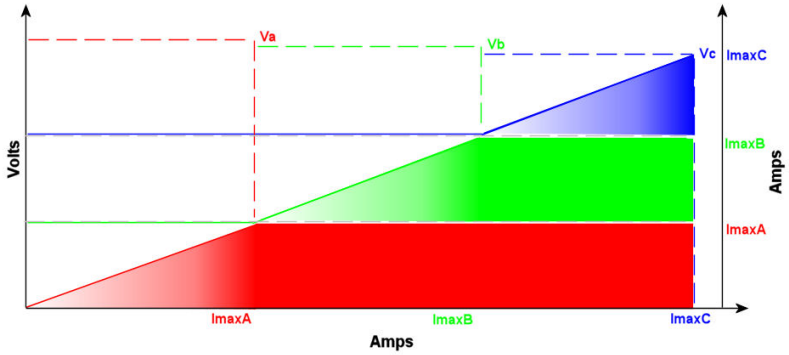
- Energy Hazards may arise when individual modules are paralleled. See the Safety section for more details.
- When modules are paralleled, their inhibit lines (J3), if used, should also be paralleled. Inhibiting paralleled modules individually may cause damage

When paralleled, the outputs can operate in two distinct modes, Normal parallel mode or Share parallel mode.

Normal Parallel Mode

For normal parallel mode, the positive power cables should be connected together and the negative power cables should be connected together. No other connections are required as shown in the diagram below.





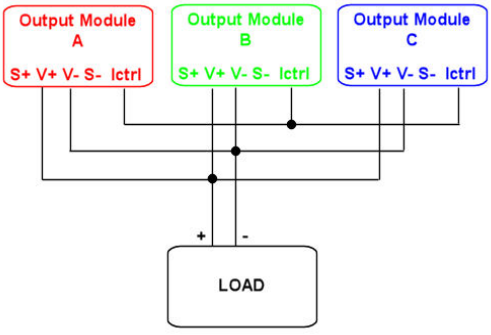
In this mode, the highest adjusted output module will supply all of the load current until its current limit is reached. If the load demand exceeds this level the output voltage will drop to the level of the next highest adjusted module and that module will begin to supply the load current while the first module continues delivering full current. This process repeats for the total number of paralleled modules. The diagram above shows the VI curve for such a system.

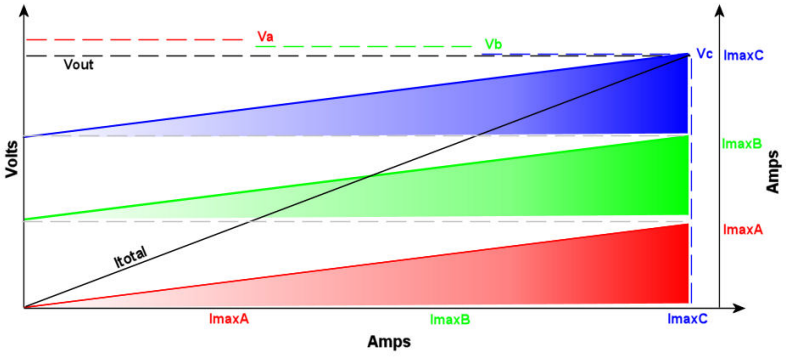
Output modules that are not delivering current will typically sink a small amount of current from the other outputs, but this will not exceed -6% of each module's maximum rated current.

Typically, system reliability is reduced in this mode as the higher adjusted modules will do most of the work with the lower adjusted modules only delivering current during peak load demand.

Share Parallel Mode

In share parallel mode, the outputs are paralleled as before and the $I_{CONTROL}$ pin of each module connected together as shown in the diagram below.





Connecting the $I_{CONTROL}$ pins together forces all the outputs to deliver the same current, ensuring that the system reliability is maximised and the work load is distributed evenly across all paralleled modules.

In this mode, the lowest adjusted output module will determine the actual output voltage and all higher adjusted outputs will reduce their voltage.

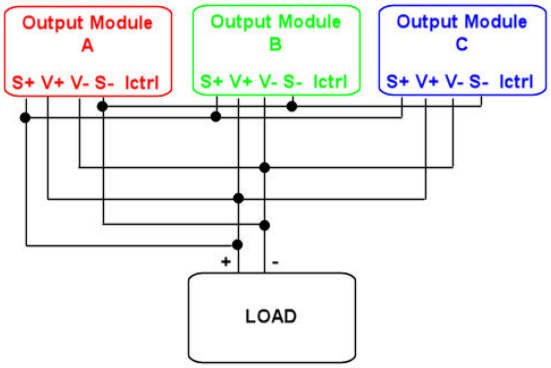
The current output signal ($I_{CONTROL}$) can still be used to measure the output current but it must be scaled by N, where N is the number of paralleled modules.

WARNING!

Care must be taken to avoid differential voltages between the negative power output terminals of share mode paralleled modules as this can cause errors at the control pins. To avoid this, it is recommended to use Vox Power parallel links to parallel modules in share mode.

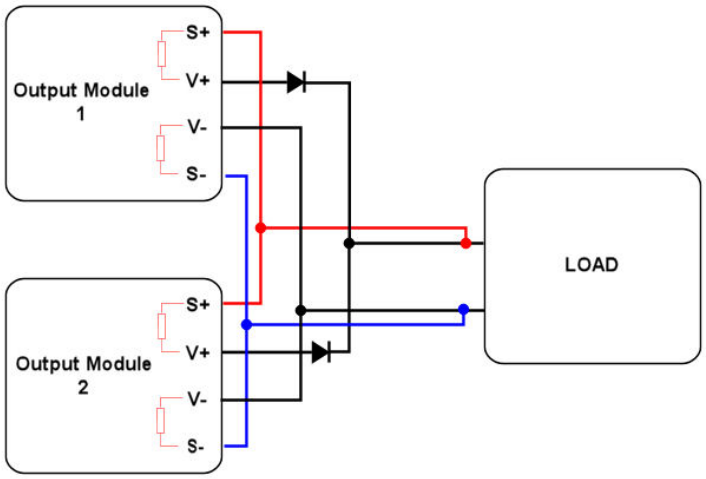
Parallel Remote Sensing

Remote sensing can be used as normal with paralleled modules. The sense lines (S+ and S-) from each of the output modules should be connected together, S+ to S+, and S- to S- as shown below. This should be done close to the power supply output and a single pair of cables brought from these sense lines to the load. Keeping cable lengths to a minimum and using twisted pairs where necessary will help reduce noise pickup in the sense lines.



N+1 Configurations

When using N+1 redundant configurations, a suitably rated diode (or controlled MOSFET) must be used on each output to prevent a device failure from causing a system failure. However, the diode introduces voltage drops between the supply and the load that significantly degrade the load regulation. To counteract this, the remote sense lines can be used to regulate the voltage at the load as shown below.

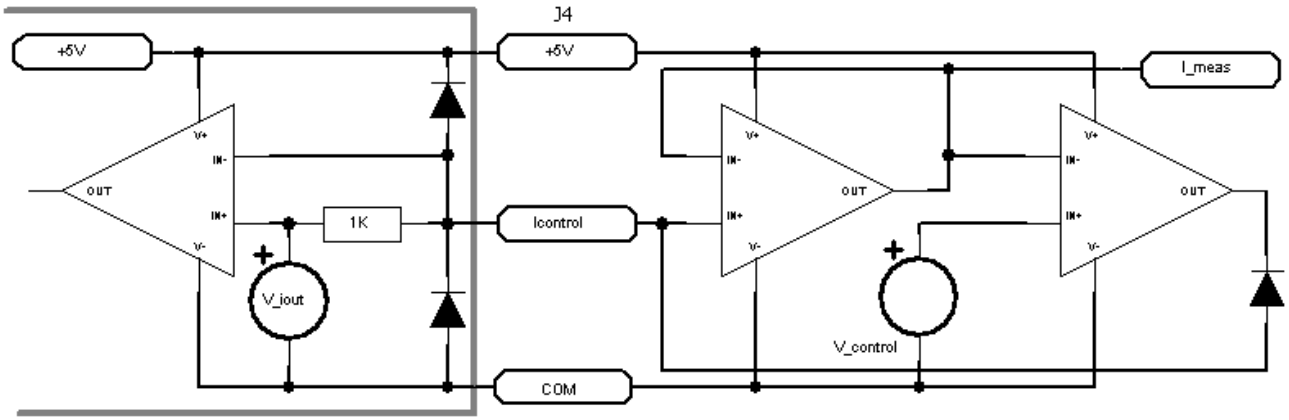


Typically, this configuration can damage the internal sense resistors used within a power supply. However, the VCCM outputs have integrated protection to prevent this type of damage and are completely N+1 compatible without any additional external protection circuitry. Note that only the positive sense terminal is protected and diodes should be used in the positive connection only.

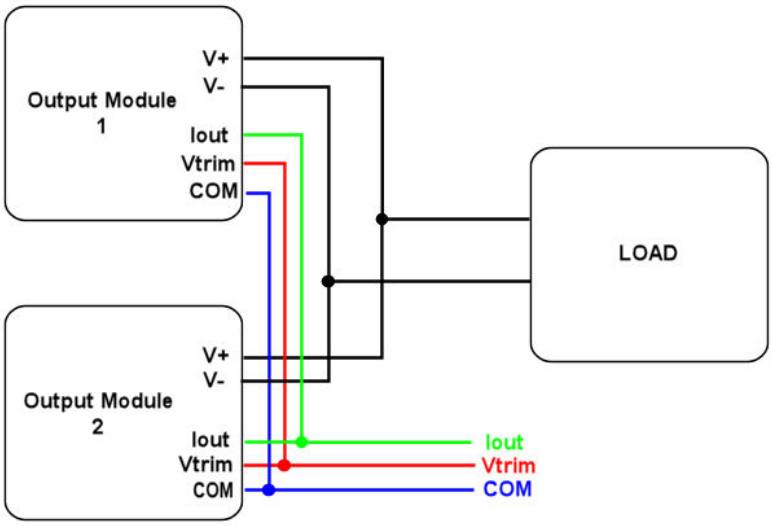
Paralleled Remote Voltage/Current Adjustments

Remote voltage programming with paralleled outputs can be achieved by simply joining all $V_{CONTROL}$ and COM pins together and applying the external control voltage between COM and $V_{CONTROL}$.

Remote current programming with paralleled outputs can be achieved by joining all $I_{CONTROL}$ and COM pins together but directly applying an external control voltage would override the current share signal and force the outputs to operate in normal parallel mode. Instead it is required to clamp the $I_{CONTROL}$ bus voltage using a circuit similar to that shown below.



It is not recommended to use remote voltage/current programming in normal parallel mode.



WARNING!

Care must be taken to avoid differential voltages between the negative power output terminals of share mode paralleled modules as this can cause errors at the control pins. To avoid this, it is recommended to use Vox Power parallel links to parallel modules in share mode.

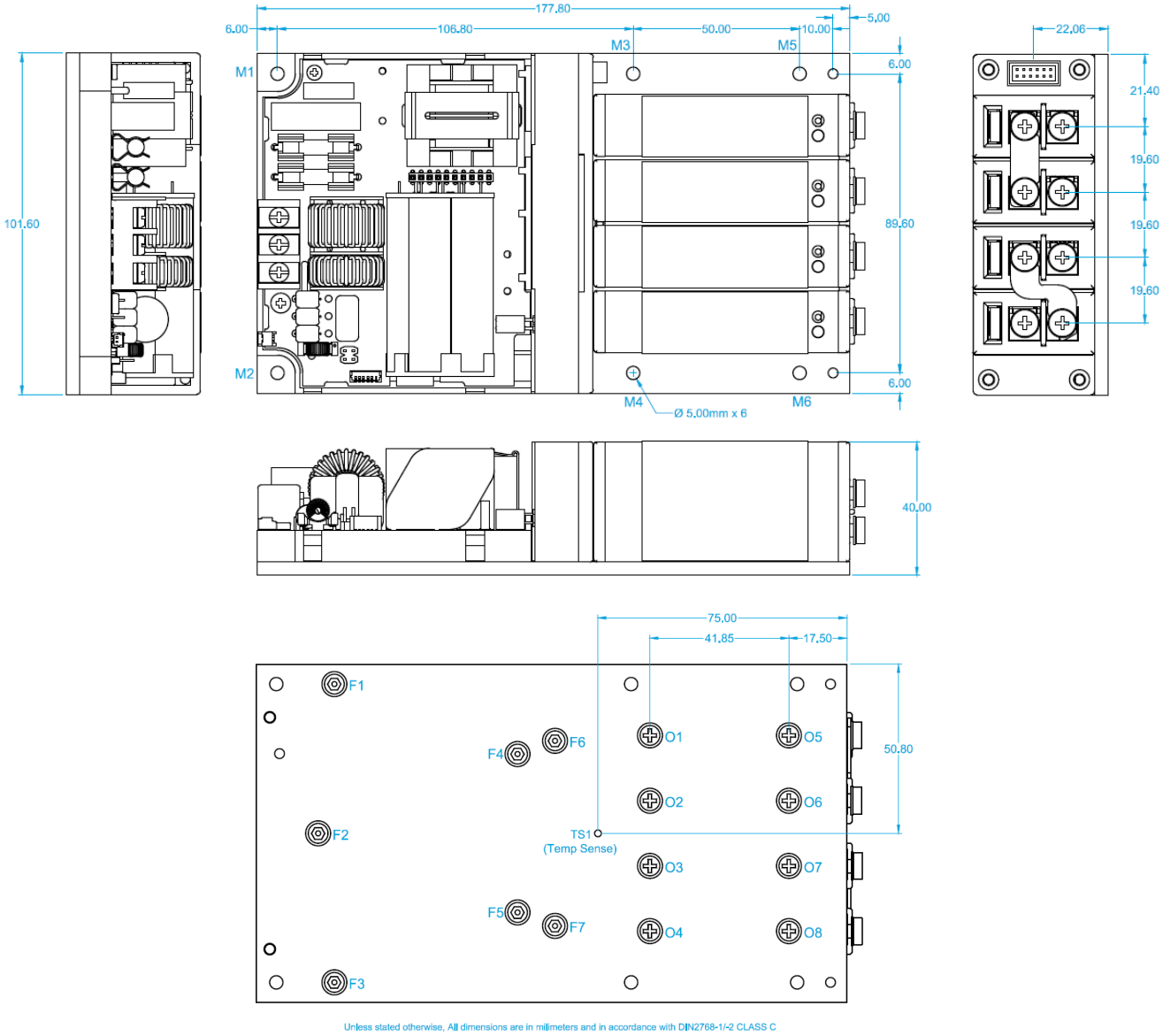
Paralleling Across Multiple Products

Paralleling across multiple product is not possible without external protection (such as external diodes or controlled MOSFETs) to prevent circulating currents between each product. Failure to provide such protection may result in damage to the power supplies. Consult Vox Power for details on how best to implement such applications.

When modules are paralleled across multiple products, the outputs in each product will not be synchronised and the peak to peak output ripple may contain beat frequencies in the audio spectrum.

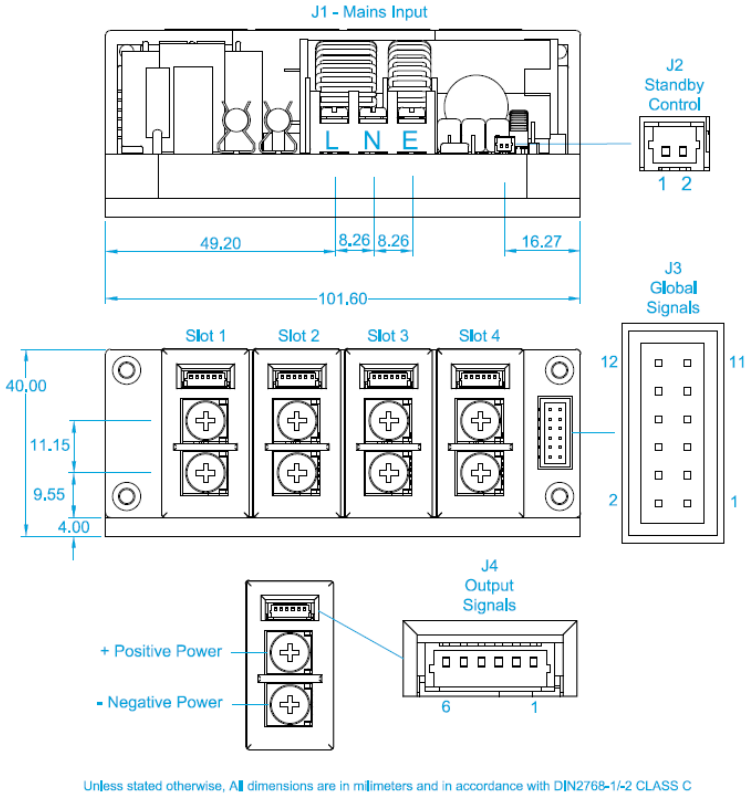
Mechanical Dimensions and Mounting

SCREWS			
Location	Details	Penetration	Tightening
Baseplate Mount: M1 – M6	Hole diameter = 5.00mm	4mm Baseplate thickness	0.55NM
Output Module Mount: O1 – O8	M3 CSK	M3 CSK screw, 8mm max length	0.5NM
Input module Mount: F1 – F5	Do not remove or adjust	Do not remove or adjust	Do not remove or adjust
Transformer module Mount: F6 – F7	M3 CSK	M3 CSK screw, 6mm max length	0.5NM
Output Module Terminal	M4 SEM	M4 SEM screw, 8mm max length	0.55NM



Connector Details

PINOUTS J1 – Mains Input	
Circuit	Details
1	Live
2	Neutral
3	Earth
J2 – Standby control	
Circuit	Details
1	Standby control negative
2	Standby control positive
J3 – Global Signals	
Circuit	Details
1	Slot 4 - Power Good
2	Slot 4 - Inhibit
3	Slot 3 - Power Good
4	Slot 3 - Inhibit
5	Slot 2 - Power Good
6	Slot 2 - Inhibit
7	Slot 1 - Power Good
8	Slot 1 - Inhibit
9	Temperature sense (T_{SNS})
10	AC OK
11	+5V (Bias Supply 1A)
12	COM
J4 -Output Signals	
Circuit	Details
1	- Sense
2	+ Sense
3	COM
4	I Control
5	V Control
6	+5V (Bias Supply 10mA)



MATING CONNECTORS				
Ref.	Details	Manufacturer	Housing	Terminal
J1 - Mains Input	3 Pin, Barrier, 6-32 Steel Screws, 0.8 Nm or 7 Lb-In Torque [1]			
J2 - Standby control	2 Pin, 1.25mm, with Friction Lock, 28-30AWG	MOLEX	0510210200	0500588000
J3 - Global Signals	12 Pin, 2mm, with Friction Lock, 24-30 AWG, WIRE TO BOARD	MOLEX	0511101260	0503948051
	12 Pin, 2mm, with Friction Lock, 24-30 AWG, IDT CABLE TO BOARD	MOLEX	0875681273	
J4 - Output Signals	6 PIN, 1.25mm, with Friction Lock, 28-30AWG	MOLEX	0510210600	0500588000
Output Power	Positive/Negative, M4 terminal, 0.55NM, use appropriately rated crimp terminal			
Notes	1. Cable 14-18AWG, 300V, 16A, 105°C, use appropriately rated crimp terminal. 2. Direct equivalents may be used for any connector parts. 3. All cables must be rated 105°C min, equivalent to UL1015			

Safety

The VCCM unit has been designed to comply with the Low Voltage Directive DIR 2014/35/EU (LVD), the EMC Directive DIR 2014/30/EU and DIR 2011/65/EU regarding the restriction of certain hazardous substances and is CE marked to show its compliance.
When correctly installed (per the installation manual) in a limited access environment the VCCM600S & M comply with the requirements of IEC/EN/UL/CSA 62368-1, IEC/EN/UL/CSA 60950-1 2nd Editions and IEC/EN/UL/CSA 60601-1 3rd Edition respectively.

- The power supply should not be operated close to combustible materials or atmosphere.
- Care should be taken to ensure liquid or metal shavings do not enter the power supply as this can cause a fire hazard.
- The power supply does not contain any user serviceable parts and should be returned to Vox Power for repair.

Approval Limitations (North America)

When this product is used with $180V_{AC}$–$253V_{AC}$ mains where no neutral is present, connect the two live wires to L (Live) and N (Neutral) on the input connector.

WARNING!

- Series connected modules with combined voltages exceeding 60 volts are not considered SELV. Paralleled and/or series modules with combined energy ratings greater than 240 VA may cause energy hazards. The equipment manufacturer must provide additional and adequate protection to service and technical personnel.
- Always remove the power before handling the unit. During operation, the external surface of the unit can become hot. Leave to stand for 10 minutes to allow the unit to cool down before handling the unit.
- Dangerous voltages are present within the power supply. Covers may only be removed by qualified personnel when the power supply has been disconnected from the mains supply voltage for more than 10 minutes. Covers must be replaced and all screws secured properly before reconnecting to the mains voltage.

SAFETY SPECIFICATIONS				
Parameter	Details	Max	Units	Notes
Isolation Voltages	Input to Output (2 MOPP)	4000	V_{AC}	
	Input to J2 standby control (2 MOPP)	4000	V_{AC}	
	Input to Chassis (1 MOPP)	1500	V_{AC}	
	Global signals (J3) to Output/Chassis	500	V_{DC}	
	Output to Output/Chassis (Standard modules)	500	V_{DC}	
Earth Leakage Current	INDUSTRIAL: Normal condition, 264Vac, 63Hz, 25°C	1500	uA	
	MEDICAL: Normal condition, 264Vac, 63Hz, 25°C	300	uA	
Touch Leakage Current	Output to Earth. Standard modules 264Vac, 63Hz, 25°C NC/SFC	20/200	uA	
Patient Leakage Current	Standard modules 264Vac, 63Hz, 25°C NC/SFC	-----	uA	Not applicable

INSTALLATION SPECIFICATIONS			
Parameter	Details	Parameter	Details
Equipment class	I	Flammability Rating	94V-2
Overvoltage category	II	Ingress protection rating	IP10
Material Group	IIIb (indoor use only)	ROHS compliance	2011/65/EU & 2015/863/EU
Pollution degree	2	Intended usage environment	Home Healthcare (M)/ Industrial (S)

EMC Compliance

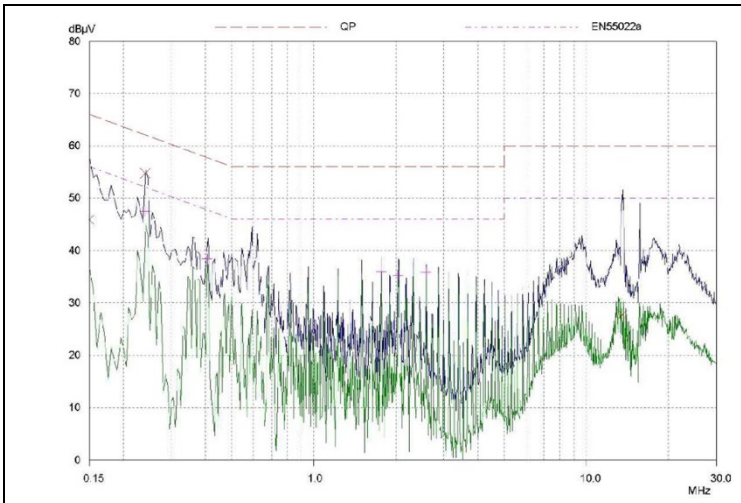
To support compliance of the final system design with the EMC directive 2014/30/EU, the VCCM600 PSU has been designed and tested to the following standards.

ELECTROMAGNETIC COMPLIANCE – EMISSIONS		
Phenomenon	Basic EMC Standard	Test Details
Radiated emissions, electric field	EN55011/32	Class B compliant
Radiated emissions, electric field, 30Hz-18GHz.	MIL-STD-461F: RE102 (Ground, Fixed)	Compliant (When mounted in enclosure)
Conducted emissions	EN55011/32, FCC part 15, CISPR 32/11	Class B compliant
Conducted emissions, power leads, 10kHz-10Mhz.	MIL-STD-461F: CE102	Compliant (External filter may be required)
Harmonic Distortion	IEC61000-3-2	Compliant
Flicker & Fluctuation	IEC61000-3-3	Compliant

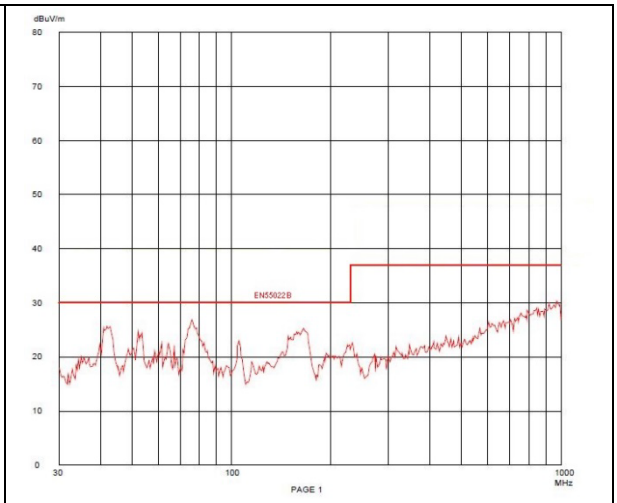
ELECTROMAGNETIC COMPLIANCE – IMMUNITY		
Phenomenon	Basic EMC Standard	Test Details
Electrostatic discharge	IEC61000-4-2	Test level 4: 15kV air, 8kV contact
Radiated RF EM fields	IEC61000-4-3	Test Level 3: (10V/m, 80MHz-2.7GHz) sine wave AM 80% 1kHz
Proximity fields from RF wireless communications equipment	IEC61000-4-3	Test levels as per IEC60601-1-2:2014 Table 9
Radiated susceptibility, electric field, 2 MHz to 40 GHz.	MIL-STD-461F: RS103	20V
Electrical Fast Transients/bursts	IEC61000-4-4	Test Level 3: (2kV Power, 1kV I/O) 5kHz(ed3) & 100kHz(ed4)
Conducted susceptibility, Bulk cable injection, impulse excitation	MIL-STD-461F: CS115	
Surges	IEC61000-4-5	Test Level 3: 1kV L-N, 2kV L-E
Conducted susceptibility, damped sinusoidal transients, cables and power leads, 10kHz-100MHz	MIL-STD-461F: CS116	
Shipboard Electric Power. Voltage Spike Test	MIL-STD-1399, SECTION 300A	Type 1, 115V 60Hz single phase
Conducted disturbances induced by RF fields	IEC61000-4-6	Test Level 3: 10V, 0.15 to 80Mhz sine wave AM 80% 1kHz
Conducted susceptibility, power leads, 30Hz-150kHz	MIL-STD-461F: CS101	
Conducted susceptibility, Bulk cable injection, 10kHz-200Mhz	MIL-STD-461F: CS114	
Power Frequency Magnetic Fields	IEC61000-4-8	Test level 4: 30A/m 50Hz
Radiated susceptibility, Magnetic field, 30Hz-100kHz	MIL-STD-461F: RS101	
Voltage Dips	IEC61000-4-11[2]	0% 10ms, 0% 20ms (Criterion A) 70% 0.5s, 40% 200mS (Criterion A at 240V and Criterion B at 100V)
Voltage Sag Immunity	SEMI-F47-0706[2]	0% 20mS, 80% 1s,80% 10s,90% continuous (Criterion A) 70% 0.5s, 50% 200mS (Criterion A at 240V and Criterion B at 100V) Criterion A is achieved for full power when Vin >=160V Criterion A is achieved at all input voltages when Pout <= 350W
Voltage interruptions	IEC61000-4-11	0% 250/300 cycle as per IEC60601-1-2:2014 (Criterion B)
Aircraft Electric Power Characteristic	MIL-STD-704F	SAC102,104,105,109,110 (MIL-HDBK-704-2) & SXF102,104,105,109,110 (MIL-HDBK-704-6)

Notes:

1. Criterion A = No degradation of performance or loss of function.
   Criterion B = Temporary degradation of performance or loss of function is allowed, provided the function is self-recoverable.
   Criterion C = Temporary loss of function is allowed but requires operator intervention to recover..
2. Tested at nominal range (100V to 240V). Line deratings applied where appropriate.



Typical Conducted emissions



Typical Radiated emissions

For radiated and conducted emissions, compliance of the final system relies on proper installation of the PSU component. The installation guidelines detailed below should be followed.

Installation Guidelines for optimum EMC performance

- VCCM units should be mounted within a metal enclosure using the mounting fixtures provided.
- If the application enclosure is not metal, then a metal ground plate should be used to mount both the power supply and the load.
- Both input and output cables should be fixed as close as possible to the ground plate or metal enclosure.
- Input and output cables should be separated as much as possible from each other or a shield/screen used to isolate RF currents
- Output power and sense cables should be twisted pairs and routed parallel to each other. Do not twist sense and power cables together.
- All cables lengths and loop areas should be minimised.
- Where cables must enter or exit the enclosure, good high frequency 100nF decoupling capacitors of sufficient voltage rating should be connected to the cables as close to the entry/exit point as possible.

For further details or assistance contact Vox Power.

Reliability

The VCCM600 series has undergone extensive testing, including HALT and Environmental testing. Reliability data is collected on an ongoing basis. Please contact Vox Power or your distributor for the most up to date reliability data.

The reliability data quoted in the datasheets are the calculated *failures per million hours* (FPMH) using the Telcordia SR-332, issue 2 standard. The procedure defined in SR-332 allows several different techniques to be used for calculating MTBF and when evaluating competing MTBF figures it is important that only the same techniques are compared.
The quoted VCCM reliability figures use Method I Case 3, Ground, Fixed, Controlled which specifies an ambient temperature of 30°C and an upper confidence level of 90%. It is also assumed that the product is operated at 100% duty cycle, has an input voltage of $220V_{RMS}$, an output power of 600W and that the baseplate temperature is the same as the ambient temperature.

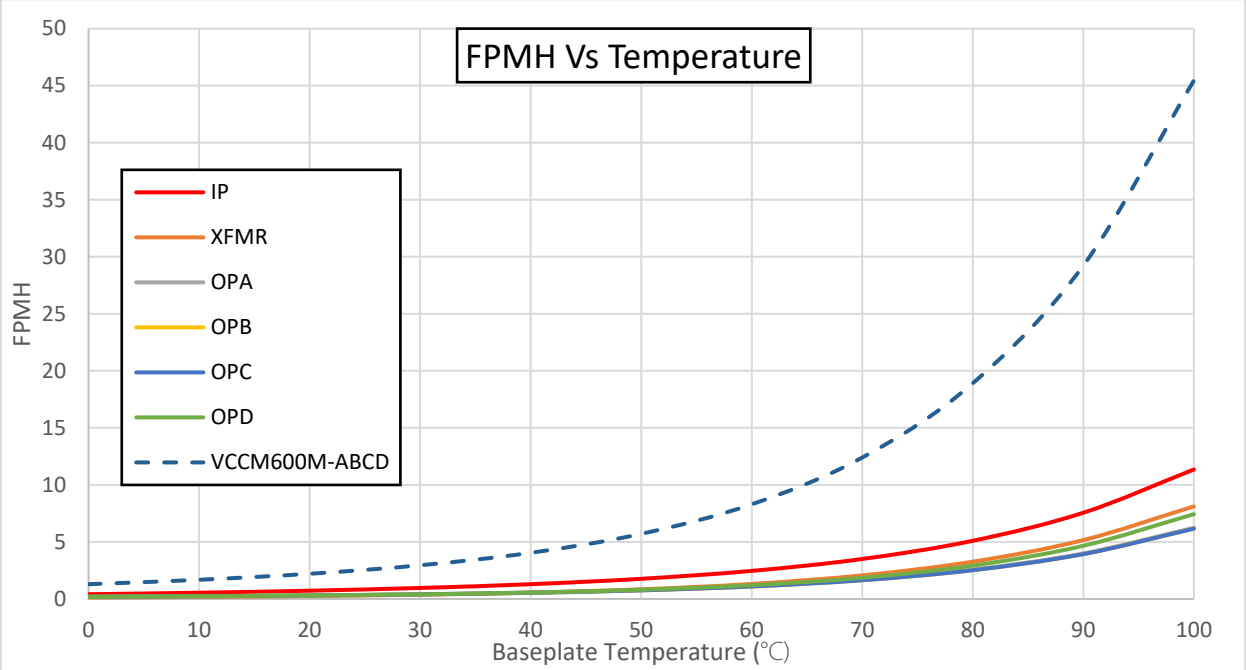
The table below shows a summary of the FPMH & MTBF for all system components and for a typical fully assembled system.

Assembly	Failure Rate (FPMH)	MTBF (Hrs)
IP	0.962972	1038452
XFMR	0.371919	2688754
OPA	0.415368	2407499
OPB	0.397808	2513774
OPC	0.398170	2511487
OPD	0.405630	2465300
VCCM600M-AAAA	2.996363	333737.934

To calculate the MTBF of any VCCM system,

- Add the FPMH figures for each system component to give the total FPMH.
- Get the MTBF by dividing 1,000,000 by the total FPMH.

The variation in FPMH is shown in the graph and table below.



Temp	IP	XFMR	OPA	OPB	OPC	OPD	VCCM600M-ABCD
0	0.41329578	0.127619	0.192619	0.185396	0.186105	0.186243	1.291276945
10	0.54688976	0.178886	0.245347	0.235357	0.235992	0.2362	1.678671789
20	0.72397837	0.255159	0.316147	0.302737	0.30326	0.305183	2.206465072
30	0.96297168	0.371919	0.415369	0.397808	0.39817	0.40563	2.951868534
40	1.29407059	0.555049	0.560829	0.538309	0.538452	0.559393	4.046103211
50	1.76616217	0.846405	0.782692	0.754326	0.754185	0.803972	5.707742381
60	2.46010898	1.315415	1.130884	1.095712	1.095216	1.202005	8.299340054
70	3.50420104	2.067304	1.686039	1.643019	1.642101	1.855247	12.39791075
80	5.09894211	3.266645	2.575169	2.523173	2.52177	2.925702	18.91140128
90	7.55815578	5.160517	3.995269	3.93316	3.931214	4.659641	29.23795696
100	11.3495991	8.112606	6.236851	6.163284	6.160733	7.430093	45.4531658

Configuring your VCCM Product

The VCCM600 power supply is designed to be used as part of an end-system in a restricted environment and therefore should only be accessible to qualified and trained personnel. Persons attempting to configure a unit must have the necessary knowledge and training before doing so. Incorrect configuration may cause damage to the power supply and may affect the warranty of the power supply.

Output power modules may be added, replaced or moved by strictly following the sequence of operations described below.
Before configuring your VCCM product, remove the VCCM600 input module and any output modules which are going to be used in the configuration from their packaging and inspect for damage.

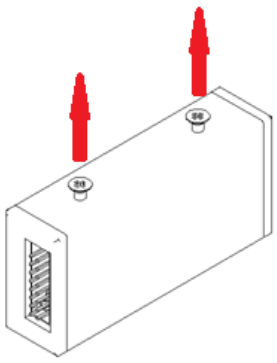
DO NOT use parts if any part of the product exhibits any kind of physical damage.
DO NOT connect any mains power before the configuration is complete.

Once configuration changes have been completed, operation of the unit should be verified and voltages can be adjusted to application requirements.

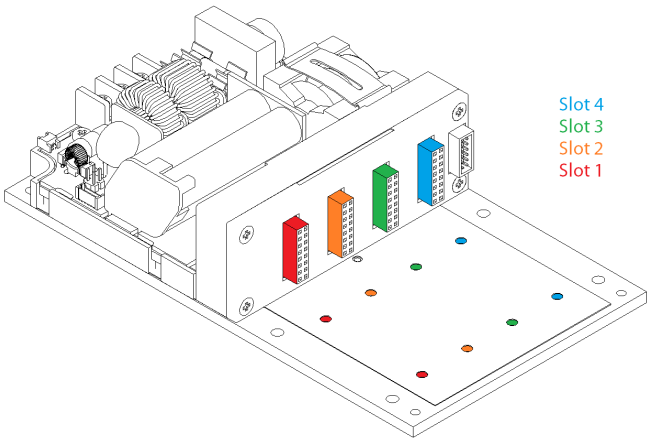
Please contact Vox Power or your distributor for assistance in configuring your power supply. Never assume, always ask.

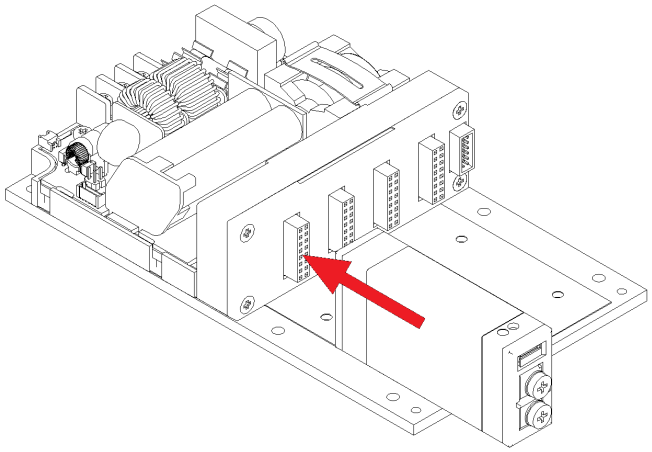
Adding Output Modules (A, B, C & D)

STEP 1:
Each module is provided with two M3x8 Stainless Steel Posi-drive Countersunk screws at the bottom. These are used to attach the module to the baseplate. Remove these screws using the correct No1 Posi-drive screw driver.

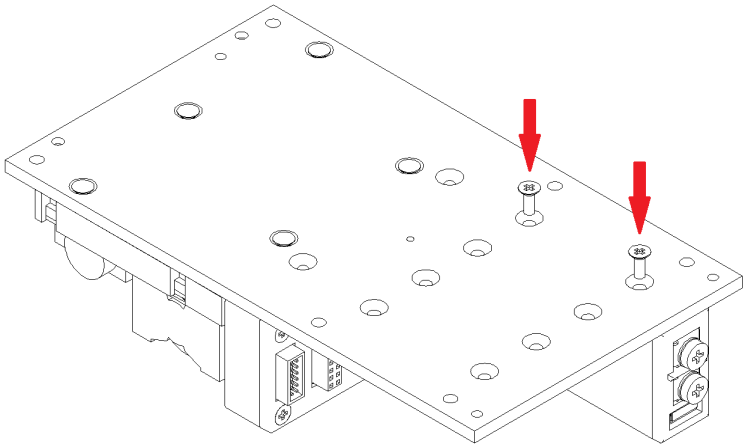


STEP 2:
Ensure that the output module base and baseplate thermal interface are both clean and free from any debris.
Insert output modules as required into any one of the four available slots in the VCCM600 transformer module. Ensure the output module and transformer connectors are properly aligned and push together. There will be a solid 'click' once a proper connection is established.
Each VCCM600 product can be configured to have up to four isolated outputs by inserting the desired output modules into the correct slots as required.



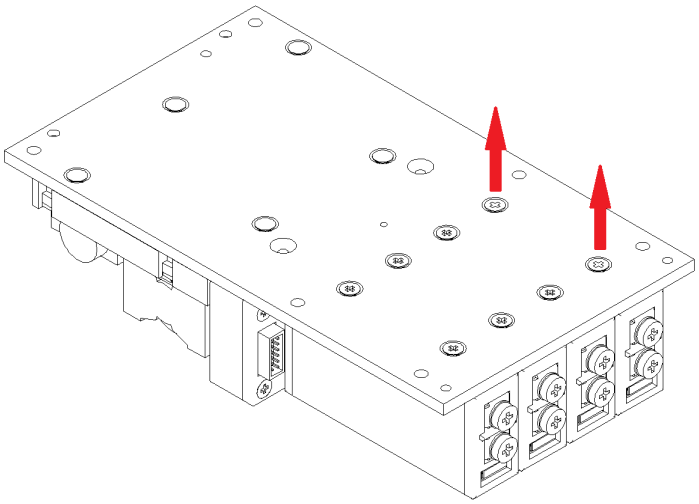


STEP 3:
Once the output modules are in place, turn the entire assembly upside down and rest on a flat surface. Secure the screws which were removed in step 1 as shown below. Tighten the screws using an appropriate No1 Posi-drive screwdriver to 0.5NM.

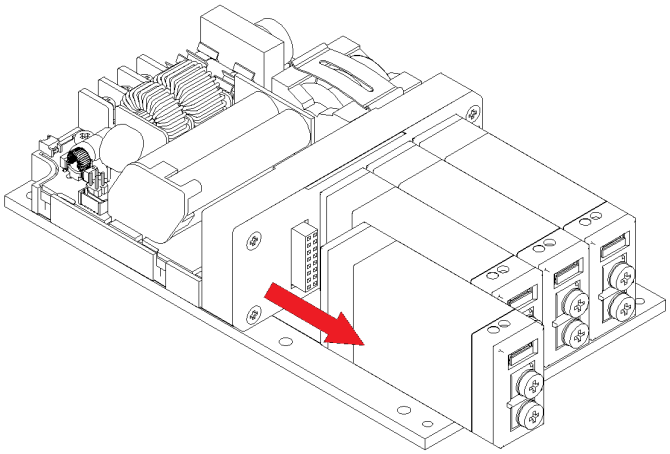


Removing Output Modules (Type A, B, C & D)

STEP 1:
Turn the configured unit upside down and identify the slot of the module you need to remove. Remove the two screws using an appropriate No1 Posi-drive screwdriver.



STEP 2:
Turn the configured unit right side up and unplug the module by pulling it away from the transformer module. To minimise stress on the connectors do not wriggle the module to remove. Take care not to damage the thermal interface material on the baseplate.



Verifying operation after assembly

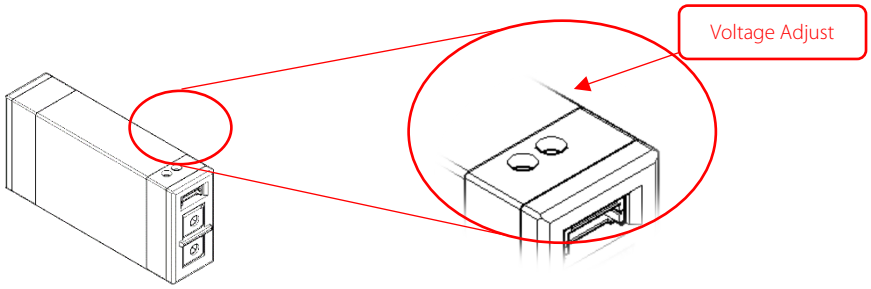
Connect the Live (L), Neutral (N) and Earth (E) terminals of the mains power cable to the corresponding terminals on the mains input connector (J1) on the VCCM600 input module. Only apply power from the mains power outlet once the connection to the VCCM600 input module has been completed.
Once power has been applied, confirm that the "Power Good" indicators for all output modules are lit. If any "Power Good" indicators are not lit it may indicate a faulty output module or incorrect assembly. The mains power should be removed and the non-functioning output module re-seated or replaced.

WARNING!

- Dangerous voltages are exposed on certain parts of the power supply even after power has been removed. The unit should only be handled by qualified personnel when the power supply has been disconnected from the mains supply voltage for more than 10 minutes.
- During operation, external surfaces of the unit can become hot. Appropriate precautions should be taken when handling the unit.

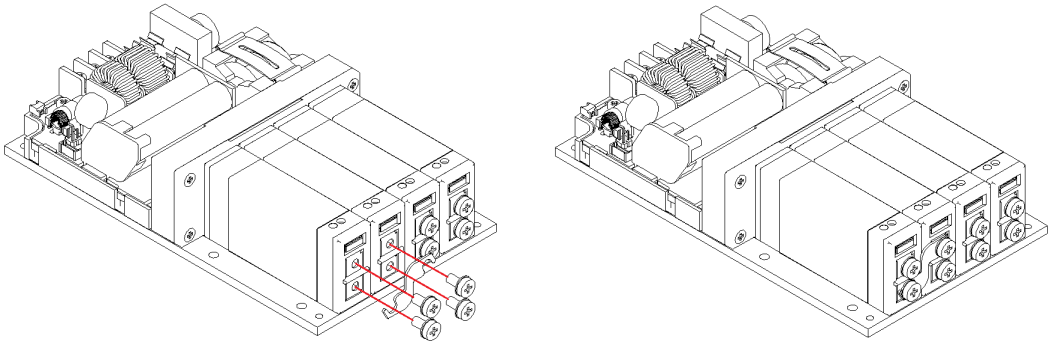
Adjusting output voltages

Each VCCM output module contains a built-in potentiometer to allow for accurate output voltage adjustments. To adjust the output voltage, connect a calibrated voltmeter (or DMM) to the output terminals and insert an appropriate trimming tool (e.g. Bourns Model H-90, maximum diameter 3mm) through the hole marked "Adjust" at the top of the output module as shown below. Do not use excessive force as this may damage the unit.
Ensure the trimming tool mates correctly with the internal potentiometer and slowly turn the tool clockwise to increase the voltage or counter-clockwise to decrease the voltage. Once the desired voltage has been achieved, remove the trimming tool and disconnect the voltmeter. Repeat this step for each output module in need of adjustment.



Connecting Output Modules in series

VCCM output modules of the same type can be series connected to achieve higher output voltages. Below is an illustration of how to series connect two output modules in slot 1 and slot 2 using a Vox series link. The Vox series link can be inserted by loosening the output module power terminal screws and rotating the series link into position. The screws should then be tightened to 0.55Nm.
The example below shows the series connection from slot 1 negative to slot 2 positive with the output voltage taken from slot 1 positive to slot 2 negative.
Further output modules can be added to the series chain by adding more series links across the remaining slots.



WARNING!

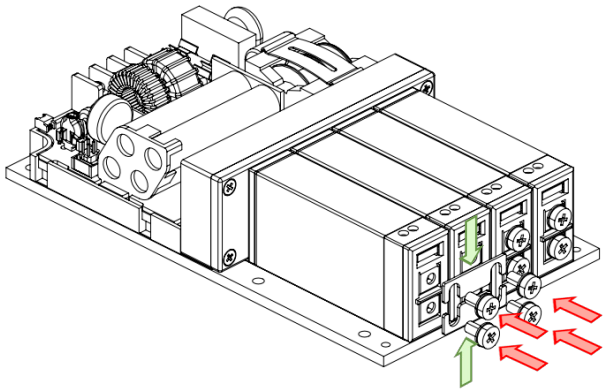
Energy and voltage hazards may arise when individual modules are series connected. When safe energy and voltage levels are exceeded ensure that an appropriate warning label is affixed to the power supply in a manner that service personnel will always notice it. See the Safety section for more details.

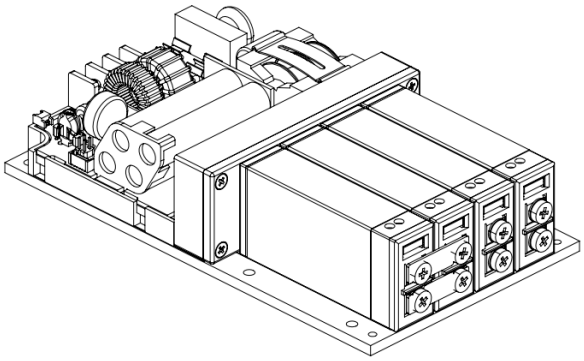
Connecting Output Modules in parallel

VCCM output modules of the same type can be paralleled in any number within the same product to achieve higher output currents. For best performance, the output voltages of each paralleled module should be pre-adjusted to within 1% of the required output voltage. It is recommended to fit Vox current share links on all paralleled output modules. Vox Power has a range of 2, 3 and 4-way current share links available. Please discuss your requirements with your distributor or with Vox Power before ordering your unit.

Below is an illustration of a mechanical connection to parallel connect two modules in slot 1 and slot 2 using Vox parallel links. Vox parallel links can be inserted by loosening the output module power terminal screws on adjacent modules and sliding the parallel link into position. The screws should then be tightened to 0.55NM. One link is required to connect the negative power terminals, and another is required to connect the positive terminals. Vox Power has a range of parallel links to connect 2, 3 or 4 output modules in parallel.

The example below shows a parallel connection from slot 1 to slot 2.



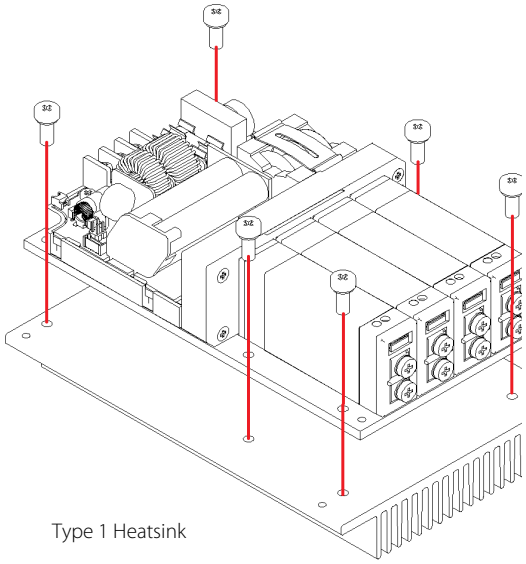


WARNING!

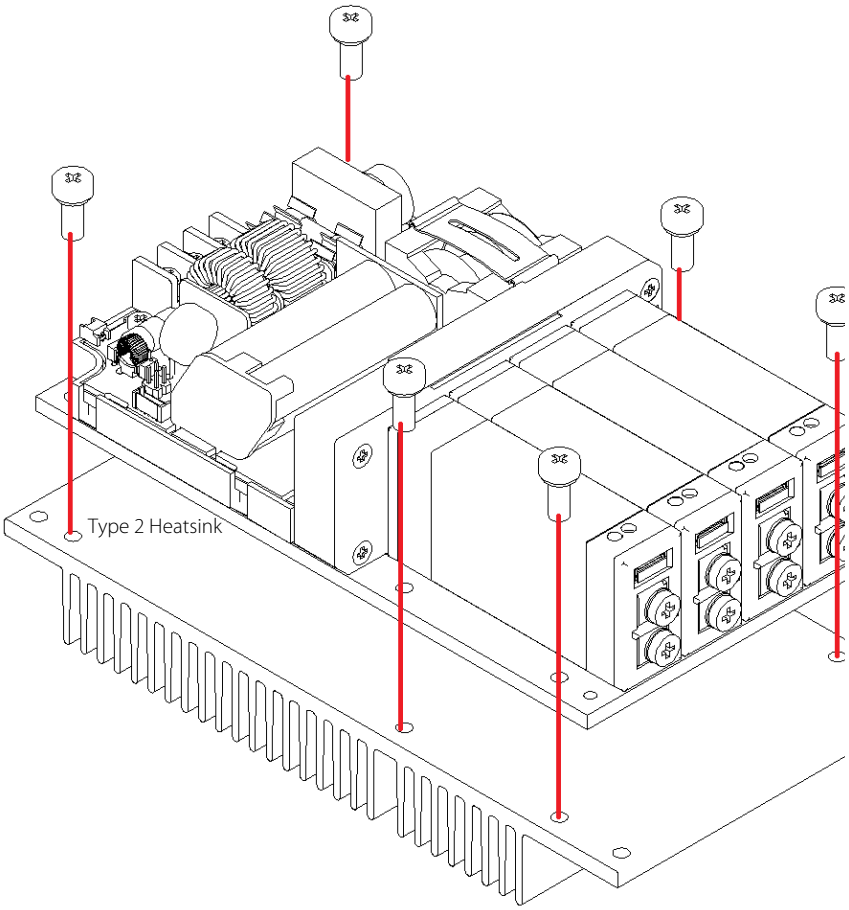
Energy and voltage hazards may arise when individual modules are paralleled. When safe energy and voltage levels are exceeded ensure that an appropriate warning label is affixed to the power supply in a manner that service personnel will always notice it. See the Safety section for more details.

Attaching a heatsink or cooling plate

For improved performance, the baseplate of the VCCM600 unit can be attached to a heatsink or cooling plate. Vox Power has a range of heatsinks available to allow the VCCM600 to be mounted horizontally or vertically.
Each heatsink comes pre-assembled with a high-performance thermal interface pad and 6 x M4 x 10mm Pozi Pan screws which can be used to attach the heatsink to the baseplate.
The diagrams below show a VCCM600 unit attachment to a Type 1 and Type 2 heatsink. Before assembly ensure both the baseplate and heatsink surfaces are clean and free from debris. The final assembly can then be mounted into the end system via the four holes (Type 1: 2 each side, Type 2: 2 each end) on the flange of the heatsink.



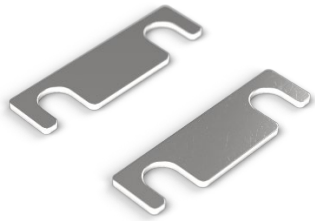
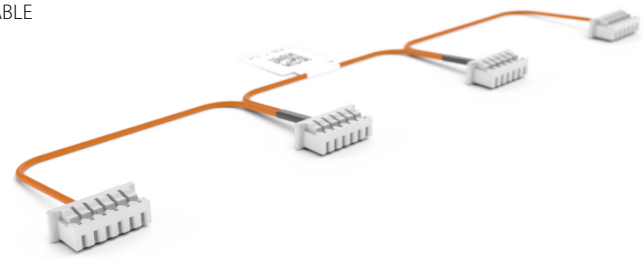
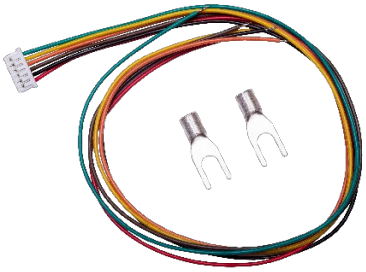
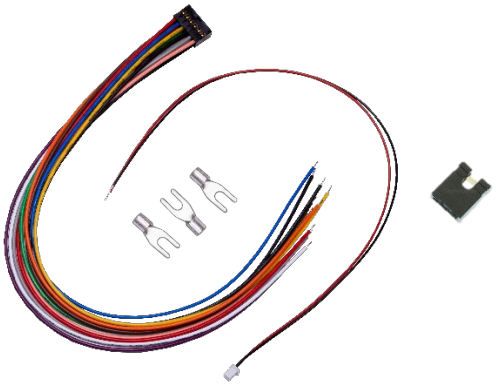
Type 1 Heatsink

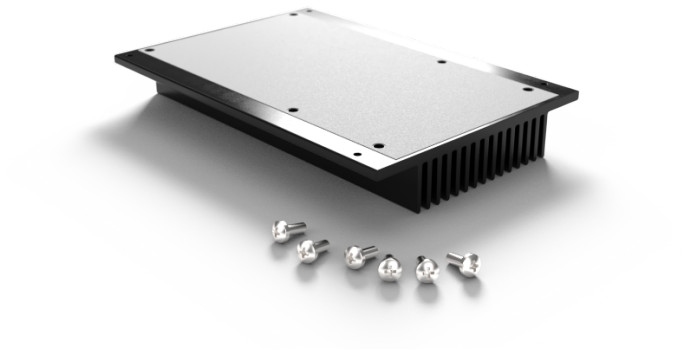
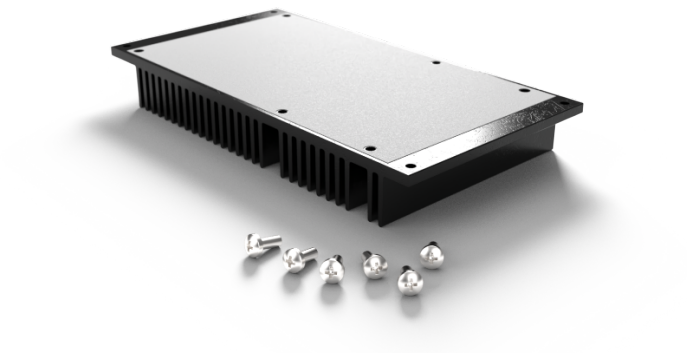


Type 2 Heatsink

It is recommended to tighten the baseplate mounting screws to a minimum of 0.55NM. In high vibration environments, an appropriate thread lock should be used. All recommended screw tightening torques are nominal values and should be verified in the application where appropriate.

Accessories

Description	Photo/Drawing	Order code
Output Parallel Links	2 WAY PARALLEL LINK 	2 way – LINK-VP2 3 way = LINK-VP3 4 way = LINK-VP4
Current share cables	4 WAY SHARE CABLE 	2 way = CAB-CS2 3 way = CAB-CS3 4 way = CAB-CS4
Output Series Link		LINK-VS
Output Quick-Connect terminal (6.3x0.8mm TAB x2)		ACC-QCT
Output Cable Set 1x Signals cable (~200mm) 2x Power terminals		CAB-VSOPL
Input Cable Set 1x Signals cable (~200mm) 1x Standby cable (~200mm) 3x Power terminals 1x Shorting link		CAB-VC6

Heatsink1 (Provided with 6x M4 x 10mm Posi-Drive screws for baseplate mounting and thermal interface ACC-TF)		ACC-HS1
Heatsink2 (Provided with 6x M4 x 10mm Posi-Drive screws for baseplate mounting and thermal interface ACC-TF)		ACC-HS2
Thermal interface (170mmx80mm)		ACC-TF